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. 6 June 2022

Regular Meetings

Second & Fourth Mondays
7/11 Salt Brook School Cafeteria
7/25 ZOOM

Upcoming Events
Digital Net Mondays at 9:00 PM
PSK on 80 or10 meters
CW training Net, Thursdays at 9:00 PM

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

MOUNTAIN SPARK GAPS

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W2PTP Paul Wolfmeyer
K2UI Jim Stekas

Weather Summary not Available

President's Column June 2022

Field Day 2022 is a "wrap"—I'll get to that in a minute (by mainly repeating my "wrapup" reflector message)…

Our summer meeting are all planned to be on ZOOM. This is because Salt Brook is closed and unavailable to us. We have made arrangement with Salt Brook to continue next school year with Hybrid meetings at Salt Brook for the first meeting of each month (except April) and the second meeting will be a ZOOM.

Thanks to all participants for a great Field Day weekend!! Lots of Qs--over 900, about 365 CW, 130 digital, and 420 phone. The operating schedules (thanks Kevin) were pretty full--better than the last couple of Field Days. Unfortunately VHF propagation was not the greatest--but we're grateful for the extensive work Rick and Al go to in setting up that station and the "flag bearing" tower!

I must repeat my standard appreciation: "As usual, you all stepped up and did what you said you would—that's a hallmark of NPARC that makes our FD work!" In fact folks showing of for setup was perhaps a record!

We set out with several goals in mind:

1) Two HF stations-- "Near HF station" delivered many phone contacts. Kevin (N2TO) managed it well.
2) A CW and digital HF station: We did learn that we want to use a doublet for that station, as well. We switched to one Saturday PM.
3) Continued success with VHF: that tower set up is always impressive!
4) Involve more operators and fill more time slots—done
5) Capture bonus points as much as possible--Al's solar-charged qrp Qs, generator operation, a mayoral visit, a Red Cross rep visit, attention to safety, getting the W1AW message, and submitting 10 traffic messages and an SCM (thanks KA2HZP), etc…

And the food was great-- thanks principally to the grill and cookery of Billy KD2JRI. Saturday sandwiches (thanks Heather KD2VZA) and Sunday bagels (thanks Brian KD2SND) met the spot. Photo documentation got completed thanks to Don Madson K2DAM, the publicity was great (the Secretary K2AL winds up with so much to do) and the logging network ran well (thanks Dave (KC2WUF))….the food canopy provided good shade (K2YG), the tables were great (KD2EKN), the antenna support (from K2EFB SK) worked well and went up/down well, antenna string was shot (Brian W2EMC) …and, from my perspective "young guys" were particularly appreciated for setup and teardown…

And the weather was absolutely outstanding!!

And we thank Dave KC2WUF as he collects material and compiles the log submission…

Thanks again to everyone. As usual in a big team operation, people get missed in the thanks—for that I apologize…**everyone's help was appreciated!!**

On our June 27 ZOOM, Field Day was discussed and suggestions/improvements noted.

73 for now, Wolf W2PTP, 201-404-6914, w2ptp@arrl.net

Father of Filters

Jim Stekas - K2UI

Scientific discoveries tend to occur years before the technology required to enable them. In 1887, a thirty year old Heinrich Hertz demonstrated electromagnetic waves using a metal ring as a receiver. Within a few years, Marconi was demonstrating wireless telegraphy using miscellaneous parts from the hardware store. By 1912, radio was practical enough for Titanic's SOS signals to summon ships to the rescue in mid-Atlantic. But except for the telegraph key, hardly any of that early Marconi station is recognizable as radio equipment today.

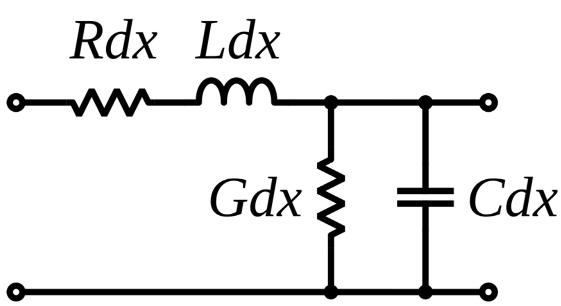
In the late 19th century, the high technologies of the day was the telegraph and telephone, and the challenge for both was increasing range from a few miles to crossing continents and oceans. The original telephone design was similar to speakers connected by a par of wires. A slight improvement over tin cans and a string.

Thomas Edison worked the problem through experimentation and came up with the carbon microphone in 1876[1], a variable resistor controlled by sound waves. The carbon microphone plus battery produced enough current to support local telephone services over copper wire pairs into the late 20th century.

Meanwhile that same year, Oliver Heaviside, an English mathematician and physicist, focused his attention on the wires and created the theory of Transmission Lines in 1876. He imagined an infinitesimal length of transmission line looking like a series inductance and shunt capacitance.

The figure at right shows Heaviside's model of a transmission line of infinitesimal length dx. All values R, L, G and C are given per unit length. Across the top of the circuit we have an impedance per unit length of: $Z = R + j\omega L$

shunted by an admittance [2] of: $Y = G + j\omega C$.



The characteristic impedance of the line shown is: $Z_0 = \sqrt{\frac{Z}{Y}} = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$.

If $\frac{R}{G} = \frac{L}{C}$, the Heaviside condition, the line impedance Z_0 is pure real and independent of frequency. But in practice, it is generally the case that $\frac{C\,R}{G} \gg L$ which means that $Z_0(\omega)$ is a function of frequency ***and*** has an imaginary component. The effect of this is dispersion that will distort the shape of the waveform being transmitted. Heaviside's theory explained why trans-Atlantic telegraphy cables were usable only at very low code speeds (i.e low frequencies.)

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1 As for so many inventions, multiple inventors independently came up with the similar solutions at roughly the same time. Once patent rights expire, so does the fighting over priority.

2 Admittance is the inverse of impedance. Parallel admittances add as series impedances add.

John S. Stone, an AT&T engineer analyzed the transmission line characteristics of the Bell System and invented a bimetallic iron-copper wire with higher inductance to achieve the Heaviside condition. Stone's solution worked but was too costly and impractical (iron rusts!)

Enter George Ashley Campbell, the hero of our story. Campbell was born in 1870 an attended McCollom Academy, an elite private high school in New Hampshire. After graduating he received his Bachelors from MIT followed by a Masters from Harvard. He received a fellowship for 3 years of graduate work in Europe where he studied with Ludwig Boltzmann in Vienna, Henri Poincaré in Paris, and Felix Klein in Göttingen! (Einstein was an unknown, else I am sure Campbell would have worked with him as well.)

After his graduate work Campbell took a research position at AT&T in 1897, well before the establishment of Bell Labs. Campbell turned his efforts to improving the transmission lines in the Bell System. His great insight was that at audio frequencies, wavelengths were very large, and lumped inductances could be used to achieve the Heaviside condition. Fortuitously, the network cables ran between man holes which were perfect locations for the "loading coils". Campbell used different loading coil values tailored to the man hole spacing being used. Loading coils enabled a 46 mile telephone circuit over the Pittsburgh cable (which was in Boston.)

At Columbia University, Michael Pupin was studying the problem and also hit upon the loading coil idea. Unfortunately, AT&T lawyers sat on Campbell's patent application and Pupin received the patent on loading coils, even though Campbell had already proven his solution in the telephone network. Rather than going through a protracted legal battle, AT&T agreed to license Pupin's patent so deployment of loading coils could begin without delay. Pupin became wealthy, AT&T saved millions, and Campbell went on to do more pioneering research.

Campbell looked at the Heaviside model of transmission lines (earlier figure) and reasoned that he could build a "transmission line" with discrete components. By putting together multiple sections Campbell's discrete transmission lines evolved into LC filters: low pass, high pass, bandpass, etc. Campbell developed the filter design rules which were formalized as the constant-k filters by Otto Zobel (another AT&T engineer). In the 1920's Zobel extended Campbell's work to create m-derived filters, the standard LC filter designs used by radio engineers through the 1950's.

One thing that drove the development of filter theory was the desire to frequency multiplex telephone signals to increase network capacity. Before digital transmission technologies, voice channels were multiplexed into groups of 12 SSB channels each 4 kHz wide. These were combined into super-groups, which in turn we combined into master-groups with 1200 circuits. In order to closely pack the channels and avoid cross-channel interference good filters were needed, and analog LC filters were the only game in town until crystal filter technology matured.

But why would people be thinking about SSB in 1920? Blame John Renshaw Carson, the AT&T engineer who patented SSB in ***1915*** in anticipation of frequency division multiplexing. Carson studied the effects of filters on modulated signals using the "operational calculus" (Laplace transforms) allowing cross-channel interference to be predicted.

There is a humorous tee shirt I saw that reads "Engineer. Solving problems you haven't heard of in ways you can't understand." Hats off to all those early AT&T engineers who did just that.