

# **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 51 NO. 10 October 2016**

## **UPCOMING EVENTS**

**Holiday Luncheon  
12/3  
Same location as last year**

**Regular Meetings  
10/14 & 10/28  
Monday 7:30  
NP Community Center**

## Meeting Schedule

**Regular Meeting:** 7:30—9:00 PM  
**2nd Monday of each month** at the  
NP Senior & Adult Center  
15 East Forth Street  
New Providence

**Informal Project Meeting:** 7:30—9:00  
PM

**4th Monday of each month**  
**Same location**

**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 2016

President: KC2WUF David Bean  
973-747-6116

Vice President: K2UI Jim Stekas  
973-377-4180

Secretary: KD2EKN Tim Farrell  
973-921-1175

Treasurer: K2YG Dave Barr  
908-277-4283

Activities: W2PTP Paul Wolfmeyer  
201-404-6914

## — 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

First & Third Mondays 9 PM  
Details as announced.

## Club Internet Address

Website: <http://www.nparc.org>  
Webmaster K2MUN David Berkley  
Reflector: [nparc@mailman.qth.net](mailto:nparc@mailman.qth.net)  
Contact K2UI, Jim

## MOUNTAIN SPARK GAPS

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Contributing Editors:

WB2QOO Rick Anderson

WB2EDO Jim Brown

K2UI Jim Stekas

Climatological Data for New Providence for  
September 2016

The following information is provided by  
Rick, WB2QOO, who has been recording  
daily weather events at his station for the  
past 35 years.

### TEMPERATURE -

Maximum temperature this September, 92 deg.  
F (September 10)

Last September (2015) maximum was 93 deg.  
F.

Average Maximum temperature this September,  
78.1 deg. F

Minimum temperature this September, 46 deg.  
F (September 25, 26)

Last September (2015) minimum was 51 deg. F.  
Average Minimum temperature this September,  
59.6 deg. F

Minimum diurnal temperature range, 7 deg. (60  
-53 deg.) 9/30

Maximum diurnal temperature range, 29 deg.  
(83-53 deg.) 9/23

Average temperature this September, 68.9  
deg. F

Average temperature last September, 69.8  
deg. F

Number of days this September with temps. 90  
degs. or higher - 3

Number of days this summer with temps. of 90  
degs. or higher - 27

### PRECIPITATION -

Total precipitation this September - 1.78"  
rain.

Total precipitation last September - 4.03"  
rain.

Maximum one day precip. event this September  
September 1, 0.78" rain

Measurable rain fell on 7 days this Septem-  
ber, 6 days last September.

YTD Precipitation - 31.8" (included rain +  
melted snow, as of 10/9/16)

=====

Rick Anderson

10/9/16

243 Mountain Ave.

New Providence, NJ

(908) 464-8912

[rick243@comcast.net](mailto: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

# This is a copy of the first issue of Spark Gaps Dated April 31, 1966

## MOUNTAIN SPARK GAPS

THIS IS NUMBER ONE

Well, here it is! Volume I, Number I of the Club Bulletin. It was made possible when Andy (W2ZWGM) latched onto a bargain in printing equipment. But it will only be successful if all members help.

In addition to meeting notices and schedules, buy, sell and swap info, the Editor needs editorial suggestions and news items.

Since Club meetings are the second Monday of each month the objective will be to get news in the mail on the first Monday. That means news has to be in the Editor's hands early in the preceding week. Next deadline: May 2. News by April 25 - 26.

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### W A S CONTEST

Here's your chance to show your stuff!

Your Club will sponsor a WAS Contest during the balance of the year open to all members and with awards for the best performances.

All bands are eligible with the contest closing December 31, 1966. It is suggested that you keep a separate log of these contest contacts by states and report at each monthly meeting. The Club will keep a chart showing the standings to date.

Let's get busy!

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### C D TEST

A hurricane passed through New Jersey on March 26 -- simulated, that is, in case you missed it.

Several Club members manned the Berkeley lights and New Providence CD Centers and contributed to the State CD exercise. The hurricane left right on schedule, too.

NEW PROVIDENCE AMATEUR RADIO CLUB

April 11, 1966

Vol. I No. I

### APRIL PROGRAM

New Providence Amateur Radio Club's program for Monday, April 11, will feature a talk on "Good Operating Procedures For The Amateur" by Hayden W. Evans (K2DZT). The meeting, to be held in the New Providence Recreation Building at 8 p.m., will be open to all interested in amateur radio.

Mr. Evans has been licensed since 1931 and has contacted more than 330 countries. He heads the Satellite Systems Engineering Department at Bell Laboratories.

Refreshments will be served.

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### FOR THE FUTURE

Coming up -- mobile exercises. We expect to participate in the Memorial Day parade again this year. We also have been invited to help with the Centennial celebration in Stirling early in June ... There will be free refreshments, too.

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### WHERE ARE YOU?

Two meter phone net meets every Friday at 2:00 on 145.8 mc. Many members have crystals ... wonder why we don't hear them. And what's happened to all the people who were going to get on to brush up on CW?

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### FIELD DAY PLANS

The field day site has been scouted and plans for the outing are being readied. If everyone pitches in we should be able to improve on last year's performance -- a real goal to shoot for.

The field day committee needs firm commitments on generators. If you know of any possibilities, (Continued on other side)

Field Day # Continued

Get in touch with one of the committee members: Roland (W4VRS/2), Bob (W2YFM) or John (K2AGI).

Let them hear from you as soon as possible.

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ON AIR FORCE DUTY

Arden (WB2GPG) will be in the Air Force for two weeks beginning April 4. Presiding at the meeting April 11 will be Jim (WB2EKA).

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FOR SALE

One BC 348 (with speaker) in excellent condition. Price: \$40. Get in touch with Jim Palmquist (WB2EKA); Telephone: 464-0836

WANTED

Charlie Derowitsch (W2RBR) needs a 200 kc crystal. Anyone have one?

MORSE TELEGRAPH LUNCHEON

The first annual commemorative luncheon to honor the birth of Samuel F. B. Morse will be held at Rod's 1920s Road House; West Orange, at 12 noon Saturday, April 23.

All Morse telegraph operators and amateur radio operators are invited.

Western Union and Canadian National Telegraphs will provide the largest Morse telegraph circuit in the world -- about 25,000 miles of wire linking all 70 chapters in the United States and Canada -- for the occasion. New Jersey will be added for the first time. Anyone who can operate a telegraph key will be welcome to try their hand.

Tickets may be obtained from L. T. O'Neil, 17 Hill Street, Bloomfield, who is Chapter president; Stuart Davis, wire chief of the Chapter, or Ken Sisco, Chief Dispatcher's office, Erie Lackawanna Railroad, at Hoboken.

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DO YOU HAVE ANOTHER NAME TO SUGGEST FOR YOUR CLUB BULLETIN?

Let's hear from you if you do.

For change of address notify John (K2AGI) Telephone 464-4644

New Providence Amateur Radio Club  
Recreation Building  
New Providence, New Jersey



John Sheetz  
5 Hansell Road  
Murray Hills, N.J.

Compliments of Harry Kundrat W2YEE

## Take it to the (Shannon) Limit

Jim Stekas - K2UI

Last month we discussed Shannon's Information Theory which defines the information content of a message in a mathematically precise way. (Check out Wikipedia if you want to see the equation.) To state Shannon's theorem in simple English, the information content of a message (e.g. a file) is equal its length in bits after maximum compression. The “optimum” compression algorithm is one that compresses all “valid” messages into the smallest number of bits. (Note: the optimum compression algorithm of English text will depend on how much variety in spelling, grammar and syntax is allowed.)

### Shannon Capacity Limit

Messages, compressed optimally or not at all, don't become communication until we send them from point A to point B. Shannon's ultimate goal was to determine how the rate that information could be sent from A to B over a communication channel characterized by its bandwidth and noise level, which is expressed by the formula:

$$C = W \cdot \log_2(1 + SNR)$$

where:

- C the “channel capacity” in bits per second.
- W is the channel bandwidth in Hz.
- SNR is the signal to noise power ratio, where the noise is assumed to be Gaussian.

Applying his formula to the typical telephone loop Shannon estimated that it could support a bit rate over 1Mbps, an astonishingly high number. It took about 40 years for data modem rates to climb slowly from 1200 bits per second in the 1960s to the 1Mbps DSL rates of the 1990s.

It is common to write Shannon's equation on terms of  $E_b/N_o$ , the ratio of  $E_b$ , the energy per bit, and  $N_o$ , the noise floor per Hz.

$$\frac{C}{W} = \log_2 \left( 1 + \frac{E_b}{N_o} \frac{C}{W} \right)$$

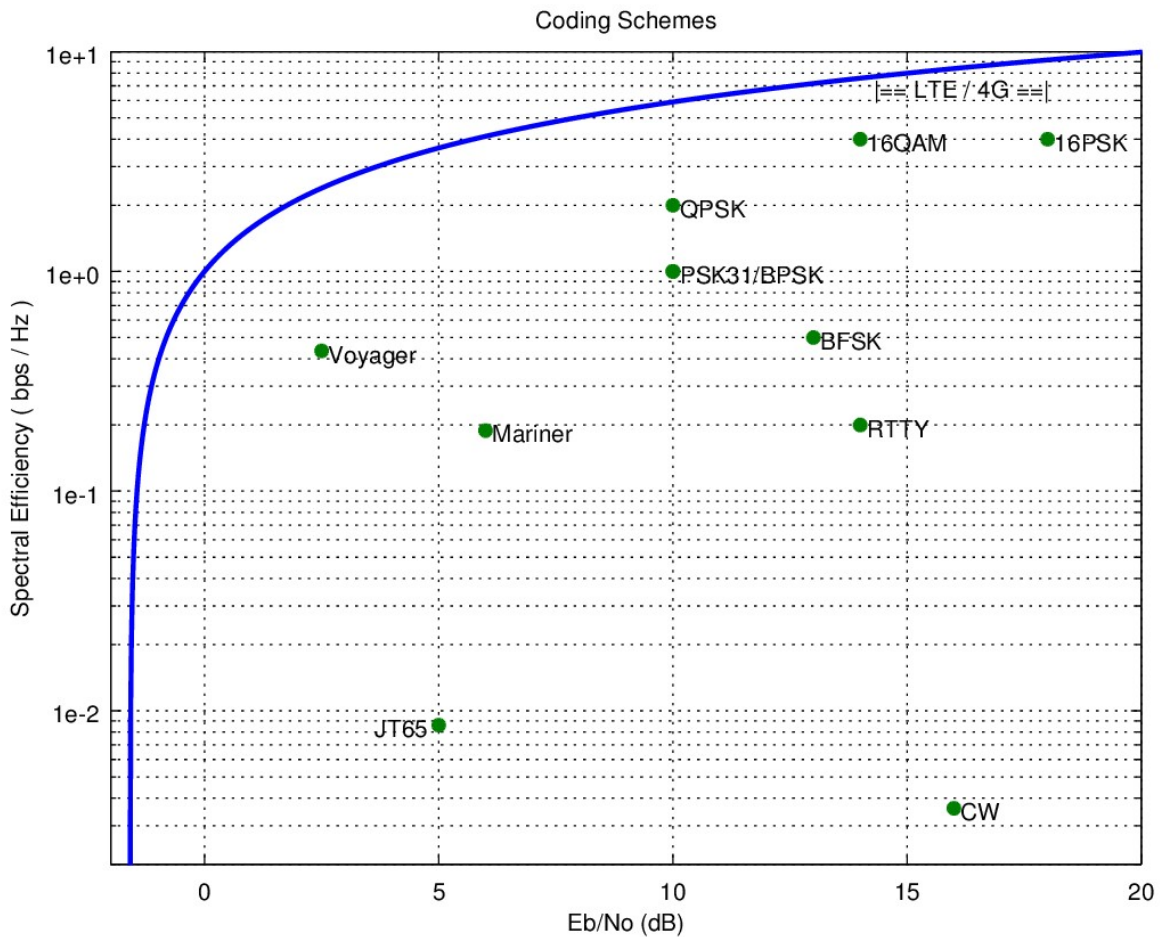
$C/W$  is the spectral efficiency, the number of bits/sec sent per Hz of bandwidth. Back in 1983 my Hayes 1200 baud modem had a spectral efficiency of  $0.3 = 1200/4000$ . At the time, a spectral efficiency of 1 was a goal akin to the 4 minute mile, not quite the holy grail, but a significant technical challenge. By the mid 1990's modems data rates reached 56kbps, a spectral efficiency of 14.

Typically, a communication channel coding is designed for a fixed bit rate and bandwidth, (e.g. RTTY at 45 baud and 170 Hz shift) and we rearrange Shannon's equation to determine the minimum  $E_b/N_o$  that supports a given  $C/W$ :

$$\frac{E_b}{N_o} = \left( \frac{C}{W} \right) (2^{C/W} - 1)$$

The figure below compares various coding schemes with respect to spectral efficiency and power/sensitivity ( $E_b/N_0$ ) for operation at estimated bit error rates (BER) of  $10^{-5}$ .

The blue line shows the Shannon limit, with realizable codes lying below the line. Note that higher spectral efficiency requires higher signal levels ( $E_b/N_0$ ). At low spectral efficiency,



Power efficiency increases toward lower  $E_b/N_0$  and that's where we find weak signal codes like JT65 and space communication links used by NASA in Voyager and Mariner missions. If you are looking to have the best weak signal performance you measure your distance the Shannon limit in how many dB you are to the right of the curve. Using the latest coding techniques, like Turbo and Low Density Parity Check (LDPC) codes, it's possible to get within 0.5 dB of the Shannon limit.

Toward the top of the graph we find the most spectrally efficient coding schemes. Here we find codes used by wireless data providers determined to cram as many bits as they can over the spectrum blocks they bought from the FCC.

The plot is actually a bit of a swindle, because it applies only to Gaussian noise which is reasonable for space communications but not for HF links. A typical HF channel has QRM and QRN (e.g. thunderstorms) and fading that can easily change signal strength by 20dB. A way around this is through diversity, i.e. spreading adjacent bits as far apart in frequency and time as possible to make the fading and noise look as Gaussian as possible. In JT65 this is accomplished using 65 different frequencies to minimize the effect of selective fading, and bit interleaving separate adjacent bits far apart in time. (Imagining scrambling the letters in a file and then randomly changing 10 in a row to X. After descrambling, those Xs would appear as obvious typos in 10 different words which would leave the text readable.)

JT65 also uses Reed-Solomon block codes to provide very strong forward error correction so, so it's your best shot at getting through in worst case conditions. But it will take you at least a minute to find out if you did, and if you didn't chances are your message will be completely garbled.

In contrast, RTTY has nowhere near the weak signal performance of JT65, but because it does not use a block code it has very low latency. That means it is also usable for rag chewing which JT65 is not.

There is no best digital code, it's all about tailoring the code for the latency and link performance you need. Many people have found that in many cases FM will outperform the digital mode (e.g. DRM) designed to replace it, providing 50% copy while the digital stream provides 0%.

#### **“Proof” of Shannon's Equation**

A formal derivation of Shannon's equation is easily found on the web, so I will only give a simple argument for its validity. We start with Shannon's capacity formula:

$$C = W \cdot \log_2(1 + SNR)$$

Applying some simple algebra we can rewrite the equation as:

$$C \approx (2W) \log_2(\sqrt{SNR})$$

where we have assumed  $SNR \gg 1$ .

The term  $(2W)$  is the Nyquist sampling rate, the minimum sampling frequency needed to digitize a signal of bandwidth  $W$ . The square root of SNR is the ratio of signal and noise RMS voltages, which is essential the number of distinguishable signal levels.

$$C \approx F_{samp} \cdot \log_2\left(\frac{|V_{sig}|}{|V_{noise}|}\right) \approx F_{samp} \cdot \log_2(N_{levels}) \approx \left(\frac{samp}{sec}\right) \cdot \left(\frac{bits}{samp}\right) \approx \frac{bits}{sec}$$

## SCIENTIFIC TIDBITS

### **The Ozone Hole – Healing at Last**

The hole in Earth's protective ozone layer, once a defining issue of the environmental movement is finally starting to shrink, new research reveals. Encircling the globe in the stratosphere, the ozone layer is a gaseous shield that absorbs the bulk of the sun's ultraviolet radiation. But in 1974, two University of California chemists sounded a dire alarm: Chlorofluorocarbons, chemicals once widely used in everything from aerosol spray bottles to air conditioners, were accumulating in the upper atmosphere, which has a finite capacity for absorbing chlorine atoms. Over the next decade, Chlorofluorocarbons went on to bore a hole in the ozone layer above Antarctica. The hole opens every year in August and is generally deepest in October. The damage was expected to worsen over time, exposing people, animals, and crops to increasing amounts of harmful ultraviolet rays, with potentially catastrophic consequences. Despite fierce opposition from the chemical industry, a 1987 international treaty known as the Montreal Protocol led to the phasing out of Chlorofluorocarbons and several other ozone-depleting gases. The strategy worked. A team at MIT has found that the hole opens later in the year and is not as deep as it used to be. In addition, it has shrunk by 1.5 million square miles and is on pace to close entirely by midcentury. This situation gives us hope that we should not be afraid to tackle large environmental problems. It also gives us hope that international cooperation can bring about all sorts of accomplishments for the betterment of mankind.

### **Stem-cell Snake Oil**

Beware of stem-cell therapy scams, a new study warns. So far, the Food and Drug Administration (FDA) has approved only one stem-cell product for sale – HemaCord, which treats certain blood disorders. However, that has not kept some 350 companies at 570 locations across the U.S. from marketing costly and unregulated stem-cell therapies directly to patients and their families. After conducting an exhaustive internet search a team of researchers found businesses advertising a vast range of treatments that have not been scientifically proven safe or effective. The products include everything from “face-lifts” to treatment for autism and devastating degenerative diseases like arthritis, Alzheimer's, and multiple sclerosis. California leads the pack with a total of 113 stem-cell dispensing clinics, but in every single state there are stem-cell therapies available that have not been approved or fully vetted by the FDA. It definitely looks as though there is an updated “snake-oil” sales program at work here.

## Earliest Ancestor of Living Things

How and where life arose out of inanimate matter is a mystery that has long consumed evolutionary biologists. Charles Darwin famously speculated that the first living things arose in some “warm little pond.” But a new genetic study suggests life first formed in a less hospitable environment: scalding deep-sea hydrothermal vents – gas-filled plumes created by the interaction of seawater and magma erupting through the ocean floor. Biologists at Heinrich Heine University in Germany arrived at that conclusion after creating a detailed genetic profile of a 4 billion-year-old organism dubbed Luca, an acronym for the Last Universal Common Ancestor. The researchers examined 6.1 million protein-coding genes found in bacteria and archaea – single-celled organisms with no nucleus (Prokaryotes) that eventually gave rise to all plants and animals (eukaryotes), The New York Times reports. After arranging the genes in evolutionary family trees, they found that 355 likely originated from Luca. The genetic reconstruction suggests Luca thrived in an intensely hot setting devoid of oxygen and relied on hydrogen and metals for energy, precisely the condition in deep-sea vents. The research does not confirm that life began in the vents. Some biologists believe the first organisms started out on land, but may have been propelled undersea 4 billion years ago, after a shower of asteroids and comets reshaped the planet. Aw, the mystery continues, but it looks as though scientists are getting closer to the truth.

Jim WB2EDO