



# PCARA Update



Volume 22, Issue 1 Peekskill/Cortlandt Amateur Radio Association Inc. January 2021

## Quite a year

2020 was anticipated to be a year during which we would commemorate and celebrate the 20<sup>th</sup> Anniversary of PCARA. Instead, we were greeted by a pandemic and great uncertainty. We went from regular monthly meetings, to those held over the air, to ones masked and responsibly socially distanced. Our famous PCARA Breakfasts followed a similar trajectory, even holding an on-the-air gathering in December. Field Day and the NY QSO Party were held virtually from member's home stations. We even squeezed in a couple of outdoor PCARA VE Test Sessions which resulted in both newly licensed and upgraded Amateurs. Zoom presentations on "Magic of Amateur Radio" and "Practical Horizontal Wire Antennas" drew dozens of attendees. Nightly Roundtable Nets and the Old Goats Net kept us in contact and up to date on current local events. Through it all, we still managed to make it work, and will continue to do so.



*Socially distanced PCARA meetings took place outdoors at the John C. Hart Library in Shrub Oak.*

Yahoo Groups has ceased operations as of December 15, 2020 and as a result Lou KD2ITZ has been busily transferring PCARA's email list to the new PCARA Google Groups. For full instructions and answers to your FAQs, please check out the Google Groups page on the PCARA website (<http://www.pcara.org/pcaragooglegroupspage.html>). Thanks Lou! [And see page 7 -Ed.]

Moving forward in 2021 we will continue to innovate and adapt. We have made it this far and will keep

in touch on the air, online, and the occasional in-person responsibly socially distanced group — weather permitting. Until we meet again, keep your heads down and stay safe. We're almost through this and we'll get through this together. Excelsior!

- 73 de Greg, KB2CQE

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## Net night

Peekskill/Cortlandt Amateur Radio Association holds a roundtable net on Tuesday evenings at 8:00 p.m. and a directed 'Old Goats' net on Thursday evenings at 8:00 p.m. Both events take place on the 146.67 MHz W2NYW repeater, offset -0.600, PL 156.7 Hz.

Join the roundtable to find out what members have been doing or join the Old Goats with net control Karl N2KZ for news and neighborly information.

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# Adventures in DXing

- N2KZ

## Mysteries of the Oil Drum - Chapter Two

The saga of the mysterious oil drum continues! Let me tell you about all the discoveries and adventures we have had since our last edition. (*PCARA Update* December 2020 – pages 3-6\*). In forty years of writing about radio, I have never received so much interest. People were volunteering to tell me more!

\* *PCARA Update* archive:

<http://nm9j.com/pcara/newslett.htm>

To begin, our first article about the oil drum in the woods attracted a lot of attention. The author I met during my initial inquiries, **Kevin Krajick**, revealed even more details about seismic data station **CRNY** in an article he authored for Columbia University's 'State of the Planet' journal. You can find it at:

<https://blogs.ei.columbia.edu/2020/12/01/the-very-lonely-seismometer/>.



*Mystery drum with antenna discovered by Karl and Sarah in early November.*

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### The Very Lonely Seismometer

December 1, 2020  
By Kevin Krajick

In mid-November 2020, we received an email from one Karl Zuk. It regarded a hike he had just taken at Mountain Lakes Park, a hilly, forested area about 60 miles north of New York City, owned by Westchester County. Zuk had been descending a steep, muddy trail in the dusk of late afternoon when he glimpsed what looked like a TV antenna amid a tangle of bare tree trunks well off the trail.

*Article by Kevin Krajick of Lamont-Doherty Earth Observatory.*

Kevin spoke with several seismologists and scientists at Columbia's Lamont-Doherty Earth Observatory gathering memories, documentation and historical details. The legacy of regional seismic data stations goes back about 50 years. The New York State Seismic Network went online in the 1970s and expanded and improved for decades providing earthquake and seismic shift information. At its peak, about 40 installations were established around our area as far away as Vermont and Maryland.

Hundreds of seismic events were documented by the network providing a new wealth of information for

scientific study. (Later on, the network would be renamed as Lamont-Doherty Cooperative Seismographic Network — LCSN.) The information Kevin gave me produced many essential leads to build the CRNY story further.

Another veteran of Lamont-Doherty, **David Lentricchia**, read Kevin's article and December's *PCARA Update* and contacted me to add even more details about the seismic network begun long ago. David's memories led me to all sorts of new information about the construction and design of this amazing system of data collection.

Listening to all the stories collected by Kevin and David and proceeding with my own research resulted in a new fascinating chapter in this saga. Although **Fred England** served as custodian of the station, Lamont-Doherty's **Doug Johnson** may have been the person who actually installed it back in December 1981. Maybe Fred and Doug worked as a team? We may never know!

A lot was going on inside the oil drum in the woods. CRNY was quite an operation. Its concise and clever self-sufficient design did the job! Early in the planning and design of CRNY, it was obvious that the station could not depend on solar panels for power. Insufficient light peered through the nearby dense trees. Another solution was needed and was found:

Two deep cycle lead-acid rechargeable batteries kept the station going for six months at a time. We now know the last time the bat-



*Two lead-acid batteries inside the drum powered the remote seismometer.*

teries were cycled was on May 19, 2005. Station CRNY probably went mute and left the air at the end of 2005 or early 2006.

In later years, grant funds for the LCSN Network were discontinued and radio frequencies once used for no charge suddenly required unaffordable license fees. Station CRNY was officially decommissioned on September 15, 2011. Someday, it may be re-fitted and revived if it becomes necessary due to active earthquake activity. Until then CRNY's status will remain 'dormant.'

The CRNY data transmitter was actually constructed by legendary amateur radio equipment manufacturer **Clegg** — famous for the ground-breaking 22'er, 66'er and 99'er amateur VHF tube transceivers of long ago. The miniature solid-state Clegg transmitter

modules used at CRNY were originally designed to be inserted into fireman's helmets. Lamont-Doherty repurposed them for seismic data transmission.

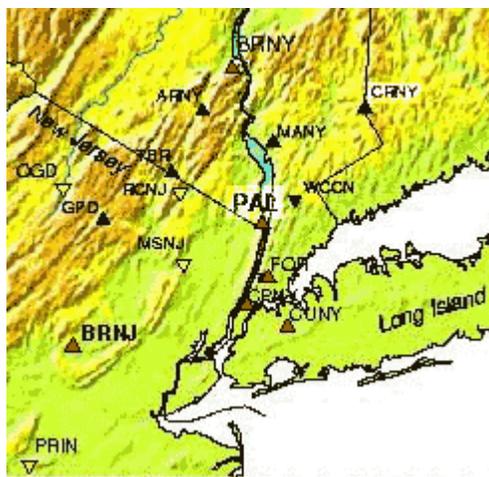


*Clegg Labs 99'er was an early 1960s AM transceiver for the 6 meter band.*

The Clegg module's 320 milliwatt FM signal used at CRNY was fortified by the ten-element Yagi attached to the oil drum to create an effective radiated power of about five watts. The narrow band FM signal used **163.609375 MHz** and broadcast continuously for six months at a time, drawing about 100 milliamps of current. Was the use of Clegg modules a clue? Could Fred England possibly have been a ham?

Lamont-Doherty was well equipped to receive CRNY's data at their Palisades, New York complex. At the highest point of their campus, a tall tower was erected to capture signals from CRNY and other regional seismic stations. Plectron receivers, originally designed to receive fire department alert tones and messages, were found to be just perfect to be adapted to pull in seismic data.

Deep in the woods, station CRNY sits at 961 feet above sea level. The Palisades campus also enjoys high elevation and the tower added additional height to the calculation. David explained that the received 320 milliwatt QRP signal from CRNY could be quite reliable. Tuned cavity filters were used to enhance reception, attenuating unwanted noise. Cross River to Palisades was a straight shot in line-of-sight! This clever and thoughtful system produced a continuous data feed for decades.



*Lamont-Doherty Palisades subnetwork map showing stations CRNY (Cross River, New York) and PAL (Palisades.)*

Also realize that in the year 2021 all of this technology has become obsolete. Seismic data collection, transmission and recovery are now all completed within the digital domain. Miniature analog

FM transmitters have been replaced by wireless Internet connections. As technology improves, change is inevitable. Time marches on!

### In the Drum

The Clegg all-analog narrow-band FM transmitter was not alone inside the CRNY oil drum. Along with the two wet-cell batteries was an amplifier to boost the seismic data signals and a voltage-controlled oscillator that created an analog audio carrier to aid transmitting the seismic data effectively. The transmitter module, the VCO and the seismic signal amplifier were all snuggled in armored safety within a re-purposed ammunition box



sitting above the batteries inside the oil drum. The now-empty third hole at the base of the drum was for feeding in the connection cable between the drum and the seismo-

*Third hole at the base of the drum was for the seismic sensor.*

graph that was mounted on the side of a rock cliff about 50 feet away.



*A team from Lamont-Doherty Earth Observatory plants a temporary seismic monitor in a farm field after a series of mysterious earthquakes near Albany, N.Y. in 2009-2010. [Pic credit: Kevin Krajick/Earth Institute]*

Setting-up and testing the station was an interesting exercise! A Bird wattmeter was used to see if adequate transmitter power was being emitted and to insure a good match with the Yagi antenna. Using the Bird meter, the Yagi's gamma match could be adjusted to minimize reflected power. The Yagi antenna produced nearly 12 dB of gain!

When you were satisfied with the quality of the basic transmission, you could use a scanner tuned to 163.60 MHz to actually hear the broadcast. The tone from the VCO would be obvious. If someone jumped up and down near the seismograph, you could hear the signal vary on the scanner. If the signal wobbled you knew the system worked!

Can you imagine the station was on the air continuously for six months at a time running on the two wet cell batteries? The very efficient all solid-state design really made CRNY possible.



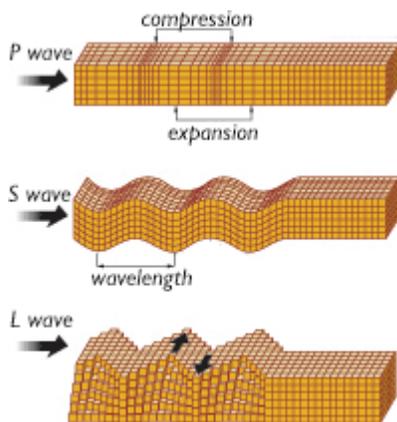
Side view of drum and antenna.

Another find was a detailed description of a typical seismic station (very similar to those used at CRNY,) complete with technical details and pictures, discovered by Malcolm, NM9J. This 1977 document “The Centipede Seismic Recording System” released by The United States Department of the Interior Geological Survey is an authoritative resource forever capturing the designs and practices of this moment in time. If you wish to see and understand the system, this document will fulfill your every wish! The Centipede System is representative of the same design vintage as the CRNY installation. Take a look at:

<https://pubs.usgs.gov/of/1977/0315/report.pdf>. (PDF file).

### Go the Distance

David also told me all about how seismologists can pinpoint the epicenter of events. The techniques used reminded me of an amateur radio fox-hunt! When an event happens, there is an initial impulse called an immediate pressure wave or P-wave followed by a slower secondary S-wave. The end of an event is called a L-wave.



Seismic wave types include P-wave (primary, compression), S-wave (secondary, shear) and sideways surface waves like the Love wave.

Each type of wave creates its own signature when

recorded on a seismograph. Comparing the velocity seen of each type of wave from each station, you can calculate how far away it was by creating circles of distance relating to the closest station. The circle size would be determined by the relative strength received at each station in the network. Combine the data of all the neighboring stations and the epicenter becomes obvious. It’s all triangulation!

The more stations you have — the more accurate your comprehension of events becomes. More detailed data leads to more accurate predictions of future events — essential to public safety and solid scientific research. Here’s a useful and concise description of these techniques: [https://www.usgs.gov/natural-hazards/earthquake-hazards/science/seismographs-keeping-track-earthquakes?qt-science\\_center\\_objects=0#qt-science\\_center\\_objects](https://www.usgs.gov/natural-hazards/earthquake-hazards/science/seismographs-keeping-track-earthquakes?qt-science_center_objects=0#qt-science_center_objects).

Want to see what a live seismogram looks like? Hop to: <https://www.ldeo.columbia.edu/LCSN/> and go to ‘View Current Seismograms.’ There you will find up-to-date readings from all of the currently existing seismic stations along with some historical readings of past remarkable events for your comparison.

David warned that day-to-day you will often see ‘cultural noise’ such as the passing of large trucks and building construction appear in the charts. Major events produce traces that are quite obvious.



Historical seismogram from station ACCN, Glen Falls NY, April 20 2002.



Won-Young Kim, chief of Lamont’s seismic network for many years, inspects the original seismograms showing the Sept. 11, 2001, jet impacts and subsequent collapses of the World Trade Center towers. “A very painful day,” he said. [Pic credit: Kevin Krajick/Earth Institute].

## Fred England's Legacy

Working from David Lentricia's recollections and my continuing research, we compiled a fine biography of Fred England's life. I suspected that Fred's artful design and construction of **CRNY** may have been derived from amateur radio experience. It took some digging but my hunch was correct. The revelation did not come easy!

Early on, I searched QRZ.com, old logbook postings and other Internet sources for information on Fred. I found no sign of an amateur radio connection. One site suggested he may have lived in Nanuet, New York but was incorrect. David opened doors by remembering that Fred lived in Upper Saddle River, New Jersey and that he moved to North Carolina somewhere to retire. This was a breakthrough.

With this additional clue, I again searched his name, this time together with 'Upper Saddle River,' and came up with a hit that mentioned a **Frederick England**. I returned to QRZ.com and — sure enough — here was a listing for *Frederick England in New Bern, North Carolina*. Fred was indeed a General class ham and held a strong old-time legacy call sign: **W2SVS** — and — he was born in 1926. I also found out that David was a fan of fellow ham and radio and television personality, **Jean Shepherd K2ORS**. I noted that Fred's amateur radio license had expired, without renewal, in September 2018.

As I continued my research, sad news followed. Fred passed away on July 4, 2019 at 92 years old. Fred's wife Dorothy passed only a few months later on October 26, 2019 at 89 years old. My sincere condolences to the England family. My daughter Sarah and I would not first encounter Station **CRNY** until more than a year later on November 7, 2020. I will never meet Fred and Dorothy but I am honored to appreciate and share his fine work — and — help his legacy live on. Is this the end of the story? Time will tell!

I want to thank Lamont-Doherty's Kevin Krajick and David Lentricia for their generous offer of time, research and fascinating detailed explanations and memories about this treasure in the woods. I received a rich and inspirational introduction into the world of earth science. Thank you! Happy Holidays and Happy New Year!

73 and dit dit - N2KZ 'The Old Goat.'



"ASK FOR FRED" message stenciled onto CRNY drum refers to Lamont-Doherty's Fred England.



## Catching Up - N2KZ

Happy New Year. Welcome to the third decade of the 21st Century!

### Straight Key Night

Start the New Year right by getting on the air! If you ever wanted to try CW, January 1<sup>st</sup> is your big chance. The ARRL presents **Straight Key Night** from 7:00 p.m. Thursday night, December 31 until 7:00 p.m. Friday night January 1. (0000 to 2359 UTC January 1.)

During this celebration, CW operators use only



Bring out your straight keys for celebrations taking place on New Year's Eve and New Year's Day.

straight keys sending code in slower than normal speeds. Many operators enjoy using vintage gear, especially tube gear that glows gently in the dark.

The result is a tribute to the way operating used to sound long, long ago. It is not a contest for fast contacts. Rag chewing is highly encouraged. It is all for fun!

Even if you do not know code or are shy to try, you can certainly listen in. Spin your dials on 80 meters (3525 to 3600 kHz) and 40 meters at 7025 to 7065 kHz — and 7100 to 7125 kHz. Remember: Technician licensees can operate on these bands in CW with up to 200 watts. No license upgrades are required! Why don't you try it and join in? Lots of us want to welcome you and say Happy New Year.

### Simplex Activity Nights

To encourage operating on 2 meter FM, I would like to start weekly 2 meter FM simplex activity nights on Mondays at 8:00 p.m. starting Monday, January 4, 2021. The calling frequency is 146.520 MHz. There is no need for a transmit offset or a PL tone — because no repeaters are in use. This is point-to-point DXing at its finest. You transmit and receive on the same frequency. Just press your PTT button and give it a try. See who you can reach!



Try 2 meter simplex on Monday Jan 4.

## DMR Results

You might recall that we featured the world of digital DMR radio in the November 2020 edition of *PCARA Update*. After a couple of months using a very simple business band DMR repeater at my place of work, I can give you a long term review.

DMR offers a long reach with little power. The coverage is very good. More than anything, it is LOUD. This digital system processes your voice and presents a very compressed and digitally processed audio that may present as being hard on the ears.

DMR is designed to host at least two full two-way transmissions simultaneously. To allow this spectrum efficiency, the transmission switches back and forth between conversations every 30 milliseconds. I found that this technology sometimes creates less than crisp received audio. Voices can sound blurry and indistinct. No doubt, you will enjoy perfectly received *signals* using DMR. The audio may remind you of Darth Vader!

Maybe the hardest thing to get used to is the inherent delay of the DMR system. It takes time to complete all the digital processing necessary. This is all well and fine if you wait a second to talk after you press your PTT button — and — you are not within earshot of another HT using your system.

I found that civilian users start talking sometimes even before they press to transmit — often creating upcut messages. If another HT is also listening to the repeater near you, you will hear your voice painfully echo back to you as if you were announcing at Yankee Stadium. It is very distracting and makes concentrating on what you have to say difficult or impossible. I am very tempted to revert back to a traditional analog repeater setting to improve user satisfaction throughout my building. No echoes and more distinct audio may result. I will experiment soon!

Amateur radio DMR and other similar digital systems are even more complex than a simplistic business one frequency — one conversation system. Determined digital hams need to be able to jump from one digital system to another because our standard is **no standard!** With several incompatible digital systems in use, it is hard to keep up with everyone, especially in local areas where you are not familiar with what is being used — or — you are not a member of the local club to know the configuration parameters necessary to



*Connect Systems' CS580 is an entry-level UHF DMR/FM HT suitable for amateur radio. This model is also available from KB Cubed in NJ.*

join in. It can be really frustrating.

No doubt some amateurs simply love digital. Some people like olives or big cigars! It is all personal taste. My conclusion is simple: Digital modes can be amazing but make sure you try them out before you invest heavily. Try it. You might really like it! (or maybe you won't?) but it is worth a shot!

## CMK Today

For those of you who enjoy all things RF, you might enjoy a newfound picture that recently circulated of the nearby FAA VOR/DME aviation waystation CMK (Carmel) located in Waccabuc in eastern northern Westchester — not far from South Salem and Ridgefield. By careful design, the FAA chose sites for these stations that are isolated and quite private in nature. Detailed current pictures are rare. This one is exceptionally crisp and fun to see.



*Site of aeronautical radio beacon CMK, Carmel. This is a VOR/DME station, meaning VHF Omnidirectional Range with Distance Measuring Equipment.*

Look for the over-the-air signal of CMK on 116.6 MHz AM within the primary aviation band of 108-137 MHz. You'll hear a repeating automated voice giving aviation weather conditions for Westchester County Airport (KHPN) combined with a very slow Morse ID sending C - M - K. Dah dit dah dit – Dah dah – Dah dit dah. DXer beware: The CMK signal is designed to project upward towards the sky. The station may be somewhat difficult to hear on the ground with a handheld scanner or obstructions.

- Karl N2KZ

# PCARA Google Group

As a result of Yahoo Groups ceasing operation on December 15, 2020 Lou KD2ITZ has transferred PCARA's email address list to the new **PCARA Google Group**. Existing users should have received a Group e-mail on December 12 with details. Here are Lou's instructions as published in the December newsletter and in the welcome e-mail.



## How can I join?

New subscribers are welcome to join by sending an email to:

w2nyw+managers 'at' googlegroups.com

## What is the purpose of the PCARA Google Group?

The PCARA Google Group allows subscribers to send email messages to other subscribers. This is also known as an email reflector or email list.

## Do I need a Google account to participate?

No, subscribers can use any preferred email account to participate.

## How do I send an email to all the subscribers?

Once you have subscribed, send an email to the following address:

w2nyw@googlegroups.com

## What sort of messages should be directed toward the Google Group?

Messages should only pertain to topics surrounding the radio hobby. Examples include radio operating events, technical questions, equipment sales, and club logistics.

## How is my privacy protected?

Messages can only be sent by subscribers to subscribers. Subscribers have been approved by the moderators to prevent access by those who are seeking to send spam messages. The additional information and message archive on the Google Groups website can only be accessed by subscribers.

## Whom do I contact for technical assistance?

Please email:

w2nyw+managers 'at' googlegroups.com

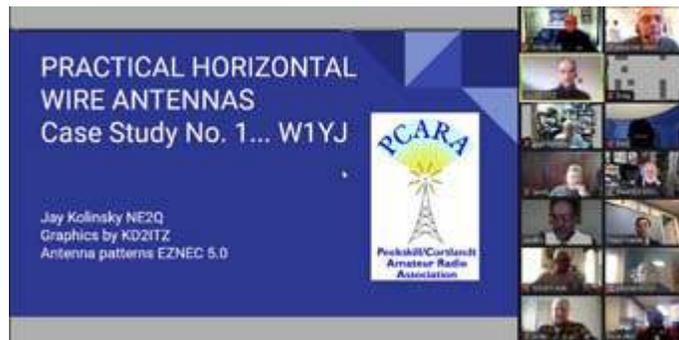
## How do I unsubscribe?

Simply send an email to the following address:

w2nyw+unsubscribe@googlegroups.com

# Wire Antennas presentation

In place of PCARA's monthly meeting on December 6, Lou KD2ITZ had arranged a Zoom presentation by Jay NE2Q entitled "Practical Horizontal Wire Antennas". Some 35 members and friends logged in to the Zoom presentation.



Around 35 people watched Jay's Zoom presentation.

Jay had been asked by Ken W1YJ for a recommendation for a multiband wire antenna that would fit into Ken's location at Croton-on-Hudson, sized 90 feet by 70 feet with 30 foot trees available for supports. The presentation featured antenna patterns calculated by Jay using EZNEC 5.0 and graphics by Lou. Antennas considered included loops, fan dipoles, OCF and G5RV-types.

Jay suggested a G5RV-type antenna for Ken which is typically 102 feet long. In order to fit Ken's 90 foot north-south dimension, it would be necessary to droop the ends of the wire dipole down.

The G5RV antenna was designed in 1946 by Louis Varney, G5RV and subsequently modified by ZS6BKW. It normally uses a 102 foot dipole, center fed with around 33 feet of open wire line. Coaxial cable is attached to the end of the open wire feeder, where Jay recommended slipping ferrite beads over the coaxial cable to act as a balun. The antenna will only work on one or two bands with the internal tuner of a modern transceiver — as SWR needs to be less than 3:1. Other bands will need an external tuner. Jay modeled a modified G5RV in EZNEC that would fit into the W1YJ yard with 90 feet flat top and 6 feet bent down at each end.

Jay's full presentation is available on YouTube courtesy of Lou KD2ITZ using the following link:  
<https://youtu.be/K8Y5JreiDk>

Computer analysis of G5RV and ZS6BKW antennas was described in *PCARA Update* for September 2020 in the article: "ZS6BKW revisited: A computer-optimized G5RV & Junior version".

- NM9J

# Making contact

In the last few weeks I have been chasing problems caused by oxidation and corrosion. Battery contacts exposed to leaking electrolyte can corrode to the point where equipment stops working. Coaxial cables terminated with connectors that are subject to moisture can also corrode. Printed circuit boards equipped with edge connectors are another area of concern.



*Corroded battery contact as a result of electrolyte leaking from an AA-size cell.*

## Noble and base metals

The materials used for contacts play a large part in their subsequent reliability. The **galvanic series** below lists the main metals used for electrical contacts — in order of their standard electrode potentials. When two dissimilar metals are dipped into a conducting solution (electrolyte) and externally connected, there will be a resulting cell voltage. Metals highest in the galvanic series are “anodic”, least noble and most likely to corrode. Metals at the bottom of the list are more noble, cathodic and less likely to corrode. The further apart two metals are on this list, the higher the cell voltage. Rate of corrosion depends on this voltage difference, and on other factors such as formation of a protective film.

**Aluminum** – used in lightweight cables, some coaxial cables and tubular antenna elements.

**Zinc** – used in alloys and in galvanized steel.

**Chromium** – used to plate steel

**Iron** – used in alloys (steel) and for magnetic cores

**Cadmium** – used to plate steel

**Nickel** – used to plate copper before applying gold plating

**Tin** – used for tin plating of steel, tinned copper wire, tinned connectors and in solder

**Lead** – used in traditional solder

**Copper** – used for copper wire, coaxial cable, circuit board traces, copper plating over steel.

**Silver** – used to plate brass and copper contacts, lowering contact resistance, and in lead-free solder

**Platinum** – Used in alloys for relay contacts

**Gold** – used to plate copper and silver for even lower contact resistance.

Some of these metals are blended into **alloys**, also used in electrical equipment:

**Brass** – alloy of copper and zinc

**Bronze** – alloy of copper and tin

**Phosphor bronze** – alloy of copper, tin and phosphorus

**Die cast parts** – usually an alloy of zinc and aluminum

**Solder** (traditional) – alloy of tin and lead

**Solder** (lead-free) – alloy of tin, silver and copper

**Steel** – alloy of iron and carbon, with other elements frequently added.

## Coaxial connectors

The “UHF series” of plugs and sockets manufactured by Amphenol® RF of Danbury CT provides an example of the wide variety of materials used in good quality connectors for amateur radio. See:

<https://www.amphenolrf.com/connectors/uhf-connectors.html> .

There are two choices of body material for fittings like the PL-259

and SO-239 — brass or diecast zinc. In

addition, there are three

choices of body finish —

nickel, silver or gold. The

coupling ring might have a

different finish

from the body. There are three choices of center

contact material – brass, phosphor bronze or beryllium-copper — and three choices of contact finish — silver,

gold or nickel. There are also six choices of insulator with PTFE, phenolic and Delrin® (acetal) most popular. Delrin could melt when the center pin is soldered.



*Amphenol part number 83-1SP (PL-259) has a silver-plated brass body, nickel-plated brass coupling nut and a center contact pin made of silver-plated brass. The insulator is PTFE or LCP.*

## UHF hints

UHF series connectors are *not* waterproof. Connectors installed outdoors should be protected as follows.

1. When soldering the braid and center conductor, keep solder and flux off the contact surfaces. Make sure the male center pin is a tight fit into the fingers of the matching female socket.
2. Protect all electrical contact surfaces on both connectors using one of the products below. Include the outer prongs and indentations on connector bodies.
3. Tighten the knurled coupling nut by hand, then use pliers to ensure a firm connection.
4. For waterproofing, use a pre-installed rubber boot or wrap the entire plug, socket and cable with self-amalgamating tape such as Scotch™ 2228.

**Dissimilar metals**

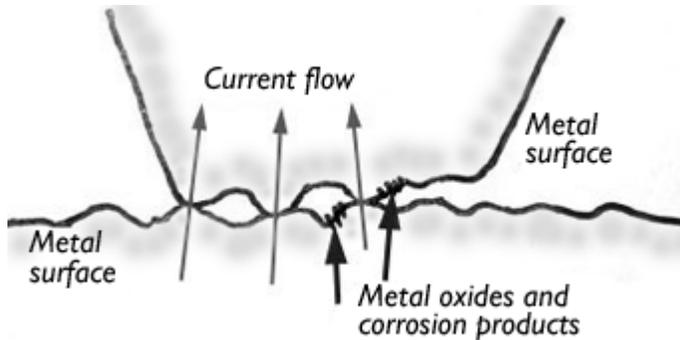
In any connector system, if the contact surfaces are all made of the same material, there is less likelihood of electrolytic corrosion. Gold or silver plated connectors are recommended for a long life. Unfortunately, you have less control over the connectors mounted as part of an antenna, on a balun, transceiver, SWR meter, ATU etc. If the contact surfaces are made from **dissimilar metals**, widely separated in the galvanic series, corrosion is likely, especially in damp conditions, where temperature cycling can expand joints and allow condensation to settle between metal surfaces.



*You have little control over the materials in a commercial antenna, including the coaxial connector.*

**Surface effects**

Even when electrolytes from a leaky battery are *not* present, chemical reaction can still affect performance of a metal-to-metal contact. Some metals are oxidized by oxygen in the air, forming a non-conductive film of metal oxide on the metal surface.



*When metal surfaces touch, current flow can only occur at the points of actual metal-to-metal contact. If the surface is oxidized or corroded, contact resistance rises. As the surfaces move past each other, resistance can vary greatly.*

This type of surface oxidation occurs *rapidly* with freshly exposed aluminum — protecting the underlying metal from further attack. The high-resistance oxide film requires special precautions whenever there are electrical contacts involving the metal. Conductive greases such as Burndy® Penetrox™ and Ideal NOALOX® can be used to prevent corrosion of aluminum cables and connectors. **Penetrox™ A** greases are compounds of a natural oil base with suspended zinc particles, to ensure good conductivity on aluminum-to-copper and aluminum-to-aluminum contacts.

A similar reaction occurs with freshly exposed

copper metal, which is attacked by oxygen, moisture and carbon dioxide. If you watch a new copper roof, copper roof flashing or a copper statue, the metal will slowly change color from shiny red to light green. The green color is a coating of **verdigris** or basic copper carbonate which protects the metal underneath.

Another form of corrosion takes place when the air contains sulfur compounds, resulting from industrial pollution and combustion of fossil fuels. The shiny surface of silver metal can become contaminated with silver sulfate and black silver sulfide. Copper is also affected by hydrogen sulfide.

Any contamination of a metal surface affects the electrical conductivity as well as the appearance. Metal oxides are poor conductors, while sulfides can act as semiconductors, rectifying RF energy and possibly causing intermodulation. The contaminants need to be removed from the metal surface to restore original performance, followed by protection of the exposed metal from further atmospheric attack.

**Best solution**

Over the years, I have tried several products for cleaning and protecting electrical contacts. The best I have found are from the DeoxIT® range by Caig Laboratories Inc. of Poway, California, near San Diego. Their products are not cheap and should be used sparingly — but they certainly work.

If you visit the Caig Laboratories web site, <https://caig.com/> you will find a wide choice of cleaners, lubricants and accessories for electronic and electrical applications. I am going to recommend just three products that should be in every amateur’s toolkit.

**DeoxIT® D-Series**

DeoxIT D-Series products are general purpose cleaners for any metal surface suffering from oxidation or corrosion. Caig Laboratories’ own recommendation is: “Use DeoxIT® D-Series to dissolve contamination, improve the connection as well as lubricate and protect the surface.” They distinguish DeoxIT from simple cleaners, saying: “The only true method of eliminating oxidation and surface sulfides is by chemical action and reaction.”

How is this accomplished? Caig Laboratories state on their Material Safety Data Sheets that the composition of the liquid component D100L is “PROPRIETARY – TRADE SECRET”. There has been speculation about

3. COMPOSITION & INGREDIENT INFORMATION				
CHEMICAL NAME(S)	CAS No.	RTECS No.	EINECS No.	%
DeoxIT® D-Series D100L	NA	NA	NA	100
REACH Reg. No. Non-Hazardous/Proprietary				

*Part of the Material Safety Data Sheet for D100L products.*

the active ingredient in D100L. Dissolution of metal oxides, sulfates and carbonates *might* be carried out by a mild acid such as liquid oleic acid — but this ingredient has been dismissed as unsuitable on Caig Laboratories' own web site. Once the metal surface has been cleaned, it needs to be protected from further corrosion and this is accomplished with a thin layer of lubricant — yet again unspecified. DeoxIT literature criticizes competing products that use greases, silicones, polymers and polyphenylene ether (PPE) as they cannot reseal an exposed surface like Caig's own products can.

Caig Laboratories provides a variety of applicators for their products — for example sprays, wipes, oilers, brush. My favorite is the **felt-tip pen** which allows precise application of liquid D100L to metal contact surfaces. The acrylic felt tip has a mild abrasive action, allowing contaminants to be gently rubbed away. Additional liquid is fed to the felt tip by pressing down on the barrel.

The pen applicator is occasionally unsuitable, for example when contact surfaces are hidden away inside a socket, switch or other inaccessible area. An **aerosol spray** can then be more helpful, though Caig Laboratories suggests being sparing with their aerosol products. Sprays are supplied with a plastic extension tube to reach difficult spots. Caution is needed around some plastic insulators which might be affected by the formulation and electrical circuits should be de-energized until any flammable carrier has evaporated.



Aerosol spray.



DeoxIT® D-Series felt tip pen has '100% solution' of D100L.

### DeoxIT® Gold G-series

You may want to protect a brand new contact surface that does not have any surface corrosion yet... or you may be dealing with a gold-plated surface which is highly resistant to oxidation or reaction with sulfur compounds. In that case, you may not need the full cleaning action of DeoxIT D-Series products and can instead choose an applicator from the DeoxIT Gold



DeoxIT® Gold pen contains '100% solution' of G100L.

G-Series, containing G100L. (These products were previously known as ProGold.) According to Caig, the formulations can remove minor amounts of oxidation, but also penetrate flaws in the plated surface and bond to the base metal underneath. The formula is said to include conditioners, deoxidizers, preservatives, conductivity enhancers and anti-tarnish compounds.

### Refurbishing pens

One problem I have run into with DeoxIT contact cleaner pens is when the felt tip becomes grimy with use and wears down until it no longer protrudes. This



A well-used DeoxIT pen with a grimy, worn-down felt tip.

makes the expensive pen almost useless, even though there is still plenty of liquid left in the barrel. Caig Laboratories has **replacement felt tips** available on their web site. An alternative is to purchase a set of inexpensive paint markers of the same size and extract the felt tips for use in a DeoxIT pen. These alternative felt tips are usually shipped dry and uncontaminated until the first press down on the paint pen's barrel.



A set of inexpensive paint markers by Kassa.

### Wide application

The three DeoxIT products described here can be used on a variety of electrical connectors inside and outside the shack. In addition to battery holders and PL-259s, don't forget **F-connectors** used for 75Ω TV and FM cable, **RCA phono** plugs for audio and video, the edge connectors on a circuit board and **jack plugs** and sockets used for audio inputs and outputs.

### OEM endorsements

Caig products are used by original equipment manufacturers to prevent problems while their equipment is in use. For example Hewlett Packard Enterprise reports that DeoxIT® D-Series products dramatically improved the performance and reliability of interconnects on their servers, including assemblies, memory DIMMs, and memory connectors. Bose reported they have been using Caig products for over forty years. Tektronix uses DeoxIT Gold Wipes to protect edge connectors and D-Series contact cleaner to eliminate intermittent problems on tin-to-tin connectors.

So — don't be vague... ask for Caig. You will be in good company.

- NM9J

# Better batteries?

Batteries are wonderful things — they keep computers running when the power goes out, they allow handi-talkies and phones that are light in weight and long in endurance — and they are incorporated into vehicles to start the engine or provide traction without fossil fuels. But there are still problems, including limited lifetimes, expensive raw materials and safety concerns for lithium-ion batteries, plus weight and toxic ingredients for lead-acid batteries. Fortunately, some interesting developments are on the horizon.

## Sodium spin-off

In Santa Clara, California a spin-off from Stanford University is developing improved batteries for uninterruptible power supplies (UPS), electric forklift trucks, smart grids and renewable energy sources. **Natron Energy** has developed an alternative to lithium-ion technology based on **Prussian Blue analogue** electrodes and a **sodium-ion** electrolyte.



Prussian blue is Iron<sup>III</sup> ferrocyanide, a dark blue pigment produced by oxidation of ferrous ferrocyanide.



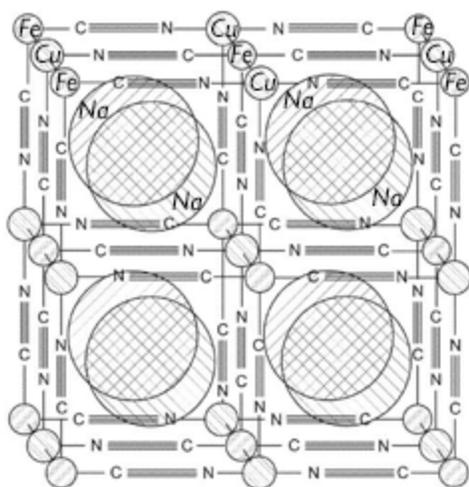
Prussian blue.

It has been used in oil paints since the 18<sup>th</sup> century. In this century, Prussian blue is used in inks, for blueprints and as an antidote for toxic heavy metals. Prussian blue can incorporate

variable amounts of water and alkali metal cations (K<sup>+</sup>, Na<sup>+</sup>) into its crystal structure.

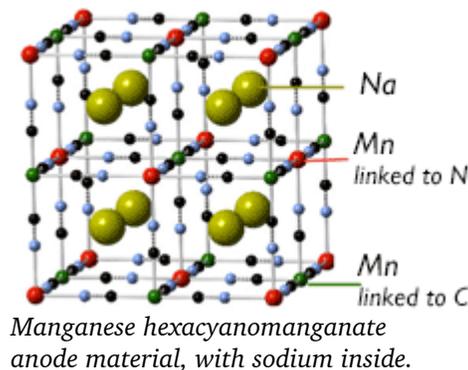
The novel cells from Natron Energy employ anodes and cathodes made of **Prussian Blue analogs** containing, for example, nanoparticles of copper hexacyanoferrate (CuHCF) at the cathode and manganese hexacyanomanganate (MnHCMn) at the anode. Like Prussian Blue, the open cubic framework of these materials, featuring iron and transition metal

atoms linked by cyanide (-C≡N-), allows



Copper hexacyanoferrate structure with sodium atoms in the lattice. (Adapted from US Patent Application US 2019 / 0109347.)

sodium ions (Na<sup>+</sup>) to move in and out of the crystal structure with little resistance. The liquid electrolyte that transports sodium ions between the electrodes could be (for example) a solution of sodium perchlorate in acrylonitrile/water cosolvent.



Manganese hexacyanomanganate anode material, with sodium inside.

Natron Energy claims its batteries can discharge and charge rapidly — in minutes rather than hours — while using inexpensive raw materials. Lithium-ion batteries incorporate expensive rare earths while the raw materials for a sodium-ion battery are mainly salt, iron and manganese. These components are also far less toxic than those of lead-acid batteries. Natron's products are not so energy dense as lithium-ion cells, so they are more suited to *static* applications such as smoothing out the irregular energy supply from renewable sources like wind and solar farms, or providing backup power at data centers. Natron's batteries have long lifetimes, achieved by eliminating the conversion reactions and electrolyte decomposition that limit the life of lead-acid and lithium-ion cells.

Another application for Natron products could be for stationary energy storage at rapid charging stations for electric vehicles. High delivery costs are associated with the peak electricity supply needed at these installations. Use of Natron stationary batteries could smooth out the intermittent high demand for grid power. This application is being co-developed with Chevron Technology Ventures and the California Energy Commission.

Natron recently began shipping its BlueTray™ Sodium-Ion 4000 battery. This is a UL-certified, self-contained rack-mounted unit without the fire, toxic gas or thermal runaway risks associated with lithium or lead batteries. Natron states that its batteries can be built using commodity materials on existing lithium-ion cell manufacturing lines.



Natron BlueTray Sodium-Ion 4000 battery.

Perhaps we can look forward to sodium-ion batteries taking the place of those expensive 12 volt LiFePO<sub>4</sub> batteries for portable use from Bioenno Power and others.



- NM9J

[Story credit: C&E News 11/16/20]

# Peekskill / Cortlandt Amateur Radio Association

**Mail:** PCARA, PO Box 146, Crompond, NY 10517

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*Newsletter contributions are always very welcome!*

Archive: <http://nm9j.com/pcara/newslett.htm>

## PCARA Information

PCARA is a **Non-Profit Community Service**

**Organization.** PCARA meetings take place the first Sunday of each month (apart from holidays, July/August break and pandemics). Talk-in is available on the 146.67 repeater.

## PCARA Repeaters

**W2NYW:** 146.67 MHz -0.6, PL 156.7Hz

**KB2CQE:** 449.925MHz -5.0, PL 179.9Hz

**N2CBH:** 448.725MHz -5.0, PL 107.2Hz

## PCARA Calendar

Please monitor PCARA's Google Group and websites for news of activities in January.

## Hamfests

**Most Hamfests scheduled for Winter 2020 have been canceled. Check with organizers before leaving.**

**Sat Jan 9, 2021:** Ham Radio University – now a Virtual Event. 8:00 a.m. - 4:00 p.m. Registration for individual forums is available at the HRU website. See: <http://hamradiouniversity.org/> .

## VE Test Sessions

**Many winter VE Test Sessions have been canceled. Check with the contact before leaving.**

**Jan 9, 16, 23, 30:** Westchester ARC, 19 Hunts Bridge Rd, Yonkers NY. 12:00 noon. Must contact VE, (914) 237-5589.

**Jan 2, 9, 16, 23, 30:** NYC-Westchester ARC, 43 Hart Ave, Yonkers NY. 12:00 noon. Must contact VE (646) 225-8600.

**Jan 10:** Yonkers ARC, Yonkers OEM, 789 Saw Mill River Rd, Yonkers NY. 11:30 a.m. Pre-reg. Walt, kd2d'at'arrl.net.

**Jan 2021:** Columbia Univ ARC. In-person VE exams are suspended. A limited number of remote video-supervised exams are available, see:

<https://www.w2aee.columbia.edu/content/remote-license-exams>



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