NVARC
Nashoba Valley Amateur Radio Club

SIGNAL

A club since 1992
Since 1993
Since 1996

de N1NC December 2019 Volume 28 Number 12

In this Issue

This Month’s Meeting

Monthly meetings are on the third Thursday of the month, at 7:30pm in the Pepperell Community Center. This month, that’s December 19th.

The December meeting presentation will be on the New England Forrest Rally by Paul Topolski, W1SEX.

Paul writes: “Ham radio on steroids! The New England Forest Rally held each July is the premier pro-am race in the northeast.

Race teams from across the nation gather to compete at speeds up to 100 miles per hour on dirt and gravel logging roads through the mountains of Maine and New Hampshire.

With NO cell service, no ham repeaters, and unreliable public safety radio communications, ham radio is the only viable communications system providing safe race operations. The racecourses are up to 12 miles long and VHF/UHF simplex radios have trouble covering the entire course. For the first time HF, 75 meter NVIS communications will be the primary communications mode.”

The Forrest Rally webpage is:
http://www.newenglandforestrally.com/.

Next Month’s Meeting

The January meeting will feature our annual “Homebrew” night. Bring a short show-and-tell on whatcha been upto this past year!

From the President
***de* Stan, KD1LE**

I recently became aware of the Boston Marathon ‘VOL OF FAME’ a play on Wall of Fame. It lists people who have volunteered at the Marathon fifteen years or more. It includes all volunteers, not just amateur radio operators, so it is quite long. I found the following NVARC members listed there:

Ralph Swick, Jeanine Swick, Stan Pozerski

Kudos to them for their public service.

Last month we had another successful QSL Card Sort. Eric, KV1J, brought four boxes of QSL cards which is one box shy of the five we often sort. With a good turnout we staged the sorting boxes outside the front door and as soon as the group before us left the building, we brought the boxes in. We got started in earnest about seven-thirty.

With enough people to staff each box on both sides sorting got underway in earnest.

By eight-fifteen the ten or twelve thousand cards were sorted and then we started consolidating on the center tables for final assembly for the letter sorters.

By then Jim AB1WQ had arrived with the pizza and drinks and we finished up the packing and shifted to pizza and chat.

After pizza and drinks, we packed everything up, loaded the sorting boxes in the trailer and the lights were out around nine PM.

A quick look through the past Signals shows we have been doing the QSL sorts since 1996, though might have been a year missed here or there due to scheduling. In one of our 'years' we did two sorts.

I want to thank everyone for helping to set up at the Community Center which was completed quickly and especially Leo K1LK who helped me load and unload the boxes at my house before and after the sort.

Not directly related to the sort, you might notice in the pictures the much brighter lighting. A few weeks ago, all the ceiling fixtures at the Community Center were replaced with LED lighting. This does make it much easier to read things like cards.

MARS Exercise

The beginning of November was a nationwide exercise of the Military Auxiliary Radio System (MARS). I will mention here that a few years ago MARS was raised from an 'Affiliated' service to an 'Auxiliary' service bringing it up to the level of the Coast Guard Auxiliary. MARS consists of two branches, Army and Air Force. In "normal" times they operate separately having their own frequencies and nets, but in exercises and disaster type events they operate as a single entity. Current exercises are fairly complex and last two to four weeks with requests for various types of information that might be needed for a Federal response to a major disaster. They are sometimes scheduled to interact with state-wide exercises and military units. The information collected may go to a number of different government agencies such as NORTHCOM (Army), Civil Air Patrol, (CAP), SHARES (SHARES is the Shared HF Resources group and is an agency built around any of the government entities that have HF communications capability). The Recent emphasis has been to develop more connections to the Amateur Radio community. That is to increase the collection of 'ground truth' much like SKYWARN does for the National Weather Service.

One unique aspect is the sixty-meter connection. Sixty meters is allocated to the military. As Amateurs we get to share that spectrum as secondary users. It is the only place that military units and MARS stations can 'talk' directly to Amateurs using their own call signs.

That option isn't always in play, but during the recent exercise a period was set aside for this to happen on a specified channel. Several high-power MARS stations did broadcasts to the Amateur community requesting a particular action to be taken.

Another aspect of sixty meters is the symbol rate limitation in force on the amateur bands is not in effect here. Digital sound card type communications using software available on the www.usarmymars.org website allow higher symbol rates. Because it is based on a mil standard protocol that is built into military radios it would allow digital communications between Amateurs and military or MARS stations. All of this is to develop paths to disseminate or seek information in a widespread communications breakdown. Another path that is being used is broadcasts on WWV and WWVH at ten minutes past the hour and ten of the hour respectively.

Public Service Opportunities in 2020

Looking ahead to the snow, argh, being gone the following public service opportunities may be of interest in 2020. Some of the dates are tentative at this point.

- Boston Marathon: Monday, April 20
- Groton Road Race: Sunday, April 26
- Mass State Triathlon: Sunday, July 12
- New England Forest Rally, July 31-Aug 1
- Groton Town Forest Race, Sunday Oct 25.
  We supported the Groton Town Forest Race in the distant past. If someone knows of a contact there maybe we can do it again.

Electric Car Longevity

While the modern versions of electric vehicles have a relatively short history, what history we do have has shown remarkable longevity. The low cost of operation when comparing fuels is one saving. Cost of regular maintenance is a second saving. Based on the records of a shuttle service company, Tesloop, cost of maintenance is two to four times higher for their gas vehicles than for their fleet of Teslas. That is only part of the story that might have regular automakers worried. Some of their Tesla's have over 300,000 miles over five years and none have yet been retired for age or wear out.

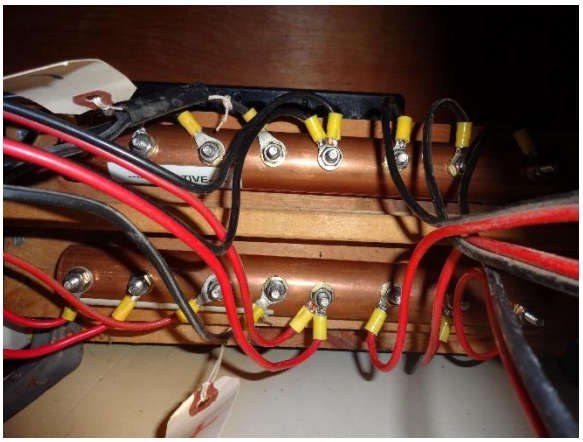
Solar Energy at Home and Elsewhere

As part of moving my radio equipment off the grid I have upgraded my battery storage from 200 Ah to 330 Ah with a goal of five days of intermittent use for emergencies and MARS operation. This is in advance of moving away from charging my batteries from the grid with a conventional charger to solar panels and a solar powered charge controller. This was completed just after the November meeting.

Some cities are moving to solar power in a much larger way. Los Angeles has finalized approval of the largest solar and battery energy storage system in the United States. It will provide power for nearly one million residents. This will help LA reach its goal of 55% renewable energy by 2025 and 80% by 2036.

Emergency Station Power

Ever since I was licensed, I have been interested in emergency service. An important aspect of this is being able to operate when the lights go out. Instead of all of the things I could do to get back on the air after a power outage, I have always run on "emergency power". The ongoing project to convert to solar for station power caused me to make some improvements to the current twelve-volt system I have run on for probably twenty years. First, I upgraded the battery bank from 200 Ah to 330 Ah. This should give me four to five days of normal operation. A central part of the power system is the buss that ties everything together. It was constructed to make it simple to remove a single device and to have a minimum voltage loss and is pictured below.



It is built out of 1-1/4 copper pipe with a 1-inch copper pipe inside to stiffen it. The ¼-20 stainless bolts secure the buss bars to the wood panel and are the attachment points for the various equipment. The wooden separator in the middle is set it a groove in the mounting board and is taller than the copper pipe so a straight object cannot come in contact with both pipes. It is even less of a possibility because the whole assembly is mounted upside down under the charger shelf.

The charger is cycled on for an hour six times a day to keep the batteries topped off and to eliminate any noise concerns during normal operating hours.

The three deep cycle batteries sit underneath on a roll out tray and are connected by cables with PowerPole connectors for easy removal.

Though the pair of batteries I was replacing were still usable it is important when paralleling batteries that they are as closely matched as possible so that they charge and discharge equally otherwise performance and battery life will suffer.

Sad Facts

The bird population of the US and Canada has declined almost 30% since 1970. That is about 3,000,000,000 less birds in just our part of North America.

-*de* Stan KD1LE

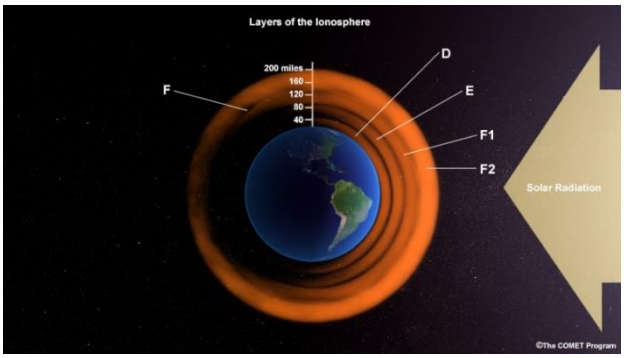
A New Perspective on the Ionosphere *de* Skip, K1NKR

The D-region of the ionosphere disappears at night, right? It comes and goes, but how does it decide to come and go? Like most students and license class instructors, I've taken this description as Gospel and never given it much thought.

But, as my late father-in-law used to say, "You don't like it? How do you like it from this angle?"

It's all a matter of perspective—or reference frame. We Earthlings look at everything from our QTH-bound perspective. How about moving away to get a different view.

Does the lower ionosphere actually disappear? Maybe not. Phil, W1PJE, forwarded me a URL for a lecture that recently was held at Haystack. Looking at one viewgraph sparked a long-delayed eureka for me.



Look at the Earth and its ionosphere from off to the side. The Sun is off to the right of the picture.

We're surrounded by an ionosphere—a sphere. See, there are the layers, D, E, F1, F2. And see, in what we might call the shadow, is the lonely F-layer. F1 and F2 have combined into a single F1 and D and E are gone. Makes sense, the layers are "energized regions" and the Sun is the source of energy. More Sun exposure, more energy to "energize."

Now let the clock tick on. What happens?

Does the whole ionosphere rotate? No, the Earth does.

Any particular QTH is in daylight now and in darkness later. That's what we call "day" and "night." Duhh, Skip.

So, the layers don't change—except for big energy changes caused by solar storms—we're just rotating from underneath the part of it that's illuminated to underneath the part that's in our own shadow. The ionosphere has just been sitting there all the time! We're spinning inside it and seeing the picture change as we rotate.

D-layer in the day; no D-Layer at night. Same picture, different view. (Oh my gosh, Professor Kepler, does the Earth really rotate around the Sun? And does the Earth itself actually rotate? Wow!)

Delayed insight can be as embarrassing as it is rewarding. Now that I've finally seen the obvious, I thought I'd share it.

The URLs Phil sent were about the 20th annual Buonsanto Memorial Lecture, which was given

by a distinguished professor[1] at the University of Colorado who did a terrific job covering great red auroras and other unusual / extreme space weather. The lecture page is here:
https://www.haystack.mit.edu/atm/pubs/buonsanto.html

And the archived YouTube lecture is here:
https://www.youtube.com/watch?v=V4oivQFSc20.

It runs about an hour and a half and has a lot of insights in it for us communicators. You might enjoy it. As Phil said, the presenter is a professor by nature, so she aimed the material just right for a wide audience.

de Skip, K1NKR

A 6 Meter 100W Amp
The Easy Way – Part Five – Power Up!
***de* Dan, KW2T**

Last month I talked about building a bias supply and setting up the bias for the amp. This month we finally get some results. But what a pain...

To test the amp, I had to have a relatively high power 50 MHz source, which would be the transverter in my ham station, but it was in the ham shack, not the electronics workbench. So, I hauled the stuff I needed up to the shack to do the testing. A big linear 24V 20A power supply, connected to the 250W eBay DC-DC converter for power, and a power resistor and voltmeters and the spectrum analyzer, dummy load, and attenuator. A bit crowded.

Tested the DC-DC into a load resistor to make sure it was working alright. Then I set up the amp, and the Bird watt meter, and a spectrum analyzer and 150W 30 dB power attenuator so I could look at the 100W output of this amp without blowing up the analyzer, digital voltmeters on volts and amps into the amplifier, and a bunch of wires and cables to get this all connected up. This was a big mess on my small radio bench, with the opportunity to easily screw up and short out things.

So, I turn on the power, and I see the bias current being pulled by the amp. The voltage was set low at 45V, bias at 80 mA to be on the safe side (data sheet says 100mA min for linearity). I key the RF (actually by hitting Tune on my FT8 app), and adjust the input power to the amp to 1W with the FT8 output power control slider, measuring the power out of a 10 dB pad on the 6 meter transverter output.

First result - nothing. No RF power out, no change in power supply current.

Start tracing it back and find out that the transverter is no longer putting out power. What the heck, it was about 10 min ago when I set the power level. After 20 minutes of trying to trace it back, I realize my dial frequency on the IF radio is at 28 MHz, but this transverter uses 14 MHz input. Somehow some of the junk in the setup hit the radio band switch!

OK, now we have RF drive for sure. Turn it on - nothing. Now what??

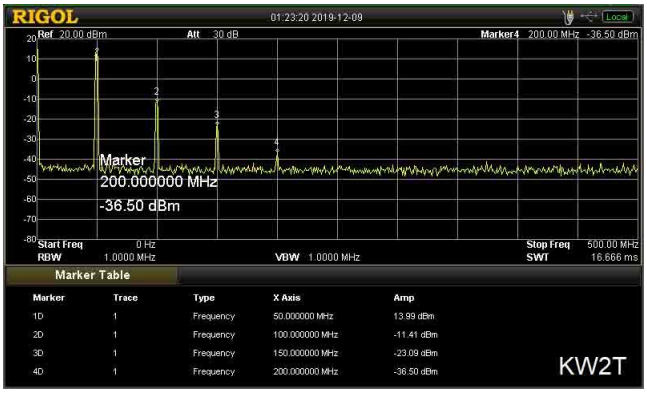
Measure the transverter output, it's still 1W. Connect it back to the MRF101 amp, nothing. What could possibly be wrong, there is only one piece of cable left! Test this brand new SMA-SMA cable, and it is dead! No, it's actually missing it's center pin. On both ends. It's an RP-SMA cable, the "reverse polarity" one used to meet FCC part 15 requirements, where the female outside thread is also the female center pin. Yes, I did buy a cable like this a couple years ago. How did it manage to find its way into this test setup?

OK, replace that with a "real" cable, and low and behold, full power out! 100W with 1W input.

OK, now to do some tests. Let's see what the gain is, how efficient, how bad the harmonics are, how much power it can do, what's the right bias, etc. I'd even like to finish with testing how easy it is to blow up. The part is only $18, I would blow it up a couple times for educational purposes.

[1] Delores J. Knipp, Emeritus Professor of Physics at US Air Force Academy Research Professor at University of Colorado at Boulder, Smead Aerospace Engineering Sciences Dept.

I did a bunch of testing, but didn't do all the testing I'd like to, ran out of time mainly due to procrastination. Here's some basic results:



Spectrum without an output filter.

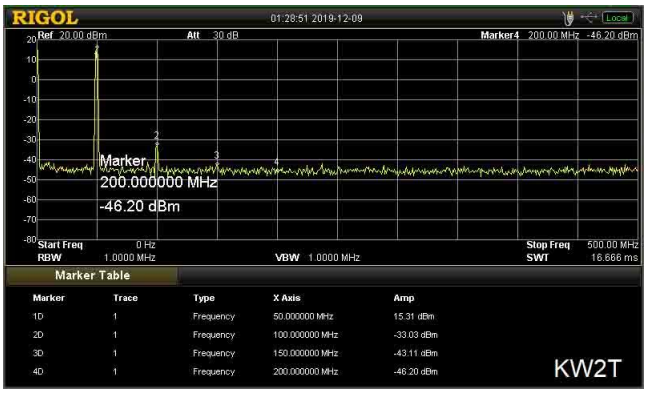
1) Gain is great, as advertised and then some. And with 1W input, it is saturated. With 0.1 W in, it does 50W out! That's 27 dB of gain, all in one part! And the gain vs power out is pretty flat (linear) to the saturation point at around 85W.

2) Max Power out at 50V is about 110W. Pretty cool for a TO-220 plastic part.

3) Efficiency is as expected, real good at the max power out, like 70%. Bad at low power out (20W), like 35%. Didn't really play with bias settings yet.

4) Harmonics are worse than I thought, maybe need to rethink the filter. 2nd Harmonic is higher than I expected, indicating some non symmetrical saturation. But everything is down at least 48 dB. I should measure how my Mirage 100W amp does that I always use on the air, might be just as bad.

5) Funny thing happens when I connect in the Low Pass Filter that I presented in an earlier part of this series: The output power goes up! That's



Spectrum with the output filter.

a bit strange, not sure that's a good sign. This and the real high gain makes me worry about instability. But I never saw any power output when there was none going in, so, so far I would call it very stable. Future testing might tell more.

6) The DC-DC is running at 115 KHz or so, and I see this in the amplifier output. I added another cap across the power supply, 220uF/100V electrolytic. This reduced those sidebands by 10dB, but they are still higher than they should be (55dB below carrier). I might try the other brand DC-DC supply. Or maybe RF is getting into the DC-DC and making it do weird things. Have to look at this more. Might go away in a neater set-up.

All for now, hopefully one more part in this series with some on-the-air tests. At this point, I would definitely recommend building this amp. It is living up to its impressive data sheet, and I haven't blown one up yet, which might be a record for power amps built from scratch.

I think next, I might build the 20 meter version of this amp. Again, if you want to build this 6 Meter version, I have some sets of parts you will need. Buy the $50 evaluation kit from NXP[2] kit, and I'll guarantee you a working amp.

de Dan, KW2T

[2] Mouser #771-MRF101AN-START, $46.87; Digi-Key #568-15353-ND, $46.88 .

What is "RST" and how is it used?

***de* Bruce, K1BG**

I was asked this question at breakfast recently, so here goes: "RST" stands for "Readability", "Signal Strength", and "Tone". It's a system used since the 1930s to let another radio operator know how his signal is being received, and is commonly used during the introduction part of the conversation between two amateur operators.

Readability is a scale from one to five, with five being the best. Most signal reports, either phone or CW (Morse code), commonly begin with a five. If you can casually receive the other station, a five is most likely given. But if there is noise, QRM, bad propagation, or if the other operator is just not being heard, then something less than a five is given.

Signal Strength is a scale from one to nine, with nine being the best. Again, if it is a very strong signal, I give the other operator a nine.

The RST system was developed BEFORE s-meters were common in amateur receivers, so the signal strength report was purely a judgment call. With s-meters being calibrated to a scale of nine, some operators tie their signal strength report to the s-meter.

I do not, because there are so many variables involved. For instance – having a hot receiver, or having a built in 20 dB pre-amp, does not make the other stations signal better, even though turning on the pre-amp might make the other station appear 3 s-units better. In other cases, I may be receiving a station that shows little or no movement on the s-meter, but I don't give him a one for signal strength. Particularly if he could be received at an even lower level! I might give this station a three for a report. So again, this is purely a judgment call.

Tone has to do with the purity of the CW signal being received, and again, it's a scale from one to nine, with nine being the best. It is not used for phone contacts (only "R" and "S" are sent for phone, for instance, "Your report is a five nine"). Back in the day, rectifying and filtering AC power supplies could be difficult. If there was an AC component that made its way into the transmitter RF path, the CW note could sound particularly nasty (with AC hum, for instance). Other things as well could find their way into the RF path, causing an impure signal to be sent. With modern transceivers these days, you almost never hear anything other than a nine being sent as part of the signal report.

Other information could be sent after an RST report. "C" indicated a "chirp" (or frequency instability) in your signal.

I engaged in a QSO just last week where the other operator was using a 1960s vintage Heathkit SB401 transmitter, and it had a chirp, so I sent a C after the signal report. "K" was indicative of key clicks (hard make and break at the beginning and end of each dit and dah, which could generate spurious emissions).

Here is a quick chart that you can print and put in your shack for reference[3]:

Readability
1--Unreadable
2--Barely readable, occasional words distinguishable
3--Readable with considerable difficulty
4--Readable with practically no difficulty
5--Perfectly readable

Signal Strength
1--Faint signals, barely perceptible
2--Very weak signals
3--Weak signals
4--Fair signals
5--Fairly good signals
6--Good signals
7--Moderately strong signals
8--Strong signals
9--Extremely strong signals

Tone
1--Sixty cycle a.c or less, very rough and broad
2--Very rough a.c., very harsh and broad
3--Rough a.c. tone, rectified but not filtered
4--Rough note, some trace of filtering
5--Filtered rectified a.c. but strongly ripple-modulated
6--Filtered tone, definite trace of ripple modulation
7--Near pure tone, trace of ripple modulation.
8--Near perfect tone, slight trace of modulation

[3] Ref: http://www.arrl.org/quick-reference-operating-aids

9--Perfect tone, no trace of ripple or modulation of any kind

Of course, if you are in a contest, everyone sends "59" (or "599" in a CW contest). But the history and reasons for this could be the subject of another article! If you have any questions or comments, please feel to reach me at bruce DOT blain AT charter DOT net.

de Bruce, K1BG

Around & About

K1NKR continues to be in contact with Gene, WW4EN, in Tuxedo Park NY. Gene's doing pretty well, considering how long he has thwarted his pancreatic cancer. In a Thanksgiving e-mail exchange, Gene said that he had spent the day with his wife and daughter and that, despite the conditions, he has much to be thankful for. He had started an investigation into EchoLink and purchased a 2/440 HT but says that the fatigue and some extremities numbness has him going pretty slowly on that project. (His QRZ.com address is still the one to use for cards and QSL greetings.)

Board Meeting Notes

Attendees:

Stan, KD1LE, Bruce, K1BG, Ed, N1YFK, George, KB1HFT
Jim, N8VIM, Ralph, KD1SM, Jim, AB1WQ,

Unless a speaker requires it, January will be Homebrew Night and February will be Members Short Subjects Night.

Discussed the Harvard Science Fair. Bruce has not gotten a reply from the coordinator.

No other activities scheduled before the Groton Road Race. Bruce is going to contact Skip about Thinking Day.

Discussion on whether to continue if it results in no license interest. If we are accomplishing only public awareness, we should be doing a different group each time.

Treasurer gave his report. Says PayPal is working, but members need to remember to **check a box that indicates that the payment is not for "goods",** so PayPal does not take a cut.

Treasurer's Report

Income for November was $80 from membership dues and $2 from ARRL membership renewals.

Expenses were $30.59 for the November QSL sort pizza and $1.17 for PayPal fees leaving a net income for the month of $50.24.

The Community Fund received contributions of $20 from the Swap Shoppe.

Current balances:

General fund	$2,693.67
Community fund	$5,698.25

As of 5 December we have 47 members who are current with their dues and 17 renewals outstanding. Thank you to those of you who mail or hand in your dues before Ralph comes to you. Please check your renewal status on the roster circulated at the monthly meeting or ask Ralph.

Membership dues can now be remitted via PayPal:

Go to https://www.paypal.me/nvarc

Please remove the checkmark in the box "Paying for goods or a service", as PayPal deducts a fee for their "purchase protection" if you leave this checked. If your "shipping address" is displayed then the box is still checked, adding an expense to the Club.

(Optional)
Enter your callsign in the
"Add a note"
field.

If you are joining ARRL or renewing your membership please consider letting Ralph send in the paperwork for you. The Club will buy the stamp and will get a commission from ARRL. ARRL membership checks should be made payable to NVARC; Ralph deducts the Club commission before forwarding your paperwork to Newington. As an Special Service Club, the ARRL expects a majority of Club members to also be ARRL members.

de Ralph KD1SM

Elmering

If you know of a young person who has recently become licensed, or who might be interested in becoming a Ham Radio Operator, and is in need of equipment to set up a station, an NVARC member has the resources to assist.

Through the generous donation of a fellow ham, he can supply the hardware and setup know-how to get a young-un up and on the air. If you know of such a person, please contact Jim, N8VIM at: N8VIM@arrl.net

STRAYS

N4UJW's Mobile Shack
All ready for Field Day

In days of old, when ops were bold, and sidebands not invented,

The word would pass, by pounding brass, and all were well contented.

NVARC
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Amateur Radio Club
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http://www.n1nc.org/

President: Stan Pozerski, KD1LE
Vice President: Jim Hein, N8VIM
Secretary: John Griswold, KK1X
Treasurer: Ralph Swick, KD1SM
Board Members:
Jim Wilber, AB1WQ, 2016-2019
Ed Snapp, N1YFK, 2017-2020
Bruce Blain, K1BG, 2018-2021

Property Master: John Griswold, KK1X
Librarian: Peter Nordberg, N1ZRG
Emergency Coordinator: [open]
N1NC Trustee: Bruce Blain, K1BG

Join NVARC! Annual membership dues are $15; $20 for a family.

Meetings are held on the 3rd Thursday of the month at 7:30 p.m. in the Pepperell Community Center.

Contact us on the N1MNX repeater.
442.900 (+), 100Hz
147.345 (+), 100 Hz
53.890 (–), 100Hz

This newsletter is published monthly. Submissions, corrections and inquiries should be directed to the newsletter editor:
editor@n1nc.org.
Articles and graphics in most PC-compatible formats are OK.

Editor: George Kavanagh, KB1HFT

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