



# SIGNAL

A club since 1992



Since 1993

de N1NC

August 2022

Volume 31 Number 8

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## NVARC Monthly Meetings

NVARC General Meetings are scheduled for the third Thursday of the month at 2430 UTC (7:30pm, Eastern Time), except for July and August, when no General Meetings are held. When held, meetings are at the Pepperell Community center and are generally simulcast via Zoom. Non-members who are interested in attending may send an email to [meetings@n1nc.org](mailto:meetings@n1nc.org) requesting the teleconference details.

NVARC thanks **Medtronic, Inc** for providing the teleconferencing services under their employee volunteer support program for non-profit organizations.

## Upcoming General Meeting

The next General meeting will be held in person at the Pepperell Community Center, 2 Hollis St, Pepperell, MA 01463 on September 15, 2022. No Zoom simulcast is scheduled. The guest speaker will be Ron Evett N1QY, who will speak on Understanding SWR. You are cordially invited.

## The President's Corner

de Bruce, K1BG

There is a great deal of excitement regarding the ARRL New England Convention, now called "HamXposition" (<https://hamxposition.org/>), which



will take place August 26<sup>th</sup>, 27, and 28<sup>th</sup> (later this month, the weekend BEFORE Labor Day) in Marlborough, MA. One of the reasons for this year's excitement is that HamXpo will feature the combined efforts of both the New England Division AND the ARRL Hudson Division. HamXpo features an exhibition area where vendors can display their latest gadgets, a flea market where you can find lots of used items, and meeting rooms where guest speakers talk about whatever their interest is. Plus there is lots of opportunity for you to have a face to face meeting with old friends and make new ones.

John, KK1X is organizing a club table where club members to gather and give us an opportunity to promote the club. Its success will depend on your involvement, so please spend an hour or so in the booth meeting and greeting people. Contact John at [kk1x@kk1x.net](mailto:kk1x@kk1x.net) if interested.

Additionally, there is an extensive array of talks being given at the Forum. I'm personally giving the CW Academy presentation, but there are many others. See [the schedule](#) for a complete list.

As I mentioned last month, I'll coordinate a "club table" at the Saturday night "Grand Banquet" *if there is interest*, and so far, nobody has expressed any interest. The guest speaker will be kit-building guru Joe Eisenberg, K0NEB. Joe will discuss how he got into kit-building and his experiences with the hobby. If you are interested at sitting at a club table, please let me know.

As many of you are aware, Larry Krainson, W1AST, of the Hamden County Radio Association is coordinating events for the Big E (formerly the

Eastern States Exposition) which will take place on September 16 – October 2. Crowds more than *1.5 million people* are expected. This is perhaps the largest amateur activity in New England since WRTC2014, and it has the potential to dramatically promote amateur radio and help local clubs.

As many of you know, NVARC used to be an ARRL “Special Services Club”, and we traditionally supported these kinds of activities in a large way. It would be great if someone stepped forward to coordinate activities on behalf of the club. This would help enormously – scheduling times, coordinating transportation, etc. But individually, volunteering for a shift or two for this activity has a positive impact on amateur radio in New England.

Time is getting short, and there are still a number of time slots open. Let me know if you are interested in volunteering, and if you are willing to coordinate club activities. For further information, go to: <https://nediv.arrl.org/project-big-e/>

Finally, Phil, W1PJE, has been lining up an extraordinary lineup of guest speakers and activities for our fall meeting lineup. September will feature Ron Evett, N1QY, who will talk about “Understanding SWR – Getting Power to the Load”. More on this in the next signal.

Please be safe and enjoy the rest of the summer. I look forward to seeing all of you on Marlboro at HamXpo.

-de Bruce, K1BG

### Lobstercon 2022



Last July, I reported on an exciting event that I attend every summer. The weekend after the Fourth of July, I head up to Brunswick Maine for Lobstercon! Lobstercon is a gather of New England QRP aficionados (and some not-so-QRP types) who enjoy camping, operating, socializing, and eating during the weekend. BTW, not everyone does all these things. Some rough it in one of the local hotels! Some attendees set up QRP (and some 100 watt) stations and both rag chew and/or participate in the IARU World Championships that is held over that weekend.



This year, I headed up on Friday morning and set up my station – consisting of an ICOM IC-746Pro and a 40 meter inverted V, situated in one of the screen rooms I bring on Field Day. The 746 ran off battery power, and I turned it down to 5 watts or so in order to conserve battery life. Conditions weren't the best, but on 5 watts rag chewed with people around the country and Europe on 40 meter CW. And I made a few contacts in the contest as well.

The highlight of the weekend are always the Saturday activities organized by Rex, W1QRP, of QRPme fame (qrp.me). 50 buck buys you a conti-



mental breakfast, all you can eat BBQ at lunch, and a spectacular lobster clambake at dinnertime (if you aren't into seafood, there are other alternatives). Thomas Point campgrounds generously provides a deep discount to the attendees.



This year, besides me, fellow NVARCers Jean, K1AVM, Dennis, K1LGQ, Peggy, KC1EIV, and John, KK1X, were in attendance.



I stayed until noon on Sunday (having made a half dozen CW rag chew contacts in the morning after breakfast), and headed home.



Another great Lobstercon in the log! If you have any interest in going in 2023, let me or one of the others in the club who go know. We'll make sure you have all the details for next year.

-de Bruce, K1BG

## Batteries and Solar for Amateur Radio Emergency Part 1

de Greg Troxel, N1DAM

### Introduction

In Amateur Radio emergency communications, arguably the most important point is to be able to communicate when the normal infrastructure fails. This means no power from electric utilities, no landline phones, and no cellphones. Therefore, having a source of power that is usable over an extended period of time is critical, and in my experience hams are set up with adequate radios and antennas before they are set up with adequate backup power.

This post presents thoughts about backup power, and collects my thoughts responding to a question: if you were starting out from nothing, and had various requirements, what might you do?

This post indirectly raises related issues for Amateur Radio emergency communication organizations, specifically how to have stations report capability of the station and emergency power. Those are not addressed here, other than to say stations checking in with a handheld and getting credit for "emergency power" is not a good plan

for incentivizing amateurs to improve their stations, and that preferentially taking less capable stations (or even non-stations such as Internet-only Echolink nodes) at check in time also gets the incentives backwards.

## Requirements

I assume that the point is to provide nominal 12V power for 12V amateur radio equipment, especially for operation when utility power is not available. Further, this is for the purpose of providing communications during a failure of the normal communications infrastructure.

## Rationale

Establishing requirements is a judgment call; we can't predict what will happen in terms of length of utility outage, what the other circumstances will be, and how much receiving/ transmitting will be desired. Any particular requirements are then a guess that the system will be adequate for most situations, with a sliding scale on adequate and most. Requirements are particular points along a continuum of capability, picked because they are useful representative points, and because it is useful to compare alternative approaches intended to meet the same requirement.

For an individual amateur wanting to improve emergency communications, any increase in battery capacity or recharging capability is useful, and the following requirements should not be viewed as bright lines – 59 Ah is almost as useful as 60 Ah, but either one is far better than 5 Ah.

## Functional

I'll pick two weeks as the length of utility power outage over which operations should be sustainable. That's of course is arbitrary, and it follows from the general concept of amateur radio emergency communications as preparing for failure of the normal infrastructure. During the ice storm of 2008 most people experienced less than 14 days of outage, and by 14 days after the normal infrastructure was restored. One might consider 21 or 28 days instead, but this rapidly leads to needing enough solar recharging, and such systems have indefinite usable lifetimes. Some people might want to plan for only 24h outages because that is what they have experienced, but 24h outages are almost never communications emergencies, and that previous outage history does not seem a reliable predictor of the next few years. I know multiple people who experienced a 7-10 day outage in

the ice storm, and 3-4 day outages are not that unusual in my town, in terms of given person's 10-year history.

There are various kinds of amateur stations, and here I'll consider only three: - a 5W handheld with a fixed external antenna (basic) - a 50W 2m/70cm mobile rig and a fixed antenna (capable local) - a 50W mobile rig and a 100W HF transceiver (capable).

I'll assume radios have been chosen to have reasonable receive-only current drain and can function from 11V to 15V, or at least 12V. Note that some radios are not OK with lower voltage and people often use boost-mode DC-DC converters. I hear that one popular brand is particularly bad about voltage requirements and fails to function entirely below 12V. Other radios simply have higher IMD and should be backed off in power a bit. The receive current drain of mobile rigs varies widely, and everyone should measure theirs. The same is true of HF rigs. Ideally, we would have measurements from an integrating ammeter for the above station types during real emergencies. Lacking that, I'll assume 12h per day of listening, with 1h of transmit for VHF/UHF. (Long ago I measured being NCS with a 50W mobile rig, or about 15 minutes of a training net, using around 1 Ah.) For HF, I'll assume 4h listening and 0.5h transmitting, SSB or CW. For handheld, mobile, and HF this leads to:

$$\begin{aligned}0.25A * 12 + 1A * 1 &= 4 \text{ Ah/day} \\0.5A * 12 + 9A * 1 &= 15 \text{ Ah/day} \\ \text{add } 1A * 4 + 20A * 0.5 * 0.5 &= 9 \text{ additional Ah/day} \\ &= 24 \text{ Ah/day} \Rightarrow 30 \text{ Ah/day.}\end{aligned}$$

For the capable station, one might need to run lights for copying traffic, and perhaps something else, and I have rounded up to 30 Ah/day without specific justification. My story is that there are always more loads you haven't thought of. It is also useful for a system to be able to provide USB power for phones, etc. Even though one can use a lighter socket and a lighter socket to USB adaptor, being already set up for USB is convenient. Of course this too is a bit more load.

## Cost, Complexity and Effort

Approaches obviously differ in cost, but also in skills required of the amateur building the backup power system, and the amount of time required to create the system and keep it running. It seems obvious that different people will have different skill levels and different cost and effort budgets, as well as different goals.

## Technologies

This subsection discusses technologies relevant for building backup power systems. Many technologies are omitted (e.g., organic flow batteries) because I do not see them as relevant for a ham constructing a backup power system in 2022. Some (e.g., generators) are omitted because they are separable issues. Still others (e.g., wind turbines) are omitted as beyond the scope of this post, even though they fit conceptually.

### Distribution

The standard approach is Anderson PowerPoles®, and most people install them on everything. This allows equipment from different people to be interchanged (so label with your callsign when you add connectors), and avoids wrong connections under stress, which can be dangerous and damaging. Installing PowerPoles absolutely requires a proper crimp tool. Otherwise, the connections may look OK and be high resistance electrically. Check out [PWRcrimp](#). Once all equipment has PowerPoles (and see fusing under safety), one can use 8-way connecting blocks and devices like the West Mountain RigRunner. Examples include:

- [RigRunner 4008](#)
- [PWR-BLOK 8](#)
- [sotabeams Fused DC Connector Box](#)

### Metering

It is very useful to be able to monitor voltage of batteries, and to measure current and particularly-integrated current (Ah) to understand capacity requirements. When choosing meters, understand the drain the meter places on the battery. While 100 mA is such a large drain that any monitoring device using that much has a design defect, consider that 100 mA \* 24h is 2.4 Ah every day.

- [PowerWerx meter](#)

Note that similar meters without connectors can be found for approximately \$20, for those who have a crimp tool and are comfortable with off-brand shopping and installing connectors. I have found this type of meter to draw about 7 ma typically, which is around 170 mAh/day.

### Battery/PS switches

There are multiple devices that have ports for power supply, battery, and load. Some have

diodes and some have low loss FETs, and the basic idea is for the power supply to power the load normally, with the battery there to take over if there is a failure. In addition to no downtime, this protects the radio from power glitches. Many of these devices incorporate a low-rate charger to charge the battery when the supply is on. Some also have a fourth port for a solar panel and a charge controller.

- [Epic PWRgate](#)
- [Super PWRgate PG40s](#)

The Epic is a little tricky to obtain what I think is proper float charge, and I am still investigating. Beware that the PG40s does not support LiFePO4 battery charging, and I do not know if the charger can be disabled.

It remains to understand if the Epic can charge LiFePO4 batteries from the power supply, without having a greater than 15V supply, which risks presenting overvoltage to equipment. Currently, it seems necessary to have either solar or a LiFePO4-specific charger. But you should have solar anyway.

### Rechargeable Batteries

I will consider batteries from about 10 Ah to about 100 Ah.

#### Valve-Regulated Lead Acid (Sealed)

[Lead acid batteries](#) have been the standard approach for a long time. They are fairly safe (if you don't eat them, drop them on your foot, or short them), and relatively inexpensive (perhaps \$2 per nameplate Ah around 35 Ah). They are built with 6 cells and float charged at [13.8V](#), and usable to perhaps 11.4V. Standard practice is to plan to use only half the capacity. Note the caution above about radios that will function down to 11 V; lead acid batteries tend to lead to needing boosters unless radios are carefully chosen. Lifetime varies, and can be a few years to more than 10 years. Even when new, some do not meet specifications. Sometimes this is a healthy battery with 90% of the rated capacity, and sometimes it is a battery with a defective cell. See the cautions in the later section about assembling systems. Lead acid battery reliability, especially for used batteries, is such that it is only reasonable to use them if you do a full-cycle capacity test on them on intake to your system and at least every two years, preferably every year. That means both having a controlled load and data logging device, and actually



doing it. Give the reasonable costs of LiFePO4 batteries, using lead acid is only a reasonable plan if you want to spent time measuring batteries as a second hobby. Lead acid batteries will fail if allowed to discharge deeply. Keeping them for emergency use requires either a permanently-connected float charger (including solar) or constant attention. Absent the permanent solar system, this usually does not go well.

My experience testing lead acid batteries is that ratings are often optimistic. If I test a battery labeled 7 Ah and I get 6.2 Ah I consider that I got a good one. That is a clue about the general accuracy of specifications, but I have had a few actually meet their specification. Lead acid batteries are often discharged to 11.4V (resting) or 10.5V (at the 20-hour rate), and this is too low for many radios. Really, a ham "12V" radio should work fine down to 11V, perhaps backing off power a bit, but there are many that do not. I will assume that one can use half the battery's nameplate capacity and that they will last 5 years in mostly-standby service with attention to keeping them charged. So the 5 year cost is \$4/Ah. Note that this is very sensitive to lifetime assumptions.

**Lithium Iron Phosphate (LiFePO4)**

LiFePO4 batteries are relatively recently (within the last 10 years) a feasible option. They are built with 4 cells of nominal 3.2V/cell (12.8), charged to 3.65 V/cell (14.6 V), and end-of-discharge is 2.5 V/cell (10.0 V). I have adopted 12.0 V as end-of-discharge; the vast majority of capacity occurs before that, at reasonable discharge currents. Conventional wisdom is that the entire capacity is usable and that they last much longer.

LiFePO4 batteries need more complicated charge management (balancing) and various protections (overcurrent, undervoltage), and generally come with a Battery Management System (BMS).

Most of the useful capacity is above about 12.8V and almost all above 12.0V. Therefore, assuming no booster in either case, even radios that (unreasonably) demand a voltage >12.0V to work are more likely to work well with LiFePO4, compared to lead acid.

There are many cautions on the web that lithium batteries of any kind should not be charged below 0 C (freezing) because that will destroy them. Until I find a good reference, this [marketing page from Relion](#) is useful; they sell a product with a heater that will heat the battery up and then charge it. (I have zero experience with the product

or the company.)

The best-known brand in amateur radio is Bioenno. It is easy to find test reports on the Internet where people say they did discharge tests and got either above rated capacity or very close. I have not seen reports that capacity was significantly worse than stated. My own tests also support the "Bioenno products meet their specifications" theory.

Bioenno batteries, supplied with PowerPoles and BMS, cost about \$10/Ah, slightly less at higher capacities. TalentCell, which does not have the length of reputation, is about \$5/Ah.

One can use the entire capacity of LiFePO4. Probably one should not discharge to 10V routinely; there are various comments to stop discharging at 20% of capacity. Note that my treating 12V as end of charge (when resting) leads to 9% capacity remaining. Of course, in an emergency, a bit of stress on the battery is acceptable, while in day-to-day use it makes sense to treat them more gingerly. It is difficult to estimate lifetime. Compared to the 5 years above for lead acid, I will estimate 10 years as they seem to degrade less. For Bioenno, the 5 year cost is then \$5/Ah.

One can estimate state-of-charge from resting voltage, meaning no current into or out of the battery, both now and over the last at least hour. Basically, if a LiFePO4 battery is over 13.3V, there's really no reason to charge it.

Voltage	SOC
13.4V	99%
13.3V	90%
13.2V	70%
13.1V	40%
13.0V	30%
12.9V	20%
12.8V	17%
12.5V	14%
12.0V	9%

**Lithium Ion including Lithium Polymer**

These have two problems. One is a fairly wide range of working voltage. The other is a lower degree of stability. I choose not to use this type of battery in sizes capable of significant energy storage because of safety concerns, and therefore do not address them further.

**Comparison**

Because of 2x usable capacity and 2x longer life (likely true; need more data), the cost for 5 years

of use is competitive for lead acid and Bioenno, and less expensive LiFePO4 brands are cheaper (assuming they deliver on capacity and longevity). Boosters are far less necessary with LiFePO4, perhaps entirely unnecessary. I expect more reliability and less drama with LiFePO4 batteries. Therefore I think we have arrived at LiFePO4 being the new standard approach. (It is interesting to note that PowerWerx is no longer carry lead acid batteries or even boxes for them.)

(End of Part 1. To be continued in the next issue.)

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-de Greg N1DAM

### Treasurer's Report

NVARC received no income in July. Expenses were \$106 for the the PO box semi-annual renewal and \$41.29 for fuel for the Field Day electrical generator leaving a net expense of \$147.29 for the month.

If you incurred approved expenses for Field Day, please submit your receipts to me so I can reimburse you.

Current balances:

General fund \$2,619.93

Community fund \$6,628.25

As of 4 August we have 43 members who are current with their dues and 34 renewals outstanding. Renewal months are in the member list on [www.n1nc.org](http://www.n1nc.org) in the Member's area; check yours on <https://www.n1nc.org/Members/Roster> or you may also email me. Thank you to those of you who mail your renewals or use PayPal without a reminder. To pay membership dues via PayPal see the instructions in the same Members area.

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. As an Special Service Club, the ARRL expects a majority of Club members to also be ARRL members. Contact Ralph for further information if you need it.

-de Ralph, KD1SM

### NVARC Board Meeting: July 7, 2022

#### Attendees:

Bruce, K1BG, John, KK1X,  
James, N8VIM, John, K1JEB,  
Ralph, KD1SM, Vlad, W1MTI

Call to order: 7:30PM

Vlad W1MTI has replaced the Signal Bulletins at Electronic Plus and Ham Radio Outlet. Vlad received two articles for publication in the Signal, one each from Skip and Greg.

Meetings are booked through the end of the year. For September, Ron Evett N1QY will present "Understanding SWR (to get power to the load)." In October, Thaire Bryant W2APF will present "What It's like to be the DX on the Other Side of the Pileup--a Travelogue." November is the QSL sort. December is the Home Brew Night, and January is the Short Subjects Night.

Bruce K1BG has submitted all the Field Day scores.

So far there are no volunteer for the Picnic. Is it dead for this year?

At the Ham Exposition August 26, 27 and 28 John KK1X needs volunteers to help manning the table.

Bruce is asking for volunteers to go to the BigE (Eastern States Exposition) in late September.

The meeting was adjourned at 7:50PM

-de John, K1JEB

### Field Day 2022 Statistics

Twenty eight people participated in the Field Day 2022 activities. 1206 total QSO's were made, of which 905 were CW, and 301 SSB. The table below gives QSO breakdown over the spectrum.

Band	CW	Phone
80m	241	18
40m	349	185
20m	177	82
15m	131	16
10m	7	

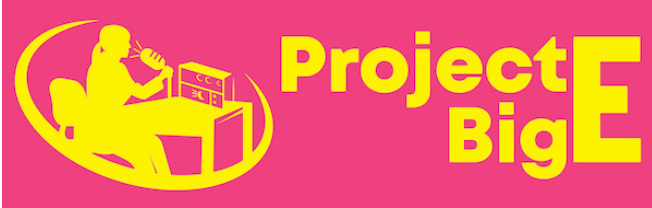
Total 1110 bonus points were received for: emergency power; media publicity, public location, public information table, receiving W1AW Field Day message, site visit by invited elected official, site visit by invited served agency, youth participation, presence of the safety officer,

social media and 50 technical points for web submission.

Total claimed points for the Field Day were 5,332.

- de NVARC, N1NC

### Project big - E 2022



Project Big E is a 16-day amateur radio exhibit to be held at the 2022 Big E from September 16-October 2, 2022 in West Springfield, Massachusetts. Western Massachusetts ARRL Affiliated Club Coordinator and Hampden County Radio Association president Larry Krainson, W1AST, is the Project Big E General Chairman.

The Big E, formerly known as The Eastern States Exposition, is billed as "New England's Great State fair." It is the largest agricultural event on the eastern seaboard and the sixth-largest fair in the nation. In 2021, the Big E had 1.5 million visitors, and over 1.6 million visitors in 2019. [Wikipedia.org]

Planning for Project Big E is underway. An impressive ham radio booth will showcase the many aspects of modern ham radio, and provide an avenue for people to sign up for information and courses in their local area.

Features proposed for Project Big E will include:

- an EmComm display
- DMR and/or other digital mobile mode demo
- Digital HF modes on a big screen
- A special event station (N1E) with unique QSL cards
- SSB, CW and digital modes
- Demonstrations of portable stations for field operation (i.e., Parks On The Air, Summits On The Air)
- A live ARISS contact

Project Big E can succeed only if there is a sufficient number of volunteers and radio clubs who

agree to participate in the event. A web page has been created at <https://nediv.arrl.org/ProjectBigE>.

Also, a special Groups.io mailing list group has been established. To join, send an email to [ProjectBigE+subscribe@groups.io](mailto:ProjectBigE+subscribe@groups.io).

### Calendar

#### August

12-14 North American Meteor Scatter Sprint

<https://kv5w.com/2022/07/24/na-meteor-scatter-sprint-digital-rules/>

13 Kentucky State Parks On the Air

<https://k4msu.com/kypota/>

13/14 Keyman's Club of Japan Contest

[https://kcj-cw.com/contest/rule/2022\\_43\\_kcj\\_dx\\_.pdf](https://kcj-cw.com/contest/rule/2022_43_kcj_dx_.pdf)

10/17/24 A1Club AWT

<https://a1club.org/contest/awt/>

16/23 Worldwide Sideband Activity Contest

<https://wwsac.com/rules.html>

#### September

3/4 IARU Region 1 Field Day, SSB

<https://www.darc.de/der-club/referate/conteste/iaru-region-1-fieldday/en/>

6/7 RSGB 80m Autumn Series, SSB

<https://www.rsgbcc.org/hf/rules/2022/rautumn.shtml>

10 Ohio State Parks on the Air

<http://ospota.org/>

### Have YOU paid your NVARC Dues?



See: <http://n1nc.org/Members/Roster> for your renewal month.



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480 King Street  
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[fpurcell@electronicsplus.com](mailto:fpurcell@electronicsplus.com)  
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**Nashoba Valley  
Amateur Radio Club**  
PO Box # 900  
Pepperell Mass 01463-0900  
<http://www.n1nc.org/>

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**Vice President:** Phil Erickson, W1PJE  
**Secretary:** John Bielefeld, K1JEB  
**Treasurer:** Ralph Swick, KD1SM

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Skip Youngberg, K1NKR, 2020-2023  
Jim Hein, N8VIM 2021-2024

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Librarian: Peter Nordberg, N1ZRG  
N1NC Trustee: Bruce Blain, K1BG

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

NVARC general meetings are scheduled for the third Thursday of the month at 2330 UTC (7:30pm, Eastern Time). Non-members interested in attending may send an email to [meetings@n1nc.org](mailto:meetings@n1nc.org) requesting the teleconference details. NVARC thanks Medtronic, Inc for providing the teleconferencing services under their employee volunteer support program for non-profit organizations.

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](mailto:editor@n1nc.org).

Articles and graphics in most PC-compatible formats are OK.

Editor: Vladimir A. Goncharov, W1MTI

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**Nashoba Valley Amateur Radio Club**

*PO Box 900*

*Pepperell, MA 01463-0900*