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October 1999

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  - –ICOM IC-706 Mk II-G HF/VHF/UHF Multimode Transceiver
  - –Hamfest "Sleepers"

On the Cover: Francis "Shep" Shepard, W7HAH, of Stevensville, Montana. Details on page 67.

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ICOM IC-821H

"By far the easiest to use satellite radio on the market today. In less than 10 minutes after unpacking the IC-821H, I was on the air at 9600 baud with KO-23."
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It's 2 Receivers in 1 Compact Box.

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An electronic keyer is built in and optional CW-narrow filters are available separately for the Main and Sub bands. Also get: adjustable keying speed and dot/dash ratio, adjustable delay time for semi break-in operation, and more.

ICOM options required for PC connections:

CT-17 CI-V Level Converter

PC Ready!

Other options also required for PC connections:

Third party serial cable, pins 1-8 & 20

Third party software

Dual Display
Shows receive (downlink) and transmit (uplink) simultaneously.

Noise Blanker
Reduces pulse-type noises

Independent Controls
For Main/Sub band

Quiet Fan
You'll appreciate the lack of noise

Tx/Rx Frequency Tracking
Normal / reverse shift

SPECIFICATIONS

Transmit: ..... 2 Meter, 440 MHz (70 CM)
Receive: ..... 136-174 MHz, 440-450 MHz
(guaranteed 144 - 148 and 440 - 450 MHz only)
Mode: ..... SSB, CW, FM
Power: ..... 2M SSB: 6-35W, continuous
2M CW, FM: 6-45W, continuous
440 MHz SSB: 6-30W, continuous
440 MHz CW, FM: 6-40W, continuous
Power Supply Requirement: ... 13.8 V DC
Memory Channels: ..... 160 Total,
80 Channels Per Band
VHF Antenna Connector: ... SO-239 (50 Ω)
UHF Antenna Connector: ... Type-N (50 Ω)
Size: ..... 9.5(W) x 3.7(H) x 9.4(D) in.
241(W) x 94(H) x 239(D) mm.
Weight: ..... 11.0 lb
5.0 kg

FEATURES

- **Continuously Adjustable TX Power**
  - More control
  - Extends satellite life by using minimum power
- **Independent Main / Sub Band Rx**
  - Tuning, AF and squelch level, and 4 function control switches per band
  - In Satellite mode, Sub is uplink, Main is downlink
  - IF shift for either Main/Sub band
- **9600 or 1200 BPS Packet Capable**
  - Direct audio modulation
  - Excellent C/N ratio
  - Excellent frequency stability
  - Adjustable ACC modulation signal levels
- **High Frequency Stability**
  - ±3 ppm standard. ±0.5 ppm optional
- **100% Duty Cycle**
- **AF Speech Compressor** for increased average talk power
- **Auto Repeater** with one-touch repeater functions
- **Built-In RIT Function**
- **Built-In Electronic Keyer**
- **RF Attenuator**
- **Noise Blanker**
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- **Separate Speaker Jacks**
  - 1 jack per band
- **AGC Time Constant Control**
- **Auto Repeater Function**
- **Rugged ICOM Construction**
- **Built-In CI-V Port**
- **2 Optional CW Narrow Filters**

ISO 9001 SGS

ICOM Connect 2000

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"(The IC-821H) is a terrific dual-band multimode transceiver for all applications. Not only is the IC-821H an excellent VHF/UHF weak signal or contest radio, it is the cornerstone of a high performance satellite station (digital or analog). Hams who have the Phase 3D satellite in mind will want to give serious consideration to the IC-821H. It also offers superb FM-voice and 9600-baud packet performance. Combine all of these features with the IC-821H's go-anywhere size and you have a radio that's ideal for almost any application above 144 MHz!"
– *QST Magazine*, 3/97

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Road Show

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DR-140T, DR-140TQ, DR-140TPKT 2m Mobile/Base

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CQ VHF Ham Radio Above 50 MHz

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FEATURES

COLUMNS

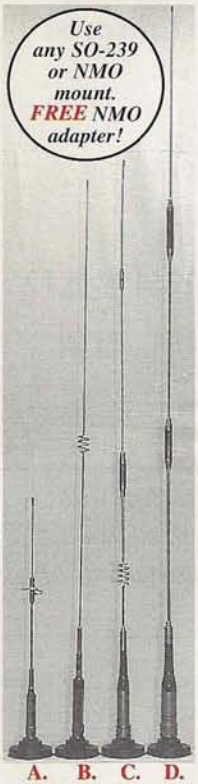
BASICS

DEPARTMENTS

Next Month: "Head to Head—Comparing the FT-100 and the IC-706 Mk II-G," by Gordon West, WB6NOA

MFJ *RuffRider*™ High Gain Mobile Antennas

Use any SO-239 or NMO mount. FREE NMO adapter!



A. B. C. D.

Shown on mini mag mounts, not included.

Each MFJ RuffRider™ mobile antenna comes with MFJ's unique 90 degree "fold-over" feature -- lets you pull into your garage without knocking your antenna over!

MFJ's heavy duty bases are extremely strong to handle super rugged rides and day-to-day highway abuse.

MFJ's *RuffRider*™ High Gain dual band 144/440 MHz mobile antenna series is for the serious mobile ham who demands the highest quality, premium products at reasonable prices.

They feature the finest quality construction using precision machined components. *RuffRiders*™ battle the elements, handle rugged rides and day-to-day highway abuse.

Stacked elements with high-Q phasing coils give you outstanding gain. Stay in solid contact!

Phased Radiators

Phased radiators flattens the radiation pattern and concentrates your power to give you *super gain.*

High-Q phasing coils are housed in weather proof high-tech plastic insulation. They're attached to stainless steel stacked radiators by solid metal end sections.

Heavy Duty Base

Rigid, heavy duty solid metal base reduces SWR flutter due to wind vibration. Two Allen set screws securely fastens radiator.

Specially treated center pin provides excellent electrical connection.

Quickly screws off -- helps prevents theft of your expensive rig.

Use SO-239 or NMO Mounts

RuffRiders™ have a PL-259 base mount for quick installation to your heavy duty SO-239 magnet, trunk/hatch, gutter or mirror mount.

A *free* NMO adapter is included for use with an NMO mount.

MFJ mounts are recommended.

All MFJ *RuffRiders*™ are dual band 144/440 MHz antennas and factory tuned for SWR less than 1.5:1 and have 50 Ohm impedance.

MFJ's *No Matter What*™ Warranty

All *RuffRider*™s are covered by MFJ's famous *No Matter What*™ one year limited warranty. MFJ will repair or replace (at our option) your antenna for one full year.

Choose from several different length and gain antennas . . .

A. ***RuffRider Junior*™.** Premium, short 16½" antenna fits in any garage on any auto. ¼ Wave on 2 Meters, ½ Wave, 3 dB gain on 440 MHz. 100 Watts. No fold-over.

MFJ-1402 **$34.95** add s/h

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MFJ-1412 **$49.95** add s/h

C. ***RuffRider High Gain*™.** 41½" long antenna gives extra gain with little height increase. Handles 150 Watts. ½ Wave, 3.2 dB gain on 2 Meters, ⅝ Wave, 5.7 dB gain on 440 MHz.

MFJ-1422 **$49.95** add s/h

D. ***RuffRider Hyper Gain*™.** 62½" brute gives a whopping 5 dB gain on ⅞ Wave 2 Meters, ⅝ Wave, 7.6 dB gain on 440 MHz. Our highest gain antenna. Handles 150 Watts.

MFJ-1432 **$69.95** add s/h

144/440 MHz Antenna Tuner with *built-in SWR/Wattmeter*

Covers 136 to 175 MHz. Handles 150 Watts. Compact 4x2½x1½". *New!* MFJ-922 **$79.95**

MFJ *RuffRider*™ super heavy duty Antenna Mounts

Trunk/Hatchback *Lip* Mount

MFJ-345 Lip Mount is shown mounted vertically to a mini-van's angled hatchback lip. Note extra-wide mount with reinforcing tab at right -- safely secures heavy antennas. Swivel mount is adjusted so antenna is near vertical away from mini-van to clear luggage rack.

MFJ-345 **$34.95** add s/h

MFJ's *RuffRider*™ super heavy duty solid steel Trunk/Hatchback *Lip* Mount mounts to any lip on your vehicle.

Extra-wide *four* inch lip and large reinforcing tabs on each side safely distributes the load over your vehicle's lip.

Two large set screws on each end of the mounting lip locks your mount in place. A scratch-proof rubber guard protects your vehicle's finish.

Secures large VHF, UHF and medium size HF antennas even at highway speeds.

Mounts on lips at any angle. Two axis of rotation lets you position your antenna vertically, horizontally or at any desired angle. Serrated swivel joints locks securely in place with huge 3/8 inch set screw.

Has SO-239 base mount. Use adapter for NMO. Includes low loss coax with PL-259 connector, Allen wrenches and protection caps for SO-239 and locking screw, One year MFJ *No Matter What*™ limited warranty.

Mirror/Luggage *Pipe Clamp* Mount

MFJ-340 Pipe Clamp Mount is shown clamped solidly to vertical mirror support rod on a pickup truck. Antenna is slightly swiveled to the left and positioned about 30 degrees from vertical to clear cab of the pickup truck.

MFJ-340 **$34.95** add s/h

MFJ's *RuffRider*™ Mirror/Luggage *Pipe Clamp* Mount mounts on support rod of mirror, luggage rack or spare tire carrier of your truck, van, RV or SUV. Mounts on any horizontal, vertical or angled rod or pipe up to 5/8 inches in diameter.

Secures VHF, UHF and medium size HF antennas even at highway speeds.

Two axis of rotation lets you position your antenna to any desired angle. Serrated swivel joints locks securely in place with huge 3/8 inch set screw.

Convenient *Thumb and Finger* turn knob makes fold-over operation quick and easy. Locks in twelve positions.

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Has SO-239 base mount. Use adapter for NMO. Includes low loss coax with PL-259 connector, Allen wrenches and protection caps for SO-239 base mount and locking screw, MFJ's famous One year *No Matter What*™ limited warranty.

MFJ's *MaxStrength*™ Hi-Flux Antenna Magnet Mounts

MFJ's *MaxStrength*™ high-flux magnet mounts give you maximum pull strength -- your antenna stays on top of your vehicle at highway speeds.

MFJ-333 **$14.95** add s/h

MFJ-335 **$19.95** add s/h

Base is *Euro-style*, black poly or chrome finish with a Mylar protective undersheet.

MFJ magnet mounts come with 17 feet of tough RG-58 coax with a PL-259 connector. Easily reaches operating position.

Choose your favorite antenna to go with these fabulous low-profile mounts for outstanding mobile performance.

MFJ-333 BS/BM, $14.95. Light to medium duty magnet mount. Low profile 3.5 inch diameter black base weighs 1½ lbs. For small to medium size antennas.

MFJ-335 BS/BM, $19.95. Medium to heavy duty magnet mount. Super strong 5 inch diameter *chrome* base weighs a husky 2½ pounds. For medium to large size antennas. It's perfect for MFJ's *RuffRider*™ High Gain mobile antennas.

Order BS for SO-239 connector.
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Tomorrow's Technology

What will the typical ham shack look like in 20 years? What SHOULD it look like, if only "they" would listen? Well, "they" are listening, and here's your invitation to help shape our hobby's future.

The revolution is over and we've won. Now what do we do? What am I talking about? The communications revolution of the past 10 years.

Fifteen years ago, only hams carried handheld radios that could automatically connect to the telephone network. Today, millions of people carry similar radios wherever they go (even if they don't know their cellphones are really two-way radios).

Fifteen years ago, only hams had access from their homes to privately owned computer networks that enabled them to send electronic messages across the country or around the world. Today, the industrialized world would grind to a halt without e-mail and the Internet.

OK, so we invented cellphones and the Internet. But that was 15 years ago. What have we done lately? The fact is that, while ham-developed technology has been revolutionizing electronic communications for the rest of the world, we've gotten into kind of a slump in developing the next generation of trailblazing technology.

"OK, so we invented cellphones and the Internet. But that was 15 years ago. What have we done lately? The fact is that...we've gotten into kind of a slump in developing the next generation of trailblazing technology."

Living in the Past

The most popular forms of ham radio communication today rely on technology that's at least 15 years old, and often older. Our VHF packet networks still rely on text-based 1200-baud user interfaces (even if the networks themselves are passing data at 9600 baud), while our telephone modems zip along at 20 to 40 times that speed. Our local voice communication networks rely on 40-year-old analog FM technology, using dedicated frequency pairs that often sit silent 18 to 20 hours a day. Single sideband, the dominant mode on HF, and one growing in popularity on VHF and UHF, hasn't changed since it was developed and popularized (by hams) in the 1950s. AM and CW, of course, go back even further.

Have we hams run out of new ideas? Have we forgotten how to take lemons (such as the bands below 200 meters in the early part of this century) and make lemonade? Have we lost interest in "the advancement of the radio art," one of the main reasons that the government gives us the use of so many valuable frequencies throughout the spectrum? I think the answer is "no" to all of these questions. But we do have a problem.

First of all, as the things we know how to do best become part of mainstream communication technology, our services are in greater demand commercially. So the ham who used to tinker with something new in his home workshop or hamshack now gets paid real money (and often lots of it) to do the same thing in a well-equipped lab at a major telecommunications company. And whatever he develops belongs to the company, not to him, and it goes directly into commercial service, without the "testbed" of amateur radio.

Second, today's miniaturized electronics have made tinkering at home difficult, unless you happen to have access to sophisticated equipment (which most hams don't). And, finally, hams are historically resistant to change—witness the ongoing code debate and remember that SSB, while developed in the in the 1950s, didn't really become dominant on the HF bands until the late 1960s and 1970s. Many of us have the attitude that analog repeaters and 1200-baud AX.25 packet "ain't broke," so why try to fix them?

Looking Forward

Why, indeed? Well, for starters, with a typical 10- to 15-year acceptance curve for significant new technology in ham radio, we need to get that new technology into the pipeline now if we want it to be available for general usage a decade from now. Plus, a steady stream of technical innovation will protect us from becoming technologically irrelevant in the future (as some people outside ham radio feel we are today).

In truth, the stream of technological innovation hasn't stopped flowing—such advances as microprocessors and digital signal processing let today's radios outperform any of their predecessors from earlier radio generations, but the basic ways in which we communicate haven't changed.

New and different ways of communicating, and of using our current communication tools, *are* out there. Our own Kent Britain, WA5VJB, has talked at VHF conferences about "IQ modulation," with which a computer can create virtually any standard modulation mode. Ev Tupis, W2EV, has refined APRS on packet to track 6-meter propagation and meteor scatter (we'll have a report from Ev next month on using his system to track the Leonids). On HF, PSK31 lets you tune in and read signals that your ear

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

can't even detect in the noise. Our January, 1997, issue focused on future technology and discussed wearable radios, trunked repeaters, and more. The 50th anniversary issue of our sister magazine, *CQ*, in 1995, predicted virtual-reality QSOs in which you could move around the other guy's shack and look out the window.

The ideas go on and on. But very few ideas ever move from ideas into reality. The people who think of them either don't have the time or the resources (or both) to pursue development. And that brings us to the point of this editorial.

The ARRL Technology Task Force

Every once in a while, the American Radio Relay League's Board of Directors manages collectively to look forward instead of backward, and when that happens, positive change often follows. This past January, the ARRL Board realized that new technology for amateur radio was more likely to be developed and to succeed if there were some means available for matching up promising new ideas with the resources needed to develop and promote them. The result was the formation of two groups: a Technology Task Force (TTF), made up of ARRL directors and vice directors, and a Technology Working Group (TWG), composed of hams with either significant technical expertise and the ability to explain technology in plain English.

The task force, according to the board minutes, would be responsible for "developing a strategy and plan of work for exploring new technologies, assessing their applicability to amateur radio, and also developing a plan as to how to incorporate such new technology in the amateur radio service." And the working group, acting as "an adjunct to and a resource for" the task force, would be "the principal investigatory arm of the Technology Task Force" and would conduct "experiments, research and development regarding newer technologies...."

Part of the "marching orders" for these groups was to work with other amateur radio organizations in identifying, developing, and promoting new technologies. And the membership of the working group reflects this diversity. At Dayton, task force chairman and ARRL First Vice President Steve Mendelsohn, W2ML, asked our publisher, Dick Ross, K2MGA, if CQ Communications and its magazines would support and participate in this effort. Dick agreed, and the two of them immediately volunteered yours truly to be chairman of the Technology Working Group.

The other TWG members include AMSAT-NA President Keith Baker, KB1SF; author, *PC Week* columnist (and former *CQ VHF* columnist) Peter Coffee, AC6EN; Mike Cook, AF9Y, Chief Engineer for ITT in Fort Wayne, Indiana; Gene McGahey, NRØNR, Deputy Manager of Communications Technology for the National Law Enforcement and Corrections Technology Center's Rocky Mountain Region; ARRL Technical Relations Manager Paul Rinaldo, W4RI; Dennis Silage, K3DS, a professor of digital signal processing and data communications at Temple University; and Doug Smith, KF6DX, Editor of *QEX* (the ARRL's

(Continued on page 82)

A Loss in the CQ Family

CQ Editor Alan M. Dorhoffer, K2EEK, became a silent key in July. We at CQ have lost a friend and colleague, and amateur radio has lost a voice of reason and common sense.

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

CQ magazine Editor Alan M. Dorhoffer, K2EEK, died on July 19 at age 61 from complications of cancer surgery.

Alan was *CQ*'s editor longer than any of his predecessors, holding the position for over 23 years. In fact, Alan spent his entire professional career at *CQ*, starting as an Assistant Editor in 1964, and moving up to become Editor in 1976. When he and Publisher Dick Ross, K2MGA, bought the magazine from Cowan Publishing in 1979, he became a co-owner as well.

Alan lived in Port Washington, New York, and had been a ham since he was a teenager. Ten meters was his favorite band, although he occasionally operated VHF as well. Outside of ham radio, his passions in life were woodworking (in his "Zero Bias" editorials in *CQ*, he often wondered why hamfests couldn't be more like woodworking shows, where people not only got to look at the toys, but also to try them out—actually getting a feel for using them) and boating—even though he never owned a boat, Alan was a New York State Harbor Master working for the city of Glen Cove.

Putting People First

At *CQ*, Alan tried to focus on the "people" aspect of amateur radio ("Ham radio is people interacting with other people," he wrote in the magazine's 50th anniversary issue) and on the things people *do* with amateur radio. "The act of *doing*, whether it's contests or awards, that's been my outlook," he said.

Alan was also a fixture at hamfests and conventions around the country, talking with readers, authors, and industry people and, in the process, becoming an expert on hamfest food (and the hazards associated with it). Going to a hamfest with Alan was always an experience. He knew everyone, it seemed, and everyone knew him. And he always made sure to hit the flea market nice and early—before we had to go to work in the CQ booth, but, more importantly, before all the good bargains were gone! And it was his presence at hamfests that many people most remembered about him.

Many other hams knew Alan only through his "Zero Bias" editorials, in which he usually managed to bring a smile to your face, even if he was politely telling you that you were behaving stupidly. Generally, he was able to make you realize on your own how foolish you were being, so he didn't have to stand up and wave a "Hey, Stupid" flag. And he was always on the mark in terms of identifying important issues, and picking out what really mattered from debates that often tended to range far afield from their starting points. His experience and his insight will be missed.

A "Stealth" Disease

Alan's death came as a shock to us here at CQ, not only because we'd lost a colleague and a friend, but because of the speed with which his illness overtook him. He hadn't been feeling well since about Dayton (in Alan's life, everything was measured by hamfests), and when he went to see the doctor about a month later, there was no indication that he was in the terminal stages of colon cancer. After tests showed what was likely cancer, he was scheduled for immediate surgery. The cancer, it turned out, had already begun to spread, and it's likely that the fact that he never recovered from the operation was actually a blessing in disguise, as it saved him from what might have been months of pain.

The most shocking thing to me, though, was the report from the surgeon that Alan had had this cancer for at least five years—with no outward symptoms, no tipoffs, until about six weeks before the end. Had he had the routine screening tests that might have prompted earlier intervention? Of course not, he felt perfectly healthy.

If you're a ham of median age—roughly 55—in fact, if you're over 50, do yourself and your loved ones a very big favor. Get yourself checked out, and repeat the test as often as your doctor recommends, even if you feel perfectly healthy. If you wait until you feel like something's wrong, it may already be too late.

Alan was not married at the time of his death, and had no children. For those who wish to do so, donations may be made to the "St. Francis Hospital Foundation." Indicate on your check that the donation is "in memory of Alan Dorhoffer," and mail to St. Francis Hospital, Attn: Development Office, 100 Port Washington Blvd., Roslyn, NY 11576.

73, OM, de W2VU

**Rich Moseson, W2VU, is Editor of* CQ VHF *magazine.*

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EDITORIAL STAFF

Richard S. Moseson, W2VU, Editor
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Bernadette Schimmel, Editorial Assistant

CONTRIBUTING STAFF

Gordon West, WB6NOA, Sr. Contributing Editor

Kent Britain, WA5VJB, Microwaves and Antennas
Ken Ernandes, N2WWD, Amateur Satellites
Dave Ingram, K4TWJ, How It Works
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CIRCULATION STAFF

Catherine Ross, Circulation Manager
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PRODUCTION STAFF

Elizabeth Ryan, Art Director
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Hal Keith, Illustrator
Larry Mulvehill, WB2ZPI, Staff Photographer
Joe Veras, N4QB, Special Projects Photographer

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25 Newbridge Road
Hicksville, NY 11801 USA.

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VHF News

FCC Changes Licensing Process

The FCC's "Universal Licensing System," or ULS, has finally caught up with the amateur radio service. As of August 16, anyone wanting a new, renewed, or modified ham radio license must *register* with the FCC using a new Form 606 and must provide the Commission with, among other things, their Taxpayer Identification Number (TIN). For most of us, that translates to our Social Security Number. This is required under the Debt Collection Incentive Act of 1996, an effort by Congress to track down "deadbeat dads" from divorced families who aren't paying child support.

If you're taking a license exam with a Volunteer Examiner (VE) team, there's no need to register ahead of time with ULS, according to a letter sent to all VEs by ARRL VEC Manager Bart Jahnke, W9JJ. Your VEs will have all the necessary paperwork. But you will have to register on your own in order to renew your license, change your address, get a vanity callsign, etc. You may register online at <http://www.fcc.gov/wtb/uls> (click the "TIN Registration" button), or by mail, using FCC Form 606, which you may request from the FCC Forms Distribution Center at (800) 418-3676.

FCC Enforcement Actions

The FCC's enforcement folks have had a busy month, issuing, among others things, seven retest letters, seven license cancellations (mostly to folks who didn't show up for required retests), eight inquiries about vanity callsigns, four interference letters, and five warnings about operating on unauthorized frequencies. Among the most significant actions were a $20,000 fine levied against a so-called "freebander," for allegedly operating without a license on the 10-meter ham band; the dismissal of a disability code waiver after consulting with the doctor who signed it; and an inquiry into possible irregularities in a VE session in New York State. A few hams have begun to challenge the FCC's actions, but all of those cases are ongoing, and none has been resolved.

Congress Trying to Limit National Weather Service

The National Weather Service will be prohibited from providing services that are, *or can be*, provided by commercial forecasting companies, under the terms of a bill now making its way through Congress. HR 1553, the National Weather Service and Related Agencies Authorization Act of 1999, has already been passed by the House of Representatives and is awaiting action in the U.S. Senate.

Among its provisions is Section 3 (c) (2), titled "Competition with private sector," which states:

> The National Weather Service shall not provide, or assist other entities to provide, a service if that service is currently provided by or can be provided by commercial enterprise...."

The only exceptions are "vital weather warnings and forecasts for the protection of life and property of the general public," and services required by international aviation agreements. According to Maricopa County, Arizona, Emergency Management Director Bob Spencer, this would bar the NWS from providing the public or other government agencies with weather watches and storm tracks, routine fire weather reports, telephone consultations to emergency management personnel, meteorological briefings to the U.S. Army Corps of Engineers, private pilot weather briefings, and specialized weather services for the Federal Aviation Administration.

This clearly would have implications for amateurs providing public service and emergency communication, and participating in the NWS's Skywarn program, although the specific impact on hams is not yet clear. At press time, the bill was before the Senate Commerce, Science, and Technology Committee, which is chaired by Arizona Senator John McCain. Spencer encourages anyone who is concerned about this provision's impact to contact their own U.S. Senators as well as Senator McCain to express their views and explain how passage of the bill as written would affect them.

Ham Satellites Still Get "Free Ride" from ITU

The International Telecommunications Union (ITU) has exempted the Amateur Satellite Service from new satellite filing fees which take effect in November. According to the *ARRL Letter*, the ITU has long required filing all frequency and orbit information for each satellite launched, but has never charged for it until now. Under a plan approved at last fall's ITU conference in Minneapolis, each member country gets one free listing per year, then pays for all others. The ITU Council, responding to a request from the International Amateur Radio Union, agreed to exempt amateur satellites "from any charges."

ARRL Adopts "New Identity"

The American Radio Relay League will continue to be the American Radio Relay League, but the organization's formal name will be de-emphasized on correspondence and publications in favor of "ARRL—the national association for Amateur Radio," the League board decided at its July meeting. The move follows several years of discussion and debate over possibly changing the League's name to include a direct reference to amateur radio and to modernize the organization's image.

ARRL Opposes Central States Petition

The ARRL Board of Directors says there's not enough of a problem to justify the Central States VHF Society's petition for FCC rules to keep wideband signals (such as FM) out of narrow-band (weak-signal) segments of the VHF and UHF ham bands. The ARRL board said it supports the intent of the petition, but feels that better education about band planning and "gentlemen's agreements" that set aside particular band segments for

Compiled by the CQ VHF Staff

different modes would be a better solution to the problem at this point than adding specific limitations to the rules.

Other opponents of the petition argue that it will limit future experimentation, while proponents see a growing problem with FM and packet signals encroaching on the frequencies traditionally reserved for SSB and CW use, along with the problem of dealing with the ham who says, when asked to change frequency, "show me where it says in the FCC rules that I can't operate FM here." The initial comment period on the Central States petition ended July 28 (not June 28, as we stated incorrectly last month).

UHF Contest Form Problem

The ARRL's Contest Manager, Dan Henderson, N1ND, says there's a problem with the Adobe Acrobat version of the online form for the ARRL UHF Contest—it shows the wrong point value for contacts made on different bands. The correct point values, says Dan, are as follows: 222 and 432 MHz, 3 points/QSO; 902 and 1296 MHz, 6 points/QSO; 2.3 GHz and up, 12 points/QSO. If you haven't already submitted your log, please make sure these values are correct.

AMSAT Teaching Colleges

AMSAT-NA will sponsor a one-day Amateur Satellite Workshop for Colleges and Universities in conjunction with its annual meeting and Space Symposium. The college workshop will be held on Thursday, October 7, at the Hanalei Hotel in San Diego, the site of the AMSAT conference on October 8 to 10. According to the AMSAT News Service, workshop sessions will include such topics as a basic introduction to amateur satellites, the role of amateur radio and the Amateur Satellite Service, amateur radio in the classroom/laboratory, and ITU/FCC rules regarding satellites operating in the amateur bands.

A growing number of colleges and universities have been looking to AMSAT for its expertise in design and development of low-cost satellites, often offering an amateur transponder aboard the finished satellite in exchange. Often, however, the students and professors enter into discussions without a basic understanding of what may and may not be done via ham radio.

Cautious Optimism for P3D Launch

While there were no official announcements about progress on launch plans for the Phase 3D (P3D) satellite at the AMSAT-UK Colloquium held in England in late July, Program Organizer Richard Limebear, G3WRL, told the *SpaceNews* newsletter there were "whispers" that an announcement would be made "real soon now," and that the long-delayed amateur satellite "should definitely be up, tested, and operational by this time next year, provided the [already chosen] launch has no problems." Limebear also pointed out that the highest frequency downlink on the new satellite is a 1/2-watt 834-nanometer laser, intended to be modulated by 400 bps data and standard CW. (*We strongly suggest that the P3D team read this month's Op-Ed on laser safety before activating this transmitter.—ed.*)

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.*

Origins of the 6-Meter Liaison Frequency

The following letter was received by "Magic Band" editor Ken Neubeck, WB2AMU:

Dear Ken:

Nice piece on the 6-meter liaison frequency at 28.885 ("Magic Band Chronicles," August, 1999). A little history, if you did not know: I moved to New Mexico in 1978 from Massachusetts, where I was WA1NNW, and wanted a way to keep track of the band openings back in Mass. So Earl, K2QWD (deceased), Bill, K1ZFE, myself, and some others started to meet on Sunday mornings on 10 meters. We would chat once a week about what was happening on the Magic Band. Over the years, we moved the frequency to get away from all the QRM and settled on 28.885. We had a few problems with that frequency because it was close to 28.888, where the Crazy Eights would meet. But over the years, it remained on .885, although we almost moved it to 28.485 because at that time Techs could not operate above .500. But we kept it on 885 and the rest is history. Keep up the good work. 73,

Ed Storer, N5JEH
Albuquerque, New Mexico (DM65rd)

ACSB on 222?

Dear *CQ VHF*:

Enjoyed the articles on the "Forgotten Band" (222 to 225 MHz) in the July issue.

Has anyone tried converting 220-MHz commercial narrow-band ACSB (Amplitude Compandored Sideband) mode equipment made by SEA or Uniden? I've talked with some large-city commercial 220- to 222-MHz system operators who say that coverage is really good. There were a lot of speculators who got commercial 220 licenses (before the FCC started auctioning) and never did anything with them, so I'd think there's equipment to be had out there fairly cheap. There always seems to be an ad or two in some of the wireless industry trade journals from people wanting to cut their losses and dump their unutilized 220 equipment.

I've enjoyed *CQ VHF* since Issue #1 and always look forward to getting each new issue. Six meters has been my favorite band since early '58 and I'm looking forward to this Sunspot Cycle heating up. 73,

Ted Tutterow, K4UFT
Keller, Texas

Ted—Thanks for the suggestion. I remember our club's (now-deceased) technical guru talking nearly 20 years ago about ACSB on 220—before there was commercial gear readily available. It seemed like a good idea then and it seems like a better idea now. Maybe your letter will spur some folks into action. Anybody out there working now on 222 ACSB? Let's hear from you if you are.

Is Politics Now Illegal?

Dear *CQ VHF*:

I have been reading about Riley Hollingsworth's efforts to "clean up" amateur radio. From what I have read, it appears Hollingsworth does not consider politics, social issues, or related topics to be legitimate subjects to discuss on the ham bands.

I point to his recent challenge of "Liberty Net" as evidence of his desire to eliminate these types of discussions. Recent comments he has made, such as his suggestion that the Internet would be a better place for this subject matter, seems to strongly reinforce this assumption.

For example, in your July 1999 issue, you quoted Hollingsworth's letter where he asked the net control station of "Liberty Net" to "explain how the operation of this 'net' is justified." You reported that he went on to write, "We are so far unable to determine how the transmissions of this group meet the standards of, or contribute to the purposes of...the Amateur Radio Service." And finally, you wrote that Hollingsworth continued with, "Your group may wish to explore operation on the Internet...."

After reading that, and still other recent comments by Hollingsworth (such as his recent suggestion that free speech does not apply to amateur radio), am I correct to assume that all subject matter such as this is now illegal on the ham radio bands? Or am I reading too much into Hollingsworth's actions and comments?

I need an answer right away. I'm planning to purchase an expensive radio soon (with antennas and accessories costing even more). And, while I certainly do not discuss politics, or similar topics, on a daily basis (nor have I ever even listened to "Liberty Net"), I do very much like a good discussion such as this occasionally. After all, ham operators do not exist in a vacuum—these things affect us also. Therefore, I do not see why we should be restricted from talking about them with our friends on the radio.

So, before I spend a considerable amount of money on radio equipment, I need to know just how restricted my radio conversations will be. In other words, does Hollingsworth think I should spend the rest of my life on the radio talking only about microphones and antennas? If so, I need to seriously reconsider just how much I want to get involved in amateur radio—perhaps the Internet is a better place for me.

Dwight Stewart, W5NET
Bremerton, Washington

Dwight—First, keep in mind that Riley Hollingsworth is not the "Lone Ranger" of the ham bands. He is acting on behalf of the FCC, which has a newfound commitment to enforcing the Amateur Service rules. Secondly, while the Constitution grants us many rights, including free speech, the right to transmit on the airwaves is not one of them. An amateur radio license grants us a certain privilege, and privileges may be withdrawn if abused. Talking about politics, social issues, etc., is not an abuse of this privilege, but using amateur radio as a platform for promoting racial and religious hatred is another story. Apparently, the FCC believes the Liberty Net has crossed that dividing line.

The following letters were addressed to "In the Public Interest" editor Bob Josuweit, WA3PZO:

Dear Bob:

Read your *CQ VHF* article on page 56 of the February 1999 issue. Enjoyed it very much. I've been following the Y2K thing

(Continued on page 82)

Product Update

MFJ 12-Hour Quartz Wall Clock has 24-Hour Trimline

This precision-accuracy quartz wall clock has a clear, clean, and highly visible 12-inch diameter face and is easily seen from 15 to 20 feet away. It has 12-hour digits on a white face, 24-hour timeline trim, seconds digits, and a thin line of gold trim that outlines the face inside and outside. The 24-hour trimline is reversed in hunter green and red stop points, and seconds digits accentuate the black hands and 12-hour digits.

The MFJ-126 is easy to set with one simple dial on the back and operates for long periods on a single "AA" battery (not included). Made of hard, durable plastic, this quartz wall clock is also protected by MFJ's *No Matter What*™ one-year limited warranty. Suggested retail price: $24.95.

To order or for your nearest dealer, contact MFJ at P.O. Box 494, Mississippi State, MS 39762; Phone: (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; Web: <http://www.mfjenterprises.com>.

Circle 100 on reader service card.

PowerPort Quick Draw HT Holster

Reach for the sky! Or maybe the floor! If you've ever been poked in the ribs or elbow by the antenna of your HT, the Quick Draw Holster™ from Cutting Edge Enterprises will take care of you. It holds your radio on your belt with the antenna down! Reception is not adversely affected and it's much more comfortable. The clip hooks onto the belt and won't come unfastened when you pull your radio out of the pouch. Crafted out of soft glove quality leather, it is available for radio models VX-1R, IC-Q7, IC-R5, C508A, C108A, DJ-C1T, DJ-C4T, DJ-C5T, and FR-460.

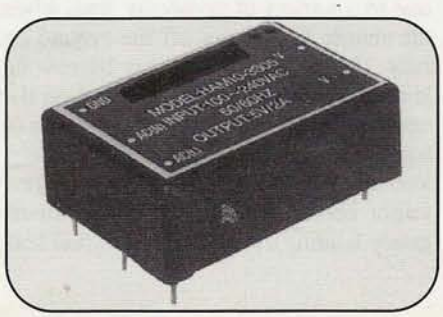
Suggested retail price: $19.95 (part# HI-H). For further information or distributor inquiries, contact Cutting Edge Enterprises, 1803 Mission Street, Suite 546, Santa Cruz, CA 95060; Phone: (800) 206-0115; E-mail: <cee@cruzio.com>.

Circle 101 on reader service card.

Total Power HAM10 Power Supplies

Total Power International has introduced the new HAM10-S (single output) and the HAM10-D (dual output) power supplies. The HAM10 is a universal input AC/DC PCB-mountable encapsulated 10-watt power supply series with an input range of 85 to 264 VAC. All models offer line regulation of ±0.1% typ., load regulation of ±1.0% typ. Efficiency up to 70%. Noise & Ripple Typ. 1% peak to peak. The hold up time is 20 mS @ 110 VAC; 150 mS @ 230 VAC. All models offer overload protection. Earth leakage is less than 4 mA @ 230 VAC.

The case is an impact resistant thermoplastic enclosure; dimensions are: 2.57 x 1.78 x .87 inches (LWH). Operating temperature range: 0-50 degrees Celsius, free air convection; output voltages: 3, 5, 9, 12, 15, 18, 24, 36, and 48 V (single output); ±3, 5, 9, 12, and 15 V (dual-output). The suggested retail price is $42 (single output) and $45 (dual-output).



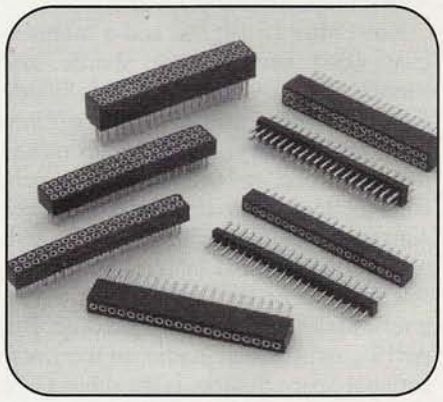
For more information, contact Amy Goad-Reidy at <areidy@total-power.com>, or Pat LeTendre at (978) 453-7272, ext. 110; Fax (978) 453-7395; E-mail: <sales@total-power.com>; Web: <http://www.total-power.com>.

Circle 102 on reader service card.

Andon Miniature Interconnects

Andon Electronics Corporation has introduced a new line of miniature interconnects, designed for board-to-board and interface connections.

The new line features molded high-temperature insulation suitable for convection soldering. All socket contacts are heat treated, polished for smooth insertion and withdrawal, and plated with terminal options including gold or tin plating.



Terminals can be supplied with straight or right angle terminations, depending on the application, while connectors and sockets can be supplied in 1 mm and 1.27 mm pitch in any number of single, double, triple, or quadruple positions. Prices begin as low as $.02 per pin. Delivery from stock is available in four weeks. You may order directly from the factory at Andon Electronics Corporation, 4 Court Drive, Lincoln, RI 02865; Phone: (401) 333-0388; Fax: (401) 333-0287; E-mail: <info@aecandon.com>.

Circle 103 on reader service card.

Ham Radio's Last Shuttle Flight

A 15-year-long "experiment"—and a chapter in ham radio history—ended with the landing of shuttle flight STS-93 at Kennedy Space Center in July...the last U.S. space shuttle flight of which ham radio was an integral part.

It all started with Owen. Astronaut Owen Garriott, W5LFL, with the help of other hams at NASA, successfully lobbied for permission to bring a 2-meter ham radio with him into space on the shuttle Columbia in late 1983, and to operate from orbit. He made more than 250 contacts and started a program that became NASA's longest-running space shuttle "experiment": SAREX, the Shuttle Amateur Radio EXperiment, with a focus on educational outreach, putting astronauts in orbit in direct ham radio contact with schools around the world.

Now, after 25 flights, and a multilingual QSO between the shuttle and Russia's Mir space station, the *Shuttle* Amateur Radio Experiment sails off into ham radio history. But it by no means marks the end of NASA's involvement with amateur radio. Renamed the *Space* Amateur Radio Experiment, SAREX will be a permanent and integral part of the International Space Station (ISS), which is now under construction up in orbit. But ARISS, or Amateur Radio on the International Space Station, is the subject of a future article. This one will focus on the just-concluded flight of STS-93.

Photo A. Astronaut Michael Tognini, KD5EJZ, a Mission Specialist aboard STS-93, talks from orbit via ham radio. Other hams on the crew of this final SAREX mission included Commander Eileen Collins, KD5EDS—the first woman to command a shuttle crew—and Mission Specialist Cady Coleman, KC5ZTH. (NASA Photo)

A History-Making Flight

STS-93 made history before it was ever launched, with the assignment of Astronaut Eileen Collins, KD5EDS, as the first woman to command a shuttle crew. There were two other hams on the five-person crew, Mission Specialists Cady Coleman, KC5ZTH, and Michel Tognini, KD5EJZ (Photo A), a French astronaut who holds a U.S. ham ticket. The two non-ham crew members were Mission Specialist Steve Hawley and Pilot Jeff Ashby. (For more on the STA-93 crew and mission, see "SAREX Flies Again," by Philip Chien, KC4YER, in the August issue of *CQ VHF*.)

The liftoff was delayed several times due to a variety of problems; and, when the shuttle finally got off the ground on July 23, it was a somewhat harrowing launch. A circuit-breaker tripped on the main computer controlling the engines (a backup computer took over immediately, averting the possibility that the crew might need to make a first-ever emergency landing), and a hydrogen fuel leak caused the engines to shut down earlier than planned, leaving the Columbia in a lower-than-anticipated orbit.

The rest of the flight was uneventful ("nominal," in NASA-speak), with the Chandra X-Ray Observatory being launched as planned, and Columbia returning on schedule in a magnificent night-time landing at the Kennedy Space Center in Florida (the shuttle was visible during re-entry over the Johnson Space Center in Houston—Mission Control—before crossing the Gulf of Mexico to its Florida touchdown). And in between, there were not only the planned ham radio

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

Photo B. Students at the Buzz Aldrin Elementary School in Reston, Virginia, await their chance to contact shuttle astronauts via ham radio. They actually got two opportunities, as the signals were very weak on the first effort and it was repeated on a later orbit. The second contact was a success. (Photo by Will Marchant, KC6ROL, AMSAT-NA SAREX Operations Manager)

contacts with school groups, but also a rare space-to-space QSO via ham radio between the crews of the shuttle and the Mir space station.

Ham Radio Glitches, Too

Initial attempts at making SAREX contacts were unsuccessful, and the problem was quickly traced to a faulty power outlet aboard Columbia. The problem was fixed, and the AMSAT News Service reported "a beautiful 'horizon to horizon' ham radio contact between Columbia and Dick Flagg [AH6NM] in Hawaii...." This was followed by the first attempted school contact, with Buzz Aldrin Elementary School in Reston, Virginia (see Photos B and C), but signals were very weak and the contact was deemed a failure by AMSAT-NA SAREX Operations Manager Will Marchant, KC6ROL.

Working with ham volunteers in NASA's Customer Support Center in Houston (including Karen Nickel, WD5EEU; her husband, John Nickel, WD5EEV; Gil Carman, WA5NOM; and several members of the Johnson Space Center Amateur Radio Club), one of the crew members retuned the SAREX antenna and moved it to a different window on the orbiter (the SAREX antenna is a simple 2-meter dipole attached by suction cups to an orbiter window). That seemed to solve the problems, and all remaining school contacts, including a second try with the Buzz Aldrin Ele-mentary students in Virginia, went off without a hitch.

When the astronauts were not active on the ham bands, the packet radio "robot" station was active, allowing hams to make digital contact with the shuttle, even though there wasn't a live person at the other end. There were also reports of APRS (Automatic Position Reporting System) relays via the shuttle's packet robot, but details were not available at press time.

"Mir from Columbia, I Hear You"

One of the ham radio highlights of the mission came on Sunday, July 25, when the shuttle crew contacted their fellow space travelers aboard Mir by ham radio (at least partially). Here are the details from an AMSAT News Service SAREX Bulletin of July 26:

Astronauts aboard the space shuttle Columbia on the STS-93 mission had the opportunity to talk with their fellow space travelers aboard the Russian Mir space station on Sunday, July 25, at 12:33 a.m. Houston time (0533 UTC). The contact was made through a combination of ham radio and NASA communications networks.

The timing of the contact was tricky—both crews had to be awake and Mir had to pass over a properly equipped amateur radio station. When Mir came over the horizon in Houston, Texas, volunteer amateur radio operator Brian Zemba made contact with French cosmonaut-researcher Jean-Pierre Haignere aboard Mir. Shuttle Columbia was almost half a world away, traveling over Indonesia.

The space shuttle was patched in via NASA's communications network and Tracking Data and Relay Satellite (TDRS). French Mission Specialist Michel Tognini aboard the shuttle exchanged greetings with Haignere. Tognini said, "Mir from Columbia. I hear you."

Photo C. Buzz Aldrin Elementary School students prepared for their SAREX contact by building a mockup of the shuttle orbiter and of the International Space Station (the big plastic bubble on the right). Many of the students slept overnight at the school while waiting for their early-morning contact. (KC6ROL photo)

The reply came, "This is Mir space station speaking, this is Jean-Pierre." The two French space travelers then conversed in their native language. Jean-Pierre then suggested handing the conversation over to the two commanders.

Eileen Collins, the first woman to command a space shuttle, exchanged a few greetings with her Mir counterpart, cosmonaut Viktor Afanasyev. Afanasyev said in broken English, "You are the first woman commander of a shuttle crew." Collins replied, "Hello Victor, this is Eileen. Dobrey-dien." Jean-Pierre assisted with translating, "Victor is listening, he wanted to congratulate you." Collins replied, "Spaseeba" (thank you)....

All together three languages were used during the 10-minute contact—French, Russian, and English.

The Associated Press reported that Afanasyev, switching back to Russian, called Collins "a courageous woman," and that she thanked him in Russian. Collins has been to Mir twice on past missions, but as part of visiting shuttle crews, not as a resident of the space station. Tognini, on the other hand, spent two weeks aboard Mir in 1992, along with Cosmonaut Sergei Avdeyev, who was aboard the space station again this summer (his third visit), and who chatted with Tognini during the 10-minute, trilingual, space-to-space contact. At the time of the contact, the two space vehicles were some 7,700 miles apart.

A digital audio .WAV file of the exchange between the two commanders is on NASA's World Wide Web site at <http://shuttle.nasa.gov/gallery/audio/shuttle/sts-93/wave/congrats.wav>. You'll need a program capable of playing back .WAV files in order to listen in. Additional information about SAREX and STS-93 is also available on the Web, at <http://garc.gsfc.nasa.gov/~kc6rol/sts93.html>

What's Next?

No SAREX operations are currently scheduled for future shuttle flights, most of which will be devoted (for the next several years) to construction and outfitting of the ISS. But ham radio activity from space will continue, both aboard Mir as long as it's occupied (it may already have been abandoned by the time you read this) and aboard the ISS, where it's slated to be a permanent fixture.

The first shipment of amateur radio equipment should be installed on the ISS during the STS-101 mission, currently scheduled for December, 1999. The ISS ham station is planned to be built in three stages—the first being a handheld setup similar to what's been used in SAREX, followed by a more permanent arrangement in stage two, and, finally, a multifaceted station for stage three with the possibility of multimode HF, VHF, UHF and microwave operation (details haven't been worked out yet for stage three).

Thank you to AMSAT-NA SAREX Operations Manager Will Marchant, KC6ROL, ARRL Educational Services Manager Rosalie White, WA1STO, and the AMSAT News Service for help in preparing this month's column.

• • •

As you may have read in last month's issue, Ken Ernandes, N2WWD, told us as we went to press that responsibilities at his job would prevent him from continuing to write the "Orbital Elements" column for *CQ VHF*. We will miss Ken's expertise and his ability to make complex science sound simple. Thank you, Ken, for all your hard work. At this writing, we have not yet settled on a successor to fill Ken's shoes.

—73 de W2VU

Ham Life in Yugoslavia Returning to Normal

A ham near Belgrade reports that, with peace finally restored (at least for now), hams in Yugoslavia are "again looking for Es, waiting for meteor showers, [and] rebuilding FM repeaters...." But another ham in Montenegro says interference there is making 2-meter communications nearly impossible.

Contributing Editor Bob Josuweit, WA3PZO, has been chronicling ham activity in the Balkans before, during, and after the NATO campaign to end the ethnic slaughter in Kosovo, and now, during peacekeeping operations. Last month, we heard from a ham in Montenegro, a Yugoslav republic that had been on the periphery of the battle. This month, Bob made contact with Branislav Kostic, YU7KB, a ham directly in the Belgrade area.

"I am interested in promoting friendship via amateur radio and am staying away from the political discussions," Bob wrote. "How have ham radio activities changed over the past six months? Are clubs active? Are repeaters and packet networks in operation?" YU7KB's response follows, with editing primarily to "clean up" his English syntax and spelling.—W2VU

"We have a lot of disturbance from radio-telephones in Kosovo and Albania...almost all radio amateur frequencies on the 2-meter band are disturbed, especially those from 145.000 to 145.200 MHz, where the repeaters are."—Dejan Tusup, YT6DTM

Hi, Bob—I'll try give to you some information about radio-amateur activity in Yugoslavia (YU) after the NATO air strikes ended. During the NATO attacks, hams were not active with normal amateur radio activity. Hams supported government operations by reporting on NATO aircraft activity. Now we are again looking for *Es* [sporadic-*E*], waiting for meteor showers, rebuilding FM repeaters that were destroyed, and the rest of what hams usually do.

For example, during the first weekend in July, there was very good activity in a continent-wide V/U/SHF contest. Many club and personal stations worked from portable locations, from mountains, and other nice locations for VHF. Activity in that contest—the IARU Region 1 Contest—was good in all of Europe.

We have had *Es* openings a couple of times, but, except for one, all openings have been short. Many hams here are still waiting for a good *Es* opening, and also the Perseids meteor shower. In YU, we have many active hams on meteor scatter [MS]. If you've heard about the MS contest organized by the Bavarian Contest Club (BCC) during the Geminids meteor shower, I was in the YU7MS team, which placed 3rd in that contest [*The BCC meteor scatter contest is probably the largest, and perhaps the only, contest devoted entirely to MS contacts.—ed.*) You can see complete information on the Internet at <http://www.ilk.de/sites/gap> (that is where I found the link to the *CQ VHF* magazine Web site).

73 from Bane, YU7KB

Report from Montenegro

Last month, Dejan Tusup, YT6DTM, in Montenegro, provided us with a detailed look at politics and ham radio where he lives. He noted that military operations were causing a tremendous amount of interference on the ham bands, but hoped that the return of peace would restore the bands to their normal condition. Now, Dejan reports that conditions on the 2-meter band have become worse since the peacekeeping operation in Kosovo began. According to Dejan:

> We have a lot of disturbance from radio-telephones in Kosovo and Albania. I don't know if there is any law against it and who is doing it, but almost all radio amateur frequencies on the 2-meter band are disturbed, especially those from 145.000 to 145.200 MHz, where the repeaters are. This is making it almost impossible to use our main repeaters. I hoped that whomever it is would stop operating once the war was over, but the transmissions are increasing!"

Dejan says local hams are having some success using tone squelch to reduce the interference, which sometimes lasts for up to two hours at a time. Dejan also offered one geographic correction to our earlier reporting. There are *four* former Yugoslav republics that are now independent states: Slovenia, Croatia, Bosnia, and Macedonia *(tnx for the correction—ed.)*.

We'll keep you updated on future developments. Meanwhile, watch for WA3PZO's "In the Public Interest" column next month, which will detail the massive health-and-welfare traffic operation in which Dejan was involved during the war in Bosnia. ■

Discover the RF Attenuator

The RF attenuator is a versatile, but underutilized, piece of equipment. Most often used in "foxhunting," the device can come in handy for a variety of other purposes as well. N9SFX shows us some of the uses he's discovered.

By Pete Ostapchuk, N9SFX*
(n9sfx@aol.com)

Do you have an RF attenuator in your shack? I doubt it. I've worked in electronics since 1966, including a three-year stint as an Army radar operator, and I've been a ham since 1993. But until I built one, I had never seen an RF attenuator in the "flesh." What *is* an RF attenuator? Simply put, it's a device that absorbs radio frequency (RF) energy, reducing the strength of the signal on the output from what it was at the input. They're used when very low powered signals are required.

My First Attenuator

I built my first RF attenuator three years ago, at a time when there was a lot of interference on the local repeater. I was part of the direction-finding (DFing) team trying to track down the source of the interference, I had a five-element Yagi antenna and was pleased with its performance (Photo A), but a problem arose when DFing stronger signals. Once I got close enough to the signal to start zeroing in, the signal strength got so high that the S-meter read full scale no matter where I pointed the antenna! So I built an attenuator[1] that would go from 0 to 95 dB (decibels) in 5 dB-steps, and that enabled me to get a whole lot closer (Photo B).

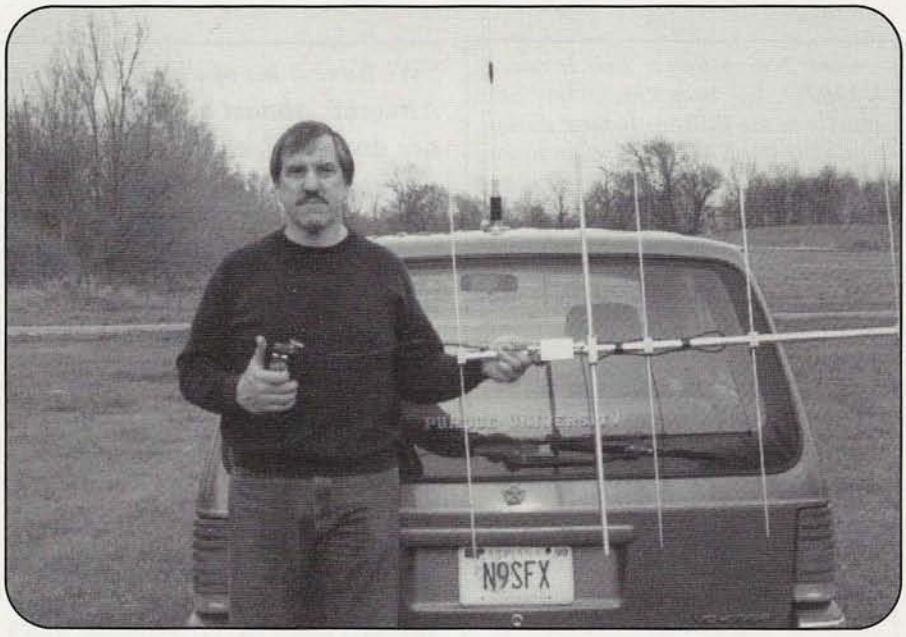


Photo A. The author, set to begin tracking down a mystery transmitter, with his HT, RF attenuator, and five-element Yagi. (Photos courtesy of the author)

It's easy to use. All you need to do, when the signal starts getting too strong, is to connect an attenuator between the antenna and the radio (Photo C) and select enough attenuation, approximately 5 dB, to get the S meter back into the active region. Keep moving toward the transmitter you're hunting and keep increasing the attenuation as necessary until you either trip over the transmitter or run out of attenuation. Theoretically, 95 dB should allow you to get closer to your target, or the "fox," by a factor of 56,000; but ours is not a perfect world, and you may run out of attenuation. If you do, you still have a number of options open to you. (A good source of foxhunting tips is a book entitled *Transmitter Hunting—Radio Direction Finding Simplified*, by Joe Moell, KØOV, and Thomas Curlee, WB6UZZ[2].)

After designing and building several working units, I began to get requests for modifications, namely more attenuation and smaller steps. Obviously, there are people out there with applications for attenuators that do not involve foxhunting. The attenuator is just a tool, like a volt-

Pete Ostapchuk, N9SFX, has been a ham since 1993, and an Extra class operator since 1994. He lives in Osceola, Indiana, where he is a volunteer examiner and volunteer ARRL Technical Specialist. He's currently working with the Civil Air Patrol to see if there are ways for hams with direction-finding skills to help speed up searches for downed aircraft.

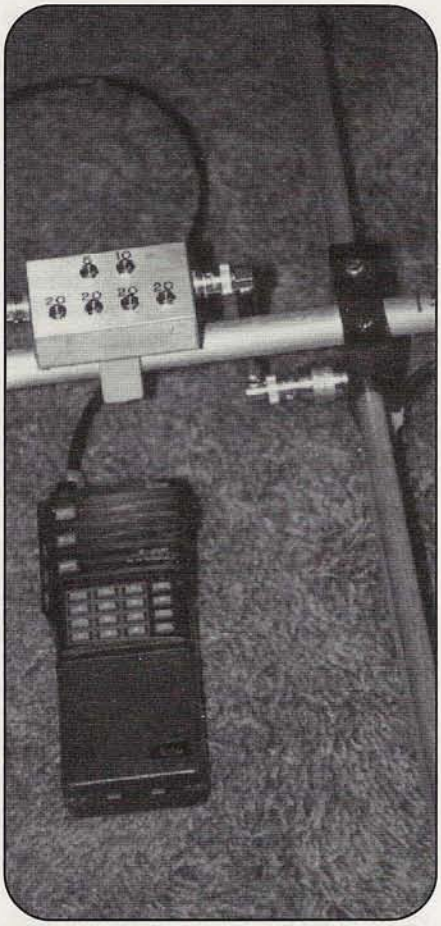


Photo B. Close-up view of N9SFX's 95-dB attenuator, clamped onto the mast of his antenna and connected to both the antenna and radio.

meter, and can be used in many different disciplines. Let's take a look at a few.

Mapping Repeater "Hot Spots"

The first non-foxhunting application I experimented with was using my attenuator to help me map out my house to help me find hot spots to solidly get into a local repeater. I took the rubber duck off my HT, attached the rubber duck to the attenuator, and attached the attenuator to the HT with a double male adapter, as shown in Photo C. I waited for the Monday night net to start and I began increasing attenuation between the antenna and the HT until the S meter read less than full scale. Now it was a simple matter to walk through the house and note where the S meter read the highest. These hot spots are where I want to be to hit the repeater with the least amount of power. Because of *antenna reciprocity*, if I can hear the repeater well, it can hear me well. This applies only when a single antenna is used for both transmit and receive, and will not always work if the repeater uses separate receive and transmit antennas.

A Transmit Attenuator

My second experiment involved transmitting through my attenuator. By transmitting through the attenuator I was able to determine the minimum power needed to access a certain repeater. This information can be kept in a log which will tell you how well your repeater is receiving over the years. It's a simple test, just talk to someone on the repeater and note how much attenuation your transmitter can tolerate before the person on the other end can no longer understand you. It's best to always use the same transmitter and antenna and talk to the same person. One thing you need to remember is that the transmitter should not put out more power than the rating of the resistors in the attenuator. In other words, if your attenuator uses 1-watt resistors, don't transmit into it with more than 1 watt.

The latest use I had for the attenuator was to connect my signal generator to my field strength meter. My field strength meter has a range of 88 to 220 MHz and is quite selective, but I needed to calibrate the tuning capacitor in the LC circuit in order to put graduations on the box so the knob could be rotated to the frequency of choice. The signal generator had too much output for the field strength meter, so I ran the signal generator output through the attenuator and then into the field strength meter.

If you don't have a signal generator, you can use a transmitter, but you might need a fixed-value power attenuator between your transmitter and the step attenuator if the low-power setting of your transmitter is higher than the power rating of your step attenuator. If you know the power output of your transmitter and the power-handling ability of your step attenuator, you can calculate the amount of attenuation needed in the power attenuator by using formulas that appear later in this article. This process will work with other pieces of test equipment that won't tolerate the amount of power coming from the device you're testing.

A Mini Antenna Range

If you build antennas or just want to test a store-bought antenna to see how

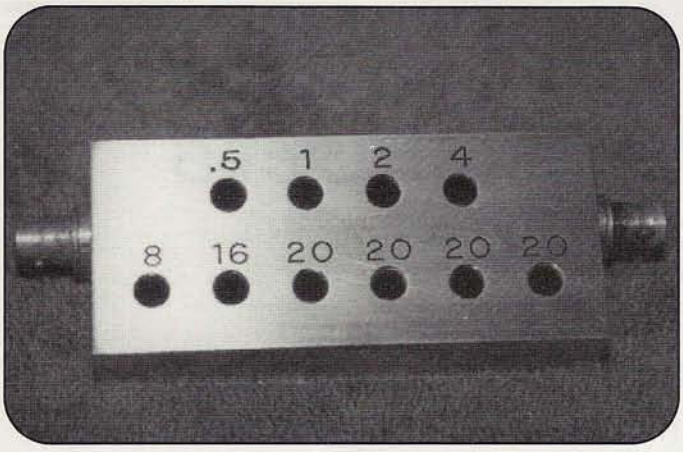


Photo D. Attenuation values are engraved into the cover of the N9SFX attenuators. This is the cover of the 10-switch unit, which provides up to 111.5 dB of RF attenuation in .5-dB steps.

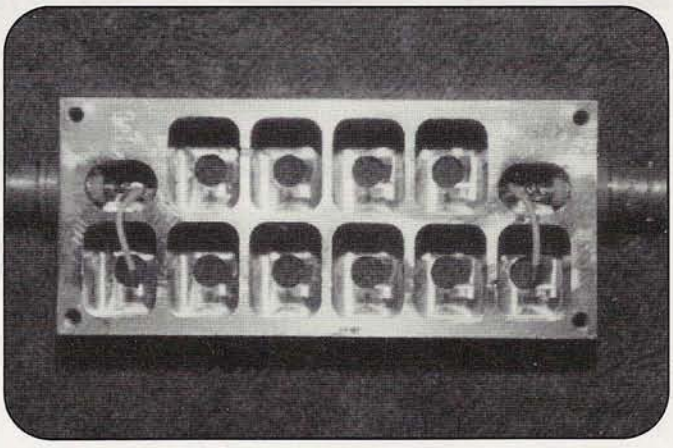


Photo E. Interior of the N9SFX attenuator before resistors and switches are added. The device is made from a machined block of aluminum.

the half power point, but as you can see from the example above, it's really 3.0103. It's only an error of one third of one percent, so unless you work for NASA, you can let it slide.

It's an easy matter to work the formulas backwards. If you have a gain of 20 dB, divide 20 by 10 to get 2; the number 2 becomes the exponent of the number 10; 10 to the power 2 is 100, and you have a power gain of 100. If you divide 20 by 20 to get 1, 10 to the first power is 10, you have a voltage gain of 10, which is also a power gain of 100 (following the formula above that 2 x voltage = 4 x power, 3 x voltage = 9 x power, then 10 x voltage = 100 x power).

Where Do I Find an RF Attenuator?

Now you know some of the things that can be done with this handy tool that will never have dead batteries, but you need to find one before you can plug it in. There are several commercial units out there, but most run anywhere from $200 to $1,000. MFJ, however, makes one in the $70 range. I hear tales of attenuators showing up at hamfests at reasonable prices, but the standard hamfest rule of "buyer beware" applies. Kits are very rare; I've read about one that's built from little pieces of pc board soldered together, but I don't know if it's still available.

I have a couple of different kits available, one a six-switch unit and the other a 10-switch unit. (These are the attenuators that were featured in, respectively, the May[1] and December, 1998[3], issues of *QST*.) The six-switch unit is used almost exclusively for foxhunting and has attenuation values of 5, 10, 20, 20, 20, and 20 dB (total 95 dB). Other values are available, but the ones just mentioned are the standard values. It works well up to 450 MHz. The 10-switch unit will do everything including foxhunting, as it's only 3-7/8 inches long, not counting the BNC connectors. The standard attenuation values for this unit are .5, 1, 2, 4, 8, 16, 20, 20, 20, and 20 dB (total 111.5 dB, with significantly smaller steps than the 6-switch unit).

Both units have the attenuation values engraved into them (Photo D), and non-standard values are hand stamped. The housings are machined from solid blocks of 6061-T6 aluminum (Photo E) and are rugged to the point that they will support a weight of several tons. Both models are available with everything needed to build a completed unit including resistors and switches. See "Resources" for prices and ordering information. The units come with lots of instructions.

However you decide to get it, just go ahead and get it, you never outgrow your need for tools. A good attenuator should last you a lifetime. ■

"A good attenuator can help you test your S-meter to see if it is graduated accurately. If your S-meter is not accurate, your attenuator can show you where the 3-dB and 6-dB points are...or you can check for other steps of your choosing."

References

1. Ostapchuk, Pete, N9SFX, "A Rugged, Compact Attenuator," *QST*, May, 1998, pp. 41–43.
2. Moell, Joe, KØOV, and Curlee, Thomas, WB6UZZ, *Transmitter Hunting—Radio Direction Finding Simplified*, TAB/McGraw Hill #2701; Tab Books, Division of McGraw-Hill, Inc., Blue Ridge Summit, PA 17294-0850; Phone: (717) 794-2191; Fax: (717) 794-2103.
3. Ostapchuk, Pete, N9SFX, "Rugged, Compact Attenuators Improve," Technical Correspondence, *QST*, December, 1998, pg. 64.

Resources

RF attenuator kits are available from the author for either $45 or $59, depending on whether you order a six- or 10-switch unit. If you have a supply of switches, you can save yourself $12 or $20, respectively. That price includes shipping, but foreign orders are $2 additional for shipping. To order, send a check or money order to Pete Ostapchuk, N9SFX, 59425 Apple Rd., Osceola, IN 46561. For more information, send a self-addressed stamped envelope (and your question) to the above address, or contact Pete via e-mail at n9sfx@aol.com.

The MFJ-762 RF attenuator sells for $69.95. To order, or for more information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; Phone: (601) 323-5869 (8–4:30 Central time, M–F); Orders/Dealer Locations: (800) 647-1800; Fax: (601) 323-6551; Web: <http://www.mfjenterprises.com>.

ICOM's IC-706 Mk II-Gets Even Better

The rig that started the battle of the HF/VHF multimodes between ICOM and Yaesu now sports a "G" in its name and UHF as well as HF and VHF coverage. The new IC-706 Mk II-G is ICOM's answer to the Yaesu FT-100.

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

Five years ago, ICOM America introduced a little ham set that took the industry, and ham operators, by surprise...a pleasant surprise. Along with all the HF ham bands at 100 watts output, it also included 6 meters with 100 watts out, plus 2-meter multi-mode capabilities, although with only 10 watts out. It was a first—a tiny HF rig with all-mode 6- and 2-meter capabilities!

The original IC-706 was an amazing performer on HF and 6 meters, and it did a terrific job on 2-meter FM, CW, and SSB. In fact, one of my first tests of the 706 on 2-meters SSB was to take it to a local mountaintop covered with commercial and ham radio repeaters (Photo A) to see whether or not it *desensed* or was overloaded with intermod. It didn't desense, nor was intermod a problem. Built into the first IC-706 was an elaborate bandpass filter system that peaked the 2-meter band and nulled out commercial channels just above and just below it.

A Few Early Problems

The first IC-706 had receive coverage far beyond the ham bands, but VHF scanning enthusiasts had a problem: the radio was rather deaf in the 150- to 160-MHz region because of the 2-meter bandpass filtering, and it also suffered in sensitivity down on the FM music band and aeronautical bands. While there was a "yellow wire mod" (see "ICOM IC-706 Transceiver—High Frequency Plus 6 Meters and 2 Meters," April, 1996, *CQ VHF*) to dramatically improve out-of-band scanning/receiving capabilities, it also let a little bit of commercial junk eat into the 2-meter side of the transceiver.

There was also the pesky problem of the DC power plug, which ICOM uniquely turned upside down (Photo B), resting right next to a GaAsFET IC (integrated circuit); and when operators inevitably tried to plug in the power cord backwards, it would physically push the white Molex receptacle on the transceiver up against the IC, dislodging it and knocking *all* VHF receive down to almost zero.

Most manufacturers using this six-pin plug on their mobile HF transceivers mount it with the locking tab pointing *up*. But due to the excellent massive heat sink that ICOM uses on its IC-706 transceivers, the only way to accommodate the locking pin was to turn the plug 180 degrees and point it straight *down*. Since battery negative was on the center two pins, and battery positive was on the two outside pins, there was absolutely *no* danger if ever the plug *was* inserted backwards, because the positive pins would go into no connection. Once the plug was turned 180 degrees, everything would work fine. But the problem of dislodging the chip persisted.

A year later, ICOM brought out the second version of the 706, the Mk II. It had the same great HF performance, and

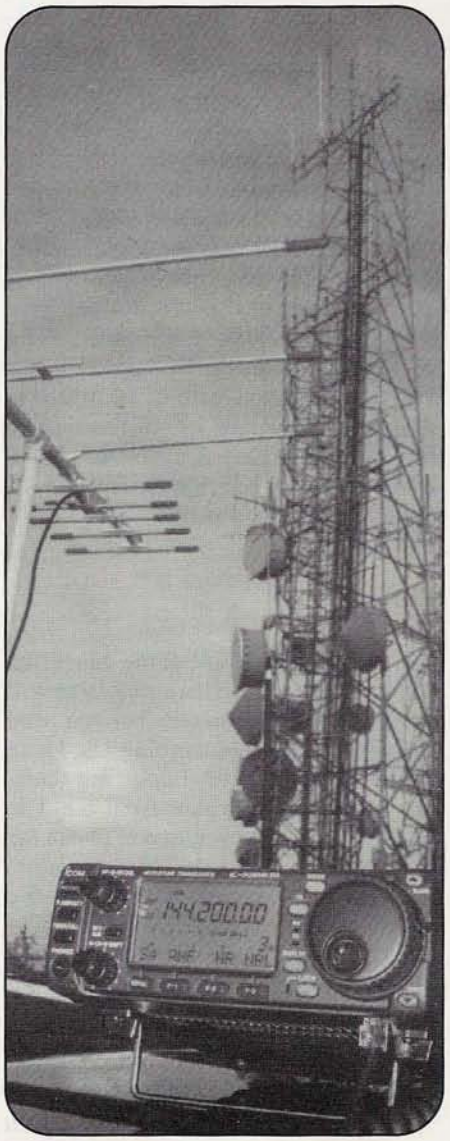


Photo A. ICOM's new IC-706 Mk II-G is just as resistant to VHF/UHF intermod as previous versions of the radio, even on a mountaintop full of amateur and commercial repeaters. (WB6NOA photos)

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

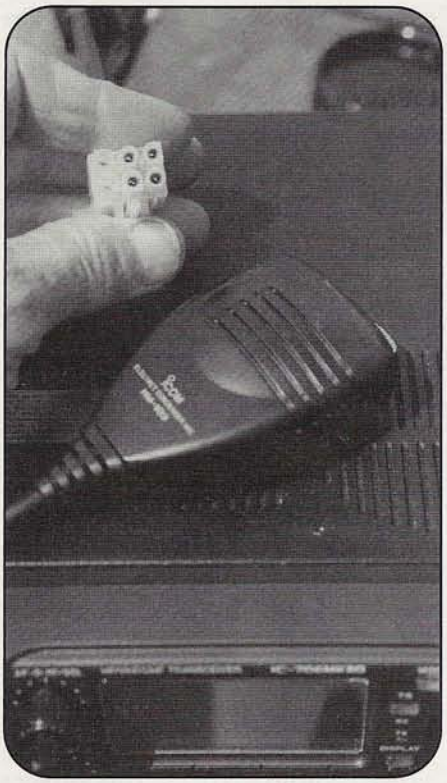


Photo B. While most rigs using the six-conductor Molex power plug have the locking tab on the top, the tight construction of the IC-706 Mk II-G made it necessary for ICOM to install it "upside down." The new model solves some of the internal problems that resulted when hams tried to connect the cord the wrong way.

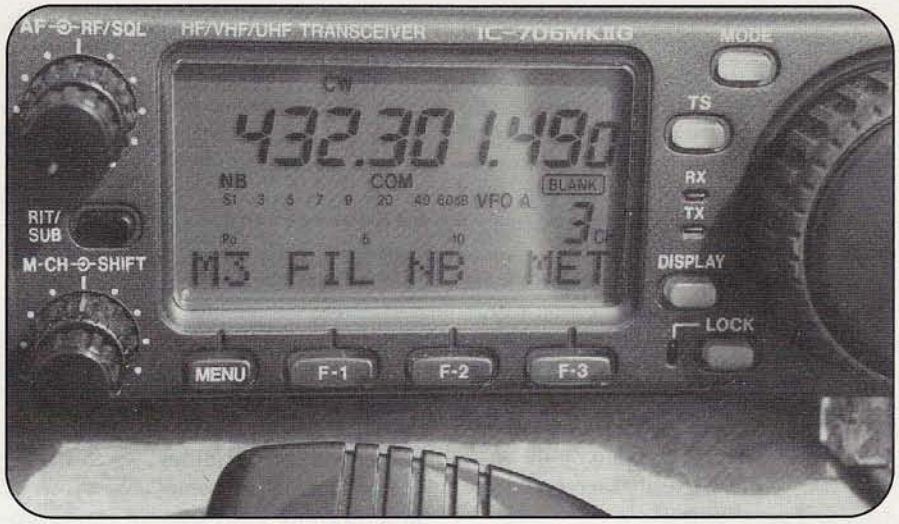


Photo C. The main feature that sets apart the "G" model from its predecessors, the IC-706 and the IC-706 Mk II, is the inclusion of multimode operation on 70 centimeters (420 to 450 MHz), but it also includes higher power on VHF and other new features, as described in the text.

much improved wideband scanning performance on TV, FM music, AM air band, and the VHF high-band up to 199 MHz. There was also more 2-meter power output and a slight redesign of the tail end of the circuit board to minimize component problems when hams continued to try to plug in the power cord upside down.

More! We Want More!

Like all hams, we always want more from our equipment than it already has. We are indeed a marketing challenge for manufacturers! And *everyone*, it seemed, wanted 70-centimeter (420- to 450-MHz) capabilities to go along with their dual-band mobile and handheld equipment (especially after Yaesu showed it was possible with its FT-847). So ICOM went back to the drawing board and has now introduced a new and improved IC-706 MkII-G— the "G" designating the inclusion of 420- to 450-MHz transceive operation (Photo C) and hot reception from 400 through 470 MHz, all with multimode capabilities.

The new "G" version of the 706 also gives us added power output on the upper bands: 50 watts on 2 meters and 20 watts on 70 centimeters. Just keep in mind that most single-band and dual-band VHF/UHF power amplifiers may require significantly lower power levels than this at their inputs, so double-check the recommended input power level for your amplifier, if you have one. Next go into the quick-set mode and individually choose appropriate power levels for 2 meters, and then choose the power level you want for 70 centimeters. These power-down settings are independent and will not affect full power output on HF or 6 meters.

Automatic Repeater Offset

The new ICOM "G" includes automatic repeater offset, something missing from the earlier versions. It's about time! On the original and MK II models, selecting and memorizing repeater frequencies required several keystrokes, and any repeater with a positive offset needed even more. It was even more complicated if you needed to input a tone frequency; if you tried to memorize tone with the output showing, it wouldn't automatically transfer over to the input.

This has all been solved with the new "G"—you simply dial in the output, and the unit automatically splits to the correct input frequency. And, with the built-in tone encoder *and* decoder, you select which tone for encode and then select (usually) the same decode tone. Menu Q6 shows **RPT** repeater tone, which is tone *encode*; menu Q7 shows tone squelch, which means tone *decode*. Don't mistake repeater tone for the tone that the repeater is sending out; rather, repeater tone means what tone are you going to *encode*.

Double-check that you're accessing the repeater, and then choose menu item G4 to program an eight-character alphanumeric name for the channel you're about to program into any one of 100-plus memory positions.

Once you get rolling with this technique, it takes you about one minute to program and name the frequencies of your choice.

Built-in DSP

The "G" has even more standard features than its two predecessors, including digital signal processing (DSP) built in, not as an option that you have to install yourself. This DSP stuff really makes a difference when weak signals are getting down there in the noise and you need to drop the noise floor even further. Select the **DSP** menu, and toggle noise reduction **ON**. Now select the **LEVEL** of noise reduction to effectively lower the noise floor, yet still retain the intelligibility of the weak incoming CW or SSB signal. There are 15 levels of noise reduction, and level 8 is about the lowest you can go to with voice to drown out the hash. On CW, you can go several levels further, extracting signals out of the ether that you barely knew were there.

On high frequency, you'll probably use the automatic notch filter to cancel annoying heterodynes. It was also quite effective up on the weak-signal (SSB) portions of the 2 meters, where I had a fax machine that gave me a steady carrier close to the calling frequency. One push of the notch filter and the tone automatically disappeared.

And if you have a noisy vehicle with spark plug interference that won't quit, the noise blanker circuit synchronizes with the spark plug racket and takes it almost completely out. The noise blanker circuit has been redesigned to be much more effective than the one on the very first 706, which had only marginal noise blanking capabilities.

There's More...

It gets better—the new "G" gives us illuminated keys and switches. At night, you can now zero in on the **up** and **down** band keys, and easily see which button to push for a menu to bring up a choice of functions with their own illuminated keys. And there's even more good news—the front panel LCD display with its bright green background and black numbers may be dimmed independently at night, in case you want to leave the key back-light control up at a different lighting level.

Satellites, Sort of...

The new 706 "G" gives us all of the FM and weak-signal activity on 70 centimeters, plus satellite activity, which I really enjoyed. Now this is not a full satellite radio—you can't transmit on one band and simultaneously listen to your downlinked signal on another (virtually all analog amateur satellites operate split band). But you *can* put the downlink frequency in VFO A and the uplink frequency in VFO B, then go back to VFO A and select **split** for VFO A receive and VFO B transmit, just by pressing the mic button. The new "G" also lets you change frequency while transmitting, often a necessity during satellite QSOs. And, although you're not listening to your downlink frequency, you could still maneuver around and get a great QSO, as I did, by going to your favorite frequencies that always seem to work during a satellite pass.

In fact, in this split mode of operation, I noticed some slight changes from what I could do with my original 706 and original MK II. When I popped open the top, I was surprised to find that the main printed circuit board had been completely redesigned. No, they didn't just plug in a 440 transverter to an existing design; for the new 706 "G," the folks at ICOM totally redesigned most of the inside circuits for improved performance on the existing bands and new performance on the 70-centimeter band.

This new design also changes the out-of-band transmit modification needed for Civil Air Patrol, U.S. Coast Guard Auxiliary, or MARS activity. Instead of removing two tiny SMT (surface-mount-technology) micro-diodes as in earlier versions, you now remove only one of these little tiny critters, which are in a programming row that you can make out in Photo D. But do this carefully and only if you are authorized, and keep in mind that the component you are unsoldering is precisely the same size as the head of a pin!

Keep a Cool Head

If you decide to remote the head (Photo E), you'll need to buy the optional 11- or 16-foot separation cable that comes along with a tiny remote head holder. You may find that double-stick tape or hook-and-loop tabs will hold the holder in place nicely. The mic may be unplugged from the back of the equipment and plugged into the remote head. You can also plug a speaker into the "phones" jack on the remote head and slide a little plastic switch (on the *back* of the head) into the speaker mode for more powerful audio output. Or, if you put the 706 "G" body under the front seat or somewhere up close to the remote head, you can run the speaker and the mic off of the main unit, and leave the head free to move around the dash anywhere you want it.

One important note: keep the head cool. If you let it get too hot, the LCD display will begin to turn black. Don't worry; it goes back to normal after cool-down, but it's hard to see anything on it when it's all black!

I also discovered one more "oops" with the ICOM LCD display: some polarized sunglasses cause the display to look absolutely jet black when you hold your head in the normal position! Yet others make the display look just great until you cock your head at an angle. There appears to be no industry standard for which way either sunglasses or the displays get polarized. So, if you're having a pair of polarized sunglasses made up at the local one-hour glasses factory, ask them to give you a blank so you can go out to your car and see which way is "up" with the display looking normal. (*Consider the 30-dB cross-polarization loss you'll encounter between vertically and horizontally polarized radio signals; same basic concept here with light.—ed.*)

Back to the Mountaintop

Since the main receiver circuit board was completely redesigned, I revisited

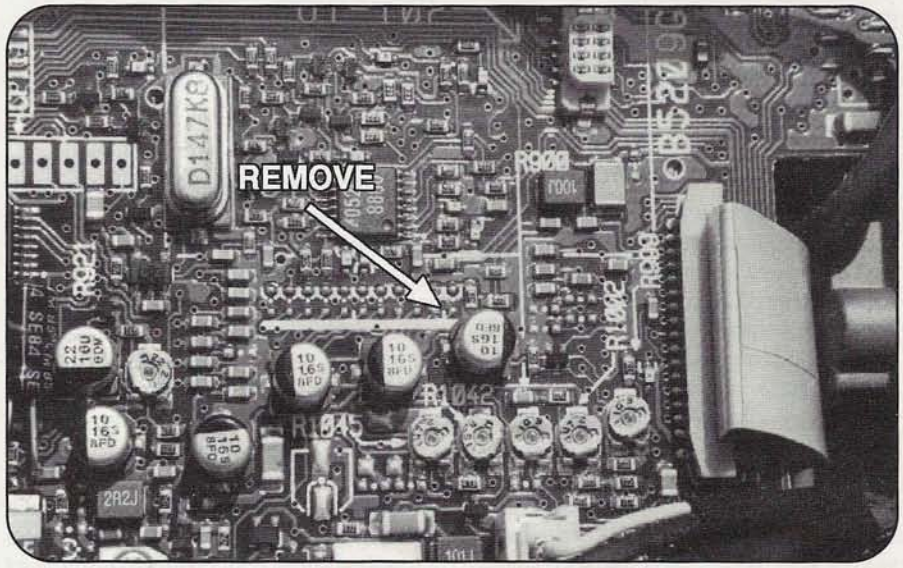


Photo D. On the new version of the 706, only one itsy-bitsy surface mount chip diode must be removed (instead of two) for expanded transmit capability for CAP, MARS, and Coast Guard Auxiliary operation.

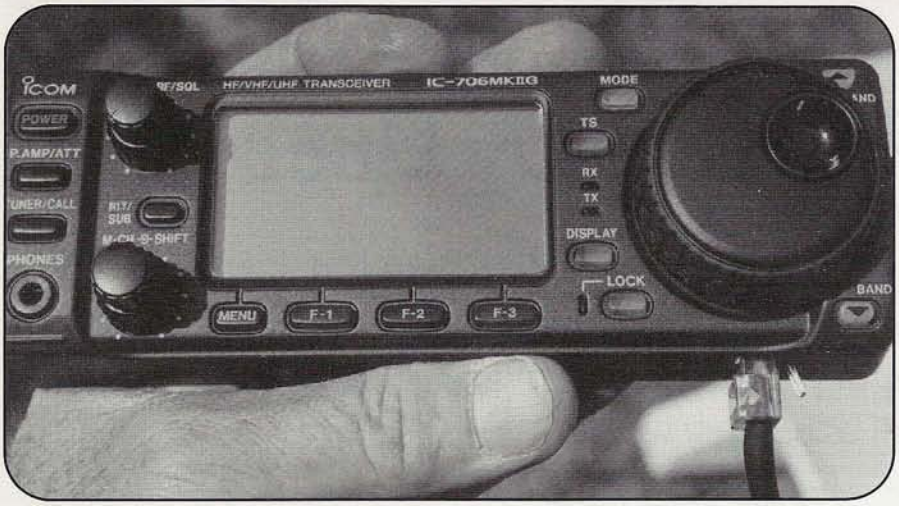


Photo E. The IC-706 Mk II-G has a remotable control head which can be detached from the radio and mounted elsewhere, as long as you buy an optional connecting cable. Mic and speaker may be plugged into either the head or the main body of the rig, and there's a switch on the back of the control head to toggle the output to the "phones" jack between headphone and speaker levels.

the mountaintop repeater site to ensure that the new 706 "G" was intermod-free. And it was, including FM and SSB reception up on 70 centimeters. The equipment continued to operate flawlessly all around several mountaintop repeater sites, and this confirms that ICOM America continues to offer amazing VHF and UHF weak-signal SSB and FM performance with combined high-frequency circuitry without loss of ham band interference-free reception. Just amazing!

Another new item on the new "G" is the **SWR band scope** function. Similar to the band scope readout on receive, the band scope can now double as an SWR plot that gives you a graphic representation of where your high-frequency mobile antenna is best matched. If you see the SWR dip right in the middle, you're set to QSY (change frequency) in either direction from this spot. But if you see the SWR dip at the top of the band, it means you need to go out to the mobile whip and pull the little "stinger" out by an inch or so in order to bring the dip into the middle of the band. And if you're into data or CW at the bottom of the band, pull the whip out a little bit farther.

Speaking of data, the new "G" is terrific on packet as well as with APRS (Automatic Position Reporting System), and you can set either 1200 bps or 9600 bps as a menu item. ICOM provides good documentation on how to wire in your terminal node controller (TNC).

There's also a remote jack for wiring in the optional CT-17 CI-V level converter to connect the rig to a personal computer. This could allow you to run the equipment remotely, but the folks at ICOM are still working on the actual program to make this all happen. Meanwhile, they say, you could write your own, or stand by for a company like RT Systems to come up with plug-and-play software.

For mariners wanting a rock-solid Winlink PACTOR system plus rock-solid weather facsimile receive, an optional high-stability crystal oscillator unit is available, as well as optional tighter IF filters. The filters are easily installed without soldering, but the high-stability crystal unit does require a couple of soldered spot-connections. And, as long as you're inside the unit, you might even consider the voice synthesizer module that announces, in English, many different modes as indicated on the front panel, enunciated in audio out the speaker.

The Bottom Line

The new ICOM IC-706 MK II G is about $300 more expensive than its predecessor (list price; $1,680; "street price" around $1,400), but it gives you some powerful additional features plus a whole new band—420 to 450 MHz at 20 watts out—with any mode including weak-signal SSB. If you're planning to mix VHF and UHF operating with worldwide high-frequency bands that we expect will soon be available to all Technician-plus operators at five wpm, the ICOM "G" is worth your consideration. ■

Solid-State Guy Lines

So you took the plunge, bit the bullet, and bought that tower you've been dreaming about ever since your license came in the mail. Now, how do you keep it standing? In this photo guide, W8CM looks at an alternative to traditional steel guy wires.

By Mike Baker, W8CM*
(mikebaker@texoma.net)

Any ham who has been there will agree: buying and erecting a tower is only part of the story. The "real" work and a significant part of your budget will go into the *guy system*, the cables that keep your tower from falling over on the first windy day. I recently decided to put up a 90-foot guyed Rohn 25G tower in order to stack some 6-meter beams with a rotating tower system so the beams could be mounted on the side of the tower instead of the top (more on this in a separate article). This meant that one of the antennas would be turning between two sets of tower guys. After looking into all the details, I decided to put up the tower with a set of "solid-state guy lines." Note that I did not say "guy *wires*."

Photo A. Dori Baker, W8YR, and Saleem Banatwala, KC5UHS, begin wrapping Phillystran guy cable in "big grip" steel wrapper. (Photos courtesy of the author)

Introducing Phillystran

Today's ham has two choices for a tower guy system. The first is the old reliable EHS (extra high strength) steel cable, but a very interesting alternative is a product made of cladded aramid fiber, called "Phillystran." This is a multiple-strand fiber, similar to the well-known Kevlar™, the material used in bulletproof vests. The fibers are very strong, with a strength-to-weight ratio five times greater than steel, and are covered with a protective extruded outer jacket sheath. Both the fiber and the sheath are non-conductive, so they won't interact electrically with antennas.

Both EHS and Phillystran are available in several diameters and equivalent strengths. For example, both 3/16-inch EHS and an equivalent Phillystran cable are rated at 4,000 pounds. So what's the difference? First of all, a guying system with Phillystran will cost about twice as much as a conventional steel EHS system, but it could be worthwhile in the long run! Steel guys have a tendency to interact with HF antennas, and, in my case, with the stacked 6-meter beams above and below them.

Normally, the "correct" way to build a ham system is to use insulators in each guy line to "break up" the guys into lengths that aren't resonant on any of the ham bands. You have to go through the very tedious process of building multiple steel guy lines with all those insulators and clamps to fully appreciate how much work it really takes, compared to the simple build-up for a Phillystran line. Also, once you've built up your steel lines and installed them, you'll find that they tend to stretch for quite a while until all the parts take their set, so you'll have to readjust the guy wire tension often for a while. The Phillystran cable, on the other hand, is set once on initial installation and doesn't need much readjustment. I feel that when you take into account all the extra time it takes to build up those insulated steel cables, plus repeatedly retensioning them, your time savings more than compensates for the higher initial cost of the Phillystran cable.

Mike Baker, W8CM, has been a ham since 1960, and particularly enjoys VHF-UHF weak signal modes. He lives in Van Alstyne, Texas, with his wife and two children, who are all hams as well. Mike is a senior manager of RF engineering for Nortel Networks in Dallas.

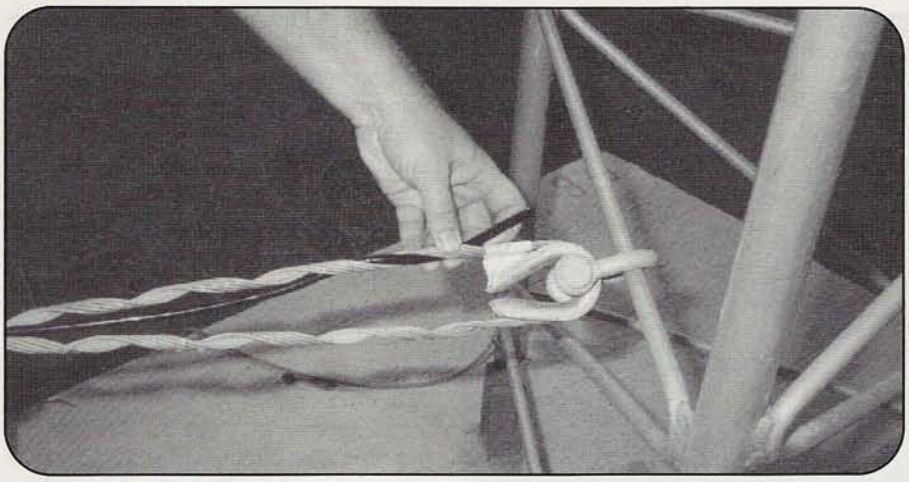


Photo B. Detail view of the "big grip" wrapping process. Note that only a couple of inches of the Phillystran cable extend beyond the initial wrapping point.

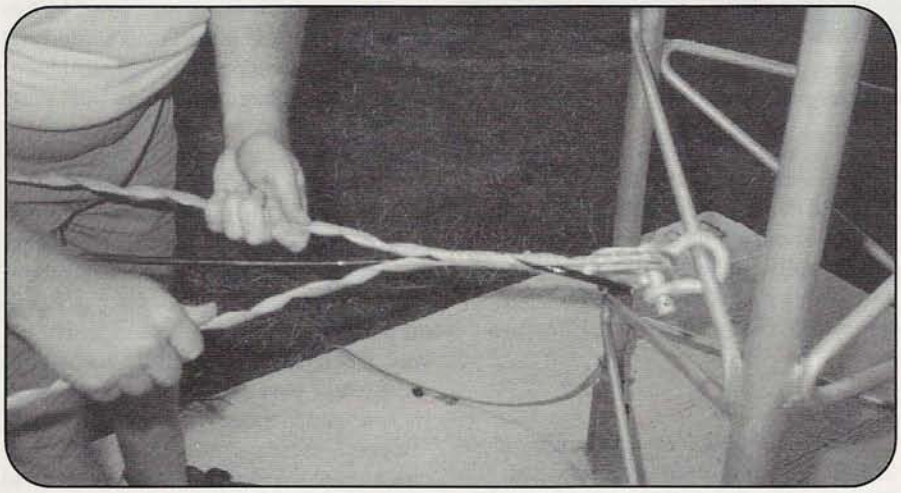


Photo C. The wrapping process continues as the Phillystran cable is secured to the "big grip."

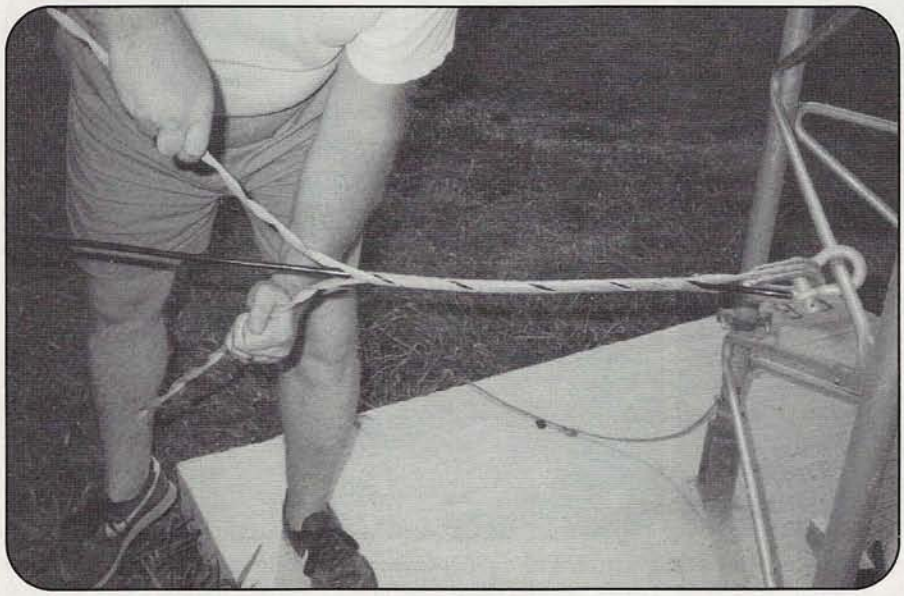


Photo D. Continuing to wrap the Phillystran in the "big grip." Patience will be required.

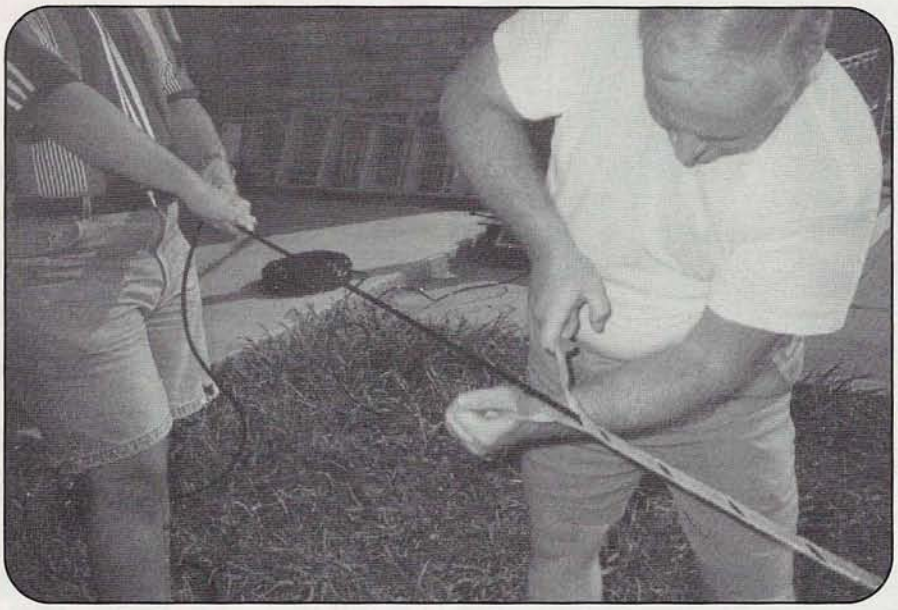


Photo E. As you approach the end of the "big grip," the cable becomes quite stiff and may be difficult to work with. The good news is that you're almost done.

OK, now that you're sold on using a nonmetallic guy system and have brought home the goodies, you should know that building and installing a Phillystran cable is simple, but it takes a little getting used to compared to how you may have made up steel cables before. The Phillystran system uses special steel "big grips" to wrap around the line and hold it in a fashion much like those kids' toys that grab your finger and won't let go. An instruction sheet comes with the line when you buy it, but you'll find it helpful at this stage to get some assistance from someone. You can put on the big grip yourself, but it really, really helps to have someone help by providing a light tension on the line while you are doing this.

Preparing the Cable

Photo A shows my daughter, Dori Baker, W8YR, and friend, Saleem Banatwala, KC5UHS, starting this process. In Photo B, you can see a close-up view of how the process is begun at the end of the line. Here, it helps to use a standard shackle and pin to temporarily anchor the required U-shaped steel Phillystran thimble to something like a tower rung. The special Phillystran big grips are marked by the factory with a dab of paint which tells you where to start wrapping, with the cable protruding a couple inches beyond.

Now, this is important: if you've installed big grips on steel cables in the past, *do no*, repeat, *do not* think you do it the same way with this line; and *do not* use the same kind of grips you used on the steel cables. Because the cladded Phillystran line can be distorted if the grips are improperly installed, it's important to start with just a couple of inches in the big grip. Once the line is started and your friend is supplying a little mild tension, you then begin wrapping both parts of the big grip around the line, using both hands to wrap each big grip piece equally around the line as shown in Photo C (the Phillystran is the black cable in the center with the steel grip halves being wrapped around it). The big grip is several feet long, so this process just keeps on as shown in Photos D and E. By the way, when you get to the last couple inches, it really gets to be stiff, so be patient (it's a good thing you can't see my "patient" expression in Photo E). Final touches are to put a plastic cap on the end of the line, cemented with something like

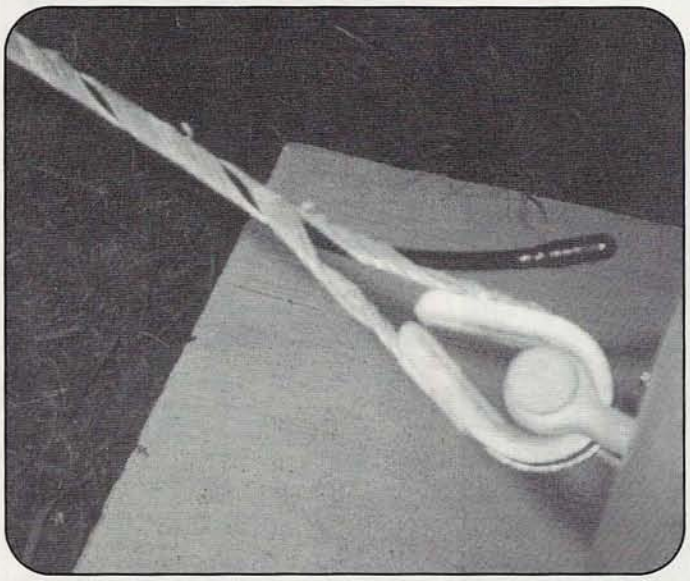


Photo F. Finish off the wrapping job by applying a plastic cap and silicone sealant to the end of the Phillystran cable, shown here sticking out from the bottom end of the "big grip."

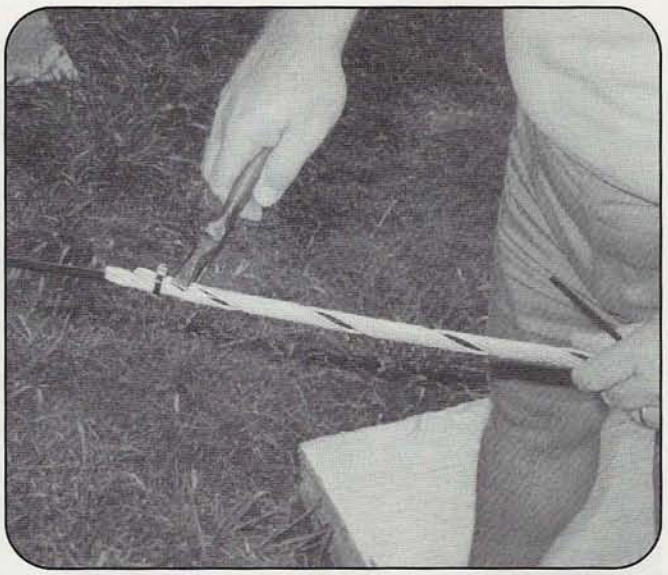


Photo G. A heavy-duty tie-wrap at the top end of the "big grip" will ensure that everything stays in place and that you don't have to repeat the wrapping process (except on the other cables!).

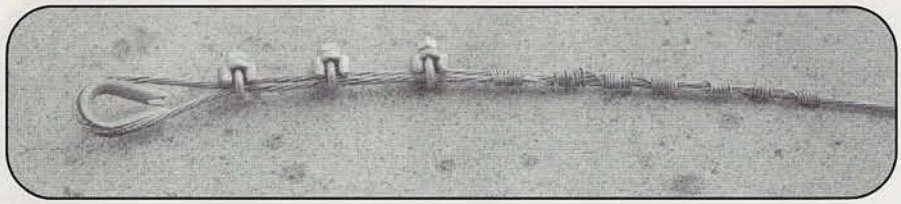


Photo H. Phillystran's manufacturer recommends using a short "tail" of EHS steel cable at the ground end of the guy line. W8CM found several benefits in doing so. See text for details of "serving" the cable (twists at far right) and attaching the cable clamps.

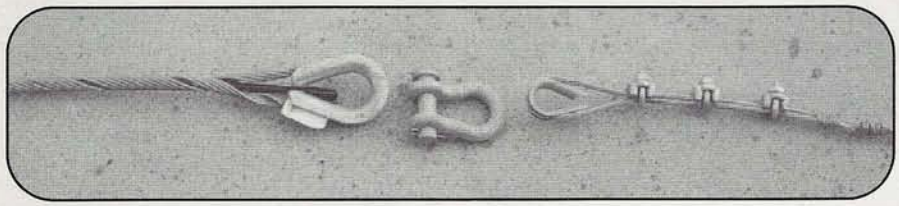


Photo I. The Phillystran cable (left) is connected to the EHS steel "tail" (right) via a 1/2-inch shackle (center).

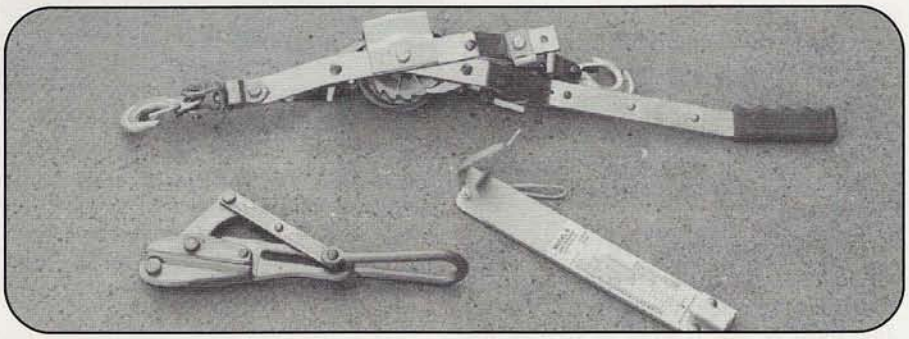


Photo J. Three helpful tools for installing and adjusting your guy lines. At the top is a wire-rope ratcheted tensioner and hook tool called a "come-along." The device at the lower left is a cable clamp that helps you attach the come-along, and on the lower right is a tension gauge to make sure your cables are pulled to the correct tension level. See text for details.

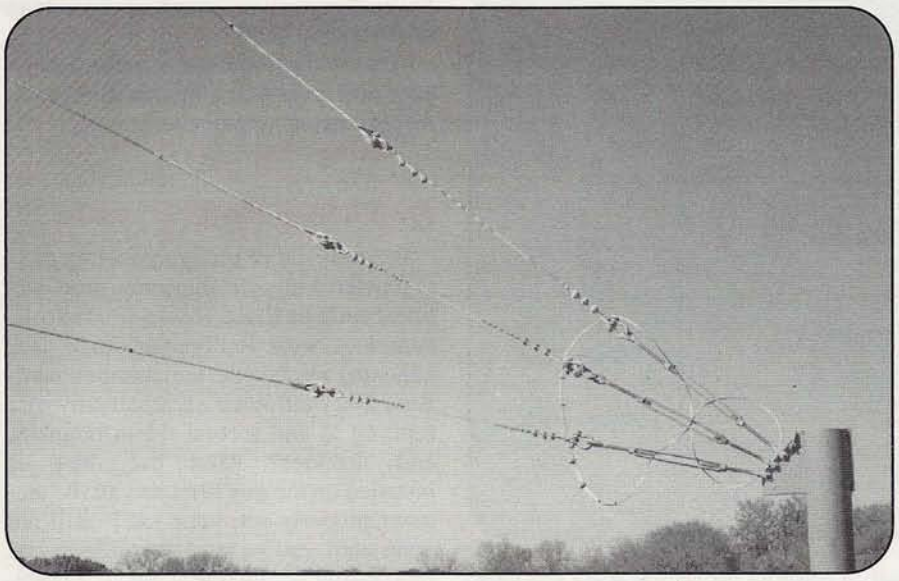


Photo K. Here you can see the connections between the Phillystran cable (far left), the EHS steel "tails" (center), and the turnbuckles that attach to the support post for the guy lines. See text and Photo L to find out about the loop of wire at the far right.

silicone sealant, as shown in Photo F, and to put a black tie-wrap near the end of the big grip as shown in Photo G.

Now for another interesting twist: the Phillystran company recommends that, for ground-mounted guy systems, you use a short steel cable at the bottom end to preclude damage from vandalism and/or grass fires. As a favor to the lawn mowing operation, my system used a massive steel pipe to get the guys above head level, but I also decided to use short steel tails. In addition to the reasons cited by Phillystran, I found two more reasons to use the short steel EHS tails. First, the steel tail gives you something to clamp onto when installing the guy line—the Phillystran is very strong but you really do not want to risk damage to the outer cladding by any mechanical clamping. Second, the available guy line tension gauges are calibrated for steel cables, so having a length of steel cable in series with the Phillystran gives you the ability to accurately measure the tension in the guy line while using a standard gauge.

Photo H shows one end of a steel EHS cable tail. As you can see, doing this properly (and you *DO* always do it by the book, right?) requires installation of three cable clamps along with *serving* each of the seven EHS strands around the cable. "Serving" is the process of taking each of the EHS cable's seven strands and wrapping it around the main cable and the other looped back strands, one by one, so that the first serve takes the first strand around the other six and the main line, then the second serve takes the second strand around the next five, and so on until the final single strand is wrapped around the main line (see the right-hand side of Photo H). Some hams tend to omit serving the seven strands, but this is necessary to comply with prescribed codes.

By the way, don't forget that there is definitely a proper way to install the cable clamps on the wire: make sure to put the "U" of the clamp around the "dead," or wrapped-around, part of the cable (again, see Photo H). Now you have to connect each EHS tail to its corresponding section of Phillystran. Photo I shows the hardware and method of coupling the two lines with a 1/2-inch shackle.

Installation on the Tower

Now that you've gotten the Phillystran guys and EHS tails assembled and are ready to install them on the tower, there are several items that will make the job

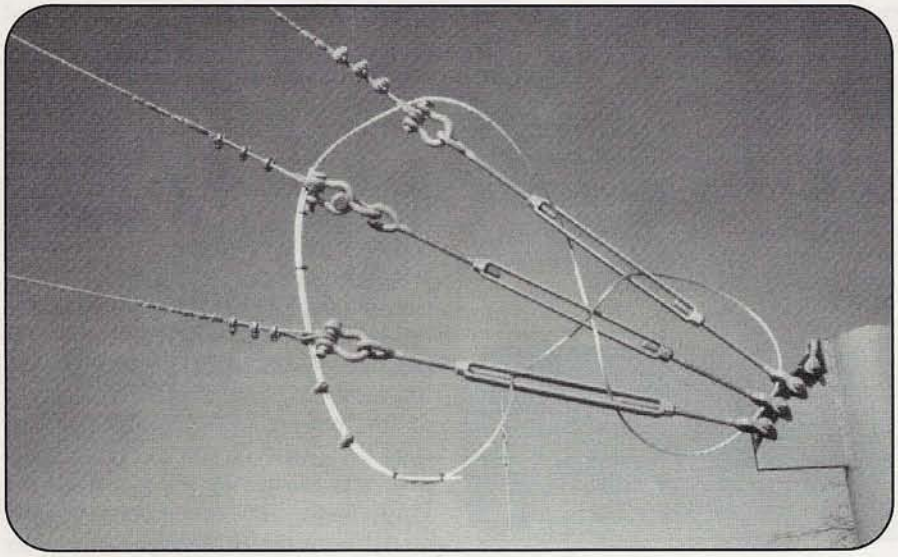


Photo L. Close-up view of the connection point to the support post for the guy lines. The loop of EHS steel cable passes through each of the turnbuckles to keep them from turning accidentally, and to catch a loose cable in the event of turnbuckle failure. See text for details.

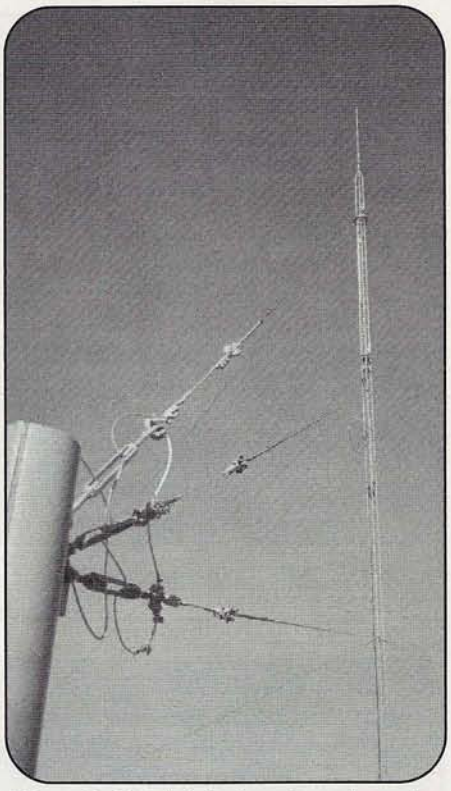


Photo N. The finished product. Assuming you've done everything properly and have met all of your local building codes, the tower should now be safe and secure enough for you to climb on up and start installing your antennas. Have fun!

easier. These are shown in Photo J, and include a common hardware store wire-rope ratcheted tensioner and hook tool called a "come-along" (at top in photo) to take the initial tension on the guy system when you're installing the lines with the turnbuckles (you'll need three, one per guy line). Also shown is a nifty cable clamp (lower left), made by Klein, that grabs the EHS line (*NOT* your Phillystran!) and gives you a way to hook on the come-along (again, three are needed). There's also a simple, inexpensive tension gauge, made by Loos (lower right), which works by simply hooking the gauge over the line, pulling to a calibrated mark, and reading the tension from a table printed on the gauge—this gauge gets my vote for the neatest thing since sliced bread.

It is most definitely NOT just good enough to snug up the guy lines to where you think they "feel about right." The guy line must be set to work at 10% of the line's rating; in the case of my tower with 3/16-inch EHS tails and equivalent Phillystran, which both were rated at 4,000 pounds per the tower manufacturer's specification, that meant setting for about 400 pounds tension. Actually, the Phillystran manufacturer recommends an initial setting at 15% of the line's rating, which lets the line settle in at the desired 10% and gives you a one-time, set-and-forget tensioning procedure.

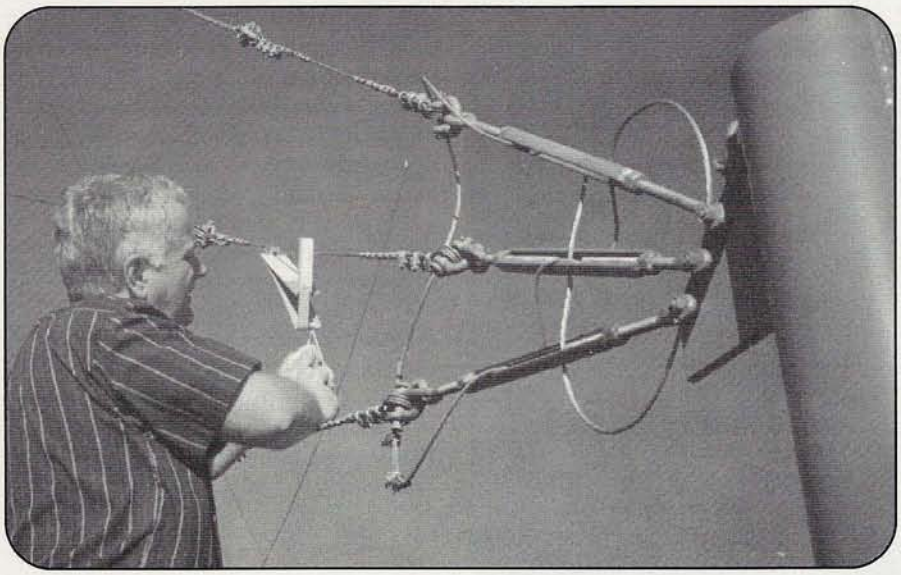


Photo M. The author uses his Loos tension gauge to check on the tension of the guy lines. Tension must be set to 10% of rated line capacity, and Phillystran's manufacturer recommends an initial setting of 15% to allow the cable to settle in at 10% without needing further adjustment.

One More Safety Issue

By now you're probably feeling pretty pleased with your shiny new set of guy lines, such as those shown in Photo K, complete with Phillystran, EHS tail, adjusting turnbuckle, and assorted hardware. But wait! What's that squiggly wire running in and around the turnbuckles and shackles? After everything is installed on the guy lines and all the tensions properly set, your job is still not done until you've paid attention to one final matter of guy line safety. It's possible that a turnbuckle might fail, and it's possible that a turnbuckle might turn and loosen with wind and guy line vibration.

Basics: Towers and Guy Lines

Towers come in many flavors, such as self-supporting, crank-up, tilt-over, and guyed. A guyed tower depends entirely on the guy system to keep the tower up and the antenna load supported. The base on a guyed tower serves only to anchor the bottom, and it carries little load in comparison to the guy lines. The tower top antenna load will be specified by the tower manufacturer in "square feet," which can be compared to the wind load square feet in the antenna manufacturer's specifications. Don't exceed the tower rating, and a little safety margin is advisable as well.

Tower ratings and designs normally focus on local conditions of prevailing wind conditions. Some areas require minimum designs for 70-mph winds, while other areas require minimum designs for higher wind conditions. The tower manufacturer and vendor should be able to provide this standard data. Such data is found in the Electronic Industries Association Standard EIA-222-D, American National Standard A58.1-1982, and the 1994 Uniform Building Code. Of course, there's nothing wrong with designing a tower to higher wind conditions than the minimum. I design everything to nominal 90-mph winds, even though the minimum for the Dallas area is 70 mph—the trade off here is project expense versus peace of mind when those gusts come in.

Guy lines are normally installed in sets of three, spaced 120 degrees apart around the tower, and the rule of thumb is that the top guy should come to ground at a distance from the tower of 80% of the tower height (for example, a 70-foot tower would need a top guy to go out to 56 feet from the base). The exact number of sets of guys on the tower from top to bottom depends on the tower design, tower height, and rated antenna loading at the tower top; this is beyond the scope of this article and is available from the tower manufacturer.

The means of anchoring the guy lines in the ground also varies, from simple screw in devices to substantial concrete forms, depending on the tower and local soil conditions. Consult the tower vendor and local experts. Check with your local homeowner and building codes regarding any tower project, and if possible get local hams can assist you. Putting up a tower is not a trivial project, and doing it correctly requires proper preparation and installation. Once done, though, the tower will provide you with many years of ham radio enjoyment.

The mandatory safety measure here is to safety-wire the entire set of guy lines with a short piece of EHS as shown (see detail in Photo L). The EHS is wound so that the wires enter the turnbuckles from opposite directions, keeping the turnbuckles from turning, as well as providing a safety loop in the event of a turnbuckle failure.

Now the job is almost done. All that remains is to make a final check of the guy line tension, as you see me doing with the nifty Loos gauge in Photo M, and then to look over at the tower you've just guyed (it might look something like Photo N), pat yourself on the back, and then realize that "all" you have to do now is install the antennas on the tower! ■

Resources

Phillystran cable, big grips, thimbles, and end caps; EHS steel cable, turnbuckles, tower items, etc. (using flexible multistranded steel "aircraft" cable instead of EHS is *not* recommended) are available from tower manufacturers and dealers, including: Texas Towers, 1108 Summit Ave., #4, Plano, TX 75074; Phone: (800) 272-3467; Fax: (972) 881-0776; Web: <http://www.texastowers.com>.

Klein clamps, Loos tension gauges, etc. may be purchased from Champion Radio Products, Box 2034, El Macero, CA 95618; Phone: (888) 833-3104; Fax: (530) 758-9062; Web: <http://championradio.com>

Come-alongs, thimbles, shackles, turnbuckles, etc. are available at local hardware stores.

Hamfest Sleepers

One good reason to go to a hamfest is the chance that you'll be among the first to see some great piece of gear that a fellow ham whipped up in his basement and wants to sell to you or me. Gordo takes a look at some outstanding "hamfest sleepers."

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

I try to "do" a hamfest a month, taking great interest in what's new in the ham market. Now you might think that, with all the equipment reviews I do, I wouldn't need to go to a hamfest to see new gear. But that's only partially true. While the big manufacturers usually preview new products in the pages of the ham radio magazines about 30 days before they start appearing on dealers' shelves, a start-up company on a shoestring may see the local hamfest as the most affordable way to introduce its new gizmo. Here are some interesting items I've purchased and tested that make ham radio operating more fun.

Autoshift 706

If you own an ICOM IC-706 HF/VHF transceiver, you know what a terrific rig it is...until you try to program 2-meter frequencies on the fly. Neither the older 706 or the newer 706 Mark II has a tracking VFO when sliding around on the 10-, 6-, or 2-meter FM repeater frequencies (the brand new IC-706-Mark II-*G does* include automatic repeater offset, but if you have an older model—without the 70-centimeter band—keep reading). Dane Westvik, KO6YD, offers a simple kit that installs inside the IC-706 to automatically set the transmit frequency as you tune the receive frequency. The Autoshift is programmed according to the ARRL band plan for repeater offset direction on 10, 6, and 2 meters. Since there are several different band plans for 6 meters (depending on where you are), the Autoshift has a simple jumper that should automatically work your particular band plan.

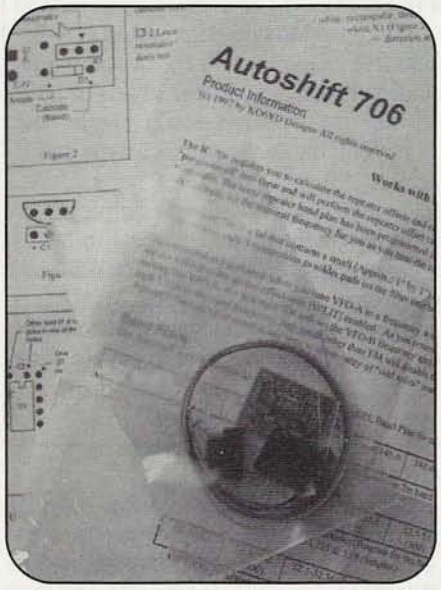


Photo A. KO6YD's Autoshift 706 provides the automatic repeater offset feature that ICOM left out of the IC-706 and 706-Mark II. The kit is simple to build and installs inside the case of the 706.

The Autoshift comes as a kit in a clear plastic bag (see Photo A). But it's an easy kit with only 10 components that can be put together in less than half an hour. Detailed assembly instructions are included, and the board is marked for what goes where. The integrated circuit chip installs in a socket, and the socket is easily soldered onto the board without fear of overheating the chip (as long as you solder in the socket before you plug in the chip!). The plug-in chip also allows future enhancements to be made by simply popping in a new relay.

Once you've assembled the kit, the Autoshift goes inside the IC-706, hooking up to voltage, ground, and the CI-V data connection pad inside the 706. The unit mounts with double-backed foam tape up near the front of the ICOM 706, and you dress the three wires back to your connection point. To operate the Autoshift, you must be on one of the FM bands, either 10, 6, or 2 meters, and select VFO-A. As you turn the VFO knob to any FM frequency, the Autoshift transmit side is in limbo. Once you stop turning the knob for about two seconds, you'll notice a quick flash of the display split indicator in the upper right-hand corner. This indicates the transmitter has now split the appropriate distance for the repeater offset.

If you should land on a simplex frequency, such as 146.520 MHz, the split indicator will still come on, but the split will be 0 kHz. You can confirm this by simply watching the frequency remain the same when you press your microphone push-to-talk button.

After installing the Autoshift, it took me a few minutes to see how the unit actually worked with the ICOM 706. I confirmed that it was splitting the right amount and the right direction by noting the transmit frequency when I pressed the mic button. There are a few 2-meter "splinter" repeaters in my area that don't follow the ARRL band plan, and I had to manually split in the opposite direction of Autoshift. No problem. I then stored

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

Photo B. Named for the popular brand of office binder clips from which it's made (along with a set of brass buttons and a wooden base), the Bull Dog iambic paddle set plugs into virtually any electronic keyer and takes up practically no space on your operating desk.

them in memory, which lets Autoshift "rest." It's during the active VFO tuning that Autoshift really works well on the ICOM 706. (See "Resources" for contact information on this and all other products listed here.)

Paddling a Bull Dog (Not)

If you ever wanted to a set of paddles to hook into your electronic keyer that will look nice but take up virtually no space, I've found a set for you: the world's smallest paddles and they're really a piece of art. The product is called the "Bull Dog" key, and it's put together by Lou Petkus, K9LU, from brass buttons and an office supply clip (Photo B). Everything is mounted on a nice piece of wood with suction cups (Photo C), and a 30-inch pre-wired cable with 3.5-mm plug is included. When I looked at this little thing, I fell in love with it because it's simply so cute! Yet it works like a champ, faithfully giving the dits and dahs with just a slight amount of finger pressure. (*I had the same experience. I saw these paddles at Dayton—forgetting that Gordon had written about them—and knew I simply had to have a set, especially for only $20! Other than food, it was my only Dayton purchase this year.—ed.*)

If you're looking for a neat little gift for a CW buddy, do consider this unique key. K9LU also offers a memory keyer put together by Gary Sutcliffe, W9XT. And if you want to roll your own, you can build this little keyer yourself for under $10, with instructions from K9LU.

Getting It Fixed

Nooooo, not your bulldog, your radio. This is a fact of ham life—sometimes your equipment might suffer a catastrophic wipeout that even the factory says it can't or won't fix. Maybe you had a power-line surge that blew out the DC input side of your equipment. Or maybe you plugged the trickle-charger into the wrong hole of your handheld, blowing the audio amp stages. Mariners with a little bit of water damage to a transceiver all get the same letter that indicates the "big three" will not fix any equipment with salt water damage because the "fix" might not last long. And this is true—salt water inside a radio will sometimes do latent damage up to a year after the initial accident occurred.

But there's a "radio doctor" who'll take a look and give you an honest evaluation on what it might take to get your equipment back in shape. His name is Charles Turner, KC6ARU, and all he does is fix factory-reject repair jobs. He does a good job, and he'll tell you straight out if the fix would cost more than it would to buy something like it used on the marketplace. He's a good guy who's repaired several "basket cases" that I've heard about and has brought several older pieces of equipment back from the dead.

Good Books

One of the things I always like to look at while wandering hamfests is anything in the way of new books about our hobby. Someone is always coming up with something new, and if they're not from the major ham publishers, you might not see them advertised. Here are some of the latest good books that I've read and liked very much:

Amateur Radio Mobile Communications Guide was written and published by Roger Krautkremer, KØYY, a well-known maritime-mobile and RV-mobile operator. Roger does a very nice job of describing what it takes to go mobile with high-frequency and VHF/UHF equipment. There are some good chapters about antenna selection, grounding, automatic tuners, and antenna mounts that won't necessarily punch a hole in your RV or poop deck. It has lots of help-

ful charts, fuzzy photos, and hand-drawn diagrams and is a good book if you have HF as well as VHF operating in your future plans.

Ride the Airwaves With Alpha and Zulu is a book for kids. John Abbott, K6YV, is a full-time teacher, so he knows how to convey ham radio Novice and Technician class theory to young kids. He subliminally teaches the Morse Code, too, by illustrating the characters in his big-format book as vertically segmented dits and dahs. The book is so good that I use it in our adult classes, too.

To go along with the book, John also has a "phoneticode" card and dice game—great for kids and adults. The cards are laminated so they won't wear out, and the dice have permanent dots and dashes on them (so no one will mistake your kids playing an educational game for throwing 21). The fun dit and dah card game can be played by yourself, or by up to eight people. You don't need the big book to go along with it, but if you do get both the book and the card and dice games, you and the kids will certainly learn more about Novice and Technician class questions and basic ham theory, as well as get a good handle on the Morse Code, too. This is the *only* book and game I've ever seen specifically aimed at getting more kids into ham radio.

Ham Radio: Simplified focuses on what to do once you've passed the license exam. Author Kevin Cornwell, N6ABW, talks about how to purchase a ham set, how to set up the antenna, and what to say when you make that first shaky voice call. Numerous sidebars include definitions, facts, and illustrations designed to aid the newbie without hindering the technically proficient. I like the idea of

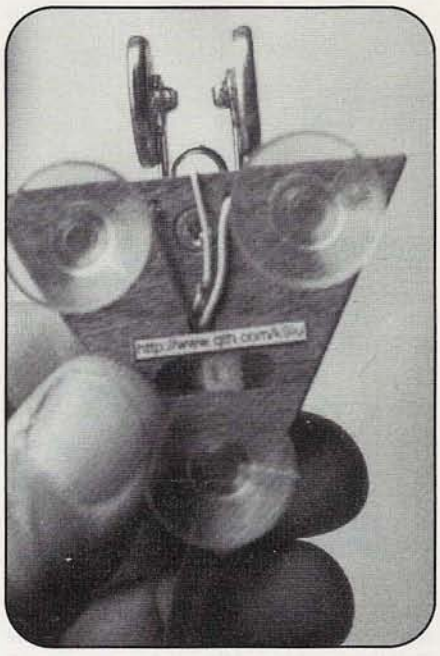


Photo C. The tiny Bull Dog paddle keeps a firm grip on your desk with three small, but effective, suction cups attached to the bottom of the triangular wood base. You really need to see one "in person" to appreciate how cute it is!

space on the side of each page for taking notes. Also, this open area provided space for some of those helpful sidebars. The drawings are professionally done and the photographs relatively sharp.

Keep Your Eyes Open

There's lots of stuff out there. Get to a hamfest and take time to look at some of the neat products that fellow hams put together, just for our ham radio enjoyment. And if you find something totally cool, be sure to let us know about it, too.

Resources

Here's contact information for ordering or learning more about the products listed in this article:

Autoshift 706: Contact Dane Westvik, KO6YD, P.O. Box 1090, Elverta, California 95626; Web: <http://www.jps.net/ko6yd>.

"Bulldog" Keyer Paddles: Contact Lou Petkus, K9LU, at (630) 443-8822, or find him on the Web at <http://www.qth.com/k9lu>.

For more information on repairing rigs the manufacturer says it can't or won't fix, contact Charles Turner at (916) 927-7430.

The books are all available directly from their authors:

Amateur Radio Mobile Communications Guide: Phone direct to order at (303) 695-8715 or e-mail Roger, KØYY, at <rogerk0yy@aol.com>.

Ride the Airwaves With Alpha and Zulu: Contact John Abbott at (805) 222-7384 to order direct or e-mail him at <abtronix@earthlink.net>.

Ham Radio: Simplified: Contact Kevin Cornwell, N6ABW, at (530) 475-0916.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—October, 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'd like to ask about your involvement in emergency and public service communications:*

1. Please indicate whether you have *ever* been a participant in:	**Circle Reader Service #**
Emergency communications	1
Disaster communications	2
Severe weather net	3
Public service event/activity (e.g., bikathon)	4
Emergency/disaster drill	5
Emergency training net	6
Message-handling (traffic) net	7
Other public service communications/activities	8
2. Please indicate whether you *regularly* participate in:	
Emergency communications	9
Disaster communications	10
Severe weather nets	11
Public service events/activities (e.g., bikathon)	12
Emergency/disaster drills	13
Emergency training nets	14
Message-handling (traffic) nets	15
Other public service communications/activities	16
3. Please indicate to which, if any, of the following groups you belong (circle all that apply):	
ARES (Amateur Radio Emergency Service)	17
CAP (Civil Air Patrol)	18
MARS (Military Affiliate Radio Service)	19
Public-service-oriented radio club	20
RACES (Radio Amateur Civil Emergency Service)	21
REACT (Radio Emergency Associated Citizens Teams)	22
SAR (Search and Rescue) Group	23
Skywarn (Severe weather spotter)	24
Other emergency/public service group	25
4. Please indicate whether you feel you'd be prepared to respond and provide needed communications if a major emergency or disaster occurred in your community.	
Yes	26
No	27
Not sure	28
Not interested	29

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

What You've Told Us...

Our July survey asked about your activity on the 222-MHz band, and, if you're not active on the band, why not. A healthy 39% of you said you've operated at least once on 222 (leaving 61% who've never tried it).

Of the readers who *have* used the band, 3% operate there exclusively, 9% are on the band frequently, 19% use 222 regularly, 35% say they're occasional users, 14% operate there rarely, and 20% say they're not currently active on the band. Again among readers who have operated on 222, 82% have used FM on the band, followed by SSB with 29%, CW at 17%, packet at 11%, and AM, with 8%.

Among the readers who have never operated on 222, 75% said it was because they had no equipment for the band, 17% said there's no one else on in their area, 12% had just never thought about it, 6% aren't interested, 2% said "other," and only 1% had other hams talk them out of operating there.

Our Special Focus on "the Forgotten Band" in the July issue got many readers thinking about getting onto 222, with 24% saying they'd like to try it for the first time; 18% would like to become regular users, 27% will encourage other hams to use the band, and 12% want to find out more about the 219- to 220-MHz high-speed digital segment of the band. In addition, 16% answered "all of the above," while 20% said "none of the above" and 8% hadn't read the articles.

This month's winner of a free *CQ VHF* subscription is Hank Koebler of Clarksville, TN. As always, thank you for participating.

The Impossible Dream: Helping Kids Learn and Remember Radio Facts

Getting young people interested in amateur radio is only half the challenge, says KC7GCL. Getting them to learn and remember what they need to know to pass their license exams and become active hams is the other half.

By Neil Dabb, KC7GCL*
(neild@cc.usu.edu)

Editor's Note: This is the second in an occasional series by KC7GCL on getting young people interested and involved in amateur radio.

There's a sign in many workplaces to the effect that "Those of you who think you know it all are very frustrating to those of us who do." This is especially true for teenagers, who *know* that they already know *everything*. On the other hand, as seasoned radio operators, it may seem that radio facts taught to young people (and even not so young people) go in one ear and run out the other, like water through a sieve. In light of this, teaching young people everything they need to know about radio may seem like the impossible dream.

A Matter of Style

Everyone has their own learning style. Some people are visual learners, some are audio learners, and some are kinesthetic (hands-on) learners (Photo A). Generally speaking, pre-teens are still developing learning strategies, and they may not have the ability to organize information in ways that make perfect sense to adults. And teenagers are just beginning to use the learning skills they've developed and probably don't have a great deal of background or experience in the common sense that drives many of the rules and regulations surrounding amateur radio.

Part of the reason amateur radio is such a valuable hobby is that the operators are almost constantly playing with the equipment and trying to figure out better ways of doing things. They're actually doing experiments and pushing the envelope of what can be done. Studies show that many graduating engineers have a hard time solving even simple practical application problems because they haven't learned how to apply the formulas and concepts they learned in class to a real "hands-on" project. This lack of hands-on training takes its toll when these students get into the real world. By getting more young people into ham radio, we're helping curb this trend, as well as giving them an edge as they enter the work force.

Getting young people working on the radio is not only a better way for most young people to learn, but it helps them develop learning skills that they may not be able to obtain anywhere else. They'll remember things they've *done* more readily than things they've seen or heard, and they'll understand how things work, making it easier to answer the questions on the license exam. Kits are a great learning experience for potential operators, new operators, and even some of those seasoned operators, and there are now several companies producing kits for

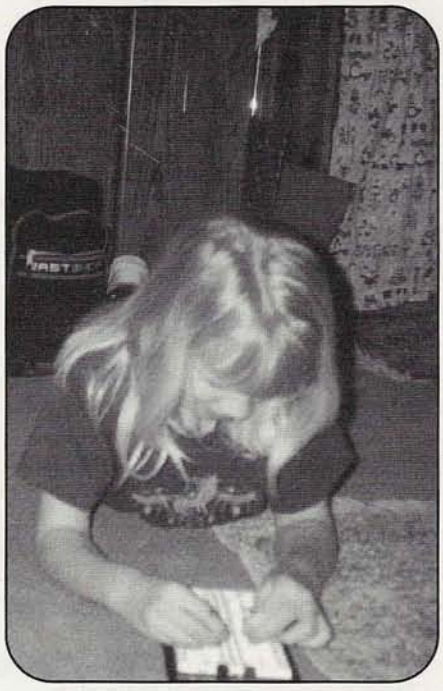


Photo A. Hands-on learning is one of ham radio's greatest benefits. Students who have the chance to work on equipment themselves will learn the concepts much faster than by any other method. And it's never too early to start laying the groundwork. Here, the author's daughter, Corrie, is playing with resistors on a bead board. (Photos by the author)

Neil Dabb, KC7GCL, works with Utah State University's "Junior Engineering State" program, which brings hands-on science and technology programs to elementary and middle school children throughout the intermountain West. He lives in Logan, Utah, with his wife and five children.

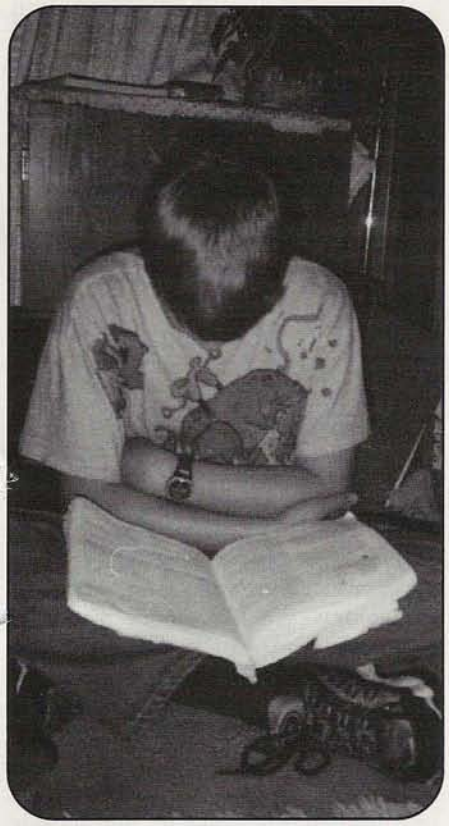


Photo B. Going it alone by just reading the book—as the author's son, Kelly, is trying to do here—can be tough. While independent study lets you set your own pace, there are many benefits to taking a licensing course, as well.

amateur radio[1]. Never underestimate the power of a good homebrew rig, made with the help of an excited young person.

1,000 Questions or 100 Concepts?

The question pool for the technician license consists of about 900 questions—an ominous number to most adults, let alone young people who are still in school and, in many cases, still learning how to learn. So how do you teach young people enough about amateur radio to pass the FCC exams?

As I mentioned in my first article[2], many young people get interested initially through shortwave listening, Citizen's Band radio, or any one of many others activities. In preparing young people to take the test, it helps to know what got them interested in the first place so you can help them figure out how it compares to amateur radio, which will often assist them in answering questions asked on the test. Make sure they understand how what they already know fits in with what they don't.

When my daughter Julie, KC7RPP, was studying to get her license, she tried several times to take the test after getting consistently high marks on the computer program she was using to help her study. Each time, she would miss passing the test by a few questions. Finally, we sat down and I helped her understand the background concepts behind every question that she missed, or even guessed on. The next time she took the test, she passed it easily, and took only a few minutes to do so.

One of the teachers of a class I spoke with pointed out that, while there are over 900 questions in the question pool, there are probably fewer than 100 areas or concepts to which those questions relate. By learning about the *concepts*, the students *understand* the answers to the questions. Besides, it's much easier understand 100 concepts than to try to memorize the answers to 900 questions.

Some of the general areas to be covered could be FCC Part 97 terminology, antennas, operating frequencies, component properties and electronic formulas, operating practices, RF propagation, and RF exposure. It may take just as long for a student to learn proper identification protocols, or what a repeater does (including a side trip into simplex, half duplex, and full duplex operation), as it would to memorize the answers, but, by learning this way, the students will be able to figure out the right answers to the questions regardless of how they're presented.

One last suggestion for young people: make sure they understand the terms used in the FCC Part 97 rules. Many of these terms may be new to young people and may not fall under the common sense rules that many adults take for granted.

Classes Versus Independent Study

The only dumb question is the question that isn't asked. While independent study allows students to move at their own speed, there are some advantages to the classroom setting; either way, there should be a great deal of hands on activity involved. One of the biggest advantages to the classroom is that the more students there are, the more likely it is that one student will ask the questions that the others also have, but are afraid to ask. Also, there may be a great exchange of ideas between students who are learning at similar levels, rather than if they go it alone. Then there's the motivation factor. A group of students working together will keep each other going.

Finding Help

Finding a class to prepare a young person to take the test is simply a matter of finding a club, or a group of potential radio operators with similar religious beliefs, who have shared interests, or who attend the same school. Almost every school or church group has the means to organize clubs and extra-curricular classes to help its members obtain information and learn about a new hobby. Checking with them and helping set up a class should be relatively easy.

The actual act of teaching the class should also be a simple matter. Simple, that is, if you're one of the few people who's not scared to death of speaking in front of others. Once you've found a fearless volunteer who's willing to teach the class, the next step is to make sure there's equipment and material for all the students. Students should each have an opportunity to get their hands on the equipment and to learn how it works. Make sure to help your fearless volunteer in obtaining enough of the proper equipment; this is not a one-person job. Seeing several types of equipment is part of the learning experience.

Some examples of "how it works" demonstrations include showing different kinds of antennas and putting SWR meters on them or, better yet, an antenna analyzer. Make sure the students understand what they're reading with the meter. Also, using a volt-ohm meter (VOM) can give the new students (especially the young ones) a better handle on Ohm's Law and on simple troubleshooting of equipment, such as checking battery and charger voltage. Use your imagination. Any homebrew project you're working on or kit you're building will help students understand the principles of amateur radio as well as keep their interest levels high.

And if there are areas that you, as an instructor, have not yet gotten your hands on, this may be an excellent opportunity for some new experiences for you! (*Learning with your students can also help with the intimidation factor—they'll see that even their expert instructor doesn't know everything about ham radio.—ed.*) Find someone who's built projects or experimented in that area, and

Photo C. Computer programs can be a great way to practice taking the test, both written and code, but the program should help students learn the concepts as well as the answers to the questions. Here, the author's daughter, Hollie, is taking a practice exam on the computer.

have them show you, and the class, how the equipment works.

Code or No-Code?

Young people (pre-teens) learn languages more easily than older people do. There's something developmental that changes with adolescence; after that, languages become more difficult to learn. Since Morse code is essentially another language, why not have younger children learn the code when it will be easier for them? It's a part of the radio culture that will be around for a long time, and it's something that some students will really enjoy.

There are computer programs and audio tapes widely available for learning code, but the best way to learn is going to be real-life practice with others. Again, the hands-on method proves to be the quickest and easiest.

Preparing to Take the Test

There are dozens of books and computer programs that can help students prepare for the FCC exams; however, as we discussed earlier, reading a book (Photo B) or taking a practice exam on a computer (Photo C) will not necessarily guarantee success in taking the test. Again, that 900-plus question pool raises its ugly head. If you're going to use software or books, they should explain the principles behind the question in great detail. Videos have, or should have, the advantage of showing students what's happening and helping them understand concepts rather than just memorizing the answers to questions. Even so, hands-on will always beat lecture (or, as one of my professors called it, "spray and pray").

Before they begin working directly on the question pool, you should be sure that your students have the necessary background information and that they understand *why* the answer they gave is right (or wrong) before proceeding to the next question. The best way to find a good program or book is to sample the materials and pick the ones that *you* like best. As the instructor, you should be comfortable with your teaching tools. See "Resources" for some samples of what is out there; there are dozens of others that can be found with a little bit of effort (and a good Internet search engine).

But the Test Is in Two Days!

Anyone who has survived school has had occasion to cram for a test. This can work temporarily for advanced learners, but not for beginning learners, especially if the goal is retention. It won't do much good if young people can't remember what they learned when they try to get on the air. One of the major goals with any group should be ensuring that there's plenty of time for the students to become familiar with the material.

Also, don't expect every student to pass on the first attempt. Some people tense up when taking tests; others will just go along for the ride and not take studying seriously enough. Many people will focus on the one area they have the most trouble with and then miss the easy questions. Either way, there'll be times when young people won't pass the test. The old adage, "If at first you don't succeed, try, try again," is appropriate when taking the FCC exams.

There are some students who'll keep trying regardless of how many times it takes, and others who will give up after one time. Keeping students trying is almost as hard as getting them to learn the material in the first place. Patience and lots of encouragement are the best tools that you have.

Making It Possible

Ham operators are involved in many projects that are on the leading edge of technology. We have more combined experience than many leading-edge businesses. We've learned by experience how to make things work, especially under less than perfect conditions and with limited budgets.

As ham operators, we'll likely be instrumental in reaching the unreachable stars, and it will be the young hams who'll see it happen. By reaching out—with patience and a few toys—when our arms are too weary, the impossible dream of young people passing the FCC exams will seem a little less impossible. ■

References
1. "The Golden Age of Kit Building Returns," by Sam Vigil, WA6NGH, *CQ VHF*, May 1998
2. "Mission: Impossible: Getting Young People Interested in Ham Radio," by Neil Dabb, KC7GCL, *CQ VHF*, March 1999

Resources

These are just a few examples of the information that's available. Searching the World Wide Web will yield more than enough to get you started.

Online testing is available at: <http://www.biochem.mcw.edu/postdocs/simon/exam.html> and at <http://www.hamtest.com>. (*Note: These are practice exams only.—ed.*)

Ham University software, which covers all license classes, may be downloaded from <http://www.crick.com/hamu/index.html>.

Nutest and other programs may be found by searching for amateur radio at <http://www.download.com>.

Q & A

Questions and Answers About Ham Radio Above 50 MHz

The following question was directed to "Antennas, etc." editor Kent Britain, WA5VJB:

Q: Kent, I just finished reading your article in the August issue of *CQ VHF*. A comment you made near the end of the article really caught my attention: "I had 11 antennas mounted inside my attic at last count." For those of us who, for one reason or another, are restricted to attic installations, perhaps you could do an article on the results obtained with these antennas you have.

I currently have a Cushcraft AR-270 dual-band vertical (2 meters/70 centimeters) with 55 feet of low loss RG-8 cable. While the results on 2 meters are acceptable, 70 centimeters is terrible. I suspect the cable has some loss at those frequencies and I would like to try 9913 Belden. Hardline would be difficult to route through cold air returns, etc. I realize there will be some compromise with indoor use, but would still like to maximize what I have. I would be interested to hear more about your indoor installations as I would like to expand my attic antenna farm as well. Thanks for the good articles. 73,

Paul Stuart, VA3FWS
Via e-mail

WA5VJB replies:

A: In general, moving your antenna from 10 feet to 20 feet picks up about 6 dB of gain on VHF. Raising the antenna from 20 feet to 30 feet picks up another 3 dB. Loss though the roof varies a bit, but with American materials (plywood and composition shingles), it runs between 6 and 10 dB. So a beam antenna inside the attic, 10 feet off the ground, has about 12 to 15 dB less signal than the same antenna outside at 20 feet.

Most of the UHFers in this area have thrown away all their 9913. The problem was water collecting inside the coax—a problem, of course, you won't have with an indoor installation.

The loss-per-100-feet table in the ARRL Antenna Book shows that regular RG-8 has approximately 3-dB loss at 146 MHz and 5-dB loss at 440 MHz; RG-8 with a foam dielectric has about a 2.2-dB loss and a 3.75-dB loss, respectively; while Belden 9913 has roughly 1.75-dB loss on 2 meters and 3-dB loss at 440 MHz. Your losses will be only about half that since your feedline is just over 50 feet long, but you can see that the differences are substantial between 146 and 440 MHz, especially with standard RG-8.—W2VU

Q: I was just wondering if anyone has been able to successfully convert older cellphones to 900 MHz, either for simplex or duplex use. I have several Emi type, which I would like to put to use. Your reply would be greatly appreciated. Thank you.

Arnd Beckmann, VE7IDK
Mission, British Columbia

A: CQ VHF *microwave columnist Kent Britain, WA5VJB, has written his three most recent columns (May, July, and September) on the topic of converting 900-MHz cellphone equipment to ham use. Generally, he's found that the cellphones themselves are not worth trying to convert, but that surplus equipment from cell sites offers a gold mine of opportunity for amateur use. I'd strongly recommend that you check out Kent's "Final Frontier" column in those three issues. All three issues are available from our office (e-mail <backissues@cq-vhf.com> for prices to Canada).*

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."

"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.

Hamfest Calendar

The following hamfests are scheduled for October, 1999:

Oct. 1–2, NWAARC HAMFEST '99, Jones Center for Families, **Springdale, AR**. Talk-in: 146.70- or 146.76-. For information, contact Northwest Arkansas Amateur Radio Club, P.O. Box 24, Farmington, AR 72730 or Clarence Morrow, KC5UEW, Chairman: (501) 631-9231, P.O. Box 264, Rogers, AR 72757-0264. **(Exams)**

Oct. 2, Ham Expo '99 Fall Fest, Bell County Expo Center, **Belton, TX**. Talk-in: 146.820- (PL 123.0). For information, contact Mike, WA5EQQ, at (254) 773-3590; E-mail: <hamexpo@tarc.org>; Web: <www.tarc.org>.

Oct. 2, Garden State Hamfest '99, Croydon Hall, **Leonardo, NJ**. Talk-in: 145.485 -6. For information, contact Hamfest, GSARA, c/o Mario Sellitti, P.O. Box 286, Keansburg, NJ 07734, or <http://www.monmouth.com/~gsara>. **(Exams)**

Oct. 2, Computer, Amateur Radio & Electronics Show, Silver Moon Antique and Flea Market Show Arena, **Hummels Wharf, PA**. Talk-in: 147.270 Repeater & 146.520 Simplex. For information, contact SVARC, P.O. Box 73, Hummels Wharf, PA 17831 (send SASE); George Machesic at <gpmac@netscape.net>; answering machine; (570) 286-2086; Web site: <http://loveland.dynip.com/svarc>; Dave Weker at <k3si@hotmail.com>. **(Handicap Accessible)**

Oct. 2, Hamfest, Knights Stadium, **Ft. Mill SC**. For information, contact YCARS Hamfest, 2129 Squire Rd., Rick Hill, SC 29730, or call Haney Howell, K2XN, at (803) 323-4534, or <www.ycars.org>.

Oct. 2, RAGS 1999 43rd Hamfest, Pompey Fire Department, **Syracuse, NY**. Talk-in: 147.90/30 MHz. For information, contact Vivian Douglas, WA2PUU, at (315) 469-0590, or visit <www.pagesz.net/~rags>. **(Exams)**

Oct. 3, Annual HAMARAMA, Middletown Grange Fairgrounds, Penns Park Rd., **Wrightstown, PA**. Talk-in: 146.52 simplex. For information, contact Mark Schreiner, NK8Q, at 662 Cafferty Rd., Ottsville, PA 18952; E-mail: <nk8q@amsat.org>; Phone: (215) 847-2285; or Bob Minch, N3XEM; E-mail: <raminch@bellatlantic.net>; Phone: (215) 822-0779.

Oct. 3, 1999 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 (eves. only); E-mail: <WB2KDG@Bigfoot.com>.

Oct. 9, Hamfest, President's Hall, Kitsap County Fairgrounds, NW corner of Fairgrounds Rd., **Bremerton, Washington**. Talk-in: 146.62(-) offset-PL Tone 103.5- WWRA repeater or 146.52 simplex. For information, contact Marcie Stilwell, KC7DAT, P.O. Box 2268, Silverdale, WA 98383-2268; Phone: (360) 697-2797; E-mail: <nkarc@yahoo.com>.

Oct. 10, 29th Annual HamFair & Computer Show, Ingham County Fairgrounds' Community Center (last year at this location), **Mason, MI**. Talk-in: 145.390 -600. For information, contact Don Tillitson, WB8NUS, (517) 321-2004, or LCDRA, P.O. Box 80106, Lansing, MI 48908. **(Handicap Accessible)**

Oct. 10, Maysville Hamfest, Community Center, **Maysville, NC**. For information, contact Jo Ann Taylor, WD4JYR, (252) 393-2120. **(No Exams This Year)**

Oct. 10, 7th Annual Nutmeg Hamfest & Computer Show, Mountainside Special Event Facility (Indoor Exhibit Hall), **Wallingford, CT**. Talk-in: 147.36/96. For information, contact Gordon Barker, K1BIY, at 9 Edge Wood Rd., Portland, CT 06480; Web: <www.wsl.net/nutmeghamfest>; E-mail: <nutmeghamfest@wsl.net>.

Oct. 10, Lima Hamfest & Computer Show, Allen County Fairgrounds, **Lima, OH**. Talk-in: 146.07/67. For information, e-mail: <Gas1950@AOL.com>; Web: <www.Anglefire.com>.

Oct. 16, Swapmeet & Hamfest, Sabbar Shrine Temple, **Tucson, AR**. Talk-in: 146.88 repeater. For information, contact Glen Henderson, WA7OBG, at (520) 749-5478; E-mail: <linus@primenet.com>. **(Exams, Handicap Accessible)**

Oct. 16, 14th Annual Tri-Cities Hamfest, Appalachian Fair Grounds, **Gray, TN**. For information, mail inquires to P.O. Box 3682, CRS Johnson City, TN 37602.

Oct. 16, Mid-West Amateur Radio & Computer Expo, Lewis & Clark Community College (River Bend Arena), **Godfrey, IL**. For information, write to Lewis & Clark Radio Club, P.O. Box 553, Godfrey, IL 62035; E-mail: <N9WHH@ezl.com>; Web: <http://www.EZL.COM/~LMILLER/LCRC.HTML>. **(Exams, Handicap Accessible)**

Oct. 17, North Central Ohio Hamfest & Computer Show, Ashland County Fairgrounds, **Ashland, OH**. Talk-in: 147.105 PL 71.9. For information, contact David Fike, N8UCA, 979 TWP Rd., 1654 RFD 6, Ashland, OH 44805, or call (419) 289-1085.

Oct. 17, Tailgate Electronics, Computer & Amateur Radio Fleamarket, Albany & Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl2A - W1XM/R. For information,

Operating Notes

For late September and October, 1999:

September	
25–26	SVHFS Fall Sprint—50 MHz (see Rules, this issue)
26	Good EME conditions
27	SVHFS Fall Sprint—144 MHz (see Rules, this issue)
30	Alpha Aurigids meteor shower peak
October	
2–3	IARU Region 1 (Europe/Africa) UHF Contest
5	SVHFS Fall Sprint—222 MHz (see Rules, this issue)
13	SVHFS Fall Sprint—432 MHz (see Rules, this issue)
18	SVHFS Fall Sprints—902 MHz -5.7 GHz (see Rules, this issue)
21	Orionids meteor shower peak
24	Good EME conditions
30–31	ARRL International EME Competition, 1st wknd (see Rules, this issue)
31	Very good EME conditions

EME data courtesy W5LUU. More contest info is available on the CQ VHF *Web page at <http://www.cq-vhf.com/navhfcon.htm>.*

contact W1GSL, P.O. Box 397082 MIT BR., Cambridge, MA 02139-7082. **(Handicapped Accessible)**

Oct. 17, Annual Kalamazoo Hamfest, Kalamazoo County Fairgrounds, **Kalamazoo, MI**. For information, contact <ka8blo @net-link.net>, or visit <www.qsl.net/ka8blo/hamfest.html>.

Oct. 23, 5th Annual Swap-Toberfest, Amateur Radio Emergency Services Convention, Polk County Fairgrounds, **Rickreall, OR**. Talk-in: 146.86 repeater. For information, contact Bob Boswell, W7LOU, at (503) 623-2513, or e-mail: <w7lou@goldcom.com>, or download a copy of flyer and pre-registration form from: <http://www.teleport.com/~n7ifj/swaptobe.htm>. **(Handicap Accessible)**

Oct. 23, Chattanooga Hamfest, Camp Jordan Arena, **East Ridge, TN**. Talk-in: <146.79(-)/444.1(+). For information, contact David Hoffman, KE4FGW; Phone: (423) 877-7398; Web: <http://www.qsl.net/w4am/carc_index.html>.

Oct. 24, 10th Annual Mason-Dixon Computer & Hamfest, Carroll County Agricultural Center, **Westminister, MD**. For more information, visit <http://www.qis.net/~k3pzn>, or phone/fax (410) 795-2556. **(Exams)**

Oct. 29–30, Amateur Radio & Computer Show, Morocco Shrine Auditorium (new location), between Jacksonville and the Beach, **Jacksonville, FL**. For information, write Greater Jacksonville Hamfest, P.O. Box 9673, Jacksonville, FL 32208, or visit: <http://www.ccse.net/~1rich/hamfest98.htm>. **(Exams)**

Oct 31, Halloween Hamfest, St. Louis, MO. Talk-in: 146.91. For information, contact Steve Welton, WBØIUN, 9847 Arv-Ellen, Affton, MO 63123; Phone: (314) 638-4959. **(Exams)**

VHF Conferences

Sept. 24–26 ARRL/TAPR Digital Communications Conference, Phoenix, Arizona. See complete announcement in the August issue, page 69. For more information, contact Tucson Amateur Packet Radio, 8987-309 E. Tanque Verde Road #337, Tucson, AZ 85749-9399; Phone: (940) 383-0000; Fax: (940) 566-2544; E-mail: <tapr@tapr.org>; Web: <http://www.tapr.org/dcc>.

Sept. 25–26, Western States Weak Signal Society, Ventura County, California. The WSWSS will hold its annual meeting and conference at the Ventura County, California, "antenna ranch" of Ron Hammel, K6WLC. The meeting will begin at 3 p.m. on Saturday, 9/25, after the conclusion of the TRW Swapmeet, and will feature speakers (including Cliff Brunck, K8BUW, on laser communications) along with a pot-luck barbeque Saturday night, a ranch-style breakfast on Sunday morning, and an antenna range, also on Sunday morning. Camping and RV sites are available on the ranch. For information, call Ron at (661) 942-1312 (weekdays, 8–5) or (661) 245-1009 (weekends); or check the Western States Weak Signal Society Web site at <http://www.wswss.org>.

Oct. 1–3, 23rd Mid-Atlantic States VHF Conference, Hampton Inn, **Willow Grove, Pennsylvania**. Sponsored by the Mt. Airy VHF Radio Club (the Packrats), followed by Hamarama '99 on Sunday at Middletown Grange Fairgrounds, Wrightstown, Pennsylvania. For information, contact John Sorter, KB3XG, 1214 N. Trooper Rd., Norristown, PA 19403; E-mail: <johnkb3xg@aol.com>; Phone: (610) 584-2489; see PackRat Web site at <http://www.ij.net/packrats> for location maps and additional information; or e-mail John Sortor, KB3XG, at <johnKB3XG@aol.com>.

Oct. 8–10, AMSAT-NA Annual Meeting and Space Symposium, San Diego, California. For details, see the AMSAT Web site at <http://www.amsat.org>, or contact AMSAT, P.O. Box 27, Washington, DC 20044; Phone: (310) 589-6062; Fax: (301) 608-3410.

Rules

SVHFS Fall Sprints

The Southeastern VHF Society is sponsoring a series of Fall Sprint competitions. Sprints are short-duration contests, generally limited to one band per event. Here are the rules:

VHF/UHF World Wide Fall Sprint Rules

1. Object: To work as many amateur stations in as many 2-degrees by 1-degree grid squares as possible, using authorized amateur frequencies on the 50, 144, 222, 432, 902, 1296, 2304, 3456, and 5760 MHz bands.

2. Contest Period:

2.1. The 144 MHz Sprint: 7 p.m. until 11 p.m. local time on the fourth Monday of September (September 27, 1999).

2.2. The 222 MHz Sprint: 7 p.m. until 11 p.m. local time on the first Tuesday of October (October 5, 1999).

2.3. The 432 MHz Sprint: 7 p.m. until 11 p.m. local time on the second Wed-nesday of October (October 13, 1999).

2.4. The 902 MHz, 1296, 2304, 3456, and 5760 MHz Sprints: 7 p.m. until 11 p.m. local time on the third Monday of October (October 18, 1999). These five Sprints run concurrently, but are scored separately.

2.5. The 50 MHz Sprint: 2300 Z Saturday until 0300 Z Sunday the fourth full weekend of September.

3. Exchange: Grid-square locator—signal report is optional. Rovers will sign with call plus Rover suffix. For CW, a /R will follow the call letters.

4. Scoring:

4.1. QSO Points: Count one point for each complete QSO.

4.2. Multiplier: The total number of different grid squares worked. Each 2 degrees by 1 degree grid square counts as one multiplier.

4.3. Final score: Multiply QSO points by multipliers. Each Sprint is scored separately.

5. Rover Category Scoring: Score shall be the total number of QSO's for contest period, times the total number of unique grid squares worked from each grid square. Once moved to a new grid square, you may re-work all previously unique grid squares for new multipliers.

6. Reporting: Logs must be submitted no later than 30 days after the event.

7. Certificates for top three finishers (non-rover) in each Sprint.

8. Certificates for top three Rovers in each Sprint.

9. Certificates for top three finishers (no-rover), and top Rover finisher, in each continental US call area, where level of competition warrants.

Addresses for log submissions are different for each Sprint. For more information, see the Southeastern VHF Society's Web page at <http://www.s vhfs.org>.

ARRL International EME Competition

October 30–31, November 27–28, 1999

It's the ultimate DX contest—with the signals for every contact making round trips to the Moon!

If you operate moonbounce, this is the year's big event, two weekends with perhaps more EME (Earth-Moon-Earth) activity than at any other time of the year. Even if you don't operate moonbounce, but can point your VHF or UHF antenna at the moon (at moonrise or moonset if you don't have elevation control), listen for CW signals at the very bottom of the bands, or even the occasional SSB signal at the bottom of the phone segments. You might be amazed at what you hear—all the way from the moon!

Here are the official rules for the 1999 ARRL International EME Competition, courtesy of the ARRL Contest Branch:

1. Object: Two-way communications via the earth-moon-earth path on any authorized amateur frequency above 50 MHz.

2. Date and Contest Period: Two full weekends, full 48-hour period UTC each weekend (Oct. 30–31 and Nov. 27–28, 1999).

3. Entry Categories:

3.1. Single Operator: One person performs all operating and logging functions, equipment adjustment and antenna alignment.

3.1.1. Multiband.

3.1.2. Single Band: Single-band entries on 50, 144, 222, 432, 902 and 1296-and-up categories will be recognized in awards offered. Contacts may be made on any and all bands without jeopardizing single-band entry status. Such additional contacts are encouraged and should be reported. Also see Rule 8, Awards.

3.2. Multioperator: Two or more persons participate; includes neighboring amateurs within one call area, but with EME facilities for different bands on different team members' premises, as long as no two are more than 50 km (30 miles) apart. Multioperator neighborhood groups cannot use the same callsigns at each location; all calls will be listed in the results.

3.3. Commercial equipment: Stations using equipment that is not amateur (such as a dish antenna for lab equipment owned by an institution or government agency) will have their scores listed separately.

4. Exchange: For a valid contact to occur, each station must send and receive both callsigns and a signal report in any mutually understood format, plus a complete acknowledgment of the calls and report. Partial or incomplete QSOs should be indicated on your log, but not counted for contest credit. Stations may be worked once per band for credit.

5. Scoring:

5.1. QSO Points: Count 100 points for each complete EME contact.

5.2. Multiplier: Each US and Canadian call area, plus each DXCC country (not US/Canada) worked via EME on each band.

5.3. Final Score: Multiply QSO points by sum of multipliers worked on each band for your final score.

6. Miscellaneous:

6.1. Fixed or portable operation is permitted. Stations operating outside traditional call areas must indicate so, identifying the call area of the operating site.

6.2. Contacts may be on CW or SSB. Only one signal per band is permitted.

6.3. A transmitter, receiver or antenna used to contact one or more stations under one callsign may not be used subsequently under any other callsign during the contest, except for family stations where more than one call has been issued, and then only if the second callsign is used by a different operator.

6.4. There is no specified minimum

EME Participation Pins

Would you like to be sure that you will receive an award when you send your International EME Competition log to HQ? Here's an award you can earn, whether you're a first-timer or a weathered veteran of the sport.

The ARRL is offering a handsome EME participation pin to qualified participants in the ARRL International EME Competition. Anyone who makes at least one contact during the 1999 ARRL International EME Competition will qualify for an EME participation pin. Also, all the individual operators of a multioperator station are eligible for their own pins. The handsome pin is marked with the year, making it a possible collector's item. Don't miss the chance to be among the first to have them! Wear them proudly in support of the International EME Competition.

To order, include with your log entry: (1) a mailing label (preferably self-adhesive label). (2) A check or money order for $5 for each pin, payable to the ARRL (includes the price of the pin, packaging, padded envelope, and postage). Your pin will be shipped after your contacts have been verified and the results printed in *QST*.

terrestrial distance for contacts, but all communications must be copied over the moonbounce path, regardless of how strong (or weak) a nearby station's terrestrial signal may be.

7. Reporting: Entries must be postmarked no later than 30 days after the contest and must include complete log data. Your summary sheet should show a band-by-band breakdown of QSOs and multipliers, and include details of your station setup and a photo.

8. Awards:

8.1. Certificates will be issued to the top five stations worldwide in each of the entry categories: single operator, multiband; single operator, single band (separate awards for each band); and multioperator.

8.2. Additional awards will be issued where significant achievement or competition is evident. In addition, each station that successfully completes at least one EME contact during the contest period will receive a certificate commemorating that achievement.

8.3. Participation Pins

8.3.1. Available, while supply lasts, to all who make at least 1 contact during the contest.

8.3.2. This includes all operators of qualifying multioperator efforts.

8.3.3. Send order to: ARRL Contest Branch, 225 Main St, Newington, CT 06111.

8.3.3.1.Price is $5 for each pin.

8.3.3.2.Make check or money order payable to the ARRL (no cash please).

8.3.3.3.Include a return mailing label (preferably a self-adhesive type).

9. Other: See rules for All ARRL Contests.

How to Get Entry Forms

Official entry forms and complete rules for ARRL contests are available electronically from several sources:

1) From the ARRL Internet Infoserver. Send an e-mail message to <info@arrl.org>. The subject line is ignored. Enter the following text in the body of your message:

HELP
SEND EME.FRM
QUIT

2) From the ARRL's World Wide Web home page, at <http://www.arrl.org/contests/forms>.

Reader FEEDBACK!

Full-Wave Loop Questions

Dear *CQ VHF*:

I read with interest, and some confusion, the review of the KB6KQ full-wave loop for 2 meters (June, 1999, *CQ VHF*), as I have done considerable modeling of full-wave loops at HF. Full-wave loops, whether round or square, have an azimuth pattern very much like that of a dipole—with two very deep nulls on the side—hardly an omnidirectional pattern.

At HF, when the loop is mounted close to the ground (from a wavelength standpoint), the nulls fill in slightly, but still remain quite deep. This same condition would not be very practical at VHF where the antenna would be less than a quarter wave above ground (20 inches for 2 meters). The other drawback to loops so close to ground is that the takeoff angle rises dramatically, radically reducing the useful horizon gain of the antenna.

Finally, the full-wave loop has gain around 2 dB less than a dipole. The advantage of a simple half-wave dipole over a full-wave loop is quite apparent.

Ray Johnston

We forwarded Ray's letter to antenna designer/manufacturer Norm Pedersen, KB6KQ. Here is his response:

I have read Ray Johnston's note with regard to the full-wave loop for 2 meters. The full-wave model was developed in an attempt to offer an antenna to support amateurs with CC&Rs (restrictive covenants that limit antennas) and operators with high-profile vehicles. Approximately 25% of our customers have very restrictive antenna regulations and cannot install outdoor antennas of any sort.

After reviewing many antenna designs, I gave consideration to the full-wave concept based upon an HF design that has been around for many years. This design is referred to as the "Loop Skywire" and is documented in many issues of the *ARRL Handbook*, including the 1991 issue, page 33-6.

Comments about the need to keep the antenna close to ground, based upon my tests, are correct. In that the antenna would be mounted in an attic (CC&R) or very close to the roof (high-profile vehicle), these conditions would be met. In conducting on-the-air tests with other operators, I found the full-wave to outperform a single half-wave, but to come in under the stacked pair model.

In the review by Gordon West, WB6NOA, it is my understanding that the antenna was tested on a high profile vehicle, meeting one of the two criteria. It is also apparent that Gordon came up with the same approximate performance findings. It is my feeling that antenna computer programs are one of many valuable tools available to us, but are not a substitute for practical experimentation and on the air evaluation. I thank *CQ VHF* and its staff for taking the time to do this "seat of the pants" evaluation. 73,

Norm Pedersen, KB6KQ

The California-Hawaii Duct (and More...)

This incredible 2,500-mile VHF-plus path opened up just in time for the 1999 CQ World Wide VHF Contest and produced some record-breaking QSOs. Senior Contributing Editor Gordon West, WB6NOA, has our report.

Extraordinary tropospheric ducting conditions prevailed on the U.S. west coast during the 1999 CQ World Wide VHF Contest this past July. On Thursday night, July 8, two days before the contest began, Paul Lieb, KH6HME (Photo A), in grid square BK29, began to receive FM music stations from the West Coast on his car radio, way out in Hilo, Hawaii. A quick check of the weather map showed a Pacific high falling into place for some extraordinary tropo-ducting possibilities.

Paul's hunch did not let him down—beginning that night, he spent an epic four days on the side of the 8,200-foot Mauna Loa volcano, making what would develop into some record-breaking contacts. Paul made some 350 QSOs overall during the opening, on 2 meters, 1.25 meters (222 MHz), 70 centimeters (432 MHz), and 23 centimeters (1296 MHz), using single sideband (SSB), FM, and even ATV (amateur television).

All the Way to 1296

"I worked Jack, N6XQ, on 1296.300 sideband and communications were crystal clear," said Lieb. "I also worked 1296.300 to KO6RS in Santa Cruz."

On Friday evening, signals were so strong on sideband that Paul switched over to FM simplex. One of his contacts was with Ken, KO6XL, in Big Sur, California. Ken first heard Paul's CQ on a scanner and, not believing his ears, went outside to his mobile to confirm what he was hearing actually was coming in from 2,500 miles away. It was. Later on, Ben Hathaway, N6FM, in Santa Cruz, easily worked Paul on 2-meter FM.

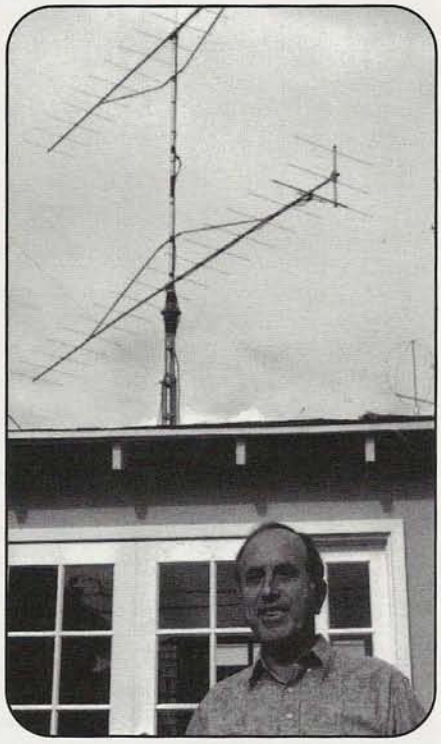


Photo A. Paul Lieb, KH6HME, holds the DX record for 2 meters, for QSOs between his Mauna Loa, Hawaii, station and hams back on the west coast of the mainland U.S. (WB6NOA Photo)

"There were times that Paul's signal on FM was giving me almost full signal strength," commented Hathaway, quite surprised that FM would propagate over the 2,500-mile path almost as well as SSB and CW. "And he was consistently coming in on our WA6HHQ remote, and, for three or four days, his signal held up fine." (*The signals were so strong that WB6NOA called me up and played a tape of KH6HME into my answering machine. "Armchair" copy!—ed.*)

On the Beach

On Saturday, the first day of the *CQ* VHF contest, Paul and I made a record contact at 2:30 in the afternoon. I drove down to the beach with a portable, 1-watt ICOM IC-202 2-meter SSB transceiver, and we made contact after about two hours of calling back and forth. Most amazing was that I wasn't using a beam, just the IC-202's built-in telescopic whip while standing ankle-deep in the surf. We also completed a contact using the IC-202 and a KB6KQ loop antenna (Photo B). And, not to be outdone, my wife, Suzy, N6GLF, made sure there'd be a QSL card from Paul with her callsign on it, too (Photo C)!

Earlier in the day, we could easily see the KH6HME 434-MHz ATV beacon. For about 10 seconds, the fluctuating picture all of a sudden peaked at a P5 (a "full-quieting" ATV signal), and this was one of the best pictures I've ever seen coming in from Hawaii on fast-scan television (Photo D).

These long-range tropo contacts were so strong that some West Coast hams were accessing Hawaiian repeaters, and many Hawaiians were heard on Los Angeles repeaters. Talk about excitement! And all of this on the VHF bands

By Gordon West, WB6NOA, Sr. Contributing Editor (wb6noa@cq-vhf.com)

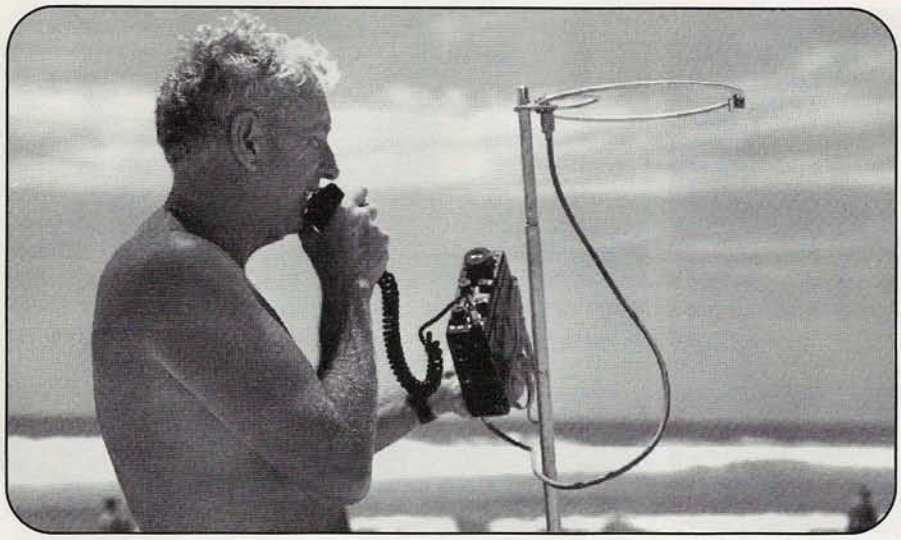


Photo B. Now, here's the way to work DX! Gordo is standing on a California beach, using a battery-powered 2-meter SSB rig and a KB6KQ loop antenna...and working Hawaii! (N6GLF Photo)

where there's no telling what DX will be rolling in.

And just when everyone thought the California-Hawaii tropo duct was fizzling out, three hams-in-a-van with a pneumatic mast drove up to the 1,200-foot level of Coco Head on the island of Oahu. Rod, KH7L, Rick, KH7O, and Arnold, NH6OF, gave out numerous contest points from this rare grid of BL11, putting out a signal on 2 meters that was often above S9 in California. They stayed on the side of the hill for over six hours and really had the experience of a lifetime. Yes indeed, the excitement between California and Hawaii during the *CQ* VHF contest was at an all-time high!

Oh, I almost forgot to mention that I also worked Alaska from southern California on 6 meters, via sporadic-*E* (*Es*).

First 6-Meter Galapagos to Panama QSO?

Well-known VHFer Jon Jones, NØJK, says he and HP3XUG completed what may have been the first-ever HC8 (the Galapagos Islands) to HP (Panama) QSO on 6 meters, on June 1. Here's Jon's report:

I was invited to operate with the HC8N group in the CQ WPX CW contest last May. I brought along a JHV seven-element 6-meter Yagi and 6-meter equipment. The JHV Yagi was put up at the HC8N station and will be left for others to use. An ICOM 551D is set up inside the shack. During my stay, from May 28 to June 1, 1999, no 6-meter *Es* or F_2 openings were observed. It was disappointing to bring all of the 6-meter gear along and have no propagation. But all was not lost.

I worked Louis, HP3XUG, in Panama, on 12 meters on May 31, and we set up a 6-meter scatter sked for the next day. We completed a 6-meter QSO via meteor scatter on June 1, 1999, at 1323 UTC. This may be the first Panama to Galapagos 6-meter QSO ever made! Louis, HP3XUG, says it is *his* first.

There have been prior 6-meter operations from HC8, but the path from the Galapagos to Panama is too short for direct F_2. It might be possible on F_2 backscatter or *Es*, but I am not aware of any documented HP-HC8 contacts via those modes.

Jon included several photos with his report. Photo E, taken by HC8GR, shows Jon at the HC8N operating position soon after making his 6-meter contact with HP3XUG. Photo F shows Jon's QSL card from Louis for the HC8-HP QSOs they made.

OH1ZAA's "Arctic Tour"

Jan Hubach, OH1ZAA, better known as "Zaba," took a summer "tour" above the Arctic Circle and brought along his 6-meter ham gear. He traveled by train to northern Finland, then drove through rare Arctic grid squares in both Finland and Norway. Here's his report:

The OH1ZAA "Arctic tour" has been completed. The number of squares visited amounts to 35, of which 20 were actual Arctic squares (above 66 degrees N latitude). These were KP17, 27, 28, 18, 08, 09, JP99, KP19, KQ10, 20, 30, 40, KP39, KQ50, KP59, 49, 39, 38, 37, 36, 46, 45, 55, KP44, 54, 43, 53, 52, 51, 42, 41, 40, KP31, 30, 20.

We repeated the MS (meteor scatter) experiment from last year with OH1XT (KP01), while driving through KP08rr; I copied a number of bursts at the "traditional RR"-site, where he's been copied before. On Saturday evening July 3, two stations were heard while dining in KQ10qa (near Alta, Norway): LA8WF and LA1AL from JP41ua, heard working SP (Polish) stations at 2020 UTC.

During the early part of the week, only 28-MHz beacons were copied at times, until JW7SIX showed up while stationed in KP45uo, on July 7. At 2047 UTC, I managed to work my first contacts: SP9NWT and

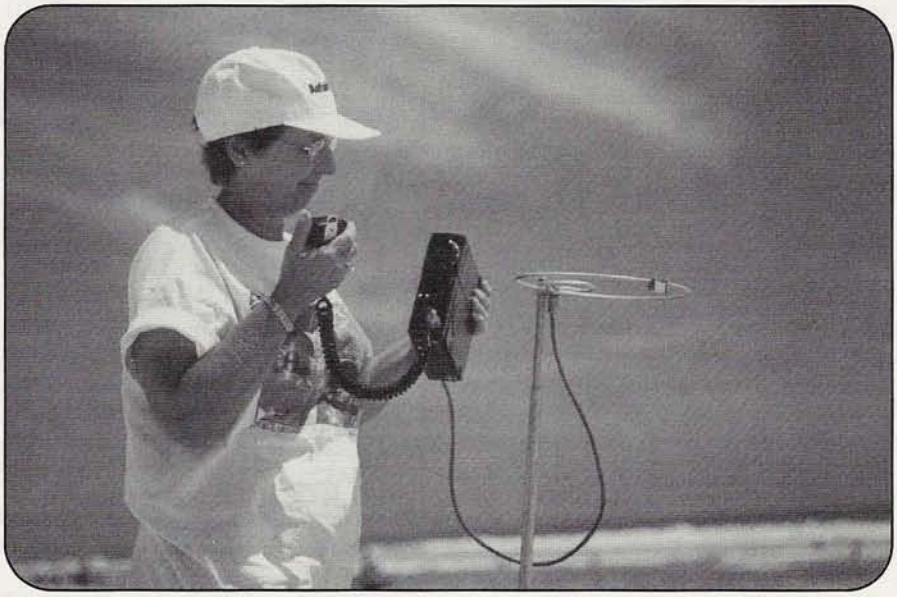


Photo C. Suzy West, N6GLF (Gordo's wife), takes her turn at working Hawaii on 2 meters from the beach in California. The right alignment of weather conditions regularly creates a tropospheric duct that traps radio signals and allows California-Hawaii QSOs on VHF and UHF that often sound local. (WB6NOA Photo)

Photo D. KH6HME's ATV (amateur television) ID screen, as monitored by WB6NOA on 434 MHz, 2,500 miles away in southern California. (WB6NOA Photo)

Photo E. Jon Jones, NØJK/HC8, operating from the Galapagos Islands. This photo was taken soon after his QSO with HP3XUG in Panama, believed to be the first-ever 6-meter contact between HC8 and HP. (Photo by HC8GR)

SQ9CXT (JO90hd). Later in the night, I moved to KP55at as OH1ZAA/8 and heard JW7SIX (JQ68TB) fade out around 2238 UTC. Also I heard a "British chat" on 50.130 just a bit earlier.

The longer stop at KP53ma was rewarding. First, OX3SIX (HP15) was in from 2200–2225 UTC July 8th, and the next evening, I heard EH1EH with a 559 signal on 50.103 MHz. A string of SM (Sweden) and OZ (Denmark) contacts started with SM7FJE at 1755 UTC; also I drove 5 kilometers down to KP52mx to serve this other square. July 10th was productive as well with 80 stations worked from KP53 between 0557 and 0652 UTC with PAØBM being the last one. After passing through eight more squares with mobile monitoring, we were home by midnight without any further conditions observed on 50 MHz. However, some of the 24-MHz beacons were audible. GSM-coverage is solid all through Finland (+Norway) and we exchanged a lot of propagation information with OH6DD/OH0, OH1VR, OH1NOA, OH1XT and OH2BC. Also many thanks to all the stations on the other side of the path. The future holds better antennas for mobile and fixed operations....

Splendid locations were found for future beacons in KQ30 and KP52, farthest Eastern European coordinate. Total kilometers driven: 4,280 km, about 40% more than expected, with two days of extension to the plan.

Activity Reports

2-Meter E-Skip

A little too late for the last issue's deadline, we received the following report of an early-July, 2-meter *E*s opening from Frank Moorhus, AA2DR, in Long Island, New York (FN30):

Several days of sporadic-*E* openings on 2 meters started on Sunday, July 4, at 0217 Z, with a QSO with Larry, NØLL, in EM09 (Kansas). Larry's QSL card stated: "First QSO into FN30 on 2 meters in a long time. And only one station!"

On Tuesday evening, July 6, the band opened again. This time, I worked 15 stations throughout the middle of the country, between 2308 Z and 0104 Z on July 7. In order, they were K4YA, EM25; WØVD, EM27; KØETC, EM27; K9IMX, EM38; WAØETH, EM38; WØFY, EM48; K5SW, EM??; N5TML, EM14; N5WKW, EM15; K5EMS, EM25; WD5GVP, EM25; K5JMZ, EM15; KD5VQ, EM14; K5YY, EM26; and W5HUQ, EM35.

On Friday, July 9, I heard WDØAPF in EN10 at 0130 Z, but had no contact. What a great 2-meter *E* opening!

A Bermuda High...

We also heard after deadline from Contributing Editor WB2AMU—he had an excuse: he was returning from a trip to Bermuda (VP9), where he managed to get in some great 6-meter QSOs from grid FM72:

I am back now from VP9 land and had some success making contacts on 6 meters as follows:

I was using 2.5 watts from my FT-690 with a whip and I was able to tap into a strong opening at 11:30 a.m. local time July 6 in Bermuda. I was able to work the following stations, all on CW from FM72 as WB2AMU/VP9 in Tobacco Bay Beach, St George, Bermuda: 1441 W3EP FN31; 1450 K2NG FN20; 1451 K2CS FN13; 1452 N2PC FN20; 1453 K2SPO FN13; 1454 W1WHL FN31; 1457 NM1K FN31; 1502 KE2LW FN13; 1505 K2ZD FN21; 1507 W1JJM FN41.

The K2ZD beacon was very strong and there were a few others coming through. I tried SSB briefly, but heard only two stations, including an FN33 ragchewing on the calling frequency. When I worked K2CS and went QRZ, it sounded like a wall of sound on 50.098 and I was able to pick out a few stations. The band faded somewhat and I had to run back to St. George to meet my wife and then return to Tobacco Bay beach. At that point the band had dropped out and I heard only the W4CHA beacon.

Over the next few days of listening here and there, I heard KP4BZ on the afternoon of July 6th and July 8th on CW on 50.105, but could not get him. I also heard the W2ZD beacon on the last morning that I was in VP9 land at 1330 Z on July 9th at 599. However, no stations to be raised.

In total, I heard five distinct openings, with the one on the 6th being the best. All five openings took place with the *E*-cloud over the ocean. This suggests that there are many more openings than we realize. I could not raise any of the locals on 50.125 during my brief stay.

DX Station Reports

The rest of our reports covered late July and early August. With the seasonal *E*s peak past (centered on the summer solstice), there were fewer big band openings, but there was still plenty of activity keeping the bands busy—especially if you *weren't* in North America!

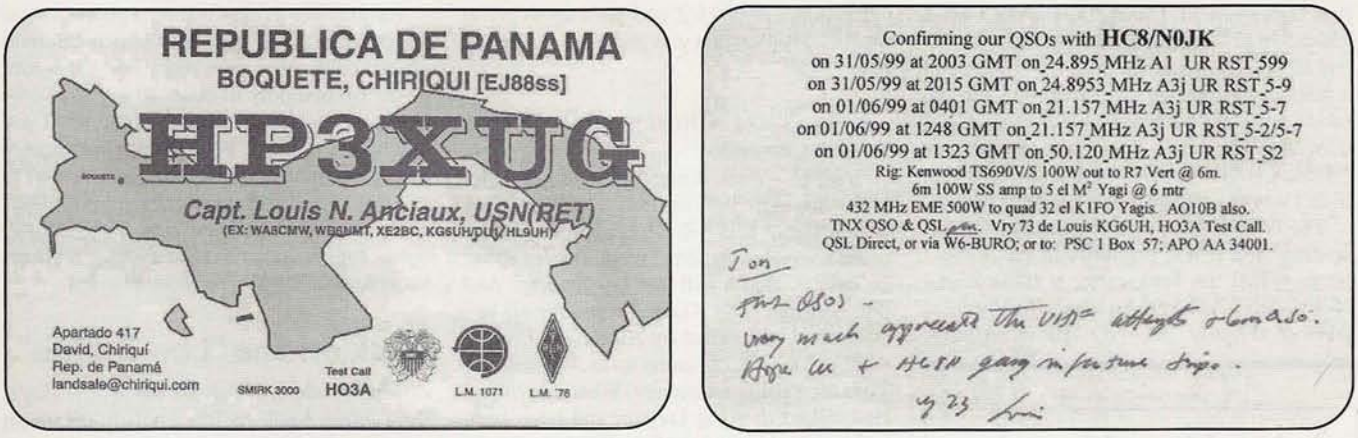


Photo F. Front and rear views of HP3XUG's QSL card to HC8/NØJK, confirming QSOs between Panama and the Galapagos Islands on 12, 15, and 6 meters. (Courtesy NØJK)

From Peter Sprengel, PY5CC, Brazil:

7/20/99—We had a very nice opening on 6 meters today. Worked 49 stations in Europe between 18:33 and 19:17 Z. Worked into: OZ (03), SM (07) SM7, SM0, SM6, heard an SM4 ???; GW (01) GW6VZW, PA (15), ES (02) ES1CW, ES1ABR (ES1CW new one on 50 MHz #167); G (09), OH (05) OH2BCI, OH2LJH, OH6KTL, OH1LT, and OH2BC (OH2BC was S9 + 20 dB). Heard a OH3??; DL (03), ON (03), F (01) F5DE.

From Gabriel Sampol Duran, EA6VQ, JM19, Spain:

7/21/99—We had another sporadic-*E* opening on 144 MHz. In spite of being at home (not at my radio-QTH) and having to work QRP (11 elements and 20 watts), without preamp and with a rusty coax cable (SWR 1.5), I managed to work 21 stations from PA, DL, and OZ. Here follows a list of the QSOs: 16:37 PE9GG JO33; 16:37 DF7KF JO32; 16:37 PE9DX JO33md; 16:39 PA9KT JO33jf; 16:39 DL6YDP JO32mf; 16:39 DL5YET JO41; 16:40 DJ5BV JO30ki; 16:40 DL6BF JO32qi; 16:41 DL8EBW JO31; 16:41 DF7VO JO32; 16:41 DF8XR JO32mf; 16:41 DF8JD JO31mf; 16:44 OZ5TG JO45vw; 16:45 DJ3LE JO44tn; 16:45 DG2LAB JO54ak; 16:47 DB3YAD JO32mf; 16:47 DF8IK JO30jt; 16:50 DF2JQ JO31; 16:55 DG3JKB; 16:55 DL1EAP JO31ik; 16:56 DL1EEX JO31ma. From Heck Stefan, LAØBY, Norway:

7/22/99—Yesterday evening after 22 UTC, Peter, JW7QIA, managed to work at least SM3JGG, SM3NRY, and OH1ZAA on 6 meters. The first reports of JW7SIX were reaching me at 1925 UTC by phone. I tried to contact Peter immediately but got the message he was late from a hiking trip. People were worried, so was I....Glad to see he returned safely and even made some contacts.

(Later...) I just talked to Peter on the phone. He worked nine calls last night on 6 meters, all from OH/SM. He will be on tonight (22 July) but has to leave the JW7SIX site tomorrow morning.

From Ed Rodriguez, WP4O, FK68, Puerto Rico:

7/23/99—Just worked KB4CRT EL89 northern FL, 52 on 50.125. I am calling CQ on 125 other KP4s CALLING on 110. Hope to work others. KP4BZ on 105.

Wake Up Call

The bands woke up here in North America on the 25th and 26th of July, with a combination of single- and double-hop *Es*, Au (aurora), and an east coast tropo opening that extended all the way to 10 GHz!

From Al Goss, K2SPO, FN13 New York State:

7/26/99—Got a nice taste of 6-meter double hop starting approx. 0200 Z last night (Sun.), all except one (noted) on SSB: KD7DCY DN17; VE7SL CN88; VE7SKA CN88; W7CI (CW) CN87; KIØBV ENO4; NJ7A DN30; K7YVZ DN13. Last Q at approx. 0240 Z, nothing heard 144 or 222 MHz.

From Dave Bernhardt, N7DB, CN85, Oregon:

7/26/99—Last night was a good opening for those of us in the Pacific Northwest. Although not a real strong one, propagation did cover a very large area. The first contact made was to Pat, VE7AGJ (CO96) 5/7 at 0221 Z. Pat was a good 5/9 at times, so there was a fairly strong cloud to the north of us this evening. Conditions picked up to the east with AAØF (EN03) 5/3 at 0257 Z. K7RWT reported to me that he heard 49.750 from UA0 TV around 0240 Z, although there was only a few minutes last night that he heard that signal. Nothing else came in from across the Pacific

that I am aware of. During the 0300 Z hour, I picked up EN80, EN70, EM79, EN51, FN10, and EN78. Most signals were S3-5. I did call a number of times on CW on 50.095 with no takers until 0337 Z when I made a couple of contacts. The last contact to the east was NØELA (DN97) 5/3 at 0400 Z. I heard (but didn't work) a station out of EM48 at 0407 Z.

The 0400 Z hour was the last part of this opening and it was primarily to the north. I heard N7ML on backscatter at 0409 Z and N7EIJ (DN17) had an Au tone to his signal at 0418 Z. Finally, KL7NO (BP51, Alaska) came in 5/2 at 0425 Z and built up to 5/7 at 0427 Z. Propagation was gone before the top of the hour.

From Dave Clingerman, W6OAL, DM79, Colorado:

7/26/99—Well, 6 meters was a whole lot of fun last night here in DM79. I was copying beacons from VE8, VE7, VE6, and VE5. Most of the Canadian stations I worked were above 20 over 9. Had a ball just ragchewing. And then just like "ON STAR," when the air bag goes off, I was called by Al, KL7NO, while waiting for a VE7 to come up to .160 with me from the calling frequency. What a surprise! Had talked to Al at Dayton and have been looking for him quite often. We talked for a few minutes and he went off to see what else he could find while I jawed with the VE7.

Later Lauren, WØLD, from DM78 called me and said that on the "prop logger," WL7KY posted that he was hearing me. I called a few times on SSB and may have caught a syllable here and there but nothing concrete. I asked that he go to CW and heard him but not enough to make a complete exchange. Oh well, maybe tonight. Good DX to all, CU 73, Dave...P.S. Nice opening to the East Coast and Midwest this morning (07/26/99).

From Bill Hudson, WAØKBZ, EM48 Missouri:

7/26/99—Nice opening on six this evening. Lots of good CW ops. Stations worked: KK7AT DN33 SSB; KC7IJ DN44 SSB; K7MT DN46 CW; VE7SL CN88 CW; W7FI CN87 CW; N4SL CN87 CW; K7JX CN87 CW; VE7CA CN89 SSB; N7EPD CN89 CW; K7XW CN96 CW; VE7ASS CN89 CW; W7DMN CN87 SSB; K7SD CN87 SSB. That's a lot of good CW contacts! Never heard the KL7s...maybe another night.

From Del Schier, K1UHF, FN31 Connecticut:

7/26/99—Saturday morning and I was glad the kids were watching TV. I flipped through channels 2-13 and found every one wiped out by co-channel interference. Two meters was pretty quiet considering the conditions. The beacons were not up a lot, but, telling from the stations that were on, the duct extended from North Carolina to Massachusetts.

I caught Dex, K4DEX, who was 20 over running 10 watts on 2 meters. We moved up to1296 and easily worked. I asked him for other bands and we went to 10 GHz. While Dex was warming up his TWT [traveling wave tube amplifier], I sent dashes and he heard me right away, sending my 3-centimeter signal back on 2 meters. He called me on SSB about 5X4 and he also gave me 5X4. The signals were fairly steady with him Q5 all of the time we talked. He had more power, 20 watts, he was having a bit of trouble on the QSB fades with my 1 watt. We worked at 1352 Z on a mostly overland path. His distance to me is 557 miles for my best on 10 GHz.

I would like to get together a phone list for active home 10-GHz stations so that we could all call each other next time. The list would be distributed only to other 10-gig operators and would not be posted on the Internet. If you would like to send me your number and not have it on the list, that's OK too.

I was very surprised and that this QSO was even possible and I am sure I could have worked more stations if I knew they were set up and could contact them by phone.

Back on the "Low Bands"

The bands were quiet for a few days, then came back to life on July 29, with openings on 2 meters as well as six:

From Dan Vanderplough, K9RQ, EN61 Indiana:

7/29/99—Just got back from lunch. 144.200 jumping here in the Midwest. Just worked NØDQS in EN22 from my EN61 location at the south end of Lake Michigan on sideband (1735 Z). Best part is, I was mobile, running only my ICOM 706 barefoot (10 watts) to a 5/8 vertical on the car. Got a good signal report from Gene out there in Iowa. Gee this is fun...!

From Dave Berhnardt, N7DB, CN85 Oregon:

7/29/99—This has been an interesting 24-hour period out here in the Pacific Northwest. I got home late in the afternoon to hear signals from the SW U.S. I did not work many stations, but I did find interesting conditions. The one disappointment was hearing XE1KK/b, but not a single XE on the band. The 'KK beacon was first heard at 0153 Z and was still in at 0219 Z. N7EIJ (DN17) was heard on backscatter at 0218 Z and NØXX/7 (CN84) was also heard on backscatter at 0228 Z. I heard a report that there was 2-meter *E* to the NW, but I did not hear anything here. The one station I did log was W3XO/5 at 0243 Z.

Thursday morning when I got up, I was surprised to hear 6 meters open to Ohio. First station worked was WA8WZG 5/9 (EN81) at 1429 Z. Others worked were W8AC (EN91), KØQQ (DN98), and KØUB (DN86). There was a loud solar noise burst at 1443 Z and within a few minutes the northern tier propagation was gone. Conditions picked up to AZ, NV, and CA about an hour later. Nothing on when I got home this evening so far.

From Don Farwell, WA6GYD, CM87 California:

7/29/99—Before I started out to lunch at about 12:30 (at 1935 7-28 Z) I turned on the 756 and worked KC7OVF in DM42, turned it off and went to lunch with AE6Z. When I came back and turned on the radio again at 0040 7-29 Z, the band was still open and I worked KB5KYJ in DM93. The band stayed open the rest of the evening past 0530 Z. Worked most of the western states via single hop *Es* and had two contacts via double-hop *Es* with N9NJY in EM58 and WS9V in EM59

Looking Ahead in CQ VHF Ham Radio Above 50 MHz

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

- "Meteor Scatter via APRS," by Ev Tupis, W2EV
- *CQ VHF* Reviews:
  - "Head to Head: The FT-100 and IC-706-G" by Gordon West, WB6NOA
  - "Alinco DJ-195 'Bug-Repellent' HT," by Gordon West, WB6NOA
  - "CAT Digital Weather Receiver," by Peter Bertini, K1ZJH

Plus...

- "Communicating with Your Computer," by Lew Ozimek, N2OZ
- "Truly Portable Packet," by Ray Rischpater, KF6GPE
- "2 Meters, Channel 2, and You," by Jim Ford, N6JF

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

"I would like to get together a phone list for active home 10-GHz stations so that we could all call each other next time [there's an opening]. The list would be distributed only to other 10-gig operators and would not be posted on the Internet."—Del Schier, K1UHF

when the band was open into Colorado (and obviously into EM58 and EM59). Band is still open into the NW at 0530 My goodness. It don't happen often into the SF bay area and vicinity, but when it does, *it does*!

From Ken Neubeck, WB2AMU, FN30 New York:

7/30/99—Friday was a very interesting day. At noontime, there was sporadic-*E* toward Quebec and then, when I got home, I heard aurora toward upstate New York and New Hampshire, all on 6 meters. Here are the details: sporadic-*E*, 1632 Z W9ALU EN50; 1640 VE2PEP FN46; 1700 VE2POH FN57; aurora, 2035 WA1OUB FN43; 2050 N2ODU FN02. Also heard K2SPO (FN13) and K4TJ. The Kp index reached 6 at this time.

Down Under and Across the Pond

From Mike Foubister, ZL3TIC, RE66 New Zealand:

8/2/99—Good band opening....0010 VK3BWT 50.140 5/9+; 0130 ZL1ADP, boy he was strong 5/9 + 60 dB; 0811 VK9NS 50.110 5/9 with QSB; 0902 JA1JFK 50.140 5/5; 0903 JQ1DPP 50.140 5/7; 0908 JA1RJU 50.110 5/5; 0908 JR2HCB 50.110 5/7; 0909 JA7WSZ 50.140 5/7; 0913 JA1VVD 50.140 5/5; 0917 JA2POK 50.140 5/7. This is the first time I have ever heard JAs (Japan) in August. Interesting stuff!! Cheers and 73

From Olli Droese, DH8BQA, Germany:

8/5/99—Here are the MS results in brief from our 24-hour mini expedition to JO74AA: EA6FB CW NIL almost 2,000 km—too far for my small seven-element beam; YU7KB CW NIL; G3KWY CW NC (Not Completed) final RRR missing; G7RAU SSB C (Completed); DH9GCD CW C; I5WBE CW C; OH6MAZ CW NIL he had antenna trouble; OH6KSR CW NIL; GMØWDD CW C; 9AØDX CW NIL.

In general, very poor and short reflections during night hours. but improving toward morning. I5WBE produced a firework so completed in 15 min. CQing afterwards but no response at all.

From Jan "Zaba" Hubach, OH1ZAA Finland:

8/6/99—JW7SIX (JQ68TB) booming into KP01 after 20.15 UTC. Hopefully JW5RIA is QRV tonight. Let's also check the 50-MHz path to North America up to 00.30 Z.

8/7/99—JW7SIX faded out at 21.04 Z....There was medium strength aurora on 144 MHz, but at very sharp headings, indicating a narrow auroral belt....No signs of OX (Greenland) or VE (Canada) beacons later in the night.

And Finally...

From Oscar Morales, Jr., CO2OJ, EL83 Cuba:

8/7/99—This morning, I decided to do some cleaning in the shack but, as always, I turned on the 6-meter rig "just in case." Nothing heard until 1419 UTC when I copied Bob, VE3KZ, FN03 (1,420 miles), with a signal that came up from 33 to 55. I called him and we both had a little chat. And that was all...nothing heard before and nothing heard after, only "white noise." That is why 6 meters is called the "magic band"!

Looking Ahead

As noted last month, this fall holds out the promise of renewed F_2 propagation—and worldwide DX—on 6 meters. So follow CO2OJ's advice and keep that radio on whenever you're in your shack. Also, next month will feature the Leonids meteor shower. Normally a minor event, it was practically a meteor storm last year, and some astronomers believe it may be at least as big this year. It's due to peak on November 18 (it was a day early last year). Even if you're not into making MS contacts, you can participate in an experiment to track the meteors via APRS! We'll have full details next month in an article by Ev Tupis, W2EV. For now, 73 and good DX! ■

New Weak Signal Columnist

We are pleased to announce that Dave Bostedor, N8NQS, will be joining the CQ VHF *staff next month as our new weak-signal columnist. Dave is an active weak-signal operator and editor/publisher of the* Great Lakes VHF - UHF Newsletter. *Dave will succeed Tim Marek, K7XC, whose new job doesn't give him time to do a monthly column. Tim does plan to write occasional features. Good luck and thank you to both Tim and Dave.—W2VU*

Modern Day Public Service... It's More Than Talking into a Mic

Hams offering public service and emergency communications must be able to do more than talk to each other. They must also learn and understand the needs, and the "lingo," of the organizations they're helping.

A reader recently wrote to me about a situation he encountered when giving a presentation on his ARES (Amateur Radio Emergency Service) group helping during a recent disaster. He described how his group had handled communications and disaster support during a tornado and then got into training and certification. His point was, "if we are going to survive as a viable, worthwhile component of any emergency response situation, then we need to learn what our served agencies are doing, how they do it, and support them in the way they need to be supported." The days of "run what you brung" radio are over, he added, noting that just showing up with an HT isn't going to cut it anymore.

"...the days of 'run what you brung' radio are over...."—a* CQ VHF *reader

One of our biggest assets as hams is our skill as trained communicators. It really doesn't matter if we're operating on the local ham repeater or helping to provide communications for the local cycling event on a business band radio. The point is that our skill sets of knowing how to operate in a directed net environment and how to send and receive messages accurately is invaluable.

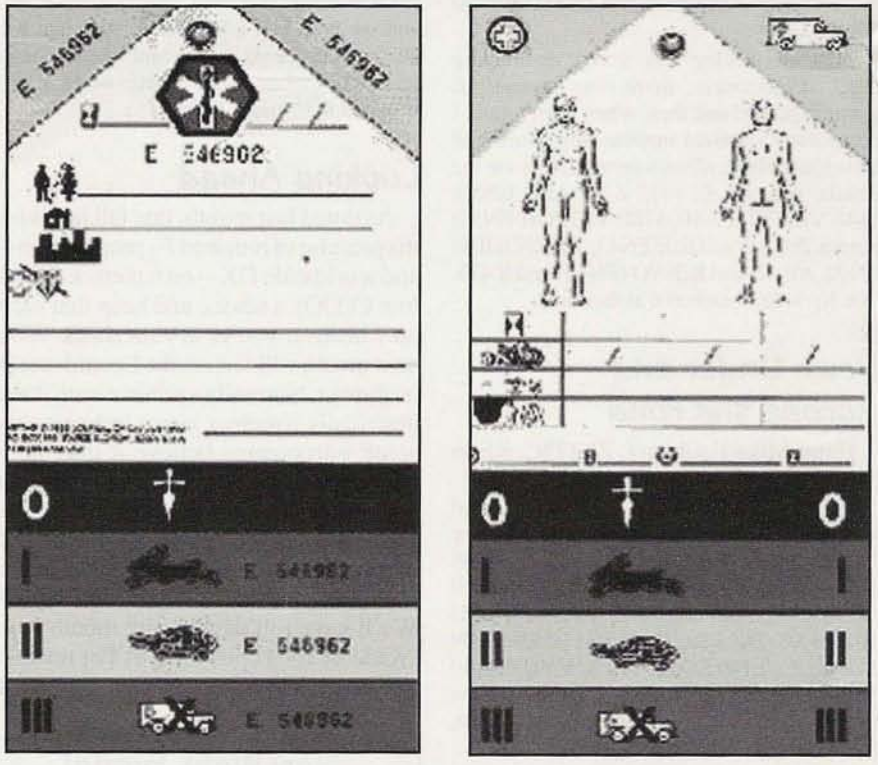


Photo A. Front and back of a typical triage tag. The strips at the bottom are color-coded and give emergency responders an immediate indication of the patient's condition. According to the Mettag Triage tag shown here, Level III (green) means that emergency transportation is not considered necessary at this time; Level II (yellow) indicates serious condition, but transport can be delayed until after Red Priority patients; Level I (red) means the patient is critical and in need of immediate care and transport. Level 0 (black) indicates that the person is dead, and should be moved to the designated morgue area. (Artwork courtesy METTAG Products, Inc.)

New APCO Guidelines for Hams

This was recently emphasized in a new set of guidelines that the Association of Public Safety Officers (APCO) suggested to hams when working with emergency management officials. The immediate objective of the APCO Volunteer Resources Committee was to develop a "generic training plan which could be used by ARES and RACES organizations to ensure that ham operators are able to

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

Photo B. When a tornado roared through remote Oglala, South Dakota, amateurs responded to provide vital communications. (Photo by Trina Blanks, KBØTYW)

function most efficiently when communicating for or with public safety agencies during emergencies."

According to APCO this should include such things as:

1. *Emergency response vehicle numbering system (police, fire, and EMS)*—Every agency has its own numbering system. The amateur operators can be more effective if speaking the same language as the public safety personnel with whom they are working.

2. *Names of political subdivisions and any numerical, or other special, designation for them used by the dispatch agency*—Knowledge of these will help the operator understand any geographical information to be transmitted.

3. *Ten-code, if used, or standard terminology for clear speech, if used*—Many agencies have gotten away from the ten-code, but, even so, standard words and phrases are normally used to prevent misunderstandings. Whatever the system, the amateur operator should learn it to properly interpret what he hears. This is not to suggest that ARES or RACES personnel use such codes on the amateur frequencies.

4. *Names and business telephone numbers of emergency management officials*—It is very helpful when an operator is deployed to a given EOC that he know the name of the emergency management (director) (coordinator). This is the individual who will assign the operator or refer him to the proper person who will assign him.

5. *Emergency room information including hospital names, locations, physician in charge, and ER telephone number*—In major medical disasters, amateurs may be assigned to hospital ERs to relay patient information on incoming victims. This is very important in allowing the ERs to be prepared for victims before they arrive.

6. *Frequencies of all emergency response agencies*—It's often helpful to monitor public safety radio transmissions to help the operator to have a better view of the scope and nature of the emergency.

7. *Patient classifications used by emergency medical personnel in your area for hospital notifications and triage tags*—In a major emergency, ARES or RACES operators may be assigned to the triage area to report on victims inbound for the hospitals. The information needed by the hospital is on the triage tag for each victim. Operators should be familiar with the triage tags and the terminology thereon (see Photo A).

"It is important that emergency management know the location and function of each amateur assigned to a specific drill or emergency."—New APCO guidelines

8. *Procedures for amateur radio operators to use when reporting emergencies via 911 autopatch to the dispatch agency*—Amateur radio reports to 911 are different from those to any other channel for reporting emergencies because of their simplex nature; that is, the dispatcher cannot speak to you while you are transmitting. It's necessary, therefore, that this be made known to the dispatcher at once when calling 911. The incident information should then be given in a format that is provided by the 911 agency.

9. *Incident Command System training for all amateur radio volunteers*—Many agencies are using the Incident Command System (ICS) to manage emergencies. All operators who volunteer for ARES or RACES in the agency's jurisdiction should enroll in an ICS course. Training in CPR and first aid is also recommended. Normally, there is no charge for volunteers.

Several Web sites are available for training. The Federal Emergency Management Agency (FEMA) offers a course on the Incident Command System. It can be found at <http://www.fema.gov/EMI/is195lst.htm>. First aid and CPR training information can be found at <http://www.redcross.org/hss/facpr.html>.

10. *Accountability*—It is important that emergency management know the location and function of each amateur assigned to a specific drill or emergency. A simple form listing the action sites on the left side and listing the call letters of hams assigned to that site to the right of the location will do.

FEMA Reinforces Incident Command

FEMA has issued an updated version of the plan for mobilizing and deploying federal resources for people and communities overwhelmed by natural disasters and manmade emergencies. The *Federal Response Plan* serves as the principal organizational guide for defining the roles and responsibilities of the American Red Cross and the 26 federal member agencies that are engaged to deliver a broad range of emergency aid during a major crisis.

"Our revised plan incorporates 11 changes and other modifications that result from the lessons learned and the experiences of our federal partners since we first employed it during Hurricane Andrew in 1992," FEMA Director James Lee Witt said. "By making the plan more consistent with current policy guidance and new ways of doing business, we have significantly improved our response capabilities for aiding distressed states immediately and expediting their recovery."

Additionally, the revised plan reinforces the use of Incident Command System principles, mentions the importance of private sector partnerships, and describes several new response resources, coordinating mechanisms, and management tools. The full text of the revised plan is currently available on FEMA's World Wide Web site at <http://www.fema.gov/r-n-r/frp/>.

New Jersey's Amateur Radio Month Proclamation

For the second consecutive year, New Jersey Governor Christine Todd Whitman has recognized the contributions of radio amateurs by proclaiming June as Amateur Radio Month in the state. Here is the full text of the proclamation:

Whereas, the State of New Jersey holds a worldwide position of leadership in the fields of communications and electronic technology and has played a major role in many of the world's greatest scientific achievements; and

Whereas, New Jersey was home to many of the early Marconi wireless stations and Radio Amateurs who advanced the radio communications art; and

Whereas, the Amateur Radio Operators of the Garden State have long been, and continue to be, a force for the advancement of the electronic communications arts and sciences; and

Whereas, these "Ham" Radio Operators participate in public service events in support of such organizations as the American Cancer Society, the Boy Scouts of America, the American Red Cross, and the March of Dimes; and

Whereas, many of New Jersey's nearly 20,000 amateurs will participate in the American Radio Relay League's annual "Field Day" emergency exercise the weekend of June 26 and 27, 1999; and

Whereas, the Garden State's Amateur Radio Operators provide their talent, equipment, skill, and service to better prepare and train for emergencies without cost to, and for the benefit of, the citizens of the State of New Jersey; and

Whereas, it is fitting to give recognition to the far-reaching technological and service achievements of Amateur Radio Operators and this important emergency preparedness exercise;

NOW, THEREFORE, I, CHRISTINE TODD WHITMAN, Governor of the State of New Jersey, do hereby proclaim JUNE 1999 as AMATEUR RADIO MONTH in New Jersey, in recognition of the contributions made by the many dedicated Amateur Radio Operators of the Garden State.

Modern Technology Outage Relies on Hams

When a construction worker cut cables which supplied communications to three counties in South Dakota, and a killer tornado struck the town of Oglala (Photo B), the Lead Amateur Radio Emergency Services group provided critical communications on behalf of emergency personnel for over 19 hours.

Later in the day, local hams were again asked to used their skills as trained weather spotters to supply information on tornadoes that passed through the area. According to the *Black Hill Pioneer* newspaper, "Lead's Certified Emergency Manager Jerome Harvey said, 'In recent years there has been an over-reliance on hard wired communication systems and cell phones. There is just no way to overemphasize the value of highly trained amateur radio operators or the willingness of these volunteers to give their all when an emergency is at hand.' "

Lawrence County ARES Emergency Coordinator Don Sanders, WØKTL, quickly put together a response team to head to Oglala, where communications services were disrupted. From the Lead Emergency Operations Center, home of the Northern Hills Amateur Radio Club (Photo C), ARES provided an emergency response which was able to tie together information from several sources. Sanders said amateurs supplied general health and welfare communications, as well as the activation of the cable TV emergency cut-in system, media notification, and coordination of emergency

Photo C. Don Sanders, WØKTL, Lead (SD) Fire Department Communications Coordinator, operates portable equipment of the Northern Hills Amateur Radio Club, KCØBXH. (KBØTYW Photo)

responses. He continued that over 190 man-hours from ARES personnel were logged just in the local phone outage crisis, which resulted in a contribution to the local community of just under $50,000 in equipment and manpower costs.

The ARES response team sent to assist in Oglala included personnel cross-trained in amateur radio communications, severe weather operations, CPR, first aid, and disaster operations. William Schnurr, KIØOZ, of Pine Ridge, South Dakota, is a physician who was in the midst of both trying to provide critical medical care to those injured in Oglala and, at the same time, using his radio skill to attempt to coordinate ambulance response to the disaster area. Other hams provided emergency communications for the Red Cross as damage assessment and other services were going on to provide the most help possible to those in the greatest need following the devastating tornadoes in that area.

According to Jamie Tollefson, NØPFS, "They had six inches of rain in the last two days, so just getting around down here is very difficult as much of the damage took place in very rural areas. A lot of the roads are either washed-out or barely passable due to the precipitation."

Hams Show Off the Right Stuff

The occasion was the Pinellas County Hurricane Expo in Largo, Florida. This is an annual event held to raise community awareness about severe and tropical weather preparedness. Several members of the Pinellas County ARES/Skywarn organization demonstrated amateur radio's commitment to emergency and severe weather preparedness at a booth set up at the Expo.

The group demonstrated several amateur radio technologies to thousands of residents who attended the Expo, including a live APRS (Automatic Position Reporting System) demonstration and an interactive SSTV (slow-scan TV) exchange, on the St. Petersburg 444.325 repeater, with WX4TBW, the amateur radio station at the National Weather Service office in Ruskin, Florida. WX4TBW was manned by Paul Toth, K2SEC, Regional Coordinator for the West Central Florida Skywarn Group.

The direct link with WX4TBW also enabled the Pinellas County ARES/Skywarn booth to directly receive a bulletin that had been issued by the National Hurricane Center in Miami upgrading Tropical Depression One to Tropical Storm Arlene.

Amateurs Recognized Around the Country

June provides the opportunity for most states to declare amateur radio month. While we can't cover all of the events around the country, we'll cover New Jersey's declaration as a representation of all of the hard work done by hams around the country.

"There is just no way to overemphasize the value of highly trained amateur radio operators...." Lead, South Dakota, Certified Emergency Manager Jerome Harvey

New Jersey Governor Christine Todd Whitman has issued a Proclamation declaring June as "Amateur Radio Month" in the state. In recognizing the American Radio Relay League's annual "Field Day" emergency preparedness exercise, the Governor lauded the "the far-reaching technological and service achievements" of New Jersey's nearly 20,000 amateur radio operators (see box for full text).

Jeffrey Friedman, K3JF, Northern New Jersey's ARRL Section Manager, was pleased by the Governor's declaration. "This is the second consecutive year Governor Whitman has seen fit to recognize 'ham' radio operators, our national organization, and our efforts to serve the community," he said.

In noting that "the State of New Jersey holds a worldwide position of leadership in the fields of communications and electronic technology", Governor Whitman recognized the Marconi wireless telegraph stations and early-day radio amateurs "who advanced the radio communications art."

"The ability to provide communications during emergencies is a large part of the reason that amateur radio continues to exist," says Friedman. "Field Day and public service events allow us to test those capabilities."

"I believe the Governor recognizes the importance of amateur radio to New Jersey's technology-based industry and economy," Friedman continued. "The contributions of Guglielmo Marconi, Edwin Armstrong, Thomas Edison, and Alexander Graham Bell to the Garden State and the world are obvious. Many people forget New Jersey's place in radio and communications history."

Looking Ahead...

In a future issue, we'll look at amateur radio operators combining the joys of VHF with the Internet. Do you have a story to tell of how your group is serving in the public interest? Please drop us a note at <WA3PZO@cq-vhf.com>. ■

The People Side of Ham Radio

A "death in the family"—the CQ family—along with one in the "American family," prompts WB2D to look at how the "people side" of ham radio has changed in the past 35 years, and how we all might help change it again...this time, for the better.

When Alan Dorhoffer, K2EEK, Editor of our sister publication, *CQ* magazine, died in late July, CQ issued a news release concerning this sad occasion. One of the points made in the news release was that Alan had always viewed ham radio as a "people hobby." He had kept the focus of *CQ* on people and what they do, rather than on machines and what they do.

Oddly enough, Alan passed away in the same time frame as John F. Kennedy, Jr. Having worked alongside Alan for several years, I knew him on a personal level. And I felt a connection to Kennedy, even though I'd never had the fortune of meeting this gentle man. Even though Alan and I definitely were not buddies, I always knew and understood that he was a gentle soul, too. I think it's high time that we again honor that trait in ham radio as well as society in general.

"Thirty-five years ago, ham radio was truly a 'gentleman's hobby.' I don't mean that in a sexist manner, even though there were fewer women involved in those days. No, I'm talking about courtesy, respect for one's fellow ham, and common decency."

A Changing Society

As TV show after TV show recounted the tragedies that have befallen the Kennedy family, it was natural to think back to how things have changed on a social level since that awful day in late November, 1963, when President Kennedy was assassinated. Within that framework, ham radio has changed, too. Old buzzards like myself can think back to those days. There's a tendency to become nostalgic and start thinking in terms of the "good old days." That's not my view—neither good nor bad old days, just different.

Thirty-five years ago, ham radio was truly a "gentleman's hobby." I don't mean that in a sexist manner, even though there were fewer women involved in those days. No, I'm talking about courtesy, respect for one's fellow ham, and common decency. To me, those are the hallmarks of being a "gentle man" or a "gentle woman."

For a moment, let's take a glance at the broader social framework. We lived in a gentler society in almost all respects then, or, at least, it *appeared* gentler on the surface. Think of the political arena of the last year. Regardless of your view of who was right or wrong, I think you have to admit that neither side acted much like gentlemen (or ladies). Compare that to the '60s, when the Republican party was led by the likes of Everett Dirksen and Nelson Rockefeller. True gentlemen, whether or not you liked their politics. Dirksen often quipped that he tried to sugar-coat his words, for too often he ended up eating them. When have you heard anything like that from a contemporary political leader?

And think of popular culture and how it has changed. In the '60s, Lenny Bruce and George Carlin were busted and harassed for uttering "dirty" words in night clubs. Now, most of those words have been uttered on the major broadcast networks at one time or another—forget what goes on in night clubs or cable TV shows. The Jetsons have been replaced by the Simpsons. And the Beaver would never survive in South Park. Rush Limbaugh and Howard Stern have replaced Wolfman Jack and Dick Clark.

On the other hand, we have artistic freedom and choice that simply did not exist then. Try to imagine Perry Como doing rap music; women and minorities have more opportunities. We're a long way from Utopia on these issues, but things have improved. So, for me, it's the "different old days," not the "good old days."

Rough and Tumble Radio

So, how does ham radio fit into all this? Our hobby has pretty much followed society in general over the past 30 to 40 years. Things have become a lot more rough and tumble on the air, particularly in certain urban areas. We've had repeater wars and jammers. On HF, we have certain nets that stake out and claim to "own" certain frequencies. And the language is often far from gentle. It's an "in your face" world now, and, for better or worse, ham radio has reflected that.

For years, it seemed like no one cared. Sure, you had the "victims" crying loudly that they had been violated. And the

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

ARRL sat in its ivory tower and chided us to be mature and responsible. But it had (and has) no teeth. Those who were responsible went ahead being responsible, and those who weren't continued on their path. As the bands became more crowded, rude behavior became much more noticeable. And it seemed like ham radio was just another reflection of a society that had embraced rudeness as a way of life.

Changes in the Wind

Now there's some evidence that that's changing. Suddenly, the FCC has taken a renewed interest in rules enforcement, most notably for the amateur service in the person of Riley Hollingsworth, K4ZDH. Over the past several months, Hollingsworth has made his presence known near and far. He has been extremely effective in removing some of the most offensive hams from the air. At Dayton, he received a standing ovation at the FCC forum.

Personally, I don't want to go back to the stuffiness of the '50s and early '60s. I don't want to go back to rigid interpretations of rules made obsolete by technology. I like the openness and freedom we have now. But I *do* like the idea of treating each other with civility. I *do* like the idea of behaving on the air like gentle men and gentle women. It's possible to be open and adventuresome without being rude.

My 13-year-old daughter stayed with us this summer, and her visit opened my eyes to trends in society. As we settled into the different routine of having a child in the house, we were shocked at times by some of her behavior. Mind you, she's a good kid—I'd like to think, a great one. But she was rude to me, to Wendy, and to other people we happened to encounter. Yet, I know that she's also a very gentle soul. Why would she act like this?

When you're confronted with a problem, you suddenly become aware that other people have the same problem. So, as chance would have it, I was watching a morning news program when the guest was a child psychologist. He was talking about how children today often have no awareness of how rude they are. TV and movies certainly share some of the blame, but he felt that it was due to cues that they pick up from a wide range of social situations. We live in a society that for the last couple of decades has glorified rudeness as a way of life.

"...why can't we have an award that honors hams who display and practice courtesy, respect for one's fellow ham, and common decency?...Perhaps we will start a trend that the rest of society will follow."

He had a fairly simple solution: when the child is rude, gently point it out to him or her. Ignoring it is condoning it. Simply explain how another person is likely to feel when they are on the receiving end of the rude behavior. Well, in our case, it seems to be working pretty well. I can see Suzy stopping and thinking before she speaks now. The frequency of rude, confrontational remarks has dropped sharply. It has involved little more than pointing out her missteps and asking her if the result she was getting matched her intention. A little bit of awareness can go a long way with a child. Of course, there's a need for frequent reminders as she adopts a different way of communicating with the world.

This system works with children when you have a good rapport with them. But it probably would not be well received by the adults who act like children on the air. One of the fastest ways to make yourself unpopular is to become a self-appointed fault finder. No, there has to be a better way to get the same message across.

A Better Way

As it became apparent that there was no hope of finding young Kennedy and his passengers alive, the reporters delved deeper into the man that he had been. Born a couple of months before his father's inauguration, his whole life was spent involuntarily in front of a camera lens. If ever anyone had just cause to be angered by the intrusion of the press, it was this young man. When his friends would comment about the invasive behavior of the photographers, Kennedy would respond with a comment about how the fellow just had a job to do. Rather than screaming at the reporters and photographers to leave his new bride alone, Kennedy had simply asked them to take it easy on her until she got used to it.

Understand that this was done from a position of inner strength, not weakness. It was not that he feared the press—he simply knew there was a better way to handle them. Compare this to the anger, rudeness, and, sometimes, violence that so many of the Hollywood types direct toward these same photographers.

Outside of ham radio circles, few people have heard of Alan Dorhoffer. The press did not hound him, so we can only guess as to how he might have handled it. Inside our circle, he was well known and a celebrity of sorts. He never tired of the hamfest circuit, meeting his readers face to face, and listening to endless gripes and suggestions for how to change the magazine or how to instantly solve some crisis. No matter how obnoxious people might be, Alan treated them all with courtesy and would listen politely. And he behaved the same way on the air, even in those 10-meter DX pileups that he loved.

When someone whom we like and respect dies, there's a tendency to raise them to sainthood in our memories. Alan was not a saint, and I suspect neither was Kennedy. But the fact remains that they both had qualities that we would do well to honor—perhaps, even emulate.

Carrot and Stick

Riley Hollingsworth is taking care of those who habitually make life miserable for the rest of us on the air. That's his job, and he's doing it well. Let him take care of the "stick" side of the equation. Why don't we focus on the "carrot" side?

John Kennedy, Jr. and his sister, Caroline, had promoted the "Profiles In Courage Awards" as a way of honoring their father's memory and encouraging positive behavior in the political arena. Well, why can't we have an award that honors hams who display and practice courtesy, respect for one's fellow ham, and common decency? It doesn't have to be a national award; there's no reason why your local club couldn't sponsor such an award each year. Perhaps we'll start a trend that the rest of society will follow. Or maybe that trend is already there in its infancy and all we will do is just help it along?

Apparently, rudeness is contagious. At least, the last couple of decades suggest that. But I think courtesy, respect, and common decency are contagious, too. Let's use the passing of these two gentle souls as a reminder that we can choose to be rude or we can choose to be courteous. After all, it's the people that make ham radio great. ■

Getting Started in Digital Communications—Part 1

Is ham radio digital communications something you've never tried but would like to? This month, N2IRZ begins a two-part series on the basics of setting up and operating a digital ham station.

This month, we'll take a look at just what it takes to set up your station for digital operation. We'll start out by taking a very brief look at what we mean by digital modes on VHF and above, and then we'll study what kinds of equipment you'll need to get started. Once we work out the details of connecting all this equipment together, we'll set up the station and (next month) walk you through a QSO.

Digital Basics

It's been a while since we last looked at setting up a digital station from scratch, so let's start at the beginning. A few years ago, when personal computers became available to the common citizen, amateurs were at the forefront, figuring out ways to send data from one computer to another. Traditionally, this had been done over wires, but amateurs wanted something both better and less expensive. Thus, the modern digital modes were born*. While the early activities were varied, eventually the "best" modes for each part of the spectrum became obvious. Today, the overwhelming majority of digital activity on VHF and above is centered on *packet radio*.

The "packet" in packet radio means that we send computer data (whatever that may be) in little bunches, or packets, of information. Breaking up a longer stream of data into little packets helps keep out errors and makes it easier to use a data network to send data farther. It's beyond the scope of this month's column to explain exactly how it works, so I ask you to just accept that it *does* work and let's have some fun, instead. (You don't need to know how it works to use it, but if you're interested, look up the May, 1996, "Digital Data Link" column).

OK, now we accept that we can send computer data, bunches of ones and zeros, using a radio. So what? What can we do with it? Sending data through a radio is no different from sending data over a wire, except that with a radio data connection you're free to roam at will, limited only by your radio's range. Amazingly, most of the activity in amateur packet radio is in *fixed* operations: stations that don't move and could just as easily be connected by wires. Of course, hams being hams, we tend to prefer radio waves, which are free, to wires, which are not.

Typical Uses

One typical example of a fixed operation is connecting to an electronic mail server (called a Bulletin Board System, or BBS) and trading e-mail with other hams. In addition to selling and buying used equipment, this comes in handy for taking care of club business, distributing ham-related information (like the orbital elements for OSCAR satellites, or ARRL bulletins) and, if need be, health & welfare traffic into and out of a disaster area.

Another example of a fixed operation is a *Chat Room*, or *Converse Node*. Here, you connect to a Chat Server and can "speak" (actually, type) with anyone else who's also connected, in real time. This is the digital equivalent of a repeater roundtable and is useful for holding club meetings over a distance, or just chewing the rag with a bunch of friends. Sure, you can do this with voice, but remember you're not limited to text—a buddy wanting to see the latest version of a program you've written can have it right away, or you can trade computer photos of your pet ham, Pinky.

Hitting the Road

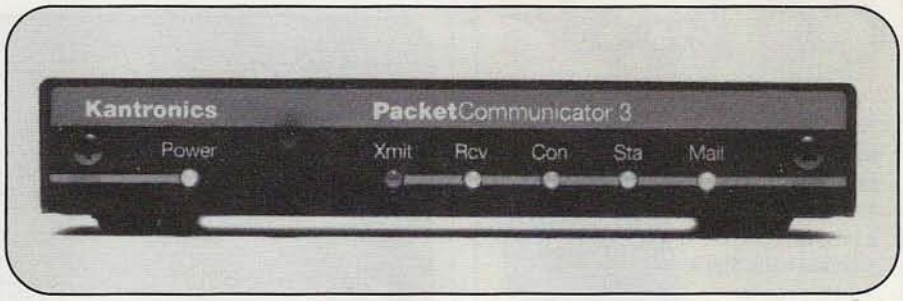
Then there are the mobile operations. No, I'm not suggesting you try to type on a keyboard and drive at the same time! Instead, the combination of digital data and radios makes for a very powerful way of trading information with objects that move. For example, combine a Global Positioning System (GPS) receiver, which reports location very accurately, with a radio and you can track absolutely anything, from a team battling a forest fire or a balloon way up in the sky, to the lead bicycle in a race or the club president at a hamfest. As you might imagine, this could be very useful in tactical planning and implementation, whether for a charitable event or a disaster relief operation. The most popular method of communicating via packet with mobile stations is called APRS™, or the Automatic Position Reporting System.

There's plenty more, limited only by your imagination. Packet networks, set up by hams and clubs, extend the range of your station, allowing QSOs over

*Actually, the first digital mode was Morse code, followed by RTTY (radioteletype), well before the advent of home computers. Modern digital modes are faster, much more robust, and require less operator skill, leaving the hardest work to computers and advanced hardware.

By Don Rotolo, N2IRZ (n2irz@cq-vhf.com)

dozens to hundreds of miles. Messages sent over these networks can span the globe. And weather data sent over such a network can help save lives in "Tornado Alley" and elsewhere. Plus, many police departments use a form of packet radio to handle routine messages and traffic stop inquiries. This only touches upon the myriad applications of digital radio—to really see what people are doing, you should give it a try.



Kantronics KPC-3 Plus.

The Technical Challenge

Of course, there's one more aspect: the technical challenge. Building a key to send Morse code isn't very challenging, but it's a start. Similarly, packet at 1200 baud is perhaps a good place to start, but getting a megabit link up and running is really a challenge, and a learning experience as well. If you're a regular reader of this column, you know what I think about learning new skills: It never hurts, and no one can take it from you.

The most important piece of equipment you'll need for packet radio is (surprise!) a radio. It would be helpful to have something more than a handheld, but that'll do. It would also be helpful to have some kind of computer, but even an old "dumb terminal" will suffice. Ideally, the radio would be a base station or mobile unit with an outdoor antenna, and the computer would run DOS or Windows. Yes, a Mac will also work just fine, but it limits some of the really cheap options for the rest of the hardware you'll need.

All that's left is a device to connect the radio to the computer. Although this is called a modem in the wired world, sending data via radio has some special requirements, so we use a radio modem combined with something called a Packet Assembler-Disassembler (PAD). These two units are generally combined in one box, commonly called a Terminal Node Controller, or TNC.

TNC Options

The easiest way to create a TNC for packet operations is to simply buy one. MFJ, Kantronics, AEA, and PacComm all make models in the under $150 range, and I've seen them for under $50 at hamfests. Regardless of brand, you'll find an RS-232 serial port on the TNC which connects to the computer and provides the proper kind of modem and signal levels for the radio. You can even buy premade cables for most any radio. It doesn't get much simpler than this.

Even simpler, and less expensive, are devices which use software for most of the work. One such device, made by the German company BayCom, is a simple radio modem and some shareware which does all the work of the PAD. BayCom modems are distributed in North America by Tigertronics (see "Resources").

Another option is using your computer's sound card. One system that uses this approach is FlexNet, which also comes from Germany. You can download FlexNet and configure one of your computer's sound card drivers to make a virtual TNC. Although I've written quite a bit about FlexNet, I've never covered this aspect. John Hansen, W2FS, wrote an excellent article in the Spring 1999 issue of Tucson Amateur Packet Radio's newsletter, *Packet Status Register*. The article includes everything you need to know and do, in a step-by-step format, for running FlexNet and the SoundBlaster driver. I hope to get permission to reprint the article here sometime soon.

On the other side of the TNC spectrum, rather far from the nearly free sound card drivers, are the Multi-Mode Data Controllers (MMDCs). These relatively costly boxes handle not only packet, but also RTTY, AMTOR, ASCII, Weather FAX, PacTor, G-Tor, Morse, and much more. While only packet is relevant for VHF and above, if you want to try DX data operations on HF, one of these MMDCs might make some sense. Personally, I use an AEA PK-232 for my regular VHF packet operations, more for the handy PC-PackRatt software than anything else. Again, contact the manufacturers listed in "Resources" for a better idea of what each one offers.

Software

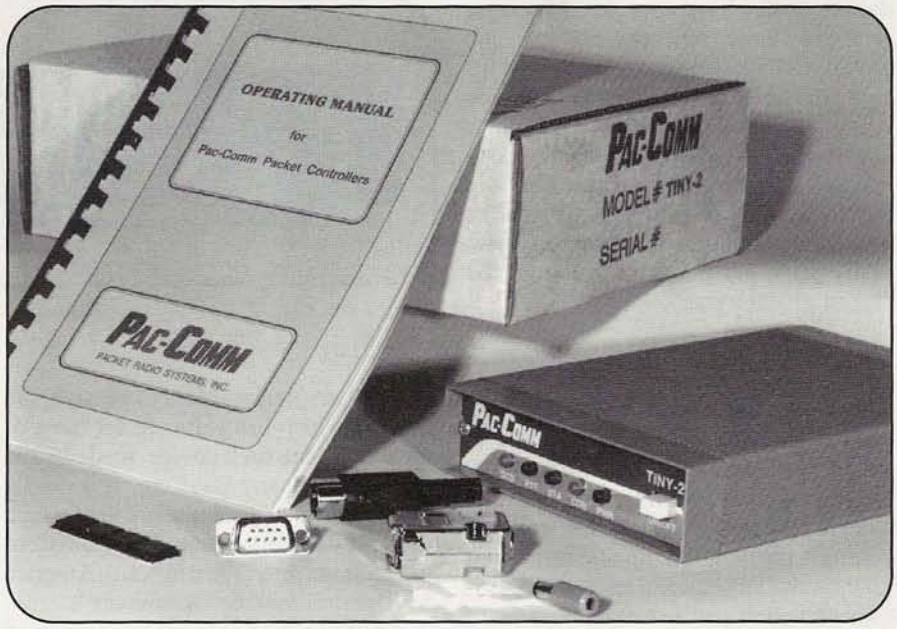
Ah, yes, I nearly forgot: the software. You'll need to get some software so you can send and receive data. When using a TNC or MMDC, virtually *any* terminal program—the kind you'd use with a telephone modem—will work just fine. Names like Procomm, Crosstalk, and even MS Windows Terminal come to mind as suitable possibilities.

There are enhanced programs (freeware, shareware, and costware), such as BayCom Terminal, PacketGold, Most Master II Plus, PC Packratt, and PK-Term 99, available for most hardware as well. These are customized for amateur packet operation, and all have various features like a convenient user interface, one-touch function keys, split screen operations, etc. If you plan on operating packet frequently, or if you just like convenience, then these are worth looking into.

Setting up Your Station

For the following, we'll have to assume you're using a PC running Windows™

MFJ-1278B.



PacComm TINY-2 Mark II.

or DOS™, a plain-vanilla TNC, and a VHF/UHF mobile or base radio. Other computers will be about the same, as long as they have an RS-232 serial port. Other hardware, such as an MMDC, will also be about the same while, for BayCom modems and FlexNet, you'll have to study the documentation for the details. As a matter of fact, you should follow the instructions for *whatever* hardware you have; the manufacturers definitely know how to connect everything and make it work better than we do, and they go into a lot more detail than will fit here. If you have an HT, don't fear—it, too, is similar, but the interface cable will be slightly more complex.

First, we need to connect the computer to the TNC. Start by looking at the back of your computer and identifying a serial port. It may be labeled COM1 or COM2. Your mouse might be connected to one, and it will have a male 9-pin or 25-pin connector, but it is *not* the one which connects to your printer, which is a 25-pin female. After you find it, write down how many pins it has (9 and 25 are the only choices here), and then have a look at the back of your TNC. Again, there will be either a 9-pin or 25-pin RS-232 serial connector, and it could be either male or female; look in the manual if you're not sure. Then, drive to RadioShack or your local computer or office supply store and buy a cable that goes from the computer connector (9 or 25 pin, female on the cable) to the TNC (9 or 25 pin, write down the gender or bring the TNC with you). You want a straight-through cable, not a "null modem" type.

"Sending data through a radio is no different from sending data over a wire, except that with a radio data connection you're free to roam at will, limited only by your radio's range."

Use the cable to connect the TNC to the computer. Start up the computer software, make sure it's "looking" at the correct RS-232 (COM) port and that both the TNC and the software are set to the same communications settings (usually 9600 baud, 8 bits, no parity, and 1 stop bit, abbreviated as 9600, 8, n, 1); even if the TNC's baud rate on the radio is only 1200, it probably communicates with the computer at 9600. Once everything is set right (again, the TNC manual is valuable here; your rig manual may be helpful, too), power up the TNC—you should see a brief sign-on message from the TNC on the computer screen. If you get garbage, make sure the TNC and computer are both set to the same baud rate (9600 works well) (*you might also have to fiddle with the other parameters. I have a TNC that uses 7E1—7 data bits, even parity, one stop bit—instead of 8N1—ed.*).

Timewave/AEA PK-96.

If you get nothing, make sure that the COM port is enabled in the computer's BIOS (check by clicking on Control Panel under "Settings" on Windows 95 or 98, or under "Main" on Windows 3.1), that the cable is a straight-through type, that it's plugged in securely at both ends, and that the TNC's power light is on. Once the computer and the TNC are talking to each other, power it all down for the next step.

Connecting the TNC to the radio seems to be the hardest part for most people, but you really only have to worry about four wires: **transmit audio** (from the TNC to the radio), **receive audio** (into the TNC), **push-to-talk** (PTT, from the TNC to the radio), and **ground**. Having a wiring diagram for the microphone helps tremendously, but there's a page on the Web where you can find connection info for almost any radio; see "Resources" for details.

Receive audio might be best taken from the external speaker jack on the radio, for two reasons: Many microphone jacks do not have speaker audio on them, and even on those that do, it's usually not variable in volume, a feature we require for packet. Transmit audio and PTT really have to go in at the microphone connector in most radios, although some newer models have dedicated data ports for these signals. Ground can be taken from either the external speaker jack or the mic plug, whichever is more convenient.

So, we simply connect the transmit audio output of the TNC to the microphone audio input on the radio. Then, the speaker output of the radio goes to the receive audio input of the TNC. Connect the TNC's PTT output (which goes to ground to key the transmitter) to the radio's PTT input (usually on the microphone connector), and, finally, connect the radio and TNC grounds together. That's it!

"Um, Don..."

My editor has just tapped me on the shoulder and told me that we're out of space again. I had wanted to explain the transmit audio adjustments and walk you through your first QSO, but he suggested I give you some time to get all this equipment together first. I'll do that, and we'll finish this topic off next month.

In the meantime, take a look at the manufacturer's catalogs, whether on the Web or by requesting one by mail or phone (don't forget to tell them *CQ VHF* sent you!). Look at what's offered, poke around at a hamfest, ask on your local repeater if someone has a TNC they'd like to sell, and get started. Admittedly, the digital modes are not for everyone, but getting your equipment on the air shouldn't be the reason you've never tried it! Finally, try to get the owner's manual for any TNC you buy—every one I have ever seen contains detailed instructions for setting up and operating the TNC, and, combined with this column, should be plenty to get you going. Just in case it isn't, don't hesitate to write or e-mail!

"...you know what I think about learning new skills: It never hurts, and no one can take it from you."

Next month, we'll conclude this topic by making a few adjustments, a test, and finally our first live QSO. Space permitting, we'll also discuss using some of the services that you'll find in Packet World, like the BBS system, for example. Until then, 73.

—N2IRZ

Resources

Packet radio hardware and software:

FlexNet Home Page: Download FlexNet software, BayCom terminal, sound card, and other drivers: <http://home.pages.de/~flexnet>.

Kantronics, 1202 E 23 St., Lawrence, KS 66046-5099; Phone: (785) 842-7745; Web: <http://www.kantronics.com>.

MFJ Enterprises, P.O. Box 494, Mississippi State, MS 39762; Phone: (601) 323-5869; Web: <http://www.mfjenterprises.com>.

PacComm Packet Radio Systems, 4413 N Hesperides St., Tampa, FL 33614-7618; Phone: (813) 874-2980; Web: <http://www.paccomm.com>.

Tucson Amateur Packet Radio (TAPR), 8987-309 E. Tanque Verde Rd., #337, Tucson, AZ 85749-9399; Phone: (940) 383-0000; Web: <http://www.tapr.org>.

Tigertronics, 400 Daily Ln., Grants Pass, OR 97527; Phone: (541) 474-6700; Web: <http://www.tigertronics.com>.

Timewave Technology/AEA, 58 Plato Blvd. East, St Paul, MN 55107; Phone: (651) 222-4858; Web: <http://www.timewave.com>.

TNC-Radio wiring diagrams:

Packetradio.com—This extensive Web site is the one of the best packet resources on the Web. *CQ* magazine packet columnist Buck Rogers, K4ABT, maintains this site with a nearly overwhelming amount of sensible and practical information for beginners and pros alike. Lots of TNC-to-radio interface diagrams. Full address: <http://www.packetradio.com>.

Understanding Tubes, Transistors, and ICs

They're at the heart of any piece of radio equipment...those components that amplify signals to levels usable for communications: tubes, transistors, and integrated circuits. Here's a look at "How They Work," along with a project using a classic VHF/UHF tube from the past.

Are you ready for more "how it works" discussions and hands-on practice you can use for many years hence, friends? Shall we also include another quick-brew project for additional fun and enticement? Well, that's precisely what's lined up for this month, and the combination promises to be a winner from any angle.

This time, our main focus is on tubes and transistors, those heartbeat-of-electronics components making up the gear we all use for both local and long-range communications. Background information for this study was included in our last few months' columns, incidentally, so I'll assume you've read or reviewed them and continue on from that point without backtracking. This will hopefully keep us focused on how modern transceivers and accessories work.

Before advancing to that high-tech level, however, we need to understand the basic operational concepts of components used in today's gear. Let's begin with a quick and simple explanation of tubes and transistors (plus ICs and microprocessors), then delve further into technical aspects and applications of each. Once armed with that basic knowledge, we can pursue a variety of homebrew projects with technical know how and confidence on our side. Read close and let's get started.

Photo A. Over the years, vacuum tubes have been made in an endless array of types and have been used in all areas of amateur radio. So much so, in fact, that collecting tubes is now a big-time interest. Shown here are seven decades worth of tubes. These include (clockwise from 9 a.m.) a WE-211, 245, 3-500Z, 6146, and an 811A.

Opening Views

Vacuum tubes have been made in a wide variety of types and styles (see Photo A). Basically, they all operate on the principle of *thermionic emission* (emission of electrons from a heated object), with concentric elements surrounding a center filament, as illustrated in Figure 1a (Figure 1b shows the schematic, or symbolic, representation of the same device. Voltage applied to the filament causes it to become a red hot heating element and emit electrons that travel outward toward the tube's plate. If a tube's filament is its only electron emitter, it's called a *directly heated tube*; if a tube's filament heats a separate electron-emitting metal wrapper around it (a *cathode*), it's called an *indirectly heated tube*. Still with us? Let's continue.

Assuming a second, higher voltage is applied between a tube's filament or cathode and its plate or *anode* (and on through an external circuit), current can flow in the second circuit. In this case, the tube acts as a diode—a rectifier or a detector. If a mesh or grid of fine wire is added between the tube's filament/cathode and anode (plate), the tube becomes an *electron valve* with its flow of electrons controlled by an external voltage impressed on that grid—a *triode*. Including additional grids in tubes accelerates the flow of electrons, cancels out inter-electrode capacity, minimizes secondary emission, etc. These multielement tubes serve numerous special functions, which

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

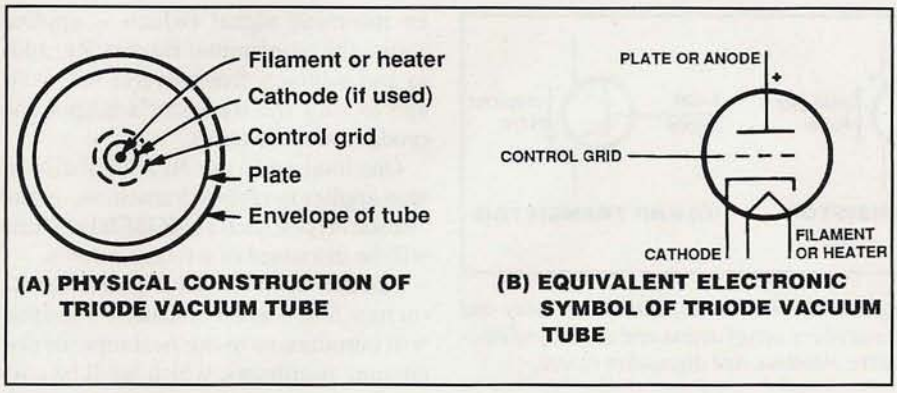


Figure 1. Physical construction/placement of elements in a triode vacuum tube as viewed from the top (A), and equivalent electronic symbol (B). Multigrid tubes have additional grids between cathode and plate. The grid closest to the cathode or filament is always the control grid.

we'll discuss later on, and carry special designations like pentodes, tetrodes, and heptodes (and no, that is not a frog wearing cool sunglasses).

Transistors are superseding vacuum tubes in numerous applications today, but tubes are still popular because they're rugged, economical, and have very high power-handling abilities. As many musicians and entertainers also know, tubes give a special full-bodied and robust sound unobtainable with transistors. Technically speaking, they produce *even*-harmonic distortion, which is pleasing to the ear, while transistors produce *odd*-harmonic distortion, which is interpreted by the brain as brash or irritating.

Transistors might easily be visualized as miniature equivalents to triode tubes, or as three-wire/element versions of those famous galena "crystal detectors" of yesteryear. In fact, internal views of early *point-contact type* transistors actually looked like tiny crystal diodes with two wires (rather than one) touching the semiconductor's surface.

Their crude design proved quite fragile, however, and soon evolved into modern *junction types* made by sandwiching tiny pieces of specially "doped" silicon or other semiconductor material, as illustrated in Figure 2a. "Doping" a semiconductor adds impurities that makes it either give off electrons (N-type) or accept them (P-type). The makeup of layers in a transistor "sandwich" determines whether it's an NPN- or PNP-type device. Both types serve the same general purpose of acting like a tiny electron valve. They just have reversed collector/emitter polarities and connect in opposite directions in a circuit.

Circuit connections to transistors are easy to understand if you remember two points. First, current always flows "against the arrow" (or in the opposite direction of the arrow) on its emitter (see Figure 2b). In the case of an NPN transistor, that means current coming from the negative/ground terminal or connection of a DC power source flows in the emitter, across the base, out the collector, and back to the positive DC connection. Second, this "negative emitter and positive collector" arrangement is similar to a tube's "negative cathode and positive plate" setup and that makes it easy to visualize if you already understand how tubes work.

ICs and Microprocessors

Integrated circuits, or *IC*s are also very popular solid-state devices today. In simple terms, they contain a group of transistors within a small package. Ah, but some ICs also contain diodes, resistors, and capacitors, you say. True! Typically, they use specially made emitter/base junctions of transistors (and ignore their collectors) to produce those components in ICs—mainly because they're smaller and less expensive to produce than discrete (separate) counterparts. There are two general families of ICs: the *analog group* used in audio and RF circuits and the *digital group* used in microprocessors and computers.

Microprocessors are made of numerous ICs on a single oversized chip (a *big* IC). Now we're really talking miniaturization and "squeezing" or "compacting." In fact, prying the top off a microprocessor and studying its innards with a magnifying glass gives the illusion of viewing a large city from an airplane flying at 20,000 feet. Microprocessors are typically used as the mathematical heart of computers and for selecting frequencies or controlling various digital-related features in transceivers. Now let's consider some interesting and useful technical aspects of tubes and transistors.

The Electron Valve Concept

Have you ever heard vacuum tubes referred to as *electron valves* and wondered about the seemingly unusual designation? Actually, the term is common reasoning and our British friends have always called tubes "valves." Why? A valve has an inlet, an outlet, and a control handle, and a tube has the comparable elements of a cathode, a plate, and a control grid. A small force applied to a valve's handle can produce a large change in its quantity of output, and a small voltage applied to a tube's grid can produce a large change in its output current. This ability to make a large reproduction of a

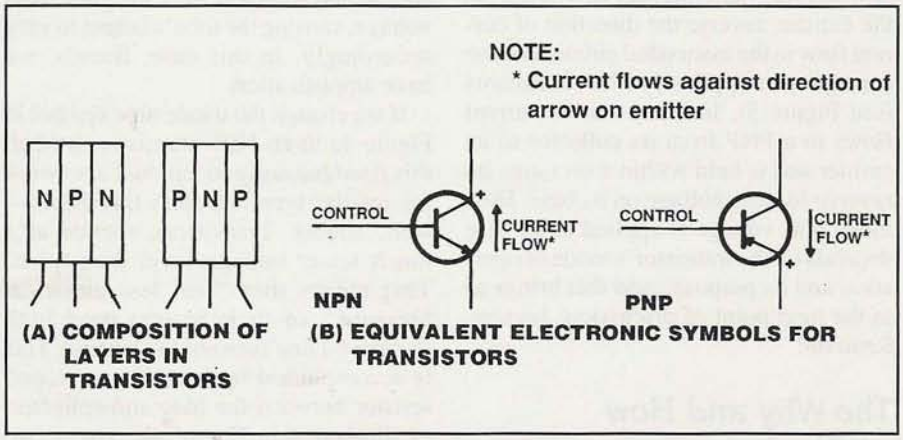


Figure 2. Physically, junction-type transistors are made by layering N- and P-type semiconductor materials (see text) as illustrated in (A). Equivalent electronic symbols for NPN and PNP transistors are shown in (B).

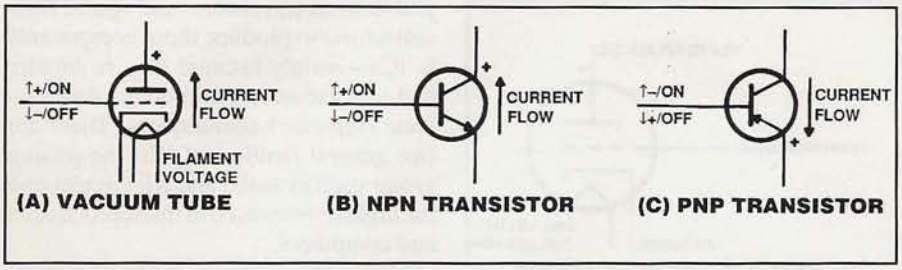


Figure 3. Vacuum tubes and transistors operate like electron valves, with the polarity and amount of voltage applied to their grid or base controlling on/off action and quantity of electrons flowing from their negative to positive elements. See discussion in text.

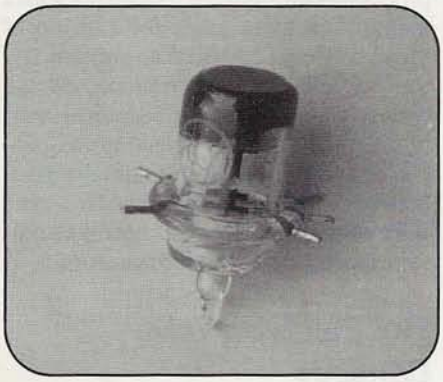


Photo B. One of the very first VHF/UHF/microwave tubes was this collector's pride RCA 955 "acorn tube." The item is still plentiful today, but you'll have to diligently search.

much smaller control signal forms the basis of what we call *amplification*.

If we consider NPNs, this valve concept can also be applied to transistors. That is, current enters at the emitter, it is varied from "full off" to "full on" by a very minute voltage applied to the base, then a larger reproduction of that signal is taken from the collector. Got that? OK, now reverse the polarities of voltage on the emitter, reverse the direction of current flow in the associated circuit, and the concept also applies to PNP transistors (see Figure 3). In other words, current flows in a PNP from its collector to its emitter and is held within a set range by *reverse biasing* voltage on its base. How much bias voltage is applied to its base depends on the transistor's mode of operation and its purpose...and that brings us to the next point of discussion: *biasing*. Read on!

The Why and How of Biasing

If a vacuum tube or a transistor is to function as an electron valve rather than just an on/off switch, it must be capable of accurately controlling current flow between its negative and positive elements. This force-controlling technique requires some assistance, which we call *biasing*. Using the familiar analogy of a water valve, you can think of biasing as a tensioning spring on the handle so it rests at a specific point and is easy (rather than difficult) to turn in either direction from that set point.

As discussed earlier, vacuum tubes require a relatively high amount of voltage or electrical pressure for operation. As a result, a small amount of "hold back" bias or negative voltage must be maintained on the tube's control grid to avoid a "full plate current" or "saturated" condition. This bias voltage can be set by a battery (not too feasible for long-term use) or by a resistor connected between a tube's control grid and ground, as illustrated in Figure 4a. Technically speaking, the ratio or values of the grid and cathode resistors establish how negative the grid is with respect to the cathode, but let's keep this simple. An incoming signal (which is AC and alternates between negative and positive polarities) then adds to and subtracts from the grid's bias voltage, causing the tube's output to vary accordingly. In this case, friends, we have amplification.

If we change the triode tube symbol in Figure 4a to an NPN transistor symbol, this *fixed biasing* concept will also work for regular type (*bipolar*) transistors—well, almost. Transistors operate at a much lower voltage level than tubes. That means they "feel less electrical pressure," so their base(s) need both reverse (-) *and* forward (+) biasing. This is accomplished by including a second resistor between the base and collector, as illustrated in Figure 4b. These two base resistors also form a voltage divider to "center the base," so to speak, with proper voltage. Then, again like a tube, an incoming signal (which is applied across the base/emitter resistor R1) adds to and subtracts from reverse bias voltage to vary the transistor's output and produce amplification.

One final point: our NPN/PNP discussion applies to regular transistors, not to "exotic" types, such as MOSFETs. Those will be discussed in a future column.

Another form of bias is *grid leak bias* (or *base leak bias* for transistors), and that will introduce us to our next topic of discussion: oscillators, which we'll be covering over the next two months. Enough theory for now, however. Let's take a break and quickly highlight a neat homebrew project with special ties to our previously discussed topics. After all, such fun pursuits are what keep ham life interesting, right?

Acorns Alive—A High-Sensitivity FSM

One of the most basic yet popular pieces of test equipment used with any and all types of amateur radio setups is a *Field Strength Meter* (FSM), a device which measures the intensity of a radio signal in the air. After using an FSM to make a couple of reference measurements, it proves handy for quick-rechecking to ensure a rig's radiated signal strength is up to its usual level, for comparing a beam antenna's front-to-back and front-to-side ratios, and for much more. Even James Bond used an FSM to find hidden spy transmitters or "bugs" in the movies.

What else can I say except that going through ham life without an FSM is like going through a day without a wristwatch. Yes, and our featured FSM is special in several ways. It is extra sensitive for checking weak signals or evaluating antenna radiation patterns from a fair distance away, it uses a classic-collectible "acorn"-type vacuum tube as shown in Photo 2 (one of the first tubes made especially for VHF and UHF, I might add), and it illustrates the technical concepts we've been discussing. This FSM circuit can also be quickly modified down the line to make a flea-power oscillator/transmitter.

Space is now tight, so read closely as we pack the following sentences with info galore! The circuit diagram of our "955FSM," plus a handy tube pinout guide, is shown in Figure 5. Basically, it works as follows: First, C1 matches or peaks an incoming signal to L1 which, in

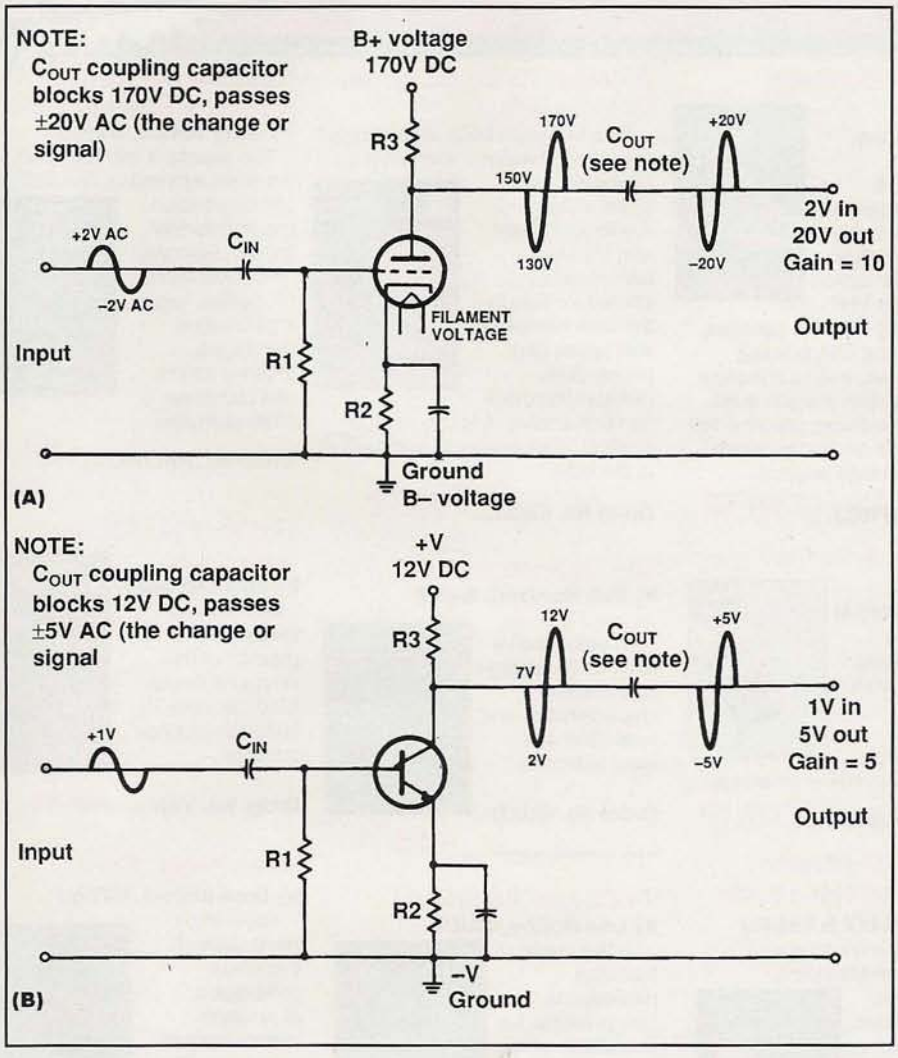


Figure 4. A bare-bones tube-type amplifier circuit (A) and the equivalent circuit using an NPN transistor (B). An incoming AC signal passes through C_{in} and is developed across R1. This varies the tube's/transistor's bias which, in turn, varies voltage drop across R3. That change in voltage is coupled through C_{out} and yields an amplified copy of the input signal.

turn, is tuned to your desired frequency by C2. The signal is then applied to the 955 acorn tube's control grid, which is biased right at the point of plate current cutoff by R1. Notice this clever point, friends. Not only does the wiring scheme for R1 vary cathode-to-plate voltage on the 955, it also ensures that the grid is always fixed-biased *more negatively* than the cathode—a prerequisite to cutting off plate current flow. A detected or incoming signal causes current to flow in the 955 (linearly, according to signal strength, rather than logarithmically, like a regular diode detector, I might add), and resultant strength/plate current is read on the meter.

As you probably surmised, homebrewing authentic classic gear of any type is quite different from quick-assembling a similar item from junkbox parts. Indeed, many of the components are genuine collectibles and are often priced accordingly. How much is that? There are no set guidelines here. I can only say pay what you feel comfortable paying and the seller feels comfortable accepting. Check hamfest fleamarkets and well-known dealers of classic parts such as Fair Radio and Antique Electronic Supply (see "Resources") for 955 tubes, their center mounting sockets, old-style trimmer capacitors, and a meter. A 100-, 200- or 500-microamp full-scale meter is ideal; 1-milliamp meter is OK if slightly less sensitivity is acceptable. Build a working showpiece! Make your friends green with envy!

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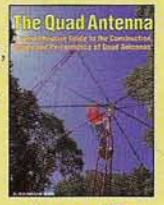

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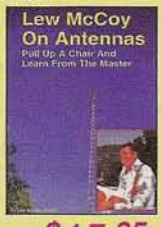

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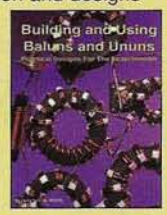

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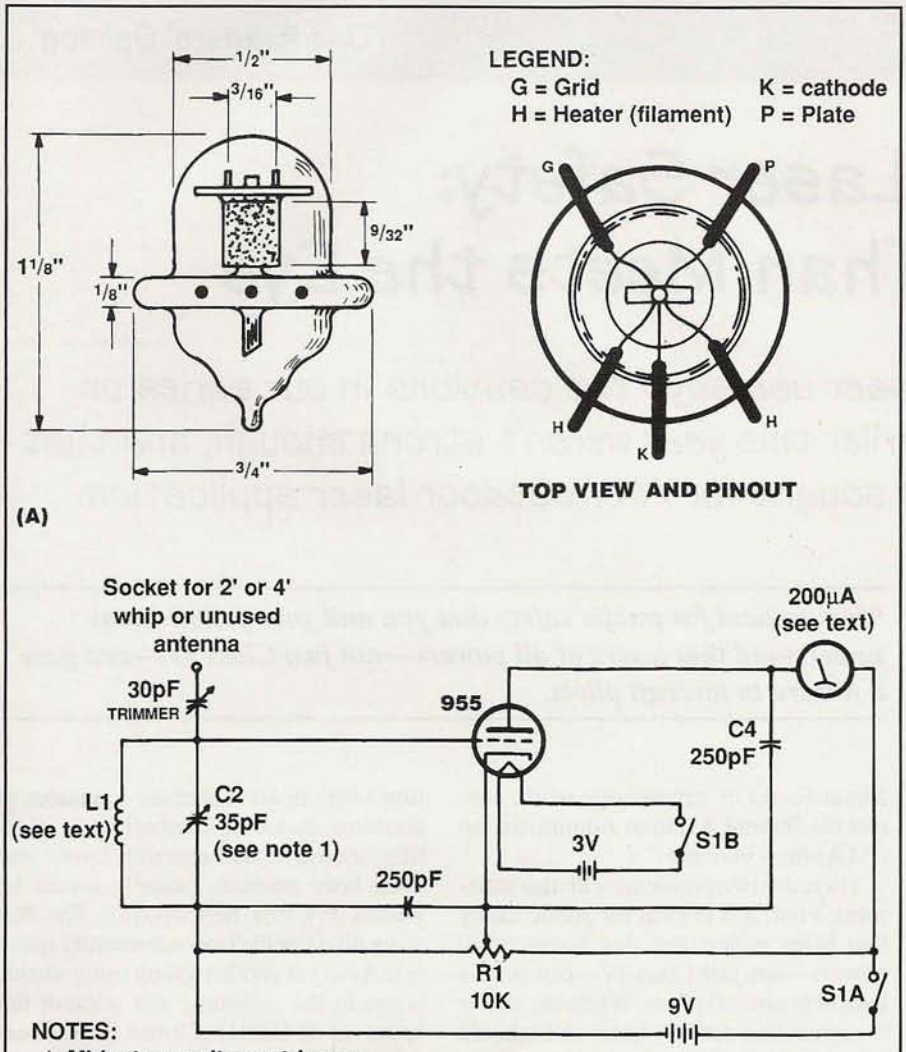

Figure 5. Pinout of the classic 955 "acorn tube" (A) and circuit diagram of the acorn tube field strength meter (B).

Original coil data for this FSM covered only 50 to 80 MHz (seven turns of number 14 enamel-coated wire wound open air style with a diameter of 1/2 inch and stretched to a length of 1 inch). Rewinding that coil for a total of only three turns, however, should extend the FSM's range to 150 MHz and higher. Finally, I should note that 9 volts is a very low plate potential, even for a little 955 (its maximum is 150 volts). In the linear amplifying detector setup, however, it is ideal. If desired, you might try series-connecting two 9 volt-batteries for even higher sensitivity. The tradeoff will be slightly less meter linearity.

Oops! We're totally out of space and must sign off for now. Stay tuned for more theory and fun projects in coming months. Next, we plan to spotlight oscillators and, believe it or not, a home-reproducible 1936 transceiver. 73,

—Dave, K4TWJ

Resources

Fair Radio Sales, 1016 E. Eureka, P.O. Box 1105, Lima, OH 45802; Phone: (419) 227-6573

Antique Electronic Supply, 6221 S. Maple Ave., Tempe, AZ 85283; Phone (602) 820-5411

On the Cover

"Weak signal is my main interest," says Francis "Shep" Shepard, W7HAH, of Stevensville, Montana, "whether it's EME or terrestrial, meteor scatter or aurora, whatever...." A ham for over 60 years, Shep says he started out on the old 5-meter band in the 1930s, but that it was his work as an air traffic controller that got him into VHF and UHF weak-signal operating. "We were hearing Chicago O'Hare's tower on 125 MHz in June, back in the 1960s, and I also saw reflections on radar—up in the gigahertz range—from ground clutter and rain up to 200 miles away. That kind of sparked my interest....When I retired in 1975, I really got into weak-signal, building my own antennas, etc."

Shep says he's worked 88 countries on 2 meters, mostly off the moon, along with all 50 U.S. states. On 432 MHz, he's worked 47 states and 41 countries; and on 6 meters, he has six countries, including the first-ever single-Yagi-to-single-Yagi EME contact with Europe—a station in Sweden, back in 1983 or 84. Speaking of Yagis, Shep has one 11-element M^2 Yagi on 6 meters; four 19-element KLM Yagis on 2 meters; and an array of 12 homebuilt 24-element Yagis on 432 MHz. Also visible in the cover photo is a dish for 1296 MHz, but he's been unable to get it put up and on the air.

The biggest change he's seen in his 61 years in amateur radio, says Shep, is that hams in general no longer build their own equipment. We're going into another change now, he added, "into computers and...seeing new types of communication, like high-speed CW on meteor scatter. It's probably not bad," notes Shep. "It makes for a very interesting hobby. We have quite a choice." (Cover photo by Larry Mulvehill, WB2ZPI)

Laser Safety: More Than Meets the Eye

An expert on outdoor laser use says the cautions in our series on laser communication earlier this year weren't strong enough, and that FAA approval should be sought for ANY outdoor laser application.

The article series, "Lasers to the Limit," by Eric Stroud, published in the March and April, 1999, issues of *CQ VHF* did not address important issues regarding laser use outdoors. Specifically, they did not note that *almost any* visible laser could distract or temporarily flashblind a pilot, and that it is therefore essential to receive a "*letter of non-objection*" in advance from the Federal Aviation Administration (FAA).

This is not a theoretical hazard. There have been numerous cases where pilots have been illuminated in flight by visible laser light similar in power and usage conditions to those described in the *CQ VHF* article. In fact, an FAA advisory group known as the "SAE G-10T Committee" has studied laser-aircraft incidents for the past five years.

Based on the SAE G10-T's work, here is more detail about laser hazards to aviation, what regulations must be followed, and recommended procedures for hams doing free-space laser communications.

"It is critical for public safety that you and your fellow hams understand that lasers of all powers—not just Class IV—can pose a hazard to aircraft pilots.

All Lasers Pose a Hazard

The April article contains the statement, "...never point a Class IV beam into the sky as this may interfere with air traffic. If you're planning to do EME (Earth-Moon-Earth) or atmospheric work, contact the Federal Aviation Administration (FAA) for a variance."

There are two problems with this statement. First, it is critical for public safety that hams understand that lasers of all powers—not just Class IV—can pose a hazard to aircraft pilots. While the article is correct that outdoor laser users should contact the FAA for prior review, it is incorrect to imply that only Class IV lasers must be reviewed. Second, it is incorrect that FAA gives variances, as explained in more detail below.

Problem: Bright Flashes

The problem is not eye-safety of pilots. It is highly unlikely that a laser below Class IV could harm a pilot's vision, especially when used in the manner described in the article. The problem is one of *distracting* pilots while in a critical phase of flight: landing, takeoff, maneuvering or emergency actions. As stated in the article, "when the telescope is perfectly aligned with the [100-mw Class IIIb American 60x] laser beam, it is extremely bright!" It is bright enough to cause effects ranging from startle and distraction to blinding glare and temporary flashblindness.

Pilots are legitimately concerned about this, and it has become an issue in the past four years or so. There are a number of concerns, including display lasers; scientific, industrial and research lasers; and even laser pointers (usually aimed by youths towards helicopters). The last thing pilots or the laser community needs is to have yet another group using visible lasers in the nighttime sky without full approval of CDRH (Center for Devices and Radiological Health) and FAA.

Regulatory Environment

Let me turn now to the regulatory environment. Ironically, the free-space communications described in the article may not be legally covered by the CDRH's regulations. The CDRH can regulate lasers—the equipment—but it can only regulate three uses: surveying, medicine, and "demonstration." In my view, use for free-space communications is not a "demonstration." Thus, there may be no legal basis for the CDRH to regulate this use. Further, the FAA has no statutory authority in this area. This is why it does not provide variances, or "approve" or "disapprove" of outdoor laser uses. Instead, the FAA issues a "letter of objection" or a "letter of non-objection."

For demonstration lasers, the CDRH requires that an FAA review be undertaken in advance for any outdoor laser display more powerful than Class IIIa

By Patrick Murphy* (pm@pangolin.com)

*Patrick Murphy is Airspace Issues Coordinator for the International Laser Display Association and a member of a Federal Aviation Administration (FAA) advisory committee called "SAE G-10T," which deals with laser hazards for aircraft. This is written on his own behalf and not in an official SAE G-10T capacity.

(5-mW, the legal maximum for laser pointers). If the FAA objects, then the CDRH will not issue a variance. But the FAA itself has no legal basis for stopping demonstrations. For all other uses (non-CDRH regulated), there is no legal requirement for prior review by the FAA. And, even if the FAA objects, there is no legal requirement to change or stop the laser use.

Someone deliberately aiming at aircraft could be charged under more general laws, such as interfering with an aircraft or endangerment (such charges have been brought, usually against ignorant individuals). But it is unlikely that a crime is committed if there is accidental exposure by a non-demonstration user, especially if the user was trying to be careful (whether or not CDRH had prior notification).

The FAA Should Always Be Notified

Having said all of the above, it is best to act *as if* one is regulated by the CDRH and FAA, whether or not this is legally required. This is the safest method, and it would certainly provide a defense should there be any legal interference (such as police officers visiting a transmission site).

To sum up to this point: *Any outdoor use of a free-space laser, where fixed-wing OR rotor craft could possibly intercept the beam, should be done only after the FAA is notified, all proper forms have been filed, and the FAA issues a written "letter of non-objection" to the laser use.*

Note that the above statement does not specify the laser power, since it is conceivable that even a Class IIIa laser, aimed at the end of a runway, could be a distraction hazard. Note also that the above statement covers almost all airspace. This is in accord with CDRH and FAA practice, which is to require FAA review even of lasers going between two buildings in a downtown area.

Now, in reality, there are some situations where the various factors of laser power, laser pointing, beam distance, local aircraft patterns, etc. are obviously safe. In these cases, it is up to an individual's judgment and comfort level whether to go ahead with free-space laser use. But I don't think that that is the case with the operation described in the *CQ VHF* article.

Based on the distances discussed in the article (4, 12, and 21 miles), it is clear that there is a lot of nighttime sky being covered by free-space communications lasers. CDRH's guidelines are that aircraft spotters are reliable in urban environments only to a distance of three miles—so a transmitter could hit a plane and not even know it. Because of this, obtaining prior FAA review should be standard operating procedure for *any* free-space communications use such as that described in the article.

More Control Needed

Laser-using hams need to be much more concerned with laser/aviation safety. There have already been incidents, with lasers in the power ranges described in the article, in which pilots have felt unable to land a plane and have turned over control to their co-pilots. You or I might not have a problem with a brief, bright flash, but pilots rely heavily on their vision, and they do not have the training to know how to react to a sudden flashblinding exposure. It becomes clear why even low-power exposures can cause in-flight problems.

Three Recommendations

Because of the importance of this issue, here are three recommendations for the ARRL and hams in general:

1) The ARRL should state that free-space laser distance records will only be certified if the operation received prior approval from appropriate authorities concerned with outdoor laser safety and if the operation was conducted within the approved guidelines. For attempts within the U.S., the ARRL would require that the operation receive and operate within a "letter of non-objection" from the FAA. This letter would be furnished as proof to the ARRL.

2) The ARRL should impose restrictions on the laser power (and frequencies) allowed for free-space laser distance records. This is consistent with regulations requiring amateur communications to use the lowest power possible at all times. This also is more sporting, as it rules out an "arms race" to merely get the biggest laser, rather than being more clever at modulation, detection, wavelength selectivity filters, etc.

3) Any articles, Web sites or other information on this topic should state much more clearly and strongly that visible lasers in free-space at nighttime are a potential hazard to aviation. The laser use must be carefully planned and, in almost all cases, should be reviewed by the FAA prior to lasing. (Invisible infrared or ultraviolet lasers also can be a hazard, but in this case they are eye hazards and should be evaluated according to CDRH or ANSI guidelines.)

Need Help? Call Me

I hope this information, summarizing a complex topic, has been clear. If you would like more information on this topic, please write to me, Patrick Murphy, c/o Pangolin Laser Systems, 771 South Kirkman Rd., Suite 113, Orlando, FL 32811; via e-mail to <pm@pangolin.com>; or call me at (407) 299-2088. Together, we can keep laser communications safe for all concerned. ■

Resources

To see photos showing what a laser beam looks like to a pilot, visit the following Web site: <http://209.121.5.101/AJshoot/AJshoot.html#Thumbnails>.

The Center for Devices and Radiological Health (CDRH), a branch of the U.S. Food and Drug Administration, may be found on the Web at <http://www.fda.gov/cdrh>, or you may request information by mail from Center for Devices and Radiological Health, Rockville, MD 20850.

Contact your local FAA center (see your phone book or go to <http://www.faa.gov/centers.htm> on the Web) for information on securing a "letter of non-objection" to your proposed laser use.

• • •

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

The Horn: A Honking Good Microwave Antenna

Think of it as a horn of plenty—plenty of signals, that is. If you operate on the microwave ham bands, the horn antenna can be a highly efficient and inexpensive way of capturing signals from other stations and sending out your own.

This month we'll cover one of the simplest (at least in concept) of all antennas: the *horn antenna* (see Photo A). It's pretty simple really, just a large funnel collecting the radio waves and concentrating them in the neck of the funnel. The radio signals then pass through the *waveguide* feedline to your receiver or a downconverter connected to a receiver.

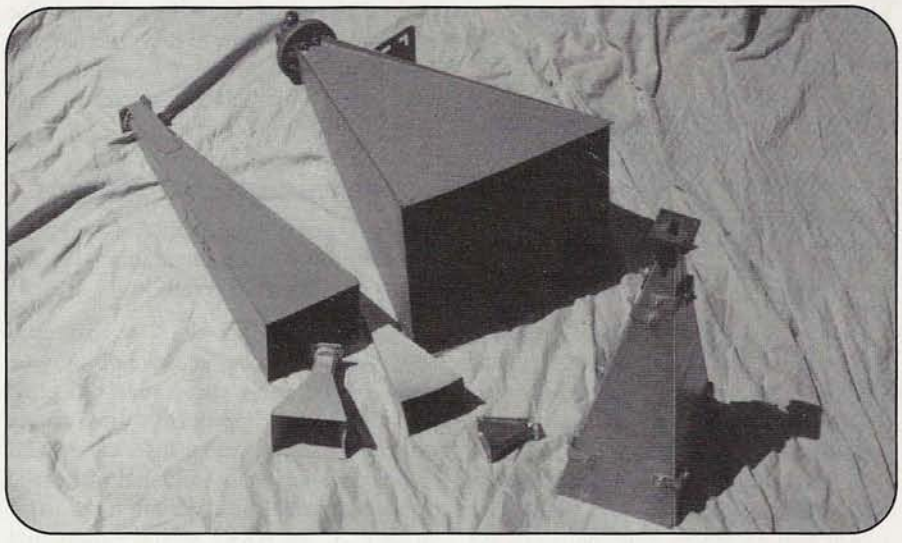


Photo A. These home-built horn antennas will operate from 4 to 24 GHz. (Photos by the author)

"The two considerations in designing a horn antenna are the* size of the opening *and the* length of the sides. *With a wider opening, the antenna catches more signal, thus increasing the antenna's* capture area. *The length of the sides controls the* phase error *in the horn."

The two considerations in designing a horn antenna are the *size of the opening* and the *length of the sides*. With a wider opening, the antenna catches more signal, thus increasing the antenna's *capture area*. The length of the sides controls the *phase error* in the horn.

In Figure 1, we see that a wave hitting the outside edge of the horn has to travel farther than a radio wave coming down the center of the horn. This will cause successive radio waves to be *out of phase* with each other, degrading the signal quality. The more we flare the horn, the greater its phase error. Making the sides longer reduces this phase error. Make the flare too small, and you don't catch as much signal. Make the flare too wide, and phase error cancels out much of your gain. So you can slap together most anything and they'll have about the same amount of gain. What we really end up with is an antenna design that's pretty "idiot resistant." I never say "idiot proof," as there are some pretty ingenious idiots out there!

Honking Big Gain

Photo B shows two examples of common 10-GHz "Gunnplexer" horn antenna systems. There are thousands of these 17-dBi-gain horns out there. The cast metal horn (top in photo) is off of one of the first Gunnplexer systems. The second horn (bottom in Photo) is a later cost-reduction version made from a metallic-coated plastic. Most of the gain of these horns comes from the outer edges of the opening. Signals coming down the very center of the horn are out of phase and create negative gain (loss). If you could eliminate this phase error, the gain of these horns would rise from their current 17 dBi to 23 dBi. That's considerable room for improvement!

One way to improve performance is to put something out in front of the horn to

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

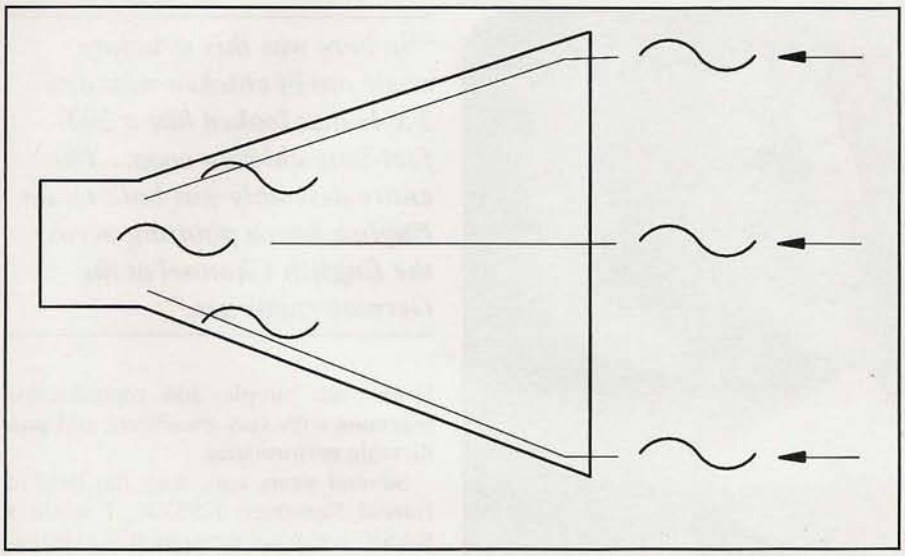


Figure 1. Radio waves hitting the sides of a horn antenna have to travel farther than those coming straight down the middle. The length of the horn is determined, in part, by the length needed to minimize phase error caused by radio waves arriving "out of sync" with each other at the antenna's focal point.

correct the phase errors. The most common phase corrector is a "lens," which works like an optical lens, even though you can't see through it (the radio waves can). Figure 2 shows how it works. As a wave travels through the denser media of the lens, it slows down. Thus, a wave traveling through the center of the lens is delayed, while waves along the edge are not. But the waves along the edge have farther to go, so the delay means more of the waves will arrive at the focal point of the antenna at the same time and in phase with each other.

If you get the thickness just right, you can get back much of the 6 dB typically lost to phase error. While the commercial companies use some really fancy plastics like Rexolite, I've had good success with Styrofoam® lenses. The lens in Photo B increased the gain of the horn by 2.5 dB. The lens may look thick, but when you think in terms of wavelengths, you realize that the lens is only four wavelengths thick. At visible light wavelengths, that would be less than the thickness of a soap bubble.

The "Infinite Balun"

A common use for a *balun* (balanced-unbalanced transformer) is impedance matching. A 4-to-1 balun is commonly found on the backs of TV sets to match 75-ohm coax to an input designed for 300-ohm twinlead. A very useful version is called the *Infinite Balun*. Let's say we want to go from 50-ohm to 75-ohm coax. If we just connect these two lines together, there will be an impedance mismatch where they are joined. This is caused by a *standing wave* (the stuff of which standing wave ratio, or SWR, is made).

But if we sneak up on it slowly, you can avoid the standing wave. By using a section of coax that slowly changes from 50 to 75 ohms impedance, no standing wave will be generated! This tapered line, or infinite balun, needs to be at least $^1/_2$-wave long at the *lowest* frequency of use. So, for 2 meters, an infinite balun needs to be about 1 meter, or 3 feet, long. When we get up to frequencies where the wavelengths are measured in centimeters, though, infinite baluns start to become very practical (see Figure 3).

The horn antenna is also an "infinite balun." The normal impedance of waveguide is about 200 ohms. The impedance of free space (including air) is 377 ohms, so the flare of the horn is helping convert the impedance from 200 ohms to 377 ohms. I want to touch on this subject a bit more—the impedance of the universe is 377 ohms??

Let's say we're beaming a signal from one antenna to another. The air, or free space, between the antennas is acting like a piece of coax cable. With a few simple experiments or calculations, it can be shown that the impedance of this "transmission line" is 120 times pi, or 377 ohms. So this means that the structure of your Yagi or ground plane antenna is also a 50 ohms-to-377 ohms impedance transformer! (This also means that if you're building a stealth aircraft, you need to find some paint with a 377-ohm volume resistivity! But we won't get into that here.)

The Sky's the Limit

Another thing to note: there's nothing in a horn antenna to limit the upper end of its frequency range. Horns are very broadband antennas. Let's say we take the typical X-band (10-GHz) horn antenna. It will usually be specified for 8 to 12.4 GHz. The absolute lowest usable frequency is where the waves get too big to fit into the waveguide, about 7 GHz. Above 12.4 GHz, the antenna pattern gets a little funny with a bunch of lobes and nulls, but the horn antenna still works.

Horn antennas are usually restricted to the microwave bands because of size constraints, but there is one case of some real-

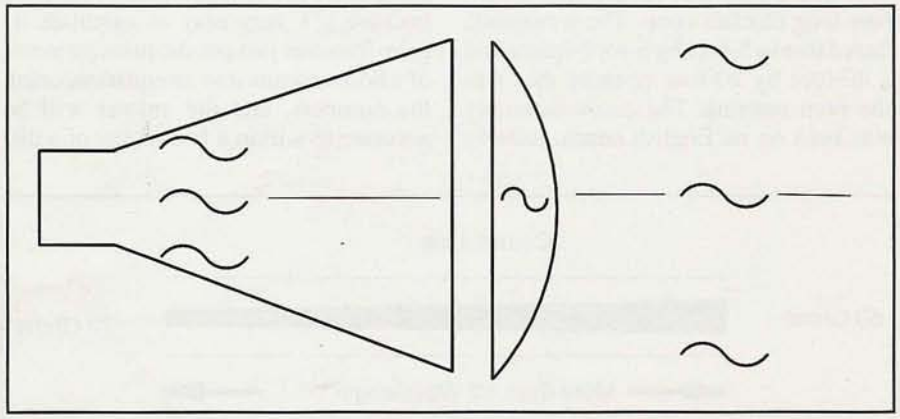


Figure 2. Putting a lens in front of a horn antenna slows down the signals entering the center of the horn, and the delay brings them more into phase with the signals traveling along the sides of the horn, which, as shown in Figure 1, take longer to reach the antenna's focal point. Reducing the antenna's phase error increases its gain.

Photo B. Two variations on the common "Gunnplexer" system. At the top is a Gunnplexer with a horn antenna, while the bottom Gunnplexer horn has a radio "lens" to reduce phase error. See text for explanation.

ly big horns antennas used at 500 MHz. The WWII German Wurskberg Radars operated near 500 MHz. To help hide the D-Day invasion, a group of Allied technicians was assigned to jam these radars like they had never been jammed before.

The design they came up with—made entirely out of chicken wire and 2 x 4s—was really interesting. Any coax of that day would have melted with the tens of thousands of watts flowing through it, so they used waveguide as feedline. Waveguide is really just a tube that traps and holds radio waves. At 500 MHz, waveguide is about 5 feet by 5 feet. So here was this structure made out of chicken wire and 2 x 4s that looked like a 200-foot-long chicken coop. The waveguide flared from a 5-foot by 5-foot square into a 40-foot by 20-foot opening that was the horn antenna. The entire assembly was built on an English beach pointing across the English Channel at the German radar net.

A quick calculation shows this combination chicken coop and little league backstop would have had about 24 dBi gain. I don't think the Germans saw them coming! An interesting idea for a 432-MHz EME antenna as well.

Horns as Reference Antennas

When measuring antenna gain, you need a *reference antenna*. This is an antenna for which you accurately know the gain. Whenever possible, I use a horn antenna as my antenna range reference because it's very easy to calculate its gain. You can just put the measurements of a horn antenna into an equation, crank the numbers, and the answer will be accurate to within a few tenths of a dB.

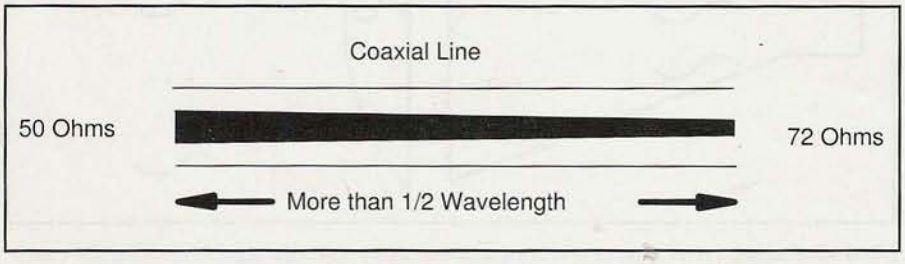


Figure 3. An "infinite balun" slowly changes impedance of a line so that no standing waves are generated and no mismatch occurs. A horn antenna serves as one type of infinite balun—between the feedline (waveguide) and air! See text for details.

"So here was this structure made out of chicken wire and 2 x 4s that looked like a 200-foot-long chicken coop....The entire assembly was built on an English beach pointing across the English Channel at the German radar net."

Horns are simple and reproducible antennas with very consistent and predictable performance.

Several years ago, with the help of Harold Reasoner, K5SXK, I wrote a BASIC computer program that calculated the gain of a horn antenna from its measurements. Drop me an e-mail at <wa5vjb@cq-vhf.com> and I'll forward you a copy. Perhaps some of you who are really into programming would be interested in updating the program into a graphical interface!

It's in the Can

An excellent way of making low-gain horn antennas is with empty cans. For example, a 3-pound coffee can works pretty well on 1296 MHz; 2-pound coffee cans make nice 2304-MHz horns; soup cans are pretty good at 3456 MHz; and save those little tomato juice cans for 5760 MHz. We'll be covering how to build these next time. And, while I haven't seen any cans small enough for 10 GHz or 24 GHz, there are some common copper plumbing fittings that work pretty well for building horn antennas for those frequencies.

Reader Feedback Wanted

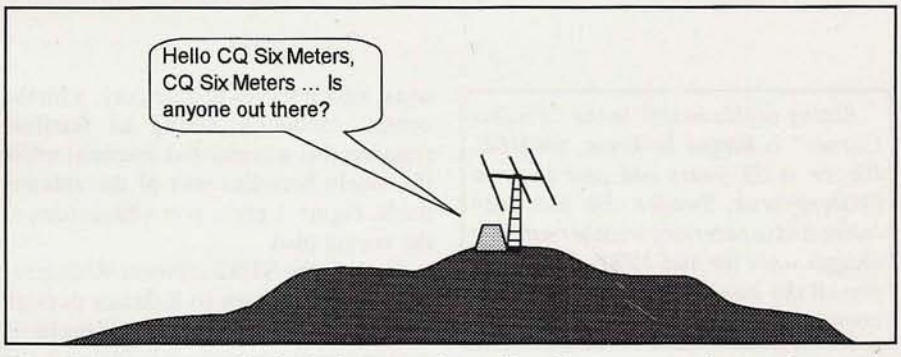
Well, I've been doing this column for over a year now. Mostly, I've been talking about what *I* find interesting. So, what else would *you* find interesting? Drop me an e-mail to the above address if you have any topics you would like covered. Yes, yes, I know, you want a 26-dBi-gain, three-element Yagi for 2 meters, but the laws of physics may limit my responses.

Finally, I would like to make a plug for the Central States VHF Society. The CSVHFS is one of the premier organizations in the world devoted to VHF and UHF activity. Membership is only $5 a year and well worth it. For more info, you can contact me or visit their Web site at <http://www.csvhfs.org>. ■

The Best Laid Plans of Mice and Hams...

A trip to activate a rare grid on 6 meters might seem easy... until you begin to understand why the grid is rare to begin with.

This month's column is dedicated to those of us who have terrific intentions of activating rare grids on 6 meters, but fall victim to any one of a number of things can come along to create havoc. "Murphy" is no stranger to the Magic Band. (*In case you've been living in a cave for the past 20 years, Murphy's Law states that "anything that can possibly go wrong, will."—ed.*)



Expeditions to rare grids don't always work out. Even if you can get there and get on the air, there may be no 6-meter band openings during your visit. And, yes, for our sharp-eyed readers, this is the same drawing that appeared (mistakenly) in our July issue. It belongs here, though.

Grid-Lock

Some grids are rare simply because there are few hams in them; others are rare because there's some sort of access problem. A few land grids fall into this limited access category, such as EL 58, a major swamp area at the far southeast corner of Louisiana. Plus there are islands just off of the mainland U.S. coast, such as Dry Tortugas (EL 83) off Florida and San Clemente Island (DM 02) off California, that are the only land masses in a grid.

But there are also many grids that are rare because they're all-water. Fortunately, we have dedicated operators like Clint Walker, W1LP, who makes several runs each year through all-water grids as part of his job as chief mate on a chemical carrier going up and down the U.S. east coast. However, a few all-water grids are so tantalizingly close to land that many dedicated 6-meter operators dream of activating them.

FN40 or Bust!

One of the all-water grids needed by many 6-meter operators is FN 40, just off of the coast of Long Island, New York. While many grid maps show FN 40 appearing to touch land, the closest point is actually a quarter-mile from shore. But being an all-water grid is only part of FN 40's access problem: The land facing this grid is entirely ocean beachfront with no deep-water docking facility where you could launch a boat large enough for ocean travel. The nearest harbor is nine miles away, and locating a boat for hire becomes another issue, anyway, one that involves significant expense. Plus, the waters in this area can get quite rough, so luck with the weather is needed as well.

In recent years, a number of groups have looked into activating this grid, only to run into these problems and subsequently decide to cancel their griDXpedition. A ham with a big boat in this area would be a very valuable combination!

The Propagation Equation

But, of course, the worst problem is the flakiness of 6-meter propagation in general, even during the strong summertime sporadic-*E* season. A few summers ago, I planned a short grid-square trip to FN 04, a rare grid in upstate New York. I was planning to operate out of my car with a decent amount of power from a state park on Lake Erie. The only problem was that there was no cooperation from the gods of propagation! I heard one brief opening to Florida during my overnight stay there, but couldn't work anyone. So much for the anticipated pileups!

In light of the potential of being skunked, one should plan on combining a grid square trip with other activities, such as camping or fishing, so the trip will still be fun, even if the temperamental Magic Band doesn't open up. Another suggestion is to bring some HF capabilities for 10- and/or 15-meter operation for filling up time between openings on six.

Still, don't let the potential problems discourage you from giving it a try. Sometimes, all the pieces do fit together just right, and then maybe dozens of people will work a new grid thanks to your griDXexpedition, and you'll become a Magic Band hero! ■

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

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

The W3KH Quadrifilar Helix Antenna—A Simpler Approach

This circularly polarized antenna is excellent for satellite reception, says the author, but is difficult to build as originally published. Here, SM5IBE offers a simpler approach to building the W3KH helix.

Sitting in this month in the "Project Corner" is Birger Eriksson, SM5IBE. Birger is 82 years old and lives in Oesterbybruk, Sweden. He has been interested in receiving weather satellite images since the mid-1990s. Considering all the snow on the ground, that's completely understandable!—ed.

Back in the August, 1996, issue of *QST*, Eugene Ruperto, W3KH, described his design for a *quadrifilar helix* antenna—four wire elements wound into two concentric loops—that is ideal for receiving weather satellite pictures in the 137- to 138-MHz band[1]. (A year later, Ruperto followed up with another QST article on weather satellite receiving techniques[2].) Having recently become interested in weather satellite reception, I read the article and decided that the quadrifilar helix would be much better than any other antenna for receiving these signals. (In fact, this circularly polarized antenna is good for working any low-Earth-orbit satellite.)

However, I found it difficult to visualize the antenna and the steps required to build it. I believe that I've come up with a clearer way of explaining and illustrating the construction of the antenna, and I've corrected one error I found in the original article.

Theory of Operation

The quadrifilar helix antenna essentially consists of two dipoles, one slightly longer than the other, wound into a cylindrical shape around a PVC form. One leg of the bigger dipole is a piece of coax, which serves double duty, with the center conductor acting as feedline (making this a center-fed antenna) while the shield becomes part of the antenna itself. Figure 1 gives you a basic idea of the wiring plan.

Turning the S1/S2 segment 90 degrees and folding it down so it passes through the B1/B2 segment will result in the basic antenna arrangement seen in Figure 2. It's not quite this simple in practice, though, because the wires must be twisted into a helix to provide circular polarization. Figure 3 shows a detailed look at the wire connections, and Figure 4 shows you how to hook everything together at the top and bottom of the antenna. You may notice that Figures 1 through 3 show an SO-239 coax connector at the bottom of the antenna, while Figure 4 shows a direct con-

Photo A. The author holding his finished quadrifilar helix antenna, as modified from the original presented in QST *in 1996 (see notes). (Photos courtesy of the author)*

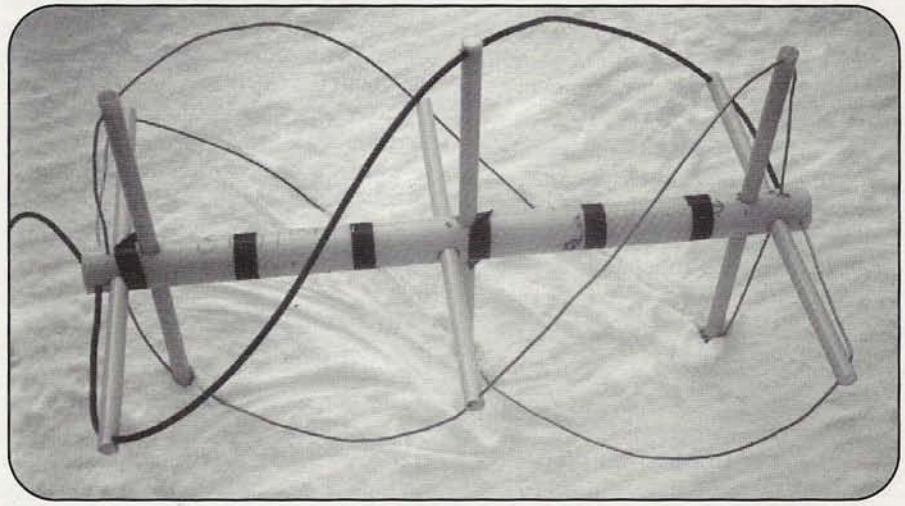


Photo B. Close-up view of the quadrifilar helix antenna. This model uses thinner RG-58 coax rather than the RG-8 used in the original. See text and figures for the function of the coax within the antenna.

By Birger Eriksson, SM5IBE (sm5ibe@swipnet.se)

Weather Satellite Receiving Basics

Here's all you need for receiving weather pictures:

- Circularly polarized antenna
- Low-loss coax
- Weather receiver
- Computer (386 or better) with sound card (the output from the weather receiver goes to the microphone connector on the sound card)
- Program for satellite tracking (e.g., Nova for Windows)
- Program for converting the signals from the weather receiver (e.g., WXsat).

Download the Keplerian elements for the weather satellites (available free on the Internet from AMSAT, ARRL, N2WWD, and others, in the same file as amateur satellite element sets) and copy the file into your tracking program. Then, when a satellite is "in view," make sure your receiver is on and your antenna is connected. The data from the satellite will flow from your receiver into your computer, where your conversion program will turn it into a map on your screen. It's that simple.

See "Resources" for information on downloading WXsat, a freeware program for decoding the satellite signals. A brief tutorial on setting up and operating this program is in W3KH's August, 1997, *QST* article[2].

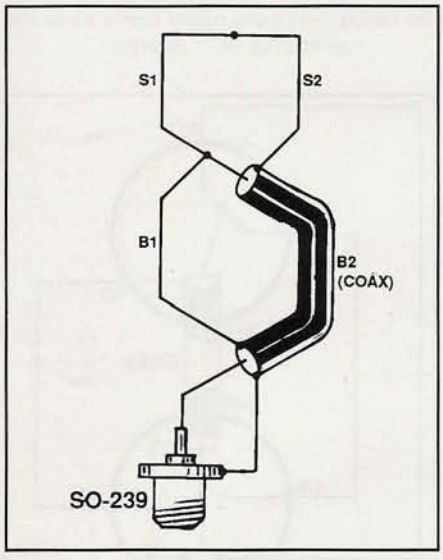


Figure 1. Basic wiring of the quadrifilar helix antenna. Wires S1 and S2 constitute the small loop, while B1 and the coax (B2) make up the big loop. The small loop will be twisted 90 degrees and folded down in the final antenna. Note that the coax shield is part of the antenna, while the center conductor operates as a feedline to make this a center-fed antenna.

nection to a coax feedline. Either way will work. I ended up using the direct connection method. You'll need to refer back to these figures as you build the antenna.

Starting with the Original

The original description in *QST* tells us that the antenna must be built as two cylinders of wire: a small inner one, and a larger outer one (see Photos A and B). One half of the outer loop is coaxial cable, which acts as part of the antenna, as well as feedline. There is a center tube of PVC pipe, and two sets of PVC support elements, one set for each wire cylinder.

The inner cylinder has a diameter of 13.4 inches and the original drawing shows that the small horizontal supporting tubes must have a length of 13.5 inches. This is OK, but I noticed that the measurements for the outer cylinder showed its diameter as 14.86 inches, while the supporting tubes were supposed to be 14.75 inches. This won't work. The length of the supporting tubes must be longer than the diameter of the cylinder. The tubes for the outer cylinder must be 1/2-inch wider than the diameter of the wire cylinder, or approximately 15.4 inches.

In addition to this one error, I found the instructions for assembling the antenna to be somewhat confusing, and I came up with what I believe is an easier-to-follow approach. Here are some hints for you to make the antenna the easiest way.

The Easy Way

The "big" vertical tube is made from 40- to 50-millimeter (1 1/2- to 2-inch) plastic. Fifty mm (2-inch) is better as you'll have more space at both ends of the tube to solder the wires. (The center tube ends up being vertical, as the antenna should be mounted vertically, as shown in Photo C.) Make the big tube 63.5 centimeters (25 inches) long. If you make a longer tube, it will be hard to solder the wires at the ends of the tube.

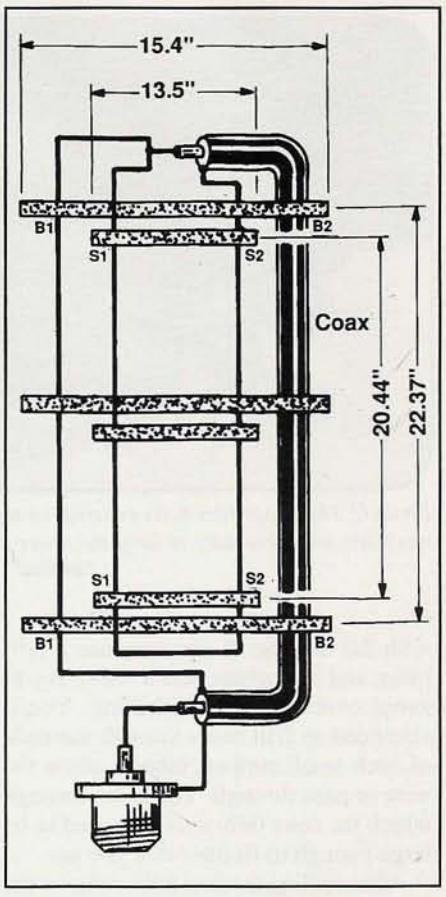


Figure 2. Arrangement of the concentric loops in the quadrifilar helix antenna, along with dimensions for the support tubes (top) and the wire elements (side). The braid of the coax must be the same length as wire B1. See text for additional details.

Next, put 15 to 20 mm (1/2 to 1 inch) of masking tape over one length of the big tube. Turn the tube 90 degrees and repeat the taping. Now, mark one piece of tape at the following distances from the "top" of the tube: 3.4, 33, and 60.5 centimeters (1.35, 13, and 23.85 inches). Then mark the other tape at the following distances from the top: 5.5, 31, and 58 cm (2.15, 12.2, and 22.85 inches).

The supporting tubes are also made of plastic. You may use whatever you can get in a diameter of 12 to 16 mm (rough U.S. equivalent: 1/2- to 3/4-inch PVC tubing). Buy an 8-foot piece of pipe (or two 4-foot sections) and cut into six supporting tubes, three 13.5 inches long, and three 15.4 inches long.

Now you need to drill holes for the supporting tubes at the markings on the big tube. Observe that these tubes must fit tightly inside the drilled holes in the big tube, so use a drill bit only slightly larger than the outside diameter of your small support tubes. Be as precise as possible

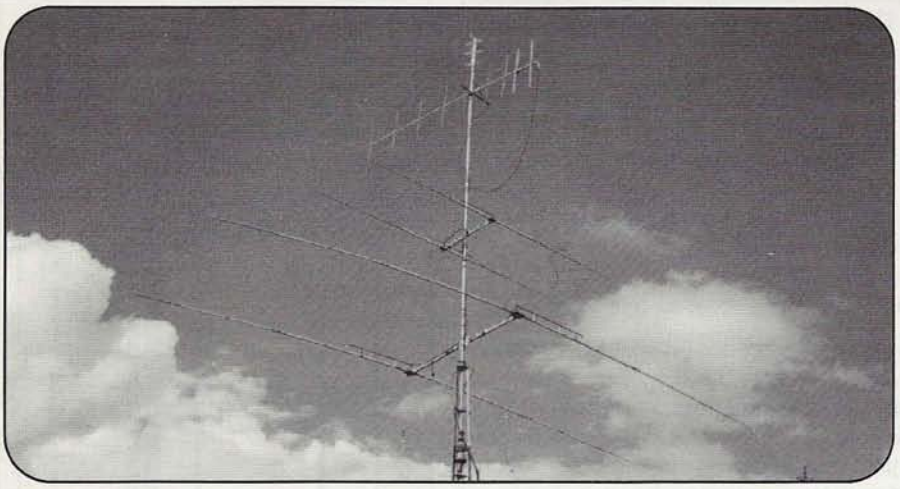


Photo C. The quadrifilar helix mounted on top of SM5IBE's tower. The author found that top-mounting was necessary to keep the tower itself from blocking signals when satellites were "behind" the tower.

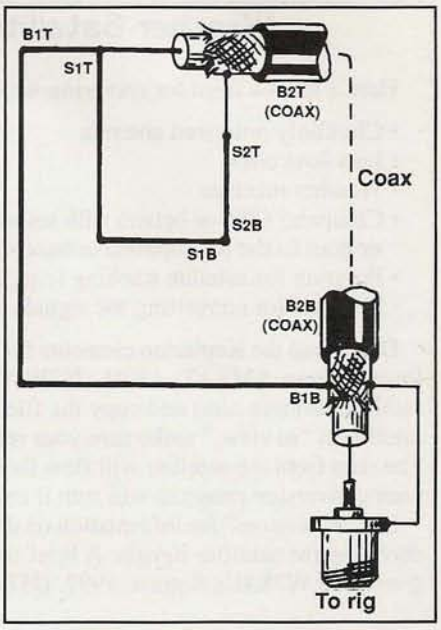


Figure 3. Detail of the connections between the various wires and cables that make up the quadrifilar helix antenna.

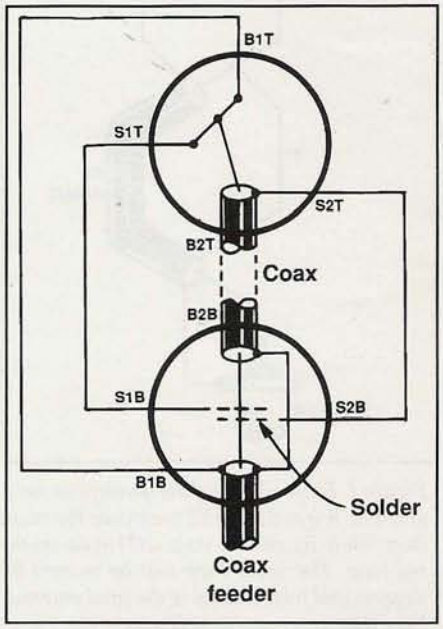


Figure 4. Detail of wire connections at each end of the center support pipe. See text for additional explanation.

with the drilling; if you can, use a drill press and a machine screw vise. Try to avoid oval holes when drilling. You'll also need to drill holes through the ends of each small support tube to allow the wire to pass through. The holes through which the coax (B2) will pass need to be large enough to fit the cable you use.

After drilling the first hole, remove the big tube from its support and put one of the smaller tubes in the first drilled hole. This will help you align the tube to drill all the other holes to match, both horizontally and vertically, giving the antenna a professional look when finished. After drilling, insert the supporting tubes in the big tube from the top as follows (L = the long tubes, S = the short tubes): L S L S S L. Center the tubes and make sure you have the bigger holes in the proper position for the piece of coax.

Attaching the Wires

Now, drill holes at the ends of the supporting tubes and mount the wires and the coax. Solder the wires and the coax as shown in Figures 3 and 4. Use 2.5-mm (.1 inch, or #10) copper wire. Begin by running wires S1 and S2—the wires that form the inner cylinder—from top to bottom and back up again. The lengths of the wires are 110.8 cm (43.64 inches) for the inner cylinder and 122.2 cm (48.1 inches) for the outer cylinder.

It was impossible for me to make the whole inner wire in one piece. I had to cut the wire in the middle (at the bottom) and solder the two wires together, side by side. This soldering caused trouble because the completed wire was now shorter than it was supposed to be (see the wire I had to add in Photo D). If you solder the wires for the inner cylinder side-by-side at the bottom, as I did, make the inner wire longer (112 cm, or 44 inches) to start with. Then cut it in half.

You should have no such problems with the other wire and the coax, since the design calls for two separate pieces of wire. I changed the RG-8 in the original to RG-58, a coax with smaller diameter but the same velocity factor as RG-8.

The coax has several functions. For instance, the braid is a part of the antenna itself, while the inner wire is the feedline. In addition, the coax serves as a $^1/_4$-wave matching transformer, assuring an antenna impedance of 50 ohms. Odd-numbered $^1/_4$-wavelengths of coax at a given frequency act as impedance transformers, so a $^3/_4$-wavelength piece of cable (122 cm, or 48.1 inches, in this case) provides a match for 50-ohm coax feedline to the radio.

While the *QST* article showed an SO-239 coax connector at the bottom of the antenna, I found I had too little space, so I soldered the receiver feedline directly to the antenna wires. If you have room to mount a connector in a PVC end cap, then you'll give yourself more flexibility in disconnecting the feedline if you need to.

Checking for Resonance

When my first antenna was finished, I used an MFJ-259 SWR analyzer to measure the resonant frequency, which turned out to be 138.0 MHz. This was too high, as I wanted the resonant frequency to be in the middle of the weather satellite band, at 137.5 MHz. The reason for the higher resonant frequency was the wire that was shortened when it was cut in half and soldered side by side at the bottom. To bring the resonant frequency down 500 kHz, I had to cut S1 and S2 a bit up on the wires (in the middle of the cylinder; see Photo D), add $^1/_2$ inch to each wire, and then solder them back together. Now the resonant frequency was 137.5 MHz and the SWR was 1:1.

Table.

Component	137 MHz	146 MHz
PVC Center tube (1.5–2 inch diameter)	25 inches (63.5 cm)	26 inches (66 cm)
Mark locations for drilling holes (1 side; measure from top)	1.35 in. (3.4 cm), 13 in. (33 cm), and 23.85 in. (60.5 cm)	1.35 in. (3.5 cm), 12.2 in. (31 cm), 22.4 in. (57 cm)
Mark locations for drilling holes side; see text)	2.15 in. (5.5 cm), 12.2 in. (31 cm) and 22.85 in. (58 cm)	2.2 in. (5.5 cm), 11.6 in. (2nd (29.5 cm), 21.5 in. (54.5 cm)
Length of supporting rods (S= small; B= big)	S: 13.5 in. (34.3 cm) B: 15.4 in. (39 cm)	S: 13.5 in. (34.3 cm) B: 15.4 in. (39 cm)
Wires S1 and S2 (each)	43.64 in. (110.8 cm); if soldering wires at bottom, make each 44 in. (112 cm) long, overlap to solder.	41.9 in. (104.4 cm); if soldering wires at bottom, make each 41.75 in. (106 cm) long, overlap to solder.
Wire B1 (& length of coax braid, B2)	48.1 in. (122.2 cm)	45.3 in. (115.1 cm)

Table. Dimensions of quadrifilar helix components for 137 MHz (weather satellite) and 146 MHz (amateur satellite) applications. Lengths are in inches, with metric measures in parentheses. For reference, 1 inch = 25.4 millimeters (mm), or 2.54 centimeters (cm). To adjust resonant frequency, make S1/S2 longer (lower frequency) or shorter (higher frequency).

Once you've made your first antenna and gotten everything adjusted properly, it's very easy to copy...and it costs almost nothing!

Performance Testing

W3KH told us in his first article that he had used different types of antennas for circular receiving, but that this antenna was an absolute top item. I agree. Other antennas consisting of several dipoles and phasing harnesses cause reduction of the signal at some spots and this will make black lines in the picture. The reception on the quadrifilar helix is fade-free, with no dead spots at all. When the satellite is above the antenna, there is no reduction of the signal. I can receive a very good picture even when the satellite is 2 to 3 degrees above the horizon, letting me copy images from the Mediterranean Sea up to Greenland (Photos E and F).

I bought the Hamtronics R-139 weather satellite receiver. This receiver is small, about 11 x 11 x 6 cm (4.3 x 4.3 x 2.3 inches), with very little space inside the receiver. But I managed to make some modifications. I mounted a speaker inside the box for hearing the signal and a switch for turning the speaker on and off. On the back of the box is a 9-pin connector to a computer. I changed it to a coax connection to the computer's microphone input. Then I mounted a 12-volt contact for external power (or you can take power from the computer), along with an "idiot diode," in case the polarity was wrong, and a fuse. The receiver has a volume control, which has to be combined with the computer's volume control at the sound card to get a perfect picture. There is also a squelch.

The receiver has crystals for five frequencies: I installed NOAA-12's 137.300, 137.400, and 137.500 MHz downlink frequencies; 137.620 for NOAA 14 and 138.850 for the Russian METEOR satellite. These are what we can receive at the moment (late 1998) here in Sweden. The receiver is set up to scan on the five frequencies, and you can automatically record incoming signals on a tape recorder when the squelch opens during scanning.

The Hamtronics weather satellite receiver R-139 seems to have a very high sensitivity. From the top of my tower, I have 20 meters (65 feet) of RG-8 coax

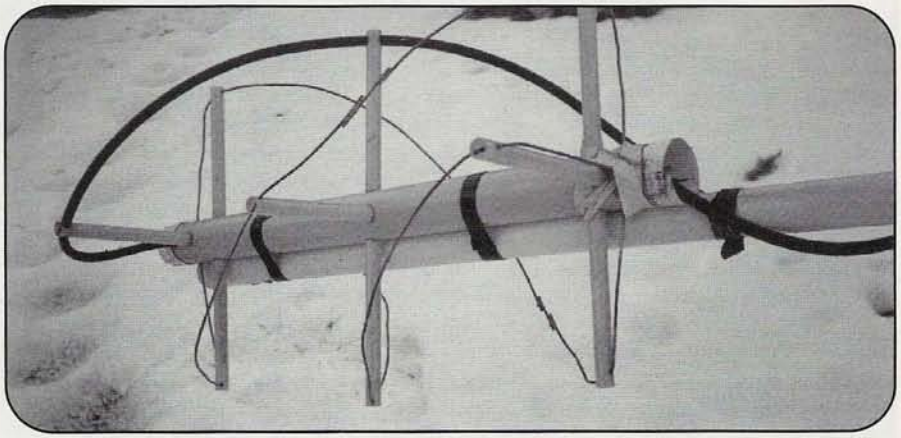


Photo D. Another close-up view of the antenna. Note that, especially if RG-8-sized coax is used, you will need to drill bigger holes in the supports where the coax goes through than where the wire goes through. Since the antenna will be mounted vertically, the author left the bottom end uncapped to allow any water that gets inside to drain.

Photo E. Satellite photo of northern Europe as received by SM5IBE. Norway and Sweden appear to have clear skies, while it's cloudy over England and northern Germany.

without a preamp, and I get excellent pictures from over all of Europe. (See "Resources" for contact information.)

Some Experiences

At first, I put the antenna halfway up my tower on the west side (the tower is 20 meters, or 65 feet, high). Sometimes I got perfect pictures; sometimes there were black lines over the picture caused by a lack of signal to the antenna. When the satellite was passing east of the tower, I realized, the iron bars in the tower caused reduction of the signal. To get perfect pictures regardless of satellite location, I had to move the antenna to the top of the tower, free from shadowing objects. Since I moved it to the top of the tower, the only time I get black lines is when an airplane passes between my station and the satellite as I'm receiving a photo.

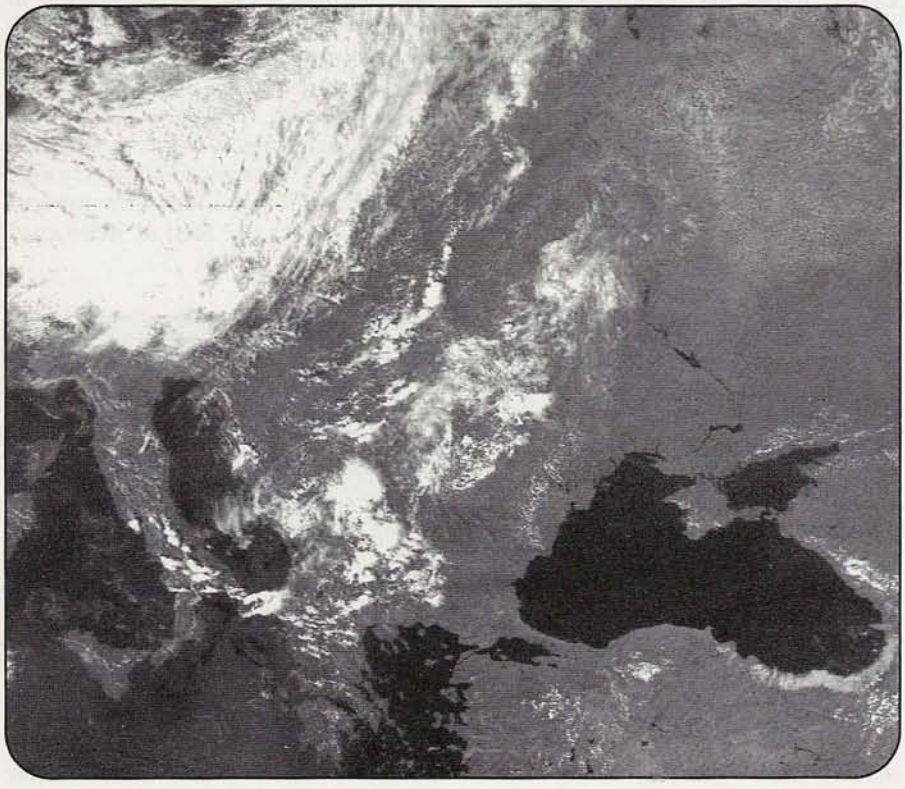


Photo F. A wider satellite view of Europe, on a day when most of northern Europe was covered by clouds. Clearly visible in the lower part of the photo, though, are Italy, Greece, Turkey, and the Black Sea.

Ham Band Use

While this antenna is designed primarily for receiving weather satellite images, it's also an excellent choice for amateur satellite communications. Of course, you'll have to change the dimensions to make the antenna resonant on an amateur band, such as 2 meters. See the Table for the specific measurements you'll need to build this as a 146-MHz antenna. Regardless of which band you build it for (*it's cheap enough; build both!—ed.*), you'll find that the quadrifilar helix antenna is an excellent performer with 360-degree coverage and no dropout.

Have fun...and figure out for yourself whether you're going to need an umbrella tomorrow! ■

References

1. Ruperto, Eugene F., W3KH, "The W3KH Quadrifilar Helix Antenna," *QST*, August, 1996, pp. 30–34.
2. Ruperto, Eugene F., W3KH, "An *Easy* Way to Copy the Weather Satellites," *QST*, August, 1997, pp. 36–39.

Resources

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

Hamtronics, 65 Moul Rd., Hilton, NY 14468; Phone: (716) 392-9430; Fax: (716) 392-9420; E-mail: <jv@hamtronics.com>; Web: <http://www.hamtronics.com>.

MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; Phone: (601) 323-5869 (8–4:30 Central time, M–F); Orders/Dealer Locations: (800) 647-1800; Fax: (601) 323-6551; Web: <http://www.mfjenterprises.com>.

Nova for Windows is available from AMSAT, P.O. Box 27, Washington, DC 20044; Phone: (301) 589-6062; Fax: (301) 608-3410; Web: <http://www.amsat.org>.

WXsat software is available online at <http://ourworld.compuserve.com/homepages/HFFAX/toc6.htm>. The software, by Christian Bock, is free for personal, amateur, and school use.

Picture This!

"Phun Photos"

Young Ham of the Year

Michelle Swann, KE4EZI, of Warner Robins, Georgia, has been named the 1999 "Newsline Young Ham of the Year" (YHOTY). The award is jointly sponsored by Amateur Radio Newsline, Yaesu USA, and *CQ* magazine. Michelle is 17 and a member of a four-ham family. Her father, Mark, is KR4YH; her mother, Jean, is KE4GRO; and her younger sister, Tiffany, is KF4DGT.

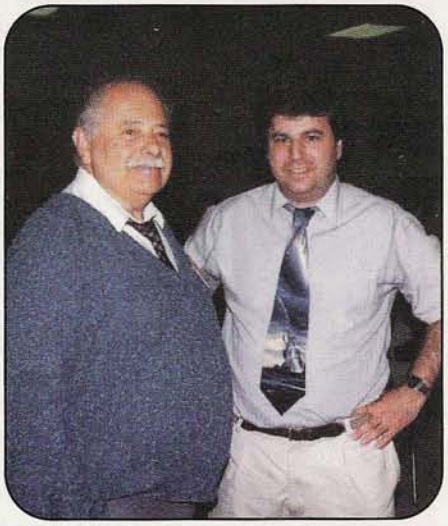
According to a news release from Newsline, Michelle was selected as this year's YHOTY recipient based on her six-year amateur radio career that has been dedicated almost exclusively to public service work, including support communications during the 1994 Georgia floods and last year's Atlanta tornadoes.

A recent graduate of Houston County (Georgia) High School, Michelle was accepted to some of the nation's top engineering schools, including the Georgia Institute of Technology, the Massachusetts Institute of Technology, the California Institute of Technology, and Stanford University. She chose Cal Tech and began classes in September. One of her possible long-term goals is to become an astronaut.

As "Young Ham of the Year," Michelle received, courtesy of Yaesu USA, an expense-paid trip to the 1999 Huntsville Hamfest, along with a gift of Yaesu ham radio equipment. *CQ* magazine treated her to an expense-paid week in Spacecamp Huntsville, as well as a variety of CQ products. Newsline provided Michelle with a commemorative plaque, whose cost this year was underwritten by Dave Bell, W6AQ, President of DBA Entertainment Inc., Hollywood, California. Congratulations, Michelle, from the whole CQ family. (Photo courtesy Bill Pasternak, WA6ITF/Newsline)

Rhode Island Skywarn Training

Volunteer severe weather spotters in Rhode Island had their heads in the clouds recently at a Skywarn training session held in West Warwick. The guest speaker was Warning Coordination Meteorologist Glenn Field (in blue tie and white pants in photo at right), from the National Weather Service forecast office in Taunton, Massachusetts. Pictured with him is ARRL Rhode Island Section Emergency Coordinator (SEC) Martin Mendelson, N1JMA. In the photo below, Field is explaining the finer points of severe weather spotting to the class of some 40 volunteers. (Photos courtesy Dan Roy, KA1BNO)



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!

Basics

Weak-Signal Modes

Weak signal is a general term used to describe Morse code (CW) and single-sideband (SSB) activities on VHF, UHF, and above that rely on *natural phenomena* to extend signal ranges beyond "line of sight." These natural phenomena include Sporadic-E and tropospheric propagation, aurora, meteor scatter, and Earth-Moon-Earth (EME, or "moonbounce") communication. The use of satellites and amateur television (ATV) is not generally considered "weak-signal" work, since no natural phenomena are at work. Even so, a good 70-centimeter/2-meter satellite station generally makes an excellent weak-signal station.

The term, "weak signal," by the way, refers to a station's ability to *receive* and make sense of a very weak signal. Serious weak-signal operators use serious power and serious antennas, but even a strong signal will sound weak by the time it reaches your receiver after, let's say, a round-trip to the moon.

Station Requirements

Basic needs for operating any of the weak-signal modes include a *multimode* transceiver capable of operating on SSB and CW, a directional antenna, and some education on the characteristics of the various weak-signal modes. When you want to go beyond the basics, you'll probably want a bigger, higher antenna; more power; a bigger, higher antenna; a receiver preamplifier; and—you guessed it—a bigger, higher antenna. You'll also want to learn Morse code, which hams typically abbreviate as *CW*.

Why CW?

You don't *need* to learn the code to do weak-signal work. So why would you *want* to? The answer is quite simple. Even though there's plenty of weak-signal work done on SSB, when signals are barely audible—and that's the usual state of affairs for such modes as EME and meteor scatter—code will get through when a voice signal won't.

Why? Because your brain only has to interpret simple sequences of dots and dashes from a CW signal, rather than the complex (and often distorted) voice patterns of SSB signals. Because of this, virtually all EME and meteor contacts are made on CW, as well as many other contacts on other weak-signal modes.

Why SSB?

Single sideband is used instead of FM for voice contacts on weak-signal modes for a variety of reasons. First, it uses less bandwidth. You can pack nearly twice as many SSB signals as FM signals into the same chunk of frequency space. Plus, narrower-bandwidth signals travel farther, meaning you'll get greater range on SSB than on FM (the same applies for CW versus SSB). And finally, SSB doesn't have the *capture effect* that's found on FM. This is the phenomenon by which the stronger of two FM signals

Carl Ebhardt, W4HJZ, operates weak signal as well as satellites from his well-equipped shack in Raleigh, North Carolina.

"captures" a frequency, totally wiping out the weaker station. On SSB, it's possible to pull out what a weaker station is saying, even in the presence of a very strong signal on an adjacent frequency.

Why Weak Signal?

What is the appeal of weak-signal modes, where signals are normally marginal and you often have to struggle just to exchange signal reports? Why not just use FM?

First of all, FM is easy, and most weak-signal operators aren't looking for "easy." They're looking for challenges.

Second, weak-signal work satisfies the primal DX urge of most hams. SSB and CW signals travel farther than FM signals every day, providing regular contacts on 2 meters, for example, of 200 to 400 miles. *Band openings*, or periods of enhanced propagation, can easily double that range. And when you add in such exotic modes as aurora, meteor scatter, and EME, distances covered can be in the thousands of miles. Try that with your FM rig!

Third, there's a greater technical challenge in assembling and operating an effective weak-signal station than in plugging in and turning on an FM rig for repeater use.

Finally, there are greater opportunities for competitive challenges through awards programs and the variety of VHF/UHF contests held each year. Virtually all of these require "direct" contacts, that is, without the help of repeaters.

Educational Opportunities

Unlike repeaters, which can be operated by the average 8-year-old with no special training, working weak-signal modes requires that you further your education—whether it's learning about the flow of solar particles to understand aurora, studying astronomy to predict your best paths during a meteor shower, or delving into the mysteries of Sporadic-E propagation. You will be infinitely more successful at these modes if you understand how they work.

You can start your education right here in *CQ VHF*, which will regularly present articles on various weak-signal modes, along with a monthly weak-signal column by Tim Marek, NC7K. But if you can't wait until next month to learn more, we recommend the following references:

The VHF "How-To" Book, by *CQ* magazine VHF editor Joe Lynch, N6CL (CQ Communications)
Getting Started in VHF video, produced by *CQ VHF* editor Rich Moseson, NW2L (CQ Communications)
Your VHF Companion, edited by Steve Ford, WB8IMY (ARRL)
The ARRL Operating Manual (ARRL)
The ARRL Handbook for Radio Amateurs (ARRL)

A word of warning: If you're bitten by the VHF weak-signal bug, the effects can be life-long. And there is *no cure!*

Contact Information

ARRL—225 Main St., Newington, CT 06111. Phone: 860-594-0200 (ARRL publications)
CQ Communications, Inc.—25 Newbridge Road, Hicksville, NY 11801. Phone: 516-681-2922 (CQ publications)

The 6-Meter DX Windows

Basics

Six meters is unique among VHF/UHF bands in that it can regularly support long-distance (DX) contacts without help from satellites or the moon. To hold down interference between U.S. and foreign (DX) stations, certain frequencies have been set aside informally as "DX windows."

For DXers Only

You should avoid these frequencies for domestic contacts, including those between stations in the mainland U.S. and the southern tier of Canadian provinces. (From a U.S./Canadian perspective, Alaska and Hawaii, Canada's northern provinces, the Caribbean, and Mexico are all considered DX.) On the other hand, if you want to work DX, the DX windows are the place to look for foreign stations calling CQ.

The main 6-meter DX window goes from 50.100 to 10.125 MHz, with a calling frequency at 50.110 MHz. (Note: There's a proposal to expand this DX window up to 50.200 MHz to accommodate the rapid growth of 6 meters in Europe and Africa, but for now, it's only a proposal).

In addition, there's a Pacific DX window from 51.000 to 51.100 MHz, for stations in Asian countries which don't permit amateur operation below 51 MHz. West coast stations should listen for DX here and should keep these frequencies clear of domestic QSOs.

Calling, Not Chatting

If you call CQ on 50.110 looking for DX—or answer a DX station calling CQ there—please remember to move off of the calling frequency (QSY) for your contacts. Be courteous and clear the calling frequency. And don't forget to listen for DX stations throughout the DX window. If the band is active and you leave your dial set on the calling frequency, you might miss out on some great DX!

Line of Sight *(from page 5)*

experimenters' magazine) and Chief Engineer for Kachina Communications.

All told (except for the chairman), it's a pretty knowledgeable group. Our first job will be to review ideas and technologies submitted for consideration and recommend the most promising ones to the Task Force. And this, folks, is where *you* come into the picture.

Ideas Wanted

I know, from four years of editing this magazine and corresponding with our readers, that the people who read this magazine regularly are among the best and the brightest in ham radio today. Some of you are already working on the cutting edge of communications technology. Some of you are new to ham radio and bring a fresh perspective to what we do and how we do it. Others are in between, experienced enough to know what aspects of our technology could do with an improvement or an overhaul, but not technically adept enough to say, "Here, this is what's needed."

We need to hear from all of you—anyone with an idea of where amateur radio technology needs to be improved, or how things might be done differently, or who have very specific proposals for bringing new technology into ham radio. I know you're out there. I know you've got great ideas to share. I invite you, and encourage you, to do so. The deadline for initial ideas and proposals is October 31, so there's not much time.

Back in the 1960s, Eldridge Cleaver famously said, "If you're not part of the solution, you're part of the problem." Be part of the solution. Help influence the future course of ham radio. They, um, we, are listening. ■

Where to Send Your Ideas

You may submit an idea or proposal to the ARRL Technology Task Force via "snail mail," e-mail, or the World Wide Web. You may use a form that's been developed for ease of submission, or just send a letter telling us who you are, what your idea or proposal is, and how it might be used in and benefit ham radio.

To contact the TTF, write to ARRL Technology Task Force, c/o Ed Hare, W1RFI, Staff Liaison, 225 Main St., Newington, CT 06111; e-mail your idea or form request to <ttfinput@arrl.org>, or visit the TTF page on the ARRL Web site at <http://www.arrl.org/news/ttf>.

Letters *(from page 10)*

for a while now and everyone just laughs me off. *Nobody* is taking this seriously. As president of the Gallatin Ham Radio Club, I presented your article to the February club meeting and again was pretty much ignored! Even by everyone in the Emergency Services group!

It's a sad state of affairs when the amateur radio community is presented with possibly the largest disaster ever to hit our country and the world, and this is the reaction that is displayed by our so-called prepared, practiced, capable, emergency readiness in amateur radio!

Thanks again for the further insight which I hadn't even seen yet! This thing could just blow over and "we'll all be fine," or we could be in for a very unhappy new year.

Thanks for listening.

Lyndel Thiesen, N7LT
Belgrade, Montana

WA3PZO responds:

Hi Lyndel—Glad the article provided some more insight, and I hope you saw the additional look at Y2K in the April issue.

It's a really tough call. I'm located in Philadelphia and I know many hospital and EOC staff are having their New Year's Eve parties at work...just in case. At this point, hams here will be on-call, but not actually staffing any facilities. This could all change over the next few months. Seems that the big cities aren't as concerned as the little towns which are worried about where the money will come to support the volunteer fire department.

My full-time job is with a major national weekly TV magazine and we've been past Y2K for several years. From routine capital expenditures to subscriptions past 2000, we dealt with it two years ago, so it's tough to keep things in perspective.

If your club is doing any public service events that you think might make interesting reading, let me know.

Hi Bob:

I always enjoy your articles in *CQ VHF*, especially the information on emergency communications and ham radio. Below is an item I came across while Web surfing. The author is unknown, but I like what he has to say:

Experienced emergency management professionals know that everyday communications links (e.g. land & cellular telephones, public service radios) may not exist during major emergencies. Almost certainly, hams will be up and ready to serve. As one individual put it, "HAM" stands for "Helping All Mankind." Unfortunately, some local and state emergency management coordinators do not realize that the presence of trained amateur radio operators, using their high-quality radio gear, is nothing short of a Godsend. Moreover, hams have not been implemented into planning and preparedness in many communities. This oversight is often due to a lack of understanding or confusion with Citizen Band radio operators.

Again, the author is unidentified. 73,

Bob Ferrey Jr., N3DOK
Pittsburgh, Pennsylvania
ARRL Emergency Coordinator,
Allegheny County

WA3PZO replies:

Promoting amateur radio is a never-ending job. In previous columns, I have suggested that local Skywarn groups promote their capability in the news media, even when a disaster occurs far away. Look for opportunities within the organizations that you serve. Does the county send a newsletter to the local townships or police/fire companies? Does the Red Cross chapter send out a newsletter to its branch offices? Talk to the editor and see if you can get a story in there.

Also use the Internet to promote your group. Get pictures of your group up on your organization's Web page (and get a Web page if you don't have one). Let the news media know that pictures are available. With the availability of the Internet, a reporter can write an article on a local story without ever being at the event.

An additional note from W2VU—It's really too bad that we keep portraying CB radio operators in a negative light. Remember, the majority of today's hams started out in CB. Plus, while CB certainly has more than its share of idiots, there are many excellent radio operators on 27 MHz who are also more than capable of providing useful emergency communication, and who do so regularly through REACT and other organizations. Perhaps it would do us all some good to focus on working together with like-minded CBers, especially in the arena of public service and emergency communications.

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

CA, Catalina Amateur Repeater Association: Meets 2nd Saturday of even-numbered months, 8 a.m. at Country Harvest Buffet, 6731 Westminster Ave., Westminster, CA. Visitors welcome. Club repeater (AA6DP) located on Catalina Island serves Southern California from Santa Barbara to the Mexican border: 147.090(+), no PL and 224.420(-) PL 110.9. Two-meter net every Monday, 7:30 p.m. followed by Swap Net, 8:15 p.m. Young People's (age 19 and under) 2-meter net every Wednesday 7 p.m. (3rd party traffic welcome). Trivia net Thursdays 8 p.m., as announced. For more information, send SASE to CARA, P.O. Box 425, Garden Grove, CA 92842-0425 or visit: <www.cara.nu>.

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), 146.474 (input) 107.2 PL. Nets: WAMO/YL/Young Persons (<16). For further information, visit: <www.qsl.net/wa6bgs> or e-mail: <kf6ila@arrl.net>.

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 at (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 non-profit 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.

DE, Penn-Del Amateur Radio Club: An ARRL Special Service Club meets 7:30 p.m. on the 4th Wednesday of all odd numbered months at Maximillians Restaurant on Naamans Creek Rd. in Boothwyn, PA. Visitors are encouraged and welcomed, membership is open to all. Club repeater KA3TWG/R, on 224.220, wide area coverage from atop the Delaware Memorial Bridge in New Castle, DE. Club activities include public service events, Skywarn nets and spotter training, and a hamfest in April each year. Net every Thursday at 8 p.m. on club repeater featuring R.A.I.N. the Radio Amateur Information Network programming. Club Web site & e-mail: <www.magpage.com/penndel>.

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>.

MA, Franklin County Amateur Radio Club: Meets second Monday of every month at Greenfield High School small auditorium, Silver Street in Greenfield, MA at 7:15 p.m. Repeaters 146.985 - PL 136.5 and 448.875-PL 136.5. For information, 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>.

MI, South East Michigan Amateur Radio Association (SEMARA): Meets the 1st Friday of the month. September through June at 7:30 p.m., at Grosse Pointe North High School, in Grosse Pointe Woods, MI. REPEATER 146.740-. For further information, contact <n8fgk@amsat.org>.

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/>.

NJ, Garden State Amateur Radio Association: Meetings held 1st and 3rd Wednesdays at 8 p.m., Bicentennial Hall, Cedar Ave., Fair Haven, NJ., 1 block off River Rd. Contact info: <gsara@monmouth.com>, <http://www.monmouth.com/~gsara>, 145.485 -600 pl 151.4. Or call Bob, N2XR, at (732) 495-3437 for more information.

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, OH. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Repeaters on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater 145.07, 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, 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 Citizens Saving Bank, Colerain, OH, on Rte 250. Features Web 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.

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, DX-peditions. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: lambda-arc@geocities.com.

TX, Hurst Amateur Radio Club (HARC): Meets 3rd Monday of every month (except Dec.), 7:30 p.m., Hurst Public Library, 901 Precinct Line Rd., Hurst, TX. Visitors are encouraged and welcome. HARC is a family-oriented club, active in community service. All levels of ARRL and W5YI exams given; see Web site for schedule. Repeaters: 147.100+ (110.9 pl) W5KXC and 442.850+ K5KKS. Net every Sunday evening at 7:30 p.m. local on 147.100+, everyone welcome. Web: <http://www.geocities.com/area51/Orion/5663/index.html>.

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.

UT, West Desert Amateur Radio Club: Meets the 1st Tuesday of each month (except July & August) 7 pm. The Tooele County Courthouse, 47 S. Main St. 84074. Meeting room is in Tooele County Emergency Management Conference Room, in the basement of the Courthouse. Access via the Public Safety Entrance at the Sheriffs Department off Vine St. next to Clairís Auto Repair, 64 E Vine St. A net is conducted on the 3rd Tuesday of each month at 7 p.m. on the 146.980/145.390 linked repeater system. WDARC supports four repeaters: 146.980/145.390 linked system (Delle; I-80 & Vernon, UT Rt. 36); 147.300 Tooele City PL 100.0 Hz; and Wendover Peak, Wendover, UT. 147.200. Contact person is Gene May, KC7MBF (Public Relations), (435) 882-1222, or David Haag, KC7PVD Secretary at P.O. Box 208 Tooele, UT 84074-0208.

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.

Advertisers' Index

WV, Charleston, Kanawha Amateur Radio Club (KARC): Meetings held 1st Friday of each month at 7 p.m. at the South Charleston City Hall Annex, 4th Avenue and D Street in South Charleston. Weekly Sunday net at 8:30 p.m. local on 145.35 W8GK club repeater. Mail to KARC, P.O. Box 1694, Charleston, WV 25326. For more information, contact N8TMW, Jim Damron, Publicity Director, at: <n8tmw@arrl.net>.

WV, Oak Hill, Plateau Amateur Radio Association (PARA): 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, Santa 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, Highlands County: Exams held 4th Tuesday of each month at 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Walk-ins are 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: 9/25 (ARRL Nat'l Exam Day), 10/30, and 12/04).

NC, Onslow Amateur Radio Club: Exams are held the last Tuesday of every month at 7 p.m. in the Onslow County Agricultural Building on College St. Call for more information. Contact Ed Napoleon, KC4JKW <kc4jkw@gibralter.net> or Juan Lopez, AC6ZM <lopezfam@coastalnet.com>, or visit our Web site at: <http://www.qsl.net/wd4fvo>.

NJ, The Garden State Association: Exams are on the 2nd Wednesday of every month at the MARS station, Fort Monmouth, NJ. Testing starts at 6 p.m. Take the Garden State Parkway to exit 105 and follow Rt. 36 to Rt. 35 North about 2 miles. Fort Monmouth is on the right, opposite Rt. 537. Contact <gsara@monmouth.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.

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

ABTRONIX: Ride the airwaves with ALFA & ZULU *cartoon* Novice/Technician license manual ($14.95), 304 pages, 100% illustrated, easy lessons, for ages 8 to 80. Web site: <http://home.earthlink.net/~abtronix>. Contact: <abtronix@earthlink.net> for quantity discounts. John Abbott, K6YB.

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>.

Communications Specialists, Inc.: Manufacturers of Tone Signaling Equipment including CTCSS encoders and decoders, Morse Station IDers, Repeater Tone Panels and much more. Please see our ad in this issue: <http://www.com-spec.com>.

HamMall.Com: Largest Web site dedicated to the sale of all types of amateur radio equipment. Check out the QSL Manager's Listing, add your call to the Call Wall, or get technical assistance. Find us at: <www.hammall.com>.

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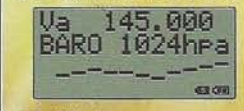

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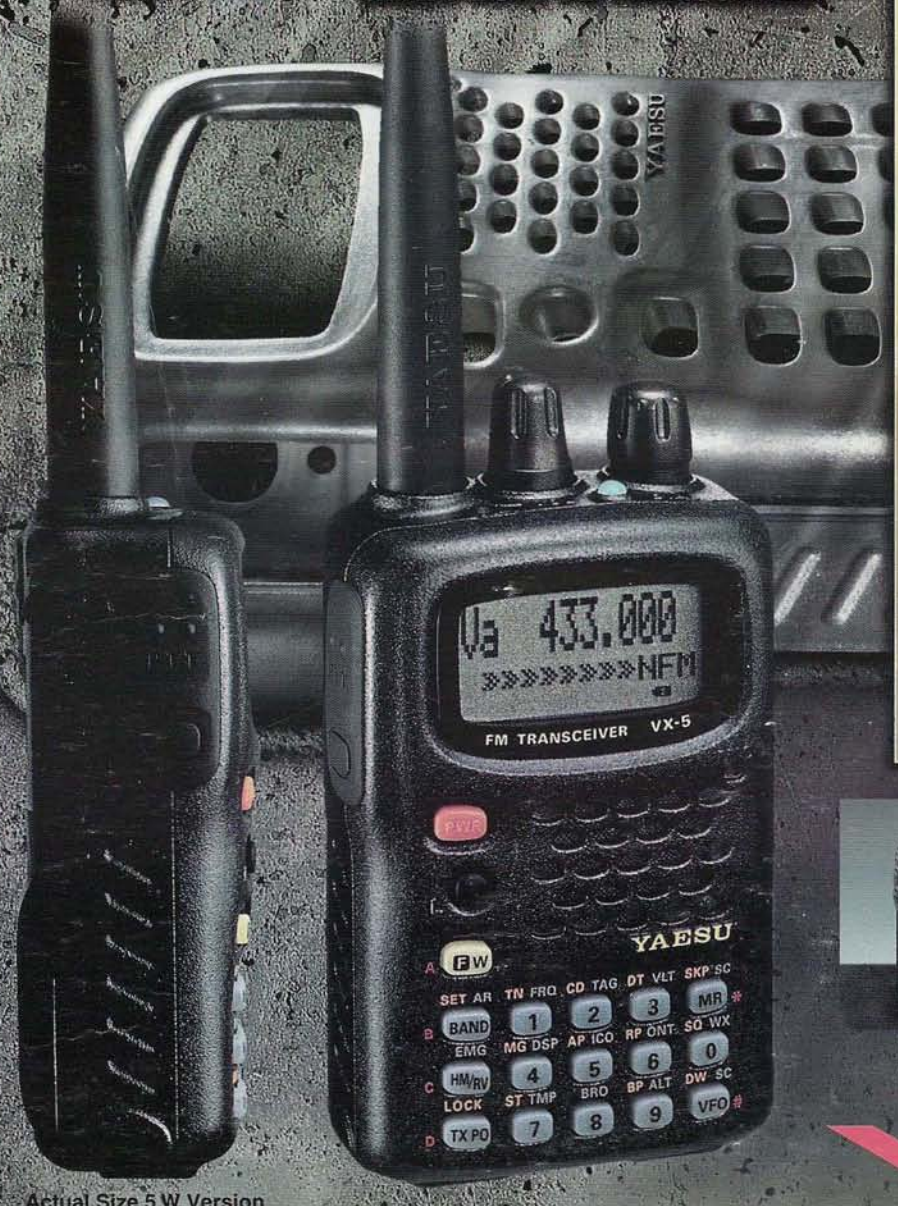

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