IEEE Unexpected Innovations Through History

The Institute

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JUNE 2003 VOL. 27, NO. 2

Page 10

MEMBER PROFILE

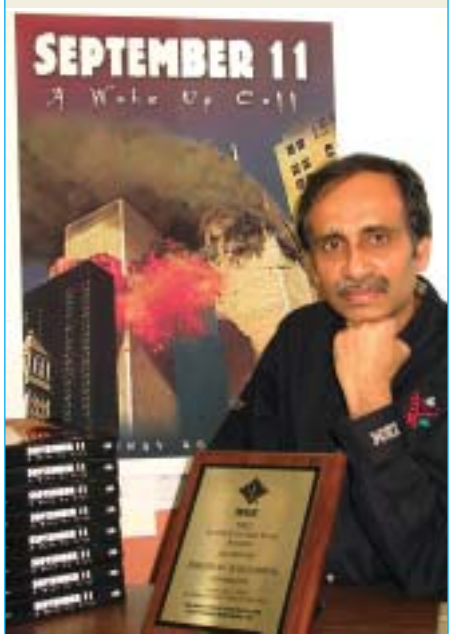
Answering A Wake-Up Call

BY ERICA VONDERHEID

CAN ENGINEERING AND technology be applied to create worldwide peace? Abhinav Aggarwal says they can.

Aggarwal, an IEEE Senior Member and vice chair of the Eastern North Carolina Section in the United States, wrote *September 11: A Wake Up Call* (1st Books Library, Bloomington, Ind., USA, 2003) to provide an engineering perspective to the terrorist attacks against the United States by studying what happened through the prism of system dynamics. For this book, he was named the 2002 IEEE Author of the Year, an annual award.

Systems dynamics, a technique created by Jay Forrester at the Massachusetts Institute of Technology in Cambridge, studies cause-effect relationships between activities to examine how one or more variables lead to a certain event. The variables are then further analyzed to trace any problem to its root cause. Aggarwal (below) used this process to explain that September 11 happened because somewhere in the grand system of human experience, there was a defect, which has a root cause that led to the attacks. [*Continued on page 14*]



Homeland Security

It's Nothing New for the IEEE

U.S. President George W. Bush watches emergency personnel attend to victims in a biohazard demonstration, in March 2002, in Atlanta, Ga., USA.

BY ERICA VONDERHEID

ON 10 SEPTEMBER 2001, when the big news was mad cow disease and a U.S. senator's affair with a missing intern, the term homeland security was hardly known. In the days following, homeland security became a central priority for all levels of government. Initiatives were soon everywhere, from the formation of the U.S. Department of Homeland Security (DHS) to community volunteer ambulance corps being trained on how to react during a biological attack.

But for the IEEE, homeland security was nothing new. Through its Members' technical knowledge, the conferences it sponsors, the standards it has helped develop, the publications it distributes, and the public policy committees it has set up, the IEEE has helped ensure safety for many years.

What is homeland security?

The U.S. government in its National Strategy for Homeland Security defines homeland security as "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and minimize the damage and recover from attacks that do occur."

Less than a month after the attacks, President George W. Bush created the Office of Homeland Security and appointed former Pennsylvania Governor Tom Ridge as its director. Early this year, the office became a cabinet-level department in the biggest federal reorganization in 50 years, and Ridge was sworn in as the first Secretary of Homeland Security. With a budget of US$36 billion, DHS, with advice from the [*Continued on page 12*]

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contents

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Page 19

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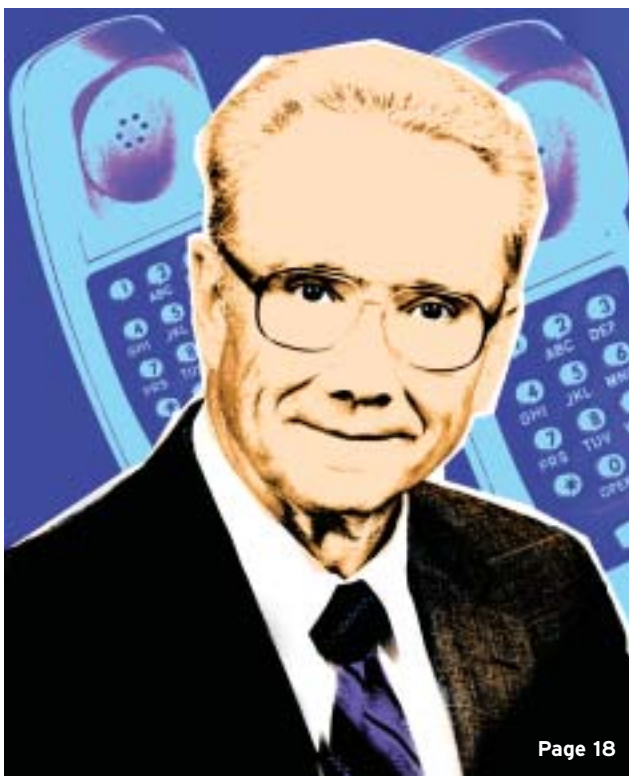

Page 18

Wireless Composition
A recently approved standard aids music composition and performance by connecting musical instrument digital interfaces over Ethernet and IEEE 802.11 networks.

Protect Your Identity
A new program helps IEEE Members combat identify fraud.

PLUS

News IEEE and Fluor Corp. named as lead co-chairs for U.S. National Engineers Week 2004.

Conference Third IEEE Conference on Nanotechnology, San Francisco, Calif., USA, 11 to 14 August 2003.

University Exchange The Student Branch at the University of Alabama at Tuscaloosa, USA, is out of this world.

Products & Services One-stop shopping for publications, conference proceedings, and books at the IEEE Catalog & Store.

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NEWS

From Around the IEEE & the World

Microwave Society Sponsors Virtual Museum Exhibit

IF YOUR KIDS THINK that microwaves are only used to make popcorn, have them visit the new IEEE Virtual Museum. There they'll have a chance to learn that microwaves are also the means by which cellphones communicate and TV signals are broadcast.

"Microwaves: From Your Kitchen to the Edges of the Universe" is the museum's first exhibit that gives a technical and historical overview of technology presented by an IEEE Society. The Web site hosting the Microwave Theory and Techniques Society (MTT-S) exhibit debuted in April and is designed for a younger, nontechnical audience.

"It is a great opportunity to reach out to people we don't ordinarily communicate with, namely future engineers," says Peter Staecker, a past president of MTT-S. The exhibit offers simple explanations of how microwave technologies work, and places each in its historical and social context. Key people in the technologies' development also are profiled. Visitors can learn how the same device that cooks food in a microwave oven helped the Allies during World War II. Other exhibits show how microwaves are used in communications, missile guidance, weather forecasting, and medicine.

Eighty Society members wrote much of the exhibit contents with help from IEEE staff member Kim Breitfelder, the Virtual Museum's project manager, who provided the exhibit graphics and animations.

Visit the exhibit at www.ieee-virtual-museum.org.

— Helen Horwitz

Meet The President-Elect Candidates

THERE ARE TWO CANDIDATES for President-Elect: W. Cleon Anderson of Salt Lake City, Utah, USA; and Michael Lightner of Boulder, Colo., USA. Vijay K. Bhargava has withdrawn his name as a candidate.

Anderson, (photo, left) a Senior Member now in his second term as vice president of Regional Activities and a former director of IEEE-USA, has served as director of Region 6 (the western United States). He is a member of both the Engineering Management and the Computer Societies. He is employed by L-3 Communication Systems-West (Salt Lake City, Utah), where, as a chief project engineer, he designs and directs the development of military and space data-link systems.

Lightner, (photo, right) an IEEE Fellow, is a professor of electrical and computer engineering and computer science at the University of Colorado in Boulder. Among his IEEE activities, he is currently the vice president of Publication Services and Products, has served as the vice president of Technical Activities, and is a past president of the Circuit and Systems Society. He also belongs to four other Societies: Communications, Computer, Education, and Engineering in Medicine and Biology.

Interviews with these President-Elect candidates were published in *The Institute's* April edition at www.ieee.org/theinstitute. The interviews covered a wide range of issues—from what inspired the candidates to become engineers to the most important problems they see facing the IEEE.

On 12 June, the IEEE Philadelphia Section will be hosting a debate between Anderson and Lightner. Read excerpts from the debate in *The Institute*'s September print issue.

Watch your mailbox in September when all members eligible to vote will receive their election ballot.

For more information about the candidates and their positions, visit www.ieee.org/organizations/corporate/candidates.htm.

—Kathy Kowalenko

New Standards Web Site Tailored for Europe

STANDARDS DEVELOPERS and users in Europe now have a new Web portal that can provide them with access to technical standards created by the IEEE and other standards organizations. The portal, called StandardsEurope, is at www.standardseurope.net.

The site helps those who want to learn about standards currently under development and to obtain some of the most popular technical standards, especially in information technology, telecommunications, and power and energy. Created by the IEEE Standards Association (IEEE-SA), StandardsEurope is a major component of the association's ongoing globalization initiative to help abolish technical barriers to trade for the benefit of industry and society.

This is the third portal dedicated to a geographic region that IEEE-SA has introduced within the past year. The others are StandardsAsia and StandardsAmericas. Regional portals are increasingly important because IEEE standards are used worldwide, and each portal will help industry and others in that part of the world participate in the IEEE-SA's work.

"This Web portal adds value to and focuses on IEEE-SA's ongoing cooperative work supporting international standardization development efforts," says Jerry Peterson, president of the IEEE Standards Association. The global groups behind those efforts are the International Electrotechnical Commission, the International Organization for Standardization, and the International Telecommunication Union.

Some of the portal's features include:

- A link to StandardsWire™, which provides timely announcements about IEEE standards activities.
- Access to IEEE "Standard Zones," which are standards grouped by specific technologies such as wireless communications, microprocessors, transportation, and power generation.
- Direct log-in capability for customers of IEEE Standards Online, a subscription-based collection of topically related standards.
- A newsletter that will showcase news, events, and profiles about IEEE's activities in Europe.

You can find StandardsAsia at www.standardsasia.net and Standards Americas at www.standardsamericas.net.

—Kathy Kowalenko

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MARKETPLACE OF IDEAS

Each month, *The Institute* poses a question for discussion. Responses are published on a three-month cycle; reader comments to the question below will appear in September.

Q As cybersecurity problems arise—from stolen credit card numbers to terrorist threats—there's good reason for the U.S. government to become the leader in developing new cybersecurity measures. In February, the U.S. Department of Homeland Security unveiled its *National Strategy to Secure Cyberspace* (read the entire report at www.whitehouse.gov/pcipb). The report focuses on improving cooperation among federal, state, and local governments, the private sector, and the public. It also establishes a public–private architecture for responding to attacks.

These are all good ideas, but with the borderless nature of the Internet, is any plan really going to prevent attacks? What can the United States do to develop cooperation with other countries to secure cyberspace? Do you think this report will spur change or will it be forgotten or ignored like the Clinton administration's earlier attempt to secure the Internet as expressed in its *National Plan for Information Systems Protection*?

TO RESPOND, *use any of the following contacts:* **Mail:** The Institute, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ, USA 08855-1331 **Fax:** +1 732 235 1626 **E-mail:** institute@ieee.org

An e-mail response is preferred, although no written submission will be ignored. It is unlikely that space will permit publication of all responses, although we will try to draw a representative sample. Comments are subject to editing for brevity and libel protection. Suggestions for discussion subjects are welcome. Please send them to any of the above contact points.

Responses to March's Question

A **If a person is convicted of using the Internet to commit a crime, should he or she be barred from surfing the Web, or was hacker Kevin Mitnick, who was barred from the Internet during probation that ended earlier this year, a special case?**

That's Brilliant

I believe brilliant minds must receive equal opportunity to have brilliant responsibilities in the execution of their brilliant jobs. However, if they do break our brilliant laws, then they must be held responsible for their not-so-brilliant actions.

These people have very useful talents. Let's give reformed hackers a chance to use their talents for everyone's benefit. If, after given the opportunity, hackers decide to continue to engage in crime, then "Book them, Sergeant!"

Jesus Alfredo Sanchez Ohep
Durham, N.C., USA

International Internet Defies Local Laws

It's ridiculous how many U.S. judges seem to feel they can regulate a person's behavior throughout the whole world. I'd like to know which law enforcement entity is capable of stopping Kevin Mitnick from accessing the Internet from a cybercafe in Mexico, Switzerland, China, Bolivia, or Brazil. Banning the use of the Internet to a free citizen is the same as forbidding him to think, read, laugh, cry, or watch television. The Internet is international and not bound by regional authorities.

Luiggi Colpocorto
Foz do Iguacu, Brazil

Hands Off

When someone uses a gun as a tool to commit a crime, that person is barred from ever owning a firearm again. But Internet access is like having a knife or fork. You cannot eat decently without such a tool, so if you commit a crime with one, you should be punished separately for the specific offense.

When it comes down to electronic devices, be it computers, Web terminals, or ATMs, banning such an item should never be permanent or a justified punishment for its own sake. Imagine you are released from jail, but forbidden from using your ears, eyes, or one of your hands.

If we are to compromise, such a ban [on surfing the Web] should only be allowed if a convict is still serving his sentence and it is part of a parole agreement.

Jade Naaman
Riad El Solh, Lebanon

Neutral Tool

I think the analogy between guns and computers is a bad one.

A gun has only one purpose and it is not a neutral tool. A computer can be used to run a spreadsheet, a word processor, and other useful applications. It is a neutral tool that can be used for whatever purpose, be it good or evil, just as an ordinary knife can be.

The fact is that no criminal ever is forbidden to use a knife because he was convicted for killing someone with such a tool. What society reproaches him for is not the use of the tool, but the murder itself. And once the criminal has paid his or her debt to society, there is no reason why he cannot use neutral tools again.

Cybercriminals should be prevented from using cracking or hacking tools, which are the real weapons they need to commit their crimes, but preventing them from using tools that any citizen is allowed to own seems unjust.

Laurent Giroud
Lyon, France

Permanent Vacation from Surfing

Not only hackers like Kevin Mitnick, but anyone—including corporate information technology employees—who commit cybercrimes must be severely penalized.

After these criminals complete their prison terms, they must be taught to behave like normal people under the supervision of a psychological treatment institution. Once the treatment phase is complete, reformed cybercriminals can get back to their normal daily lives. However, they should be barred from surfing the Web permanently.

Yakup Gurol Gurbuz
Ankara, Turkey

Separation Anxiety

Of course it is good to separate criminals from their weapons of choice as a reasonable measure of risk reduction, just as released pedophiles should be separated from children. But separation does not resolve the initial motivation for the crime.

If that person wants to commit another crime, he or she will surely find a way—we know them as repeat offenders. If a murderer used pantyhose as the weapon of choice, wouldn't the same logic dictate that he or she be barred from having pantyhose?

Alicia Hinton
San Jose, Calif., USA

Leaping Tall Networks in a Single Bound

Separating the criminal from his "weapon" is an excellent idea, but it's unenforceable. Sure, you can keep a cybercriminal away from the Internet while he's in prison, but there is no technology that can prevent him or her from using a computer afterward. Even if you could somehow ban the person from buying a personal computer, a hacker with that technical expertise could build one from computers tossed in the trash. There's no real security screen when you sign up with an Internet service provider, so Web access is guaranteed. Plug the computer into a cellphone and everyday technology makes him a Superman.

Just as we cannot reach out and kill every mosquito that may bite us, we can only make our immediate surroundings as safe and secure as possible through better firewalls, password systems, and the proper disposal of old data, equipment, and media.

John J. Christiano
Franklin, N.J., USA

BY MIKE ADLER

I Need Your Ideas for New Products and Services

Once in a while I think it's important to take a moment and reflect upon the impact of technology on our work. After all, it is we engineers who have helped to create the technology that has transformed how we work and, moreover, compelled us to accept constant change as part of our professional lives.

Consider how you now acquire the information that enables you to do your work. Instead of just relying on print publications, attending conferences as time permits, or going to your Society or Chapter meetings, you—and a growing number of members—are now also using a wider range of IEEE electronic services.

For example, most of you now receive an e-mail alert from *The Institute* to inform and link you to the articles that appear in the publication's monthly online edition. This is especially important in months when the paper version is not published.

Depending on the user profile you have provided to us, you may also receive IEEE *Xplore*™ e-mail alerts that advise you when new articles and related information are available in your areas of technical interest.

Or perhaps you are one of the more than 160 000 subscribers to the monthly *What's New @ IEEE* electronic newsletters. All of these are available as part of your membership. Ten focus on a particular technical area, and the editors of *IEEE Spectrum* produce two more: the weekly *IEEE Career Alert* and the biweekly *IEEE Tech Alert*.

The new IEEE Member Digital Library is another of the growing array of electronic information-sharing services for members. With a subscription, you can instantly access, print, and save the most essential technical information appearing in IEEE publications during the last five years.

But even with the advent of these electronic services that, without a doubt, improve how we acquire information, I still contemplate this question: what is the next thing that the IEEE can do to help make all the information we provide even more valuable?

Dedicated groups of volunteers—supported by committed staff members—are already working to answer this question. One concept they have identified as a future improvement includes developing an advanced search tool that will gather information across the IEEE's entire Web site, resulting in fewer links and better content. This tool is aimed at improving how quickly and efficiently you can get to the specific information you want.

Another idea is to enable members to define their expertise so that other members can contact them to ask questions, discuss ideas, and share experiences. The spirit behind this thinking is to go beyond providing information in a printed or electronic format, and instead make the IEEE the place to go to get your question answered—whether it's from our publications, our member experts, or even from an alternative provider outside the IEEE.

Also under development are the IEEE Virtual Communities (VCs). VCs have enormous potential. They will provide online interactive forums on technical areas or any related topic for which members share common interests. In these communities, you will be able to network with others while discussing vital issues and sharing experiences and resources without regard to geographical location or time zones. You can participate from anywhere and at any time. The IEEE is piloting over 20 VC communities today at www.ieeecommunities.org. We are interested in your input about the type of additional communities you might like to see developed or to help form.

The IEEE is founded on the premise that society stands to benefit when individuals come together to share experiences and information. This continues to be true.

The IEEE was founded on the premise that society stands to benefit when individuals come together to share experiences and information. This continues to be true, and the way in which we all leverage our relationships with one another will determine just how much of an impact the IEEE and each of us as members have on society.

I recognize that our needs are a moving target, and we don't necessarily know what it is we want, except to observe, "I'll know it when I see it." But if you have ideas—whether about technical communities or about alternative value-added services that the IEEE should be considering—please share them with me by sending an e-mail to president@ieee.org.

LETTERS

Two Thumbs Up

I like your newly designed print publication. It is attractive, easy to read, provides additional details, and includes new information in a format that motivates me. For instance, I wanted to get an IEEE credit card for some time, but was not sure how to proceed. Your advertisement on page 9 in the March issue presented the instructions in an easy-to-follow format. Now I'm on my way to applying for a card.

As a long-time IEEE member—my student membership started in 1950—I've served the organization in a number of capacities. Recently, I volunteered to publish the newsletter for the IEEE Consultants' Network of Connecticut, USA. Your new format will be an inspiration for me.

Loering Johnson
Tarrifville, Conn., USA

Nominations Invited for IEEE Technical Field Awards

IEEE Sections, Societies, and individual members are invited to submit nominations for 2005 IEEE Technical Field Awards (see awards, recognitions, and sponsors below). The IEEE Awards Board urges members to nominate and endorse outstanding candidates. For nomination information, visit www.ieee.org/about/awards or contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, NJ, USA 08855-1331; telephone, +1 732 562 3841; fax, +1 732 981 9019; e-mail, awards@ieee.org.

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● IEEE MASARU IBUKA CONSUMER ELECTRONICS AWARD
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For outstanding contributions to international communication.
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● IEEE INTERNET AWARD
For exceptional contributions to the advancement of the Internet technology for network architecture, mobility, and/or end-use applications.
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Sponsor: *Philips Electronics NV*

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For outstanding achievement(s) in photonics.
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Information supplied by the IEEE Awards Board.
IMPORTANT: The deadline for receipt of nominations is 31 January 2004.

New Medal Honors Japanese Microelectrics Industry Leader

BY KATHY KOWALENKO

Jun-ichi Nishizawa, better known as Japan's "Father of Microelectronics," will be honored by the IEEE with a new medal next year that pays tribute to his extraordinary contributions in materials science and technology, fiber optics, and power systems. The IEEE Jun-ichi Nishizawa Medal will recognize outstanding contributions to material and device science and technology, including practical applications.

Nishizawa earned his sobriquet because his inventions are credited with spurring Japan's leadership in the microelectronics industry after World War II. An IEEE Life Fellow, Nishizawa's landmark inventions include the pin diode and static induction transistor that led to the birth of the semiconductor-laser and optical-fiber-communication industries. His discovery of ion implantation was a key contribution to integrated-circuit manufacture.

Nishizawa is president of Iwate Prefectural University in Iwate, Japan where he continues to work in the microelectronics field. His development of the terahertz static induction transistor and terahertz waves generated by using lattice and molecular resonance are opening up applications in the nanotechnology field.

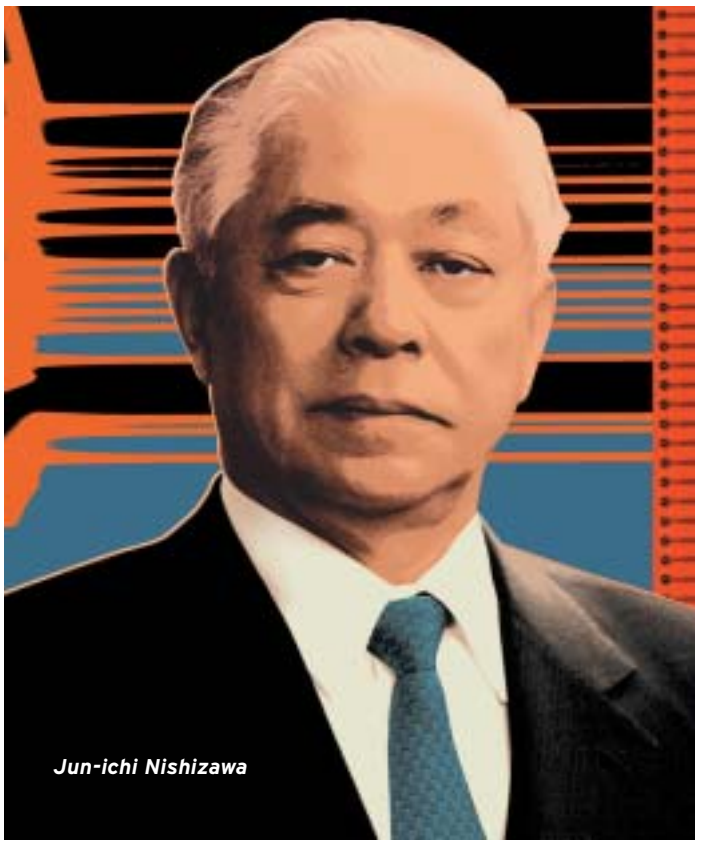
"His approach is not confined within the narrow, vertical field of his own profession, but is interdisciplinary and international as well," notes a representative of the Federation of Electric Power Companies Japan of Tokyo, one of the award's sponsors. The other sponsor, the Semiconductor Research Foundation of Sendai, Japan, is part of the Semiconductor Research Institute (SRI). In 1961, Nishizawa donated several patents for his inventions to establish SRI and has been its director since 1968.

"Among Japan's great leaders of industry, Nishizawa's contribution is really the largest," notes a SRI representative. "His works have established new systems and networks that benefit society."

Nishizawa has received numerous honors, including Japan's Person of Cultural Merits (the Japanese government's highest honor) and was the recipient of the 1983 IEEE Jack A. Morton Award and the 2000 IEEE Edison Medal.

The IEEE Jun-ichi Nishizawa Medal will be awarded annually to an individual or team of up to three and is comprised of an honorarium, gold medal, bronze replica, and certificate.

The deadline for nominations is 1 July 2003. For more information, visit www.ieee.org/awards. ●



Jun-ichi Nishizawa

When Serendipity

Accidental engineering created batteries, X-rays, microwave ovens, and more

BY TRACY EDDY
IEEE History Center

There is no doubt that many important electrical engineering discoveries were the eagerly anticipated result of careful study and calculation. Thomas Edison's light bulb, for example, was the culmination of many years of methodical research. However, careful planning doesn't rule out the possibility of spontaneous discovery. Some important innovations are the result of serendipity—accidental discoveries that have opened up unexpected fields of exploration. Below are six examples of such discoveries that changed the field of electrical engineering, as well as the world.

Jumping frog legs

In 1791 Luigi Galvani, an Italian physician and an anatomy professor at the University of Bologna, was dissecting a frog in his laboratory, work which eventually led an acquaintance of his to build the world's first electric pile, or battery. As he worked near an electric machine that was continuously generating sparks, he noticed that each time he touched his metal scalpel to a nerve in the frog's leg, it twitched.

Galvani deduced that his scalpel was somehow picking up electricity from the sparks and sending an electric pulse through the frog's nerve. He decided to test his theory by hanging frogs' legs on brass hooks on a gate in his garden. The legs kicked the first time Galvani touched the brass hooks to the iron gate, but not the second or third time. Perplexed, Galvani consulted Alessandro Volta, a professor of physics at the University of Pavia in Italy.

While Galvani concluded that animals contained an electrical nerve fluid that reacted to a completed electrical circuit, Volta suspected that electricity was not produced by the frogs' legs but by the hook they hung on. He replicated Galvani's experiment in his laboratory with the frog legs several times using hooks made of different metals. After discovering that the largest pulse demonstrated by a kick of the frog's leg came from contact between zinc and silver in a moist environment, he invented the Voltaic pile—the world's first battery. To honor Volta's and Galvani's breakthroughs, the basic unit of electric potential, the volt, is named for Volta and the tool that measures current, the galvonometer, is named after Galvani.

Bright idea

In 1883, shortly after he improved the incandescent lamp, Thomas Edison was experimenting with it by introducing an extra electrode into the bulb. He soon realized that even though that electrode wasn't part of the bulb's circuit, it carried a current. Edison observed that within the vacuum of the bulb this hot filament emitted electrons, which could then be absorbed by the extra electrode, and became known as the Edison Effect.

However, there is speculation that the effect was actually discovered by William J. Hammer, one of Edison's engineers. The story goes that while Hammer was researching the incandescent bulb, he observed a bluish glow surrounding the positive pole of the light bulb and the lamp's negative pole turned black showing how electrons moved from a negatively charged filament to a positively charged plate. In either case, the Edison Effect was one of science's first forays into the field of electronics, which led to the development of the first radio tubes 20 years later.

The X-files

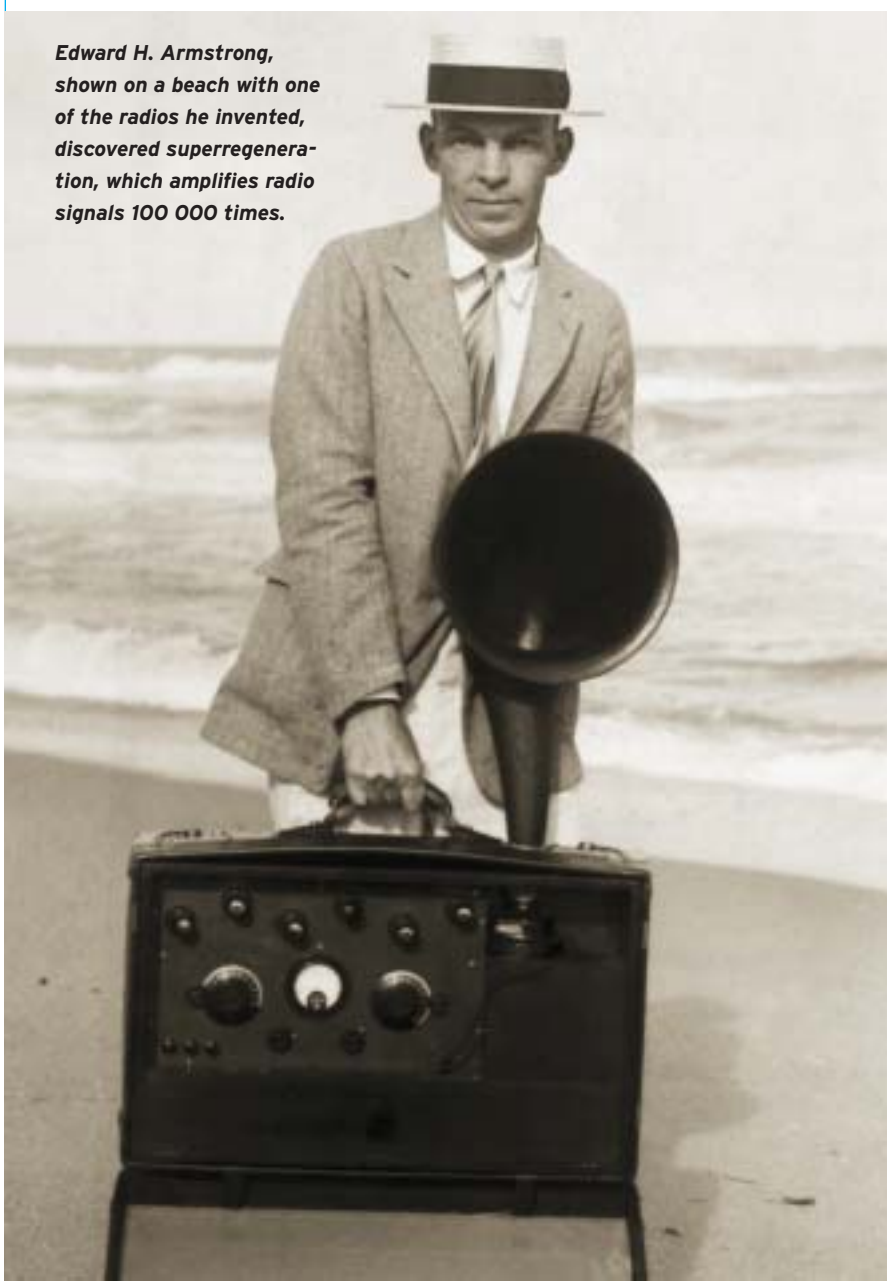
On the evening of 8 Nov. 1895, German physics professor Wilhelm Conrad Röntgen was testing a cathode-ray tube in his dark laboratory when he realized that when the gas in the tube was charged with electricity and sealed in thick black cardboard, it made a piece of paper coated with a florescent chemical across the room glow.

For seven weeks, Röntgen ran various experiments trying to find out what caused this unexpected effect and discovered that the new rays were produced by the impact of cathode rays on an object. One of the most well-known experiments involved placing his wife's hand in the path of the rays from the cathode-ray tube over a photographic plate. After he developed the plate, an image of the bones in his wife's hand and her wedding ring emerged, marking the first "röntgenogram" ever taken. Because the nature of the rays was still unknown, Röntgen named them "X-rays." By early 1896, his fascinating discovery gripped the world's attention. More than a century later, Röntgen's accidental breakthrough continues to be an indispensable part of science and medicine.

Pump up the volume

By 1921, Edwin H. Armstrong, an instructor and assistant in the electrical engineering department at Columbia University in New York City, had spent nearly a decade working on a regeneration technique that would amplify radio signals. While he was preparing a regenerative circuit for use in a patent case in his laboratory one evening, Armstrong heard a signal that was much louder than anything he expected.

Armstrong was listening to a message from the Brooklyn Navy Yard, 16 km



Edward H. Armstrong, shown on a beach with one of the radios he invented, discovered superregeneration, which amplifies radio signals 100 000 times.

Strikes

away, but the signal disappeared within minutes. However, he wanted to understand why that signal had come in so strongly. After weeks of experimentation and study, Armstrong identified the principle of superregeneration—an extension of the feedback principle of the regenerative circuit, which allowed a received signal's original strength to be amplified up to 100 000 times, much louder than his regenerative circuit.

This unexpected discovery helped create the Identify Friend or Foe (IFF) systems used by the Allies in World War II, a system that used radio waves to trigger a response from friendly aircraft, and was instrumental in developing radios for police and emergency medical services.

An out-of-this-world discovery

In 1931, while Karl Jansky, a radio engineer with Bell Telephone Laboratories, was working on shortwave radio telephones, he was asked to figure out what was causing crackling static that interfered with overseas telephone reception. He built a large directional antenna at Bell's Holmdel, N.J., USA, station, and recorded two expected forms of static: one from local thunderstorms and the other from distant storms reflected from the ionosphere. But he also detected a third, unexplained sound: a weaker static that sounded like steady hissing, barely distinguishable from internal receiver noise.

Jansky originally concluded that the radio waves were coming from the sun, but a year of careful study revealed that they were actually coming from outside our solar system. This project at Bell Labs led to an entirely new field of science: radio astronomy. In his honor, astronomers named the unit of radio flux, variations in frequency, the jansky.

A sticky situation

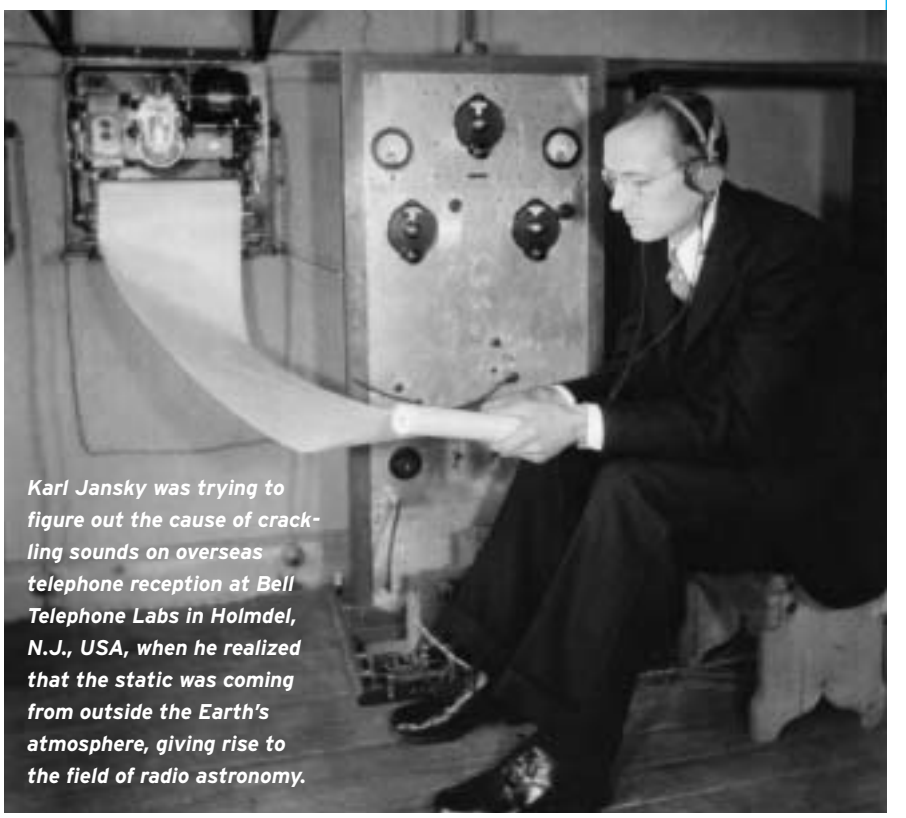
In 1946, Percy Spencer, an engineer and inventor who held more than 120 patents, was conducting radar-related research for Raytheon Corp. While testing a new type of vacuum tube—the magnetron—he noticed that a chocolate bar he had been carrying in his pocket had melted. Intrigued, Spencer began conducting more experiments. He watched popcorn "pop" and bounce around the room when he held a bag of uncooked kernels up to the tube. Next, Spencer observed a raw egg placed next to the magnetron explode from the pressure that had built up inside.

Spencer concluded that each of the items had "cooked" when exposed to low-density microwave energy emitted by the magnetron. Raytheon engineers quickly adapted his discovery, and the first commercial microwave oven, the "Radarange," began its move into household kitchens the following year. ●

Thomas Edison discovered that an extra electrode he had placed in the vacuum of a light bulb but did not connect to the bulb's circuit would still carry a current, a phenomenon later known as the Edison Effect.

While experimenting with cathode ray tubes, Wilhelm Conrad Röntgen observed an object across the room glowing. He later placed photographic paper behind another object, in this case his wife's hand, to create the world's first "röntgenogram" or X-ray.

Percy Spencer observed microwaves' culinary applications when a chocolate bar in his pocket melted during an experiment, leading to the first microwave oven, the Radarange from Raytheon Corp. demonstrated here cooking a hamburger in 1947.



Karl Jansky was trying to figure out the cause of crackling sounds on overseas telephone reception at Bell Telephone Labs in Holmdel, N.J., USA, when he realized that the static was coming from outside the Earth's atmosphere, giving rise to the field of radio astronomy.

Security personnel at Sandia National Laboratories in Albuquerque, N.M., USA, observe a new explosive device designed to stun terrorists.

[**HOMELAND** *from page 1*] Homeland Security Advanced Research Projects Agency, coordinates many security and counterterroism research and development projects—from sensors that detect nuclear, biological, or chemical agents (photo, opposite page) to devices that scan the contents of cargo containers at seaports.

Ralph James, an IEEE Fellow and associate laboratory director at Brookhaven National Laboratory in Upton, N.Y., USA, divides homeland security technology into four categories. The first he calls "knowing the knowable," which involves advanced sensor technologies that can detect nuclear, biological, and chemical agents quickly and remotely. Next, technologies that safeguard dangerous agents ensure that nuclear materials and chemical agents remain secure in storage facilities.

Another is protecting borders, which includes looking for for nuclear, biological, or chemical weapons at transportation choke points such as the Ambassador Bridge in Detroit, Mich., USA, where large numbers of vehicles cross the border between Canada and the United States.

And the fourth, protecting the infrastructure, deals with analyzing possible vulnerabilities in the power grid, public water system, transportation, telecommunications networks, and emergency and other critical services, and then devising ways to compensate for those vulnerabilities.

Meeting a need

For the last 35 years, the IEEE has sponsored the premier conference on security technology: the IEEE Carnahan Conference on Security Technology. Robert Cosgriff, an electrical engineering professor at the University of Kentucky in Lexington, USA, established the first conference in 1968 in response to threats within the United States after President Lyndon B. Johnson declared his war on crime. This year's conference will be in Taipei, Taiwan, 14 to 16 Oct., and will include papers on counterterrorism, biometric identification systems, cryptology, and airport security.

The IEEE Boston Section has been hosting conferences on homeland security technologies approximately every six months since the 9/11 attacks. These conferences feature not just technical sessions, but also presentations on working with government agencies and major contractors, systems integration, policy procedures, and obtaining funding.

"It's not just a bunch of nerds presenting review papers or giving sales pitches," says Ted Kochanski, vice chair-elect of the Boston Section and co-organizer of the conference. "It is an opportunity for engineers from academia, industry, and government to come together to produce something greater than the parts."

The most recent conference, held in May, had a special track on transportation safety featuring discussions on automated explosion detection systems, document verification, and secure information systems at airports and seaports.

Read all about it

IEEE Security & Privacy, a magazine launched earlier this year, provides a discussion forum and information source for engineers working on security technologies. Planning for the publication began in mid-2001, before the terrorist attacks. The idea for it emerged at an editorial board meeting for *Pervasive Computing* magazine, first published in late 2002. Board members speculated on what technological topic the IEEE should tackle next, recalls George Cybenko, editor-in-chief of *IEEE Security & Privacy*. The answer was information technology security and network privacy.

"The editorial board thought that security was something engineers should know more about and be involved in," Cybenko explains. Another reason the IEEE developed the magazine was because the fields of security and privacy span several IEEE fields of interest such as power electronics, networking, biomedical engineering, computers, and nuclear and plasma sciences.

Recently, *IEEE Security & Privacy* issued a call for papers about understanding privacy—its technological, commercial, and social aspects.

Shaping public policy

Since the IEEE-USA's Research and Development Policy committee was formed in 1998, the IEEE has encouraged funding research on national security projects. After 9/11, the committee's focus has become more intense, says Ron Hira, the committee's chair. Since then, the committee has stepped up efforts to get more dollars allocated to new homeland security R&D efforts.

In April 2002, Hira testified before the U.S. Congress in support of a bill that appropriated US$800 million for the National Science Foundation (NSF) to mobilize U.S. science and technology expertise to combat terrorism and increase funding for R&D in cybersecurity.

Many IEEE-USA members work on

U.S. Secretary of Homeland Security Tom Ridge (standing)

WHEN YOU LOOK AT research and development funding, engineering does not get the same kind of investment as other scientific disciplines.

technologies related to homeland security. If R&D funds are not made available, IEEE Members could lose their jobs or miss opportunities to expand their technical horizons, Hira says.

"When you look at the research and development numbers, engineering does not get the same kind of investment as other scientific disciplines," Hira says.


The badge on the left has been exposed to radiation.

The committee also has written letters and position statements, which summarize the IEEE's opinion on an issue allow IEEE-USA staff and committee members to react quickly when a bill comes before Congress. One letter went out to all U.S. Senators supporting the inclusion of an Under Secretary for Science and Technology within the DHS, a position later filled by Charles E. McQueary. To read more about these communications, visit www.ieeeusa.org/committees/RDC.

IEEE-USA's public policy committees meet with members of Congress and their staff members in the White House to promote the organization's positions. Legislators often ask IEEE-USA committees to review a draft of a bill and make suggestions for improvement. The committee also monitors how much money is being invested by congressional appropriations committees. For example, just because Congress told the NSF it has US$800 million to spend doesn't mean it will all go to homeland security R&D projects. If the committee finds fault with the appropriations, committee members can work with legislators to strike a better balance.

Hira and his colleagues currently are drafting a cybersecurity position statement.

Setting homeland security standards

As engineers develop new security technologies and discover vulnerabilities in existing systems, IEEE Standards Activities (IEEE-SA) keeps pace with standards.

Currently IEEE-SA is undertaking an information assurance initiative (AI). Information assurance is a new discipline devoted to the timely and accurate delivery of information. It attempts to make all components of a network invulnerable to attack. Through this initiative, the IEEE IA Standards Committee of the Computer Society (IASC) works with the National Information Assurance Partnership, a collaboration of the National Institute of Standards and Technology and the National Security Agency, to look at networks as a whole and determine how to make the entire system secure, rather than just individual components. The IEEE's contributions to the initiative include standards such as P1619, an encryptedsharedmedia standard and P1618, a structure for exchanging digital certificates to establish the identity of an individual or organization.

"With the information assurance initiative, the IEEE-SA is taking a leading role in securing critical infrastructure by providing a neutral platform for the public and private sectors and academia to develop relevant standards," says Edward Rashba, manager for new technical programs at IEEE-SA.

IEEE-SA also serves as the secretariat, or the administrative umbrella, for other accredited standards organizations that are developing standards on radiation detection devices and instrumentation for homeland security.

The IEEE also aids homeland security technology through its position on the interim steering committee of the American National Standards Institute's Homeland Security Standards Panel. The panel is comprised of approximately 10 standards-developing organizations that coordinate the accelerated identification and development of standards to enhance technology that can prevent the occurrence, and mitigate the impact of terrorist attacks. In addition, the IEEE has been working with the new Department of Homeland Security to determine what standards the department requires.

IEEE-SA will host a workshop later this year that will look at security gaps in information technology and telecommunications and brainstorm how to fill in those gaps. ●

For More Information

IEEE Publications
http://www.ieee.org/products/periodicals.html
IEEE-USA Research and Development Committee
http://www.ieeeusa.org/committees/RDC
IEEE Conferences
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IEEE Standards Activities
http://standards.ieee.org

[**MEMBER PROFILE** *from page 1*]

He says he can apply systems dynamics processes to human problems because of two universal laws: Newton's first law of thermodynamics says that for every action, there is an equal and opposite reaction; and the Bible teaches that as you sow, so shall you reap. Still, Aggarwal says just because he can create a complete model to explain September 11 doesn't mean it needs to be done.

"To make a complete systems dynamics model for the terrorist attacks, I would have to cover the walls of a huge room, but then it will become incomprehensible for the average person," Aggarwal says. Instead, he uses partial models to examine individual aspects of events that led up to the tragedy so that, as he puts it, even a 12-year-old could understand.

Problem solving

September 11 changed Aggarwal's life. Before then, he was a software consultant at IBM Corp. in Raleigh, N.C., USA.

"On that day I felt that all my education, research, and experience was no good if I was unable to apply it to solving problems of the world," Aggarwal says.

He left IBM to devote his time, he says, "to creating a peaceful world."

"As an engineer, I have solved problems for much of my life," he explains. "When there is a system failure, we go back and trace it to a network fault or to an overload, crash or congestion." Aggarwal learned problem-solving techniques while studying systems management at Punjab Engineering College in Chandigarh and at the Indian Institute of Technology-Delhi, both in India. He holds a bachelor's in electronics and electrical communications engineering, a master's in systems management, and a Ph.D. in information technology.

"We cannot fix the terrorism problem by merely tightening security at airports and being more vigilant," he says. "Instead, we must deal with the core reasons making people embrace such violence."

Aggarwal is no stranger to violent conflicts over ideology. A Hindu, he hails from Kashmir in northern India, a hotly disputed area that borders Pakistan. He lived through two wars there between India and Pakistan and watched fighter jets dogfighting from the roof of his house. Although the conflict continues in his homeland, Aggarwal says that "living under those circumstances teaches you two things: compassion and an ability to struggle and survive and yet still grow."

The IEEE as a role model

The problem of terrorism is vast and complex, but a model for one solution—creating a worldwide futuristic, interdependent, and united society, one based on connecting and cooperating—is closer to home. For a role model, look no further than the IEEE, Aggarwal says.

"I have always considered the IEEE a family of technical professionals from all over the world committed to making the world a better place through their technical and scientific contributions," he says. "What's more, the IEEE builds interdependence by making less privileged countries more independent through education."

Aggarwal cites the IEEE Distinguished Lecturer program as an example of how the IEEE benefits the world at large. IEEE Societies select members, such as Aggarwal, to travel to Section or Chapter meetings in cities, regions, or countries throughout the world to lecture on their area of expertise. Often the Society pays for the lecturer's travel expenses.

"Those who do not have access to Distinguished Lecturers are being deprived of knowledge and technology. The IEEE is a role model in the sense that it provides those opportunities," Aggarwal says.

Governments, political organizations, and other professional societies can look to the IEEE as a role model because it is an international entity that focuses on cooperation rather than competition, he notes.

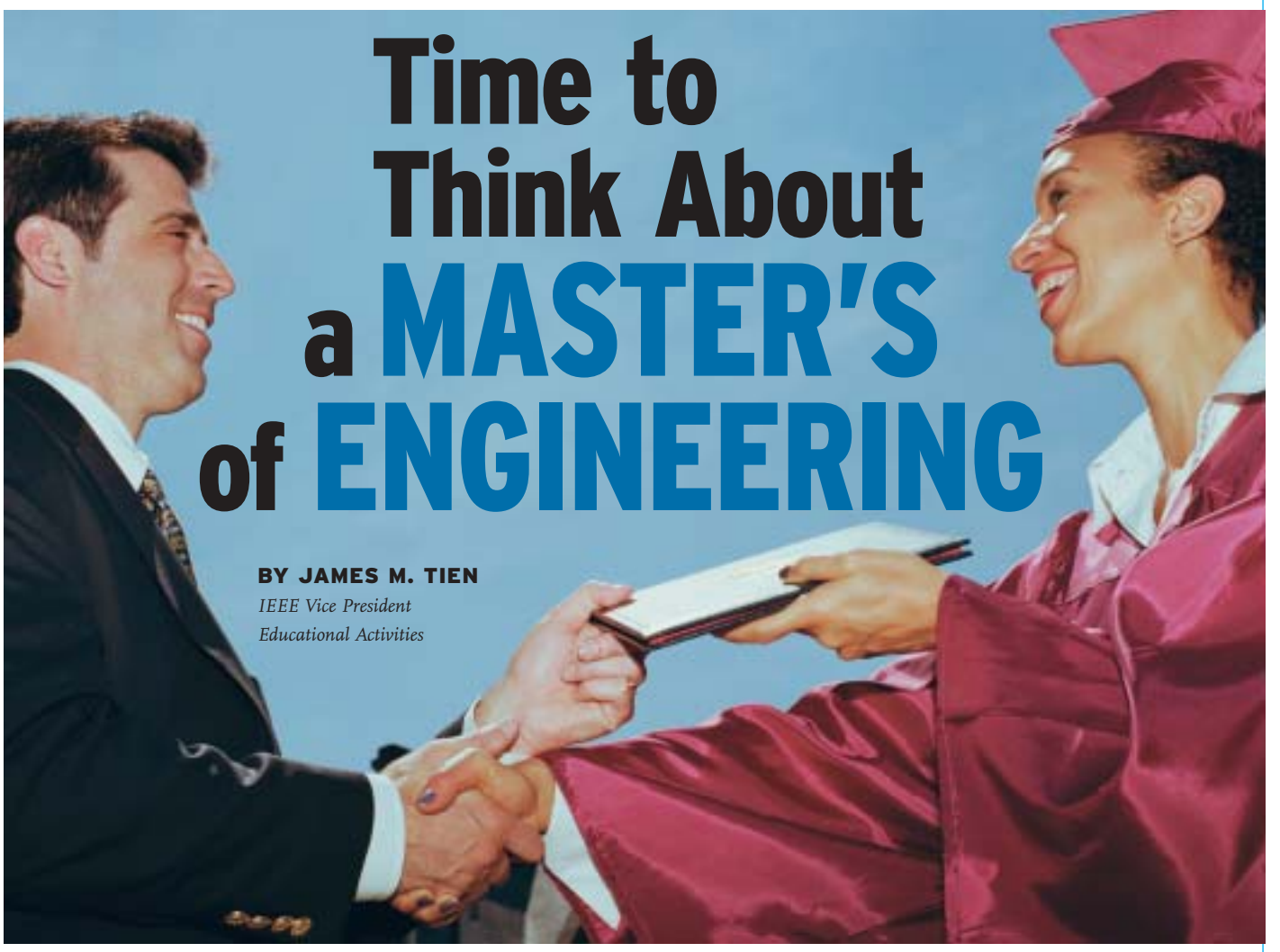
In addition to writing *September 11: A Wake Up Call*, he and some engineering colleagues also established the Society for Universal Oneness in Chapel Hill, N.C., USA, a nonprofit organization whose goal is to educate people about how technology can be used to create peace.

Aggarwal's next book, *Technology for Peace: A Vision of the Future*, grew out of his work with IEEE-USA. Due out early next year, the book, based on ideas he and others in an IEEE-USA working group on the future of technology developed, will examine how a dialogue for peace can be created by using technology.

"The objective of our technologies should not be to kill, but to save lives," Aggarwal says. "Engineers and scientists should research weapons that do away with the need to fight and kill." For example, he suggests creating electronic or chemical weapons that create an immediate laughing spell, forcing enemy soldiers to surrender.

"The objective of creating peace by an effective use of technology has to be morally owned by each one of us, the engineers of the world, the members of the IEEE," he says.

Visit www.firstbooks.com/bookview/12572 to order a copy of *September 11: A Wake Up Call* or go to www.sfuo.org for more information on the Society for Universal Oneness. Aggarwal can be reached at abhinav@sfuo.org. ●



Time to Think About a MASTER'S of ENGINEERING

BY JAMES M. TIEN
IEEE Vice President
Educational Activities

As engineers, we are in the business of designing new and better ways to solve problems. That same thoughtfulness and determination should be applied to moving engineering education to a level on a par with doctors and lawyers. I believe this can be accomplished with a master's of engineering degree—perhaps built on a two-year/three-year framework—that can help ensure that future engineers will have a better technical grounding as well as a more professional status.

Long before nanotechnology, computational cybernetics or space flight, there was a call to reform engineering education. It was made by C.R. Mann in a 1918 article he wrote for the Carnegie Foundation for the Advancement of Teaching. In it he urged that language, economics, and social science subjects be added to an already overcrowded curriculum.

Even though industry persistently calls for engineers to have more communication and management skills, a solid knowledge base, and a practical design approach, universities are still trying to cram all that content into only four years. There wasn't enough time to cover these in the 20th century, and four years certainly won't be enough time in the 21st.

I propose restructuring the U.S. undergraduate and graduate degrees into a professionally oriented program based on a five-year European model such as the Diplomingeniur program in Germany, which includes writing a master thesis similar to that required by the current U.S. master's of business administration degree. IEEE Fellow Adolf J. Schwab of the University Karlsruhe in Germany noted that his university had tried the separate bachelor's and master's degree model, but believes "that the classical five-year program is superior."

We must also address the dual stresses created by the U.S. education system on poorly prepared students and rising tuition costs. The lack of pre-college preparation leads to a shocking drop-off in potential engineers. Less than one-half of students who enroll as science and engineering majors complete a degree within five years, according to the U.S. National Science Board.

One solution is to split the five years into a two-year preparatory or associate's degree followed by a professional three-year study leading to a master's—rather than a bachelor's—degree as the first professional degree. This change would create a paraprofessional, two-year degree for those who want to stop there and become technicians.

Although the first two years of study could be done at a traditional university, it would be more cost effective if students took these classes at a community or junior college, saving them anywhere from US$1000 to US$10 000 a year.

The two-year, pre-engineering undergraduate curriculum would emphasize the fundamentals of engineering, such as math, physics, and computing. Teachers at community colleges could pay closer attention to students and assign them remedial work, if necessary.

The reduced tuition and frustration may lead to more students transferring to a university. Transferring engineering students—who are usually more focused and mature—have higher retention and graduation rates than other students.

The ensuing three years would allow students to take discipline-specific courses, conduct hands-on experiments, explore growing cross-disciplinary fields, work with mentors, practice management skills, and carry out team-based projects.

The distinction between technicians and engineering professionals would help properly define an engineer's role and gain greater esteem for the profession in the public's eye.

Stakeholders' challenges

The three main groups that share the responsibility for evolving engineering education—universities and their students, industry, and professional associations—face many challenges.

The effort it would take for universities to change how they've taught engineers for the last century cannot be minimized. Universities and accrediting bodies would have to establish new evaluation procedures. Students would face a mandatory extra year of studies at a time when only the most ambitious and focused graduate on schedule in a four-year program. Although educators face a difficult transition, the need for well-educated engineers is imperative.

Companies cannot afford to hire employees who lack proper education, and engineering graduates with bachelor's degrees may still have a lot to learn. In the past, industry often subsidized advanced degrees, and older employees turned novices into engineers through mentoring. But the weak economy and accelerated pace of technology have caused many companies to streamline their operations.

"Industry is no longer willing to take on the role of being an engineering finishing school," according to a report by Terry S. King, dean of engineering at Kansas State University in Manhattan, USA.

Industry may balk at the higher salaries that more advanced professionals command, but the need for more thorough schooling before beginning an engineering career has undeniable benefits.

Getting to work

Professional associations traditionally have been the guardians of their members' educational requirements and program accreditation. Therefore any change in educational criteria would have to be mandated by these groups, such as the IEEE, the American Society of Mechanical Engineers, and others. Just as the American Medical Association and American Bar Association took the lead in changing the parameters of undergraduate and graduate curricula for their professions, engineering associations will have to do the same.

Responsibility for accreditation is complicated by the profusion of engineering disciplines, each represented by a different learned society. We need a coalition that would work for the 10 to 20 years it may take to change the individual engineering disciplines.

Much work has already been done. Engineering professional societies have brainstormed ideas, industry and government organizations have issued papers, and conferences have been convened. Already, groups such as the Industry University Government Roundtable for Engineering Education, the National Science Foundation, the National Academy of Engineering, the Engineering Deans Council, and the Corporate Roundtable of the American Society of Engineering Education have been working on updating and enhancing engineering education. ●

Leadership Makes the Difference

THE IEEE AND THE IEEE FOUNDATION thank the following individuals, families, foundations, corporations, and IEEE units that provided the foundation with philanthropic support during 2002. These contributions helped support programs to advance technical education and to promote the beneficial use of technology.

Not all donors are listed because of space constraints. But every gift is crucial to the development and expansion of new programs, and the IEEE Foundation would not be able to grow without the contributions of so many.

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The White family in the 1960s

Father's Memory Honored with Radar Award

BY KATHY KOWALENKO

Dana Star remembers her father, Warren D. White, as a quiet, careful, shy man who loved his family. But the engineering world will remember White, an IEEE Life Fellow, for the Warren D. White Award for Excellence in Radar Engineering that Star and her brother established to honor excellence in radar engineering.

White, a radar engineer who worked on classified projects for Airborne Instruments Laboratory in Mineola, N.Y., USA, wrote numerous technical papers on radar and held several patents.

According to Star's husband, Michael, White pondered solutions to everyday problems like traffic jams. Rather than getting upset about being stuck on the Long Island Expressway, he wrote a paper using a mathematical formula to explain why traffic jams happen.

White also spent much time thinking about his family. He donated funds to memorialize loved ones by among other things establishing a scholarship in honor of his father, and creating a park bench in his wife's name.

When White died in 1998, Star searched for the perfect tribute to her father's achievements.

"My brother Warren and I decided that because our father made all those donations for others, we felt that he would have wanted us to do something for him," Star says, "although when we asked our father for some ideas before he died, he never had anything specific in mind."

The siblings first considered a scholarship at the university where their father received his degree, the University of Missouri School of Mines and Metallurgy in Rolla, USA, but then decided against it because he used to say that, "scholarships were always given to students who had to show financial need," Star says. "My father felt that a student who did really good work should also get some kind of reward as well."

Star looked to the IEEE after she recalled that her father attended IEEE conferences to upgrade his skills and learn about the latest research in radar to spark ideas for new projects.

She fondly remembers when White was elevated to an IEEE Fellow.

"My father was tremendously flattered by that recognition," she says.

Because neither Star nor her brother are engineers, they weren't familiar with the IEEE. Dana is a teacher in Montreal, Canada, who works with students with visual impairments, and Warren, an air pollution expert, works at the University of California at Davis, USA. The pair asked their father's former co-workers about the organization and learned that the IEEE could help their family fund an appropriate recognition.

"The Foundation staff talked to us about our purpose, what we wanted to do, and what our father's preference would have been," Star notes.

The IEEE Foundation helped establish the Warren D. White Memorial Fund that supports the annual award presented by the IEEE Aerospace and Electronic Systems Society. This US$2000 honorarium and a commemorative plaque recognize outstanding achievements for a major technical advance, or a series of advances over time, in the art of radar engineering.

"My brother and I felt the award would have been something both our parents would have been very pleased with," Star says. "We really feel we did a good thing; it was a very satisfying experience."

The first award was presented to Marshall Greenspan in May 2000 at the IEEE International Radar Conference held in Washington, D.C.

White's children attended the ceremony and met their father's friends who had come especially for the award's first presentation.

"At the ceremony, my father's colleagues shared their memories of him," Star says. "I learned that my father was genuinely well respected as an engineer and as a person who was willing to sit with other engineers, listen, and help figure things out." ●

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PASSINGS

Barry Allen Bell, Former Washington Section Chair

BY NORMAN BELECKI
IEEE Fellow

I met Barry by accident during a trip to Leeds & Northrup, the instrumentation company, north of Philadelphia, Pa., USA, in the early '70s. Microprocessors were just then coming on the market and Barry was designing instrumentation that incorporated them.

My boss and I were struck by Barry's work and the broad and long-term views he held about electronics as applied to instrumentation in general. We thought that he would be an ideal person to transform the Electrical Instruments Group at the National Bureau of Standards into a viable source of measurement standards and technology. He soon joined the bureau and, under his direction, the group developed phase standards, data converter calibration systems, ultra-high-speed sampling voltmeters, and electronic bridges for impedance measurements.

Barry took a great deal of ribbing about his lengthy group meetings and the level of detail he would go into on a subject, but his people realized that, as boring as these meetings might be, they always knew what was going on. Throughout his career, he was an exceptionally nurturing supervisor, and set a good balance between providing technical guidance and encouraging people to do their own thing.

Finally, if something had to be done, no matter how onerous it was, Barry would volunteer to do it. At the end of his career, he was promoted to deputy division chief, something he had looked forward to because it meant giving up routine administrative responsibilities and myriad other chores that comprise too much of line supervisors' work. Not long afterward, Barry was asked to resume his old job temporarily, but for a larger group. He willingly complied because the job needed to be done. When there was a conflict, Barry always put his team's needs ahead of his personal desires. ●

BARRY ALLEN BELL, 65

DIED: 13 March 2003

MEMBER GRADE: Life Fellow

EDUCATION: Stanford University in California, USA, and Yale University in New Haven, Conn., USA

FIELD OF INTEREST: Electronics standards

CAREER MILESTONES: Bell worked at Leeds & Northrup before joining the National Bureau of Standards, now the National Institute of Standards and Technology (NIST) in Gaithersburg, Md., USA. There, he was leader of the Electronic Instrumentation and Metrology Group for 25 years, and became deputy director of the Electricity Division in 2001. He served as a NIST post-doctoral advisor since 1993.

IEEE VOLUNTEER ACTIVITIES: Washington Section Chair, 1993 to 1994; Instrumentation and Measurement Society Technical Committee Chair, 1976 to 2003.

AWARDS: U.S. Department of Commerce Silver Medal in 1981 for developing the technical basis of a measurements program to support modern electronics systems and instrumentation.

MEMBER RECOGNITIONS

Microwave Pioneer Receives Award

BY KATHY KOWALENKO

The next time you relax while listening to a favorite CD or use a phone that lights up in the dark, think of IEEE Fellow **BERNARD DELOACH JR.** Not only did he find a way to extend the life of lasers for use in such products as CD players, but he also invented a process to incorporate visible light-emitting diodes into telephones. He was a key figure behind the millimeter wave communication system for high-frequency applications.

To recognize these and other technical contributions he made in the fields of microwaves and optics, DeLoach received the Eta Kappa Nu Vladimir Karapetoff Award on 28 April. This annual award is given to an electrical engineering practitioner who has distinguished himself or herself through an invention, development, or discovery in electrotechnology. Eta Kappa Nu is a U.S. electrical and computer engineering honor society.

DeLoach spent nearly his entire 33-year career with AT&T Bell Laboratories in Murray Hill, N.J., USA, where he retired in 1989. His work on microwave sources in the mid-1960s culminated in the discovery of the impact avalanche and transit time device, known as an IMPATT diode. This diode efficiently generates micro- and millimeter waves above the frequency ranges at which transistors normally operate when a battery is placed across it. This discovery ultimately led to AT&T's deployment of millimeter-wave communication systems in its copper telephone cables. But the IMPATT diode never achieved its place in the sun, according to DeLoach.

"IMPATT's unique place in history was bypassed by political decisions that allowed MCI's microwave routes to parallel AT&T's heavy-duty routes," he explains. "The growth of the AT&T systems turned negative instead of positive, and we didn't need a heavy-duty cable system."

Today, IMPATT devices are used in missiles and other high-frequency power applications.

DeLoach next turned his attention to researching how to create a laser chip that lasted long enough to make a fiber-optics communication system possible.

"The world record for laser life in 1973 was 30 minutes," DeLoach says. "When we finished, the average time to failure was 1000 years." Besides enabling AT&T to get into the fiber-optics business, lasers with that sort of lifetime are today used in products like CD players.

DeLoach also is credited with inventing a process to incorporate visible light-emitting diodes into AT&T's home Trimline telephones to illuminate the keypad. He holds 18 patents.

During his career, DeLoach also received the IEEE David Sarnoff Medal in 1975 and the IEEE Medal of Engineering Excellence in 1993 for the first development of highly reliable semiconductor lasers. He's written numerous papers for IEEE publications.

DeLoach is a professor with the department of electrical engineering at the University of Central Florida in Orlando, USA, where he researches microwave technology. ●

For Computer Processing Architecture

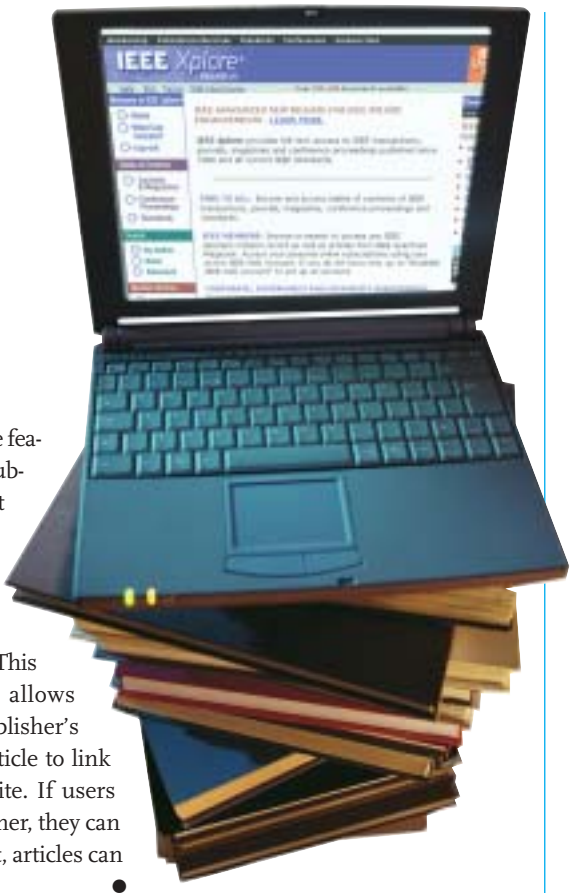
IEEE Member **MIKKO HERMAN LIPASTI** was also honored by Eta Kappa Nu with its Outstanding Young Electrical Engineer Award for his contributions to computer processing architecture. The award is presented annually to computer or electrical engineers under the age of 35 who have made outstanding professional achievements and have been active in service to their community.

Lipasti is an assistant professor of electrical and computer engineering at the University of Wisconsin-Madison, USA. He co-authored a textbook on computer architecture and wrote a groundbreaking paper on value locality and value prediction. Value prediction ensures that a programming instruction will load the same value that it did the previous time it executed.

Before joining the university, Lipasti worked for IBM Corp. in software, advanced processors, system performance analysis, and design guidance, as well as in kernel implementation of operating systems. A kernel is a software module that encapsulates an elementary function of a system.

Finding Research Papers Faster and with Ease

BY KATHY KOWALENKO



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