By Ev Tupis, W2EV

BEACONNet

Dust off your packet radio TNC and use it to identify band VHF openings!

Imagine a system that can probe the ether for propagation anomalies, pursue long distance transmissions via meteor-trail refraction and allow VHF contest rovers to announce their locations as they move from grid-to-grid using nonassisted all-amateur means. If Amateur Radio had a versatile Swiss Army knife, it may very well be called BEACONet.

The introduction of the BEACONet concept occurred in the November 1999 issue of *QST*[1]. That issue contained an article that described setting up a packet station to "bounce" signals off the ionized trails of Leonids meteors. Since that time, the system has grown to encompass a much broader visionary experiment for the summer of 2001 that includes 24/7 propagation experimentation, and has assumed the name: BEACONet.

Think of BEACONet as a sort of an "ether tester." When the RF path is "open," signals will propagate. When the RF path isn't open, they won't. No matter what the condition of the RF path, BEACONet will be able to display it for participants graphically, using software called *UI-View* on their *Windows*-based computer.

[1]Notes appear on page 00.

Figure 1—This is a simulation of the 2-meter band "at rest" (147.585 MHz), as viewed from BEACONet station KJ4X. Notice that only icons representing local stations appear on the map.

Figure 2—This is a simulation of a band opening in progress. Notice that, in addition to the local stations, others have appeared on the map as well.

Would you be surprised to know that this system is based on AX.25 packet radio technology? Don't be. Packet is a much-maligned mode that is capable of much more than simple "BBSing." The BEACONet concept takes known packet technology to the next level by using it as a basis on which to build a multifaceted, graphical, continuous propagation-plotting system. No matter what your band of interest (at present: 10 meters, 6 meters, 2 meters and 125 cm), BEACONet has something to offer.

The concept is straightforward: establish a network of stations that periodically transmit their call signs, locations and a few station-specific items (such as power output, antenna type, etc) and let a computer program decode any received information to a map. As conditions ebb and flow, stations will enter and retreat from range right before your eyes (see Figures 1 and 2). The system will instantly display not only the fact that a band is open, but also in what direction and how far! While at first, it may seem like a 21st century version of a standard propagation beacon system, BEACONet is so much more.

According to the Amateur Extra ques-

The Frequency Is In Use: How To Peacefully Coexist

It is always best to use the good amateur practice of listening before participating. In some areas of the country, it is possible that a BEACONet frequency may be used for simplex voice communications. If this is the case, it may be possible to determine a time of day in which the voice users aren't likely to be active and confine your transmit participation to then.

You may confine your BEACONet activity to certain times of the day or night very easily by using a simple appliance timer. Power your TNC with it. Set it to power-on during times of the day when the frequency is clear.

Alternatively, there is nothing wrong with being a BEACONet lurker. Go through the steps outlined in the article and simply leave your TNC-to-transceiver microphone plug *unplugged*. Your system will stay in receive mode and not bother any local voice activity. The good news is that you will be able to receive and decode any DX transmissions that happen to make it into your area anyway!

Figure 3—An actual BEACONet screen shot from W4UK showing successful receptions of 147.585 MHz transmissions made during the November 2000 Leonid meteor shower.

tion pool, packet has been identified as a mode that is particularly well adapted for meteor scatter work[7]; and BEACONet proves the point. Reception reports exceeding 1000 kilometers are not uncommon for "Meteor Mode" experimenters (see Figure 3).

It is even possible for Rover-category VHF contesters to place a BEACONet transmitter and GPS receiver in their vehicles. Doing so allows them to transmit their location precisely, allowing anyone in range to know that they are ready and available to make contact. In this mode, BEACONet is an all-amateur, non-relayed means of communication.

For the purposes of this article, we will key-in on the propagation-tracking aspects of the BEACONet system. Of course, it is no coincidence that this is being published just as the summer sporadic-E season is about to get underway!

So Simple, So Easy...So Participate!

Dust off that KISS-capable packet TNC and get it connected and communicating with your *Windows*-based computer and transceiver. Once you've reached that point, you're about 45 minutes from being a BEACONeteer!

Follow these six simple steps to get BEACONet active:

1. Prepare your TNC for "Level-1" functionality using simple terminal software. See the sidebar "Preparing your TNC for Level I."

2. Download *UI-View* from the BEACONet Web site at go.to/BEACONet under a hyperlink titled "Turbo Links." *UI-View* will run on any Intel-type PC that is running *Windows 3.11* or newer.

3. Install UI-View on your *Windows* based computer. After downloading the program, "double-click" on the icon and the installation process will occur. *Do not* launch the program yet (this will be covered in step 5).

4. Identify your station's operational parameters and encode them into a station *Configuration Code*. You'll encode things like: operating frequency, antenna gain, power output, etc, into a 6-character field that others will receive...allowing them to analyze the communication circuit more accurately.

If you wish to skip this step, simply use the value of "CQ" with nothing else and continue to the next step. However, by spending a little extra time here, you can help to provide others with valuable data to analyze. The Configuration Code will take the following form: **BSNPAH-D**.

B = Band. For the purposes of this article, this value is either "H" for HF or "V" for VHF[8].

S = Segment. For the purposes of this article, this value is one of the following (depending on which BEACONet frequency you choose to operate on). Y=28.128 MHz, B=53.530 MHz, K=147.585 MHz, S=223.780 MHz. See Table 1 for a more detailed explanation of the BEACONet frequency-labeling system.

N = Network personality of your station. This can be a little confusing. For your TNC: use the value of 1 if your TNC is a Kantronics with ROM 8.2 or above.

Preparing your TNC for Level I

The BEACONet system is designed to be able to operate, even if you don't wish to leave your computer powered-on. By following the Level I instructions, you will be able to power-off your computer but leave your TNC and transceiver "on" to provide a signal that others can listen for, should the band "open" for long distance propagation. Once again, even if you can't leave your computer powered-on all the time, be sure to leave your transceiver and TNC functioning for others to use as signal sources!

Do not skip this step. Open a communications terminal session between your computer and TNC. Connect to the TNC and follow the instructions that are associated with the type of TNC that you own.

TNC Function	Kantronics w/ROM 8.2 or greater	TNC2 or compatible
Restore factory default values	RESTORE D INTFACE TERM	RESET
Set TNC call sign	MYCALL	MYCALL [your call]
Configure your Grid (6 characters)	4T 1 [your grid][11] UNPROTO	BTEXT [your grid] *BSNPAH-D*[12]
Transmit once every 5 minutes	BLT 1 EVERY 00:05:00	B E 30[13]
Activate network support	UITRACE HOP,60	Not applicable
Decode with squelch "open"	CD SOFTWARE	Not applicable

Table 1
Transmit Frequency Designators
Note: All frequencies are shown in MHz. Amateur bands are in **bold** type.

	(X)tra Low	*(L)ow*	*(M)ed*	*(H)igh*	*(V)ery High*	*(U)ltra High*	*(S)uper High*	*(E)xtra High*
0	0.003	0.030	0.300	**3**	30	300	**3000**	30000
A	0.004	0.040	0.400	4	40	**400**	4000	**40000**
B	0.005	0.050	0.500	5	**50**	500	**5000**	50000
C	0.006	0.060	0.600	6	60	600	6000	60000
D	0.007	0.070	0.700	**7**	70	700	7000	**70000**
E	0.008	0.080	0.800	8	80	800	8000	**80000**
F	0.009	0.090	0.900	9	90	**900**	9000	90000
G	0.010	0.100	1	**10**	100	1000	**10000**	1000000
H	0.011	0.110	1.1	11	110	1100	11000	**1100000**
I	0.012	0.120	1.2	12	120	**1200**	12000	**1200000**
J	0.013	0.130	1.3	13	130	1300	13000	1300000
K	0.014	0.140	1.4	**14**	**140**	1400	14000	**1400000**
L	0.015	0.150	1.5	15	150	1500	15000	1500000
M	0.016	0.160	1.6	16	160	1600	16000	1600000
N	0.017	0.170	1.7	17	170	1700	17000	1700000
O	0.018	0.180	**1.8**	**18**	180	1800	18000	1800000
P	0.019	0.190	**1.9**	19	190	1900	19000	1900000
Q	0.020	0.200	2.0	20	200	2000	20000	2000000
R	0.021	0.210	2.1	**21**	210	2100	21000	2100000
S	0.022	0.220	2.2	22	**220**	2200	22000	2200000
T	0.023	0.230	2.3	23	230	**2300**	23000	2300000
U	0.024	0.240	2.4	**24**	240	**2400**	**24000**	**2400000**
V	0.025	0.250	2.5	25	250	2500	25000	2500000
W	0.026	0.260	2.6	26	260	2600	26000	2600000
X	0.027	0.270	2.7	27	270	2700	27000	2700000
Y	0.028	0.280	2.8	**28**	280	2800	28000	2800000
Z	0.029	0.290	2.9	**29**	290	2900	29000	2900000

Table 2
RF Output Designators

Designator	Output
0	<2 mW
1	2 mW
2	4 mW
3	8 mW
4	16 mW
5	32 mW
6	64 mW
7	125 mW
8	250 mW
9	500 mW
A	1 W
B	2 W
C	4 W
D	8 W
E	16 W
F	32 W
G	64 W
H	125 W
I	250 W
J	500 W
K	1 kW
L	2 kW

The values above should be understood as "starting at this level and continuing until the next level is reached."

Table 3
Antenna Designators

Note: Unless you are certain of your antenna's gain, use the element count.

Gain Designator	Gain (dBd)	Element Designator	Element Count
A	0	0	1
B	3	1	2 or 3
C	6	2	4 to 7
D	9	3	8 to 15
E	12	4	16 to 31
F	15	5	32 to 63
G	18	6	64 to 127
H	21	7	128 to 255
I	24	8	256 to 511
J	27	9	512 to 1023

If it is not, then use a value of 0. For *UI-View*: Use a value of 1, without regard as to the type of TNC you have. Yes, it is possible to have a different Configuration Code programmed into your TNC than used within *UI-View*. This all comes down to identifying your station's ability to respond to future BEACONet network functions (visit the Web site for a more in-depth discussion of this topic).

P = Power output. Use Table 2 to determine the correct value.

A = Antenna gain or Yagi element count. Use Table 3 to determine the correct value.

H = Antenna Height Above Average Terrain (HAAT). Use Table 4 to determine the correct value.

D = Directivity vector of the antenna. Use Table 5 to determine the correct value.

For examples of some common Configuration Codes, see Table A.

Assemble your Configuration Code from the tables, write it down and proceed to Step 5.

5. Set up *UI-View* with your personal station information and input the station Configuration Code that you calculated in the previous step. This is considered establishing a Level-II graphical station.

Before doing any "in program" reconfigurations, it will be necessary to edit *UI-View's* initialization file. That file isn't created until you launch the program for the first time. So, launch the *UI-View* software that you had previously installed. A notice that "This looks like a new system" will greet you. Press the **OK** button. Next, a pop-up window titled "Quick Start Guide" will need to be closed. Lastly, exit from the program entirely.

In your *UI-View* folder, edit (using *Notepad*) the file called *UI-View.ini*, scroll to the end of the data file. Adding the following statements to the end of that file will prepare your system for proper BEACONet operation in the future:

[DIGI_OPTIONS]
UIFLOOD=
UITRACE=HOP

Save the file and exit.

There is one last piece of housekeeping to take care of. There is a useless map that comes with the distribution of the software. It offers no substantive advantage to keep, and tends to clutter your screen later. Now would be a good time to simply delete it. Go to your *UI-View* folder, enter your Maps folder and delete *Colorado.gif* and *Colorado.inf*. The remaining maps are of Europe, the UK, the USA and USA/SouthernCanada'.

Assure that your TNC is on and launch *UI-View* again. Your screen will show a map of the UK and a notice that the software isn't registered". Select **OK**. From the drop-down menu titled "Map," select the option "Load a Map" and select the one titled "The USA."

Configure UI-View *to talk to your TNC correctly*

Setup\Coms Setup

Close the Pop-up Notification window and the Help window that follows it.

Setup\Coms Setup (again)

Set Baud Rate, Parity, Data Bits, Stop Bits and Com Port to communicate with your TNC properly

From the Drop-menu titled "Host Mode," select "KISS"

Press the **Setup** button to the right of "Host Mode"

Under "Easy Setup," select the button that most closely describes your TNC (TNC2, Kantronics, etc)

Press **OK** and **OK** again, returning you to the map screen.

Configure UI-View *with your station information (note: enter only the parameters noted, leaving others blank or at default values)*

Setup\Station Setup

Close both pop-up windows that appear

Setup\Station Setup (again)

Call sign = your Amateur Radio call sign

Unproto Address = the Configuration Code from the previous section'

Beacon Comment = [GR##ID]
e-mail@host.com

Where: [GR##ID] is your 6-character Maidenhead Grid Locator, placed between square brackets and your e-mail address is included to make reception reports easier

UI-View Tag = **BB**selected

Beacon Interval Fixed = 5

Select **OK**

Advertise your connection with the BEACONet project:

Table A

Frequency	Network Function*	RF Output	Antenna	HAAT	Pointing	Config Code
28.128 MHz	UI-View software	100-W	½-wave vertical	30 feet	Omni	HY1G02-15
147.585 MHz	UI-View software	160-W	4-element Yagi	40 feet	Due South	VK1H23-6
53.53 MHz	UI-View software	100-W	½-wave vertical	60 feet	Omni	VB1G00-15
223.78 MHz	UI-View software	120-W	10-element Yagi	50 feet	Due East	VS1G43-3
28.128 MHz	TNC2 (Level-I)	25-W	4-element Yagi	20 feet	West	HY0E22-9

Setup\Status Text

Status Text = Stay connected with BEACONet at: **go.to/BEACONet**

Select **OK**

There is a feature of BEACONet operations that will support the need for digipeating certain types of information. This will support a future feature of BEACONet. Please do not skip this step unless the program tells you that your Host mode doesn't support digipeating.

Setup\Digipeater Setup

Close both pop-up windows that appear

Setup\Digipeater Setup (again)

Enable Digi = x

Alias Substitution = x

HOPn-N = x

NOTE: leave WIDEn-N unchecked for now

Alias(es) = your call sign

Sub Alias = your call sign

Dupe Secs = 60

Select **OK**

Normally, *UI-View* will cause icons to disappear from the screen once 60 minutes have elapsed without a reception from a given station. Once we've reached a critical mass of participants, this will be a nice feature. However, until then it may be a good idea to set the icon expiration time to 24 hours (1440 minutes). You can leave the system functioning and check it periodically to see what it caught over the previous 24 hours!

Setup\Miscellaneous

Expire Time = 1440

"More" in detail windows = x

Note: leave all other items at default values

Select **OK**

Lastly, you may wish to setup *UI-View* to display field and grid lines to make for a nicer visual display:

Options\Show Grid Squares

6. Power-up your transceiver and see what comes your way!

Tune your transceiver to one of the several BEACONet frequencies: 28.128, 53.530, 147.585 or 223.780 MHz. With the exception of 28.128 MHz, which utilizes the USB mode, all other BEACONet operations take place using FM. The most popular bands are 10-meters and 2-meters. Interest on the 6-meter band is growing, with pockets of activity in the Northeast and Southwest. The 223-MHz band has just recently been added to the BEACONet repertoire, with sparse activity to date.

Although there is a high probability that these frequencies are vacant in your area, please follow the good amateur practice of listening for a period of time before transmitting. Pockets of FM voice activity have been found on 147.585 MHz. By listening first, and making contact with other users of the frequency in your area, you may be able to determine what time(s) the frequency is not used and occupy it then. You may even be able to persuade existing users of the frequency to join you in your Summer/Fall 2001 BEACONet endeavors.

Table 4
Height Above Average Terrain Designators

Designator	*Height (in feet)*
0	(up to, but not including, 10 feet)
1	10+
2	20+
3	40+
4	80+
5	160+
6	320+
7	640+
8	1280+
9	5120+

Table 5
Antenna Directivity Designators

Designator	*Direction (+/–15° unless otherwise noted)*
–0	undisclosed
–1	30°
–2	60°
–3	90°
–4	120°
–5	150°
–6	180°
–7	210°
–8	240°
–9	270°
–10	300°
–11	330°
–12	0 or 360°
–13	undefined
–14	undefined
–15	omnidirectional

Odds and Ends

For the sake of simplicity and ease of participation, VHF BEACONet uses 1200-baud packet on a standard FM carrier. While FM is far from optimal within the context of maximum efficiency of communication, it provides a noncritical tuning component that makes the system extremely easy to use. The use of FM makes the system as close to "plug and play" as it can be—mostly due to the proliferation of FM transceivers. In retrospect, this has proven to be an excellent compromise.

Ten meters is a different story. At present, FM-based data communication is prohibited in the US, even though it is the only HF band on which 1200-baud data is allowed. As such, BEACONeters

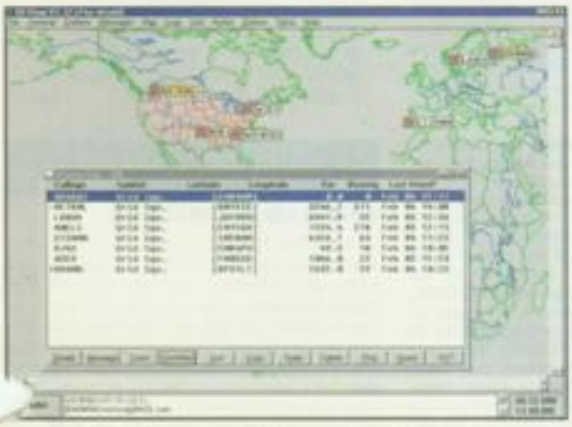

Figure 4—This is a screen shot from WD4RBX showing BEACONet in action on 28.128 MHz in February of 2001. Compare this screen shot to Figure 5 taken on the same day, but from N1NCO.

Figure 5—A view of BEACONet 10-meter activity from N1NCO.

Establishing a BEACONet Hub

This information is for those folks who see the true potential for this system, and are in a position to provide continuous BEACONet service to the amateur community. All it takes is a TNC (Kantronics-brand preferred), transceiver (the higher power, the better) and a vertical (omnidirectional) antenna. No other connected computer or software is required.

A Hub-class station is one that is operated without a local computer (in unattended mode) and ideally operated at altitude (house-top, tower-top, hill-top, mountain-top, etc), with high power. The TNC is configured according to the instructions found in the sidebar "Preparing your TNC for Level I." In this case, the use of a Kantronics-brand TNC (with ROM 8.2 or greater) is probably your best choice because it will provide participants with future BEACONet advantages[9].

Imagine the continent (or world, in the case of 10-meter operation) blanketed with these stand-alone Hubs, periodically pinging for propagation. Home users may come and go on a whim, but Hubs can be constant features on the BEACONet landscape. This is not unlike the NCDXF's HF CW beacon system that presently operates on several HF bands. The difference is that anyone can (and is actually encouraged to) establish a BEACONet Hub[9]. No other coordination is necessary because the TNCs CSMA[10] circuitry will do its thing to keep the frequency as QRM-free as possible. The more Hubs (or any participants) that exist, the better the BEACONet system works!

With enough participants, it will be possible to visually identify band openings in progress, easily charting their course and destination. Establish a Hub or two if you can. Join- n on the pioneering spirit that is Amateur Radio!

tune 28.128 MHz USB. At this part of the solar cycle, 10 meters can be open for world-wide communication. Figures 4 and 5 illustrate this fact quite well.

As previously mentioned, the system is based on UI-Frame AX.25 packet radio technology. This is the same technology on which the APRS system is based—a similarity that ends there. Rather than being a tactical and emergency communications system, BEACONet is—in a broad sense—a real-time propagation-experimenter's tool.

Antennas are generally vertically polarized. This makes for easily obtained omnidirectional patterns, a major advantage when you don't know to which direction the band may open at any given time. Additionally, this affords a little extra isolation to the VHF SSB/CW operator who may choose to use BEACONet as a supplementary propagation-monitoring tool in support of chasing DX or Rovers on the low end of the band.

BEACONeters use a variety of methods of staying in communication with one another (when the bands aren't propagating, that is). One method is through the official BEACONet Web site at **go.to/BEACONet**. Another is through an Internet e-mail list. Information on joining the Tucson Amateur Packet Radio (TAPR) sponsored remailer is found on the Web site.

The Summer Season Starts to Sizzle

BEACONet is designed to regularly test for anomalous events. Sit and wait, periodically checking your screen to see if anything was caught. Think of this as a digital fishing trip. You can go a long time with nothing, only to be rewarded with "the big one" when you least expect it. When the band opens, icons will magically appear on your map.

The summer months are known for a great deal of Sporadic-E (E_s) propagation on the 10, 6 and 2-meter bands, and tropospheric inversions on 2 meters and 222 MHz. This would be an excellent time to set up your BEACONet station and let it run continuously. Who knows? You may be the one to alert others to a band opening in progress! The experiment is slated for the Summer and Fall of 2001. Come join the fun!

Notes

[1]An update and follow-up article on the use of the BEACONet system for meteor scatter work appeared on the ARRLWeb in November 2000.

[2]The "Meteor Mode" application of BEACONet has even spawned Web sites that are dedicated to keeping folks informed of that facet of activity. Rich Parry, W9IF, has developed one such site at **go.to/METEORegistry**.

[3]HF encompasses the frequencies from 3 to 30 MHz. VHF is defined as the frequencies from 30 to 300 MHz.

[4]This identifies the personality of your station from the perspective of the BEACONet network. If your station is capable of contributing to the BEACONet network as something more than a simple signal source, then this value will be something other than "0" (zero). An in-depth discussion of this aspect of the Configuration Code is contained on the BEACONet Web site at **go.to/BEACONet**.

[5]A world map is also available, for those inclined to be joining the participation on 10 meters. Visit the BEACONet Web site (**go.to/BEACONet**) and select the "Turbo Links" button to download it. Once downloaded, it needs to simply be moved into the *UI-View*/Maps folder in order to be accessed.

[6]*UI-View* is fully functional from a BEACONet perspective as-is. However, this is a 16-bit application that is designed to get people familiar with the program. If it is of use to you, please register it. Registration then allows use of the 32-bit version, which will continue to be developed into the future. Registration may be accomplished on-li at **www.uksharereg.com/uiview.html**.

[7]Alternately, you may simply use "CQ". While doing so is easy, participants are ***strongly*** encouraged to use a properly calculated Configuration Code to make analysis of band openings easier. Minimally, include the antenna-pointing vector as part of your CQ, with a clock-face as your guide. CQ-3 means you are using an antenna that is pointed East, CQ-9 means your antenna is pointed West, CQ-15 means you are using an omnidirectional antenna.

[8]In the future, BEACONeters will be able to utilize Hub-class stations to digipeat. The advantage is that two or more stations that are in range of each other may be experiencing differing degrees of anomalous propagation. By enabling HOPn-N call-substituted digipeating (as the Kantronics TNC does, uniquely) it will be possible to not only be given a heads-up that conditions are building, but the path that is propagating will be traceable, too! For more information, visit the BEACONet Web site at **go.to/BEACONet**.

[9]Of course, it makes little sense to locate Hubs too close together. Where multiple Hubs are established, local and regional land topology should dictate their separation distance.

[10]Carrier Sense Multiple Access

[11]You may wish to include your e-mail address after the [GR##ID], making it easy for people who receive your transmission to contact you to let you know. In that case, invoke using the format: BTEXT [FN03XD] **w2ev@arrl.net**

[12]See Step 4 for the correct values for "BSNPAH-D."

[13]Use whatever value your TNC manual states will provide one transmission every 5 minutes.

You can contact the author at 17050 LaDue Rd, Holley, NY 14470-9736; **w2ev@arrl.net**

Update!

As this article went to press, BEACONeters were experimenting with the marriage of the BEACONet concept and PSK31. This is highly experimental at this time. For more information, visit the BEACONet Web site at **go.to/BEACONet** and/or join the BEACONet e-mail list (details are available on the Web site). QST

STRAYS

HAM CLUB DATABASE 1.0

◊ *Ham Club Database 1.0* is now available. Keep track of Amateur Radio club member addresses, telephone numbers, membership status and other important details for your organization. The handy Search function lets you easily create and print mailing lists on a key word of your choosing to organize your data for a specific use. Easily copy and pa data into spreadsheet programs such as *Ex* to generate reports. The program will also search by any criteria such as ZIP code, city, call, etc. This *Windows*-based shareware is free to try and only $10 to register. Download the program from **www.a3fjp.com**.