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CQ VHF Ham Radio Above 50 MHz

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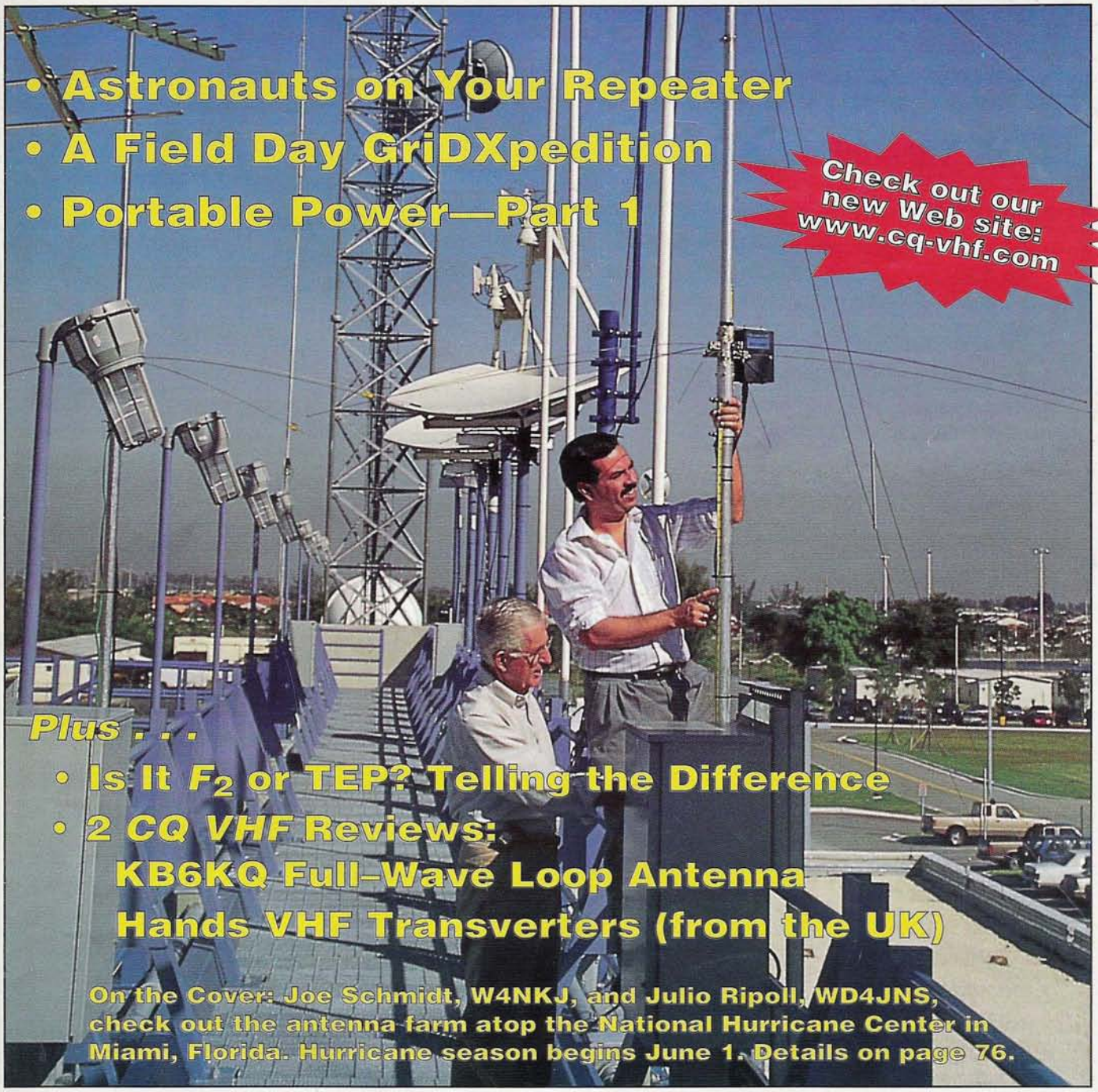
June 1999



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- A Field Day GriDXpedition
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Plus . . .

- Is It F_2 or TEP? Telling the Difference
- 2 *CQ VHF* Reviews:
  KB6KQ Full-Wave Loop Antenna
  Hands VHF Transverters (from the UK)

On the Cover: Joe Schmidt, W4NKJ, and Julio Ripoll, WD4JNS, check out the antenna farm atop the National Hurricane Center in Miami, Florida. Hurricane season begins June 1. Details on page 76.

U.S. $3.99/ Canada $5.50

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- SMA antenna connector
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These radios have not yet been type accepted by the FCC. They may not be sold or leased until the approval of the FCC has been obtained.

·**Cellular blocked.**

CIRCLE 174 ON READER SERVICE CARD

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- Alphanumeric display
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- S-meter
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MFJ pocket size Morse Code Tutor

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They'll help get you ready for your FCC exam. When you're comfortable copying these QSOs, you're ready to pass and upgrade!

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MFJ's *CodeTest*™ set lets you practice *only* the characters required on FCC exams.

MFJ Word Recognition Mode™

MFJ's *Word Recognition Mode*™ gives you hundreds of commonly used words in amateur radio. Practice recognizing *entire words* instead of individual letters.

Learn to copy words without writing it down and carry on an entire CW conversation without paper -- just like pros on 40 Meter CW.

You can save 10 words of *your choice* for word recognition practice -- *an MFJ exclusive.*

You'll never run out of practice

Select letter, number, punctuation, prosign or code test sets, random call signs, random words, QSOs or combination sets for practice -- you'll never run out of study material.

You can even make up and save your own word and character sets for practice.

NEW! MFJ-418 **$79.95**

MFJ InteractiveMode™

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Select normal or Farnsworth spacing.

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Farnsworth character speed is adjustable 10 to 60 words-per-minute for high-speed practice.

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Use fixed length or more realistic random length groups. Up to 8 characters per group.

Change Speed on the Fly

Change speed on the fly while you're playing a session -- 3 to 55 words-per-minute.

No Instruction Manual needed!

Choose from easy-to-use menus on LCD display. Simple 3 button operation.

SettingSaver™

Your settings are *automatically* saved, ready to use next time -- no more #$%* resets!

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Read words, letters, numbers and punctuations in *plain English* as code is being sent. It's a powerful sound and sight aid!

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Pocket Size

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Toss it in your briefcase, travel bag or stash in your car's glove compartment and you'll always have it ready for instant practice.

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You'll pay more for a few sets of code tapes than an MFJ-418. The MFJ-418 is less expensive, lots of fun and *far* more effective.

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MFJ-713
MFJ-714
$59.95

Intermod causing squeaks, squawks, unidentified voices and other noises all across the 2 Meter band? Can't use your radio?

MFJ *IntermodFighter*™ eliminates intermod by reducing interference up to 50 dB with three high-Q bandpass filters. Plugs between radio and antenna.

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CIRCLE 128 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

Volume 4, Number 6—June, 1999

page 8

page 28

page 44

FEATURES

COLUMNS

BASICS

DEPARTMENTS

Next Month: "222 MHz—The Forgotten Band," by Bill Cameron, KB2BZP

ICOM IC-T81A

Add the Wide-Open Microwaves to Your Fun

JIS 4 WATER RESISTANT

YOU'VE GOT IT ALL. With four bands at your command, excellent audio, 124 memory channels, water resistant construction, and ICOM durability, get ready for the most fun ever!

SIMPLICITY, RIGHT OUT OF THE BOX. Function keys can be confusing. The 'T81A doesn't use any! It's so easy to use, many operators said they never needed to open the instruction manual.

LISTEN BEYOND THE HAM BANDS. Pick up incredibly clear, wide band* reception. Tune in a ball game (radio *or* TV broadcast), listen to air traffic control, or scan for police activity. Take your 'T81A everywhere!

AN EXTRA BAND, AND 1/2 THE SIZE *Compared to an older tri-band HT model of just a few years ago, the IC-T81A is smaller, offers more features, is water resistant, and adds 6 meters! The IC-T81A is more affordable, too.*

PC Ready!

ICOM options required for PC operation:
OPC-478 Cloning cable,
CS-T81 Cloning software

IC-T81A ACTUAL SIZE*

WORLD'S FIRST! FOUR BANDS IN ONE HAND

SPECIFICATIONS

Transmit: ..... 6M, 2M, 440 MHz, 1.2 GHz
Receive: ..... 50-54, 74-174, 400-470, and 1240-1300 MHz*
*Reception guaranteed on US ham bands only
Mode: ..... WFM and AM (Rx only), FM
Power: ..... Up to 5 Watts @ 13.5V, 1 Watt on 1.2 GHz
Memory Channels: ..... 124 total Including 100 regular, 20 scan edges, and 4 call
Size : ..... *2.3(W) x 4.2(H) x 1.1(D) in. 58(W) x 106(H) x 28.5(D) mm.
Weight : ..... 9.9 oz /280 kg

FEATURES

- **Slim, Powerful Ni-MH Battery**
  – 4.5 Watts @ 9.8V/680 mAh (4-6 hrs)
- **Rugged ICOM Construction**
  – Die-cast aluminum chassis
  – JIS-4 water resistance rating
- **CTCSS Encode/Decode (Tone Squelch)**
  – 50 tones, pocket beep
- **DTMF Encoder, 9 Memories**
- **Multi-Function "Joystick"**
  – Easy to change bands, cruise menu options, and set modes
- **Built-in Guide Function**
- **Auto Repeater**
- **Backlit Alphanumeric Display**
  – Use a PC to name channels
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- **Battery Voltage Indicator**
- **9 Tuning Steps** (7 for 1.2 GHz band)
- **"AA" Alkaline Battery Pack** (optional)
- **Wall Charger and Belt Clip Included**

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"Could Amateur Radio Save America?"

This isn't an idle question, and we're not the first ones asking it. Our country is becoming increasingly dependent on wireless technology, but young engineers and technicians seem to have little interest in radio. Here's how ham radio can help solve this growing problem.

The title of this month's editorial is in quotes because it was the title of another editorial in another magazine—a non-ham radio magazine—a couple of years ago. The editorial appeared in the August, 1997, issue of *EE Product News*, a magazine for electronic design engineers, and it was written by that magazine's Editor-in-Chief, David Maliniak, who also happens to be N2SMH.

In it, he talks about the fact that "a childhood fascination with radio" was responsible for the careers of many of today's electronic engineers. But then he notes that "it seems as if that early interest in math or science isn't as prevalent among today's kids," and adds that "If America falls any farther behind in terms of turning out top-flight engineering talent, our economy—and hence, our prosperity—will surely suffer in the future."

His suggestion? Find ways, ham radio among them, to encourage children to wonder about how and why things work "I'm not saying that amateur radio is the *only* avenue by which young people might gain a technical bent," says Maliniak, but "a healthy fascination with radio could be an avocation that serves as the springboard to a rewarding career that fewer young people seem to be pursuing."

Earlier this year, I got in touch with David and asked him what kind of response he'd received to that editorial. "There must have been 40 or 50 responses," he told me, and I can tell you that 40 to 50 responses to a magazine on any single topic means you've hit a nerve someplace. "Most correspondents bemoaned the lack of interest on the part of today's younger generation in science in general," David continued, noting that "even the non-amateur folks agreed that getting kids involved in a technical hobby was a good idea."

> ***"If America falls any farther behind in terms of turning out top-flight engineering talent, our economy—and hence, our prosperity—will surely suffer in the future."—David Maliniak, N2SMH, Editor,* EE Product News**

"I'm not sure that existing hams can necessarily satisfy the dearth of RF techs and designers," he added. "My thought was to get kids started early in the hope of awakening that all-important impulse that drives good designers and techs to want to know how and why things work."

Can Ham Radio Save America?

N2SMH is 100% on the mark, and amateur radio can be a major part of addressing this problem. Amateur radio is a multidisciplinary educational tool that can become a central part of any school's technology program. Ham radio can be used as a teaching tool for language arts, social studies, math, physics, earth science, space science, and much, much more—at any level of education. The main difference between ham radio and computers in this setting is that computers generally are research tools; you learn *about* things by using a computer. With ham radio, you learn *to do* things. Build a satellite station, for example, and communicate through ham satellites, and you're not just learning *about* satellite communications, you're learning to *do* satellite communications.

Engineering schools should *require* at least one RF-related course of all EE students—forget whether they *want* to learn about it—part of a college's job is to tell you what you *need* to learn to succeed in your chosen field. And ham radio should be strongly encouraged as a way to put concepts from the classroom into practice in real life.

No, we'll never push the computers aside, and we shouldn't. But ham radio can remind everyone—educators, parents, and kids—that there's more to technology than a keyboard and a monitor; and it can provide a valuable starting point for technological careers that may extend beyond ones and zeros.

Beyond the Keyboard

Back in our March issue, Neil Dabb, KC7GCL, wrote an article entitled "Mission Impossible?" about attracting young people to amateur radio. Dabb noted that he's involved with a program, called Junior Engineering State, that's bringing hands-on science and technology to elementary and middle schools

By Rich Moseson, W2VU, Editor (w2vu@cq-vhf.com)

throughout the intermountain West. Naturally, I asked him if ham radio was included. "No," replied Neil. "Our hands- on science program does not have a ham radio module yet. I'm still working on convincing our director that we need one, not to mention finding funding for such a module (if you have any ideas, let me know)."

Here's another big part of the problem we face today: professionals in science and engineering who have a stereotypical view of ham radio that probably dates back to the commercial operators who (most likely) began calling amateurs "hams" in the first place. This is an issue that Ken Neubeck, WB2AMU, examines more closely in this month's "Op-Ed" column. Meanwhile, Neil, please give a copy of this editorial to your boss, and especially the following:

A Letter to Neil's Boss

Dear Mr. or Ms. Director:

Why does a hands-on science and technology program need a ham radio module? After all, radio's obsolete, right? In today's world, if it doesn't have a keyboard and a monitor, it's not really technology, right? Well, the people who sell computers would certainly like us to believe that, but what about the people who design and build wireless networks to link those computers together? And what about the people who design and build cellular telephones, cellular networks, television transmitters and receivers, aircraft radar and telemetry systems, communications satellites and other spacecraft? Or, for that matter, cars and trucks and planes and trains? Technology is all around us, in nearly everything we use and do. And more and more of it today is "wireless."

Going "Wireless"

Back in the early part of the 20th century, "wireless" meant just one thing: radio. I can still remember my grandfather suggesting that we "turn on the wireless" to hear the latest weather forecast. Well, now it's the end of the 20th century and guess what? "Wireless" still means just one thing: radio.

Every wireless remote for a TV or VCR, every cordless phone, every cellphone, every baby monitor, every pager, every computer-network wireless LAN, is a radio. Without exception, they work by sending information from point A to point B via radio. Every TV set is really a radio. Every satellite sends its data back to Earth via radio. The Global Positioning System (GPS) receiver that tells you where on Earth you are is...that's right, a radio. So is the LoJack® device that helps the police find your stolen car. And, of course, the police department and the department of public works and the military all use radio to keep in touch.

Radio transmitters, receivers, and networks don't design themselves, build themselves, or fix themselves. But the nation's engineering schools seem to think they do. Most electronic engineering students learn ones and zeros and can do great things with computers—but they can't get the computers to talk to each other without wires.

Courses in RF (radio frequency) engineering are few and far between, as are opportunities for hands-on experience. But that's not really a problem, is it? After all, most incoming students, having been exposed to computers since kinder-

(Continued on page 24)

VHF News

FCC: Don't Ignore OO Reports

The FCC is putting "teeth" into "OO Advisory Notices," cards sent by ARRL-appointed "Official Observers" to hams who appear to be violating FCC rules. In a letter to Richard Whiten, WB2OTK, of Easely, South Carolina, about allegations of obscenity, profanity, and other illegal transmissions, FCC amateur enforcement chief Riley Hollingsworth, K4ZDH, noted that "you apparently ignored notices from Official Observers of the American Radio Relay League (ARRL)," and then added, "Failure to take notices seriously and to take corrective action where possible will not be tolerated by the Commission, and such conduct will lead to monetary forfeiture or license revocation."

OO notices are, by their nature, advisory, and the League's own OO manual points out that "The OO must avoid any hint of enforcement....You are not an enforcer; you are an advisor-helper." However, it seems that those notices are now being taken seriously by the FCC enforcers, who warn that amateurs need to take them seriously as well.

New Scanner Rules Affect Ham Gear

Ham rigs with extended receive coverage on non-amateur frequencies between 30 and 960 MHz and the ability to scan for active frequencies are subject to new FCC rules intended to tighten the prohibition on monitoring cellphone calls. According to the ARRL, the new rules require that receivers "be designed so that tuning, control circuits, and filtering be inaccessible, and that any attempted modifications render the receiver inoperative." In addition, the rules make it illegal to modify scanners as a business or on an ongoing basis, and they say that any modifications to scanning receivers are prohibited and will invalidate their type-acceptance.

Squeezing More Repeaters onto 440

The Southern California Repeater and Remote Base Association (SCRBBA) is reportedly considering a plan to change the repeater spacing on 70 centimeters from 25 kHz, the current national standard, to 20 kHz, in an effort to open up more frequencies for repeater operation. According to a report on "This Week in Amateur Radio," the proposal was slated for discussion and a vote at a special SCRBBA meeting on May 1. The 440-MHz band is used more heavily in southern California than in any other part of the U.S. Approval of the new plan would create one new repeater channel-pair for

(Continued on page 79)

Compiled by the CQ VHF Staff

CQ VHF Ham Radio Above 50 MHz

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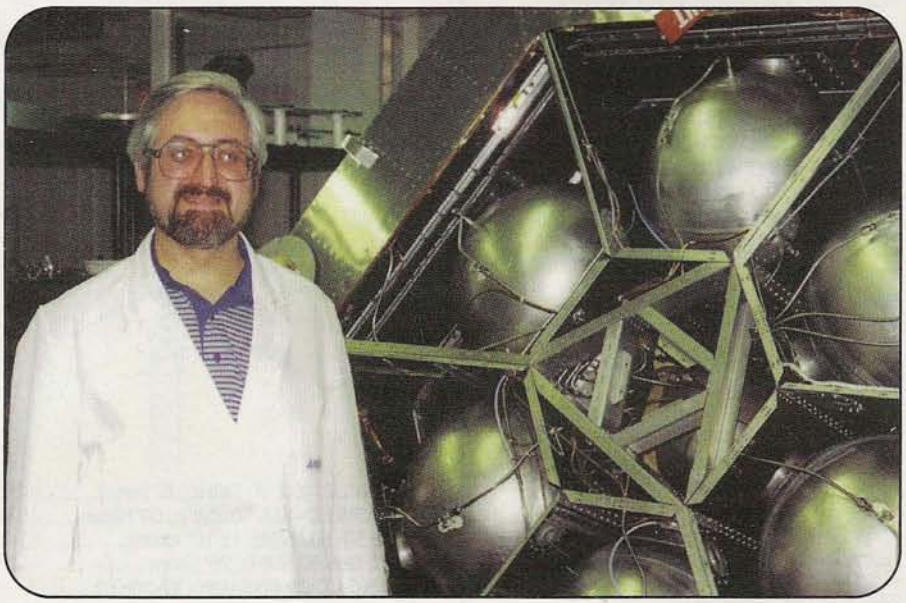
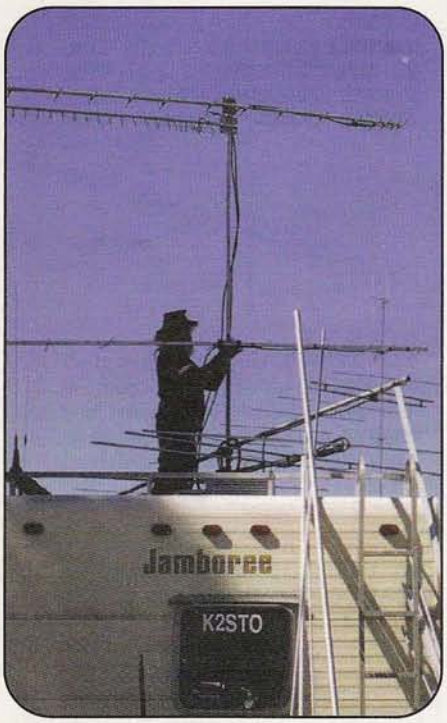
A Visit to Orlando

It was a tough assignment, but somebody had to do it. *CQ VHF* Editor Rich Moseson, W2VU, drew the short straw, and poor Rich had to spend President's Day weekend in Orlando instead of New Jersey. He brought along his camera so everyone could see what a miserable time he had in the warm Florida sunshine.



You can just see the misery on W2VU's face during a visit to the Phase 3D satellite at AMSAT's P3D Integration Lab in Orlando. Look for more pictures and a story in our August issue. (Photo by Arnie Sposato, N2IQO)



Being away from home doesn't keep John Lodgson, K2STO, from his VHFing. After setting up his flea market tables at the Orlando Hamcation (mostly selling antennas and antenna hardware, which you see leaning against his motor home), John put up his own antennas for 6 meters through 1296 MHz.

If you've got a cool snapshot to share with us, but don't have a whole article to build around it, send it in to "Picture This," along with a brief description of who and what we're seeing. If we like it, too, and have the space, we'll print it (no pay, just glory). Send your color prints to *CQ VHF*, 25 Newbridge Road, Hicksville, NY 11801. Please don't write on the front of the photos or use ballpoint pen on the back. If you'd like your photo(s) returned, please tell us so and include an SASE (self-addressed, stamped envelope) with sufficient postage. Thanks!

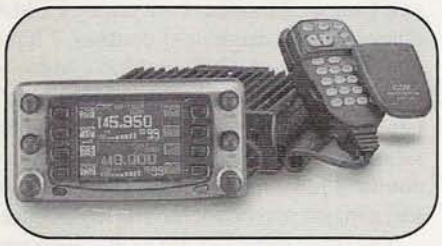
A new way to put the glow back into old tubes. Donna Viglione, AD4LE, turns tubes into beautiful lamps that she sells at hamfests, at prices ranging from about $35 to about $70.

Another one of AD4LE's tube lamps, this one made from two 813s (we didn't get the number of the tube in the middle). Donna's lamps are also available by mail. If you're interested, write to her at 9235 S. Timberline Terrace, Inverness, FL 34452.

Product Update

ICOM IC-2800H Color-Display Dual-Bander

ICOM's new IC-2800H dual-band mobile radio features a full-color LCD display with user-selectable modes and video capabilities, along with a removable control head, bandscope function, 9600-bps packet, independent tuning controls, convenient memory editing, and much more. In addition to operating frequencies, the IC-2800H's three-inch color LCD remote control head gives wide-angle viewing for mobile flexibility and all-around usability. The high-visibility screen offers a variety of information, including scope, S-meter, memory names, and scan condition. The brightness and contrast controls are easy to adjust and are located in the edit menu. You can also (with optional equipment) preview real-time VCR or digital camera images, monitor TV broadcasts with a TV tuner, display GPS maps, and more.



The IC-2800H control head is compact, measuring 2.75 x 5.5 x 1.3 (HWD) inches. The main unit, measuring 1.6 x 5.5 x 6.6 (HWD) inches, can be easily placed under a car seat. The IC-2800H transmits 50 watts on 144 to 148 MHz and 35 watts on 430 to 450 MHz.

For more information, contact ICOM America, Inc., 2380 116th Ave. NE, Bellevue, WA 98004, (425) 454-8155. To request a free brochure, call (425) 450-6088 or visit ICOM's Web site at <http://www.icomamerica.com>.

Circle 100 on reader service card

MFJ "JimHandy" HT Code Keyer

Want to get some code practice on 2-meter FM, but can't figure out how to generate CW tones on your HT? No problem. MFJ's "JimHandy" CW interface converts code from a hand key into audio tones that are sent to your mic jack and transmitted by your HT. A built-in sidetone speaker with volume control lets you monitor your outgoing code signals, and the transmit/receive switch on the "JimHandy" automatically keys the push-to-talk switch on your HT and keeps it keyed until you've finished sending. An adjustable T/R delay control may be set for either slow or fast code.

The MFJ-552 "JimHandy" is $59.95 plus shipping. It comes with an open-ended cable for wiring to your HT mic jack, or you may purchase a prewired interface cable for most major brands for an additional $14.95. MFJ will even sell you a code key to plug into the "JimHandy" for $7.95. A 9-volt battery (not included) is required.

For more information, contact your favorite dealer or MFJ Enterprises, Inc., at P.O. Box 494, Mississippi State, MS 39762 (8–4:30 Central time, M–F); Phone: (601) 323-5869; Orders/Dealer Locations only: (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; Internet: <http://www.mfjenterprises.com>.

Circle 101 on reader service card

Cutting Edge HAM-Pack

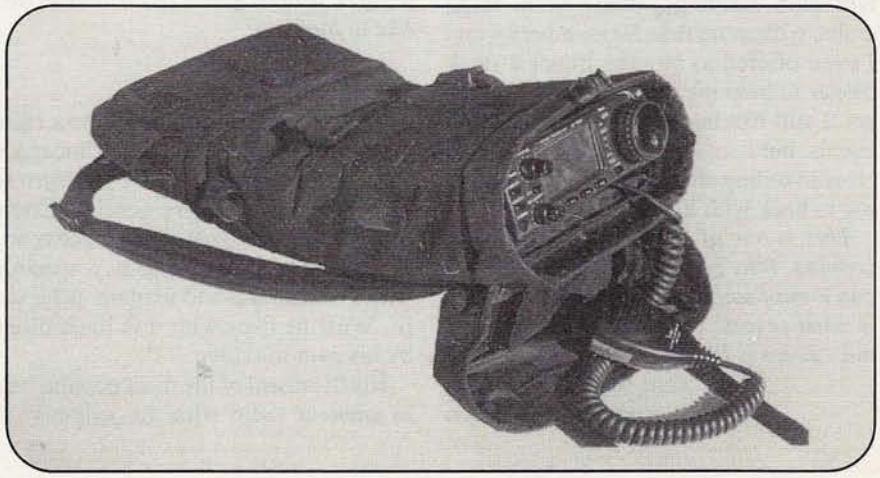
Cutting Edge Enterprises, a manufacturer of portable power supplies and radio accessories, has an offering for the vacationing ham. The HAM-Pack lets you carry your 110-watt station easily on your back on planes or trains, or safe and compact in the car. This specifically designed "man-pack" will carry the new mobile HF rigs, such as the ICOM-706 or the Yaesu FT-100, securely on your back with a compartment below for a rechargeable power supply and a pocket on the side to secure your mobile antennas.

The backpack is constructed of laminated, heavy-duty black nylon with 1/4-inch foam padding. The radio is secured in the upper compartment in an adjustable radio sling that allows the unit to be raised or lowered easily for access and protection. Power cords pass through openings into the lower padded compartment that's designed to hold a rechargeable battery power supply (also available through Cutting Edge). The construction is sturdy, well padded, and weather resistant. The lid has a convenient pocket for microphone storage. The pack can be carried on your back with body-contoured shoulder straps or carried by the handle at the top. A mobile antenna, such as the Outbacker, fits neatly in a side pocket with easy access straps securing the upper portions.

This pack is small enough to qualify as airline carry-on luggage, is complete enough to serve as an entire station, and is comfortable enough to carry for miles. Special introductory prices: HAM-Pack (p/n HMP) $47.95; Power Supply Kit (p/n HPP9A), $63.95.

For further information or distributor inquires contact Cutting Edge Enterprises, 1803 Mission Street Suite #546, Santa Cruz, CA 95060; Phone: (800) 206-0115; E-mail: <cee@cruzio.com>

Circle 102 on reader service card



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 <letters@cq-vhf.com>. Please specify that it is a letter for* CQ VHF *magazine.*

Responses to Ryan

Editor's Note: April's editorial, "Old Men Making Lunch Plans," which detailed the difficulty that a new ham in Chicago was having in getting other hams to help "Elmer" him in his new hobby, appears to have touched a nerve among many hams. We've received more responses on that column than on any other single topic in quite a long time. Because of this, we're going to devote all of this month's "Letters" column to "Responses to Ryan." We'll return to our regular letters next month.

Dear *CQ VHF*:

In your editorial in April's issue, Ryan is right....I have held my Tech No-Code license for about two years, and I cannot find an "Elmer" to assist me with programming a scanner, hooking up an amp with the right connectors, learning Morse code, and questions about ham radio in general.

I have asked for an "Elmer " at at least two club meetings—these were large clubs, with more than 50 members—and I even offered to buy the Elmer a steak dinner to help me. Guess what? No takers. I still like ham radio and assist with events, but I am losing interest and came close to selling all my equipment and saying to heck with it.

This is one of the reasons ham radio is dying. Why get your license when you can e-mail someone just as easily? That is what several of my friends have told me....Ryan is right.

Carl Jensen, KF6LBM
Sacramento, California

Dear *CQ VHF*:

Can you supply Ryan's full e-mail address? We're not in the immediate Chicago area, but I thought that even help from the St. Paul, Minnesota, area would be of help to the two brothers. I'll sure be glad to try and help them all I can from here.

Ham radio is indeed in a sad state right now. It has priced itself out of an everyperson's hobby into a big buck hobby. Equipment has gotten too expensive for the average school kid to afford.

I have been in ham radio since the early '50s, originally licensed as KØPSI. My favorite band back then was 6 meters. Can you work at getting more practical build-it-yourself articles in *CQ VHF*? That's one of the things we lack in the hobby right now. 73,

Jack Sheldon, KBØQIK
St. Paul, Minnesota

Jack—Thank you for your interest in helping Ryan and his brother, even from a distance. I've sent you his e-mail address and I hope you can help him find some of the enjoyment that ham radio has brought to you (and to me).

I'm afraid I must disagree with you on the cost of ham radio, though. Actually, a new radio today costs less, after adjusting for inflation, than did those classics of past decades. And they don't drift, either!

I hope you're still enjoying 6 meters. As for practical build-it-yourself projects, we can only print 'em if people send 'em to us. We do have a bi-monthly "Project Corner" column and often have project-type features as well. If you (or anyone else, for that matter) have a favorite project you'd like to share, we'd like to look at it.

Dear *CQ VHF*:

Just some comments about your editorial on the new ham, Ryan, in Chicago, in the April issue of *CQ VHF*. In return for taking a couple of very nominal examinations, he has been given access to a huge slice of radio frequency spectrum which he can use and explore as he sees fit. What he does with it is limited only by his own initiative.

His dismissal of the most popular band in amateur radio with the judgment "2 meters is no fun" reflects a passive mentality that expects to be stimulated and entertained by others. Instead of asking, "what's in this for me?" maybe he should be more willing to reciprocate and ask "what can I contribute?"

He can get on that repeater and chat with those old guys, not just to pick their brains, but to share his own knowledge of computers. He needs to offer something in return, not just expect help and fun as his due for being a ham. Thanks and 73.

Ed Butler, KF6DXX
San Diego, California

Dear *CQ VHF*:

I was reading your editorial, "Old Men Making Lunch Plans" in April *CQ VHF*, and I fully agree. I am 34 and a Tech, and I have been trying hard for over a year since I moved back to this area to get to know the local hams, but still know only a handful of calls. I was a "core" type of ARES member where I was in Oregon, and I am well trained. I am taking FEMA emergency management courses. I have a well-equipped 4WD and have made it clear I am available, but the "leadership" here seems to be part of the good-ol'-boy school and hasn't been interested in a newcomer. I have no faith in them and have lost a major reason for having my license.

The other thing is I am a satellite operator (FO-20, FO-29, AO-27). I am having difficulty getting operating tips other than that listed in AMSAT or the sat manual. Like, what is a good uplink frequency? What are some good ways to tune up? The same thing for weather sats. It seems there are no hams working satellites in my area. I hope you can help.

Brent Hampton, KC7EXA
Wenatchee, Washington, CN97

Brent—It's impossible to tell from your letter, but attitude counts for a lot. If you came in with an attitude of "I know everything, let me show you how to do it better," then it shouldn't be surprising if people push you away. On the other hand, if your attitude was more along the lines of "I've had a fair amount of training and I'd like to help in any way I can," a better reception should be expected. As for getting to know local hams, have you gone to club meetings? Introduced your-

self to people at activities? Tried being a friend as well as looking for one?

On the satellite front, my first advice is to keep reading CQ VHF. *Our "Orbital Elements" column covered AO-27 in detail in April (same issue as Ryan's story), and will do the same for FO-20/29 next month. Plus, you should contact AMSAT's Area Coordinator for Washington, Art Coulombe, W7HGK (e-mail: w7hgk@amsat.org) and see if he can help you find a satellite "Elmer" nearby.*

Dear *CQ VHF*:

I have trouble mustering much sympathy for Ryan and his brother, two young hams mentioned in the April '99 "Line of Sight." Ryan is described as "being into computers," yet there is no mention of him utilizing the Internet to obtain any of the information and assistance he is seeking. I was on the QCWA rolls before the use of home computers and the Internet became widespread, yet I have had no trouble accessing Web pages, forums, and newsgroups that deal with every imaginable facet of amateur radio.

Lack of information and assistance for new hams is no threat to amateur radio. In fact, an unprecedented amount of information is available with relatively little effort required. Real threats to amateur radio are the increased use of restrictive covenants (CC&Rs) that prohibit antennas and their supporting structures, and the proliferation of consumer electronics with no immunity to radio frequency interference.

Dave Thier, WA3GWK
Toney, Alabama

Dear *CQ VHF*:

I got my latest copy of *CQ VHF* yesterday and, as is my habit, I read it from cover to cover. Something about your "Line of Sight" column has been bothering me ever since.

My first reaction is that you have been conned. While I am not a member of AMSAT, I find it amazing that they will give an e-mail address to a non-member. If "Ryan" has an AMSAT e-mail address, it seems that he knows enough about a given ham radio organization to obtain benefits from it. He also has enough knowledge of ham radio to find your fine magazine and e-mail you a note. Further, he would seem to have Web access, too. A quick visit to any decent search engine would give him tons of hits pertaining to ham radio and relevant interest groups. Information about the multifarious aspects of our wonderful hobby is literally at his fingertips.

Assuming that the young gent is legit, I suspect that what we have here is yet another case of Silver Platter Syndrome. My experience with hams over quite a few years is that most go out of their way to assist newcomers to the ranks. Most of us have loaned equipment, and rendered assistance to help people come up to speed. I have not noticed any slacking off of this Elmering activity as of late. So long as a newcomer shows some good interest, they are helped by the rest of us. Perhaps "Ryan" is perceived as being insincere by those he has contacted? As for being disabled, I have known a fair number of hams who ran the gamut from outstanding athletes to quadriplegics. All were able to enjoy themselves, and contribute to the health of the hobby. I wonder why "Ryan" has a problem in this area where so many others have grown and prospered?

Even if talking about lunch plans bores "Ryan," it sure is a big deal to a lot of other people. One of my longest-standing friendships is with another ham. Chuck and I used to travel out to Laramie, Wyoming, in order to get together for a few beers. That is a mighty long trip by motorcycle. Boring? I think not. Many of our older hams have been getting together for years at local restaurants. It is their major form of socializing, and they make great efforts to attend.

Perhaps if "Ryan" is fortunate enough, he, too, might wind up enjoying getting together for lunch with his ham buddies of many years. Ham radio is one of the greatest hobbies going, but a person has to be willing to give of themselves in order to receive the benefits in return. Most of us seek out and find opportunities to serve. Others, like your correspondent seem to want everything handed to them on a silver platter. This is not only counter-productive, but totally contrary to the spirit of public service exemplified by real hams. 73,

Steve Berg, WA9JML
DeKalb, Illinois EN51

Steve—I'd be more inclined to agree with your conclusion if it wasn't for all the other letters we received, saying, "Yeah, that happened to me, too." So I have to conclude that the problem is real.

Astronauts on Your Repeater

Live audio and video from space are available via satellite during shuttle missions, courtesy of NASA TV. But you don't need a satellite receiver to listen in—the astronauts may be as close as your local repeater.

By Philip Chien, KC4YER*
(pchien@digital.net)

NASA TV is your best front row seat for what's happening in space. With NASA TV you can look over the shoulders of the flight controllers and astronauts as they perform their tasks. You can watch the same briefings the press watch and find out what's happening first hand. You'll see everything live and uncensored. Instead of one-minute news stories on TV, or newspaper articles written for someone with a sixth-grade education, you'll find out the details. An hour-long news conference may end up on the news as a 15-second sound byte on TV. Often, the rest of the hour is more interesting, but the sound byte was the only "quotable" thing which was said.

"Instead of one-minute news stories on TV, or newspaper articles written for someone with a sixth-grade education, you'll find out the details."

NASA TV also shows archival films from the golden age of the space program—see how NASA presented itself to the world during the moon race and the Cold War and how much the world has changed since then.

On the other hand, even the most die-hard space fans will have to admit that NASA TV can also be the most boring thing on TV. Watching a half-filled control room for eight hours while the astronauts sleep is about as exciting as watching paint peel. Fortunately, many astronauts and flight controllers have excellent senses of humor and bad puns are often heard on the air-to-ground audio, adding some enjoyment to otherwise utilitarian communications.

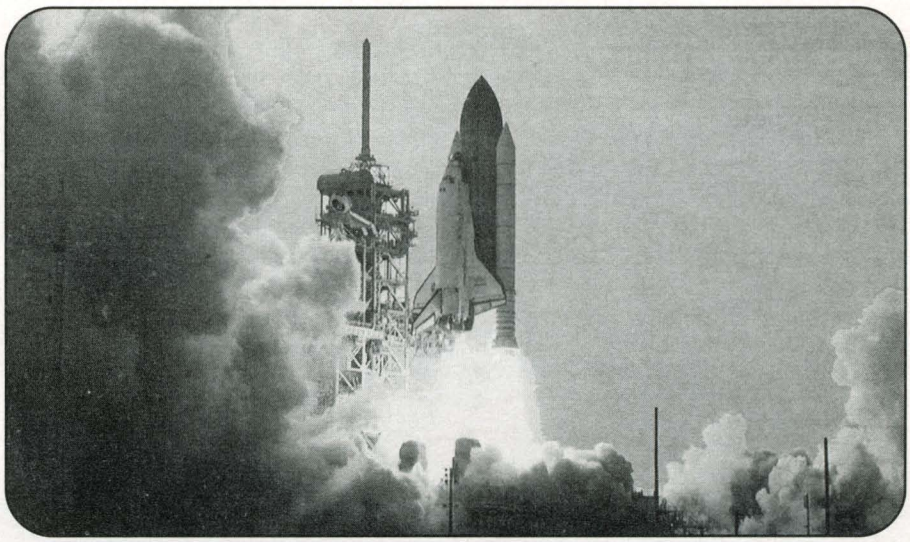


Photo A. Shuttle launches and other NASA activities may be watched live—and without TV anchors' chatter—via NASA TV. Video and audio from shuttle missions may be rebroadcast by hams, and more than 100 repeaters around the U.S. and Canada regularly do so. (NASA photo)

Space Junkie TV

NASA TV was originally called "NASA Select," and was put in place so TV stations around the country could follow the space program without the expense of sending reporters to the Kennedy and Johnson Space Centers. It quickly turned out, though, that the most enthusiastic audience was space fans with access to satellite dishes. NASA-TV, as NASA Select was renamed a couple of years ago, is on the GE-2 satellite, transponder 9C, located at 85 degrees West. It can be viewed by all of North America and Hawaii. (But as we'll discuss later, in many cases, the audio and sometimes even the video, are available on the ham bands as well.)

The NASA TV transponder operates full-time during shuttle missions (Photo A) and other major activities. At other times, programming from NASA's vast library is shown on a four-hour schedule, repeated several times each day. Live activities include press conferences, special activities, presentations from NASA Headquarters, and, most importantly, 24-hour coverage of shuttle missions. This coverage normally gets priority over other programming. See "Resources" for accessing the NASA TV schedule.

Since NASA TV's primary purpose is to inform the media about the agency's activities, much of the programming is presented in a format which requires lit-

*Philip Chien, KC4YER, writes about the space program from his home in Merritt Island, Florida, right down the road from the Kennedy Space Center.

Yes, It's Legal

Here's the full text of the FCC regulation which applies to retransmissions of NASA feeds:

Part 97.113 (5) (e) "No station shall retransmit programs or signals emanating from any type of radio station other than an amateur station, except propagation and weather forecast information intended for use by the general public and originated from United States Government stations and communications, including incidental music, originating on United States Government frequencies between a space shuttle and its associated Earth stations. Prior approval for shuttle retransmissions must be obtained from the National Aeronautics and Space Administration.** Such retransmissions must be for the exclusive use of amateur operators. Propagation, weather forecasts and shuttle retransmissions may not be conducted on a regular basis, but only occasionally, as an incident of normal amateur radio communications."

**Note: NASA has given blanket permission for amateurs to retransmit shuttle communications, so specific request for permission are no longer required.

tle effort on the part of television stations, newspapers, and other mass media to use. So the daily "video file" consists of simple sound-bites and video clips ready to air on the evening news. There's not much substantial information and never a technical term. An outline of each day's "video file" contents may be found on the Internet (see "Resources").

Out to Launch

Launches of NASA payloads on other rockets are also broadcast live; however, non-NASA satellite launches rent commercial transponders. Launches of commercial and military satellites normally are not carried on NASA TV. In the past decade, only one launch of a NASA spacecraft has not been carried live on NASA TV—the launch of the X-Ray Timing Explorer on December 30, 1995, in the middle of the federal government shutdown.

A second transponder, #5, is used for engineering purposes. During countdowns, it's used to transmit launch pad engineering views to engineers at the Johnson Space Center and Marshall Spaceflight Center. It's an unscrambled signal and not purposely encrypted, but it does look kind of strange. Two camera views are multiplexed and, on a normal TV set, it looks kind of like a double exposure.

During missions, the engineering transponder signal is scrambled, officially in order to protect the astronauts' medical privacy, but the scrambling is on continuously, not just when data needs to be protected. During the STS-74 mission, which overlapped the federal government shutdown, the signals were un-scrambled (the personnel responsible for scrambling were not considered "essential" and were not at work). At no point during that mission was the crew's medical privacy compromised. It appears that the key reason for the scrambling is to permit the Johnson Space Center video personnel to choose which air-to-ground signals they wish to send out to the rest of the world and what is to be viewed only within NASA. Regrettably, the existence of the scrambled feed has lead conspiracists and UFO fanatics to believe that NASA is purposely hiding something. And, as with any conspiracy theory, it's impossible to prove that a conspiracy doesn't exist.

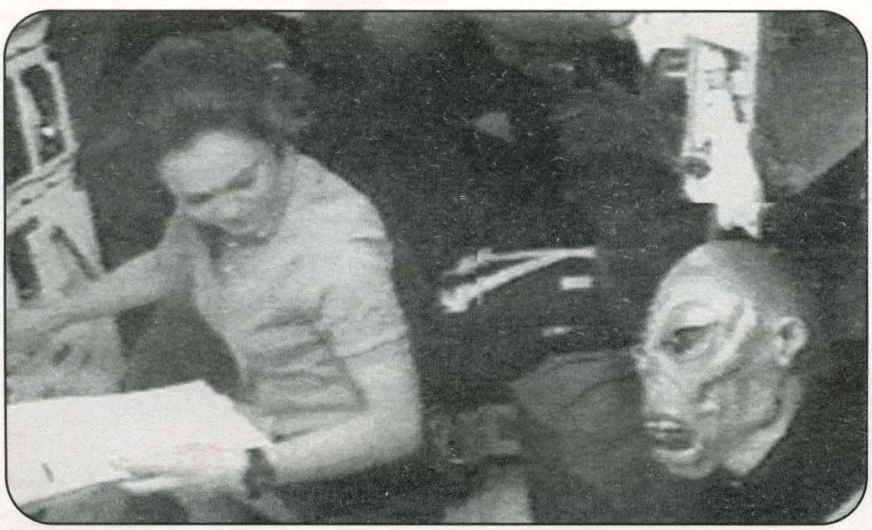


Photo B. "Proof" that space aliens exist! Astronaut Tammy Jernigan is "kidnapped" by an alien as seen on NASA TV...on Halloween. Note that the photo is somewhat fuzzy due to jamming attempts by the aliens (not because the author digitized a freeze-frame off his TV).

ET Phone Home!

Speaking of which, UFOs and space aliens have appeared on NASA TV at least once! As the STS-52 crew was packing up the shuttle to return home, a rather strange video came down from space (Photo B). Astronaut Tammy Jernigan was busy working on the shuttle's flight deck when an "alien" appeared on camera and dragged her off screen! The screen quickly went black...and was replaced by a title screen, "Happy Halloween from the STS-52 crew."

After the flight, Tammy admitted, "I'll just say that there's a crewmember who served as our space alien, but he'll remain nameless." She promptly added, "But his initials are MB [Mike Baker]."

On the STS-73 mission, Astronaut Cady Coleman made a casual comment about a UFO entering the Spacelab module, and suddenly the audio stopped. Conspiracists immediately took this as evidence that some high-level NASA official had pulled the plug. The trouble with that theory was that Cady was in the Spacelab module without any external windows, so she couldn't possibly have seen a UFO outside the crew cabin! What she did see was fellow astronaut Mike Lopez-Alegria, and she was kidding him about floating into the cabin. And the reason the audio stopped? There was no need to comment further, and she went back to work. Mystery solved.

Tuning in NASA TV

There are at least five ways to receive NASA TV in the U.S.: C-Band satellite

Table 1. North American Repeaters Regularly Carrying Shuttle Audio and/or Video

Canada

Prov.	City	Freq. (MHz)	Updated	Call	Notes
BC	Vancouver	442.350	12/07/98	VE7RUK	
ON	Waterloo	146.865	11/20/96	VE3RCK	

United States

State	City	Freq. (MHz)	Updated	Call	Notes
AL	Birmingham	443.750	01/01/97	KB4KCH	
AL	Bessemer	53.150	01/01/97	N4AHN	
AL	Bluff Ridge	145.150	01/01/97	N4AHN	
AL	Ensley	145.190	01/01/97	N4IQT	
AL	Huntsville	147.100	04/25/98	KS4LU	Source/Sponsor N4AZY
CA	Los Angeles	448.500	12/04/96	WA6VLD	Mt. Wilson
CA	Los Angeles	1241.250	11/30/95	K6KMN	Mt. Wilson
CA	Los Gatos	440.050	01/15/97	KB5JR	
CA	Mountainview	154.585	11/18/97		NASA Ames
CA	Pasadena	147.150	01/15/97	W6VIO	
CA	Pasadena	224.080	01/15/97	W6VIO	Occasional
CA	Redondo Beach	145.320	12/05/98	W6TRW	PL 114.8 - TRW Radio Club
CA	Sacramento	147.405	03/31/98	N6ICW	
CA	Sacramento	427.250	01/16/97	W6CX/ATV	Video, Ch. 58, Mt. Diablo
CA	San Diego	146.640	02/14/97	WB6WLV	Mount Otay
CA	San Francisco	443.300	01/16/97	KB5JR	Mt. Loma Prieta
CA	Santa Rosa	145.585	04/18/97	W6SRJ	
CA	Sunnyvale	145.585	01/15/97	K6MF	
CA	Ventura	146.655	01/20/97	N6QOL	
CO	Aspen	449.600	03/18/96	NØNHJ	
CO	Boulder	145.460	11/20/96	WA1JHK	
CO	Colorado Springs	145.160	11/20/96	WA1JHK	
CO	Denver	147.225	11/20/96	WA1JHK	
CO	Denver	224.980	11/20/96	WA1JHK	
CO	Glenwood Springs	447.100	03/18/96	KBØSMW	
CO	Grand Jct	449.300	03/18/96	WA4HND	
CO	Vail	449.900	03/18/96	WØKEA	
CT	Bridgeport	441.500	02/15/97	N1LXV	
CT	Bristol	442.850	02/15/97	K1DFS	
CT	Milford	433.100	02/21/97	K1PXE	Simplex
CT	Monroe	463.100	02/18/97		
FL	Clearwater	442.075	09/03/97	K4LK	
FL	Cocoa	421.750	03/28/96	K4ATV	Video & Audio Ch. 57
FL	Dunedin	145.230	08/06/97	K4LK	
FL	Fort Lauderdale	145.210	05/20/96	KA4ZAY	
FL	Fort Lauderdale	145.750	01/21/97	KE4TP	
FL	Fort Lauderdale	442.650	05/20/96	KA4ZAY	
FL	Holiday	427.250	08/06/97	K4LK	Video & Audio Ch. 58
FL	Jacksonville	144.360	04/21/98	W4YJC	Simplex - PL 179.9
FL	Largo	51.840	01/08/97	K4LK	
FL	Macclenny	144.330	04/21/98	W4YJC	Simplex - PL 173.8
FL	Merritt Island	146.940	11/30/96	K4GCC	Next to Kennedy Space Center
FL	Miami	146.850	08/27/98	AA4EE	
FL	Palm Bay	145.170	01/13/97	KF4APQ	Only during launch/landing
FL	Port Richey	443.950	01/08/97	K4LK	
FL	St. Petersburg	147.285	01/08/97	K4LK	
FL	St. Petersburg	444.700	08/06/97	K4LK	
FL	Sarasota	442.550	01/08/97	K4LK	
FL	Tallahassee	146.910	04/22/98	K4TLH	Tallahassee Amateur Radio Society
FL	West Palm Beach	147.360	10/30/98	WB4FPB/R	Palm Beach Repeater Assn.
IL	Champaign-Urbana	146.880	11/30/93	KA9SZX	

IL	Champaign-Urbana	426.250	11/30/93	KA9SZX	video
IL	Lisle	224.360	11/20/96	AF9M	Link from Schaumburg
IL	Moline	146.550	06/19/96	KB9BNR	Grid EN41
IL	Schaumburg	446.575	04/01/97	K9MOT	Motorola ARC
IL	Schaumburg	910.250	02/26/97	K9MOT	AM video only
IN	Warsaw	446.050	01/20/97	N9NJK	
MD	Greenbelt	3.860	05/19/97	WA3NAN	Only when crew awake
MD	Greenbelt	7.185	05/19/97	WA3NAN	Only when crew awake
MD	Greenbelt	14.295	05/19/97	WA3NAN	Only when crew awake
MD	Greenbelt	21.395	05/19/97	WA3NAN	Only when crew awake
MD	Greenbelt	147.450	05/19/97	WA3NAN	Only when crew awake
MN	Minneapolis/St. Paul	145.150	11/26/96	WBØGDB	
MN	Waseca	147.450	02/12/97	KØQX	
MS	Bay St. Louis	146.700	03/26/96	WB4FUR	
ND	Fargo	446.600	11/20/96	KEØVN	Simplex
NJ	Lincroft	439.250	11/19/96	N2SMT	Video & Audio
NJ	Paterson	146.610	12/03/97	W2FCL	
NM	Artesia	146.820	12/29/96	KU5J	Occasional
NM	Artesia	442.000	12/29/96	KU5J	
NV	Las Vegas	449.500	02/12/97	N7TND	
NV	Las Vegas	1241.000	02/12/97	KB7BY	Video & Audio
NY	Albany	920.800	11/30/95	KD3NC	
NY	Long Island	145.430	12/03/97	N2QPD	
NY	Troy	447.225	11/30/95	KD3NC	
OK	Tulsa	146.805	02/11/97		
OH	Akron	147.330	02/12/97	WB8CXO	
OH	Cleveland	145.670	12/01/95		NASA Lewis ARC
PA	Harrisburg	147.375	10/25/96	WA3KXG	
PA	Pittsburgh	145.620	02/15/97	WA3PBD	
PA	Pittsburgh	421.250	02/22/96	WA3PBD	Video & audio
SC	Charleston	147.345	03/24/97	KD4TXX	Early evening to midnight
SC	Lyman	144.340	05/15/97	KF4DET	
TN	Pigeon Forge	146.450	11/07/98	N4YEK	Simplex PL-67hz
TX	College Station	147.540	01/14/97	W5AC	
TX	Dallas	445.000	01/14/97	WB5EPI	
TX	Houston	146.640	11/22/96	W5RRR	
TX	Houston	171.150	05/29/96		NASA/JSC
TX	Temple	145.310	07/16/97	N5ZXJ	
TX	Waco	910.250	03/18/96	W5TAH	Video and audio
UT	Brigham City	145.290	05/17/96	KE7FO	Thiokol ARC
UT	Ogden	449.775	05/17/96	N7TOP	
UT	Orem	448.025	01/13/97	N7HMF	
UT	Payson	147.400	01/13/97	NV7V	
VA	Chesapeake	144.340	10/13/98	KO4FR/WA1TSS	
VA	Chesapeake	427.250	10/13/98	KO4FR/WA1TSS	Video
VA	Chesapeake	431.750	10/13/98	KO4FR/WA1TSS	

Table 1. The amateur radio operators listed above have indicated that they retransmit NASA TV audio on a regular basis. Special thanks to Bill Bard, WD4IXI, for permission to reprint it. Contact Bill at WD4IXI@amsat.org with any changes or corrections. This list is also available online at <http://www.amsat.org/amsat/sarex/shutfreq.html>.

dish, Dish Network, cable, Internet, and amateur retransmissions. NASA news chief Brian Welch stated "All of the material that airs on NASA TV belongs to the taxpayer. So all of the material is in the public domain and we're happy for folks in the country, and even around the world, to receive it however they can. We don't run a television station, it's primarily a source for the news media for information. It's more of a resource to provide information to the news media so they can cover the space program."

The best way to receive NASA TV is on a C-Band satellite dish. For most of the U.S. a five- to eight-foot dish is adequate. The GE-2 satellite has a solid signal over the contiguous U.S. and Hawaii (an EIRP, or effective radiated power, of about 37 dbW over the contiguous U.S., with a 31-dbW spot beam aimed toward Hawaii; see Figure). All other things being equal, the quality of the signal is proportional to the size of your dish. If you're willing to accept a mediocre signal with a bunch of snow, then a dish as small as three or four feet may be acceptable, but it will be a pretty rotten signal.

Plus, with a relatively small satellite dish, you may encounter some "spill over" from adjacent satellites, especially if you live west of the Mississippi. Still, a mediocre signal is better than no signal

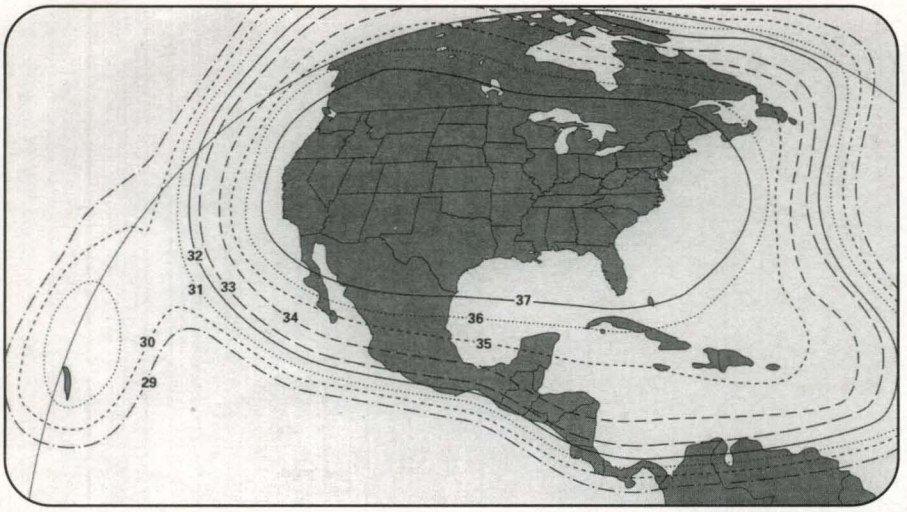


Figure. The "footprint," or coverage area, of the GE-2 satellite, which carries NASA TV signals. Numbers indicate signal strength in dBw (decibel watts) and show a strong 37-dBw signal over the contiguous 48 states, plus a 31-dBw "spot beam" over Hawaii.

at all if you live in a location where a larger dish isn't practical (or permitted).

Many hams have put together a C-Band system out of spare and used parts for less than $100. A more sophisticated and better-quality setup can range anywhere from $500 to $1,500, depending on your technical abilities and scrounging skills.

GE-2's footprint covers North America. On some shuttle flights with strong international participation (for example, one carrying a European crewmember), a commercial broadcaster or the other country's space agency may choose to retransmit NASA TV on an international satellite, providing coverage outside North America.

The only small satellite dish service (Primestar, DSS, Dish Network) which includes NASA TV is the Dish Network (Echostar), which carries NASA TV on channel 213 on Echostar 3, along with other niche programming, international shows, network broadcasts from local stations around the country, and high-speed data transmissions. Echostar 3 is visible from most locations east of the Rocky Mountains. It's an extremely powerful satellite, so only a 12-inch dish is required. If you have an existing single-dish Dish Network setup, the second dish can be added for a nominal charge.

Some cable companies and wireless cable firms carry NASA TV at least on a part-time basis. Cable and DBS (direct broadcast satellite) companies pay broadcasting companies on the basis of the number of subscribers, typically a couple of cents to a couple of dollars per month per subscriber. Since NASA TV is created by the government for public distribution, the cost to the cable company is as low as it can be: zero cents per customer. As a bonus in areas where cable is regulated, NASA TV counts towards the cable company's required "educational content." How often NASA TV is on depends on the company's policies, and whether or not somebody in charge is a space fan.

Ham Retransmissions

Amateur radio operators have retransmitted NASA TV during shuttle missions since 1983. Over 100 amateur radio repeaters regularly retransmit NASA audio, and many amateur television groups retransmit the NASA TV video signal. The list of frequencies on which NASA TV may be heard and/or seen in different parts of the country may be found in Table 1.

John Anderson K4GCC, a ham who lives near the Kennedy Space Center, was the first to retransmit NASA TV, starting with the STS-7 mission in June, 1983. The Goddard Amateur Radio Club, WA3NAN, started its transmissions on the Goddard VHF repeater a couple of months later, on August 31, 1983, seven hours before the launch of STS-8. Goddard's shortwave retransmissions started with the STS-9 mission. (Table 2 lists the frequencies and antennas at the Goddard retransmission site.)

The Johnson Space Center Amateur Radio Club, W5RRR, started its VHF NASA audio retransmissions in October 1983, shortly before the STS-9 mission, which featured the first use of ham radio aboard a spacecraft, by Astronaut Owen Garriott, W5LFL. Several other hams were granted FCC waivers for permission to retransmit NASA audio. In 1990, the ARRL sought permission to retransmit shuttle communications. NASA agreed, and the FCC amended its rules to permit the retransmissions of the air-to-ground audio. See "Yes, It's Legal," for the entire text of section 97.113 (5) (e) of the FCC's rules.

While the FCC rule says you must get permission from NASA before retransmitting shuttle communications, NASA has given blanket permission for any amateur radio operator to retransmit NASA TV. So there's no requirement for any individual to request permission from NASA. It's also important to note that the FCC waiver specifically permits music originating from NASA to be

Table 2. NASA TV Audio Retransmissions by the Goddard Amateur Radio Club

Frequency (MHz)	Mode	Antennas
3.860	LSB	N-S/E-W Dipoles
7.185	LSB	N-S/E-W Dipoles
14.295	USB	3-element Yagi
21.395	USB	5-element Yagi
28.650	USB	4-element Yagi
147.450	FM Simplex	Phased vertical (Washington, DC, local area)

Table 2. Retransmission of shuttle air-to-ground audio from WA3NAN may be heard on the frequencies and modes listed above. A shortwave receiver with a Beat Frequency Oscillator (BFO) is needed to receive either LSB (Lower Sideband) or USB (Upper Sideband) transmissions.

retransmitted via amateur radio, but that the waiver applies *only* to *shuttle* retransmissions. There is *no* waiver in place for other NASA TV activities, such as spacecraft landings on other planets, news conferences, or other non-shuttle activities.

Where can you hear these ham-band retransmissions? Just about anywhere, either on VHF or HF...and sometimes even in space! A couple of years back, Dr. Shannon Lucid was finishing her stay on the Mir space station, along with her Russian crewmates Valeri Korzun and Sasha Kaleri. She said "I saw STS-79 after it had launched and it was like a great big white star. And while I was watching it at one window, Sasha came and said "quick-quick come." He wanted me to listen to it on the ham radio, which was in another module, so I flew in there and listened [to the K4GCC repeater in Florida]."

Finally, you can "watch" NASA TV on the Internet. At minimum, you should have a 28.8k modem and a 100-MHz processor. Two sources for streaming video are <http://shuttle.nasa.gov/realdata/index.html> and <http://www.broadcast.com/events/nasa/>.

The Future of NASA TV

Each year when NASA's budget comes up for review in Congress, someone always questions whether NASA TV is worth the cost. It's an extremely expensive operation, with several television studios in remote locations, high production values, and two dedicated satellite transponders. So far, NASA TV has survived the budget ax, but its future is always in question. There have been experiments with highly compressed fiber-optic video distribution, and anything which could save money will certainly be considered. If you want to show your support for NASA TV, the best thing to do is send a letter to your member of Congress, explaining how useful it is to you.

NASA Select has evolved over time into NASA TV, and will certainly continue to evolve as NASA changes to adapt to the new century. When it was started, nobody thought it would have such a wide-reaching audience, or that it would it would affect how the general public could find out about NASA's activities.

Next month (July), we'll take a look at the Shuttle Amateur Radio Experiment (SAREX) and how you can talk to the astronauts via ham radio. ■

Resources

The Goddard Amateur Radio Club WA3NAN may be contacted by several methods. Mail: Goddard ARC/WA3NAN, P.O. Box 86, Greenbelt, MD 20768-0086; Phone (during missions): (301) 286-6673; Internet: telnet to <wa3nan.gsfc.nasa.gov> (128.183.105.17); Modem: (301) 286-4137 (up to 14.4 kbaud supported); Packet Radio: WA3NAN on 145.090 MHz in DC area; World Wide Web: <http://garc.gsfc.nasa.gov/www/garc-home-page.html>.

NASA TV schedules are available on the World Wide Web at <http://www.nasa.gov/ntv/>. The shuttle TV schedule is located at <http://shuttle.nasa.gov/realdata/nasatv/schedule.html>. It is important to note that times in schedules are estimates and events may not always begin as scheduled.

An outline of each day's NASA "video file" telecast may be found on the Internet at <ftp://ftp.hq.nasa.gov/pub/pao/tv-advisory/nasa-tv.txt>.

KB6KQ Full-Wave Loop Antenna

This double-sized 2-meter loop antenna is handy not only for mobile use but also for stealth SSB operation from an attic, if space is tight or outdoor antennas aren't allowed where you live.

By Gordon West, WB6NOA*
(wb6noa@cq-vhf.com)

The popularity of 2-meter single sideband (SSB) has grown dramatically over the last couple of years. Some operators have gone to 2-meter SSB because working 2-meter repeaters was no longer a challenge. Others enjoy the ability on single sideband to reach out hundreds of miles for some exciting DX contacts. Why does 2-meter SSB go so much farther than simplex FM?

The Sideband Advantage

"For one reason, the majority of 2-meter SSB operators operate big horizontal beams to pull out relatively weak signals from the noise," comments antenna designer Norm Pedersen, KB6KQ. "Another reason 2-meter SSB propagates farther than FM is the single-sideband mode itself—one-third the bandwidth of FM for a much lower noise floor, no phase distortion that you get with weak FM signals, much hotter SSB 2-meter receivers using GaAsFET technology, and distant radio operators who monitor 144.200 MHz with their squelch off and headphones on!" adds Pedersen. (*GaAsFET is short for Gallium Arsenide Field Effect Transistor, and 144.200 MHz is the 2-meter SSB calling frequency.—ed.*)

In addition, the availability of small multimode transceivers that cover both 2-meter and 432-MHz SSB, such as the new Yaesu FT-100 and ICOM's new IC-706MkII-G, allow the enthusiasm for weak-signal work on VHF and UHF to go sky high!

Antenna Matters

Two-meter SSB signals are almost all horizontally polarized. This minimizes manmade noise. But horizontal polarization requires a rather special type of mobile antenna—a vertical "whip" won't cut it—and the KB6KQ mini-loops, along with the M^2 HO loops (see review, May, 1999 *CQ VHF*), W6OAL's Olde Antenna Lab loops, and Par's triangular "loop," have provided mobile operators with good results in the horizontal plane.

In fact, these loops have become so popular that many apartment and condo dwellers are considering them for horizontal operation in their attics where an outside beam would not be permitted.

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

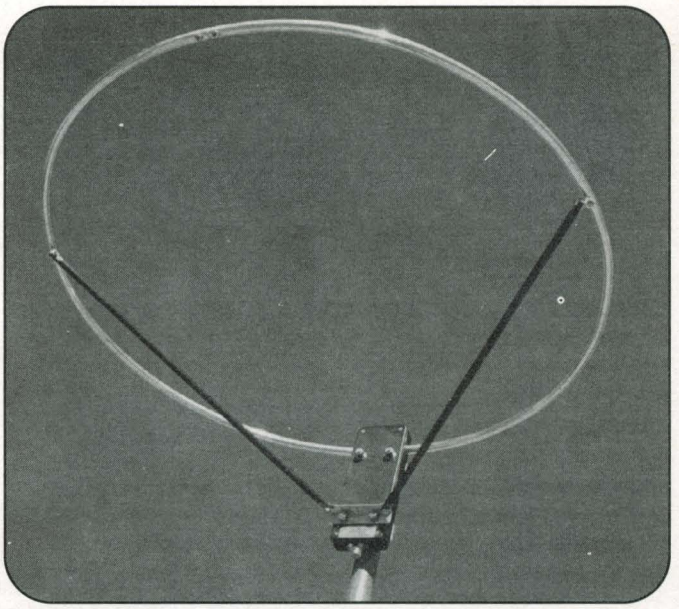


Photo A. KB6KQ's new full-wavelength loop for 2 meters is an ideal horizontally polarized antenna for attic-mounting by apartment and condo-dwellers who want to operate single sideband (SSB), but cannot put up outdoor antennas. They may also be used for mobile operating, although they are kind of big.

"I'm not allowed to put any antennas on the roof, so I run my 2-meter SSB on a horizontal loop in the attic," comments Bill Alber, WA6CAX, an active weak signal operator in the San Francisco Bay Area. "I'd like to stack a pair of loops for additional gain, but I don't have enough room below the roof line," adds Alber.

Enter the Full-Wave Loop

So Norm, KB6KQ, best known for his single and stackable half-wave mini-loops, has developed a new full-wave loop that's perfect for stealth operation in an attic or below the roof peak (see Photo A). Of course, it's also installable in a vehicle, even though it's a little large at 28 inches in diameter (versus 12 inches for the half-wave version).

"My new full-wavelength, mobile/base 2-meter loop can now handle 750 watts of power, and it has absolutely no detuning

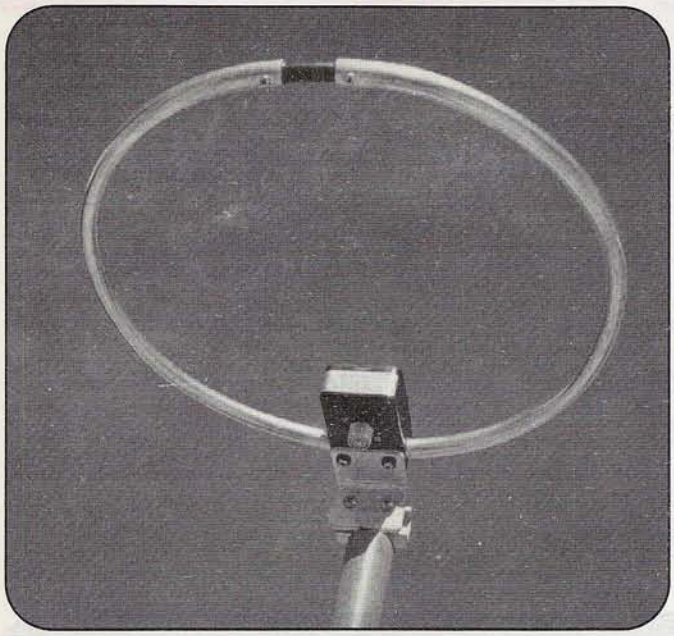


Photo B. The redesigned KB6KQ half-wave loop for 2 meters no longer has the inner loop formerly used as a matching network. All matching is now done in the balun contained in the box that holds the feedline connector.

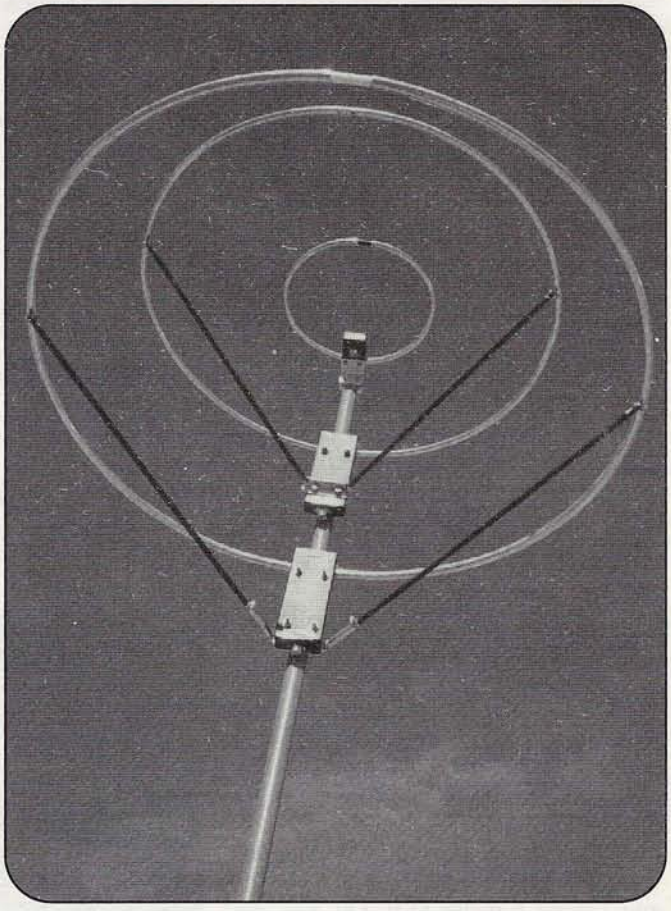


Photo C. A whole new look for KB6KQ's loop antennas, all of which have been redesigned with the "balun-in-a-box" replacing the inner matching loop. In this photo, from the top, are the redesigned 2-meter half-wave loop, the new 2-meter full-wave loop, and the redesigned 6 meter half-wave loop.

problems in wet weather," comments Pedersen, adding, "the bandwidth is wide enough to now cover both 2-meter SSB weak-signal work, as well as 2-meter SSB satellite work almost 2 MHz up the band."

Norm and his wife, Karen, assemble the loops themselves in their home workshop, and I have personally inspected the facility. While it is truly a "garage operation," Norm and Karen really do turn out some fine weak-signal loops that cover from 10 meters through 432 MHz with special order projects always welcome.

"For 2-meter SSB enthusiasts who are not allowed to put up an outside antenna, the new bigger loop performs extremely well in an attic, pulling in distant signals from all directions without any deep nulls."

The new KB6KQ full-wave 2-meter loop has all its coaxial balun matching at the feedpoint, with no capacitor at the end (see Photo B). In fact, Norm has redesigned his present half-wavelength mini-loops to incorporate this new feedpoint design (Photo C). He's also planning to produce full-wave loops for other bands, as well.

Field Test

When I compared this dramatically larger single loop to a stacked pair of Norm's mini-loops, the performance was about equal. This is good news for those who need to reduce wind resistance in a mobile installation, yet still obtain good horizontal omnidirectional performance. I also found that the big full-wave loop was not nearly as sensitive to placement near the built-in air conditioner unit on my van's roof as were the earlier versions of KB6KQ mini-loops.

For 2-meter SSB enthusiasts who are not allowed to put up an outside antenna, the new bigger loop performs extremely well in an attic, pulling in distant signals from all directions without any deep nulls. I asked whether or not a pair of the big full-wavelength loops could be stacked, and Norm said, "Yes, but let me make up the special stacked pair here so they will be perfectly matched for a base station installation."

I suppose you could stack a pair of these full-wave loops for mobile operation, but, quite frankly, the results I achieved with just the single loop were adequate to give me 200- and 300-mile contacts to distant stations using beam antennas pointed in my direction. My advice: Start off, mobile, or in the attic, with a single full-wave loop and enjoy! ■

Resources

KB6KQ full-wave 2-meter loop antennas are sold assembled and pre-tested, for $75 plus $15 shipping. To order, or for more information, contact: KB6KQ Antennas, c/o Norm Pedersen, 70 Arrowhead Dr., Carson City, NV 89706; Phone (note new area code): (775) 885-7885; Fax: (775) 841-1880; E-mail: KB6KQNORM@aol.com; Web (new): <http://www.kb6kq.com>.

A Field-Day GriDXpedition

One of the great things about VHF is that you often don't have to travel very far or spend tons of money to mount a DXpedition that will have people clamoring to contact you. KD4GHQ found that out by operating Field Day from a rare grid square.

By Bill Hays, KD4GHQ*
(billhays@aol.com)

The thunderous roar of callsigns coming through my headphones gave little doubt there was a pile-up going on...and *I* was the object of their desire! Was this a dream or had I finally saved enough funds to make it to that rare jungle paradise or frozen tundra so sought after by DX-hunters?

Actually, I'm only about 20 miles from my back door, it's Field Day '98, and I'm on 6-meter SSB. Oh, yes, my location is a grid square known as Fox-Mike 13 (FM13).

Turning Back the Clock

Let's turn back the Coordinated Universal Clock to early spring of 1997. The big clubs here in Wilmington, North Carolina, already had their prime locations staked out for Field Day. I could have gotten on their work rosters, but the rebel in me wanted to work Field Day as Class 2-B (two operators, non-club portable).

I wanted a public place to show off amateur radio (what ham doesn't enjoy showing off? Besides, it gives you bonus points on Field Day), so I started checking and dismissing places for things like too much RF noise, not enough public access, etc. I knew I had to get away from as many power lines as possible, so my task kept taking me farther south toward Carolina Beach. At the southern end of Carolina Beach, I stopped by the North Carolina Aquarium at Ft. Fisher, and I pitched my idea of setting up a station in the corner of their parking lot. The aquarium director, James Lanier, was very receptive, so Field Day '97 was on.

Photo A. Braving the sand flies and the salt marsh mosquitoes, author Bill Hays, KD4GHQ (left), and Steve Wilder, KE4LKC, operated Field Day 1998 from the nearly all-water grid of FM13, one of the rarest in North America. (Photos courtesy of the author)

One of our local 6-meter enthusiasts, Rick Tharrington, KD4JRX, was excited when he learned where I'd be setting up. He started talking about grid-squares and how a lot of VHFers collect them. I hadn't even thought of setting up a 6-meter station, even though my ICOM 706 had 6-meter capability. I had only used it mobile on 2 meters and HF. He was sure my location was close to a "rare" grid...FM13. A phone call to the aquarium prompted one of their staff to check my site location with a GPS unit. When I received the coordinates, I plugged them into a grid program which confirmed my site was indeed in FM13.

What makes FM13 so rare? It's mostly water. The bit of land on which I was set up was just about the only point in FM13 from which you could operate without being on a boat. That meant hams who needed FM13 toward their VUCC Award would be very interested in working me! (The VUCC Award is given by the ARRL's VHF/UHF Century Club for confirmed contacts on VHF and UHF

**Bill Hays, KD4GHQ, has a General class license and is a second-generation ham. He's been active since 1991 and can usually be found on a local VHF repeater or on HF RTTY. Bill lives and works in Wilmington, North Carolina, where he makes fiber-optics at Corning, Inc.*

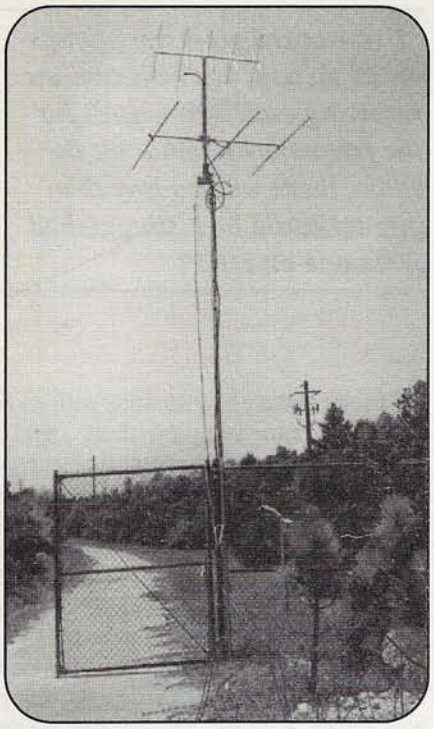


Photo B. The VHF antenna system at KD4GHQ/4, a three-element beam on 6 meters and a five-element quad on two. The power lines in the background were so noisy that they blocked out any signals coming in from the west.

with a certain number of grid squares on each band. On 6 meters, you need to confirm 100 2-degree by 1-degree grids).

At Rick's prompting, I added 6 meters to my station plans, but Murphy's Law had other ideas for 1997's Field Day operations. A low-pressure system parked itself just off the coast that weekend and pumped in stormy weather that forced numerous station shutdowns. Contacts were very limited. Fortunately, when I approached Mr. Lanier about setting up another station for Field Day in 1998, he again agreed.

Fast-Forward to 1998

For Field Day '98, I again concentrated my efforts on VHF while my partner, Steve Wilder, KE4LKC, was to work the HF unit (see Photo A). When we set up our station at the aquarium, Murphy's Law came at us again. No rain this time, but the temperature under a merciless sun was approaching 100 degrees, with a heat index of 115.

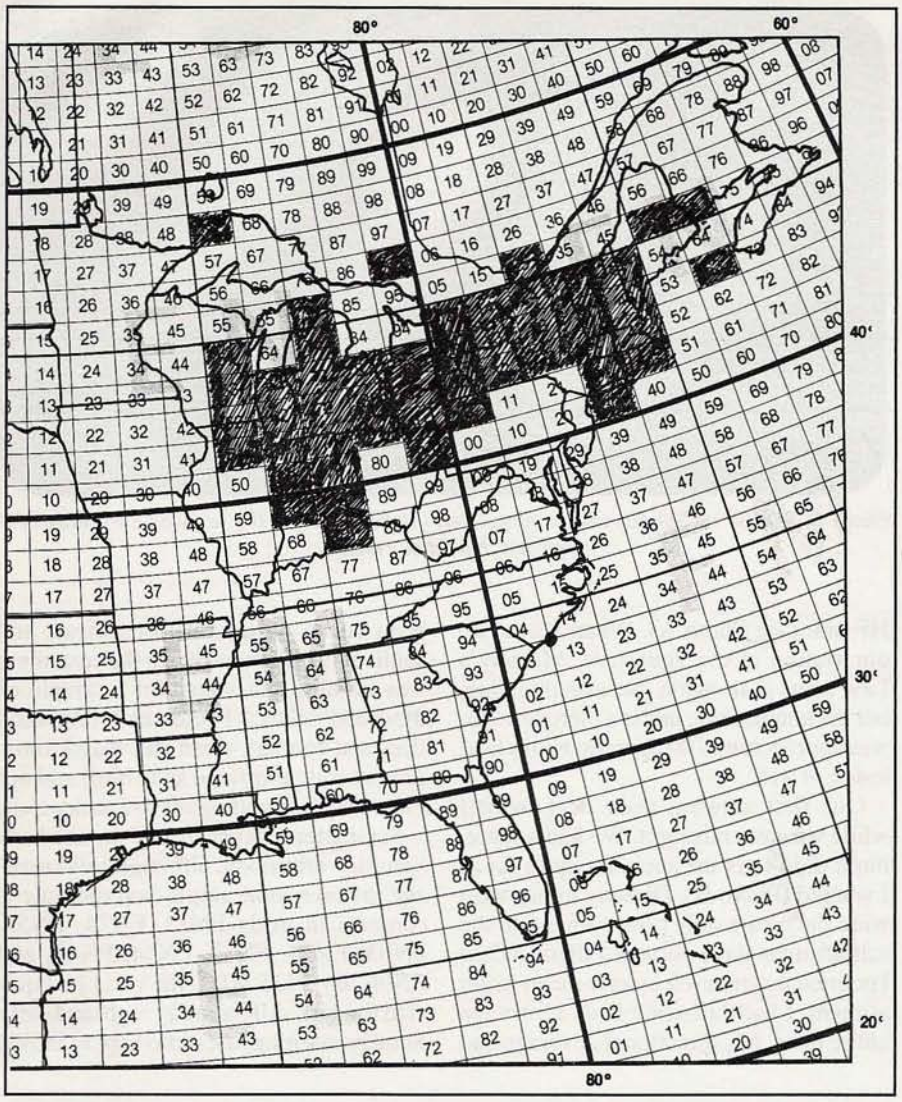
"I closed my call with, 'This is KD4GHQ in grid Fox-Mike 13, QRZ?' and the 'Magic Band' burst wide open! Dozens of calls came back all at one time, and each time I worked one, more kept piling up."

Photo C. Sunrise on Sunday was beautiful, but the haze around the sun was a warning of a very hot, humid day ahead.

Our first antenna mast bent in half while we were raising it. We had a spare, but it didn't get the antennas up as far as I wanted (Photo B). Directly to our west were the area's only power lines and the salt air must have corroded them. When I pointed the three-element 6-meter beam at them, I had full-scale hash across the entire band. My directional coverage had been cut to northwest-to-northeast and south only! (Remember, to the east, there was nothing but water for a couple of thousand miles.) Factor in biting sand flies and football-sized salt-marsh mosquitoes (our unofficial state bird) and our Field Day was getting off to a rocky start.

Six-meters never really opened on Saturday afternoon, although I did manage to make some single-hop sporadic-*E* contacts in grids FN33, FN24, FN55, FN03, FN34, FN32, FN44, FN42, and EN96. By 2235 UTC, the band had quieted to a hiss. All Saturday night and early Sunday morning, the radio kept scanning

Photo D. Even with a heat index of 115 degrees, Bill managed to stay focused on his radio when 6 meters opened up Sunday morning, letting him put more than 70 grids in his logbook.



This Cushcraft grid square map tells it all. From the little dot at the northwest corner of FM13, Bill worked stations from Illinois to Maine...and who knows what the map would look like if the power line noise didn't block out everything to his west.

but only background noise came out of the speaker.

Abra-Cadabra! The Magic Band Comes to Life

Dawn Sunday came on hot, hazy, and humid (Photo C). Finally, a few stations started coming through, so I put on my headset and worked my first Sunday contact at 1241 UTC. I closed my call with, "This is KD4GHQ in grid Fox-Mike 13, QRZ?" and the "Magic Band" burst wide open! Dozens of calls came back all at one time, and each time I worked one, more kept piling up.

Steve saw my eyes bugging out and when I unplugged the headset so he could hear, he couldn't believe the pandemonium. I've worked plenty of pileups on 20 meters, but *never* on the receiving end! If it wasn't for the frequency readout on the radio, there was no way this pile-up could be distinguished from one on HF!

One thing I noticed was that everyone on the air was extremely polite (a fading trait on HF). Whenever I pulled a callsign out of the melee and requested that station only to respond, the airwaves were silent except for that call. Of course, when I said QRZ?...WOW!

Making Time for "Real" Contacts

There were a few stations that were only interested in a contact point and then moved on, but most took time to give me their grid and thanked me for getting FM13 into their logs.

"I've worked plenty of pileups on 20 meters, but* never *on the receiving end! If it wasn't for the frequency readout on the radio, there was no way this pile-up could be distinguished from one on HF!"

I tried to take a few seconds with each station, commenting on their signal, exchanging weather conditions, etc. (Photo D). Yes, I know this was a contest, but just getting a fake 5/9 report and a "thank-you-now-go-away" is not what I feel amateur radio is about. I guess I'll never make it in the "big league" contest scoring, but I bet I'll have more fun!

After every 15 to 20 contacts, I stopped for a few minutes, made sure everything was square with the log, guzzled down some Gatorade (remember the 115-degree heat index?), and got back on the air. One call from me and everyone was back going at it again. I really appreciated everyone's patience during those short breaks. After nearly two hours, the band closed up with only a few sporadic contacts to be made until Field Day ended.

How did things rack up for me on 6-meters? Well, here's the score: 94 total contacts (six short of my original minimum goal), 49 grids confirmed, and, as of this writing, 20-plus unconfirmed. Hopefully the stations that didn't give me their grid number over the air will put them on their QSL cards.

Grids confirmed: FN: 01, 02, 03, 04, 12, 13, 14, 22, 23, 24, 25, 30, 31, 32, 33, 34, 41, 42, 43, 44, 55, 63, 65 EM: 69, 78, 79 EN: 51, 52, 53, 54, 58, 60, 61, 62, 63, 70, 71, 72, 73, 74, 75, 81, 82, 83, 90, 91, 92, 93, 96 (see map).

Looking to '99

Things I'll do differently for Field Day '99: get my 6-meter beam up higher; check the area power lines for noise about a month ahead of time and notify the power company to fix them if necessary; have a better logging system and better advertising. Part of my advertising goal is being accomplished right here, so mark your calendars for FD '99 and be listening for me on 6 meters USB from the North Carolina Aquarium at Ft. Fisher in grid Fox-Mike 13! ■

Annual VHF Contest Calendar

The past year has seen many changes on the VHF contesting calendar. Our updated annual calendar of major North American VHF contests will help you plan.

There's a major VHF or UHF contest nearly every month in North America. The following calendar is taken from the *CQ VHF* World Wide Web page at <http://www.cq-vhf.com>. It includes the major North American events plus several European contests in which North American stations regularly operate (see below for further information on European VHF contests). Additions or corrections are welcome.

European VHF Contests

Non-FM VHF operating is much more popular in Europe than it is in North America, and, not surprisingly, there are many more VHF contests in Europe than in North America—in fact, there are nearly 200 separate events on this year's calendar! Rather than try to list them here, we'll refer you (at the end) to a comprehensive listing on the World Wide Web.

"Non-FM VHF operating is much more popular in Europe than it is in North America, and, not surprisingly, there are many more VHF contests in Europe than in North America—in fact, there are nearly 200 separate events on this year's calendar!"

But to keep you from getting overwhelmed as you scan the long list of contests, we'll pass along some advice here from contester Catharinus van Tuijl, PE1AHX/N4QXT, in the Netherlands, who tells us there are five *really* big contest weekends on which many countries hold simultaneous competitions (see "Viva Contesting!").

Month	Date	Contest
Jan	3rd full wknd	ARRL VHF Sweepstakes
Mar	1st full wknd	DUBUS EME 144, 1296 MHz (European)
Mar	3rd full wknd	*CQ VHF* Spring Activity Weekend (FM)
Mar	Last full wknd	DUBUS EME 432, 2304+ MHz (European)
Apr	2nd Mon	144-MHz Spring Sprint
Apr	3rd Tues	222-MHz Spring Sprint
Apr	3rd full wknd	*CQ VHF* National Foxhunting Weekend
Apr	4th Wed	432-MHz Spring Sprint
Apr	4th full wknd	*CQ VHF* Spring Activity Weekend (SSB/CW)
Apr	4th wknd	Six Club Spring Sprint
May	1st Sat	902/1296/2304-MHz Spring Sprint
May	3rd wknd	50-MHz Spring Sprint
May	4th full wknd	*CQ VHF* Spring Activity Wknd (Spec. Modes)
May	4th wknd	Six Club Weekend Contest
June	2nd full wknd	ARRL June VHF QSO Party
June	3rd full wknd	SMIRK 6-meter QSO Party
Jul	2nd full wknd	CQ World Wide VHF Contest
Jul	2nd full wknd	Internet 6-meter Contest
Jul	3rd wknd	Six Club Summer Sprint
Aug	1st full wknd	ARRL UHF Contest
Aug	3rd full wknd	ARRL 10-GHz Cumulative Contest (1st wknd)
Sept	2nd full wknd	ARRL Sept. VHF QSO Party
Sept	3rd full wknd	ARRL 10-GHz Cumulative Contest (2nd wknd)
Oct	Last full wknd*	ARRL International EME Contest (1st wknd)
Nov	Last full wknd*	ARRL International EME Contest (2nd wknd)
Dec	3rd week	BCC Meteor Scatter Contest (European)

* = Specific dates of the EME contests vary to allow for scheduling based on best EME conditions. Check the monthly contest calendars in *QST* and *CQ VHF* magazines for specific dates each year.

The Whole Thing

For a comprehensive list of VHF/UHF contests in Europe, get on the World Wide Web and point your browser to DK3XT's "Make More Miles on VHF" Web site at <http://fs1.ilk.de/sites/gap/contest.htm>. We also have a link to this page from the North American VHF contest calendar on the *CQ VHF* Web site. *CQ VHF* would like to thank PE1AHX for providing us with the above information, as well as the link to DK3XT's calendar page, compiled by DL2FZN.

Viva Contesting!—Competition European Style

There are at least 100 contests a year over here. However, the main ones are the VHF/UHF/SHF contests on the first full weekends of March, May, July, September, and October. These are all 12-hour contests, running from 1400 UTC Saturday until 1400 UTC Sunday, and include all bands from 2 meters up (except the IARU Region 1 144-MHz contest in September and the 432-MHz contest in October). There is very little 6-meter contest activity, which I'll explain below. *(IARU is the International Amateur Radio Union, and Region 1 comprises Europe and Africa. North and South America are in Region 2, and Asia/Oceania are in Region 3.—ed.)*

"The March, May, and July contests tend to be national contests, with each country running a separate event. However, most countries schedule these contests on the same weekends, so the bands are very active...."—PE1AHX

National Contests

The March, May, and July contests tend to be national contests, with each country running a separate event. However, most countries schedule these contests on the same weekends, so the bands are very active (Britain is a notable exception, often scheduling its contests on a different weekend).

Some very popular international contests are the Alpe-Adria contest in southern Europe, the European-wide Marconi CW Contest, and the Nordic Activity contests, held every Tuesday night, with a different band each week (i.e., 144 MHz on the first Tuesday of every month). The CQ World Wide VHF Contest is popular here as well, as shown in the consistent good results of participants from Region 1. In addition, there are long-term competitions, such as one for whomever has the most contacts over 500 kilometers in a calendar year (sponsored by VHF-Gruppe West/DL8EBW, in Germany).

The Situation on Six

Six-meter contests are still very rare in Europe, mostly due to the fact that 50 MHz is still a relatively new ham band in many countries. *(Until recently, there was a European TV channel covering 50–54 MHz.—ed.)* And some countries still limit power output and prohibit contesting on 50 MHz. Here in the Netherlands, for example, until recently, we were limited to 25 watts output on 6 meters.

Of course, 6 meters is so far the only band on which there'd be any possibility of making contacts between U.S. stations and Europeans, since the ocean has yet to be crossed on 144 MHz or higher and all of these contests prohibit EME (moonbounce) and MS (meteor scatter) contacts for contest credit.

—Catharinus van Tuijl, PE1AHX/N4QXT

Line of Sight *(from page 5)*

garten, equate technology with computers and have no interest in an outmoded analog technology like radio. But that is *a problem, a* major *problem, since, as we noted just a moment ago, radio transmitters, receivers, and networks don't design themselves, build themselves, or fix themselves. And the nation's telecommunications companies are getting desperate to find qualified RF engineers and technicians to replace people who are retiring. Many are calling people back out of retirement.*

Meeting a National Need

How can the nation meet this fast-growing need for RF engineers and technicians? In the short run, it's going to be a problem. In the long run, if children are exposed to radio in elementary, middle, and high school—and are given opportunities for hands-on experience—just as they are with computers, then perhaps more of them will grow up interested in pursuing careers in radio-related fields.

What's the best way to provide children with an introduction to radio communications? And opportunities for hands-on learning? There's really only one answer, really only one radio service that encourages tinkering, and in which the FCC allows you to build, modify, and repair your own equipment. It's amateur radio, and it's as close as your local radio club. For the cost of a reasonable computer workstation, a school can set up a very reasonable ham station, and put kids on the air...talking to other people all over the globe, learning about electricity and electronics, learning earth science (by learning the many ways that radio waves travel beyond the visible horizon), physics, math, geography, and the list goes on and on. Plus, involvement with a local radio club provides the school with greater community participation.

How Do We Pay For It?

Funding sources may be as close as the individual school districts with which you work. Many school districts today have pretty hefty technology budgets, so the money may already be there. In addition, many hi-tech communications companies have technology grant programs. These grants may be available to your program or to individual districts participating in it. Show this editorial to one of your grant-writers, and ask Neil or another ham in your community to explain ham radio's educational value (in non-technical terms), and see what you can dig up out there. Grant money is widely available, if you know how to find it and ask for it.

In Closing...

A final note to Neil's boss: If this hasn't persuaded you that ham radio has a vital place in your program, please call me or send me an e-mail at w2vu@cq-vhf.com, and let's talk more about it. I'm looking down the information superhighway, and I see radio antennas at every milepost.

Sincerely,

Rich Moseson, W2VU
Editor, CQ VHF

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 Rd., Hicksville, NY 11801 (send an SASE for writers' guidelines), by e-mail to <cq-vhf@cq-vhf.com>, or via our World Wide Web page, <http://www.cq-vhf.com>. We look forward to hearing from you.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—June, 1999

We'd like to know more about you...about who you are and where you live, about the kind(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 different 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).

And, as a bit of 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 with questions about your reactions to* CQ VHF *and its contents:*

1. Please indicate which segments of *CQ VHF* you generally read in each issue (circle all that apply):	**Circle Reader Service #**
Feature articles	1
Monthly columns	2
Basics section	3
News/Opinion/Letters	4
Product news	5
Advertisements	6

2. *CQ VHF* covers a wide range of topics and activities. Please indicate whether your regularly read...	
Only articles about my area(s) of interest	7
Articles about topics or activities that are new to me	8
A mix of both types of articles	9

3. If you purchased this copy of *CQ VHF* "off the shelf" at a newsstand, bookstore, ham dealer, or hamfest, please indicate the factor that *most* influenced your buying decision:	
Enjoyed previous issue(s)	10
The title (*CQ VHF*)	11
The topic (Ham Radio Above 50 MHz)	12
Cover info about the articles	13
A specific article	14
A combination of the above	15
None of the above	16
Don't know	17

4. If you are a *CQ VHF* subscriber, please indicate how likely you are to renew your subscription when it expires:	
Will definitely renew	18
Will probably renew	19
Undecided	20
Probably won't renew	21
Definitely won't renew	22

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

What You Told Us

Our March survey asked more about your employment, activity, license upgrading, and organization memberships. Just over half of you (52%) are employed full-time, a drop of 8% from 1998, and one-third of you are retired (up 4% from '98). Another 5% work part-time, 4% are disabled and not working, 2% are full-time students (less than 1% are part-time students), 2% are unemployed, and 1% are full-time parents/homemakers.

Upgrading stats remain steady for the third straight year, with 20% of those able to upgrade years doing so (not counting the 12% who have been Extras for more than two years, the 8% licensed less than two years, and the 1% who are not yet licensed).

Your participation is up in most modes and activities. ATV is up to 12% (vs. 9% in '98); contesting is steady at 36%; FM simplex is up two to 82%; hidden-transmitter hunting is down three at 18%, as is packet at 33%. Repeaters keep the top spot at 84% (up 3%); satellites are up 6% to 26%, after a drop last year; SSB/CW activity is up slightly to 45% (an 18% overall increase since 1996); "other" holds steady at 10%; and 2% say "none of the above" (half of last year's figure).

You're also active in ham organizations, led by local radio clubs (68%) and the ARRL (61%), followed by ARES (29%), Skywarn (28%), RACES (20%), weak-signal clubs (10%), AMSAT (16%), packet clubs (6%), NTS (5%), MARS (4%), and CAP (2%).

This month's winner of a free one-year subscription is J.E. Griger of Monessen, PA. As always, thank you for your responses.

Portable Power—Part 1

One drawback to battery-powered radios is that, sooner or later, the batteries run down. In this series, we'll look at several options for staying on the air longer, with more power, than by using your radio's stock battery pack.

By Brent Walton, KF6FGB*
(kf6fgb@pacbell.net)

This is Part 1 of a three-part series on communications battery power supplies. In this part, I'll discuss portable power for your handheld transceiver. In Part 2, I'll discuss portable power for your mobile rig or HT with an amplifier. Finally, in Part 3, I'll discuss power for your home—a 12-volt DC and 110-volt AC solution. You'll gain ideas about how you can power your rig whether on the trail, on the road, or at home.

—KF6FGB

Photo A. The author's HT shown with stock NiCd batteries. Getting an extra battery pack will extend your "talk time," but won't give you higher output power. (Photos by the author)

I'm an avid bicyclist and hiker. Because of the amount of hiking and bike riding I do, I'm very interested in portable 12-volt power for my HT. Naturally, I prefer a lighter-weight power source over a heavier one. Nobody wants to wander around carrying a 20-pound battery. On the other hand, if you go on a hike or a ride and you take your HT, you want to able to use it. Otherwise, why would you have brought it?

Initial Experiments

I've tried several things for additional power for my HT. My first solution was carrying an extra NiCd battery made specifically for my radio (Photo A). This didn't quite suit my needs because the NiCds made for my radio only allowed an output of 3.5 watts and sometimes—like when I'm biking or hiking in remote hills—I need the full 5 watts that the radio is capable of putting out. All the extra battery pack bought me was more time.

There are several commercial solutions out there. PowerPort, for example, makes several neat little packs. Some of them hold both your HT and battery pack. Quantum Instruments also makes a neatly packaged unit that will keep you talking at 5 watts for quite a while. Most of them are very nicely packaged and, if you have the money, they're a good bet. But for many, a cheaper solution is preferred.

The Gel-Cell Solution

My most successful homemade 12-volt power source for hiking and riding was a 2.3-AH (amp-hour) gel-cell, originally made for a large VHS camcorder. I picked it up on sale at a local RadioShack. At the time, it was about as big as I wanted to carry, it and gave me the most amp-hours per dollar. And, with 2.3 AH, I could go most of the day.

"Nobody wants to wander around carrying a 20-pound battery. On the other hand, if you go on a hike or a ride and you take your HT, you want to be able to use it. Otherwise, why would you have brought it?"

Brent Walton, KF6FGB, has been a ham for about three years. He rides his bike to work whenever possible and operates bicycle mobile, often talking with his wife, Elizabehte, KF6OQV. They live in Pittsburg, California.

Photo B. Two different 2.3-AH (amp-hour) batteries. Top: replacement camcorder battery with homemade clamp; bottom: commercially available gel-cell with built-in accessory jack.

Parts List

Parts required for an 8-cell AA battery pack:

8-cell holder (RS 270-407A or 270-387)
Appropriate power plug to connect to your HT
9-volt battery snap connector (RS 270-325 connects to 8-cell holder)
Short piece of 2-conductor speaker wire

Total cost for above parts (less batteries) is less than $5.

This battery, also known as a brick battery, has one major flaw: its terminals are recessed chrome-plated tabs that cannot be soldered. To resolve the problem with the terminals, I devised a clamp that would hold two screws against the terminals. (Photo B, top) Although it looks cumbersome, it works well.

Shortly after devising my clamp for the terminals, a friend gave me the same battery with a built in lighter receptacle. This works much better and looks a lot nicer. Apparently, the battery is also sold by Motorola for its cellular phones and might be available through a cellphone dealer. (Photo B, bottom)

Two nice things about gel-cells are that they don't develop a memory and they're rechargeable. The bad thing is, if you run them down all the way, you ruin them, so you have to monitor their charge status. Fortunately for me, my HT displays the voltage of the battery. If your HT doesn't, you might want to invest in a cheap battery meter available at RadioShack or most auto parts stores. This monitor is a little circuit with three LEDs that shows the charge state of the battery (Photo C).

Another down side to gel-cells is their weight. After all, they are *lead*-acid batteries, which have to be the heaviest batteries you can find. So, I was still looking for a better solution.

Weight Consciousness

For those of you concerned with weight, the most weight-economical solution I've found is AA alkaline batteries. Eight of these connected in series are about the size of a deck of cards (Photo

"My most successful homemade 12-volt power source for hiking and riding was a 2.3-AH (amp-hour) gel-cell, originally made for a large VHS camcorder."

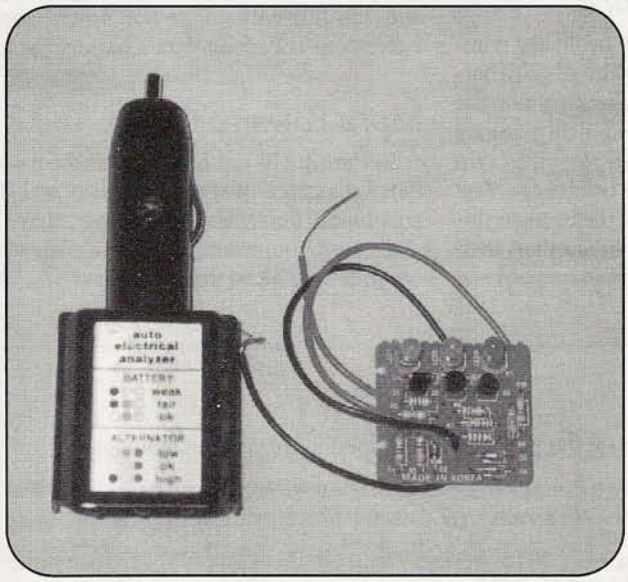


Photo C. RadioShack 12-volt charge monitor and circuit board with same 12-volt monitoring circuit (sorry, we don't have the schematic available).

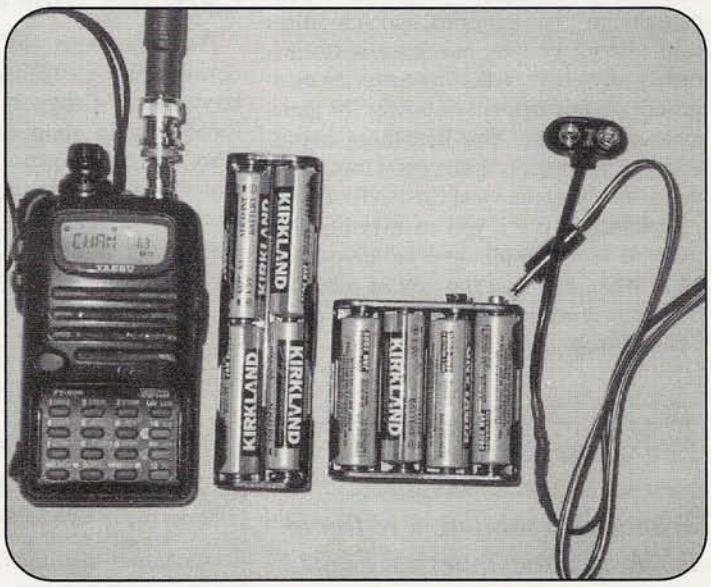


Photo D. HT with two 8-cell AA battery packs for size comparison. An 8-cell AA pack has more capacity than a 2.3-AH gel-cell and weighs much less. But replacement cells can be expensive. Holders and connecting cords are available at RadioShack.

Photo E. Bicyclist's fanny pack designed to hold two water bottles can also hold radio gear. In photo, the HT is in the right pocket and a 2.3-AH cell is in the left pocket, connected together with 12-volt adaptor. The center pocket is available for carrying anything else, such as spare battery, lunch, or maps.

Photo F. A camera case also serves well to carry an HT in the back pocket and a battery pack in the front.

D). A simple 8-cell holder is available at RadioShack for about $2. Add some wire and a connector that fits your radio and you have a 12-volt, 2.8-AH pack (based on Duracell's specifications of 2850 mAH for an AA cell; see "Parts List" at the end of this article). That's about one-fifth the weight of the 2.3 AH gel-cell!

There are also nice things about alkaline batteries. If you're traveling and you don't have access to a place where you can charge your batteries, the AA solution allows you to purchase batteries nearly anywhere. Alkaline batteries also produce a fair amount of power for their size and weight. The bad thing about alkaline batteries is their cost. I buy mine 40 to the box at the local Costco for about 25 cents each. But if you're traveling and have to buy AA alkaline batteries at a local store, they can run you as much as $2 each. It could cost you $16 to refill your 12-volt pack!

"For those concerned with weight, the most weight-economical solution I've found is AA alkaline batteries. Eight of these connected in series are about the size of a deck of cards."

Which choice is better? It's up to you to decide what's best for your specific needs. For me, if I were going backpacking for a week, I'd take a box of AA batteries and my 8-cell battery pack. But for riding around town where I know I can recharge my gel-cell when I return home in the evening, I prefer to use my gel-cell because it is more economical.

Carrying Your Pack

As a final note, you're probably wondering how to carry this extra plug-in battery pack. I'd suggest checking out the local bicycle shop or sporting goods store. Packs meant for carrying two water-bottles work great (Photo E). You can put your HT in one of the bottle holders and the battery pack in another, then just run a cable between the two pockets.

Also, if you're backpacking, the side pockets of your backpack can work well for holding a HT and batteries.

Even a simple camera case (Photo F) or a two-compartment fanny pack will hold most smaller HTs and an 8-cell AA battery pack. Add a speaker-mic to your rig and you'll hardly notice that you're carrying your HT along with a battery pack.

More Power or More Talk?

In Part 2, I'll tell how to make a pack that will power most mobile rigs or an HT and linear amplifier. Of course, it will also give you more talk time at 5 watts on your HT. More power to you! ■

Resources

For more information on the products mentioned in this article, contact:

PowerPort-Cutting Edge Enterprises, 1803 Mission, #546, Santa Cruz, CA 95060; Phone: (831) 429-5384 or (orders only): (800) 206-0115; E-mail: <cee@cruzio.com>.

Quantum Instruments, Inc., 1075 Stewart Ave., Garden City, NY 11530; Phone: (516) 222-6000; Fax: (516) 222-0569.

RadioShack, 1500 One Tandy Center, Fort Worth, TX 76102; Phone: (800) 843-7422; or your local RadioShack store.

ARRL June VHF QSO Party June 12–14, 1999

This is it...the biggest VHF contest of the year. And here are the official rules, courtesy of the ARRL.

This year's ARRL June VHF QSO Party will be held on the weekend of June 12–14, and VHF contesters will head for the hills (literally) to make as many contacts as possible in as many grid squares as they can reach. Even if you're not "in the contest," operating this weekend presents a great opportunity to work stations at distances you may never have thought possible.

Rules, ARRL June VHF QSO Party

1. Object: To work as many amateur stations in as many different 2 degrees X 1 degree grid squares as possible using authorized frequencies above 50 MHz. Foreign stations work W/VE amateurs only.

2. Date and Contest Period: The second full weekend of June. Begins 1800 UTC Saturday, ends 0300 UTC Monday (June 12–14, 1999).

3. Entry Categories:

3.1. Single Operator.

3.2. Single Operator, QRP Portable.

3.3. Rover.

3.4. Multioperator.

3.5. Limited Multioperator.

4. Exchange: Grid-square locator (see April 1994 *QST*, p 86).

4.1. Exchange of signal report is optional.

5. Scoring:

5.1. QSO points:

5.1.1. Count one point for each complete 50- or 144-MHz QSO.

5.1.2. Count two points for each 222- or 432-MHz QSO.

5.1.3. Count three points for each 902- or 1296-MHz QSO.

5.1.4. Count four points for each 2.3-GHz-or-higher QSO.

5.2. Multiplier: The total number of different grid squares worked per band. Each 2 degrees X 1 degree grid square counts as one multiplier on each band it is worked.

5.3. Final score: Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score.

5.4. Rovers only: The final score consists of the total number of QSO points from all bands times the sum of unique multipliers (grid squares) worked per band (regardless of which grid square they were made in) plus one additional multiplier for every grid square activated (made a contact from).

5.4.1. Rovers are listed in the contest score listings under the Division from which the most QSOs were made.

6. Miscellaneous:

6.1. Stations may be worked for credit only once per band from any given grid square, regardless of mode. This does not prohibit working a station from more than one grid square with the same callsign (such as a Rover).

6.2. Only one signal per band (6, 2, 1 1/4, etc.) at any given time is permitted, regardless of mode.

6.3. Multioperator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station (transmitter, receiver and antenna) must exist for each QSO made under these conditions.

7. Awards:

7.1. Plaques (if sponsored) will be awarded in the following categories:

7.1.1. Top ten single operator scorers

7.1.2. Top five single operator QRP portable scorers

7.1.3. Top five rover scorers

7.1.4. Top ten multioperator scorers

7.1.5. Top five limited-multioperator scorers

7.2. Certificates will be awarded in the following categories.

7.2.1. Top single operator in each ARRL/RAC Section.

7.2.2. Top single operator on each band (50, 144, 222, 432, 902, 1296 and 2304-and-up categories) in each ARRL/RAC Section where significant effort or competition is evident. (Note: Since the highest score per band will be the award winner for that band, an entrant may win a certificate with additional single-band endorsements.) For example, if WBØTEM has the highest single-operator all-band score in the Iowa Section and his 50- and 222-MHz scores are higher than any other Iowa single operator's, he will earn a certificate for being the single-operator Section leader and endorsements for 50 and 222 MHz.

7.2.3. Top single-operator, QRP portable in each ARRL/RAC Section where significant effort or competition is evident. (Single-operator, QRP portable entries are not eligible for single-band awards.)

7.2.4. Top rover in each ARRL Divi-sion and Canada where significant effort or competition is evident. (Rover entries are not eligible for single-band awards.)

7.2.5. Top multioperator score in each ARRL/RAC Section where significant effort or competition is evident. (Multioperator entries are not eligible for single-band awards.)

7.2.6. Top limited multioperator in each ARRL/RAC Section where significant effort or competition is evident. (Limited multioperator entries are not eligible for single-band awards.)

8. Other: See general rules for All ARRL Contests and for VHF Contests.

Hands Electronics VHF Transverters

GM4PLM gives us another look at VHF ham gear from Europe, this time coming down from the microwave bands to "near DC," reviewing a pair of transverters for 6 meters and 4 meters (yes, 4 meters).

By Simon Lewis, GM4PLM*
(emn@pacsat.demon.co.uk)

Transverters are back. After falling into some disfavor a couple of decades ago, VHF/UHF transverters are again popular and available from a variety of sources. This review will look at a pair of British transverters, from Hands Electronics. But first, a very quick look at what transverters *are* and what they *do*.

Transverters are ***trans**mit-receive con**verters*** (see where the name comes from?) that translate frequencies from one band to another, allowing the amateur to add more bands to the shack by simply plugging in additional modules to a basic transceiver. This technology has been utilized by some of the main manufacturers for a number of years and examples can be seen in the Yaesu FT-726 and 736 and Kenwood's TS-790, all of which allow the user to add bands by purchasing band modules which are inserted into the main unit. Essentially, these band modules are internal transverters.

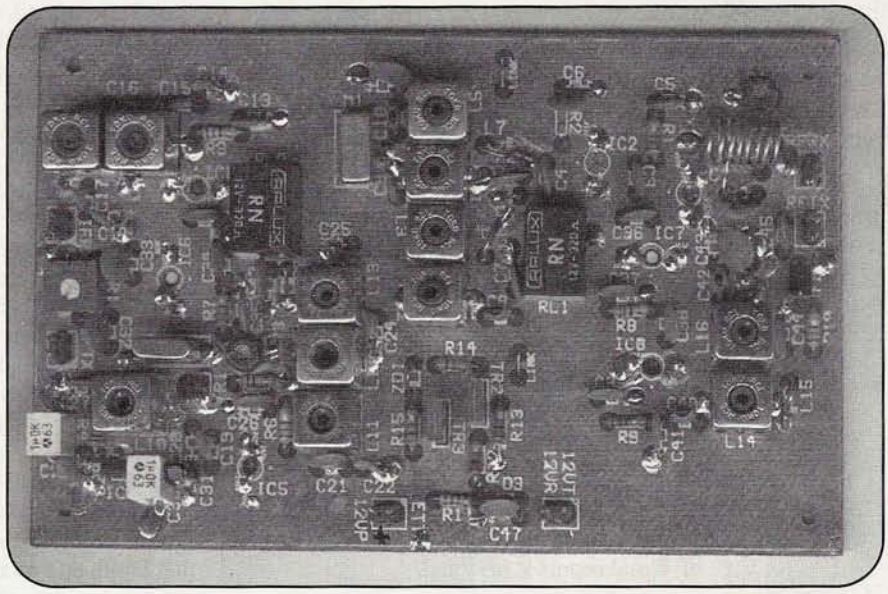


Photo. Circuit board of the Hands Electronics DX-50 6-meter transverter kit. Kits are available directly from the manufacturer or through a U.S. distributor, Kanga USA.

A Less-Than Stellar Start

Transverters became very popular during the early 1970s when they were, in many cases, a ham's only access to the SSB portion of the VHF bands. At that time, there was very little available in the way of commercial SSB equipment for VHF (*AM was still king, and FM gear was just beginning to show up—ed.*) and transverters provided a quick and easy route to SSB operation.

Most early transverters were driven from new transistorized HF radios, and the front ends of these radios were notoriously bad, degraded by the use of new frequency synthesizer units instead of traditional crystal oscillators, VFOs, and mixers. These problems were compounded by the new transverters, which themselves suffered from poorly designed front ends, maximized for highest gain and poor noise figures. These overloaded easily on strong signals and subsequently overloaded the HF front end. Early transverters made a poor start and earned a reputation of being unreliable and poor performers.

Luckily, both time and technology change. Modern HF radios have vastly superior receivers compared to those early solid-state models, and the latest VHF transverters have been designed to operate under the most demanding con-

"Transverters became very popular during the early 1970s when they were, in many cases, a ham's only access to the SSB portion of the VHF bands."

**Simon Lewis, GM4PLM, is Editor of* European Microwave News *and a frequent contributor to* CQ VHF.

Transverter Math

In the Hands DX-50/70 transverters, incoming 50-MHz signals are mixed with a local oscillator frequency of 22 MHz for 50-MHz operation, or with an LO frequency of 42 MHz for 70 MHz.

In the case of the 6-meter mixing process, the receive side subtracts the mixer frequency of 22 MHz from the incoming 50-MHz signals to produce an output at 28 MHz. Transmit signals from 28 MHz are mixed with the 22-MHz LO signal, but, in this case, the signals are added to produce an output at 50 MHz. On 4 meters, the same subtraction and addition take place, using a 42-MHz LO frequency to produce (70 – 42) 28 MHz on receive and (28 + 42) 70 MHz on transmit.

This is, of course, a very basic description of what is occurring. Any mixing process will produce both addition and subtraction of the frequencies involved, and so require additional post-mixer amplification and filtering to provide clean signals at the required levels for feeding to transmit amplifiers or the HF receiver.

ditions. In fact, many high-grade contest stations in Europe today are built around transverters, rather than off-the-shelf transceivers—a far cry from the transverters' introduction in the early 1970s.

Designated Driver

Most 50- to 432-MHz transverters use 10 meters as the driver, or IF (intermediate frequency) band. Higher bands generally use 144 MHz or higher for drive, as it's easier to separate the wider-spaced mixing products by using stripline or cavity filters.

A main advantage of "transverting" from the 10-meter band to the VHF bands is that, in general, VHF radios do not offer the same user-friendly features that appear on HF radios. The ability to select these functions, which are intended to help HF operators under crowded conditions, can be of great benefit while operating weak-signal VHF bands, or under busy contest/rover conditions.

Many modern HF radios already include 50 MHz as standard, but only the Yaesu FT-847 (UK version) currently offers *70 MHz* as standard, and this has not been without problems, as the radio was never intended to cover this band (also known as 4 meters). The release of the 70-MHz band to amateurs in a number of European countries offers new and exciting challenges in addition to those found on 6 meters, and it may interest and encourage U.S. readers to at least acquire receive coverage for cross-band work from 10 or 6 meters.

The DX50 and DX70 Transverters

Hands Electronics currently markets two high-performance transverter kits in the form of the DX50 and DX70 units. These high-dynamic range transverters were designed by Sam Jewell, G4DDK, and offer high performance at low cost. They use the latest semiconductor technology and high-performance TUF1-H diode ring mixers for optimum performance. They are both designed to be driven by HF transceivers operating in the 28-MHz band.

Both transverters are built on double sided printed circuit boards (pcbs) measuring 140 x 90 millimeters (approximately 5.5 x 3.5 inches). The pcbs are tinned and screen-printed with component locations (see Photo).

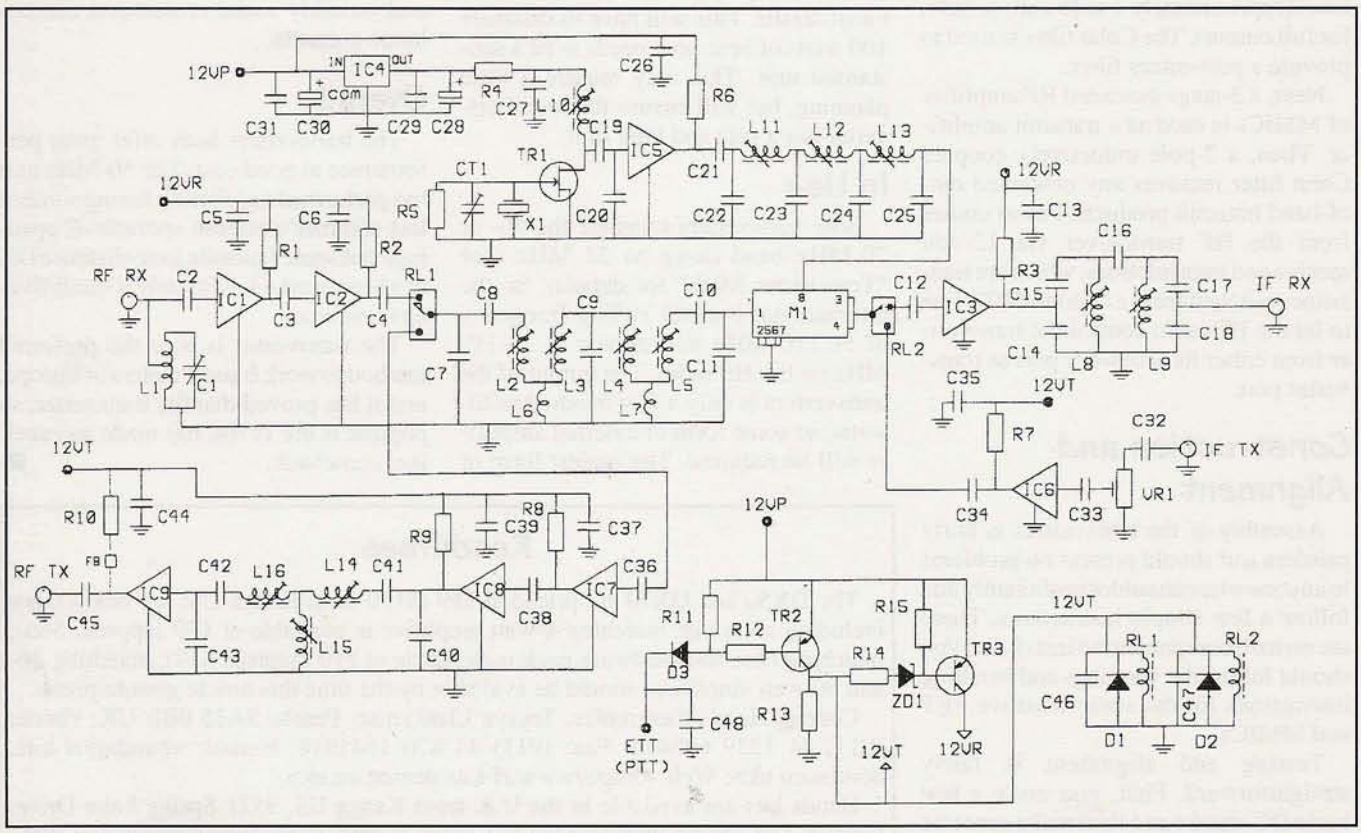


Figure. Schematic diagram of the DX-50 6-meter transverter. The 70-MHz version (Model DX-70) is identical except for the local oscillator frequency.

The compact size of these units makes them suitable for mounting inside older, and generally much larger, HF radios. Their circuitry (see Figure for schematic) is identical except for the frequency of the mixer circuit, so this review applies equally to both.

Circuit Description

Receive signals from 50/70 MHz are coupled by an LC (coil/capacitor) input filter to a cascaded RF amplifier consisting of two MMICs (Monolithic Microwave Integrated Circuits). The output of the RF amplifier is fed via relay to the premixer 4-pole Cohn filter. The transverter local oscillator is provided by an FET (Field Effect Transistor) oscillator and MMIC amplifier, followed by another LC filter. The mixer output is switched during receive to a post-mixer MMIC amplifier with a wide bandwidth to correctly terminate all mixer products in 50 ohms.

A 2-pole Butterworth filter follows the amplifier to attenuate any remaining out-of-band products and provide a match for the following receive RF stage. During transmit, the relay is engaged to switch the mixer IF port to the IF transmit buffer and amplifier. A simple level pot (potentiometer) is provided to adjust the IF drive level (approximately 1 milliwatt, or mW, for full output). The Cohn filter is used to provide a post-mixer filter.

Next, a 3-stage cascaded RF amplifier of MMICs is used as a transmit amplifier. Then, a 2-pole inductively coupled Cohn filter removes any unwanted out-of-band transmit products. Power comes from the HF transceiver via 12-volt receive and transmit lines, which are transistor-switched from a common PTT line to let the HF radio control the transverter from either its accessory port or transverter port.

Construction and Alignment

Assembly of the transverters is fairly painless and should present no problems to anyone who can solder proficiently and follow a few simple instructions. There are no hard components to install, but you should follow the warnings and handling instructions for the static-sensitive FET and MMICs.

Testing and alignment is fairly straightforward. First, you make a few basic DC checks and then make sure that the LO (local oscillator) is running. Next, using either a signal generator or an on-air signal source (such as a beacon), you peak the receive levels. Finally, the receiver inductors are peaked for maximum signal as well.

Transmit testing follows a similar path, that is, transmitting and ensuring that everything is peaked for maximum output.

Connecting the Transverter to the Radio

The transverter requires a receive input to the HF radio, a *low level* transmit output at 28 MHz (around 1–10 mW) and a PTT line that goes to ground on transmit. Some older HF radios have specialized transverter output sockets that allow easy connection to a low-level transmit signal and direct receive path, as well as disabling the high-power PA (power amplifier). Many recent radios do not have such features and will require some way of reducing their output down to the required 1 mW. It's important that you do not feed the 100 watts from a modern HF transceiver into the IF port of the transverter. It will die a very quick and very expensive death!

The easiest and safest way is to insert a high-power attenuator in the transmit path. To obtain a 10-mW signal out at 100-watts input, you'll need an attenuator of 40 dB. This will have to dissipate 100 watts of heat, so it needs to be a substantial unit. This may require a little planning, but will ensure that the transverter has a safe and long life!

In Use

Both transverters translate the 50- or 70-MHz band down to 28 MHz (see "Transverter Math" for details). So the international 6-meter calling frequency of 50.110 MHz will appear at 28.110 MHz on the HF radio. The output of the transverters is only a few hundred milliwatts, so some form of external amplifier will be required. The easiest form of amplifier could utilize one of the fine black brick Mitsubishi RF modules, or the add-on Hands RF amplifier could also be used. Additional switching to use a single 50/70-MHz antenna socket is also required (as opposed to separate sockets for receive and transmit).

Both transverters performed beautifully on the air. I used the 6-meter model extensively during the 1998 sporadic-*E* season. Even with the barefoot transverter (no amplifier), I was able to work many stations around Europe and received many 5-9 signal reports even though my output power was less than 1 watt! With the addition of a 10-watt amplifier, I was able to work into South Africa from the UK on one opening.

The 70-MHz version may also be of interest, even in the U.S. Although not open to U.S. operators, it's worth noting that many European stations are now being given permission to operate on this band, and numerous cross-band contacts have already taken place between them and non-70-MHz countries. Propagation is similar to that on 6 meters and, with the increasing solar activity, should lead to some interesting contacts on the 4-meter band. So U.S. hams looking for an additional challenge might want to consider a 70-MHz transverter to listen on and possibly make cross-band transatlantic contacts.

Overall

The transverters both offer great performance at good cost. The 50-MHz unit has performed excellently during some of last summer's intense sporadic-*E* openings and some fantastic long-distance DX has been worked, with only a small five-element beam.

The transverter is now the preferred method to work 6 and 4 meters in Europe, and it has proved that the transverter, so popular is the 1970s, has made an excellent comeback. ■

Resources

The DX50 and DX70 are priced at £89 ($150 from Kanga US; see below), not including shipping; matching 4-watt amplifier is available at £39 (approx. $66); matching case and hardware pack is available at £10 (approx. $19); matching 20- and 50-watt amplifiers should be available by the time this article goes to press.

Contact Hands Electronics, Tegryn Llanfyrnac, Pembs SA35 0BL UK; Phone: (011) 44 1239 698427; Fax: (011) 44 870 1641918; E-mail: <hands@rf-kits.demon.co.uk>; Web: <http://www.rf-kits.demon.co.uk>.

Hands kits are available in the U.S. from Kanga US, 3521 Spring Lake Drive, Findlay, OH 45840; Phone: (419) 423-4604; E-mail: kanga@mail.bright.net; Web: <http://www.bright.net/~kanga/>. Add $5 shipping on all orders.

Q & A

Questions and Answers About Ham Radio Above 50 MHz

Q: I read *CQ VHF* from front to back and enjoy it very much. Not so long ago you had an article on NiCds vs. Nickel Metal Hydride (NiMH) batteries ("Are NiMH Batteries Really Better?" by Ken Collier, KO6UX, December, 1998). I read this several times and found it to be very helpful to new and old hams alike. I now see the new batteries out are Lithium Ion. They say that they have an " IC" chip inside and you can leave them on the charger for as long as you like, unlike a NiCd that has a memory and NiMH that is not supposed to have one. I read all about these, the pros and cons of each type. The article was *great* and, now, could you tell me more about these new Lithium Ion batteries. I know they cost a lot, but are they worth it? Also, I've seen where someone had a re-conditioner for the new Lithium Ion batteries. Why would you need this, or do they have memory?

Doug Ritter, KB8RQH
Bellevue, Ohio

A: Author Ken Collier, KO6UX, replies:

For certain applications, they might be worth the extra expense. Radios are getting smaller and smaller these days, and on a lot of these "pocket size" units there just isn't room for a big ol' battery pack. The new Lithium Ion (Li-Ion) battery technology offers one great advantage: much higher energy density than either NiMH or NiCd packs. Essentially, Li-Ions let you pack much more energy into a much smaller space, which means that your battery pack, and therefore your radio, can be much smaller than would otherwise have been possible. This is a huge step forward for the creation of super-small handheld radios. In the past, even if a manufacturer had designed a palm-sized radio, the unit would have had to be offered with either a very large battery pack, or a reasonably small pack with very low capacity and, therefore, very low operating time.

There are some major problems with Li-Ion packs, though. Namely, they are very hard to charge properly, and complex charging logarithms have to be used to vary the voltage and current of the charger. These usually have to be built into the charger, but, rather than having to offer special chargers for these batteries, some manufacturers have begun building these logarithms into ICs. These ICs are actually included inside the battery, eliminating the need for a special charger! However, this solution is expensive and raises an already expensive battery pack even more.

Currently, no manufacturer I know of is offering aftermarket Li-Ion battery packs, and the reason is largely based on the higher cost. Of course, the cost of manufacturing battery packs continues to get lower, and newer and battery technologies continue to be introduced. It's only a matter of time before someone does introduce Lit-Ion packs for all of your radios.

As for reconditioners, I think the same kind of logic applies to them as to NiMHs and NiCds. In spite of what you may have heard or read, "memory" doesn't really exist in NiCds these days, and NiCds, NiMHs, and (presumably) Li-Ions still need to be conditioned. Reconditioning the battery actually treats a problem known as "crystalline formation." This phenomenon occurs when the semi-liquid electrolytic chemicals in the battery start to solidify, or crystallize. That prevents electrons from moving as easily through the battery and it lowers the battery capacity.

As I said, both NiCds and NiMHs suffer from this and need to be reconditioned. NiMHs aren't as susceptible as NiCds, though, so they only need to be reconditioned about one-third as often. I'm guessing that Li-Ions probably need to be conditioned even less often, but that they still do need to have a good discharge applied from time to time.

Q: I often wonder how to make the packet network faster using what we already have (1200 bps TNCs). I could have sworn that, here and there, I saw something about a Sound Blaster Modem. Is this using the Sound Blaster card in one's computer as a modem? Could this technique be used for packet? I would most certainly hope so. I would much rather pay for a software upgrade rather than buy a new TNC and hook it all up again and again. Would you happen to know about anything like this? I would be interested in anything you would know about this and in your opinion on it.

Jason Kitchen, KC8ERI
McComb, Ohio

A: "Digital Data Link" editor Don Rotolo, N2IRZ, replies:

Yes, you certainly *can* use a Sound Blaster as a 1200-baud modem. I know FlexNet supports one, and I think there are stand-alone programs you can get. If I find out any specifics, I'll send them to you and/or print them in a future column. Do you have Web access? If so, try a search on "SoundBlaster Packet Modem."

Concerning increasing performance at 1200 baud, I wrote about this quite some time ago. Perhaps I should cover it again. It doesn't come down to using higher baud rates, but to faster radios (TX/RX switching) and, most of all, better network design. Oh, I also wrote once about converting a 1200-baud TCM3105 modem (likely what's in your TNC) to 2400 baud. Costs about $2. I'll send that, too.

"Q&A" Goes Online!

We've added a "Q&A" page to our Web site, so anyone visiting us on the Internet can pose any question they'd like about Ham Radio above 50 MHz. Answers may come from anyone who has them (not just *CQ VHF* authors and editors) and, just like the olden days on packet bulletin boards, you'll be able to follow a "thread" of questions, answers, responses, and replies on each topic. Just point your Web browser to <http://www.cq-vhf.com> and click on the "Q&A" button on the left-hand side. Then follow the instructions to post questions or answers, or to read what others have posted.

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 Rd., Hicksville, NY 11801; via e-mail to <q&a@cq-vhf.com> or via our Web page at <http://www.cq-vhf.com>. Be sure to specify that it's a question for "Q & A."

Something for Everyone in Public Service

No matter what your ham radio interest, chances are there's a way to put that interest to work helping your neighbors...in the public interest. We'll start with lessons from an air disaster.

I recently attended an emergency management conference on aircraft disasters. The keynote speaker was Captain Al Haynes, pilot of the ill-fated United Airlines Flight 232 that took off from Denver and crashed on the runway at Sioux City, Iowa, in 1989. Amazingly, 184 of the 296 people on board survived one of the most dramatic events ever caught on video. The film shows the aircraft approaching the runway. When the plane was just feet off of the ground the plane appears to roll on its nose flipping upside down. (*You may have seen the recent TV movie about this flight.—ed.*)

Captain Haynes described how the number 2 engine, the one at the tail of the DC-10, broke apart and damaged all of the hydraulic systems, making the plane barely controllable. Pilots receive a lot of training to do their job. The trainers and aircraft designers have built so many backup systems into an aircraft that there are only four situations that are classified as an "emergency." The others are "unusual events" or "anomalies." This particular event was one of those emergencies.

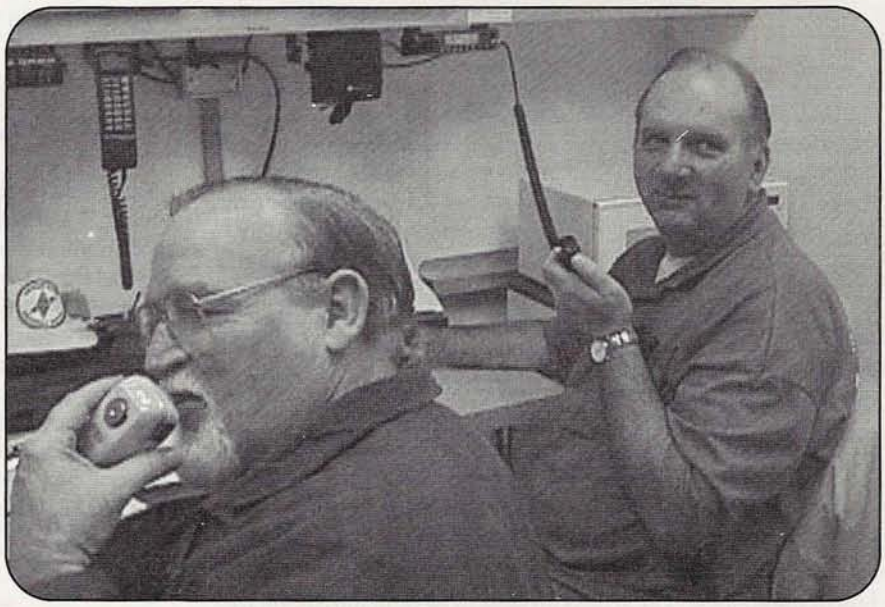


Photo A. George Ritchie, KD4NCF (left), and Hank Koebler, N3ORX (right), operated Net Control positions from the comfort of a Red Cross EmTrac van (see text for details), while many other volunteers worked out in the cold and rain and rubble from a tornado that swept through Clarksville, Tennessee, in January. (Photo courtesy of N3ORX)

Going by the Book

Just prior to the engine failure, the crew members were going about their routines. The plane was on autopilot. When things started going wrong, the first step was for the pilot to put his hands back on the wheel and fly the aircraft manually. The next step was to pull out the Emergency Procedures Manual. The manual documents every possible step to take to fix a problem or to gain control of the situation. There are three hydraulic systems in a DC-10 and the plane can be flown with any one of them. The procedures described in detail what to do using any combination of the systems...but nothing on how to fly with *none*. The plane was still flying, so they knew a new procedure had to be formulated as they were flying!

If the crew was going to land the plane, they would have to apply *teamwork*. It didn't matter that the captain was the senior official on the plane. It didn't matter that there were over 103 years of combined flight experience among the crew members. None had experienced an emergency situation before. They had to put their heads together and think of different ideas.

The next step was to call the training supervisors—the people who knew the DC-10 inside and out. They said the plane couldn't fly, but it was. In fact these "knowledge experts" put the plane through flight simulators and crashed on 45 different tries. As Haynes put it, "When something goes wrong, everyone has a obligation to work on the problem." Teamwork was an important part of their "Total Quality Management" program.

By Bob Josuweit, WA3PZO (wa3pzo@cq-vhf.com)

Photo B. Warminster ARC's APRS team (left to right): Rocky Pistilli, N3FKR; Mark Kempisty, N3GNW (APRS "base"); Ron Wenig, NY3J; and Domenica Kempisty, N3GNW's daughter. (Photo by Bill Gorodetzer, K3MFI)

While the aircraft experts were applying their knowledge, airport and emergency management staff in Sioux City were preparing for the aircraft to land. There were three aircraft controllers in the tower. One maintained contact with the plane while the others diverted traffic and made the airport ready to receive the "patient."

Captain Haynes offered one final comment that really hit home: The flight controller who maintained contact with the plane was calm and collected in what he said on the radio. There was no sense of panic. Haynes stressed that this was extremely important as the crew did what had to be done. Everyone had less than 45 minutes to bring the aircraft down. When the aircraft crashed, the level of panic and stress was immediately apparent on the radio. The presentation went into much more detail, but I think the example can be used as an illustration for *Integrated Process Management*.

Lessons for Hams

"What!", you say? I thought we were covering ham radio. We are. But Integrated Process Management is really just a fancy name for what hams traditionally do in public service and emergency communications—keeping all the "players" in contact with each other, keeping lines of communication open, and using their radios in a calm and professional manner so that everyone can do what they need to do.

Applied to ham radio, the above example identifies:

• The need for an ARES/RACES group to maintain/sustain routine operations when there is a problem. The air traffic controllers performed the same operation as our Net Control Stations, serving as the one main point of contact, with staff ready to provide backup as needed. Their calmness kept everyone focused and thinking clearly.

• The need to document procedures and plans. As new procedures are formulated, the need to document the new procedures and train on them (but after the emergency is over).

• The need to consult—and listen to—a knowledge expert when appropriate. A knowledge expert could be someone with specialized training in emergency management, someone who knows how to fix radios or computers, or someone who knows about a particular mode of operation, such as Automatic Position Reporting System (APRS).

• The need for *all* to participate in the solution. The supervisor or ranking officer may not be the one with the answer. Don't rely on the "seasoned ham" to know all of the answers. There may be newcomers with specialized knowledge that's needed right now. Call on them. By the same token, don't be shy about letting coordinators know if you have special skills or training. There is a place for all of us in public service. Take some time and get involved!

Dispatches from the Front...

This month we have reports of hams serving in the public interest year round. We'll start at the beginning of the year, as hams in Tennessee responded when several tornadoes touched down in their state on one day in mid-January.

Madison County Emergency Coordinator (EC) Kenny Johns, AB4EG, worked with volunteers from several areas to assist the Red Cross with damage assessment in 19 affected counties. According to the ARRL, Johns said more than 300 homes, apartments and mobile homes in Jackson and in Madison County, were completely destroyed. Another 357 received extreme damage. ARRL Delta Division Vice Director Henry Leggette, WD4Q, reported that more than 200 hams helped out in some way after the storms. "This made me very proud to be an Amateur Radio operator," Leggette said.

The town of Clarksville, Tennessee, also received significant damage from the January 22 storms. Hank Koebler, N3ORX, the Public Information Officer for the Clarksville Amateur Transmitting Society (CATS), sent in this information on the local ham radio response:

> The Clarksville Amateur Transmitting Society [CATS] Emergency Services Group contributed over $55,000 in equipment and services during the response and recovery phases of the tornado (*Refer to "Calculating Hams' Value," to see how Hank arrived at that figure.—ed.*). A total of 89 trained amateur radio operators volunteered over 1,200 man-hours to the effort during the period from January 22 to January 30, 1999.
>
> The ARRL reported that Tennessee Section Emergency Coordinator Jim Jarvis, WD4JJ, in Bristol, relayed a request for amateurs with mobile units to assist at the Clarksville/Montgomery County Emergency Operations Center. Jarvis reported, "The police department and city hall have been completely demolished, and the downtown area is a complete wreck." Jarvis also reported damage in Humphreys County, as well as in McEwen, Waverly, and Camden counties.
>
> During the initial response phase and up until late Friday afternoon, amateur radio was the only reliable means the Red Cross had to maintain contact with the Emergency Operations Center, shelters, headquarters, food

Photo C. Bike-mobiler Ron Wenig, NY3J, rides the tail end of the Thanksgiving Day run with a portable APRS transmitter. (Photo by Bill Gorodetzer, K3MFI)

distribution points, and all other facets of their operation because cellular phones were either down or overloaded. Every vehicle that provided food, hot coffee, etc., to the police, firemen, and rescue workers downtown had a ham operator on board. This allowed the Red Cross to dispatch the vehicles efficiently and ensure maximum coverage without duplication. Also, the food vehicles were dispatched to the hard-hit residential areas.

The radio operators on board were able to provide immediate contact to Red Cross headquarters to assist residents with pressing problems, such as getting a portable generator to provide power to a disabled resident who was on oxygen and didn't have electricity to power the system. They were also able to assist in locating displaced people, particularly dependents of Ft. Campbell soldiers who were in the field and informing them of their condition. As the recovery phase began, radio operators deployed to all affected areas and performed damage assessment, which helped the Red Cross provide more rapid assistance to those affected the most by the tornado.

On "Clean-up Saturday," CATS members were assigned to each work group, the staging area, the Red Cross, the first aid station, and the operations area at a local shopping mall. Again, food service, work status, injuries, and overall coordination of efforts was rapid, efficient, and effective as a result of the efforts of those participating.

The Red Cross brought in one of their two EmTrac vans for the clean-up. This is a tractor-trailer outfit that was put together after the Oklahoma City bombing. It is a standalone response center which includes a complete communications suite, offices, and first aid area. It has its own onboard generator and is self-sustaining. The communications suite includes an Alinco dual-bander for ham operations, commercial VHF/UHF public safety radios, VHF radios pre-tuned to Red Cross frequencies for coordination, a computer, fax, television and complete 25-line plug in phone system. Antennas are on a 40-foot telescoping mast. The Red Cross invited CATS members to use it for net control during the clean-up day (see Photo A). It was an absolute pleasure to work from, and the hams were able to make use of all the equipment to monitor public safety communications, direct the hams in the work areas, and coordinate Red Cross activities using their VHF equipment.

CATS prides itself on working closely with supported agencies and organizations. Members train and are prepared to provide rapid, efficient communications in response to any disasters or emergencies which affect Montgomery or any of the surrounding counties. In short, CATS and its members provide an integrated process with the agencies they serve to provide smooth and efficient processes to serve in the public interest.

APRS Goes Bike Mobile

The Warminster Amateur Radio Club in suburban Philadelphia has traditionally helped out with public service communications at the local Thanksgiving Day Race. This past year, several club members added a new dimension to this. Rocky Pistilli, N3FKR, Ron Wenig, NY3J, and Mark Kempisty, N3GNW (Photo B), set up an APRS network for the event. This allowed the club as well as the public to track the race's lead and tail runner positions over the course.

APRS utilizes amateur radio's packet abilities and the Global Positioning System (GPS) to transmit the location of a mobile tracking station (also known as a tracker). According to Kempisty, receiving stations use this information to display the tracker's position on a computer-generated map. Not only can you monitor the progress of a tracker in real time, but you can also record the information for later use. The mapping system used by the group displayed all of the local streets. So if a runner needed assistance, his location could have been relayed to the police or medical personnel assisting in the event.

Pistilli and Wenig put together their tracking systems and operated bicycle mobile to easily keep up with the runners (Photo C). The GPS receivers they carried were each interfaced to a packet radio Terminal Node Controller (TNC) and a 2-meter transceiver. Kempisty's set-up at the base station (Photo B) consisted of a computer to run the APRS display software and mapping program, plus a 2-meter transceiver and the TNC.

Kempisty explained that a second monitor was used to let the public review the race's progress (Photo D). Quite a few people were interested in the system and asked a number of questions. He pointed out the need to have a knowledgeable operator available to answer the public's questions while adjustments were being made to the tracking software.

"In summary," Kempisty said, "our first use of real-time tracking and APRS was a success. We were able to keep track

Photo D. Members of the public watch APRS activities on the screen of a second computer monitor set up specifically for public viewing. Bike-mobile APRS transmitters provided visual indications of where the lead and tail runners were at any given time. (Photo by Bill Gorodetzer, K3MFI)

Calculating Hams' Value

By Hank Koebler, N3ORX

How do you calculate the value of ham radio's contribution to an emergency or a public service event? Here's how the Clarksville Amateur Transmitting Society did it, in reply to a request from local officials who wanted to get an idea of the total cost of the ice storm of 1994. We were heavily involved in that response and a lot of what we learned there, refined through several smaller tornadoes and floods, was put into practice for the January, 1999, tornado. And it turned out we made the right changes.

First of all, we maintain a list of what equipment each Disaster Team member has and uses in response to a callout, whether for a disaster, Skywarn activation, training, or whatever. From that, we derived an average equipment value, which we rounded off to $400 (it was actually a few dollars more, but $400 is easier to work with). We then figured in the average costs for gasoline, food, and other miscellaneous supplies, and this worked out to an average of $25 per ham per incident. So we use the figure of $425 per ham for the equipment value.

Next, we contacted the Tennessee Emergency Management Agency and asked them what would they charge per hour, including salary and benefits, if they were to contract out a communications technician to another agency. The answer was that they didn't do that, but if they were to, then it would be in the vicinity of $15 to $18 per hour. We decided to go with the lower figure, so we use $15 per hour per ham when figuring it out. We realize that the overall figure is actually a little low because we don't figure in a lot of things, like vehicle costs other than gas, batteries (we went through several cases of AA batteries during the tornado week), personally purchased safety equipment (such as reflectorized vests), etc., but we would rather figure it low...our focus is not how much it costs us, but rather what we can do for the community.

of the lead and tail runners and keep the race organizer informed as to their progress. We also had a chance to demonstrate some of amateur radio's latest technology to the public...."

Taking Field Day Literally

The Warminster Amateur Radio Club continued to show its commitment to providing public service communications on a weekend that many of us assume to be a contest. For Field Day last year, the club took to heart the object of the annual ARRL exercise: "to learn to operate in abnormal situations under less than optimal conditions. A premium is placed on skills and equipment developed to meet the challenge of emergency preparedness and to acquaint the public with the capabilities of Amateur Radio."

Last year, the club decided that it could make a greater contribution by assisting during the annual air show at the Naval Air Station Joint Reserve Base in Willow Grove, Pennsylvania, than by devoting its resources to contesting. The air show benefits the base's morale and welfare groups and often takes place on Field Day weekend.

On June 27, 1998, nearly 30 hams descended on the Naval Air Station, set up emergency antennas, and developed an operational plan. "For the next 12 hours, they manned a medical communications net to assist the Navy Medical Corps with the expected crowd of between 60,000 and 130,000," said WARC Past President Thomas Michaud, WA3TQJ, who explained that the net "sent Amateur Radio communicators with roving teams of medical personnel throughout the crowd to determine if there were any medical emergencies and to deal with them." Other hams handled net control, aid stations, the public address system, a clinic, security, a van, and different ambulance groups. Hams made sure the medical team had communication with the different groups throughout the base.

"Imagine, the Navy, Army, Marines, Air Force, and National Guard cannot talk to each other because they operate on different frequencies," Michaud said, noting that during the course of the day,

"Imagine, the Navy, Army, Marines, Air Force, and National Guard cannot talk to each other because they operate on different frequencies. — Thomas Michaud, WA3TQJ, past president, Warminster ARC

the hams were called on to provide communication support, "and the medical personnel were glad we were there."

Michaud said the club members repeated the performance on the second day of the event. Most equipment was run from battery power, except for the command and control station and the clinic location. Each station had several backups if needed.

"During the two-day operation, the amateurs proved to the public, the Navy, and to themselves that we are able to handle a field day," Michaud concluded. "It is not possible to measure our score by the number of contacts made. However, we could score points on power levels and public relations."

In all, more than 60 hams took part and picked up some actual emergency-type operating experience "which will make them perhaps better operators during future emergencies," Michaud said. "We operated under adverse conditions, using equipment unfamiliar to us, and persevered and showed the public that this is Amateur Radio at its finest."

In a letter to the club, D.C. Berry, Commander, Medical Service Corps, United States Navy, said,

Your pride and professionalism is noted with great pleasure. On behalf of the thousands of 1998 'Sounds of Freedom' air show spectators and staff, I commend the Ham Radio Operators for their total commitment and support to the United States Navy and the Naval Air Station Joint Reserve Base, Willow Grove.

Those in the Know Recommend Hams

T. Patrick Harkness, an emergency management consultant in Chilliwack, British Columbia, plugs ham radio—especially the skills of ham radio operators—when ever he talks to groups about being prepared.

With little experience in real disasters, the day-to-day frustration of attempting to convince someone in authority that emergency preparedness is real and worthy of their support provides many of us with a reason to persevere in our quest to make our country, our province, or our community a safer and more prepared place in which to live....And if you need a network of communicators, use the local amateur radio [hams] to give valuable linkages between sites and command centers and yourself. Yes, get a ham to be with you all the time even though you may have all kinds of telecommunications equipment readily available.

In Conclusion...

This month, we focused mostly on the need for teamwork. The idea of Process Management and standard operating procedures go a long way to helping us be the most effective communicators we can be. We can learn from those who have experienced a disaster situation, but we can also learn from those who are knowledge experts in other disciplines or areas of expertise. Finally, we must be willing to work as a group. When you're out on an event, you are there to serve a customer. The customer may be the local emergency manager or the public service event coordinator. By understanding the type of events for which you may be called upon to provide communications, you may get to the point when you have only a few situations which will be considered emergencies.

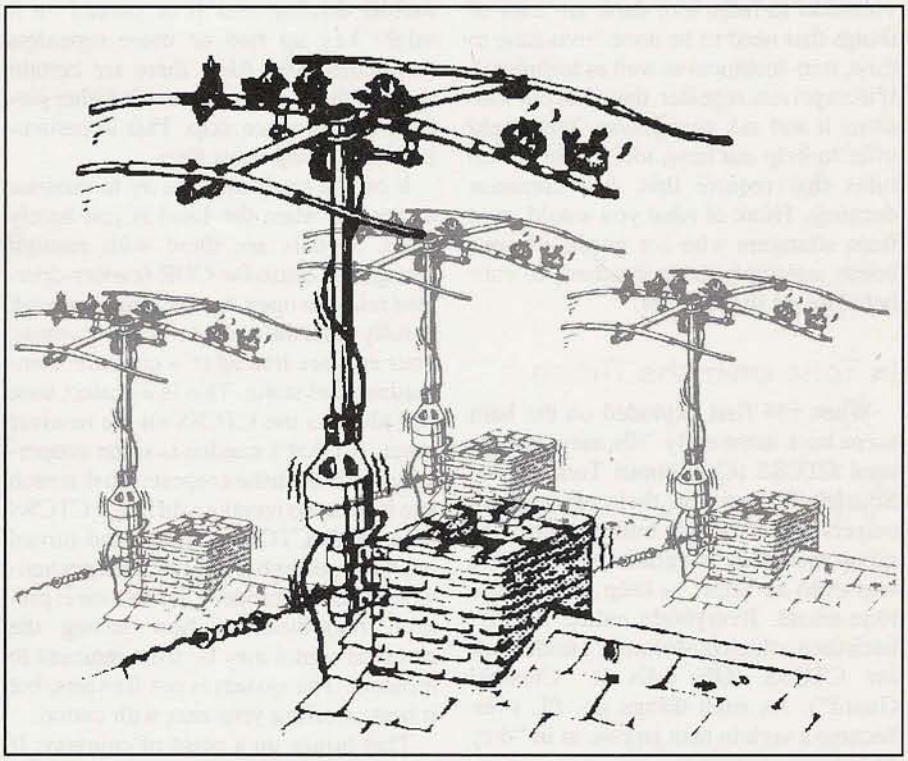
Do You Have a Story to Tell?

Thank you to all of the groups that submitted stories this month. Do you have a story to tell? Is your club serving in the public interest? Then drop us a line at WA3PZO@cq-vhf.com. ■

An Electronic Village

Knowing how to set the frequencies on your radio and press the mic switch is only part of knowing how to operate on a repeater. The other part has to do with what you say and how you say it.

Last month, we looked at the physical makeup of a repeater. This time, we're going to talk about the *social* aspects of using repeaters. As we go through these discussions, please keep in mind that repeaters are supposed to be *fun* to use. Some of them have some clever tools ("bells and whistles") to play with. So, it's OK to want to play with them—just do it responsibly.



A ham radio repeater often forms the core of an "electronic village." In order to be considered a "good citizen," there are some basic rules you need to know and observe.

Using Someone Else's Station

One thing that was implicit in last month's discussion should be stated here unequivocally: Because of the special requirements of repeaters, it takes a fair amount of money (and/or ingenuity and scrounging) to put a repeater on the air and to keep it on. Somebody has to pay for it. So most repeaters across North America are club operations. There are some privately owned repeaters, particularly on 222 and higher, but the majority are group operations.

Whoever owns the repeater, whether a group or individual, has put a lot of time, money and effort into getting the repeater on the air. It is *their* station. Within legal limits, they can do whatever they want with it. They set the tone or atmosphere for communicating. And they have the right to restrict who can use the system and how it can be used. To paraphrase Walter Cronkite, "That's the way it is."

When you look through the *ARRL Repeater Directory*, you will notice that some repeaters are listed as "open" and others as "closed." An open repeater is one that has been made available to the public for use—not misuse, not abuse, just USE! It is an open invitation to join as you pass through the area, or to use from time to time if you live or work in the area. However, if you're going to be a regular or frequent user, you should help contribute to its upkeep. That's generally done by joining the sponsoring club (see below).

A closed repeater, on the other hand, is one whose use is limited to those invited to join in. Closed repeaters are more prevalent among those that are privately owned, but there are plenty of clubs around that restrict use to club members in good standing. There is nothing wrong with this. Just accept it as the way things are. Such repeaters are often dedicated to a special use, such as DX spotting, or the members tend to have similar narrowly defined interests (all involved in broadcasting, for instance).

In the past, this has been a controversial issue in some areas. Certain hams took the attitude that the airwaves are free and that anyone can and should be able to use any repeater he wants in any manner he wants. The airwaves are free, but

By Peter O'Dell, WB2D (wb2d@cq-vhf.com)

the station isn't. The repeater is a station just the same as the one you have in your home. Suppose someone came over to your house and demanded to use your home station. Or maybe they just walked in and started using it without saying anything. Or, perhaps, someone walks up, pulls your handheld off your belt and starts using it without asking. Well, a repeater is a station, too. And it belongs to someone. So, they have a right to run it pretty much however they want.

What it boils down to is this: if you're going to use a repeater that belongs to a club, you should join that club as soon as you start to use the repeater on a regular basis (it would be considerate of you to volunteer to help, too; there are a lot of things that need to be done from time to time, non- technical as well as technical). If it's a private repeater, then find out who owns it and ask permission. You could offer to help out here, too. There are no rules that require this, just common decency. Think of what you would want from strangers who are guests in your home, and apply those standards to your behavior on the repeater.

In Tone with the Times

When FM first exploded on the ham scene back in the early '70s, some groups used CTCSS (Continuous Tone-Coded Squelch System) on their repeater receivers as a means of limiting access to group members. In certain groups, there was even an effort to keep the specific tone secret. Everybody called it "PL" back then, which is Motorola's trademark for CTCSS (GE calls it "Channel Guard"). As such things go, PL even became a verb in ham jargon, as in "they PL'ed the machine."

So don't be surprised if you run into a few old-timers who carp about the "evils of PL" and the curse that it has brought onto ham radio. They came up through the ranks when it was a tool of exclusion—perfectly legal, perfectly justifiable—but a tool of exclusion nonetheless. There are some people who just don't deal well with any form of rejection.

In those days, a CTCSS encoder was big, ugly, and expensive, and you were limited to one tone, too. I don't recall a single FM radio offered directly to the amateur market then that featured a CTCSS encoder as an option, let alone as a standard feature. To add one to your radio, you had to be technically proficient. Now, nearly all new ham FM transceivers come with a CTCSS encoder built in—one that can dial up any of the 32 standard tones at the touch of a couple of buttons. Many rigs also include CTCSS decoders that can listen to a tone-encoded signal and tell you what its frequency is.

All of this makes CTCSS of little value these days to help enforce a closed repeater's status as such. But CTCSS does have some really wonderful uses. With the proliferation of repeaters, it's not uncommon to find some unintentional overlap in coverage areas. For instance, a particular hilltop might be outside the prime coverage area of two or more repeaters. But because of its height, any mobile driving over it or parked on it might key up two or more repeaters simultaneously. Also, there are certain areas of the country prone to weather patterns that produce skip. This is particularly true along coast lines.

It can be maddening to try to monitor a repeater when the band is just barely open. Signals are there with enough strength to cause the COR (carrier-operated relay) to open, but not strong enough to fully quiet the receiver. In other words, your ears are treated to a constant bombardment of static. This is a perfect time and place to use CTCSS on the receiver input. All that's needed is some cooperation with the distant repeater so that each site is set up to receive a different CTCSS tone. With CTCSS in place and turned on, the repeater transmitter does not activate unless the proper CTCSS tone is present, regardless of how strong the received signal may be from moment to moment. The system is not flawless, but it beats stuffing your ears with cotton.

That brings up a point of courtesy: If you happen to live where you can key up more than one repeater on the same frequency, it would be a good idea to use a directional (beam) antenna. That way, you can "point" your signal at the repeater that you intend to use and leave the other(s) in peace. Also, FCC rules require you to use the minimum power level to maintain good communications—a largely unenforceable rule, but one that just makes good sense. If 5 watts will do, then turn off the 100-watt amplifier. You don't need it. Running an amp when you don't need it just makes you look immature.

Joining In, On the Air

The best way to get started on a repeater is to spend a lot more time listening than talking. You learn a lot that way. Each group has its own set of rituals and ways of doing things. The closer you follow the set pattern, the easier it is to blend in. When you do this, it's much easier to gain acceptance and make new friends.

Once you have the patterns down—it won't take long—it's time to get on the air (if you're really concerned, make some notes of what to say and how to say it; no one will know!). If there's no one talking at the moment, make yourself known by keying the mic and saying something like, "This is WB2D monitoring." (Of course, you use your own callsign, not mine.) Speak clearly, distinctly, and at a tempo in the middle range of the group. If this is your first time using a mic, you may have a few butterflies in the stomach. This is normal the first few times you talk over the radio. Butterflies tend to cause you to speed up, so make a conscious effort to talk slowly (*but not so slowly that it sounds unnatural—ed.*).

When someone calls you back, jot down their name and callsign as you go back to them. In my early days, I once blanked out on my own callsign because I was so nervous. After that, I kept notes in front of me at my operating desk with my name, callsign, phonetics, and any other trivia likely to come up.

How to Talk

Just talk normally with as little jargon and "cutesy" language as possible. One of the fastest ways known to mankind to annoy old-time hams is to use the pseudo-cop language prevalent on CB. The "10-signals" and such that you hear there do not belong here, and using them is an invitation to being ignored, laughed at, or even asked to go away. That's not to say that hams haven't come up with some really stupid-sounding words and phrases themselves over the years. In the early days of FM, it was common to hear someone sign off the repeater by saying that he was "destinated." That non-word always brought up all sorts of bizarre images in my mind when I heard it. Fortunately, it seems to have finally died a natural (perhaps, unnatural) death.

One of the best features of FM communication is that there is little static and communication is clear and easy. As such, there is generally no need for Q signals, phonetics and other aids. Just speak clearly and distinctly. It's a good idea to know the phonetics for your callsign, should someone ask you. Other than that,

the use of phonetics should be kept to a minimum. And save the cute phonetics—"Willy Billy Two Doggie," for instance—for the club meetings or the bar after the club meetings. It just comes across as childish.

If You'd Prefer to Be Alone...

Once you've become active, here are some sure ways to destroy your credibility on the air:

1) Talk incessantly. Launch into long discourses on any subject that comes up. Most repeaters have timers that limit the length of any single transmission, usually three minutes or less. So, one of the fastest ways to get ridiculed is to "time out" the machine. Do it consistently and people will start avoiding you. (*Don't freak out if you do it once, though; everybody does, sooner or later.—ed.*)

2) Closely associated with the incessant talker is the person who forces himself into every conversation that starts on the repeater. It's wonderful to be an active ham whom everyone knows is there when needed or called. But it's also OK to let other people carry on conversations without you, particularly when you have nothing of substance to add to the conversation.

3) Jump in instantly when the other guy stops transmitting. Most repeaters reset their timers when the received signal disappears. As mentioned last time, many repeaters are equipped with a hang-time timer that keeps the transmitter on the air for a few extra seconds. This provides "smoother" listening and saves on equipment wear and tear. Some repeaters have a courtesy tone to alert you that the time-out timer is reset. If the repeater you're using is so equipped, you should wait to hear the courtesy tone before transmitting. Otherwise, just pause a second or so before beginning your transmission. This also gives another station the opportunity to break into the conversation. It's just common courtesy.

4) Insult people on the air. You may just be joking around, but you can be easily misinterpreted. So be careful with the jokes, jabs, insults, and teasing. Some studies suggest that the meaning of the words spoken account for as little as seven percent of the communications received. As much as 60% may come from visual cues. This is a double-edged sword. First, the person you're teasing or joking with on the air may not catch on that you're joking, at least not as quickly as in person. Second, you have no visual feedback to tell you that the other person is becoming uncomfortable. In addition, other people may be listening and not realize that you're joking and may form poor opinions of you.

My Lessons

Unfortunately, it took me a long time to learn my lesson in this area. I like to joke and tease, but I went too far with several people on the air. I thought I was just being cute and funny. Based on subsequent behavior, I believe they had rather a different slant on my "humor." These were people with whom I could have been good friends had I been a little more sensitive.

Repeaters are fun. I've made some great friends on repeaters. I've made all sorts of mistakes, too, many of which have been mentioned here. Just go have some fun, now. ■

Promoting Packet

Packet radio doesn't promote itself anymore, so if you're active and you want more company, you'll need to be more assertive in promoting packet. Here are some tips on doing it effectively.

Since the Internet's arrival into the mainstream of our culture, packet operators throughout the country have lamented that the ham radio digital modes are dying. The explosive growth seen in the early 1990s has reversed itself, with the number of networks and users declining dramatically. This is to be expected, since many of packet's early proponents were really just looking for reliable digital communications—something that couldn't be had anywhere else. The Internet now provides them with a faster, more reliable alternative. However, this mass exodus is not necessarily a bad thing. Now, the only folks left are those who are really interested in packet, willing to endure glacially slow connections and still have fun doing it.

Believe it or not, packet is not a mode that everyone enjoys. Much like any other mode, such as SSTV, CW, or moonbounce, it takes a level of commitment to the mode—financial and otherwise—to participate. I see the future of packet as being just another mode, with a sizable fraction of devoted operators. There will always be those who have tried it, found it uninteresting in some way, and rarely use it again.

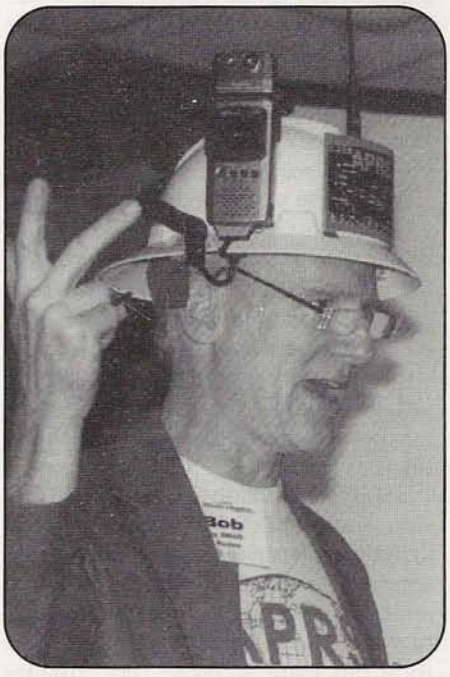
But within that enthusiastic fraction of devoted operators, packet is alive, well, and growing. APRS, the Automatic Position Reporting System, is the hottest use for packet these days, surpassing DX spotting. Packeteers are maintaining networks and, with FlexNet introduced to North America after hibernating for a decade in Germany, some new blood is entering the fraternity. Here in the New York City area, the network is actually growing and, in order to maintain that growth, we need to more actively promote packet in our communities. By promoting packet, I mean talking up the mode to hams and non-hams alike. There are many ways to do this and, this month, we'll take a look at some ideas to accomplish this.

Finding Potential Packeteers

If you were to take a group of 100 hams and explain packet to them, I guess that maybe 70 will have heard about it, 25 will have some interest in exploring further, and five might actually get serious about it. Perhaps the fractions are a little different where you are, but the order of magnitude is at least close. Remember that not everyone will have an interest, much like promoting CW, SSTV, or whatever. The goal is to find those five and give them every opportunity to get "hooked." How do you go about doing that?

First off, we have to find that hypothetical hundred hams. It seems obvious, but you have to go to where the hams are. Find out about the ham clubs in your area, as many as you can, and arrange to give presentations on packet. Most clubs will welcome presentations on just about anything and you gain an audience for a few hours' time. The key to any successful endeavor is information; give them everything they need, in a form they can understand, remove all barriers, give every opportunity.

One effective presentation you can cook up is to explain how to connect your TNC. This is the biggest stumbling block to packet operation, and the process is really quite straightforward. If your audience is already computer-savvy, explain that a TNC is just like an external modem,



Talking Tip #1: Provide props. APRS developer Bob Bruninga, WB4APR, caught everyone's attention at last year's AMSAT conference by beginning his talk with a self-contained APRS and slow-scan TV station mounted on his safari hat. (W2VU photos)

so the connection from TNC to computer is nothing more than an ordinary RS-232 cable. The radio connection is only a bit more complex. All you need is four connections: ground (simple enough); receive audio (speaker output from the radio into the TNC); transmit audio (output from the TNC into the microphone input of the radio); and Push-To-Talk (PTT, also on the mic connector).

Make up a set of overhead slides and print out smaller copies for each person

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Talking Tip #2: Present yourself professionally and dress with authority. Wear a tie, for example, as CQ VHF *6-meter columnist Ken Neubeck, WB2AMU, did at his 1998 Dayton presentation. People will believe you know what you're talking about and take you more seriously. Note that Ken also provided plenty of props.*

so they can take it home with them (or in case an overhead projector can't be found). Briefly explain what packet is, the equipment required, connections to computer and TNC, a little bit about the local network, and who they can call for help (you). It might be a good idea to print out some of the more common radio-TNC connection diagrams, such as ICOM, Yaesu, and Kenwood 8-pin round and HT styles. *CQ* magazine packet columnist Buck Rogers, K4ABT, has about the largest collection of these diagrams (see his Web site at <http://www.packetradio.net>, and be sure to give him credit if you use his material).

Another idea for a presentation topic would be the important TNC configuration commands: MYCALL, TXDelay, MONitor, etc. Be sure to cover setting transmit audio level, and a map of the local user ports and servers would be helpful as well. There are many more topics for presentations you can prepare—using a BBS, surfing the packet network, Chat nodes, DX servers, and so on—allowing you to tailor the presentation to the audience and the time allotted.

"But I'm Not a Public Speaker"

At this point, I can hear a large number of you thinking, "I'm no good at presentations." Yes, you are...or at least you can be. Giving presentations is definitely a learned behavior, not one you're born with. If I can learn to do it, most anyone can.

Getting up in front of an audience requires confidence in yourself, and confidence is gained by knowing the material thoroughly. As you prepare the overhead slides, you'll be learning it all over again, and when you know that you know the material inside out and backwards, you'll be more relaxed. I always get the jitters before starting, but, once I get into it, I relax and get to be myself again. Of course, there are some techniques that might make the presentation better, like eye contact, speaking voice, movement, but you can get those from a book.

I don't care what kind of work you do for a living, you will definitely benefit from becoming a better presenter. An effective presentation helps you get what you want, and being able to get things going your way is the trademark of an effective leader. People who are seen as effective tend to do better in their careers. Even if you're retired, maybe you want to make your point to the town government about something or other; a well-prepared and delivered presentation could tip the scales in your favor.

Visit the local library or bookstore. Look for a book on presentations, read it, and practice. You'll never find a friendlier audience than a bunch of hams, especially when you're talking technical. While you're looking at books, get a copy of Dale Carnegie's classic, *How to Win Friends and Influence People*. This isn't about presentations, but about the psychology of people—what we all need, and how you can use this to influence others.

Most hams I know could really benefit from this book. We're a friendly lot, but tend to be a little bit blind to human relations. There are notable exceptions, of course, but many of us (myself definitely included) are socially inept, as technical people tend to be (politicians, on the other hand, have to master these skills, or they are spectacularly unsuccessful). Best $7.00 you'll ever spend, I guarantee it.

Until you're ready to take on the task of making a full-fledged talk on your own, I'd recommend that you use the CQ video, "Getting Started in Packet Radio," as the centerpiece of your presentation. This 45-minute video covers all the basics in an entertaining and easy-to-understand way. You can then follow up the video with a live demonstration and a Q&A session. Once you get comfortable dealing with an audience during the demo and Q&A, you'll find it much easier to move into making your own presentations in the future.

On the Campaign Trail

Aside from making personal appearances and pounding the flesh (yes, if you're campaigning for packet, you'd better act the part), you can push out information in many other ways. If there is a packet club within driving distance, join it. A club will have resources that one person alone does not. You can get pointers and technical advice from other members, many clubs can share the task of answering new user questions, they might have a newsletter you can pass out to prospective packeteers, and so on. If there is no club near by, then form one. Publicize your meetings, and not just on the packet BBS, either. Most local newspapers offer free space for non-profit club meeting announcements. You could also post a sign at the local electronics store, and mention it on the repeaters during rush hour or the evening roundtable. You know where hams hang out, find them and issue invitations.

Write an article for the local club's newsletter. Write about something you did, plan on doing, or something you know how to do. Club editors are always

happy to print anything they can get their hands on. Put your packet presentation into words and diagrams. Explain everything, whatever you can, from basic to advanced. Even if the readers don't fully understand an advanced topic, they'll get something out of it, and they might get into packet just to learn more. Submit everything you write to all the ham magazines, too...you never know, they might just print it! (*but if you're submitting material to more than one publication at once, please let them all know that.—ed.*) You can then easily get permission to hand out reprints, enhancing your credibility. It thickens your wallet a little, too.

It would also be helpful to join a larger packet organization, such as TAPR (Tucson Amateur Packet Radio), NEDA (North East Digital Association), SEDAN (Southeastern Emergency Digital Assn. Networks), or TPRS (Texas Packet Radio Society). Again, there is yet another level of resources available. Most will let you reprint articles from their newsletters with an acknowledgment, and all accept articles from anyone for publication. You also have a much larger membership that can help with questions.

An often overlooked benefit of membership to a large regional packet club is contacts. You get to meet the network node operators and perhaps gain their cooperation when you want to put up your own link into the network. If you don't know these people, it's really difficult to build onto the network. It's also easier to cooperate with what exists than to create something new, not to mention that packet isn't so popular that we can afford a duplication of efforts.

Beyond Hams

One excellent source of packet enthusiasts that doesn't necessarily include all hams is the local emergency management authorities. Packet really shines at transferring large amounts of written information, with no errors, to multiple destinations in a brief time. Your county or state emergency management authority would just love to have something like packet as a cheap and reliable backup system.

Start with the local authorities or your ARRL Section Emergency Coordinator by explaining what packet is, what it does, and offer some examples of what it can do for them. Ask for ideas on how to approach the county and state folks, the hospitals, shelters, and so on. Offer to specify and build a network for them, and be prepared to set up a demonstration network for them to try before they commit funding. Just imagine linking together every hospital and police station in your state (what a source for node sites!) and getting someone else to pay for it!

Of course, the emergency network should have local hams who will care for it and who will constantly pass traffic on it to ensure it is always working. A word of caution: Don't try to do this alone. Get help in maintaining the network. In an emergency, you won't be able to travel far to fix whatever's broken.

Some Things That Do Not Work

Certain approaches to promoting packet are not likely to work and I recommend you avoid them:

Buying a network. If you take a large amount of your own money and buy a ton of equipment, install it and get it all working, you'll be disappointed that nobody will use it much. First of all, potential users need to know about your network, so promoting it in person is essential. Second, if they didn't have to work or suffer for it, it has little value to them. No pain, no gain. A sense of ownership, if missing, will hurt operations and, if present, will greatly enhance it.

Ignoring what's already there. If you do something that upsets the existing network or the people operating it, you'll face an uphill battle. Don't put up a dumb digipeater on the user port frequency without asking anyone or you'll only get "flamed" into toast. Don't create links where none are needed, or compete with the established BBS. However, if the existing conditions are unbearable, say the BBS op is a "lid" for example, then go ahead and shake things up. Don't give up just because the "gurus" claim that such a link is unnecessary—keep working to get it going. Just don't try it without support from others...unless you enjoy being a pariah.

Expecting others to do it. If you want to put up a link, expect to pay for *both* ends. I know that I wouldn't pay for half of a link to someone else's site. I also wouldn't take "orders" from someone else to give a presentation at a meeting, set up a booth at a hamfest, or whatever. If you want it done, don't try to delegate —do it yourself. Read Dale Carnegie's book on some ways you can entice others to help, but you've still got to take the lead here.

Talking Tip #3: There's nothing like a live demonstration to generate interest in what you're doing—and it doesn't have to be formal, either. Here, we're back at the 1998 AMSAT conference, where WB4APR (on table) is tuning in 9600-baud signals from the POSAT satellite (PO-28), while Steve Bible, N7HPR (center), shows another ham the downlinked information as it appears on the screen of his palmtop computer.

Not trusting others. I have a few TNCs that are a little beat up but still functional. I loan these out for people to try. Some like them and actually ask to buy them after a while, but many return them after a year, finding that packet isn't what they want. I even loan out radios (there are some I haven't seen in nearly eight years), but I know they're still in service, and the guy borrowing them knows who owns them. I hope.

Investment (of Time) Required

I won't claim that promoting packet, or anything else for that matter, doesn't take

a deep personal commitment, a lot of time and effort, and some sacrifice. Be careful to keep it from getting between you and your family; this happens easily. Think about your specific goals and outline the process for getting there. Enlist the help of others by building their enthusiasm, but remember that you'll have to take the lead. Good ideas are a dime a dozen, but implementing them is the real work.

Oh, before I forget: If you belong to a club with tax-exempt status from the IRS (such as TAPR or the ARRL), and you have expenses related to volunteer work performed for them, you might be able to deduct these expenses from income taxes. This can make all those miles you drive from meeting to meeting a bit easier to justify. Check with your accountant or tax advisor and keep careful records.

So, get out there and tell the world about packet. Local clubs, hamfests, emergency management authorities are all good places to find people interested in packet, although each for their own reasons. Think like a politician (but be honest), or perhaps a preacher, and get out there and inform the world of what they're missing. Or at least how to connect the radio to the TNC.

Backyard Update

I've been making slow but steady progress with the laser-to-the-shed project (see "Digital Data Link," December, 1998, and April, 1999, issues). Murphy has reared his ugly head more times than I care to think about, but I've actually got it working...somewhat. Next month, I'll provide an update, along with a foray back to the basics. Until then, make plans to visit a club and explain the network to them. 73,

—N2IRZ

Resources

"Getting Started in Packet Radio" and other CQ videos are available for $19.95 each, plus shipping, from the CQ Video Library, 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926; E-mail: <cq-vhf@cq-vhf.com>; Web: <http://www.cq-vhf.com>.

For more information on the regional packet organizations listed above, contact:

NEDA (North East Digital Assn.), P.O. Box 563, Manchester, NH 03105; Internet: <http://www.cam.org/~burt/neda/>.

SEDAN (Southeastern Emergency Digital Assn. Networks), Web: <http://www.sedan.org>.

TAPR (Tucson Amateur Packet Radio), 8987-309 E. Tanque Verde Rd., #337, Tucson, AZ 85732; Phone: (940) 383-0000; Fax: (940) 566-2544; E-mail: <tapr@tapr.org>; Web: <http://www.tapr.org>.

TPRS (Texas Packet Radio Society), P.O. Box 50238, Denton, TX 76202-0238; Web: <http://www.tapr.org/tprs/>.

What Does Satellite Tracking Software Do?

Amateur satellite operators commonly use tracking software. These computer programs provide convenient information and/or automatic control of radios and antenna rotors at fast update rates. Let's look at the basic functions of these computer programs.

Tracking software is one of the most convenient tools available to the satellite operator. These computer programs automate complicated calculations, plot satellite positions, make radio-tuning adjustments, and point your antennas, all at high speeds. Two previous "Orbital Elements" columns provided reviews of specific satellite tracking programs. This article explains what satellite tracking is and what tasks tracking software typically performs to make satellite operating simpler and more pleasurable. I've given the information at a conceptual or functional level without the gory mathematical details.

What Is Tracking?

My definition of satellite tracking is any activity that monitors the position or flight progress of an orbiting object. Tracking a satellite's current position and flight progress (i.e., real-time tracking) is the most important software function when communicating with an amateur satellite. The most important real-time tracking functions are graphically plotting the satellite's flight progress, determining antenna pointing angles, and determining tuning corrections to correct for Doppler frequency shifts.

Most tracking software also provides pass predictions. Pass predictions are a non-real-time tracking function that tells you when the satellite of your choice will

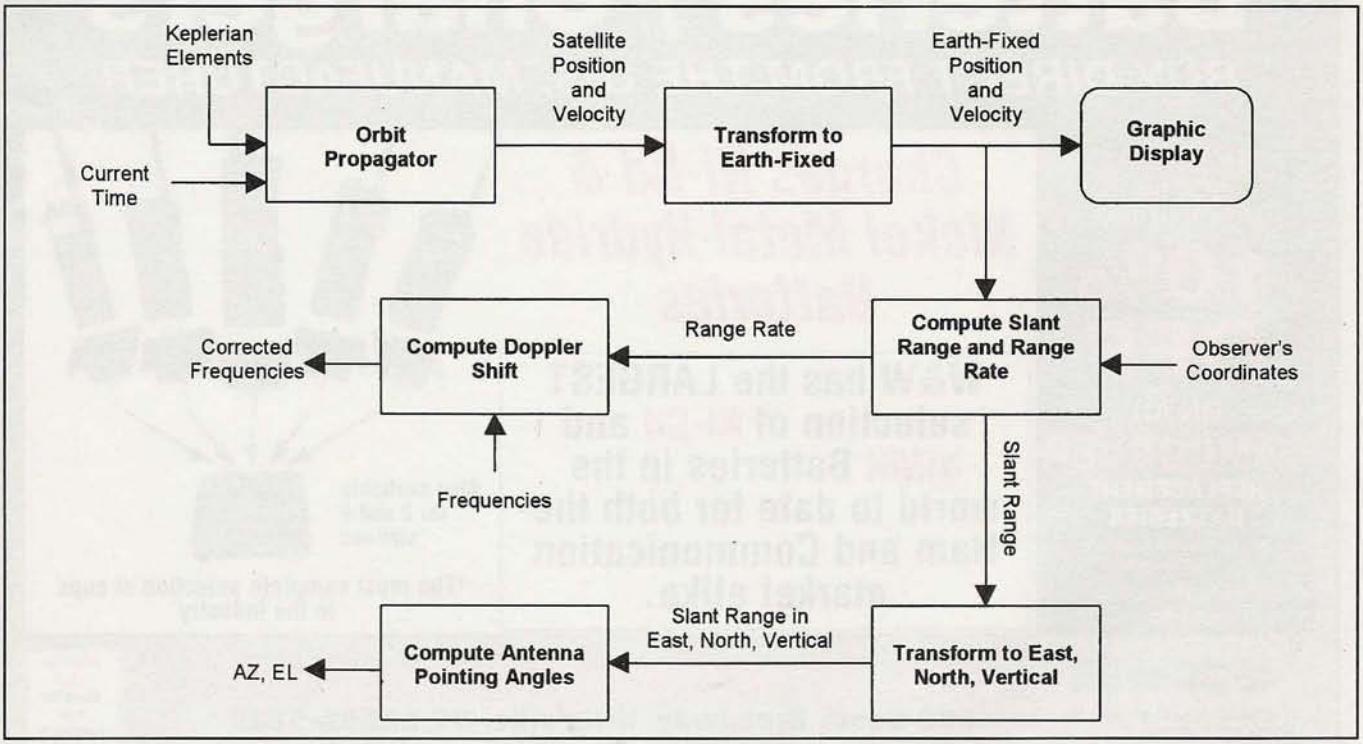


Figure 1. Satellite tracking program flow diagram. Inputs include observer's location, operating frequencies, current time, and Keplerian elements. Outputs include Doppler-corrected frequency information and antenna pointing angles.

By Ken Ernandes, N2WWD (n2wwd@cq-vhf.com)

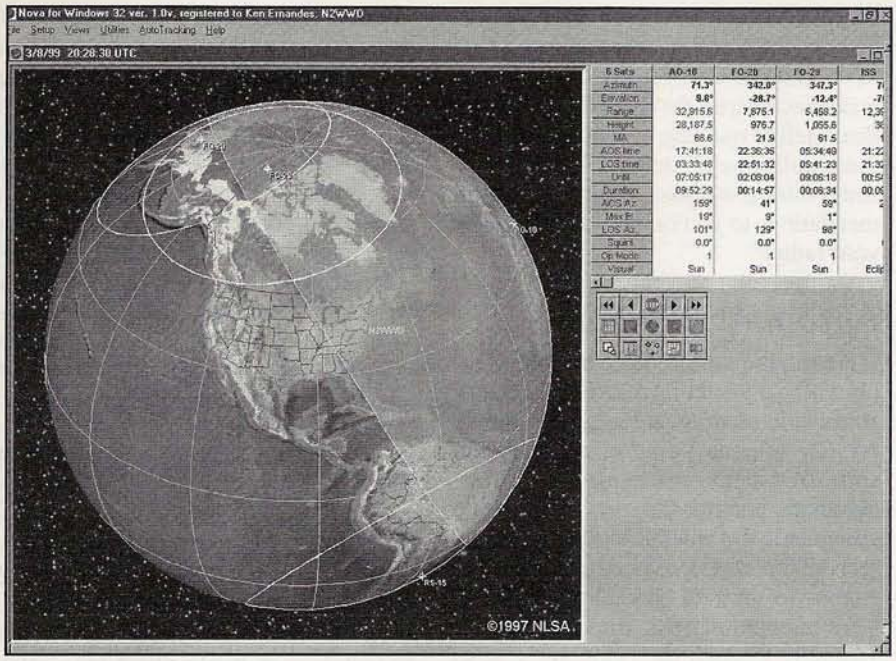


Figure 2. Graphic display from the Nova satellite tracking program. What you see on the screen may vary from program to program, but the basic information is the same regardless of which one you use.

be in your view and available for communications. This lets you plan your operating schedule days, or even weeks, in advance. Satellite pass predictions are far more accurate than any method of predicting HF band openings.

Tracking software needs to know the characteristics of the satellite's orbit to compute its position and flight progress. It also needs to know the operator's location when determining operator-specific information, such as pass predictions, antenna pointing angles, and Doppler frequency shift on the communications signals. The following sections will give a little more detail on how the software uses this information to perform these tracking functions.

Satellite Positions

One of the more mysterious tracking functions is predicting a satellite's position at a desired time. For real-time tracking, that desired time is now (i.e., where is the satellite now?). *Keplerian elements* describe a satellite's orbit mathematically at a snapshot in time. How, then, do you use this information to determine the satellite's positions at various desired times? The answer with a special sequence of calculations (or algorithm) called an *orbit propagator*. Most orbit propagators expect you to give them the satellite's Keplerian elements once and the propagator will give you the satellite's position (location) and velocity (speed and heading) corresponding to any time(s) you input. Figure 1 illustrates this as part of the tracking process in a flow diagram.

There are many excellent orbit propagators available in the public domain, but the most relevant one is NORAD's Simplified General Perturbations, version 4 (SGP4). (*NORAD is the North American Air Defense Command and it keeps track of virtually everything that's orbiting the Earth.—ed.*) I call SGP4 the most relevant because it produces the most accurate predictions from the NORAD Keplerian elements made available by NASA. I should point out that SGP4 is not the most accurate orbit propagator in the world—just the one that gives the most accurate result for the most commonly available data.

One inconvenience of most orbit propagators, including SGP4, is that their output positions and velocities are vectors in a non-rotating (inertial) astronomical coordinate frame of reference. This inertial frame of reference makes the propagator's calculations easy, since satellites normally orbit in nearly stationary planes.

We live on the surface of the Earth, which is a rotating body. Since our location references (lines of longitude and latitude or grid squares) rotate with the Earth, we need to relate the satellite's position velocity to these Earth-fixed references. This is done by another mathematical process called a *coordinate transformation*, also shown in Figure 1. Once we know the position and velocity vectors relative to the Earth, we can compute the satellite's longitude, latitude, heading, and speed relative to the Earth.

Plotting Graphically

Figure 2 is an example of the Nova tracking program's graphical plot. Plotting the satellite's position and flight progress on a map or globe projection is a useful tracking tool, and its value shouldn't be underestimated. The old saying, "a picture is worth a thousand words" applies to the tracking graphical display. Besides being just plain attractive, showing the satellite's position and flight progress conveys a lot of information to the operator, such as who else is in the satellite's communications range and who may be coming into the satellite's range soon. This is valuable information if you're planning a contact with a friend, trying to work all states via satellite, or looking for some exotic DX.

Which Way Do I Point?

The satellite tracking program needs to know your position on the Earth's surface before it can tell you which way to point your antennas. The tracking programs usually ask for your latitude, longitude, and altitude (above sea level), from which it computes your position (in vector form relative to the Earth). The satellite's position relative to you (i.e., the slant range) is then computed by subtracting your position vector from the satellite's position vector as shown in Figure 3. The tracking program computes the antenna pointing angles from this slant range vector.

Satellite antenna pointing angles are usually expressed in terms of *azimuth* (*AZ*) and *elevation* (*EL*). AZ is the angle measured clockwise along the horizon from north to the satellite's direction. So, at 0°, the satellite is at true north; it's 90° when east, 180° when south, and 270° when west. (AZ is similar to a compass bearing except that compass bearings are relative to magnetic north, while AZ is relative to true north.) EL is the angle of the satellite above the operator's horizon, ranging from 0° on the horizon to 90° directly overhead.

The tracking software computes AZ by measuring how much of the slant range

points north (or south) versus how much of the slant range points east (or west). Similarly, the tracking software computes EL by measuring how much of the slant points vertically compared to the full slant range. The AZ and EL angle calculations are done with trigonometry using the north, east, and vertical slant range components.

Doppler Compensation

The Doppler effect is a frequency shift between you (the observer) and the object you're observing (in this case, the satellite) due to the velocity difference between the observer and the satellite.

The best-known example of the Doppler effect is in audio frequencies, using a simple train whistle. As the train is approaching, the pitch on the whistle is higher. There's an abrupt change as the train passes, with the whistle frequency becoming lower as the train moves away from the listener. Doppler works basically the same way with radio frequencies, except the object you're observing needs to be moving much faster than a train before the frequency shift is enough for you to notice. Satellites, such as the Space Shuttle, move at 17,000 miles/hour (28,000 kilometers/hour) and the Doppler effect is definitely noticeable at VHF and higher frequencies.

To compensate for the Doppler effect, the ground observer needs to adjust both transmitter and receiver tuning. When the satellite is approaching, you need to adjust your receiver higher, since the Doppler effect has shifted the satellite's (perceived) transmitting frequency higher. The ground operator also needs to make this adjustment for the satellite by transmitting on a lower frequency so that, after the Doppler shift, your frequency matches the satellite's receiver. So in the early portion of a pass, when the satellite is approaching, you transmit low and receive high. Similarly, when the satellite is moving away, you transmit high and receive low.

How do you know how much to shift the transmitter and receiver frequencies at different times during a pass? That's actually a bit complicated because the amount of Doppler shift depends on both the radio frequency and how quickly the satellite is approaching you or going away from you. The rules are: a) the higher the frequency, the greater the Doppler shift; and b) the faster the satellite is approaching or receding, the greater the Doppler shift. This is even more complicated in practice, since the apparent speed of the satellite changes during a pass and is not necessarily the same for each pass. But satellite tracking programs can compute uplink and downlink frequency shifts during the pass and make recommendations to you or automatically tune your radio.

Automatic Control

Automatic controls are convenient features of many satellite tracking programs. Automatic controls are most commonly AZ/EL antenna pointing and Doppler shift frequency compensation. Under automatic control, the tracking program commands the antenna rotor to the correct AZ/EL angles and/or tunes the transceiver to correct for Doppler shift. Communication with these devices is generally through the computer's serial (COM) or parallel ports. Thus, in addition to making antenna pointing and Doppler frequency shift calculations, most tracking software can command the rotor and/or transceiver to track the satellite.

Yaesu has the most popular two-axis AZ/EL rotors for satellite communications, the Yaesu G-5500, which is the replacement for the G-5400B, the previous standard satellite antenna rotor. The Kansas City Tracker® is the most popular among more than a half dozen available hardware interfaces for the Yaesu satellite rotor. Many satellite tracking programs can accommodate one or more of these interfaces. Each interface is commanded differently, so the tracking software needs to know which hardware interface is connected between the computer and the rotor control box.

Many modern transceivers have control interfaces to your computer's COM port. In the case of the Yaesu FT-847, for example, this is simply a null modem cable hookup. Some other transceivers require an interface that is little more than a few electronic components. Through these interfaces, you can not only set frequencies (for Doppler correction), but you can also command different modes, such as USB, LSB, CW, and FM. As with rotor control, the tracking software needs to know which transceiver it's controlling since each major brand (as well as some individual models) have different sets of commands.

Pass Predictions

Pass predictions let you know which satellites will be above your horizon (i.e., within line-of-sight) at what times. This is very helpful for planning your operating schedule. The satellite tracking program searches a time period of interest

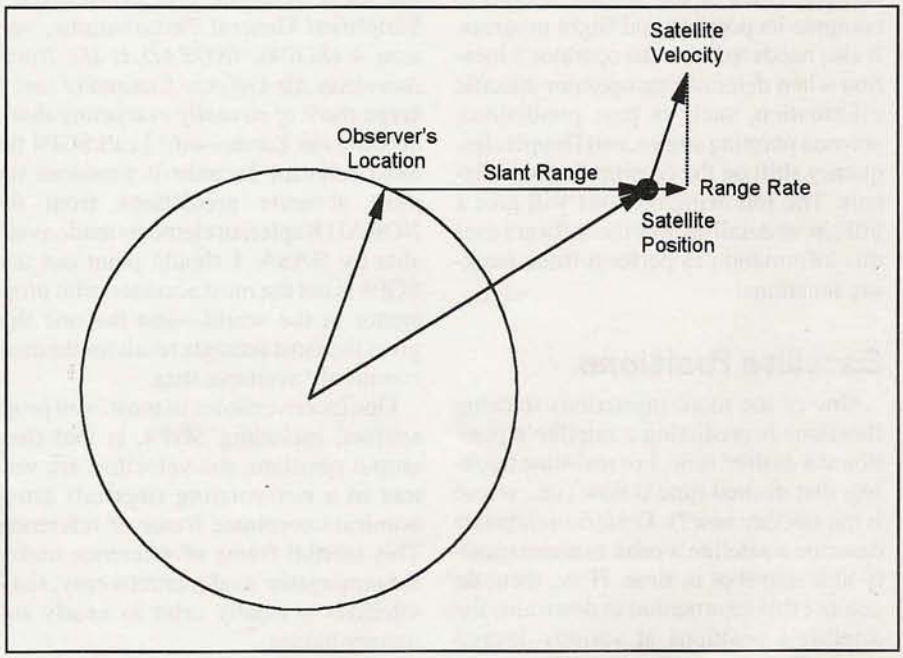


Figure 3. Satellite tracking programs calculate the times of satellite passes and antenna pointing angles by determining the satellites' "slant range" and "range rate," which are in turn calculated from information on the observer's location and the satellite's position and velocity at a given point in time.

(usually in the future) and lists the pass opportunities it finds in tabular and/or timeline (graphic) format. This process uses the same computations needed for antenna pointing and usually also has search strategies to find the pass opportunities quickly and efficiently.

Keeping Your Data Current

The computations a satellite tracking program makes can be no more accurate than the data you provide the program. In other words, garbage in, garbage out. There are three basic things you need to do to ensure the tracking program gives you accurate results. First, you need to give the program accurate coordinates for your location. Second, you need to make sure your computer's clock is set to the correct time (within a second or so) for accurate real-time tracking. Finally, you need to make sure your Keplerian elements are up to date.

The first one is relatively easy. If you always operate from the same location, your station's geographic coordinates only need to be entered once into the tracking program. Time is slightly more difficult, since computer clocks can drift quite a bit. You can manually set your computer clock from WWV broadcasts or you can do an automatic update from a GPS receiver or from several sites on the Internet.

Keplerian elements also need to be updated periodically. The longer the time difference from epoch time (the starting point for your current set of elements) to the present, the less accurate your predictions of the satellite's position tend to be. In general, the narrower your antenna beam width, and the more automated your station is, the more frequently you should update your Keplerian elements. While it doesn't hurt to update as frequently as is practical, once every week or two is usually good enough. My personal Web site (see "Resources") has up-to-date information, usually with three major updates per week and minor updates daily.

Summary

Satellite tracking programs give you a convenient way to monitor a satellite's position and flight progress, often with a graphic display. These programs perform complicated sets of computations to determine antenna pointing angles and the correct transmitter and receiver frequencies to compensate for Doppler shift. Many satellite programs also have connections to the rotor and/or transceiver that allow them to automatically point the antennas at the satellite and track it across the sky and tune the transceiver, correcting the frequencies for Doppler shift. ■

Resources

For updated Keplerian elements, you can visit my Web page at <http://www.mindspring.com/~n2wwd>. There are also e-mail lists available, through ARRL and AMSAT, which will automatically e-mail you updated element sets each week. For more information, see their respective Web pages at <http://www.arrl.org> and <http://www.amsat.org>.

The "Orbital Elements" column in the July, 1998, issue of *CQ VHF* reviewed two specific satellite tracking programs, "STSPlus" and "The Station Program." The April, 1997, issue, covered the "WiSP" program. Back issues are available for $4 each, postage included, from *CQ VHF* magazine, 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926; E-mail: <cq-vhf@cq-vhf.com>; Web: <http://www.cq-vhf.com>.

Many popular tracking programs may be ordered through AMSAT, the Radio Amateur Satellite Corporation, at P.O. Box 27, Washington, DC 20044; Phone: (301) 589-6062; Fax: (301) 608-3410; Web: <http://www.amsat.org>.

For information on the Yaesu G-5500 AZ/EL rotor, see your favorite ham dealer or contact Yaesu USA, 17210 Edwards Rd., Cerritos, CA 90703; Phone: (562) 404-2700; Web: <http://www.yaesu.com>.

The Kansas City Tracker is available from L.L. Grace Communications, P.O. Box 1345, Voorhees, NJ 08043; Phone: (609) 751-1018; Fax: (609) 751-9705; Web: <http://www.llgrace.com> (please note that those are lower-case "L"s, not ones, in the Web address).

A Mini Course in Microphones—Part 3

In Parts 1 and 2 of this series, we discussed the different types of microphones you might use and how to equalize your mic to match your voice. Now, we'll finish up with notes on hooking up your mic to your rig, and maybe even building a mic on your own!

This month's column concludes our three-part series on microphones and the quest for beautiful sounding audio. On tap this time are discussions of interfacing various mics and rigs and homebrewing mics, and we'll even squeeze in some ideas on collecting (and using!) classic microphones for a special fun treat. Incidentally, if you missed the first two parts of this series and/or their background information on technical specs and measurements, I would heartily encourage you to get copies now while back issues are plentiful. See "Resources" at the end of the column for information on ordering back issues.

Before delving into this month's discussions (and they are indeed captivating!), let's add a few more tips and notes that would not fit in last month's column. Hang on and read closely—we have quite a bit of good ground to cover!

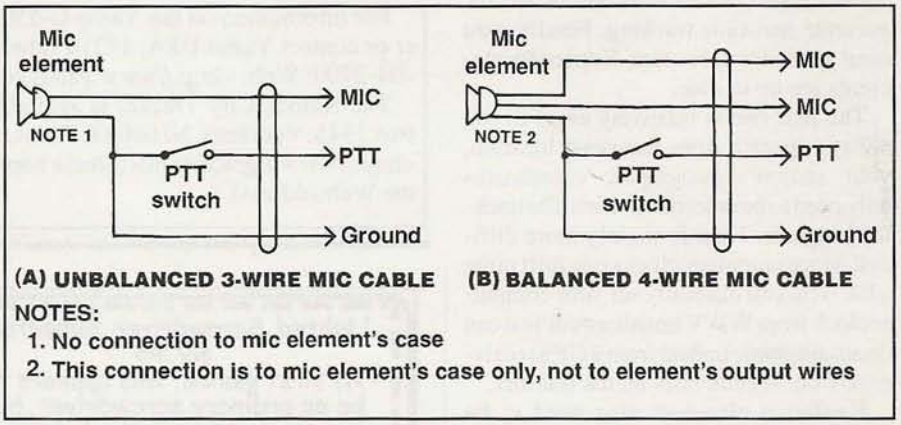


Figure 1. Comparison of wiring arrangements for unbalanced (A) and balanced (B) mics/cables. Up/down tuning wires and audio output for an extra speaker are also included in many eight-pin/eight-wire microphones.

More Tips, Tidbits, and Notes

Once engrossed in (addicted to?) the pursuit of superb-sounding audio, an almost endless number of additional and closely related tidbits worthy of consideration beg to be shared. These following notes are presented for your general knowledge and "mix 'n match" pleasure.

First, rumors of one type or make of transceiver "sounding better" than another may indeed hold merit. True FM rigs, for example, tend to sound richer and more robust than phase-modulated transceivers. Next, SSB filters in Kenwood gear are usually wider in bandwidth than other rigs' filters; consequently Kenwood's transmitted audio usually sounds more full-bodied. Vacuum tube amplifiers also get into the act by producing even-order distortion products, which are pleasing to our ears; while solid-state amplifiers produce odd-order distortion products that our ears often interpret as brash (remember, audio frequencies are low, so some harmonics fall within a radio's audio passband).

Collins SSB gear traditionally had narrowband 2.1-kHz SSB filters, yet it was world-famous for outstanding audio. Why? During production and/or factory alignment, the IF's (intermediate frequency's) injection/local oscillator was meticulously set so the center and sides of the filter's response curve emphasized mid-range tones. It boosted 1800-Hz tones, while rolling off tones outside the 300- to 2400-Hz range, thus adding a sort of in-rig audio equalization. Later, other manufacturers made that oscillator frequency adjustment a receive-only front panel control and called it *IF shift*. Tune the IF shift on your SSB rig and notice how it emphasizes bass, mid-range, or treble tones of received stations. Interesting, eh?

Here's another tidbit. In talking with Greg Weremey of Electronic Service Professionals (see "Resources"), I learned that he does more than modify D-104 mics as mentioned last month. One attention-grabbing service is modifying Kenwood TS-520/530/830 rigs so their IF shift works on *both transmit and receive*. Combine that with a mic equal-

By Dave Ingram, K4TWJ (k4twj@cq-vhf.com)

Photo A. If you appreciate great audio and want your rig to sound as good as a big home stereo, cable one of these Alpha Delta VRC speaker systems to its output. The unit features adjustable bass/treble equalization, a ducted port bass reflect speaker, and can make your home or mobile station sound like a recording studio. Photo courtesy Alpha Delta Communications, Inc.

ized for your voice and you might even get SSB audio that approaches the sound quality of FM. Whew!

Do I sense some readers now asking how receive audio can be improved so it sounds as good as your transmitted audio? Once again, equalization is the key, and that pursuit can be as simple or as sophisticated as you desire. Want an "instant good results" example of that statement? Check out Alpha Delta's audio equalizing "Variable Response Console" speaker system shown in Photo A. This unit has a built-in ducted port bass reflex speaker, push-pull (even harmonic) audio amplifier with 12-db boost/attenuate bass adjustment, and twin SCAF filter with adjustable cutoffs up to 10 kHz. It makes off-the-air FM, AM, SSB, or even CW recording studio quality. Want to really blow away the local mobile gang? Connect one of these "VRC" speakers to the (already transmit audio-equalized) rig in your car for a real rolling romper! For more information on VRC speakers, see "Resources."

Interfacing Mics and Rigs

One of the most frequently asked questions in amateur radio circles is how a particular microphone or mic element can be used with a specific model transceiver. That's a most understandable inquiry for sure, but the vast number of mics and rigs in existence makes a simple "applicable to all" answer impossible. So let's take a quick look at some of the main factors associated with interfacing, then you can answer that question according to your own needs and criteria.

First, *older model vacuum tube-type transceivers* typically utilize a high-impedance and unbalanced mic input and usually prove the easiest to mate or interface with crystal or dynamic mics. Microphone elements usually have two output wires for hookup to an external unit or circuit. If the mic/element has unbalanced output, one of its two wires is connected to ground and the other wire is connected to the input circuit/plug's "hot" or "positive" terminal (for most communication mics, there's a third wire, for push-to-talk, or PTT; see Figure 1A). If you can follow a basic wiring diagram or description like "mic hot to plug's tip, PTT to plug's center ring and ground for both to shell or back end of plug," hookup is usually a snap. Just be sure to match impedances and check (scrutinize) transmitted audio quality.

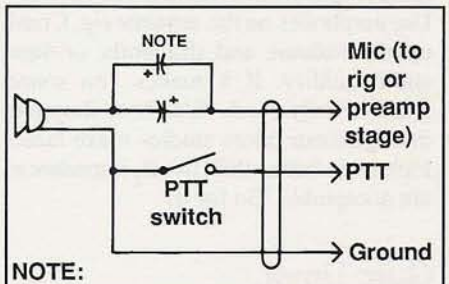
Some of the later model transceivers (Kenwoods in particular) have a low-impedance and balanced microphone input. In this case, both microphone wires are insulated from, or "above," ground and connect to separate pins on their related plug or socket. PTT and ground wires also connect to separate plug/socket pins, as illustrated (and compared to an unbalanced mic cable for clarity) in Figure 1B. If you try to interface an unbalanced mic and a balanced input rig by grounding one of the mic's wires to the rig's cabinet or by grounding one of the rig's two input pins, the result is usually hum on your transmitted signal (sound familiar?). Study the mic element you wish to interface, however, and you can usually find a way to connect its two wires to a rig's two balanced input pins without grounding either one. Then, if necessary, the mic's metal case (not the element's case or wires) can be grounded as necessary to avoid RFI (radio frequency interference).

Interfacing Electret Mics

Microphones with electret elements, as discussed in my past two months' columns, are used in many FM handhelds, various VHF and UHF mobile rigs and (to the best of my knowledge) all ICOM transceivers. As I have also pointed out, the "phantom voltage" to power an electret element's associated preamp is supplied from its mating transceiver, through connecting pins on the mic socket. Some preamps operate from a 6- to 8-VDC source, and some require only 1.5 or 3 VDC. Interfacing thus calls for a bit of "electronic detective" work to first determine if the preamp is in the mic's case or its element, then applying minimum voltage required for proper operation. Studying the manual or spec sheets of both your rig and mic can prove most helpful here. If they're not available, you may be faced with a "try and see" dilemma—but be careful with "mystery" elements/mics.

If you direct-connect a crystal mic's element to a rig with phantom voltage on its mic socket, the element can be permanently damaged. Placing a 1-µfd non-polarized capacitor in series with its positive or "hot" output lead will block phantom voltage (if you can't find a non-polarized capacitor of this value, two reverse-connected polarized capacitors will accomplish the same thing; see Figure 2), but you may then need to add a preamp back in line to compensate for lost gain. You can possibly slip by this entanglement by changing only the mic's element and leaving its preamp intact (assuming, naturally, that the element and preamp are separate items). Once you get it going, recheck audio quality.

Anytime you interconnect a non-matching mic and transceiver, there's a possibility of noticeably mismatched impedance—and consequent altered frequency response. Read that last sentence again: it explains why some mics adapted from one application (such as a tape



NOTE:
If available, use one 1-5µF, 16-25V non-polarized capacitor. Otherwise, two "reverse connected" polarized capacitors may be substituted (as shown).

Figure 2. Adding a non-polarized capacitor or dual polarized capacitors (see note) in series with a rig's electret mic element or mic wire will block phantom DC voltage and protect a different type/non-powered mic element. See discussion in text.

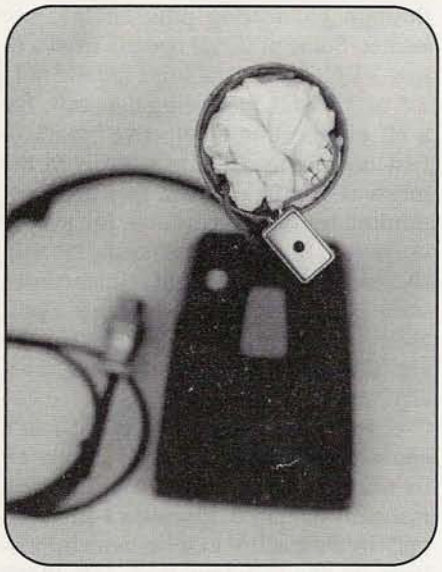


Photo B. Here we are breathing new life into an old and discarded mic by upgrading it with a Heil HC-5 "full bodied" element. A new (homebrewed) cable with plug has also been added. Next, the element's wires will be replaced with shielded equivalent. Then the element will be secured in place with double-sided tape and the grill will be taped back in place.

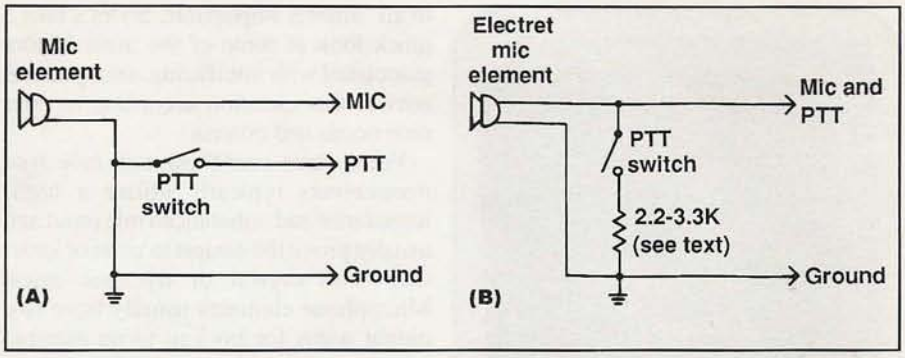


Figure 3. Popular wiring arrangements and PTT activation schemes used with modern hand-held FM transceivers. Figure 3A shows the conventional three-wire hookup, which has one line for mic audio, one line for the PTT switch, and one shared ground line. In 3B, we have a two-wire hookup for an electret mic, in which both mic audio and PTT share one wire. When the PTT is pressed, a resistor in series with the switch causes a voltage drop that sends power to the element's preamp. See discussion in text.

recorder or computer sound card) to another (such as a ham rig) may sound tinny, bassy, or mushy. Can impedances be measured with a volt ohm meter (VOM)? Not really. Impedance is AC resistance. A VOM measures DC resistance. Ah, but Doctor Dave offers a good alternative idea. After hooking up your mic and rig, transmit into a dummy load and tune in your signal on a separate rig (borrow one from a friend if you need to). Use earphones on the separate rig. Crank up the volume and diligently critique audio quality. If it makes you sound good—*really* good—like those shopping mall glamour photo studios make ladies look even better than usual, impedances are acceptable. Go for it!

Quiz Time!

Are you starting to visualize the concept of interfacing mics and rigs? OK, answer this question: What might result if you connect a dynamic or controlled-reluctance mic/element to a transceiver set up to use an electret mic? Think back on element construction and you can answer correctly. The element's coil of fine wire will either burn out and open like a short circuit popping a fuse, or (if the coil of wire is heavier) short out the transceiver's phantom mic voltage power supply. Either reaction equates to an unnecessarily expensive repair that could have been avoided by first checking your rig's mic socket for phantom voltage. Yes, and once again a 1-µfd non-polarized (or even a 2- or 4.7-µfd non-polarized) capacitor could block DC voltage without altering frequency response (once again, see Figure 2).

Let's try one more interfacing question. What would result if you connected an electret mic/element to a rig set up for a dynamic mic? The answer is "no workee"—nil. Why? Because the preamp is not powered. Will the rig be damaged? No, not unless it has audio output or tuning voltage on pins you mistakenly or accidentally short circuit by improperly wiring a mic plug. Hmmm, maybe you should also read that last sentence again. Sometimes we think we see wiring diagrams right when in fact we see their pin numbers wrong, or we look at a plug from the front (or back) rather than in the manual's way. Then, too, our second looks or checks tend to be oriented toward confirming that our wiring is correct rather than honestly hunting for something—anything—wrong. My philosophy here is, "if there was not something wrong, it would work." Doesn't that seem logical?

Notes on Homebrewing Mics

We occasionally need a rough-and-ready microphone for some special application like hands-free mobiling, bicycling, or walking portable operations. In such cases, your "microphone" might consist of a small custom element mounted in a "salvaged-from-the-junkbox-and-enthusiastically-resurrected" enclosure, like the one shown in Photo B. Or you might creatively adapt an item like a shower head (Photo C) to concoct a one-of-a-kind enclosure. There's absolutely nothing wrong with such forms of self expression. Just exercise good electronic practice and enjoy! Who knows...you might even start a new trend in microphone styling!

"Anytime you interconnect a non-matching mic and transceiver, there's a possibility of noticeably mismatched impedance—and consequent altered frequency response."

With those thoughts in mind, some basic facts and considerations applicable to home-assembled mics follow.

Some FM talkie speaker mics are straightforward and some are doggone confusing. The "three-wire versions" illustrated in Figure 3A are easiest to understand as they have separate connections for element, PTT, and ground. However, the "two-wire hookups" illustrated in Figure 3B require some study and maybe some dinking. Here's why: the electret mic element requires operating voltage, but its "hot" wire is also used for the PTT line. How is this possible? A resistor of usually between 2200 and 3300 ohms is connected in series with *only* the PTT switch. When the switch is closed for transmit, the voltage drop across the resistor powers the electret element. But isn't the mic-impressed volt-

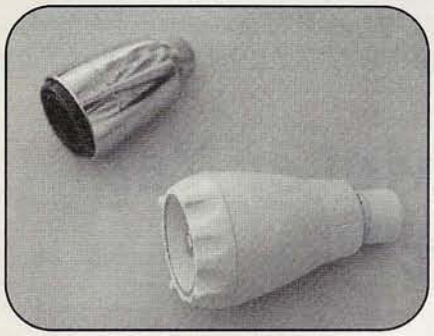


Photo C. Adapting or modifying a shower head makes a unique mic case for home use. Line the inside of a plastic head with copper or aluminum foil (and ground it!) for maximum RF immunity.

Photo D. This impressive collection of famous mics belongs to the Shure Brothers Company and includes treats from the roaring '20s and fabulous '50s to the '90s. Getting behind any one of these heartthrobs truly makes one feel like a big-time broadcaster! Photo courtesy Shure Brothers.

age greater when the PTT switch is open? Yup: zener diodes protect the element's preamp in that case. So how do you determine proper resistor value? Just connect a 5K-ohm pot in lieu of the resistor, key the PTT, and adjust the pot until the talkie just reliably switches to transmit mode—no more, no less. Then measure the pot's value and replace it with a fixed-value resistor. Bingo, one custom speaker mic.

Now let's quickly add a few extra notes. First, double-sided tape (the thick variety) makes good mounting material for fitting an element in an enclosure. Second, thick grill cloth (or a hefty wind screen) will attenuate upper audio frequencies. Listen to your homebrew mic while trying various grill cloths in/behind its grill. That way, you'll know exactly how it sounds with your voice and your rig on the air. Good luck homebrewing an artistic mic and we invite (encourage) you to share a photo of your brainchild with readers worldwide via this column!

Collecting Class Mics

More and more radio amateurs are collecting both attention-grabbing mics and keys from eras past, and with good reason. They have a special warmth and glamour, they are true hold-in-your-hand pieces of communications history, and many of them can be effectively used on the air with modern rigs today. How do you start collecting mics?

That's a very good question, as finding them is the first big challenge. Knowing when and how to jump quickly when a special goodie is found is even more difficult. You spot one being unloaded or under a table at a fleamarket, or maybe in a behind-stage junkbox at an old church, theater, or school. The gem registers in your mind (wow!), but you question if another collector would consider it a "collectable," and divert your attention to something else. Then it's forgotten. A few days, weeks, or months later, you realized you passed up "going for the goodie." The moral? Be (stay!) prepared and remember the best opportunities surface at the most inconvenient times...and may never be repeated.

There are no set guidelines on collecting mics. Every collection is different and unique. They range from small (a few personal memories or favorites from yesteryear) to quite large (a couple hundred mics). One admirable collection is the group of Shure Brothers delights shown in Photo D. These beauties cover more than six decades and really look dazzling.

Prices or values of mics also vary widely. The only criterion I can offer is this: a proper price equates to what the buyer will pay and the seller will accept. One final suggestion: consider building a "petting zoo" so you can occasionally enjoy using each mic on the air, maybe on FM where its beauty can really shine. You could become a star for such terrific sounding audio. Really!

Gracious goodness, I have once again overflowed available space and must bow out for another month—and quickly! Here's hoping you acquired a wealth of knowledge from this three-part series on microphones. Now, reread all three parts for even greater understanding and stay tuned for more hot topics in future columns. 73,

—Dave, K4TWJ

Resources

To order back issues of *CQ VHF* (Parts 1 and 2 of this series are in the April and May '99 issues), contact CQ Communications, 25 Newbridge Road, Hicksville, NY 11801; Phone (516) 681-2922; Fax: (516) 681-2926; E-mail: <backissues@cq-vhf.com>; Web: <http://www.cq-vhf-com>. Back issues are $4 each to U.S. addresses, postage included.

For more information on modifications to Astatic D-104 mics and certain Kenwood transceivers for better SSB/FM performance, contact Greg Weremey, Electronic Service Professionals, 13 Kildee Rd., Harwichport, MA 02646; Phone: (508) 432-8831.

Alpha Delta's VRC speakers (and more details on same) are available from Alpha Delta Communications, Inc., P. O. Box 620, Manchester, KY 40962; Phone: (888) 302-8777.

Gain Verticals and a 6-Meter Yagi Design "Contest"

We always like to have a little more gain out of our antennas, so this month we're going to discuss ways of getting more gain out of a vertical antenna. Plus, we have an antenna design challenge for anyone who's interested.

Vertical antennas are very popular on VHF and UHF, mostly because of their relatively compact size and because they can be mounted relatively unobtrusively on your car. For these reasons and others, vertical antennas have become the standard for FM operation on the VHF and UHF ham bands.

About the simplest and most common vertical antenna for VHF/UHF use is the 1/4-wave whip (Figure 1). When this antenna is mounted over a good-sized ground plane, it "looks" electrically like a 1/2-wave dipole (with half the impedance as well, but more on that in a later article), as the ground plane creates an "image antenna" to balance it out. Gain of this 1/4-wave vertical will be pretty close to that of a dipole: 0 dBd (decibels versus a dipole) or about 2 dBi (decibels versus isotropic, a theoretical antenna that radiates equally in all directions).

So how do you get real gain out of a vertical? One way is to stack two antennas. It would appear that the easiest way to stack two verticals would be to just make the antenna longer. Figure 2 shows an oversimplification of what would happen if you did that.

See how we have two "waves" going to the right and one wave going to the left. The wave to the left would cancel out one of the waves to the right, meaning that only one-third of your signal is going out! Now, those of you who have spent some time reading antenna books know that I've skipped over the minor detail that the waves are back in phase at an angle about 40 degrees above the horizon. But this doesn't help the average mobile station very much, does it? What we need is a way of getting rid of that middle wave.

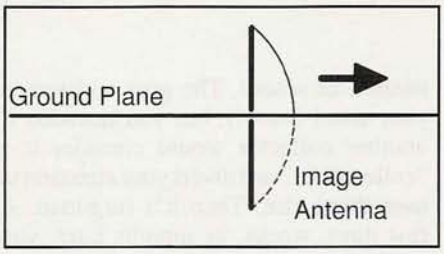


Figure 1. The 1/4-wave whip is about the simplest vertical antenna you can make for VHF/UHF work. Mounted over a ground plane, it acts like a 1/2-wave dipole, meaning it provides a good match to your radio but exhibits no real gain.

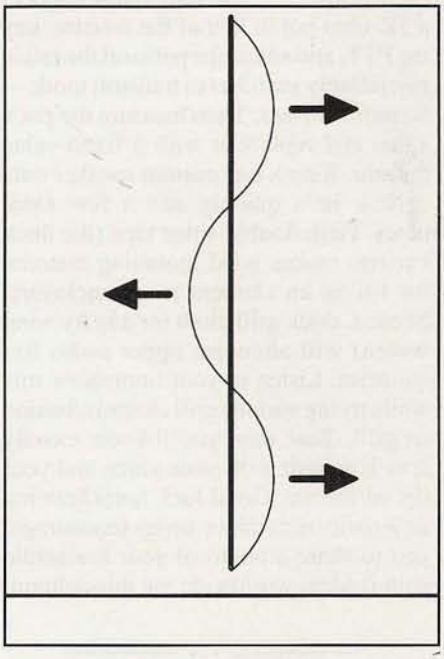


Figure 2. An oversimplified look at what happens if you try to create a gain vertical by simply lengthening the wire. Multiple simultaneous waves cancel each other out, leaving you with less signal than you had with a simple 1/4-wave whip.

Different Types of Gain Verticals

In Figure 3A, we shield that middle wave by using a 1/4-wavelength-long piece of coax between the top and bottom sections, effectively changing the center of the antenna from a radiator into transmission line. This "sleeve" technique is very popular among a large variety of commercial antenna companies.

In Figure 3B, we use a stub. This stub does radiate a tiny bit, but, because it folds back on itself, the currents in the stub cancel out. Now, the "bad" part of the wave is canceled out and only the "good" part is radiated. Gee...I've just invented the "Ringo Ranger"™.

In Figure 3C, I've taken that stub and wound it into a loose coil. This loose coil does not behave the way we usually think of for loading coils; rather, it's a way of keeping the middle section of the antenna from radiating a coherent wave. Essentially, this is not a loading coil at all, but a delay line keeping the top and bottom sections of the antenna in phase

By Kent Britain, WA5VJB (wa5vjb@cq-vhf.com)

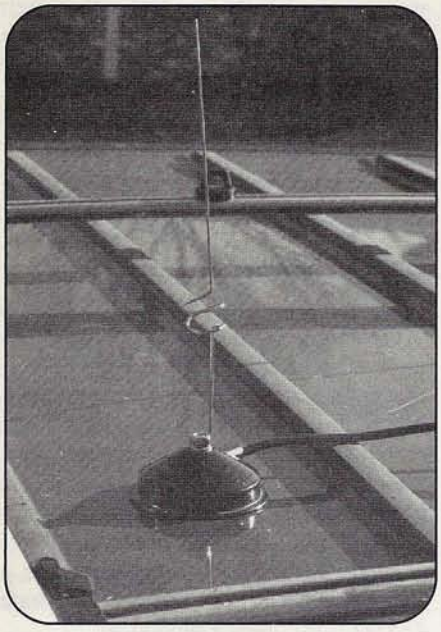


Photo A. It's easy to build your own vertical gain antenna, such as this one for repeaters or amateur television (ATV) on the 23-centimeter band (1240–1300 MHz). Just follow the directions in Figure 5.

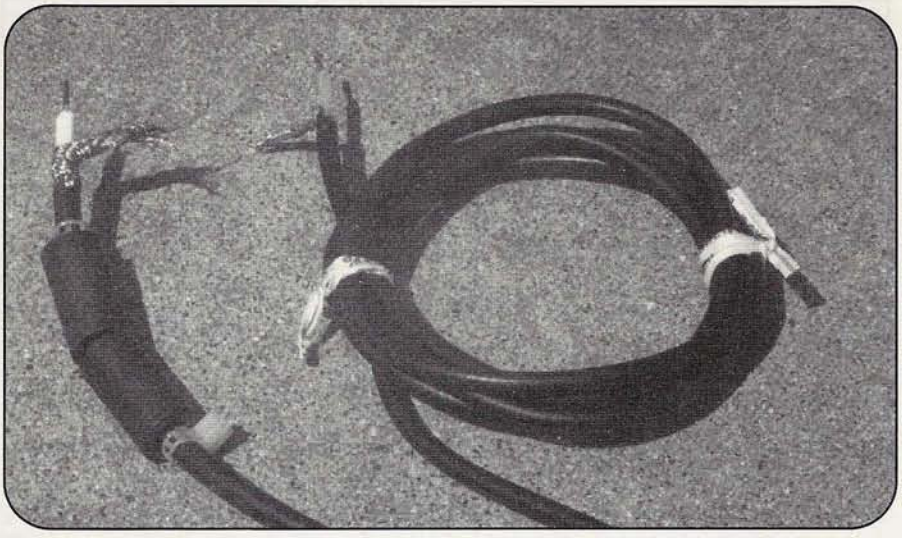


Photo B. Two different ways of making a 6-meter "noise balun" (see text) to keep RF from running back up the outside of the feedline. On the left, two big ferrite beads do the job, while the balun on the right uses three or four turns of the coax itself to create an RF choke.

(except in multi-band antennas, where it acts like a delay line on one band and a loading coil on another; more on that in a minute). While this is not quite as efficient as the sleeve-type verticals, they're much easier to build—just look at the millions of cellphone antennas out there.

In Figure 4, we have just a few of the combinations of vertical collinears that are possible. A collinear antenna is actually an array of several dipoles, mounted end-to-end, and fed to produce in-phase signals. Each has its advantages and disadvantages when it comes to gain, gain versus length, and impedance.

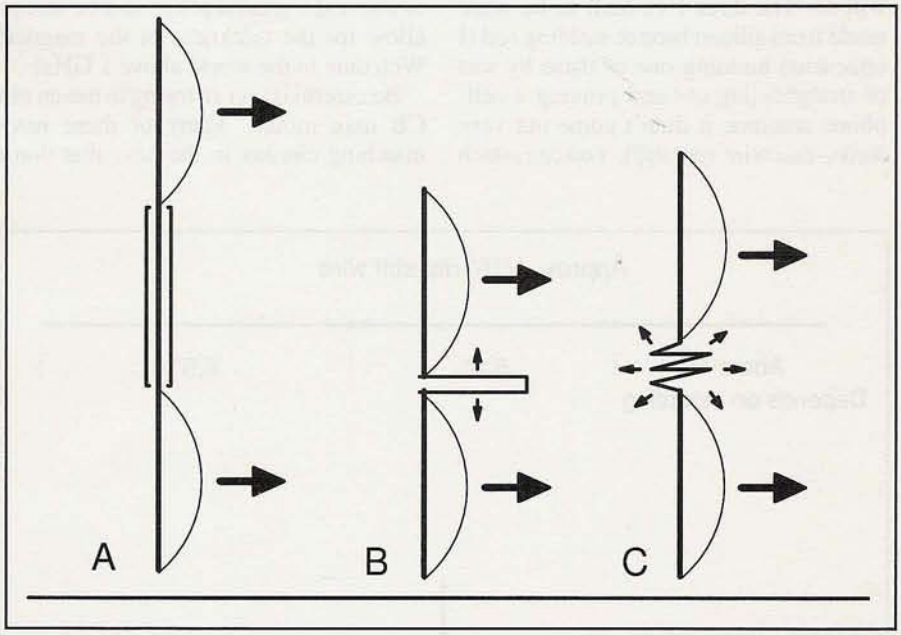


Figure 3. Some popular ways of building vertical antennas with gain. In Figure 3A, part of the antenna is actually a section of coax that blocks transmission of an out-of-phase wave that could reduce signal output. Figure 3B shows the use of a stub to cancel out that "bad" wave. And in Figure 3C, we've wound that stub into a loose coil that acts as an RF choke in that segment of the antenna and produces the same result.

Building a Gain Vertical

There's a very large number of ways we can build these gain verticals. We could start with a 1/4-wave on the bottom, the delay line in the middle, and then a 1/2-wave on top (Figure 4A). Or perhaps a 1/4-wave on the bottom again, with a 5/8-wave element above the coil (Figure 4B), or 5/8-wave on the bottom and 1/2-wave on top (Figure 4C). So we have many possible combinations of 1/4-wave, 1/2-wave, 5/8-wave and even 7/8-wave gain verticals to work with. Interestingly, in the antenna in Figure 4B, the coil functions as both a delay line and a 5/8-wave base loading coil.

The next trick is to come up with combinations that resonate on more than one band. That delay line might be a delay line on 440 MHz, but on a lower frequency, say 146 MHz, it looks like a loading coil again. With enough math to drive an antenna designer mad (maybe that's my problem), it's possible to come up with a design that's a stacked vertical collinear on 450 MHz, a split 1/4- and 1/2-wavelength on 146 MHz, and a loaded vertical on 50 MHz...all the while keeping the base impedance near 50 ohms on all bands. This is the basis of the multi-band VHF/UHF mobile antennas sold by many companies.

Build Your Own

Here's a very easy-to-build 1290-MHz vertical gain antenna for 23-centimeter repeaters or even ATV (amateur televi-

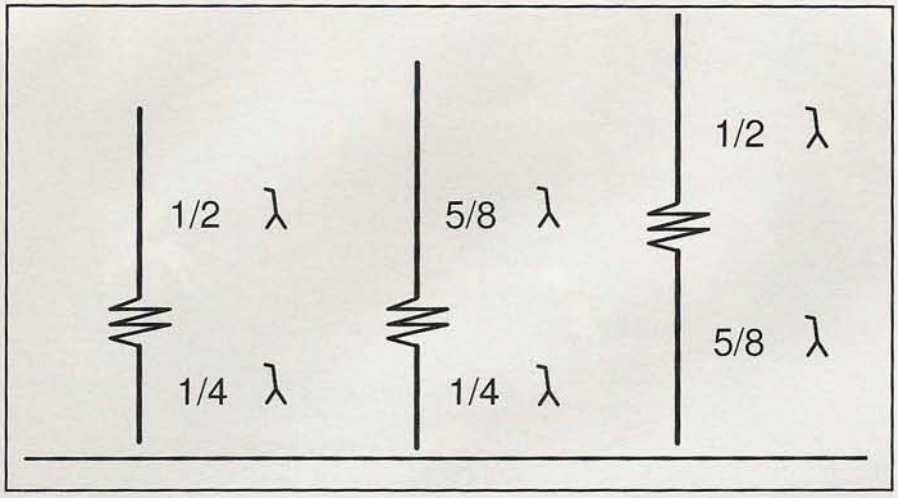


Figure 4. Several different arrangements of collinear vertical arrays. In a collinear, multiple dipoles are stacked end to end and fed in phase. See text for details.

sion). Use a metal rod about 15 inches long and mark it as in Figure 5 (see Photo A also); just about any kind of stiff wire will do. The three I've built so far were made from silicon bronze welding rod (I once tried building one of these by sort of straightening out and pruning a cellphone antenna; it didn't come out very well—that wire was *stiff*). You can attach the wire to most any small magnet base, or even a permanent mount. Just make sure that the base of the coil is 3.5 inches above the ground plane, and be sure to allow for the thickness of the magnet! Welcome to the world above 1 GHz!

Be careful if you're trying to use an old CB mag mount. Many of these have matching circuits in the base that don't work very well 50 times higher than their design frequency. If you can measure SWR at 1290 MHz, do your tweaking by slightly expanding or squeezing the loading coil. Gain runs about 5 dBi.

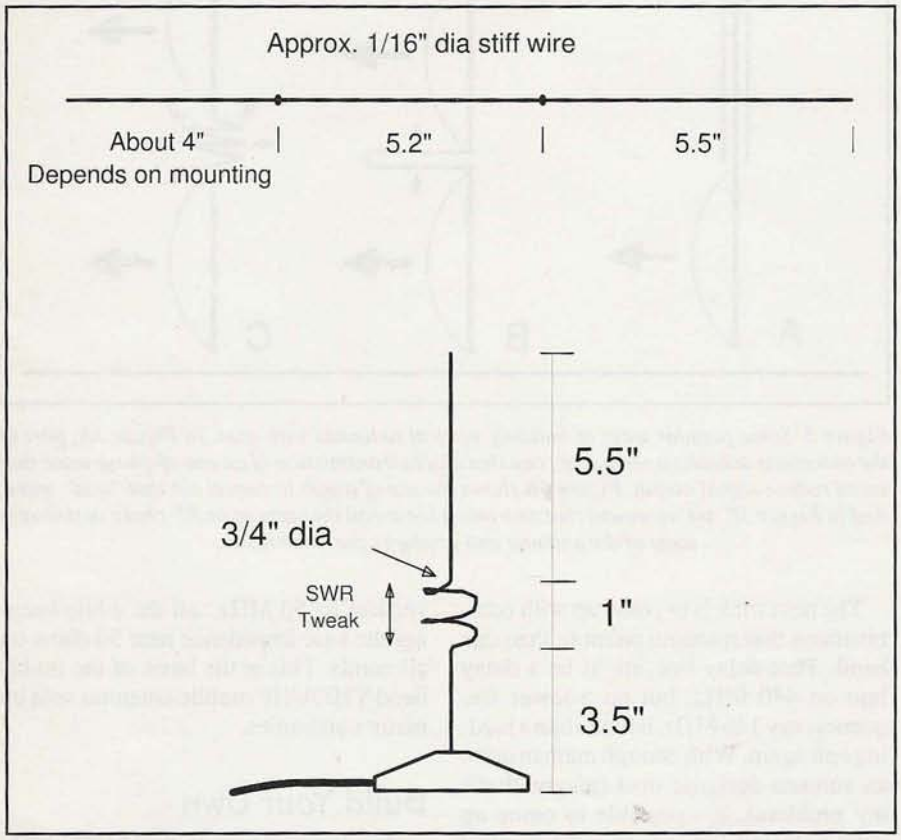


Figure 5. Dimensions for making your own 23-centimeter vertical gain antenna. This can be used for either repeaters or amateur TV.

A Note on Circular Polarization

The circularly polarized (CP) antennas in the April issue have brought up a common misconception. Circular polarization is an excellent way of communicating with a tumbling satellite, but the circular polarization is not caused by the tumbling antenna. A CP antenna appears to rotate at the frequency of use, so a signal from a 145-MHz CP antenna appears to rotate 145,000,000 times a second; a 435-MHz CP signal appears to rotate 435,000,000 times a second, etc.

50-MHz Cheap Yagis

Many readers have requested personal copies of my 50-MHz "cheap Yagi" design. My problem is that I haven't come up with a really good mechanical design. And with 50-MHz sporadic-*E* season coming along with this issue, it's time to do something. Here's your chance to come up with something better.

In Figure 6, there are three designs for lightweight 6-meter beams. The first (A) is a conventional two-element 50-MHz beam. The second (B) goes against common convention; it's a two-element Yagi, but with just a driven element and a director (no reflector). The driven element/director combination has more gain and a better front-to-back (F/B) ratio than the driven element/reflector combination. But this doesn't make sense to most hams and this configuration is rarely used, even though it really *does* have more gain and a better F/B. The third design (C) is a three-element beam tweaked for a very clean pattern rather than just gain. The computer predicts 6-dBi gain with 11-dB F/B for the first design; 6.4-dBi gain with 12.5-dB F/B for the second one; and 7.0-dB gain with 20-dB F/B for the three-element Yagi.

In each case, I am again using the structure of the Yagi itself for impedance matching. The driven element is a simple dipole, about 72 ohms in free space, and the loading effects of the other elements lower the impedance of the driven element to permit a direct 50-ohm connec-

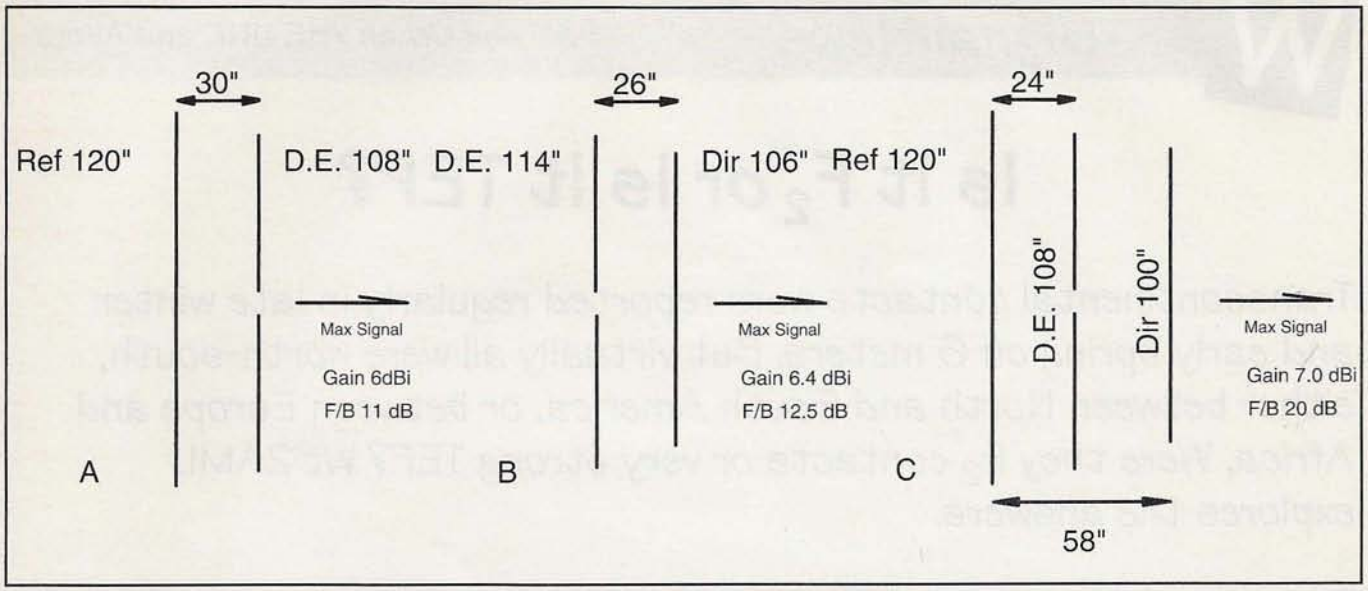


Figure 6. Three designs for lightweight 6-meter beams. Design 6A is a conventional two-element beam with predicted gain of 6 dBi. Next (6B) is a two-element Yagi with a driven element and a director instead of a reflector. Even though it flies in the face of common wisdom, this design works better than the conventional driven element/reflector combination, with a predicted 6.4-dBi gain. Finally, we have (6C) a three-element beam tweaked for a very clean pattern and 7.0-dBi gain.

tion. So, no T-Bars, no Gamma matches, no lengths of weird impedance coax are needed. Simple!

You may need to slightly adjust the length of the driven element for best SWR. In fact, the length of the driven element is a "best guess" to start with. Feel free to lengthen or shorten the driven element as necessary for best SWR.

A Noise Balun

Now these antennas will need something to keep RF from running back down the outside of the coax. This type of RF choke is called a "noise balun," and Photo B shows you two ways of making one. If you have some ferrite beads that fit snugly over the coax, put a few over the cable an inch or two from the end (on left in photo). One or two are good, three or so are better, but 10 will just make the antenna heavy. The second way (on right in photo) is to make the coax itself an RF choke. Put three or four turns of coax into a four-inch loop. Smaller loops tend to damage the coax, as the center of the coax will move around a bit when the coax gets hot in the summer sun. This changes the impedance of the coax if you're lucky, shorts it out if you're not. Tie the loop together with tie wraps, garbage bag ties, electrical tape, etc.

Get Out Your Design Hat

So what's next? I hate to call this a design contest, because then I might have to come up with a prize for the "winner," other than showing the world your mechanical design. But think about it and see if you can come up with a simple, cheap, and reproducible mechanical design for a 6-meter beam. The parts have to be easy to find—if a part can be found only in *your* junk box, then others can't use it. Of course, if you're building this 6-meter beam for your own personal use and don't care if anyone else can build another just like it, then use whatever you like!

One closing note: The antenna was designed for 1/2-inch diameter elements, but you can make them a 1/4 inch bigger or smaller with little effect. The dimensions are also for a non-conductive (wood/PVC) boom, but a metal boom 1 inch or less in diameter can be used without correction factors. Have Fun! ■

Is It F_2 or Is It TEP?

Transcontinental contacts were reported regularly in late winter and early spring on 6 meters. But virtually all were north-south, either between North and South America, or between Europe and Africa. Were they F_2 contacts or very strong TEP? WB2AMU explores the answers.

Last month, this column featured reports of increasing F_2 propagation on 6 meters, highlighted by long, strong openings to Central and South America from the southeastern U.S. and Caribbean areas. Our own "Magic Band" editor, Ken Neubeck, WB2AMU, said he felt the contacts were much more likely TEP (Trans Equatorial Propagation) than F_2. I asked him how he could tell the difference. His answer follows.—W2VU

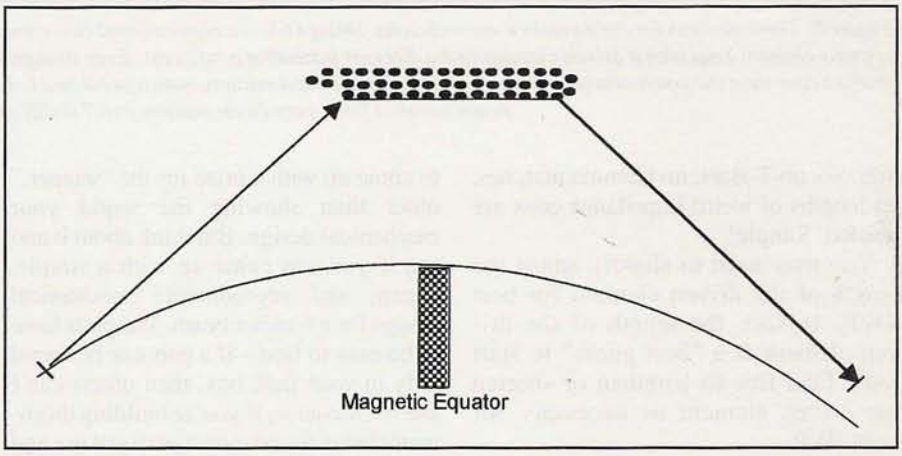


Figure. Graphical representation of trans-equatorial propagation (TEP); note that the Earth is sideways in this view. Traditional TEP allows stations at equal distances on either side of the magnetic equator to work each other, generally at distances of 5,000 to 6,000 miles. While TEP occurs even in low-sunspot years, its frequency, duration, and range appear to increase along with increasing sunspot numbers.

During February and March of this year, some significant openings were observed on 6 meters between stations located in the southern U.S. and the Caribbean area and stations south of the magnetic equator in South America, Oceania, and New Zealand. A number of stations have asked whether these signals were heard and/or worked via the transequatorial (TEP) or F_2 propagation modes. The answer is probably both of them! I'll try to explain what appears to be happening, but, first, a quick overview of F_2 and TEP for those who aren't familiar with the terminology.

F_2 propagation refers to the refraction of signals off the F_2 layer of the ionosphere. Because this is the highest refractive layer (in altitude), F_2 signals generally travel farther than those refracted off other, lower layers. The F_2 region is responsible for most long-distance HF propagation and is highly dependent on the sunspot cycle. Only during years of high solar activity is there enough ionization of the F_2 layer to support communication above 30 MHz.

TEP is a specialized form of F_2 propagation, in which stations equidistant from the magnetic equator may contact each other. As we'll explain in a moment, the ionization of the F_2 layer in the region of the magnetic equator is so much greater than in other areas, especially in the northern winter, that TEP is possible even during the bottom years of the sunspot cycle. But it gets better and stronger as the sunspots increase.

Typical TEP Contacts

Typical examples of the openings observed in recent months on 6 meters were reported to me by Jim, K4BI, at his vacation location on the Grand Cayman Islands, where he operated during mid-March as ZF2MU. He noted that every afternoon, beginning at 3 p.m. local time, he would start to hear stations from Argentina and Uruguay until the early evenings. On March 21, he worked over 20 stations from Argentina and a couple from Uruguay in the course of a few hours, with signal reports ranging from 53 to 59 and with the characteristic "buzz" of TEP on the signals. Some band openings during his stay lasted until 9 p.m. local time. Jim—along with a number of Texas stations—also reported working Frank, LU1VK, in Argentina during the month and he would come in with a 5 x 9 signal, even though he was only using 3 watts! Distances covered

By Ken Neubeck, WB2AMU (wb2amu@cq-vhf.com)

were standard TEP distances, in the area of 5,000 miles or more, following the process shown in the Figure.

But there were exceptions, too. For instance, a number of stations higher up in South America, such as HC5K in Ecuador and N6XQ/CP1 in Bolivia, were also worked during March by the stations in the southern states and the Caribbean. On the surface, this appears to be F_2-related propagation. But, because these stations were near or just below the area of the magnetic equator (and remember, the magnetic equator does not always follow the geographic equator), it appears that there is a connection between the high TEP activity and the presence of these stations. So what types of propagation are these stations really dealing with?

Consulting the References

In his classic book, *Ionospheric Radio Propagation*, author Kenneth Davies says a number of things about TEP. First he notes that, "the *F* layer is much thicker near the magnetic equator than elsewhere." Second he states, "There are regions of high electron concentration at geomagnetic latitudes of about ±20 degrees during the afternoon and early evening. This distortion of the ionosphere is of importance in transequatorial radio propagation...." In the same section of his book, Davies presents noon profile graphs of solar cycle changes that show the increase in electron density with sunspot count, particularly during the winter months.

If you connect the various points that he presents, it would logically be inferred that the electron density over the magnetic equator would also increase with sunspot count, and hence you could expect an increase in TEP activity to the point of better coverage and louder signals. This would explain the fact that the great majority of the openings observed from the southern U.S. and the Caribbean into South America were observed during the late afternoon and covered distances greater than 4,000 miles—both of which are characteristics of TEP. What may be confusing to some operators is that the signals were stronger than what has been observed during previous years of low sunspot count.

It's also noteworthy that, during the last few years, when the 10-meter band was relatively quiet, basically the only DX being worked there by much of the U.S. was TEP-related activity into South America. TEP, like F_2, has an MUF (maximum usable frequency) value for the highest frequency that the ionization over the magnetic equator can support. The MUF associated with *F*-layer electron density can logically be seen to climb as the sunspot count goes up for certain areas of the world, and most certainly for the area over the magnetic equator, which is heavily ionized to begin with. Also, because of the heavy ionization in this area surrounding the magnetic equator, the openings have been consistent to the point of being observed during the same time period every day.

On-Air Consultation

I had the opportunity to discuss this propagation on the air recently, during a 10-meter QSO with John Butrovich, W5UWB, who lives in Texas and has quite a bit of experience with these sorts of contacts. He agreed that any path that crosses the equator is probably TEP, particularly into mid- and southern Argentina; occurrences above the equator, he said, are F_2. John also agreed that TEP increases in strength and duration as the sunspot count goes up. He pointed out that during the high sunspot years, openings from noon local time through the afternoon tend to be the strongest and that openings late in the evening often result from a weaker TEP known as "spread *F*." John followed up with an e-mail message that said, in part:

> A very good article, quite short, contained in the UK *VHF/UHF DX Book*, pages 2-52/2-54, really explains in layman's terms the *three* types of TEP. It points out that the late-evening openings are termed "spread-*F*," and how it comes about. I strongly recommend you get a copy and look it over.
>
> I am keeping an eye open this cycle for a TEP contact to lower South America on 2 meters. I am perhaps a bit too far north (27.9 degrees), and a bit off being perpendicular to the geomagnetic equator, but one never knows what can happen! So, I monitor 144.3 late whenever six is open to South America, and also in the late evenings (7–11 p.m. local), just in case.

The Radio Society of Great Britain's *VHF/UHF DX Book* is indeed an excellent resource. Another item of note in the section on TEP, and one particularly relevant to these March contacts, is that TEP is best around the equinoxes, because those two belts of high electron concentration at ±20 degrees latitude are roughly equal in size (they vary with the season, according to this book). When this happens, they can support *direct chordal hops* between them—with no bounce off the ground—for really long-haul QSOs.

Splitting Hairs

However, because we're still dealing with heavy *F*-layer ionization that happens to be over the area of the magnetic equator, it's really splitting hairs to ask if what is being observed is really conventional F_2 or TEP. The answer is that it's probably a mixture of both modes. However, if a distinction has to be made, it would probably be more technically correct to identify the long-haul propagation that occurs during the afternoon and covers 5,000-plus miles as TEP and the shorter ranges as conventional F_2. Stations in the higher latitudes of the U.S. and Canada will be able to tap into these TEP/F_2 openings when other propagation links occur, such as sporadic-*E* (as discussed in detail in the article, "Mix and Match Propagation" in the February, 1998, issue of *CQ VHF*).

Activity Reports

TEP and/or F_2 propagation on 6 meters accounts for most of this month's reports, along with the occasional bit of 2-meter activity (there was probably more to report on two, but the DX being worked on six made it seem tame by comparison). Here are the reports...

From Jeff Buerger, WB2WIH, FN20:

3/8/99—Between 2115 Z and 2253 Z I worked the following stations on the 6-m band: LW5EJU, LU1DMA, LU8DIO, LW5DX, LU2DEK, LW6EUQ, LU9EHF, CX8BE, CX1DDO, CX1CCC, and CX2CC. Signals were S-6 to +10db over 9. This was most likely TE.

From Paul Womble, AJ4Y EL97:

3/8/99—Wow! Today was the first time in the little over a year that I have been active on 6 meters that I have heard South American stations *that* loud. Sounded just like conditions during the ARRL DX contest this past weekend on 10 m. *Lots* of LU stations. Worked LU9APM @ 2239 Z in GF05, CX8BE @ 2234 Z in GF15, plus several others. LUs and CXs were all-time new countries and grids for me.

From Mike Foubister, ZL3TIC, RE66 (New Zealand):

3/9–10/99—Good conditions 09/03/99–10/03/99: 2330 XE1KK/B 5/5; XE2UZL 5/2; 0030 46.170 (TV) strong on backscatter beaming Stateside; 0100 49.750± (TV) 5/9++

"[Six meters] sounded just like conditions during the ARRL DX contest this past weekend on 10 m."—Paul Womble, AJ4Y

Lots of offsets; 0130 JA1RJU 5/9 50.110; 0134 JE2DWZ 5/9 50.140; 0142 JG2AJK 5/9 50.140; 0142 JR2IPN 5/9 50.140; 0143 JA3GR 5/8 50.140. It is now 0230 49.750 still 5/9.

From Dave Goodwin, VE2ZP, FN25:

3/10/99—On Wednesday 10 March (Tuesday the 9th, local time), I noted auroral propagation on 2 and 6 m. Starting at about 0330 Z, I managed to work the following: K2CS FN31 500 km (NY); W9ZIH EN51 1125 km (IL); KØVSV EN41 1260 km (IA). I also heard, but did not work: K8EB EN73 750 km; WA9JML EN54 975 km; WA4SEI (unsure of callsign) EN65 875 km. There was also a fair amount of 6-m activity, I did work a few stations on CW and SSB. I was much more interested in working 2 m, as this was my first experience with aurora on that band. I was quite surprised that I started hearing stations on 2 m before I heard anything on 6 m.

From Ken Osborne, G4IGO, IO80:

3/14/99—Good and interesting day today. From around 12:00 to 12:25, had LA (Norway) TV in with weak sigs from OZ/beacon (Denmark) on 50.055 and OH1XT (Finland) with good sigs from SM3EQY (Sweden). MUF to 55 MHz. From 1259 started to RX wk 48/49 TVs from EU. Then the band began to shift to the south, starting with a weak carrier, probably from 5Z?? (Kenya). From 13:08 to 13:32, ZS6TWB/b (South Africa) on 50.043 was up to S4. From 14:16 to 1425, 9G1BJ (Ghana) up to S2 working Italy. From 14:37 to 15:37, 9G1BJ was up to S8. Please note that John will not take kindly to constant calling—if he calls a station that is not you, then *keep quiet*!!—He will go QRT if there is any trouble. Also in from 14:44 to 16:29 was 3C (Equatorial Guinea) TV.

From 19:10 to 20:05, 7Q7/b (Malawi) was in to S9! Also 3C TV and EA3/b. From 20:30 to 20:57 EA9/EA7 (Spain) to S9+ with CN/b (Portugal) and weak ZD8/b (Ascension Is.) – TVs in till 21:24 – nil more – or is it?. Also on 13/3/99, IT9 (Italy) was in from 11:46 to 11:55.

From JR4ENY/1, PM95UM (Kawasaki, Japan):

2-m FAI report in Japan:

March 06—Hrd JA1, JA6 Wkd: JR6CTI, JJ6JAE; March 07, 08, 12: Hrd JA1, JA6, none worked; March 13: Hrd JA1, JA6, Wkd:11 JA6s, as follows: 2252 JF6RVW 53/55 144.120 (MHz) Fukuoka (QTH); 2256 JG6MFD 55/59 144.120 Fukuoka; 2259 JP6PHD 53/57 144.120 Saga; 2300 JG6FCP 57/59 144.120 Saga; 2316 JJ6JAE 55/51 144.120 Kagoshima; 2319 JE6EKW 53/59 144.120 Miyazaki; 2327 JF6IWM 55/59 144.120 Kumamoto; 2331 JJ6FLP 57/59 144.120 Kumamoto; 2334 JR6CTI 57/59 144.120 Nagasaki; 2338 JO6BQR 55/59 144.120 Nagasaki; 2354 JF6ASQ 53/55 144.120 Miyazaki; March 15 2130 Hrd JA1, JA6, Wkd: JR6CTI, JF6IWM. Distance is about 800 to 1,000 km, with 10-degree elevation and 260- to 270-degree azimuth at my end. 1st FAI opening last year was March 30, but this year was March 06! Condx are much better than last year.

From Ken Neubeck, WB2AMU (relaying reports from 28.885 MHz, the 6-meter "liaison" frequency):

3/22/99—Daily reports out of Puerto Rico from several stations, KP4BZ, KP4EIT and WP4O, indicate consistent TEP openings and apparent F_2 openings throughout March. It appears that these stations and a few others in the Caribbean are in the "sweet part" of the TEP zone where signals from South America on the other side of the magnetic equator are being heard and worked.

Jim, K4BI, brought his radio down to Grand Cayman for a one week period in late March where, as ZF2MU, he has been working quite a few stations via TEP and F_2. Jim reports that TEP has been consistent each afternoon, beginning around 3 p.m. and lasting as late as 9 p.m. local time. On 3/20, Jim worked about 20 stations in Argentina, a couple of Uruguay stations, and three Brazilian stations during the afternoon. Signal strength ranged from 53 to 59. Jim also worked Jack, N6XQ/CP1 during his expedition to Bolivia via an apparent F_2 opening at 1815 on 3/21. Jim's setup is a modest 50 watts to a three-element Cushcraft beam.

Tim, N2PC, was on Ascension Island as ZD8PC and has been doing very well on the Magic Band, apparently via F_2 skip during the middle of March. Tim has worked 18 different countries from four continents, including Malta and Spain in Europe, Caribbean stations, South America, and Gabon in Africa. It's nice to see some rare ones on 6 meters that helped several hams reach DXCC on the band!

John, K5IUA, from EL29 in Texas has been experiencing a mixture of TEP and F_2 activity during March. On the 21st, John worked LU9HUP (FF76) at 1800 Z with the Argentine's station at 53 signal strength. John also worked HC5K the day before and he reports that this station has worked as far north as Kansas and North Carolina. John also worked N6XQ/CP1 on the 21st and reports that that station is working as far north as grid EM57. Another station John worked during March, LU1VK, is running less than 5 watts into a beam and is being worked by a number of southern U.S. stations, including W5UWB. In addition, ZF2MU worked him on 3/22 and reports that he has a 5 by 9 signal.

If this TEP and F_2 activity continues throughout April and early May, Northern U.S. stations and Canada may be lucky enough to catch a random opening during the late afternoon via a TEP and sporadic-*E* combination. So it may pay off to monitor your radio every afternoon during this time.

From Pat Dyer, WA5IYX, EL09:

3/25/99—An amazingly productive day when one considers that the solar flux was barely above 100. The geometry of these paths is so delicate that, with much higher flux levels, there has actually been less DX. Stations heard and worked: 1922 HC2FG/B 50.088 appears "on schedule" to well after 2045; 1935 50.750 Ch A2 audio spur in Spanish; 1944 other "noisy FM repeater" signals 50.1, 50.475, 50.6, and 50.650; 2036 CX1AO 50.123 SSB; 2044 LU6DRV, LU9EHF; 2046 LU9AEA; 2048 LU9APM (CW) 50.104; 2055 LW5DX, LW6EUQ; 2058 LW5EJU; 2122 LU9EHF/B 50.014; 2150 CX8BE; 2203 CX1CCC; 2259 49.2 music f/out; loud 47.8, 48, 48.3 music until after 2330. At one time, LU9EHF moved up to 50.200 to get free of the QRM.

In the LU and CX call letter scheme, it is the letter after the number that denotes the station location; e.g., A, B, and C are Buenos Aires City, D and E Buenos Aires province, M-Mendoza, etc.

From Steve Gregory, VK3SIX:

3/27/99—T33RD, Banaba, was worked by all and sundry from 0300 Z today. The first new DXCC country into VK east coast this cycle.

From Tom K4SUS (via WB2AMU):

Oops...

We let a few errors slip by in the past couple of issues, so here are the corrections:

First of all, back in February, we had a few wrong addresses in "Digital Data Link." Guest columnist Andy Nemec, KB9ALN ("Web Pages on Packet Radio?"), may be reached by mail at 453 Cottage Grove Ave., Green Bay, WI 54304. And his current e-mail address is <kb9aln@juno.com>. Plus, the correct Web address (URL) for downloading the programs to allow Windows 3.11 and 95 to operate TCP/IP with a TNC is <http://hambox1.cqu.edu.au>. In addition, Andy tells us WAPRA (Wisconsin Amateur Packet Radio Association) has a new treasurer, whom you should contact for information on WAPRA. He is Al Schnepf, NØGMJ, 5000 Hwy. 86, Ogema, WI 54459.

Skipping ahead to April, the caption for Figure 6 on page 58 ("Project Corner") has drawings A and B reversed. So when you see "6a," think "6b," and vice-versa. Tnx to KC8LTL for the catch.

"From 13:08 to 13:32, ZS6TWB/b (South Africa) on 50.043 was up to S4. From 14:16 to 1425, 9G1BJ (Ghana) up to S2 working Italy. From 14:37 to 15:37, 9G1BJ was up to S8.... Also in from 14:44 to 16:29 was 3C (Equatorial Guinea) TV."
—Ken Osborne, G4IGO

3/27/99—I was one of the first to work Jack, CP1/N6XQ in Bolivia on 50.102, both SSB & CW. Worked him on 23 Mar '99 @ 0257–0315 UTC. Band was open, and still is, to LU (Argentina), HC (Ecuador), CP, CX (Uruguay), etc. every night. On 25 Mar '99, I wkd CX8BE & CX1CCC GF15 & LW6EUQ, GF05 around 2255 UTC. On 22 Mar '99 I wkd LU8MB, LU5MAO & LU2MHP in FF57 around 0100 UTC. 6 m was even open mid-day several days ago (F_2 ?) to SA and even mobiles were working the CP! Six meters is great here!

From: Bart Miller, KC5NOA, EL08 (via WB2AMU):

3/27/99—I have been getting tons of DX from all over South America! On 3/25/99, I was getting backscatter DX up to Maryland and northern Ohio. If anyone wants to try a contact via backscatter, get in touch with me and I will try to give them a contact. I love *CQ VHF*!

From TI5KD (Costa Rica):

3/29/99—Just worked S07UN (*anyone know where S-zero-7 is? We can't find it.—ed.*) and CN2UN (Morocco) on 50110 SSB at 1738 Z for new ones. Only other Africa this cycle was ZD8PC on 3/21/99 at 2241 Z.

From Bryn Jones, KF4GKO (EM65):

4/1—Working KØMQS (EN31) on 144.200 on 25 W. With a dual-band FM five-element Cushcraft antenna. The distance is 486 miles.

From Ed Rodriguez, WP4O:

4/2/99—On 1 April, KP4EIT and WP4O worked HC2FG (Ecuador) on 50.110 at 1815 Z, signals 59; plus; on 2 April, WP4O worked PY8GC (Brazil) on 50.115, time 1800 Z, signals 57 with rapid QSB (fading). Other stations here in Puerto Rico also worked PY8GC.

At 1955 Z, KP4EIT and others (but not I) worked ZD7VC on 50.115. It was to late for me to work him as he was working into Europe, but maybe some other time. He peaked 59 at my QTH. (*ZD7 is St. Helena Island, in the South Atlantic, off the west coast of Africa and south of Ascension Island, ZD8.—ed.*)

From Dave Clingerman, W6OAL (Colorado):

4/2/99—I missed it, but WØNRI, Frank in Evergreen, CO, worked a bunch of LUs (Argentina), starting at 2013 today. They came on the band at 50.110 and some went on up in freq. to work him and free up the DX calling frequency.

From Oscar Morales, Jr., CO2OJ (Cuba):

4/3/99—Today at 1930 UTC, worked LU9EHF, FF95, and LU1DVT, GF11, both with 59++ signals (with the back of my beam). They were working W5s and W3s, and I heard LU1DVT worked also HI8R.

From Pat Dyer, WA5IYX, EL09 (San Antonio, TX):

4/3/99—A somewhat amazing amount of F_2 (*or maybe TEP, as we learned above—ed.*), considering that the solar flux is hardly over 100. Times are UTC (Z). (These are *not* all QSOs—I just try to find some new folks to work.):

1955 48.3 music; 2003 HC2FG/B 50.088, now apparently stuck in the key-down mode (I'd thought that I'd a new local birdie to deal with at first!); 2008 CX8BE/B 50.046 peaking 20 over 9; 2020 LU9EHF; 2022 LW5EJU; 2025 LW5DX; 2028 LU1DZ; 2048 LU2FFD —showed that his 300-mW exciter was 57 copy on 50.175; 2050 50.156 SSTV!

• • •

Don't Forget the June Contest!

Elsewhere in this issue, you'll find the complete rules for the ARRL June VHF QSO Party. This is the biggest VHF/UHF weak-signal operating activity of the year. Even if you're not into contesting, you're likely to find more SSB/CW activity this weekend (June 12–13) than at any other time of the year. If you're lucky, the propagation gods will smile on you and you'll have plenty of band openings to keep you busy, working new grid squares, contacting old friends, and making new ones. Help keep the rovers and QRP stations in your area busy by listening for them and working them as often as the rules permit. But most of all, have fun! —WB2AMU

Thank you to WB2AMU for filling in this month as "Weak Signal News" reporter, as well as for collecting and forwarding many of the reports you see here. As we went to press, our regular weak-signal columnist, Tim Marek, K7XC, was just finishing up a move from Nevada to Arizona. He says he plans to resume stewardship of this column as soon as possible, hopefully as soon as next month's issue. For now, 73 and enjoy the summer propagation.
—W2VU

Transcoastal Reflections at 11 p.m.

Each month, we ask readers to share their own 6-meter experiences in the "Magic Band Chronicles." Now, courtesy of Bob Scupp, WB5YYX, we bring you a recollection from nearly three decades ago.

One of my many great adventures and experiences on 6 meters was with the Knight Raiders VHF Club in northern New Jersey during an ARRL June VHF QSO Party in the early 1970s. Our "primo" portable contest operation site for the June and September VHF QSO Parties was atop the Paterson Mountains, just south of the observation tower on Garrett Mountain. Jack Wilk, K2KDQ (later N2DXP and now a Silent Key), somehow "obtained" an indefinite permit from the county park commission for our new "Mount Olympus" site. While there was a definite lack of civilized accommodations, we roughed it as well as possible (we operated the January contests from Jack's "dungeon" at home).

At the time, Jack was the Knight Raiders' President and Chief Sergeant-At-Arms (at age 18, I needed the most disciplined, roughest guy around as my mentor!). To say that he treated us as would a drill sergeant training his troops for battle is an understatement! But it all paid off, beginning with this very contest.

Bob Scupp, WB5YYX (left), with his VHF mentor, Jack Wilk, K2KDQ/N2DXP (now a Silent Key), at the 1993 Dayton Hamvention.

A Hot Start

Propagation on six couldn't have been better as our operating began on Saturday afternoon. With Jack's Drake TR-6 transceiver, a 20-foot telescoping mast, rotator and three-element beam, we worked everything we heard, from Maine to the Carolinas, and west to Ohio and other parts of the Midwest. The excellent conditions continued until around sunset, when the propagation plug was pulled out of its power source. From then on, it seemed that nearly all of the big contest operators gave up and the band became void of any activity.

Later that night, the 6-meter station was "abandoned." Everyone feared it was a waste of time and effort, where you'd be endlessly calling "CQ Contest" with only band noise in return. In addition, the rotator on the 6-meter beam had jammed in one position. So 6 meters became a no-man's land...until K2KDQ's technically advanced procedure provided a temporary solution: Jack hit the base of the mast over and over with a sledge hammer until the rotator freed itself! We all took turns with vigorous exercise and enthusiasm. This complicated the 6-meter operation because we feared hitting something or someone else by accident. But it got us back on the air...sort of. Seems there was still no one willing to take the night shift on six.

"Who's on Six?"

I finally asked K2KDQ who was assigned that shift to operate 6 meters. With a blunt reply of, "nobody," I became the sucker who volunteered to straighten matters out. After calling an eternal "CQ Contest" with no response (they told me

Bob Scupp, WB5YYX, was originally licensed in New Jersey in 1967 as WN2CXS. Today, he lives in New Mexico and holds an Extra class license, but has never lost his enthusiasm for VHF.

*By Bob Scupp, WB5YYX (bobscupp@worldnet.att.net)

so!), and tuning between 50.1 and 50.2 MHz until the dial on the TR-6 almost failed, I was ready to give it up due to lack of vocal ability and oxygen. But then, at approximately 11 p.m., I finally heard a response. This amateur repeated our call-sign for quite some time and then came back with a W7 call...from Washington State! His signal was loud enough for us to exchange contest information, probably a 55–56, on upper sideband. For the next half hour, I continued to contact 7-land stations in Oregon and Washington. A few other local contesters awakened to these events, and tried, but many failed to connect. By 11:30 p.m., as if someone threw an antenna switch, the band opening ceased to exist.

At that point, I finally abandoned the 6-meter station and brought my section of the contest log to Jack. He laughed very heartily, exclaiming to the world, "Beautiful! Beautiful! Beautiful! Very Good! Very Good! Very Good!"

I sighed with relief. I had gained us several new ARRL sections (which were the contest multipliers at the time) on the band. Great work for a newcomer to VHF contesting and operation. I have never been more elated in my amateur career.

Expect the Unexpected

I learned, through first-hand VHF contesting experience, to expect the unexpected. The never-give-up attitude gained in contesting has certainly figured into VHF operation of all kinds. These examples of good amateur conduct, discipline, and teamwork were ingrained early in my mindset as a radio amateur.

Back then, as noted above, multipliers were counted by ARRL sections instead of the more numerous grid squares of today. This single amendment to the rules most definitely changed VHF contest scoring forever. I remember that 6 meters had much lower activity levels then, as opposed to today's conditions, often mimicking something closer to 20-meter levels. Most important, it was very exciting and fun (despite the death threats from Jack).

This adventure story is dedicated in loving, respectful memory of Jack Wilk, K2KDQ/N2DXP, my Elmer, who taught, beat, and whipped me into the art of VHF operation and contesting. ■

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.

Reader FEEDBACK

"Great Idea. Go Do It Yourself"

The following letter was sent to "Digital Data Link" editor Don Rotolo, N2IRZ:

Dear Don:

Good article in the March issue. I've been building radio stuff for about 65 years. Real bread-boards early on. Then I graduated to square cake pans, etc. I like the idea of a kit for a really fast "thing." I say "thing" since I have a thought that I presented to TAPR a year ago which got me a "go do it yourself" response. Indeed, I believe in it enough to offer enough money to fund at least a few prototypes. I believe they thought that I was trying to get cheap development for a commercial item. Not so. However, I believe that FM analog is the better way.

Essence: 1.2-GHz FM radio totally controlled from the computer. A software-controlled radio with the high-speed modem as software also. The radio itself would be in a hermetic box with integral antenna, with all power, control, and two-way data going up on a cheap piece of TV coax. Minimum of 2 watts RF out and state-of-the-art receiver. The RF head could be mounted on a rotator, and an antenna integral to the box is envisioned. A several-element Yagi or a corner reflector arrangement would suffice. Of course an SS (spread-spectrum) radio would also fit the mechanical profile. I'm not sharp enough to determine if the concept is viable. All of the components seem to be available. The 23-centimeter band plan provides for this sort of activity. This is a band we should be preserving by activity.

I'm slowly working on a 10-GHz transverter "kit" purchased from a group in San Diego (Chuck Houghton). I have experience with HF radio, SSB, CB, and FM (VHF and UHF). I know what both megawatt and milliwatt transmitters are, but modern receivers slow me down. I've designed many, but I'm not up to today's standards. How far off base am I? 73,

Herb Vanderbeek, WY6G
Palo Alto, California

N2IRZ responds:

Herb—I don't think you're off base at all. What you propose is named an RF data modem. It combines the TNC functions and RF deck into a single package, with some of the TNC functions being handled by the computer. Such items exist already, but in the commercial world, and are expensive. I'm not sure why you'd need or want a rotator—you can use an omnidirectional antenna for 1.2-GHz user ports or a fixed Yagi for links. No matter, doesn't change the idea much.

Regarding TAPR: Well, that is the answer I'd also give to such a suggestion. The idea is an excellent one. I have to commend you on it, really, and I'm certain that you have thought it out much more than you describe in your message. I'm also just as certain that if I countered with "build it for 1.2 *MHz* instead of 1.2 *GHz*", you'd probably even get it working in short order. The GHz shouldn't scare you.

The problem, as I see it (and I think TAPR is the same, but I do not presume to speak for them), is that humans fall into three basic categories: thinkers, doers, and users—75% are users, 20% are thinkers, and 5% are doers. It should be easy to see that ideas greatly outnumber development capacity. Another way of stating it: good ideas are easy, good designs aren't.

Herb, you are clearly a "visionary," one of those highly creative souls who tend to be leaders. I admire you for that. But, the reality of amateur radio is that ideas and money don't help in designing a product...you need expertise. You obviously know that, because you also realize you don't (yet) have (all) the expertise needed to finish this project. What this means is: the ones with the expertise tend to work on their own ideas, not those of others, as their own ideas are more fun (to them).

As good as your intentions are, TAPR basically told you "good idea, why don't you do it?", and that is not because it isn't a good idea, but because they prefer to spend their time on their own ideas. They're only human, like all of us. If we look at the project as a series of blocks, I'm willing to bet that you can probably do it all. You might not think so, but you might also be surprised.

From the computer, think Baycom. They make software and hardware that is essentially a TNC. Look at the Tigertronics Web site. OK, we have data, for the RF deck and modem think "integrated data circuits"—look at MAXIM, Phillips, and Siemens, they all make "radio on a chip" systems, in the GHz range, for data. RF power is easy: Hitachi, Motorola, and others make power modules. Also, T/R PIN diode modules.

I encourage you to look into this further. Even if you never build it, I'd be surprised if you didn't come up with a good model on paper. All within your capabilities! (For areas where you really get stuck, contact a consultant if you have a little money. They'll give advice at a reasonable price, especially for amateur projects. The IEEE consultants list is a good starting point). 73 & good luck,

—N2IRZ

Roll Your Own 902-MHz Repeater

Finding ready-made repeaters for 902 MHz isn't easy. But finding surplus 800-MHz commercial radios is. W7UVH shows us how to convert some of these units for use as 902-MHz repeaters. A word of warning: This is NOT a beginner's project.

Several years ago, a friend of mine, Jon Marcinko, W7FHZ (now WR7JM), gave me an 800-MHz General Electric (GE) Exec II Control Station to see if it could be used in any way in the 902- to 928-MHz ham band. After converting the exciter and retuning the receiver (which can be retuned anywhere in the 902 to 928 band without modification), I decided that the 45-MHz IF (intermediate frequency) oscillator in the receiver made it a bit difficult to pursue any worthwhile plan (I'll explain why as we proceed).

"The project sat and only casual thoughts of its existence crossed my mind until I retired in 1986 and had to get all of my junk together and move it from my work area."

The project sat and only casual thoughts of its existence crossed my mind until I retired in 1986 and had to get all of my junk together and move it from my work area. Moving this big heavy unit (Photo A), I decided it was time to give this shelved project more serious thought.

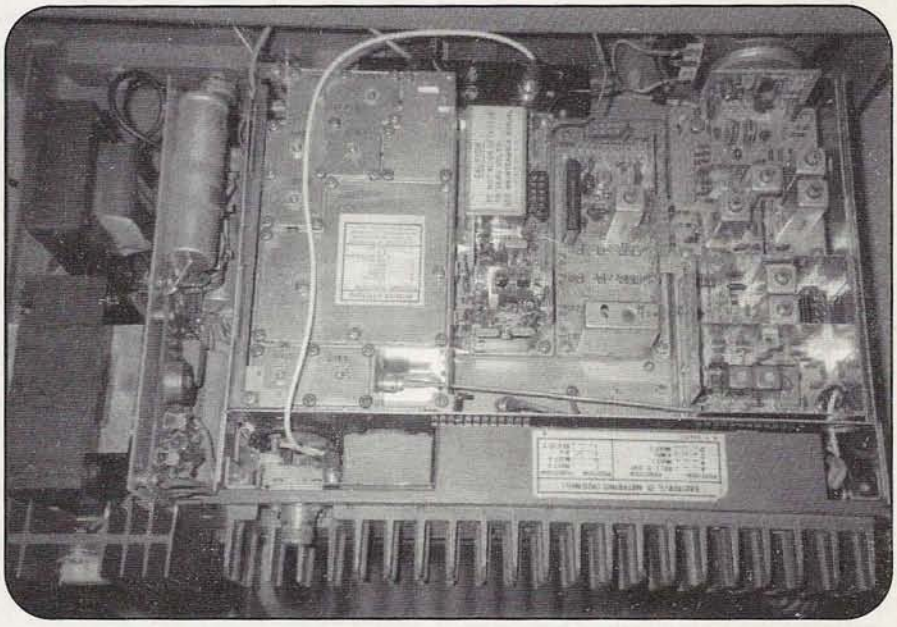


Photo A. Top view of an 800-MHz GE Exec II with receiver preamp. The receiver needs no modification to tune the 33-centimeter (902- to 928-MHz) amateur band, but significant changes are needed to make it function as a 902-MHz repeater. (Photos by the author)

The 800-MHz Band

To begin with, let's look at the scheme of the 800-MHz commercial band. Virtually all of the mobile units on this band transmit 45 MHz below their receive frequency. With a 45-MHz IF, this offset is very easy for half-duplex radios, since the oscillator and multipliers for the transmitter become the first injection frequency for the receiver's first IF. In the transmit mode, audio is applied to the oscillator and the multipliers, with the resulting signal being switched to amplifiers which bring output power up to 15 to 35 watts, depending on the radio. This is true in most 800-MHz radios.

But while this 45-MHz offset is fine for the commercial band (whose band plan was probably built around this easy offset), it creates a problem for ham use. If you were to set up the transmitter for 902.250 MHz and add 45 MHz, you would be receiving on 947.250—out of band! You can't have a 45-MHz split in a band that's only 26 MHz wide!

A Separate Receiver String

Well, I thought, that might be solved by having a separate receiver multiplier string. Looking closely at the multipliers, I saw that the last multiplier is in the 400-MHz band and is doubled to 800. Having previously used a GE MVP UHF (450 to

Gene Colson, W7UVH, is retired from the mobile communications business. He has converted more than a dozen surplus commercial repeaters, and he put one of the first 6-meter repeaters on the air back in the mid-1950s. Gene lives in McCleary, Washington.

*By Gene Colson, W7UVH (genec@ptinet.net)

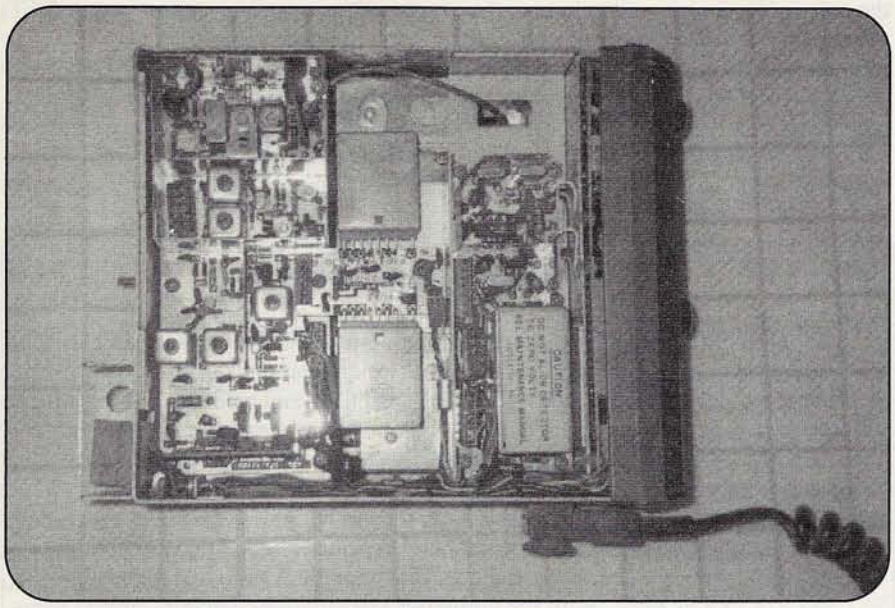


Photo B. Exciter side of the GE MVP mobile radio. This exciter board can be modified to help turn an Exec II into a 33-centimeter repeater.

512 MHz) exciter strip (Photo B) for a multiplier to arrive at an injection frequency for a GOES weather satellite receiver, I thought, why not use one for the 900 MHz receiver?

Please note: The following conversion is necessary only for making a repeater out of the Exec II. Another scheme will be used for using the Exec II as a control station or mobile, and it will be described later in this article.

Converting the MVP Exciter Board

First question: where to put it? Simple enough. Lift up the unit from the case and right there, in the bottom of the unit, is a place just made for it (Photo C). I mounted the board with six number 6-32 screws with washers through the ventilation holes in the bottom...but I'm getting ahead of myself. Before mounting the board, it's best tune it to receive 45 MHz above the multiplied frequency (remember, this is a separate receiver string, so the 45-MHz IF will have no impact on the transmit frequency).

If we use a standard GE MVP or UHF Exec II exciter board (450 to 512 MHz), the modifications needed are as follows (*By the way, it will be* extremely *helpful to have a service manual and schematics available for any of these radios.—ed.*). Reduce the size of L108 and L109 by half, then remove L113 and replace it with a loop of number 16 wire, 1/2 inch above the pc board. (These are not very critical, because there are two helical resonators in the Exec II that will tune the circuit and provide ample injection.) Next, some coils will require added capacitors, all of which are available in a single package from RadioShack, part number 272-806. I simply added these caps on the bottom of the pc board. Here's what goes where: add 6 pF across T105, 12 pF across T106, 4 pF across T107, and 3 pF across T108.

To calculate the crystal frequency for the oscillator, simply subtract 45 from the desired receive frequency. In my case, I use 902.250 MHz as the repeater's receive frequency, with a 25-MHz split that keeps both signals in the ham band (see "Band Planning Problems" for more on 902-MHz repeater frequencies and offsets). Subtracting 45 from 902.25 equals 857.25 MHz. Remember that the frequency was doubled in the last multiplier stage, so divide 857.25 by two and you get 428.625 MHz. Finally, using GE's formula, divide that number by 36, and you end up with a crystal frequency of 11.90625 MHz. See "Resources" for crystal ordering information.

Now back to the exciter board. *This conversion will be necessary in all Exec IIs, whether the exciter is to be used as a control station, a repeater, or a mobile.* The following capacitors will need to be removed and replaced with the values listed: C 127 = 22 pF; C 129 = 22 pF; C136 = 18 pF; C137 = 15 pF; C147 = 4 pF; C148 = 2 pF. On the oscillator board, C22 should be changed to 18 pF. No other capacitors should be need or replaced, anywhere.

Now find the two helical resonators, Z101 and Z102. These are covered with copper and are wound on a very fragile plastic. The tuning of these two stages is done by the dielectric of the plastic. Everything is very fragile. Remove these two covers very carefully, then carefully cut 1/4 turn from each coil. Keep the wire in against the form as the tuning portion may screw down over the coil. You don't want it to drag on the coil. On the radios

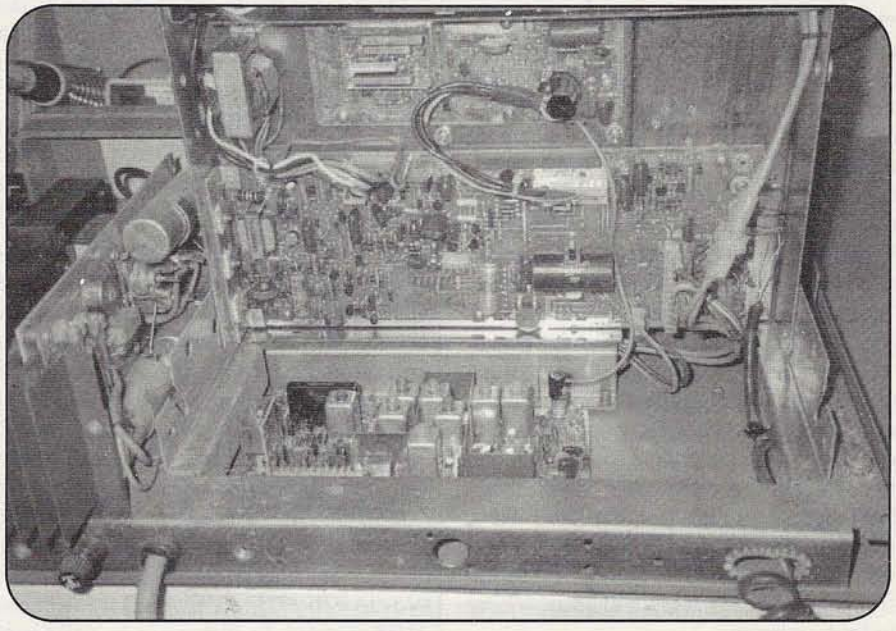


Photo C. An 800-MHz Exec II with an MVP UHF exciter board installed in the bottom for use in the receiver section.

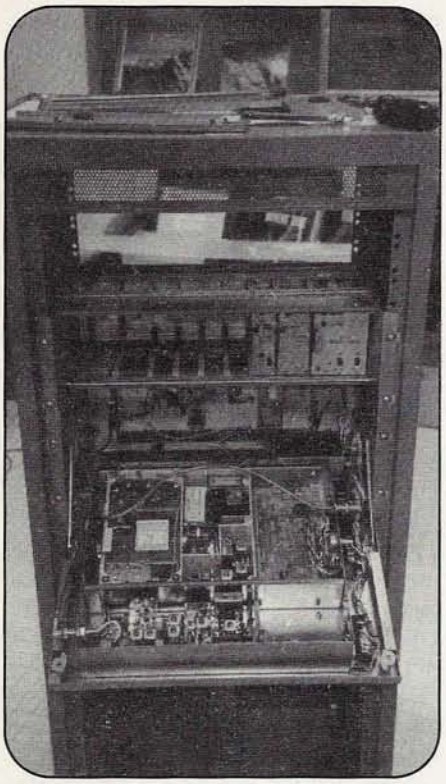


Photo D. A GE Mastr II 800-MHz repeater. This can also be modified to work on 902 MHz, but takes a different set of mods than the Exec II.

that I have converted, I've found that removing 1/4 turn gives the resonator a tuning range from 902 with the adjustment nearly all of the way in, and to 928 with it nearly all of the way out.

When you've finished and put the covers back on, I suggest you solder only a couple of spots until you've tuned the unit as you might have to remove the covers a second time. In one case, I cut a 1/2 turn and had to take it apart again. I was able to solder a 1/8-inch piece of wire across the coil from the end and it worked—I also broke one beyond repair. From GE-Ericsson parts (see "Resources"), it was nearly $20. These parts may be on their "not supported" list , but it can't hurt to check if they still have some in stock.

Tuning for this circuit or, for that matter, the receiver multiplier, should be done using the specific procedures set out in the manual. I use a spectrum monitor when tuning such items. If you don't have access to one, you can also use a receiver. By looking at the multiplication scheme, you should be able to figure the frequency of each stage and know where to look or listen..

If the exciter is to be used for a repeater, then I would also suggest that you remove the relay, K1, and install a jumper between pin 4, where the relay was, and ground. Also, jumper a wire between pins 1 and 3. This will put the RF out on the receiver jack, but will keep active the "A" reading on the test set. With 10 volts permanently applied to both pins 1 and 8, you can use a pull-to-ground on pin 2 (F1) to key the transmitter.

Some additional notes: Feed the audio in on the mic line and not the on Channel Guard (CTCSS) line. The Channel Guard line doesn't have deviation limiting and is not designed for the higher frequencies.

Band Planning Problems

The 902- to 928-MHz band is one on which amateurs have a secondary allocation and a growing number of both licensed and unlicensed (but legal) neighbors. Hams must avoid interfering with industrial, scientific, and medical (ISM) devices, automatic vehicle monitoring (AVM) systems, and certain government stations. On the unlicensed side, our most numerous neighbors are cordless phones.

What's the amateur band plan here? Well, as far as repeaters go, there really isn't one at the moment. For several years now, the ARRL has been in the process of updating its original band plan (with 12-MHz repeater offsets) because that plan's repeater subbands now pose potential conflicts with the AVM allocations at 904 to 921 and 918 to 926 MHz. With the numerous (mostly non-amateur) current users of this band, I personally fail to see how a good band plan can be adopted. At the time I selected 902.250 and 927.250 for my repeater, both frequencies were outside the AVM part of the band and I didn't see many cordless phones in this area. Now that's changed and it seems that the entire band is open to all kinds of services. As mentioned in the main article, I'm now hearing modulation from a cordless phone somewhere near these frequencies.

Split Over Splits

A 25-MHz split seemed good when I first set up my repeater, as 800-MHz duplexers could be retuned to that split with the least degradation, and I wanted to keep the mobile receive at the upper end of the band, as far away as possible from cellular phones. Again, it now doesn't seem to make much difference. They have us surrounded. Some thought might be given to a 21.4-MHz offset, or even other splits, such as 9.4, 10.7, or 11.2 MHz (or the ARRL's recommended 12 MHz). Experimenting with different offsets may help determine what's the best—and easiest to achieve—for a national standard.

Despite the negatives on 902 to 928, don't get discouraged. The band is ours (subject to sharing limitations) and we should use it, even though we will suffer some problems from time to time with other legal services. The surplus commercial equipment is out there. Having worked in the 800-MHz services for a number of years, what I've learned here has helped me a great deal. You'll have to learn some truths for yourself, about antennas, for instance, and about not relying on vendors to tell you what they *think* their specs are. This is a band that's wide open to the experimenter and it awaits exploring and exploiting.

Editor's Note: The ARRL band plan sets aside 902 to 903 MHz for weak-signal operating, with 902.100 MHz as the SSB/CW calling frequency. In some parts of the country, weak-signal operation is centered on 903 MHz, with a calling frequency at 903.100. Gene's repeater transmit frequency of 902.250 seems to be far enough away from both calling frequencies not to pose any interference problems, but anyone setting up a repeater or other FM operation on this or any band should do everything possible to avoid interference to the weak-signal areas. In addition (and this applies to all bands), you should check with the frequency coordination group for your area to find out the local band plan, including repeater offsets, frequency availability, etc. These groups are listed in the ARRL Repeater Directory. *Our publication of this article does not constitute an endorsement of the author's frequency choices. Please note also that amateur operation within the 904- to 921- and 918- to 926-MHz AVM windows is permitted as long as there is no interference to AVM systems. So if there is no AVM activity in your area, or you can avoid active AVM frequencies, you may operate within those band segments.*

Parts List

MVP Exciter Board

Repeater-only Modification

(1) 3-pf capacitor
(1) 4-pf capacitor
(1) 6-pf capacitor
(1) 12-pf capacitor

(all are available in a single package from RadioShack, part #272-806)

Short length of #16 wire

All-uses Modification

(1) Crystal (see text)
(1) 2-pf capacitor
(1) 4-pf capacitor
(1) 15-pf capacitor
(1) 18-pf capacitor
(2) 22-pf capacitor

MVP Oscillator Board

(1) 18-pf capacitor

Exec II Modification (changing IF Freq.)

(1) 34.4-MHz oscillator crystal (for 25-MHz IF and offset; frequency will change if other IF/split is chosen; see text)
(1) 4-pf capacitor
(3) 33-pf capacitor

MVP Transmitter (when using MVP intact as transceiver)

(1) Crystal (1/48 of chosen transmit frequency; see text)
(1) 10-pf capacitor
(2) 12-pf capacitor
(1) 15-pf capacitor
(1) 22-pf capacitor
(1) 33-pf capacitor

Mastr II

Exciter

(1) Crystal (1/48 of chosen transmit frequency; see text)
(2) 15-pf capacitor
(1) 22-pf capacitor
(1) 27-pf capacitor
(2) 39-pf capacitor

Receiver

(1) Crystal (1/48 of chosen transmit frequency; see text)
(1) 10-pf capacitor
(1) 33-pf capacitor

Mitrex "Maybe Amplifier"

(2) .001-µF feed-thru capacitor
Teflon® coax (see text)
Muffin fan
3-inch piece of 1/2-inch aluminum tubing

The output of the exciter will be around 50 to 65 milliwatts and will drive the PA (power amplifier) to its rated power of 25 or 35 watts (depending on the specific radio you start with). My current repeater is running 35 watts output. Finally, the high-pass filter is not a problem, but you might gain a watt or two by carefully spreading the coils a little or adjusting them in different ways.

This completes the conversion of the Exec II for use as a repeater or as a control station with the 45-MHz IF left intact and a separate oscillator/multiplier strip. For more on converting the Exec II to a repeater, there's an excellent Web site (see "Resources") from which you can download all the information you'll need.

A Different Approach

Now let's look at an alternative way of keeping the one-oscillator/multiplier method used in most 800-MHz radios. Note that you cannot use this method for full-duplex operation (simultaneous transmitting and receiving), so it will not work for repeaters. What we're going to do here is change the IF from 45 MHz to 25 MHz, maintaining the original circuit design of the radio, but keeping both receive and transmit frequencies within the ham band.

Let's start by examining the radio before modification. The transmit oscillator in these radios runs all the time, but is without modulation in the receive mode, thus generating a receiver IF of 45 MHz. From the schematic in your manual (you *do* have the manual, right?) you'll see that there's an amplifier tuned on the input and the output directly following the first mixer, followed by a 45-MHz 4-pole filter. This filter provides more than 30 dB of adjacent channel rejection.

Next we move from the filter and another tuned circuit to the second mixer. Here, A 35.6-MHz crystal oscillator plus the second IF (9.4 MHz) equals the 45-MHz first IF. Now, if we were to change the second oscillator frequency to 34.4 MHz, then subtract the second IF (9.4 MHz), we'd end up with 25 MHz, which, as noted above, is the split I've chosen for my repeater and which I felt at the time was a good offset for 902 to 928 MHz (again, see "Band Planning Problems" for more on offsets, etc.). If we remove the crystal filter and pad the coils down to 25 MHz, it will work (see Figure for block diagram of this arrangement).

A side-note here: There's nothing magical about a 25-MHz split except that it works, and I've converted several radios using that offset and don't want to start over. For those who are starting from scratch, though, there are other possibilities. For example, there are a lot of 21.4-MHz crystal filters around and, if you wanted to keep better selectivity in a metropolitan area, you might give some thought to a 21.4-MHz offset. The second oscillator would be 30.8 MHz and more "c" would have to be added to all of the coils. I haven't tried this scheme, but it might be a thought. Now, back to the 25-MHz plan.

In this conversion, the receiver has not suffered in sensitivity but has given up quite a bit in adjacent channel rejection. I can live with that, although I must admit that with a very good preamp, and without Channel Guard, I do hear some modulation from someone using a 900-MHz cordless phone. I've noticed that most analog phones deviate 15 kHz or more. CTCSS is desirable anyway. By the way, many cordless phones are also using a 25-MHz offset.

Changing the Offset to 25 MHz

Here's how to make your Exec II or the MVP receiver operate with a 25-MHz

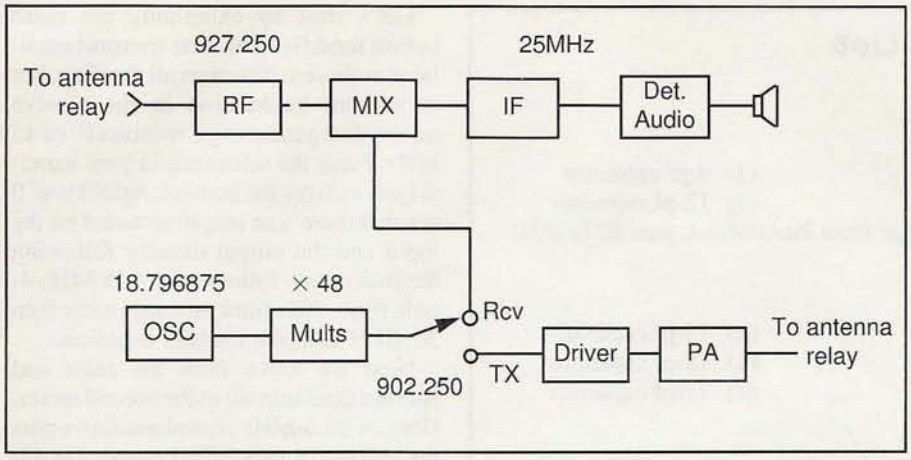


Figure. Block diagram of a single oscillator/multiplier string applied to both receive and transmit. Note that the 927.250-MHz received signal mixes with the 25-MHz IF to arrive at the local oscillator (and not coincidentally, transmit) frequency of 902.250 MHz. Using the radio's original 45-MHz IF would result in an out-of-band receive frequency. The local oscillator/multiplier chain is switched between receive and transmit.

offset—no adjustments are required in this circuit, just a new crystal and some added capacitors. First, replace Y1, the 35.6-MHz second oscillator crystal, with a 34.4-MHz crystal. This crystal might be available from any of the crystal manufactures, but International has the GE part number (19B206221G3) in its inventory and will cut it to 34.4 MHz (International's catalog number is 471460). Next, remove the crystal filter, FL1, and jumper a 4-pF capacitor from the input of where the crystal filter was to the output side. Add a 33-pF cap from the input side to ground, and another 33-pF cap from the output side to ground. This adds 33 pF to L2 and L4. Then add yet another 33-pF cap across L1 terminal 6 to ground. That will put everything very close to 25 MHz.

If you first tune up the receiver to somewhere in the 902- to 928-band, it will be very easy to tune the 25-MHz stages, as they are rather broad. Perhaps this scheme will turn on a few lights and some of you who are more knowledgeable about synthesized radios might come up with some ideas for those units. My experience, though is that many of the newer radios went to fixed front-end filters and cut off very abruptly above 890 MHz.

MVP Transmitter Conversion

These conversions so far have covered the Exec II transceiver and the MVP receiver. Now to the MVP transmitter, in case you're using the MVP intact as a control unit or mobile rig, rather than pulling out the exciter board.

The MVP uses the same oscillator frequency as the Exec II, and the 2C ICOM oscillator modules are interchangeable (see "The Other ICOM" for more on these precision crystal oscillators), but the multipliers are a little bit different. Essentially, though, you're multiplying by 48, so you'd need a crystal frequency of 18.796875 MHz to produce a transmit frequency of 902.250 MHz (see Figure). The following capacitors need to be removed and replaced with the following values: C 133 = 33 pF; C 114 = 22 pF; C 123 = 12 pF; C 125 = 10 pF; C 133 = 15 pF; C 135 = 12 pF.

The helical resonators, Z101 and Z102, are the same as in the Exec II. Carefully remove the copper covers and cut 1/4 turn off each. Re-install and tune. At 10 watts out, this little MVP makes a very nice control station, even though it is kind of large for a front-mount mobile in most vehicles today. I have a small control head that I've made and, one of these days, I'll have a trunk mount MVP.

Converting the Mastr II

The Mastr II station or repeater (Photo D) is again a bit different from the Exec II or MVP. The transmitter and receiver are totally independent of each other, in that they each have their own oscillators. The exciter and the receive oscillator (Photo E) each use a 1C ICOM for frequency control. The 1C is a 1 part per million oscillator only and does not have a modulator. It's used here because the Mastr II is a phase-modulated FM radio. Conversion is about the same as the Exec II or MVP, although—again—the multiplication is a little different. In the end, though, you're still multiplying by 48. The same procedures apply to the two output resonators, Z101 and Z102. Remove 1/4 turn from each. And the capacitors to change are as follows: C 127 = 27 pF; C 129 = 22 pF; C 136 = 39 pF; C 137 = 39 pF; C 147 = 15 pF; C 148 = 15 pF. Tuning of this exciter is easy and straightforward.

The receiver side's oscillator/multiplier is a bit different, even though the multiplication is still 48 times, and conversion is very simple. Change C404 to 33 pF and C410 to 10 pF. The two copper resonator covers and Z 401/Z 402 are of

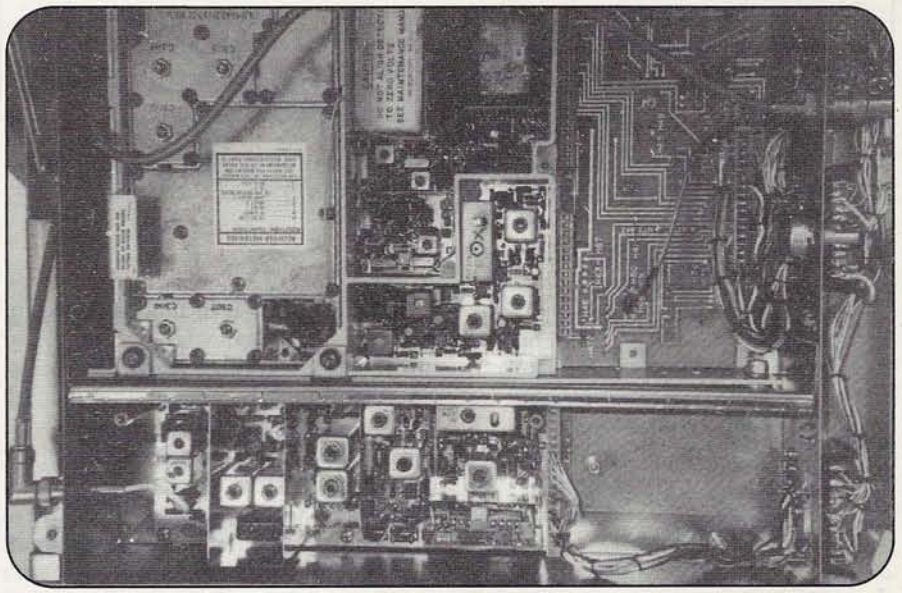


Photo E. Close-up view of the Mastr II receiver and exciter drawer.

The Other ICOM

A few words about crystals and GE "ICOMs." These are not made by the ICOM America with which we hams are familiar (although the company does make similar precision crystal modules for some of its high-end radios). In this case, ICOM is GE's abbreviation for "*Integrated Crystal Oscillator Module*," which is generically known as a *TCXO*, or *Temperature Compensated Crystal Oscillator*. Extreme heat or cold will change a crystal's frequency, so these precision crystal oscillator modules include "temperature compensation" (heating or cooling) to keep the crystals' frequencies within exact tolerances. The temperature compensation feature kicks in at temperatures below 32 degrees F or above 131 degrees F.

Each of these oscillator modules is slightly different and serves a specific function. For example, the 1C ICOM used in the Mastr II is a high-stability oscillator only and cannot be used in the Exec II or MVP because it does not include a modulator. Those radios use a 2C ICOM, which has its own FM modulator built in and cannot be used in the phase-modulated Mastr II. Finally, the EC ICOM requires external temperature compensation. No compensation is available on any of these three units, so the ECs are out as far as they're concerned.

As for sending ICOMs in to Ericsson for new frequencies, I've had very good results in buying the crystals and installing them myself. I've stayed with two of the major, long-time vendors (see "Resources"), monitor my repeater frequencies very closely, and have had no problems. Some people may not be comfortable working on these precision modules and may feel the expense of having the frequency changed professionally is worthwhile. You have to do what you feel is right for you.

the same construction as the other ones, except that these are at 400 MHz, not 800. The coils are made of enamel-coated wire. In this case, carefully remove one *full* turn from each coil. There is no 800- or 900-MHz tuning on this board. The helical resonators, L306 and L307, tuned by C306 and C307, will tune the output of the multiplier board for the injection 45 MHz below the receive frequency (again, with independent transmit/receive oscillators, there's no need to change the IF frequency in order to operate at a split other than 45 MHz).

That's all there is to the Mastr II conversion. The 35-watt PA will deliver 25 to 35 watts. This will vary from unit-to-unit, and some massaging of the output filter may increase output. If you intend to use this amp to drive a non-GE amplifier, you may have more than you need anyway. The original GE high-power amp required the full 35 watts to obtain full power. A couple of amplifiers that I've put together, which are described below, require only 5 to 8 watts to get 80 to 90 watts output, so even the 10-watt MVP does very well.

A "Mitrex Maybe" Amp

At one of the ham fairs last year, a stack of 800-MHz Motorola Mitrex mobiles sat until the show was nearly over, the price dropping by the minute, until a friend of mine, Fred Baker, W7SIX, came over and dumped four of them on my table. I guess he came up with a real bargain.

What to do with 800-MHz mobiles? No manuals, no information, nothing! Months later, I took one apart. The first thing I found was that the bandpass filters would not do 900 MHz, so it looked pretty bleak. I never cared much for the type of PAs used in the UHF radios, and these did not look any better. Maybe the transistors were good for something. I searched the Internet and all available cross-reference books and came up with a zero all the way around.

The rest of the radio wasn't much good for 900 MHz either, so with nothing to lose, I decided to see if some of the parts could be useful. Maybe I could build an amplifier for 902. I removed the PAs from two of the units and a driver from one of them. I took out all of the white Teflon® coax, too. Then, from among my "someday projects," I dug out a GE Mastr II heatsink. I drilled and tapped 4/40 screw holes to mount two of the "35-watt-looking" PAs side by side, nearly in the middle of the heatsink. I attached a BNC connector and a short lead of 4 or 5 inches of coax to the driver input, and I mounted the driver close enough to the PAs that I could use a quarter-wavelength of the white Teflon coax to get to the amplifier inputs (Photo F).

The velocity factor of the coax was unknown, so I just took sort of a guess and decided maybe 2 1/4 inches would be about right. I ran two lines in parallel from the output of the driver, one running to each PA input. The PA outputs were too far apart for a 1/4-wave, so I made two 3/4-quarter wavelength sections, about 7 3/4 inches each. I ran these from the output of each PA to an N connector where they both were tied together.

Next, I supplied 12 volts DC to each amplifier with a separate lead, using a ferrite bead on each amplifier close to the board. Each power lead went through a .001-µF feed-thru capacitor before being joined to one large power lead.

Testing the "Maybe" Amp

I set up a converted MVP on 900 MHz with the power control turned all the way down. I must confess that I was absolutely amazed when power was applied and I started to increase the power on the MVP—things really started to happen on the output of the new amplifier. At 7 watts input, I had over 50 watts output.

Experimenting with may different ideas, I came up with the following to achieve roughly 90 watts of continuous power out: Add a 2 1/4-inch piece of the Teflon coax, shorted on one end, to the point on the driver board where the two cables go to the PAs. All of these should have a common ground point next to the center conductor. I used a short length of heat shrink over the shorted end of the stub, made another one and connected it, in the same fashion, to the point where the PAs and the antenna came together. At this point, a lot of heat is generated in the coax. I put heat shrink tubing over these four pieces of coax and slid them into a 3-inch length of 1/2-inch aluminum tubing, then made up a bracket to hold the tube a couple of inches up from the heatsink.

I've made two of these amplifiers and both turned out about the same. One has 95 watts out, while I could only get 85 out of the other. If I had more of these, I'd like to try a true Wilkerson divider for the PAs. Maybe someone has tried that or will in the future.

By the way, all of the time these were being tested, I was using a spectrum monitor and watching it very closely. I saw nothing out of the ordinary from DC to 1 GHz. Running the output power through a bandpass cavity showed only the cavity loss.

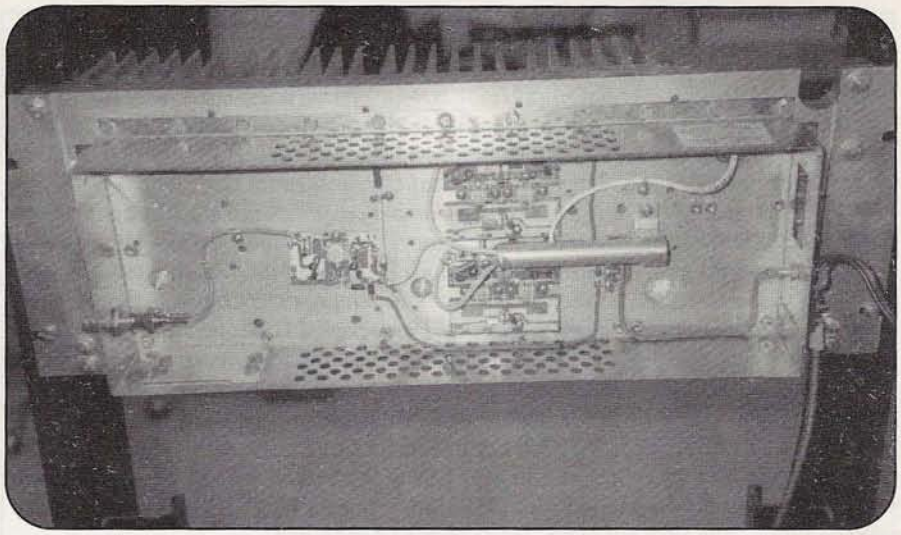


Photo F. The "Mitrex Maybe" amplifier. Built from two power amplifiers and a driver from surplus Motorola Mitrex transceivers, and mounted on a GE Mastr II heatsink, the unit amazed the author by working the first time and producing 95 watts out for about 8 in. This is one of two amps he's built this way.

Finally, I mounted a small muffin fan on the amplifier. With this configuration, I've had the PA keyed at its full 90 watts for many hours with no change in power or heating. On the other hand, the 100-watt dummy load had to have a big fan on it!

And, oh yes...along the way, I broke one of those wonderful white ceramic type-a boards. I soldered the runs with an extra amount of solder and, believe it or not, it worked just fine (it's a part of the 90-watt unit).

The Mitrex also has a predriver, and I tried using one of these in front of the driver. All that happened was that I had to reduce drive to less than 2 watts and there was some slight instability in the pre driver. With 6 to 8 watts of input power available from the MVP, I set that aside and stuck with the driver/dual-amplifier configuration.

Got a Better Idea?

Someone might come up with a better PA from these little units, and I hope they do. I still don't know what the transistors are or what they're rated at, nor do I have any idea what the impedances should be at some of the points in the circuit. I guess it doesn't matter too much. I now have two high-power amps that I didn't have before...and four fewer boat anchors. ■

Resources

For more information on converting GE Exec II radios to amateur repeaters, Ron Wright, N9EE, has an excellent guide on the Internet at <http://www.cdi2.com/build_it/ex2reptr.htm>. This is one of many postings on the "Amateur Repeater Builder's Home Page" put together by Eric Homa, N6NMZ. If you're interested in the challenge of building a repeater, check out this excellent resource at <http://www.cdi2.com/build_it/>.

GE radios are now made and supported by Ericsson. Parts may be ordered by contacting Ericsson, Attn: Service Parts, Mountain View Rd., Lynchburg, VA, 24502; Phone: (800) 368-3277. Additional information is available online at <http://www.ericsson.com> or <http://www.ericsson.se>.

I order my crystals from either of the following two companies:

Bomar Crystal Co., 201 Blackford Ave., P.O. Box 10, Middlesex, NJ 08846-0010; Phone: (732) 356-7787; Fax: (732) 356-7362; E-mail: <sales@bomarcrystal.com>; Web: <http://www.bomarcrystal.com>.

International Crystals, P.O. Box 26330, Oklahoma City, OK 73126; Phone: (800) 725-1426 (orders only) or (405) 236-3741; Fax: (405) 235-1904 or (800) 322-9426; E-mail: <freeland@icmfg.com>; Web: <http://www.icmfg.com>.

Can VHF Save Ham Radio?

What does the Fugs music group have in common with ham radio? For one thing, they share the same blank look you often get when mentioning either one to the general public. WB2AMU says ham radio needs to broaden its base, and that VHF needs to be center-stage in that effort.

It's funny how interesting parallels can be drawn to ham radio from situations that occur in other areas of life. Recently, I had the opportunity to attend a lecture in conjunction with a visiting writers program at one of the local colleges. The speaker was Ed Sanders, who, besides being one of the cleverer satirists of our times, was the driving force behind the 1960s music group, the Fugs.

Even though the meeting was held in the middle of the day, the organizers hoped that many non-students who were around during the 1960s would attend the talk. Unfortunately, the audience of 70 people turned out to be about 10% non-students and 90% students, many of whom were *required* to attend as part of their writing course.

If this talk had been given 25 years earlier, there would have been a few hundred people there, all fully aware of what the speaker was about. As it turned out, it was a bit sad, as there seemed to be a disconnect between the students and the speaker, as they knew little about him and his previous accomplishments. This was not a reflection on the talent of the speaker, who gave an excellent presentation, but rather what one of the faculty members called "...a reflection of the time [of day] and of the times."

The Ham Connection

I thought about how this same situation applies today to ham radio, which currently suffers from a similar disconnect between the hobby and the general public, particularly younger people. So many people today know nothing at all about ham radio, and those who might have heard a little bit about it often confuse it with CB radio, an erroneous connection that upsets many hams but is irrelevant to most other people. Accurate, up-to-date information about our hobby is just not getting out to the general public! As a whole, the hobby is poorly advertised and poorly marketed.

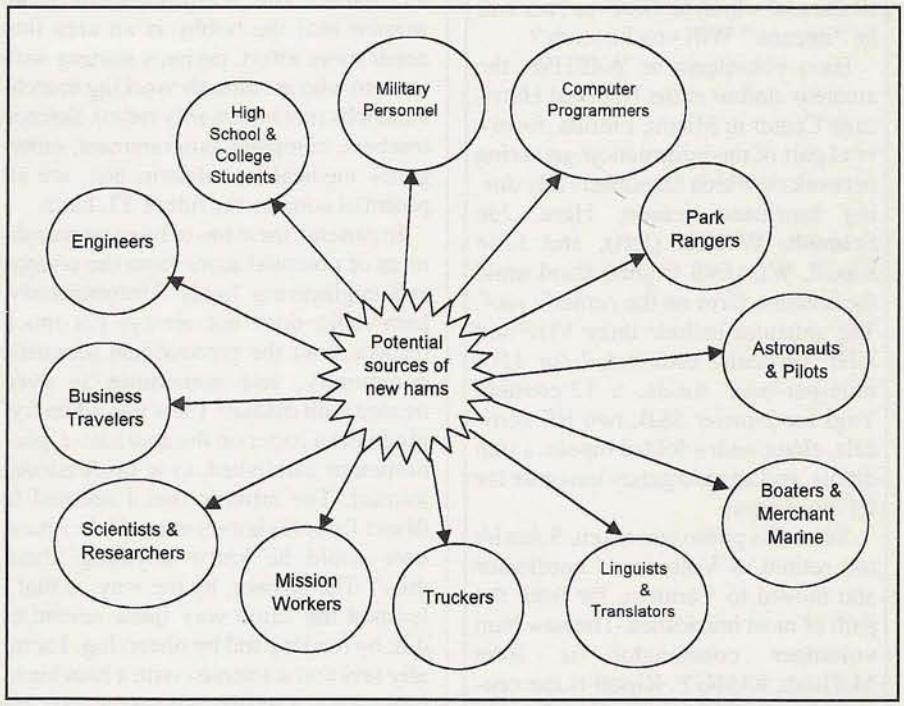


Figure. Anyone in a technical career or one that requires long periods away from home is a good candidate to become a ham. Recruitment efforts should focus on all of these groups.

There is much talk about trying to recruit young people through Boy Scouts and school radio stations. This is important. Yet, I don't think that we want our young people to hear some of the bad things—such as the cursing on 75-meter phone or jamming incidents on 2-meter FM—and think that this is what ham radio is about. Certainly, youth is key to keeping the numbers high in the ham radio population, but there are other areas that need to be addressed. Reaching our

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*By Ken Neubeck WB2AMU (wb2amu@cq-vhf.com)

On the Cover

June marks the beginning of the 1999 hurricane season, one in which Colorado State University hurricane guru Dr. William Gray predicts there will be 14 tropical storms and nine hurricanes, of which he believes four will be "intense." Will you be ready?

Ham volunteers at W4EHW, the amateur station at the National Hurricane Center in Miami, Florida, form a vital part of the information-gathering network on which forecasters rely during hurricane season. Here, Joe Schmidt, W4NKJ (left), and Julio Ripoll, WD4JNS (right), stand amid the antenna farm on the center's roof. The antennas include three VHF and UHF verticals, each rated for 150-mile-per-hour winds, a 12-element Yagi for 2-meter SSB, two HF verticals, along with a folded dipole, a trap dipole, and an emergency longwire for HF operations.

Since this photo was taken, Schmidt has retired as Volunteer Coordinator and moved to Vermont, far from the path of most hurricanes. The new ham volunteer coordinator is John McHugh, KU4GY. Ripoll is the center's Assistant Volunteer Coordinator, and he says that a major part of W4EHW's VHF operation is collecting automatically transmitted weather data via APRS, the Automatic Position Reporting System. When Hurricane Georges swept across the Florida Keys last year, Ripoll says, APRS data was the *only* weather information coming into the center from the Keys.

In the wake of 1998's very active and deadly hurricane season, the W4EHW volunteers received the National Hurricane Center's first-ever public service award, plus a national award presented at the 1999 National Hurricane Conference in Orlando. Congrats to all from *CQ VHF*. (Cover photo by Larry Mulvehill, WB2ZPI)

youth should not be the *only* solution to increasing the ranks of the ham radio population. And there are some aspects of the hobby, particularly in the area of VHF operating, that may be very important in recruiting efforts.

Targeted Recruiting

If we look at ham radio, we see that it is primarily composed of men, with very few women. Several other hobbies have this same situation. Could this because the concept of radio is a technical subject to which few women are exposed? Or it because radio as a hobby has little appeal to women?

Some of the men in the hobby sometimes display chauvinistic attitudes on the air that may be a turnoff to potential YL hams. The recruitment of more women into the hobby is an area that needs more effort, perhaps starting with women who are already working in technical jobs (not necessarily radio). Science teachers, computer programmers, emergency medical technicians, etc., are all potential sources for future YL hams.

In general, there has to be more recruitment of potential hams from the science and engineering fields. Unfortunately, ham radio does not always get much respect from the professional scientific community, and sometimes is even treated with disdain. I saw this when trying to get a paper on the sporadic-*E* phenomenon published in a professional journal. The attitude that I seemed to detect from reviewers was, "He's a ham, how could he know anything about this?" The answer, by the way, is that I learned the same way these scientists did: by reading and by observing. I actually feel that a scientist with a ham background has a terrific advantage over his colleagues because he has an easier time making such observations. The hobby needs more respect and participation from the professionals.

The Figure shows the various target groups that we should be looking at for potential newcomers to the hobby. During my long ham radio career, I have worked hams from every one of the groups shown in the figure. For example, I have worked Rick Kissell, WB9GYT, a Spanish translator who credits exposure to Spanish DX stations on the ham bands as a major part of his career. I have worked a few park rangers, including Dave Frankenberry, KD3RZ, who operates 6 meters from some rare

"Did you know that hams were the first to discover the sporadic-E phenomenon in 1935 in the 54-MHz range?"

grids during his assignments to various national parks in Minnesota. I have worked both recreational boaters and professional mariners, such as Clint Walker, W1LP, who is a chief mate on a chemical carrier and who activates many rare water grids on 6 and 2 meters during his frequent trips.

Let's Be Salesmen

The future need not be bleak for ham radio. We just need to focus a little bit more on our target audience and spread the word. Any person who is away from home for long periods of time is a potential candidate for ham radio. In this group are astronauts, missionaries, businessmen, and truckers, all people who spend a lot of time "on the road." I can tell you from personal experience that, in some places where one can get stuck on a business trip for a week or more, and checking out the local mall is the only excitement, ham radio can be a real godsend! Not only is it fun to observe conditions from a new location, but it provides you with an opportunity to meet local hams (*who can be a lot more interesting than the local shopping malls—ed.*). I have done this not only on 2-meter FM but also on 6-meter SSB! (By the way, those giant mall parking lots make good mobile station locations!)

Addressing potential candidates from the target areas shown in the Figure may also help bring in more young people to ham radio. Many of the adults in these target groups have children, and passing down the hobby from a parent still remains one of the most viable paths for getting young people into the hobby.

Promoting Ham Research

Amateur radio is losing ground in the area of emergency communications. Cellphones and other radio services are sometimes more effective than what hams can offer to a community or service group. This is more a reflection of the changing times than a specific fault with hams in this area. Even so, hams must continue to upgrade their skills and look

for ways to keep up with new trends that they may be able to use in emergency and public service communications.

While it's still important to push our emergency capabilities, it's just as important to promote the research aspects of our hobby. And here is where VHF takes center stage. Think about it for a minute: Where are the new scientific challenges in the ham radio hobby? There is really is not much new to be discovered in the area of HF, except for some technical advances, such as DSP filtering. F_2 skip activity on HF during the solar sunspot peak is pretty much old hat. Contests are always fun, but there's no real new ground being broken here, either. It would appear that VHF is really where there are still challenges, both in the areas of technology and propagation research, specifically in regard to microwave, high-speed meteor scatter, and satellite communications, and such propagation modes as aurora and sporadic-*E*.

Did you know that hams were the first to discover the sporadic-*E* phenomenon in 1935 in the 54-MHz range? In 1938, J. A. Pierce, W1JFO, combined the sporadic-*E* observations made by hams on 54 MHz with scientific insights for a study conducted by Harvard University, and documented his research in the September, 1938, issue of *QST*. Hams continued to provide observations on the 6-meter band in the late 1940s that provided data to Oliver "Perry" Ferrell in his articles on sporadic-*E* in *CQ* magazine. Similar ground-breaking research has been done by hams with regard to meteor scatter and aurora propagation modes. (*In addition to his propagation column in* CQ, *Ferrell headed a federally funded "Radio Amateur Scientific Observations" project, based solely on observations by hams, that formed the basis for much of what we know today about VHF+ propagation.***—*ed.*).

**"*CQ*: Taking the Mystery Out of HF Propagation," by George Jacobs, W3ASK, *CQ* magazine, January, 1995, p. 81.

"There's more work that needs to be done in understanding some of the unique propagation modes that we have in [the VHF/UHF] range, and hams can continue to make a significant contribution."

VHF is the key to the future for the hobby to survive as something meaningful that will draw the attention of new candidates. The garbage on 75-meter phone, the DX pileups on the HF bands, and the jamming of 2-meter repeaters are not activities that will appeal to the potential candidates we would want to join the hobby.

We should be encouraged to share our hobby with those who don't yet know about it. During your lunch breaks, demonstrate some of the stuff that you can work on your ham radio to people whom you work with. Bring in your QSL cards from other states and countries to accentuate the fun aspect of the hobby. After all, it's not all just technical jargon!

A Real Opportunity

There's a real opportunity for us in the VHF field to make things happen. There's more work that needs to be done in understanding some of the unique propagation modes that we have in this range, and hams can continue to make a significant contribution. In the meantime, we have to continue to make the hobby relevant and not just a closed clique. If we do not expand beyond the current walls that we have set up around the hobby, then someday a ham will be speaking in front of an audience (as our speaker did at the beginning of this article) and find his listeners to be indifferent or disconnected. Let us all push the envelope a little, particularly in VHF, to make this hobby appealing and interesting to all! ■

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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.*

Hamfest Calendar

The following hamfests are scheduled for June, 1999:

June 4–5, 1999 Hamboree 21 & Iowa State Convention, Marina Inn, **South Sioux City, NE**. Talk-in: 146-31/.91. For information, contact Mike Nickolaus, NFØN, 316 East 23rd Street, South Sioux City, NE 68776; Phone: (402) 494-6070; E-mail: <nføn@avalon.net>. **(exams) Handicap Accessible**

June 5, Annual Spring Hamfest, Fairleigh Dickinson University, **Teaneck, NJ**. Talk-in: 146.790 -600. For information, call Jim Joyce, K2ZO, at (201) 664-6725 (please no calls after 10 p.m.). **(exams)**

June 5, Hamfest, Illinois State Fairgrounds, **Springfield, IL**. Talk-in: 146.685(-). For information, contact Ed Gaffney, KA9ETP, 13997 Frazee Rd., Box 14A, Divernon, IL 62530; Phone: (271) 628-3697; E-mail: <egaffney@fgi.net>. **(exams)**

June 5, Picnic & Tailgate Hamfest, Bronco Club, **Courtland, VA**. Talk-in: 147.30/.90 (K4SPS repeater). For information, contact Stewart Tyler, WA4JUO, 801 Normandy Drive, Suffolk, VA 23434-2907; E-mail: <Stu.Tyler@Juno.com>.

June 5, 12 Annual Bangor Hamfest, Hermon High School, **Bangor, ME**. Talk-in: 146.34/94, 146.52. For information, contact Roger W. Doyle, KA1TKS, Chairman, RR #2 Box 730, Bangor, ME 04401, (207) 848-3846. **(exams)**

June 5, 19th Annual IRA Hamfestival, Hudsonville Fairgrounds, **Grand Rapids, MI**. For information, contact Kathy Werkema, KB8KZH, at (616) 698-6627 between 4 and 7 p.m.

June 6, Starved Rock R.C. Princeton Hamfest, Bureau County Fairgrounds, **Princeton, IL**. For information, e-mail: <w9mks@qsl.net>, call (815) 856-3773, or Web: <http://www. qsl.net/w9mks/>.

June 6, Hall of Science Amateur Radio Club Hamfest, New York Hall of Science parking lot, Flushing Meadow Corona Park, **Queens, NY**. Talk-in: 444.200 repeater, PL 136.5, 146.52 simplex. For information, contact Stephen Greenbaum, WB2KDG, at (718) 898-5599 (evenings only); E-mail: <WB2KDG@Bigfoot.com>.

June 6, 45th Breezeshooters' Hamfest, Butler Farm Show Grounds, **Butler, PA**. Talk-in: 147.96/.36. For information, send SASE to Rey Whagner, W3BIS, Hamfest Chairman, 5430 Cove Run Road, Cheswick, PA 15024 or call (412) 828-9383, or e-mail: <w3bis @freewwweb.com>. **Handicapped Accessible**.

June 6, Manassas Hamfest, Amateur Radio, Electronics & Computer Show, Prince William County Fairgrounds, **Manassas, VA**. Talk-in: 146.97- @ 224.660-. For information, contact Mary Lu, KB4EEP, at (703) 369-2877 for hamfest details, or visit their Web site: <http://www.qsl.net/olevahams>.

June 6, 15th Year Hamfest, Medina County Fairgrounds Community Center, **Medina, OH**. Talk-in: 147.630 in / 147.030 out. For information, contact Mike at (330) 273-1519; E-mail: <m2mgroup @aol.com>. **(exams)**

June 6, 31st Annual Hamfest & Computer Show, Wabash County 4-H Fairgrounds, **Wabash, IN**. Talk-in: 147.03/147.63 -442.325/ 447.325. For information, SASE to WABASH, County Amateur Radio Club, c/o Ralph Frank, 4010 N. 700 W. Wabash, IN 46992; Office phone: (219) 563-8487; Fax: (219) 563-8489 - (765) 833-7372-home; Web: <www.netusal.net/~qrziota/>.

June 11–12, 17th Annual Albany Hamfest, at Hasan Temple, **Albany, GA**. Talk-in: 146.82. For information, contact Ricky McCrary, KD4OZR, AARC., P.O. Box 70601, Albany, GA 31708-0601, (912) 438-9714, <rmccray@planttel.net>. **(exams)**

June 12, Macon, MO Hamfest & Fleamarket, Macon Vo-Tech School, **Macon, MO**. Talk-in: 146.805-. For information, contact KØKY, Dale Bagley, P.O. Box 13, Macon, MO 63552; E-mail: <dbagley1@istmacon.net>; Web: <http://www.istmacon.net~kfoster/hamfest.htm>. **(exams)**

June 12, 1999 Winston-Salem Classic Hamfest, Dixie Classic Fairgrounds, **Winston-Salem, NC**. Talk-in: 146.64 MHz (-600 kc), alt. 145.47 MHz (-600 kc). For information, contact FARC Hamfest, P.O. Box 11361, Winston-Salem, NC 27116-1361; Phone: (336) 723-7388; Web: <http://members.xoom.com/w4nc/Hamfest.htm>.

June 12, 25th Annual Fleamarket, Fergus Community Center, **Fergus, Ontario, Canada**. Talk-in: 146.97- or 145.21-. For information, contact Bill Smith, VE3WHS, 32 McElderry Rd., Guelph, ON, Canada N1G 4K6; Phone: (519) 821-6642; Packet: <VE3WHS@VA3SED.#SWON.ON.CA.NA>; Web <smith.ve3whs @sympatico.ca>.

June 12–13, Moose Swappers Hamfest & Computer Fleamarket, Lancaster Fairgrounds, **Lancaster, NH**. Talk-in: 145.430, 145.150, 147.315. For information, contact Russ, N1YZE, at (603) 922-5514; E-mail: <custv@together.net>. **(exams)**

June 13, 42nd Annual Ham Radio and Electronic Fleamarket (also featuring Antique & Vintage radios), DuPage County Fairgrounds, **Wheaton, IL**. Talk-in: K9ONA, 146.52; K9ONA/R 146.37/97 (107.2). For information, contact 24-hour InfoLine: (708) 442-4961. **(exams)**

June 13, "Ham-O-Rama'99", Summit View Middle School, **Independence, KY**. Talk-in: 147.255+ or 147.375+ repeaters. For information, contact N8JVM, c/o NKARC, P.O. Box 1062, Covington, KY 41022.

June 13, 33rd Annual Hamfest & Electronics Fleamarket/ ARRL Tennessee State Convention, National Guard Armory, **Knoxville, TN**. Talk-in: W4BBB-147.30+/224.50-/ 444.575+. For information, contact David Bower, K4PZT, at (423) 974-5064 (work), (423) 670-1503

Operating Notes

For Late May and June, 1999:

May

21–23	**CQ VHF Spring Activity Weekend (specialty modes) (see March *CQ VHF*)**
21–23	Six Club weekend contest
23	Good EME Conditions

June

7	Arietids meteor shower peak
9	Zeta Perseids meteor shower peak (don't confuse this with the major Perseids shower in August)
12–14	ARRL June VHF QSO Party (see rules, this issue)
18–20	SMIRK 6-meter QSO Party
26–27	ARRL Field Day

EME data courtesy W5LUU. More contest info is available in our "Annual VHF Contest Calendar," elsewhere in this issue and on the CQ VHF *Web page at:* <http:/www.cq-vhf.com/navhfcon.htm>.

(home), or write to P.O. Box 50514, Knoxville, TN 37950-0514, e-mail: <rack@korrnet.org>. **(exams)**

June 13, Hamfair, Ham Radio & Computer Fleamarket, Briarcliffe College, **Bethpage, NY**. Talk-in: 146.85- repeater. For information, contact Long Island Mobile Amateur Radio Club at: (516) 520-9311; E-mail: <hamfest@limarc.org>; Web: <http://www.limarc.org>. **(exams)**

June 13, 32nd Annual Hamfest & Family Picnic, Wingfoot Lake Park, **Akron, OH**. Talk-in: 146.985, 146.520. For information, contact Dave White, KA8KNP, 719 Notredame Ave., Cuyahoya Falls, OH 44221; Phone: 330-928-7625; E-mail <rjtaylor@akron.infi.net>.

June 18–20, 29th Annual Picnic and Hamfest, Burbank Campsite, **Alberta, Canada**. Talk-in: 147.150 +600 MHz or 146.520 simplex. For information, contact Bob, VE6BLD, 5540 54th Ave, Lacombe, Alberta, Canada, T4L 1L6 or call (403) 782-3438 (evenings); E-mail <kingel@telusplanet.net>.

June 19, Electronic Flea Market, Rutland United Church Hall, **Kelowna, BC**. For information, call OCARC at (250) 766-2179; Web: <http://www.okanagan.net/ocarc/>; E-mail: <ve7kng@rac.ca>.

June 19, 23rd Annual Hamfest, Gerstacker Fair Center, Midland County Fairgrounds, **Midland, MI**. Talk in: 147.000+ MHz. For information, contact MARC Hamfest, P.O. Box 1049, Midland, MI 48641-1049, call Del, WB8FYR, at (517) 636-5097; E-mail: <lafevordel@aol.com>; Web: <http: //www.qsl.net/ w8kea/MARC-SWAP.htm>. **(exams)**

June 19, Eastern Ontario Hamfest & Computer Fleamarket, Marmora Area Curling Club, Marmora, Ontario. Talk-in: 146.520 MHz. For information, call Paul, VE3UUM (613) 472-3449, or Pete, VA3PGB (613) 473-1171; E-mail: <rhobson@blvl.igs.net>; Web: <www.redden.on.ca/~tcarc/tricnty.htm>.

June 19, Hamfest, Columbia Park, **Dunellen, NJ**. Talk-in: 146.025/625, 146.520 simplex. For information, contact Bob Pearson, WB2CVL, at (732) 846-2056, or Fred Werner, KB2HZO, at (732) 968-7789 before 8 p.m.

June 20, Hamfest & Computer Show, Monroe County Fairgrounds, **Monroe, MI**. Talk in: 146.72/12. For information, contact Fred VanDaele, KA8EBI, 4 Carl Drive, Monroe, MI 48162 or call (734) 242-9487 after 5 p.m.

June 20, Tailgate Electronics, Computer & Amateur Radio Fleamarket, Albany & Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl2A - W1XM/R. For information, contact W1GSL, P.O. Box 397082 MIT BR., Cambridge, MA 02139-7082. **Handicapped Accessible**

Looking Ahead in CQ VHF

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

- "Setting Up a SAREX Contact," by Phil Chien, KC4YER
- "222 MHz—the Forgotten Band," by Bill Cameron, KB2BZP
- "Rover: More Than a Contest Category," by Dave Bostedor, N8NQS

Plus...

- "Hollywood Ham Watch," by Bill Tracy, KE6EJQ
- "Communicating with Your Computer," by Lew Ozimek, N2OZ
- "Portable Power—Part 2," by Brent Walton, KF6FGB

News *(from page 6)*

each 100 kHz of spectrum in the 70-centimeter repeater subband.

New Coordination Group Formed in Connecticut

There is a new repeater coordination group in Connecticut, according to one of its founders, Mark Casey, K1MAP. The Connecticut Spectrum Management Association (CSMA) was established in March—at a meeting attended by representatives of 42 Connecticut repeater—to pick up where the now-defunct Tri-State Amateur Repeater Council (TSARC) left off. TSARC had provided coordination for repeaters in Connecticut, southeastern New York State, and northern New Jersey. No replacement groups have yet been formed in those other areas.

ORSI: Reports of Our Death Are Greatly Exaggerated

April's "VHF News" column reported on a letter received from former Oklahoma Frequency Coordinator Hal Dietz, WB9VMY, stating that the Oklahoma Repeater Society (ORSI) had not appointed a successor to him and had apparently stopped functioning. For this reason, Dietz said, he and other hams had formed a new coordination group, the Oklahoma Repeater Coordination Group.

We now have word from ORSI Treasurer John Brassfield, N5SAM, that the original organization is indeed still alive and "continues to function without (Dietz's) support." The letter also charges that Dietz has refused to turn over the state repeater coordination database and is refusing to accept certified letters from ORSI.

So what we appear to have in Oklahoma is an old-fashioned repeater war, with competing coordination groups vying for "legitimacy." Ultimately, that will be determined by the majority of the repeater owners/trustees in the state, who now must decide which group can better serve their needs.

"Team USA" Members Sought for Foxhunt Competition

The first International Amateur Radio Union (IARU) Region 2 amateur radio direction-finding (ARDF) championships will be held this summer in Oregon, and organizers are recruiting experienced "on-foot foxhunters" for the U.S. team. Registration forms may be downloaded from the Web site of U.S. ARDF Coordinator Joe Moell, KØOV, at <http://members.aol.com/homingin/> (don't forget that last slash), or by mail (please send an SASE) from Joe at P.O. Box 2508, Fullerton, CA 92837. The Canadian team coordinator is Perry Creighton, VE7WWP, who can be reached at <ve7wwp@rac.ca>. In other countries, contact your national ARDF coordinator or your national ham radio society. The championships will be held the second week in August.

First Voice Contact Made via SunSat

Two key players in the construction and launch of SO-35, or SunSat—South Africa's first amateur satellite—made the first voice contact through it in mid-March. According to the AMSAT News Service, Project Leader Garth Milne, ZR1AFH, contacted AMSAT-SA President Hans van de Groenendaal, ZS5AKV, with strong signals and excellent voice quality reported. At press time, SO-35 was not yet open for general amateur use. ■

Basics

Emergency Communications

Staying on the air in emergencies and getting messages into and out of disaster areas is probably the single best-known aspect of amateur radio. When all else fails, ham radio gets through. But how do we stay on the air when no one else can? And how do we know what to do when the need arises? The answer is simple: preparedness and practice.

Preparedness includes knowing your equipment and its capabilities (as well as its limitations), having what you'll need for extended operation in less-than-ideal circumstances (batteries, antennas, etc.), and training in how to set up and use your equipment effectively and efficiently in an emergency. Once you've learned how to set up and operate under emergency-type conditions, you need to *practice* those skills by helping out at public service events, such as parades, walk-a-thons, bikathons, etc., and by participating in formal "nets," or on-air networks, to learn procedures.

Amateurs in Utah assist in search and rescue operations. Proper training before the emergency is vital if we are to be truly helpful. (Photo courtesy Utah County SCATeam)

Who Provides the Training?

Ham radio emergency communication is generally conducted under the umbrella of one or more emergency service organizations. These may be totally within ham radio or may be part of larger organizations. Most often, hams are trained by other amateurs who have gone through the process before and want to share their skills with others. Let's take a brief look at some of the best-known groups in the U.S.

ARRL Groups

ARES stands for the *Amateur Radio Emergency Service* and is the emergency communications arm of the American Radio Relay League (ARRL). Usually organized by county, an *Emergency Coordinator,* or *EC*, runs local ARES operations. You may register with ARES (through your EC) whether or not you are an ARRL member. Most ARES groups hold regular training nets and participate in drills and public service activities.

NTS, an abbreviation for the *National Traffic System,* is the ARRL's message-forwarding network. If you've ever been to a fair and seen a sign that says "Free Messages By Ham Radio," chances are these messages are sent through the NTS. Generally, non-emergency messages into and out of a disaster area are also routed through NTS. Most NTS nets meet daily, handling routine "traffic," or messages, giving participants plenty of opportunity to learn and practice their skills in handling written message traffic.

Off to the RACES

RACES is the *Radio Amateur Civil Emergency Service* and is actually a separate radio service established under Part 97 of the FCC's Rules and Regulations. RACES is operated on a national basis by the Federal Emergency Management Agency (FEMA) and locally by state and local Offices of Emergency Management (or whatever they happen to be called in your area). Under FCC rules, hams participating in RACES are limited to one hour of practice each week, and may speak only with other RACES-registered stations when operating in a RACES net. RACES emergency nets may be activated only at the formal request of an authorized government official and must shut down when an emergency is declared to be over.

(The ARRL recently petitioned the FCC to relax some of these restrictions. The League requested authority for RACES groups to conduct up to five hours of training each week, which would allow participation in long-term drills, and for RACES stations to communicate with any other ham "working" an emergency, even if that ham isn't a RACES member. This would enable RACES and ARES groups to exchange messages, or a RACES station at an emergency management facility to contact a ham at a Red Cross shelter without having to worry if that other ham is also a RACES member.)

CAP, MARS, and SKYWARN

Three non-amateur services in which many hams participate, and which also are active in emergency communications, are *CAP*, the *Civil Air Patrol*;

MARS, the *Military Affiliate Radio System*, and *SKYWARN*, the National Weather Service's corps of volunteer weather "spotters."

CAP is the U.S. Air Force Auxiliary and is heavily involved in search-and-rescue and other emergency operations. CAP communicators—many of whom are hams—use frequencies just outside the VHF amateur bands. Most VHF ham rigs can be modified to operate on these frequencies once you show your dealer or the manufacturer your authorization to operate there.

There are three separate MARS organizations: Army, Air Force, and Navy /Marine Corps. Hams who join MARS are issued separate MARS callsigns and also operate on frequencies immediately adjacent to both HF and VHF amateur bands. Most often, MARS members are involved in handling messages and "phone patches" to and from members of the U.S. Armed Forces, no matter where in the world they may be. (Phone patches are connections between radio and telephone, so that a serviceman or woman overseas may be hooked up with a ham back in the U.S., who then phones a family member and "patches" the two together.) MARS members may also be called on to provide emergency communications, especially if the armed service has also been called in to help deal with a disaster or other situation.

When severe weather threatens, the National Weather Service (NWS) relies on *SKYWARN* volunteers to report conditions and observations in various places. Many of these trained weather spotters are hams, and there are many SKYWARN nets in operation around the country. Hams who are SKYWARN spotters generally use amateur frequencies to report their observations, and some NWS offices have permanent ham stations installed in order to monitor SKYWARN reports.

Served Agencies

Most ham radio emergency groups don't operate in a vacuum, talking only among themselves. To be most useful, hams are sent to places where their communication skills can be put to use in keeping disaster response organized and functioning smoothly. These places typically include hospitals, Red Cross shelters, etc. Organizations such as the Red Cross, the NWS, and emergency management agencies are often referred to by hams as *served agencies*, since they're the agencies for whom we commonly provide communications services. Served agencies also include the sponsors of various non-emergency events through which we get much of our "on-the-job training," for instance, the March of Dimes, the American Diabetes Association, etc.

Most of these organizations don't operate their own communication networks (which is why they ask us for help), so ham radio participation is usually through an amateur group, such as a local radio club or ARES group. Generally, the served agencies provide us with the *opportunities* for training, while our own groups provide the actual training.

Getting Involved

Most emergency communications activity on VHF/UHF is conducted on FM and packet. The best way to get started is right in your home area. Ask for information from other hams you meet on the air. Listen on your local repeaters for NTS traffic nets, ARES training nets, etc. Try to get a feel for the net procedure. Check in if you feel comfortable doing so; otherwise, wait until after the net is over and call the Net Control Station and ask for information on participating in the net. You can expect to be welcomed and invited to join the next session. For more general information, see the "Resources" box accompanying this article.

You Must Remember This...

Hams' ability to provide emergency communication—and our record of doing so successfully time after time—is a critical reason for our continued existence and our continued access to frequencies that could easily bring billions to Uncle Sam on the auction block. It's equally critical that every ham have at least a passing understanding of how to provide useful communications during an emergency. Consider it your "rent" for the use of the frequencies. And the time to learn is *before* the tornado or hurricane hits, not *after!* ■

Resources

For more information about the various organizations described in this article, we recommend the following:

ARES—Contact your local ARRL Emergency Coordinator, Section Emergency Coordinator or Section Manager (SMs' names and addresses are listed in every issue of *QST* magazine and on the ARRL Web page, <http:www.arrl.org>, or contact ARRL Headquarters at 225 Main St., Newington, CT 06111; Phone: (860) 594-0200. Ask for field service.

CAP—Request an information package from CAP National Headquarters at 1-800-FLY-2338; write to HQ CAP/ DPM, 105 S. Hansell St., Maxwell AFB, AL 36112-6332; or connect to the CAP World Wide Web site at <http://www.cap.af.mil>.

MARS—Look for MARS tables at local hamfests, ask about it at club meetings, or visit the Army MARS Web site at <http://members.aol.com/aat6fv/>.

NTS—Contact the Net Control Station, Net Manager, Section Traffic Manager, Section Manager or ARRL Headquarters (see ARES listing for contact information).

RACES—Contact your local or county Office of Emergency Management (or whatever it's called where you live). If there's no specific listing in the phone book, call your town, city, or county clerk's office, or the police department's *non-emergency* number.

SKYWARN—Contact the National Weather Service forecast office serving your area. If there's no listing in the phone book (or the office listed in your phone book is closed!), tune in NOAA Weather Radio (162.400, 162.475 or 162.550 MHz, depending on where you live) and listen for the location of the forecast office from which your local broadcast originates. Then call directory assistance for the phone number, and ask for the meteorologist in charge of SKYWARN.

CQ VHF Hamlink

CQ VHF "Hamlink" offers *free listings* of clubs, licensing classes, and exam sessions for up to four months at a time! *Plus*, for $1/month or $10/year, we also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings are $5/month or $50/year).

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 are 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 via the Web at <hamlink@cq-vhf.com>. Be sure to say what it is in the subject line (e.g., Club Listing).

Club Listings

AL, Pell City, St. Clair County ARES: Meets 1st Monday of each month at 7 p.m. St. Clair County EMA Building basement, 1610 Cogswell Ave., Pell City. ARRL testing 3rd Monday of each month, same location. Repeater: 145.130-PL 103.5. ARES net Tuesday 8 p.m. Contact Rick Yuhas, 525-4669.

CA, El Cajon, Amateur Radio Club: Meets 2nd Thursday of each month at 7 p.m. La Mesa Church of Christ, 5150 Jackson Dr., La Mesa, CA. Visitors welcome. Repeater: 147.420 (output) 146.475 (input) 107.2 PL. Nets: WAMO/YL/Young persons (<16); E-mail: <KF6ILA@hotmail.com>; Web: <http://www.eylar.com/arcec/>.

CA, Fremont, South Bay Amateur Radio Association (SBARA): Meets 3rd Wednesday of every month (except June abd December) at 7:30 pm., Freemont Community Center, 40204 Paseo Parkway, Fremont, CA. For information about SBARA, see our club Web page: <www.qsl.net/sbara>; E-mail: <sbara@qsl.net).

CA, Fullerton Radio Club: Meets 3rd Wednesday of every month at Fullerton Senior Center at 340 W. Commonwealth Ave., Fullerton, CA at 7:30 p.m. PST. Tuesday night net repeater 147.975, 8 p.m. PST. Visitors welcome. For more info, visit Web site at: <http://ourworld.compuserve.com/homepages/kc6yhm>, or call Mike Cramer, KC6YHM, at (714) 996-4510.

CA, Sacramento Amateur Radio Club: Meets 2nd Wednesday of every month at 7 p.m., Sacramento Blood Bank, 1625 Stockton Blvd., Sacramento. Visitors welcome. Repeater W6AK 146.91- PL100. Info at P.O. Box 161903, Sacramento, CA 95816-1903 or Tom, KQ6EO, at (916) 722-9358; E-mail: <ke6eo@jps.net>; Web: <http://home.sprynet. com/sprynet/w6ak>.

CA, San Clemente, Beach Cities Wireless Society: Meets 2nd Thursday of each month at 7 p.m. Ole Hanson Beach Club at beach end of Ave Pico and PCH, San Clemente, CA. Visitors welcome. Open repeater 146.025(+) PL 110.9), net Wed. eves. 8 p.m.. For more info, visit club Web site at <http://www.qsl.net/bcws> or contact Tom (949) 661-4307, e-mail: <prmercury@earthlink.net>, or write to BCWS, P.O. Box 4016, San Clemente, CA 92674-4016.

CA, Santa Barbara Amateur Radio Club: Meets 3rd Friday of month September–May at 7:30 p.m., County Schools Auditorium, 4400 Cathedral Oaks Rd., Santa Barbara. For more info, see <http://www. sbarc.org>, or call (805) 569-5700.

CO, Bicycle Mobile Hams of America: National nonprofit club of bicyclists who use VHF radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at HamVention. Net: 14.253, 1st & 3rd Sundays, 2000 UTC. E-mail: <hartleyal@aol.com>. For info, sample newsletter, send SASE to BMHA, Box 4009-CV, Boulder, CO 80306-4009.

FL, Clearwater Amateur Radio Society: Meets 7:30 p.m. 2nd Tuesday of each month, Clearwater Red Cross, 624 Court St. Linked repeaters: 146.97 (103.5), 224.94, 444.15 (103.5) and 444.575 (131.8) Club net: Wednesday at 8 p.m. Web: <www.fgcarc.org/cars>; E-mail: <k2sec@amsat.org>. Paul E. Knupke, Jr., KR4YL <pk@ij.net>.

FL, Englewood Amateur Radio Society: Meets 3rd Friday of each month at 7:30 p.m., Room 400 of Englewood United Methodist Church, 700 East Dearborn St., Englewood. Two-meter net at 7:30 p.m. all other Fridays (146.700). For more info, visit <http://www.flnet.com/~crosby/ears>, or call Jack, W4JS, at (941) 475-1929.

FL, Highlands County Amateur Radio Club: Meetings held 3rd Monday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Visitors are welcome. Repeaters at 147.045 +.6, 442.350 +5.0, with packet on 144.970. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

FL, Lakeland Amateur Radio Club, K4LKL: Meetings held first Monday of each month, 7 p.m. @ 2400 Buckingham Ave., at the Campfire Center in Lakeland. Talk-in on club repeater 146.685. Club net each Thursday at 7:30 p.m. For more info: <www.qsl.net/k4lkl>; E-mail: <aj4y@arrl.net> or <kf4dnw@juno.com>

FL, Lake Monroe Amateur Radio City (Greater Orlando): Meets 1st Thursday of the month at 7:30 p.m., Casselberry Senior Citizens' Center, Lake Triplett Dr., Casselberry, FL. Repeater 147.285. Contact KK4ND at <wayright@magicnet.net>; club Web site: <http://www.qsl.net/mars>.

MA, Falmouth ARA: Meets last Thursday of every month at 7:30 at Falmouth Town Hall. All levels of exams given at 9 a.m. 2nd Saturday of every month at Falmouth Town Hall. Rptr1446.655/70cm. 444.250pl141.3/. Boston link, 445.175pl.141.3. For more info, see our Web site: <http://www.falara.org>. Membership available on the Web.

MA, Franklin Couty Amateur Radio Club: Meets second Monday of everymonth at Greenfield High School small auditorim, Silver Street in Greenfield, MA at 7:15 p.m. Repeaters 146.985 - PL 136.5 and 448.875-PL 136.5. For info, e-mail Richard, KD1XP, at <kd1xp@arrl.net>

MB, Canada, Winnipeg Amateur Radio Emergency Service (WARES): Callsigns VE4YWG (Public Service Communications), VE4EOC (City Emergency Operations Centre). Meetings 3rd Tuesday of month, 1930h at Sir Wm Stephenson Library, 765 Keewatin St. Membership open to all licensed amateurs at least 18 years of age and living in or near Winnipeg and interested in emergency amateur communications. E-mail Jeff Dovyak, VE4MBQ, Emergency Coordinator at <ve4mbq@ve4umr.ampr.org>; Web: <http://www.geocities.com/CapeCanaveral/Hanger/1632/wares.html>.

MD, Baltimore Radio Amateur Television Society: Meets 3 p.m. 1st Saturday of the month at the Pikesville Public Library, 1301 Reisterstown Rd., Pikesville, MD. BRATS sponsored FM repeaters are 147.030/224.960/447.325 MHz linked system (main), 145.130, 224.800, and 443.350 MHz. Also sponsors second oldest ATV repeater in the country, the W3WCQ repeater, input 426.250/1253.250-output 439.250/911.250. Holds nets in the 147.03 system, Sunday 8 p.m. Listening Post, Monday 7:30 p.m. Horsetraders, 9 p.m. Traffic and information, Wednesday 8 p.m. Newsline, Thursday 9 p.m. ATV, Saturday 1 p.m. News Bulletin, 1:20 p.m. Answer Men. Club activities include public service events, field day, hamfests, ATV repeater linking, amateur classes. Membership open to all. For more info, write, BRATS, P.O. Box 5915, Baltimore, MD 21282-5915, call (410) 461-0086, e-mail: <brats@smart.net>; Web: <www.smart.net/~brats>.

ME, Milo Piscataquis ARC: Meets 4th Monday of each month at Piscataquis County Emergency Operations Center (EOC) at 7 p.m. For more info, contact Piscataquis ARC, c/o George R. Dean, P.O. Box 365, Brownville Jct., ME 04415; E-mail: <parc@qsl.net>; Web: <http://www.qsl.net/parc/>. (Also participates in a number of other club events).

MO, Morely, Tri-County Amateur Radio Club (TRICO): Callsign KBØZAW. Meetings 2nd Tuesday of every month at 7 p.m. at Scott County Emergency Management Agency in Morely, Missouri. Membership open to all licensed hams and their family members. Visitors are encouraged and welcome. ARRL exams given with prior requests. Club repeater, 146.730-. Net held every Thursday at 8 p.m. local time on 146.730-, and every Sunday at 9 a.m. on 3.905. Contact Clay Adams at <kc5pin@ldd.net> for info. Web site: <http://www. geocities.com/capecanaveral/hall/2819>.

MO, St. Louis, Gateway to Ham Radio Club (KBØUAB): A youth-focused club, meetings are held each month on Saturdays. Get on our new repeater at 443.225 (146.2 pl). For more information, visit our Web site at <http://www.iidbs.com/gateway/>.

NC, Charlotte, 2-Meter SSB Net: 144.220 USB, Wednesday nites @ 9:30 p.m. est/edt. Net control stations are Wilton/WB4PCS & Bill/W4GRW, both in Charlotte area of EM95. This net is now 5 weeks old & we have been averaging 20 check-ins each week (purpose is to increase activity on 2-meter SSB & promote fellowship).

NC, Onslow Amature Radio Club, WD4FVO: Meets 1st Tuesday of every month at 7 p.m. in banquet room of Fishermans Wharf Resturant, located on Hwy 17 on the bank of New River in the heart of Jacksonville, NC. Exams are last Tuesday of every month at 7 p.m. in Onslow County Agricultural Building on College St. For more info, contact Ed Napoleon, KC4JKW, at <kc4jkw@gibralter.net>, or Rob DeVega, KF4OVM, <kf4vom@yahoo.com> or visit our Web site: <http://www.qsl.net/wd4fvo>.

NC, Stanly County Amateur Radio Club: Meetings held every 4th Thursday at Stanly Community College. Two-meter nets held at 9 p.m. (local), Wednesday (146.985), and Friday (147.390). Six- meter rag chew each Thursday at 8:30 p.m. (50.135). For more info, visit Web site: <www.qsl.net/scarc>.

NY, Brooklyn, Kings County Repeater Association (KCRA): Meets 3rd Tuesday of the month (except July & August), 7:30 p.m., at Fort Hamilton Army Base, Building 213, Brooklyn, NY. Visitors welcome. Call Don, W2DON, at (718) 248-0752 for more information. Club repeater (WA2ZWP) 146.430, up 1 MHz, PL 136.5. Web: <http://www.qsl.net/kcra>. VE exam sessions last Tuesday of every month (except July, Aug., Dec.), 7 p.m. Pre-registration is a must. Call Harvey, KB2EA, at (718) 948-2290 to register.

OH, Cleveland Area, Cuyahoga Amateur Radio Society: Meets 3rd Wednesday of every month except December at 8 p.m. at Busch Funeral Home community room, 7501 Ridge Rd., Parma, Ohio. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Re-peaters are on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater at 145.07, and club simplex frequency of 146.475 MHz. For more info, contact club president, Tom Wayne, WB8N, at (440) 232-4193 or at <wb8n@en.com>.

OH, Hocking Valley ARC: Meets 1st Tuesday of every month at 7:30 p.m. in EMA building at 56 S. Market St., Logan, OH. Packet Node LOGAN: AA8BJ-2 on 145.53 MHz, club net Wednesdays at 9 p.m. on 147.345+. E-mail: <aa8bj@hotmail.com>

OH, Lawrence County, Amateur Radio Emergency Service: Meets 3rd Monday of every month at 7 p.m., EMA/911 building, 515 Park Ave., Ironton, OH. Net every Thursday night 9:30 p.m. local time on repeater 146.715. Info e-mail: <wn8f@wwd.net>, or visit web site at: <http://www.wwd.net/user/syrinix/ares.html>. Read our newsletter, "Hello Radio," at: <http://wwwwwd.net/user/wn8f>.

OH, Triple States Radio Amateur Club: Operates over a wide area with members in 50 states & 3 foreign countries. Meets 2nd Saturday of the month at 1 p.m. at Citzens Saving Bank, Colerain, OH, on Rte 250. Features Web

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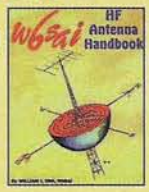

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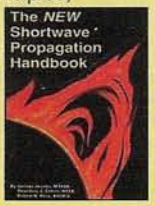

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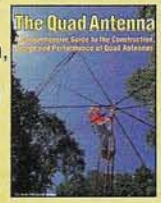

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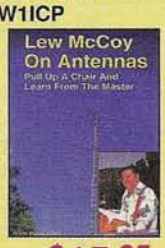

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page: http://www. qsl.net/tsrac>, major Wheeling/Martins Ferry Hamfest Aug. 8; all-mode SSB/FM/AM/CW 6-m net Wed. 9 p.m. EST/EDST on 50.150/50.151; very popular club bulletin; send for sample copy; ARRL/ VEC exam sessions, meeting room, last Monday of the month at 6 p.m. at club's meeting room, phone notice required (740) 546-3930; E-mail: <k8an@aol.com>; Fax: (740) 546-3685.

OK, Tulsa: American Airlines Amateur Radio Club. Repeaters 145.345, 147.000+, 147.000-, 449.875, autopatches on 147.00 and 145.345. Club meetings held last Saturday of the month at 9 a.m. local time at Lil Abners Restaurant, Catoosa, OK. W5YI VE testing for all amateur radio classes held immediately following meeting. For more info on VE testing, club activities, and map on how to find Lil Abners Restaurant, see club Web page: <http://www.webzone.net/n5jk/aaarc.htm>.

PA, Lambda Amateur Radio Club (LARC), Philadelphia: 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. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: lambda-arc@geocities.com.

PA, Monessen Amateur Radio Club: Meetings 3rd Monday of month at Mon Valley Community Health Center, Monessen, PA, 4th floor at 7:30 p.m. Everyone welcome. Repeaters on 147.27+, 443.8+, 224.58+. Net on Tuesday at 8 p.m. on 147.27+. For more info, contact Allan, N3UML, P.O. Box 26, Sycamore, PA 15364, (724) 852-6449 evenings.

TX, Greater Houston Area, Brazos Valley ARC: Meets 1st Thursday of each month at 7:30 p.m. at Sugar Land Community Center, 226, Matlage Way, Sugar Land, TX (across street from the Main Post Office). Talk in frequencies are 145.46 - (PL 123) and 444.55 + (PL 103). For info, contact B-VARC, Box 1630, Missouri City, TX 77459-1630; Irv Smith, KK5QQ, (281) 437-4803. <http://hal-pc.org/~bvarc>, <bvarc@hal-pc.org>.

UT, Rocky Mountain Radio Association (RMRA): Offers Utah, Wasatch Front, unique UHF to 6, UHF to 2, and UHF to HF remote gateways. Net Thursday at 9 p.m. on 447.900 PL 114.8 UHF/6-meter gateway open 24 hours on 448.700 PL 114.8. Visit Web site at <www.inconnect.com/~rmra>; or e-mail: <rmra@inconnect.com> for more info.

VA, Alexandria, Mt. Vernon ARC (K4US, MVARC): Meets 2nd Thursday of every month (except Dec.), 7:30 p.m. at Mt. Vernon Governmental Center, 2511 Parkers Ln., Alexandria, VA. Repeater frequency is 146.655. If interested, write to P.O. Box 7234, Alexandria, VA 22307, or contact Bob, KT4KS, at (703) 765-2313.

WV, Plateau Amateur Radio Association (PARA), Oak Hill, WV: Meetings held 1st Tuesday of every month, 7:30 p.m. New River Pawn Shop basement, 328 Main Street, Oak Hill, WV. Mailing address: PARA, P.O. Box 96, Fayetteville, WV 25840. Repeaters are 146.790-; 147.075- and 443.300+. For more info, contact Juddie Burgess, KC8CON, Secretary, at <kc8con@usa.net>.

Exam Sessions

CA, Sant Ana: FCC Amateur Radio Testing every Wed. of each month at Orange County Chapter of the American Red Cross. Open to the public (walk-in). All levels of testing. Begins at 6:30 p.m. upstairs in the Blood Center, Room 206. Address: 601 North Golden Circle Drive, Santa Ana, CA. Call (714) 835-5381, ext. 140, and ask for Amateur Radio Testing information.

FL, Casselberry, Lake Monroe Amateur Radio Society (Greater Orlando): 4th Saturday of every odd month at Casselberry Public Library on Oxford Rd., Casselberry, FL. For information, contact Al LaPetrer, W2IL, at (407) 671-1056.

FL, Clearwater: Exams held 2nd Monday of each month (except December) at 7 p.m. at the Salvation Army at 1625 North Belcher Rd. For more info, contact John Townsley, AE4GB, at (727) 376-6705, e-mail: <ae4gb@gte.net>, or Mike Branda, K4HN, e-mail: <k4hn@amsat.org>. Paul E. Knupke, Jr., KR4YL <pk@ij.net>.

FL, Englewood: ARRL exams held 3rd Saturday of each month, 9:30 a.m., Englewood Chamber of Commerce Building, 601 South Indiana Ave., Englewood. Two-day advance reservation required. For info and reservations, call Jack, W4JS, at (941) 475-1929.

FL, Highlands County: Exams held 4th Tuesday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Walk-ins welcome. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

IN, Evansville: Exams held once a month on a Saturday morning starting at 9 a.m., local time at Evansville Red Cross, 111 Diamond Ave., Evansville, IN. No pre-registration for sessions. For more info, call Terry Brooks, AA9MM, at (812) 421-9135. (Exam dates: 4/24 (ARRL Nat'l Exam Day), 6/19, 7/31, 8/28, 9/25 (ARRL Nat'l Exam Day), 10/30, and 12/04).

NC, Wilmington: Azalea Coast Amateur Radio Club, VE testing sessions 2nd Saturday of even numbered months at UNCW Morton Hall at 10 a.m. All persons wishing to take amateur radio tests, please arrive before 10 a.m. Test candidates only. For further info, call (910) 791-1566.

OH, Cincinnati, OH-KY-IN Amateur Radio Society: Will offer exams in Cincinnati, OH, on Saturday, May 8th, at Salem Presbyterian Church in Western Hills. The church is located at intersection of Mozart and Higbee, just behind the White Castle restaurant at Harrison and Boudinot. Novice through Extra exams will be offered and will start promptly at noon. Walk-ins accepted, but pre-registration is appreciated as it speeds up registration process. For advance registration, send completed FCC 610 form and a check or money order payable to OH-KY-IN A.R.S. in the amount of $6.45, along with a copy of all certificates of successful completion and your current license (if any) to: Bill Simpson, KI4QJ, 10743 Palestine Dr., Union, KY 41097. For more info, call Carol Hugentober, K8DHK, at (513) 661-5323; E-mail <k8dhk@juno.com>; Web site: <www.qsl.net/k8sch>.

OH, Cleveland Area Cuyahoga Amateur Radio Club: Holds exam sessions on 2nd Sunday of each odd-numbered month (except May), at the Olde Independence Town Hall, 6652 Brecksville Rd. (Rte 21), Independence, OH. Sessions start 9 a.m. Fee is $6.95 and a valid ID and copy of your FCC license is required (if you are already licensed). For more info, contact Gary Dewey, NI8Z, at (216) 642-1399 or at <gdewey@en.com>.

PA, Monessen Amateur Radio Club: Test session 1st Sat. of even months (Feb, Apr, Jun, etc.) 10 a.m. at New Eagle Boro Bldg. Main St., New Eagle, PA. Walk-ins welcome but pre-registration preferred. For more info, contact Allan, N3UML, at (724) 852-6449, P.O. Box 26, Sycamore, PA 15364.

PA, Philadelphia: The Philmont Mobile Radio Club sponsors exams on 1st non-holiday Thursday of each month at Franklin Institute, 20th and Ben Franklin Pkwy, Philadelphia, PA. Walk-ins welcome. Exams start at 6:30 p.m. For more info, contact, Dusty Rhoades, ND3Q, at (215) 879-0505.

TX, Garland Area: Test sessions 4th Thursday each month except November. Exams begin promptly at 7:30 p.m. at Austin Street Church of Christ, 800 Austin St., Garland, TX. Contact W. H. (Bill) Reynolds, K8DNE, at (972) 475-9407 for recorded session information, or send e-mail to <k8dne@arrl.net>.

TX, Houston: Meets 2nd Tuesday of each month, 6:30 p.m. Strake Jesuit High School. Bellair @ S. Gessner (SW Houston) Pre-registration requested, walk-ins accepted. Sponsored by Brazos Valley ARC (B-VARC). Call Cass Germany, KG5IT, at (713) 682-6897; E-mail: <cassg@hal-pc.org>.

Personal Web Site Listings

"The Radio Picture Archive," URL: <http:// www.e-etc.com/rpa> (corrected). Speciality collection of pictures of radios.

"Telegraph Key/Museum/Collector's Guide" URL: <http://w1tp.com>. Collector of telegraph keys, old radios, microphones & apparatus history, appraisals, buying, trading.

Commercial Web Site Listings

Byers Chassis Kits: Aluminum chassis and cabinets kits, VHF & UHF antennas and parts. Catalog: Callbook address. E-mail: <k3iwk@herd.net>; <http://herd.net/byerschassiskits>.

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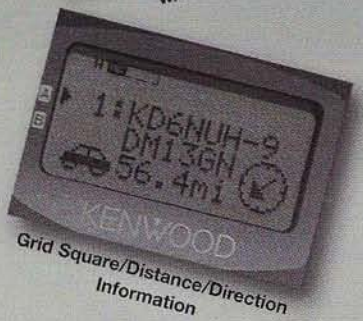

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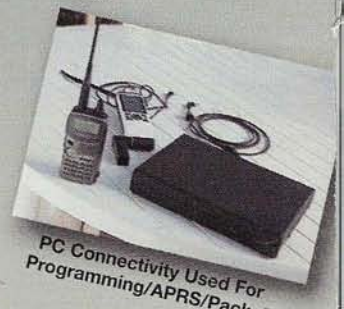
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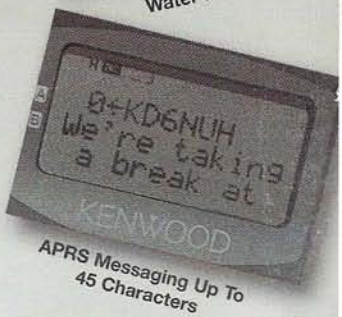

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