



# PCARA Update



Volume 7, Issue 1

Peekskill / Cortlandt Amateur Radio Association Inc.

January 2006

## On the brink

Once again we find ourselves on the brink of a brand new year. Many of us are making resolutions and plans for the coming twelve months. Just like people, organizations need to have plans, goals, and objectives. I would like members to bring ideas and suggestions with them to the January meeting.

PCARA is in need of a Secretary/Treasurer. If anyone is interested please let us know. At this time I would like to thank Jim, W2JJG who held the office for the past year. Jim did an excellent job and was able to smooth out quite a few wrinkles during his tenure. On behalf of the membership Jim, **Thank You!**

I wish each of you and your families a very Happy, Healthy, and Joyous New Year. I hope to see each of you at the January 8<sup>th</sup> meeting at Hudson Valley Hospital Center.

– 73 de Greg, KB2CQE

## Holiday Dinner

PCARA's annual holiday dinner took place on Sunday December 4 at the *At The Reef* restaurant. Ray W2CH and Marylyn KC2NKH had made arrangements



PCARA members and friends gather for the holiday dinner on December 4 At the Reef restaurant.

L to R: Ray W2CH + Marylyn KC2NKH, Bob N2CBH + Diane KB2SFV, Armen N2PLZ, Joe WA2MCR + Alan, Mike N2EAB, Jim W2JJG, Clint KB2ZRJ + Samantha.

for the festive meal. The gathering was well attended, and it was a pleasure to see Clint KB2ZRJ with daughter Samantha and long-time member Armen N2PLZ.

## Postal news



The U.S. Postal Service is raising the price of a first class stamp from 37 cents to **39 cents**, from Sunday January 8 2006. If you have envelopes on file with your QSL manager, don't forget to send some top-up stamps.

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*What do you think Bob N2CBH is doing in this recent photo taken in Texas? Find out on page 2.*



## PCARA Officers

President:

Greg Appleyard, KB2CQE

kb2cq at arrl.net

Vice President:

Joe Calabrese, WA2MCR;

wa2mcr at arrl.net

Secretary/Treasurer: open.

# FM combiner

## and antenna system in Houston, Texas

### – ERI and BDI join forces, by N2CBH

Recently my company was hired to design and install a control and monitoring system for a multi-station FM and digital combiner to be used by nine radio stations in the Houston, Texas market. This month and next I'd like to share some of my experiences from this project along with some stunning photos of the project. There is only room in the newsletter for a few of these pictures. For more great photos chronicling the project visit: [http://w5.typepad.com/photos/srtg\\_iboc\\_antenna/index.html](http://w5.typepad.com/photos/srtg_iboc_antenna/index.html).

First I'd like to share a little history of FM combining and the Senior Road, Texas site. The process of combining R.F. sources together to produce one composite signal has been refined over the last fifty years or so. The first successful combination of FM carriers for the purpose of sharing a common antenna was in Chicago, Illinois at the John Hancock Tower. This system was called a run-out system. Essentially each station combines into a Tee where the line lengths to the respective transmitters are phased in such a way as to cancel the incoming R.F. from the other transmitter. This prevents intermodulation components from being developed in the class C final stages of the FM broadcast transmitters.

The Alford Manufacturing Company of Boston, Massachusetts had pioneered multicarrier combining back in the 1950s when it was commissioned to design and build a diplexer to be used by WOR-TV in New York City. This was a simple four-port combiner allowing for the first time combining of the aural carrier and visual carrier together to be fed to a common antenna.

Previous to this, separate aural and visual antennas were used for most VHF TV work.

In 1965 a new two-station combiner was built to accommodate WQXR-FM and the then WHOM-FM atop the Empire State Building. Today WHOM carries the call letters WXRK. Alford Manufacturing was awarded

this contract as well. The combiner that Alford devised for this system was referred to as a modified run-out combiner system. Instead of relying on line lengths alone, Alford used half wave cavities and a hybrid system to simulate the phasing required for cancellation of the opposite transmitter R.F. These methods provided better isolation and slightly better pass band response for each transmitter path to the antenna. It was also believed to be a more practical way to combine more than two stations together. This proved to be more of a challenge than anyone imagined at the time! This system grew to eleven stations by the late 1970s and was having growing pains.



*Guyed mast at the Senior Road Tower Group site in Missouri City, Texas is almost 2000 ft tall. The location is 18 miles southwest of downtown Houston.*



*Old FM combiners at Senior Road.*

In the late 1970s a new technique was developed for combining stations. This technique used a combiner system that was a series of notch filters combined with an input and output hybrid. Each station would be combined in a daisy-chained type of connection — the first feeding the second until the last station's combiner actually fed the antenna system. This worked better for larger systems but there was still another advance waiting in the wings. At this point in time (the early 1980's) the original Houston Texas system known as the Senior Road project was being contemplated. The Houston broadcasters had been utilizing a site in downtown Houston known as One Shell Plaza, which was the U.S. headquarters building for the Royal Dutch/Shell Group. Yeah, this is oil country alright! This system suffered from a number of deficiencies and was slated for replacement.

In the fall of 1982 a new system was being constructed by the Dielectric Corporation of Raymond Maine and the Harris Corporation of Quincy, Illinois. In the late fall the combiner system had been built and tested and the antenna was slated to be hoisted on the tower shortly thereafter. On the day that the antenna was to be hoisted, the tower rigging crew decided that if the antenna were to be lifted the way the manufacturer specified, the antenna would have bent in the middle and would likely be ruined.

The procedure for how the antenna is raised into position is called the pick plan. A plan had been de-

vised by Harris engineers that would have successfully raised the antenna in place and rendered it useless for operation. The crew decided to modify the plan and shortly afterward disaster struck. The antenna was being raised with four tower hands riding the antenna up. At about midway up, one of the makeshift attachment points let go and the antenna shifted causing it to rock back and forth like a pendulum. At some point the whole antenna came in contact with one of the tower's guy wires severing it. The tower suffered a major structural failure and all four tower hands were killed in the accident. The tower and several antennas already mounted on it were also lost in the accident.

This accident made the network news that night along with a videotape that recorded the tragedy. This tape was shot by an old friend of mine named Andy Hudak. Andy and I both worked for Viacom Broadcasting at the time of the accident. He was with KKIK-FM in Houston and I worked for the then WKHK-FM in New York. I spoke recently to Andy about the accident and he recalled that he shot video until he thought it would be a good idea to get the hell out of there! He dropped the camera and began running away. Realizing he was leaving behind a very valuable piece of tape he risked his life to go back and retrieve it. Luckily, Andy got the camera, tape and himself out of there intact! Of course this tape was played back by all three networks that night and was later used in the lawsuits that were brought by just about everyone concerned.

Miraculously, within a year the tower was replaced along with the antennas and transmission lines. The system was commissioned in the fall of 1983. Fast forward to 2005 and the old Dielectric/Harris system was slated to be replaced by yet a new technology. The new combiner system is being supplied by Electronics Research, Inc. of Chandler, Indiana. ERI pioneered a new combiner technology known as the constant impedance band pass combining system. Instead of using notch filters, band pass cavities are used. This method provides superior isolation between stations and allows FM stations which are as close as 800 kHz to be combined together with no interaction. This type of combiner was actually furnished in New York in 1994 when the old Alford system was decommissioned. Today, seventeen radio stations utilize a single FM antenna using this system at the Empire State Building.

The Senior Road system is a nine station combiner that not only combines analog but digital broadcast signals as well. My firm Broadcast Devices, Inc. was contracted by ERI to supply a monitor and control system for the new combiner. We were responsible for providing the switching logic to switch three nine-inch, four-port antenna switches into four operating modes. In addition, we provided a safety interlock system that commands all analog and digital transmitters off when switching is performed and then back on again when

all of the switching is complete. The photo of the equipment racks shows the controller chassis and the nine Bird Electronics watt meters that monitor each station's R.F. input to the system. There is also a computer-controlled alarm system which provides alarm closures and e-mail notification in the event of a



*Monitor and Control system installed by Broadcast Devices Inc. to keep track of the nine separate stations at Senior Road.*

failure of the system. All the combiners, switching and control interface are housed in one open space. Each station's transmitters are located in the same building, but in individual leased spaces. Transmitter signals are fed to the combiner room via flexible 3 inch coaxial cable.

The tower used by the nine broadcasters is a guyed three sided affair that is 1,963 feet tall. To put this in perspective, that's 603 feet taller than the Empire State Building to its tip! All of these stations are designated as class C stations with a 100 kW effective radiated power. In order to cover approximately the same number of people that you can easily do in the northeast, in Texas you need lots of height and power. This is all big stuff compared to what I spent most of my career with, working as a broadcast engineer in the northeast. The output transmission line from the combiner to the switching complex is nine inches in diameter. There are three four-port antenna switches which have nine inch connections as well. To watch these switches operate is poetry in motion.

I will wrap up this month at this point. You now have a little history and how we got to where we are today with this technology. Next month I will discuss the installation that we did along with some of the new digital technology that is being incorporated into the system. Oh yeah, sadly there are no ham repeater antennas on this tower as of yet! There is a bright spot though. Wes Whiddon N5WW is the site manager and has a nice HF station in his office at the site!

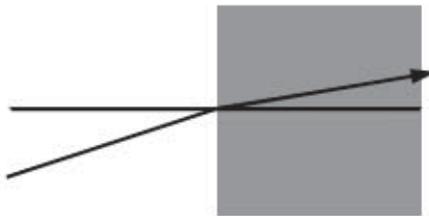
– Until next month, 73 de Bob, N2CBH

# Negative index

Researchers at Purdue University recently reported a new material that has a “negative refractive index” in the optical range.

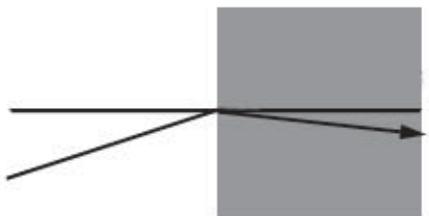
You might wonder what is meant by a “negative refractive index”. Let me remind you of a little high school physics... When light passes into a denser medium – for example from air into water – the light slows down and the change of speed causes a change of direction. That is why a stick pushed into a pool of water appears to be bent. The amount of bending depends on the ratio of the refractive indexes of the two materials involved.

Normal materials have a refractive index greater than 1, so the bent ray is tilted toward a line perpendicular to the surface of the two materials.



Light passing from a rarer into a denser medium is refracted **toward** a line perpendicular to the surface of the two materials.

Now imagine a new material with a negative refractive index. Light entering this material would not just bend toward the perpendicular; it would be bent back on itself *beyond* the perpendicular. The theoretical properties of such a material had been worked out in the 1960s, but no such material existed at the time.



If the denser medium has a **negative** refractive index, then the radiation is bent **beyond** the line perpendicular to the surface.



Split-ring resonator.

repeated 5-mm pattern. This material has negative refractive index for electromagnetic radiation in the

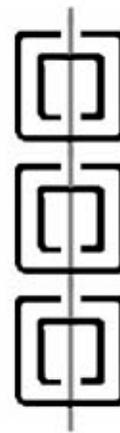
10 GHz microwave region.

The researchers at Purdue have now devised a new nanomaterial made of pairs of tiny gold rods embedded in glass. The repeating pattern is in the region of 2 micrometers, and the material has a negative refractive index for near infrared wavelengths around 1.5 micrometers, equivalent to a frequency of 200 TeraHertz. These frequencies are commonly employed in fiber optic communications.

Researchers predict that as these new “metamaterials” become more efficient, novel uses will be found for them. Examples include highly sensitive antennas shaped to fit inside any enclosure, completely planar (flat) lenses that focus light to a perfect geometric point, materials with a reverse Doppler effect (a radiation source approaching an observer would appear to *reduce* its frequency), and a “superlens” capable of imaging objects that are much smaller than the wavelength of the radiation. With such materials, microscopes capable of viewing molecules with light may become a possibility!

Sources: Chemical & Engineering News, +Plus Magazine, EETimes, Science a GoGo, Optics Letters, Wikipedia.

- NM9J



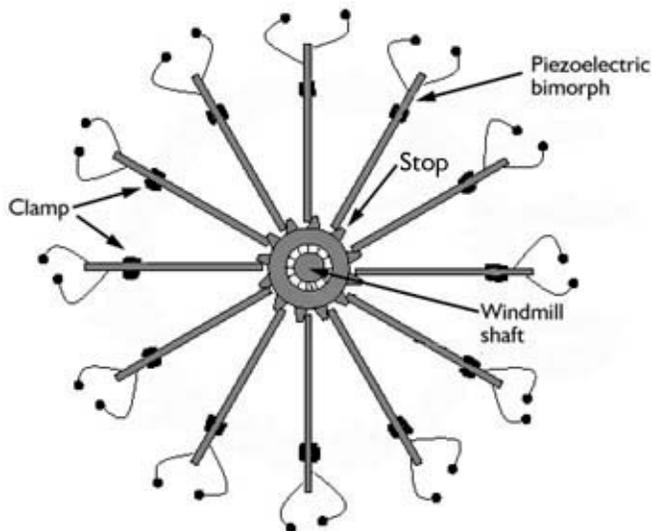
10 GHz Split-ring resonators lie on one side of a fiberglass board while the wire strip lies on the other side.

## Tiny windmills

Scientific journal *Nature* reported in November that a University of Texas, Arlington professor is developing tiny windmills capable of powering remote sensors and communication devices. The windmills developed by Dr. Shashank Priya do not use a conventional electric motor to generate power, but instead use inexpensive piezoelectric elements that are flexed as the windmill turns.

Radio amateurs are already familiar with piezoelectric devices. The quartz crystals we use as stable frequency sources and in crystal filters rely on the piezoelectric effect, where a voltage appears across the faces of a slab of material when it is flexed. The reverse effect – in which a voltage applied across the faces of a crystal, causes the crystal itself to flex – is equally useful.

Dr Priya’s device is described as a “bimorph transducer”, with layers of piezoelectric ceramic material separated by a non-conductive layer to form a sandwich. Stops on the propeller shaft of a windmill



Dr. Priya's arrangement of twelve piezoelectric bimorph transducers around a windmill shaft. When the ring of stops is rotated backward and forward by wind energy, it flexes the transducers and generates electricity.

cause these transducers to flex and create a small amount of electrical energy. In one of the group's papers, a prototype windmill with 12 bimorphs generated a power of 10 mW across a load of 4.6 kilohms after rectification. This energy could be stored in a capacitor or lithium battery.

I started thinking about possible amateur radio applications... how about an isolated, mountain-top repeater site with no mains supply, or perhaps the natural power section of Field Day? Unfortunately, the generated power level of 10 milliwatts is not going to burn a hole in the ionosphere anytime soon. And given the choice of a mechanical windmill with flexing ceramic panels, or a conventional solar cell, I think I would prefer the solar cell on the grounds of reliability, efficiency and available power output. Either one of these natural power systems would need to charge a battery to maintain power when the wind drops, or when night falls.

Maybe we could persuade one of PCARA's QRPP enthusiasts to try piezo-power if the mini windmills become popular.

Sources: Journal News, University of Texas, Japanese Journal of Applied Physics, INDOLink.

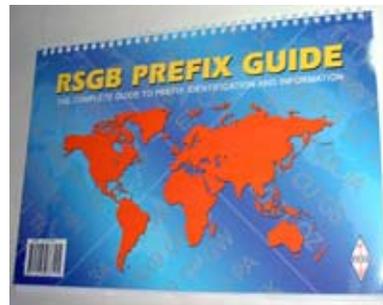
- NM9J

## Prefix Guide

The Radio Society of Great Britain has just released the latest edition of the "RSGB Prefix Guide". First published in 1995, the Guide is compiled by Fred Handscombe, G4BWP. It contains an alphabetic listing of amateur radio prefixes, along with special prefixes used for contest and special event stations as well as

ITU prefix allocation blocks that might yield even more special call signs down the road.

For example, suppose I worked 5U7JB during the recent 10 meter contest... a quick check in the prefix listing shows that 5U is the prefix for **Niger**. In fact the country of Niger has the entire ITU block from 5UA to 5UZ. Glancing along the 5U entry reveals that Niger is in continent AF (Africa), CQ Zone 35, ITU Zone 46, is 1 hour ahead of GMT and had the earlier prefix of FF8.



The "RSGB Prefix Guide" is spiral-bound, for easy lay-flat use like a radio log book.

There are copious notes on the prefix listing. For example, did you know that the block VPA-VSZ for U.K. overseas territories now has a 'hole' at VRA-VRZ for the "Special Administrative Region of the People's Republic of China"? This allowed Hong Kong to continue using the VR2 prefix after it was transferred to China in 1997.

Other lists in the "Prefix Guide" include DXCC Deleted Entries; CIS and Russian prefixes; countries and places that have changed names (where's Myanmar?); an "Islands on the Air" checklist and a DXCC checklist. Details of other awards are also given.

The RSGB Prefix Guide is available direct from the RSGB for £8.99 plus postage, or from ARRL for \$19.95.

- NM9J

## Soldering on

Radio amateurs in Europe have been worrying about tin/lead solder and the EU's Restriction on Hazardous Substances (RoHS) regulation that will require electronic goods manufactured or imported into Europe to be free of hazardous materials from July 2006. Radio amateurs have been buying up reels of old-style Sn/Pb solder, fearing that it may not be available for much longer.

Consumer products made with lead-free solder turn out to be less reliable than those assembled with tin/lead solder. Now it appears that the EU Directive does not apply to the repair or reuse of equipment that was put on the market *before* July 2006 — and components intended for military and medical applications are exempt from the lead solder ban. So perhaps tin/lead solder will be around for a while. Apparently lead-free solder is *too unreliable* for applications where safety of life is concerned and its use is prohibited in the medical and aviation fields.

Sources: RadCom, ElectricNews.

# Peekskill / Cortlandt Amateur Radio Association

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*Newsletter contributions are always very welcome!*

Archive: <http://home.computer.net/~pcara/newslett.htm>

## PCARA Information

PCARA is a **Non-Profit Community Service Organization**. PCARA meetings take place the first Sunday of each month\* at 3:00 p.m. in Dining Room B of the Hudson Valley Hospital Center, Route 202, Cortlandt Manor, NY 10567. Drive round behind the main hospital building and enter from the rear (look for the oxygen tanks). Talk-in is available on the 146.67 repeater. \*Apart from holidays.

## PCARA Repeaters

**W2NYW:** 146.67 MHz -0.6, PL 156.7Hz

**KB2CQE:** 449.925MHz -5.0, PL 179.9Hz

(IRLP node: **4214**)

**N2CBH:** 448.725MHz -5.0, PL 107.2Hz

## PCARA Calendar

**Sun Jan 8:** January meeting, 3:00 PM. HVHC.

## Hamfests

**Sun Jan 8:** Ham Radio University/Section Convention, Briarcliffe College, 1055 Stewart Avenue, Bethpage NY, 8:00 a.m.

**Sun Feb 26:** LIMARC Long Island Hamfair, Levittown Hall, 201 Levittown Parkway, Hicksville, NY. 9:00 a.m.

## VE Test Sessions

**Jan 9:** Split Rock ARA, Hopatcong HS, Rm C-1, Hopatcong, NJ. 7:00 p.m. Contact Sid Markowitz (973) 724-2378.

**Jan 20:** Bergen ARA, Westwood Regional HS, 701 Ridgewood Rd, Washington Township, NJ. 7:00 p.m. Contact: DonaldC Younger, (201)265-6583.

**Feb 5:** Yonkers ARC, Yonkers PD, 1st Precinct, E Grassy Sprain Rd, 8:30 a.m. Contact D. Calabrese, 914 667-0587.



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