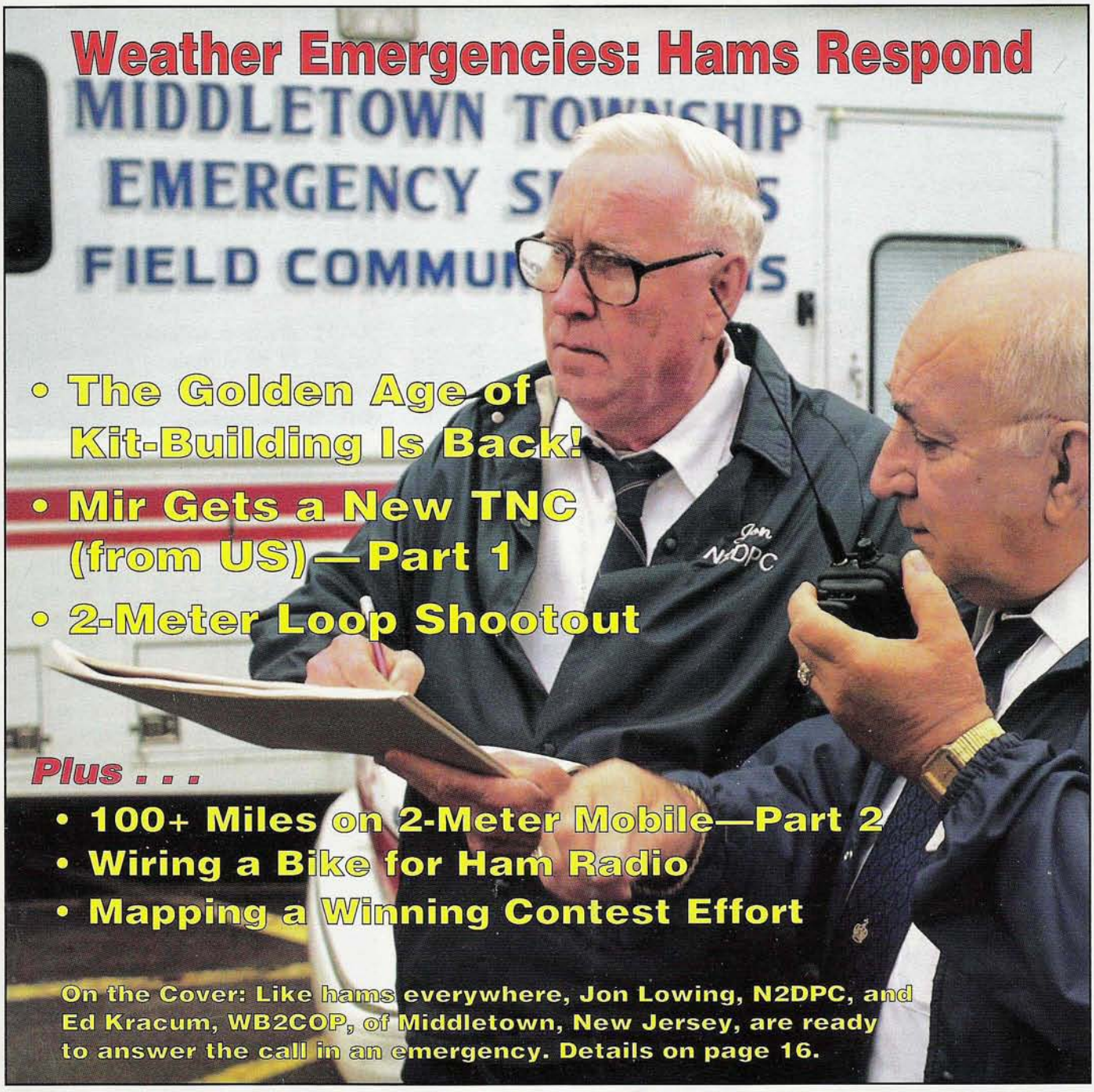
ICD 08237

CQ VHF Ham Radio Above 50 MHz

May 1998



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On the Cover: Like hams everywhere, Jon Lowing, N2DPC, and Ed Kracum, WB2COP, of Middletown, New Jersey, are ready to answer the call in an emergency. Details on page 16.

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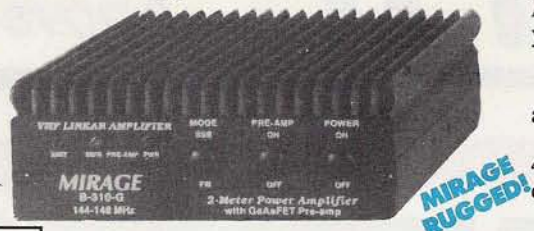

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Power Curve -- typical B-310-G output power							
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Watts In	¼	½	1	2	4	6	8

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Mirage's integrated *HeatsinkCabinet™* and whisper quiet fan gets heat out fast!

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Free 3 foot handheld to B-310-G coax cable -- just plug and play! ***Free*** mobile bracket! ***Free*** rubber mounting feet for home use!

Plus more . . .

Automatic RF sense Transmit/Receive switch. Remote keying jack. LEDs monitor "On Air", high SWR, pre-amp, power. Push buttons select SSB/FM, pre-amp, power. Draws 15 amps at 12-15 VDC.

Full one year MIRAGE warranty

With Mirage's legendary ruggedness, you may never need our superb warranty.

Dual Band 144/440 MHz Amp

$159.95 BD-35 Suggested Retail

Power Curve -- typical BD-35 output power							
Watts Out (2Meters)	30	40	45	45+	45+	45+	45+
Watts Out (440 MHz)	16	26	32	35+	35+	35+	35+
Watts In	1	2	3	4	5	6	7

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Works with all FM handhelds up to 7 watts. Power Curve chart shows typical output power.

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35 Watts for 2 Meter HTs

B-34-G

$89.95

Suggested Retail

Power Curve -- typical B-34-G output power								
Watts Out	18	30	33	35+	35+	35+	35+	35+
Watts In	1	2	3	4	5	6	7	8

- ***35 Watts Output on 2 Meters***
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- ***Custom heatsink, runs cool***
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- ***One year MIRAGE warranty***

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35 watts, FM only . . . $69.95

B-34, $69.95. 35 watts out for 2 watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

160 Watts on 2 Meters!

B-5016-G

$299

Suggested Retail

MIRAGE RUGGED!

Power Curve -- typical B-5016-G output power								
Watts Out	130	135	140	145	150	155	160	165
Watts In	20	25	30	35	40	45	50	55

The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

Ideal for 20 to 60 watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard™*.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

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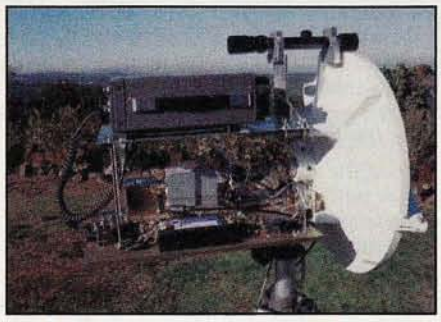

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Next Month: CQ VHF Review—Yaesu's New FT-847, by Gordon West, WB6NOA

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Are You a "Real Ham"?

There seems to be a lot of disagreement over who is and isn't a "real ham." Here's a proposal for a standardized way to qualify and certify really real "real hams."

Recently, I had an e-mail debate with a friend and long-time fellow ham over what qualifies one to be a "real ham." In his view, you were only a "real ham" if you had qualified for HF operating privileges. When I took issue with that—strongly—he "softened" his statement to say that you weren't a "fully qualified" ham if you didn't have HF privileges. Well, that got me thinking...What exactly *is* a "fully qualified" ham?

If you agree with my friend that HF privileges make you "fully qualified," then anyone with a Novice or Tech-Plus license meets the criteria. Well, then, why don't they have "full amateur privileges" on those bands? In fact, if you base your reasoning on frequency privileges alone, then only Extra class hams are "fully qualified," as they are the only hams with operating authority on all amateur frequencies. So, by that definition, I guess only Extra class hams are "real" hams.

(As an Extra class ham myself, I can assure you that this is certainly true! This is due to the magical properties of the Extra class license document itself. As soon as I took it out of the envelope, I was enveloped by a golden glow and was instantly imbued with all knowledge of everything related to amateur radio, even—especially—aspects of the hobby that I'd never tried! Unfortunately, there's a sizable number of Extra class hams who actually believe that!)

Now we've got a problem, though. If simply qualifying for HF privileges (read "passing a code test") isn't enough to make you a "real ham," then how *do* you qualify? Fortunately, there's no shortage of suggestions.

Depending on who you talk to, you're a "real ham" only if you...

- have HF operating privileges (see discussion above)
- actually *operate* HF (and preferably work DX)
- provide public service/emergency communications
- design, build, and repair your own equipment
- talk through satellites
- design, build, and repair your own satellites
- leave every hamfest with your arms full and your wallet empty
- well, you get the message...

The "Real Ham" Certification Plan

With all the different requirements and prerequisites that various amateurs place on what qualifies one to be a "real ham," it occurred to me to it would be a great convenience, and indeed, a service, to all amateurs if there was some universally recognized way to certify who is and isn't a "real ham." Perhaps there could be several levels of "real ham" certification, depending on your qualifications. A beginner's certification, for example, might identify you as a "nearly real ham," while someone who is "fully qualified," as my friend puts it, could be certified as a "really real ham."

Of course, once you get into a certification program like this, you have to deal with certain questions, such as who decides what the qualifications are for each level of certification and how you demonstrate that someone is qualified to upgrade from, say, "nearly real ham" to "barely real ham." Should there be an exam? If so, who should conduct it? How do we assure fairness and consistency? And what do we do if you *say* you're a "really real ham," but I *know* that you're only a "merely real ham?" Pretty complicated, huh?

It CAN Be Done

We *can* do it, though, especially if we can find an impartial third party to develop the qualifications for each level of "real ham" certification; perhaps design exams for each level, certify official examiners, and maybe even issue official "real ham" certificates. Maybe we could

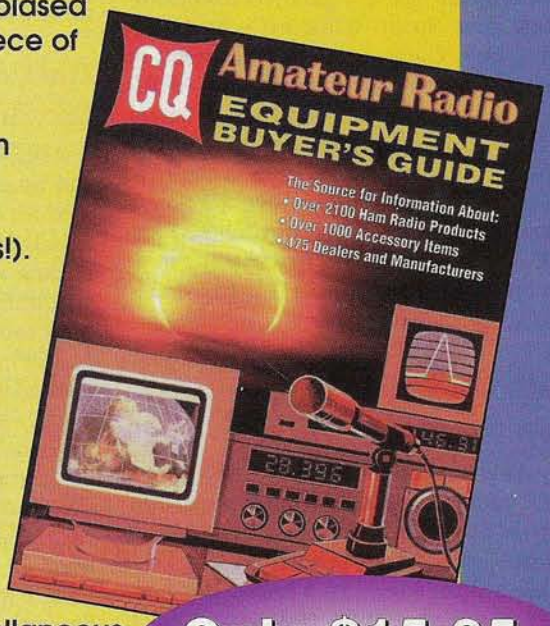
(Continued on page 70)

By Rich Moseson, W2VU, Editor

The book you've been waiting for...

CQ Amateur Radio Equipment Buyer's GUIDE

This information-packed book is your most reliable, unbiased source for detailed information on practically every piece of Amateur Radio equipment and every accessory item currently offered for sale in the United States. From the biggest HF transceiver to Ham computer software, it's in the CQ Amateur Radio Equipment Buyer's Guide, complete with specs and prices. There are over 2100 product listings (3100 including transceiver accessories!).



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The CQ Amateur Radio Equipment Buyer's Guide also includes the most comprehensive directory anywhere of Ham product manufacturers and dealers in the USA, complete with phone numbers, FAX numbers, Web sites, and e-mail addresses. Dealer and Manufacturer listings include major products manufactured or sold, and service and repair policies, where applicable, with 475 dealers and manufacturers listed. These listings alone are worth their weight in gold.

The CQ Amateur Radio Equipment Buyer's Guide is jam-packed with solid information and great reading. In addition to being an incredible source of insight into the current state of Ham Radio technology, it will continue to be a reliable Ham equipment reference source for many years to come.

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VHF News

SAREX and Senator Glenn

Two hams and the SAREX ham station will accompany Astronaut/Senator John Glenn (D-Ohio) on his upcoming shuttle flight, scheduled for October, according to various news reports. The hams on the crew will be astronauts Scott Parazynski, KC5RSY, and Pedro Duque, KC5RGG, a European Space Agency (ESA) astronaut from Spain. While not a ham himself, Sen. Glenn is a longtime friend of amateur radio and appears in the ARRL video, "The New World of Amateur Radio," speaking to students in California via the W3USS ham station at the U.S. Capitol. Glenn has also been a keynote speaker at the Dayton Hamvention. Plus, of course, he was the first American to orbit the Earth, in 1962. This will be his first trip back to space.

Mir Ham Station Back on the Air

After several months of relative quiet, the ham station aboard the Russian Mir space station is active once again—with a new packet TNC donated by *CQ VHF* (see article, page 19), a renewed schedule of school contacts and random voice QSOs by Astronaut Andy Thomas, KD5CHF/VK5MIR. In addition, the Earth-based MIREX group, which provides support for Mir amateur operations, conducted a two-hour experiment on March 10 with running APRS (Automatic Position Reporting System) through the RØMIR digipeater.

Mir has been plagued by a variety of problems in recent months, leaving the crew little time for casual ham conversation. Nonetheless, keeping the ham station on the air was a major priority, according to MIREX Education Director Miles Mann, WF1F, who says it was often more reliable than the "official" channels of communication.

P3D Nearly Ready to Fly

AMSAT officials were still awaiting word in mid-March on whether the Phase 3D amateur satellite would be able to fly on the Ariane 503 booster, scheduled for a late spring/early summer launch. As of mid-February, officials at AMSAT's Integration Lab in Orlando, Florida, reported that work was 90% complete on getting the satellite ready to fly after making ESA-mandated changes to strengthen the spaceframe. The changes, which were ordered after the loss of Ariane 501, caused AMSAT to miss its scheduled launch opportunity on Ariane 502 (which ended up depositing the satellite it *did* carry in the wrong orbit).

AMSAT Conference/Call for Papers

AMSAT-NA's 16th annual meeting and Space Symposium has been scheduled for October 16 to 18 in Vicksburg, Mississippi. Anyone interested in presenting a paper at the symposium or in submitting a paper for the *Proceedings* must submit a one-page abstract by June 1, 1998. Subjects should be "topics of interest to the amateur radio satellite service," according to the conference announcement and call for papers.

Abstracts should be sent via e-mail (Word or WordPerfect file preferred) to <w5xx@magnolia.net> or by regular mail to Malcolm Keown, W5XX, 14 Lake Circle Dr., Vicksburg, MS 39180. See the AMSAT Web site at <http://www.amsat.org> for additional details.

"The Sky Is Boiling!"

Ham radio emergency communicators were called into action in February and March in virtually the four corners of the continental U.S., as *El Niño*-influenced severe weather continued to cause death and devastation.

In mid-February, a string of tornadoes left a path of destruction across central Florida, and emergency communications help was provided by ARES and RACES as well as REACT, according to Osceola County Emergency Management Coordinator Steve Proctor. (ARES is the ARRL's Amateur Radio Emergency Service; RACES is the Radio Amateur Civil Emergency Service; and REACT, which often uses ham radio and GMRS as well as CB, stands for Radio Emergency Associated Citizens Teams.) Proctor told the *ARRL Letter* that the storm knocked out a main telephone trunking station, increasing officials' reliance on radio communication. Skywarn nets tracked the storms on February 22 and 23, and the volatile cloud action at one point prompted Paul Catineau, KF4UTN, to report that "the sky is boiling."

Clear across the country, hams in Oregon were called out when a mid-January ice storm knocked out electricity and telephone service to much of the Portland area. The *ARRL Letter* reported that ARES members provided communications help for local emergency agencies. Floods and mudslides in California kept hams busy as well. *CQ VHF* author Sam Vigil, WA6NGH (whose unrelated article appears elsewhere in this issue), reported that his search-and-rescue (SAR) unit was called up to help find the two California Highway Patrol officers who were killed when a road washout landed their car in a river. Sam says many of the SAR team members are hams and that GPS and UTM (see our last few issues) were used extensively.

Finally, *CQ VHF* public service columnist Bob Josuweit reports in detail this month on amateur radio emergency communications in California, Kentucky and the northeast. See his "In the Public Interest" column on page 42.

NFCC Proposes Coordinator Standards

The National Frequency Coordinators' Council (NFCC) has proposed a set of certification standards to its membership for approval. The NFCC is an umbrella organization of repeater/frequency coordinating bodies from across the U.S. The proposed standards would set forth minimum requirements for frequency coordinators who wish to be certified by NFCC, and would make certification a requirement for NFCC membership. However, the proposal emphasizes that both certification and NFCC membership are voluntary.

Highlights of the proposal include defining a "frequency coordination entity" as an individual or group recognized as a frequency coordinator "by a majority of the holders of coordination" within a specified service area; requiring certified coordinators to maintain a coordina-

Compiled by the CQ VHF Staff

tion database and provide key information to NFCC for a national database; and to publish their coordination guidelines and policies. NFCC members were to have voted on the proposal by March 15.

70 Centimeters Under Attack in Australia

The land mobile radio industry in Australia is reportedly going after the 70-centimeter amateur band there. "Newsline" quotes a published report as saying that the Radio Site Owners and Users Association, the land mobile industry's lobbying group, "is urging its members to campaign for the reallocation of the 380 to 400 MHz and 420 to 450 MHz bands away from their current users," and that it is warning members "that they may have to go into what amounts to a war with amateur radio to get the 70-centimeter band."

The Wireless Institute of Australia (their major ham radio organization) is already working to gain support for maintaining the status quo from the Australian Department of Defense, which holds the primary allocation on 420 to 450 MHz.

NY Times Touts VHF Ham Radio

Satellite communication, packet radio, and VHF in general are at the forefront of an article in the *New York Times*, focusing on the "new, digitally hip generation [that] is sweeping into ham radio and virtually reinventing it from the inside out." The article is titled, "Ham Radio, Version 2.0, for the Silicon Era," and it appeared March 5 in the "Circuits" section of the newspaper. It features AMSAT Executive Vice President Keith Baker, KB1SF, who, it notes, relays e-mail "through a fleet of communications satellites that he helped build," and Tucson Amateur Packet Radio's Dewayne Hendricks, WA8DZP.

"In a sense, the hams' shortwave radio spectrum was the original version of what is now called cyberspace," writes reporter John Verity, adding that "most of the innovation now involves much shorter—and therefore higher-frequency—radio waves than before." In other words, VHF. So, folks, like we've been trying to tell you: if you're reading *CQ VHF*, you're on the cutting edge of ham radio technology! A digital copy of the article can be viewed on the World Wide Web at <http://www.nytimes.com/library/tech/98/03/circuits/articles/05ham-radio.html>.

DX Operating to Get Easier

The European Conference of Postal and Telecommunications Administrations (CEPT) has approved a U.S. application to participate in the guest licensing program for amateurs who travel among CEPT countries. Holders of CEPT licenses may operate in any CEPT-participating country without having to apply for a reciprocal license.

When the final rules are in place, according to the ARRL, which lobbied the FCC and State Department to submit the application, a U.S. Technician license will be equivalent to a CEPT Class 2 license, with all privileges above 30 MHz, and Tech-Plus to Extra class licenses will be equivalent to a CEPT Class 1 license, with full HF and VHF privileges. U.S. Novices will be left out in the cold, since there is no equivalent CEPT license. ■

Letters

Your Spot to Speak Out

CQ VHF *welcomes comments and suggestions from readers. We'll print a representative sampling each month, and we reserve the right to edit letters for length or style. All letters must be signed and show a return mailing address or valid e-mail address. Writers' names will be withheld from publication upon request. Address letters to Letters,* CQ VHF, *25 Newbridge Rd., Hicksville, NY 11801; or via e-mail to <CQVHF @aol.com>; <cqcomm@delphi.com> or <72127.745@compuserve.com>. Please specify that it is a letter for* CQ VHF *magazine.*

Volunteer Protection Act Doesn't Offer Much Protection

Dear *CQ VHF*:

Thought you might be interested in a brief note I wrote on the Volunteer Protection Act. (This was printed in the Jan. '98 *VOX*, the newsletter of the Huntsville, Alabama, Amateur Radio Club. Of course, that does not imply endorsement.)

The Volunteer Protection Act: A Review

On June 18, 1997, the President signed into law the Volunteer Protection Act. This act has been praised as offering amateur radio operators protection from liability litigation stemming from their volunteer service. However, my reading of this act leaves several questions unanswered. Having read the law carefully, twice, it appears to me that the protections granted in Section 4 (a) against suit for any harm resulting from the performance of volunteer duties are specifically withheld by Section 5 in the case of non-economic loss. Since Section 5 is on the same level as Section 4 it appears that the intent is to override a portion of Section 4 and permit and encourage civil litigation for non-economic loss. As I now understand this law, it appears to me that amateur radio operators could be sued for their actions as a volunteer which caused or contributed to nothing more substantial than inconvenience. The protection provided by the act if the amateur radio operator acted based on unofficial information, such as a TV weather man's declaration or cancellation of a watch or warning, and someone suffers harm of any kind, is not at all clear. Neither is it clear that this act protects the amateur radio operator if his/her volunteer service is in support of a for-profit entity, such as a TV station weather net.

I raised these questions in a very specific letter to Representative Bud Cramer, (AL, 5th District). His response did not address the questions but it advised that "...the Justice Department and the court system on both the State and Federal level will hear cases involving this act." This seems a rather cautionary note for a law which was to have clarified the situation.

A copy of this law can be obtained from your U.S. Senator's or local Representative's office simply for the asking. I recommend you obtain your own copy and read it, carefully. I believe that you'll conclude, as I have, that the Volunteer Protection Act of 1997 does not offer the protections advertised for it.

John J. Czerwinski, KE4KBM
Huntsville, Alabama

Up From "Velleity"

Dear *CQ VHF*:

Very great praise for Jeffrey Lih, N2VHV's, "From 'No-Code' to 'Know-Code'" in the February, 1998, issue. This is a masterpiece, a short article but comprehensive. N2VHV really tells me all I need to know.

I am a practically inactive amateur, Advanced class. I have often "wished" that I might get to 20 wpm, and study for Extra class. This "wish" has always quickly degenerated into a "velleity," as a wise old bird, Ernest R. Hull, S.J., used the term in *The Formation of Character*, published in 1921. N2VHV almost raises my "velleity" to an "intention."

Jim Kaufman
72064.3074@compuserve.com

Jim—Since I hadn't read The Formation of Character, *I had to check the dictionary to learn that* velleity *is "a mere wish that does not lead to the slightest action." I'm glad you found some inspiration in Jeffrey's article to move beyond velleity. Good luck in turning your "intention" into an "accomplishment."*

Dear *CQ VHF*:

Thanks for the great article on learning the code. I've just started learning it and I found Jeffrey Lih's tips very helpful. Especially Table 2, Morse Code Letters in Element Groupings, and Table 3, Memory Kickers. Thanks to "Here Comes the Bride," or the "Dragnet" theme, I'll never forget the letters Q and Y again!

Keep more articles like this coming!

Michael Front, KBØRIA
Sioux Falls, South Dakota

More on 6-Meter AM

Dear *CQ VHF*:

Hello from KE4WBO in Jupiter, Florida. I just surfed in to your Web site to comment on your excellent magazine. The information on my favorite band (6 meters) in your January issue about AM rigs was great. I own a Lafayette HE45 w/VFO and have been on AM about one and a half years (including USB on my TS-60S), making two contacts locally. I agree it should not be an abandoned mode, but another fun way of making QSOs on 6 meters. The recent major opening at Christmas—about 48 hours long, with single-hop from Florida into Canada, New York, Pennsylvania, and other states east of the Mississippi—was just amazing. Sporadic-*E* propagation was so good, a coat hanger with 10 watts could have done the job.

I have found that you actually need both types of antennas—horizontal and vertical polarization—during an opening. On December 26,1997, in my area (EL96), the *E*-skip was horizontal until 9:30 EST, then as the ionized cloud shifted, the polarization shifted 90 degrees to vertical until 1:00 a.m. December 27. I am using a stacked set of Cushcraft 5-el Boomers, a G5RV with tuner, and a triband Diamond vertical 0 db, which works real well.

I was wondering if, in future articles, you could do an antenna "shootout" and also some modifications to HF amplifiers (solid state or tube) for 6 meters. Information for this seems to be scarce. Enjoy, and keep up the good work! 73

Graham Huls, KE4WBO
Jupiter, Florida

Graham—There's a good reason why 6 meters is called "The Magic Band"! You're right, of course, about shifting polarization during a sporadic-E opening, though it may change even more frequently than you observed. One solution to that problem is a circularly polarized antenna, such as the Telrex "Spiralray," discussed in March's "Q&A." Too bad nobody's making it anymore.

As far as an antenna "shootout," I know it's not 6 meters, but take a look elsewhere in this issue for Gordon West's "shootout" among 2-meter loop antennas. Finally, on the topic of modifying HF amplifiers for 6-meter use, the reason that information seems scarce is because the FCC has clamped a tight lid on amps capable of operating below 144 MHz, due to abuses by CBers and "freebanders." See sections 97.315 and 97.317 of the FCC rules for specifics.

Dear *CQ VHF*,

Hi, I am Scott. I just recently got my licensee. My callsign is KF6PGH. My dad had been pushing me to get it since I was seven (I am 11 now). When my school had a magazine sale, my dad said that he would get this magazine (*CQ VHF*) if I got my license. I had already passed my Novice element, so I said yes. As you can probably tell I got my license. I really enjoy reading the magazine, especially the letters to you—so I decided to write one myself. See you on the airwaves.

Sincerely,

Scott, KF6PGH

P.S. I am currently working on my General license.

Scott—Congratulations and welcome to ham radio! I'm glad you're enjoying CQ VHF. *Good luck on your upgrade, and have lots of fun!*

And the Beat Goes On...

Dear *CQ VHF*:

I just wanted to take a moment to thank you for your article about heart attack/disease in the February issue. As one who had been involved in the field of emergency medicine for 25 years, I've come to one conclusion, not just backed up by research but by practical experience: Most of my emergency runs could have been avoided if folks would have spent a few minutes each week taking care of themselves...a few minutes of sensible exercise, a sensible diet, quitting smoking.

Perhaps some of your readers don't believe an article like the one you printed belongs in a ham magazine. I say Kudos to you for printing it, for heart disease is no respector of people. Again, thanks for a great article, and a great magazine. The longer we stay healthy, the longer we stay hamming!!! 73,

Rick Garrett, N9GSU
Muncie, Indiana

Dear *CQ VHF*:

I have always wanted to become a ham operator and am now planning on getting around to it. However, I find very few publications for beginners. Actually, I have found very few publications on ham radio at all. I saw your mag (Feb. '98) today at the book store, and picked it up. By going through the various articles and letters, I probably doubled my knowledge (which was *close* to none). I even discovered that I am in grid FN11, as near as I can tell. However, there is still much information I need.

Mainly, I need to know what I *need* to know. I see books in RadioShack about amateur radio; some are quite big, some are quite small. I worry that if I get the smaller book, I'll miss some information; if I get the big book, it'll have extraneous information, and I'll study the wrong stuff.

Next, I had originally believed that I'd be getting onto the 2-meter band. I had believed that the 2-meter band was the term, and the various frequencies within it were all I had to worry about. Now I'm seeing that there is VHF/UHF, microwave, SSB, and FM. I'm not sure how much would apply to me, how much lies within the 2-meter band, and which of these techniques I should focus on. I believe that your magazine should devote a couple pages to these subjects, showing where to start, the various technologies involved, and a chart showing what technology people should choose based on their interests. This section can include a glossary, a resource list, and similar items. The section shouldn't change too much from issue to issue, only to reflect new technologies, resources, or glossary terms.

John Hogenmiller
Hopewell, Pennsylvania

John—Thanks for your letter. I agree that there aren't enough books "out

there" in general, and in particular, books for beginners. We at CQ have put a lot of effort into providing more information for newcomers to ham radio, and CQ VHF *is part of that effort (even though it's not just for beginners). We also have seven introductory videos and a book available, all on the very basics of getting started in various aspects of amateur radio. One of our main goals here at* CQ VHF *is to provide new hams with information that's hard to find or understand in other places (for example, all the stuff you learned from reading just one issue).*

Yes, there's a lot more available to you with a Technician license than 2-meter FM. Too many people come into ham radio thinking that 2-meter FM is all there is unless you pass a code test and get on HF. We want to dispel that myth. As to what's available on 2 meters, there is FM, SSB, CW, satellites, moonbounce, and who knows what else? Two meters is ham radio's most popular band, but many of its activities remain well-kept secrets.

What you "need to know" to get your license is included in any of the various license manuals that are on the market. The two that you see at RadioShack are the ARRL's Now You're Talking *and Gordon West's* New No-Code. *They both contain the same basic information but differ in their presentation, which accounts for the difference in size. Your choice should be based on your preferred learning style.*

Finally, if you look in the back of each issue of CQ VHF, *you'll see our "Basics" section, which includes much of what you're looking for in the way of introductory information. It'd take up too many pages to run all of our "Basics" material over and over each month. But keep reading and you'll find more of what you're looking for.*

On the Leading Edge

Editor's Note: The following letter was directed to "In the Public Interest" columnist Bob Josuweit, WA3PZO.

Dear Bob:

I have become a real fan of your column. I just got the March issue and was really impressed by how thorough and complete your explanation of UTM is. Frankly, I never even heard of it before your column. I got myself a Garmin GPS III and have really been enjoying the built-in maps. Last month, from Gordon West, I found out that the Maidenhead Grid system ("Grid Squares") is built into the GPS III. Guess what? So is UTM! So you're really right on the leading edge of all this stuff—as you have been for *years*.

Bart Feroe, KC3BP
Boyertown, Pennsylvania.

Dear *CQ VHF*:

Well, just read my latest issue of the world's greatest ham mag. I saw something in there about building a laser diode communications system out of old CD player parts. When is this going to happen? I'm very interested! We are currently working on several projects dealing with microwave in two clubs that I am a member of. Your microwave issue came just in time. We are still in the drawing board stages, but they are coming along at a good pace.

We are going to attempt to build a microwave data network that will feed out of the University of Miami to the users' homes via somewhere near S-band. It will be like using packet at 28k baud, and also a portable communications unit like the ones used by the phone company, except using microwave in-stead of fiber to link the units. The latter has been done before, but it would be nice to have one here in Dade County for public service use. Keep up the good work!!!

Robert Cruz, KE4MCL
Miami, Florida

CQ VHF *microwave columnist, Kent Britain, WA5VJB, replies:*

Hello, Robert:

The idea is to keep it very very simple. The laser system I will be showing is designed for use during VHF contests for QSO points. The Laser will be modulated at about 500 Hz by passing the beam through the blades of a small muffin fan. Detection will be with a solar cell connected to an audio amplifier. Communication will be CW, turning the laser on and off with a hand key. About as simple as I can get. Good luck with your project, Let me know how it comes together.

CQ VHF Ham Radio Above 50 MHz

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Product Update

Kenwood Takes Slow-Scan TV Portable

Ever wish you could send a photo back to net control from a public service event or emergency scene, but weren't set up for full amateur television (ATV)? Well, the folks at Kenwood have put slow-scan TV (SSTV) in the field with their new VC-H1 "Visual Communicator." A handheld CCD camera, scan converter, and LCD monitor, the VC-H1 runs on four AA batteries and can be plugged into the speaker/mic jacks of any Kenwood transceiver, including an HT.

The VC-H1 is compatible with all major SSTV formats and can store up to 10 images in memory, letting you choose the best picture to transmit. The 1.8-inch TFT (thin film transistor) display allows you to preview your pictures before transmitting and to view received images. The unit also includes a built-in speaker-mic to compensate for plugging into the speaker/mic jacks on your radio. The VC-H1 can also be hooked up to a laptop computer (via an optional RS-232C cable) and includes software to let you save and retrieve pictures in JPEG format. And, to keep you legal, it also includes a provision for superimposing your callsign on transmitted photos.

In SSTV, single (still) video frames are transmitted by radio in the bandwidth of a standard voice signal, making the mode permissible in all amateur bands, both HF and VHF/UHF. No price announcement for the VC-H1 had been made as of press time. For more information, see your Kenwood dealer or contact Kenwood Communications Corp., Amateur Radio Products Group, P.O. Box 22745, 2201 E. Dominguez Street, Long Beach, CA 90801-5745; Phone: (310) 639-5300; Internet: <http://www.kenwood.net>.

Circle 101 on reader service card

ICOM IC-T8A Tri-Band Handheld

ICOM has announced the world's smallest tri-band handheld, and the only one with 50-MHz coverage: the ICOM T8A. Weighing only 9.9 ounces, the T8A covers the 6-meter, 2-meter, and 440-MHz amateur bands. This includes receive coverage of the popular aircraft,

150- and 450-MHz public safety bands, and FM and TV broadcast.

The T8A's transmitter output power is 5 watts on all bands. It is powered by an NiMH battery pack. The T8A has a 123-memory capacity, including 10 scan edges and one call channel per band. A variety of scanning methods are included, accommodated by 10 groups of 20 channels each. It is water-resistant and features a die-cast aluminum chassis for durability and reliability.

Tone squelch, pocket beep, and auto-squelch are standard features, as well as auto-power saver, electronically controlled volume and direct keypad input. A guide function allows display of the selected set mode item in the T8A's display window for setup convenience.

The ICOM IC-T8A is supported by a complete line of ICOM accessories. For more information on the ICOM IC-T8A, contact your ICOM dealer, or ICOM America, 2380 116th Avenue NE, Bellevue, WA 98004; WWW: <http://www.icomamerica.com>.

Circle 102 on reader service card

ARRL Satellite Handbook and More

The ARRL has introduced an updated and renamed version of its handbook for satellite operators. *The Radio Amateur's Satellite Handbook,* by Martin Davidoff, K2UBC, is an updated version of Davidoff's *The Satellite Experimenter's Handbook,* which was last revised in 1990. The new title perhaps reflects the fact that amateur satellites are no longer experimental, but that operating them is something within the grasp of every amateur. New chapters include overviews of both analog and digital satellite communications, an introduction to satellite antennas, and a section on hams who have operated from space (a list that was much shorter a decade ago than it is today).

The League has also released updated versions of several other publications in recent months. The 6th edition of *The ARRL Operating Manual* is an update of the 1995 version and includes a 24-page "Ham Desktop Reference" booklet for quick lookups of calling frequencies, beam headings, Q signals, and other frequently-looked-for items. And the 14th edition of *Hints & Kinks for the Radio Amateur* is a compilation of projects and ideas that have appeared in *QST*'s "Hints & Kinks" column between 1992 and 1996.

A brand new book is *The ARRL VHF/UHF Radio Buyer's Sourcebook.* It's a compilation of *QST* product reviews on VHF/UHF transceivers and accessories that originally appeared between 1991 and 1996.

The Radio Amateur's Satellite Handbook is $22; The *Operating Manual* is $25; and *Hints & Kinks* and the *VHF/UHF Radio Buyer's Sourcebook* are $12 each (plus shipping: $5 for books over $20; $4 for books under $20) from ARRL, 225 Main St., Newington, CT 06111; Sales phone: (888) 277-5289; Fax: (860) 594-0303; E-mail: <pubsales@arrl.org>; WWW: <http://www.arrl.org/catalog>, or see your favorite ARRL dealer.

Array Solutions 6-Meter StackMatch

Array Solutions has extended the capability of the StackMatch Product to cover the 6-meter amateur band. This was a breakthrough in using micro-strip design, careful relay selection, and a new broadband transformer design. The new design gives the VHF DXer and contester the flexibility to chose all combinations of two or three stacked 6-meter beams.

With the Mini-StackMatch, the choice also will allow up to *six* antennas in the stack. Also the BIP/BOP function is maintained to allow high-angle *E*-skip to be worked easily.

For additional information, contact Array Solutions, 350 Gloria Road, Sunnyvale, TX 75182; Phone: (972) 203-8810; Fax: (972) 203-8811; E-mail: <wx0b@arraysolutions.com>.

Circle 103 on reader service card

Make 1998 A Banner Year!

Amateur radio clubs can show their colors with a professionally designed banner from Old West Graphics of Loveland, Colorado.

Banner sizes run from 2 x 4 feet to 4 x 20 feet and come in a variety of colors. Custom sizes are also available. Banners are a great way to advertise for club functions, including Field Day, hamfests, ARES/RACES events, conventions, and any other special events.

Old West Graphics recently released their new 1998 catalog, featuring such products as banners, decals, magnetic signs, photo ID name tags, personalized computer mousepads, graphic design services, and other great services.

For more information, contact Old West Graphics, 490 N. Saint Louis Avenue, Loveland, Colorado 80537-5878; Phone: (800) 484-9892 XT. 8601; E-mail: <oldwest@verinet.com>; Internet: <http://www.successmarketplace.com/shops/oldwest>.

Circle 104 on reader service card

The Golden Age of Kit-Building Returns

Join WA6NGH on a trip down memory lane as he builds a "brand-new" Heathkit and takes a look at the modern rebirth of a treasured ham institution—radio kit-building.

By Sam Vigil, WA6NGH*
E-mail: Lvengr@aol.com

Have you ever been at a radio club meeting and listened to some old timer (like me) waxing eloquent about the joys of building a Heathkit? He might say something like this: "Opening it up was like Christmas morning. There is nothing like the joy of opening that big box on the kitchen table, spreading out all the parts, and dreaming of the fun of building the kit."

Just what was all the fuss about? What are all these old timers talking about? Is this one of these things that never *really* existed, like nickel Coca-Cola and quarter movies, something from the distant past? Well, in this article I'll describe actually building a brand new Heathkit. Yes, a rare, unbuilt Heathkit. And then—even better—I'll tell you about kits you can build today that are just as much fun and cost even less than the original Heathkits. First, let's look at that unbuilt Heathkit.

A Rare Find

I was minding my own business at a recent meeting of the local ARES group (San Luis Obispo Emergency Communications Council), when Bill Palmerston, K6BWJ, approached me after the meeting and said, "Sam, I hear you talking about packet radio all the time. Why don't you just go out and buy a TNC?"

*Sam Vigil, WA6NGH, is a Professor of Environmental Engineering at California Polytechnic State University where he teaches courses in waste management, recycling, and wastewater treatment. He is the co-author of a college textbook and numerous technical articles and reports.

Photo A. Imagine finding a Heathkit under your Christmas tree! WA6NGH couldn't wait till Christmas morning to open his package, but at least he waited long enough to get a picture taken under the tree!

I replied, " Well, Bill, I'm a little short of money at the moment, and I just don't have the spare cash around to buy one."

Bill countered, "Well Sam, I am going to make you an offer you can't refuse. I've had an unbuilt Heathkit TNC sitting in my closet for the last 10 years. It was given to me by a friend who didn't have time to build it and I'm tired of looking at the thing. I will *give* it to you if you'll build it and put it up in one of our remote ARES sites. We want to have packet sites at all the local fire stations." Wow, what an opportunity! I leaped at it.

I took the kit home and contemplated what was to be a great adventure. The last Heathkit I had built was in 1964, when I was in college. I had a part-time job working in the Physics Department, and, because of an ordering error, the department had ordered a number of instruments—audio generators, in this case—in kit form instead of assembled. I had some experience with kit building (a few years earlier, in high school, I had built a receiver and 50-watt transmitter made by Knightkit, one of Heathkit's major competitors) so I was hired for the grand sum of $2.00 per hour to put them together (remember minimum wage in those days was only about $1.75 per hour). What a great job for a ham, actually getting *paid* to put together a Heathkit. I couldn't believe my good fortune!

These were tube units and by today's standards the components were huge. Quarter-watt and half-watt resistors, huge disk capacitors, tube sockets, point-to-point wiring with terminal blocks—no printed circuits in these kits. Anyway, those audio generator kits in 1964 were the last kits that I had built. College, Navy active duty, graduate school, raising a family, and job responsibilities had drawn me away from ham radio and kit building. But here I was in 1997, Heathkit box in hand, ready to build again (see Photo A).

The Kit

The kit was Heathkit's first terminal node controller (TNC), the Model 4040, a first-generation TNC based on the Tucson Amateur Packet Radio (TAPR) TNC-1 design. TAPR developed the

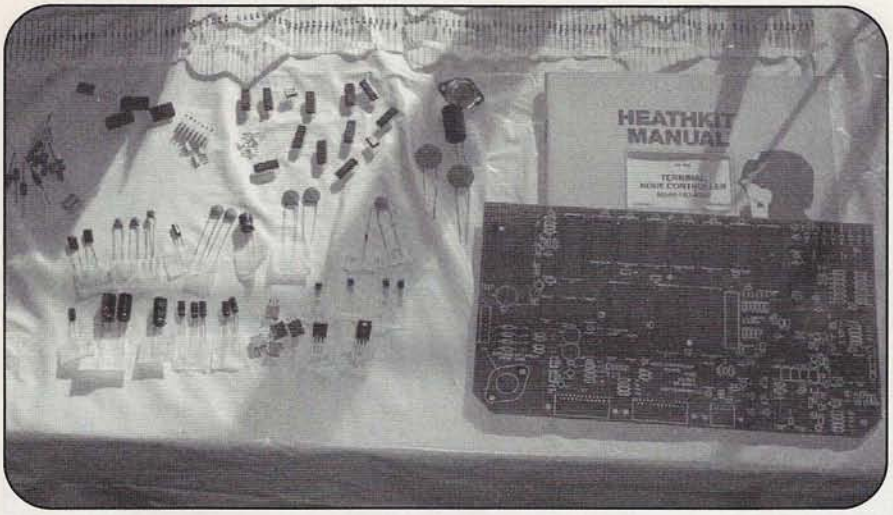

Photo B. An important first step in building any kit is unpacking and laying out all the parts and making sure everything is there.

TNC-1 in 1981 and licensed the design to several manufacturers, including Heathkit. In 1985, TAPR developed an improved model, the TNC-2, which was again licensed to manufacturers, including Heathkit. The TNC-2 design is still the basis of most 1200-baud TNCs on the market today. But my Heathkit Model 4040 TNC was essentially obsolete!

I wasn't sure what the implications of this were, so I sent an e-mail to noted packet expert Stan Horzepa, WA1LOU, author of several ARRL packet and APRS books (see "Resources") and asked for his advice. Stan's reply was that a TNC-1 would be able to communicate with the current generation of TNC-2s, but it wouldn't have some of the more advanced features and it wouldn't be compatible with APRS (Automatic Position Reporting System), one of my main interests in packet radio. He assured me, however, that for most point-to-point communications, the TNC-1 would be adequate. He also said there were sets of upgrade chips developed in 1985 that might still be available. I decided to build the kit as it was and try to track down the upgrade chips later.

Photo C. One of the "niceties" of Heathkits was that parts such as resistors were taped together in the order in which you'd be using them. This minimized the chances for errors or lost parts.

To get my kit-building skills back up to speed, I practiced first on a QRP antenna tuner and SWR meter, before tackling this larger kit. But now it was time... almost. The first thing I had to do was to find a safe place to build the kit. This was always a struggle in my teenage and college days as I really did not have a dedicated desk for myself. Well, today I have my own desk, but is taken up by a computer, a printer, a gigantic 17-inch monitor, and stacks and stacks of paperwork. What to do? Ever the ingenious ham, I appropriated a picnic table temporarily installed in the dining room for holiday guests as my kit construction center.

Just opening the Heathkit box was a great thrill for me, bringing back 30-year-old memories. Step number one—no, I hadn't forgotten—was to lay out all the parts and group them together (Photo B). Heathkits were famous for their packaging: parts were grouped into bags in the order of assembly. Small parts like resistors were taped together in assembly sequence (Photo C)—a great time saver. Heathkits were also justifiably famous for their clear cutaway diagrams and impeccable check-off sheets. If you followed the instructions carefully, you had a good probability of success.

Building the kit proceeded very smoothly. By today's circuit board standards, the parts on the TNC circuit board were very widely spaced, so soldering them was relatively easy (Photo D). Heathkits came with their own solder, but I chose to use a more modern silver-based solder and a Weller temperature-controlled soldering station. I also used a magnifying glass to check all of my solder connections. This may or may not be necessary depending on your eyesight, but I certainly needed it. I took my time building the kit, working about five or six hours per day over my Christmas break (I'm a college professor). Even so, the kit took me four days to complete (see Photos E and F).

The Heathkit manual provided both resistance and voltage checks for a preliminary checkout. Calibration of the TNC is performed using built-in software routines. My TNC worked on the first try, although I had found a couple of construction errors on my own prior to powering up the unit. My most serious error was grounding the hot side of the AC line! This would have probably been caught by

On the Cover

Ready to respond...hams across America have been called on this winter and spring to help provide communications in the wake of weather-related emergencies. For details, see this month's "VHF News" (page 6) and "In the Public Interest" (page 42).

In our cover photo, Jon Lowing, N2DPC, and Ed Kracum, WB2COP, of Middletown, New Jersey, stand outside their township's new emergency communications van. Jon is Assistant Radio Officer for Middletown Township RACES (Radio Amateur Civil Emergency Service), and Ed is the group's Digital Coordinator and Training Officer. The van contains operating positions for police, fire, first aid, and RACES communicators. The RACES station includes separate rigs for FM voice, standard packet, and APRS (Automatic Position Reporting System), all on 2 meters. The voice rig is scheduled to be replaced this month with a dual-bander, adding 70-centimeter capability as well.

Several of the Middletown RACES group's 30 members have APRS stations (linked to Global Positioning System, or GPS, receivers) in their vehicles, according to Kracum, who notes that the group has also installed permanent ham antennas on each of the town's schools (which serve as shelters during storms) and in area hospitals. Middletown is along the New Jersey coast and the RACES group is regularly called up when hurricanes or other coastal storms result in flooding and other damage.

Ed has been involved with Middletown RACES since 1960, and remembers using 3-watt Gonset 2-meter AM radios when he started out. Ed's long involvement in emergency preparedness and amateur digital communications was detailed in a December, 1996, profile here in *CQ VHF*. (Cover photo by Larry Mulvehill, WB2ZPI)

Photo D. Soldering the circuit board is an exacting process, but it was a lot easier to work on the Heathkit board from the early '80s, which was designed for discrete components and normal-sized fingers, than on one of today's super-tiny surface-mount boards.

the resistance checks. After rigging up a TNC-radio cable and plugging in a standard modem cable to connect to my desktop computer, I was on the air!

The Modern Kit-Building Age

Alas, Heathkits are no more. Surprisingly, the Heath Company itself still exists, albeit in a different form. It now primarily markets educational products, derivatives of some of the products developed back in its kit days. The company has undergone many ownership changes since the glory days of the 1950s to 1980s and is no longer interested in the kit business (see "Resources" for Heath-related Web sites). However, all is not lost. There is a new generation of companies making and selling ham radio kits. And many of these new kits are useful to VHF hams. In this section, we'll take a look at a couple of them.

Starting Simple

If you're new to kit-building, it's probably best to start with something simple. One thing that every ham needs is an

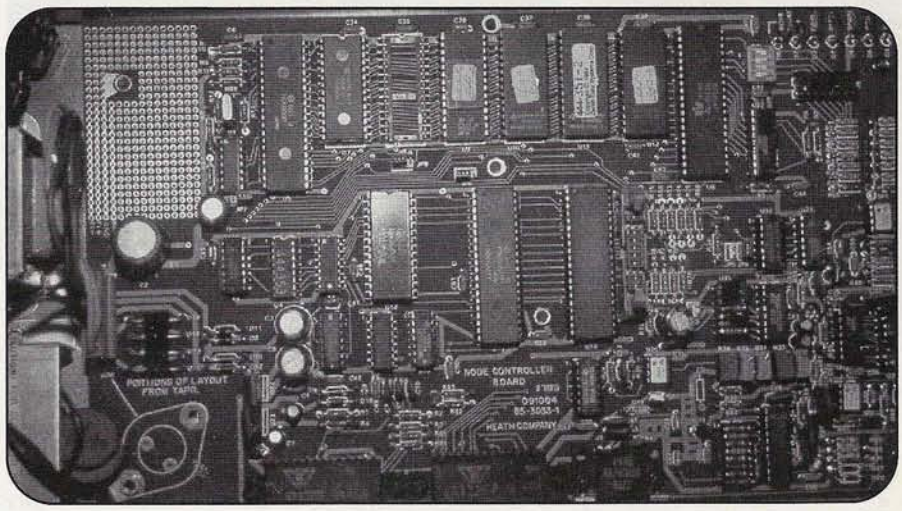

Photo E. Completed circuit board. Everything went together smoothly, in true Heathkit style.

Photo F. Assembled kit. It worked on the first try! You can't get Heathkits anymore, but other manufacturers are filling the void and starting a new "Golden Age of Kit-Building" in ham radio.

SWR meter. Ten-Tec, the well-known manufacturer of HF rigs, also offers a line of kits, called *T-Kits*. Their Model 1202 SWR meter covers both the HF bands and 2 meters. This would be an excellent starter kit. Ten-Tec also manufactures several more complex VHF kits, such as the Model 1220 2-meter mobile transceiver. This kit is available in a 5-watt version or in 30 watts with the addition of an optional power amplifier module. Both the transceiver and power amplifier module are also available in 6-meter and 222-MHz versions.

Some of the more intriguing VHF kits in the Ten-Tec line are the 6-meter and 2-meter *transverters*. A transverter takes a signal from a rig on one frequency band and up- or down-converts it to another band. In the case of the Ten-Tec units, HF signals are converted to either 6 or 2 meters, depending on the model you choose. Transverters are the most inexpensive way to run VHF single sideband (SSB), as used HF SSB rigs are plentiful and relatively inexpensive. One caution with using a transverter is that a low-power input signal (less than 5 watts) is required. This may mean using an external attenuator (resistor network) to reduce the power output of the HF rig. Some HF rigs offer a low power output to simplify connection to a transverter.

Single Sideband HF Kits

There has been a resurgence in recent years of small, independent kit makers within the HF QRP (low power) community. Several small kit manufacturers have been producing interesting kits over the last few years, some under the auspices of clubs such as the NORCAL QRP club in the San Francisco Bay Area. All of these kits are primarily focused on the HF bands and are generally CW-only (the circuitry is simpler). However, there are

"Someday in the future, hams of the '90s will talk about the good old days when they built a Ten-Tec...transverter, or even a White Mountain 20 or an Elecraft K2. They'll also brag how Coca-Colas were only 75 cents and movies were only $7.50."

several QRP SSB kits on the market which could be combined with VHF transverter kits to make very cost-effective 2- or 6-meter SSB rigs.

Probably the lowest-cost approach is the *White Mountain 20*, or *WM 20*, produced by Dave Benson, NN1G, of Small Wonder Labs. The complete kit consists of a 6-watt PEP output, 20-meter SSB transceiver with a custom enclosure and a unique Morse code frequency counter for only $160. Combined with the $100 Ten-Tec 6-meter transverter kit, this would produce a 6-meter SSB kit for approximately $260. The WM 20 is also available as a board-only kit for $100. This kit could be combined with a K1MG Digital Clock/Counter Kit, available from Blue Sky Engineering Company for $30, to form a low-cost digital-readout 20-meter transceiver. Again, add a transverter kit for VHF use.

Another SSB HF kit is manufactured by Elecraft, a new company. Elecraft's senior designer, Wayne Burdick, N6KR, has already designed several very successful QRP transceivers under the auspices of the NORCAL QRP Club (such as the NORCAL 40A and Sierra radios, now commercially produced by Wilderness Radio). His new venture, Elecraft, is focusing on the K2, a digital-readout, computer-controlled multiband SSB rig. The K2 can operate on all nine HF bands, including 20 and 10 meters, making it suitable as a front-end for either the Ten-Tec 2- or 6-meter transverter. It's available in several different option packages, each of which can be later upgraded. In its basic form, the rig can be adjusted to operate from 0 to 10 watts output—a perfect range for driving most transverters.

One outstanding advantage of both the White Mountain and the K2 kits is that they've been designed for extremely low power consumption on receive: 120 mA for the WM20 and 100 mA for the K2. Low receive-power usage is very important for portable operation as most operational time is spent receiving, thus the receive power consumption has the most influence on battery life. By comparison, commercial transceivers such as the ICOM IC-706 MKII and the Alinco DX-70 have receive power consumptions of 1.8 amps and 0.8 amps, respectively, making them less suitable for solar or battery operation.

Closing Thoughts

Happy days are here again. Someday in the future, hams of the '90s will talk about the good old days when they built a Ten-Tec SWR meter, 2-meter mobile transceiver or transverter, or even a White Mountain 20 or an Elecraft K2. They'll also brag how Coca-Colas were only 75 cents and movies were only $7.50. It's time to start building your own memories for the next generation of hams. Happy building!

Acknowledgment

Many thanks to Bill Palmerston, K6BWJ, of the San Luis Obispo Emergency Communications Council for cleaning out his closet and giving me this unique opportunity to build a Heathkit of the early '80s in the late 1990s. ■

Resources

Heathkit Information

Heath Company Web site: <http://www.heathkit.com/parent.html>

Bill Willkinson's Heath Company Page (many Heathkit links): <http://members.aol.com/wwheco1/index.htm>

Modern Kits

Blue Sky Engineering Co. (K1MG Digital Clock/Counter Kit), 400 Blossom Hill Road, Los Gatos, CA 95032; Phone: (408) 356-4420; Fax: (408) 356-4650; Internet: <http://www.blueskyengineering.com>; E-mail: <info@blueskyengineering.com>.

Down East Microwave, Inc., 954 Rt. 519, Frenchtown, NJ 08825; Phone: (908) 996-3584; Fax: (908) 996-3702; Internet: <http://www.downeastmicrowave.com>

Elecraft (K2 SSB Kit), 434 Vista Del Mar Dr., Aptos, CA 95003; Internet: <http://www.elecraft.com>

Hamtronics, Inc., 65-V Moul Rd., Hilton, NY 14468-9535; Phone: (716) 392-9430; Fax: (716) 392-9420; Internet: <http://www.hamtronics.com>

Ramsey Electronics, Inc., 793 Canning Pkwy., Victor, NY 14564; Phone: (716) 924-4560; Fax: (716) 924-4555; Internet: <http://www.ramseyelectronics.com>

Small Wonder Labs (White Mountain 20 SSB Kit), c/o Dave Benson NN1G, 80 East Robbins Ave., Newington, CT 06111; Internet: <http://www.fix.net/~jparker/sml.html>

Ten-Tec, Inc. (VHF Transceiver and Transverter Kits), 1185 Dolly Parton Parkway, Sevierville, TN 37862; Phone: (423) 453-7172; Fax: (423) 428-4483; Internet: <http://www.tentec.com>

Wilderness Radio (QRP Kits), P.O. Box 734, Los Altos, CA 94023-0734; Internet: <http://www.fix.net/~jparker/wilderness/kc2.htm>

Packet Radio Information

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Horzepa, Stan, WA1LOU, *Getting on Track with APRS*, American Radio Relay League, 1996.

Moseson, Richard, W2VU (Producer), "Getting Started in Packet Radio" video, CQ Communications, Inc., 1992.

Rogers, Buck, K4ABT, *The Packet Radio Operator's Manual*, CQ Communications, Inc., 1995.

Williams, Bruce, WA6IVC, "TAPR, Heathkit, and AEA Terminal-Node Controllers," *QST*, November, 1985, pp 54–57.

Mir Gets a TNC Upgrade (from US)—Part 1

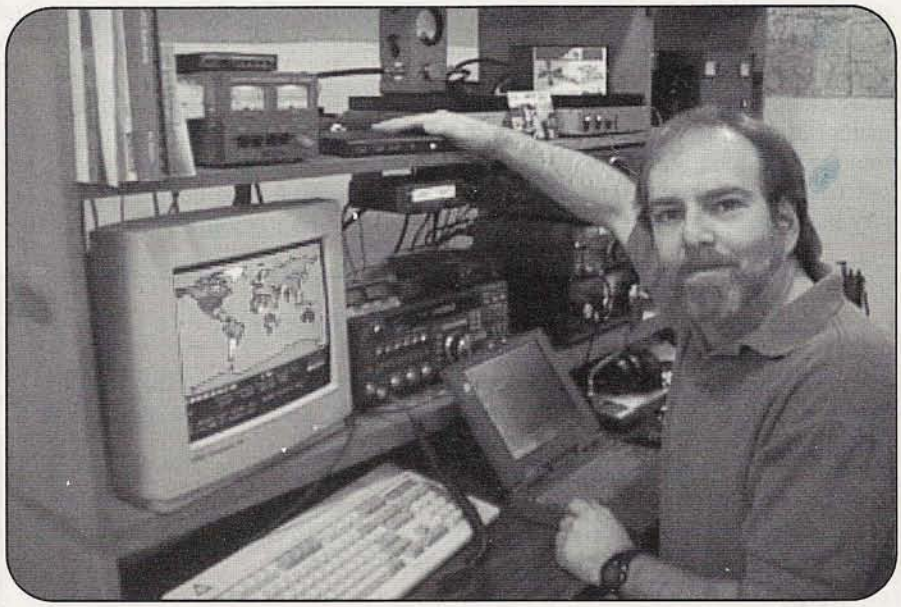
Maintaining a ham station aboard a space station takes a lot of work on the ground as well as in orbit. Here's the story behind the story of Mir's recent TNC upgrade. Part 1 takes us from choosing the equipment to getting it to the launch pad.

By Miles Mann, WF1F*

Many of you have heard about the amateur radio station on board Mir, the orbiting Russian space station. But few are aware of the work that goes on in the background to keep Mir's ham station working and the crews trained in how to use it. The first thing that's required is ongoing cooperation between amateur groups and space officials in three countries: Russia, Germany, and the United States.

The Russian side of the program is known as MAREX (Mir Amateur Radio Experiment). All projects for Mir must be approved by the MAREX team, which is run by Sergej Sambrouv, RV3DR, Chief of the Amateur Radio Cosmonaut Department. Most of the original amateur radio equipment on Mir came from the SAFEX group in Germany. This equipment includes a 2-meter FM packet station and a popular 70-centimeter FM repeater. Getting this equipment launched into space was not an easy task. The SAFEX group did an excellent job in forging new territory in the Russian space program. Now hams around the world had easy FM access to a 2-meter mono-band "easysat."

The U.S. component of the project is called MIREX, for "Manned International Amateur Radio Experiment." The MIREX team was formed in 1990 by Dave Larsen, N6CO (formerly N6JLH), and yours truly, Miles Mann, WF1F. The rest of the team is made up of volunteers who help provide the additional support required to keep Mir's amateur station on the air. The main components of this support include helping to maintain the equipment on Mir and providing additional in-flight training to the crew members in using the station.



"My first project in space"—ours, too. The author tests the KPC-9612 Plus TNC—purchased by CQ VHF*—that was flown on board Mir, before shipment to Moscow.*

Meeting the Challenges

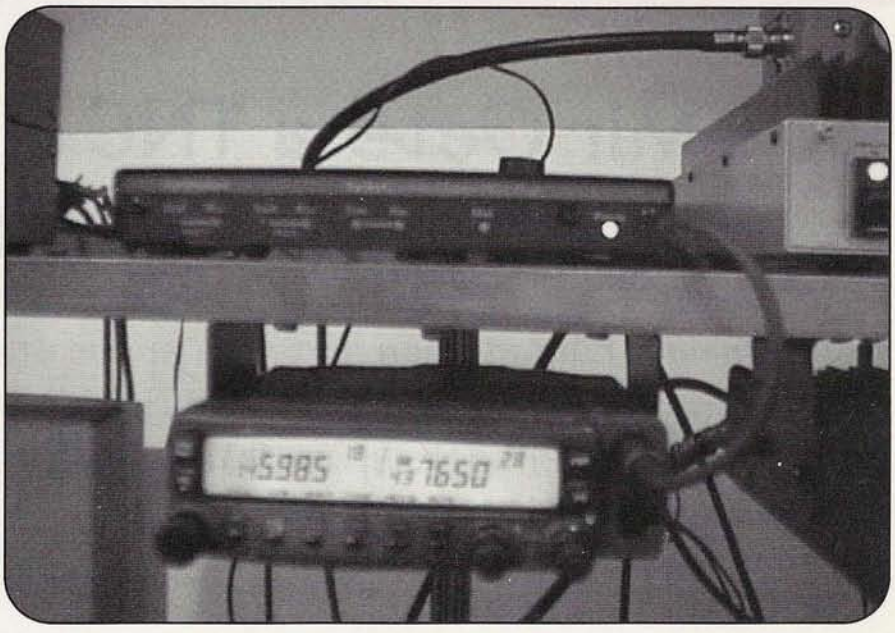
Training the new Mir crew members in amateur radio operation while they're in orbit has always been a problem, although our job is easier when one or more of the crew members already has a ham license, plus some previous amateur radio experience (some are licensed but have had very little on-air experience before going into space). The necessary training includes not only how to operate the Mir ham station, but also getting the equipment set up and keeping it working. We can't "stop by the shack" if someone's having a problem, and passes for direct radio contact are very brief. Plus, the crews have a very busy work schedule and, on top of that, there is a crew change every five to six months, so we have to start on-air training all over again for each new crew.

Miles Mann, WF1F, is Education Director of Project MIREX, the Manned International Amateur Radio Experiment, which supports amateur radio operation on the Russian Mir space station.

Each crew does receive *some* training on the ground before their mission, and there is a short period of time (sometimes as long as four weeks, actually) when both crews are living together within the cramped quarters of Mir. MIREX will sometimes schedule a school contact during a crew changeover. This allows the old crew to show the new crew both how to run the amateur radio equipment and how to run a school schedule.

Dealing with Equipment Trouble

Another problem occurs when the equipment begins to fail due to old age. And "old age" tends to come mighty quickly in the rugged space environment. For example, after two full years of reliable service, the station's original PacComm TNC began to fail. It seemed that its memory battery had gone dead, and, whenever the TNC would crash (as it did periodically, especially during solar flares), it would lose all of its parameter settings. The battery was soldered into the TNC and, therefore, it was not practical for the crew to replace the battery in flight.



Closeup view of the KPC-9612 Plus TNC (above the radio). If you want to see it now, you'll have to visit Mir...or Moscow. An identical twin is set up at the Russian space agency.

The MIREX team decided it was better to begin periodically replacing the amateur radio equipment on Mir, rather than waiting for the next failure. Every three to four months, Energia (the Russian space agency) launches an unmanned supply rocket, called the *Progress*, to the Mir space station. MIREX then made arrangements with MAREX to deliver a replacement PacComm HandiPack TNC to Mir on the next convenient *Progress* flight. The new TNC, which we'll call PacComm-2, arrived in 1994 and was immediately put into service on Mir's 2-meter Personal Message System (PMS).

Let me make it clear that the TNC problems we were having had nothing to do with defective equipment, but rather with the harsh space environment. We were using "off-the-shelf" amateur radio hardware, which was not "radiation hardened," and anything outside the protection of Earth's atmosphere is subjected to a constant barrage of cosmic radiation. Electronic equipment is particularly vulnerable to damage from this sort of radiation. Realizing that this would be a recurring problem, the MIREX team then decided to try to replace the PMS TNCs every two years, hopefully before there were additional hardware failures.

Too Much of a Good Thing

The MAREX PMS was a very popular amateur packet radio station. In fact, it was *too* popular. The PacComm TNC only had 13 kilobytes of memory available for message storage. During a good day, it was not unusual for the PMS mailbox to fill up in 24 hours. This required

Update (and a Little Oops)...

Several VHF specialty groups/newsletters weren't included on the list in February's "Line of Sight." Plus, we had one small boo-boo. Additional listings we've received are:

Microwave

San Bernardino Microwave Society: Monthly newsletter, $15/year. Contact Bill Burns, WA6QYR, 247 Rebel Rd., Ridgecrest, CA 93555.

Six Meters

The 50 MHz DX Bulletin: Newsletter, $25/year for 12 monthly issues (to U.S./Canada); Contact *The 50 MHz DX Bulletin,* P.O. Box 762, Menlo Park, CA 94062; E-mail: <frank@sneezy.sri.com>.

Weak Signal (VHF DXing/Contesting)

Side Winders On Two (SWOT): Two-meter SSB; newsletter and on-air activities. c/o Howard Hallman, WD5DJT, 3230 Springfield, Lancaster, TX 75134-1214; WWW: <http://www.flash.net/~wd5djt>.

West Coast VHFer: Newsletter, c/o Bob Cerasuolo, WA6IJZ, Editor, P.O. Box 685, Holbrook, AZ 86025

The Little Oops

Finally, we gave you the wrong P.O. Box for the *Rocky Mountain VHF+* newsletter. The correct address is *Rocky Mountain VHF+*, P.O. Box 473411, Aurora, CO 80047-3411.

Tnx to Rocky Mountain VHF+ *publisher Wayne Heinen, NØPOH, and Jason Baack, N1RWY, for the above info. Jason maintains an Internet listing of VHF/UHF newsletters at <http://www.umecut.maine.edu/~baack/vhfnewslist/>. We will try to post our list on the* CQ VHF *Web site as well.*

the crew to make sure they took the time to read and delete mail messages daily to keep the mailbox open. For some crews, the PMS was just too time-consuming, and when the mailbox filled, the crew would just shut it down for days on end.

To help alleviate the full PMS mailbox problem, MIREX wanted to fly a TNC with more memory (at least 128k) and possibly more options. Our next hardware delivery opportunity would be in the summer of 1997. As you might imagine, arranging to fly hardware into space takes a lot more planning and preparation than just shipping a box to Moscow with a "Deliver to Mir" label on it. Sometimes, flight-ready hardware must be delivered to Moscow a whole year in advance.

While several manufacturers make amateur radio TNCs, PacComm remained our first choice. The company has been very supportive of the manned amateur satellite projects, and their TNCs have proven to be very reliable and have flown on both Mir and the Space Shuttle. Unfortunately, PacComm did not have a high-memory TNC available to meet our upcoming launch date. MIREX began searching for a new TNC and for funding of the replacement TNC project. As a backup, Dave Larsen hired an engineer to modify the software for the PacComm TNC, in an attempt to make the PacComm TNC work with 128k RAM. But the launch date was getting closer, and we realized we'd have to settle for an existing "off-the-shelf" TNC.

The KPC-9612 Plus

After extensive searching, the Kantronics KPC-9612 Plus was chosen to be the new TNC on board Mir. This TNC was already in production and supported 128k of RAM for message storage. It also supported both 1200-and 9600-baud data rates. MIREX made arrangements with *CQ VHF* magazine to purchase two of the KPC-9612 Plus TNCs for evaluation purposes. To complete the project, we would need a total of *six* TNCs to meet all the needs of testing, training, and System-Operator (sysop) stations. The first two TNCs arrived on June 24, 1997, and testing began immediately. We realized we'd miss the July 1st delivery date for the July *Progress* 35 cargo rocket, so the TNC project was rescheduled for the December *Progress* 37 launch. After all, I still needed four more TNCs to complete the project. With the change in schedules, it looked as if I would have time to get the extra TNCs and cables completed in time for the December launch. Well, at least that's what I *thought*.

Ready to fly. Kenwood TM-733 and KPC-9612 TNC await repacking for shipment to Moscow and eventual delivery to the Mir space station.

Pre-Launch Testing

Most of the testing was conducted in my home shack and in my company's RF lab at night. The Kenwood Corporation provided MIREX with two identical Kenwood TM-733 dual-band radios. The TM-733 is the same radio which is currently used on board Mir, and it was important to test the TNCs in a configuration identical to what would be used on the space station.

I built some temporary cables and connected each of the two TNCs to a TM-733. The parameters of the KPC-9612 Plus were adjusted to match the specifications of the Kenwood radio, and I made additional adjustments based on my six years of experience with Mir packet operations. Both TNC and radio configurations worked flawlessly in the lab. The next test was to place the TNCs 10 miles apart and test their weak-signal reception capability.

Jerry Muller, KØTV, volunteered to take one of the systems and set it up at his home. Over the next week, we performed extensive testing to verify the TNC's ability to detect weak data packets, in both 1200- and 9600-baud modes. The station at Jerry's home was configured for 5 watts into an omni-directional antenna. The station at my home was connected to a directional beam. By rotating

my beam, I could cause the received signal from Jerry's station to vary from S9 down into the noise level, allowing me to test a wide variety of signal and noise levels. It's very important for the TNC and radio under test to be able to detect weak packet signals. On any given pass, Mir is in radio range of a specific point on Earth (such as your home) for a maximum of 10 minutes. When Mir first comes over the horizon, it is over 1,500 miles away. The signals are usually very weak at the beginning of a pass, but will generally rise from S0 to 10 over S9 in just a few minutes. To conserve power, the Mir crew usually keeps the PMS radio set for the low power setting of 5 watts. The existing setup on Mir has proven to be very reliable at this low power setting. The goal was to design the new TNC system to perform just as well.

The new Kantronics KPC-9612 Plus worked very well with the Kenwood TM-733 in both 1200- and 9600-baud modes. There were a few operational differences with the new TNC that users of the existing system would have to get used to, but nothing serious enough to prevent the project from flying. The TNC combination seemed stable enough to send to Moscow for evaluation. The new TNC passed the Moscow MAREX team's evaluation and MIREX was given permission to send the replacement to Mir.

Schedule Change

Then, out of the blue, came a change in delivery schedules. Instead of the December *Progress* 37 cargo rocket, there was a possibility of sending the TNC on the August *Soyuz* manned crew-change rocket. This was a problem, as I was still was not quite ready because the hastily built power and data cables were not "flight quality." I needed to build flight-quality cables overnight and get this package on its way to Moscow by courier.

So I did what all engineers do in a pinch: I ran down to RadioShack and stocked up on supplies. Working through the night building and testing cables, I was able to complete one full system by morning. But I had run short of the DIN data connectors for the Kenwood radio and was not able to send Moscow both TNCs in one shipment. Flight rules state that there must always be a backup system at the launch pad, just in case the primary system stopped working. These rules also applied to amateur radio equipment, but I had my fingers crossed that they might make an exception for us.

The *Soyuz* rocket launched on time with a new crew and supplies for American Astronaut Mike Foale, KB5UAC. There was no word from Moscow as to whether the TNC was aboard the *Soyuz*, but I had sent Mike a status report on the TNC project, and had asked him to look around for it. He sent me this less-than-encouraging packet message:

Stat : PR
Posted : 08/08/97 11:50
To : WF1F
From : RØMIR
Subject: TNC

Miles, so far not seen the TNC. They [the replacement crew] have very little stuff with them. I will pass your greetings.

Mike.

Later, I was informed by Moscow that the Kantronics KPC-9612 Plus did not fly on August *Soyuz* launch because I had sent only one TNC. Oh, well, time to build the second cable set. The parts finally arrived and I was able to get the second TNC on its way by courier to Moscow. But because of the change in schedules, I still had not had time to get the additional four TNCs for the training and sysop stations. Everything I had was sent to Moscow, even the manuals. Meanwhile, the date for the TNC launch kept changing. Finally, MIREX was assigned a new launch date on the *Progress* 36 cargo rocket set for October.

Up in the Air...

All the work that could be done on the ground was done. But while we were getting ready and waiting for launch, a whole new set of problems and challenges arose aboard Mir. In Part 2 of this article, we'll get KB5UAC's perspective on meeting those challenges and the rest of the story of getting Mir's new TNC unloaded (in December), hooked up (in January), and on the air (in February). ■

Resources

For additional information about MAREX and MIREX, please check out the MIREX Web page at <http://www.ik1sld.org/mirex.htm>.

For additional information about the products discussed in this article, please contact the following:

Kantronics Co., Inc., 1202 E. 23rd St., Lawrence, KS 66046; Phone: (913) 842-7745; Fax: (913) 842-2031; Internet: <http://www.kantronics.com>.

Kenwood Communications Corp., Amateur Radio Products Group, P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745; Phone: (310) 639-5300; Internet: <http://www.kenwood.net>.

PacComm Packet Radio Systems, Inc., 4413 N. Hesperides St., Tampa, FL 33614-7618; Phone: (813) 874-2980; Fax: (813) 872-8696.

Communicating with Mir and the Space Shuttle

The Mir Space Station and the U.S. Space Shuttle offer unique satellite communications opportunities with very modest equipment requirements. This article gives you the information you need to communicate with these spacecraft.

Amateur radio offers you the opportunity to participate in the space program by communicating with crew members of manned spacecraft. You can make voice or packet radio contacts using very ordinary VHF or UHF equipment (that you may already own). The Mir Space Station also has a 70-centimeter FM repeater called SAFEX. Using SAFEX (when it's turned on), you can make long distance contacts with other hams when you both have direct line-of-sight visibility to Mir.

An important legacy of both the Shuttle and Mir is that amateur radio will be a permanent payload on the International Space Station (ISS), scheduled to begin assembly this summer. This will be known as Amateur Radio on the International Space Station (ARISS). Any equipment that you build or buy for communicating with either the Shuttle or Mir will also be useful for ISS communications.

To get you ready for communicating with the Shuttle or Mir, we'll first discuss what communication modes and frequencies these spacecraft use. Then we'll identify what equipment you'll need for the contacts. Once you're equipped, you'll need to know when the spacecraft is visible to your area and thus available for communications. Finally, I'll give you some hints for successful operating.

It's a direct line-of-sight path to the Russian Mir Space Station from any point below that's within its 2,800-mile diameter "footprint." But you have to know when the spaceship will be "in your neighborhood." (NASA photo)

Communications Modes Available

Both Mir and the Shuttle carry amateur radio equipment for space-to-ground amateur radio communications (*although ham gear is not present on every shuttle flight, and the ham radio shuttle missions in 1998 are quite limited.—ed.*). There are three distinct modes that are commonly available to you: crew voice contacts, spacecraft packet communications, and ground-to-ground repeater communications. Mir gives you all three modes; the Space Shuttle gives you the crew and repeater contact modes.

Crew Voice Contacts

Both the Shuttle and Mir give you the opportunity to talk with an astronaut or a cosmonaut using your 2-meter FM transceiver. Mir has recently added a 70-centimeter FM voice frequency for crew contacts. Since Space Shuttle passes typically last about eight minutes, contacts with shuttle astronauts are almost always short (DX or contest-style) pile-up exchanges. Contacts with the Mir crew might be either horizon-to-horizon (nine to ten minutes) "rag chews" or the shorter pile-up exchanges. Table 1 lists the frequencies used for crew voice contacts.

Packet Radio Communications

The Shuttle and Mir also give you the opportunity to communicate with their on-board packet radio systems. Mir allows you to communicate with the crew by packet messages. The Space Shuttle will recognize your call sign and give you a contact identification number. The Shuttle may also downlink mission status messages generated by the crew.

The packet callsign for Mir is RØMIR-1; the Space Shuttle's packet callsign is W5RRR-1 (derived from the Johnson Space Center Amateur Radio Club's callsign). Table 2 lists the frequencies used for Mir and Shuttle packet contacts. Since

By Ken Ernandes, N2WWD (n2wwd@amsat.org)

Table 1. Crew Voice Contact Frequencies

Spacecraft	Uplink (MHz)	Downlink (MHz)	Comments
Mir	145.200	145.800	Voice or Packet
Mir	145.985	145.985	North America Only
Mir	435.725	437.925	151.4 Hz CTCSS
Shuttle	144.910	145.550	Voice except Europe.
	144.930	"	Crew doesn't favor any
	144.950	"	uplink frequency ("luck
	144.970	"	of the draw")
	144.990	"	"
Shuttle	144.700	145.550	Voice—Europe only.
	144.750	"	"
	144.800	"	"

Table 1. Crew voice frequencies for the Mir Space Station and the U.S. Space Shuttle (on missions that include SAREX, the Shuttle Amateur Radio Experiment). Note that the frequencies vary not only by spacecraft but also by location. Callsigns vary with crew members.

both spacecraft use FM modulation, a standard Terminal Node Controller (TNC) is adequate.

SAFEX Repeater

The SAFEX repeater on Mir is the easiest way to get started in long distance (DX) satellite communications. SAFEX is a 70-centimeter (single-band) FM repeater that gives you ground-to-ground communications with other stations in Mir's footprint (ground coverage). Mir's footprint is a circle 4,400 kilometers (about 2,800 miles) in diameter that provides some opportunities for coast-to-coast contacts in North America. The SAFEX uplink frequency is 435.750 MHz with a 141.3 Hz CTCSS (also known as 4A PL); and the downlink frequency is 437.950 MHz.

Station Setup

Now that you know what kinds of communications these spacecraft offer, let's see how to set up your station. Since you're working with relatively weak signals, it's good practice to minimize feedline losses. This is done by using good quality coaxial cable (coax) and keeping the cable as short as possible.

Since the spacecraft are in low-altitude orbits, most good quality cable will work (you don't need premium cable like hardline or even a Belden® 9913 equivalent, but it helps). A good low-loss RG-8 class cable should do an acceptable job (RG-58 probably has too much loss). If you're buying new cable or upgrading an existing station, pay attention to the cable's loss in decibels (dB) per 100 feet (for the frequencies you'll be using). Since the losses are higher at UHF than at VHF, you should use the higher quality cable for long 70-centimeter runs.

How much feedline loss can you tolerate? Keep in mind that for every 3 dB of loss, your power will be cut in half. Therefore, 3 dB of loss cuts your power in half, 6 dB of loss cuts it to one quarter, and 9 dB of loss cuts it to one eighth. For example, if your transmitter outputs 25 watts, only 12.5 watts will make it to the antenna with 3 dB of feedline loss, and only about 6 watts will get to the antenna with 6 dB of loss.

Antenna placement is also important for satellite work. Antenna height is not as important as having a clear line of sight to the spacecraft. Radio signals at VHF and above tend to reflect off buildings, while trees and other vegetation tend to *absorb* UHF signals. You should do the best you can to give the antennas as little sky obstruction as possible.

Transceiver Needs

Most 2-meter FM transceivers will work well for communicating with the Space Shuttle and Mir. However, not all 70-centimeter transceivers have the needed frequency coverage. Many 70-centimeter transceivers do not work below 440 MHz (i.e., they don't cover the 435 and 437 MHz frequencies used by Mir and other FM amateur satellites). If you're buying a new transceiver, pay attention to its frequency range if you plan to use it to communicate with Mir (or the ISS in the future).

You may be wondering about transmitter power requirements. As a general rule, 10 watts is a practical minimum (although I, and others, have worked these spacecraft with just a handheld transceiver). Higher power is often needed to overcome things like feedline losses and absorption by vegetation. Because of the FM capture effect (i.e., the stronger signal wins), higher power often makes the difference in breaking a pile-up.

Antennas

The ideal antenna setup for satellite work is made of circularly polarized

Table 2. Packet Frequencies

Spacecraft	Callsign	Uplink (MHz)	Downlink (MHz)	Comments
Mir	RØMIR-1	145.200	145.800	Voice or Packet
Mir	DPØMIR-1	435.775 to 436.775 at 25 kHz spacing	437.975	9600 Baud
Shuttle	W5RRR-1	144.490	145.550	1200 Baud

Table 2. Packet frequencies for contacting the Shuttle and Mir. Note that the callsigns generally have a "-1" identifier after them, so you'd have to try to connect, for example, to W5RRR-1.

"The SAFEX repeater on Mir is the easiest way to get started in long distance (DX) satellite communications....[It] provides some opportunities for coast-to-coast contacts in North America."

beams and a two-axis azimuth/elevation (AZ/EL) rotor. But because this is a relatively expensive setup—about $150 per antenna and $500 for the rotor—it's usually used only for high performance satellite stations. Less complicated (and less costly) fixed antenna systems will perform well with low-altitude satellites.

When planning a fixed antenna system, you should consider the antenna's gain pattern. The gain pattern describes how much of the transmitted energy is sent in each direction, or what the favored "listening" directions are for receive. Vertical antennas with good gain values (5 dBi or more) will work very well at low-elevation angles (near the horizon) but will work poorly overhead. Simple ground planes, discones, or M^2 "Eggbeater" antennas perform well at all elevations. Excellent homebrew antenna choices for low-altitude satellite work include the turnstile, the Lindenblad, and the quadrifilier helix. Construction details for these antennas are available in the ARRL's *Satellite Experimenter's Handbook* (see "Resources").

Finding the Spacecraft

If you own a computer, satellite tracking software is the easiest way to predict when you'll be able to communicate with these spacecraft. Tracking software needs current *Keplerian elements* to make valid predictions. The Keplerian data is available from a variety of sources including Internet e-mail, the World Wide Web, and packet radio.

AMSAT offers weekly Keplerian element updates by e-mail. You can subscribe to this service by sending a **subscribe Keps** message to <listserv@amsat.org>. AMSAT posts these same weekly updates on its Web page at <http://www.amsat.org/>. I post Keplerian element updates on my personal Web page, <http://www.mindspring.com/~n2wwd>, three times weekly, normally on Monday, Wednesday, and Friday. For Mir, you should update your Keplerian elements about once per week. (*If you don't have a computer or access to a tracking program, last month's "Orbital Elements" column provided maps and charts for manually tracking Mir. The charts were valid only for April, but you may be able to roughly determine May passes by extending the April data.—ed.*)

Space Shuttle Keplerian elements tend to predict accurately for only short intervals (sometimes less than a day) since orbit-adjusting thruster firings often occur throughout the mission. NASA Spacelink created the Space Transportation System Two-Line Element (STSTLE) e-mail list to provide timely Keplerian element updates during Space Shuttle missions. You can subscribe to this list by sending an e-mail message to <listproc@spacelink.nasa.gov>. The body of the message should be **subscribe STSTLE your name** (put your first and last name in place of "your name"). This mailing list usually has four updates per day. Since four updates is more than most amateur operators want, the data are also uploaded to the AMSAT Web page and my personal Web page. Rather than deleting the extra e-mail messages, you can download the orbital data from either Web page whenever you need an update.

If you're not comfortable with tracking software and Keplerian elements, but have Web access, there is an alternative. The NASA Shuttle-Mir Web page <http://shuttle-mir.nasa.gov/shuttle-mir/ops/mir/tracking/target.txt> posts Mir visible pass opportunities for major cities around the world. Likewise, the

Table 3. WA3NAN Space Shuttle Retransmissions

Frequency (MHz)	Mode	Band
3.860	LSB	80 meters
7.185	LSB	40 meters
14.295	USB	20 meters
21.395	USB	15 meters
28.650	USB	10 meters
145.450	FM	2 meters

Table 3. The Goddard Space Flight Center Amateur Radio Club, WA3NAN, retransmits NASA Shuttle-ground communications on these HF and VHF frequencies. Some amateur repeaters retransmit the same information from the audio portion of NASA Select TV, which they downlink from a commercial communication satellite.

Table 4. SAFEX Repeater Doppler Compensation

#	Uplink (MHz) 141.3 Hz CTCSS	Downlink (MHz)	Comments
1	435.740	437.960	Beginning of Pass
2	435.745	437.955	
3	435.750	437.950	Mid Pass
4	435.755	437.945	
5	435.760	437.940	End of Pass

Table 4. Making effective use of the Mir's SAFEX repeater requires that you program in frequencies both above and below the "standard" repeater frequencies to compensate for Doppler shift, which makes the frequencies appear to change as the spacecraft moves toward or away from you.

"The complete list of VHF and UHF repeaters that retransmit NASA TV is too big to print here, but it is available on the AMSAT Web page and is also linked on the Space Shuttle section of my personal Web page."

NASA Shuttle Web page gives Shuttle visible pass opportunities. Its Uniform Resource Locator (URL) varies slightly based on mission number. For example, STS-89's URL was <http://shuttle.nasa.gov/sts-89/orbit/orbiter/sighting/sighting.html>.

Visible opportunities are only a subset of the available line-of-sight passes. However, you can estimate some other opportunities by looking also at approximately 90-minute offsets before and after the visible pass opportunity. In many cases, there will also be pass opportunities at a 180 minute offset before and after the visible pass.

Operating Tips

There are two things that can help you successfully communicate with these spacecraft: choosing the best times to operate and your radio frequency settings.

The Mir SAFEX repeater is usually available at all times, and packet is generally available when the crew is not making voice contacts. If you're attempting a crew contact for either Mir or the Shuttle, you should know their work and sleep schedules. Mir operates on Moscow time. Their operating schedule varies, but I have heard them most often between 07:00 and 17:00 UTC (add your time zone offset to convert to local time). Many successful Mir contacts have been made in the earlier part of that time block, which for North American stations is either very late at night or early in the morning (depending on your location).

Amateur retransmissions of NASA TV are an excellent source of information on Space Shuttle crew activity (including SAREX operating tip-offs). Table 3 lists the Goddard Space Flight Center Amateur Radio Club (WA3NAN) HF and VHF NASA TV retransmission frequencies. The complete list of VHF and UHF repeaters that retransmit NASA TV is too big to print here, but it is available on the AMSAT Web page and is also linked on the Space Shuttle section of my personal Web page.

Doin' the Doppler

Doppler frequency shift is less disruptive to FM than to SSB or CW transmissions, but it can't be completely ignored. On 2 meters, Doppler can shift the frequency ±3 kHz for the Shuttle and Mir orbits; on 70 centimeters, the Doppler shift can be as high as ±10 kHz.

The most successful Doppler technique for standard FM rigs is pre-setting different frequency pairs in the radio's memories. Since most FM rigs' smallest tuning steps are usually 5 kHz, you may want to set aside three memories for 2-meter contacts and should set aside five memories for 70-centimeter contacts. To compensate for Doppler shift: (1) in the early part of the pass, transmit lower than and receive higher than the standard frequencies; (2) use the standard frequencies at mid-pass; and (3) transmit higher than and receive lower than the standard frequencies in the latter part of the pass. Table 4 has a Doppler frequency sequence for the Mir SAFEX repeater.

You can get away without Doppler compensation on 2 meters, but you may lose the beginning and the end of the pass. For a SAREX crew contact, you can instead set aside memories for each of the uplink frequencies (with each memory receiving on the standard downlink frequency). This strategy allows you to try each of the uplink frequencies on which the crew may be listening.

QSL Information

If you make a contact with a crew member or the packet station on Mir or the Shuttle, you'll probably want to get a QSL card. To get confirmation of your contact, send your QSL card annotating the callsign worked, the UTC date and time of the contact, the frequency, and the mode (voice, packet, SWL). Be sure to include an SASE (or a self-addressed envelope with an IRC for a foreign QSL manager). The "Resources" section lists the QSL addresses.

Opportunities for Hams

The information I've given you should be enough for you to communicate successfully with the Mir Space Station, the Space Shuttle, and—in the future—the ISS. These spacecraft offer you, the radio amateur, opportunities for voice communications with space crews, packet radio contacts with the on-board packet computer, and an FM repeater to relay ground-to-ground communications. Since these spacecraft use FM and are in low-altitude orbits, you can effectively communicate with a modest VHF/UHF station.

Resources

Books:

The Satellite Experimenter's Handbook, by Martin Davidoff, K2UBC, 1990, ARRL, $23.

QSL Managers:

Mir QSL (U.S. Stations): David G. Larsen N6CO, Box 1501, Pine Grove, CA 95665, USA

Mir QSL: Sergej Samburov RV3DR, P.O. Box 73, Korolev-10 City, 141070, Russia

Shuttle QSL: ARRL EAD, STS-XX QSL, 225 Main Street, Newington, CT 06111-1494, USA (Note STS-XX refers to the mission number for the contact.)

Web Links:

AMSAT: <http://www.amsat.org>
ARISS: <http://garc.gsfc.nasa.gov/~ariss/ariss.html>
Orbitessera: <http://www.mindspring.com/~n2wwd>
SAREX: <http://www.nasa.gov/sarex/sarex.html>
Shuttle-Mir: <http://shuttle-mir.nasa.gov>
Shuttle: <http://shuttle.nasa.gov>
WA3NAN: <http://garc.gsfc.nasa.gov>

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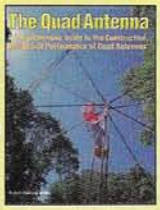

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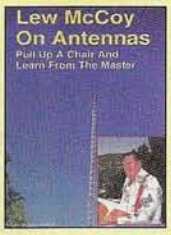

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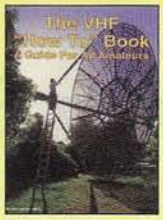

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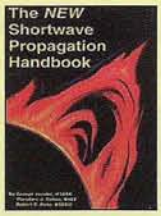

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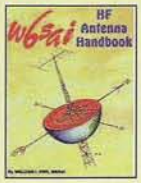

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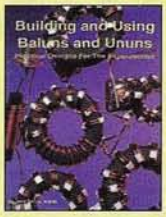

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Two-Meter Loop Shootout

High noon at the Circle-O Ranch...and Gordo's right in the middle of a big shootout—among 2-meter loops, halos, and other omnidirectional, horizontally polarized antennas. Who came out on top?

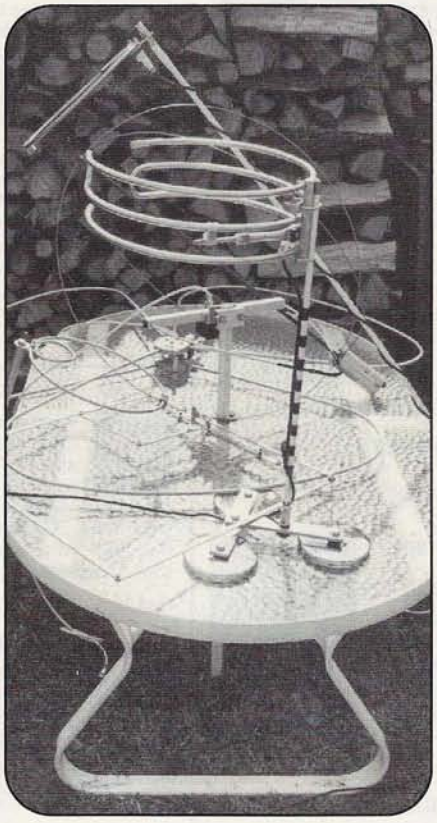
By Gordon West, WB6NOA*

One of the hottest growth areas in VHF today is the so-called "weak-signal" modes: single-sideband (SSB) and Morse code (CW). This is due in large part to the inclusion of VHF bands in multimode HF rigs, such as the Alinco DX-70 (HF plus 6 meters), ICOM's IC-706 (HF plus 6 and 2 meters), and Yaesu's brand new FT-847 (HF plus 6 and 2 meters and 70 centimeters). But you'll be missing out on most of the fun if you just plug in your vertical FM antenna to the VHF or UHF connections on these radios. That's because all weak-signal VHF stations use *horizontally polarized* antennas. Vertical antennas have over a 20-dB *cross-polarization* loss when working a station with a horizontal antenna, and that will rob you of many otherwise-easy QSOs. You must go horizontal like everyone else on single sideband.

Goin' Horizontal

Going horizontal with a beam antenna on the base station is no problem—just take your vertical beam (if you already have one), rotate it 90 degrees so that the elements are lying flat, and you're all set. Chances are you'll still be able to work FM repeaters with the beam in the horizontal plane, but, when you go horizontal, your SSB weak-signal communications will jump to life! You'll work other horizontal stations that you didn't even hear before.

Going horizontal on a mobile installation is a bit more challenging. If you're going to operate SSB mobile, the little whip you're used to for FM work will barely be heard by other horizontally polarized SSB mobile and base stations. A great way to go horizontal in your car with 360-degree coverage, minimal fading, little noise, minimum multipath, and maximum range to other SSB stations is with a *mobile loop antenna.* And these same horizontal loops can be used on a base station, as well, for omnidirectional coverage. Best of all, the ready availability of mobile loop antennas makes them just a phone call away (see "Resources").



No, this isn't what was left after the "shootout." It's a group shot of all the various 2-meter loop antennas tested for this article.

This article will focus on loop antennas for 2 meters, which offers the best mix of reasonable size (6-meter loops are kind of large on your car roof) and activity (there's much more on 2 than on 70 centimeters).

The 2-Meter Loop Shootout

I wanted to test the performance difference between all of the loops in current production. I also wanted to see whether or not a co-phased, stacked pair of loops would really boost my mobile signal, and to see whether any of these loops had major nulls in their horizontal radiation patterns as I drove a vehicle around an open loop course. I gathered some friends to listen to the various antennas and set to work on the great "2-Meter Loop Shootout."

Our test was conducted in a big parking lot right at the Pacific Ocean seashore. There were very few cars around and no metal buildings to skew the results. For each antenna, I drove 100 yards down the parking lot, made a lazy U-turn, drove 100 yards back, and turned again to get back to the starting spot, all the while transmitting a steady carrier. This allowed receiving stations to look for peaks and valleys on the incoming signal, see any effects of the U-turns on signal reception, and the effect of stopping the vehicle quickly so that the loop would swing back and forth on the fiberglass mobile mast.

Three stations continuously monitored the test to assure all receiving stations were getting about the same type of results on signal strength. They were:

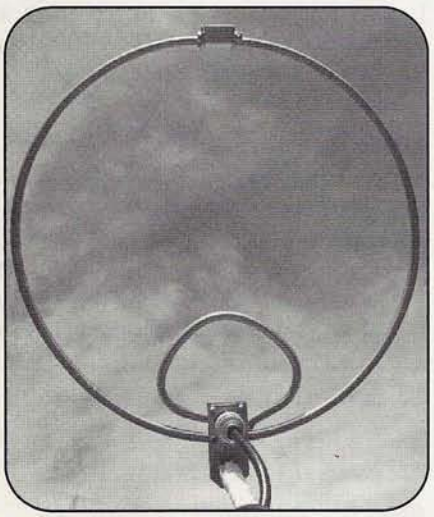
- Ron Hammel, KC6WLC, located 90 miles to the north at 5,300 feet elevation

**Gordon West, WB6NOA, is Senior Contributing Editor of* CQ VHF.

The test course was an empty parking lot overlooking the Pacific Ocean. The lack of nearby cars and buildings minimized reflections that might have skewed the readings.

- Chip Margelli, K7JA, 20 miles west, at 100 feet elevation
- David Peters, KI6FF, 12 miles west, at 100 feet elevation

To keep from saturating the S-meters of the close-in stations, I limited the output power to 4 watts. I didn't know if there'd be enough signal strength to reach Ron consistently on his faraway hilltop, but his contest array of long-boom 2-meter horizontal beams was easily able to hear my flea-powered mobile signal from each loop antenna.



The KB6KQ Super Loop turned in the best overall performance for its size among the single loop antennas tested.

Our test vehicle was the new Radio School communications van, and each loop was positioned approximately three feet above the fiberglass roof. This ensured that there was no interaction between the loop and the vehicle. We repeated each test twice, just to make sure there were no measurable changes in the propagation path. In all cases, all three stations agreed on the relative signal strengths from each antenna tested. Here are the results, listed in the order that we tested them:

M² "Sqloop"

This lightweight square loop gave all stations an adjusted S-4 in signal strength. The square loop exhibited some minor fading as we went through the U-turns. We judged its construction "adequate," but worried about moisture ultimately leaking into the black plastic protective cover. But even after our rain test, it still continued to perform at a steady S-4.

KB6KQ "Super Loop"

This was another good performer at an S-4 level, but without the significant fades that the Sqloop encountered during the turns. The construction of this loop was judged "solid," but there have been reports that rain could de-tune its performance. Sure enough, a rain squall did cause the SWR to rise slightly, but there were no reports that our signal strength tapered off. We liked the loop around crowds because there are no square corners to jab anyone.

Stacked "Super Loops"

A pair of the KB6KQ "Super Loops," stacked 48 inches apart, gave us the highest overall signal strength—S-7, even though there were little fades around the U-turns. This is a relatively large package to put on a small car, though, so one wonders whether the increase in signal strength is worth all of the strange looks you're going to get. But if you want the very biggest amount of signal strength on transmit and receive, stack a pair of KB6KQ loops, and be sure to order the coaxial cable stacking harness, too.

Laddy "Cloverleaf"

This antenna was formerly known as the "Big Wheel," and, to my knowledge, is now only manufactured on the local

Finding the 2-Meter Weak-Signal Action

You're going to *enjoy* weak-signal work on the 2-meter band. The mode may be single-sideband (SSB), as well as CW. It might also be FM through a couple of the orbiting satellites, too. But before you can start to enjoy weak-signal QSOs, you've got to know where to look for them.

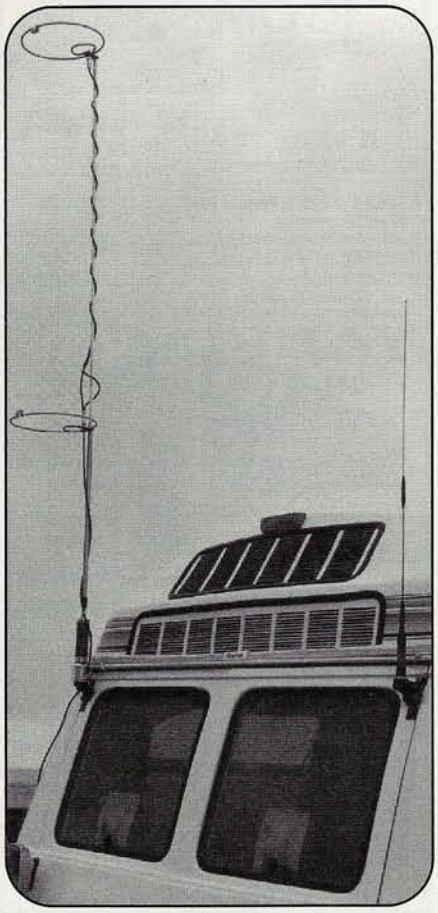
SSB operators hang out around 144.200 MHz. Once they make contact with another weak-signal station, they (should) QSY up or down the band to keep the calling frequency open for other SSB stations. The 2-meter SSB "window" is from 144.100 to 144.300. That means *absolutely no FM* activities below "300." Even though FM stations won't hear any activity below "300," there very well could be ongoing weak-signal SSB communications. *No FM below 144.300*! Thank you.

The satellite "window" is from 145.800 to 146.000 MHz. Use FM there only for FM satellites. Please avoid this window for terrestrial contacts in any mode. Thanks.

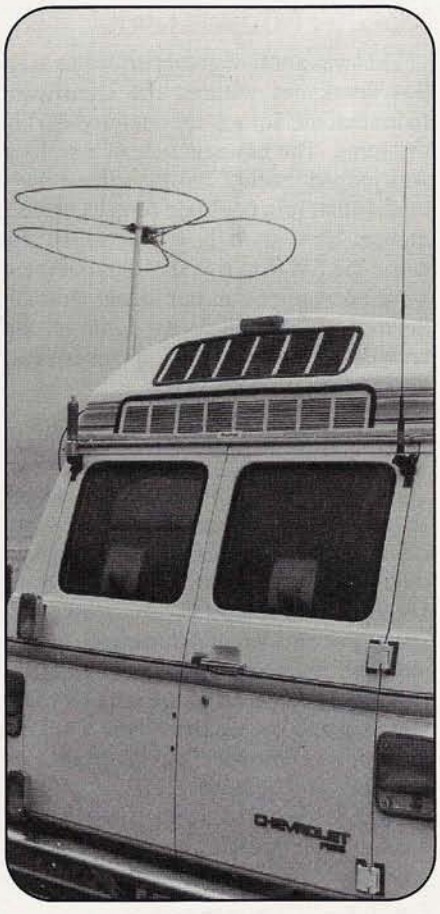
level by Laddy. It did better than the small single loops—S-5. Even though the Laddy loop is a homebrew project, he cranks them out on a regular basis and many hams will stack two or even four of these, one above the other, for increased omnidirectional gain at their base stations. But by itself, the massive cloverleaf did only a little bit better (1 S-unit) than the smaller square and round single loops.

"Chip Loop"

Just for fun, we also tested an old-time loop, probably called a "Halo," provided by Chip Margelli, K7JA. It did 1 S-unit better than the smaller single loops, probably because there is more surface area with the triple loops, one above the other, giving both incoming and outgoing signals a slight boost. The SWR was readjusted the next day, and repeated tests showed this older loop to be a terrific performer—slightly outdistancing the "Sqloop" and the KB6KQ "Super Loop." If you can find one of these used, buy it!



Standing tall—a pair of stacked, co-phased KB6KQ Super Loops outperformed everything else. But they'll also double your "funny look" factor from other motorists.



The Laddy Cloverleaf—a modern version of the Big Wheel antennas from the past—came in 1 S-unit higher than the smaller single loops. It also takes up much more space.

M² "Eggbeater"

This was our runner-up antenna, putting in stronger signals than the single loops, and slightly edging out the Laddy "Cloverleaf." The "Eggbeater" looks just like the name implies: four stiff wires that form the elements of the antenna for smooth omnidirectional horizontal polarity. We did notice some slight nulls through the U-turns, but other than that, the "Eggbeater" gave us slightly more signal than the other single-loop and "wheel" antennas. Incidentally, for satellite users, there is a right-hand circular takeoff at the top of the antenna going almost straight up, making the antenna suitable for satellite use, too.

Par Triangle

This is a brand new product from Par Electronics, and it gave us an extremely stable radiation pattern through the U-turns. Almost everyone indicated that there were minimal fades. The antenna assembles without tools and was comparable in signal strength to the single M² "Sqloop" and the single KB6KQ "Super Loop." But aerodynamically, I liked it best because of the natural way it adjusts to the wind while you're driving.

Overall Findings

I am happy to report that none of the loops did poorly. They all lived up to their advertised gain of "omnidirectional." In terms of decibels, this would be 0 dB gain!

The only way you're going to get gain out of an omnidirectional antenna is to

"I am happy to report that none of the loops did poorly. They all lived up to their advertised gain of "omnidirectional." In terms of decibels, this would be 0 dB gain!"

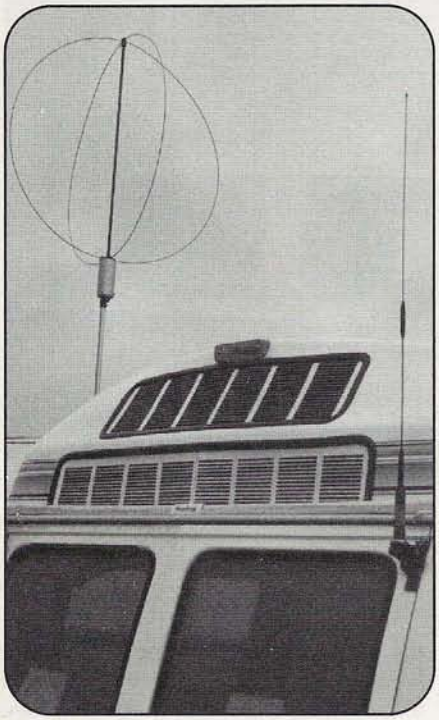
Chip Margelli, K7JA, with his 10-year-old 2-meter Halo antenna. If you can find one of these at a flea market (the antenna, not Chip), buy it.

stack them in a collinear array, one above the other, as we did with the KB6KQ loops. And for stationary mobile operation, the twin loops gave us our best reports. But for everyday driving across town, or across the country, I'll stick with any one of these single loops, elevated as high as possible above the roof line of the vehicle. I'd also feed them with LMR-style coax, keeping feedline losses to a minimum.

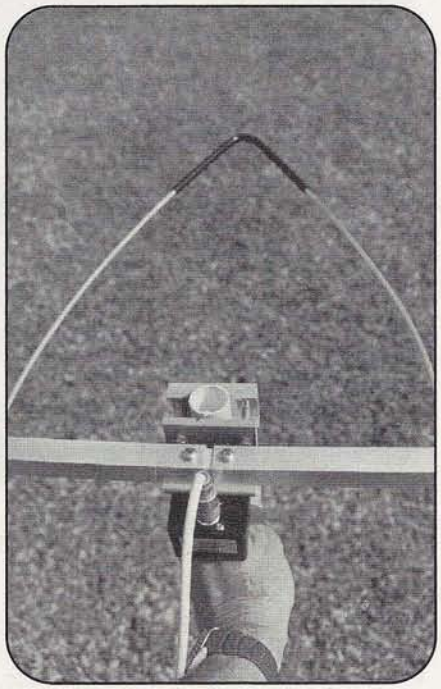
Overall, and not surprisingly, we found that the smaller the loop, the less signal strength was achieved. Conversely, the bigger loops, with their greater the capture area, offered a slight increase in signal strength, but had problems with fading around the U-turns. We also found that raising the loops three *more* feet above of the original three feet off the roof would increase our signals by half an S-unit. In fact, putting each single loop to the height of the phased, stacked upper Super Loop just about equaled the stacked array performance. *Almost* equal—the stacked array of KB6KQ Super Loops still outdid everything else we tried on the communications van.

Bottom line: They all work—so find one that looks good to you and come on aboard the world of weak-signal SSB and CW down around 144.200 MHz. ■

"Bottom line: They all work—so find one that looks good to you, and come on aboard the world of weak-signal SSB and CW down around 144.200 MHz."



The runner-up in our competition was the M² Eggbeater, which outperformed all of the single-loop antennas, including the Cloverleaf. It also provides a "straight-up" signal lobe for satellite use.



The newest entry to the omnidirectional 2-meter horizontal antenna market is the new Par Electronics triangle loop. It had very little fading through U-turns on the course and seemed to be best at handling the wind at higher speeds.

Resources

KB6KQ Antennas ("Super Loop"), c/o Norm Pedersen, 70 Arrowhead Dr., Carson City, NV 89706; Phone: (702) 885-7885; Fax: (702) 841-1880; E-mail: <KB6KQNORM@aol.com>.

Laddy ("Cloverleaf Loop"), c/o Wladimir Reisinger, N8EWU, 2416 Dunstan, Oceanside, CA 92054

M² Antenna Systems, Inc. ("Sqloop" and "Eggbeater"), 7560 N. Del Mar Ave., Fresno, CA 93711; Phone: (209) 432-8873; Fax: (209) 432-3059; E-mail: <m2sales@aol.com>

Par Electronics ("Triangle Loop"), 6869 Bayshore Dr., Lantana, FL 33462; Phone: (561) 586-8278; Fax: (561) 582-1234.

These loops are in current production, but if you keep an eye out at local swapmeets, chances are you may find an oldie but goodie "Halo"-style antenna, which should always remain a prized possession. In fact, if anybody has an old-style "Halo" multi-element, 2-meter, horizontal mobile loop, give me a phone call!

Get 100-Plus Mile Mobile Range on VHF Sideband!—Part 2

If Part 1 of K1MAP's series persuaded you to set up a VHF SSB station in your car, keep reading for Mark's operating tips...which should help you be in the right place at the right time to be heard by hams farther away than you ever thought VHF would work!

By Mark Casey, K1MAP*
e-mail: K1MAP@juno.com

Editor's Note: In Part 1 of this series, which appeared in the April, 1998, issue of CQ VHF, *K1MAP covered the nuts and bolts aspects of setting up a mobile SSB station for VHF—choosing a rig and antenna, installation, etc. This month, Mark concludes with what to do next—maximizing your chances of making contacts as far away as possible.*

Once you've got your mobile VHF sideband station set up, it's time for some fun on the air! The beauty of a mobile setup is that you can use it just about anywhere: on the way to and from work, at lunchtime, in your driveway, on weekends, vacations, while the wife and kids are in the mall, or—the best place of all—on top of that picturesque hilltop you drive up to just before sunset.

Distance to the Max...

Even if you live in some of the flatter parts of the country, you can still pick a high spot, or just a clear area like an unused parking lot, away from trees and buildings. These locations increase your range by leaps and bounds. If you're lucky enough to live in an area with a relatively clear hilltop of even only 100 to 200 feet above the surrounding terrain, you'll find that a 50-to-100-mile range will increase to 150 or more miles, and that a 150-mile range will go to 200-plus miles.

If you can drive there, you can operate there—even sometimes on the beach! That's the author's daughter, April, guarding the van.

The other technique for increasing your station's range is to operate at the most likely times of *signal enhancement*. There are many types of enhancement used by the mobile operator, but the most common is *tropospheric ducting*, or just *tropo*. The best times to encounter this effect on a regular basis are during warm weather, from sunrise to 8:00 or 9:00 a.m., and from just before sunset to several hours after. Summertime is your best bet, but if your weather forecast shows warm air streaming north in mid-winter, expect some tropo. And, as I mentioned in Part 1, tropo increases as you head south, and winter tropo openings are more

Mark Casey, K1MAP, enjoys VHF/UHF/microwave operating from his home in Hampden, Massachusetts, while mobile and while hiking.

commonplace as you head toward the southern tier of states from Florida across to Louisiana, Texas, and California.

DX Heaven

One of my most memorable mobile contacts took place around sunset on an evening in August of 1996. I was on my way home after a day of hiking in far western Massachusetts, and I stopped to have the last sandwich of the day alongside beautiful Plainfield Pond in the Central Berkshire Hills. Not quite tired of radio after a day of operating portable/backpack (we'll have to cover that subject in another article), I reached up and turned on the sideband rig and called out a few of CQs on 144.200, the 2-meter SSB calling frequency. The first one to come back to me was Del, KD1DU, from southern Connecticut, just about 100 miles distant. A minute later, Ray, W1REZ, joined in from central Maine, and we were up to 250-plus miles. This was getting good! Then Sid, K8ZES, from western New York, came in, putting us in the 300-plus mile distance class *and* I've got a four-way QSO going with a span of over 500 miles between the two most distant stations *and* we can all hear each other! My conclusion: tropo works *great* with mobile operation!

The best of both common VHF/UHF distance enhancers—a high hill and a good tropo opening—can put the mobile sideband operator in DX heaven! So take a ride in your mobile station, find the best hilltop or open area you can, take a listen, then give a call, and listen for a while again, as sideband operators sometimes take a minute or two to get fired up to respond to your call. And don't forget to ID as a mobile station. While it's not required, base stations just love to talk with mobiles. I think that you'll be pleasantly surprised!

A two-band mobile setup with omni-directional halo antennas for 6 and 2 meters (the bigger one is for six), plus a 2-meter beam for distance.

Who, What, Where & When!

You can also be *un*pleasantly surprised if you go home from your hilltop with few or no contacts in the log because you picked the wrong time, band, or frequency on which to operate. To keep that from happening, here's what to expect on the sideband portion—always *upper* sideband on VHF—of the most popular VHF and UHF bands, along with tips on where and when to find the most action (see the Table for a handy reference chart to the most commonly used frequencies on each band):

6 Meters

Calling frequencies vary on six, and 50.125, 50.150, and 50.200 MHz are alive daytimes during contests, as well as during the December to January and May to August *E*-skip seasons. And 50.110 is an international-only calling frequency; if you hear something there, you might have a real DX station.

Most other activity is in the evening, especially Sunday night, which is "activity night" (activity nights are specific evenings each week set aside to encourage SSB operation on a particular VHF or UHF band). Many stations monitor 50.125 for DX stations, so if you're going to be on with one station for more than a few minutes, it's best to move up a bit, to say 50.130 or .135. The calling frequencies should be reserved for just that—calling and making brief contacts. Don't worry, other stations will find you even if you move.

2 Meters

This is by far the most popular VHF-SSB band, and in many parts of the country, you'll find activity from early morning to late evening on the frequencies between 144.105 and 144.270 MHz. Here, 144.200 is the calling frequency and you'll hear the most activity within 30 kHz in either direction. Monday evening is 2-meter activity night and you'll see an increase in operators on the band then, and all weekday evenings between 8:00 p.m. and 11:00 p.m.

"If you're lucky enough to live in an area with a relatively clear hilltop of even only 100 to 200 feet above the surrounding terrain, you'll find that a 50-to-100-mile range will increase to 150 or more miles, and that a 150-mile range will go to 200-plus miles."

Since 2 meters has the most activity, this is the band on which you're most likely to experience what serious VHF weak signal operators think are the most rewarding contacts of all: those via long distance tropo and *E*-skip (not to mention aurora and FAI, or Field Aligned Irregularities, which often "opens up" 2 meters after a big sporadic-*E* opening on 6 meters, even if the *E*-skip doesn't make it all the way up to two). Again, many stations monitor 144.200 for DX, so if you're going to be on for more than a few minutes with one station, it's best to move up or down 5 or more kHz.

Above 2 Meters

There's less activity on these higher bands than on six and two, but with some perseverance, and perhaps a "sked" or two, your mobile station can shine here, as well.

- 1.35 meters—Most SSB activity is in the evenings near 222.100 MHz. Tuesday is activity night, but stations are still sparse. We need more stations on this band, but equipment is difficult to come by. Operate on the call frequency on this band and higher frequency bands to increase the odds of a contact.
- 70 centimeters—Evenings near 432.100 MHz are your best bet. Wednesday is activity night. Microwave operators meet up on this band and on 2 meters to schedule higher frequency contacts.
- 23 Centimeters & Up—Evenings are best, not because the propagation is better, but because that's when the greatest number of people are available. Except during contests, there's generally not enough activity on these bands to have

Table. VHF+ Sideband Operating Frequencies in MHz

Calling frequencies are in parentheses.

Band/Frequencies	Primary Use(s)	Notes
6 Meters		
50.080–.100	CW	
50.100–.125 (.110)	USB+CW	International QSOs
50.125–.300 (.125, .150, .200)	USB+CW	General Use
2 Meters		
144.050–.100	CW+EME/CW	
144.100–.275(.200)	USB+CW	General Use
144.275–.300	Beacons	
144.300–.500	SSB+CW+FM+AM	Mixed Use
1.35 Meters		
222.060–.200 (.100)	USB+CW	General Use
70 Centimeters		
432.070–.300 (.100)	USB+CW	General Use
33 Centimeters		
902.000–.300	West Coast USB+CW	General Use
903.000–.300 (.100)	East+Midwest USB+CW	General Use
23 Centimeters		
1296.080–.300 (.100)	USB+CW	General Use

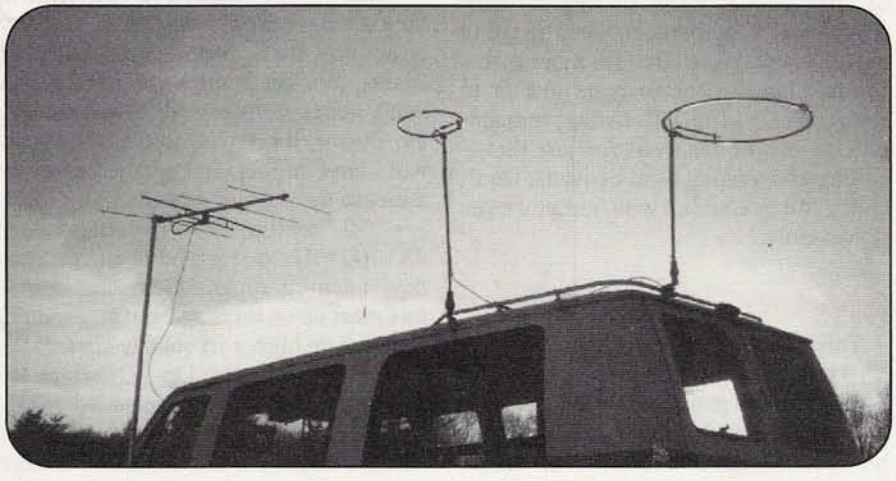
much success with calling CQ. You'll do best to make a schedule (a "sked") by calling on 144.200 or 432.100 MHz and looking for people who want to talk on the higher bands.

The bottom line for mobile operating is that, if you're in a normal morning and afternoon commute, 6 meters and 2 meters will be your best choices because of higher activity levels. If you travel at off-hours or in the evenings, when more people tend to be on the air from home (and you have a few extra bucks to spend), you might want to try going mobile on 432 or above.

Mobile Operating Tips

Mobile operating poses greater challenges than operating from home, because you're generally running less power and smaller antennas than base stations. Plus, you're a moving target if you're talking while driving. Here are some tips for making yourself heard on SSB mobile:

- *Listen*—On the call frequency, for at least a couple of minutes. A mobile usually has some ambient noise from the vehicle which often masks an ongoing QSO.
- *Call CQ*—On the call frequency. It *is* proper to use "CQ" on VHF, especially when you're using sideband. A minute-long call giving your location relative to the nearest major town (several times) is great, as it gives base stations your direction and time to turn their beams toward you.
- *Listen Again*—Sometimes it takes a while for the dedicated base station weak-signal operator to get on the air (tube-type amplifiers take time to warm up). You'll be surprised to hear a station reply after you've quit calling for a minute or two!
- *Move off the call frequency*—If you're planning to chat longer than a few minutes. Many weak-signal operators monitor the call frequency in search of rare propagation openings and DX stations.
- *Move at least 10 kHz*—Away from other QSOs or from the call frequency if you *or the other station* are using power greater than 25 watts.
- *To join an ongoing QSO*—Drop in your call between transmissions. Be prepared to call more than once. Most mobiles aren't nearly as strong as base stations, and it may take a while before you're heard. Patience pays off and most VHF weak-signal base station operators will welcome you. They're *glad* to hear a new station on!
- *Have Fun*—Get as many stations as possible involved, try a new hilltop, try a nice open beach location, try a new band. You'll all have a blast!



A better look at the author's mobile antennas. From left, his 2-meter beam, 2-meter halo, and 6-meter halo.

"The best times to encounter [tropo] on a regular basis are during warm weather, from sunrise to 8:00 or 9:00 a.m., and from just before sunset to several hours after."

"I've got a four-way QSO going with a span of over 500 miles between the two most distant stations* and *we can all hear each other! My conclusion: tropo works* great *with mobile operation!"

Q & A — Questions and Answers About Ham Radio Above 50 MHz

Q: In your January, 1997, issue, page 40 through 42, you printed an article titled, "Build a $5 Headset Mic." I felt I could use a headset with mic and purchased the headset and tried to purchase the components. However, the wiring diagram on page 42 called for a 2.5-mm *stereo* plug for the external mic hookup on my RadioShack HT.

Upon examining my RadioShack HT, it appears to me that it uses a 2.5-mm *mono* plug for the mic. Is this a misprint in the article? If not, where can I purchase a 2.5-mm stereo plug?

Herbert Berger, KF6FZV
Thousand Oaks, California
<herbberger@aol.com>

A: I'm not sure if we got the diagram wrong or if RadioShack changed the type of plug it uses. In any event, if you look at the instructions closely, you'll see that there are connections only to the tip and sleeve of the 2.5-mm stereo connector (nothing to the ring). So if your HT uses a mono connector, you can probably use a mono plug and wire to tip and sleeve as directed. The only time there'd be a problem is if the radio does use a stereo socket, in which case a mono plug would produce a short between the ring and the sleeve.

Q: I am a builder and am interested in sources for variable capacitors and specialty tubes, such as 2C39 tubes and sockets. Can you direct me to some commercial or surplus outlets where I can find RF components to construct VHF and UHF linear amplifiers? Thank you.

Don S. Righello, W6PJJ
Sacramento, California
<DSRIGHELLO@aol.com>

A: In my e-mail reply, I pointed Don toward the usually referred parts sources, such as Mouser, All Electronics, Surplus Sales of Nebraska, etc. Do any of you readers know of other sources that may be better stocked on the specialty items for which Don is looking? If so, please share them with us. Thanks.

Q: Hello from Gatineau, Quebec. I am shopping for a VHF ham radio to be installed on a small boat which will be cruising the east coast of your country and eventually as far south as the French Antilles. I have researched the Web for a list of stations with Internet gateways but I have been unable to find this information for the Caribbean region.

1. Do you know of the existence of such a list? My main interest is to maintain e-mail communications with family and friends while traveling on my boat.

2. Which radio, TNC, and antenna would you recommend for this purpose?

3. What range should I expect with a 70-watt transceiver?

4. Is it reasonable to expect e-mail transmission via amateur satellite, say once a week?

Thank you for you time. Any recommendations are more than welcome. 73,

Jacques Lauzon
Gatineau, QC Canada

A: First of all, you should be aware that you must have an amateur radio license before you may use an amateur radio transmitter; and if you'll be in the territorial waters of another country, you'll need a reciprocal permit from the other administrations involved (there's automatic reciprocity between Canada and the U.S.). In addition, amateur radio may be used only for non-commercial messages. Now, to your questions:

1. Direct amateur/Internet links are fairly uncommon, because of the difficulty in preventing commercial e-mail from getting onto the amateur circuits. There is some linking, via the "ampr.org" domain, but my understanding is that it is a parallel Internet connection, not a direct link.

2. The specific gear that you get would be dictated by your personal preferences, distance from shore, etc. We can't make any specific recommendations.

3. A 70-watt transceiver should give you a 50 to 60 mile minimum range, particularly over water, but a variety of factors will influence your actual range at any given time.

4. Most amateur digital satellites have a minimum of three passes each day within range of just about any location on the planet. If you connect, you may download any waiting messages at that time. Keeping a good connection to a satellite making a 15-minute pass while on a boat that's rocking on the waves will be difficult, however, as it'll be hard to keep your antenna pointed at the satellite (it's hard enough when you're not moving up and down or side to side). Good luck on your sailing trip.

Do YOU have a question about any aspect of "Ham Radio Above 50 MHz"? We'll do our best to give you a clear, concise answer—or if it's not a question that has just one easy answer, then we'll invite readers to offer their solutions. Send your questions to: Q & A, *CQ VHF* magazine, 25 Newbridge Road, Hicksville, NY 11801; via e-mail to <CQVHF@aol.com> or <72127.745@compuserve.com>; or via our Web page at <http://members.aol.com/cqvhf/>. Be sure to specify that it's a question for "Q & A."

CQ VHF Ham Radio Above 50 MHz

Reader Survey—May, 1998

We'd like to know more about you...about who you are and where you live, about the kinds(s) of work you do, and about your ham radio interests and activities. Why? To help us serve you better.

Each month, we'll ask a few questions, and ask you to indicate your answers by circling certain numbers on the Reader Service Card and returning it to us (we've already paid the postage).

As an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, we continue repeating last year's questions to see how our readership has changed in the past year.*

	Circle Reader Service #
1. Please indicate your highest level of education:	
currently in elementary, middle, or high school	1
out of school (did not finish high school)	2
high school graduate	3
currently in technical school (post high school)	4
technical school graduate	5
currently in college (undergraduate)	6
college graduate	7
currently in graduate school	8
completed graduate school	9
2. Please indicate highest college degree held:	
Associate	10
Bachelors	11
Masters	12
Doctoral	13
3. Please indicate the job category that most closely describes your work:	
student	14
homemaker	15
professional/executive	16
educator/writer/creative	17
technical	18
service industry worker	19
government worker	20
factory worker	21
unemployed	22
retired	23
4. Do you plan to upgrade your ham license in the next two years?	
yes	24
no	25
Extra class, can't upgrade	26
5. Please indicate all modes on which you are active on VHF/UHF.	
If you are active on...	
APRS	27
ATV	28
FM	29
Packet	30
SSB	31
None	32

Thank you for your responses. We'll have more questions for you next month.

What You've Told Us...

Our survey questions in February dealt with how "well-connected" you are to VHF specialty organizations, newsletters, etc. First, we wanted to get a sense of your operating preferences, and a majority of you who responded (55%) operate FM plus at least one other mode. Another 41% operate FM only, and 4% are not currently active.

Just about three-quarters of you are familiar with at least one VHF specialty organization, newsletter, or conference, both among FM-only operators (76%) and among FM-plus operators (74%). And a solid majority of you (60%) belong to at least one VHF specialty organization (39% FM/ repeater group; 21% non-FM group). In addition, the remaining 40% say they would consider joining such a group. The numbers are similar for VHF specialty newsletters.

Not surprisingly, only 18% of you have ever attended a VHF specialty conference, but it's encouraging that 71% say you'd consider it, and only 11% say you're not interested. Finally, *CQ VHF* seems to be your major source of information about these groups, newsletters, and conferences, with 35% of you who are familiar with them saying you learned about them here, followed by 24% from other hams (over the air), 21% from other ham publications, and 19% from other hams (off the air).

This month's winner of a free one-year *CQ VHF* subscription is J. Dean Williams of Robbins, North Carolina. As always, thanks for sharing your views with us.

New Records and New Possibilities on 76 GHz Plus...Goin' Microwave Mobile!

If you think microwave communication is limited to fixed stations using point-to-point paths, think again. This month, Kent takes us on the road—on microwave. But first, some news from the bands...

Two hams in California have set two new U.S. records on the 76-GHz band. On November 28, 1997, Lars Karlson, AA6IW, and Will Jensby, WØEOM, made their first QSO on 78.000 GHz over a 4.6-kilometer (2.75-mile) path between Lars' house in Los Altos Hills, California, and the nearby Stanford Radio Club. It became the record by default, as no one else on this side of the Atlantic has made any other distance claims for the band. While records have stood for years on our 120-GHz and higher bands, somehow, our 76-GHz band has been overlooked, so this quick QSO was now the North American 76-GHz record (the band, by the way, stretches from 75.5 to 81.0 GHz—that's 5500 MHz wide!).

Equipment problems that day prevented any extensions of the record, but Will and Lars tried again on December 11th and extended their record to 12.7 kilometers (7.6 miles), from Lars's house (again) to the campus of Canada College in Redwood City, California. AA6IW used an 18-inch dish and 2 milliwatts (.002 watt) out (see Photos A and B). WØEOM used a 12-inch dish and .5 milliwatt (.0005 watt) of power (Photo C).

The weather that day was sunny and warm, with the temperature around 70 degrees. While it was comfortable for the operators, these were actually horrible conditions for the high microwave (millimeter wave) bands. A 78-GHz signal has a wavelength of 4 mm. That's 4 millimeters, about 1/6th of an inch! Water vapor absorbs millimeter waves, so the best band conditions are up in the mountains, typically higher than 5,000 feet, with the temperature below freezing. As equipment and conditions improve, I'm sure we will see this record extended.

Photo A. Lars Karlson, AA6IW, and his 18-inch dish for 78 GHz. Lars and Will Jensby, WØEOM, set a new U.S. record for the band last December by making contact over a 7.6-mile path.

The Future of 76 GHz

I can easily guess what many of you are thinking. "Big deal. So what? They talked a few miles using thousands of dollars worth of exotic stuff." Well, I know these guys, and I can assure you there was a lot of effort expended scrounging parts, but not that much cash.

It may be challenging to build a 76-GHz station today, but not necessarily tomorrow. The major automobile companies are planning to offer collision avoidance radars for passenger cars in the near future. These radars will look at the distance to the car in front of you, measure the closing rate between your cars, and factor in your current speed in calculating the stopping distance. From this information, a warning light/buzzer will tell you if you're tailgating! Other sys-

By Kent Britain, WA5VJB

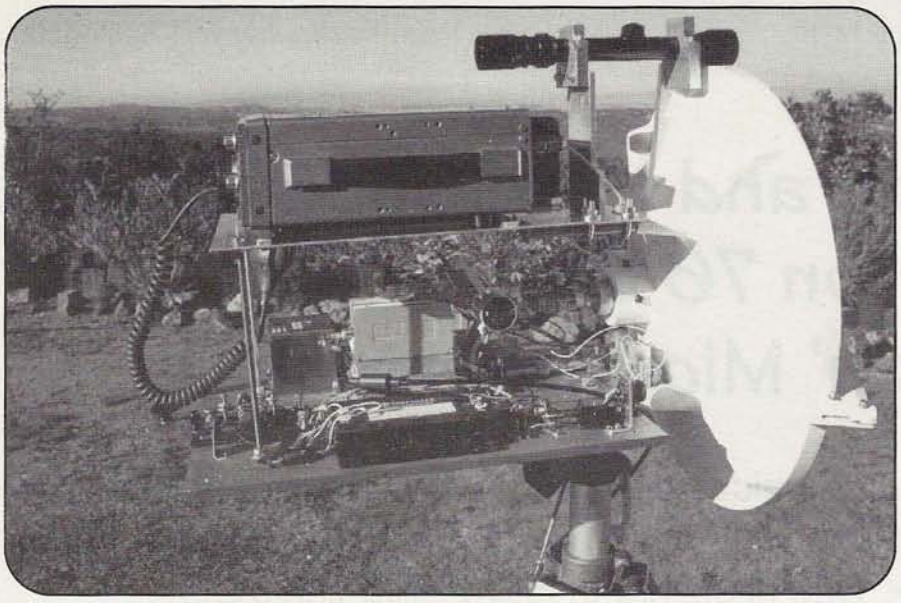


Photo B. The "nuts-and-bolts" of AA6IW's 78-GHz station. This end of the record-setting contact produced 2 milliwatts to the 18-inch dish antenna. At the very top of the whole setup is a rifle scope which was used to precisely aim the antenna.

tems would look to the sides and let you know if it's safe to change lanes.

These anti-collision radar systems are going to be operating in the same 76-GHz microwave band we share. This means millions of 76-GHz rigs are going to be on the road in the coming years—complete with antennas, transmitters, receivers, and other microwave parts. I'm licking my chops already. And bandwidth!! Data links with 5 Gigabit/second data rates! Imagine a packet data link that could theoretically download the entire contents of a hard drive in one second! Or maybe 2,000 digital ATV channels? Our millimeter bands have incredible potential and are a valuable resource.

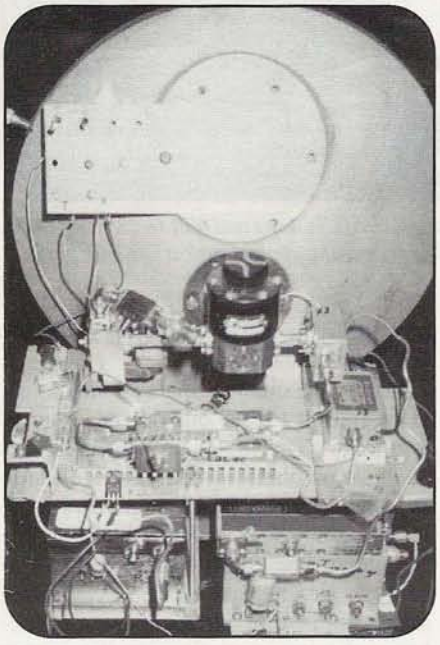


Photo C. The "other end" of the circuit. Will Jensby, WØEOM's 78-GHz station operated with .5 milliwatt out to a 12-inch dish. How's that for QRP? (Photo courtesy WØEOM)

Another Record Down Under

Neil Sangfroid, VK6BHT, and Wally Howse, VK6KZ, report a new Australian 24-GHz record of 143 kilometers (about 86 miles). These guys, uh blokes, were not up on some mountains, but down on the beach! The 143-kilometer path was entirely over water, as Neil and Wally took advantage of an *evaporation duct*. Evaporation ducts form just above the surface of warm water. Both stations ran 20 milliwatts (.02 watt) of SSB and used 18-inch dish antennas.

Where There's a Will, There's a Way

In Photos D and E, you can see RW3BP's 10-GHz EME station in Russia. Sergei lives on the 16th floor of an apartment complex in Moscow, but that doesn't stop him from running microwave moonbounce. His six-foot dish is bolted to the side of the apartment building with a hinge at the base. This allows the antenna to swing over to the window for servicing. Sergei's preamp is from a satellite TV receiver and he has a 50-watt Traveling Wave Tube (TWT) amplifier mounted below the feed. Sergei has worked just about all the active 10-GHz EMEers in the U.S.—except for me! But I hope to have this corrected by the time this reaches print.

I know what you're thinking, and it was the first question I asked Sergei: "How did you get permission to put that antenna there?" Well, it seems that there wasn't anyone who could tell him he *couldn't* install his dish. And the dish was brought up on the elevator! As for that small 50-watt, 10-GHz amplifier, well, it seems they have some pretty good fleamarkets around Moscow these days.

Goin' Microwave Mobile

In my last column (March *CQ VHF*), I spoke a bit about mobiling on the microwave bands. Let's take a band-by-band look to see what you can expect:

1.2 GHz

I've done very little 1296-MHz SSB mobile. Over on FM, I've helped put together four 1292-MHz repeaters in the Dallas-Ft. Worth area. Taking advantage of the 20-MHz split between transmit and receive, and the almost nonexistent intermod on the band, we can really crank up the gain on the receivers with a hot GaAs FET preamp. Coverage is fantastic. Signals bounce all over the place—how about full quieting from underground parking garages? About the only difference you'll notice is, when going over that last hill 75 miles from the repeater, the fade out is much sharper than on 2 meters or 440 MHz. If you're thinking of building a 1292-MHz repeater, 440-MHz mobile duplexers tune up great on their third harmonic!

2.3-GHz SSB

I haven't done any FM mobile on this band, but I have noticed one interesting effect. That "picket fencing sound" you hear on 2 meters when you pass bridges and such, is actually a Doppler Shift effect. On 2.3 GHz and at highway speeds, picket fencing occurs around 120 Hz. You would swear that the other guy just cut all the filter capacitors out of his power supply as you went under that overpass (most power supplies use full wave rectification, so the ripple is 120 Hz, not 60 Hz).

Photo D. Sergei, RW3BP, and his 10-GHz EME station. His six-foot dish antenna is bolted to the side of his Moscow apartment building, and can be swung in to a window for adjustments and maintenance.

I've made SSB mobile QSOs to better-equipped stations out as far as 80 miles. WA5DBY has made mobile QSOs out to 250 miles under good conditions. No repeaters, no satellites, just key the mic and talk.

3.4 and 5.7 GHz

Mobile operation on our 3.4- and 5.7-GHz amateur bands is quite similar. The Doppler effects are now to the point that you almost always have a low tone during the QSO when you're moving. Range is similar to the other bands.

10-GHz SSB

Here is where microwave mobiling becomes a lot of fun (and I won't even mention that whistling into the microphone will set off a radar detector at two miles!). Doppler is now a constant companion. Say your friend tunes you in on SSB. You hit the gas and take off down the highway. He has to retune about 800 Hz to follow you. Up the band? Down the band? Depends on whether you're coming or going. The fun part is driving though a downtown area, as your signals bounce off of hundreds of reflectors, each with a different Doppler shift. The ones behind you are lower in the band, the ones in front are higher. The signal kind of sounds like you're on the end of a pile up with a half dozen stations calling you. Lots of fun, but I really don't see 10-GHz SSB mobile as a growth area.

While mobiling during the ARRL 10-GHz contests, I typically run 4 watts of SSB into a 12-dB gain slot antenna. On 144 MHz, I run 160 watts of SSB into a halo antenna. The 10-GHz rig consistently out-talks the 2-meter rig.

I have made many 100-mile QSOs on 10 GHz while driving down the road with just an omnidirectional antenna on top of the van. Signals at 10 GHz bounce off of everything and usually get through... well, through everything but trees. If you're pretty much in open country, or it's the wintertime, signals get out great. But drive through a wooded area with lots of green leaves, and range is reduced.

10-GHz FM

Terry Turner, W5ETG, and I have done quite a bit of 10-GHz FM mobile work. That Doppler stuff I've been talking about is really a diffraction pattern through which the mobile station is passing. The reflected waves form peaks and valleys. The mobiles pass though these peaks and valleys, so the Doppler tone is really an AM-modulated signal. Switch over to FM and the Doppler tones go away. With wideband FM, the signals stay in the receiver passband and AFC (automatic frequency control) keeps everything tracking.

Actually, FM doesn't make the Doppler tones go away entirely. Most FM radios have a limiter circuit. This limiter circuit takes out all the AM-modulated signals. Most noise is AM, so FM doesn't have all that static. Well, the limiter needs a good strong signal to work with, so a Doppler tone will return as the mobile is passing out of range, just before his signal drops out entirely.

24 GHz

I haven't talked to anyone who has done 24 GHz mobile as yet. But I know that just aiming across a field of grass, you can hear the Doppler effects on CW or SSB of the wind blowing through the grass. With wideband FM (deviation greater than 25 KHz), 24-GHz mobile should be possible.

All Those Useless Frequencies...

Eighty years ago, hams were given "all those useless frequencies" above 2.0 MHz. Sixty years ago, everyone felt those frequencies above 30 MHz were useless. Twenty-five years ago, hams felt frequencies above 148 MHz were useless. And today, most hams will tell you the frequencies above 450 MHz are useless (while talking to you on their 1900-MHz digital cellphone!) Do me a favor, set them straight!

Hope to hear you on the higher bands.

—WA5VJB

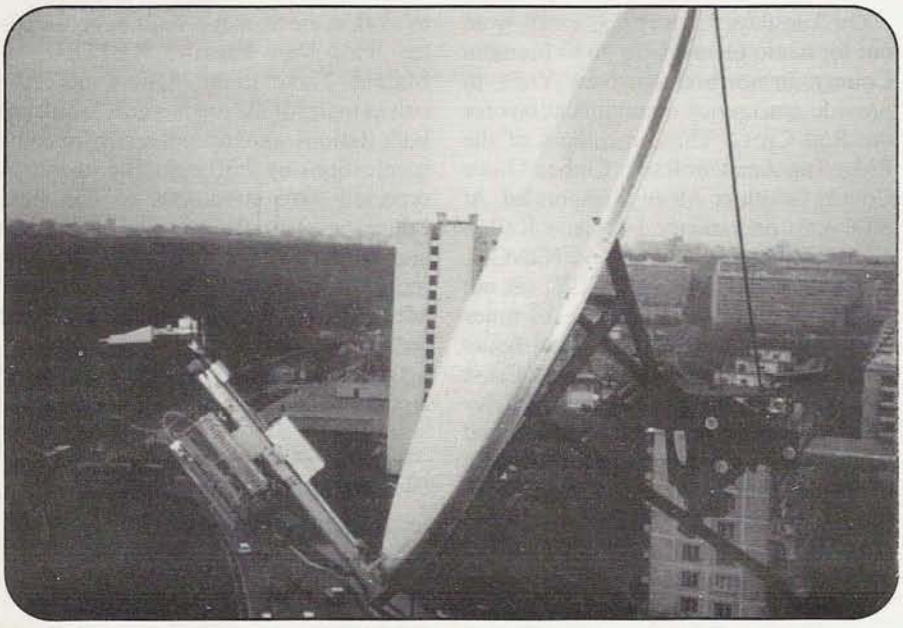


Photo E. Sergei's EME station in the operating position. RW3BP has managed to contact just about all active 10-GHz EME stations in the U.S. from his downtown Moscow QTH—except for WA5VJB!

Weather Woes Keep Hams Busy

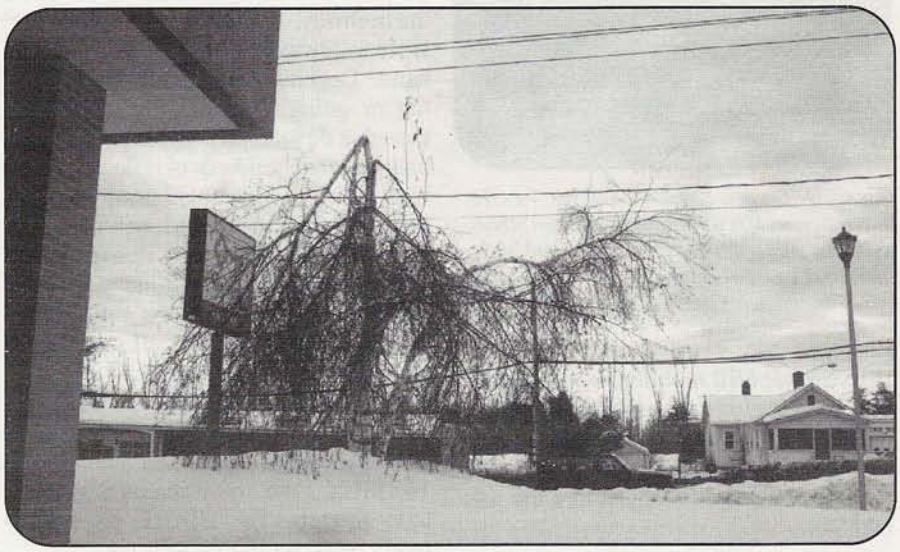
Wicked winter weather kept hams busy earlier this year in upstate New York, Kentucky, and California. Is El Niño to blame?

El Niño is an abnormal warming of the ocean temperatures across the eastern tropical Pacific that brings important consequences for weather around the globe. El Niño episodes usually occur approximately every two to seven years. This time around, the warm tropical ocean waters first appeared in March, 1997, and quickly strengthened to become one of the strongest El Niño events on record. And it's not over yet.

The National Oceanic and Atmospheric Administration (NOAA), the arm of the U.S. Department of Commerce that runs the National Weather Service, says the strong El Niño conditions that were first forecast last May are expected to continue through early summer of this year, with continued increased rainfall across California and the southeastern U.S., and continued milder-than-normal conditions over much of central North America.

"The 1982–83 El Niño led to more than $10 billion in weather-related damages worldwide—and this El Niño may be just as strong," according to Commerce Secretary William Daley. "Providing this type of accurate weather information six months in advance has never been done before and has enabled our communities and businesses to better prepare and protect themselves."

But, as we'll see, this has not lessened the need for amateur radio communications. This month we cover some of the weather events that have required amateurs to serve...In the Public Interest.



January's northeast ice storm snapped trees like matchsticks, and, when they fell, they often took power and phone lines down with them. Once again, ham radio came through, helping maintain communication links for relief efforts. (Photo courtesy Deb McKay, WX2DEB)

New York Clean Up Continues

Reports of ham radio response to the massive northeast ice storm this past January were just coming in at last month's deadline (see April issue). Here's another report of hams helping in the public interest.

On Tuesday, January 13, a call went out for ham volunteers to go to Franklin County, in northeastern New York, to provide emergency communications for the Red Cross. Three members of the RidgeTop Amateur Radio Club in Ulster County (south of Albany) responded. At 8:00 a.m. on January 14, Gene Keller, N2MNZ, Eugene Melnyczuk, N2NCM, and Kimberly Giese, KC2CCY, set out for Malone, New York, some 10 miles from the Canadian border. Eight hours later, they checked in at the Red Cross headquarters. Driving in and out of lighted areas, over downed power lines, and around debris gave the three a small idea of the devastation the area had suffered. Most of the town of Malone had electric power, but surrounding areas had lost both power and telephone service.

N2MNZ and KC2CCY were assigned to work at the Brushton Moira Central School shelter and N2NCM was assigned to work at the St. Regis Falls School shelter with Dan Farrow, KB2TBL, of Malone. Travel to the shelters was difficult as many of the roads were closed, but both stations were up and ready for communications by 7:30 p.m. The operators reported road conditions to the State Police, passed traffic between the shelters and the Red Cross, and provided communications between the Disaster Medical Assistance Teams (DMAT) and their headquarters.

Giese reported the shelters were full of anxious residents awaiting power restora-

"Without these volunteer amateurs, this operation would have been very difficult."— Ron Headley, WD8QAZ, KY-1 DMAT Communications Officer

By Bob Josuweit, WA3PZO (bjosuweit@aol.com)

Antennas and towers didn't fare much better than trees in the northeast ice storm, meaning that public service agencies tied to permanent antenna installations were also cut off, increasing reliance on hams and their flexibility in setting up temporary stations. (WX2DEB photo)

tion. On Thursday morning, announcements were made to the shelter guests that they could get messages to their friends and relatives via amateur radio. This service was the hit of the day, as having been sheltered for some time without being able to get word to their loved ones was emotionally difficult.

Going to DMAT...

The DMAT units had come to New York from Kentucky and Michigan, and the Kentucky group (KY-1) had Ron Headley, WD8QAZ, with them at headquarters, making direct contact possible via ham radio. As it turns out, this was a good thing, since the DMAT groups' UHF public service radios couldn't always make the trip. Ron picks up the story from here.

After it was determined where the team's UHF radios would and would not work, we started a search of the VHF and UHF amateur bands for operational repeaters. The only amateur equipment available was a Yaesu FT-50R dual-band handheld with a spare battery pack and rapid charger that works on 12 VDC or 110 VAC. The best antenna available was a 1/4-wave dual-band mag-mount which was mounted upside down on a door frame, placing the antenna in the center of the glass on the door. We also had an AOR 8000 scanner, along with 12-VDC and 110-VAC chargers. Both radios can also work on AA batteries and we had 24 of them on hand. No amplifiers were available, so output was limited to 5 watts.

We were able to copy several 2-meter repeaters. Our first contact was with a repeater located near Montreal, Quebec. The Canadian amateur operators were very busy with their own version of the disaster in Quebec Province, but did offer to relay traffic for our team back to Albany via 75 meters.

On this deployment, the Medical Staging Unit (MSU) was in Albany and the DMATs were spread out in a six-county area of northern New York. The Malone location was somewhere around 170 air miles from Albany. The terrain is low mountains with the Adirondack mountain range located between us and the MSU in Albany. It is possible that a better 2-meter antenna and a power amp might have enabled me to reach one of the wide area repeaters and be in direct contact with the MSU, but with all of the cold weather gear and equipment we had to bring, the space for extra amateur gear was very limited.

Our first local contact was made with Jeff Casagrande, K2KYR, on the 147.225 repeater that I was able to access using my 2-meter handheld (the repeater is in Malone). This repeater was operating from a generator the entire time we were in Malone. Jeff and the entire North Franklin Amateur Society club are to be commended for their fine work on keeping the repeater working and for establishing emergency communications in that area of New York. The North Franklin group is an ARES (Amateur Radio Emergency Service) group and had obviously practiced emergency communications. In addition to the 2-meter repeater, the group had 75-meter contact with the state emergency networks and was able to establish 75-meter contact for us with the MSU. Because of this group, our initial situation of being isolated and dependent on marginal telephone and cellular lines to Albany became one of direct radio links which were maintained throughout our deployment.

Locally, the group managed to place amateur radio operators in all of the region's shelters, hospitals, and nursing homes on a 24-hour basis. Amateur operators came to help from various parts of New York state as well as Vermont. This ARES volunteer staffing and operation opened a great window for KY-1 Communications, allowing us to directly contact every area that team members were staffing and visiting. Without these volunteer amateurs, this operation would have been very difficult. While the phone lines to our headquarters at the Davis school did work the entire time, the school had only three lines and they were constantly busy. Several team members had cellphones that sometimes worked and sometimes didn't.

Team Relays

The amateurs quickly figured out that we had a roving medical team with which we

were not in constant UHF radio contact. The amateurs at the shelters began relaying information on this team's location of as well as its expected *next* location. This became a routine part of each operating day: Call the amateur at the shelter where the roving team was and ask to have the roving team telephone back to our base at Davis school. Then, get people to get off the phone lines at the school so they could get through. Along with all of the other traffic handled by the radio amateurs at the shelters, this help in keeping up with the roving team was a great asset to this mission.

In the future, I might look into bringing a dual-band amateur mobile and cross banding from my handheld to allow more flexibility in operation while away from the ops center. Things like packet could also have helped and certainly my laptop computer would have been very useful. The key to making it work, though, was making contact with and utilizing the local amateur operators to plug into the state emergency network. This is exactly what all ARES and RACES operators are trained to do, and their training certainly paid off for our DMAT unit in New York.

Surprise Winter Storm Hits Kentucky

Ron also discovered that he couldn't escape the winter weather by going home to Kentucky. Early morning on February 4 brought a surprise snowstorm to the central part of the Bluegrass State, dumping more than 18 inches of snow on the Lexington area in two days. National Guard units were activated in 30 counties, and 10 deaths were blamed on the storm.

Pat Spencer, KD4PWL, ARRL Assistant Emergency Coordinator for Fayette County, which includes Lexington, says winter storms of this magnitude are uncommon in the region. "Public safety agencies and disaster relief organizations quickly find their communication systems overburdened, and sometimes failing," says Spencer. "Amateur radio operators are quickly called to assist with emergency communication for local and state Emergency Operations Centers (EOCs)."

When the February storm struck, hams responded quickly to supplement communications for local agencies, relief organizations and the Kentucky Disaster and Emergency Services (DES) Area 13 EOC located in Lexington. Operations included providing communications regarding a 30-mile traffic jam on Interstate 75, a major north/south corridor; gathering information for state officials regarding highway conditions, utility disruptions, and the need for National Guard deployment; and many local duties.

Fayette County amateurs supported the district by staffing the station at the Area 13 EOC, and answering calls for assistance from amateurs on the road. Ron Ritchie, KF4MOM, stood watch at the DES office in Lexington, handling traffic for 30 hours. This traffic helped state officials coordinate their response to the storm, and was relayed to Frankfort, the state capital.

In nearby Bourbon County, over 25% of the amateurs were on the air during the two-day emergency. Operators there relayed information on local conditions and road status to the local emergency management agencies and the Lexington DES office. They also relayed information between adjacent counties. Emergency Coordinator Dale Sanders, KE4OOS, said county amateurs remained on standby through the entire period to respond to all calls for assistance.

East of Lexington, the city of Winchester and Clark County began activating amateurs early on the 4th. Amateurs staffed the local EOC, provided communications for local agencies, and relayed traffic for state officials at the DES EOC in Lexington. Those in four-wheel drive vehicles transported medical personnel and supplies until the National Guard arrived. Amateurs were then placed in rescue vehicles and National Guard "humvees" for additional communications. Clark County ended its state of emergency on February 7.

Gary Epperson, KD4RON, Director of Disaster and Emergency Services for Winchester/Clark County, praised the

California mud slide—this one was in Sausalito. The little blobs in the circle are actually men in raincoats at the top of the hill. A seemingly never-ending string of heavy rainstorms kept emergency crews and hams in California busy all winter. (Photo courtesy Robert Sanford, N2OWI)

"Public safety agencies and disaster relief organizations quickly find their communication systems overburdened, and sometimes failing....Amateur radio operators are quickly called to assist...."
—Pat Spencer, KD4PWL, Ass't EC, Fayette Co., Kentucky

amateur response: "If it weren't for the assistance of amateur radio personnel providing communications expertise and support of operations within the EOC, plus providing 4-wheel drive vehicular support, our response to the citizenry and healthcare facilities would have been lessened dramatically," he said.

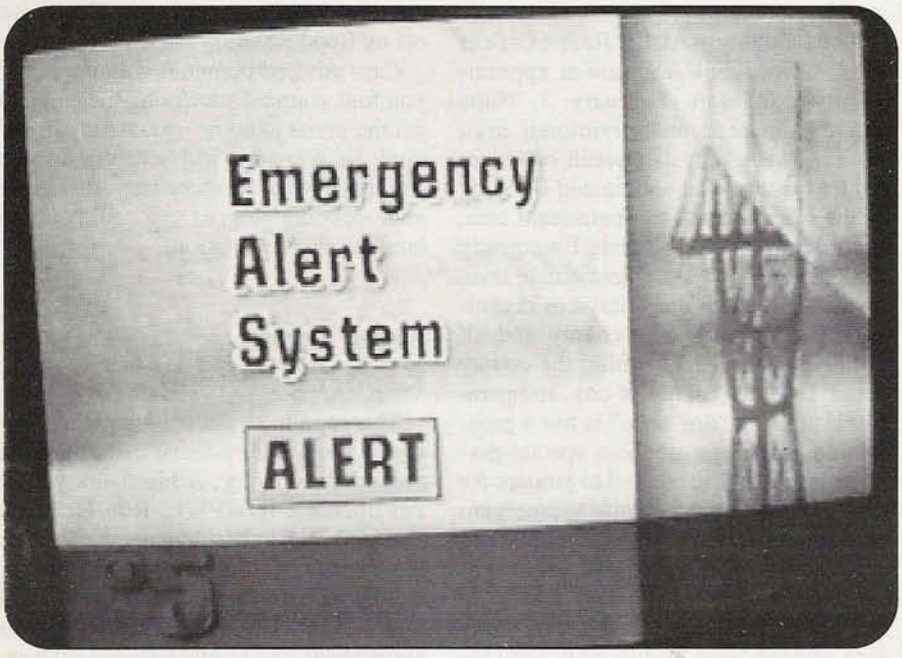
In rural Harrison County, the phone system was jammed for 24 hours during the storm, and a single amateur operator provided liaison between local officials and the DES EOC. Eddie Lutes, KF4OIR, passed all necessary traffic and provided information to the DES regarding road conditions and local roof collapses.

Next door in Scott County, amateurs freed a local resident from her home when drifting snow covered her front door, transported a cancer patient for treatment, and provided local officials and the DES with needed information—including the official declaration of emergency. The DES office in Lexington was unable to fax the emergency declaration document to the Scott County EOC due to storm-related line problems. So Ron Headley, WD8QAZ, who had recently returned from DMAT duty in northern New York (see above), volunteered to receive the document at his home, and hand-carry it to local officials.

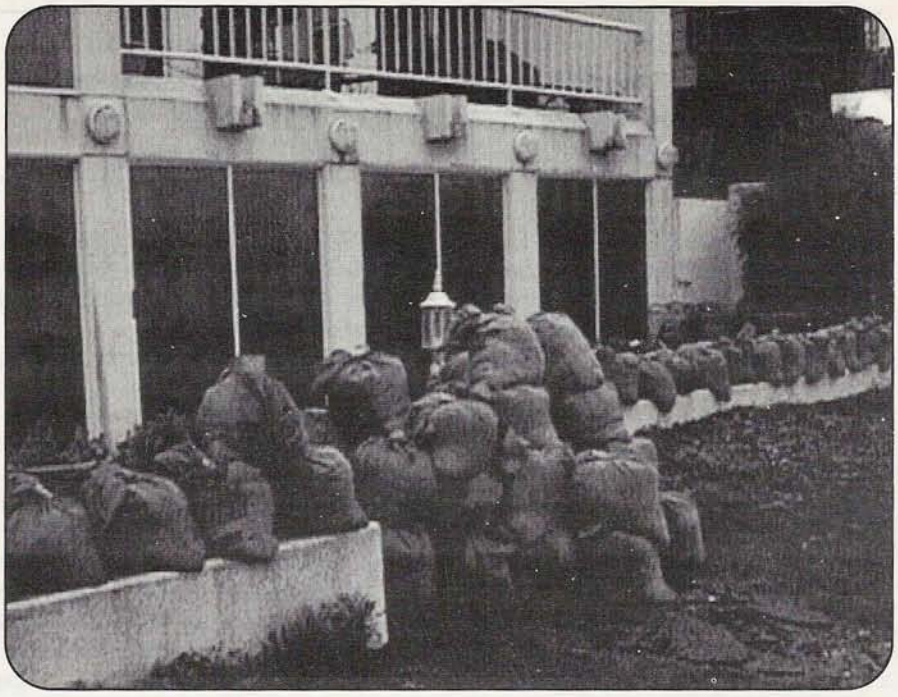
Amateurs in Madison County, south of Lexington, started operations at 3:00 a.m. on February 4 and continued to pass traffic for 60 hours. Nine stations remained on the air throughout the storm, providing information on road conditions for stranded motorists and state officials. Martin Hensley, KF4EBC, worked with the American Red Cross coordinating information regarding availability of shelters and their population in a five-county area. Areas in the south of the county had significant power outages because of the storm, and one of the primary repeaters in the county was off line due to lack of power.

Mudslides & More in California

In February, 27 counties in "storm-racked" California were designated for federal aid by the head of the Federal Emergency Management Agency



EAS Alert—You know things are bad when this pops up on the TV. Always remember to protect yourself and your family before heading out to be a "ham hero." (N2OWI photo)



Local sandbagging efforts managed to protect some—but not all—homes from flooding. Of course, sandbags provide no protection from mudslides. (N2OWI photo)

(FEMA) following President Clinton's major disaster declaration. The declaration covered damage from severe winter storms and flooding in early February, and, by the middle of the month, most areas of northern and central California had already reached their average annual rainfall totals. Southern California has already set several records for high surf, strong winds, and precipitation.

Napa County RACES Radio Officer Mark Caro, KE6UAX, said at approximately 1:00 a.m. February 3, Napa County declared an *operational area state of emergency* as a result of severe winter weather and anticipated flooding of the Napa River. An operational area, according to the California Emergency Services Act, is "...an intermediate level of the state emergency services organization, consisting of a county and all political subdivisions within the county area." Unlike a county or city, an operational area, or "ops area," is not a jurisdiction. Each ops area is a special-purpose organization, created to prepare for and coordinate the response to emergencies within a county.

The Napa County RACES unit was activated to provide backup service at Napa Central Dispatch, Napa County Fire, and the Napa County EOC until the ops area EOC was shut down in late afternoon. "We managed to dodge the bullet with only road closures and some short term evacuations of mobile home parks beings necessary," said Caro. "All in all, our situation was minor." But he noted that there was no way to know that when the RACES group was first called up. "The situation was highly fluid and we really didn't know what to expect," Caro explained. "Our situation gets interesting quickly in that we get geographically cut off by flood waters."

Caro advised potential volunteers, "If you find yourself answering the call and get the invite to come up and play in our mud, be prepared with everything you can think of for wet weather. Also bring your sleeping gear, as you could end up bunking in a fire station."

Keep Those Reports Coming...

This month, reports of amateurs serving in the public interest came in from around the country. A big thank you to Pat Spencer, KD4PWL; Ron Headley, WD8QAZ; Kimberly Giese, KC2CCY; the *Hudson Division Loop* newsletter for supplying information; and to N2OWI and WX2DEB for the photos. Let us know about your public service activities. Send them to <bjosuweit@aol.com> or <CQVHF@aol.com>. ■

Taking the Fear Out of Calling 911

If just thinking about having to report an emergency makes your palms start to sweat, this article by KC7GCL is just what you need.

By Neil Dabb, KC7GCL*

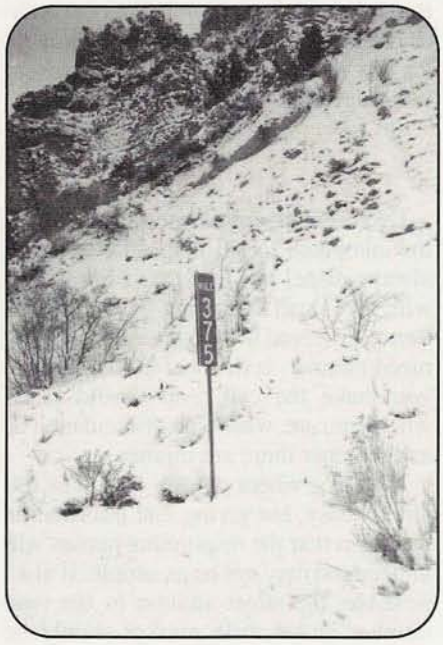
For most people, the mention of 911 conjures up images of disasters and heroic rescues. For me, when I was a brand new ham, just hearing those three little numbers come up on the repeater autopatch struck fear and panic into my heart. What if it had been *me* out there, encountering an accident or other emergency? Would I know what to do? Would I know what to say?

I have since overcome this fear, although I still listen more closely when 911 comes up on the autopatch. Hopefully, this article can dispel some of those same fears for other new (and maybe not so new) operators. In addition, there are some hints on how to get help when the need does arise.

First Things First

If you're a *brand-new* ham, though, the fear of calling 911 in an emergency may take second place to another fear: that of getting on the air and making contacts! Taking the first step in pressing that PTT (Push-To-Talk) button can be intimidating, but once that first step is taken and an operator has found out how to make a contact, the rest should be fairly easy.

Most hams are more than willing to help a new operator or inactive operator find out how and where to get help in the area. Local nets can also be a good source of information on how to get help when the need arises. (Nets are regularly scheduled on-air meetings, often with a specific purpose, such as sending messages or learning emergency procedures.)



Mile markers are one of the best landmarks to give when calling in an accident. (Photos by the author)

My father-in-law, who is a member of the Civil Air Patrol, once said that the purpose of a regular net is to show operators how to use the radio. There's some truth to that. It's pretty hard to help if we don't know how to use the radio, don't know the local repeater or simplex frequencies, or don't know how to use an autopatch. Since most of our time is spent close to home, there should be no excuse for not knowing how to get help in the area where we live. Start close to home, then worry about what to do when you're on the road.

Getting Involved

If you drive, then it's almost certain that you'll eventually come upon some sort of mishap. It may just be a fender bender, or it may be more serious. Most people will pass by because they don't think they can help or they don't want to get involved. As amateur radio operators, we can always help and should not be afraid to get involved, especially since Congress has recently acted to protect volunteers (*The Volunteer Protection Act of 1997 provides limited protection from lawsuits, but only for those volunteers working with organizations such as the ARRL.—ed.*).

Autopatch Basics

In many cases, the closest source of help will be the use of an *autopatch*, an *automatic patch* between the repeater and the telephone network. This is another area where practice will be invaluable. Most autopatches have a code to bring the patch up (often with an * in the code) and then use # or another code to take it down (hang up). Getting the codes from other operators shouldn't be too hard if you're willing to talk (*some clubs restrict autopatch access codes to club members, so you may not be able to get the codes over the air—ed.*).

Since each radio has a different method of accessing the DTMF tones used to access an autopatch, a quick call home now and then can be a very good idea to remind you how to use the autopatch (as well as reminding the folks at home that you do still exist).

Knowing what area the repeater you're using covers is also vital if you need to call for help. It won't do much good if you call 911 and get the dispatcher for a distant community. For repeaters that cover very large areas, there may be different codes to access help for the different communities. For example, on our repeater, dialing 911 connects you to the

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**Neil Dabb, KC7GCL, is an industrial trainer and freelance writer from Logan, Utah. He first got interested in ham radio in high school and obtained a Novice license which later lapsed. He returned to ham radio in 1995 and now holds a Tech-Plus license.*

The route number is also important when giving the location of an accident, especially if you're outside of heavily populated areas.

primary county that the repeater serves; 912, 913, and 914 are used to access the three neighboring counties within the repeater's coverage area. (These aren't actual phone numbers, but codes that tell the autopatch to dial the real number of the appropriate agency.)

Another approach that I've seen used is that a 911 call on the repeater will send the operator to a dispatcher who will then transfer the call to the appropriate agency. Since most 911 calls immediately bring up the address from which you are called (*this is a feature of "Enhanced 911" systems—ed.*), some repeaters will dial the *non-emergency* dispatch number instead of actually dialing 911 in order to avoid confusion (having the dispatcher think you're calling from the repeater site, since that's the address that comes up on the screen). Even so, you should always tell the dispatcher that you're an amateur radio operator and that you're calling from your car.

Information on how the 911 feature is set up on a particular repeater should be available from the local club. It's a good idea to find out such things *before* you come upon an accident. Another thing to remember is that many autopatches have a time-out feature. This means that after a preset number of minutes, the repeater will hang up the phone—even if you're not done talking. Some repeaters will allow you to press a key and reset the timer, but others will not. This is another reason why it's important that you let the 911 operator know you're an amateur radio operator using an autopatch.

What to Report

Even if an operator knows how to use the autopatch to get help, that does not always dispel the fear that's associated with a 911 call. Knowing what information to give, and how to give it in an organized manner, is the next hurdle. Before you make the call, you should know where you are, what type of accident it is, and whether there are injuries.

Knowing where you are should be relatively easy, but giving that information in a form that the responding parties will understand may not be as simple. If at all possible, the street address or the road number and a mile marker should be given; there's little room for error in these two methods. Well-known landmarks can be used if needed, but they leave a greater margin of error. The type of accident should be fairly obvious (vehicle, pedestrian, car off the road, etc.)

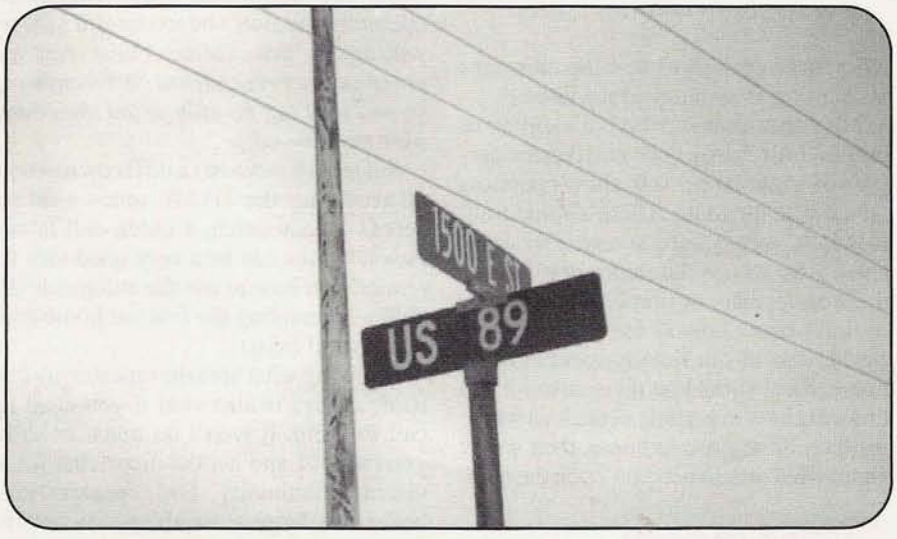
Injuries introduce another element of concern and stress to the operator arriving on the scene. Not all of us are trained paramedics; in fact, most of us have little or no formal training in first aid. This being the case, *don't move an injured person unless they are in imminent danger.* Try to find out what kind of injuries there are (Are the victims breathing? Conscious? Bleeding heavily?) and get that information to the 911 operator. If immediate aid must be given, the 911 operator should be able talk you through the process (or put you in touch with someone who can).

I visited with Marcene Parker, Dispatch Coordinator for the Logan City, Utah, Police Department, to see what kind of events should be called in, when 911 should be used as opposed to the non-emergency number, and the information that 911 dispatchers need from the caller. The rule of thumb she gave me is that, if the emergency is in progress (such as an accident, fire, vandalism, or robbery), it should be called in on 911. If it is past tense (if there are officers etc. on the scene or the damage has been done and is under control) then the business or non-emergency line should be used.

The information that should be provided is the location (addresses are best, followed by community landmarks), the name of the person calling in, the type of accident, and a call back number. *It is vital to make sure the dispatcher knows that you are a ham operator and that there is not a call back number.*

The a description of the type of event being called in comes next, which for a vehicle accident would include the number of vehicles involved, the number of injured people, and types of injuries (once again, are they breathing, conscious, bleeding, etc.?). The 911 operator should then repeat the information back to you to ensure accuracy and let you know that help is on the way.

Since not all repeaters have autopatches, there will be times when you'll have to rely on someone else to call 911 and get help. In these situations, it's vital that you have all the information given above and that the operator who is calling for you has it all accurately. Have him or her read back the information to you to dou-



Around town, street signs are vital in giving the address of an accident. Keep track of where you are when you're on the road.

Even simple things like knowing what an area is called can give an emergency dispatcher clues as to where to send help if you're in unfamiliar territory.

ble check accuracy before placing the call and then contact you after the call is completed. Try to remain available in case the 911 dispatcher needs more information.

On Unfamiliar Ground

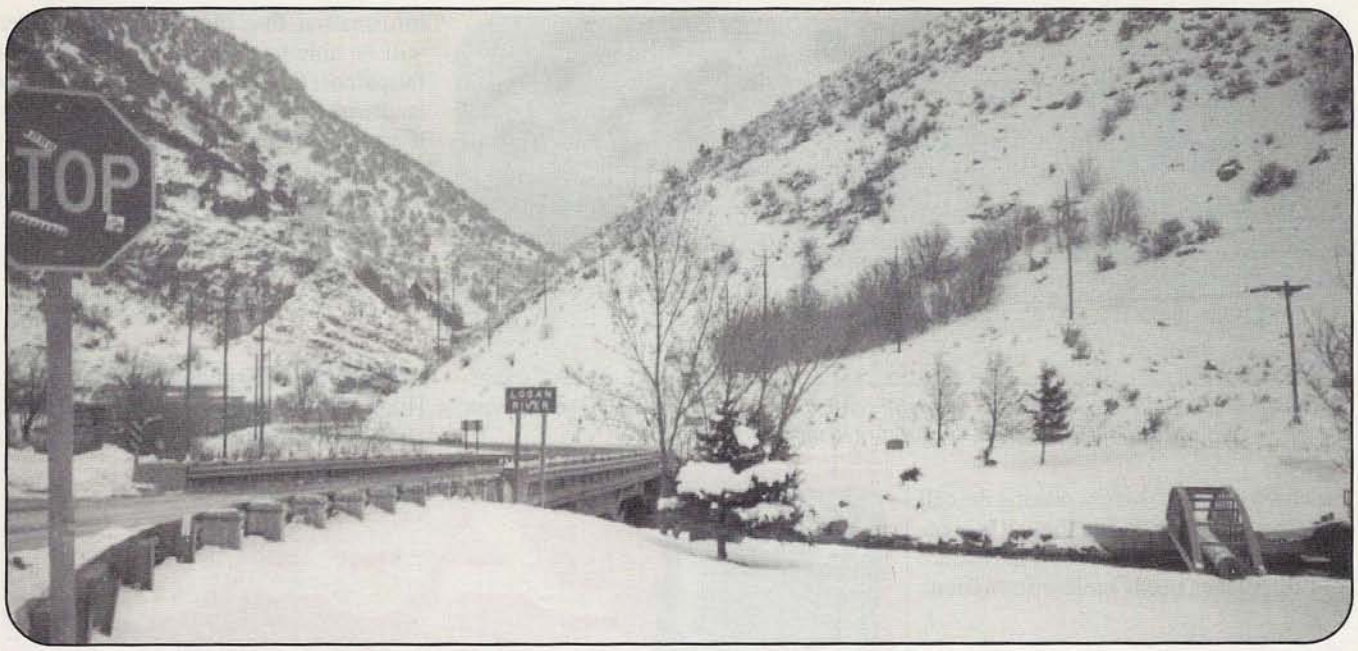
While many of the accidents we come across will be close to home, there is always the possibility that an accident you encounter will be while you are out on the road in unfamiliar territory. This does not relieve you of your responsibility to help. One of the best tools for a ham to have is a repeater directory. Then, listen to the frequencies of the local repeaters to make sure the machines are up. If the frequency is quiet, you can transmit your callsign and listen for the courtesy beep. (It is bad form, and illegal, to "kerchunck" a repeater or to transmit a carrier without identifying yourself. Please don't.) By testing to see of the repeater is up, if you *do* come across an accident, you can ask one of the local operators for help.

Finding your way when you are unfamiliar with the territory is one of the areas where hams have a great advantage over Joe Cellphone. I've been on the local repeater several times when someone came on and needed directions. While many of them were local people and were familiar with the same landmarks as I was, there were a couple of hams from out of the area, who had to go by street signs and more basic landmarks. Many travelers will have the benefits of a map. With a map and a good eye for spotting highway markers, it is nearly impossible to get lost.

Another option for the operator who is unfamiliar with the area is to ask those involved in the accident where they are (assuming they are conscious and coherent). They may be able to give you some information that the police dispatcher will be able to use to send help. Police Dispatcher Parker also explained that any landmark is better than none, especially if an operator can tell the dispatcher the community they are in. Even something as simple as "just down the street from the big yellow barn" can help.

Off-Road Emergencies

Not all accidents happen on the streets. Hikers, mountain bikers, snowmobilers, and other off-road trekkers may also



How many landmarks can you find in this photo that could tell a dispatcher where to send help?

"...any landmark is better than none [if you're not sure of your location], especially if an operator can tell the dispatcher the community they are in. Even something as simple as 'just down the street from the big yellow barn' can help."

come across emergencies of one type or another. Here the challenge of knowing how to use the radio to hit a repeater, or even another operator, becomes a major concern. My daughter found this out when she went on a hike with a school group. A man coming down the trail had broken his arm and needed help getting back to where his car was parked. My daughter had her radio with her, but was in a radio "hole" and couldn't hit the local repeater. She was in the process of moving around trying to find a hot spot with good repeater access when some horseback riders came by and offered to take the man back down the hill.

Since there may not be another group coming down the trail, it falls to the amateur radio operator to get help if it is needed. A different antenna can make a world of difference when working in remote areas (a twin lead J-pole or a "Hot Rod" telescoping antenna are both good choices for portable operating). Monitoring the repeater while traveling (when possible) will give you some indication of hot spots where the repeater can be hit. Once you have found a hot spot, DON'T MOVE. While camping one year, I found that I couldn't hit the repeater at all from one side of the vehicle we were using. On the other side, however, I could hit it almost full-quieting. Once you've made the initial call for help, work with other operators in relaying information until help arrives (especially if your hot spot is away from the accident).

Taking Charge

Most of the information we've covered so far is common sense, but it may still leave a sense of foreboding and fear to an operator who hasn't been there. The thing to remember is that, in most cases, *everyone around you is in the same boat.* By taking charge, acting like a professional, and getting help on the way, you're dispelling the fear that others around you are feeling as well. Another thing to remember is that other operators will come out of the woodwork to help once that 911 call is made.

A couple of years ago, a power line across the street from my home snapped and fell down. No one was in the area and there didn't appear to be any great danger, so we called central dispatch rather than 911. When the officers arrived, they said it was serious enough to have called 911. If there is a hazard—meaning potential for injury—that needs to be reported to the authorities, call 911.

There's probably no way to make someone who hasn't "been there" feel totally comfortable in making an emergency call, but knowing which repeaters to use, and how to use them (including the autopatch), knowing what information to give, and being willing to take charge and act like a professional will help dispel some of the fear that is regularly associated with those three little numbers, 9-1-1. ■

Editor's Note: The common-sense advice that Neil has shared with us in this article can be helpful to non-hams as well, especially now that it seems everyone is becoming a radio operator (even if they think *it's a telephone). The second call I made on my then-new cellphone was a 9-1-1 call, reporting an accident while en route home from a club meeting. Even though I wasn't using my ham rig, my knowledge gained through ham radio allowed me to know instantly what to report, and how to do so calmly and clearly.*

How to Wire a Bike for Ham Radio

If AA6WK talked you into trying "bicycle-mobile" hamming last month, W8HI has some tips for you on turning your bike into a two-wheeled ham shack.

By Bill Sharp, W8HI*
e-mail: bsharp@midohio.net

What's the best way to hook up a ham rig to your bike? What's the best rig, antenna, etc.? As with anything, there are several "right" ways to do it.

Early on, it's mostly a matter of personal preference. Where do you want the radio? How do you communicate now? How do you need to communicate? Are you thinking in terms of using the rig mostly for emergencies, or for more frequent conversations, such as what's common during a net?

Your answers to these questions will influence the specifics of your setup, but there are some fundamentals that apply in all cases:

• *Make it convenient.* If the radio isn't easy to use, it quickly becomes dangerous. I've learned the hard way with a couple of dislocated shoulders and a broken clavicle (collarbone).

• *Make it light.* Anything that goes on the bike just makes it heavier and takes more work to make it go.

• *Make it fixable.* Making something out of nothing is a credo of many hams. It's how the hobby moves forward in many cases. But when you want something to work, you want it to work, or you want to be able to fix it with parts you can find—in this case, while on the road.

The author on his "bikemobe" station. Note that his Larsen 1/2-wave antenna is resting on a shelf behind the saddle (seat), so it's not necessary for him to have a rear carrier on his bike on which to mount the antenna. Just below Bill's elbow are the power cable and coax leading to his handheld, which is in his rear jersey pocket (and hidden by his arm). The speaker-mic is clipped to his jersey zipper. Finally, the white circle in front of Bill's sunglasses is a rear view mirror which attaches to his helmet, the mirror and helmet being the two most important safety devices for cycling.

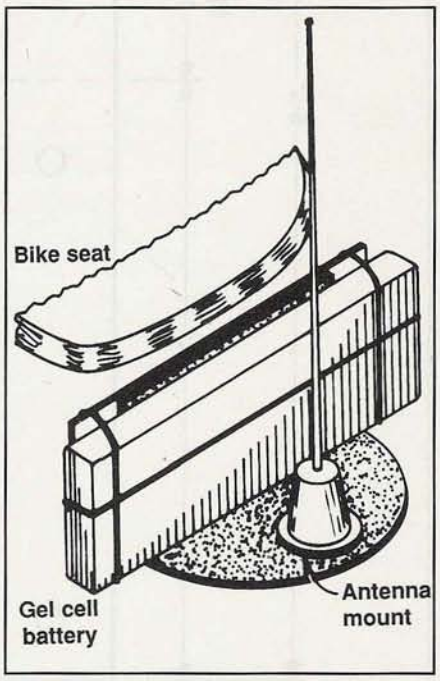


Figure 1. Typical "GOBA" setup for mounting both antenna and battery behind a bicycle seat. The gel-cell battery is mounted with big rubber bands and uses pieces of inner tubes for cushioning between the battery and the shelf.

Lessons from GOBA

That said, here's what I've come up with after nine years of research during GOBA (the *Great Ohio Bicycle Adventure*, a family-oriented week-long ride, with 3,000 or more riders each year): *The antenna must be a 1/2-wave.* Yes, all savvy hams on 2 meters run 5/8-wave antennas (*and the rest of us use 1/4-waves —ed.*); however, that's on a car where there's a ground plane. On a bike, unless you want to make a ground plane or, more accurately, a counterpoise, the 1/2-wave is the only way to go. So, find a 1/2-wave antenna you like. On GOBA, we use Larsen's NMO-mount 1/2-waves (Model No. NMO 150-C-HW), as they're of the highest quality. But more importantly, *all* the parts are easily replaceable.

Cables and Connectors

Next comes the cable to connect the antenna to the radio. Because of the properties of a 1/2-wave antenna, it's necessary to match the antenna to the radio

**Bill Sharp, W8HI, is Director of Communications for GOBA, the Great Ohio Bicycle Adventure. He lives in Delaware, Ohio, when he's not bicycling around the state.*

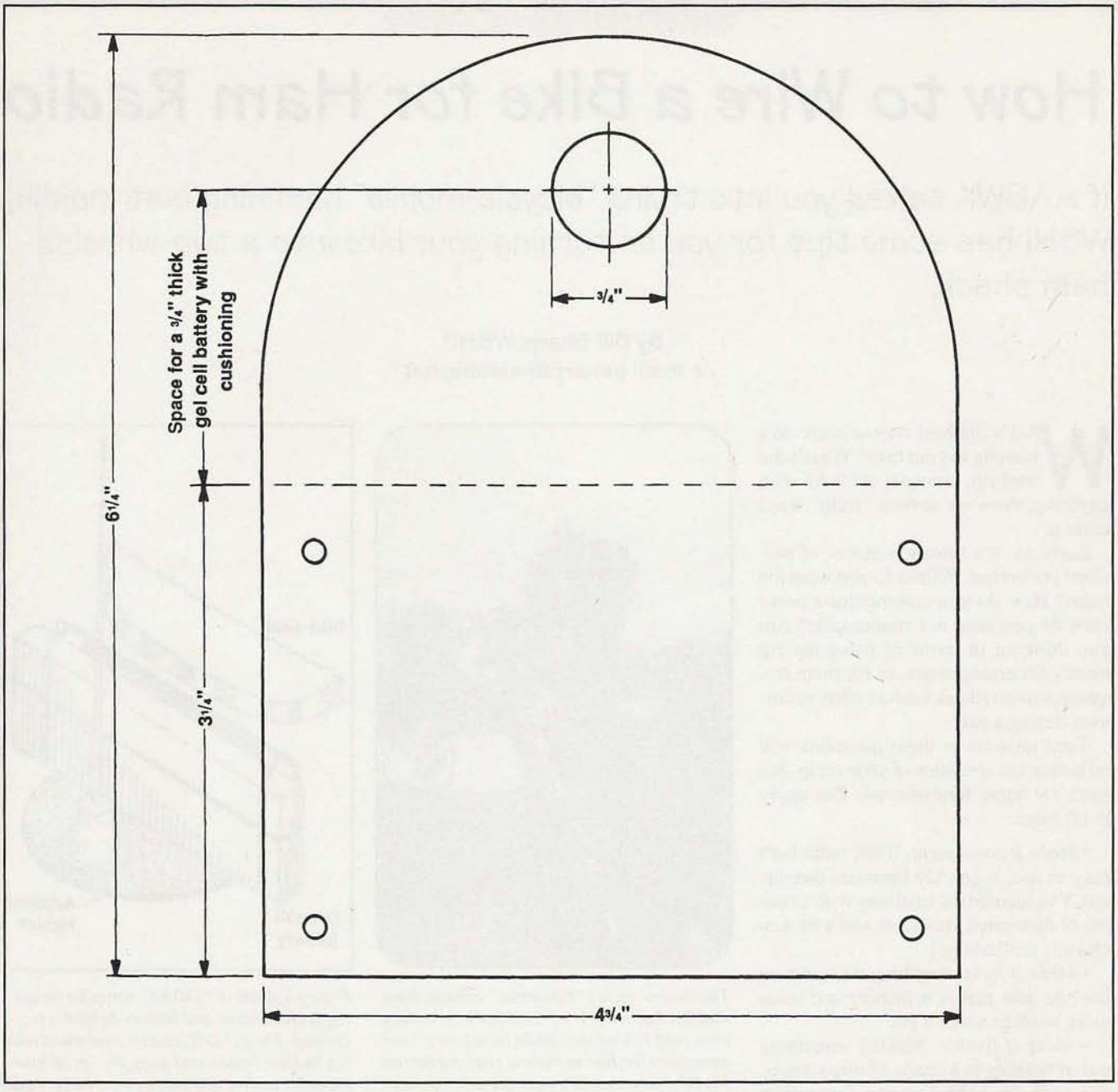


Figure 2. Template for making the GOBA antenna mount from aluminum stock. The 3/4-inch hole is to accommodate a Larsen NMO mount. Different mounts may have different requirements.

using *an odd multiple of a 1/4 wavelength.* For 2 meters, that's about 57 inches, i.e. three 1/4 wavelengths. If you want it longer, such as for a tandem bike, then go to five 1/4 wavelengths. Or, you can call Larsen and order a GBR-1 (three 1/4 wavelengths) or GBR-2 (five 1/4 wavelengths). They're custom-made for us "bikemobes," or bicycle mobile hams, as Larsen feels it's important to serve the bicycling community in this way.

"There are lots of ways to wire a bike for amateur radio, none of which is very difficult or complicated."

It's important also that the proper connectors come already installed. Most problems occur in the connectors of any set-up, so if there's any way to reduce the likelihood of failure of your rig on the road, this is it. Get a cable with *factory-installed* connectors. Larsen's GBRs come with an NMO mount on one end and a BNC on the other. Larsen will accommodate other connectors if you ask. You can also get double shielded cable, again, if you ask.

Mounting Your Antenna

Mounting the antenna on the bike is also a personal thing. Some like to use a telescoping antenna mounted directly to the radio and sticking out of a handlebar

Resources

Half-wave antennas suitable for bike-mounting are available from a variety of manufacturers and dealers, including:

Larsen Electronics, 3611 NE 112 Ave., Vancouver, WA 98682; Phone: (800) 426-1656 ext. 724, ask for Cindee Spickelmier; Fax: (800) 525-6749; Internet: <http://www.larsenat.com>.

Gel-cell batteries are also available from a variety of manufacturers and dealers, including:

Advanced Battery Systems (formerly Periphex), 300 Centre St., Holbrook, MA 02343; Phone: (800) 634-8132; Fax: (617) 767-4599.

Batteries Plus, 5010 N. High St., Columbus, OH 43214; Phone: (800) 381-2288, ask for Steve Sutton and let him know that you're calling because of BMHA; Fax: (614) 431-9594; Internet: <http://www.batteriesplus.com>.

E.H. Yost & Co. ("Mr. NiCd"), 2211-D Parview Rd., Middleton, WI 53562; Phone: (608) 831-3443; Fax: (608) 831-1082; e-mail: <ehyost@midplains.net>.

Connectors and other small parts are also available from a variety of manufacturers and dealers, including:

Mendelson Electronics (MECI), 340 E. First St., Dayton, OH 45402-1257; Phone: (800) 344-4465; Fax: (800) 344-6324; Internet: <http://www.meci.com>.

Mouser Electronics, 958 North Main St., Mansfield, TX 76063; Phone: (800) 992-9943; Fax: (817) 483-0931; Internet: <http://www.mouser.com>.

bag. Still others want to mount the antenna on a pannier rack in back, using a small aluminum shelf you can build from aluminum sheeting found in most hardware stores (see Figure 1). Just cut it to size, use tie wraps to hold it on, and drill a 3/4-inch hole for the NMO mount.

For GOBA, we use a little shelf, also made from aluminum sheet, which mounts on any dual-water-bottle saddle bracket (just drill the holes appropriately; see Figure 2). It can be either aluminum or plastic. You'll find these bottle holders in triathlete magazines. Profile makes one for two water bottles, as does Minoura. The aluminum shelf mounts on the saddle rails, allowing the antenna to stick out from the back of the saddle (*otherwise known as the "seat"—ed.*).

Power Options

The power source we recommend for GOBA is a 12-volt gel-cell (lead/acid), which will last for a couple of days, even under heavy use. These batteries are available from a variety of sources. One dealer that works closely with BMHA (the Bicycle Mobile Hams of America; see "Why Put a Perfectly Good Ham Rig on a Bicycle?" in last month's issue) is Batteries Plus. Their battery designations are BP2312 (2.3 Ah) and BP2012D (2 Ah). The accompanying charger is their model number TP1250, a 0.5-amp, 15-volt transformer with a Panasonic connector for the batteries. The Panasonic connector, which you need to solder to the handheld's power cord, is available from Mendelson Electronics, or any of several other supply houses. The battery is held snugly on the aluminum antenna shelf with a heavy-duty rubber band. The power cable, with fuses on each side (both + and -), is coiled along with the coax and tie-wrapped to the appropriate length for convenience.

On to the Radio

After all the ground work is laid, it's time to pay attention to the radio and what goes on in the "cockpit." Here again, with GOBA, because of our need to be in almost constant communication, most of us bikemobe ops prefer a speaker-mic setup. We stash the radio in a plastic bag, which is, in turn, stashed in a jersey pocket (those invaluable pockets in the rear of a bike jersey). The speaker-mic cable comes over or around the shoulder and clips on the front jersey zipper (see Photo).

Because it's a speaker-mic, the non-ham cyclists around us can hear what's going on, and they seem to enjoy the extra safety we bikemobe ops provide. We also prefer speaker-mics to boom mics because we tend to get the boom mic's little ear button soaked with sweat. They're also more cumbersome in an emergency. Great idea, but perhaps more appropriate in the shack. Another option is to put the rig in a handlebar bag and clip a speaker-mic to the edge of the bag or on the brake cables.

That's About It...

As you can see, there are lots of ways to wire a bike for amateur radio, none of which is very difficult or complicated. You can use any number of antennas. You can run a generator—pedal-powered—rather than batteries. And it really doesn't make much difference where the radio goes as long as it's convenient when you need it. Most of this is a matter of personal convenience. The keys are the antenna—a 1/2-wave—and the connecting cable, with well-mounted connectors. For dependability and reliability, especially for emergency use, we at GOBA and the BMHA suggest the Larsen setup. The people at Larsen know about bicycle mobile hamming. They'll understand when you call. On the other hand, as is so often the case with amateur radio, nearly anything will work, as long as it's convenient, lightweight, and fixable. ■

Demystifying Capacitors, Coils, and Antenna Tuners—Part 2

Last month, Dave discussed the basics of capacitance and inductance. Now, he'll show us how they work together in an antenna tuner.

Greetings again, friends! I'm back with the second part of our discussion on capacitors, inductors, and antennas, and I have some good "hands-on" views that I'm sure you'll find interesting and informative. Who knows? Maybe the views may even inspire you to "roll your own" antenna tuner for home or mobile use.

Appealing idea? Here's the main point to keep in mind: Transmitting-type capacitors with wide spacing between their plates can be pricey when purchased new or in pairs. Check hamfest fleamarkets for special bargains—but be sure you're getting useful goods before walking away with a big grin. Whether using a professionally made or homebrewed tuner, however, it's always beneficial to understand the "How It Works" theory behind the unit. With that thought in mind, let's pick up where we left off last time.

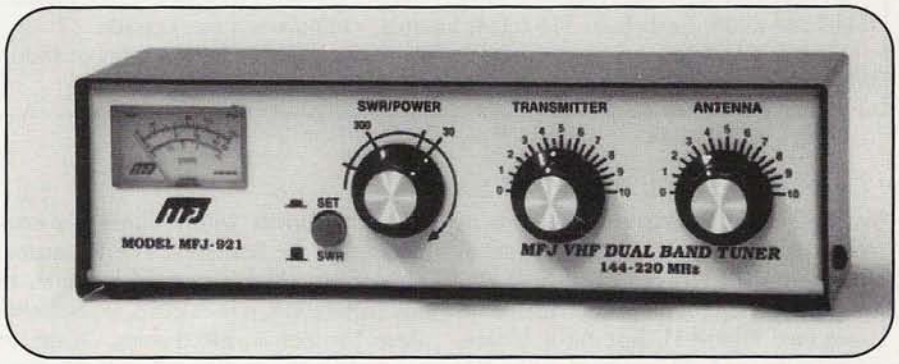


Photo A. Compact MFJ-921 2-meter/222-MHz antenna tuner. This unit has a wide impedance matching range, built-in SWR meter, and handles up to 300 watts.

Radiation Resistance vs. Ohmic Resistance

Last month, I compared an antenna to a series-tuned circuit. Then I explained how its capacitive and inductive reactances could be canceled with an antenna tuner. Now let's look at the remaining part of the equation: the antenna's *radiation resistance*. This value is not what you measure with an ohmmeter (that's its DC *ohmic* resistance). Radiation resistance brings in AC conductivity of the feedline/cable, the antenna's element(s), and its associated ground system or radials. The radiation resistance of a good home/base station vertical is around 15 ohms, a whip on an auto is 1 or 2 ohms, and a beam antenna is between 15 and 30 ohms. Some form of step-up arrangement is (or should be!) used in each case to raise the radiation resistance to near 50 ohms.

"But the mobile whip on my auto doesn't have an impedance-matching section or transformer, and its SWR is only 1.4 to 1," you say? Hopefully, you simply overlooked how the matching component is integrated into the antenna system. Otherwise, a portion of your transceiver's output power is being dissipated as heat in the feedline/cable, ground system, and antenna wire/conductor. Don't fret: many of us have been living with radiation resistance-associated heat losses for a long time—and having a ball contacting nearly everyone we call.

Antenna Tuners: How They Work

Living with antenna variations and limitations and getting around them by using antenna tuners is a natural part of our amateur radio life. We often install an antenna at roof level rather than on a tower, for example, or we attach a whip to an auto's rear deck area rather than punching a mounting hole in the roof. Understanding how antenna tuners actually work lets us feel more comfortable and confident when using them.

In light this, I invited one of the leading manufacturers of antenna tuners, Martin F. Jue, K5FLU, President of MFJ Enterprises, Inc. to share some views of his tuners with us. First, let's look at the MFJ 921 shown in Photos A and B and in Figure 1. Martin explains his tuners as follows:

A dipole-type antenna can be represented by an inductor, capacitor, and resistor in series. Below resonance, the antenna looks like a resistor in series with a capacitor. Above resonance, the antenna looks like an inductor in series with a resistor. At resonance, the antenna looks like a resistor which may or may not be 50 ohms. The resistor represents the part of the antenna that accepts power from the transceiver and radiates it as radio waves.

By Dave Ingram, K4TWJ

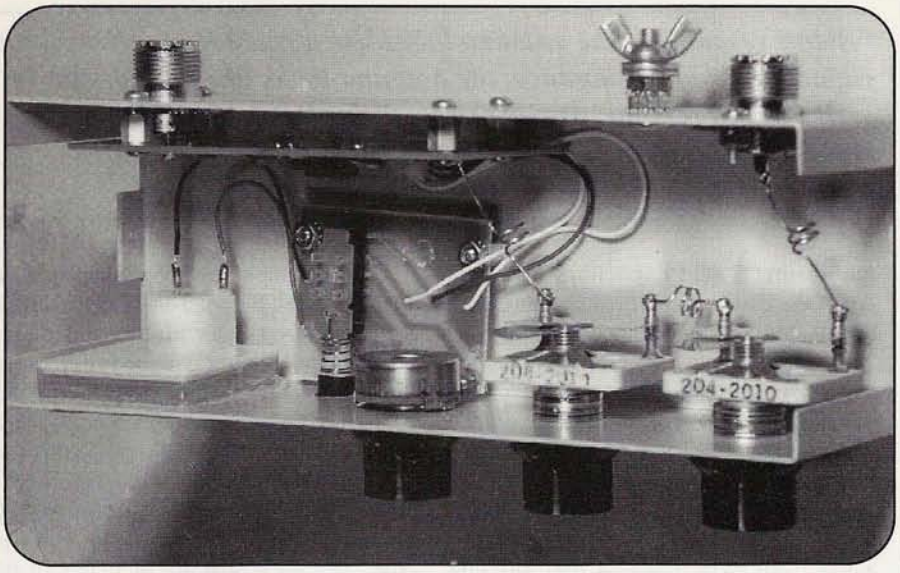


Photo B. Inside view of MFJ-921 2-meter/222-MHz antenna tuner. Note that only two-turn coils and two plates on capacitors are used for operation in VHF range. (Photos B through D courtesy David Branch, KB5VKY, of MFJ Enterprises, Inc.)

If an antenna is not resonant, it looks like inductive or capacitive reactance and may not be a good load for your transceiver. An antenna tuner cancels that undesired reactance and transforms the resistance to 50 ohms, which gives a 1:1 SWR for your transceiver.

Most antenna tuners for HF use a T-network because a Pi-network requires several thousand picoFarad of variable capacitance to produce a reasonable matching range. At VHF/UHF, however, the values of variable capacitance are small enough that a Pi-network can be used—and it reduces hand capacitance. MFJ goes a step further and uses dual Pi-L networks to further extend the tuning range and minimize hand capacitance in our VHF/UHF tuners.

Thanks for those words of wisdom, Martin. Now look behind the front panel of the MFJ 921 144/222-MHz antenna tuner shown in Photo B, and take a close look at its circuit diagram shown in Figure 1. Notice that the coils are not adjustable. How can you vary their inductance?

You start by using coils with more total inductance than needed, then canceling out the unneeded amount (for both the tuner and the antenna) with the adjustable

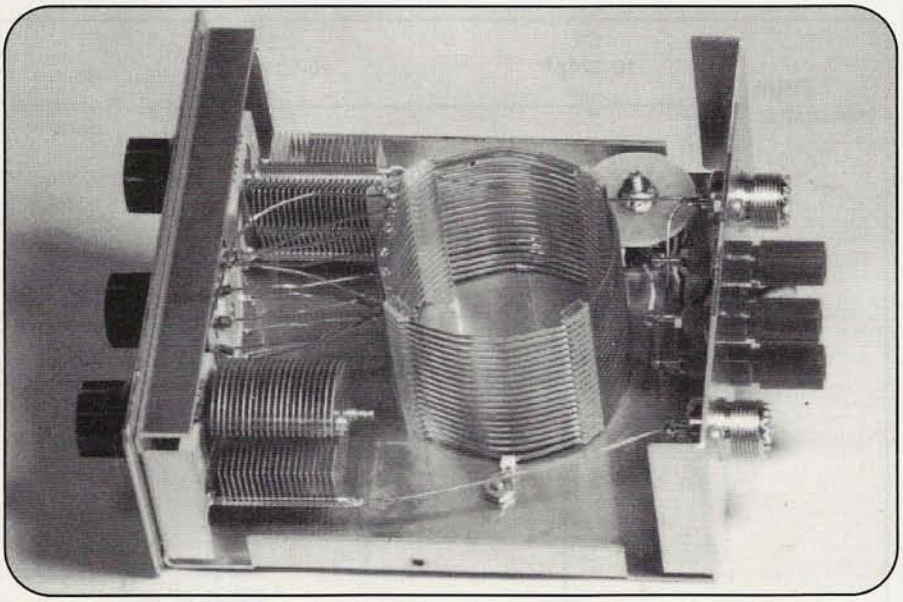


Photo C. The 300-watt MFJ-901B HF antenna tuner. This unit sports a T-network with tap-adjustable coil and variable input/output capacitors, as discussed in text. Compare the number of capacitor plates in this HF tuner with the VHF version in Photo B.

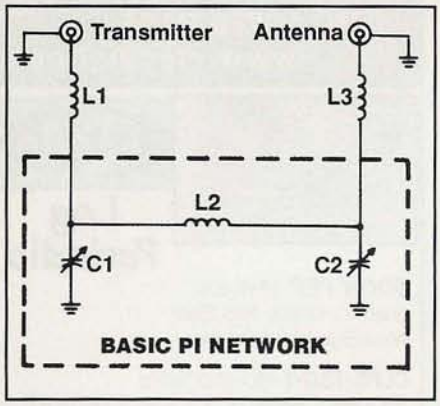


Figure 1. Circuit diagram of the MFJ-921 VHF antenna tuner. The section within dotted lines indicates a basic Pi-network. Coils outside the dotted line (L1 and L3) add additional inductance and make the tuner a dual Pi-L network. See additional discussion in text. (Diagrams courtesy MFJ)

capacitors. In other words, the inductive effects of L1, L2, and L3 can be set to any level by C1 and C2—or completely overridden so C1 and/or C2 add any desired amount of capacitive reactance. Neat, eh?

Now let's quickly discuss impedance matching. You'll remember from last month that I said capacitors can pass AC? OK, that explains how C1 can effectively connect L1 (and a part of L2) "across" the transceiver's output connector. Likewise, C2 can connect L3 (and a portion of L2) across the antenna's connector. As you adjust C1 and C2 to vary the inductance of L1, L2, and L3, you also electrically vary their turns ratio, producing step-up or step-down action! And you thought that antenna tuners were simply tuned circuits in a cabinet, eh? Surprise!

"Below resonance, the antenna looks like a resistor in series with a capacitor. Above resonance, the antenna looks like an inductor in series with a resistor. At resonance, the antenna looks like a resistor which may or may not be 50 ohms."—Martin F. Jue, President, MFJ Enterprises, Inc.

Differences in Antenna Tuners

Next, let's study the MFJ-901B HF (160 to 10-meter) antenna tuner shown in Photo C and Figure 2. As Martin pointed out, this tuner uses a T-network with an adjustable coil because exceptionally large (huge!) variable capacitors would be required to match a wide impedance range. Thus, an operator first makes a "ball park" adjustment with the coil, then fine-tunes (tweaks required input/output inductive or capacitive reactance) with the capacitors.

Compare the size of components in the MFJ 921 with the MFJ-901B. Notice that less capacity (fewer plates) and inductance (smaller coil(s) with fewer turns) are required for higher frequencies like 146 MHz, compared with 3.5 or 28 MHz. Next, compare the size of capacitors and the coil in the MFJ-901B—which will handle 300 watts—with the MFJ-989C (Photo D), that will handle 1500 watts. Note that wide spacing of plates in the '989C prevents arcing.

Unique Impedance Matching Concepts

Although seldom realized, a miniature form of tuner and impedance matching network is included in the base of many dual-band 2-meter/70-centimeter antennas. Consider, for example, the popular styles of 1/4 wavelength on 2 meters and 1/2 wavelength on 70 centimeters. The 2-meter section is low impedance and can present a suitable match—as is—to a handheld or to a transmission line connected to a mobile rig. The 70-centimeter section is high impedance, however, and requires a small inductor and capac-

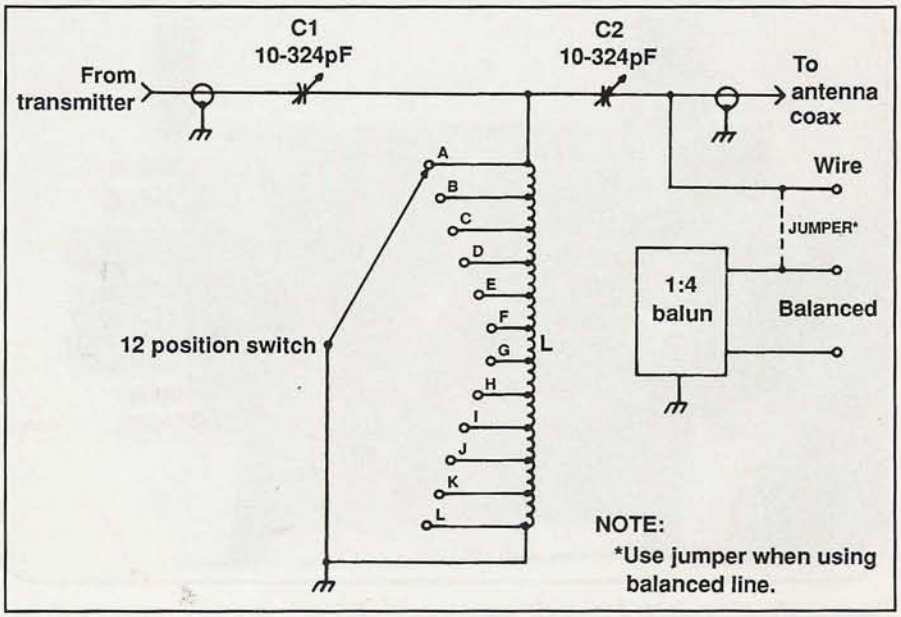


Figure 2. Circuit diagram of the MFJ-901B HF antenna tuner. Note that the positions of the capacitors and coil are reversed, in comparison to the MFJ-921, to yield a T-network.

Looking Ahead in

CQ VHF Ham Radio Above 50 MHz

Here are some of the articles that we're working on for upcoming issues of *CQ VHF*:

- "CQ VHF Review: Yaesu FT-847 HF/VHF/UHF/Satellite Transceiver," by Gordon West, WB6NOA
- "Mir Gets a TNC Upgrade (from Us)—Part 2," by Miles Mann, WF1F
- "Include 6 Meters in Your Field Day Station," by Ken Neubeck, WB2AMU
- "Rover Operating—Scottish-Style," by Simon Lewis, GM4PLM

Plus...

- "Repeater Timed Out...," by Rich Moseson, W2VU
- "Make Project Labels with Your PC...on Paper," by Raymond Schneider, W6JXW

If you'd like to write for *CQ VHF*, you may download our writers' guidelines from the *CQ VHF* World Wide Web site at <http://members.aol.com/cqvhf/> or FTP to <ftp://members.aol.com/cqvhf/General> and look for the file, "writguid.txt." Or, you may send a written request with an SASE (self-addressed stamped envelope) to *CQ VHF* Writers' Guidelines, 25 Newbridge Road, Hicksville, NY 11801.

Technically Speaking

Antenna tuners are great for ensuring that your rig "sees" a low SWR, especially when inclement weather discourages outdoor "dink sessions." Before installing a tuner, however, take a few minutes to be sure that it's not being used to cover up a problem that should be corrected.

Compare your antenna's SWR with its manufacturer's specs and try to determine why it's higher than normal. Is the antenna mounted exceptionally close to other metallic objects? Are its elements the right length? Are element joints shiny clean or corroded with age or exposure to salt water spray? Is the antenna's connecting coax cable old and brittle? Has its outer vinyl jacket been nicked/broken open? Are the coax connectors solid and fully waterproofed (very important—rain can be drawn into an unprotected connector, travel inside the coax, and render the cable useless in only a couple of months time)? Simply wrapping a connector with electrical tape is *not* waterproofing it. Using a heavy coat of silicone or hand-moldable Coax Seal to enclose all the connection area and an inch of the coax cable is highly recommended.

All of the previous factors can cause high SWR that can be reduced with a tuner—but signal losses will still exist. On the other hand, if your antenna's SWR is, say, 2.2:1 at 144.050 MHz and 1.5:1 at 147.000 MHz, it's probably mistuned or mildly affected by nearby objects and a tuner easily solves the problem.

itor in an "L" network for matching. The necessary values are very small at 440 MHz and generally equate to a curved wire positioned between two pieces of metal. If you have ever "dissected" a dual-band antenna, you've probably seen those components but assumed they were parts of the base mount. Although the network is simple, it performs its duty on 70 centimeters. It also appears "transparent" at 2 meters. In other words, 145-MHz signals do not electrically "see" the network. Again, pretty neat.

Switching to Power Supplies

Our discussion of antenna tuners could continue indefinitely (isn't it amazing what only two components can do!), but

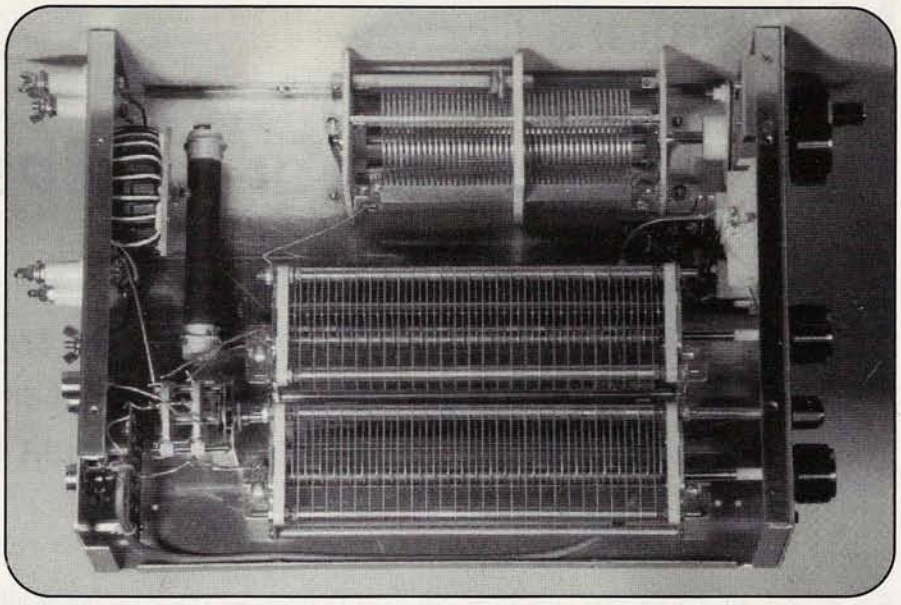


Photo D. Inside view of "Big Daddy" MFJ-989C reveals variable capacitors with approximately the same capacity as MFJ-901B, but with larger size and wider spacing between plates to handle 1500 to 3000 watts.

I'm out of space for now. Hopefully, I shed some light on antenna tuners that will help you understand them. Next month, I'll continue with another application of capacitors and coils, and an interesting discussion on how power supplies work. Stay tuned! 73,

Dave, K4TWJ

Failure or Feedback?

In our last episode, Keith was close to quitting his quest to upgrade his ham license when Peter encouraged him to hang in there, but not to wear pajamas on a job interview. Now, Peter and Keith must deal with the heartbreak of psoriasis, umm, failing the code test, on..."As the Rotor Turns"...

"So, am I your first failure, or what?" Keith asked, looking extremely dejected.

"What happened?" I replied.

"I failed the code test this morning. Thought that I was ready for it, but guess not. Maybe, I'm not cut out for this CW stuff in spite of your ideas."

Keith was wallowing in self-pity. He is so serious—I never know whether to laugh or tease him or ignore it. Today, I decided to ignore it.

"First of all, there is no such thing as failure—only feedback," I told him.

"Well, the feedback is that I can't pass the blasted code exam. At least, I didn't waste money on an HF rig."

"I thought you had ordered that new one that was announced in *CQ* magazine last month."

"Yeah, well, I had thought that I would get it, but then I decided to wait and see if I passed the exam. Guess it was a good thing that I waited, huh?"

"I don't think so. Do you know the difference between a wish and an intention?"

"Oh, boy, here we go again. You are off on one of your philosophical tirades, aren't you?"

"Yes." I ignored his jab. In spite of his facade of anger, I knew he wanted help—otherwise he wouldn't have come to see me. "You really do want to get the General, don't you?" I continued. "So tell me—do you know the difference between a wish and an intention?"

"No. Go ahead." Keith tried to fake disinterest, but I knew that deep down he was hurting. His ego wasn't used to coming up short in any situation. Code has a way of doing that to some people. Like golf, it's one of those activities that brings all of your doubts and insecurities out of the shadow and sharply into focus.

Wish or Intention?

"A wish is just sort of a daydream, like thinking about winning the lottery. For most of us, it is just a pleasant diversion, but we have no real belief that it is going to happen to us. Other than wasting a buck or two, we never do anything about it either—not that there is much that you can do short of some heavy-duty fraud."

"But an intention is something that has life to it. You're willing to take action, whatever action is necessary to get the job done. Here's an example: We were playing mixed doubles the other morning. Jill, who is a good tennis player, was my partner. Early on, she lost her serve. She immediately started bad-mouthing herself, and her play got worse. My first thought was, 'well, we'll lose every game.' And we would have if I had stayed in that mode of thinking. But I just decided to play the best game of tennis that I had ever played. It wasn't a wish, it was an intention. I went for every ball whether I was close to it or not. Jill just sort of stood back and watched for a while as I played like a man on a mission. We won that game, and the next. When it was Jill's turn to serve again, her confidence was back, and she won. We ended up winning the set."

"I'll keep that in mind if I ever take up tennis, Mr. Agassi."

"Oh, come on, do I have to spell it out for you? We didn't win because I am some great tennis player. We won because of my intention, my commitment to do whatever it took to get the job done and to do the best that I could. I didn't win every point, but I did begin to play like someone in the zone."

"Isn't that some award *CQ* sponsors?"

"Smartaleck. It is that state of letting go of consciously trying to control things. Athletes shoot for it all the time. When I lost a point, I was only interested in objective feedback."

"What do you mean by that?"

Objective Feedback

"For instance, say the ball sails out of the court when I stroke it. Objective feedback is stuff like 'how far out did it go?' or 'did I put top spin on that one?' and that sort of thing. It is information that your unconscious can use to zero in on what you want done. Compare that to subjective or judgmental feedback like 'that was the worse shot I ever made. What's wrong with me?'."

"Yes, I know, I know. If I ask myself questions like that, I'll get answers that seem plausible, right? Then I'll start believing these answers and things will get worse, right?"

"You said it. So what kind of feedback are you giving yourself about what happened this morning?"

"Well, I failed. What else can you say?"

"What did you fail?"

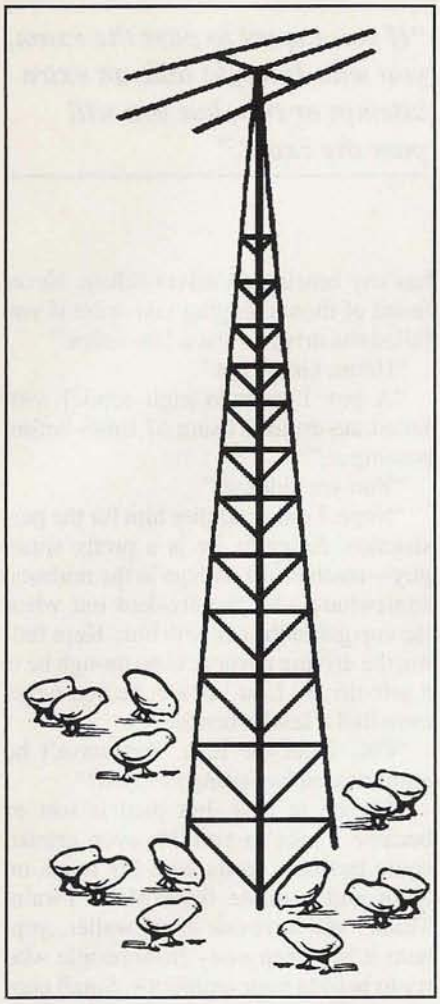
"Geeesh. I failed the General."

"The whole thing? The theory as well as the code?"

"No, just the code."

"So, you only failed one part of the exam, right?"

By Peter O'Dell, WB2D (<success@qth.com)



"Well, if your cousin can make an extra chicken materialize out of Texas weeds, I ought to be able to get a tower out of Florida grass."

"Yes. Are you trying to go somewhere with this?"

"By what score did you fail the code portion of the exam?"

"I missed by one."

"That makes you a failure? That means you can't do it? Get real. I'm not giving you a pity party for that kind of showing. If you want a pity party, you're going to have to do a lot worse than that."

"Well, darn it, it just seems hopeless to me now."

"So did playing doubles with a partner who had already given up. Maybe I should have quit, too, no?"

Keith just glared at me, but I knew that, deep down, he knew I was right.

The Power of Intention

"There is another dimension to this idea of an intention. Some people might call it an expectancy. I can tell you a true story that illustrates the power of

expectancy or intention. My cousin Bud runs a small farm out in Texas—well, it's small by Texas standards, only a thousand acres or so. The land is not that good. He's not wealthy, but he does have a bunch of kids. So, the farm is a family business of sorts."

"Last year, Bud had some spring wheat to bring in. The whole family was out in the fields harvesting for a week while the kids were off from school. There is local chicken hatchery in town and Bud orders chicks from them once in a while. So, this one day he called and ordered four dozen chicks to be delivered the next day. Told the guy that everyone would probably be in the field and to just leave them on the front porch."

"When he got in the next evening, he found chicks running all over the yard. The delivery guy hadn't noticed that the cage door wasn't latched. Bud went into a frenzy and got everyone out scurrying around looking for chickens. By the time they gave up at midnight, they had only rounded up 43 of the 48 he had ordered.

"Next morning, Bud called the hatchery and read them the riot act. He really let the guy have it. But when he told the hatchery guy that they had only found 43 of the chicks when they quit around midnight, the guy started laughing. Finally, Bud shut up long enough for the hatchery guy to tell him that they only delivered 42 chicks. The rest were backordered. Who knows where the extra one came from? But if Bud had expected only 42 chicks, he would have only found 42. If you expect to pass the exam, you will. It might take an extra attempt or two, but you will pass the exam."

"So you think that I didn't expect to pass the exam?"

"Well, did you? You didn't order the rig like you said you would. Look, personally, it doesn't matter to me whether or not you pass the code exam. I'll still be your friend. I won't think any less of you if you choose not to do it. But, I think that you want to do it. I think that it matters to you. And since it matters to you, I want you to do it."

The Shame of It All

"But I'm really embarrassed by failing. I don't want to get on the repeater. I don't want to go to a club meeting. Don't want to talk to anyone. They know that I am a failure now. They'll never respect me again."

"What?"

"It's embarrassing. That's what."

"Well, I failed more than my share of code exams before I got the Extra. Should I be embarrassed?"

"No. You have your ticket."

"Yep, but by your definition, I either am a failure or was a failure or something like that. Which is it? And all this time, I thought you respected me."

"You are absolutely the most confusing person I've ever known. You're not making any sense."

"I'm making just as much sense as you are. Two-thirds of the club members have failed an FCC exam somewhere along the line. Believe me, no one cares. It is just something that you have to get through. Some people pass the exam first time out. Some don't. Doesn't make you a better ham."

"Well, I hear some guys bragging that they never failed an FCC test."

"Sure, and those same guys brag about having a bigger hard drive than their friends or a faster processor. So, if one of them has a bigger hard drive than you, does that mean that he knows more about computers than you do?"

"No."

"Does it mean that he somehow a better person than you?"

"No."

"Well, what does it mean?"

"Nothing in particular."

"That's right. That's what I have been trying to get through your thick head. But you don't look convinced."

"Well, it just seems to me that there is some inherent value in passing tests."

"The only value that I know of in passing tests is that the FCC gives you a license with more privileges when you pass the right combination of tests. That's all."

"I'm not so sure."

"OK, I can't think of any objective way of comparing test results with worthiness as a ham. But what about cars?"

"What do you mean?"

Driven to Succeed

"It seems to me that there are a lot of similarities between driver's licenses and ham radio licenses. You pass a test and the government gives you certain privileges, but passing the test doesn't make you a better driver or even a safe driver."

"How do you know?"

"First of all, if there were a relationship, the insurance companies would know about it. They track everything that has any bearing on driver safety. Never heard of them charging you more if you failed the driver's test a few times."

"If you expect to pass the exam, you will. It might take an extra attempt or two, but you will pass the exam."

"Hmm. Guess not."

"A guy I went to high school with failed the driver's exam 67 times before passing it."

"You are kidding."

"Nope. I rather admire him for the persistence. Actually, he is a pretty smart guy—teaches in a college in the midwest somewhere—he just freaked out when the cop got in the car with him. Kept failing the driving portion, even though he is a safe driver. Last I heard, he had never even had a fender bender."

"OK, I get the idea. But wasn't he embarrassed by failing so often?"

"Maybe at first, but then it sort of became a joke to him. He even printed some business cards with his name on them and a quote from Mark Twain. Think I still have one in my wallet...yep, here it is. 'Keep away from people who try to belittle your ambitions. Small people always do that, but the really great make you feel that you, too, can somehow become great.' Whenever someone started needling him about the driver's license, he handed them this card."

Keith looked at it for a long time, smiled and asked "So, how'd you get a copy?"

"I'm not telling you. Anyway, I have matured since then."

"So, you think that I'll pass the exam?"

"I'm sure of it. If not the next time, the time after that, or the time after that. My great psychic abilities tell me that it will not take you 67 times to pass that silly code test."

"Guess I'll go home and order my HF rig. Can you come over tomorrow and help me map out where to put the dipoles so they won't be in the way of the tower?"

"What tower?"

"Well, if your cousin can make an extra chicken materialize out of Texas weeds, I ought to be able to get a tower out of Florida grass."

"Why wait 'til tomorrow? Let's go do it now."

"Great. I need a cigarette."

"Yuck." ■

ARRL Convention? Thanks But No Thanks

The Great 1997 ARRL National Convention wasn't so great, says the author, who thinks it's time the ARRL took a hard look at what its conventions are supposed to accomplish.

What a *bust*. In the future, ARRL, do Jacksonville, Florida, a favor—*do not come back*. It was 38 years since the ARRL held a convention in Jacksonville—it could have been a lot longer. We have a great ham community. Our unifying organization is North Florida Amateur Radio Society (NOFARS). I am a member but *not* a spokesman for it. I am also a member of the ARRL, but not their chosen spokesperson, either.

I was surprised and very disappointed at our combined Jacksonville HamFest and the 1997 ARRL National Convention. This was no regional convention but the *big* national one. I belong to many professional associations and when we have a National Convention it is a big deal. The ARRL's National Convention is not—it is only a very big expense to the host group(s).

HamFest Benefits

NOFARS takes the proceeds from the HamFest and puts the money directly back in our local ham communities. It has helped pay for most of the Florida Crown Emergency Net's emergency communications gear, our packet system, and our Florida Crown Digital Network with high speed backbones and Internet Gateway. NOFARS has also paid for equipment for SKYWARN, APRS, and many other programs.

**Ronald T. Cyre, KE4QWP, was a volunteer at the 1997 Jacksonville HamFest/ ARRL National Convention. He holds an Extra class license.*

"...none of these [ham] groups got any funds from NOFARS in 1997. Why? The HamFest lost money. Why? Due to ARRL National Convention expenses."

NOFARS allocates HamFest money to the following local area ham groups: Jacksonville Range Association (VHF/ UHF), Orange Park Amateur Radio Club, Nassau Amateur Radio Group, Beaches Amateur Radio Society, North Florida DX Association, First Coast Amateur Digital Association (FICADA). Our digital network includes Starke, Gainesville, St. Augustine, Orange Park, Jacksonville, Jacksonville Beach, and Callahan...all six counties are linked together. As you can see, our annual HamFest benefits the entire amateur community in the greater Jacksonville area.

A Costly Convention

But none of these groups got any funds from NOFARS in 1997. Why? The HamFest lost money. Why? Due to ARRL National Convention expenses. NOFARS had to rent or guarantee rooms at the convention hotel and pay for the banquet. We normally rent half of the Prime Osborn Convention Center for the HamFest; we had to rent the whole thing for ARRL Convention.

We normally have vendors that come back each year. Some of our regulars did not book last year—due to the ARRL National Convention. Which major ham radio manufacturers booked for the National Convention? None, nada, zero. We have had much better showings by major manufacturers in the past years for our HamFest without an ARRL convention.

How was attendance? Up very slightly above our normal hamfest attendance. Nothing like the ARRL National Convention title would suppose. We run our HamFest by volunteers only. As far as I could see, the ARRL staff surpassed our volunteer staff for the three days of the hamfest, but they did not buy tickets like I did. I work two days as part of our security detail, but I still bought tickets.

The only cop-out the ARRL could say is that NOFARS did not spend enough money advertising the HamFest...which would be right because we have no money to spend until the advance tickets are sold. The HamFest was listed in all the major ham journals but not with big ads like the Dayton HamVention®. The name "ARRL National Convention" should count for something—this time it only meant lost money for a local ham community.

We have a unique community of hams and ham clubs in Jacksonville. The ARRL National Convention was supposed to be a big deal. It was not a big deal here. No madding crowds; in fact, on Sunday, the HamFest seemed to close earlier than before.

By Ronald T. Cyre, KE4QWP*

Where is the ARRL's ability to draw crowds? We did not expect attendance like the HamVention gets, but we did expect a bigger crowd than we got—the 2,000 people who attended was only a little over our normal attendance. If the ARRL staff was counted in that total, then we had *lower* attendance. Even the W1AW/4 special event station that was set up did not draw many calls.

Unconventional Conventions

Where are the hams for a National Convention? At home. Why come? The forums at the convention were not action forums to change policy, only to explain policy. If it were a true national convention, then the forums should have been standing room only—packed with lively debates of *delegates*. You take minutes, take votes, and implement the views of your membership.

Then I saw the light in *QST* why nobody came: The ARRL can have 60 or more Official Conventions a year! Just look at Florida:

1997 Annual Convention, Jacksonville, Florida, August 2–3;
1997 Florida State ARRL Convention, Tampa, FL, November 22–23;
1998 Florida State ARRL Convention, Miami, FL, February 7–8.

So each state has one ARRL Convention each year—52 in all if you include Puerto Rico and Micronesia. Then we add 15 ARRL Divisions—each could have an ARRL Convention. Add in the National Convention and that gives you 67 possible ARRL Conventions a year. But somebody loses out since there are only 52 weeks in a year and then a few weekends are always left open: Thanksgiving, Christmas, and maybe Easter. That leaves us with 49 official meaningless conventions a year.

"If it were a true national convention, then the forums should have been standing room only—packed with lively debates of delegates. You take minutes, take votes, and implement the views of your membership."

A Better Idea

I think the real losers are hams. Maybe a better idea would be one national plus one division convention for a total of 16 per year; or rotate so you would have each division convention every other year, plus the annual national convention (= eight or nine). Maybe if the staff could attend six or eight conventions a year instead of dozens, more would get done and ARRL costs would go down.

This is a hobby, not a paid Congress. The ARRL was in a tight money bind recently; maybe this is the way, to help the budget. The ARRL cannot just print more money when it needs to like Congress can. Maybe the ARRL could get back to grass roots with delegate members deciding on policy rather than the remote Board of Directors and staff. Then an ARRL Convention might mean something. ■

The opinions expressed in this column are those of the author and do not necessarily reflect the views of CQ VHF *or its publisher, CQ Communications, Inc.*

If you have an opinion on this issue or another matter of importance to the VHF ham community, we'd like to hear from you. Well-reasoned, well-written commentaries will be considered for our Op-Ed page. If we publish your Op-Ed article, we'll give you a complimentary one-year subscription (or extension of your current subscription) to CQ VHF. *Submissions not accepted for the Op-Ed page may also be considered for Letters to the Editor.* CQ VHF *reserves the right to edit all submissions for length and style.*

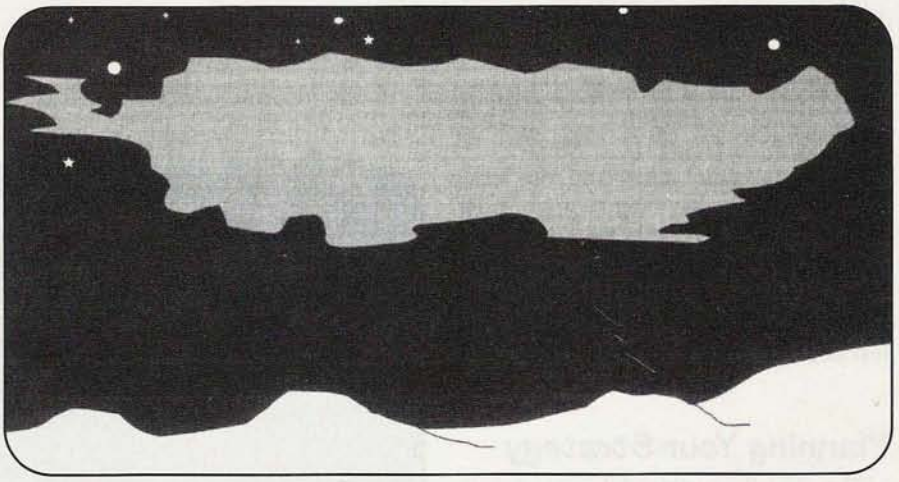
The Strangest Propagation Mode

One of the things that makes 6 meters the "magic band" is the wide variety of unusual propagation you can find there. But perhaps the most unusual of all is the one you can also see—aurora.

Aurora—with its watery-sounding signals and visible curtains of light—is one of the strangest propagation modes experienced by hams on the VHF bands, from 6 meters through 70 centimeters. It wouldn't be unreasonable for newcomers to the bands to initially think that something is wrong with their receivers when they hear radio signals with the watery, distorted sound associated with aurora (which you'll also see abbreviated as Au). I know that was what I thought the first time that I heard an aurora opening on six in the fall of 1991.

Unlike little children, aurora formations can be seen as well as heard. They typically can be seen in the night sky in the northern latitudes, such as Alaska and Canada, and they come in different colors, such as red and green. There have been many great auroral events recorded, including the one that caused power outages in parts of Canada in October of 1989. And likewise, many great band openings have been recorded on 6 meters as a result of aurora, with their effects on the VHF bands greatly outdistancing their visual range.

Auroral events are generally observed around the spring and fall equinoxes, with more occurrences being observed during the higher sunspot count years when geomagnetic activity is high. Major solar flares can also touch off auroras during other times of the year. As a rule, aurora occurs in the higher latitudes, so stations in North America tend to have their antennas pointed northward. (*For a more detailed look at the phenomenon of aurora, see "Aurora: A New View," in the March, 1997, issue of* CQ VHF.—*ed.*)



Aurora formations can be seen as well as heard.

My First Time

I remember the first aurora opening in which I was able to work stations. It occurred on May 10, 1992, and it was an all-day affair during which I worked into Ohio, West Virginia, and Maine. The station in Maine was Lefty, K1TOL, and, through subsequent correspondence, he told me of some Au events that he had experienced in which the signals actually had full fidelity rather than their more typical watery sound. Lefty's location in Maine is ideal for picking up many of the Au events in Canada, sometimes as high as the Yukon territories!

As I found out during this and subsequent openings, power levels of over 100 watts seem to be necessary to get through, and the best mode is CW, as it's a little bit easier to pick out the letters of the call from a constantly shifting signal in code than in voice. Aurora events can happen anytime during the day, including very late at night and into the early morning hours (and you thought those hams chasing 80-meter DX in the wee hours were nuts!). I experienced an opening like this on the night of April 16, 1994, when I worked into the early hours of the morning contacting stations in Michigan, Ohio, Pennsylvania, and up into Canada from my QTH in Long Island, New York. The Canadian station was Mike, VE9AA, in New Brunswick and, though the magic of 6 meters, I have now worked him via three different propagation modes: sporadic-*E*, meteor scatter, and aurora.

Many of our friends located in the southern states of the U.S. are not fortunate enough to hear aurora events because the aurora itself occurs in the higher latitudes near the poles. (That's OK, since they get the reverse phenomenon of Transequatorial propagation, or TEP, which we never hear up north). But for those of us located in the middle and higher latitudes, aurora remains the strangest mode of all for the Magic Band. ■

Do *you* have a 6-meter adventure to share? If so, we'd love to hear about it. Just contact us by mail or e-mail.

By Ken Neubeck, WB2AMU

The Evolution of a Winning Contest Effort

What does it take to put together a "winning" VHF contest entry? The simple answer is "many things"...the correct answer is just a bit more involved.

So you're not a newcomer to VHF contesting anymore. You've "been around" and "paid your dues" and now you're ready to "play with the big boys"—to play to win. But putting on a winning effort starts long before the contest does.

A "Single Op" station is a one-man show. You set up, operate, and tear down alone, usually atop some remote hilltop.

Planning Your Strategy

The first thing required is to choose which category to enter. In the ARRL contests, you have five choices. First is "Single Op," where it's a one-man show. You set up, operate, and tear down alone, usually atop some remote hilltop. "QRP Single Op" is for the diehard VHFer who hikes to the tallest peak with minimal equipment due to weight restrictions and operates using less than 5 watts output.

"Multi Op" is where two or more people get together to field a station larger than what any one of them could do alone. With more warm bodies in front of more radios, it's almost a given that more QSOs will take place. Here the category is split into two camps. The "Multi-Limited" stations use four or fewer bands, while the "Multi-Unlimited" stations use five or more bands.

Last, but not least, is the "Rover" category. These enterprising individuals load up their vehicles with radios from DC (6 meters) through light and operate from as many grids as possible, usually while mobile. This category is perhaps the most complex and demanding of them all, as so much is happening at once. Each entry category has its advantages and disadvantages. Pick the one best suited to your style of operating and run with it!

Plan, Plan, Plan...

Once you've picked your category, what can you do to improve your chances of winning? It all begins at least six months before the contest with your preliminary planning session(s). Now is when the real brainstorming happens. Any and all ideas are encouraged, scrutinized, kept or discarded, and then you move on to the next one. This can be some of the most fun of all—six months before the event takes place! At this point, *anything is possible*!

Take out your arsenal of maps and look at all candidate operating sites to get a feel for which one would suit your needs best. Does it offer an unobstructed 360-degree view with minimal or no commercial systems nearby to cause problems? Is permission required to access the site? Is commercial power available? etc, etc....

With five months to go, it's time to put together your "to do" list, with items added and removed as they're thought up or completed. At this time, you should also make a complete inventory of the

By Tim Marek, K7XC (K7XC@VHF.RENO.NV.US)

The "Multi Op" category allows two or more people to get together and field a station larger than what any one of them could do alone. "Multi-Limited" stations use four or fewer bands, while "Multi-Unlimited" stations use five or more bands.

Be sure to pack everything you could possibly need, especially if you're heading to some remote location far-removed from civilization and convenience stores.

proposed station, including the small items like extension cords, bug spray, spare connectors, etc. Describe in detail how each band will be set up, with what antenna, amplifier, and radio. Be specific! Identify any possible spares you can bring. You can never have too much stuff 250 miles from home and 60 miles from the nearest pavement!

Collect and Check

As time draws even closer (less than 90 days away), you should begin to gather the larger pieces into a "holding area" where they can be systematically inspected, tested, checked, and rechecked. All of the coax assemblies should be built to length, with the appropriate connectors installed. Each rotor needs to be torn down, inspected, repacked with fresh grease, and stored away. All the antennas get a once-over, looking for obvious problems, then they're temporarily hoisted airborne for testing with the new cables and connectors. All tower trailers and antenna masts must be inspected and made ready to travel.

Any new equipment, built or purchased, should be thoroughly tested under simulated contest conditions. Each generator should have its oil and air filter changed, and a tank of gas should be run through it, just to be safe. With six weeks left, all the checking should be done and it's time to store everything away, ready to travel on a moment's notice.

It Pays to Advertise

With four weeks left to go, your public relations campaign should kick into high gear. Tell everyone who will listen about your planned operation, where you'll be, when, and where to find you. Make it easy for everyone to know how to contact you. Use the Internet, HF nets, VHF nets, postcards, phone calls, letters, personal appeals, anything that will get people committed to look for and work you during the contest.

Over Memorial Day weekend each year, I visit my site of choice along with two alternates and do a survey. Has the road deteriorated since I was last here? Are there any new noise sources on the hill to deal with? Is the road open or do I have bust it open now so the snow can melt between now and the contest? This usually ends up being a two-day trip, but it's well worth it from a planning and peace of mind point of view.

Time to Go Shopping

With two weeks left to go, I begin shopping for non-perishable supplies like water, canned food, sunscreen, lantern mantles, batteries, 60-watt light bulbs, soap, paper towels, etc. About now is also when all vehicles get a real close once-over. All filters and fluids should be changed and a minor tune-up performed. You don't want to break down in the middle of nowhere.

Look at everything as a possible threat to your contest plans and deal with it accordingly. A few minutes and dollars spent now will go a along way to make sure everything goes as planned in just a few weeks.

One week to go...time begins to compress, items on the "To Do" list start to get prioritized or abandoned. My "to do" list always has a few items that would have been nice to get done but were not a high priority.

With just a few days to go, I begin loading the vehicle. Everything goes into the truck in the reverse order in which

it'll be needed once we're on site. For example, tools and antennas are loaded *last* as they're the *first* thing I need when I arrive on site.

Almost Ready

The last day before I leave is spent addressing all the little things that fell through the cracks, filling both tanks (my truck has two gas tanks) and every gas can to the brim, loading the ice chest full of water and ice, stopping by the store on the way home for a week's worth of groceries (leaving the most perishable for the last stop just before climbing the hill), packing a suitcase with a week's worth of clothes, and then...one last slow tour of the house, shop, and backyard for anything that might have been missed.

The next morning, I take it all to work with me for my final day (Thursday) before leaving town. It's generally a hectic day spent trying to put all the details to bed before leaving for seven days. Then around 2:00 or 3:00 p.m., I say my good-byes and head out of town for the next staging point, a town close to the mountaintop where I can get a good night's sleep, pick up some last minute items in the morning and then, around 9:00 a.m., begin the trek up the mountain.

(Editor's Note: Don't let Tim scare you into thinking you'll need to be away from home and work for a full week in order to put in a winning contest effort. The actual time required varies with your distance from the contest site and whether you'll be spending the whole contest in one spot. On some of Tim's Rover expeditions, he ends the contest over 1,000 miles from home, which is why he's thinking in terms of a full week! You have to figure in your travel time both before and after the contest, plus a full day of set up, two days of operating, and, in the case of a major multiop station, another day of tear-down. So it can quickly turn into a week if you let it. But a closer spot and a smaller station can significantly reduce your time commitment.)

At the Site at Last

Usually on site by midday, we spend the rest of Friday assembling antennas, towers, rotors, feedlines, rotor cables, radios, amps, generators, extension cords, power supplies, etc., into fully functional VHF contest stations. By the time the contest starts at 1800 Z Saturday, we are *ready to play*!

From here on, the contest will take care of itself if you did the planning well and implemented it correctly. You can only control so much and nobody can dictate band conditions...but with my method, you can eliminate a lot of troubles up front, putting you in position to take advantage of whatever propagation comes your way. Enjoy...*you earned it*!

WSWSS CW VHF Sprint

The 1998 Western States Weak Signal Society CW VHF Sprint has been moved to Saturday May 23rd from 22:00 Z to 03:00 Z Sunday May 24th, an added incentive for the many mountaintoppers who visit their June operating sites over Memorial Day weekend. And it's not limited to VHFers in the western U.S. Anyone may play!

This is a CW-only event lasting five hours utilizing the CW subbands of 50 and 144 MHz. Suggested operating frequencies are between 50.080 and 50.100 and 144.080 and 144.100 MHz. Each contact is worth one point with unique grids worked per band as multipliers. The final score is your total points times the total mults from both bands. Rovers are encouraged and will be judged under the *original* ARRL Rover rules.

Certificates will be awarded to top scores in each of the 10 U.S. call areas. All contest entries are to be sent to Tim Marek, K7XC, WSWSS Vice President/ Contest Chairman (see address below) and must be received no later than 30 days after the event.

Tower trailers, vehicles, and other accessories must be checked out before you hit the road. You don't want a breakdown to snag your contesting plans.

WSWSS Sacramento Get-Together Results

From Larry, W6OMF—What A Blast!!!! The tally was 63 great weak signal enthusiasts gathering at the West Sacramento's Bakersquare Restaurant on Saturday morning, Feb. 28th. They came from far and wide. Mike, KE6NRO, and Chuck, N6HKF, flew up from the La Mesa/Corona, California, area. Jim, WB2ODH, grabbed his van, loaded it up with Bob, KD6UIH, Dick, K6KWQ, Pat, N6RMJ, Ed, WA6DJS and Ken, WB6DTA, and drove up from the LA basin. Thanks for going to the trouble, guys. The Reno area was represented by Tim, K7XC, and his friend Jennifer, N7TUA; Norm, KB6KQ and his lovely bride Karen; also Shawn, N7LQ, Dave, K7UI, and Michael, N7OVD.

I just can't say enough about the Sacramento and San Joaquin area hams. They were there in force. From Magalia to Fresno, they were there meeting and greeting all. They did a great job hosting. Many thanks to you all, especially Richard, KA6NBC, for opening his shop and filling the refridge with pop; and Greg, KJ6KO, and Chuck, KC6ARU, for manning the benches and bring quite a few rigs back on track....Again Thanks!

There were plenty of door-prize winners. We always recycle any profit into door prizes and with the additional help from area hams donating, it made for some happy hams. Thanks to Norm,

KB6KQ, for the 222 Loop; Bob, WA6IJZ, for the one year subscription to *West Coast VHFer*; Ron, KE6DPV, for the HamCall CD and Auto Mapping CD-ROM; Chuck, KC6ARU, for the power cord; Paul, KA6CHJ, for the QSL card holders; WSWSS for a copy of their *Proceedings*, and Sue, K6SUE, for the lunch, breakfast, and putting up with me.

I had a blast with a great bunch of wonderful hams all going the extra mile. Many many thanks for putting up with me and forgiving my many mistakes. If I've forgotten someone, please let me know. Until next time, which will be Sept. 5, 1998, same time, same place....See Ya There!!

"With four weeks left to go, your public relations campaign should kick into high gear. Tell everyone who will listen of your planned operation, where you will be, when, and where to find you."

Iowa Bill Threatens Mobile Operating

From Jerry, KØCQ:

On February 23, 1998, a bill was introduced in the Iowa House to ban the use of cellphones or any mobile radio connected to the phone system for more than one minute while driving. The proposal requires each mobile phone user to disconnect or pull over to continue the call. It doesn't prohibit dialing while driving, just continued talking. Rumor has it that the Congressman who introduced the bill was hit by a driver using a cellphone. Its been sent to the Judiciary Committee. The full text is available on the Internet at: <http://www2.legis.state.ia.us/GA/77GA/Legislation/HF/02400/HF02406/Current.html> As it's worded, it probably could be applied to amateur and commercial phone patches, not only cellular or PCS systems. It does not prohibit continued emergency communications, such as calls to 911 or #55, or limit normal emergency communications. However, it doesn't seem to allow for "practice" emergency communications.

Activity Reports

The bands were fairly quiet in February, with neither the Tropo nor sporadic-*E* seasons starting up yet, leaving aurora (Au) as the predominant DX mode available to VHFers in North America. Plus, while it *wasn't* on Au, WP4O claims what might be the first U.S. mainland-to-Puerto Rico QSO on 222 MHz, with KF4FWU on February 25. Here are the reports:

From Russ, K2TXB:

17 Feb 1998—It was a nice Au. KØMQS was in here the whole evening, sometimes above S9. Best DX was W7XU EN13 in SD. Worth mentioning was KBØPYO EN24, WØKT EM49, WØIZ EN42, and VE2BKL FN48. It was FUN! Been a long time since we had a good Au like this one.

From Darryl, KDØPY EN41ux:

17 Feb 1998—Best Au in some time. Thanks to those I worked, Especially W2FCA FN22, a new one! One more to go for 200! Station here is a IC275A, Mirage 2516G, and a 215WB @ 30 ft. Elevation: 860 ft.

From Rich, NØHJZ EN34fv:

17 Feb 1998—Great Au, strongest aurora we've had in a LONG time. Worked many stations on 144 MHz. The range was from DM98 to EN17 to FN03 to EM89 to EM49. Stations on 222 MHz were worked in EN73, 54, 53, 52, 50, and EM89 with strong signals (S3-S7) and I don't have a preamp! EN73 was a new one! It's been a *long* time since I got a new one on 222! My only complaint—Guys still are calling CQ on or near .200 too often. Spread out! There is a guy in a nearby grid with 1500 watts and four yagis. Does he ever move off .200? Nope! Heard a few N2s and W2s but they were near .190–210. Too many "locals" made a QSO difficult. Spread out! Station here: 144 MHz—TS700S, 160 watt TE Systems brick and preamp, 1/2" hardline to 12 ele @ 45 feet; 222 MHz—TS930 and Sinclabs Xvtr, 120-watt brick, 1/2" hardline to 16 ele @ 47 feet.

From Andrew Flowers, KØSM EN10rt:

02/17/98—I got home at 23:40 Z, looked at the Internet, and called one CQ on 144.195. At 23:50 Z K4TO EM77 replied, Boy, was I really surprised! Grids worked: EM56, EM77, EM79, EN17, EN18, EN26, EN33, EN35, EN41, EN42, EN44, EN52, EN53, EN61, EN72, and FN03. I still need ND and WY, both of which I could have easily worked had a station been on! Equipment here is FT-290RII 160 W 13b2 @ 20 ft. Five new grids in all.

From Mike, VE9AA/P FN76oc:

19 Feb 1998 2336 Z—VE8BY/B, 50.048.4 MHz, FP53rs, 579AE, same time as two nights ago within several minutes. Amazing thing is, I have a very marginal setup here at the portable QTH. A simple horizontal wire maltese full wave loop at 30', optimized for 50.100 fed with mini RG8! TS530s and a TT xvtr. Wish I had 48MHz RX to check over the pole stuff from the NE...oh well! I wonder how many dB over s9 it would have been at a real station?

From Ed, WP4O FK68:

02/24/98 2350 Z thru 0355 Z 25 Feb (power outage here in KP4 LAND)—W4MOS EL97 144.200 59+ 2350 Z; KF4FWU 144.200 EL97 59+ 2351 Z; W4MOS 432.100 2357 Z; KF4FWU 432.100 2356 Z; KF4FWU 222.100 0002 Z SSB (this might be the first USA/PR QSO on 222 MHz); K4NB 144.200 EL96 0028 Z; W4FF 144.200 EL96 0340 Z; K9KNW/C6A FL15 144.200 59+ 0342 Z; WA4LOX 144.200 EL87 0345 Z; WA4LOX 222.100 0355 Z (then the lights went out in PR).

From Bruce, K2RTH:

02/24/98—144/432 opened to FK68 from EL95, EL96, EL97 & EL87. Band seems better from further north then south in Florida, open to both the Atlantic and Gulf coasts. KP4EIT, KP4EOR, WP4O, and others active on Puerto Rico end.

From Dave, W6OAL DM79:

3/3/98—50 MHz, worked into OH, IN, TN, AR between 1730 and 1830 Z today from Parker, CO, 15 mi S.E. of Denver

In Conclusion...

For the June issue, I'm compiling a list of Grid DXpedtitions around the country for the ARRL June VHF QSO Party—a "who's on, with what, and from where" kinda thing. Looks like a group of us from Reno will activate Mt. Moses in DN10 on 50, 144, 223, and 432 MHz. Wish us luck! Keep all the reports coming in. Snail-mail: Tim Marek, K7XC, 360 Prestige Ct., Reno NV 89506; Phone: (702) 972-4722; Fax: (702) 972-5011; E-mail: <K7XC@VHF.RENO.NV.US>. Thanks!

73 from DM09bp de Tim K7XC/R

Line of Sight *(from page 4)*

even get a government agency to take this on (they *do* work for *us*, don't they?). Let's see—what about the FCC? After all, they're supposed to know *something* about radio communication...not as much as a "really real ham," of course, but probably enough to make the process fair, equitable, and reasonably representative of the skills needed to be a "real ham." Great idea, huh?

Well, being the cautious sort and knowing that the FCC is severely understaffed and that most of the staff resources in the ham radio division are already devoted to enforcement, I figured I'd check to see if the agency was up to such a task before I proposed it publicly. So I called up a friend of mine at the Commission and outlined the proposal.

Surprise, Surprise...

Imagine my surprise when he informed me that the FCC not only was up to the task, but that it already had a structure in place for administering the certification program. If fact, my friend told me, the FCC has been running a similar program for years. According to my friend in Washington, the FCC offers six levels of "real ham" certification, each of which grants greater operating privileges, as you pass exams designed by the Commission staff, written by a group of "really-really-real hams," and administered by certified "real ham" volunteers.

As you pass each level of "real ham" exam, and the "real hams" who tested you sign off on your "realness," the FCC issues a "real ham" certificate that's good for 10 years. Of course, being a government agency, the FCC can't *really* call it a "real ham certificate." That doesn't sound "real" enough somehow. So the Commission gave the certificate an appropriately official-sounding title: *Amateur Radio License*.

As far as I'm concerned, it's like the classic courtroom scene in the movie, "Miracle on 34th Street," in which the Post Office delivers thousands of letters to Santa Claus to the courtroom where a state judge is faced with deciding whether Kris Kringle really *is* Santa Claus. "If the federal government thinks this man is Santa Claus," says the judge, burrowing out from under the piles of letters, "then who am I to disagree? Case dismissed." Likewise, if the federal government says having of one these "Amateur Radio License" certificates makes you a "real ham," then who am I to disagree?

• • •

Change of Address

We always ask you to keep us posted if you move to a new address. Now it's our turn. After nearly 20 years at 76 North Broadway in Hicksville, New York, CQ Communications has moved to new offices, just down the street, actually, but with a different address and a bigger parking lot. Please make a note of our new mailing address: *CQ VHF*, 25 Newbridge Road, Hicksville, NY 11801 (*CQ* and all of our other magazines have moved here as well). Phone, fax, and e-mail are all unchanged. By the way, if you're notifying us of a change in *your* address, please be sure to include the old address as well as the new one (and be sure to tell us which is which!). Thanks and I hope you enjoy this issue.

73 de W2VU

Help Wanted

If you're involved with a project or activity that you think would be of interest to your fellow *CQ VHF* readers, we'd like to hear from you. Article submissions are welcome, as are "Op-Ed" opinion pieces if you have a point of view you'd like to share about a VHF-related topic. You can contact us by mail at 25 Newbridge Road, Hicksville, NY 11801 (send an SASE for writers' guidelines), by e-mail to <CQVHF@aol.com>, or via our World Wide Web page, <http://members.aol.com/cqvhf/>. We look forward to hearing from you.

A ROSE by Any Other Name...

A rose by any other name would smell as sweet, at least according to Shakespeare. Last month, we took a look at setting up a network node using TheNET X1 software. This month, we'll do the same thing, but with a focus on ROSE networking software.

This is the third installment in our series of close looks at packet networking software. If you haven't been reading along so far, the March issue contained an overview of networking software, and last month's issue looked at the most popular variety, TheNet X1J. This month, we head out to the garden to take a look at ROSE. (There are certain basic terms and concepts that were explained in last month's column. Repeating them here will make this month's column take up nearly the whole issue, so if you're not familiar with things like EPROMs, please dig up a copy of last month's *CQ VHF* for reference.)

The ROSE X.25 Packet Switch software is written by Tom Moulton, W2VY, and is supported by the Radio Amateur Telecommunications Society (RATS). ROSE is an acronym for RATS Open Systems Environment, referring to the ROSE software's adherence to international standards, such as X.25, X.121, and Asynchronous Framing Technique (AFT). While ROSE isn't nearly as popular as TheNET and others, it serves as an excellent example of a different concept for packet networking.

In contrast to other networks, ROSE is a very simple "data pipe." It doesn't add or subtract anything from the data, nor does it "care" about what that data is—it just transports it from one place to the other. TheNET, in comparison, features a user interface, with which you can interact directly with the node. This is not really something that a network is supposed to be doing; it's more of a job for an application, such as communication software.

This strict adherence to the ISO (International Standards Organization) network model is somewhat unique in the amateur world, and this is both ROSE's greatest feature and greatest problem. More on that later. For now, the point is that ROSE is completely compatible with everything that's out there—TCP/IP,

ROSE Z80 X.25 Packet Switch EPROM Creation Program

```
TNC type TNC2B.OVR    SWitch ROSEZSW.BVR  OUTput 201722.BIN
output MODE BINary    (BINary | HEX)

CALLsign = N2IRZ-3    DIGIpeat call = N2IRZ-2  ADDress = 3100201722
messages: SETUP       Call being Setup
          COMPlete Call Complete to
          BANner Test ROSE Switch, N2IRZ

L2FRack  3000 ms L2RESptime  2000 ms L2CHeck  300 L2RETry  12 L2MAXframe  2
L3FRack  3000 ms L3RESptime  2000 ms L3CHeck  600 L3RETry  12 L3MAXframe  3

          PORT 0 (5 Pin Din)              PORT 1 (DB25/DE9)
TX Delay (0TXDelay)     300 ms.   (1TXDelay)     0 ms.
DWait (0DWait)          0 ms.     (1DWait)      0 ms.
FULLdup (0FULL)         OFF       (1FULL)       OFF

Type OK, QUIT or Help
EPROM>
```

Figure 1. A typical MAKEPROM screen. You type in the desired parameter settings (see "Making MAKEPROM Parameters") and this DOS program creates the EPROM image for you.

By Don Rotolo, N2IRZ (N2IRZ@compuserve.com)

TheNET, TexNet, whatever—because it's just a simple pipe. And that's all that a network is supposed to be.

Grow Your Own ROSE

Let's go through the steps of getting a ROSE switch (it isn't referred to as a *node*, but as a *switch*) on the air. The basic steps include getting the software, creating the EPROM, installing it and putting the switch on the air, then creating a configuration file and uploading it (over the air) into the switch (this lets you alter the configuration of any switch from any place in the network—very useful for those remote mountaintops).

Of course, all the mundane stuff, like TNC-to-radio cables, setting the deviation, and so on, has to be dealt with as well, but I'll leave that up to you (or should I write an article on how to do that? Write and let me know).

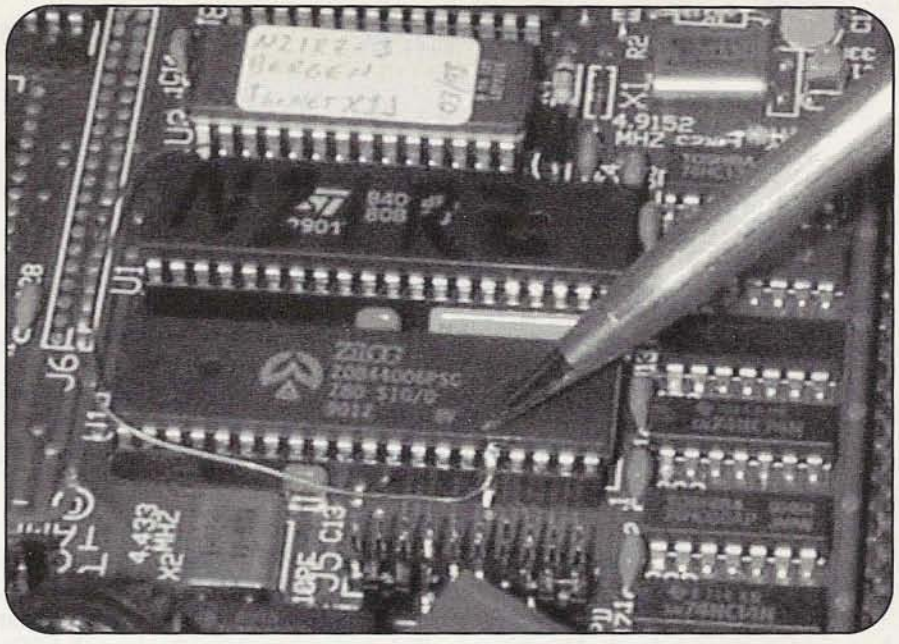
A note on TNCs, while we're on the topic of hardware: Just like TheNET X1 that we discussed last month, ROSE is designed only for a TNC-2 or compatible controller. This means, in a practical sense, that only the MFJ 1270 and PacComm Tiny-2/Spirit-2 series are useful. Kantronics products, Timewave/AEA products (except the old PK-88), BayCom modems, and so on, simply won't work with ROSE. Contact your manufacturer if you're not sure about your TNC.

Creating a ROSE Switch

The first step, of course, is to get the software. It's available online (for free) from CompuServe and from lantz.com, the latest version being RZSW37.ZIP, which is version 3.7. If you don't have Web access, you can get a copy by sending a DOS-formatted floppy to RATS (see "Resources"), along with a postpaid return mailer.

When you unzip the file, be sure to use the *-d* option (as in **PKUNZIP -d RZSW37.ZIP**) to put all the files into their correct subdirectories. If you don't, you'll encounter problems later. Note that the documentation, which hasn't kept up with versions (it's for version 3.3, about four years old), is in a separate file, named RSWD0330.ZIP.

To create the EPROM, you run a simple DOS program named MAKEPROM.EXE. A shot of the screen is shown in Figure 1. Much like TheNET's PATCH program, you can also create a text file beforehand containing all the parameters, and just load it into MAKEPROM using the INCLUDE command. A sample parameter file is shown in Figure 2, and I recommend that you copy it when you make YOUR parameter file. On a side note, if you don't have ANSI.SYS loaded, your screen will look a little different from what you see in Figure 1—you'll see some funny characters, but the program runs just fine.



If this photo looks a lot like last month's, there's a good reason—the TNC modification necessary to run ROSE software is identical to that required for running TheNET X1J, which we covered in detail in April. Please see last month's issue for specifics on making this change.

MAKEPROM operates with a user prompt, seen on the bottom line. You interact with the program by typing in commands. For example, to include a text parameter file like that in Figure 2, you would type "INCLUDE N2IRZ-3.PAR" here (substitute your file's name) to add the parameters to the screen. You can also change the parameters one at a time, by typing in the parameter name, a space, and the new value. When all the parameters are just how you want them, type OK and the EPROM binary image file will be created, with the filename specified by the OUTFILE parameter. The program will report some information, including the EPROM's checksum, and return you to the DOS prompt. To exit without creating an image file, just type QUIT. (See "Making MAKEPROM Parameters," for specific information on what each MAKEPROM parameter means and which ones must be changed.)

Once you have the binary EPROM image, you have to program it into an EPROM. Unlike TheNET, the complete 64 kB image is created, not as two halves, which makes the programming process much easier. ROSE, like X1J, uses a 27C512 (64 kB) EPROM.

As I wrote last month about programming an EPROM, if you already own an EPROM programmer (or "burner," as they're known), then you should know what to do. If you don't own one, then find someone who does, or buy one yourself. You can get a good one from Intronics for $130 which has the advantage of running off the parallel port (no cards to install, and it's portable; again, see "Resources"). But be aware that high-end programmers can run into the $1,000 price range.

Preparing the TNC

Once you've managed to get that EPROM programmed, make sure you put a small label on top, noting the callsign and SSID, Nodename, and software type. I also put a date on it. Now, it's time to modify the TNC, if necessary. This is the exact same modification that's used for TheNET X1J, so please refer to last month's column for details on whether you'll need to make the modification and, if so, how to do it.

One note that I missed last month: Before you start, remove the RAM Battery Back-up jumper inside the TNC,

to allow the TNC's RAM memory to erase itself. This should be done any time you replace a TNC's EPROM, no matter what software is going in. A little insurance never hurts. If you don't do this, you might crash the TNC, as it tries to execute the EPROM code using old data in the RAM.

After double-checking your work, connect the TNC to the radio and power. Switch on the radio, then the TNC, and the TNC should first light up the STA and CON LEDs for a time (about five seconds), then begin alternately cycling the STA and CON LEDs. This is called "Cyloning" (after the faceplates of the evil Cylons from the '80s sci-fi show "Battlestar Galactica"), and this indicates that the switch is alive and well. If this ever stops, the switch has crashed for some reason. Once the switch starts seeing RS-232 data traffic, the LED pattern will change from alternate flashing to flashing together, then back again. If this happens, don't fret—it's normal.

Configuring the Switch

At this point, the switch is almost completely dumb. It knows nothing about itself and the network around it. ROSE is unique in that the network is completely configured by the sysop—nothing is automatic—and this configuration can be very difficult if you're not familiar with it. I remember writing configuration files by hand and never being able to get them right on the first try.

To resolve that difficulty, Bill Slack, NX2P (whom, you may remember, also designed the WireModem mentioned in the March '98 issue) wrote a really nifty program for Windows™ named NETMGR (Net Manager). Visit Bill's NETMGR Web page at <http://www.qsl.net/nx2p/netmgr/> to see a more thorough version of the documentation on the program, currently at version 2.20.

You can get a copy of NETMGR from CompuServe (in the HAMNET forum) and from lantz.com (look in the \RATS\NETMGR\ directory), as well as by mail from RATS. Ask for it at the same time that you request the ROSE software itself. All three programs (ROSE, Documentation, and NETMGR) will fit on a single 1.44-MB floppy.

To create a configuration file (or a set of files for an entire network, or any portion) you simply start NETMGR, and, after placing the switch sites onto the screen (a simple command adds site symbols), draw in all the links, add the switch details (such as callsign, address, etc.), and the program generates all the configuration files for you, automatically. Figure 3 shows a sample map in NETMGR with most of the various icons available. The NETMGR documentation has details on how to use the program.

NETMGR creates a text file with all the configuration data. The file is named with the switch's address and the filename extension .CNF. You then have to convert this file into a Hexadecimal format that the switch can understand. This is done by running a DOS program included with the ROSE software, named CONFIGUR.EXE. Usually, you just type a command like CONFIGUR.EXE 201722.CNF (substitute your file name) and out pops the converted file, with an filename extension of .TBL.

Once you have the .TBL file, you then upload it to the switch. Follow this procedure closely, as it's easy to make a mistake. From your TNC's **cmd:** prompt, issue a connect command such as "**C CONFIG V N2IRZ-3, 201722**" (where N2IRZ-3 is the callsign and 201722 is the address of the switch you created. The address generally consists of the telephone area code and exchange in which the switch is located.). Then, send the .TBL file to the switch as a text file transfer. The switch will respond with 11 "OK" messages (12 if you've set a password). Once you receive the last OK message, you can disconnect, and the switch is configured.

For a standalone switch, the configuration file is fairly simple, since the routing table is nearly empty. In the middle of a real network, the file can become quite large. Don't worry though; each line in the .CNF file is explained in the documentation. To learn more, play with NETMGR and see the effects.

Of course, ROSE has a password protection feature to prevent unauthorized changes to the switch's configuration. It operates much like TheNET X1's password feature (see last month's column), and it's covered well in the documentation, so I won't cover it again here.

```
# This is a sample parameter file for ROSE
# with 27512 EPROM and TNC-2. 2/98 N2IRZ

TNC   TNC2B
SW    ROSEZSW.BVR
OUT   201722.BIN
CALL  N2IRZ-3
DIGI  N2IRZ-2
ADD   3100201722
BAN   Test ROSE Switch, N2IRZ

#Parms from USER12.PAR
L3FRack      3000
L3RESptime   2000
L3MAXframe   3
L3RETry      12
L2FRack      3000
L2RESPtime   2000
L2MAXframe   2
L2RETry      12

# Set your Radio port TX Delay!
0TXD 300
```

Figure 2. The sample parameter (.PAR) file used in this example. Instead of typing all the parameters into MAKEPROM, you can just create a simple text file with all the settings. These settings are loaded into MAKEPROM by using the Include <filename> command at the MAKE PROM command prompt.

Making Your ROSE Bloom

At this point, you've created a single ROSE switch. You can connect to and through it, although it isn't too much fun, or terribly educational, until there are at least three switches in your "network" since that's where routing decisions can be seen. Build two additional switches, all with different addresses and callsigns,

and connect them together using WireModems or radios.

The real beauty of ROSE isn't seen in a small network, but in a large one: The same basic command is used to make any connection, whether it's just one hop through the network, or 20. You just specify the distant station's callsign, the local switch's callsign (where you are entering the network), and the address (at the other end of the network) where the distant station can be found. For example, to connect to a server named "ANDY", which is accessible through the Switch at address 201722, and your local ROSE switch is N2KBD-3, you'd type at your TNC's "**cmd:**" prompt: **C ANDY V N2KBD-3,201722**. From there, the network automatically takes care of routing your connection through the best available path. If the connection can't be made, the network reports why, and, if a link is broken, it reports which link has the problem.

This "one-step" connection process is similar to how we use a telephone—just dial the number and it gets you there. This is a huge advantage for automated stations, and in negotiating large networks, since you don't need to set up the routing on your own.

On the downside, the simple one-step connect has its problems. You have to know the six-digit address of your destination station's local switch. And because the system is so easy to navigate, the users are shielded from the internal network operations, making it more difficult to get them to notice, learn about,

Making MAKEPROM Parameters

When running MAKEPROM, you need to customize many parameters in order to create a usable switch. Each parameter is listed below, along with its meaning and recommended setting. You only have to type in the part of the parameter name shown in uppercase; for example, **SW** is the same as typing in **SWITCH**.

Basic Parameters

TNC type: This sets the TNC type. Since ROSE supports both a 27256 and 27512 EPROM, you need to select the TNC type file for the EPROM you'll be using. For a standard TNC2, use the file name "TNC2B" (where the "B" means "Big EPROM").

SWitch: This sets which switch image (32k or 64k) will be used. Set this to "ROSEZSW.BVR"

OUTput: This specifies the DOS file name used to store the EPROM image. Change this to something convenient.

output MODE: This toggles the output file format between Binary and Hexadecimal. Which one you need depends upon your EPROM programmer, but Binary is more common.

ID and Network Settings

CALLsign: This sets the callsign of the switch. Use your callsign and select an SSID between -1 and -15 (-3 is recommended).

DIGIpeat call: This sets the callsign that the switch will respond to for digipeated packets (such as for APRS), as well as the entry port for "safe mode" connections. This mode is used by a server (such as a BBS) to ensure that data is not corrupted during a network failure.

ADDress: The network address of the switch. The first four numbers are the Data Network ID Code (DNIC) for the country the switch is in. The code for the U.S. is 3100, other codes are listed in the documentation. The second three numbers (in North America) are the telephone area code the switch is in, and the last three numbers are the telephone exchange nearest the switch. In other countries, use from four to eight digits for the area code and exchange. In the entire network, the network address should not be duplicated anywhere, so, in a dense network, you might have to "fudge" the address a little. In the example, the switch is located at my house, and my phone number is (201) 722-xxxx, hence the 201722 address.

You can set three messages: **SETUP** (what the user sees while the call is being set up), **COMPlete** (what the user sees when the call is actually connected) and **BANner** (a brief info text to let users know about your switch). Since some automated programs depend upon the SETUP and COMPlete text to be always the same, you should only change the BANner text.

It's in the Timing

For all of the following timing parameters, I recommend using the values provided in the accompanying .PAR files. For my test user port switch at 1200 baud, I used the file USER12.PAR. There are also files for wire-line connections (such as using a WireModem) and point-to-point RF links. The parameters starting with L2 are for user-to-switch (level 2) connections, and those starting with L3 are for switch-to-switch (level 3) connections. Otherwise, these settings have the same meaning as in a plain old TNC, so I won't describe them in detail:

L2FRack, **L3FRack**: Frame Acknowledgment (ACK) time, in milliseconds. The switch waits this amount of time after acknowledging a frame before retrying.

L2RESptime, **L3RESptime**: Response time, in milliseconds. The switch waits this amount of time before sending an ACK to a received frame.

L2CHeck, **L3CHeck**: Check time, in seconds. If no response is heard from the other station in this amount of time, the link is disconnected.

L2RETry, **L3RETry**: The number of times the switch will retry a link before concluding the other station does not respond.

L2MAXframe, **L3MAXframe**: The maximum number of frames the switch will send at one time.

For all of the following parameters, both the radio port (port 0) and the RS-232 port (port 1) can be set independently. A single TNC can be used with an RS-232 modem (phone or packet) to create a two-port switch.

0TXDelay, **1TXDelay**: The time after keying the transmitter before data is sent. For wired RS-232 connections, this should be 0. The radio port should be set according to the needs of the radio.

0DWait, **1DWait**: The time added to the timing parameters to allow for a connection made through a digipeater. Generally obsolete, should be set to 0.

0FULLdup, **1FULLdup**: Full duplex operation on or off.

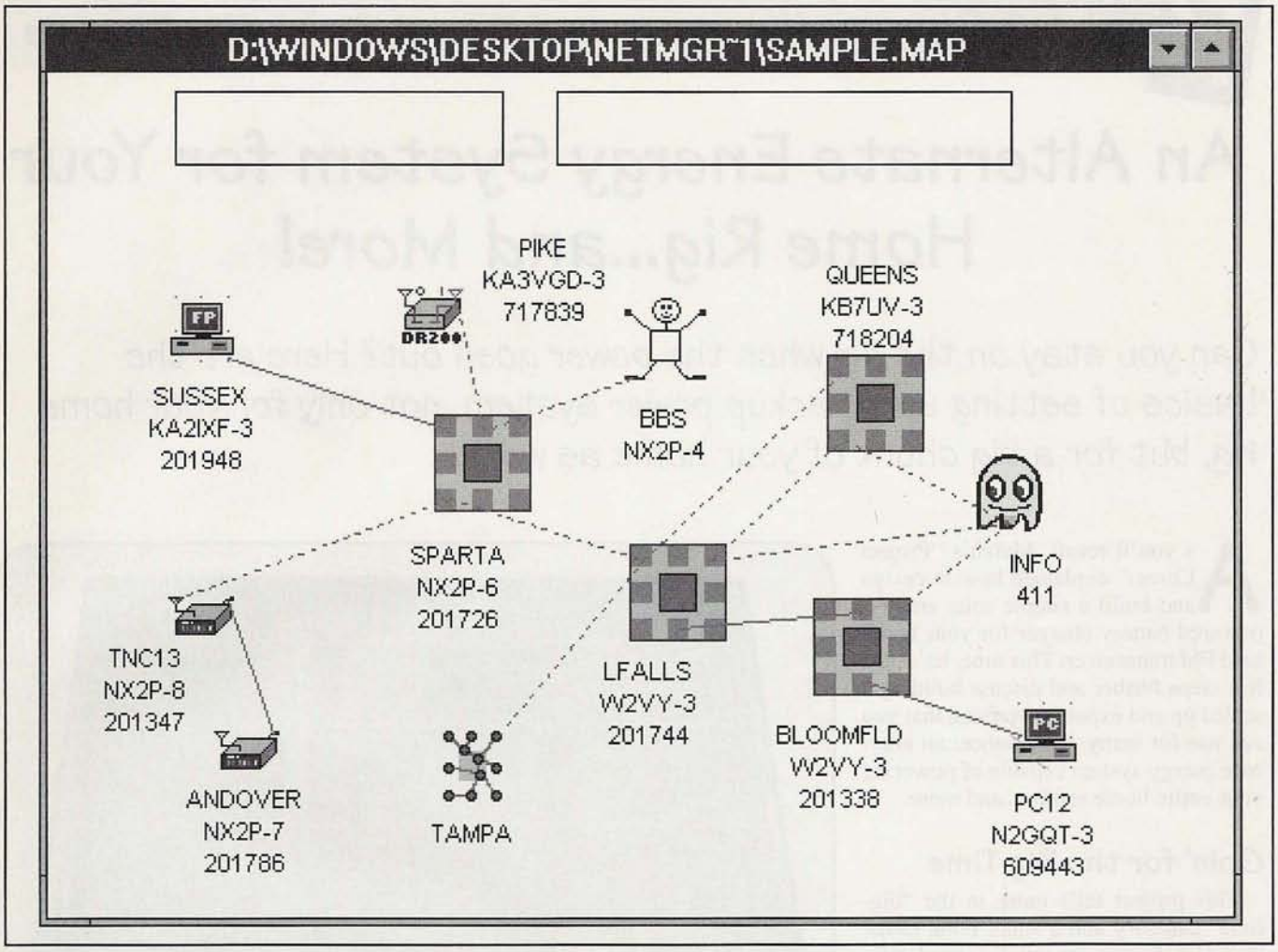


Figure 3. This shows a sample map in NETMGR, written by Bill Slack, NX2P. This windows-based utility makes the configuration of a ROSE network a simple drag-and-drop operation. As an added benefit, the resulting map files are compact and can be distributed via packet.

and *support* the network. Also, ROSE has suffered in recent years from a number of bugs, causing some larger ROSE networks to switch to other networking firmware. Unlike TheNET, ROSE's source code is not in the public domain, and software author W2VY is the only person working on bug fixes and feature additions, so progress is, at times, understandably slow.

Moving on to FlexNet

That's all the space we have for this month. Next month, we'll start with the FlexNet network. If you want an overview of FlexNet, have a look at the June 1997 issue of *CQ VHF*, or in the *Proceedings* of the 14th ARRL Digital Communications Conference, or both! After that, we'll look at TCP/IP and wrap up the series with an overall comparison of everything that's available. Until next time, 73 and happy networking.

Resources

When contacting any of these resources, be sure to mention that you read about them in *CQ VHF*.

The Radio Amateur Telecommunications Society:(*RATS*) : They can help with ROSE questions and software. Please include an SASE or, for software, a DOS-formatted floppy and postage-paid return mailer. RATS, c/o Brian Boccardi, 203 Bishop Blvd., North Brunswick, NJ 08902; E-Mail: <askrat@rats.org>; Web: <http://www.rats.org>.

Digital Communications Conference Proceedings: Available through TAPR, 8987-309 E. Tanque Verde Rd #337, Tucson AZ 85749-9399; Phone: (940) 383-0000; Fax: (940) 566-2544; E-Mail: <tapr@tapr.org>; Web: <http://www.tapr.org>

Lantz.com: Their ftp site at <ftp://www.lantz.com> carries a wealth of current and archival amateur radio software—networking, BBS, TCP/IP, APRS, and more.

SEDAN: The SEDAN Web site <http://www.sedan.org> has good information on modifying your TNC to accept a 27C512 EPROM. If you don't have Web access, send an SASE to Buck Rogers, K4ABT, 211 Luenburg Dr., Evington VA 24550, asking for modification info for your specific TNC model.

Intronics: EPROM programmer is one of the best values I've seen, at under $130. They also sell EPROM erasers. Intronics, Inc., Box 13723, 612 Newton St., Edwardsville KS 66113; Phone: (913) 422-2094.

CQ VHF: Back issues are available from our office for $4 each, postage included (in the U.S.). *CQ VHF* Back Issues, 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926. Payment must accompany order.

An Alternate Energy System for Your Home Rig...and More!

Can you stay on the air when the power goes out? Here are the basics of setting up a backup power system, not only for your home rig, but for a big chunk of your home as well!

As you'll recall, March's "Project Corner" explained how to design and build a simple solar energy-powered battery charger for your hand-held FM transceiver. This time, let's go a few steps further and discuss building a scaled up and expanded version that you can use for many years hence: an alternate energy system capable of powering your entire home station...and more.

Goin' for the Big Time

This project falls more in the "big-time" category and a small book rather than a brief magazine article is needed for a complete description, but the main steps are learning what's involved and planning a system to fill your needs. That fits our available space, solves some mysteries, and provides enough guidance to get you started. Whether you're powering a remote shack atop a mountain, preparing for winter power outages, or striving for independence from commercial power lines, this project is a winner!

Understand that almost every alternate energy system is different in design, as everyone's plans, restrictions, needs and budgets differ. Truly, "one system does not fit all." We have quite a bit of ground to cover, so let's get started! Let's begin with an overview of the various components making up a system, then look at ways they can be combined to custom-make a system that's just right for you.

Solar Panels

As we discussed last month, solar panels convert photon energy from the sun into Direct Current (DC) that can be used to charge batteries and power various types of electronic gear. The amount of voltage and current obtained from solar panels typically ranges from 15 volts at 2 amps to 20 volts at 5 amps (see Photo A). Any number of same-voltage panels can be wired in parallel to obtain more current. The only limitations are your available space, sunlight, and budget restrictions. One clever way to build up your solar power capacity is by starting off with a single four-foot-square panel, then adding one or two more panels each year (see Photo B). Cover the roof of your house with solar panels, and you have a terrific source of natural or alternate energy for many years (assuming, naturally, that sunlight hits the roof and the panels are not destroyed by ultra-high winds).

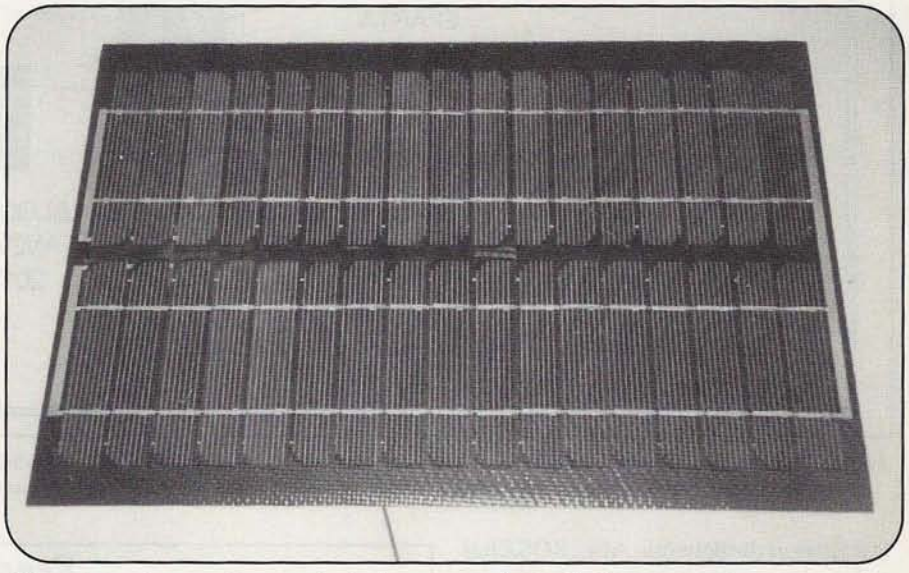


Photo A. A solar panel is comprised of numerous photocells that convert photon energy from the sun into voltage. Modern panels are quite durable and any number of them can be wired in series or parallel to produce a desired voltage and current.

Solar energy is a readily available resource in most areas of the U.S., although it may not be abundant precisely when needed. That's why many people use solar panels to charge one or more deep-cycle storage batteries and draw power from the batteries as needed. In other words, the solar panel(s) is similar to a large battery charger. Charging current must be held within safe limits to avoid overheating battery(ies), so a charge controller is placed/wired between the solar panel(s) and the battery(ies). That charge controller, incidentally, is just a sized-up and more elaborate ver-

By Dave Ingram, K4TWJ

Photo B. Solar energy supreme! Panels on roof (approximately 34 of them) mated with a bank of 20 or 30 batteries that are discharged only 10 to 15 percent by daily loads can serve as a quite effective stand-alone power system for home and rig(s). (Photo courtesy Alternative Energy Engineering)

sion of the homebrewed controller featured in March's "Project Corner."

Wind Generators

If you live in a coastal area, atop a mountain (ham heaven!), or other windy area, setting up a wind generator may give you a surprising amount of free electrical power. "Far out," you say? Nay, nay: wind generators are springing up in increasing numbers around the country (see Photo C). They can be installed on a push-up mast or chimney top and can deliver 300 to 1500 watts output in winds of 12 to 25 miles per hour. Both 13-VDC and 120-VAC models are available.

Simply described, a wind generator consists of a six- or seven-foot airplane-type propeller attached to a shaft or rotor that drives a generator mounted in an enclosure behind the propeller. A stabilizing tail is mounted on the far end to move the generator (keeping it in the wind), and an internal governor prevents damage during abnormally high winds. Many models also include a "tilt" feature so the whole generator can swivel vertically to avoid destruction during hurricane-force winds.

Like solar panels and automobile alternators, wind generators deliver slightly more than normal voltage for charging storage batteries. Consequently, a charge controller is connected/wired between the generator and battery(ies) to be charged. Setting up a combination solar and wind power system is a neat idea: when one source is not plentiful, the other one can usually "fill in"!

Motor-Driven Generators

Portable gasoline engine-driven generators are quite popular for stand-alone production of AC power on an occasional basis, especially since they don't require sunlight or wind for operation. Indeed, many of us have used "gas gens" for Field Day operations or as a backup for commercial power during winter storms. Their high RPM, hourly fuel consumption, noise level, and routine maintenance, however, limits their use on a day-to-day basis.

Two approaches have merit here: One is selecting a generator with a 13-VDC output and using it to supplement a solar and wind power system for charging a battery bank as needed, or for direct use during times of high energy requirements. Connecting a 13-VDC to 120-VAC inverter to the battery bank's output then provides power for regular home lights, appliances, etc. Meanwhile, radio gear parallel-connected to the battery bank's output can be used without "double conversion" of 13-VDC to 120-VAC and then back to 13 VDC. The other possibility is opting for a 5- to 10-kilowatt diesel engine-driven generator for production of 120 and 240 VAC power on a long run basis. Although "diesel gens" are more expensive than "gas gens," they are quieter, run at half the speed, require less maintenance, and use less fuel. Recently introduced models, incidentally, are also quite economically priced.

One interesting variety of motor-driven generator is shown in Photo D. The little "Power Pony" is available from The House of Generators (see "Resources") in both 120-VAC and 13-VDC models and it 's a real treat. You can carry it to Field Day (it's lighter than a bowling ball), power a 50-watt rig on the spot, or use it to back up a small battery bank at home. Another generator option from the same folks (not pictured) is a 7500-watt unit driven by a 14-horsepower Acme diesel engine. It has a key-activated electric starter, shock mounts to minimize vibration, an oversized muffler to reduce noise to a low tone, and weighs 247 pounds. The generator has both 120 VAC/62 amp and 240 VAC/31 amp outlets, plus a built-in 13-VDC battery charger. Big-time power, for sure!

Charge Controllers

The main purpose of a charge controller is to regulate voltage applied to a battery pack (or in this case, a battery bank) to prevent overcharging. It also has reverse-current protection diodes to pre-

Photo C. This lightweight "Whisper" wind generator is easy to install on a two-inch mast and produces a creditable amount of power in a mild breeze. (Photo courtesy Alternative Energy Engineering)

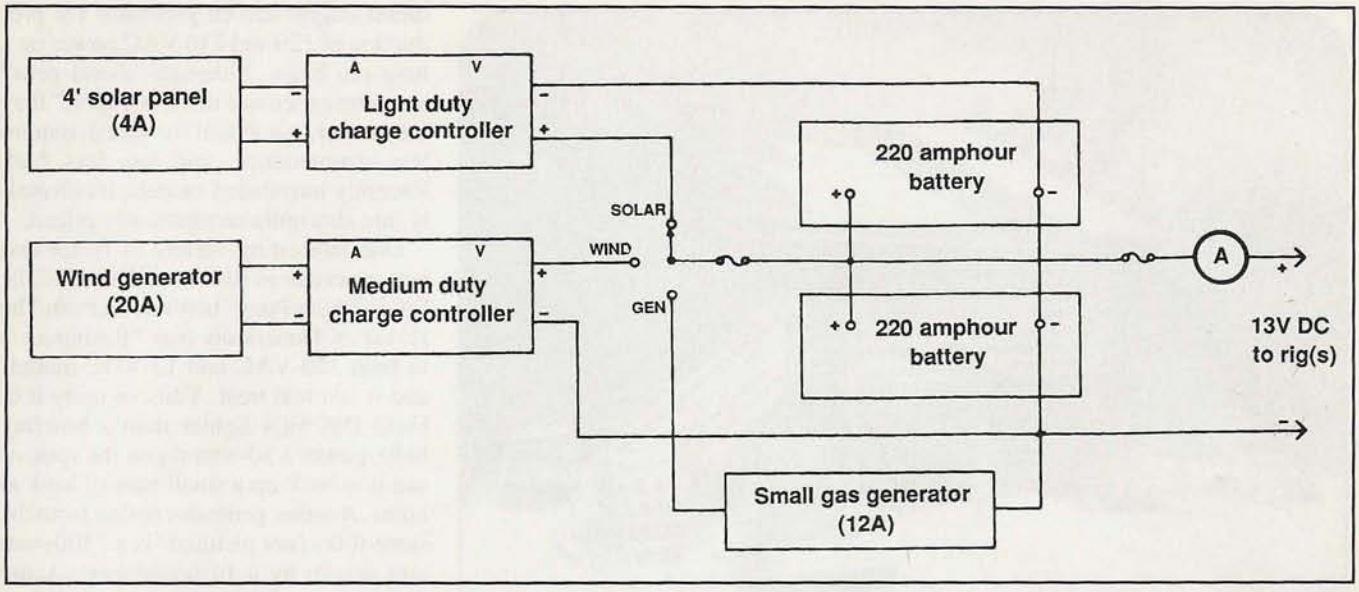


Figure 1. Block diagram of a solar and wind alternate energy system to power a full home station. Small gasoline engine-driven generator is used for backup if/when batteries drop to 15 percent of full charge condition. See discussion in text.

vent the battery(ies) from discharging back through the charging circuitry when the input is low or a full charge is attained. Charge controllers are available in all sizes from 200 to 15000 watts, and usually include panel meters for monitoring battery voltage and current. One popular model is shown in Photo E.

Power Inverters

Inverters such as the one shown in Photo F "chop up and step up" 13 VDC to produce 120-VAC power. This conversion allows you to power home appliances, lights, antenna rotors, etc. from a battery bank. Modern inverters are as easy to install as a charge controller, and they're exceptionally efficient (85 to 90%!). For example, they can convert 13 VDC at 20 amps (260 watts) to 120 VAC at 1.9 amps (228 watts), with the 32-watt difference dissipated as heat. We need that kind of efficiency in the power amplifier section of our FM rigs! Wow! Inverters are also available in all sizes and power ratings. A 4000-watt model for big-rig or full-home use is shown in Photo F.

Battery Banks

Although an automobile's storage battery can be pressed into service for powering 13-VDC gear in the home station during emergencies, it's a poor choice for an alternate energy system. Similar size deep-cycle lead-acid batteries are a better bet. Why? Auto batteries are designed to deliver maximum current in short bursts followed by full recharges, whereas deep-cycle batteries deliver their rated current over a longer time and can be recharged a little or a lot for continued use. Deep-cycle batteries may look like auto batteries, but they cannot deliver peak currents required for cold winter starts.

The size of a deep-cycle battery bank depends on the amount of current needed to power your home station, the current supplied by its charging source(s) and estimated times of "running without a recharge." In many ways, these are similar to barrels farmers use for collecting rainwater. If rain is plentiful and needs are light, a small barrel is sufficient. If rain is scarce or needs are heavy, a larger barrel is necessary. Get the idea?

Evaluating Your Energy Needs

The next step in planning your setup is determining how large it should be and

Photo D. This little "Power Pony" is available in both AC and DC versions from the House of Generators (see "Resources"). Miniature generator measures 10 x 10 x 11 inches, and the 13-volt/12-amp DC model can power a 50-watt rig for eight hours on a gallon of gas. (Photo courtesy House of Generators)

"If you live in a coastal area, atop a mountain (ham heaven!) or other windy area, setting up a wind generator may give you a surprising amount of free electrical power. 'Far out,' you say? Nay, nay: wind generators are springing up in increasing numbers around the country...."

the size of its components. Let's assume you have a 50-watt FM transceiver and a 100-watt CW/SSB transceiver, plus a desktop scanner, and you wish to use all three rigs simultaneously six hours a day (now that's living!). Checking each rig's manual, you find that the FM rig draws 13 volts at 1 amp on receive, and 9 amps on transmit; the SSB rig draws 13 volts at 1 amp on receive, and 20 amps on transmit; and the scanner draws 13 volts at .5 amp (all values are estimates; check your rigs' manuals for specifics). Let's also estimate total receive time as five hours and total transmit time as one hour. Total receive current will thus equal 2.5 amps x 5 hours, or 12.5 amps, and total transmit current will equal 29 amps x 1 hour, or 29 amps. The grand tally is thus 41.5 amps per day or (41.5 x 7) 290.5 amps per week.

Now let's assume you have one four-foot solar panel that produces 4 amps for seven hours a day (28 amps total), a small wind generator that yields 20 amps for two hours a day (40 amps total) and a little 12-amp Power Pony for backup use. Combined solar and wind energy is (28 amps + 40 amps) 68 amps per day, or (68 x 7) 476 amps per week. Assuming you use two 220-amp/hour batteries, and allowing for "minimum sun or wind" times plus charging losses and extra operating time, the overall setup is "comfortably sized" (batteries stay within 15 percent of full charge).

Going a step further, let's say you want to power a refrigerator (approximately 4 amps x 24 hours, or 96 amps per day) and four home lights (2 amps x 15 hours, or 30 amps per day). Their combined total is 126 amps per day, or 882 amps per week. If you use four solar panels and get (16 amps x 7 days) 112 amps per week, plus a wind generator that produces 25 amps for three hours a day (75 amps total), your tally is (112 + 75) 187 amps

Photo E. Charge controllers are available in a variety of shapes and styles. This one is made by Solarex, includes volt and amp meters and handles 200 to 5000 watts to fit both "beginning" and future needs. (Photo courtesy Alternative Energy Engineering)

per day. The weekly total is (187 x 7) 1309 amps which, again, has fair recharging/power inverting "headroom." Plus, you can still use a small to medium-size gas gen for backup charging. Room doesn't permit adding more examples, but go back over the previous two again, then substitute figures for your needs accordingly. That's the first step in designing your own system.

Assembling an Alternate Energy System

Let's begin by outlining the system we discussed earlier for powering a home station (Figure 1). Here, a single solar panel and wind generator charge two 220-amp/hour batteries that, in turn, supply power to a rig(s). Charge controllers are located between solar and wind inputs to limit current and terminate charging when the batteries are fully charged. Battery voltage and current can be monitored on the controllers' meters, and the generator can be brought into action if the solar and wind chargers are temporarily disabled. Fuses are included on both sides of the batteries for malfunction and short circuit protection. Since low voltage and high current are used, all components should be interconnected with large wire (preferably number 10 or 6 gauge) to minimize heat

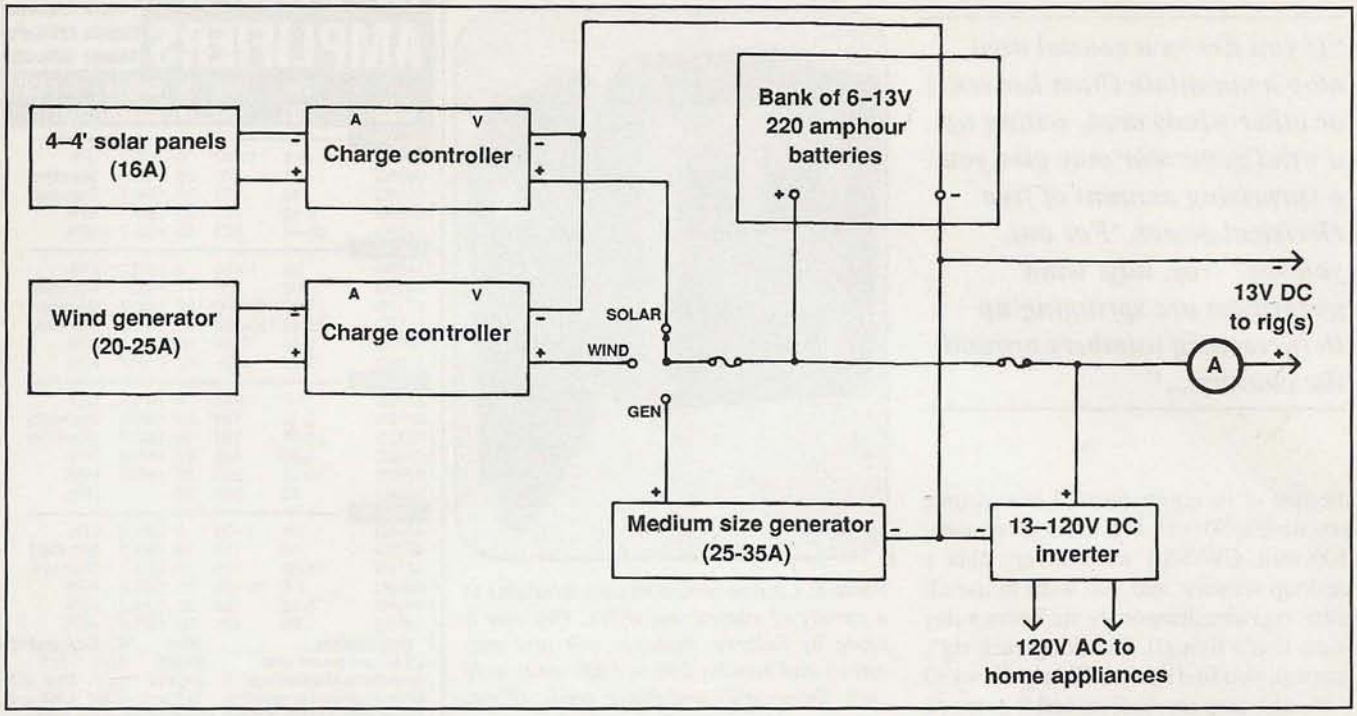


Figure 2. A larger alternate energy system might use four solar panels, wind generator, six deep cycle batteries, and a medium-sized generator for backup. This system can power a full home station plus some home appliances, as discussed in text.

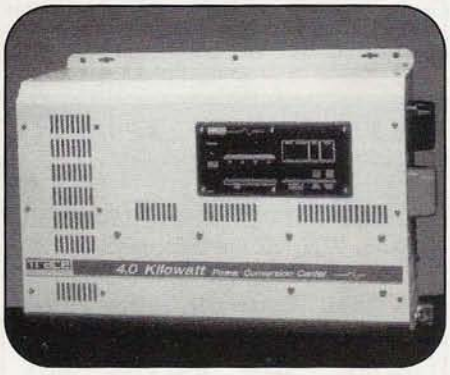


Photo F. This 13-VDC to 120-VAC inverter is made by Trace Engineering and will handle loads up to 4000 watts. Combined with a good battery bank, it will serve a medium-size house. (Photo courtesy Alternative Energy Engineering)

and current losses. Installing large wire at the beginning also permits upgrading in the future without a full rewiring.

A larger setup for both rig and home use is illustrated in Figure 2. Here you have four solar panels plus a wind generator charging six batteries to provide a 1300 ampere storage level. A medium-sized motor-driven generator is used for "backup." If a large generator is substituted, it can also be used "stand-alone" style with a 120-VAC to 13-VDC inverter for powering both rigs and appliances during times of peak loads.

A switchbox or positive switching arrangement should be included to avoid outside/commercial power from feeding back into the alternate energy system. The easy way around that is simply unplugging appliances from wall sockets and plugging them into an extension cord routed to your inverter.

Additional examples would be nice, but we're out of space. I think, though, that you've got enough information to get started planning a small system that can expand as your knowledge and funds grow. Good luck, and may the next commercial power outage not catch you off guard! Incidentally, I've got additional information on alternate energy systems in my new book (number 19!), *Survival Communications* (see "Resources").

A Closing Note

When "Project Corner" returns in the July issue, it will be under new stewardship. The April issue of *CQ VHF* premiered my new monthly column, "How It Works," which is basically a continuation of the "In Theory" column originally written by Don Stoner, W6TNS. And, of course, I continue to write my monthly "World of Ideas" column in *CQ*. Having two monthly columns to worry about doesn't leave enough time to a third column every other month, especially one like "Project Corner" that's so "hands-on." So you'll see a new name in the "Project Corner" as of July, but I'll still be here—every month—with "How It Works."

73, Dave, K4TWJ

Resources

An outstanding source of solar panels, wind generators, charge controllers, inverters, batteries, and guidance on installation/use is Alternative Energy Engineering, P.O. Box 339C, Redway, CA 95560; Phone (800) 777-6609. Check out their catalog—it's terrific!

The amazing little "Power Pony" and other gasoline and diesel generators up to 10000 watts are available from the fine folks at The House of Generators, 16601, Unit D, Gothard Street, Huntington Beach, CA 92647; Phone (800) 987-4484.

My new book, *Survival Communications*, includes additional and more detailed information on alternative energy systems. It's available for $20 plus $4 S & H from Universal Electronics, Inc., 4555 Groves Road, Suite 12, Columbus, OH 43232.

Hamfest Calendar

The following hamfests are scheduled for May, 1998:

May 1–3, International DX Convention, Holiday Inn Visalia, **Visalia, GA**. For information, contact the program chairman, Harvey Shore, K6EXO, (818) 716-5681, or visit their Web site for convention information at: <www.primenet.com/~scdxc/dxconv98.html>.

May 2, Annual Hamfest, West Franklin Bingo Hall, **Gastonia, NC**. For information, contact GAARC, P.O. Box 85, Iron Station, NC 28080-0085.

May 2, Annual Hamfest, Cadillac Middle School, **Cadillac, MI.** Talk-in: 146.98 repeater. For information, contact Dan, KE8KU, Wexaukee, A.R.C., P.O. Box 163, Cadillac, MI 4960, or call (616) 775-0998; e-mail: <ke8kudan@juno.com>. (exams)

May 2, Cochise County Hamfest, Cochise College, **Sierra Vista, AZ**. For information, contact Ron DeWillers, P.O. Box 1405, Sierra Vista, AZ 85636; or e-mail: <d1234@sinosa.com>.

May 2, Swapfest, Doherty High School, **Colorado Springs, CO**. Talk-in: 146.970 (100 Hz CTCSS) or 146.52. For information, call Phil Pearsall, KC5LXC, (719) 531-5319; e-mail: <pearsall@msn.com>.

May 2, Hamfest, H.A. Alexander Park, **Moulton, AL**. Talk-in: 146.960, 53.170, 442.425 & 3.965 MHz. For information, call Lee Creuzer, N8MCH, (205) 351-7916; or e-mail to: <N8MHC@AOL.COM>. (exams)

May 2, 6th Annual Hamfest, Sportscenter, **Owensboro, KY**. Talk-in: OARC repeater 147.81/.21, 146.265/865 alt. For information, contact George Stokes, KD4CKT, 1218 W. 3rd Street, Owensboro, KY 42301, or call (502) 683-2169, Fax: (502) 684-2433 after 3:00 p.m.; e-mail: <w4nho@occuky.campus.mci.net>. (exams)

May 2, 2nd Annual Tailgate Party, Rosewood Farm, **Elko, SC**. Talk-in: 147.030. For information, contact Bill Wetzel, W4OXA, 107 Tanglewood Rd., Bamberg, SC 29003, or call (803) 245-5522; e-mail: <wchapman@scescape.net>.

May 2–3, Hamfest, Abilene Civic Center, **Abilene, TX**. Talk-in: 146.160/760. For information, contact Peg Richard, KA4UPA, 1442 Lakeside Dr., Abilene, TX 79602, or call (915) 672-8889. (exams)

May 3, Ham Radio Auction, Millard Social Hall, **Omaha, NE**. For information, call Ed Edwards,KØIL, (402) 552-5426; e-mail: <k0usa@qsl.net>, <k0il@qsl.net>; or visit their Web site: <http://www.qsl.net/k0usa>.

May 3, Hamfest, Sandwich Fairgrounds, **Sandwich, IL**. Talk-in: 146.73 minus o/s or 146.52 simplex. For information, call Bob Yurs, W9ICU at: (815) 895-3310; e-mail: <W9ICU@aol.com.>; packet: N9VJQ@WB9SLE.IL.USA>; WWW: <http://tbcnet.com/~jleonard/hamfest.html>.

May 3, Giant Electronic Fleamarket, Lincoln High School, **Yonkers, NY**. Talk-in: 449.425 MHz PL 156.7, 223.760 MHz PL 67.0, 146.910 MHz, 443.350 MHz PL 156.7. For information, contact Otto J. Supliski, WB2SLQ at (914) 969-1053. (exams)

May 9, Hamfest and Computer Swapfest, Manitowoc County Expo Center, **Manitowoc, WI**. Talk-in: 146.01/61. For information, contact Mancorad RC, P.O. Box 204, Manitowoc, WI 54221-0204 or call Red (920) 684-9097 days or Glenn (920) 684-7096 day or evening. (exams)

May 9, Hamfest & Computer Fair, National Guard Armory, **Grand Junction, CO**. Talk-in: 146.94. For information, contact Diana Dodd, KBØREW, 507 Liberty Cap Ct., Grand Jct., CO 81503. (exams)

May 9, Spring Hamfest, John S. Burke Catholic High School, **Goshen, NY**. For information, contact Edward J. Moskowitz, N2XJI, 123 Harold Avenue, Cornwall, NY 12518, (914) 534-3492. (exams)

May 15–17, Hamvention 98, Hara Arena, **Dayton, OH**. For information, contact Hamvention, Box 964, Dayton, OH 45401-0964, or call (937) 276-6930, Fax: (937) 274-8369; e-mail: <info@hamvention.org>; WWW <http://www.hamvention.org>.

May 16, 1st Annual Hamfest & Electronics Swapmeet, Sr. High School Cafeteria, **Willmar, MN**.Talk-in: 146.91-. For information, contact Willmar Hamfest Committee, 209 Hawaii Street NE, Willmar, MN 56201; or e-mail: <WØSW@AMSAT.ORG>. (exams)

May 16, Annual Spring Auction & Fleamarket, VFW Post 6342, **Forestdale, RI**. Talk-in: 146.76, 146.94, 223.76, and 447.425 repeaters in Market. For information, contact Rick Fairweather, K1KYI, 106 Chaplin Street, Pawtucket, RI 02861 or call (401) 725-7507 between 7:00 and 8:00 p.m.

May 22–23, Hamfest '98, Jackson County Fairgrounds, **Pascagoula, MS**. Talk-in: 145.110 down, Alt 146.880 down. For information, contact Charles "Kim" Kimmerly, N5XGI at (228) 826-5811. (exams)

May 22–24, Hamfest, Edmonton Inn Hotel, **Edmonton, Alberta**. For information, contact Ron Gordon, VE6RLG, <ve6rlg@narc.net>, or (403) 437-0579; WWW: <http://narc.tnc.com/~hamfest>.

May 24, 24th Annual Dur-Ham-Fest, South Square Mall, **Durham, NC**. Talk-in: 147.225 MHz+. For information, contact Rodney Draughon, AE4JW, 794 Harris Mill Rd., Rougemont, NC 27572, or call (336) 364-7420; e-mail: <ae4w@juno.com>. (exams)

May 24, Annual Hamfest, DeVry Institute of Technology, **Chicago, IL**. Talk-in: 147.255+. For information, call George (773) 545-3622 or Dean (708) 331-7764; write to CARC, 5631 W. Irving Pk. Rd., Chicago, IL 60634.

May 29–30, 1998 Midwest/Dakota Division Convention with Hamboree 20, Marina Inn, **South Sioux City, NE**. Talk-in: 146.31/91. For information, contact Mike Nickolaus, NFØN, 316 East 32nd Street, South Sioux City, NE 68776, call (402) 494-6070; e-mail: <nfØn@avalon.net>. (exams)

May 29–31, Rochester Hamfest, Monroe County Fairgrounds, **Rochester, NY**. For information, contact Rochester Hamfest, 300 White Spruce Blvd., Rochester, NY 14623, or call (716) 424-7184, Fax: (716) 424-7130; or see their Web site at: <www.rochesterhamfest.org>; e-mail: <rochfst@frontiernet.net>.

May 31, Annual Swapmeet, Bella Vista High School, **Fair Oaks, CA**. Talk-in: 145.190 MHz (162.2 Hz tone) and 224.400 MHz. For information, contact Bob Naylor, AC6HF (916) 966-3654; e-mail: <ac6hf@juno.com>.

May 31, Hamfest, The Curling Club, **Sorel-Tracy, Providence of Quebec**. For information, contact Club Radioamateur Sorel-Tracy, Box 533, Sorel (Quebec), J3P 5N6, or send an e-mail to: <jgadoury@sorel-tracy.qc.ca>.

Operating Notes

For late April and May, 1998:

April	
25–26	**CQ VHF National Foxhunting Weekend (see article, last issue)**
26	Good EME Conditions
29	ARRL Spring Sprint, 432 MHz (see rules, last issue)
May	
3	Good EME Conditions
5	Eta Aquarids meteor shower peak
9	ARRL Spring Sprints, 902/1296/2304 MHz
16–17	ARRL Spring Sprint, 50 MHz
23–24	WSWSS CW VHF Sprint, (see "Weak Signal News," this issue)
31	Good EME Conditions

EME data courtesy W5LUU. More contest info is available on the CQ VHF *World Wide Web page at:* <http://members.aol.com/cqvhf/navhfcon.htm>.

Basics

Connecting with Packet Networks

There are three ways of making contact with someone on packet radio. If the person is nearby, within range of your transmitter and antenna, you can connect directly. To do that, simply type "C-space," and the call of the person you want to contact. Then press return.

But if you're too far apart for a direct connection, you'll need to use a *packet network.*

Network stations are called *nodes* or *switches.* They receive, briefly store, and then forward your packets either to another ham, a bulletin board or another network node station.

Using "TheNet" Nodes

The most common nodes are part of networks using "TheNet" or "NetRom" software. You connect to the node and, from there, connect again, either to another node or to the station you're trying to contact.

Nodes generally don't use regular ham callsigns. Instead, they use shorter "aliases" which are intended to give you some idea of what they do or where they're located. So, if you live in Raleigh, North Carolina, you connect to "RNC." The WA2SNA bulletin board in Northern New Jersey uses the alias, "BBSNNJ." It *is* legal, by the way, since the node sends out its callsign along with its "alias."

If you're not sure how to route your message, connect to the node, then type "nodes" and it will send you a list of other nodes that it can contact. You then use the same "C <callsign or alias>" command to connect to the next node in line.

The node acknowledges each of your transmissions itself, then retransmits what you sent with your callsign followed by a "dash-15." That means your message is being relayed through a network node. You can then string together as many nodes as you need to reach the station you want to contact.

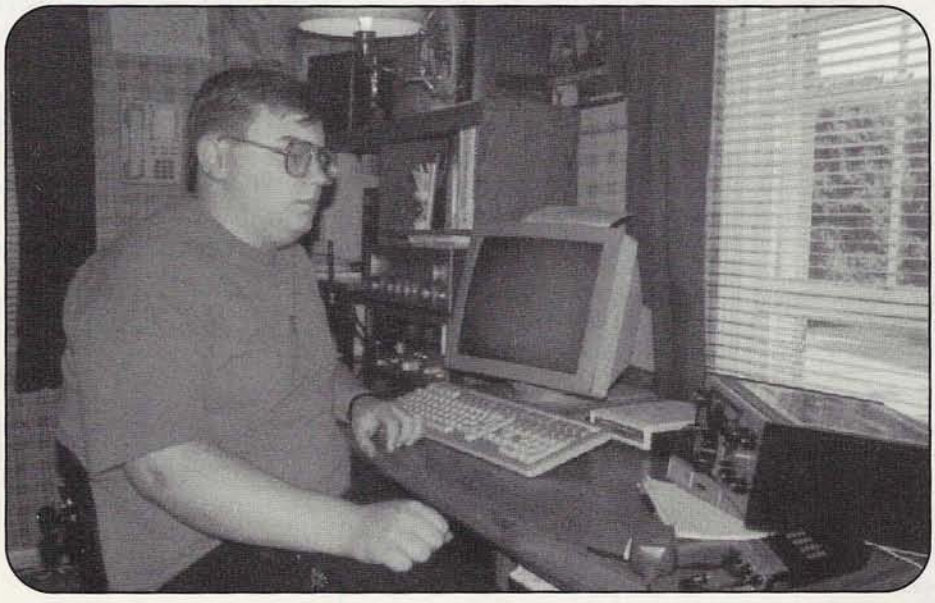
When you're done with your contact, you need to disconnect—generally by typing "B" or "BYE" and pressing "enter." Often, you must disconnect separately from each link in the chain. This can be good, though, if you want to explore what the different nodes along the way have to offer. If your first disconnect dropped all the links, then you'd have to rebuild the chain for each new connection.

If you get confused, sending the node a "/h" or "/?" command will generally bring you to a help screen. Many nodes include the procedure for getting help in their sign-on messages, so be sure to read those carefully. One final note: After you've disconnected, you may still be in "converse" mode, so you may have to tell your TNC to re-enter the "command" mode before you make your next connection.

Other Networks

While "TheNet" and "NetRom" are the most commonly-used networks, there are several others in use around the country. These include the ROSE network and Texnet, among others. Each uses a slightly different approach to getting you hooked up with a faraway station. And the digital ham radio satellites have their own special system for relaying information. What they all have in common, though, is their ability to let you relay real-time contacts (except on satellites), messages, files, and computer programs.

If the tips we suggest here don't seem to work for you, try to make a direct contact with a packet station in your area (look for a regular callsign with a "*" before it and no numbers after it), and ask for help. You might even make a new friend in the process. ■



Packet networks can expand your VHF horizons by connecting you with other hams and packet "servers" (automated stations performing a specific function beyond the range of your own signal. Here, Lenny Mack, KB8KTC, operates his packet station in Fair Lawn, Ohio.

Basics

CTCSS Tone Frequencies

The following is a listing of the 42 standard CTCSS (Continuous Tone-Coded Squelch System) tone frequencies, along with the Motorola PL® designators often used to describe them. Many repeaters require that you transmit a CTCSS tone along with your signal in order to have your signal retransmitted by the repeater. CTCSS is usually used to minimize interference to and from other repeaters, not to restrict access.

Frequency (Hz)	"P/L" Designator
67.0	XZ
69.3	WZ
71.9	XA
74.4	WA
77.0	XB
79.7	WB
82.5	YZ
85.4	YA
88.5	YB
91.5	ZZ
94.8	ZA
97.4	ZB
100.0	1Z
103.5	1A
107.2	1B
110.9	2Z
114.8	2A
118.8	2B
123.0	3Z
127.3	3A
131.8	3B
136.5	4Z
141.3	4A
146.2	4B
151.4	5Z
156.7	5A
162.2	5B
167.9	6Z
173.8	6A
179.9	6B
186.2	7Z
192.8	7A
203.5	M1
206.5	8Z
210.7	M2
218.1	M3
225.7	M4
229.1	9Z
233.6	M5
241.8	M6
250.3	M7
254.1	ØZ

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All Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF Weblink*, Attn: Bernadette Schimmel, 25 Newbridge Road, Hicksville, NY 11801. Credit card orders also accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF Clublink*, or by e-mail to CQVHF@aol.com. Be sure to say what it is in the subject line (e.g., club listing).

Club Listings

FL - Metro Dade REACT 4881 - One of the few **all-ham** REACT teams in the U.S., providing public service through communications. Mtgs ev. Thurs. 8 p.m., details on 147.315 MHz (+600) repeater. For info, contact: Metro Dade REACT, 3735 SW 89 Ave., Miami, FL 33165; e-mail: <react4881@juno.com>; WWW: <http://www.geocities.com/Heartland/Ranch/4881>. For more information, contact Robert Cruz, KE4MCL, President, <react4881@juno.com>.

IL - Logan Area Amateur Radio CLub - Logan County, Illinois. Meetings held 3rd Saturday of each month, 7 p.m., American Red Cross Building, 125 South Kickapoo St., Lincoln, Illinois. Primary repeater: 147.345+. Secondary Repeater: 145.390-. Contact President, Bob Rucker, KB9JSE, (217) 735-2506; <KB9JSE@ccaonline.com>.

PA - Lambda Amateur Radio Club (LARC) - Philadelphia PA. Since 1975, the only open and visible public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, internet listserv and IRC, hamfest meetings, chapters, DXpeditions. E-mail: <LARC@net-quest.com>.

TN - Cleveland - Cleveland Amateur Radio Club, Meetings are held every 2nd and 4th Tuesday of the month (except December) at the C.A.R.C. Clubhouse, 560 Johnson Blvd., Cleveland, TN, at 7:00 p.m. during EST hours, and at 7:00 p.m. during EDT hours. The C.A.R.C. operates a 2-meter repeater on 146.925 MHz (600), and a UHF repeater at 444.275 MHz (+5 MHz). Contact W4GZX, P.O. Box 2683, Cleveland, TN 37320-2683; e-mail: <carc@rocketmail.com>; Web site: <http://www.geocities.com/SiliconValley/Lab/1660>.

ONT - Canada - Muskoka Amateur Radio Club, Huntsville, ONT. Meets at the Huntsville Hospital Board Room at 2:00 p.m. on the second Sunday of each month. Visitors welcome. Net at 7:00 p.m. Monday on 146.775. Muskoka Amateur Radio Club, VE3MZY, 437 Aspdin Road, Huntsville, ONT, P1H 1Y4, Canada.

Exam Sessions

IL - Lincoln - L.A.A.R.C.: Our club offers ARRL VEC exam sessions for Novice, Technician, and Tech Plus licenses on the 2nd Saturday of every other month (next session May 9, 1998) at Lincoln Public Library Annex Building, 725 Pekin St., Lincoln, Illinois. Pre-registration recommended but not necessary. For info contact: Mike Roos, N9WGT, (217) 732-6323. Exam fee is $6.39.

IL - Chicago: Ham Radio Testing session the first Thursday every month, from 7–10 p.m. We test all levels from Novice thru Extra. Reservations are NOT required. For information, contact Dennis L. Sladek, N9OZ, 4344 W. 51 St., Chicago, IL 60632; Phone: (773) 838-8088; e-mail: <n9oz@juno.com>.

Personal Web Site Listings

Robert Cruz, KE4MCL, Web site: <www.geocities.com/Heartland/Estates/5281>. KE4MCL Swap Shop, is a place for hams to advertise their old gear and place want ads. No dealer ads will be accepted.

Commercial Web Site Listings

Woodhouse Communication. Antennas and publications for weather satellite imaging: <www.view2earth.com>.

Teletec manufactures 6, 2, 1 1/4 meter and 70 cm Linear Amplifiers as well as Receive Pre-Amplifiers. <http://www.Teletec-usa.com>.

MS-Windows Software: RAC Callbook CD-ROM, Ultimeter Weather Stations and more, info <n2ckh@cybercomm.net>, <www.QTH.com/n2ckh.bytewise.org>.

Looking for "Looking Ahead?" Look back—it's on page 58.

Advertisers' Index

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†Smallest HT as of Jan. 1998

Seeing is Transceiving

Portable SSTV is here! Kenwood's new VC-H1 Visual Communicator combines an image-scan converter, CCD camera and LCD monitor in a compact battery-operated unit. Simply hook it up to your Kenwood transceiver to start sending and receiving color images over the air.

VC-H1 Visual Communicator

◗ Ideal for outdoor SSTV

Until now, for anyone interested in SSTV (slow-scan television), portability has not been an option. But thanks to component miniaturization the VC-H1 is not only small enough for handheld use but it runs off 4 AA batteries so you can take it anywhere. This makes it ideal for field days, special events, disaster communications and even fishing trips.

◗ Full compatibility

The VC-H1 can be connected to any transceiver with just a cable, and it offers full compatibility with all of the standard SSTV formats. Uploads/downloads are quick and easy; the images are also sharp and clear.

◗ All-in-one design

In addition to the detachable 1/4-inch CCD camera, the VC-H1 features a 1.8-inch color TFT (thin film transistor)-type display. As well as viewing incoming pictures, you can review your own prior to transmission. The built-in microphone & speaker can be used in place of a separate speaker-microphone for your transceiver.

◗ Image memory

Up to 10 pictures can be stored in memory. This allows you to compare and pick the best shot to send. You can also store incoming pictures and protect them from unintentional deletion.

◗ Computer connectivity

One of the great features of the VC-H1 is the ability to work with a personal computer. Hook it up to the RS-232C port on your laptop using the optional connection kit (includes Microsoft® Windows® 95 software) and you can save pictures (in JPEG format) that you send and receive. You can then cut and paste using standard graphics software, or even superimpose your own text. What's more, you can actually control the VC-H1 from your computer.

◗ Call sign superimpose

◗ AF mute

◗ Auto power-off

SPECIFICATIONS

• Terminals : Data I/O (for transceiver), Video in, Video out, COM (for computer),DC IN (4.8 ~ 7.0V) • Dimensions, projections not included (WxHxD): 2-5/8 x 1-3/8 x 6-3/4 in (62 x 30 x 160 mm)

Specifications are subject to change without notice.
Screen-shot photographs are simulated.
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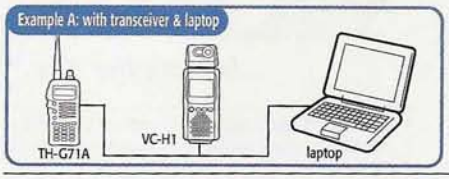

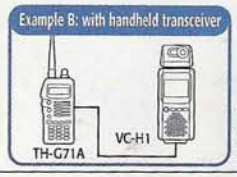

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