

Cathay May 2013

www.cathayradio.org

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Mission: The Cathay Amateur Radio Club is basically an active social club of Ham Radio Operators and their spouses. We support local community requests for HAM emergency communications. Several of us are trained in CPR/ First Aid and are involved with community disaster preparedness.

Monday Night Net Time: 9 PM Local Time/PST, Frequencies: 146.67MHz -600KHz PL85.4 and 442.70 +5MHz PL 173.8. The repeaters are linked only during the CARC Monday night net. The CARC Monday night net is the best way to find out the latest club news. All check-ins are welcome.

Message from the President: George Chong, W6BUR

Hello CARC Members and Friends,

For those of you that attended the April 6, 2013 ORCA meeting, you got a real treat from Edison Fong's – WB6IQN 2m/440 J-Pole antenna design lecture.

Edison had the audience riveted to their seats as he explained the performance and design hurdles that he had to overcome when he built his low cost patented J-pole antenna.

For more information about Edison's antenna designs check out this URL:
<http://www.arrl.org/files/file/Technology/tis/info/pdf/0302038.pdf>

During the ORCA meeting I increased my knowledge about antennas and I also managed to score a couple of books from the ORCA raffle. All in all a very good ORCA meeting for me!

I like to point out some of the interesting highlights of this month's CARC newsletter as follows:

Public Service Announcements

There are several events upcoming events that may be of special interest to our CARC members.

- Cancer Society Relay Fund Raiser - CARC member, Skip Weiss - KG6SCE is asking for communications support during an upcoming Cancer Society Relay Fund Raiser.
- Auxiliary Communications Service (ACS) has some very interesting informational events planned. Learn about: Cross-band Repeater, SFPD Communications Van, Verizon Wireless contingency plans. These events will take place during ACS regularly scheduled meeting.

Special Interest Article:

Since many of our CARC members are community minded folks doing volunteer work for the Red Cross, ARES, NERT/CERT, and Churches that it would be appropriate to present an article on the new volunteer SFPD ALERT program.

"The First San Francisco Police Department (SFPD) ALERT Class" by our CARC Editor – Rodney Yee (KJ6DZI) provides insight into the new ALERT program.

Featured Tech Article

This month's Tech Article consists of two separate articles from the University of Illinois.

The first article (Batteries charge very quickly and retain capacity) was published in March 2011 and deals with creating a three-dimensional nanostructure battery cathode (+ terminal) that would greatly improve rechargeable battery performance.

Electrons are negatively charged and are attracted to the positive end of a battery and repelled by the negative end. When a battery is inserted into a circuit, the electrons flow from negative terminal (anode) of the battery to the positive (cathode) terminal.

The second article (Small in size, big on power: New micro batteries a boost for electronics) was published in April 2013 and it builds upon previous battery research, taking it to the next logical step where nanostructures are extended to the negative (anode) terminal along with other enhancements.

These two articles illustrate how the scientific community collaborates and builds upon earlier research to create breakthroughs in technology that benefits us in our daily lives.

I can envision the day when a 50 watt mobile HAM radio rig can be powered by a shirt pocket sized battery weighing a couple of ounces.

Now that I have your attention, please enjoy reading the Tech Article Section Part I and Part II.

CARC Final Wrap Up Message:

Chat sub s'em to all you CARC members!

- George W6BUR.

Public Service Announcements

From CARC Member Skip Weiss, KG6SCE

Event: Relay for Life / Daly City - A 24 Hour Cancer Society Relay Fund Raiser

Time: Starting at 10:00 am Sat June 29 and ending at 10:00 am Sun June 30, 2013

Location: Westmoor High School Sport Stadium
131 Westmoor Ave, Daly City, CA 94015
Entrance at corner of Del Prado Dr. & Mariposa Ave

To Sign Up: http://main.acsevents.org/site/TR?pg=informational&fr_id=48859&type=fr_informational&sid=128501

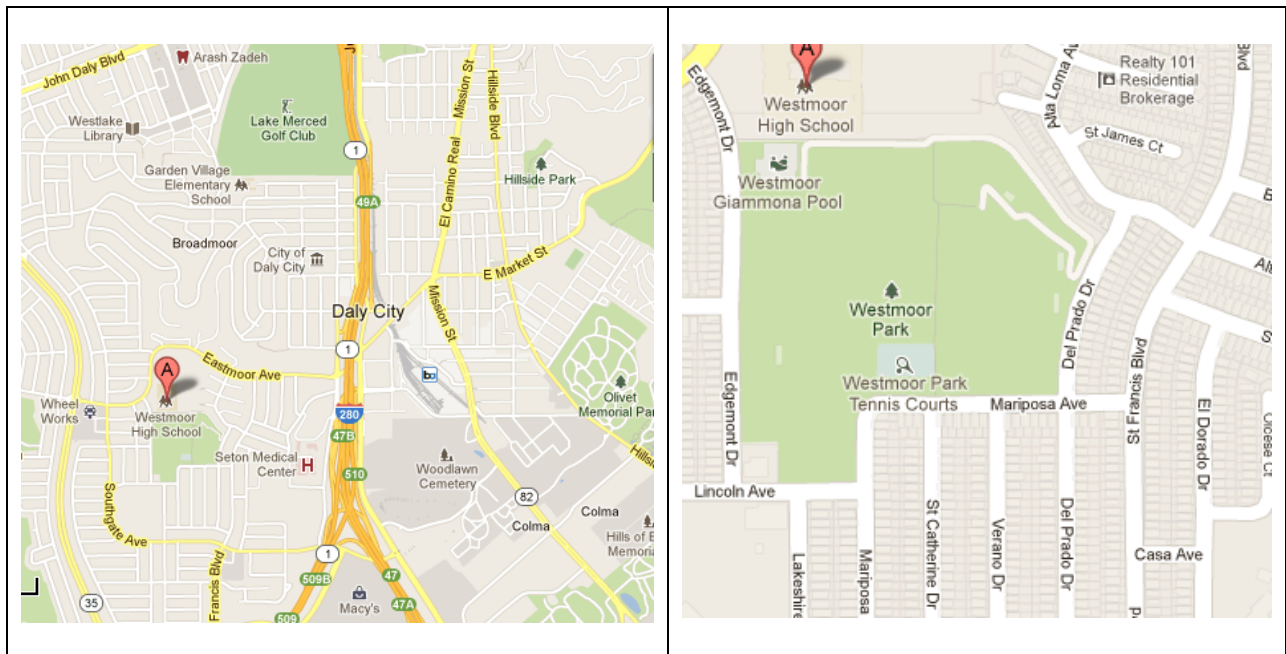
HAM volunteers are needed to help with directing cars, public safety and HAM radio communications support.

Please contact Skip Weiss, KG6SC via email for further details and assignments.

- Email address: "Skip Weiss" calgrizzly@earthlink.net
- Subject Line: Relay for Life/HELP

Skip (KG6SCE) and his VFW are supporting this worthwhile event.

Map of Westmoor High School Location is shown below:



The Relay Event is:

- Organized, overnight community fundraising walk
- Teams of people camp out around a track
- Food, games and activities provide entertainment and build camaraderie
- Family friendly environment for the entire community

The scheduled activities are:

Opening Ceremony: 10:00 am Saturday, June 29, 2013

The Opening Ceremony brings everyone together for a high-energy event kickoff to celebrate the lives of those who have battled cancer, to inspire hope by sharing recent accomplishments and progress, and to remind everyone that while we are winning this battle, fighting cancer is a year-round priority.

Survivors & Caregivers Lap: 10:30am Saturday, June 29, 2013

During the Survivors & Caregivers Lap, upbeat music plays as all cancer survivors and caregivers at the event take the first lap around the track cheered on by the other participants who line the track, celebrating their victory over cancer and their fight to end cancer!

Luminaria Ceremony: 9:15pm Saturday, June 29, 2013

The Luminaria Ceremony is a time to remember people we have lost to cancer, to support people who currently have cancer, and to honor people who have fought cancer in the past. The power of this ceremony lies in providing an opportunity for people to work through grief and find hope.

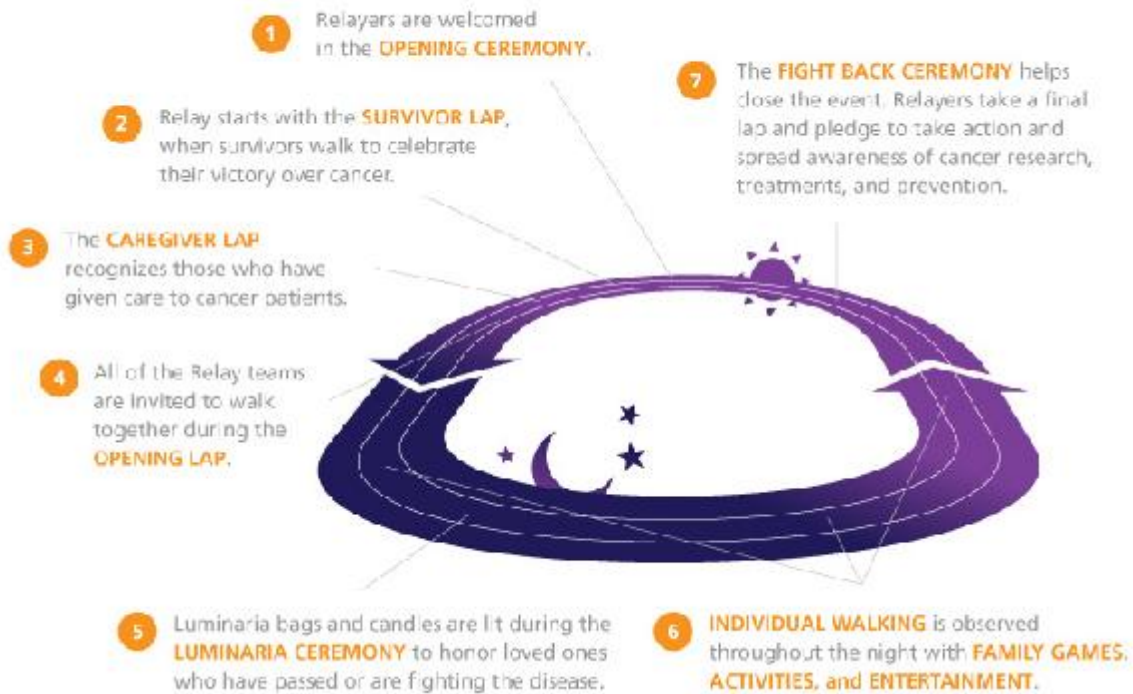
Fight Back: 9:30am (Sunday, June 30)

The Fight Back Ceremony symbolizes the emotional commitment we each make to the fight against cancer. The action we take represents what we are willing to do for ourselves, for our loved ones, and for our community to fight cancer year-round and to commit to saving lives.

Closing Ceremony: 10:00am (Sunday, June 30)

The Closing Ceremony is a time to remember the lives of those lost and to Celebrate that each of us has committed, through our participation in a Relay event, to fight back against this disease over the next year.

What is Relay for Life?



HAM CRAM / HAM Licensing

For upcoming HAM Licensing locations please refer to:

<http://www.arrl.org/find-an-amateur-radio-license-exam-session>

Bart Lee – K6VK

Attention all HAM, it is MayDay!!

The California Historical Radio Society (CHRS) and its amateur radio station W6CF is caught up in its landlord's bankruptcy (Inner Cities Broadcasting). This forces CHRS to purchase the Berkeley KRE building and property now or lose it.

TODAY'S UPDATE – March 27th– We started with \$93,000 in our Museum Fund last

June, and today we have 255 donations and pledges totaling \$685,420! THANK YOU! Our goal is \$750,000+. We only have \$64,580 to go! Holy Cow, we have already raised nearly three quarters of a million dollars! It's downhill from here. We have done so well, please dig deeper and make this happen! We should be able to raise the rest with your help and support.

\$25,000 CHALLENGE: CHRS MEMBER TOM NELSON, WHO WORKED AT KRE IN THE 1940s, REALLY WANTS TO SEE CHRS PURCHASE KRE AND NOT LOSE THIS HISTORIC PROPERTY. TOM PLEDGED \$5,000 THEN INCREASED IT TO \$25,000. NOW, TOM HAS OFFERED UP A CHALLENGE, POTENTIALLY WORTH \$100,000. THIS WOULD PUT US OVER THE TOP. HERE IT IS:

Tom will pledge another \$25,000 if 3 or more people will step up and match his pledge or increase their pledge by at least \$25,000, making this challenge worth at least \$100,000... or more! We know there are people reading this right now who can meet this challenge and ensure that CHRS stays at KRE. AS OF TODAY... NO ONE HAS OFFERED TO MATCH TOM'S CHALLENGE. Please step up!

THESE EVENTS DO NOT MEAN AN END TO OUR FUNDRAISING BY ANY MEANS. WE ARE AWARE THAT SOME OF YOU MAY NOT BE ABLE TO FULFILL YOUR PLEDGES, SO OTHERS MUST STEP AND PLEDGE FOR THE FIRST TIME OR INCREASE YOUR PLEDGES. WE ALSO HAVE INSURANCE, OPERATING COSTS AND FUTURE EXPANSION PLANS FOR KRE TO CONSIDER. PLEASE PLEDGE NOW. WE HAVE AMAZED THOSE OUTSIDE OF CHRS FOR OUR ABILITY TO REALIZE ALMOST ALL OF OUR GOALS IN A VERY SHORT TIME. WE KNOW THAT YOUR SUPPORT AND THE SUPPORT OF OTHER ORGANIZATIONS HAS BEEN TREMENDOUS. WE WILL BE ABLE TO DO THIS, WITH YOUR HELP.

MANY OF YOU HAVE ASKED TO BE MADE AWARE OF WHEN WE ARE GETTING CLOSE TO OUR GOAL SO YOU COULD INCREASE YOUR PLEDGES. NOW IS THAT TIME. THE PUSH IS ON. SO, PLEASE DIG DEEPER AND REMEMBER THE THOUSANDS OF HOURS OF SWEAT THAT YOUR CHRS BROTHERS AND SISTERS HAVE PUT INTO THIS PROJECT. WE KNOW THERE ARE MANY PEOPLE READING THIS WHO HAVE NOT PLEDGED. WE ARE VERY CLOSE. YOUR PLEDGE WILL MAKE A DIFFERENCE. IF YOU HAVE THOUGHT ABOUT MAKING A PLEDGE, DON'T HESITATE. DO IT NOW AND BE PART OF THIS IMPORTANT EFFORT.

REMEMBER – You can pledge now, but you need not send any funds until we need them. [CLICK HERE TO PLEDGE.](#)

SUPER DONORS – The list keeps growing. Be part of it! EVERY pledge and donation means a great deal to CHRS. But it is worth noting several pledges / donations that are really helping us to reach our goal:

Jack Bethards	– \$5,000	Bert Buss	– \$5,000
Elmo & Kim Giovanetti	– \$5,000	Chip Lim	– \$5,000

Tom Nelson	– \$25,000	Robert & Reina Swart	– \$5,000
Judy Mears & Bart Lee	– \$10,000	Norm Howard Lehfeldt	– \$15,000
Larry & Joan Drees	– \$16,600	Tom & Julie Bonomo	– \$25,000
George Patterson	– \$25,000	Gilles Vrignaud	– \$25,000
Norman Leal	– \$75,000	Philip Monego	– \$100,000
Scott Robinson	– \$100,000	John Staples	– \$100,000

Organization Donors of note:

The CHRS Central Valley Chapter – \$3750 The Alabama Historical Radio Society – \$1000
The SF Bay Area SBE Chapter 40 – \$1000 The Sacramento SBE Chapter 43 – \$1000
The Mt. Diablo Amateur Radio Club – \$1000 The Delaware Valley Historic Radio Club – \$1000
The Art Deco Society of California – \$500 The Iowa Antique Radio Club and Historical Society – \$500

We are grateful to these fine organizations for their support! And we need more support...

Our \$25,000 Challenge Pledge from Gilles Vrignaud towards our KRE building purchase fund is complete! Thank you Gilles and all who pledged during this challenge. The challenge and matching pledges were worth \$50,000! – Who will step it up and offer a \$50,000 Challenge next?

That is potentially worth \$100,000 and puts us very close to our goal. So, if you have not pledged, do it now! Many people have recently increased the size of their pledges. You can do the same and we would really appreciate it.

All donations to the CHRS are tax deductible and will be for the good cause of preserving the KRE building.

KRE 2012 - after CHRS Restoration



For additional information see: <http://www.californiahistoricalradio.com/>

Auxiliary Communications Service (ACS)

The Auxiliary Communications Service (ACS) was organized by the San Francisco Office of Emergency Services (OES) following the 1989 Loma Prieta Earthquake to support the communications needs of the City and County of San Francisco when responding to emergencies and special events.

The Auxiliary Communications Service holds General Meetings on the third Tuesday of each month at the San Francisco Emergency Operations Center, 1011 Turk Street (between Gough Street and Laguna Street), from 1900 hours to 2100 hours local time. All interested persons are welcome to attend.

The ACS Net begins at 1930 hours (7:30 p.m.) local time each Thursday evening, on the WA6GG repeater at 442.050 MHz, positive offset, tone 127.3 Hz. The purpose of this net is to practice Net Control skills, practice checking in with deployment status in a formal net, and to share information regarding upcoming ACS events. Guests are welcome to check in. ACS Members should perform Net Control duty on a regular basis. On the second Thursday of each month, the net will be conducted on the output frequency of the WA6GG repeater, 442.050 MHz no offset, tone 127.3 Hz, simplex.

For more information, please attend an ACS meeting or check in on a net, or call 415-558-2717.

Upcoming meetings: Tuesday 7pm, May 21,2013 Cross-band Repeater
Tuesday 7pm, June 18,2013 SFPD Communications Van
Tuesday 7pm, July 16,2013 Verizon Presentation

May 21,2013 Martin Alperen of ACS will do a presentation on Simplex Cross Band Repeat Operations. A demonstration will be done with two handheld radios that do cross band. These two handhelds were lifted on a kite and together, acted as a true repeater.

June 18, 2013 there a show and tell of a SF Police Department Communications Van and passing of messages.

July 16, 2013 Verizon Wireless will discuss their plans to keep their system up during a major disaster such as earthquake and show off some equipment.

Gilbert Gin (KJ6HKD)

Free Disaster Preparedness Classes In Oakland:

<http://www.oaklandnet.com/fire/core/index2.html>

CORE is a free training program for individuals, neighborhood groups and community-based organizations in Oakland. The underlying premise is that a major disaster will overwhelm first responders, leaving many citizens on their own for the first 72 hours or longer after the emergency.

If you have questions about the recertification process, you may contact the CORE Coordinator at 510-238-6351 or core@oaklandnet.com.

Free Disaster Preparedness Classes In San Francisco – NERT Taught by San Francisco Fire Department

RSVP to sffdnet@sfgov.org or call 415-970-2024 to register. Visit www.sfgov.org/sffdnet to learn more about the training, other locations, and register on line.

Upcoming Special NERT Events.

May

4th: Intro to Ham Communications Team (HCT) 101, 8:30 a.m. - 3:30 p.m., SFFD DOT*
New or interested HAM operators beginner course (no license required)
HAM operators that want disaster communication instruction are welcome after lunch

7th: Ham Radio for "dummies", HCT 300 & 301, 6:30pm-9:00pm, SFFD DOT*
Get to know your radio. Basic how to instruction: turning on, tuning in, changing batteries etc. (Amateur Radio license required)

8th: Ham Emergency Messaging for the non-hobbyists (hobbyists allowed),
HCT 303, 6:30pm-9:00pm, SFFD DOT*
Learn and practice creating emergency messages (an important skill for ALL NERTS) and practice talking on the radio. Overcome your hesitation and just do it.

9th: Advanced Ham Radio for "dummies" Ham Communications Team (HCT) 400
Hands on training, 6:30pm-9:00pm, SFFD DOT*
Bring your radio and practice, practice, practice: buttons, antennas and tones etc.
(Amateur Radio license required)

11th: DART IV, Animal Rescue Team Exercise, 9:00am-4:00pm, ACC, 15th and Harrison
This is session 4 of 4. See March 16th for registration requirements and details

16th: Neighborhood Coordinator/Leadership College, 8:30am-4:00pm, SFFD DOT*

* SFFD DOT is the Division of Training @ 19th Street/Folsom. (enter through yard on 19th and park along back wall) Division of Training classroom is in the 1-story building directly next to the Fire Station on the corner

San Francisco Police Department: Auxiliary Law Enforcement Response Team(ALERT)

The Auxiliary Law Enforcement Response Team (ALERT) is a citizen disaster preparedness program designed. The ALERT program is for volunteers 16 years of age or older, who live, work, or attend high school in San Francisco.

Graduates of the San Francisco Police Activities League (P.A.L) Law Enforcement Cadet Academy are also eligible to join.

ALERT volunteers will first complete the Fire Department's Neighborhood Emergency Response Team (NERT) (www.sfgov.org/sfnert) training and then graduate into an 8 hour Police Department course specifically designed for ALERT team members.

ALERT members will work closely with full-time and/or Reserve Police Officers in the event they are deployed after a disaster. The Basic ALERT volunteer will have no law enforcement powers other than those available to all citizens.

Upcoming ALERT Training

The second ALERT training class has been scheduled for Saturday, June 22nd, 2013. The class will be held at the San Francisco Police Academy, in the parking lot bungalow, from 8am-5pm (one hour lunch break).

IMPORTANT- All participants must complete the background interview process in order to be eligible to attend the ALERT training class.

Eligible ALERT participants may register for the June 22nd training class by contacting the ALERT Program Coordinator, Mark Hernandez, at sfpdalert@sfgov.org, or by telephone at 415-401-4615. To register by email send your request to sfpdalert@sfgov.org with your NAME and PHONE NUMBER.

ALERT Information Meeting:

An informational meeting will be held at the San Francisco Police Academy, located at 350 Amber Drive, Parking lot bungalows, on Thursday, May 30th, 2013, at 7pm. All members of the public are welcome. Interested individuals will have their questions about the program answered at the meeting.

For more information on the San Francisco Police Department ALERT Program, email us at sfpdalert@sfgov.org, or call Sergeant Mark Hernandez (SFPD, Ret.), SFPD ALERT Program Coordinator, at (415) 401-4615.

For additional information on the web please refer to: <http://sf-police.org/index.aspx?page=4019>

Special Interest Article:

The First San Francisco Police Department (SFPD) ALERT Class

By Rodney Yee – KJ6DZI

April 25, 2013

A new chapter in the history of San Francisco Police Department (SFPD) was made on Saturday April 13, 2013, with the very first Auxiliary Law Enforcement Response Team (ALERT) training class held at the San Francisco Police Academy.

I was very fortunate to have attended and completed this first SFPD ALERT class, as I have found it to be extremely informative and useful. It became apparent very early on during the ALERT training that the program has the full backing from the highest levels within the SFPD, as Deputy Chief Lyn Tomioka was in attendance and senior SFPD instructors were conducting the ALERT training.

The SFPD ALERT training was taught by the following SFPD personnel: Capt. David Lazar, Lt. Kirk Yin, Officer John Ferrando, Capt. Robert O'Sullivan, Capt. Mark Osuna, Officer Rollie Canales, Officer Ray Padmore, and Officer Jeff Smethurst.

The implementation of the SFPD ALERT training was put together in collaboration with SFPD Captain David Lazar, Lt. Erica Arteseros (SFPD NERT Coordinator), Sgt. Mark Hernandez (Ret.SFPD Sgt., SFPD ALERT Coordinator) and several others behind the scenes.

The push for ALERT training program was first proposed in 2007 by (now retired) SFPD Captain Stephen Tacchini, who saw his vision implemented, as he was in attendance to congratulate the very first graduating ALERT class.

The SFPD ALERT program is a framework to utilize the volunteer talents and skills of the San Francisco community to assist the SFPD during major disasters. It was modeled after the San Francisco Fire Department NERT program, and does not compete with it but rather will complement it.

During the SFPD ALERT class introductions a question was posed:
“Why take the ALERT Training Class?”

The common response theme among all the attendees was:
“To Better Serve Our Community”.

The ALERT training consisted of how ALERT members would assist the SFPD during a disaster with a variety of support functions in the following manner:

- Traffic Control
- Contacting SFPD Officers for shift assignments
- Assist in handing out supplies
- Assist with being the eyes and ears of the SFPD
- Work with NERTS in search and rescue
- Work with Bay Area DART members to care for pets
- Assist with reunification of families
- Help direct people to shelter and food sites
- Assist SFPD to cordon off unsafe areas.
- Provide communications support.
- Assist in record taking

Frankly, I am usually intimidated by police officers. However, the SFPD officers at the ALERT training quickly put me at ease with their very cordial and relaxed manner. They were also very receptive to student questions along with providing very detailed and informative responses.

Upon the completion of the all-day SFPD ALERT course the entire class of 25 people were assigned the following uniform and equipment:

- Wind Breaker
- Baseball cap
- Polo Shirt
- Traffic Flashlight with holder
- Basket Weave Belt
- Whistle and Lanyard
- Neoprene gloves.
- SFPD ALERT ID Card
- Certificate of Completion

The SFPD ALERT course stressed the importance of volunteer ALERT members being professional and to only perform tasks as covered within the limits of the SFPD ALERT training. The ALERT members will work under the direct supervision of a SFPD Officer or a SFPD Reserve Officer.

Since ALERT members are associated with the SFPD, upon leaving the ALERT program all issued equipment is to be return to the SFPD.

A few pictures taken at the first SFPD ALERT training class are as follows:



Visionary Capt. Stephen Tacchini (SFPD– Retired) and SFFD Lt. Erica Arteseros (Program Coordinator of NERT)



Officer Rollie Canales of SFPD K-9 Unit with his Belgium Malinois partner: Pyro



Ken Craig – ALERT Member and contributor to the SFPD ALERT Program Manual.



Instructor Officer Ray Padmore



Instructor Officer Jeff Smethurst



SFPD intern and ALERT Program assistant, Eric Duncan



Instructor Capt. Mark Osuna



Capt. David Lazar, Deputy Chief Lyn Tomioka, and SFPD ALERT Program Coordinator Mark Hernandez (SFPD Sgt. Ret)

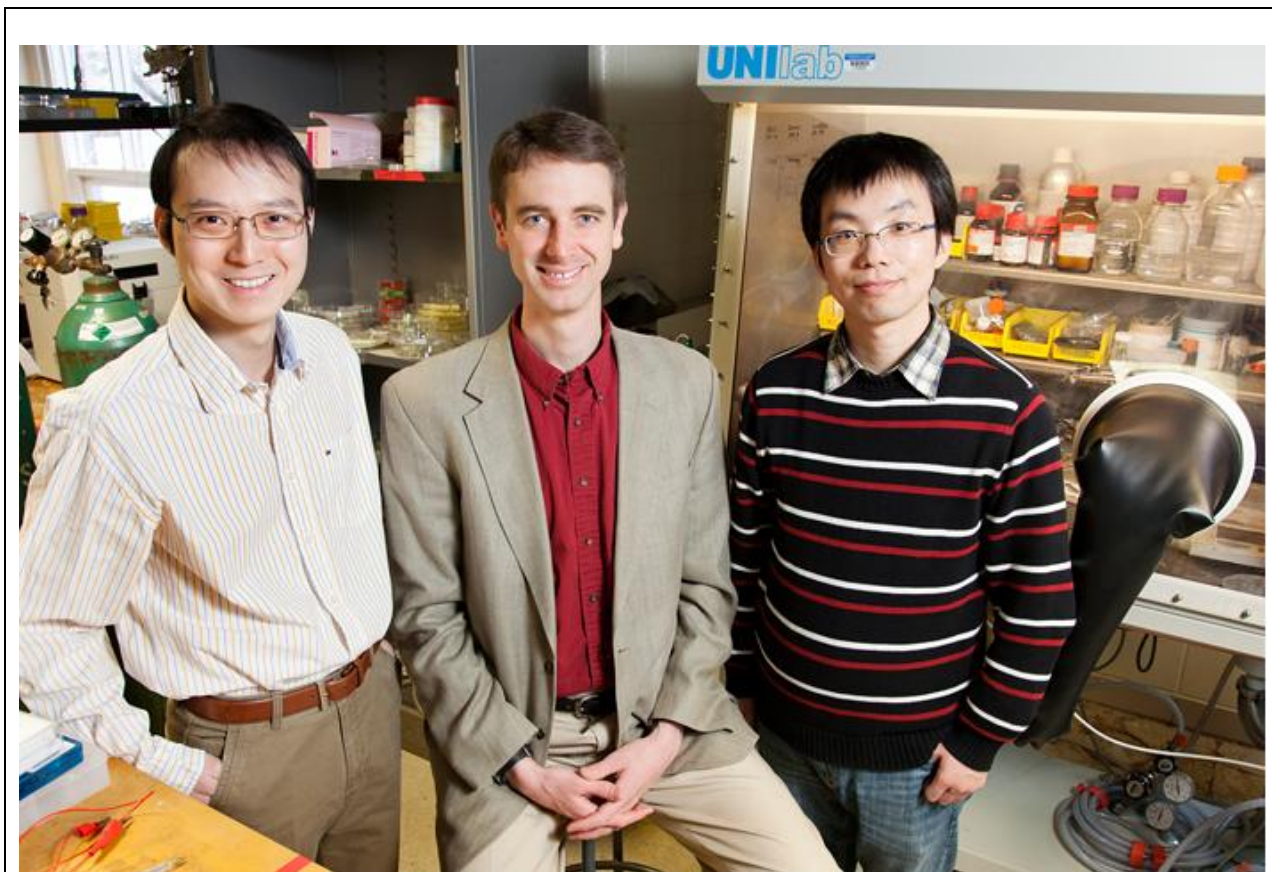
Tech Article Section – PART I of 2

Batteries charge very quickly and retain capacity, thanks to new structure

http://www.news.illinois.edu/news/11/0321batteries_PaulBraun.html

By Liz Ahlberg, Physical Sciences Editor | 217-244-1073; eahlberg@illinois.edu

Date: 03/21/2011



Paul Braun, professor of materials science and engineering, center, led the research group of graduate student Xindi Yu, left, and postdoctoral researcher Huigang Zhang that developed a three-dimensional nanostructure for battery cathodes that allows for dramatically faster charging and discharging without sacrificing energy storage capacity.

Photo by L. Brian Stauffer

CHAMPAIGN, Ill. — The batteries in Illinois professor Paul Braun's lab look like any others, but they pack a surprise inside.

Braun's group developed a three-dimensional nanostructure for battery cathodes that allows for dramatically faster charging and discharging without sacrificing energy storage capacity. The researchers' findings will be published in the March 20 advance online edition of the journal *Nature Nanotechnology*.

Aside from quick-charge consumer electronics, batteries that can store a lot of energy, release it fast and recharge quickly are desirable for electric vehicles, medical devices, lasers and military applications.

"This system that we have gives you capacitor-like power with battery-like energy," said Braun, a professor of materials science and engineering. "Most capacitors store very little energy. They can release it very fast, but they can't hold much. Most batteries store a reasonably large amount of energy, but they can't provide or receive energy rapidly. This does both."

The performance of typical lithium-ion (Li-ion) or nickel metal hydride (NiMH) rechargeable batteries degrades significantly when they are rapidly charged or discharged.

Making the active material in the battery a thin film allows for very fast charging and discharging, but reduces the capacity to nearly zero because the active material lacks volume to store energy.

Braun's group wraps a thin film into a three-dimensional structure, achieving both high active volume (high capacity) and large current. They have demonstrated battery electrodes that can charge or discharge in a few seconds, 10 to 100 times faster than equivalent bulk electrodes, yet can perform normally in existing devices.

This kind of performance could lead to phones that charge in seconds or laptops that charge in minutes, as well as high-power lasers and defibrillators that don't need time to power up before or between pulses.

Braun is particularly optimistic for the batteries' potential in electric vehicles. Battery life and recharging time are major limitations of electric vehicles. Long-distance road trips can be their own form of start-and-stop driving if the battery only lasts for 100 miles and then requires an hour to recharge.

"If you had the ability to charge rapidly, instead of taking hours to charge the vehicle you could potentially have vehicles that would charge in similar times as needed to refuel a car with gasoline," Braun said. "If you had five-minute charge capability, you would think of this the same way you do an internal combustion engine. You would just pull up to a charging station and fill up."

All of the processes the group used are also used at large scales in industry so the technique could be scaled up for manufacturing.

The key to the group's novel 3-D structure is self-assembly. They begin by coating a surface with tiny spheres, packing them tightly together to form a lattice. Trying to create such a uniform lattice by other means is time-consuming and impractical, but the inexpensive spheres settle into place automatically.

Then the researchers fill the space between and around the spheres with metal. The spheres are melted or dissolved, leaving a porous 3-D metal scaffolding, like a sponge. Then a process called electropolishing uniformly etches away the surface of the scaffold to enlarge the pores and make an open framework. Finally, the researchers coat the frame with a thin film of the active material.

The result is a bicontinuous electrode structure with small interconnects, so the lithium ions can move rapidly; a thin-film active material, so the diffusion kinetics are rapid; and a metal framework with good electrical conductivity.

The group demonstrated both NiMH and Li-ion batteries, but the structure is general, so any battery material that can be deposited on the metal frame could be used.

"We like that it's very universal, so if someone comes up with a better battery chemistry, this concept applies," said Braun, who is also affiliated with the Materials Research Laboratory and the Beckman Institute for Advanced Science and Technology at Illinois. "This is not linked to one very specific kind of battery, but rather it's a new paradigm in thinking about a battery in three dimensions for enhancing properties."

The U.S. Army Research Laboratory and the Department of Energy supported this work. Visiting scholar Huigang Zhang and former graduate student Xindi Yu were co-authors of the paper.

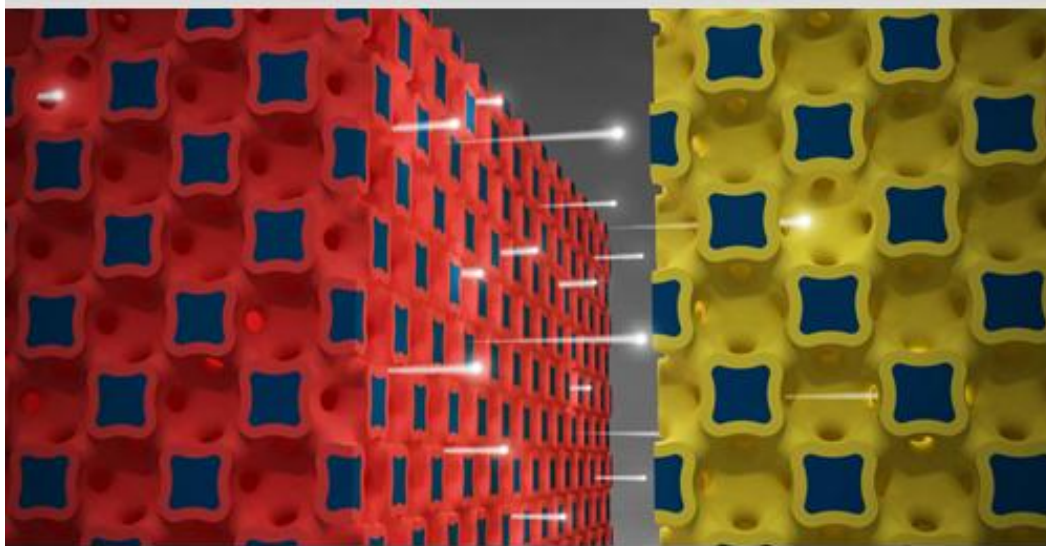
Tech Article Section – PART 2 of 2

Small in size, big on power: New microbatteries a boost for electronics

http://news.illinois.edu/news/13/0416microbatteries_WilliamKing.html

By Liz Ahlberg, Physical Sciences Editor | 217-244-1073; ahlberg@illinois.edu

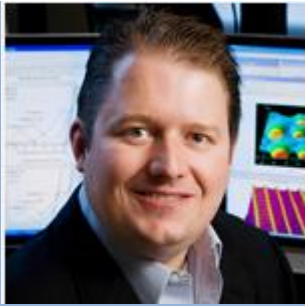
Date: 4/16/2013



The graphic illustrates a high power battery technology from the University of Illinois. Ions flow between three-dimensional micro-electrodes in a lithium ion battery.

Image courtesy of the Beckman Institute for Advanced Science and Technology

CHAMPAIGN, Ill. — Though they be but little, they are fierce. The most powerful batteries on the planet are only a few millimeters in size, yet they pack such a punch that a driver could use a cellphone powered by these batteries to jump-start a dead car battery – and then recharge the phone in the blink of an eye.



Mechanical science and engineering professor William P. King led a group that developed the most powerful microbatteries ever documented. | Photo by L. Brian Stauffer

Developed by researchers at the University of Illinois at Urbana-Champaign, the new microbatteries out-power even the best supercapacitors and could drive new applications in radio communications and compact electronics.

Led by William P. King, the Bliss Professor of mechanical science and engineering, the researchers published their results in the April 16 issue of Nature Communications.

“This is a whole new way to think about batteries,” King said. “A battery can deliver far more power than anybody ever thought. In recent decades, electronics have gotten small. The thinking parts of computers have gotten small. And the battery has lagged far behind. This is a microtechnology that could change all of that. Now the power source is as high-performance as the rest of it.”

With currently available power sources, users have had to choose between power and energy. For applications that need a lot of power, like broadcasting a radio signal over a long distance, capacitors can release energy very quickly but can only store a small amount. For applications that need a lot of energy, like playing a radio for a long time, fuel cells and batteries can hold a lot of energy but release it or recharge slowly.

“There’s a sacrifice,” said James Pikul, a graduate student and first author of the paper. “If you want high energy you can’t get high power; if you want high power it’s very difficult to get high energy. But for very interesting applications, especially modern applications, you really need both. That’s what our batteries are starting to do. We’re really pushing into an area in the energy storage design space that is not currently available with technologies today.”

The new microbatteries offer both power and energy, and by tweaking the structure a bit, the researchers can tune them over a wide range on the power-versus-energy scale.

The batteries owe their high performance to their internal three-dimensional microstructure. Batteries have two key components: the anode (minus side) and cathode (plus side). Building on a novel fast-charging cathode design by materials

science and engineering professor Paul Braun's group, King and Pikul developed a matching anode and then developed a new way to integrate the two components at the microscale to make a complete battery with superior performance.

With so much power, the batteries could enable sensors or radio signals that broadcast 30 times farther, or devices 30 times smaller. The batteries are rechargeable and can charge 1,000 times faster than competing technologies – imagine juicing up a credit-card-thin phone in less than a second. In addition to consumer electronics, medical devices, lasers, sensors and other applications could see leaps forward in technology with such power sources available.

“Any kind of electronic device is limited by the size of the battery – until now,” King said. “Consider personal medical devices and implants, where the battery is an enormous brick, and it's connected to itty-bitty electronics and tiny wires. Now the battery is also tiny.”

Now, the researchers are working on integrating their batteries with other electronics components, as well as manufacturability at low cost.

“Now we can think outside of the box,” Pikul said. “It's a new enabling technology. It's not a progressive improvement over previous technologies; it breaks the normal paradigms of energy sources. It's allowing us to do different, new things.”

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