MOUNTAIN SPARK GAPS

NPARC—The Radio Club for the Watchung Mountain Area

Website: http://www.nparc.org
Club Calls: N2XJ, W2FMI
Facebook: New Providence Amateur Radio Club (NPARC)

VOLUME 55 No. 2 February 2022

Regular Meetings

Second & Fourth Mondays
2/14/22 Salt Brook School Cafeteria
(Same location as last auction)
3/28/22 Zoom

Upcoming Events

Digital Net Mondays at 9:00 PM
PSK on 80 or10 meters
CW training Net, Thursday at 9:00 PM
Watch for Email announcements.

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
2nd & 4th Monday
of each month
Watch for Emails

Everyone is Welcome
If a normal meeting night is a holiday, we usually meet the following night. Call one of the contacts below or check the web site

Club Officers for 2022

President: W2PTP Paul Wolfmeyer
201-406-6914
Vice President:W2EMC Brian DeLuca
973-543-2454
Secretary: K2AL: Al Hanzl
908-872-5021
Treasurer: K2YG Dave Barr
908-277-4283
Activities: KC2OSR: Sam Sealy
973-462-2014

On the Air Activities

Club Operating Frequency
145.750 MHz FM Simplex

Sunday Night Phone Net
Murray Hill Repeater (W2LI) at 9:00 PM
Transmit on 147.855 MHz
With PL tone of 141.3 Hz
Receive on 147.255 MHz
Net Control K2AL

Digital Net
Mondays 9 PM
28,084 — 28,086
Will be using PSK and RTTY
Net control K2YG

Club Internet Address

Website: http://www.nparc.org
Webmaster KC2WUF David Bean
Reflector: nparc@mailman.qth.net
Contact K2JV, Barry

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WB2QOQ Rick Anderson
W2PTP Paul Wolfmeyer
K2UI Jim Stekas

Climatological Data for New Providence for January 2022

The following information is provided by Rick, WB2QOQ, who has been recording daily weather events at his station for the past 40 years.

TEMPERATURE -
Maximum temperature this January, 56 deg. F (January 2)
Last January(2021) maximum was 47 deg. F.
Average Maximum temperature this January, 34.1 deg. F
Minimum temperature this January, 5 deg. F (January 16)
Last January(2021) minimum was 15 deg. F.
Average Minimum temperature this January, 20.0 deg. F
Minimum diurnal temperature range, 5 deg. (53 - 48 deg.)1/1
Maximum diurnal temperature range, 25 deh.
Average temperature this January, 27.1 deg.
Average temperature last January, 32.0 deg. F

PRECIPITATION -
Total precipitation this January- 3.63” rain/snow melt; 13.45” snow
Total precipitation last January- 2.87” rain/snow melt; 3.8” snow

Maximum one day precip. event this January-

January 7, 5.0” snow; January 17, 1.26” rain.
Measurable rain fell on 6 days this January,7 days last January.
Measurable snow fell on 6 days this January.

YTD Precipitation - 3.63”

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Rick Anderson
2/24/2022
243 Mountain Ave.
New Providence, NJ
(908)464-8911
rick243@comcast.net

Lat = 40 degrees, 41.7 minutes North
Long = 74 degrees, 23.4 minutes West
Elevation: 380 ft.
CoCoRaHS Network Station #NJ-UN-10

President's Column February 2022

We had our first hybrid meeting, a successful auction, and a featured speaker from India! First, the hybrid meeting: Ken Hanzl W2IOC got us set up and it worked. We were about "split" between ZOOM and in-person at Salt Brook. We do need to improve our mike operation at Salt Brook and we are working to do that. The cafeteria room acoustics offers challenges but we'll learn how to make it work better. Thanks Ken for getting us going in this style!

Regarding the auction, I'll mainly repeat what I said in my message posted on the reflector. Thanks to all for your work to make Saturday's Auction a success. As we come out of the pandemic, folks are glad to see each other as was evidenced by the attendance—down from the record two years ago but still very solid. Support from the Salt Brook personnel was again excellent. Joe did his terrific and efficient auctioneering and the "handlers" and cashiering team kept things moving well. And--Everyone seemed to have a good time.

It was good to have our Hudson Division Director, Ria Jairam, N2RJ, in attendance--and good to see our retiring Vice-Director (and club member) Bill Hudzik W2UDT.
I'm always impressed (and pleased) with the way NPARC club members step up to volunteering for the tasks and then performing them. It was again true; that makes the leader/coordinator's job pretty smooth. Thanks again.

I won't repeat my spreadsheet, but particular thanks to Al for Publicity, Rick for signs, Joe for auctioneering, Hillary for coffee/tea prep, Dave for "cashiering, etc", and the "handlers" (a lot of the stuff was really heavy.) And there were lots of club members "at the ready" to pitch in, and you did pitch in…Actually setup and cleanup was really very easy because Lenny, our custodian at the school, did so much!! Thank to him!! Lots of help makes the task go quick.

And our last Monday meeting featured Bharathi VU2RBI from India. What a role model and inspiration she is for amateur radio! She talked about dxpeditions, tsunamis, being honored by Queen Elizabeth, and her work with YLs—great for the future of our hobby. And she is responsible for 44 licensed hams in her family!! Her website is www.vu2rbi.com –and check her out on qrz.com. Thanks Heather KD2VZA for linking us up with her.
Our next meeting is March 14—watch the reflector for meeting info.
73

Wolf W2PTP 201-404-6914 or W2PTP@arrl.net

Interaction Between Antenna Elements
Jim Stekas - K2UI

The magic that makes a Yagi antenna work is the mutual coupling between the antenna elements. Radiation from the driven element induces currents in the passive elements which also radiate. By properly adjusting their spacing and lengths, the radiation from all the elements will add together in phase in the forward direction to produce a “beam”. That sounds simple, but because all the elements interact with each other, optimization of element spacing and length is not an easy problem.

The “traditional” approach to Yagi design[1] requires modeling the self impedance of each element as well as the mutual impedance between all element pairs. Formulas for element impedance as a function of length, diameter, and taper have been developed from theory and experiment. Mutual impedances between each pair of elements were also modeled in a similar way. These impedances feed into a matrix equation relating the currents in the antenna elements to the voltage on the driven element, namely:

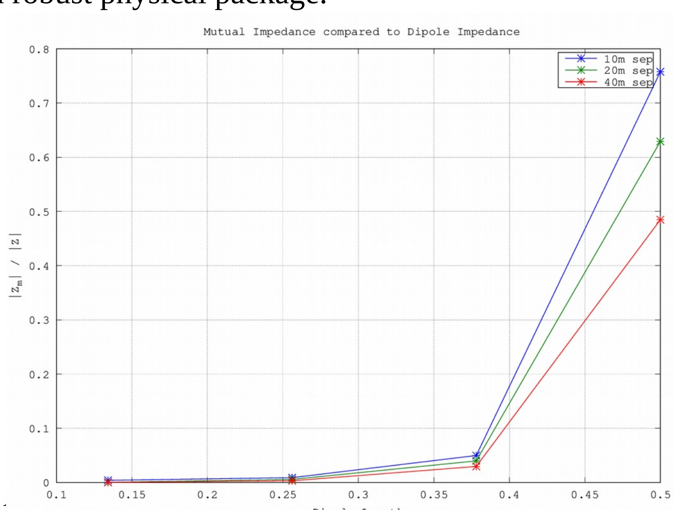
$$\begin{pmatrix} Z_{11} & Z_{12} & Z_{13} & Z_{14} \\ Z_{21} & Z_{22} & Z_{23} & Z_{24} \\ Z_{31} & Z_{32} & Z_{33} & Z_{34} \\ Z_{41} & Z_{42} & Z_{43} & Z_{44} \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{pmatrix} = \begin{pmatrix} 0 \\ V_2 \\ 0 \\ 0 \end{pmatrix}$$

The above matrix equation can be easily solved with a BASIC program on an early 1980's computer to give the currents in each element. From the currents the antenna pattern can be calculated.[2] The above procedure would need to be repeated for different element lengths and spacings to optimize the beam pattern.

In a typical single band Yagi, all the elements are approximately ½ wavelength long, with spacings on the order of 0.1-0.25 wavelengths. By being close to ½ wavelength, the elements act like high Q resonant circuits that can share energy efficiently with weak coupling. The genius of the Yagi design is that it produces useful gains with a simple and robust physical package.

To get the narrowest beam without grating lobes, the “optimum” directive array has elements spaced ½ wavelength and a broadside beam. If we drive all the elements of our array we can use elements shorter than ½ wavelength.

The plot at the right shows the magnitude of the mutual impedance between dipoles elements of varying length and separation.



1 “Yagi Antenna Design” by James L. Lawson, W2PV,

2 The current values are for the center of each element. No current distribution over the element is given (as in miniNEC), but a simple cosine distribution is a reasonable assumption for calculating the beam pattern.

Note that when elements are shorter than ¼ wavelength the ratio of the mutual to self impedance ($|Z_m|/|Z|$) is very small, regardless of the spacing.   That means that we can ignore the mutual impedances and simplify the matrix equation, namely:

$$\begin{pmatrix} Z_{11} & 0 & 0 & 0 \\ 0 & Z_{22} & 0 & 0 \\ 0 & 0 & Z_{33} & 0 \\ 0 & 0 & 0 & Z_{44} \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{pmatrix} = \begin{pmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{pmatrix} \quad \text{for elements shorter than ¼ wavelength.}$$

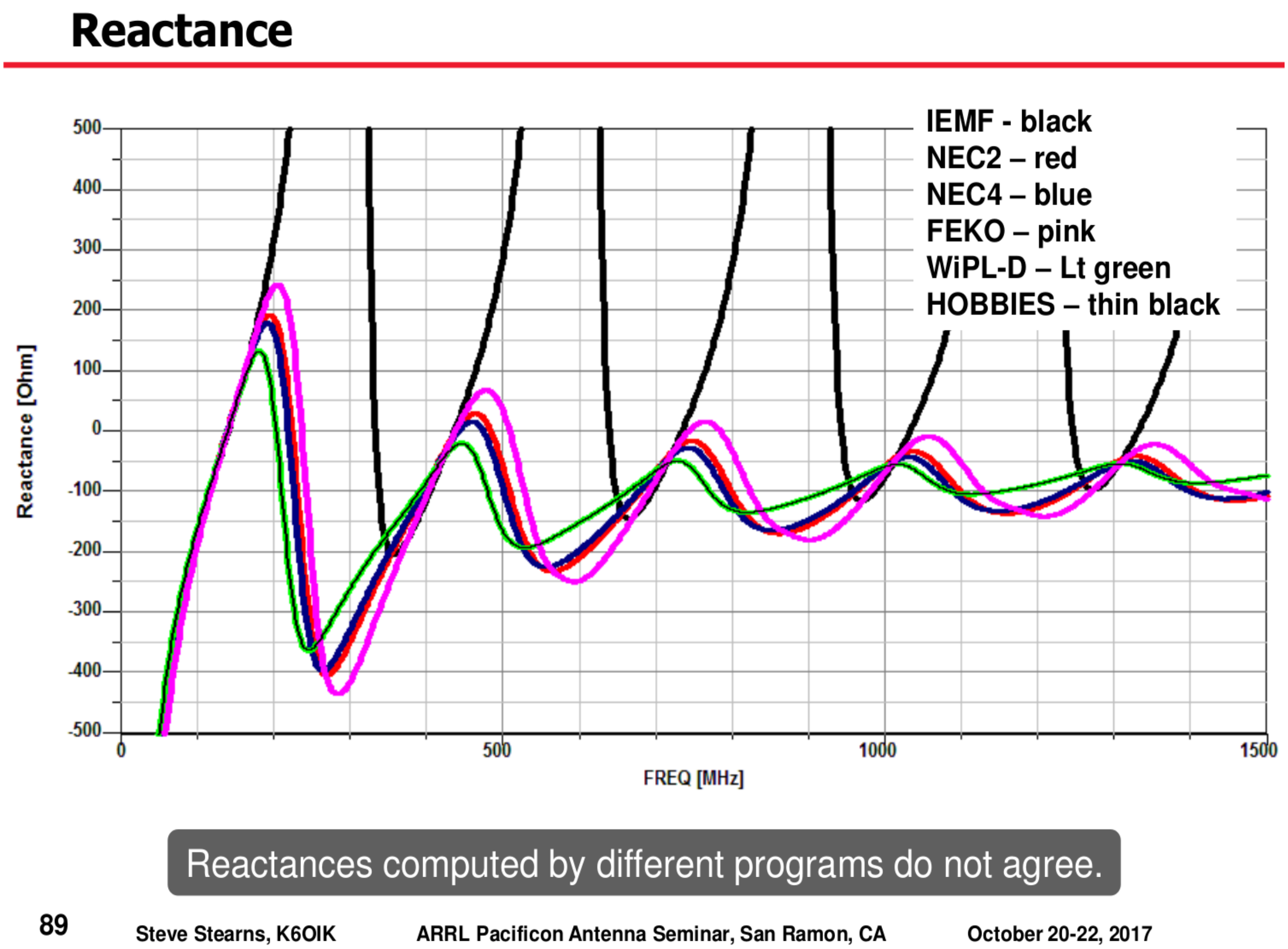
If we build an array out of 4 small dipoles (or loops) the beam can be "steered" by adjusting the phases of the feed voltages. This could be accomplished by switching in appropriate lengths of coax or through software phase adjustments in an SDR setup.

Phasing adjustments by adding or removing coax won't work for arrays with ½ wavelength elements because adding coax to one element will change the current phases of all the elements due to mutual coupling. The ½ wavelength elements act as high Q resonant circuits that have a strong mutual interaction even when coupling is minimal. That's why arrays of ¼ wavelength verticals require tricky phasing networks.[3]

An array of small loop antennas would be a nice approach for 160m. Small loops would provide immunity from man-made noise sources. And even though small antennas are lossy, this isn't a serious problem on 160m where levels of atmospheric noise are very high.

3   When you install your 160m four-square verticals, DX Engineering can supply the array steering network.

We can also look at the reactive component of the feedpoint impedance, which we expect to be near zero a resonance. At the 1/2 wavelength dipole resonance (~150MHz) all the models cross X=0 at the same frequency. But at higher harmonic frequencies the models disagree as to where X=0 occurs. All the computer models predict that for F>800 MHz the reactance remains capacitive (X<0).



It is surprising that state-of-the-art computer models cannot agree on the impedance of ideal dipoles[4] longer the ½-wavelength. Real antennas aren't ideal. They tend to couple in unknown ways to ground, coax, gutters, AC. wires, etc. Except for the one and three half-wavelength resonances (which are fairly well behaved) the impedance at other frequencies will be uncertain. If you want to know the impedance of your antenna vs. frequency you will need to sweep it with an antenna analyzer. If you are lucky, will get rough quantitative agreement with your antenna modeling software.

4 An "idea dipole" is one isolated in free space, who's dimensions are exactly known, and fed directly by a voltage (or current) source.