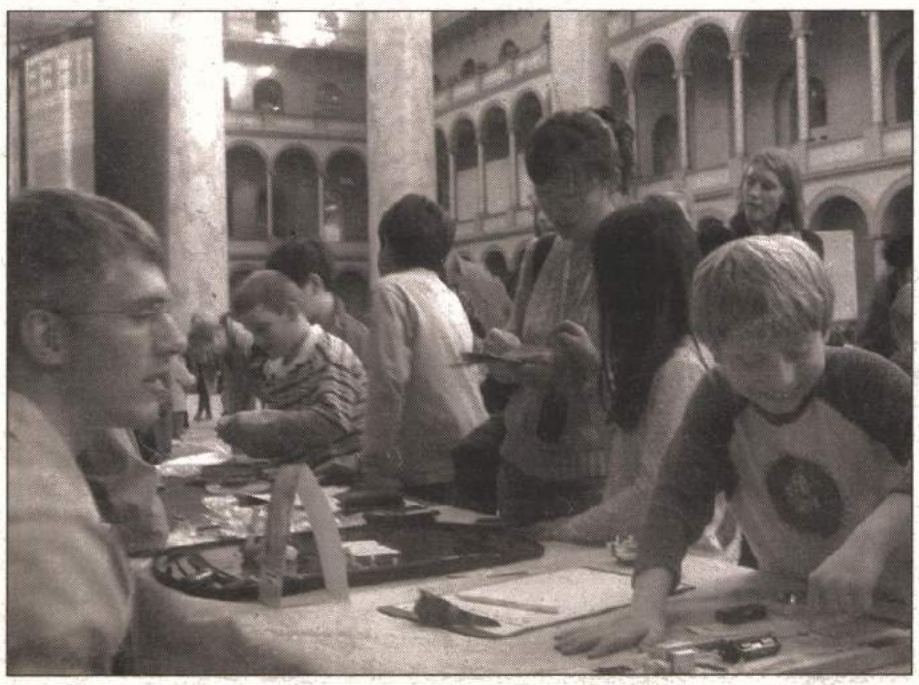
IEEE

The IEEE NATIONAL CAPITAL AREA

# SCANNER

A JOINT PUBLICATION OF THE NORTHERN VIRGINIA AND WASHINGTON SECTIONS

May–June 2006 Volume 21, No. 3



***Engineers Week***—*At the Discover Engineering Family Day in February, an adventurous young man receives his "free shock" at the IEEE-USA booth as GOLD Chair Kerry Hartman (left) observes. The event was held at the National Building Museum in Washington and featured a variety of hands-on activities to introduce children to engineering fields. (Photo by Monica A. Mallini)*

## IEEE Spring Career Festival Offers Something for Everyone

**By Monica A. Mallini**

There are as many different ways to drum up consulting business as there are consultants, just as there are a number of types of formal relationships possible between the consultant and the client. Many people find business development to be one of the least enjoyable, but of course most important, parts of their practice.

Brainstorming for Business (or "How I learned to stop worrying and go out and get some work!") will be the subject of an interactive session lead by Lisa King at the IEEE Spring Career Festival on Saturday, June 3.

Other activities will include Senior Member upgrade applications completed online with the assistance of volunteers, networking opportunities, door prizes, lunch and refreshments.

The Spring Career Festival will be held at Virginia Tech Advanced Research Institute in Arlington from 11:00 a.m. to 2:00 p.m., and is free for IEEE members or $10 for guests. For directions, see the Calendar, p. 3.

Sponsors include the National Capital Area Consultants' Network, Women in Engineering, the Power Engineering Society, the Industry Applications Society, and IEEE-USA.

Individuals who should attend include IEEE members who want to upgrade to Senior Member, engineers at career crossroads, and students. Anyone, including students, who wants to join IEEE at this event will get free admission.

Members who want to advance to the Senior Member level should bring their resume or credentials, and volunteers will walk them through the online application process. Senior Members and Fellows will be available to review credentials and provide references.

IEEE-USA and the Consultants' Network will host information booths to help engineers navigate those early career, mid-career, and late career rough spots. Students can learn about IEEE employment assistance, dues reductions and the IEEE affinity group for new graduates, and how to become involved in IEEE leadership before graduation.

Lisa King, manager of technical and creative staffing for Randstad, will provide a briefing on a Thomas Friedman style "world flattener," describing the staffing world, how it works and where it's going. She will show how outsourcing is not only an international but also a local phenomenon that is often surprisingly good for both employees and employers. She will provide examples of ways in which outsourcing is changing the employment landscape, and will discuss the evolving technology employment picture in the Washington area.

She then will lead a brainstorming session to identify and capture current best practices, little-known techniques, tricks, tips, and perhaps ideas that are way outside the box of normal thinking. Attendees will participate in distilling the ideas and capturing the best for distribution after the meeting.

## BP Solar Facility Tour Provides Photovoltaics Primer

**By Monica A. Mallini**

On a beautiful sunny Friday in November, the Washington Chapter of the IEEE Nuclear and Plasma Sciences Society hosted a tour of the BP Solar plant in Frederick, Maryland. The weather provided a fitting backdrop for the visit, which was led by Chapter Chair Harry Sauberman and attended by 28 IEEE members.

BP Solar hosts Bill Poulin and Jean Posbic displayed an impressive knowledge of technical, economic, and policy issues surrounding the solar energy industry. The presentation, titled "Everything you wanted to know about Solar Photovoltaics but were afraid to ask," was true to its name.

Why is BP, one of the world's largest oil and petrochemicals companies, interested in solar energy? The reason is that oil companies are looking ahead, anticipating the decline of the finite fossil fuel supply. Solar and other forms of renewable energy are "the next thing." Moreover, solar energy is attractive because the photovoltaic (PV) technology that enables it is simple, and its products are reliable. After a payback period, the electrical energy delivered by a PV system is free. For these reasons, there is a rapidly growing worldwide demand for solar and hybrid solar systems.

Most of our energy supply in the United States is derived from coal. Is solar energy a viable alternative? Conceptually, it is, with current technology. A PV array field 300 miles square could supply all the electrical energy currently used in the U.S. This hypothetical array demonstrates the capability of solar energy; however, an enormous central plant is not the correct way to satisfy a nation's energy demand. The real advantage of solar energy is its modularity, which suggests distributed applications.

Mr. Posbic gave an instructive primer on PV. Each individual solar cell produces 5 amps of direct current at 0.475 volts. By combining cells, a large range of current and voltage combinations can be obtained, to power virtually anything that uses electrical energy. In practice, individual cells are combined in series to achieve the voltage required to drive an inverter. A solar module typically consists of 72 cells, producing 120 to 180 watts of power in full sunshine. The manufacture of solar modules requires as much electricity—for all phases from production to disposal—as the module will produce in two years or less.

The plant tour highlighted key stages of the module production process. One may be surprised to learn that solar cells can be manufactured from only "5 nines" grade silicon, much cruder than the "9 nines" grade needed by the semiconductor industry. In the refining process, large silicon ingots are cast. Impurities float to the top and are simply machined away before the ingot is cut into blocks. The silicon blocks are sliced into polycrystalline wafers of p-doped silicon, 220 microns thick, with a 1-micron layer of phosphorous, forming an n-over-p junction. When photons strike the surface of the wafer, electrons travel to the back, developing a potential of 0.475 volts between front and back.

One limitation of silicon as a material for solar cells is its cutoff wavelength of 1100 nm, the maximum useful photon wavelength. Because 30 percent of the solar spectrum is above 1100 nm,

**BP SOLAR FACILITY TOUR**
*continues on page 8*

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## Editorial Policies and Procedures

### Calendar Items and Announcements

Please submit calendar items in the format used in the Calendar of Events. You can send email to ncac-scanner@ieee.org. If possible, include a synopsis of the event and a biographical sketch of the presenter including academic background, current position, notable achievements, and IEEE and other professional affiliations.

Other contributions, such as reports on chapter events and other member activities, reviews of books by or of interest to members, are most welcome. Please submit them to the managing editor, electronically if possible, at ncac-scanner@ieee.org.

## On the Web

### eSCANNER Calendar of Events

The calendar is available at **www.ieee.org/escanner**. Check here for events submitted too late for print publication.

### IEEE National Capital Area Virtual Community

Exchange ideas and participate in discussions with local IEEE members at **www.ieeecommunities.org/nca**.

### Advertising

Contact the advertising manager about ad rates and to place advertising orders. Ads must be submitted by the deadline below.

### Deadlines

The editor reserves the right to set policies and procedures necessary to provide members with a newsletter that is informative and timely. Deadlines must be strictly adhered to to keep the publication on schedule. If you are planning an event and have insufficient information by the deadline, please contact the managing editor.

The deadline for the upcoming issue will always be published on this page.

***The deadline for the July–August issue is June 1, 2006***

IEEE National Capital Area SCANNER is published bimonthly by The Institute of Electrical and Electronics Engineers, Inc. Corporate Office: 3 Park Avenue, 17th Floor, New York, NY 10016-5997. It is sent automatically at a cost of $1.00 per member per year (included in annual dues) to each member of the Washington and Northern Virginia Sections. Periodicals postage paid at New York, NY, and at additional mailing offices. Postmaster: Send address changes to IEEE National Capital Area SCANNER, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. (ISSN 0894-0452)

# CALENDAR OF *events*

## Tuesday, May 2, 2006
### Washington Section Administrative Committee Meeting

**Time:** Dinner at 6:00 pm; meeting at 6:30 pm
**Place:** Allie's American Grill, Bethesda Marriott, 5151 Pooks Hill Rd., Bethesda, MD
**Directions:** From the north, take 270 South to Route 355 and exit at Wisconsin Ave. From the south, take 495 exit 34 (Wisconsin Ave.) to Pooks Hill Rd.
**More Info:** All interested IEEE members are welcome to attend.
**Contact:** Debra Meale at 703-492-0047 or nca-admin@ieee.org. Please include the term IEEE in the subject line of your email.

## Tuesday, May 2, 2006
### ◆ Virginia Procurement Technology Assistance Program

**Sponsor:** National Capital Area Consultants' Network
**Speaker:** Bill Hamilton, Consultant
**Time:** Dinner at 6:00 pm; speaker at 7:00 pm
**Place:** Corner 7 Cafe, Tysons Corner Marriott, 8028 Leesburg Pike, Vienna, VA
**Directions:** From the east or I-495, take Route 7 West, turn right on Towers Crescent Drive, then immediately right into the Marriott parking lot. From the west on Route 7, turn right onto Old Gallows Road just opposite the Marriott, proceed around to the left until you have completed almost a full circle, and turn left into the Marriott parking lot. Free parking.
**More Info:** See Diamond story, p. 4.
**Cost:** Attendees are responsible their individual orders.
**Contact:** Rick Cunningham at rick@corridor-rd.com.

## Wednesday, May 10, 2006
### Northern Virginia Section Administrative Committee Meeting

**Time:** 6:30 pm
**Place:** Wickers Cafe, Tysons Corner Holiday Inn, 1960 Chain Bridge Road, McLean, VA
**Directions:** From I-495 or I-66, take Route 267 West. Exit at Route 123 West (Chain Bridge Road). Turn right on International Drive, then left on Greensboro Drive. Look for the Holiday Inn entrance on the left. Free parking.
**More Info:** All interested IEEE members are invited to attend.
**Contact:** Debra Meale at 703-492-0047 or nca-admin@ieee.org. Please include the term IEEE in the subject line of your email.

## Tuesday, May 16, 2006
### ◆ Multichannel Biomedical Imaging for Cancer Detection

**Sponsor:** Engineering in Medicine and Biology Society
**Cosponsors:** Nuclear and Plasma Sciences Society, Computer Society, Power Engineering Society, Geoscience and Remote Sensing Society, Aerospace and Electronic Systems Society, Consultants' Network, Women in Engineering, George Washington University Student Branch
**Speaker:** Dr. (Joseph) Yue Wang, Virginia Tech Advanced Research Institute
**Time:** 6:00-8:00 pm
**Place:** Virginia Tech Advanced Research Institute, 4300 Wilson Blvd., Suite 750, Arlington, VA
**Directions:** From Ballston Metro Station (Orange line), turn right at top of escalator then left on the street. Proceed two blocks toward Hecht's. Turn right and walk one block to Ballston Point at the intersection of Wilson Blvd. and Glebe Rd. ARI is on the 7th floor. See www.ari.vt.edu/ari_directions.htm.
**More Info:** Light refreshments will be provided. For more information, see Diamond story, p. 4.
**Contact:** Please RSVP by May 14 to Debi Siering at siering@ieee.org or 703-633-3155 ext. 9095.

## Wednesday, May 17, 2006
### ◆ New Age Fiber Crystals

**Sponsor:** Lasers and Electro-optics Society
**Speaker:** Philip Russell, Max-Planck Research Group, Institute for Optics, Information & Photonics, University of Erlangen-Nuremberg, Germany
**Time:** Light refreshments and socializing at 6:00 pm, lecture at 6:30 pm, optional dinner following lecture with the speaker at nearby restaurant
**Place:** University of Maryland, A. V. Williams Building, Room 2460, College Park, MD
**Directions:** From the north or I-495, take Route 1 South. Approx. 2 miles south of the Beltway, turn right onto Campus Drive, then immediately take Paint Branch Drive and the A.V. Williams Building will be on the right. From the south on Route 1, turn left onto Campus Drive, and follow above directions. Ample parking is available after 4:00 pm. See www.parking.umd.edu/themap.
**More Info:** See Diamond story, p. 4. This is a LEOS Distinguished Speaker Seminar.
**Contact:** Dominique Dagenais at 301-951-7095 or dominique_dagenais@avanex.com, or Lucy Zheng at 703-578-2721 or lzheng@ida.org.

## Thursday, May 18, 2006
### ◆ Electromagnetic Pulse—Transient/Surge Suppression Mitigation Techniques

**Sponsors:** Power Engineering Society, Industry Applications Society
**Speaker:** Roland Oliveira, Transtector Systems, Inc.
**Time:** Refreshments at 6:00 pm, speaker at 6:30 pm
**Place:** KEMA Consulting, 4400 Fair Lakes Court, Fairfax, VA
**Directions:** From I-66, take the Fairfax County Parkway North exit. Turn right onto Fair Lakes Parkway at the first light, then left onto Fair Lakes Court at the first light. KEMA is in the first building on the left (AFCEA).
**More Info:** See Diamond story, p. 5.
**Cost:** Free for IEEE members; $10 for guests.
**Contact:** RSVP to Monica Mallini at 703-387-6021 or m.a.mallini@ieee.org.

## Saturday, June 3, 2006
### IEEE Spring Career Festival

**Sponsors:** National Capital Area Consultants' Network, Women in Engineering, Power Engineering Society, Industry Applications Society, IEEE-USA
**Speaker:** Lisa King, Manager of Creative and Technical Staffing, Ranstad
**Time:** 11:00 am to 2:00 pm
**Place:** Virginia Tech Advanced Research Institute, 4300 Wilson Blvd., Suite 750, Arlington, VA
**Directions:** From Ballston Metro Station (Orange line), turn right at top of escalator then left on the street. Proceed two blocks toward Hecht's. Turn right and walk one block to Ballston Point at the intersection of Wilson Blvd. and Glebe Rd. ARI is on the 7th floor. If driving, enter the parking garage from the small lot shared with Hecht's. Weekend parking is $1 for the first 3 hours. Limited street parking is available. See www.ari.vt.edu/ari_directions.htm.
**More Info:** See story on p. 1.
**Cost:** Free for IEEE members; $10 for guests.
**Contact:** Monica Mallini at 703-387-6021 or m.a.mallini@ieee.org.

## Tuesday, June 6, 2006
### ◆ EMC Expo 2006 Colloquium and Exposition

**Sponsor:** Electromagnetic Compatibility Society (Annapolis, Baltimore, Washington, Northern Virginia and Southern Maryland chapters)
**Speakers:** Dr. Bruce Archambeault, IBM; Andrew Drozd, ANDRO Computational Solutions; Edward Hare, American Radio Relay League; Dr. Eric Mokole, Naval Research Laboratory
**Time:** 8:00 am to 5:00 pm, reception 5:00 pm to 8:00 pm
**Place:** Waldorf Holiday Inn, 45 St. Patrick's Drive, Waldorf, MD
**Directions:** Take I-95 to Maryland Exit 7A Route 5 South. Drive south to Waldorf and merge with Route 301 South. Turn right on St. Patrick's Drive (before St. Charles Mall).
**More Info:** This is a practical colloquium with two tracks to satisfy the broad interest range of members in our area, plus an industry table top display of EMC components, products, services and equipment. The presentations are designed to improve your efficiency as an engineer, product designer or technical manager, and

**CALENDAR**
*continues on page 4*

## CALENDAR

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include troubleshooting tips and strategies from the experts. For details about the tracks and speakers, see Diamond story, p. 5.

**Cost:** IEEE Members: $125 postmark before May 1; $175 postmark May 1-15; $225 postmark after May 15 or at door. Non-members: $50 additional. Full-time students: $75 postmark by May 15, with copy of valid Student ID. Unemployed or retired attendees: 50 percent discount off IEEE Member fees. Please make checks payable to Washington Laboratories, Ltd. and mail to EMC Expo, c/o Washington Labs, 7560 Lindbergh Drive, Gaithersburg, MD 20879. An online registration form is available at www.wll.com/Jun6seminar.shtml. Fees include refreshments, lunch, reception and speaker notes.

**Contact:** Fred Heather, EMC Expo Chair, at 301-342-6975 or heatherf@ieee.org.

### Tuesday, June 6, 2006

### Washington Section Administrative Committee Meeting

**Time:** Dinner at 6:00 pm; meeting at 6:30 pm

**Place:** Allie's American Grill, Bethesda Marriott, 5151 Pooks Hill Rd., Bethesda, MD

**Directions:** From the north, take 270 South to Route 355 and exit at Wisconsin Ave. From the south, take 495 exit 34 (Wisconsin Ave.) to Pooks Hill Rd.

**More Info:** All interested IEEE members are welcome to attend.

**Contact:** Debra Meale at 703-492-0047 or nca-admin@ieee.org. Please include the term IEEE in the subject line of your email.

### Wednesday, June 14, 2006

### Northern Virginia Section Administrative Committee Meeting

**Time:** 6:30 pm

**Place:** Wickers Cafe, Tysons Corner Holiday Inn, 1960 Chain Bridge Road, McLean, VA

**Directions:** From I-495 or I-66, take Route 267 West. Exit at Route 123 West (Chain Bridge Road). Turn right on International Drive, then left on Greensboro Drive. Look for the Holiday Inn entrance on the left. Free parking.

**More Info:** All interested IEEE members are invited to attend.

**Contact:** Debra Meale at 703-492-0047 or nca-admin@ieee.org. Please include the term IEEE in the subject line of your email.

### Thursday, June 15, 2006

### ◆ Optimal Industrial Safety Using Infrared Thermography

**Sponsors:** Power Engineering Society, Industry Applications Society

**Speaker:** Erica Wolfkill, FLIR Systems

**Time:** Refreshments at 6:00 pm, speaker at 6:30 pm

**Place:** Virginia Tech Advanced Research Institute, 4300 Wilson Blvd., Arlington, VA

**Directions:** From Ballston Metro Station (Orange line), turn right at top of escalator then left on the street. Proceed two blocks toward Hecht's. Turn right and walk one block to Ballston Point at the intersection of Wilson Blvd. and Glebe Rd. ARI is on the 7th floor. See www.ari.vt.edu/ari_directions.htm.

**More Info:** See Diamond story, p. 5.

**Cost:** Free for IEEE members; $10 for guests.

**Contact:** RSVP to Monica Mallini at 703-387-6021 or m.a.mallini@ieee.org.

# ◆◆ DIAMOND STORIES ◆◆

### Tuesday, May 2, 2006

### Virginia Procurement Technology Assistance Program

The Virginia Procurement Technical Assistance Program (PTAP) is a not-for-profit organization funded by the Defense Logistics Agency and George Mason University, intended to increase contracting activity between small businesses, prime government contractors and the government.

PTAP's mission is:

- to generate employment and improve the general economy of a locality by assisting business firms in obtaining and performing under DoD, other federal agencies, and state and local government contracts;
- to expand the industrial base of the DoD and other federal agencies;
- to provide a link between the federal government, major prime contractors, and small businesses;
- to provide technical assistance to small businesses interested in federal, state and local government contracting; and
- to apply George Mason University resources to improve the business climate and economic development in local communities.

From its office in Fairfax, PTAP offers marketing, technical consulting and educational services to businesses in the Northern Virginia and Washington metropolitan area. (The PTAP center at the University of Maryland offers similar services.)

**Bill Hamilton** will discuss the program and review services available at the center. He will also provide a mini-primer on doing business with the federal government, identify ways in which it differs from the commercial world, and answer questions.

Hamilton is a management consultant concentrating in business strategy including start-up development and turn around management. He has over $100 million in career bookings in companies ranging in size from large multi-million dollar integrators to very small entrepreneurial start-ups. His experience includes broad coverage of agencies in the federal government including the Department of Defense, and in the commercial information technology market. Technology areas he has addressed include system design and integration, process management, data mining and analysis, language analysis, sensor management, aerospace engineering and communications, telecommunication network design including call centers, forensic science and behavioral sciences.

### Wednesday, May 16, 2006

### Multichannel Biomedical Imaging for Cancer Detection

Multichannel biomedical imaging promises powerful tools for the visualization and elucidation of important disease-causing biological processes. Recent research aims to simultaneously assess the spatial-temporal/spectral distributions of multiple biomarkers, where the signals often represent a composite of more than one distinct source. A novel development is the blind source separation algorithm for quantitative dissection of mixed yet correlated biomarker distributions. Dr. Wang will demonstrate this approach on mixtures of real biomedical images acquired by multispectral microscope, dual-energy x-ray, and dynamic contrast-enhanced magnetic resonance imaging. Applications of this technique include detection of cancer and other diseases.

**(Joseph) Yue Wang** received his B.S. in computer science and M.S. in electrical engineering from Shanghai Jiaotong University in 1984 and 1987, respectively. He received his Ph.D. in electrical engineering (with a minor in computer science) from the University of Maryland in 1995. After a year of post-doctoral training at Georgetown University School of Medicine, he joined the department of electrical engineering and computer science of The Catholic University of America in 1996, where he served as the founding director of the Computational Bioinformatics and Bioimaging Laboratory (CBIL).

Dr. Wang was also affiliated with the Johns Hopkins University School of Medicine as an adjunct associate professor of radiology. He has extensive experience in image processing, image segmentation, and change detection. Dr. Wang has served on multidisciplinary cancer research teams since 1995, first in prostate cancer detection, then breast cancer detection and therapy. He recently led a multidisciplinary team in a $5.5 million project to develop bioinformatics tools to improve cancer treatment outcomes. In 2004, Dr. Wang was inducted into the College of Fellows of the American Institute for Medical and Biological Engineering for his contributions to biomedical informatics.

Currently an associate professor of electrical and computer engineering at the Virginia Tech Advanced Research Institute in Arlington, Virginia, Dr. Wang continues to direct the CBIL. His research interests include intelligent computing, machine learning, pattern recognition, statistical visualization, and advanced imaging and image analysis, with applications in computational bioinformatics and bioimaging.

### Wednesday, May 17, 2006

### New Age Fiber Crystals

Photonic crystal fibres (PCFs) have been the focus of increasing scientific and technological interest since the first working example was reported in 1996. Although superficially similar to a conventional hair-thin glass optical fibre, PCF has a unique microstructure, consisting of an array of microscopic

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## DIAMOND STORIES

*continued from page 4*

hollow channels running along its entire length. These channels act as optical barriers or scatterers, and suitably arranged can "corral" light within a central core (either hollow or solid glass). PCF can trap light in two different ways: by a modified form of total internal reflection, when the core must have a higher average refractive index than the photonic crystal cladding; and by a two-dimensional photonic bandgap, when the index of the core is uncritical—it can be hollow or filled with material.

Light can be controlled and transformed in these fibres with unprecedented freedom, allowing for example precision guidance of light in a narrow hollow core, the creation of highly nonlinear PCFs with accurately controlled dispersion profiles, the design of fibres that guide only one mode at all wavelengths, and the observation of stimulated Raman scattering in hydrogen at threshold powers six orders of magnitude lower than ever seen before in single-pass geometries. These are just a few examples of how the PCF concept has ushered in a new and more versatile era of fibre optics, with a multitude of different applications spanning many areas of science.

**Philip Russell** is director of the Max-Planck Research Group for Optics, Information & Photonics at the University of Erlangen, Germany. From 1996 to 2005 he founded and led the Photonics & Photonic Materials Group at the University of Bath. He specializes in periodic structures, nonlinear optics, waveguides and their applications. A Fellow of the Optical Society of America, in 2000 he won its Joseph Fraunhofer Award/Robert M. Burley Prize for the invention of photonic crystal fibre. In 2005 he was elected Fellow of the Royal Society and received the Thomas Young Prize of the UK Institute of Physics and the Körber Prize for European Science.

### Thursday, May 18, 2006

## Electromagnetic Pulse—Transient/Surge Suppression Mitigation Techniques

Electromagnetic pulse (EMP), lightning strikes, and high powered microwave (HPM) weapons can damage susceptible electronics and communications equipment by transient power surges. These events and weapons generate very short, intense energy pulses producing a transient surge of thousands of volts that destroys semiconductor devices. EMP, associated with a nuclear explosion, and HPM weapons can disable practically any modern electronic device within the effective range of the weapon. What can be done to stop these damaging effects and keep equipment operational during the worst-case power quality transient events? Both commercial and home environment protection will be discussed during this IEEE forum. Do elevators cause transients? Coffee pots? Drink machines? Motor control centers? Attend this informative technical briefing and learn how to select a surge suppressor that will best protect your electronic hardware investment.

**Roland Oliveira** has been involved in the power quality industry for nearly 20 years, consulting, training and selling transient voltage surge suppression to industry and government end users, including the Internal Revenue Service, the Federal Bureau of Prisons, and the Department of Defense. Included in his accomplishments are protecting automation systems at a chicken processing plant and ensuring military unmanned air vehicles (UAVs) are not interrupted by transients or poor power quality.

### Tuesday, June 6, 2006

## EMC Expo 2006 Colloquium and Exposition

**Track 1: EMC Design for Working Engineers**

This full-day session by **Bruce Archambeault** will cover a wide range of basic topics in EMC, including grounding, bonding, shielding, PCB design for EMI decoupling, system EMC, I/O design issues and fullwave EMC modeling and simulation.

Dr. Archambeault is a member of IBM's senior technical staff in Research Triangle Park, North Carolina. He received a B.S.E.E degree from the University of New Hampshire (UNH) in 1977 and an M.S.E.E degree from Northeastern University in 1981. He earned his Ph.D. from UNH in 1997. His doctoral research was in computational electromagnetics applied to real-world EMC problems. Dr. Archambeault has authored or co-authored a number of papers in computational electromagnetics, mostly applied to real-world EMC applications. He is currently a director for the IEEE Electromagnetic Compatibility Society (EMCS) and is a past director for the Applied Computational Electromagnetics Society. He has served as an EMCS distinguished lecturer and as associate editor for the IEEE Transactions on Electromagnetic Compatibility. He is the author of *PCB Design for Real-World EMI Control and the lead author of EMI/EMC Computational Modeling Handbook.*

**Track 2: Advances in Spectrum Effects**

Four presentations will cover contemporary technologies for the experienced electromagnetic environmental effects engineer. First, Andrew Drozd will present information on current and future policy requirements for the next generation of software programmable radios and will examine dynamic spectrum access, or the concept of expanding spectrum by allocating use in domains other than frequency. Dr. Drozd's afternoon topic will be new paradigms for system-level EMC modeling and analysis. Edward Hare's brief on broadband over power lines spectrum compatibility will provide insights on this new consumer technology and implications to ham radio. The final speaker, Dr. Eric Mokole, will discuss waveform diversity and how future radar systems may change and achieve spectrum compatibility.

**Andrew Drozd** is president and chief scientist for ANDRO in Rome, N.Y., and is the current president of the IEEE Electromagnetic Compatibility Society. Mr. Drozd's expertise is in area of systems engineering and assuring life cycle EMC. His work has involved the use of sophisticated computer modeling, simulation and analyses codes to study EMC problems in large, complex systems. He has also consulted on hardware design for EMC specification compliance, and conducted EMC lab tests and verification experiments. He has recently been at the forefront of innovative research to apply expert system technologies for EMC modeling and EMC analyses. He continues to apply more than 27 years of technical and program experience in electromagnetics technologies primarily for E3 modeling and analysis of government and commercial systems. Mr. Drozd is a NARTE-certified EMC Engineer and an IEEE Fellow. He has authored and co-written over 130 technical papers, reports, and newsletter and journal articles. He received a B.S. in physics and mathematics in 1977, and an M.S.E.E. specializing in communications and signal processing in 1982, both from Syracuse University.

**Edward Hare** (W1RFI) was first licensed in 1963. After 16 years in the electronics industry, he arrived at the American Radio Relay League (ARRL) headquarters in Newington, Connecticut, in 1986. He started as ARRL's product review test engineer, advanced to "RFI guru" (notice his call), and now holds the position of laboratory supervisor. He is a member of the Society of Automotive Engineers EMC Committee, the IEEE C.63 Committee, and the IEEE Standards Coordinating Committee 28, representing ARRL and the interests of amateur radio in developing standards for the immunity of consumer equipment and motor vehicles and standards for RF exposure. He has written many RFI articles for publications ranging from QST and the ARRL Handbook to professional trade journals. He is also a contributor to the *ARRL RFI Book and the author of ARRL's RF Exposure and You.*

**Eric Mokole** is head of the Surveillance Technology Branch, Radar Division, U.S. Naval Research Laboratory, which he joined in 1986. He has been conducting research and system analyses on space-based radar, on shipboard Navy radars and the associated electronic countermeasures and electronic counter-counter measures, and on ultra-wideband radar. These efforts have involved information extraction, non-Gaussian detection theory, data analysis, system simulation and modeling, threat and electronic-attack modeling, antenna theory (element and arrays), electromagnetic propagation near the Earth's surface and through the ionosphere (deterministic and random), pulsed propagation in a dispersive medium, and RF scattering from the sea and land. Additionally, Dr. Mokole has over 40 conference publications, journal articles, book chapters, and reports, and is co-editor of the 2003 book, *Ultra-Wideband, Short-Pulse Electromagnetics 6.* He received a B.S. in applied mathematics from New York University in 1971, an M.S. in mathematics from Northern Illinois University in 1974, M.S. degrees in physics and applied mathematics from the Georgia Institute of Technology in 1976 and 1978, respectively, and a Ph.D. in mathematics from the Georgia Institute of Technology in 1983.

### Thursday, June 15, 2006

## Optimal Industrial Safety Using Infrared Thermography

Thermography is the use of infrared cameras to not only "see" heat emissions, but also to measure heat output, thus enabling the detection of equipment operating outside normal temperature parameters, requiring maintenance, and with the potential (and hazard) of imminent failure. Infrared cameras are thus an important tool for preventive and predictive maintenance applications.

A recently developed infrared camera is capable of detecting volatile organic compound (VOC) gas leaks, a boon for leak detection and repair programs in the petrochemical and refinery industries. This device enables real-time scanning of refinery facilities and transfer stations, and even miles of pipeline and transportation vehicles, while in motion.

This presentation will focus on real-world infrared technique and application examples--from capturing images on the job, to detecting and averting potential trouble spots--showing the benefits of thermography to enhanced preventive maintenance and leak detection programs.

**Erica Wolfkill** has been with FLIR Systems for two years. She holds Level 1 Thermography Certification as well as Building Science Thermography Certification. She covers the mid-Atlantic region for FLIR, and interacts directly with all end-users of the FLIR cameras. She is responsible for all commercial and government FLIR thermography camera sales in Maryland, the District of Columbia, and Northern Virginia.

# FIRST Robotics Contest Introduces Students to Engineering Challenges

**By Christopher Evers**
**Oakton H.S. Student**

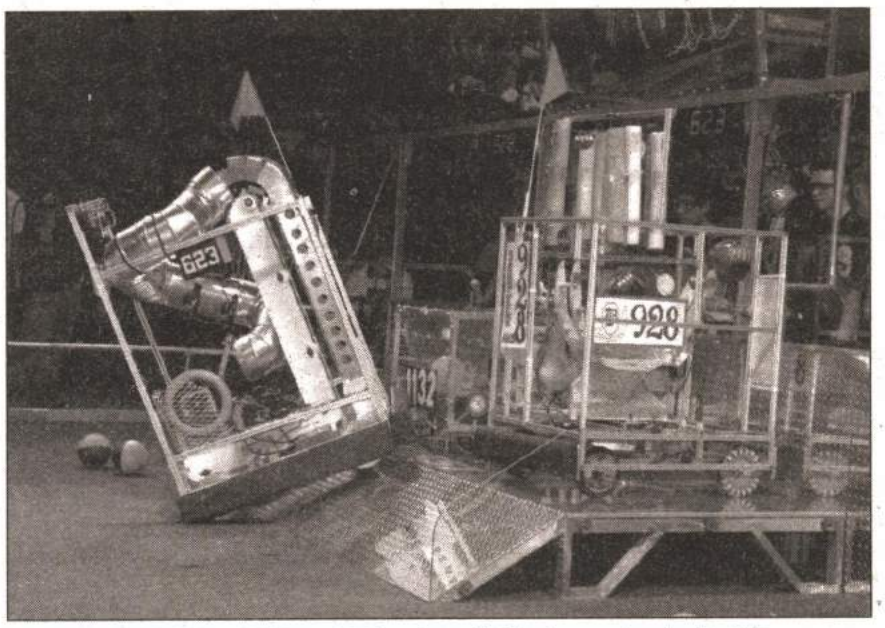
Anticipation was thick in the air in early January, as 60 Oakton High School students and mentors watched the 2006 For Inspiration and Recognition of Science and Technology (FIRST) robotics competition webcast, along with more than 50,000 students around the country. Each year FIRST announces an entirely new game design for its series of regional robotics competitions designed to bring technical interest to high school students.

For the next six weeks, students and mentors were challenged to design, prototype, build, program and test a fully functional robot. Each team was provided with a basic kit that included frame, drive train, electronics and pneumatic components. Oakton's team 623 also started off with an inspiring quote from Scott Haney, our team captain, "I don't know the solution, but I admire the problem."

The team spent the first week reading the rules, developing gaming strategy and brain storming a design. Functions like the ball shooter and feeder had to be custom built. We went through a prototyping phase to test design ideas. We refined the prototypes to improve performance and completed the robot. At the end of the six week period, our robot was shipped to the Richmond regional competition site.

Over 1900 teams hailing from California to Iraq met at the various regional competitions, shooting for gold medals and seats at the nationals in Georgia. Several matches were conducted during the competition. Each match involved three robots battling against three other robots. This required the school teams to partner.

The match consisted of a series of autonomous, defensive, offensive and free-for-all periods. Two rectangular goals at floor level and one elevated circular goal at 10.5 feet were located at each end of the field. The elevated goal had a green beacon light above it. Teams earned 1 or 3 points respectively by shooting balls through these goals. Each match started with a 10 second autonomous period during which onboard sensors were used to navigate and locate the goals. Typically, dead reckoning was used to position the robot and a beacon tracking camera was used for targeting. At the end of the autonomous period, the high scoring team initiated play as offense, while the other team defended its goals. In the next period, the two teams switched offensive and defensive roles. The last period was a free-for-all with all the teams scrambling to rack up points. Our robot participated in several matches, each time with new teaming arrangements.



*Oakton High School Team 623's robot (left) plays a basketball-like game with its match partners.*

Team 623 is proud of our accomplishments. We captured the excitement and intensity of this engineering experience in our award winning website at www.ohsrobotics.org. I highly recommend spending a day visiting one of these competitions where you will see the future of engineering. (For competition information, visit www.usfirst.org/robotics.)

Special thanks go to IEEE for their generous sponsorship, which enables us students to share an experience that makes engineering exciting.

# *'March Madness' in Annapolis Features Student-Built Robots Playing Ball*

*The Friendship High School team poses with their robot.*

**By Mike Gilliom**

How does this thing work?

As I inspect the curious combination of sprockets, Plexiglas, and bicycle chains, I try to determine how this robot is going to accomplish its primary goal of shooting foam balls into a hoop ten feet above the ground. It seems like no more than a plastic toy bin on wheels. I stare at it blankly.

Finally, determined to understand, I make my way over to the competition area—a section of the Naval Academy field house closed off with aluminum rails and matted to protect the gymnasium floor from scuffing. In a few moments, six robots, designed by six different high schools, will participate in a game not unlike basketball. As the master of ceremonies announces the scores from the last event, teams in the queuing area move to the competition floor to set up for their turn to play. Music blares over the P.A. as the teams make final checks to their RC radios. Finally the buzzer sounds, and the robots spring to life. I see immediately that the robot I was so interested in was not meant to shoot at the 10 foot goal at all, but rather runs speedily to the floor goal, a small door at the sideline of the playing area, and deposits a generous cache. Although floor goals are worth fewer points than lofting balls through the basketball-like hoop, it quickly becomes apparent that most robots can more efficiently score their points at ground level.

That's not to say of course, that all the competitors had chosen this strategy. My attention quickly turns to Ms. Daisy, a brightly colored robot from a high school in Philadelphia. Daisy obviously has no trouble scoring points from the 10 foot goal. One after another, it lofts its ammunition gracefully through the hoop. Like some kind of comically large Nerf ball machine gun, it makes me wonder what kind of a decrepit prototype I could have produced with my clumsy hands back in eleventh grade. I smile to myself—in the illustrious words of my two favorite sock puppets, this team must be the "Michael Jordan of Thomas Edisons."

The event I attended was a regional competition for FIRST (For Inspiration and Recognition of Science and Technology), called simply the FIRST Robotics Competition. Nearly 100 teams, mostly from the mid-Atlantic region, converged at the United States Naval Academy this March to establish robotic dominance. While some teams had trouble even getting their robots to respond under remote control (and let's be fair, these are high schoolers after all) some teams did so well that they could have earned a first-round draft in the robot NBA.

Even as I walked into the field house, I instantly recognized the feel of a high school sporting event from my days as a swimmer. As I walked through the gym, however, I started to realize that this was more like the Kentucky derby than any high school swim meet that I'd ever been to. The excitement was tangible. There were painted chests and personalized team uniforms everywhere. Mascots ran rampant.

I was stunned to see such a difference from more "conventional" engineering competitions that I had been to. As an engineering student in college, I had participated in several, and none of them was as exciting as this. "That's exactly what we're trying to accomplish," says Janet Lathan, the director of FIRST activities for the Washington area. "Kids like entertainment, and if you want to encourage high schoolers to pursue degrees in technical professions then you have to make technology interesting to them." Encouraging high schoolers to pursue technical degrees is part of FIRST's mission statement, and well it should be; according research done by the Manhattan Institute, only 59 percent of students in the

**MARCH MADNESS**
*continues on page 7*

# *Chantilly FIRST Robotics Team Advances to National Competition*

**By Murty Polavarapu**

For the second year in a row, the FIRST Robotics Team at Chantilly Academy in Chantilly, Virginia, sponsored in part by the IEEE Northern Virginia Section, is going to the National level competition in Atlanta.

At the Chesapeake Regional event held in Annapolis on March 16-18, the Chantilly Team received the prestigious Regional Chairman's Award recognizing it as "a model for other teams to emulate, and which embodies the goals and purpose of FIRST." The team members were cited for finding innovative ways to motivate and inspire their fellow students and community members in science and engineering.

Their outreach efforts drew the attention of a family with a disabled toddler needing help. The team jumped into action and built a motorized baby-walker to help the child become mobile.

At the Annapolis event, the team mentor, Jerry Skene, received the Woody Flowers Award for five years of mentoring the teams at Chantilly Academy.

The Chantilly team also fared well at the NASA/VCU Regional event held in Richmond on March 2-4. There, the team received the Engineering Inspiration Award in recognition of their efforts to inspire students at all levels in engineering.

For more information about the Chantilly team and to see the pictures of the team members and their robot, visit www.chantillyrobotics.com.

## New Senior Members

Congratulations to the following new Senior Members:

John Anderson (W)
Ramie Kishek (W)
Amy O'Brien (NV)
Robert Pettit IV (NV)
P. Jonathan Phillips (W)
Guixiu Qiao (W)
Marc Rigas (W)
Kamran Sayrafian-Pour (W)
Fred Seigneur (NV)

If you are interested in becoming a Senior Member, please consult www.ieee.org/seniormember for qualification requirements. For help with references, contact Michael Cardinale at cardinal@ieee.org for Northern Virginia (NV) Section members, or Howard Needham at howardn@ieee.org for Washington (W) Section members. Or attend the Spring Career Festival (see story, p. 1).



## MARCH MADNESS

*continues from page 6*

Washington area graduate with a high school degree.

Dr. Chris Grimm, a team mentor from Ballou, an inner-city high school in Washington, agrees. "The best part about this competition is turning these kids into real engineers," he tells me. "I'm amazed every year at how far they come [in terms of technical proficiency]." I can only agree as I watch his team work diligently on their robot, awaiting their next turn on the court. "Technology is their ticket out," he tells me later. When I ask him how many of his students have gone on to pursue college degrees he looks me right in the eye and responds with just one number: "100 percent."

The adults aren't the only ones who know how much good the competition is doing. The kids are as proud of their robots as the mentors are of the kids. Kevin Lyles, a student at Friendship High in Washington, told me that the competition is different from other school projects because it's "more hands on and specialized. But also, as far as competing while getting this hands-on experience, it's a whole lot better." Friendship is one of many teams in the competition whose robot improved in strides from last year. "It's nice playing more offense instead of just defense," Lyles admitted.

Denzel Twyman, a student at Roosevelt High School, tells me that he participated in the robot competition because he thought he would enjoy it. "Not a lot of people [at school] do it," he told me, "I just wanted to try something new." Since he joined the team he has learned to write software code and use electronic tools—things that most high schoolers don't get to experience. The icing on the cake is that Lyles and Twyman both tell me they are applying to college, and they seem to think that they might not have if it weren't for the competition. "It got the attention of the interviewer when I mentioned FIRST," confided Lyles. "That was really encouraging."

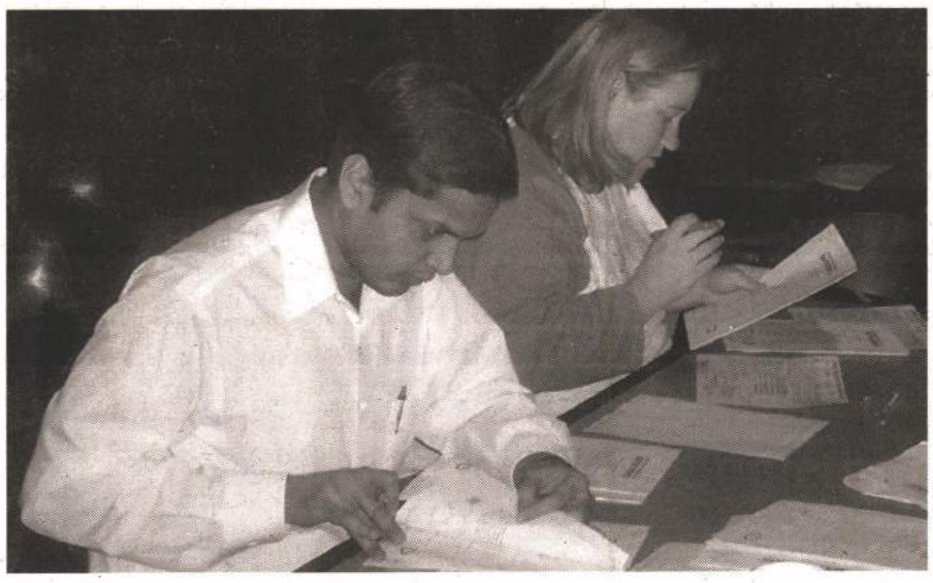
Despite all the success that FIRST has had with their competition, however, they still feel like some kids aren't getting the experience they deserve. "The money we get is very generous," Grimm told me, referring to third party donations to the FIRST program (in fact some teams are able to raise funds directly from corporations). "But we need people more than we need money." FIRST encourages professionals to volunteer to help teams. Engineers can become mentors who work closely with one team, or they can help many teams by hosting seminars or workshops. Either way someone's got to teach these kids the skills they need to build their robots—some team mentors don't have the expertise, and some teams don't even have mentors.

IEEE certainly has a large pool of professionals to draw from, although word has been slow to get out and there hasn't been much response from the membership. Worse yet, now that the competition has taken place, it may seem too late to help out. "Not so," Lathan tells me. Most teams plan their designs for much longer than just the build season, in fact, schools are already recruiting their teams for next year. Even if it weren't for that, teams need to learn their skills with plenty of time to practice before they ever apply it to a robot. Volunteers are appreciated always, regardless of when they join.

FIRST's efforts are certainly a good start, although it falls on engineers to promote the field of technology. We are the only ones who can share our experiences and generate more interest. Volunteering with FIRST is easy, just call Janet Lathan at 240-393-1464 to find out how you can help, or email her at janetlathan@comcast.net. There are six teams in the Washington area that competed at the competition this year, and there may be more in the future. Starting a team at your own high school is also a possibility—any high school can participate, it's just a matter of registration.

As I left the field house, I glanced back to take one last look at the competition floor. The robots were still crashing into each other in a frenzy of foam and metal, and the spectators were yelling and clapping and cheering. Little doubt that the students and mentors alike who participated in this event are better for it, and the opportunity exists for countless more. The trick is getting more people involved.

# Volunteer Experience with MathCounts Brings Personal Benefits, Satisfaction



***GOLD Volunteer**—Abhay Bakshi (left) grades student answers at a MathCounts competition.*

**By Abhay Bakshi**
**GOLD Member**

On February 11, I represented IEEE at the MathCounts chapter-level competition for middle school children. Eight or nine local schools participated, and the student count was close to 80.

I spent about four hours as a grader for all three rounds in which the participating schools competed. There were more than a dozen graders, including some from Northrop Grumman.

There were no monetary rewards for this work, only feelings of personal accomplishment and satisfaction. Who does this for money? No one. Personal benefits for me included chances to interact with other graders and the competition event hosts. Personal overall satisfaction feelings included a kind of feeling you receive when you perform a social service to perfection, a feeling of happiness to see glad faces of the winners, and the knowledge that the younger generation is being motivated towards programs in math and science. Promoting education is one of the primary purposes of the Graduates of the Last Decade (GOLD).

The graders were rewarded with an honor call to the stage to be recognized, and each received a personal calculator in appreciation of his or her service.

Would I recommend that anyone joining IEEE participate in MathCounts and other events? Absolutely. The reasons? They are all included in this small article.

For more information about MathCounts, see www.mathcounts.org.

## BP SOLAR FACILITY TOUR

*continued from page 1*

only 70 percent of solar radiation striking the wafer is available for electricity production. A further limitation is that each photon produces only a single electron, resulting in a maximum theoretical efficiency of 30 percent. Optical enhancement is obtained by applying a 700-Angstrom silicon nitride coating to the polycrystalline wafer to fill in crystal defects and improve photon capture rate. As a result, polycrystalline cells may perform nearly as efficiently as the more expensive monocrystalline cells, with module-level efficiencies up to 15 percent. The silicon nitride layer gives the gray silicon wafer a distinctive blue color. Incidentally, it is technically possible to manufacture silicon wafers in any color, although cell efficiency may be reduced with alternate colors due to less favorable optical characteristics.

There are ongoing attempts to extend conversion efficiency, by cascading multiple junctions, and by connecting wafer layers in series. To date, these techniques are problematic. Non-silicon cells have achieved higher efficiencies, but their use is limited to specialized applications such as satellites because the cost may be several orders of magnitude higher. A novel approach to improving overall solar system efficiency is cogeneration. This concept is under study, with some researchers attempting to exploit the potential of solar modules to heat water by using energy not available for electricity.

Why is so much attention focused on module efficiency? In the second installment of this article, we will examine this and the bigger issue of solar PV economics, as explained by Mr. Posbic. Meanwhile, if you have an opportunity to visit BP Solar's facility in Frederick, this fascinating tour is highly recommended by 28 of your fellow IEEE members.