



# Sierra Foothills Amateur Radio Club

<http://www.sf-arc.org/>

January 2011

PO BOX 1005. NEWCASTLE. CA



## At the key of SFARC

### OFFICERS

#### PRESIDENT

Al Martin, NI2U  
amartin4@wavecable.com

#### VICE PRESIDENT

Charles Baker, AE6LR  
ae6lr@yahoo.com

#### SECRETARY

Vacant

#### TREASURER

Bob Balthorpe, KD6WTY  
kd6wty@yahoo.com

#### DIRECTORS

Mary Ann Balthorpe, KE6EST  
Gary Cunningham, KQ6RT  
Jim Griffith, KI6AZH

#### Field Day Chairman

Dave Hund, N6SHD

#### REPORTERS

Satellites: Greg, KO6TH  
History: Gary, KQ6RT  
Misc Radio: Fred, K6DGW  
Sunshine: Richard WA6RWS  
rkuepper@ymail.com  
916-482-5027

### RESOURCES

#### REPEATERS

145.430 (-0.6 MHz/PL 162.2)  
440.575 (+5.0 MHz/PL 94.8)  
223.860 (-1.6 MHz/PL 100.0)

#### CLUB NET

Thursdays, 7:30PM, W6EK/R  
145.430

#### CLUB MEETINGS

Second Friday of the month,  
7:30PM at the Library, 350  
Nevada St, Auburn CA

#### CLUB BREAKFAST

Last Sat of the month at  
Susie's Café, Cirby at Riversix  
Roseville - 8:00 AM

#### NET CONTROL OPS

Dave Jenkins, WB6RBE  
Gary Cunningham, KQ6RT  
Norm Medland, W6AFR

#### Casey McPartland, W7IB

#### NEWSLETTER EDITOR

Matthew Diridoni, KC6RUO  
916-749-3032  
matteod@comcast.net

#### WEBMASTER:

Carl A Schultz, WF6J

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## Calendar of Events



January 8-9 RTTY Roundup

January 14 Club Meeting

January 22-24 January VHF Sweepstakes

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## SFARC CLUB MEETING PRESENTATION

To be announced on the SFARC Thursday night net.

**We encourage members to receive Sierra Signals via email to save the Club the cost of reproduction and mailing**

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From the Presidents Shack

Al Martin, NI2U

President's Thoughts

The last month has been busy with a terrific Christmas Party and all of the family holiday traditions and visits.

I want to wish the entire club a Happy New Year and am looking forward to a great year.

Al Martin, NI2U



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info@metro-electronics.com www.metro-electronics.com



SFARC has testing sessions on the first Saturday of each month at Raley's on the corner of Auburn Folsom Road & Douglas Bl. in Granite Bay. Sessions are in the multi-purpose room in the back left hand corner of the store. The session starts at 8:00 AM



Sierra Foothills Amateur Radio Club

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<http://www.sf-arc.org/>

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Sun: 10:00-5:00  
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**CLUB BREAKFAST**



Last Saturday of the month  
Susie's Café, Cirby at Riverside,  
Roseville 8:00 AM

## MISCELLANEOUS RADIO

### Fred Jensen, K6DGW Reciprocity

One of the really big things we take for granted in our everyday lives is the concept of reciprocity. It's sort of, "What goes in, comes out." For example, on a very hot, sunny day, and you wear a black shirt, you will get hot. Black absorbs infrared very well. On a cold day, it also radiates well ... don't wear black when it's cold. On the other hand, a white shirt on a hot sunny day will reflect much of the heat, and you'll be a lot cooler. Likewise, on a very cold day, white clothes will keep you warmer than dark clothes which will radiate your body heat as fast as they collect it on a hot day. This is the origin of the physics term, "Black Body Radiator." OK ... I made that part up, it isn't the origin of the term but I couldn't resist, and the principal is valid.

We expect that an antenna that "get's out well," will also "get in well" too, and that is usually the case. On any given antenna, it will hear about as well as it transmits. Your transmit power compared to the power of the station you want to contact does matter, but for equal power, we expect our antennas to work both ways about equally well.

This, however, is not always the case. Sometimes, receiving as well as you transmit isn't the best strategy. The big factor is Signal to Noise ratio. An S6 signal is likely to be loud in your headphones ... unless your PG&E noise level is S7, when it might be discernible at best. At the Coastal Marine station I worked at as a HS Senior, we had various antennas. The Point-to-Point guys had rhombics aimed where they talked to. We had wide Vee beams, [huge by ham standards], which spread our 5KW signal over broad swaths of the Pacific. At our receiving site, right on the coast, we had similar antennas ... and several others for receiving only ... which is the subject of this month's Miscellaneous Radio.

Possibly the most common receiving antenna is the Beverage antenna, named for Harold Beverage who fooled around with antennas meant strictly for receiving around 1919 or so. It is a "traveling wave" antenna, and is amazingly simple. And, strangely, it violates just about everything we commonly believe about antennas.

Figure 1 shows the basic unidirectional Beverage. It



comprises a wire, one to several wavelengths long strung a few feet above the ground. The receiver connects between the wire and ground at one end. The other end is terminated in a resistor to ground. The impedance of such an antenna will be in the 400 ohm range, and that's the value for the resistor.

**How Does It Work?** A plane wave arriving from the right travels down the wire. Because the wire is low, the impaired conductivity of the ground causes the wave front to tilt over in the direction of travel, and in doing so, it induces current in the wire traveling in the direction of the receiver. The currents at each instant [and thus point along the wire] are in phase and add, eventually reaching the receiver. The wire is not resonant, so the length is not critical however longer is better ... a longer wire provides more time for the wave to induce currents.

A wave arriving from the left does exactly the same thing, and the power it induces is dissipated in the resistor and does not appear at the receiver. Waves arriving parallel to the wire [i.e. into/out of the page] cut all parts of the wire at the same time and induce no current. Thus, this configuration is directive, receiving signals from the direction of the resistor and rejecting those from other directions. This directivity is quite striking in fact, and the longer the wire, the more pronounced it becomes.

**So, What Does This Do For Us?** The Beverage is typically a low-band antenna. Extremely long ones [as in several kilometers] operate in the LF bands below the AM broadcast band. Ham Beverages are usually several hundred meters long and operate at 80 and 160 meters. At these frequencies, it is nearly impossible to obtain directivity with what we normally use, such as multi-element yagi's. At the lower frequencies, atmospheric noise dominates, and the directivity will shut out a great deal of the received noise, greatly improving the signal to noise ratio at the receiver.

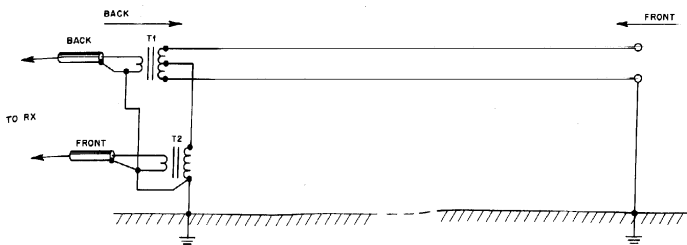
There is a down side to this however. The antenna is very inefficient with gains ranging from -10 dBi to -20 dBi or worse. At first, this sounds pretty awful, and no one ever attempts to transmit into such an inefficient antenna. However, since atmospheric noise dominates the receiver input at these frequencies, the improved S/N translates into the ability to copy signals you wouldn't hear on a typical 160 meter transmitting antenna. And, you can always include a receiver preamplifier to bring the absolute signal input level to the receiver back to normal.

Receiving on a Beverage is a very interesting experience, especially if you can switch between it and the transmitting antenna. On the Beverage, the receiver gets really quiet, both from the directivity eliminating noise from all but one direction, and from the inefficiency. The desired signal just stands out from the weak noise however, and often is not

discernible on the efficient transmitting antenna. Serious top-band operators will have an array of Beverages, generally fanning out from a central point, with a selector switch to choose the one to be used for any given QSO.

If you omit the resistor, the antenna becomes bi-directional. A wave arriving from the right behaves as before. One arriving from the left induces currents which reflect from the unterminated end and travel back down the wire to the receiver. The noise capture goes up since you're now hearing in two directions, but if you can only have one antenna, pointing the open end at about 070 degrees gives you coverage of much of the US and Europe, and the reciprocal coverage is at about 250 degrees, pretty much right at the south Pacific.

As usual, there are all sorts of variants of this theme. One is the two-wire Beverage. A wavefront arriving from the right induces currents in both wires which cancel in the transformer such that nothing shows up



on the "BACK" coax. The common-mode currents exit via the center-tap and the second transformer sends them to the "FRONT" coax.

A wavefront arriving from the left also induces currents in both wires. The currents in the bottom wire are shunted to ground at the far end. Those in the top wire reflect, travel back down the wire, through the transformer, out the bottom wire and also to ground. That current through the transformer sends the signal out the "BACK" coax. Since the transformer is balanced, nothing comes out the center-tap so nothing gets fed down the "FRONT" coax. So, using this scheme, you can cover all of the compass directions with half the number of antennas.

The antennas are typically supported on short insulated poles, 2 – 3 meters off the ground. A wavelength at 160 meters is 525 feet, probably bigger than any dimension of a typical city lot, so you tend to find beverages in ham installations on significant land. We live on 5 acres, and the longest dimension of the property is about 800 ft, unfortunately in a N-S direction. I can get about 500 feet of wire strung out in an approximately 070° – 250° line. It's not exactly straight, and it has to cross the driveway and a couple of barbed wire fences, however strangely, none of this really matters. I just string it out when I need it for a contest, and then wind it back up when I'm done. It

crosses the driveway on the ground. In fact, you can lay out your entire Beverage **on** the ground! It's called a BOG [Beverage On Ground], and will be somewhat more inefficient than one supported above ground, but it works just fine.

There are a number of receiving-only antennas in use, some of which do not require the space that a Beverage does and the plan is to cover several of them in succeeding issues in 2011. Happy New Year to everyone, hopefully the upward trend in sunspots and solar activity we've seen in the latter part of 2010 will continue.

73,  
Fred K6DGW



### Fifty Years Ago at SFARC Gary Cunningham, KQ6RT

Jan. 11, 1961

The first meeting of the year was called, to order by our new president, Lin Hunter, at home of Mike Bowman.

The minutes and treasury report of the out-going secretary-treasurer were read and approved.

Discussion was held on finding a permanent meeting place and Jim Carmen explained the possibilities of acquiring a room in the old naval reserve building as soon as they build a new Naval Reserve building next to the armory, scheduled for April or May, 1961.

Sunday net was discussed. There will be no change until further notice.

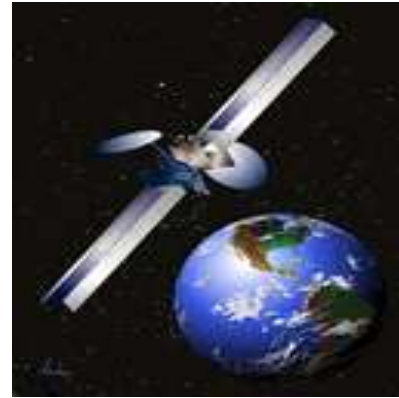
Ways of acquiring more members were discussed. It was suggested that a mimeographed letter be sent to past members and inform them of our activities.

A barbecue outing at Recreation Park was planned for June 4<sup>th</sup> or 11<sup>th</sup>. The steak drinks and ice cream will be bought by the Club, and the remaining food such as bread, salads, beans and dessert will be potluck. Drawings will be held for remaining steaks.

It was moved by Frank Carmen and seconded by Jim Carmen that we hold the outing as planned above. Motion was passed.

All old bills were approved and paid. Field Day was discussed, along with a trip to Manteca for surplus gear. Motion was made and seconded to adjourn at 9:30 P.M.

(No dues were collected)  
Respectfully Submitted,  
Sage Otow, Sec. - Tres



## SATELLITE REPORT GREG DOLKAS, KO6TH

### ROGUE SATELLITE UNDER ARREST

You might recall last year that the normally invisible infrastructure of this planet's geostationary communications satellites hit the mainstream press. Galaxy-15, which served North America from its home at 133 degrees West longitude over the equator, had gone rogue. Everything was going fine until early April of 2010, when the satellite stopped responding to ground station commands. The current belief is that a solar flare knocked the command computer upside its head, and, dazed from the blow, it stopped processing. The transmitters and receivers were on and operational, but without station-keeping commands from the ground, the satellite started drifting in its orbit.

This planet's fleet of communications satellites are positioned along a magic orbital ring over the equator, some 22,000 miles up. This particular orbit, named after Arthur C. Clarke, the famed science fiction writer who wrote about it in 1945, is unique in that the time it takes for a satellite to go around the Earth (orbital period) is exactly one day. From the ground, these 4,500 pound marvels zip along at 6,800 miles per hour, thus appear motionless, eliminating the need for ground station antenna tracking. Just aim the antennas, and bolt them into place.

Each geostationary satellite has an assigned position in the ring, but with the slight gravitational tugs from the Sun and Moon, and the not-so-perfect shape of the planet itself, a satellite needs constant nudging by the use of small thrusters to maintain that position. Otherwise it will drift.

## GEAR WANTED

### Looking for 900 MHz

I am looking for a 900 MHz radio. I don't want to buy a boat anchor but a small compact radio like a modified Kenwood TK-941. The Motorola's are out unless the programming software comes with the deal and show me lessons on how to use it.

Bill WV6J [wv6j@arrl.net](mailto:wv6j@arrl.net), [bill@wv6j.org](mailto:bill@wv6j.org).  
Telephone 530-823-7401

## HF GEAR WANTED

Ken Ryland is looking for used HF gear.

Call 530-626-4588

## HF GEAR FOR SALE

Kenwood TS430S with matching Kenwood AT250 Tuner.

ICOM IC735 with matching AT150 tuner.

Contact Dr. Whit Woodard, K3WB  
916-768-5022.

And, drift it did. Galaxy-15 began heading East. While there wasn't much risk in an actual collision, several other satellites use the same frequency pairs for up- and down-links. This had the potential for causing a cosmic double, possibly knocking out the other satellites' operations as the rogue passed by. Between April and December, 2010, Galaxy-15 had passed more than a dozen other satellites during its Eastern trek, forcing evasive maneuvers and communication link reconfiguration of the possible victims as it passed.

To regain control of the satellite, ground operations tried various means to reset the main computer. They sent commands, they tried overloading it (screaming at it), in hopes of triggering a power system malfunction that would trip a reset. Nothing worked. So, they brought in the team of Isaac Newton and Albert Einstein, or rather, sat back let them do their work.

Most large satellites use a combination of thrusters and reaction wheels (similar to gyroscopes) to control their orientation. The thrusters on Galaxy-15 were useless without ground control, but Newton's reaction wheels were working just fine, keeping the satellite's solar panels aimed at the Sun, thus keeping the batteries charged. As the satellite's orientation started to drift, the motors on the wheels would kick in, speeding them up. Newton says that every action has an equal and opposite reaction, so pushing the spinning wheel in one direction pushes the satellite back in the other direction.

On average, all things being balanced, the reaction wheels should keep humming along at a fairly constant rate. But Albert Einstein said otherwise. This is because of his famous equation,  $E=MC^2$ , which equates energy and mass. When a powerful transmitter beams a signal out into space, that beam of energy pushes back on the antenna ever so slightly. Since the transmit antennas on Galaxy-15 are not exactly centered, they tend to push the satellite ever so slightly into a slow rotation.

But there's a limit to how fast you can spin a reaction wheel.

Eventually, in late December 2010, they had reached their limit. No faster could they turn, so the satellite started to rotate and not be pointed at the Sun. Without a constant source of power from the solar panels, the batteries feeding the rogue's hungry transmitters ran down and the satellite's power system failed, resetting the command computer. On the next rotation, the solar panels brought things back on-line enough for the awaiting command team to take control and put the spacecraft into safe mode. Got'cha!

With the rogue satellite now under arrest and no longer a threat to the planet's communications infrastructure, the command team is running through a complete diagnostic review of the spacecraft's health. They will also re-initialize the station-keeping thruster system, keeping the satellite from drifting farther. Assuming it's still in working condition, they expect to be able to re-deploy it, either back in its original role, or use it as a replacement for another satellite.

Aren't we lucky that our little cubesats aren't nearly as difficult to control?

73s,

Greg KO6TH