


February 2012
Inside this issue:

From the Chair	1
STEM Expo	2
GOLD	3
Pre-College EDU 2012 Goals	3
High Vacuum in Electronics	4
2012 Officers	5
Region 5/ Green Tech Conference	6
Officer Training	7

Special points of interest:

 Official newsletter of IEEE-Denver Section
 Published Quarterly

Editor:

 Submit articles for consideration to:
khasling@ieee.org

From the Chair

Welcome to the IEEE Denver section newsletter.

I am the Denver Section chair in 2012. 2012 is going to be an exciting year for Denver section IEEE members. Besides our regular events, we have plans for several major events. We have many volunteer opportunities for you if you like to help. Even if you are too busy and don't have time to volunteer, you can still join our activities. In 2013, Denver will be hosting IEEE region 5 meeting - Green Technology and College Robotic competition. All the planning and preparation work are happening in 2012. You can read from Tim Weil's article in this issue and learn more about the conference. Besides, our pre-college activities are going to be big this year. We are going to bring TIPS program to Denver this year. Abhi is heading the effort. The theme of IEEE this year is

to reach out to our members and give them the most benefits they deserve. There are more than 3500 members in the Denver section. We have many chapters that serve your interests. Our events will be announced in IEEE Denver section LinkedIn group and you can see our activities by visiting us at IEEE-denver.org. If you want to join a chapter event, click on technical societies and you can find your favorite society information. You can also see our activities posted on our calendar. Mile High Spark is another channel for you to know about IEEE activities. We will have our social events in spring and fall. Our fellow members Gordon Day (IEEE president and CEO) and Jim Jefferies (Region 5 Director) are in Denver section.

- Louis Tsai
2012 Chair



Join us and attend the Next
 Denver IEEE ExCom meeting at:
 DeVry University
 1870 West 122nd Ave Room 121
 6:00 pm—8:30 pm

STEM Expo 9/30/11

How do you keep young (K-5 grades) students interested for longer than 30 seconds?

First Trick:

"Hands-on Science," involves at least three of the five senses: touch, vision and hearing (and even the sense of smell, in detecting ozone, from electric sparks).

Second Trick:

Ask each student what is going on, in any experiment, to engage the mind.

After the first three "R's:" Reading, wRiting and aRithmetic we always include the (often ignored) fourth "R:" Reasoning. [continued on next page](#)

STEM Expo 9/30/11

In education, STEM is the abbreviation for Science, Technology, Engineering and Mathematics.

IEEE-Denver.org members have long been involved in education, on many levels, including volunteering as long-term mentors at local schools (such as DSST (Denver School of Science & Technology)), at clubs including Robotics and the Calculus Bowl, and at single events, like the annual STEMpalooza.

The ever-popular STEMpalooza, traditionally held at the Colorado Convention Center was missed in 2011. We expect a welcome return in October 2012.



Students were able to touch real minerals and animal fur, hammer nails, measure pH in non-toxic liquids, peer into microscopes to watch protozoa, fly paper airplanes, watch huge sparks from Van de Graaff generators and Tesla coils, launch chemical “rockets” and more! At my experiment station, students:

- spoke into a microphone and watched their voices converted into glowing, wiggly green waveforms on an oscilloscope screen.
- twiddled a “Twanger,” (a long thin strip of spring steel) to make different notes by strumming it overhanging a table edge. Spring-steel resonators are vital to simple musical instruments, such as the Jaw Harp (monophonic), and the “Kalimba” African Thumb-piano (polyphonic).
- played with ring-shaped ceramic magnets, stacked individually on a pencil, to illustrate magnetic repulsion.
- constructed an electromagnet (using a steel nail, and insulated telephone wire).
- drew “Graphite Resistors” on paper, with an ordinary No. 2 pencil. They measured the resistance (which varied with thickness and length), using a sensitive Ohmmeter. The Ohmmeter measured skin resistance (which varies with skin moisture), and introduced one of the sensors in a Polygraph (popularly called the “Lie-Detector”).

Teachers and parents joined their students, who learned how to safely “electrocute” their parents, using an automotive ignition Spark Coil, and a small, 1.5 Volt AA battery. Creating a magnetic field (in the primary coil), and then interrupting the current (by opening the circuit) created a higher voltage, just high enough to cause a surprising “muscle twitch”).

A Slinky spring, stretched more than 20 feet, illustrated standing waves: fundamental, various harmonics, transverse polarization, and Shear waves and Pressure waves, produced by earthquakes, and recorded by seismographs.

The most popular of the experiments was a tuning fork. Students tapped it, to start it vibrating, then dipped the very tips into a small bowl of water, which appeared to be boiling, as the liquid scattered.

By the end of the day, hundreds of rambunctious students and IEEE-Denver instructors were smiling from the fun filled day.

- Richard C. Rew

GOLD (Graduates of the Last Decade)

GOLD is an affinity group in IEEE catering to the needs of the young professionals - specifically those within 10 years of their first degree. The Denver Section GOLD group focuses on a variety of events including:

- local lab/facility tours
- happy hour/networking events
- technical and non-technical talks

The Denver GOLD group also invites local student branch members to events as they will soon be the new face of GOLD. The GOLD group has recently been "reborn" in the Denver Section and we are looking to build momentum.

If you are within 10 years of your first degree and interested in volunteering a few hours a month to help us plan OR just interested in attending GOLD events as the IEEE point of contact, contact Jennifer Kramer at jenniferkramer@ieee.org

We would love to have officers from all around the Denver metro area including the tech center and south Denver, downtown Denver, and the north Denver/Boulder area. If you aren't GOLD and would like to help out the young professionals in the Denver Section, we could use your help! If your company can offer a tour, you have an area of interest for young professionals, or just want to get involved, please email Jennifer the appropriate contact information.

We are only as strong as our members and the help we receive! We look forward to a great 2012, and our most active year yet!

- Jennifer Kramer

Pre-College Education—Goals of 2012

Gordon Day, IEEE President and Chief Executive Officer, recently mentioned (during IEEE Denver Officer Training on February 11, 2011) how each century poses new problems for engineers. One wonders what problems would be the most challenging (and interesting) for the engineers of the 21st century – would it be designing electromechanical gear for a powered exoskeleton or understanding the impact of a solar storm on our smart power grids.

It is no wonder that IEEE is strongly focused on raising the functional and technological literacy of young children so that they can solve many such problems of the century. The main goal of IEEE Pre-College Education Board is to keep alive the innate curiosity of young children about science as they move into middle school and high school, so that they will continue to enjoy mathematics, science, and technology. As a Vice Chair for Pre College Education for IEEE Denver chapter since 2011, I have been fortunate in taking this message and supporting several local STEM activities. IEEE Denver supported BEST Robotics, CALC Bowl, and STEM Expo at Ben Franklin Academy in 2011. As we step into 2012, we would like to promote IEEE's Teacher in a Service Program (TISP) in a local School District (Douglas County). In addition to funding an annual student award to Denver School of Science and Technology, IEEE Denver has also committed to fund an annual student award for Ben Franklin Academy (BFA). BFA is a new charter school in Highlands Ranch that has a mission is to groom children into young adults whose character reflects personalities like America's founding Renaissance man, Benjamin Franklin: well-read, scientifically curious, and civically engaged. Details of the award can be obtained from the BFA web site (<http://www.bfacademy.org/news/ieee-partners-bfa>).

As I strive to work with my IEEE colleagues for implementing IEEE's goals at the grass roots level, I often think about a Chinese proverb that a friend once said to me about his teaching profession:

"Tell me and I'll forget; show me and I may remember; involve me and I'll understand."

- Abhijit Sur

High Vacuum in Electronics

Cathode Ray Tubes (CRTs) are rapidly becoming replaced by a variety of flat-panel technologies (obsolescent Plasma, common LCD, increasingly common LEDs).

Vacuum tubes (colloquially termed: "Firebottles") were thought to be completely obsolete, more than fifty years ago, when semiconductors were developed to amplify, oscillate and switch much more efficiently, more reliably (and more economically), in low-power applications such as radio and television receivers, calculators, computers, etc.

Lately, there has been a resurgence in manufacturing of new vacuum tubes (as in the Czech Republic). Recently, electronic engineers have been creating new designs, in certain niche markets, such as powerful audio amplifiers for electric guitars (and other electronic instruments, performed on stage), and driving banks of speakers.

High-power (> 10 kiloWatts) RF transmitters in frequency ranges of HF, VHF and are dependent on robust (nearly bullet-proof) power amplifiers. Most large RF transmitters still use specialized vacuum tubes, at least in the final output stage. Power transistors (often arrayed in parallel) have been tried, in such challenging applications, and were even made to work, up to a point. However, most semiconductor amplifiers have not proved to be sufficiently reliable, in unforgiving environments, which include regular lightning strikes to the transmitter tower, and strongly reflected power, VSWR (Voltage Standing Wave Ratio) whenever the antenna impedance does not closely match the amplifier impedance.

Semiconductors still have at least two inherent weaknesses, such as:

- Thermal destruction can occur, if transistors are allowed to overheat.
- Transistors have a limited ability, to operate simultaneously at both high voltages and at high currents, which exist in RF amplifiers, in excess of 10 kiloWatts.

[More on the Semiconductor](#)

Thermal limitations of semiconductors are being overcome gradually, as Germanium (100 degrees C) was replaced by Silicon (200 degrees C). Newer semiconductors (still expensive) include GaAS (Gallium Arsenide), Silicon Carbide (300 degrees C) and Diamond (1000 degrees C, still available in rather small chips).

Additional Article Resources: [Wired Diamond](#) and [PCWorld Diamond Chips](#)

High vacuum is necessary, in specialized photomultiplier tubes, and in various UHF tubes, such as TWT (Traveling Wave Tubes), power Magnetrons (in most radar transmitters and in every microwave oven), and power Klystrons (certain tunable radar transmitters, and in particle accelerators).

Creating a high vacuum requires several kinds of pumps:

- **Roughing pumps** are typically mechanical, and have evolved from reciprocating cylinders and valves, to more reliable venturi aspirator and rotary types, such as spinning vanes, meshing gears or lobes, meshing screws and even high-speed turbines (multiple compressor stages, modeled on jet engines).
- After the pressures have been sufficiently reduced, many kinds of **high-vacuum pumps** include: diffusion pumps (gas molecules carried along with a flow of condensing fluid, which have evolved from Mercury vapors), extremely-fast-spinning turbo-molecular pumps (vanes on magnetic bearings), getter sorption pumps (capturing atoms, and reacting them with clean layer of metallic titanium), ionization pumps, and cryogenic pumps (cold enough to freeze-out all gases, except helium).
- Several different types of [vacuum pumps](#) are required to achieve higher vacuum beyond vacuum ranges that can be reached by a roughing pump.

[More on Vacuum Gauges](#)

High-vacuum sensors may include thermal (Pirani gauge), ionization such as principles found in an ordinary triode amplifier tube (hot cathode), and cold cathode types: Penning gauge, inverted magnetron, etc. Several different types of vacuum gauges are required for measuring vacuum, starting with simple aneroid mechanical bellows or bourdon tubes (driving moving-needle gauges) and Mercury in vertical capillary tubes (barometer and McLeod gauges).

[continued on next page](#)

Check out [this fascinating video](#) (17 min) on new vacuum tubes being created from nickel and tungsten metals and glass by a French expert, Claude Paillard.

High Vacuum is actually required, in order to create high-purity metals, semiconductors, transistors, integrated circuits, photovoltaic solar cells, flat-panel displays, as well as vacuum tubes and long particle accelerators, etc.

Manufacturing (and refining of super-pure materials) might become economical, in low Earth orbit, because of endless free vacuum, which requires no special pumps, or gas-tight enclosures. Only a few hundred miles above the surface of Earth, there is a higher vacuum (in terms of free atoms per cubic meter), than the best vacuum pumps can achieve on Earth (always fighting our soup of atmosphere). You might imagine the ISS International Space Station, or any spacecraft, with high-power RF transmitter tubes, without any glass or ceramic enclosures, with amplifier "tubes" lifespan limited only by slow evaporation of the incandescent cathode.

Even cathode heaters will soon become unnecessary, because of recent developments in cold cathodes, which boil-off electrons into the high vacuum, from extremely sharp needle-tips of graphite, or from CVD (Chemically-Vapor Deposited) diamond points, or from graphite microtubules.

- Richard C. Rew

2012 Denver Officer and Leadership Positions

Here are your other 2012 ExCom committee members who are serving the IEEE community. We have a very strong team.

Vice-Chair 2013 Chair Elect)	Tim Weil
Secretary	Allen McLain
Treasurer	Cliff Alston
Past-Chair	Bob Faus
Vice Chair, Professional Activities	Krista Hasling
Vice Chair, Student Activities	Abhijit Sur
Vice Chair, Membership Development	Daniel Helmick
Vice Chair, Conference	Mohammad Mavadati
Vice Chair, Electronic Communication	Richard Rew
Webmaster	Adam Smiley
IEEE Newsletter	Krista Hasling
Awards and Recognition	Katie Bair
Public Relations	Valerie Schlecht
Government Liaison	Dan Lubar
University Student Chapter Liaison	Jennifer Kramer
Finance & Audit	Rick Robinson and Bob Wilson



IEEE Denver Section to Host 2013 Region5/Greentech Conference

The Denver Section has been selected to host the 2013 Greentech Conference and IEEE Region 5(R5) meeting to be held next year (April 4-7, 2013) at the Hyatt Tech Center hotel in South Denver. With 14 months to go, an Executive Committee (ExCom) has been formed with representation from Region 5, government, industry, academia and an influx of local IEEE volunteers. This article for the SPARK newsletter will be updated throughout the year as more focus is given to the planning and volunteer efforts needed to manage this event.

As reported in '[Today's Engineer \(June 2011\)](#)' the 2011 Greentech conference was conceived on the pressing need to address one of the nation's most complicated challenges: *securing green and clean energy sources for the 21st century*. The development and application of new alternate energy sources will require the cooperative effort from many disciplines of engineering, science and architecture. Thus, [IEEE-USA](#), [Region 5](#), the [IEEE Denver Section](#) local area universities and businesses will be planning throughout this year to manage the conference events. Our goal will be to provide a forum for professionals from around the world to work together to develop realistic solutions to address the current energy crisis and reduce carbon emissions and other greenhouse gases. The Greentech conference will feature two days of technical presentations, representing the cutting edge of clean energy research, development, and demonstration. Local renewable energy firms and IEEE supporters will be invited to participate as exhibitors and patrons of this event.

Overall, the different conference programs are structured as a 4-day event with includes the IEEE Green Technology Conference, Regional 5 Student Competitions, Student Professional Activities (SPACs) and the bi-annual Region 5 business meeting. The R5 Business meeting will include a wide range of topics – Officer Reports, Finances, Educational Activities, Membership Development, Affiliate Group Reports (WIE, GOLD), Professional Activities Committee for Engineering (PACE). Saturday, there will be over 30 Student Robotics teams competing in the SPAC program. Student competitions will also include competitions in Circuit Design, Ethics and Student Paper (undergraduate) events. The evening banquet will feature a guest speaker and recognition of SPAC competition teams and IEEE programs across the 26 R5 membership sections.

Significantly, the Denver Section has been awarded the R5 Annual Conference for 2013 and our planning for these events (over 300 attendees with the Region 5, SPAC and Greentech programs) is just getting underway. Members of the ExCom are planning to attend this year's 2012 R5 Regional meeting hosted this April in Tulsa, OK - <http://www.ieeegreentech.org/>. An overview of the conference is available at the Region 5 portal - <http://www.ewh.ieee.org/reg/5/> and through thr R5 Community Portal (login required) - <http://ieee-region5.oc.ieee.org/>. To learn more, Tim Weil, General Conference Chair at tweil.ieee@gmail.com or Rick Robinson, Co-Chair at rrobinson256@ieee.org.

- Tim Weil

Denver in 2013, Tulsa in 2012

The IEEE Green Technologies Conference and IEEE Region 5 Business Meeting and Student Competitions is being held in Tulsa, OK on April 20-22. Sign up today!

[Greentech Conference Registration](#)

[R5 Business Meeting and Student Competition Registration](#)

Find out what all the buzz is about because this joint conference is returning to Denver in 2013.

Officer Orientation Builds Chapter Management Skills

Being a volunteer leader is challenging as well as rewarding. To help you get the job done, the Denver Section Leadership Training provides a comprehensive overview of chapter management. Over 30 area IEEE officers showed up for a snowy Saturday morning program which offered valuable information for running a successful chapter program.

The half-day workshop offered tools, ideas and the experiences of veteran members to help chapter and affiliate leadership run a successful program. The different session topics covered planning, publicizing and conducting successful technical meetings essential for new chapter officers. Our membership was also lucky to have IEEE President Gordon Day on hand for an opening talk on the spirit of volunteerism that makes IEEE so successful as the largest technical society in the world.

Workshop Topics

- IEEE/IEEE-USA Structure, Requirements and Resources
- Denver Section Overview (Rebates, Public Relations, 2012 Initiatives)
- Officer Roles & Responsibilities
- Student Branches, GOLD and Pre-College Activities
- Financial Reporting
- Running an Effective Chapter
- Student Chapter Programs

- Electronic Publicity (Constant Contact, Web Hosting, vTools)
- Meeting Logistics & Successful Events
- 2013 Region 5/Greentech Conference (Denver)

Tools for membership development such as SAMIEEE, e-Notice and Constant Contact were explained. Other topics included meetings and activities ideas as well as sources of funds. Participants had the opportunity to share ideas with other chapter officers, and to meet section and region leaders. Over a dozen affinity group and student branches were represented at the seminar.

—Tim Weil



Chapter Officers at the Officer Training Program

IEEE Denver Section

Mission Statement

Enrich the professional and personal lives of the Rocky Mountain Region members, developing them into valued contributors to society through quality programs, continuing education, career development and community service; in collaboration with IEEE, industry, government and academia.



The IEEE Denver Section is comprised of over 3600 engineers and technical professionals in the Denver - Boulder area.

<http://www.ieee-denver.com/>