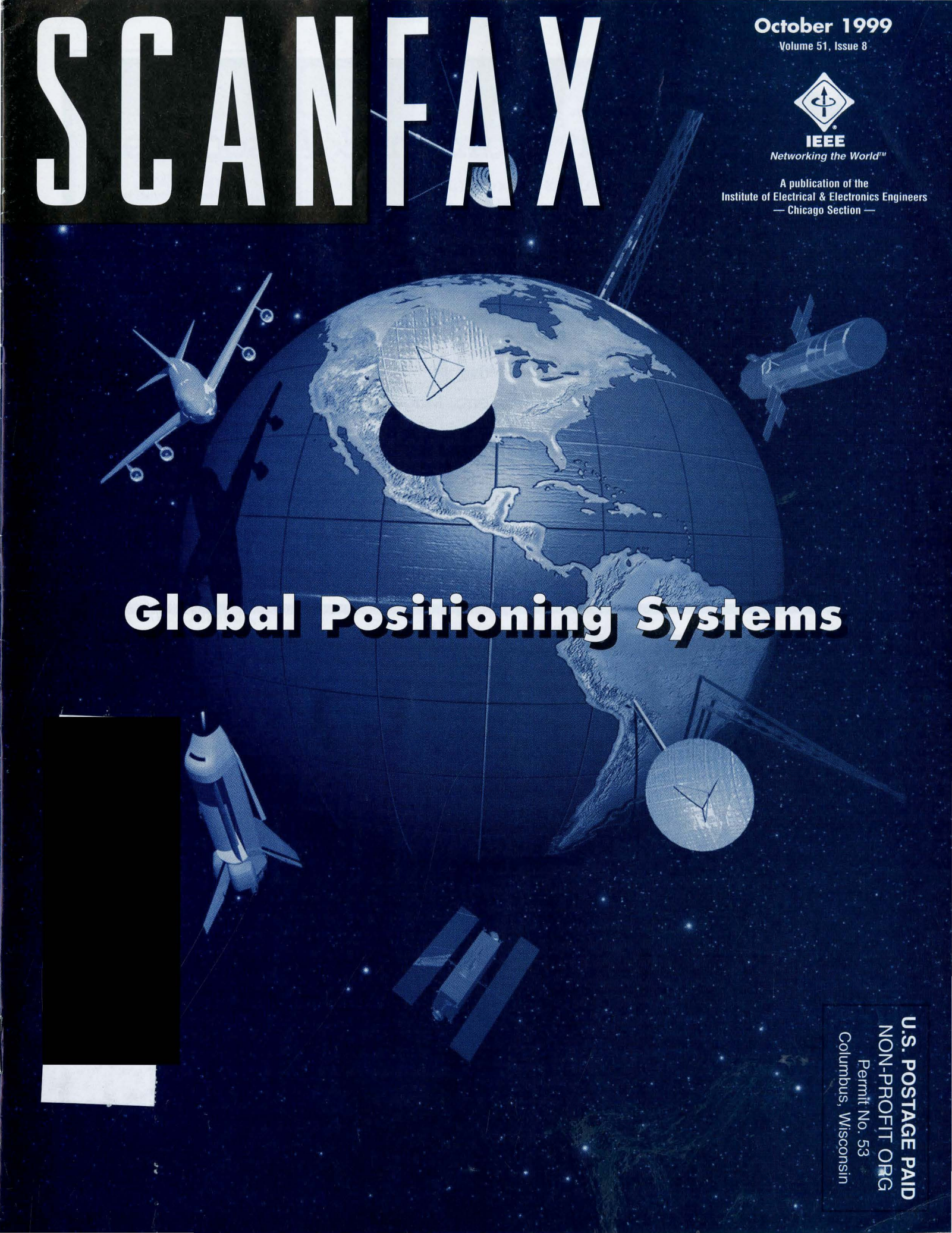


SCANFAX



October 1999

Volume 51, Issue 8



IEEE

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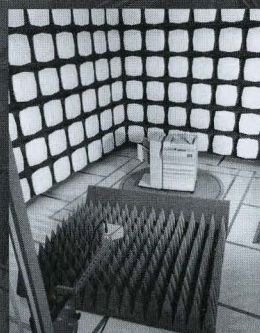
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October 1999

Volume 51, Issue 8

SCANFAX

Features

5 Global Positioning Systems

Global Positioning Systems (GPS) are making their way into our daily lives as easily as the modern day telephone or computer.

Departments

4 Chairman's Message

UPCOMING EVENTS

- 7 *UniForum Chicago Workshop
GLEN STAFFORD'S UNIX BOOT CAMP
October 9, 1999*
- 8 *Chicago Power Engineering Society
COMED'S RETAIL COMPETITION LOTTERY:
MAKING CUSTOMER CHOICE WORK
October 13, 1999*
- 9 *IAS/IES Joint Meeting with the Northwest Subsection
Dinner Presentation
ARC FAULT CIRCUIT INTERRUPTERS (AFCI) PRESENTATION
October 20, 1999*
- 10 Professional and Business Directory

CHICAGO SECTION EXECUTIVE COMMITTEE MEETING

Tuesday, October 12, 7:15 pm

DeVry, 1221 N. Swift Rd., Addison, IL

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Chairman's Message

Edward G. Bogus, PhD.
IEEE Chicago Section,
Chairman

The IEEE, with over 330,000 members in 147 countries, is the world's largest technical professional society. It has the technical objectives of advancing the theory and practice of electrical, electronics and computer engineering, and computer science. And through its members, provides leadership in areas from aerospace, computers and communications to biomedical technology, electric power and consumer electronics. The IEEE mission is to promote the engineering process of creating, developing, integrating, sharing, and applying knowledge about electro- and information-technologies and sciences for the benefit of humanity and the profession. The IEEE vision is to advance global prosperity by fostering technological innovation, enabling members' careers and promoting community worldwide.

These objectives, mission, and vision are realized through numerous activities and opportunities that IEEE provides to its members. Almost 30 percent of the world's literature on electrical engineering, electronics and computing is produced by IEEE through a pub-

lishing program of periodicals, books, standards, conference proceedings, and mixed media. Over 300 conferences are held annually and more than 700 standards groups exist. Volunteer activities provide opportunities to develop leadership and other personal skills, and the international and local conferences and seminars enable networking and career development. The extensive network of IEEE societies, sections, chapters and student-branch chapters serves as a vehicle to promote the industry and profession in the community.

All Chicago members are encouraged to take advantage of the many activities that IEEE has to offer. Participation at local chapter and subsection meetings is particularly rewarding since it provides an opportunity to hear excellent technical presentations on a regular basis. Last month all the Chicago IEEE chapters were listed in SCANFAX for your reference. Use this list to find the chapter with your technical interest. Then, attend the meetings, bring friends, and together we can make the Chicago Section the best section in Region 4.

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Global Positioning Systems

By Terri Biloff

Global Positioning Systems (GPS) are making their way into our daily lives as easily as the modern day telephone or computer. But the birth of GPS really began as a military navigation system which included the launch of the first satellite, Sputnik back in 1957. Scientists then developed a method to track the satellites' orbit by observing shifts in radio frequency signals by the Sputnik.

By 1964, the U.S. Navy began using this technology to track accurate positions of ships and submarines around the world. Years later atomic clocks made it possible to design a satellite constellation which carried a network of clocks precisely synchronized to a common time reference.

Thanks to the Federal Government who had spent millions of dollars to perfect the original designs, GPS can be found in boats, planes, cars and even laptop computers, expanding the functionality far beyond the scope of the original design.

How do GPS work?

There are five basic functions or applications associated with GPS. This article attempts to highlight some of the more common uses in today's society, while providing some background information.

GPS are a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. These man-made stars are used as reference points to calculate positions as accurate as to the centimeter.

Since navigation and positioning are crucial to so many activities today, GPS provide many benefits to drivers, pilots and many other people whose goal is to make work or play more productive and safer. There are five basic functions or applications of GPS.

1) **Location**- A simple determination of position, GPS offer highly precise location data for any point on the planet in any weather. Locating stranded motorists or providing location information for surveying projects are just a few modern day uses.

2) **Navigation**- Originally designed to provide navigational data for ships and planes, this technology has expanded to help navigate not only recreational boaters, but fishing boats and long-haul container ships as well. Getting from point A to point B has never been so easy!

3) **Tracking**- Monitoring navigation as it moves from one point to another is the process of tracking. GPS used in conjunction with communications links and computers provide the backbone for systems tailored to applications in agriculture, mass transit and package delivery services.

4) **Mapping**- Once a position is located, navigated and tracked, it can be mapped and modeled into graphical format to be used by utilities and land surveyors alike.

5) **Timing**- Although known more for its location, navigation, tracking and mapping, GPS are also used to disseminate precise time, time intervals and frequency. And since time is a commodity, knowing the exact time is a very powerful tool. There are three fundamental ways GPS use time: as a universal marker-when things happened or will; as a way to synchronize-keeping people events and even certain types of signals on schedule; and how long things last-provides a sense of duration.

How accurate are the results?

Interestingly enough, while I was doing research for this article, CNN reported that GPS accuracy rates are being put to the test. Apparently any GPS made on or before

1980 are experiencing problems and may not be generating accurate results. With that in mind, let's look at accuracy and how it is measured.

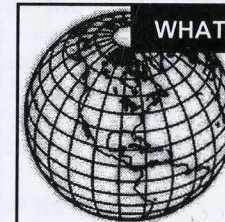
The first thing to remember is that both the satellite as well as the receiving device, need to be precisely synched up in order to obtain the most accurate results. Accuracy is not merely measured by using standard benchmarks and comparisons, but rather comprehensive multiple positions and measurements are taken over many time intervals. Some of the ways of measuring accuracy are:

1) **Selected Availability (SA)**: this refers to the method incorporated by the Federal Government to limit GPS accuracy except for select users. SA has a 95 percent accuracy within 100 meter imposed specifications of accuracy.

2) **Differential GPS (DGPS)**: enhances accuracy by using correction data supplied by a known stationary site. Special equipment is needed. This mode is used mostly for professional surveying.

3) **Standard Positioning Service (SPS)**: consumer units are equipped with this. But unless also equipped with DGPS, their accuracy is unknown.

Continued on page 6.



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Continued from page 5

4) **Precise Positioning Service (PSP):** is only available to the U.S. Department of Defense and authorized users. A second frequency ensures high levels of accuracy.

5) **Post-Positioning (PSP):** computer processed GPS data with DGPS (correction data supplied by a known stationary site) is not available with consumer units.

6) **Continuously Operating Reference Station (CORS):** similar to a DGPS, CORS provide both "code" correction and "carrier phase" corrections, which provide professional survey grade accuracy. CORS requires post-positioning (number five above). This is not available in consumer units.

7) **Horizontal Dilation of Precision (HDOP):** measures the horizontal accuracy and takes into account the current "in view" satellite configurations. Accuracy is unknown.

As a general rule, most consumer grade SPS units in non-DGPS use, with a couple of days averaging, will locate a position within a couple of meters of the true coordinates.

GPS Accuracy Error Sources:

1) Noise: code noise and noise within the received

2) Bias: from Selected Availability (see above) due to imposed specifications

3) Satellite clock errors: atmospheric changes in temperature, pressure and humidity

4) Human error: human intervention or computer software inaccuracies or failures

Tracking and Mapping Software:

Wildlife Management

- Wildlife tracking
- Wildlife reserve & Park Boundaries
- www.cybertracker.co.za/index.html

Recreation

- 3-D golf course mapping
 - 3-D race course mapping
 - Hiking/biking trail systems
 - Snowmobile/cross country trail
 - www.navtechgps.com/supply
- Forestry/Land Management
- Root harvest mapping
 - Road systems
 - Insect/disease tracking
 - Forest fire monitoring
 - www.newholland.com/na/pfs.index.html
 - www.pearstechnology.co.uk

Transportation/Navigation

- Marine/aircraft navigation
- Auto navigation
- Navigation for outdoor enthusiasts
- www.dimesoft.com/gps/
- www.gps.4fun.com/del_trip.html

Mining/Exploration

- Site mapping
- Mineral claim boundaries
- Land surveying
- www.cse-ltd.com
- www.effective-solutions.co.uk/gpsnav.html

Common Terms:

Accuracy: The degree of conformance between the estimated or measured position, time and/or velocity of a GPS receiver and its true time, position and/or velocity as compared to a constant standard.

Analog: Transmission characterized by variable waveforms representing information, contrasted with digital.

Automatic Vehicle Location: (AVL) A type of system using any sort of technology to track or locate a vehicle.

Availability: The percentage of time that the services of a navigation system can be used within a particular coverage area.

Bandwidth: The range of frequencies in a signal.

C/A Code: The coarse/acquisition or clear/acquisition code modulated onto the GPS signal.

Carrier: A radio wave having at least one characteristic, such as frequency, amplitude or phase, that may be varied from a known reference value by modulation.

Channel: A channel of GPS receiver consists of the circuitry necessary to receive the signal from a single GPS satellite.

Chip: The length of time to transmit either a "0" or a "1" in a binary pulse code.

Chip Rate: Number of chips per second. For example: C/A code = 1.023 MHz

Clock Bias: The difference between the clock's indicated time and true universal time.

Control Segment: The world-wide network of GPS monitor and control stations that ensure the accuracy of satellite positions and their clocks.

Data Message: A message included in the GPS signal which reports that satellite's location.

Doppler Shift: The apparent change in the frequency of a signal caused by the relative motion of the transmitter and receiver.

Ephemeris: A list of accurate positions or locations of a celestial object as a function of time.

Handover Word: The word in the GPS message that contains synchronized information for the transfer of tracking from the C/A to the P-code.

P-Code: The precision code of the GPS signal. A long sequence of pseudo-random binary bi-phase modulations.

Satellite Constellation: The arrangement of space of a set of satellites. For GPS, the fully operational constellation is composed of six orbital planes, each containing four satellites.

Standard Deviation: The measure of the dispersion of random errors.

SV: Satellite Vehicle

Y-Code: The encrypted version of the P-Code.

Some excerpts were obtained from Global Positioning System informational web sites and the University of Texas. Glossary of terms provided by GPS World Wide Resources. ■

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Glenn Stafford's Unix Boot Camp

Saturday,
Oct. 9, 1999

Glenn Stafford, UniForum Chicago Board Member

About the Speaker: Glenn has spent more sleepless hours as a Systems Administrator than some of us would dare to admit. He is a veteran speaker at UniForum Chicago presentations and one of their Board members.

About the topic:

- The role of the Unix administrator
- Unix tools and procedures
- Security: traps, pitfalls and Punji Stakes
- HELP! When and how to get it

Location:

College of DuPage, Lambert Road and 22nd Street, Glen Ellyn, Student Resource Center (SRC), Room 2801 on the Second Floor. Use the parking lot north of building and south of 22nd Street. (We'll be posting some signs to help you find this room.)

Time: 9:30am to 5:30pm (the fee will include a catered lunch)

Reservations: Only 80 seats are available, so register ASAP.

\$75 for UniForum members (lunch included), \$100 for non-members (lunch included)

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IEEE PES

CHICAGO CHAPTER

ComEd's Retail Competition Lottery: Making Customer Choice Work

Wednesday,
October 13, 1999

Congratulations!

The Chicago Chapter of the IEEE Power Engineering Society would like to congratulate Jennifer Snow, winner of the 1999 Outstanding Engineer Award. Jennifer received the 1999 Outstanding Engineer Award for her exceptional service to the PES and significant contributions to the power engineering profession. She is a former Chair of the Chicago Chapter of the IEEE PES and continues as the moderator of the "Careers in Power" panel sessions held at local universities. Jennifer is a Senior Sales Engineer at Square D Company in Palatine, Illinois.

The Outstanding Engineer Award is an annual award directed toward IEEE PES members in the Chicago area recognized for their outstanding technical contributions, outstanding professional/leadership contributions, outstanding community contributions, or outstanding educational contributions to the power engineering profession. Each chapter may present one award per calendar year.

For more information about the Chicago Chapter of the IEEE PES, please visit our web site: www.ece.iit.edu/~flueck/chicago_pes/

LUNCH MEETING

Kevin Brookins, Electric Supplier Services Manager, Commonwealth Edison

About the Speaker:

Mr. Brookins is the Electric Supplier Services Manager at ComEd. He is responsible for managing ComEd's business relationship with retail suppliers that need ComEd's delivery system to serve electric power and energy to retail customers. In this capacity he is responsible for managing the business agreements between the suppliers and ComEd.

In preparing ComEd for customer choice, Mr. Brookins was responsible for the development and implementation of new computer systems and work processes that will allow suppliers to deliver electric power and energy to retail electric customers. In this capacity he negotiated retail access rules with suppliers, consumer groups, and other interested parties at the Illinois Commerce Commission.

Mr. Brookins is a versatile electric utility manager with 16 years of experience, half in corporate planning and half in T&D engineering and construction. In his most recent assignment as T&D Business Services Director, he reported to ComEd's Senior V.P. of Transmission and Distribution (T&D) Operations where he was responsible for T&D business planning, T&D computer technology development, and T&D infrastructure management.

Mr. Brookins has a Bachelor of Science Degree in Electrical Engineering from Howard University in Washington, D.C. and an MBA from Governors State University in University Park, IL.

About the topic:

Kevin Brookins will provide an overview of customer choice in the electric utility industry. What is the Customer Choice and Rate Relief Law? When will business customers have choice? What will change? What will remain the same?

Location:

Chicago Bar Association, 321 South Plymouth Court (Near Jackson & Dearborn), Chicago, IL 60604.

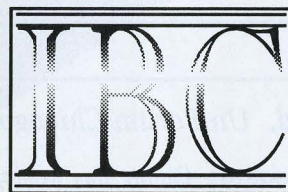
Time:

Social: 11:30 am.
Lunch: 12:00 pm.
Presentation: 12:15 pm.
Adjourn: 1:00 pm.

Reservations:

Lunch tickets can be purchased in the lobby bookstore (\$10.50). Please call the IEEE Business Office at (800) 898-IEEE to make your reservation.

For more information, please visit the Chicago Chapter IEEE PES web site: www.ece.iit.edu/~flueck/chicago_pes/



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IAS/IES JOINT MEETING WITH THE NORTHWEST SUBSECTION

ARC Fault Circuit Interrupters (AFCI)

Wednesday,
Oct. 20, 1999

IAS/IES DINNER PRESENTATION

Robert J. Clarey, Manager Applications Cutler-Hammer, Pittsburgh, PA.

About the topic: According to 1997 Consumer Product Safety Commission (CPSC) figures, electrical distribution system fires in residential units caused some 350 deaths, 1700 injuries and \$700 million in property damage. Many of these electrical fires resulted from an electrical arcing fault. Present over current devices (breakers and fuses) are designed to protect the electrical conductors. However, an abused or damaged cable/cord can cause an electrical arcing fault. The addition of Arc-Fault Circuit Interrupters (AFCI) to Residential Circuit Breaker represents a major improvement in electrical fire-safety. This presentation describes our technical approach and provides relevant fire statistics. These new AFCI residential circuit breakers have additional enhanced circuit protection for the branch circuit conductors to mitigate the effects of arcing faults. AFCI devices will be required by the National Electrical Code (NEC) in the year 2002 for all new residential construction. The presentation starts with an AFCI Video defining the problem and the solution required. Second is a detailed presentation including: the characteristics of today's branch circuit protective devices, the technical challenge of arcing faults, the enhanced protection of Arc Fault Circuit Interrupters, studies cited and performed, and availability of these products. Wrapping things up is an AFCI product demo that shows an AFCI breaker responding to arcing faults and the presentation will end with questions.

About the speaker: Robert J. Clarey is an Electrical Engineer BSEE from University of Iowa. Robert is currently located in Pittsburgh, PA and is the Manager of Applications for Cutler-Hammer Molded Case Circuit Breakers.

He has been working with arch fault protection since 1991. Outside of work, Robert is a past chairman of the NEMA Molded Case Circuit Breaker Section, chairman of the NEMA Harmonization Task Force for a tri-national Molded Case Circuit Breaker Standard, and a member of the NEMA Molded Case Circuit Breaker Section Task Force on Arcing Fault Circuit Breakers. Robert has made over 27 AFCI presentations in the past 2 years to over 2,000 electrical inspectors, electrical contractors, consultants, and other groups such as the Consumer Product Safety Commission (CPCS) in the USA and Canada.

Location:

Como Inn, 564 N. Milwaukee Ave, Chicago, IL.
Directions: The Como Inn is located on Milwaukee Avenue just off the Kennedy Expressway (I-90/94) near Grand Ave. and Halsted St.

Time:

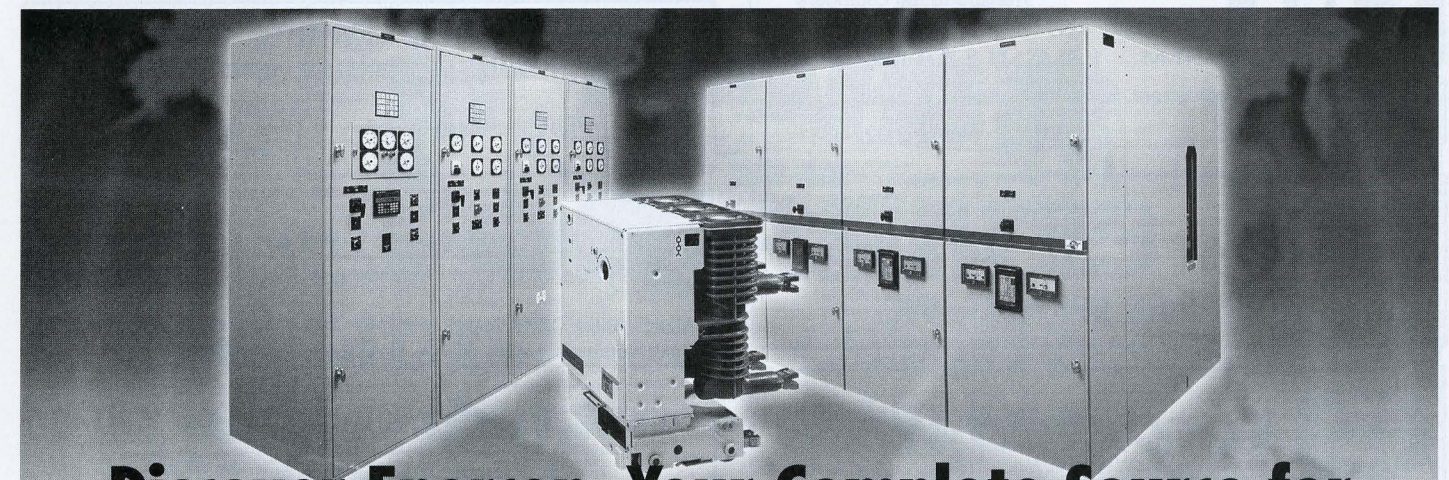
Social: 5:30pm.
Dinner: 6:00pm.
Presentation: 7:00pm.

For reservations:

Cost: \$25 includes the presentation and your choice of a chicken or pasta four course dinner. Please call the IEEE Business Office at (800) 898-IEEE or (630) 724-0200 with your entree preference on or before October 15.

NOTE: For P.E. licenses that require continuing education for renewal, attendance at IEEE Technical Meetings is acceptable as one Professional Development Hour (PDH) per meeting.

The upcoming 1999-2000 IEEE - IAS meeting dates are: November 17, January 19, February 19, March 15, April 12 and May 17 (lunch).



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