NVARC
Nashoba Valley
Amateur Radio Club

SIGNAL

A club since 1992
Since 1993
Since 1996

de N1NC August 2019 Volume 28 Number 8

In this Issue

This Month's Meeting

By custom, there is no NVARC meeting in July or August

Next Month's Meeting

The September meeting program will include a presentation on the CWOPS CW Academy by Bruce, K1BG.

From The President

***de* Stan, KD1LE**

I hope everyone is having a great summer. The NVARC Cookout took place July 28th at the KD1LE/N1PBL QTH. The weather was quite warm but not at hot as it had been. Between natural and artificial shade providers there was enough for everyone. By my count there were 23 participants, two grills, and people brought many items to share. Though scheduled from 1-4 PM the last visitors left around 5:30 PM. With lots of food and chatter a good time was had by all.

I have acquired five plus gallons of exterior paint for the repeater building. We need someone to organize a work party to paint the building.

There is nothing like a deadline to get things done. Cleaning up the parking area for the cookout encouraged me to get the rack for my solar panels up on the roof. Not that it is as much of a challenge as it would be for others. I hope to have my station running on solar by the fall.

TOWER SAFETY

The New Hampshire Union Leader recently reported that a New Hampshire Amateur was killed and another injured when taking down a tower.

The full account may be seen at:
https://www.unionleader.com/news/safety/ham-radio-operator-killed-in-deerfield-tower-crash/article_e21dadf3-3ec7-544c-8da0-1c05f864c806.html

My point in mentioning this is that working on a tower has high risks:

- You should not work alone.
- There should be sufficient ground crew to minimize the effort of the person(s) on the tower.
- You should check the condition of the tower and the guys before climbing and as you ascend.

- When taking down or putting up a tower, use temporary guys to stabilize the tower rather than have long sections unsupported.

I'm sure there are many more pointers, but nothing should be assumed.

Don't be afraid to ask for assistance when you plan to do this kind of work. The ARRL carries a book on the subject and I am sure there are others.

Free Emergency Communications Course

The ARRL now has an on-line, mentored course "EC001" that is free. The course became available early this year but was and probably still is booked solid.

I signed up for it when it was first offered and my session started this month. They estimate it takes about 45 hours to complete the course and you are allowed nine weeks. When you take a course such as this one, or participate in an event with another club, you can always learn something. Within the first few sections of the course I was surprised by a few things that I learned that I thought I knew.

I hope everyone has a safe and enjoyable summer, stay cool and see you in September.

de Stan, KD1LE

From the Editor
"A Busy Summer"

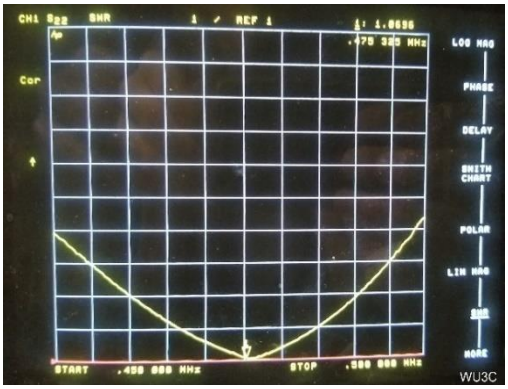
NVARC members have been busy this summer. With both the successful Field Day and Picnic events behind us, our attentions turn to the mid-summer seasonal radio projects: construction, repair, and maintenance of our equipment while the weather is good. For instance, Jessica, WU3C, with the help of several members including Bob, W1XP, Peter, N1ZRG, Jim AB1WQ, and others, has set up what I would call a "physically short vertical dual-cone cage antenna for use on 630 meters".

Bob, W1XP, helps adjust the spreaders before the antenna is hoisted.

From the feed point, near ground level, six 14-gauge wires spread out to a 15-inch circle, then converge at the top, where 5 top-hat radials extend outward.

When hoisted, the antenna measures ~ 45 feet tall.

The matching network at the base of the antenna.



A VSWR scan of Jessica's 630 meter cage vertical, showing a nice wide minimum at ~475kHz.

Indoor radioactivity on those unavoidable rainy days is always in order: I know my shack could do with an hour or two of just sorting and tidying up of all the junque.

Jessica, WU3C, has, in addition to building the antenna described above, built a multi band transmitter from junkbox parts:

The layout is on a scrap of pine lumber, and features a 12AX7 VFO/Buffer, an EF95 multiplier, and a 6V6 power amp.

Jessica relates, “it wasn't so much a design as a cobb of old QST articles with mods to accommodate what I had on hand. The VFO was adapted from the McCoy VFO in the QST of Feb 1962. I used brass nails I had for a furniture project for the connection points. It only does 2 watts, but could do better. It still needs some tinkering.”

Also happening: Dan Pedtke, KW2T, is hosting a series of interesting, informal, sessions wherein Dan, as well as special guest speakers, discuss aspects of RF design with the attendees. Check out the Tech Night web page at:

http://www.danstechnight.com/

The current sessions detail his professional, real-time, designing of a 6M radio optimized for digital modes, including RTTY, FT8, PSK31, WSPR, etc. Dan has had a set of prototype PCBs made and is in the process of experimentally fine-tuning component values.
See:
http://www.danstechnight.com/RadioProject.html for more details on the radio.

The sessions (usually) occur at 7pm on the second Thursday of the month at the Grady Research Building in Ayer, MA.

The next session is scheduled for September 12.

de KB1HFT

Field Day
or
“Guess Who’s Coming to Dinner”
***de* Jim, AB1WQ**

One of the key issues involved in planning Field Day is providing meals for the NVARC members participating in the weekend-long event. The on-air activity commences at 2:00PM Saturday each year, and is fully underway by 6PM, dinnertime, that evening. Many members stay late into the evening--and some overnight--and fueling that effort is one key element of a successful Field Day.

When I began my Field Day (FD) planning involvement in 2015, I asked how many dinner attendees we should plan for. "We're not sure...usually anywhere from 10 to 20...," I was told. "Well," I asked, "how many total club members do we have?" About 50, I was told. So, there you have it: Guess who's Coming to Dinner? Anywhere from 10 to 50 members.

Group dynamics tend to ebb and flow and evolve over time and things had reached the point by 2015 where instead of asking members to confirm their plans to attend FD, the plan was to guesstimate attendance and buy and bring enough food to cover the high end of the range. Fortunately, we never had a situation where we had 10 meals prepared and 50 arrived (thanks in part to Leo Hunter K1LK's long experience in FD meal planning).

But this year (June 2019), I felt we had reached a point where instead of a single-option dinner menu, people would appreciate the freedom to choose in advance from a list of several dinner options and have a hot, restaurant-style meal served at FD. Sure, that would put a little more pressure on our food budget, so we asked everyone to kick in $5. to reserve the meal of their choice.

It worked: We had, as I recall, the best attendance at Saturday dinner! And the food was quite good.

Over the years, I came to understand that, even without dinner reservations, 100% attendance wasn't likely to be a problem. But that was a problem I wanted to have!

My goal each year, in '15, '16, '17, '18, and '19, was to maximize attendance. Perhaps you've heard of the "Network Effect," also known as Metcalfe's Law[1] named after Bob Metcalfe, one of the inventors of Ethernet. Briefly the law states that the cost of a network is proportional to the number of participants (nodes?), but the overall value is proportional to the

[1] See https://en.wikipedia.org/wiki/Network_effect.

square of the number of participants. To maximize the value of Field Day, I wanted to maximize attendance-- bring together as many of our interesting, knowledgeable, and entertaining members as possible.

In my messages promoting Field Day, I have tried to convey the diverse environment we have succeeded in creating at our Field Day: Well-equipped operating stations (transceivers and antennas) so a serious operator--a contester even--can run up a lot of QSOs in a short time; but enough common space for members to congregate over snacks or a meal and get to know one another better. Maybe learn or teach something, face to face, about this sprawling hobby of ours. After recharging their biological batteries, members are ready for their next stint at a radio microphone or key. "Eatin', Operatin', and Educatin'..."-- It's what we aim for.

To create a convenient environment, in 2015, with help, Dan, KW2T, and I provided a third, "express lane" operating station (to supplement the typical two) to minimize wait times for anyone to get on the air. In practice, there were almost no wait times to get on the air, though this freedom was something of a luxury, given the effort required to set up and manage the third station. An infrastructural challenge was that our excellent overall collection of five HF antennas (80m through 10m) are accessed via a 2x6 multiplexing switch (no 3x6 option), so a separate, single, antenna was required.

The ARRL FD rules allow for a separate GOTA (Get-On-The-Air) station that doesn't raise the base entry class. We chose not to support one because it is restricted to use by "generally inactive" licensees or new licesees. We decided that the few users who met these criteria could easily be supported on the two or three base entry (e.g., "2A") stations.

Another incentive we tried was to award each NVARC member who participated with the official ARRL annual Field Day pin, suitable for wearing on a shirt, lapel, or hat and serving as a keepsake. (Those of us who serve as Boston Marathon Amateur Radio volunteers are presented with a similar, custom Marathon pin.) In this regard, there is some financial restriction: The ARRL pins are nominally $6. each, and that must be paid from a member's $15. annual dues. This year we decided to redirect those financial resources toward an upgraded Saturday evening dinner. We still, however, offered to subsidize $3 of the cost of a FD pin for those members desiring one.

To sum up, if I have accomplished one thing up to this point, I hope to have established a norm for people to look forward to Field Day, knowing they'll find a good "impedance match" between their interests and orientation toward operating, as well as a tasty dinner of their choosing on Saturday evening. Let's keep shooting for 100% attendance.

These are the folks who brought you a first-rate Field Day. Great big thanks!

- Stan Pozerski, KD1LE
  Mowing, laptops, dipoles, filters, cables, floors, guys, transport.
- Jim Hein, N8VIM
  Rural electrification: 5kW generator, electrical distribution, cables, networking.
- Bruce Blain, K1BG
  Station captain, transceiver & acc., N1MM, antenna switch, as well as many QSOs.
- John Griswold, KK1X
  Station captain, transceiver & acc., tent.
- Michael Solt, NC1V
  VHF Station captain
- Leo Hunter, K1LK
  Canopy tent and food preparation.
- Bob Johnson, AB1CV
  Lemonade, water, cookies, Quartermaster extraordinaire.
- Jessica Kedziora, WU3C
  Chief breakfast provider.

*d*e Jim, AB1WQ

On Contesting
***de* Bruce, K1BG**

After last month's article, I got a number of questions. I'd like to address two of them.

Q: "How does someone participate in a CW contest when their code speed is not very fast?"

A: Here is a tip when you are starting out. Tune the band listening for a strong station calling "CQ TEST", who is just sitting on a frequency and "running". Listen to him work several people in a row. In most contests, the exchange NEVER changes. So, listen to the station work a number of people, until you have their callsign and exchange correctly

written down BEFORE you call them. This is a form of "searching and pouncing"

You'll never have to ask for a repeat because you already have the information correct. And you don't have to be anxious about being slow or missing the info because you already have it. This is how I learned CW contesting. You will get the hang of it quite quickly. BTW, a changing exchange usually means a sequential serial number is part of the exchange. So be prepared to recognize that, incrementing the serial number with each contact until he calls you.

While I was working with Peter, N1ZRG during Field Day this year, I asked him to try something new. He called "CQ QRS TEST", meaning CQ contest, but slow. He did this at about 15 words per minute. I was amazed at how many people respected his QRS (slower speed) and how many people worked him that way.

Q: "Are there slow speed contests?"

A: Once a year, there is an ARRL "Rookie Roundup" CW contest. See: http://www.arrl.org/rookie-roundup

While you might not be a rookie, you can participate, and there are sure to be slower stations on.

Three times a year, the CW Ops CWT contests (https://cwops.org/cwops-tests/) are conducted at a maximum speed of 20 WPM.

That's it for this month. If you have any questions, please direct them to bruce.blain@charter.net.

73, *de* Bruce, K1BG

A 6 Meter 100W Amp The Easy Way

***de* Dan, KW2T**

There is a new RF power transistor out that works really well for ham radio power amplifiers. Here's a quick way to make a 6 meter 100W amp from a vendor-supplied demo board and kit.

The part is the NXP MRF101, which is kind of strange, to see a part from NXP with the old Motorola prefix in the part number. But this is explained by the purchase of Freescale by NXP, and Freescale was a rename of the Motorola Semiconductor group when it was sold. Most of the Motorola line of RF transistors had part numbers that started with "MRF", which for most RF designers indicated the Cadillac for high power stuff.

FET Evolution

Regular FETs have been around since the late 1960's, and make up the vast majority of semiconductors in every computer and cell phone. However, due to their design's geometries on the silicon, they just can't handle any significant power: the channel where the current flows does not have a good thermal path to a heatsink.

In the 1970s some people at Siliconix got the idea to make the channel path vertical by cutting down into the silicon and putting the gate vertically in a V-groove, making the heat flow closer to the drain.

Now one could get some significant power out! Almost all switching power supplies today use "Power FETs" which go back to this design.

RF power amplifiers designers can also take advantage of this innovation, but there are limitations due to internal capacitance that keep operation to below 500 MHz.

LDMOS FETs as RF Power Amplifiers

Then someone figured out how to diffuse the gate channel *sideways* into the semiconductor from that vertical groove - voila: Lateral Diffusion, which addresses the capacitance issue. These days, LDMOS FETs work up to 5 GHz.

Another advantage to this arrangement is that higher voltage operation is possible, which further helps increase the limit on power output.

Nowadays, every cell site, FM, and TV broadcaster is using LDMOS power FETs.

Recent Developments

In the last year, NXP has released two new parts that are very interesting to Amateur operators. These are RF LDMOS power FETs. One is rated at 300W and one at 100W.

The high power one is the MRF300, the low power one MRF101. Mouser has both of these, for $30 and $18, respectively, in 25 quantity. There are some neat features that these parts share.

First, they are both rated for 1.8 to 250 MHz. That covers a few ham bands. They are both rated up to 50V power supply (breakdown of 133 Volts) but are spec'd from 30-50V. Both are packaged in inexpensive plastic packages: the MRF101 in the very familiar TO-220 tab package. And, rather unusual-

ly, they both have the metal tab as the Source of the FET, not the usual Drain of most power FETs.

So, in most cases, you can just ground the tab to the heatsink with no insulator required. Solder the tab to a block of copper, which works great for heat spreading.

Yet another unusual feature of these devices is that they both come in 2 varieties, an A and a B part. One has the gate on the left and drain on the right, the other has it flipped around.

By providing these gate/drain "mirror image" parts, with the Source on the tab and center pin, NXP has made possible push-pull PCB layout geometries that allow operation up to 250 MHz, even though the parts are in inexpensive packages.

These are really nice parts for just about any Amateur radio power amplifier. Two 300W parts in push-pull and you are only 3dB down from a KW. And for the small portable amp to take camping, one small part does 50-100W.

Another really cool spec on this part is the gain. The 100W part has a gain of 23 dB at 50 MHz, which means you need ½ W drive to get 100W out. This would be a good match for the Tech Night Radio, since its output is to be ½ watt.

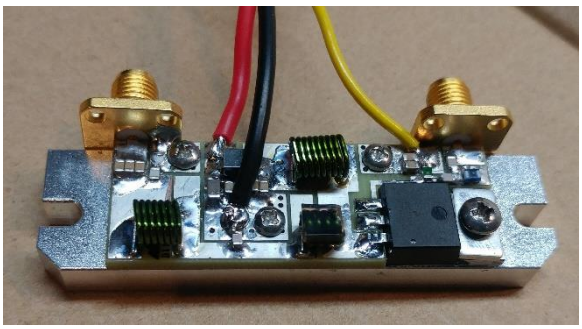
The 300W part is even more amazing, it has 27dB gain, which means you need ½ W drive to get 300W out! Or a pair of them, 1W to get 600W! Pretty amazing. If nothing else, you can put a nice resistive pad on the input to make sure everything is nice and stable, and drive it with your 10W rig easily. The part's data sheet is at:

https://www.nxp.com/docs/en/data-sheet/MRF101AN.pdf

An Easy 100W 6M Amp for Amateurs

An easy way to build your own 100W 6M amp, would be to buy the NXP MRF101A experimenter's kit, available from NXP for $50. The starter kit's specs are at:

https://www.nxp.com/products/rf/rf-power/rf-ism-and-broadcast/1-600-mhz-broadcast-and-ism/mrf101an-rf-essentials-kit:MRF101AN-START-KIT



Assembled 6M version

The kit includes the board, connectors, heat sink interface block, and 2 MRF101 parts. You purchase coils & caps separately depending on the band you want.

In this article, a single transistor is matched for 50 MHz, but you can build the amp for other bands, or even a broad-band version with RF Transformers, and you can get more power by using multiple parts. Since the Tech Night Radio could be built for other ham bands, one could do different versions of the radio and this power amp for any other band from 137KHz to 222 MHz.

I acquired one of these and the additional caps, coils, and resistor, one needs for a 6M configuration, and plan on running the kit through its paces.

In a future installment, I'll detail the additional components needed (a low pass output filter, a bias supply for the gate, and a big heatsink), and describe the experimenter's kit, its construction, and measured performance. Stay Tuned!

de Dan, KW2T

MF/LF Propigation on the 630 and 2200m Bands a Whole New Ballgame

de Phil, W1PJE

US amateurs now have a new set of bands to use at longer wavelengths than the traditional 160m "Top Band": 630 meters, and 2200 meters. At these wavelengths, every practical antenna is electrically short! It turns out that propagation is also very different as well, and this is of interest to NVARC's growing population of 630 meter users, led for example by Bob W1XP's pioneering work back when experimental licenses were required.

At these very long wavelengths - below the commercial AM band - it turns out that the combination of the vertical structure of the ionosphere, and its strongly magnetized nature, mean that complex factors, not just the frequency, are very important to how signals propagate away from your antenna.

One of these factors is polarization, which is not in most peoples' wheelhouse of concern, since at HF frequencies, of course, both ordinary (O mode) and extraordinary (X mode) propagation typically experience more or less equivalent attenuation within a few dB.

O and X are the two modes allowed by magnetoionic propagation theory within the ionospheric

plasma at angles not directly along the magnetic field[2].

In other words, on the traditional bands, horizontal and vertical polarization can both work well.

But on 630 meters and up, one enters an interesting region where the frequency of the transmitted wave is below or in the neighborhood of the electron gyro frequency, defined as the rate at which electrons spin around the background magnetic field lines. These values are a approximately a few hundred kHz to 1.8 MHz in our planet's magnetic field.

Depending on the exact frequency of interest and on the structure of the ionosphere, the wave starts interacting strongly with those electrons in the ionosphere, and one can get situations where the O mode is completely attenuated and only the X mode propagates - or vice versa! So which polarization works well here? The classic answer: "It depends".

Furthermore, the refraction of these very long rays is happening in the D and lower E regions (70 - 110 km altitude), meaning the first-hop distance is shorter and the ray spends more time in the highly absorptive D region where there are few charges and mostly a neutral atmosphere. You might think "well, then it all gets absorbed and nothing gets through, right?". But that's not the full story either: the absorption is much less at night and sometimes even gets through during the day. Add in the presence of NEGATIVE IONS (yes, negative ions) (*) in addition to positive ions, and you have a complicated and at times totally unpredictable result. Fuel for the curious mind!

I point Signal readers to the excellent foundational article by Carl Luetzelschwab K9LA (**) entitled "Propagation on 630-Meters and 2200-Meters":

http://k9la.us/Dec18_Propagation_on_630m_and_2200m_-_revised_24Dec2018.pdf

Carl updated this theoretical article with some real world information in a recent HamSCI forum booth talk at Hamvention 2019 - the slides are also highly recommended:

https://hamsci.org/sites/default/files/publications/2019_Hamvention/20190518_1300-Carl_Luetzelschwab_K9LA.pdf

After these, the August 2019 QST article by Robert Logan NZ5A describing long term experiments at MF and LF would really get you up to speed on the interesting properties of these new bands.

But one of K9LA's conclusions is worth quoting here: "We have a lot to learn; Document your efforts; Report to the world (or at least to HamSCI!)" So once again, NVARC can play a key role in advancing understanding of LF and MF propagation. I'm looking forward to what emerges.

de Phil, W1PJE

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(*) Atmospheric chemistry is ferociously complex in the D region below 90 km altitude, exceeding the worst nightmares anyone had when taking their final exams in high school or university. Consider that the Södankyla Ion and Neutral Chemistry model, pretty much the world's most comprehensive treatment of atmospheric chemistry at D region altitudes, has "70 ions and 400 ion-neutral reactions, and over 2000 ion-ion recombination reactions." No, that's not a typo! (If you really want to dig more, see Verronen et al, J. Geophys. Res., 110, A09S32, doi:10.1029/2004JA010932, 2005. But I warned you.)

(**) Carl K9LA is a modest fellow but is probably the definitive word in the ham universe on the subject, being the author of the 2019 ARRL Handbook section titled "Propagation Below the AM Broadcast Band" as well as the longtime World Radio / CQ Plus magazine propagation column which he inherited from the legendary Robert Brown NM7M.

NVARC Swap Shoppe

The following items are available for a donation to the NVARC Treasurer; monies to be paid to the Treasurer. Items to be picked up from Stan, KD1LE:

- Kenwood TM-D700A dual band radio body $25
- An almost complete Kenwood TM-D700A with remote adapter panel but no serial cable or microphone $45
- MFJ 944 Versa Tuner II $20
- Henry Electronics two meter amplifier 1 to 5 watts in 80 watts max out $25
- KLM 10-70B two meter amp 10 watts in 70 watts out $25
- Ranger Communications RCI-600 VHF/FM Marine Radio with microphone. Looks brand new/unused $45
- Stanley Electric pencil sharpener $5
- Velleman VTSS5 soldering station $5
- GE External speaker $5 (there are two)
- Yaesu FT 7800 with Kantronics 3+ attached $40
- Yaesu FT 7800 marked"hot on transmit" $5

[2] [Ed: Cf: https://en.wikipedia.org/wiki/Electromagnetic_electron_wave]

- MFJ 12728BX mic/tnc switch $5
- MFJ 12738BTV mic/tnc switch $5
- HP V1905-24 poe switch $50
- Regency ARU9PLRH606B don't know what it is, but it has a nice heat sink, looks like a VHF transceiver vintage $10
- MFJ Versa Turner II MFJ-949E $50
- LINKSYS WRT54G, BEFSR41,BEFW11S4 $5 each

Board Meeting Notes

Attendees:

Stan, KD1LE
John, KK1X
Ralph, KD1SM
George, KB1HFT
Jim, N8VIM
Bruce, K1BG,
Jim, AB1WQ

- $21.00 in picnic expenses were reported.
- Pete Hoover can't do September - Bruce volunteering for CW Ops presentation Have Skip check with Pete for October meeting?
- Reviewed Field Day expenses. $121 over budget, but some late decisions (pins) caused a change from our expectations. Food expenses were about double the expectation (i.e. budget). We did eat well.
- Coffee mugs need to be replenished. $2.55 ea. for a gross - it lasted 16 years. Ralph to check pricing for 72.
- Bruce turned in receipts for science fair prizes.

de John, KK1X

Treasurer's Report

Income for July was $50 from membership renewals, $4 from ARRL membership renewals, and $10 from Field Day meal ticket sales.

Expenses were $84 for ARRL Field Day pins (50% to be reimbursed by those receiving the pins), leaving a net expense for the month of $20.

Donations from the sale of miscellaneous items of the estate of Larry Sweezey W1ESR brought $20. Per custom these donations are placed in the Community Fund for future use to contribute back to our local communities.

Current balances:

General fund	$3,053.06
Community fund	$5,616.52

As of 1August we have 50 members who are current with their dues and 16 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.

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

Calendar

August

3 North American CW QSO Party 1400-1800Z
http://www.ncjweb.com/NAQP-Rules.pdf

17 North American QSO Party: SSB 1800-2359Z
http://www.ncjweb.com

17/18 International Lighthouse Lightship Weekend 0001Z – 18Aug, 2400Z
http://www.illw.net

17/18 ARRL 10GHz & Up
http://www.arrl.org/10-ghz-up

18 Flea at MIT 0900-1400Z
http://w1mx.mit.edu/flea-at-mit/

18 ARRL Rookie Roundup: RTTY 1800 – 2359Z
http://www.arrl.org/rookie-roundup

18 Flea at MIT
http://w1mx.mit.edu/flea-at-mit/

18/19 North American QSO Party – SSB

25 Western CT Hamfest 8 a.m., Sunday, August 25 at Edmond Town Hall, 45 Main Street.
hamfest@cararadioclub.org.
Website: hamfest.cararadioclub.org . VE exams.

31 World Wide Digi DX Contest 0000Z – 1SEPT, 2400Z
https://ww-digi.com/

September

6/7/8 Northeast HamXposition @ Boxboro
https://hamxposition.org//

21 New Jersey QSO Party 1600 – 0359Z
http://www.k2td-bcrc.org/njqp/njqp_rules.html

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

Advertisers

For Sale: CV-591A/URR SSB Converter for R-390A receiver:

Plugs into the IF input of a radio. Interior is pristine, w/all tubes. Never powered it up. $200 or BO. Contact George, KB1HFT: george.kavanagh@comcast.net.

NVARC
Nashoba Valley 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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