FARS
K6YA FOOTHILLS AMATEUR RADIO SOCIETY
March 2009 Volume 40, Number 3

March Club Meeting

Date: Friday, March 26, 2009
Time: Socializing at 7 pm, Meeting at 7:30
Place: Covington School, 205 Covington Road, Los Altos
Speaker: Gary Gordon, K6KV
Topic: A Field Day Triplexer

Summary: Gary Gordon, K6KV, will show and describe a Field Day Triplexer that permits three stations to operate simultaneously on different bands while sharing a single antenna. Gary helped design and build the triplexer, and WVARA used it at 2009 Field Day. An article describing the triplexer will appear soon in QST. You can see the unit in person at FARS March meeting and hear Gary tell how it works.

About the speaker: Gary Gordon, K6KV, was first licensed in high school in 1955 as WN7ZNG. He built half of his own equipment, mainly amplifiers. The hobby got him interested in electronics, which led him to degrees from Cal and Stanford and a career as an engineer at Hewlett-Packard. At HP, he originated ideas for new instrumentation, which resulted in 70 patents, including the modern optical computer mouse. After retiring once, he helped start a company that automates TV studios. Retiring a second time, he is now helping the HandiHam organization. He is also working with a small company that helps folks with severe disabilities, developing an aid that will move a cursor around on a screen just by moving one's eyes.

The club offers refreshments (great coffee, great cookies) and technical advice at the meeting: Bring your questions for Dr. Know-It-All and get great answers. Be sure to attend for an enjoyable evening

Pre-Meeting Dinner: There is a pre-meeting dinner at 6:00 pm for those who would like to attend. We meet at the Beausejour Restaurant, 170 State St., Los Altos. There are Great Early Bird specials.

February Meeting Report

Steve Stearns, K6OIK, spoke about HF Propagation. He described the radio science behind HF propagation, how the ionosphere is formed by nature, what the key variables are and how the D, E, Es, and F layers respond to solar radiation. After describing the physics, Steve covered propagation prediction by statistics. This talk was an update to Steve's talk at FARS July 2005 meeting.

General License Class Starting April 15th

Sign up on the web at http://www.fars.k6ya.org/classes or email Kevin at k6xxx@arrl.net for more information. More detail is available later in this newsletter.

President's Corner

General Class Amateur Radio License Course. Beginning April 15th, FARS is presenting an upgrade course for the general class amateur radio license. If you are still working with a technician license and would like to get on HF, this is the course to take. The course is spread over six evenings on Thursday nights so you have time to learn the material and get questions answered. The course is $30 ($25 for students and seniors). To sign-up or get more information, go to k6ya.org/classes. The course is limited to about 30 students, so sign up now to ensure your spot.

Membership Meeting. The next regular membership meeting is Friday, March 26th at 7pm. The program is "**A Field Day Triplexer**" by Gary Gordon, K6KV. Gary describes how the triplexer permits three stations to operate simultaneously on different bands sharing a single antenna. See k6ya.org/meeting meetings for details.

Am-Tech Day. The next Am-Tech Day is scheduled for April 24th. There will be food, radios, and hams. Check the web site (k6ya.org/amtechday/) or the email list (k6ya.org/mail/) for the date and program information.

Electronics Flea Market. The Electronics Flea Market continues on April 10th. This is the best local flea market for hams to find all kinds of electronics and amateur radio related items. Be sure to drop by the food booth and support local ham club. The proceeds from the food booth and the vendor fees benefit your local amateur radio organizations. Check out www.electronicsfleamarket.com for all the details.

MakerFaire. FARS is participating in MakerFaire this year on May 22nd & 23rd demonstrating amateur radio to the public. Michael Pechner, NE6RD is organizing this event and needs volunteers to help. Contact him if you would like to participate.

Email Notices. Subscribe to the FARS Announcement list (k6ya.org/mail/) to receive reminders of FARS activities and other news.

de Mikel, KN6QI

Upcoming Events

Mar 26	7:00 pm, Club meeting, Covington School
Apr 1	7:30 PM, Board Mtg at the Los Altos Town Crier
Apr 10	Electronics Flea Market, hosted by SCCARA
Apr 15	General Class License Course, 6 week course
Apr 23	7:00 pm, Club meeting, Covington School
Apr 24	8 am to 9 pm, Am-Tech Day, SLAC NAL
Thursdays	8:00 pm, FARS net, 145.230(-), 100 Hz PL

See more events, FARS Calendar <http://www.fars.k6ya.org/events/calendar>

March Raffle Prizes

The first prize will be a Samlex America Model 1235M 30Amp DC Switching Power Supply with meters. 2nd prize will be MFJ-392B Communications Headphones with dual volume control; 3rd prize is a 2010 Northern California Repeater Directory; 4th prize is an ARRL Repeater Directory. See later in this relay for more information on prizes.

CLUB INFORMATION

President:	Mikel Lechner, KN6QI
Vice President:	Steve Stearns, K6OIK
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Relay Editor:	Mark Hardy, K6MDH

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K6YA Trustee:	Phil Hawkins, KA6MZE
FARS Web Page:	http://www.fars.k6ya.org
Download Relay:	http://www.fars.k6ya.org/relay

Club members and non-members are encouraged to subscribe to the FARS Announcement list by browsing www.fars.k6ya.org/mail, clicking on Subscribe/Unsubscribe and following the instructions under "Subscribing to fars-announce.

You may submit announcements to the FARS Announcement at fars-announce@svpal.org. The list is moderated and messages will be posted as approved by the list moderator.

Contact the FARS board of directors at fars-board@svpal.org

Club meetings are held at 7 PM on the fourth Friday of each month except January (Winter Banquet); and sometimes there are changes for June (for field day) and Nov. & Dec (for holidays).

Annual club membership is $20. Club badges are $9. Visitors are always welcome! Directions in this newsletter. Talk-in: N6NFI (145.23-, 100 Hz) or W6ASH repeater (145.27-, 100 Hz).

FARS *Relay* is the official monthly newsletter of the Foothills Amateur Radio Society. Contributions to the newsletter from members, family, and guests are earnestly solicited! Contributions are subject to editing and/or compression. All readable forms welcome.

Here is how to reach the editor:
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Santa Clara, CA 95055
Voice: 408-243-0701 (Before 9 PM, preferred)
Email: mark.af6do@gmail.com, At FARS meetings.

Software Defined Radio Article

This is an interesting article on software defined radio by a by Louis E. Frenzel, a Ham that was looking for a receiver to use with his home built QRP transmitter.
http://electronicdesign.com/article/communications/software_defined_radios_are_here_now.aspx

General License Class Starting April 15th

Upgrade now! Sign up for the FARS General Class License Training Course. There will be six (6) two-hour weekly classes from 7 – 9 pm on Thursdays starting April 15th and running through May 20th. There are five instructional classes followed by the test session class held at the Mountain View Fire Station, 1000 Villa Avenue, Mountain View CA 94041. Sign up on the web at http://www.fars.k6ya.org/classes or email Kevin at k6xxx@arrl.net for more info. Course cost will be $30 ($25 for K-12 students, or seniors 65 or older). Text book not included.

Dr. Know-It-All

April 2010

Dear Doctor,

After reading your article on discone and bicone antennas [*FARS Relay*, February 2006], I have some questions.

1. Is "cone angle" the included angle that's measured between the opposite sloping sides of the cone or is it measured from the cone's centerline to the cone's sloping wall?

2. For uhf reception, the best cone angle seems to be about 1/3 of that for the preferred included angle for flat triangular bow-tie antenna (e.g., some 20 degrees for the cone and some 70 degrees for the bow-tie). Why is this so?

3. For the bicone, are the two cones spaced about 1.2 cm apart (i.e., at a spacing that's about equal to the wire spacing of typical balanced 300 ohm transmission line)?

4. For the biconical dipole, are the two cones supported at their apices or at points that are about halfway along the length of each cone?

5. If two bicones are stacked broadside, say, 1/2 wavelength apart, is the impedance of the two-bicone array still about 300 ohms?

6. For the biconical dipole, if the two cone lengths are each about 1/2 wavelength long, thereby making the overall width of the bicone about one wavelength, then why isn't the bicone's impedance likely to be more like that of a full wave dipole – viz., 2,000 to 6,000 ohms?

7. Lastly, why is it that the cone configuration is better at receiving UHF signals than is (1) a flat, solid triangular plate or (2) a "fat," cylindrical-element dipole having an *l/d* of, say, about 10?

Joe Genese

Answer: The questions are straightforward. A definitive article on the discone and biconical dipole antennas appeared in *QEX*, Jan/Feb. 2007. "Solid sheet" triangular monopoles and bow-tie antennas were measured and characterized by Brown and Woodward [2]. "Wire frame" bow-tie antenna was evaluated by Smith, Butler, and Umashankar [3].

1. The term "cone angle" can refer to the total included angle or to the angle measured from the cone's axis to its side. For bow-tie antennas, the angle is called a "flair angle" rather than a cone angle. Different authors use different definitions. The article in *FARS Relay*, February 2006, states in the third paragraph that the angle θ denotes the angle measured from the cone's axis.

2. The cone or flair angles of bicone or bow-tie antennas are generally chosen to achieve a specific SWR bandwidth. For example, a 60º (total included angle) solid-fill bow-tie provides an SWR < 2 into 300-ohm line over a 2 to 1 bandwidth if the length (total length of both halves) is $L = 0.8\lambda$ (edge length = 0.92λ) at the center frequency. If one examines graphs of feedpoint resistance and reactance with the cone or flair angle as a parameter, it is evident that the extreme values associated with the first antiresonance are reduced if the (total included) cone or flair angle is chosen to be near 30º [3]. However, a 30ºangle gives a fairly large impedance at the second antiresonance. So a trade is made. One chooses the length, angle and line impedance together to achieve a desired SWR bandwidth. The operating band is

positioned to either include or avoid the first, second and higher antiresonances.

3. A biconical dipole's apex-to-apex distance is chosen for mechanical design convenience and electrical performance. The antenna can be made with truncated cones in which the apex is chopped off and replaced with a small flat metal cap or a wire spider web. The end caps act like a small capacitor in parallel with the antenna's feedpoint, which shifts the antenna's impedance curve on the Smith chart down and to the left, roughly in a clockwise direction, with each point of the curve moving along a constant conductance circle on the Smith chart.

4. For low frequency operation, a biconical dipole becomes massive, and sheet metal cones are impractical. The cones can be made as a skeleton of wires or rods. It is mechanically preferable to build the structure around a boom that runs the length of the antenna through the interiors of the cones. Often the outer ends of the cones are capped, or rods are bent, to provide for attachment to the boom. The cones may be attached to the boom by metal supports inside the cones. For vertical bicones, the feedline can enter one of the cones through a coaxial choke balun at its end. For horizontal bicones, the feedline is brought out at a right angle to the antenna's axis just as with a horizontal dipole.

5. If two independent and uncoupled 300-ohm bicones in free space are connected to 300-ohm lines which are then connected in parallel, the impedance that results is 150 ohms. If the lines are connected in series (by using 1:1 transformers), the resulting impedance will be 600 ohms.

When stacking antennas in an array, the method of phasing and feeding has a big effect on the array's impedance bandwidth and pattern bandwidth. An unfortunate practice used by many Radio Amateurs is to connect an upper antenna in a stack to the one below it through a half wavelength of transmission line. Several things should be known about this method of stacking antennas. First, the physical length of a half wavelength of transmission line is always shorter than a free space half wavelength due to the line's velocity factor. So the antenna's in the stack must be closer than a half wavelength apart. Second, although the impedance seen looking into a lossless line repeats for lengths that are multiples of a half wavelength, the direction of current repeats at multiples of a full wavelength. So if half wavelength lines are used, the connections to the antennas must be crisscrossed every half wavelength. Otherwise, the antennas in the stack will be out of phase. But this method of feeding a stacked array is inherently narrowband. Suppose the connections are crisscrossed to put the antennas in phase at some frequency. Then at twice that frequency, the lines are a full wavelength long and the connections should not be crisscrossed, but they are, and so the antennas are again out of phase. One might as well forget about that one-octave bandwidth if this is how the antennas are connected.

To feed a stacked array so that the feed structure does not act like a filter and limit the array's bandwidth, one can use a "corporate" feed structure. This can be done by running equal lengths of transmission line from each antenna back to a common point, where the lines are connected together in series (using transformers) or parallel. The advantage of corporate feed is that all antennas in the array are fed in phase at all frequencies. Hence array pattern bandwidth is not reduced by antennas being out of phase. Since the line length is a variable, it can be optimized for parallel connection at the common point. In critical phased array feed designs, one must consider the effects of mutual coupling among the antennas because it can affect the array's pattern.

6. Consider a biconical dipole having a cone angle near zero. It behaves exactly like a thin-wire dipole of the same length. As the cone angle is increased, several things happen. The resonant and antiresonant frequencies decrease steadily to about 1/2 to 2/3 of their original values. Also, the maximum values of resistance and reactance, which occur near the antiresonances change values. The resistance and reactance at the first antiresonance decrease, reaching minimums when the cone angle (total included angle) equals 30º. As the cone angle increases beyond 30º, the maximum values of resistance and reactance increase. In all cases, the maximum resistance and reactance are in the range of 400 to 800 ohms for the bicone and bow-tie antennas, or about one-tenth that of thin wire dipole having length-to-diameter *L/d* ratios > 1,000.

7. If the objective is wide bandwidth operation, then a discone or biconical dipole generally performs better than a triangular plate over a ground plane or a solid bow-tie, and the latter generally performs better than a wire bow-tie. The advantage is mainly in terms of the magnitude of the resistance and reactance extremes versus frequency. For narrowband operation, none of these antennas has a clear advantage over the others, assuming proper matching. Fat dipoles can also be used and can be made of solid sheet metal or rods in a cage construction. The latter is preferred if the dipole is very fat because cage construction prevents a problem common to fat dipoles, namely currents having azimuthal component that wrap around the dipole's circumference. The cage permits only longitudinal currents parallel to the dipole's axis. The trouble with azimuthal currents is that they are hard to predict accurately. Such current patterns are fragile or unstable; small changes in an antenna's near-field environment can lead to notable impedance shifts.

That's it for this month. You can send your comments or questions about any aspect of Amateur Radio to Dr. Know-It-All. Written comments and questions are accepted at the monthly meetings of the Foothills Amateur Radio Society, by email to FARS officers and board members, or through the FARS web site at http://www.fars.k6ya.org.

Further Reading

S. Stearns, K6OIK, "All About the Discone Antenna: Antenna of Mysterious Origin and Superb Broadband Performance," *QEX*, pp. 37-44, Jan/Feb 2007.

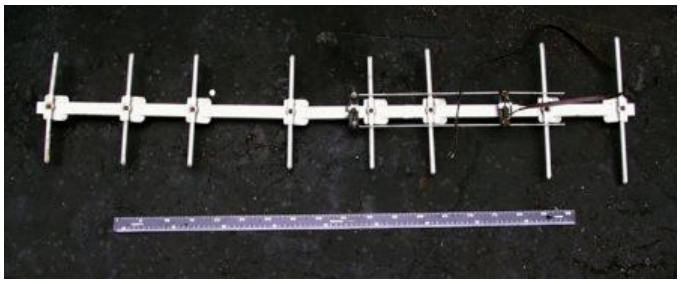
G.H. Brown and O.M. Woodward, "Experimentally Determined Radiation Characteristics of Conical and Triangular Antennas," *RCA Review*, vol. 13, no. 4, pp. 425-452, Dec. 1952.

C.E. Smith, C.M. Butler, and K.R. Umashankar, "Characteristics of a Wire Biconical Antenna," *Microwave J.*, vol. 22, no. 9, pp. 37-40, Sept. 1979.

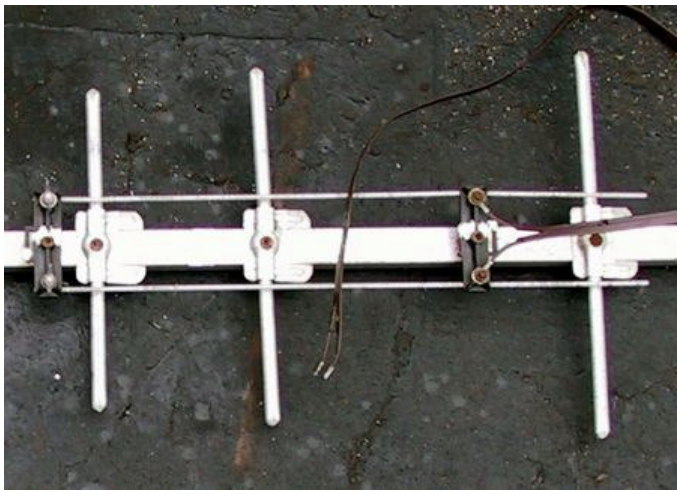
MYSTERY ANTENNA

A non-ham friend got a used antenna he thought was for UHF TV. He could not figure out how to connect it.

After examining it and talking to various antenna experts, I think it was designed for a purpose other than UHF TV, but it is still not obvious how to connect it and / or what pieces might be missing. Have any of our readers seen this antenna?



The picture shows 8 elements on a boom about 40 inches long. The other picture shows what should be the feed assembly. Just ahead of element 5 is a plastic insulator holding two screws with wing-nuts. Connected these screws and parallel to the boom are two metal rods. The rods extend past element 7. The dimensions and spacing compute to be a transmission line of 440 Ohms.



Between elements 6 and 7 is another plastic insulator. Under the nuts are terminal lugs holding a piece of 300 Ohm twin lead. Both ends of the twin lead have factory crimped connectors. At the second insulator, the nuts are regular hex nuts, not wing nuts. Where the wing nuts intended as the place to attach the feed line down the mast? Was the other piece of feedline intended to connect to another part of the antenna?

The rods do not connect to any element. Being perpendicular to the elements, the rods _probably_ to not couple strongly to the elements. There are mixed opinions on this point.

I modeled the antenna using EZNEC. Connecting the feed point to either set of terminal screws results in very high SWR at all frequencies from 400 to 1000 MHz.

Disregarding the feed assembly and modeling the antenna with element 7 as the driven element gives good gain and low SWR from 450 to 500 MHz. This makes me believe that the antenna was designed for one of the services in the 450-470 MHz range, and not UHF- TV. If it was designed for UHF TV, the antenna should work to 800 MHz. Originally UHF TV went to 900 MHz. Then the FCC relocated 800-900 MHz to cell phones. UHF TV continued to 800 MHz until the recent change to DTV. Broadcasters lost 700 - 800 MHz, as well a 54-88 MHz in that process.

Some hams have suggested that it is part of larger TV antenna. While it superficially resembles the front part of some big, traditional TV antennas, there are some problems:

UHF TV covers 470 to 800 MHz. EZNEC modeling suggests this antenna is narrow banded.

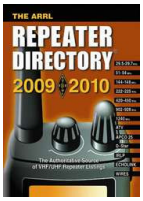
There are a pair of mounting holes in the middle of the boom, and the holes are deformed, presumably from usage. The TV antennas I have examined have a much longer boom with the mounting holes well behind the UHF section.

The several TV antennas I have examined all use some strips of sheet metal, not twin lead, to connect the driven element of the UHF portion to the rest of the antenna.

I have taken this antenna to several different meetings. It has generated lots of interest by antenna enthusiasts, but no one has recognized this antenna. - de Paul AA6PZ

March Raffle Prizes

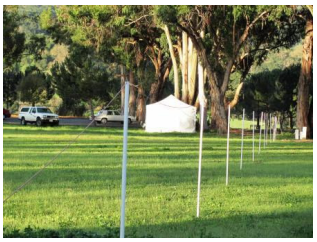
The first prize will be a Samlex America Model 1235M 30Amp DC Switching Power Supply with meters. The power supply has Two meters: Volts, Amps, Advanced switch-mode technology, Reliable power with minimum weight and size, and Circuit innovations that minimize output voltage ripple and RFI (picture and text from http://www.samlexamerica.com/).



2nd prize will be the MFJ-392B Communications Headphones with dual volume control. 3rd prize 2010 Northern California Repeater Directory; 4th prize ARRL Repeater Directory.

160 Meter Contest

FARS participated in the 160M contest Feb. 27-28. Here are some pictures of that event, courtesy of Joanna Dilley, KI6YRU.



Upper Left: Ed Fong, WB6IQN, and Phil Hawkins, KA6MZE.

Above: Clark Murphy, KE6KXO.

Left: 160 m Beverage antenna with the "shack" in the background.

FARS 2010 MEMBERSHIP RENEWAL FORM Date: _____

PLEASE fill out the form for all new/renewal memberships.

Name(s) & Callsign(s) & Class (E-A-G-T-N-None): _____

_____

Mailing Address: _____

_____

Home phone: _____ Work phone: _____

Fax (H or W?) _____ Packet BBS Address: _____

E-mail: _____ ARRL Exp Date(s): _____

Preferred modes: (e.g. HF-SSB/VHF/QRP/Other): _____

I'm willing to Elmer new hams with: _____

_____

Special topics of interest / suggestions for club meeting speakers:

_____

Dues: $20 per year, new members add $9 for badge fee. **Please note:** Membership runs from January 1 to December 31.

Send your check payable to FARS, to:

David A. Cooper
PMB 41
270 Redwood Shores Parkway
Redwood City, CA 94065-1173

How to get to FARS Club meetings (Visitors always welcome)

Meetings are held at the Covington Elementary School (directions below) on the fourth Friday. Socializing at 7 PM with the regular meeting at 7:30 PM. There may be changes in the meeting dates for January, June, November, and December.

DIRECTIONS:

From Interstate 280. take the El Monte exit Northeast. Cross Foothill Expressway. (A) At the first traffic light turn right on Covington. (B) Immediately at the fork take the left street (Covington). Go about 1/10th of a mile. Turn left into the parking lot. The gym is the tall building to your right with red and white stripes.

From Foothill Expwy., take the El Monte exit and go Northeast; then follow directions as above at point (A).

From US101 or El Camino: take San Antonio Road west (to Foothill Expressway). Then follow directions above at point (A).

TALK-IN via the N6NFI (145.230-; 100Hz PL) repeater or the W6ASH 145.27- (100Hz PL) repeater.