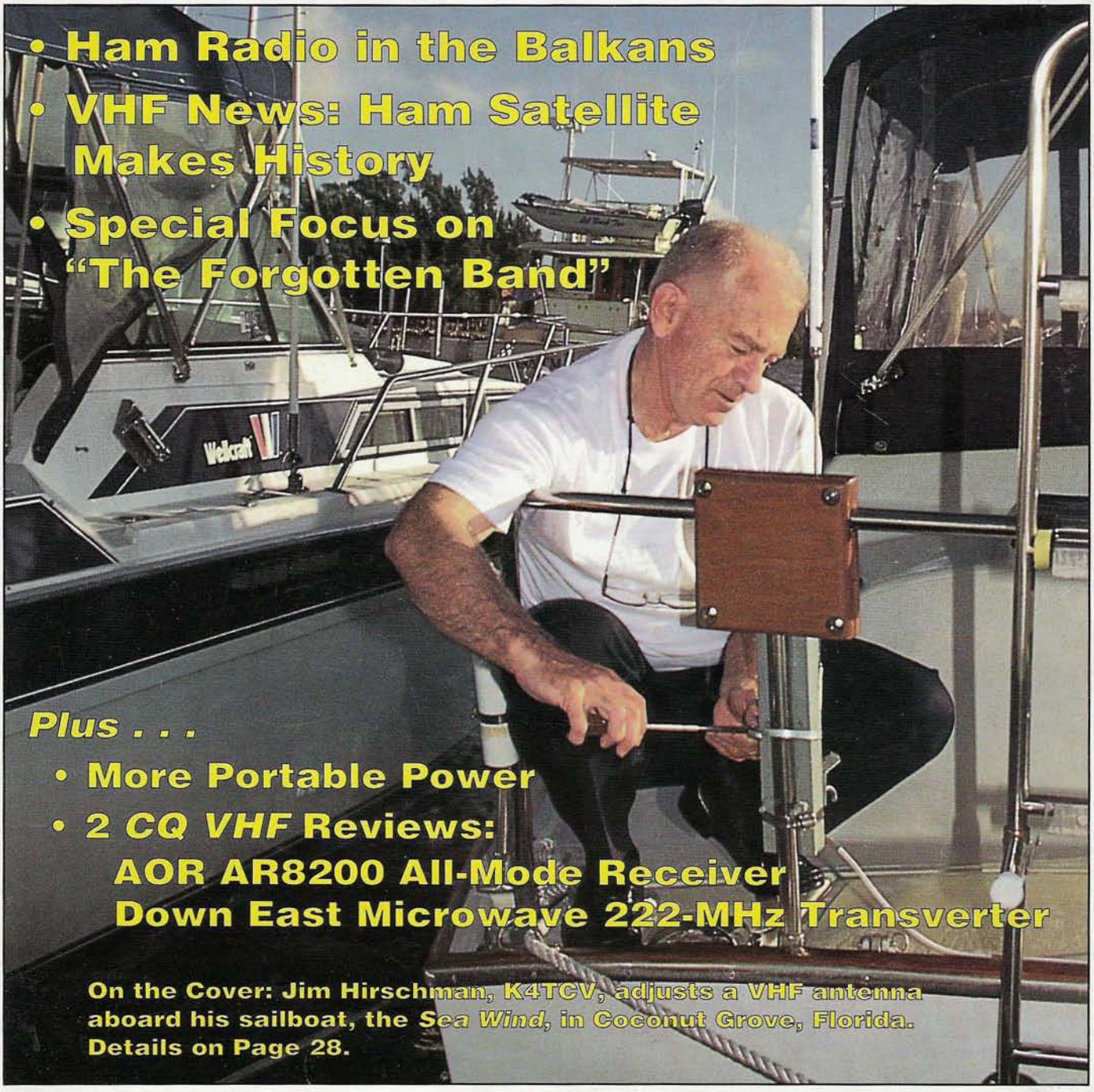
ICD 08237

CQ VHF Ham Radio Above 50 MHz

www.cq-vhf.com

July 1999



- Ham Radio in the Balkans
- VHF News: Ham Satellite Makes History
- Special Focus on "The Forgotten Band"

Plus . . .

- More Portable Power
- 2 *CQ VHF* Reviews:
  AOR AR8200 All-Mode Receiver
  Down East Microwave 222-MHz Transverter

On the Cover: Jim Hirschman, K4TCV, adjusts a VHF antenna aboard his sailboat, the *Sea Wind*, in Coconut Grove, Florida. Details on Page 28.

U.S. $3.99/ Canada $5.50

0 74851 08237 9

■ Repeaters & FM ■ Packet Radio ■ VHF/UHF ■ Microwaves ■ Amateur ... ■ Amateur TV ■ Plus...Reviews, ... News, VHF Basics, and much more!

ICOM IC-2800H

NEW Top-of-the-Line Dual Bander Adds Video Excitement to Audio Excellence

High Visibility Color LCD
Customizing the brightness, contrast and background color to fit your operating requirements is fast and easy.

APRS,™ SSTV, GPS... Now You're Ready. The '2800H's color LCD screen is more than a pretty face. Display the latest in visual ham communications, and open up a new dimension to your hobby.**

9600 BPS Packet Control.** Packet popularity is growing. Have fun! The '2800H offers a dedicated data port on the main unit.

Independent Band Controls. Independent controls make it easy to work dual or cross band repeat. Tuning, AF and squelch level, and four function switches are available per band.

External Video Input
Accepts NTSC video signals (PAL in European model). Simple connection works with most digital camera or VCR plugs.

Separate Control Head
Install the main body under a seat, in the trunk, or wherever it remains out of the way.

Full Function Microphone
Total control! Backlit keys, too.

6 Pin Data Port
*Simple packet connection.**

SPECIFICATIONS

Transmit: ..... 2 Meter, 440 MHz (70 CM)
Receive: ..... 118-174 MHz, 430-450 MHz*
*(guaranteed 144 - 148 and 440 - 450 MHz only)
Mode: ..... AM (118 - 135.9 Rx only), FM
Power: ..... 2 Meter: 50W/20W/10W/5W
440 MHz: 35W/20W/10W/5W
Power Supply Requirement: ... 13.8 V DC
Memory Channels: ..... 232 Total
Including 12 Scan Edges, 10 Log, 10 Repeater, and 2 Call
Size & Weight (approximate):
Control head: . 5.5(W) x 2.75(H) x 1.3(D) in.
140(W) x 70(H) x 34(D) mm.
10.2 oz /290 g
Main Unit: ..... 5.5(W) x 1.6(H) x 6.6(D) in.
140(W) x 40(H) x 165.8(D) mm.
2 lb, 9 oz /1.15 kg

FEATURES

- **Totally Separate Control Head**
  - Independent band controls
  - High visibility TFT color LCD monitor
  - Connection cable included
- **Independent Tuning Controls**
  - Tuning, AF and squelch level, and 4 function control switches per band
- **Tone Squelch (CTCSS Encode) with Pocket Beep and Tone Scan (CTCSS Decode) Standard**
  - 50 independently programmable tone frequencies for repeater and tone squelch use, respectively
- **On-Screen Menu "Soft Keys"**
- **Simple Band Scope**
- **9600 BPS Packet**
- **Fast Scanning**
- **Air Band Rx***
- **Auto Power OFF**
- **Built-in Duplexer**
- **Selectable Attenuator**
- **Auto Repeater Function**
- **Rugged ICOM Construction**
- **Mounting Brackets Included**
  - One for controller, one for main unit
- **Wireless Mic (optional)**

HOW WILL YOU SEE YOUR IC-2800H?

Put your knowledge to the test. **ICOM will reward the best, most original working application for the IC-2800H's visual display with a $1000 cash prize.** All entrants must describe how to execute the application. The best entries will be shown on the ICOM America Website where fellow hams will be asked to select a winner. For details, visit your authorized ICOM dealer or ICOM America's Website. No purchase necessary, void where prohibited. Contest ends 8/31/99.

Simple Band Scope
The high visibility screen offers a wealth of information: scope, S meter, memory names, scan conditions, and more. User-adjustable brightness and contrast controls are easily located in the edit menu.

Other Images
*Preview real time VCR or digital camera images**, monitor TV broadcasts with a TV tuner**, scan GPS maps**,... maybe even keep an eye on traffic behind your RV**. Experiment!*

Explore SEEING as well as hearing more of today's amateur activity. Visit your ICOM dealer, or call our 24-hour brochure line. **425-450-6088**

See and hear the new IC-2800H on the ICOM Funmobile. We'll be with the Nashua Area Radio Club for Field Day June 25-27. Talk-in repeater 147.045.

ICOM options required for PC connections:
CS-2800 Cloning Software
OPC-478 Cloning Cable

PC Ready!

ICOM®

www.icomamerica.com

MFJ 6 Meter SSB Adventure Radio™

Incredibly low $259.95 . . . for No-code Techs and Veterans alike . . . Explore the world . . . Ragchew with locals . . . 10 Watts Out . . . Super Hot Receiver . . .

MFJ-9406
$259.95
MFJ-9406X
$269.95 with mic

Work exciting 6 Meter DX from all over the world on ham radio's *"magic band"*!

It's an adventure every time you turn on your MFJ-9406 six meter SSB transceiver.

Distant stations come rolling in loud and clear with crystal clear armchair copy. You'll have fun exploring exotic 50 MHz band openings -- Tropo, Sporadic E, F2, TE, Aurora, Meteor Scatter, and more.

Ragchew with locals, hunt down new grid squares from far-away places from home, car or mountain top.

Special Offer! MFJ-9406X, $259.95! Includes MFJ-9406 & MFJ-290 microphone.

Here's what you get . . .

Full SSB/CW coverage: 50.0-50.3 MHz covers SSB, CW, propagation beacons.

Potent signal: 10 Watts PEP output. MFJ's exclusive *Constant-Current*™ syllabic speech processing gives you up to 6 dB more punch to cut thru noise, fading, QRM.

Hot receiver: Crystal-mixed single-conversion superhet with low-noise preamp digs deep into the noise to capture weak signals. If a station is there, you'll hear it!

Easy to operate: No microprocessor mumbo-jumbo . . . just turn on and tune in.

Low power drain: Mountain-top all day on lightweight NiCads or operate from home on 110 VAC with MFJ-4110, $39.95.

Excellent selectivity: Sharp *HF proven* SSB crystal ladder filter reduces QRM and passband noise.

TVI protection: Seven element low-pass filter knocks out TVI -- lets you operate when *you* want to!

Real S-meter: Give meaningful signal reports, accurately steer your beam, monitor speech processing.

Smooth tuning: Vernier reduction drive makes tuning precise and easy.

External amplifier: Jack provides a key-line for activating 6 Meter SSB amps.

Built to last: Premium PC board, quality components, brushed-aluminum panel and tough vinyl-clad case gives years of service.

Compact: At only 2½x6½x6 inches, the MFJ-9406 fits in just about anywhere.

Fully guaranteed: MFJ's exclusive one-year *No Matter What*™ warranty. We will repair or replace (at our option) your MFJ-9406, no matter what happens, for 1 full year.

MFJ-9406 Accessories

Handheld dynamic SSB microphone: Specially matched to compliment the *Constant Current*™ speech processor used in the MFJ-9406. **MFJ-290, $29.95.**

CW Module: Install this and operate CW -- a must for DXers. Provides semi-QSK break-in and sidetone. **MFJ-416, $39.95.**

Power Supply: Heavy duty wall transformer and voltage regulator delivers 13.8 VDC for MFJ-9406. Powerful, yet small. Fits in your coat pocket! **MFJ-4110, $49.95.**

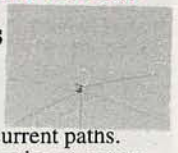
Portable Battery/AC Power Pack: Use Ni-Cad, Alkaline, regular D cells or 110 VAC. Charges Ni-Cads. Fastens to MFJ-9406. Batteries not included. **MFJ-4112, $69.95.**

6 Meter Antennas

MFJ 3 element 6 Meter Yagi

MFJ's three element 6 Meter Yagi quadruples your effective radiated power over a half-wave dipole. 6 foot boom. 2 pounds. Can use TV rotator and mast. Handles 300 Watts PEP SSB. Mounts vertically or horizontally. Current balun decouples feedline. Excellent front-to-back ratio. MFJ-1762 **$69.95**

MFJ 6 Meter low-angle DX Vertical



MFJ's omni-directional low-angle vertical radiator lets you work plenty of DX in all directions even with low power. A *GroundIsolated*™ radial system eliminates common mode current paths. Reduces undesirable feedline/supporting structure radiation. 55" *high-strength* aluminum radiator. MFJ-1756 **$69.95**

MFJ 6 Meter J-pole Travel Antenna

Hang up this 6 Meter J-pole in the clear and enjoy some exciting DX QSOs. Omni-directional full size halfwave antenna with low angle radiation that outperforms 1/4 waves. MFJ-1736 **$24.95**

MFJ 6 Meter folded dipole

MFJ's efficient low SWR folded dipole is light-weight, easy-to-carry, easy-to-put up. Perfect for MFJ-9406 and other 6 Meter rigs. MFJ-1776 **$34.95**

MFJ full halfwave 6 Meter Antenna

MFJ's *full halfwave* 6 Meter centerfed antenna has excellent bandwidth and low angle radiation for super DXing! Mounts vertically for FM/Packet or horizontally for SSB. Strong light weight aluminum. Two 47" radiators, 23" boom. 1½ pounds. MFJ-1764 **$44.95**

MFJ Dual Band 6/2 Meter Mobile

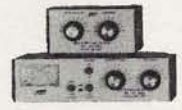
On 6 Meters, it's a high performance *full quarter wave* mobile magnet mount antenna. On 2 Meters, it's a *maximum gain* 5/8 wave antenna. Low SWR, handles 300 Watts. MFJ-1728B **$24.95**

MFJ 6 Meter *FM Communicator*™ Transceiver

MFJ-9606
$159.95
MFJ-9606X
$169.95 with Mic

The MFJ-9606 *FM Communicator*™ is the most inexpensive way to get on 6 Meter FM Voice or Packet! 10 Watt transmitter, *CrystalClearVoice*™ puts the fun and fidelity back into ham radio with true-to-life speech quality and ultra-clean AFSK data signals. *Super fast* PIN diode switching, no compromise dual-convers- ion FM receiver with quiet LNA, factory installed 52.525 MHz calling frequency crystals. Addl plug-in crystals, $24.95 per freq.

MFJ 6 Meter Antenna Tuners



MFJ-906, $79.95. Lighted 2 Range Cross-Needle SWR/Wattmeter, bypass switch. 100 watts FM, 200 Watts SSB PEP. 8x2½x3 inches.

MFJ-903, $49.95. Like MFJ-906, no meter, bypass switch. 5x2½ x3".

MFJ-945E, $109.95. Compact *mobile* tuner covers 6 Meters thru160 Meters. Lighted Cross-Needle SWR/Wattmeter. Antenna bypass switch. 300 Watts PEP SSB. 8x2x6". Mobile mount, **MFJ-20, $4.95.**

MFJ-969, $189.95. MFJ-969 has MFJ's superb *AirCore*™ Roller inductor, *continuous* 6 Meter - 160 Meters coverage and *QRM-Free PreTune*™! Wide matching range, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, 4:1 balun., 300 Watts PEP SSB. 3½x10½x9½".

Free MFJ Catalog

Nearest Dealer . . . 800-647-1800

• 1 year *unconditional* warranty • 30 day Money Back guarantee (less s/h) on orders from MFJ • Add s/h

MFJ ENTERPRISES, INC.
P.O. Box 494,
Mississippi State, MS 39762
Prices/Specs subject to change. ©1997 MFJ Inc.
• **MAIN** 601-323-5869 • **FAX** 601-323-6551 • **TECH** 601-323-0549
• **Call** 8-4:30 CST, Mon-Fri • **E-Mail:** mfj@mfjenterprises.com
Web Site: http://www.mfjenterprises.com

FCC Type Accepted!

MIRAGE . . . 150 Watt 6 Meter Amp

MIRAGE
A-1015-G
$389
Suggested Retail
Call your favorite dealer for your best price!

Work exotic 6 Meter DX with 150 Watts of brute power! The A-1015-G is the *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. Ideal for 1 to 15 Watt mobile, home or handheld rigs. 150 Watts out with just 10 Watts in. Extra heavy duty heatsink spans length of cabinet. Draws 18-22 amps at 13.8 VDC. 12x3x5½ in.

Power Curve -- typical A-1015-G output power for your HT input

Watts Out	6	22	42	63	84	98	122	142	150
Watts In	.25	1	2	3	4	5	7	9	10

Free Catalog/Nearest Dealer 800-647-1800
Tech: (601) 323-8287 Fax: (601) 323-6551

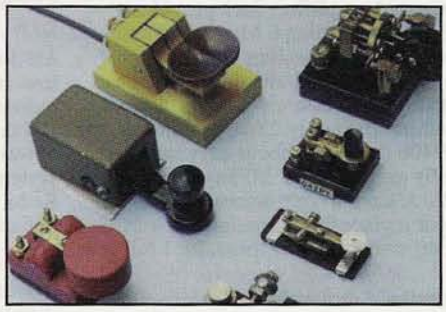
MIRAGE
COMMUNICATIONS EQUIPMENT
300 Industrial Park Road, Starkville, MS 39759
. . . the world's most rugged VHF/UHF Amplifiers!

CIRCLE 143 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

Volume 4, Number 7—July, 1999

page 38



page 73

page 80

Next Month: "A Visit with P3D (or Is It C3PO?)," by Rich Moseson, W2VU

AWESOME TWOSOME!

The only thing better than a new radio from Alinco is TWO new radios from Alinco! Check out these exciting new products from Amateur Radio's Value Leader™

NEW!

DJ-V5T VHF+UHF Compact HT

- Alphanumeric Display, up to 6 characters
- 200 memory channels plus two call channels
- Full VHF + UHF Amateur Band Coverage
- Expandable Receive Range, (76 ~ 999 MHz*) includes Wide FM capability
- Up to 6 watts output, 3 output settings
- CTCSS Encode+decode, DTMF squelch and 4 different European Tone Bursts
- Accepts up to 13.8 VDC direct input
- 4 scan modes, 5 programmable scan banks
- Input voltage display with over voltage warning
- MARS/CAP capability
- Autodial memories
- Automatic high temperature protection feature
- Standard high-power 700 mAh Ni-Cd battery pack EBP-45N
- SMA antenna connector
- Eight different tuning steps
- Wire cloning capability
- Wide choice of accessories
- Audio output control (high/low)
- Split-band operation capability

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

*Cellular blocked.

CIRCLE 174 ON READER SERVICE CARD

NEW!

DJ-195T 2 Meter HT

- Alphanumeric display
- 40 memory channels
- 5 watt output with standard battery
- CTCSS encode+decode and DCS
- 13.8 VDC direct input
- Direct frequency input
- S-meter
- Autodialer
- Cable Cloning
- Additional features, including theft alarm!

Ask your dealer about the wide choice of accessories for your Alinco radio. There's a large selection of speaker mics, batteries, chargers, DC input cables and more!

Simple ▪ Clean ▪ Dependable

ALINCO®

AMATEUR RADIO'S VALUE LEADER℠

U.S.A. Alinco Branch: 438 Amapola Ave. • Suite 130 • Torrance, CA 90501
Phone: (310) 618-8616 • Fax: (310) 618-8758 • Internet: http: //www.alinco.com

"Could Amateur Radio Save America?"—Part 2

Last month, we talked about ham radio as an integral part of technology education in our schools. This month, we'll look at the potential benefits of the social side of our hobby.

I am writing this in the aftermath of the tragic violence at Columbine High School in Littleton, Colorado, and it's difficult not to write something about it. Soon after it happened, I was talking about the tragedy with *CQ* Editor Alan Dorhoffer, K2EEK, who said he also couldn't avoid writing about the topic in his editorial.

The two teens who killed so many of their classmates, and then themselves, were said to be outcasts, we noted. "Of course, if they'd been hams," Alan said with mock seriousness, "this never would have happened." And then we both immediately realized that—even though he hadn't meant the comment seriously—he was probably right.

If They'd Been Hams...

If they'd been hams, chances are they would have had some interaction with other amateurs, probably adults, and wouldn't have felt like such outcasts. If they'd been hams, they might have had enough contact with enough individuals of diverse backgrounds that they might not have developed their apparent hatred of certain groups. If they'd been hams, they might have spent their time on the Internet complaining about the impending demise of ham radio instead of learning how to build bombs. If they'd been hams, the same skills they used to build bombs might have been used to build radios. And it's very difficult to use a radio to kill people.

Of course, that's all a fantasy. And maybe ham radio wouldn't have helped them a bit. Clearly, these youngsters were seriously disturbed, and perhaps not even ham radio could have helped them. But my point is this: Ham radio is a social activity as well as a technical activity. By its very nature, it forces you to interact with other people. It's hard to have a QSO with yourself. One of the drawbacks of the Internet is that it can easily be a very solitary activity—just you and your computer, interacting only with Web sites put up by who knows who. Another drawback in this situation is its privacy. You can spend hours and hours online, learning how to build bombs and reading hate messages, and unless someone (like a parent) is looking over your shoulder, nobody knows what you're up to until it's too late.

"Ham radio is a social activity as well as a technical activity. By its very nature, it forces you to interact with other people. It's hard to have a QSO with yourself."

On the other hand, ham radio, by its very nature, is a public forum. Imagine getting on the local repeater and asking another ham if he can help you build some bombs. Or talking on 10 meters about how you're planning to blow up your school. Forget it. Someone is going to overhear you. And if they don't talk to you about it directly, they're going to contact the authorities, especially now that we have authorities who are listening.

Still unanswered at this writing are questions of how their parents could have not known they were building bombs in the garage, not known they were collecting weapons, whether they tried to get help for their children, and whether the authorities had advance warning of trouble but failed to act. Could ham radio have prevented this tragedy? Probably not. Are the social benefits of ham radio another good reason to encourage making it part of school curricula? No doubt about it.

Moving into Middle Age

The major focus of my editorials last month and this month has been on promoting ham radio to young people. But in this month's "Op-Ed" column, Steve Berg, WA9JML, asks "What's wrong with being middle-aged?" He goes on to point out that young people often don't have time or money to dedicate to ham radio—but that middle-aged folks often do—and that with today's increased life expectancies, someone who enters the hobby at age 40 could easily contribute to it for another 35 to 40 years. "Our hobby is not on the verge of dying off simply because many of us are past 40," Steve writes. "There are people moving up into that age bracket all the time."

Steve got some very interesting, if unintentional, back-up in the spring issue of *10-10 International News*, the newsletter of the Ten-Ten organization. It features photos of its early members, taken back in 1962 and 63. You know what?

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

"Finally, we say goodbye to a VHF pioneer, former CQ and CQ VHF columnist, and good friend, Don Stoner, W6TNS. Don was largely responsible for sparking hams' interest in solid-state equipment and for proposing the concept of amateur radio satellites."

Most of them were middle-aged or downright elderly! The old guys were the middle-aged hams of the '30s and '40s. And those middle-aged folks are senior citizens today. So we have a new generation of middle-aged hams who have taken their place. And there will be more behind them. I am in full agreement with Steve—yes, we should continue trying to recruit young people to ham radio, but that should not be our sole focus; and we should not be using median age figures as "evidence" of ham radio's condition.

In This Issue

We've got some great articles for you in this issue, starting with WA3PZO's very timely look at ham radio in the Balkans. When people aren't shooting at each other, there's a lot of innovative VHF and UHF activity in that part of the world. We also devote three articles to a band that's often overlooked: 222 MHz. KB2BZP will tell you all the reasons you should get on this band; K5MAT will tell you what to expect when you do get on; and KM5FA reviews a transverter that's one of a suddenly growing list of equipment options for the 1.35-meter band.

Finally, we say goodbye to a VHF pioneer, former *CQ* and *CQ VHF* columnist, and good friend, Don Stoner, W6TNS. Don was largely responsible for sparking hams' interest in solid-state equipment and for proposing the concept of amateur radio satellites. (See Obit, page 34.)

Not in this issue are two articles we'd been hoping to bring you. Part 2 of KC4YER's series on ham radio and astronauts was squeezed out by some of the breaking stories, but the next shuttle flight carrying ham radio into space has also been delayed, so we're OK. And while we'd been hoping K7XC would be back to resume his "Weak Signal News" column, he's not quite unpacked enough in his new QTH in Arizona to start writing. Plus, as he explained yesterday in a call from a truck stop near his house, he has no phone service, so will have to rely on "snail mail" to get articles to us the old-fashioned way. Keep sending him reports, though, at <k7xc@cq-vhf.com>. As soon as he gets a phone line and an Internet connection, he'll pick up everything that's waiting for him. You can also send him reports and photos at P.O. Box 277, Tonopah, AZ 85354.

Have a happy hamming summer!

—W2VU

Help Wanted

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

VHF News

New Ham Satellite Makes History

The newest amateur satellite in orbit, UoSAT-12 (now officially known as UoSAT-OSCAR-36, or UO-36), made history when it was launched April 21 from Kazakhstan aboard a Russian SS-18 intercontinental ballistic missile, or ICBM. This is the first time one of the former Soviet Union's SS-18 missiles has been used for a satellite launch. Under terms of the START arms reduction treaty, the entire stockpile of SS-18 missiles had to be converted to peaceful uses or be destroyed.

This is the 12th satellite built and launched by the University of Surrey in England (thus its pre-launch designation as UoSAT-12). According to the AMSAT News Service, it was renamed UO-36 after it successfully reached orbit and began to transmit. This brings to three dozen the number of successfully launched ham satellites since 1961, not including the Russian RS- satellites, for which OSCAR numbers have never been requested. UO-36 carries a variety of payloads, including imaging, digital store-and-forward (9600-baud packet), and transponders for Mode L (1.2 GHz up, 435 MHz down) and Mode S (435 MHz up, 2.4 GHz down). Preliminary reports indicate that all systems are working well on the satellite, and there have been several reports of hearing its telemetry signals on 437.400 MHz. In addition, a newly developed "Space GPS Receiver," designed jointly by Surrey Satellite and the European Space Agency, has been turned on and is operating well. This is believed to be the first use of the Global Positioning System to determine the location of an object in orbit.

For additional information and updates on the commissioning progress of UO-36, see the Surrey Satellite Web site at <http://www.sstl.co.uk/>.

OSCAR-10 "Wakes Up"

As amateur radio's newest satellite, UO-36, gets ready for hams around the world to use, one of the oldest functioning ham satellites is out of "hibernation" and back in use with good signals. AMSAT-OSCAR 10, launched in 1983, can no longer be controlled from the ground, but, when its batteries are charged, its Mode B transponder (435 MHz up, 145 MHz down) is still usable. Peter Klein, KD7MW, is reported by SpaceNews and Newsline to have posted a notice on the Internet that AO-10 is back in business and that several people are trying to use the new digital mode, PSK-31, on AO-10's analog transponder. Apparently, the only problem is that you must constantly follow slight variations in frequency caused by the satellite itself. The variations are only ±25 Hz, but that's enough to make you lose the PSK-31 signal. "If you stop to read what you're copying," says SpaceNews, "you'll miss something."

Anyone who wants to try a PSK-31 QSO with Peter via AO-10 is encouraged to contact him by e-mail at <kd7mw @amsat.org>. There is an excellent introduction to PSK-31 in the May issue of *QST* magazine.

Hams Assist in Multiple Disasters

Ham radio has played key behind-the-scenes roles in several recent natural and man-made disasters. According to the *ARRL Letter*, ham radio may have prevented the death toll in May's massive Oklahoma tornado outbreak from climbing even higher. The League says ham radio weather-spotting nets were in operation before, during, and after the storm struck on May 3, killing at least 50 people and causing billions of dollars of property damage. The Skywarn nets provided reports to the National Weather Service which helped form the basis of its warning notices. "Based on the excellent warning, most of the victims appear to have left the disaster area prior to the strike," ARRL Oklahoma Public Information Coordinator Thomas Webb, WA9AFM, told the *Letter*.

In addition, the Salvation Army Team Emergency Network (SATERN) established ham radio support of Salvation Army canteens, along with an innovative Internet link for taking health-and-welfare requests. Anyone looking for information on loved ones in the Oklahoma City area could log onto a Web site (<http://www.angelfire.com/satern411/emailfrm.htm>) and fill out a request form. Hams also provided communications support after the same group of twisters hit Kansas, and for a separate severe storm that hit Tennessee on May 5.

The *ARRL Letter* also reports that ham radio operators provided communications support in the aftermath of the Columbine High School massacre in Littleton, Colorado, and shootings a few days earlier at a Salt Lake City, Utah, library. In Littleton, hams supported the Salvation Army and the Red Cross, and provided communication between facilities in the vicinity of the high school that were gathering points for law enforcement personnel, reporters, and mourners. Ham radio was instrumental in evacuating the Family History Library in Salt Lake City on April 15, when a gunman entered the building and opened fire. Two employees who are hams used their 2-meter HTs on a simplex frequency to coordinate evacuation and to provide reports to police of activity inside the building. The Salt Lake City gunman killed two people and wounded five before being shot and killed by police.

Swatch Pulls Plug on "Beatnik" Amid Ham Protests

The Swatch watch company canceled plans to launch its "Beatnik" satellite—amid a storm of protest from ham radio operators around the world—the day before it was scheduled to be hand-launched by a spacewalking cosmonaut from the Mir space station. The "Sputnik 99" mini-satellite had been built by hams in Russia and France, the third in a series of replicas of the original Sputnik satellite which launched the space age in 1957.

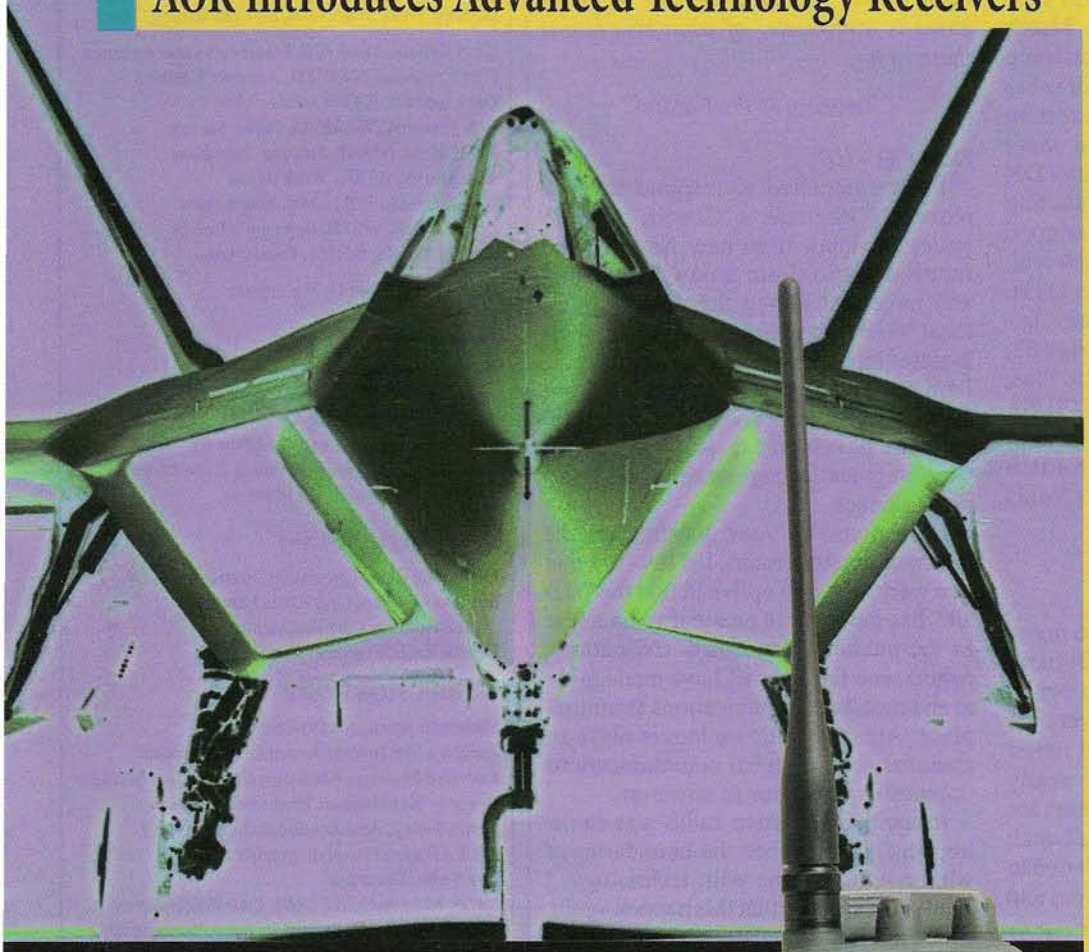
Controversy erupted when hams learned that Swatch had signed an agreement with Russia's space agency to use the satellite to broadcast—on the 2-meter ham band—messages the watch company had collected on its Web site. According to the ARRL, the messages related to Swatch's campaign to establish

(Continued on page 52)

Compiled by the CQ VHF Staff

Your concept of the word "scanner" is obsolete.

AOR introduces Advanced Technology Receivers™



Calling an AOR Advanced Technology Receiver a "scanner" is like referring to a modern fighter aircraft as an "airplane."

AOR has long been at the forefront of receiver technology. The new AR 8200B, and the forthcoming AR 16 Wide Ranger and the limited edition AR 7000B DSP Wide Range Receiver are new concepts that redefine what is possible in wide-band multimode receivers. Discover AOR, *the serious choice in Advanced Technology Receivers.*℠

AR 8200B Wide Range Receiver

The AR 8200B is an all-new receiver, not an update of a previous model.

- 500 KHz~2040 MHz *coverage
- 1,000 memory channels (20 banks)
- Computer control and programming. *(requires optional connection cable)*
- Download free control software from AOR web site!
- "All Mode" reception includes "super narrow" FM plus wide and narrow AM in addition to USB, LSB, CW and standard AM and FM modes
- True carrier reinsertion in USB and LSB modes. Includes 3 KHz SSB filter!
- Detachable MW antenna with negative feedback
- Optional internal slot cards expand the AR 8200B capabilities. Choose from Memory Expansion (up to 4,000 memories), CTCSS Squelch & Search, Tone Eliminator, Voice Inverter and Record Audio (saves up to 20 seconds of audio)
- Tuning steps programmable in multiples of 50 Hz in all modes
- 8.33 KHz airband step is correctly supported
- Noise limiter and attenuator
- Band activity "scope" display with "save trace" capability
- Four-way side panel rocker switch allows one-hand operation
- Large display includes A and B VFO frequencies and signal strength meter
- Battery Save function with Low Battery indicator
- Operates on 12 VDC external power
- 4 AA Ni-Cd batteries supplied, also uses standard AA dry cells
- BNC antenna connector
- Wide choice of accessories

These are but a *few* of the features of the new **AR 8200B.** Visit your dealer or the AOR web site for more information!

*Cellular frequencies blocked in compliance with USA regulations. Continuous coverage model available for authorized users/agencies, documentation required. AOR engages in ongoing efforts to improve its products. As such, design and performance parameters may change without notice or obligation on the part of the manufacturer and/or distributor(s).

CIRCLE 156 ON READER SERVICE CARD

AOR™ U.S.A., Inc.
20655 S. Western Ave., Suite 112 • Torrance, CA 90501
www.aorusa.com 310-787-8615 Phone • 310-787-8619 Fax

Letters — Your Spot to Speak Out

The following letter was addressed to CQ VHF *"Magic Band" Editor, Ken Neubeck, WB2AMU.*

Dear Ken:

Congrats on the super article in Feb. '99 *CQ VHF* mag, "Mix 'n Match Propagation! Also, thanks for mentioning "KC4SUS" (now K4SUS), and for using some of my data in this most interesting article....Wish I could give you more input of recent long-distance 6-meter DX contacts, but this cycle is just not starting out as well and TE has not been as good either. PY5CC is still working the world, though, as usual, from his unique QTH. Corrections: on page 30, "25 degrees" latitude is OK for my QTH, but on page 32, it says 23 degrees." It is really 25. Plus, my call is now K4SUS (ex: KC4SUS). 73,

Tom Glaze, K4SUS
Miami, Florida

About My Letter...

Dear *CQ VHF*:

Just a line or two in response to my e-mail that you published in the February issue of *CQ VHF*. I read my own e-mail and wondered what impression everyone out there got of me; it sounded rather depressing! My point, which I really didn't make, was that not all amateurs are "bad," and VHFers are really a nice bunch of guys. The operating habits I referred to were those of the HF contesting types and transplants from HF to the VHF spectrum. Education is the answer, but it certainly tries one's patience when the offending persons literally tell you where to go and how to get there!

I think I discovered the "kick-start" for myself after reading the meteor scatter (MS) section and all the fun those guys had with the "rocks." I have never attempted MS, but now I have the inspiration to give it a go (I'm not from England). The MS article was truly one of the best and the most inspiring to me personally. Thanks again for *the* best ham mag out there.

Alex Kaplinsky, K5UNY
Dallas, Texas

Alex—Thanks for the clarification, and I'm glad our report on the Leonids meteor shower provided the "kick-start" you needed to broaden your ham radio horizons. I hope we can continue to "kick-start" the interests of hams who are stuck in neutral. There are far too many of us losing interest and letting our licenses lapse when all that's needed in many cases is a reminder of what else is out there to try.

Looking to the Future

Dear *CQ VHF*:

I felt compelled to respond to your request ("Beginner's Corner," March issue) for input from new hams on the future of radio. I am a new Technician and have just joined the ARRL and a local VHF club where I actively use their 2-meter repeaters. In the working world, I am an executive with a global company where I'm responsible for computer software development. Academically, I have degrees in engineering and computer science.

In response to your question on the future of amateur radio, I'd say first that you were very perceptive in that the "sizzle" has gone out of amateur radio as far as the public is concerned. Cellphones, pagers, and the Internet have made global and mobile communications commonplace. Amateur radio no longer plays an essential role in global communications or mobility; it is time to move on.

In the past, amateur radio was exciting because it pushed the boundaries of what could be done with technology. I think it is essential that this happen again. There are important areas of application of communication technology yet unexplored. Likewise, I am sure that there are portions of the electromagnetic spectrum yet untapped from a communication perspective.

I would think that there needs to be a forward looking group of individuals within the FCC and ARRL gathered together to generally chart out the new boundaries of knowledge and technology as it relates to the amateur radio service and decide how it needs to move forward. Any specific ideas I put forward would be incomplete and seem far-fetched (like satellite communications and meteor DX did many years ago?!), but I'll throw out some thought provoking questions.

1. How do animals and plants communicate? What could we learn from them?

(Continued on page 80)

CQ VHF Ham Radio Above 50 MHz

EDITORIAL STAFF

Richard S. Moseson, W2VU, Editor
Edith Lennon, N2ZRW, Managing Editor
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
Bob Josuweit, WA3PZO, Public Service
Ed Manuel, N5EM, Amateur Television
Tim Marek, K7XC, Weak Signal
Ken Neubeck, WB2AMU, Magic Band
Peter O'Dell, WB2D, Beginner's Corner
Donald Rotolo, N2IRZ, Packet Radio

Doug Bailey, KØFO, Webmaster

BUSINESS STAFF

Richard A. Ross, K2MGA, Publisher
Arnie Sposato, N2IQO, Advertising Manager
Nicole Tramuta, Sales Assistant
Sal Del Grosso, Accounting Manager
Ann Marie DeMeo, Accounting Department
Judith Erickson, Office Manager

CIRCULATION STAFF

Catherine Ross, Circulation Manager
Melissa Gilligan, Operations Manager
Jean Sawchuk, Data Processing
Denise Kells, Customer Service

PRODUCTION STAFF

Elizabeth Ryan, Art Director
Barbara McGowan, Associate Art Director
Edmond Pesonen, Electronic Composition Manager
Dorothy Kehrwieder, Production Manager
Emily Leary, Assistant Production Manager
Pat Le Blanc, Phototypographer
Hal Keith, Illustrator
Larry Mulvehill, WB2ZPI, Staff Photographer
Joe Veras, N4QB, Special Projects Photographer

A publication of

CQ Communications, Inc.
25 Newbridge Road
Hicksville, NY 11801 USA.

Offices: 25 Newbridge Road, Hicksville, New York 11801. Telephone: (516) 681-2922. FAX (516) 681-2926. E-mail: cq-vhf@cq-vhf.com; Web:<http://www.cq-vhf.com>. CQ VHF (ISSN 1085-0708) is published monthly by CQ Communications Inc. Periodical postage paid at Hicksville, NY 11801 and additional offices. Subscription prices (all in U.S. dollars): Domestic—one year $24.95, two years $45.95; Canada/Mexico—one year $34.95, two years $65.95; Foreign Air Post—one year $44.95, two years $85.95.

U.S. Government Agencies: Subscriptions to CQ VHF are available to agencies of the United States government, including military services, only on a cash with order basis. Requests for quotations, bids, contracts, etc. will be refused and will not be returned or processed. Allow six weeks for change of address.

Printed in the United States of America.

Postmaster: Please send change of address to CQ VHF magazine, 25 Newbridge Road, Hicksville, New York 11801.

Product Update

MFJ's SWR Analyzer Deluxe Carrying Pouch™

MFJ is offering a soft foam carrying pouch, the MFJ-29C, to protect your MFJ-259B or other SWR analyzer from casual bumps, scrapes, and scratches. MFJ-29C has a large, clear plastic protective LCD and meter window that lets you operate your MFJ-259B without taking it out of its pouch. Convenient component hole cutouts also allow coax, antenna, dip coil, or frequency counter input with the analyzer in the pouch. A heavy duty nylon shoulder strap has a tough rubber guard and strong hard-plastic clips on each end, making it easy to carry up a tower or to remote locations. The tuning and bandswitch knob holes make tuning precise and easy: just set the bandswitch and tune the dial. The MFJ-29C also has a convenient KangaPoc™ back pocket for carrying dip coils and other antenna related accessories.

The MFJ-29C costs $24.95 and is covered by MFJ's "No Matter What" one-year limited warranty.

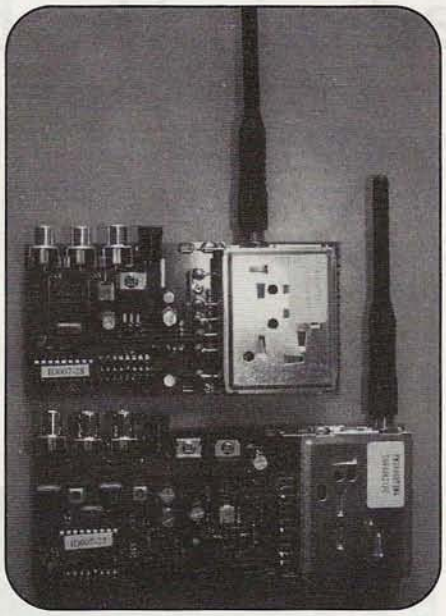
To order or for your nearest dealer, call (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; or check out dealer/ordering information at: <http://www.mfjenterprises.com>.

Eversecure ATV Products

Eversecure has introduced two new low-cost, 100-milliwatt, eight-frequency amateur television (ATV) transmitter and receiver products the for 13- and 23-centimeter ham bands. The ATV product line uses FM modulation with two audio subcarriers, and has excellent frequency stability.

Both versions are mounted on single-sided pc boards. The transmitter consists of a metal RF module, 1 3/4 x 2 3/4 x 5/8 inches, connected via a 3-inch ribbon cable to a main board with identical dimensions for easy mounting in an enclosure. The receiving unit is 4 7/8 x 2 1/4 x 5/8 deep. Three RCA female jacks are provided for inputs, along with one standard 2.1-millimeter plug for unregulated DC and a Molex connector for 12-Volt DC portable operation. A special receiver enclosure is currently being tooled and will be available in August.

The Model ATV-2400 transmitter uses a microprocessor crystal-controlled oscillator to produce eight frequencies



between 2398 and 2445 MHz. Model ATV-1200 handles 1240 through 1282 MHz, with a separate 915-MHz channel as well. Frequency stability is better than one part per million. The composite video input will accept PAL or NTSC inputs up to 2.0 volts Peak-to-Peak, as well as two audio channels with a flat response curve from 50 Hz to 55 kHz, ±0.5 dB. The audio channels can be easily used for data transmission of speeds exceeding 150 K bits per second.

The ATV receiver uses DIP switches for the eight transmit frequencies as well as a special "scan mode" which allows the receiver to automatically scan all available frequencies. Receiver sensitivity is better than -80 dBm. Both models come standard with a type-F female connector on both transmitter and receiver units, with an option for an SMA connector as well. Two standard rubber-duck antennas are included, providing an omnidirectional range of over 2,800 feet. Other antenna configurations are available, including a 6-dB patch antenna.

Price is $119 per pair for up to nine pairs. This includes a transmitter-receiver pair, two straight rubber-duck style antennas, and a female Molex mating connector for 12-volt DC operation. Shipping is $8 anywhere in the continental U.S. Visit the Web site for foreign order information.

A variety of accessories are available including battery packs and related microwave test equipment. For further information, visit the Eversecure Web site at <http://www.4atv.com>; E-mail inquires to <sales@4atv.com> or write to Eversecure, P.O. Box 181, Bensenville, IL 60106.

Contact East 1999 Catalog

Contact East has introduced its largest catalog ever, with 308 pages of new tools and test instruments for engineers and technicians, as well as hobbyists. Featured are quality products from brand name manufacturers for testing, repairing, and assembling electrical and electronic equipment. New product highlights include Hakko's Programmable Soldering Stations, Leatherman's Wave multi-purpose tool, and Microcare's SuperClean ozone-safe cleaner for defluxing and degreasing.

Also covered is a full selection of DMMs and oscilloscopes, power supplies, solder/desoldering equipment, heat guns, precision and hard-to-find tools, cordless power tools, measuring instruments, ESD protection products, adhesives, and custom-made tool kits. Choose from quality proven brand names including Fluke, Tektronix, Hewlett Packard, Weller, Metcal, OK, Pace, Milwaukee, Makita, Xcelite, Excelta, Loctite, Leatherman, and 3M. All products are fully guaranteed; same day shipping.

For more information, contact Contact East Inc., 335 Willow St., North Andover, MA 01845; Phone: (978) 682-2000; Fax: (978) 688-7829; Order online: <http://www.contacteast.com>.

U.S.-Made Tubes Are Back

American-made 3-500Z and 4-400A/C tubes have returned to the market. Triton Services, Inc., of Easton, Pennsylvania, formerly ITT, Inc., acquired EIMAC's Glass Tube Division in 1996, along with all the original equipment and technology, and has again begun producing tubes.

Triton reintroduced these two types at the original specs and D&C Electronics has become their exclusive distributor. For more information, contact D&C Electronics Sales Department at 3089 Deltona Blvd., Spring Hill, FL 34606-3109; Phone: (800) 881-2374 or (352) 688-2374; Fax: (352) 683-9595; Web: <http://dandcelectronics.com>.

Ham Radio in the Balkans

Amateur radio has played a role in most American military actions since the 1960s. With U.S. troops involved in NATO bombing of Yugoslavia, WA3PZO looks at ham radio—and VHF/UHF activity—in that part of the world.

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

Editor's Note: In order to protect hams in the region from potential danger as a result of the publication of this article, we have not identified specific individuals or Web sites connected with amateur radio activity in Yugoslavia.

In March, NATO members began an intensive bombing campaign against Yugoslavia and its leadership in response to aggression against ethnic Albanians in Kosovo, a province of Yugoslavia that had previously had significant autonomy. The bombing continues at this writing, as we take a look at amateur radio activity in some of the Balkan countries (see Map for reference). We begin...

In the War Zone

There are very few direct reports of current amateur radio activity in Kosovo or other parts of Yugoslavia. What we do know is that ham radio is not what it used to be since the bombing began (see Photo A). As one Serbian ham posted on his Web home page in April:

It was my home page about hobbies: astronomy, HAM Radio, aquaristics, etc....Sorry, but I can NOT talk about these nice things now, when my country is bombed by NATO. NATO is claiming no civil victims but houses, schools, hospitals and other purely civilian objects are destroyed. Civilians, innocent children, innocent people are killed by NATO bombs. What is the truth?. Nothing is fully black or fully white.

Other reports from and about hams have come primarily from the Internet or the news media. In mid-April, a Yugoslavian Web site reported:

01:59 As reported by radio-amateurs, one NATO airplane was downed near Dobovac. The search for the pilot is under way.

This Web site reports the downing of NATO aircraft on an almost daily basis, and, to date, this has been the only mention of amateur radio on the site. With no independent way of confirming this information, we cannot be sure whether this information is accurate.

A limited number of health-and-welfare messages from refugees are making their way to the U.S. via ham radio.

"01:59 As reported by radio-amateurs, one NATO airplane was downed near Dobovac. The search for the pilot is under way."—Unconfirmed report from a Serbian Web site, attributed to hams

Map. The former Yugoslavia is now divided into several smaller countries: Yugoslavia (consisting of Serbia, Montenegro, and Kosovo), Bosnia and Herzegovina, Croatia, and Slovenia. (CIA map)

*Bob Josuweit, WA3PZO, is CQ VHF's Public Service editor. He also helped with Vietnamese refugees coming into the U.S. in the 1970s, and worked with the National Disaster Medical System (NDMS) on the use of ham radio during the Gulf War.

Photo A. Bomb-damaged office building somewhere in Yugoslavia. (Downloaded from a Yugoslav Web site)

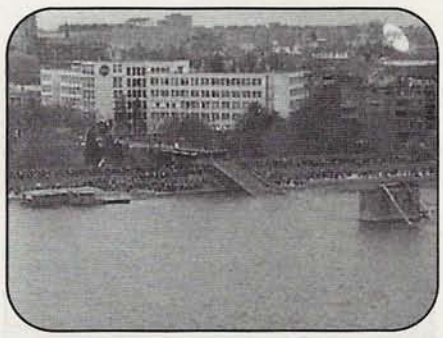


Photo B. A view of the northern Yugoslavian city of Novi Sad, showing a bridge destroyed by NATO bombs early in the campaign. (Via the Internet)

According to a report in the *Hudson Division Loop*, an e-mail newsletter, the International Emergency Assistance Unit, a division of the Mid-Island Amateur Radio Club of Mt. Sinai, New York, was activated by MIARC President Mike Christopher, KG2M.

Christopher explained that the IEAU activation was for the purpose of passing health and welfare traffic from refugees in the war zone back to family members and loved ones in the U.S. This is being accomplished with the help of one ham in Bosnia-Herzegovina, the only country in the Balkans with which the U.S. has a third-party traffic agreement (a third-party traffic agreement allows ham radio operators to exchange messages on behalf of non-hams in the respective countries). This ham has been in contact daily on 80 meters with the war zone and refugee areas, gathering health and welfare traffic, then passing that to the IEAU on 15-meter phone. The messages are then forwarded into the ARRL's National Traffic System.

Bombs Coming... Head for the Roof?

Ham radio operators in Belgrade have been heading for the rooftops instead of the bomb shelters, according to the British newspaper, *The Independent*. The paper indicates that hams have been tuning in to NATO's state-of-the-art air alliance communications. According to *Independent* reporter Robert Fisk in Belgrade, the pilots he's heard on hams' tapes are unmistakably American. He says,

> There are very few moments of emotion in those voices from the other world, just the hint of a joke and some laughter come down from the ether. Or the sudden, unprofessional surprise of a young pilot who didn't realize how real his bombs were until they exploded. An unidentified pilot says, "Two impacts—wow, look at that." Then there are seconds of silence.

As Fisk points out, if the ham radio operators can pick up the conversation, the Yugoslavian military are listening with much more professional ears than the men on the rooftops. According to the paper, Yugoslav officials are selectively editing their tapes to change the conversations. Fisk continues, "Not so the radio ham intercepts which are undeniably real, a tape of which has been handed to *The Independent* on Sunday in Belgrade. And it is just possible—even for a non-technical ear—to understand how the NATO air strikes are controlled."

Goooooood-Morning, Kosovo

As of this writing, there are no other reports of amateur radio activity in the war zone, but there appears to be some "on-the-air in-the-air" broadcasting going on, with reports that the U.S. sent two aircraft—transmitting radio and television messages over normal broadcast frequencies—to the crisis area.

According to Glenn Hauser's *Short Wave DX Report*, two "Commando Solo" aircraft of the 193rd Special Operations Wing left the U.S. for the Balkans at the end of March. The Radio Society of Great Britain (RSGB) News Service said information from another source indicated that the two planes are flying at around 20,000 feet and broadcasting on 1003 kHz-Medium Wave and 87.9 MHz VHF, around the clock, to Serbia and Kosovo. The 1003-kHz frequency lies between the regular European broadcast channels of 999 kHz and 1008 kHz, both of which carry Serbian programs from Belgrade, the Yugoslavian capital. The 87.9-MHz frequency is within 200 kHz of local broadcasts in Novi Sad, Serbia (see Photo B).

Outside the War Zone

Ham Radio in Slovenia

Slovenia is one of three countries that used to be part of Yugoslavia during Communist rule but are now independent. The other two are Croatia and Bosnia-Herzegovina. Slovenia declared its independence from Yugoslavia in June, 1991.

"A limited number of health-and-welfare messages from refugees are making their way to the U.S. via ham radio....This is being accomplished with the help of one ham in Bosnia-Herzegovina, the only country in the Balkans with which the U.S. has a third-party traffic agreement...."—from the* Hudson Division Loop *newsletter

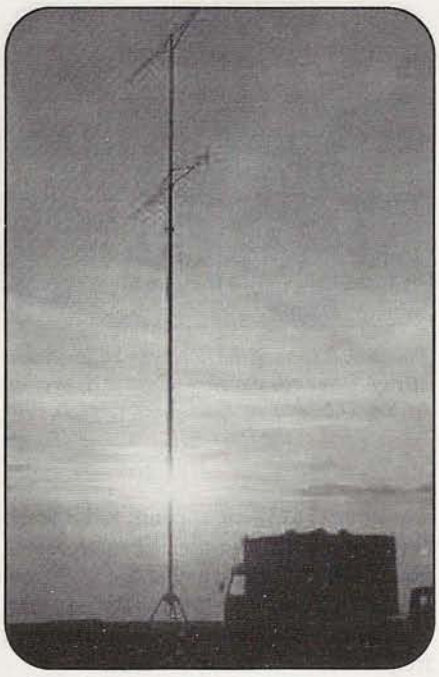


Photo C. The Slovenian Army Radio Club "General Maister" is active on HF to 1.2 GHz and operates 12 to 15 VHF contests each year from portable locations such as this one. (Courtesy S56JBB)

In Slovenia there are three amateur radio license classes. They are First class (all frequencies, all bands, all modes, maximum power allowed is 1500 watts); Second class (some of the HF bands—160, 80, 30, 15, and 10 meters—and all VHF and higher frequencies, with maximum power of 300 watts on HF); and Third class (VHF and higher only, no Morse code requirement, maximum power 50 watts).

There are several ham radio clubs in Slovenia, many of which are in or near the capital city of Ljubljana. The national society, ZRS, Zveza Radioamaterjev Slovenije, has around 7,300 members. While most of the clubs are similar to radio clubs in this country, here's one that's a little different...

S59SLO

The amateur radio club "General Maister" was officially established in December, 1993, by a group of radio amateurs working in the Signals Unit of the Slovenian Armed Forces. Its callsign is S59SLO. The club also has a contest callsign, S53T, and a secondary call used by a section of the club located at Krim, S59GMA. With support offered by the Signals Unit Command as well as the General Staff of the Slovenian Armed

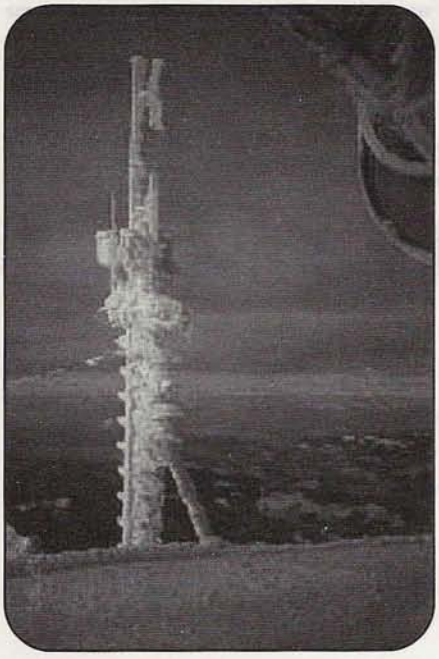
Photo D. Radio Club "General Maister" in Slovenia operates in the field on 144 MHz, 432 MHz, and 1.2 GHz. (Courtesy S56JBB)

Nikola Tesla: A Serbian Radio Connection

The brilliant inventor and electrical engineer, Nikola Tesla, was born in Smiljan, Croatia, then part of Austria-Hungary, in 1856. He developed alternating current (AC) and was granted more than 100 U.S. patents. Many of his discoveries led to electronic developments for which other scientists were later honored.

Although Tesla had laid the theoretical basis for radio communication as early as 1892, Guglielmo Marconi claimed all basic radio patents because of his own pioneering work in the field. In 1915, Tesla made an unsuccessful attempt to obtain a court injunction against Marconi's claims. When the U.S. Supreme Court reviewed this decision in 1943, however, it reversed the lower court decision and invalidated Marconi' s patents on the ground that they had indeed been anticipated by earlier work.

During his later years, Tesla led a secluded, eccentric, and often destitute life, nearly forgotten by the world he believed would someday honor him. Tesla died in New York City in 1943. The Tesla Museum in Belgrade, Yugoslavia, was dedicated to the inventor. In 1956, the Tesla, a unit of magnetic flux density in the metric system, was named in his honor.



Photos E and F. Winter in northern Slovenia puts a "chill" on these ATV (amateur television) antennas, but they keep on working. On the left is the S55TVG ATV antenna system; on the right is S55TVK and other ATV repeaters. At an elevation of 1700 meters (nearly 5600 feet) above sea level, these repeaters cover a wide area of northern Slovenia and some parts of southern Austria.

Forces, the club has reached a considerable level of technical provision as well.

The "General Maister" is the only amateur radio club within the Slovenian Armed Forces. Members are chiefly military personnel and their family members. Over the last five years, the club has grown considerably and has organized numerous activities, including participation in VHF and UHF contests. Club members head to the field at least 15 times each year to participate in various contests (see Photos C and D).

Another important area of ongoing activity is educating club members and attracting new members. The club has also organized various ham classes and has been responsible for licensing more than 100 new amateurs, many of whom are soldiers and other military personnel. At present, the club has 24 members.

"...if the ham radio operators can pick up the [NATO pilots'] conversation, the Yugoslavian military are listening with much more professional ears than the men on the rooftops. According to the paper, Yugoslav officials are selectively editing their tapes to change the conversations."

Digital Modes

The Radioclub Ljubljana maintains a full service packet–Internet gateway. According to the club Web page, the idea of a packet radio-Internet gateway got started in 1994. The major problems were getting enough money to buy equipment and finding a location with an Internet provider. The club raised the money it needed, and the first gateway was up and running in January, 1995.

The gateway is open to the entire Internet as well as the whole packet radio network. The current gateway equipment includes a Pentium P166 pc with 32 MB RAM; a 1-GB hard drive; a quad speed CD-ROM; an Ethernet card; and a KISS connection to SuperVozelj ANET:S55YAN (SuperVozelj is similar to TheNet nodes used in the U.S.). Software is JNOS 1.11x7, compiled for the club by S57BBA.

SuperVozelj nodes are homemade 68010 computers with three SCC chips, giving six channels. Each node has remote hardware reset, and software can be uploaded over the air. The ANET: S55YAN has six channels, but only five of them are in use. The first and third channels are linked to the packet network (to LJU:S55YLJ SuperVozelj) at 1.2288 Mbps (*yes, folks, that's 1.2* Megabits *per second—ed.*) and 19200 bps; channel 2 is a wire link to S50LEA; channel 4 is a wire link to S55TCP; and channel 6 is a 1200-bps AFSK local port.

"Over the last five years, ["General Maister," the only amateur radio club within the Slovenian Armed Forces] has grown considerably and has organized numerous activities, the most important of which is participation in VHF and UHF contests. Club members head to the field at least 15 times each year to participate in various contests."

Amateur TV and Other Interests

There is an extensive ATV system in Slovenia. With antennas on 23, 13, and 3 centimeters in northeastern Slovenia, the S55TVK and S55TVG repeaters (see Photos E and F) cover a wide area of northern Slovenia, plus parts of Austria, Hungary, and Croatia. Local clubs have cameras mounted outside to give spectacular views of the countryside, and some ATV systems allow for two-way video conferencing.

As in this country, not every amateur is interested in 50 MHz and above. Many Slovenian hams are active DXers and HF contest operators. In fact, the Slovenia Contest Club will host the World Radiosport Team Championship in 2000.

A Final Thought...

Amateur radio has played an important role in many recent conflicts. During the civil war in Bosnia-Herzegovina a few years ago, amateur radio was a lifeline for villages that were holding out against attack. During the Gulf War, a lone amateur radio operator in Kuwait provided information on the Iraq occupation, and, during the Vietnam War, amateur radio played a key role in helping put refugee families back together again as they entered the U.S.

The complete story from *this* conflict may not be known for some time, but you can be sure amateur radio is there. ■

AOR AR8200 All-Frequency/ All-Mode Handheld Receiver

It's a shortwave receiver, it's a scanner, but perhaps most importantly for VHF hams, it's an all-mode VHF/UHF receiver you can use to monitor beacons or satellite downlinks. And it's handheld!

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

Many ham radio VHFers and UHFers are also into scanners, big time. Of course, many amateur handhelds double as scanners, with most dual-banders tuning from the aircraft frequencies around 120 MHz through 170 MHz or so on VHF, and, at a minimum, 430 through 470 MHz on UHF. Some offer even greater coverage, and one, the new Yaesu VX5, offers receive coverage from the bottom of the AM broadcast band up to 999 MHz, with cellular frequencies blocked.

By and large, however, if you want really broadbanded frequency coverage, you'll need to look into a dedicated scanning receiver. Even so, only a few manufacturers have so far met the challenge of offering a handheld receiver that goes from 500 kHz up to 1500 MHz. Fewer yet offer the option of CW and single sideband reception in addition to AM and FM. In fact, I know of only three.

I've worked with the Alinco DJ-X10 all-mode scanning receiver, and, although it doesn't incorporate any ham transceiver capabilities, it does give you all modes from 100 kHz to 2 GHz, cellular blocked. I've also tested the ICOM R-10, which covers 500 kHz to 1300 MHz, multi-mode. My latest test—and the subject of this review—is the new AOR AR8200 wide-range, all-mode handheld receiver (Photo A), which covers 500 kHz to 2040 MHz. Although slightly higher priced than the comparable Alinco and ICOM equipment, it was an amazing performer in tuning in high-frequency ham bands on upper and lower sideband, as well as all of our VHF and UHF bands, with capabilities of taking one of five "slot cards" (Photo B) for the following features: 4,000 memories, 20-second voice playback, 256-step tone eliminator, CTCSS squelch and search, or a 157-step voice inverter (for experimental applications only).

AOR has been around for many years in Japan as a manufacturer of high-quality radio communications equipment. Scanners are the company's main import item to the U.S., and AOR USA is operated out of Torrance, California, under the leadership of "Taka" Nakayama, KW6I, Executive Vice-President and an active ham. Taka was formerly with Alinco.

Photo A. WB6NOA with the AOR AR8200 handheld receiver. Gordon apparently misunderstood the reference to coverage of "worldwide" frequencies and felt compelled to test the radio in England as well as California! Here, he's standing at the prime meridian in Greenwich, listening to—what else?—WWV! (Photos by the author)

Introducing the AR8200

The AOR AR8200 is shipped with four rechargeable nickel cadmium (NiCd) AA cells (separate cells, not a battery pack) and a charger. The handheld can also take four long-life alkaline cells (they last twice as long as the NiCds, but can't be

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

Photo B. The AR8200 has a trap door to accept one of five "slot cards" that provide additional options (kind of like a PCMCIA card on a laptop computer). See text for details.

recharged), but, because alkaline cells are ever-so-slightly longer than the supplied rechargeable cells, I had to really work at getting them to fit into the AOR 4-cell battery tray (Photo C). I am told this is on purpose to ensure that the batteries won't work loose. Believe me, they won't! By the way, the NiCd cells may be recharged while the radio is in use, although it will take longer to reach full charge. In addition, the AR-8200 comes with a DC power cord, with a cigarette-lighter plug on the end, for mobile use.

Once you get the receiver up and running, you'll be impressed with the large LCD screen (Photo D), that reads out everything from frequencies to a graph that lets you look at a snapshot of band activity, and by the capability of storing *1,000* favorite frequencies in 20 banks, any mode of reception, from 500 kHz through 2040 MHz, minus cellular. For improved AM broadcast band reception, the AOR 8200 has a plug-in ferrite bar antenna that really boosts 550- to 1800-kHz reception (Photo E).

A Smart Radio

Getting around the frequencies is relatively easy with the side-mounted thumbwheel frequency selector (Photo F) or the capability of simply key-entering the frequency or channel of your choice. When tuning around the ham bands, the AOR *automatically* recognizes which band you're on, and gives you lower or upper sideband for the worldwide bands and FM for the VHF and UHF bands (see the example for 40 meters in Photo D). You can also swing over to upper sideband for weak signal and satellite operation. In fact, it "knows" when you're in SSB territory on the VHF ham bands and automatically adjusts the mode.

In the 2-meter mode, the AR8200 will automatically select upper sideband as soon as you go below 144.600 MHz. It also automatically goes to sideband in the recognized satellite bands on both 2 meters (145.800 to 146.000 MHz) and 70 centimeters (435 to 438 MHz). Very smart radio!

The arrangement of single-hand operation was good, letting your thumb control quick-tuning up and down the ham bands, or any frequency band for that matter. But don't tune too quickly or the PLL won't keep up with you and you might skip over some important signals. On single sideband, in very small steps, you won't miss a thing, but if you're rapidly zipping in big jumps through AM or FM frequencies, you could whiz by something important.

There is a side keypad providing four arrow keys in a single "rocker" that allows easy entry to the on-screen menus (see Photo F), and it let me quickly add up to 12 characters of text comments about each and every memory channel I wanted to store.

The band scope is another terrific feature. I could look at an entire amateur radio band and see where all of the activity was. The receiver mutes during band scope operation, but this is normal in almost all band scope offerings among the handheld manufacturers.

HF Operation

For high-frequency ham operation, the little rubber antenna should be removed (it has a BNC mount) and you need to stick on something a lot longer, such as an external mobile antenna—if you're trying to tune in weak signals. On the other hand, if the signals are relatively strong on shortwave, upper sideband or lower sideband reception could actually work on the little rubber antenna.

I was amazed that, while visiting in Greenwich, England (Photo A), I was able to receive time station WWV in Boulder, Colorado, with just the little rubber antenna, held close to some surrounding metals that probably acted like an inductive antenna. I then substituted a telescopic whip for the little rubber duck and high-frequency reception improved a little. But for the best HF reception, a dipole or long wire works wonders!

Photo C. This handheld scanner/shortwave receiver comes with rechargeable nickel-cadmium (NiCd) batteries, but will also work with standard alkaline cells. Alkaline batteries will last twice as long as the NiCds, but can't be recharged.

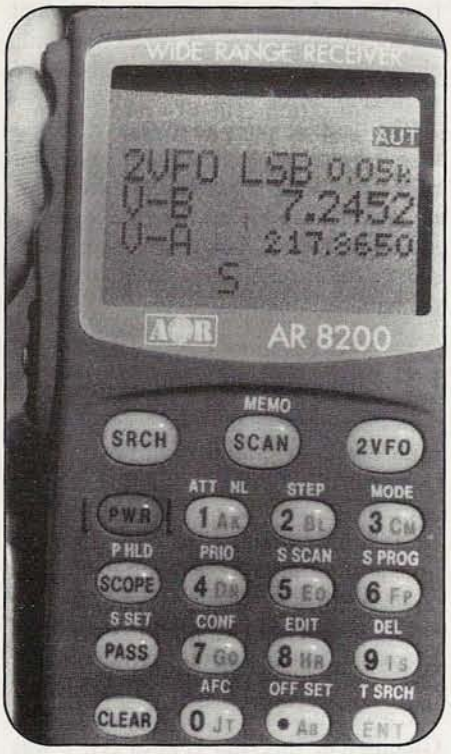


Photo D. The AR8200 features a dot-matrix LCD display that is easy to read, even in low light. The display provides a wide variety of information, and the radio automatically selects the receive mode based on what's most commonly used on the frequency to which you tune, such as lower sideband (LSB) on the 40-meter ham band.

The automatic gain control (AGC) is not adjustable, so high-frequency reception is a bit "punchy" on upper or lower sideband. Strong signals are loud, and weak signals are in the equal-volume noise. But HF reception of the ham bands was just as sensitive when compared to a companion's dedicated ham set. The ham set had slow AGC, which made listening to different signal strengths a lot easier on the ears, but I was still impressed with the 8200's great sensitivity on HF.

Superb VHF Performance

Up on 6 meters, 222 MHz, 440 MHz, and even way up on the 1280-MHz ham band, sensitivity for incoming FM calls, as well as upper sideband weak signal and satellite calls, was superb. I compared the AR8200's reception to dedicated single-band and dual-band ham transceivers and it was equal.

Sensitivity was also excellent on 2 meters, but paging transmitters at 152 MHz all but covered up weak signals from 144 to 148 MHz. The offending pager stations put in such strong signals to my outside high-gain antenna that they literally swamped the receiver, and what I could normally pick up with a dedicated, single-band 2-meter transceiver was barely audible on the AOR. Even when I switched in the attenuator, those powerful paging transmitters completely wiped out the 2-meter band.

Luckily, there was a rather simple cure: I stuck on the small Par notch filter, tuned to the pager transmitter at 152 MHz, and instantly the AOR 2-meter reception popped back to life. But this problem didn't surprise me—one of my usual bench tests of a VHF receiver is with and without the notch filter, and very few handheld receivers with major frequency capabilities can survive the incessant paging transmitter. When I went from the high-gain antenna to the telescopic whip and the supplied rubber duck, signals that had been lost on the outside antenna due to receiver swamping came in loud and clear.

Frequency Flexibility

While operating in Europe, I discovered that certain VHF and UHF channel spacings were different from those in the U.S. No problem. I could key-enter the specific frequency, or "step-adjust" to any oddball stepping arrangement, and this made the side-tuning control very simple to manipulate. There's also automatic frequency control (AFC) to lock onto ham frequencies up at 1280 MHz from a cold start of the receiver. In other words, the receiver will stay locked on the frequency you've set, even though it is "warming up" and stabilizing.

Satellite Action, Too

I found that selecting the mode *WAM*, for wide amplitude modulation, would produce good weather facsimile imagery from low earth weather satellites in connection with a computer program. In the WAM mode, the AR8200 uses a wider IF filter and allows for the satellite signals to easily pass through to the audio stage.

It's in the Book

How to operate the AOR 8200 is well documented in a—catch this—140-page instruction *book*. Everything is covered, and the book even explains how the somewhat mysterious operations like "push" and "press" are different from each other (with *push* meaning a momentary key entry, and *press* meaning to push and hold in).

Never a Dull Moment

But best of all about the AOR AR8200 are its many features that you'll begin to learn after months, and maybe even years, of owning the equipment. The design of this scanner allows you to slowly grow into everything it can do, rather than requiring you to master it in a day and possibly leaving you dissatisfied that it doesn't have any more features. This one will come up with more and more features as you better understand all of the options offered from the keypad.

All of the hams to whom we loaned the handheld were extremely impressed with the sensitivity and selectivity, saying they matched what they were presently getting with a single-band or dual-band ham transceiver. When I loaned the equipment to shortwave and scanner experts, the scanner experts were dazzled with everything it could do, and the shortwave folks couldn't believe it could pick up the high-frequency signals, using single sideband, just as well as much larger equipment from Sony and Grundig.

Photo E. If you enjoy broadcast-band DXing, the supplied ferrite rod antenna can be added on to dramatically improve reception on the AM broadcast band.

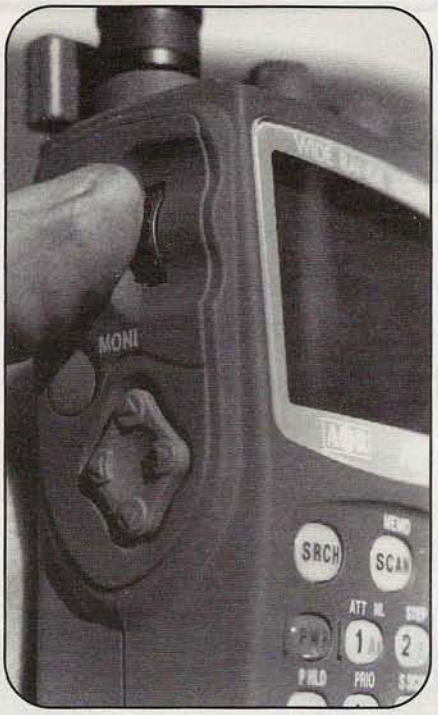


Photo F. The side-mounted thumbwheel lets you tune smoothly through the bands in user-selected steps. The four-position rocker switch below the thumbwheel is your access point to the on-screen menus that let you program in such things as tuning steps.

My little AR8200 traveled all the way from Los Angeles to London, and I could always pick up something local or worldwide, wherever I went. And that includes operating right at the prime meridian in Greenwich, England, and hearing WWV out of the noise!

If you enjoy the challenge of learning a full-featured, pocket shortwave receiver and scanner, the new AOR AR8200 may very well have the most bells and whistles of them all. List price: $699. ■

Resources

For more information on the AR-8200, see your favorite dealer or contact AOR USA, Inc., 20655 S. Western Ave., Suite #112, Torrance, CA 90501; Phone: (310) 787-8615; Fax: (310) 787-8619; E-mail: <info@aorusa.com>; Web: <http://www.aorja.com>.

For more information on Par notch filters, contact Par Electronics, 6869 Bayshore Dr., Lantana, FL 33462; Phone: (561) 586-8278; Fax: (561) 582-1234; E-mail: <par@rf-filters.com>; Web: <http://www.rf-filters.com>.

222 MHz—The Forgotten Band

The FCC said nobody was using the 220-MHz ham band and took away 2 MHz. They were only partially wrong. If we don't get more activity on this great band, and quickly, how safe is the rest of "the forgotten band"?

By Bill Cameron, KB2BZP*
(KB2BZP@hotmail.com)

Imagine a piece of prime ham radio real estate—say a hilltop location with a clear view for antennas in all directions—and an owner who says all hams are welcome to operate there. Now imagine that this great spot is somewhat hard to reach, and lots of people say they've heard from others (who have heard from others) that operating there isn't all it's cracked up to be. And for these reasons, even though it's available to any ham who wants to operate there, there have been very few who have actually made the effort to do so. So few, in fact, that the owner, under pressure from commercial users for hilltop space, has sold and fenced off a big chunk of the land.

Now, hams in the area are justifiably worried that, unless more amateurs use the hilltop, they'll lose access to the rest of it as well. This is especially worrisome to those hams who *have* made the effort to go up there, because they've found that operating there is *at least* as good as operating from other nearby (and overcrowded) hills.

Well, you don't have to imagine it. Over the years, the majority of the amateur community has essentially ignored some of the finest radio "real estate" available: the 222- to 225-MHz band (which used to be the 220- to 225-MHz band). Located between the popular ham bands of 2 meters and 440 MHz, 222 is truly the "forgotten band." While 2 meters and 440 brim with activity, 222 continues to be a generally silent, unexplored territory, despite being available to hams for over half a century, and despite being one of only two bands open to hams of *all* license classes. Hams know it's there, but most have never used 222 MHz, or "220" as many still call it. Tell them you're on 222 and you'll get that look that simply says, "really?"

Photo A. The new 30-watt ADI AR-247 is the first new mobile rig in years for 222 MHz. (Photo courtesy Premier Communications)

What's the Problem?

To understand why there's so little use, let's take an in-depth look at the characteristics of the band. Also known as either the 1.25- or 1.35-meter band, but hardly ever referred to as that, 222 MHz is not quite VHF, not quite UHF. Therefore, first and foremost, 222 suffers from an identity problem. You can clearly establish 2 meters as VHF and 440 as UHF, but 222 is in that odd territory, similar to the location of 6 meters, which is on the cusp between HF and VHF. Another problem is that the band is not available to hams worldwide, so manufacturers have not catered to it as they have HF and the other VHF bands, which are in use across the planet. Most of the amateur 222-MHz activity is in North America only.

*Bill Cameron, KB2BZP, lives in Lockport, New York. He's been a ham since 1986 and can often be found on the 222.94-MHz K2AER repeater in Newfane, NY.

One Family's 222-MHz Story

In the RF-rich environment of western New York, allocations for repeaters on popular amateur radio bands are hard to come by. Even broadcast frequencies on both AM and FM are full. Affecting this region are signals from three major metropolitan areas: Buffalo, Rochester, and Toronto. So in 1974, when Frank Gilson, W2KY, of Newfane, New York, wanted to put a new repeater on the air, he chose 1.25 meters—222 MHz.

"I wanted to fill a void in this area," said Frank. "220 was literally not being used by anyone." Frank also got his two sons involved in amateur radio. Today, Darrell, N2CVQ (see Photo B), and Devon, N2DRY, both use the 222-MHz band on a regular basis.

In its early stages, the WR2AER repeater, was nothing more than a Tempo 220 commercial rig from Henry Radio (Photo C), modified with separate transmit and receive boards. "The repeater proved especially useful during the "Blizzard of '77,' " said Darrell. "We used 220 to coordinate transportation of children from the local school to home via snowmobiles. Two-twenty was also used to coordinate getting prescriptions from a local drug store to those who needed them."

Photo C. The first repeater for 220 veteran Frank Gilson, W2KY, back in the early 1970s, was a Tempo 220 commercial rig, modified with separate receive and transmit boards for repeater operation.

Photo B. Darrell Gilson, N2CVQ, at the controls of the K2AER 222-MHz repeater in Newfane, New York. Darrel's father and brother are also hams, all active on 222. (Photos B through F by the author)

Today, with new club callsign K2AER, the repeater (224.94 -) has changed dramatically. Still at Frank's home, but now used by an enthusiastic 222-MHz group known as The Niagara County Amateur Radio Association, the repeater is part of a linked system on 222 MHz that allows local amateurs with "flea" power handhelds to enjoy a nearly 100-mile radius of coverage (see Photos B and D).

Frank says, "The repeater is ready to go in an emergency. It has battery and generator backup, can operate at 20 watts or 100 watts, is linked to a repeater about 50 miles south of here, and has voice messaging and autopatch for club members." He also says the current repeater is frequency agile, meaning it can interact with other in-house transceivers for VHF, UHF, and even HF.

Frank, and other 222-MHz enthusiasts like him, offer a fine example of the extent to which 222 MHz is actually being used today.

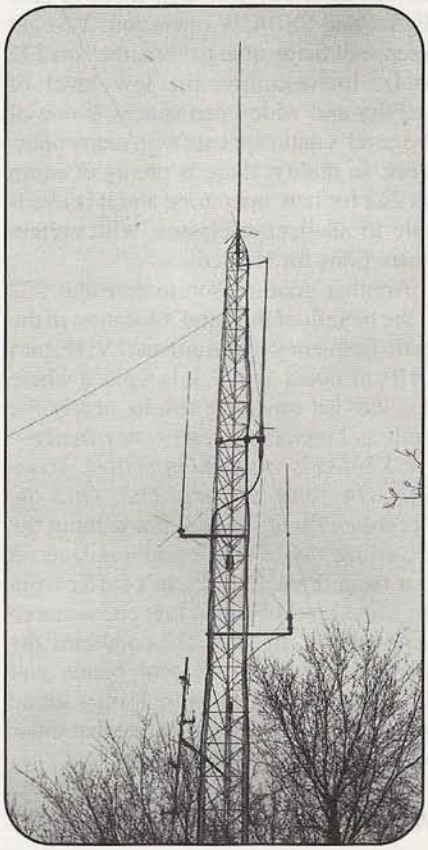


Photo D. Repeater antennas for the K2AER 222-MHz system in Newfane, New York. Included here are the repeater antenna and two link antennas, which connect K2AER users with other 222-MHz repeater users in Western New York and Ontario.

If you scan catalogs for equipment, there are limited varieties to choose from. Recently, however, two manufacturers, ADI/Pryme and Alinco, have released new handheld 222-MHz radios. ADI also has created excitement with its new 30-watt 222-MHz AR-247, the first new mobile rig for the band in years (Photo A). This is encouraging, as most companies have abandoned the design and manufacture of new 222-MHz equipment. The companies can't be blamed, as they simply respond to demand. The only thing that will reverse this trend will be to increase demand, essentially by having more hams use the band. So the natural question you must be asking is, "Why should I get on 222 MHz?"

Why Bother with 222?

Those who have ventured onto this band have found an atmosphere of genuine enjoyment. Like the other VHF and UHF bands, FM is the primary mode of communication, although there is also digital and SSB/CW operation. You get a sense of being able to "breathe" on 222 MHz. Interestingly, the low level of activity and wide-open spaces is one of the band's main appeals with many operators. In reality, there is plenty of room on 222 for new operators, and it is available to all license classes, with certain restrictions for Novices.

Another good reason to consider 222 is the benefit of the band's location in the radio frequency spectrum: part VHF, part UHF, as noted above. It is a place where you can get coverage results nearly the same as 2 meters (*in some cases, better—see K5MAT's companion article, "Getting On, and Getting Out On, the Forgotten Band."—ed.)*, but without the crowding that's now commonplace on that band. Plus, 222 doesn't suffer from the same level of signal loss encountered at 440 MHz. In fact, 222 combines the positives of both adjacent bands and eliminates their negatives. It may sound too good to be true, but that's what those of us on the band have found.

What's on 222?

When listening to or operating on 222 MHz, you'll find many operators will use home-based repeaters simply to talk with other licensed family members and their close ham friends in the more private environment that 222 MHz offers (see "One Family's 222-MHz Story," for an example). Most low-end scanners don't include 222 MHz in their coverage, so there's less chance of being overheard by non-hams. When you do listen, it may sound like a small group or clique dominates some repeaters. While that may sometimes be true, it's much more likely that the current operators have been talking to each other for years, and newcomers are few and far between.

"Also known as either the 1.25- or 1.35-meter band, but hardly ever referred to as that, 222 MHz is not quite VHF, not quite UHF. Therefore, first and foremost, 222 suffers from an identity problem."

If you've purchased a 222-MHz radio and hear activity on a repeater, don't hesitate to say you're listening (in fact, do it even if you *don't* hear activity). If you announce you're on the repeater, you'll generally be welcomed with open arms.

No radio yet? The best advice is to first network with other area hams or consult a repeater directory and see if there are any 222-MHz repeaters in your area. But beware: directories can contain information that has not been updated for some time, so it's best to simply network in your local ham community first. If you do find out that there's a repeater near you on 222, try to contact the owner and tell him or her that you're thinking of getting on the band. Ask about the level of activity in your area, what 222 MHz offers, and what equipment would best suit your needs. Again, local hams who are active on the band will be your best resource for information on local activities and are also likely to be very encouraging for you to get on the band.

Where the Action Is

In North America, current "hot spots" for 222 MHz include southern California and larger metropolitan areas across the U.S. and Canada. In California, 222-MHz hams make impressive use of the band through statewide linking systems. Some details of those systems can be found on the Internet by simply searching with the keywords "222 MHz." You'll find several Web pages with information specific to them.

My region, western New York, has a better-than-average amount of use. This can be attributed to the enthusiastic use of VHF and UHF in general in the Rochester area, and the high population of hams in Buffalo and north into Toronto, Canada. Niagara County, where I live, is in the middle of that region. It's home to two 222-MHz repeaters, and there are four others right outside of Buffalo. While these repeaters experience long periods of quiet during a typical day, they do offer a great tool for communication that's readily available.

No activity in your area? Try to start some. Local use of 222 MHz tends to build slowly, mainly through word-of-mouth. Recently, during a 2-meter conversation, I learned the other ham had a 222-MHz module in his radio and his vertical antenna could accommodate 222 MHz, but he had never used it. It was the typical excuse of, "I never thought anybody was up there." In a matter of minutes, we were on a local 222 repeater. At the end of the conversation, he remarked how much he liked the band and said he'd be back.

Ragchew Central

While ham radio's basis is communication, many "ragchewers" are understandably chased off of 2-meter repeaters, which tend to get pretty busy during a typical day. Due to heavy activity, it can get frustrating when your 2-meter operating is essentially cut down to "soundbites" about the type of radio and antenna you have and where you're located. Not so on 222, where you'll likely be able to talk to another ham for hours at a time. This band tends to have a more relaxed atmosphere for conversation than 2 meters, almost like HF operating without the interference and fading. A typical conversation on 222 MHz can delve into more detailed and interesting topics that can go on at length.

As for propagation, the band offers everything that 2 meters does, except sporadic-*E* (*Es*) skip. Actually, there is *one* confirmed *Es* contact on 222, and it's possible that there are other occasional *Es* openings on the band that have been missed due to inactivity. You can help document the occurrence of *Es* on 222 by calling CQ on the band when there is evidence of *E*-skip on 2 meters and the high VHF TV channels (7–13). Aurora, meteor scatter, and moonbounce are all possible on 222, as on its VHF and UHF cousins. Complicating long-distance

Today's 222 Marketplace

The recent introduction of three new radios for 222 MHz was welcomed enthusiastically by the 222 community, since it has been many years since any major manufacturers have paid much attention to the band. Here's a rundown of the new equipment available today for 222 MHz (some examples of handhelds are shown in Photo E and of mobile rigs in Photo F):

Alinco offers the DJ-280T handheld, and ADI/Premier Communications has the new Pryme PR-222. The Alinco model is a virtual twin to the durable and easy-to-program DJ-180T, a 2-meter model which was released in the early 1990s. The Pryme PR-222 also has a 6-meter twin, the PR-52. Specifications for both can be found on each company's homepage on the Internet (see "Resources" at end of this article).

Certainly the most exciting recent news in the 222 MHz world is the release of ADI's new mobile, the AR-247 (Photo A). It offers 30 watts output, with selections for 15 and 5 watts for local work. This is the newest design for a 222-MHz mobile in years and it boasts a variety of up-to-date features, including 81 memory channels, direct frequency entry, and both CTCSS and Digital Coded Squelch.

Models are also available from other amateur radio manufacturers. Kenwood's standby 222-MHz mobile has been the TM-331A. It's an older, but sensibly designed, FM transceiver that transmits with 25 watts. A few years ago, Standard Radio offered an expensive, but very highly rated 2-meter/222-MHz dual-band handheld, the C228A, along with a single-band 222-MHz handheld, the C288A. Standard has left the amateur market, but some dealers may have leftover units in inventory, or you may find these at flea markets. Yaesu and ICOM have also offered 222-MHz rigs, and some vendors still sell these models. Yaesu's FT-33 handheld is still in its current lineup. ICOM currently offers nothing for 222, but you might find a leftover IC-38A handheld or dual-band IC-2340H mobile rig on a dealer's back

Photo E. Some of the 222-MHz handhelds offered over the years, including (left to right) ICOM's IC-3AT, IC-03AT, and IC-V21AT (dual-bander); Standard's dual-band C-228A; an ICOM IC-3SAT; and, the only one of these currently in production, the new Pryme PR-222. Alinco and Yaesu also offer 222-MHz handhelds.

shelf or at flea markets, where you can also watch for such classics as ICOM's IC-3AT and IC-03AT. For those who enjoy building, transceiver kits are available from Ten-Tec and Ramsey.

If you'd like to purchase just a handheld and would like a little extra wattage at home or in the car, a number of amplifiers for 222 MHz are available from major manufacturers, such as Mirage. You can explore what's available on the used market, too. A nice variety of antennas, whether mobile or fixed, is also available from the major manufacturers. Again, you simply need to do some research.

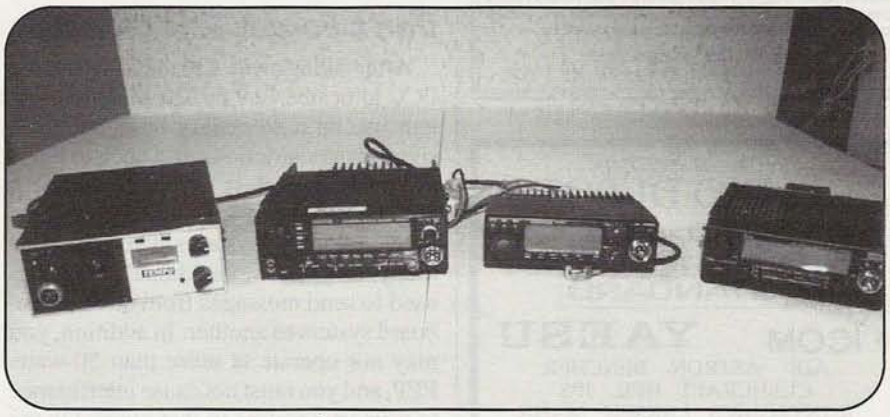


Photo F. Mobile rigs through the years for 222 MHz include (from left): 1970s Tempo 220, Kenwood TM-631A dual-bander and TM-331A single-bander, and the ICOM IC-2330A dual-bander. Of these, the TM-331A is the only one still offered new, along with ADI/Premier's new Pryme AR-247 (not pictured), and transceiver kits available from Ten-Tec and Ramsey.

work is the fact SSB and CW equipment just isn't readily available for the band. To explore those modes, you'll need to build a rig, buy or build a transverter (*such as the Down East Microwave transverter reviewed elsewhere in this issue—ed.*), or opt for an expensive multimode VHF/UHF rig with a 222-MHz module.

But FM is still where you'll find the greatest number of stations on 222, and there's plenty of opportunity for FM DXing as well. In fact, you can sometimes do better in the DX department on 222 FM than you can on 2-meter FM. Because of the uncrowded nature of 222

MHz, FM tropo-ducting can be a real joy when conditions permit. Fewer repeaters and fewer operators add up to the chance of great long-distance contacts during even a marginal tropo opening. During such an opening, you might easily be able to bring up a repeater two or three states away on a normally quiet frequency. If you're successful on a repeater, switch to a simplex frequency and see if you can work direct. (*For some specific examples of DX you can work on 222, see K5MAT's companion article.—ed.*)

The Band Plan

Where do you go to find stations using these various modes? Most non-FM operation is found in the weak-signal area of the band, between 222.000 and 222.150 MHz, with the SSB and CW calling frequency on 222.100 MHz.

For FM work, repeater inputs are between 222.250 and 223.380 MHz, with outputs 1.6 MHz higher (223.85 to 224.98 MHz), and the national simplex frequency is at 223.500. Digital modes are found between 223.520 and 223.640, with 223.640 to 223.70 MHz reserved for links and control frequencies. These frequencies are from the ARRL's national band plan and specifics may vary in different areas.

It should also be noted that Novices are limited to 25-watts PEP in the 222-MHz band, but they have the opportunity here to experiment with all modes, such as CW, phone, image, and others.

Don't Forget 219 to 220

After taking away 220 to 222 MHz, the FCC allocated 219 to 220 MHz to amateur use on a secondary basis and with significant restrictions. It's open to hams of any license class except Novice, but may be used only for fixed digital message forwarding systems. This translates today to packet "backbone" networks used to send messages from one bulletin board system to another. In addition, you may not operate at more than 50-watts PEP, and you must not cause interference to primary services in that range. On the plus side, the maximum signal bandwidth is 100 kHz, allowing for some pretty high-speed digital transmissions. There are some more specifics that must be followed, such as advance notification of your intent to use this band segment, and certain geographically based restrictions on operating here. For more information on this allocation, refer to the FCC rules, Section 97.303 (e). If you're interested in putting up digital links on this band, contact the ARRL for details on what you need to do in your specific location.

On the Air on 222

Equipment may *appear* to be hard to come by, but that's an illusion, especially today. While you won't find as many ads for 222-MHz gear as you will for 2-meter or 440 equipment, it's out there and relatively easy to locate. Simply put, if you look, you will find it (see "Today's 222 Marketplace" for some help).

While operating on the band, you will find that "fluttering" caused by airplanes, buildings, and other objects is worse than on 2 meters, but it's nothing that's intolerable. You'll have to pay closer attention to signal loss in your set-up than you do on 2 meters, but you'll notice that it's much more forgiving than 440 MHz. In fact, 222 MHz generally is a more solid performer than the more popular 440-MHz band.

A simple station consisting of a mobile rig or handheld hooked up to a power supply and outdoor antenna can bring years of enjoyment. The majority of mobile rigs (with the exception of the new ADI mobile) are limited to 25 watts output, designed to accommodate the power limitation placed on Novices. While external amplifiers are available from manufacturers and can be added, 25 watts or less and a good antenna should be more than enough to work repeaters within your region.

HF-VHF Links

Some 222-MHz repeater operators have found that it's also a great band to link to 6- and 10-meter FM repeaters. During band openings, 6- and 10-meter links to 2 meters can annoy some 2-meter operators, as they may want only local communications. The quieter nature of 222 MHz offers a sensible link option for repeater owners who want to let others get a taste of DX, but may not own HF radios covering those frequencies (*and yes, it's legal for a Technician to be linked onto 10 meters as long as* you *are transmitting on an authorized frequency, and as long as the repeater licensee and control operator are authorized to transmit on 10 meters*).

That brings up another point. Sometimes, when you're listening to 222 MHz and hear some activity, it turns out to be a link to 2 meters or possibly 440 MHz. To generate some "activity" on 222 MHz, many repeater owners link their 2-meter

and 440-MHz systems to a 222-MHz machine. Straight 2-meter to 222-MHz links offer no real advantage though, since most people on 222 MHz probably already have 2 meter radios. Plus, each band is similar in coverage. If you can work it on 2 meters, you'll probably be able to work it on 222.

The idea behind such links is that they give the perception of activity on 222 MHz and may help preserve the band should it ever be threatened (*one advantage is that telling enough people that you're talking on 222 may encourage some of them to try the band themselves.—ed.*). Of course, in your ham radio endeavors, you do not have to abandon 2 meters or 440 MHz, as those bands certainly have their advantages and enjoyments, but 222 MHz might be just the right place to escape to for a change of pace.

Room to Grow

Realistically, 222 MHz will probably never rise to the level of use that 2 meters enjoys. It does not benefit from "top-of-mind awareness" after so many years of neglect. On the other hand, with companies like ADI/Pryme and Alinco selling new radios for the band, now is perhaps the most economical time to get on the band. The crystal ball is definitely showing a brighter future for 222 MHz. So, if you're looking to explore new territory and want to tread off the beaten path, why not try the "forgotten band?" 222 MHz is there with all its benefits; it's just up to us as hams to make the most of it. ■

Resources

For more information on radios, radio kits, transverters, and power amplifiers for 222 MHz, contact the following manufacturers:

Alinco Electronics, Inc., 438 Amapola Ave., Lot #130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758; Internet: <http://www.alinco.com>.

ADI/Pryme: Premier Communications, 480 Apollo St., #E, Brea, CA 92821; Phone: (714) 257-0300; Fax: (714) 257-0600; Orders only: (800) 666-2654; Web: <http://www.adi-radio.com>.

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

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

Mirage Communications Equipment, 300 Industrial Park Rd., Starkville, MS 39759; Phone: (601) 323-8287; Orders/Dealer Locations: (800) 647-1800; Fax: (601) 323-6551; Web: <http://www.mirageamp.com>.

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

Ten-Tec, Inc., 1185 Dolly Parton Parkway, Sevierville, TN 37862; Phone: (423) 453-7172; Fax: (423) 428-4483; E-mail: <sales@tentec.com>; Web: <http://www.tentec.com>.

Yaesu USA, 17210 Edwards Rd., Cerritos, CA 90703; Phone: (562) 404-2700; Internet: <http://www.yaesu.com>; or your favorite Yaesu dealer.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—July, 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, with our focus on 222 MHz, we'd like to hear from you about your activity on the band.*

1. Have you ever operated on the 222-MHz band?	**Circle Reader Service #**
Yes	1
No	2

2. If you answered "yes" to question 1, please indicate how often you operate on 222 MHz.

Rarely	3
Occasionally	4
Regularly	5
Frequently	6
Exclusively	7
Not currently active	8

3. If you answered "yes" to question 1, please indicate which mode(s) you operate or have operated on 222 MHz.

AM	9
CW	10
FM	11
Packet	12
SSB	13
SSTV	14
Other	15

4. If you answered "no" to question 1, please indicate your main reason for not operating on 222 MHz.

No equipment	16
No one else in my area is on	17
Other hams talked me out of it	18
Not interested	19
Never thought about it	20
Other	21

5. Please indicate whether the articles in this issue about 222 MHz have gotten you interested in any of the following.

Trying 222 for the first time	22
Becoming a regular user of the band	23
Encouraging other hams to get active on 222	24
Finding out more about the 219–220 MHz high-speed digital segment	25
All of the above	26
None of the above	27
Did not read the articles	28

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

What You Told Us

Our April survey asked about your experiences in getting—and giving—ham radio help. Virtually all of you (95%) have, at least once, tried to get help from another ham. And 76% of you got that help easily. Another 14% said yes, but with difficulty, and 10% didn't get the help you needed. Most hams found help through radio clubs (37%) or on the air (28%), 3% went through other organizations, 2% found help on the Internet, and the remaining 30% had "other" sources.

Of the readers who had never asked for any help, 60% said they'd learned all they needed from books, magazines, and videos, 22% didn't know where to turn for help, 19% said "other," and 3% were afraid people would think they were stupid for asking.

On the flip side, 90% of you have offered help to another ham, and 89% of those offers were accepted enthusiastically. Another 8% were accepted reluctantly, and only 3% were turned down. Once the help was offered, 54% of you were able to provide all the help needed, while 44% provided some help. Among the 10% who have never offered to help anyone with anything, 59% said no one had asked, 32% felt they didn't know enough to teach themselves, and 9% said "other."

Finally, when asked about club programs to help hams trying new things, 55% of you who belong to clubs (25% don't) said yes, 26% said no, and 19% don't know.

This month's winner of a free *CQ VHF* subscription is Bill Potter of Porterville, CA. As always, thank you for participating.

Getting On, and Getting Out On, the Forgotten Band

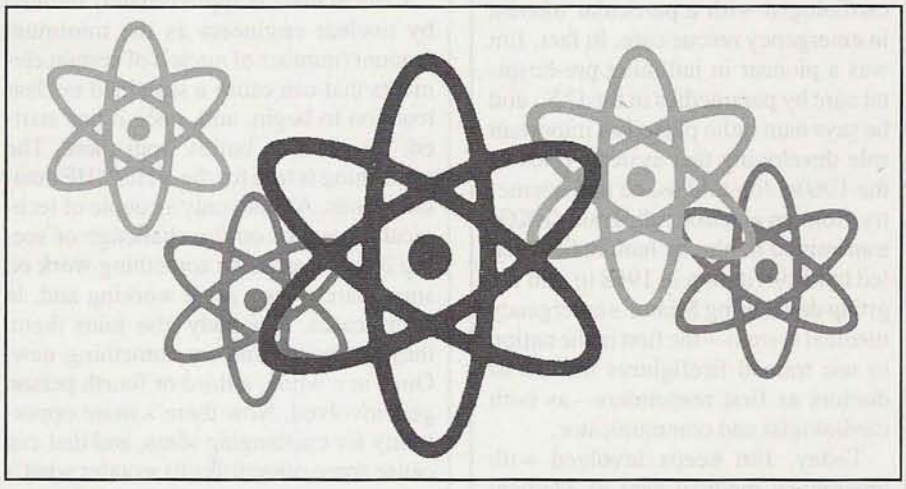
If 6 meters is the "magic band," then 135 centimeters (222 MHz) is the "forgotten band." K5MAT takes a look at one way to get on the band and what to expect when you get there.

By Bill Wageman, K5MAT*
(oldham73@aol.com)

There is a ham band below 500 MHz that is seriously underpopulated, and if you have any experience in the VHF/UHF part of the spectrum, you probably know what it is. In most parts of the world, it's not an amateur band at all, but, in the western hemisphere, it's available to most hams. In the U.S., all classes of licensees have access to it, yet in most parts of the country, one can listen for long periods of time on the main calling frequencies without hearing a signal.

I'm referring to the band that runs from 222 to 225 MHz, or the 135-centimeter band. In his companion article, "222 MHz —The Forgotten Band," Bill Cameron, KB2BZP, looked at some of the reasons for this lack of activity. First, and probably most important, is the relative lack of ready-made gear that can be bought off the shelf from your friendly ham dealer. Second is the perception that propagation on 135 centimeters is poorer than on 2 meters or even 70 centimeters.

I'd like to go into a little more detail on one part of the equipment question and on the matter of 222-MHz propagation. Plus, I'd like to offer one additional explanation for the band's under-population—a phenomenon that I call "critical mass," which must be met before large numbers of hams will want to join in on the fun.



Like a nuclear reaction that won't begin until it reaches "critical mass," the 135-centimeter band (222 MHz) has yet to achieve the critical mass of activity needed for it to grow in popularity to a level near either 2 meters or 70 centimeters.

Getting on the Forgotten Band

KB2BZP talks about the new FM radios coming on the market for 222 from Alinco and ADI/Premier. These should offer the band a good "shot in the arm." But what about those of us who like to work single sideband (SSB) and CW? There's virtually nothing on the market for 135-centimeter weak-signal work, except for a couple of decade-plus-old Yaesu satellite rigs (the FT-726 and 736) which have slots for adding your choice of bands, including 222.

The only viable way right now to get on 222-MHz SSB and CW is to buy or build a *transverter*. These are devices that translate both receive and transmit frequencies from one band to another. Most commonly, the "IF band" (the band from and to which those frequencies are converted) for 222 is 28 MHz, but some folks prefer to transvert from 50 or 144 MHz. Using lower frequency bands than 28 MHz is fraught with potential problems and is not recommended.

There are several designs[1–4] for "rolling your own" transverters, including

**Bill Wageman, K5MAT, is a long-time VHFer whose 222-MHz transverter design appears in the Winter, 1999, issue of our sister magazine,* Communications Quarterly. *Bill lives in Albuquerque, New Mexico.*

On the Cover

Jim Hirschman, K4TCV, works on a ham antenna on his sailboat in Coconut Grove, Florida. Jim used this same 2-meter collinear back in 1995 when he was providing communications for the 1996 Olympic sailing trials in Biscayne Bay.

A ham for 50 years, Jim is a Miami cardiologist with a particular interest in emergency rescue care. In fact, Jim was a pioneer in initiating pre-hospital care by paramedics in the U.S., and he says ham radio played an important role developing that system. Back in the 1960s, Jim told us, he had telemetry from an electrocardiogram (EKG) transmitted to him by ham radio. That led to his invitation in 1968 to join the group developing Miami's emergency medical system—the first in the nation to use trained firefighters instead of doctors as first responders—as both cardiologist and communicator.

Today, Jim keeps involved with emergency medical care as Medical Director of the Coral Gables Fire Rescue System, a post he has held since 1974. He also has an automated weather reporting station set up at a local hospital, which transmits weather information via APRS (Automatic Position Reporting System) to other ham stations in south Florida, including W4EHW at the National Hurricane Center. When we talked, he had just returned from running a first aid class at a local radio club.

For relaxation, Jim obviously enjoys sailing, mostly to the Bahamas and the northern part of the Florida Keys, and communications related to sailing. The ham gear aboard his 32-foot sloop (one-masted sailboat)—named the *Sea Wind*—includes an ICOM IC-2000 for 2 meters and a Kenwood TS-440 HF rig. (Photo by Larry Mulvehill, WB2ZPI)

"Simultaneous transmissions were made both ways on both bands, and we agreed that reception was nearly always better on 135 centimeters than on 2 meters, even though the 2-meter receiver was thought to be somewhat better than the others."

one of mine. Construction of transverters for 135 centimeters is straightforward, but, of course, it's necessary to have access to some relatively simple and common test equipment to make it work right. Ready-made and kit transverters may be purchased from Down East Microwave[5]. DEM frequently advertises in this and other journals. All transverters are "all-mode," depending on the "IF" rig used to drive them. So if you plug your 222-MHz transverter into an all-mode HF rig, you now have an all-mode 222 rig as well.

Generating Critical Mass

Critical mass is approximately defined by nuclear engineers as the minimum amount (number of nuclei) of certain elements that can cause a sustained nuclear reaction to begin, and, once it has started, the reaction builds from there. The same thing is true for the VHF/UHF amateur bands. At first, only a couple of technical guys take on the challenge of seeing if they can make something work on some band. They get it working and, in many cases, if nobody else joins them, they get bored and try something new. Once in a while, a third or fourth person gets involved. Now there's more opportunity for exchanging ideas, and that can cause some *other* folks to wonder what's going on up there on that weird band. When *that* begins to happen, you've achieved critical mass for the radio version of a "nuclear reaction," and band occupancy begins to grow.

Propagation on the Forgotten Band

Propagation—the means of getting a radio signal from one point to another. The conventional wisdom is that above 50 MHz, it gets worse as you go up. You can work the world on six. A few have worked the lower 48 on 2 meters without the benefit of EME (moonbounce). Moving up, 135 centimeters is poorer than 2 meters and has the disadvantage of much lower population, says this "conventional wisdom." The 70-centimeter band may be still poorer, but at least there are lots of folks out there.

Can this stand up to a few observations made by a variety of experienced amateurs? My eyes were opened years ago when Bob Foster, K5CQH, and I ran some very unscientific comparisons on 146.52 and 223.5 MHz.

First, a bit of background is necessary for these experiments to have any meaning at all. On 2 meters, my station had an ICOM IC-22S with an excellent receiver and 10 watts out to a vertically mounted homebrew five-element Yagi, while on 135 centimeters, I had a Clegg FM-76. It had a much poorer receiver (I found that out many years later) and also 10 watts out to a similar Yagi. Bob was mobile, about 60 miles away, using the same type of transceivers to 5/8-wavelength vertical antennas. The path was *not* line of sight, and, as he drove around, signals ranged from inaudible to full quieting.

Simultaneous transmissions were made both ways on both bands, and we agreed that reception was nearly always better on 135 centimeters than on 2 meters, even though the 2-meter receiver was thought to be somewhat better than the others. The only exceptions occurred, most likely, when there was a null in the diffraction pattern of the 223.5 transmission! It turned out later that the Clegg FM-76 needed a U310 low-noise preamplifier (noise figure about 2 dB and 12 dB gain) ahead of it to make it comparable to the ICOM's receiver. In other words, 222 gave us equal or better performance in comparison to 2 meters, even with a significant receiver disadvantage.

If It Meows Like a Cat...

Does that prove anything? Those were not scientific experiments, and we have only gut feelings and no documentation. However, I did have another experience that reinforced those feelings. One day, the late K5CXN was driving north into Colorado, equipped with about the same gear used by K5CQH. He was out of 2-meter simplex range well before 223.5 faded out. The distance covered reliably on 135 centimeters was a bit over 60 miles, and there were plenty of physical obstructions between us.

Are there others with similar observations? Tom Ellis, K5TEE, has done a bit of balloon chasing, and he told me that he and his pilots felt that the 135-centimeter handhelds were superior to the 2-meter versions of the same design. *CQ VHF* editor Rich Moseson, W2VU, remembers being able to communicate on a 222-MHz repeater, from a basement location, using an HT with a rubber duck, while he couldn't even key up a co-located 2-meter repeater.

Several others have had similar experiences, but that still doesn't constitute proof of better propagation on 135 centimeters than on 2 meters. Real scientific proof would be hard to come by at best, and may very well be impossible without sophisticated measuring equipment. I don't have proof, but if it looks like a cat, meows like a cat, and claws up the furniture like a cat, it may be a cat!

An All-Mode Advantage

I've had similar results comparing 222 with 144 on SSB and CW. My best DX on forward scatter on those two bands is with WA7KYM (who was featured on the cover of this past February's *CQ VHF*) in Wyoming, and we heard each other better on 222, even though I was running about 3 dB less power there than on 144. The antennas were again quite similar, ex-cept horizontally polarized at both ends.

So, are communications always better on 135 centimeters than on 2 meters? No, especially when it comes to meteor scatter. The lifetime of the effectiveness of a meteor burn on 222 must be about 1/3 as long as on 144. And although sporadic-*E* has been observed on 135 centimeters, it is certainly extremely rare. But for tropo and forward scatter, the modes most commonly used, my guess is that 222 MHz is—at the very least—as good for communication as 144 MHz.

Do I have any kind of reasonable explanation of why this might be? I'm not a communications engineer, and although my training was in physics, I have only a rudimentary knowledge of the propagation of radio waves. My feeling is that, quite possibly, the effects that I have described here are not due as much to propagation effects as they are to the *noise floor*, especially in cities.

The noise floor of a receiver is determined primarily by two factors. For years, the main factor on VHF was the actual noise figure (internal noise) of the receiver itself, but most modern gear can actually hear the noise generated on the antenna by external sources. For example, the measured noise floor on 2 meters at my home in the city of Albuquerque is almost 20 dB higher than out in the boondocks, away from the city. Unfortunately, because of the lack of portability, I have no way of making a similar noise floor measurement on 135 centimeters.

Our experiments were done many years ago when the noise floor was generally quite a bit lower, especially in Albuquerque, where Bob was driving. My location at the time was quiet on both bands in most directions, with a slight increase in noise when the antennas were pointed toward nearby cities.

What we've observed might not hold true in some other parts of the country. For instance, New Mexico has a rather dry climate most of the year, and it's certainly true that water vapor attenuation has a strong effect at some frequencies. We also have poor ground conductivity compared to most of the rest of the nation, and how ground conductivity would effect similar experiments elsewhere is not at all certain. My antennas at the time were less than 20 feet above ground level and just barely peeked over the highest point of the roof.

Whatever the reason for the observed effects, it's time for us to start populating the forgotten band as much for the excitement of doing it as to keep all of us from losing it. I hope to see you someday on 222.1-MHz SSB or CW, 223.5-MHz FM, or even on one of the local 135-centimeter repeaters.

Acknowledgments

I would like to thank K5TEE for his discussions and his many insights into these comparisons, and particularly to K5CQH for patiently taking part with me as a co-conspirator. ■

References

Designs for 222-MHz transverters may be found in several places, including:

1. Stroud, Richard, W9SR, 1985 *ARRL Handbook*, pp. 31-18 to 31-25
2. Drexler, Paul, WB3JYO, 1991 *ARRL Handbook*, pp. 31-17 to 31-28
3. Lau, Zack, KH6CP (now W1VT), 1995 *ARRL Handbook*, pp. 17.88 to 17.92
4. Wageman, Bill, K5MAT, *Communications Quarterly*, Winter 1999, pp. 25-30
5. Transverter kits and fully-built units are available from Down East Microwave, 954 Rt. 519, Frenchtown, NJ 08825; Phone: (908) 996-3584; Fax: (908) 996-3702; Web: <http:// www.downeastmicrowave.com>.

The Down East Microwave DEM222-28CK 222-MHz Transverter Kit

This transverter kit from DEM filled in the last rung on a university amateur radio club's 160-meter to 70-centimeter "ladder" by getting the club station on 222 MHz. KM5FA takes a look not only at building and using the transverter, but at its importance to the club.

By Kenneth Harker, KM5FA*
(kharker@cs.utexas.edu)

A Note of Caution on Kit Reviews: With the growing interest in kit-building among hams—a trend that we at CQ VHF *certainly want to encourage—we feel that offering kit reviews provides a valuable service to our readers. However, an inherent risk in publishing a review of equipment built from a kit is that the quality of the finished product depends as much on individual kit-building skills as on the parts and design provided by the manufacturer. A manufacturer has no control over the quality of the assembly when a piece of gear is built from a kit, and even an experienced kit-builder may accidentally make an error that will result in performance that varies from the manufacturer's specifications. This is something that you should be aware of and take into consideration as you read this or any kit review.—W2VU*

University amateur radio clubs are wonderful things. One of the first things I discovered when I joined the University of Texas Amateur Radio Club (UTARC) was that the club station (then W5EHM, now N5XU) not only had HF equipment, but 6-meter and 2-meter multimode rigs as well. Almost all of my ham radio experience to that point had been with packet and the occasional FM repeater contact. The club's well-used Kenwood TS-600, with its analog dial and burnt-out backlights, introduced me to the world of 50-MHz SSB and CW. It rejuvenated my interest in ham radio and encouraged me to learn and do more. I've since upgraded and become active on HF, but VHF weak-signal work is still one of my absolute favorite aspects of the hobby. And that Kenwood TS-600 is still seeing plenty of use.

Adding New Bands

One of the things our club has tried very hard to do in the past two years is expand our club station by adding new VHF-plus bands. Most of our members have only FM radios on 2 meters and 70 centimeters, and the multimode radios at the club station provide a unique opportunity for our members to try out 50-MHz *E*-skip for the first time, to try out SSB on 432, to work a VHF contest, or make a meteor scatter contact with a station 1,000 miles away. While not every club member will find VHF weak-signal activity to be their passion, I think it's important to provide a wide variety of equipment and bands to help expose people to aspects of the hobby they might otherwise never experience.

The U.T. club recently purchased a Down East Microwave DEM222-28CK transverter, giving us SSB/CW capability on 222 MHz, and putting N5XU on all bands from 160 meters to 70 centimeters. To save money, we acquired the transverter in kit form and I took on the task of building and testing it. The kit is of moderate difficulty level, but fun to build and performs well on the air.

Kit Construction

Unpacking the Kit

The DEM222-28CK uses a 28-MHz intermediate frequency (IF), requiring a 10-meter radio for use as the IF rig. It puts out 35 watts on transmit and employs a GaAsFET preamplifier on receive (*Gallium Arsenide Field Effect Transistor. Sorry you asked?—ed.*). The transverter uses split 28-MHz transmit (TX) and receive (RX) lines with BNC jacks for connection to the IF radio. It can be built with a single common N-connector for 222 MHz, or you can split the 222-MHz RX and TX lines with another BNC con-

Ken Harker, KM5FA, is a graduate student working on a Ph.D. in Computer Sciences. He is also President of the University of Texas Amateur Radio Club, and he wrote and runs the WWW Amateur Radio Safety Calculator at <http://www.cs.utexas.edu/users/kharker/rfsafety/> (There's a link directly from the *CQ VHF* Web page.—ed.)

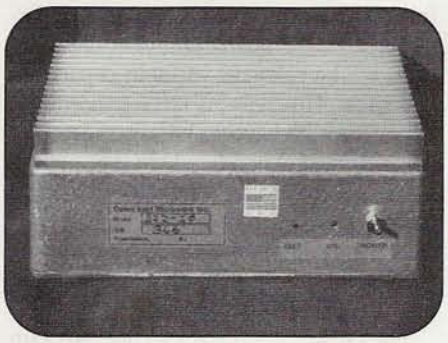


Photo A. Front view of the Down East Microwave DEM222-28CK 222-MHz transverter. This photo shows the case as supplied by DEM. The author chose to paint his unit to match other equipment.

nector. Power, PTT (push-to-talk), and the AUX (for keying an external amplifier) connections are all phono jacks. The transverter is housed in a Hammond 7.4 x 4.7 x 2.2-inch die-cast aluminum case, predrilled for all connectors, with an external 3/4-inch thick heat sink that covers the top of the case.

The kit comes well packed with the pc board, hardware, and all the parts (except the heat sink) inside the die-cast box. The pc board is double-sided with plated-through holes. The parts are organized in five plastic bags, some of which (like the hardware bag) are obviously shared with other DEM transverters, such as the 144-MHz model. One bag contains mainly resistors, another mainly capacitors, another mainly inductors, and another mainly transistors. The enclosed manual contains 11 pages of assembly instructions, two pages of packing list, a page of schematics, and a page each for the top and bottom sides of the pc board.

Building the Transverter

The instructions are comprehensive, but do require a certain amount of thought and consideration. The first steps are soldering the surface-mount components, probably the most technically difficult part of the assembly. A whole page and a half is devoted to tips and advice on how to solder these components, and, although I had never before soldered a surface mount component, I found the process relatively painless. I was somewhat surprised to discover just how small a GaAsFET device actually is! And whatever you do, don't drop those tiny surface mount caps into a carpet!

You do need to form your own coils for this kit, but, again, there were plenty of tips and lots of encouragement for this step and it shouldn't be any trouble at all. The kit even comes with a small amount of extra wire in case of mistakes. As with a lot of other kits, many stages in the assembly process are simply a list of components, and you need to refer to the PC board diagram to determine where to place them on the board. Not every hole in the board is populated—there are some spots where optional components go, and I suspect this board design may be common to other Down East Microwave transverters as well.

Most of the assembly is relatively straight forward, although I did get confused for a few minutes when a step asked me to install capacitors I had already installed on the previous page of instructions, and I couldn't find them in my pile of uninstalled components. The parts list and the pc board diagrams were 100% accurate, however.

Customizing the Case

I imagine a lot of people will assemble the kit with the plain aluminum enclosure "as is." Black text dry-transfer labels are included for the front and rear faces of the unit. I decided plain aluminum wasn't going to cut it, so I painted the case black, first using a sandable spray primer on the bare aluminum, followed by several coats of black spray paint. I labeled the unit using white dry rub-on transfer lettering that I found at a local hobby store, and completed the job with a few coats of clear acrylic spray paint. I masked off the top of the case so that the heat sink would sit against bare aluminum.

The heat sink itself is a nice polished silver color that was quite acceptable to me, and was left as is. Looking back, I should have started this part of the job earlier, as the many coats of spray paint and the lettering job left the completed circuit board waiting for several days.

Putting It All Together

Assembly into the box is pretty straightforward. The eight screws that secure the heat sink to the top of the case are also used as the standoffs for the pc board. There are, however, 10 holes in the top of the box and the heatsink, and I had to figure out which two are used later to secure the power module from the inside. But before you put the power module in

Photo B. Rear view of the DEM222-28CK. The author suggests replacing the RCA jack for the DC power input to avoid the possibility of accidentally plugging 12 volts into one of the other two RCA jacks on the rear panel.

the box, several electrical tests must be performed. The unit runs on 13.8 VDC, and I fashioned a power cord complete with in-line fuse in order to run the tests. I guess I did everything correctly, as my unit passed that step on the first try.

The rest of the assembly seems like it should be trivial, but getting the LEDs (light-emitting diodes) to sit correctly in their holes in the case actually gave me a lot of grief for some reason, probably because I was tired when I got to that part. The kit uses two red LEDs for the POWER and XMIT indicators, but I decided to substitute a green LED for the power indicator. I found working with the tiny coax used for the 222-MHz N-connector wasn't all that difficult, but it does take patience, and careful measurement is important.

This was a fun kit to build. Portions of it were challenging, but nothing was frustrating. Taken in small stages, it will easily provide for several evenings of soldering fun!

Tune-up and Operation

Tuning the Transverter

You will, of course, need some external cabling to connect up the transverter and get it working. The specifics may vary, depending on the HF radio you're using for the IF rig. In all cases, you'll need to fashion a DC power cable with a phono plug on it. You'll also need a PTT or TTL (Transistor-Transistor Logic) line, depending on your HF rig, to key the transverter between transmit and receive.

The 28-MHz radio we're using in our setup is a Realistic HTX-100 10-meter USB/CW transceiver. These were rather popular a decade or so ago and can still be found at hamfests and such for around $100. The radio requires some modification for use as a transverter IF radio (the subject of other articles). The modifications create a PTT jack and add a new low-level output connector, using the existing antenna jack as the receive connector. Cables for the IF RX and TX lines complete the hookup between the HTX-100 and the transverter. Other HF radios may involve different hookups, such as using a special transverter port on the HF radio, or maybe an external attenuator, but the folks at Down East Microwave can help you decide what may be necessary.

Tuning up the transverter involves following a list of steps in the manual, mainly adjusting variable capacitors. This step requires a VHF wattmeter and dummy load, and the manual discusses how even more precise tuning can be done using a frequency counter and low-level signal generator.

One of the things I like to do when building kits is to create a "cheat sheet" I can glue into the inside of the case cover. In this case, the cheat sheet listed the steps for tuning the transverter and a small diagram of the pc board, showing the locations of the relevant variable capacitors and such. This way, if the transverter is ever used with another HF rig, the tuning instructions are handy whether or not the manual is around. I got this idea when the club once borrowed a 70-centimeter transverter and had no idea how to tune it for more than 3 watts output because it didn't come with a manual.

The DEM 222-28CK can operate with up to 250 mW of 28-MHz IF drive. At this level, the transverter should put out 35 watts of 222-MHz RF. According to the manual, just 1 mW of drive will produce 10 watts out, and 10 mW will produce the full 35-watt output, although the manual recommends operating with no more than 25 watts output, as the amplifier can become non-linear at higher levels. The unit also includes a variable attenuator to pull down the output to any level you desire, if reduced output power is required to drive an amplifier. It was unclear to me from the manual, though, where this attenuator was located or what you need to do to turn it on or set the level. I did not try to bring the level above 25 watts.

Originally, we were able to get only 20 watts out of the unit, but it turned out that our modified HTX-100, which was supposed to put out 45 mW, actually produced only 24 mW. That, coupled with three feet of cable, three connectors, and a barrel coupler, between the IF rig and the transverter, probably pulled the actual input power below the 10 mW required to produce full output. We later tuned it up on a Kenwood TS-830S, using the transverter port on the back of the radio (which puts out 10 mW), and were able to produce 25 watts of output

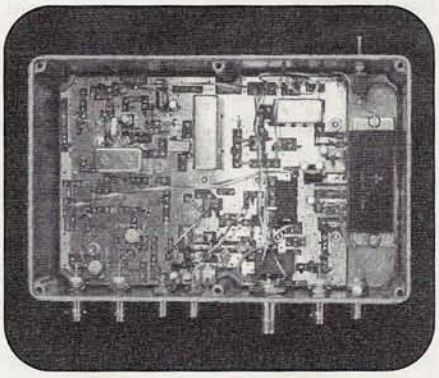


Photo C. Interior view of the 222-MHz transverter. The pc board is double-sided with plated-through holes.

on 222 MHz. Again, we didn't try to go any higher.

On the Air

One of the benefits of using a transverter to operate on a particular band is that you can pair it with the HF radio of your choice. If you don't have a lot of cash or don't need a lot of features, you can choose something like the Realistic HTX-100 the U.T. club station is using. If you already own a feature-rich HF transceiver or want the latest and greatest DSP technology, you can spring for the big-bucks HF transceiver. What this means is that your experience on the air will be highly dependent upon your choice of IF rig—the better the 28-MHz radio performs, the better your 222-MHz transverter setup will perform.

Our transverter's first real trial was during the 1998 ARRL January VHF Sweepstakes. It turns out that we had some trouble with the IF radio, which developed some audio quality problems. Before the contest, we made our first 222-MHz contact with K5IUA (ex: KB5IUA) in EL29 near Houston, and received excellent audio reports using a Kenwood TS-830S for the IF rig. Both during initial trials and during the contest, we had spectacularly nice receive capability, and, despite our IF radio's bad transmit audio, made seven QSOs in six grid squares (a respectable number of contacts for any 222-MHz station in south Texas, I have since learned).

Using a borrowed 13-element Yagi at 100 feet, our longest distance QSO was around 250 miles. Nonetheless, that weekend we set a West Gulf Division record score in our category (limited multiop). We've since replaced the IF radio with another HTX-100, which works great, and hope to add an external 222-MHz amplifier soon. We hope to do much better in future contests and to do our own small part to increase local interest in the 222-MHz band.

Some additional fiddling with the transverter and radio setup since the contest has reinforced my good opinion of the transverter. Using a transverter with a 28-MHz IF radio is a more complex approach to operating than using a VHF transceiver. You need to pay attention to things like using quality coax to connect the transverter to the IF rig, for instance.

My one major complaint about the design of the transverter is the choice of using an RCA jack for the 13.8-VDC power input. RCA jacks are a poor choice for power connectors, as it seems to me now that it would be far too easy if someone's not paying attention to plug 13.8 VDC into some other RCA jack and fry something. If I were building the kit again, I would likely substitute a standard coaxial power connector for this part (an advantage of buying the kit!)

"...your experience on the air will be highly dependent upon your choice of IF rig—the better the 28-MHz radio performs, the better your 222-MHz transverter setup will perform."

Otherwise, once it is assembled, connected to your HF radio, and tuned up properly, the transverter itself requires no operational adjustments. The heat sink on the transverter works great; after a half hour SSB QSO, it was warm but significantly less warm than our Mirage 2-meter amplifier gets in half an hour, for instance.

Summary

Buying a transverter kit may not be for everyone—but fear not, the transverter is also available factory-assembled and tested for those of you who prefer not to build. For me, building the 222-28CK transverter was a rewarding experience and getting on 222-MHz SSB/CW is a lot of fun! This is a high-quality product, and I think it will serve the University of Texas Amateur Radio Club station well. I would encourage anyone interested in getting on the 222-MHz weak-signal band to consider the Down East Microwave transverter. ■

Resources

Down East Microwave's DEM222-28CK is available directly from Down East Microwave, Inc., 954 Route 519, Frenchtown, NJ 08825; Phone: (908) 996-3584; Fax: (908) 996-3702; Web: <http://www.downeastmicrowave.com/>. Price is $250 in kit form, $395 factory assembled and tested.

Don Stoner, W6TNS, Silent Key

Don Stoner, W6TNS—satellite and solid-state pioneer, long-time CQ and CQ VHF columnist—is dead at age 67.

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

The father of the amateur radio satellite program has died. Don Stoner, W6TNS, was also a prolific writer, a pioneer in using solid-state technology in ham radio, a lifelong Elmer to new hams, and an active opponent of restrictive covenants that bar antennas. He passed away May 4 while undergoing surgery in Florida. He was 67.

A Pioneering Amateur

Stoner planted the seed for the amateur satellite program with what he later called a "throwaway line" in his April, 1959, "Semiconductors" column in *CQ* magazine. Describing a transistorized 2-meter transmitter he'd designed, whose 50-milliwatt signal was heard more than 100 miles away, Stoner thought about signals traveling 100 miles straight up, and asked, "Does anyone have a spare rocket for orbiting purposes?" That column led to the development of Project OSCAR, and the launch in 1961 of OSCAR-1, the first ham radio satellite—and the first non-governmental satellite ever put into orbit.

Another of Don's milestones during the same time period was his "Semi-conductor Space Spanner" transmitter (Photo A), which, as colleague Dave Ingram, K4TWJ, later wrote, "helped usher transistors into amateur radio."

Don wrote four different columns for *CQ* over a period of seven years, including "Surplus," from 1956–57; "Novice," from 1957–62; "Transistor"/"Semi-conductor," from 1957–62; and "VHF," from 1962–63. Three decades later, Don returned to the *CQ* family as the "In Theory" columnist for *CQ VHF* magazine from January, 1996, until October, 1997, when his health began to fail.

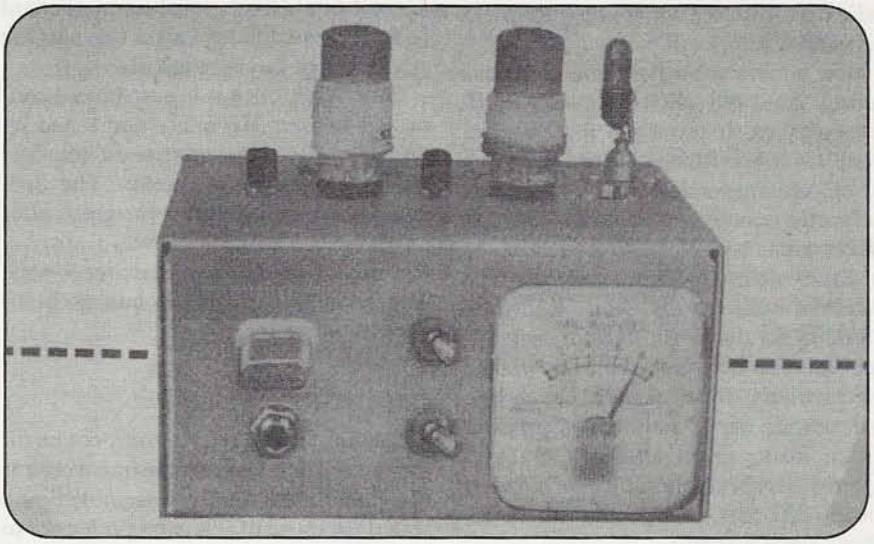


Photo A. One of the original Semiconductor Space Spanner transmitters introduced in the late 1950s by Don Stoner, W6TNS, through his semiconductor column in CQ *magazine. This two-transistor transmitter served as many hams' introduction to solid-state electronics. (Photo courtesy Dave Ingram, K4TWJ)*

Helping new hams into the mainstream of amateur radio was a cornerstone of Don's ham activities. In addition to his columns for new hams in *CQ* and *CQ VHF*, Don founded the National Amateur Radio Association (NARA) in 1990—acting on a belief that the ARRL wasn't doing enough to reach out to new hams—and became editor and publisher of its *Communicator* magazine.

Fighting for Antenna Rights

In 1994, Don left NARA to concentrate on a new mission: the battle against restrictive covenants in condominiums and housing developments that bar outdoor antennas of any type. Don found a unique way to solve his own antenna problems: he purchased the penthouse apartment of an under-construction condo tower in Clearwater, Florida, on the condition that his right to put up antennas be guaranteed in his contract. The developer, facing the loss of a $1 million-plus sale, agreed to Stoner's terms. But Don understood that few amateurs had that sort of financial clout and was a leader, until his death, of the ongoing battle against those restrictions in Florida.

Don's money, according to former NARA colleague Bill Everett, W7OO, came from a business that he founded in the 1980s which made automatic tele-

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

Photo B. Don Stoner, W6TNS, in the "driver's seat" of his ham shack in Clearwater, Florida—the converted front end of a Mercedes Benz! Kind of redefines mobile operating... (Photo courtesy hammall.com)

phone equipment for bill collection agencies! Don started the company, Digital Electronics, after going bankrupt in an earlier business venture, Stoner Communi-cations, that built high-quality, single sideband CB radios during the CB heyday of the 1970s. Apparently he learned quite a bit from his earlier business failure, though, as he retired from Digital Electronics in 1989 as a multi-millionaire. It is, in Bill's words, "a real rags-to-riches story."

At his Florida condo, Don built his ham shack into the front end of an old Mercedes! (see Photos B and C). Don's own recollections of his now-famous satellite column appeared in the January, 1995 (50th anniversary) issue of *CQ*, and will be posted on the *CQ* Web site <http://www.cq-amateur-radio.com>.

Don is survived by his wife, Lucy, two sons, Tim and Dan. Ham radio has lost a leader and a friend. He will be greatly missed by all who knew him. ■

Photo C. The RF side of Don's "mobile" ham station. Wonder how many QSOs to the gallon he got? (Photo courtesy hammall.com)

Announcing

The 1999 CQ World-Wide VHF Contest July 10–11

Let's hope band conditions are as hot as the weather for this annual CQ magazine VHF event.

By Joe Lynch, N6CL*

Here are the complete rules for the 1999 CQ World-Wide VHF Contest, which runs from 1800 UTC Saturday, July 10, 1999, to 2100 UTC Sunday, July 11, 1999:

I. Contest Period: 27 hours for all stations, all categories. Operate any portion of the contest period you wish.

II. Objectives: The objectives of this contest are for amateurs around the world to contact as many amateurs as possible in the allotted 27-hour period, to promote VHF and above activity, to allow VHF and above operators the opportunity to experience the enhanced propagation available at this time of year, and for interested amateurs to collect VHF and above Maidenhead grid locators for awards credits.

III. Bands: All authorized amateur radio bands above 50 MHz may be used, as authorized by local law and license class.

IV. Class of Competition:

1. Single op fixed station.
2. Multi op class I fixed station.
3. Multi op class II fixed station.

A fixed station is defined as one that is a regular home station location. You may operate from your home station or you may be a "hired gun" at another home station to qualify for a fixed station category. A multi op class I station is one that operates five or more transmitters simultaneously on all authorized amateur frequencies above 50 MHz. A multi op class II station is one that operates four or less transmitters simultaneously on all amateur frequencies above 50 MHz.

4. Single op portable station.
5. Multi op class I portable station.
6. Multi op class II portable station.

A portable station is defined as one that you set up away from a regular home station location.

7. Rover station. A rover station is one that is manned by no more than two operators, must travel to more than one grid locator, and must sign "rover" or /R. The spirit of this class is to encourage operation from rare grid locators by persons who are inclined to do so. It is not the intent of this class to encourage one operator to move from one super station to another super station in another grid locator in order to compete in this category.

8. QRP station. Anyone operating a station running 25 watts output, or less, is eligible to enter this category. There are no location restrictions. You can operate from your home QTH, or from the highest mountain you can find. However, you cannot run more than 25 watts output on any band.

V. Exchange: Callsign and Maidenhead locator grid locator (4 digits, e.g., EM15). Signal reports are optional and need not be included in the log entry.

VI. Multipliers: The multiplier is the number of different grid locators worked per band. A "Grid Locator" is counted once per band. Exception, the rover who moves into a new grid locator can count the same grid locator more than once per band as long as the rover is himself or herself in a new grid locator location. Such change in location must be clearly indicated in the rover's log. It is required that rover category operators maintain separate logs for each grid locator location.

A. The rover who changes location during the course of the contest is free to contact as many other stations as he or she wishes. The rover becomes a new QSO to the stations working him or her when that rover changes grid locator.

B. The grid locator is the Maidenhead grid locator to four digits (FM13).

VII. Scoring: One point per QSO on 50, 70, and 144 MHz; 2 points per QSO on 222 and 432 MHz; 4 points per QSO on 903 and 1296 MHz; 6 points per QSO on 2.3 GHz and above. Work stations once per band, regardless of mode. Multiply total QSO points times total number of grid locators (GL) worked. Contest entrants may not transmit on 146.52 MHz, or your country's national 2-meter FM simplex calling frequencies, or commonly recognized repeater frequencies for the purpose of making or requesting contacts. Contacts made within your own country, in the DX window of 50.100–50.125 MHz, are discouraged. Contacts made on the SSB calling frequencies of 50.110 MHz, 50.125 MHz, and 144.200 MHz are discouraged. Contest participants are required to use UTC as the logging time. Incentive scoring: Operators completing two-way CW or MCW contacts may add one point to the QSO value for each contact.

Example:
W1XX works stations as follows:

37 QSOs, with 3 QSOs on CW (34 x 1 = 34; 3 x 2 = 6; 34 + 6 = 40) and 10 GLs (10 multipliers) on 50 MHz.

*Joe Lynch, N6CL, is the VHF Editor of CQ magazine.

45 QSOs (45 x 1 = 45) and 8 GLs (8 multipliers) on 144 MHz.

26 QSOs (26 x 2 = 52) and 4 GLs (4 multipliers) on 222 MHz.

38 QSOs (38 x 2 = 76) and 5 GLs (5 multipliers) on 432 MHz.

2 QSOs (2 x 4 = 8) and 2 GLs (2 multipliers) on 903 MHz

6 QSOs (6 x 4 = 24) and 2 GLs (2 multipliers) on 1296 MHz.

W1XX has 245 QSO points (40 + 45 + 52 + 76 + 8 + 24 = 245) x 21 multipliers (8+4+5+2+3 = 21) = 5,145 total points.

VIII. Awards: Certificates suitable for framing will awarded to the top-scoring stations in each category in each continent. Certificates may also be awarded to other top-scoring stations who show outstanding contest effort. Certificates will be awarded to top scoring stations in each category in geographic areas where warranted. Geographic areas include states (U.S.), call areas (Japan), provinces (Canada), and countries and may also be extended to include other subdivisions as justified by competitive entries.

IX. Miscellaneous: An operator can sign only one callsign during the contest. This means that an operator cannot generate QSOs by first signing his callsign, then signing his daughter's callsign, even though both callsigns are assigned to the same location. All contacts above 300 GHz must use coherent radiation on transmissions and employing at least one stage of electronic detection on receive. A station located exactly on a dividing line of a grid locator must choose only one grid locator from which to operate for exchange purposes. A different multiplier cannot be given out without moving the complete station at least one hundred meters.

X. Log Submissions: You must request log sheets from: The CQ VHF Contest, *CQ* magazine, Hicksville, NY 11801. Please include an SASE with your request. Completed logs must be postmarked no later than August 31, 1999, to be eligible for awards. All logs should be mailed to: Joe Lynch, N6CL, VHF Contest Chairman, P.O. Box 73, Oklahoma City, OK 73101. Logs may be submitted on disk, provided a hard copy of the log is sent with the disk and the data is in an ASCII format compatible with an IBM-PC type computer. ■

Oops...

The caption for the table in May's "Magic Band Chronicles" column indicated that all of the rigs listed offered multimode operation on 6 meters. They did...until we added two recently introduced 6-meter handhelds. While we'd love to see multimode HTs, these are FM only. The only 6-meter multimode rig with self-contained power and antenna is the Yaesu FT-690R Mark II.

And while we're on the topic, the Yaesu FT-100, which was listed as "not yet available" in the table (and wasn't when we went to press), is now on the market and will be reviewed soon here in *CQ VHF*. Thanks to KC7NDX for catching the multimode error.

Portable Power—Part 2

Wouldn't it be nice if you could carry around your mobile rig, with its high power and other features, like it was a slightly heavy handheld? Well, you can, and here's one way to do it.

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

In Part 1 of this series, I described a couple of ways to get 12 volts to your handheld transceiver (HT), allowing it to produce its maximum output power, for a long period of time. Although the solutions given were light and easily transported, they didn't have what it takes to power a 25-watt mobile unit or linear amplifier. This month, I'm going to show you how you can get even more power, or more talk time, and what's needed to take your mobile rig almost anywhere (Photo A).

Getting Untethered

I was tired of either my signal not getting out from my HT, or being tethered to my automobile. When working a nearby repeater, my 5-watt HT has more than enough power. But when working at a civic event, where I might be stationed in a poor location, I found I had to either sit in the car or be close enough to grab the mic of the mobile radio.

My 2.3-Ah (Amp-hour) "brick" gelcel was better than the batteries made for my HT, but it merely provided more talktime. I still had the problem occasionally of not having enough power. So, I began my quest to find the ultimate HT.

I looked at "field" radios (mobile-sized units with attachable battery packs that allow them to be carried), but there were two problems. First, I already had a good feature-packed radio (my HT). Second, I really didn't want to invest several hundred dollars for another radio that covers the same band.

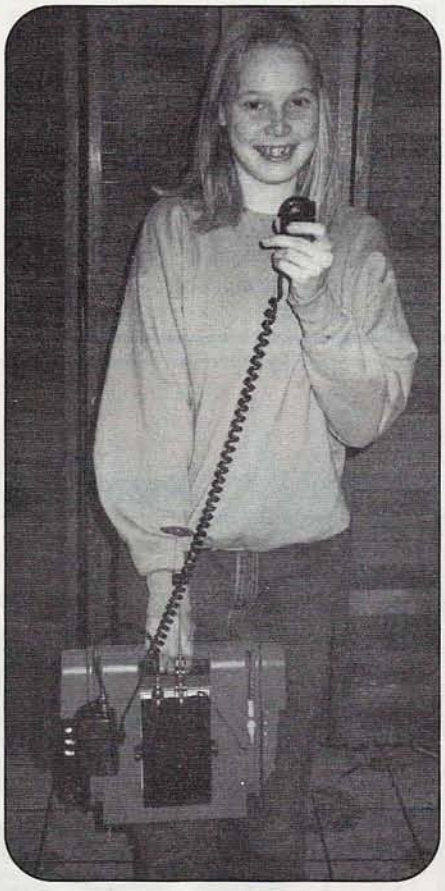


Photo A. Author's daughter, Laura, holding completed "handheld mobile" setup. (Photos by the author)

Analyzing my situation, I determined that I'd like at least 25 watts of power. It would also have to be something I could carry with one hand while operating my rig with the other hand. Finally, at 25 watts, I figured I'd need somewhere between 15 and 20 Ah at 12 volts.

I attended Pacificon 1998 (*a major west coast hamfest—ed.*) and saw numerous battery systems. Some of them were NiCd (nickel cadmium) based, some NiMH (nickel metal hydride), and some lead-acid. But in each case, I was looking at more money than I was willing to spend. Plus, none of them was suited to my specific requirements.

Getting a Jumpstart

Then, one day I was in the local Costco and noticed a 12-volt portable battery system—for less than $50—for jump starting a car with a dead battery (see Photo B). Reading the specifications on the box, it was difficult to tell what size and type of battery it contained. However, based on some of their claims, I concluded the battery was a sealed 12-volt gel-cell and somewhere between 15 and 20 Ah. Just what I needed.

The system consisted of a red plastic case with a handle, jumper cables neatly stored on each side, a 12-volt cigarette-type receptacle, a test button, and four LEDs (Light Emitting Diodes) that light to show the battery's charge level when the test button is pressed. Upon opening the red plastic case, I found a neatly packaged 17-Ah Panasonic gelcell, a circuit breaker, and a circuit board for testing the battery level (plus, there was plenty of room for other small circuits if I had the need).

On the backside of the unit, I installed the mounting bracket for a RadioShack 30-watt, 2-meter amplifier that I purchased for under $40. The amplifier itself, once mounted, occupied about the same

**Brent Walton, KF6FGB, became a ham through his cycling hobby. He was planning to help lead a 360-mile bike ride by his Boy Scout troop, and Bruce Crosley, AHØU, suggested ham radio would be a good way to stay in touch during the trip.*

Photo B. 12-volt portable pack intended for jump-starting cars contains a 17-Ah gel-cell battery inside. It can power a 30-watt ham station for hours and hours.

area as the consumer warning label on the back of the battery pack. Rather than using the 12-volt receptacle for the amp's power, I decided to run the power leads through an existing hole in the back of the pack. I drilled a few more small holes and looped tie-wraps through them to secure the leads (Photo C). Although I chose to mount an amplifier and HT to the power unit, this doesn't mean that someone else couldn't mount a mobile rig instead. There's plenty of room on the unit for most any mobile-sized radio.

Back to the amp...

The Power's in Your Hands!

In order to mount the bracket, I had to remove the backside of the case, which only involves removing four Phillips-head screws from the back. I placed the unit face-down to remove these screws, and the weight of the battery kept the front part of the case on the table as I lifted off the rear section. I then had to drill holes in the back. I chose my hardware carefully as I didn't want the bolts to protrude so far that they could puncture the battery case. I trimmed the ends of the bolts so they were even with the nuts. Even with trimming, they were right up next to the battery.

The battery's terminals are lead tabs with bolts to hold the wires. A trip to the auto parts store produced some crimp-on connectors that fit the bolts perfectly. Using these crimp-on connectors, I connected the amplifier's leads directly to the battery terminals. (Note: Make sure, if you direct-connect these leads, that you have an in-line fuse to protect your gear!)

Also on the backside, I looped through a couple of more tie-wraps so I could slip the belt-clip of my HT onto the unit. With the HT mounted next to the amplifier, I discovered the amplifier would suit my needs best if it were mounted upside down with the antenna connections facing up. This allowed for a short run of coax to connect the HT to the amplifier. Also, with the amplifier's antenna connectors facing upward, it became easy to attach an SO-239-mount antenna. By mounting this type of antenna on the amp, you now have a 30-watt portable unit with about two hours of talk-time available (assuming the amplifier or radio you're using draws about 5 to 6 amperes at 30 watts.)

"Although I chose to mount an amplifier and HT to the power unit, this doesn't mean someone else couldn't mount a mobile rig instead. There's plenty of room on the unit for most any mobile-sized radio."

On-Air Check-Out

After checking all my connections, I connected the antenna jack to a home-made J-pole, powered up the radio and the amplifier and tuned to a simplex frequency. I keyed the mic and requested a radio check. A faint signal came back, reporting I was reaching him full quieting. I asked for the station's location and he reported that he was about 100 miles from my home! This was a pretty good performance for an indoor antenna on an HT system.

To test the unit, I charged it according to the instructions. I then started hauling it around with me. I hauled it back and forth to work for an entire week. I have

"A faint signal came back, reporting I was reaching him full quieting. I asked for the station's location and he reported that he was about 100 miles from my home! This was pretty good performance for an indoor antenna on an 'HT' system."

an hour commute each direction. Using the HT with the linear, I was able to go the full week with no noticeable drain on the battery. At the end of the week, when I pressed the test button on the battery pack, it still showed a full charge!

Given that the battery in the unit I chose is 17 Ah, I figure I have over 10 hours of talk time with just my HT. When powering the linear, based on actual measurements, I have about three full hours of talk time. If one assumes a 1:5 talk-to-receive ratio, this 17-Ah pack could allow you to operate all day long on a single charge (remember from Part 1, you do not want to run down the battery completely or else it will be damaged. Fortunately, this pack has that test button.)

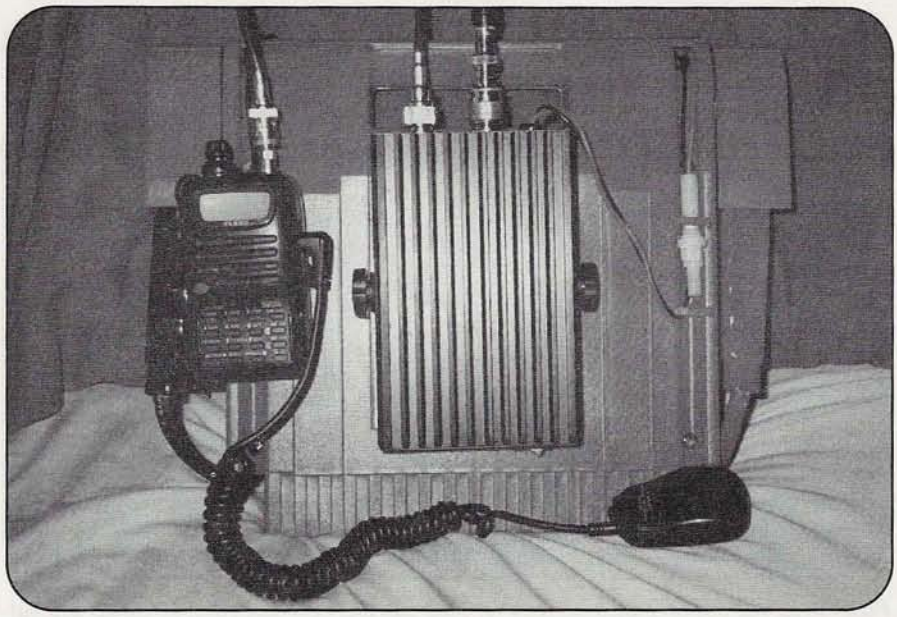


Photo C. Back of battery pack with amplifier and HT mounted. The HT is held in place with nylon tie-wraps looped through holes drilled in the case of the power pack.

Power to Spare

Since starting this project, I've found this same battery pack available at most auto parts stores and many department stores. There are also a couple of different brands out there. One even has a built-in lamp. I've also learned that the same company makes two other models that are even larger. So you should have no problem finding one and, if you look around, you'll be able to custom-tailor the thing to your own power requirements.

In Part 3, I'll discuss an even larger solution. These first two were portable solutions. However, the final article in this series will show you how to make a stationary power solution. Call it a UPS (Uninterruptable Power Supply) or a 12-volt power supply. You'll see how you can have power to spare even when the lights go out. ■

Parts List

Parts required to build a 12-volt, 17-Ah battery pack:

12-volt rechargeable power source (Jumper 850 by Century or equivalent)

HT and linear amplifier with mounting bracket and hardware
–OR-
Mobile radio with mounting bracket and hardware

8-inch coax jumper with connectors to fit HT antenna connector and amplifier input (if choosing to use the HT/amp combo)

6 nylon tie-wraps

Antenna to fit on linear's or mobile radio's antenna connector

Wiring harness (for your radio or amplifier)

2 crimp-on loop terminal connectors (for connecting power leads for your radio or amplifier)

Fuse & fuse holder (see text)

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

The following question was directed to CQ VHF *columnist Dave Ingram, K4TWJ:*

Q: In "Project Corner" in the March, 1998 issue, there was an article about solar-powered battery chargers for HTs. I'm interested in solar-charged battery back-up for my shack but would like to have the battery hooked to the charger all the time. The device described in the article was one that required the operator to monitor charge status and disconnect the battery when it was fully charged. What kind of device would, essentially, do that for me? Are there any kits available? Thanks for your time.

Martin Orloski, N1WST
Saint Albans, Maine

K4TWJ responds:

A: Get in touch with Alternative Energy Engineering, Box 339, Redway, CA 95560; Phone: (800) 777-6609. They should have everything you're looking for or be able to help you homebrew one. And please tell them *CQ VHF* sent you.

The following questions were posted on the "Q&A" section of the CQ VHF *Web page:*

Q: I'm looking for feedback from anyone who has used an attic antenna for VHF. I have a small homemade beam (log type), but have waited on installing it. I have room to rotate the antenna. The roof is Spanish style tiles on a two-story house. My concern is loss. My antenna has 9 dB gain, but if I lose 6 dB....I live in a restricted area, so outside is no good. Interest is SSB on 2 meters.

John Irvin (no callsign given)

Antennas, etc. Editor Kent Britain, WA5VJB, replies:

A: The general rule of thumb for inside versus outside the roof is about 10 dB, or almost two S-Units. Of the 37 antennas I currently have around the QTH, 11 are inside the attic. In these cases, I still get enough signal, so it's no big deal. All in all, it's about the same as running 144-MHz SSB mobile. You'll make plenty of QSOs, so go for it!

Q: I am interested in building the SWR meter in the November 1997 edition of *CQ VHF*. The article does not mention how long the brass rods are to be cut. Is the length of the rods critical or do they only need to fix comfortably in the metal box?

Ron Clarke (no callsign given)

Author Dennis Wilkison, KE6UZQ, replies:

A: The length is determined by the connectors that are placed inside the box in Figure 4. The center rod ($^3/_{32}$) should start as a length of 4 inches, but will need to be cut down according to the distance between connectors inside the trough. The two secondary rods ($^1/_{16}$) will be 3 $^3/_4$ inches, but can be 3 $^1/_2$ inches to fit in the trough. The lengths are important but not critical at 2 meters and 70 centimeters. Above this, they become more critical.

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.

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*:

- "Setting Up a SAREX Contact," by Phil Chien, KC4YER
- "A Visit with P3D (or Is It C3PO?)," by Rich Moseson, W2VU
- "Truly Portable Packet," by Ray Rischpater, KF6GPE

Plus...

- "The RF Attenuator," by Peter Ostapchuk, N9SFX
- "Communicating with Your Computer," by Lew Ozimek, N2OZ
- "Portable Power—Part 3," by Brent Walton, KF6FGB

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.

"Rover"—More Than a Contest Category

Mention the word "rover" to many VHF-active hams and, if they don't think of their dog, they'll think of stations that travel to and activate rare grid squares during a VHF contest. But N8NQS says "roving" doesn't have to be limited to contests.

By Dave Bostedor, Jr., N8NQS*
(vhfuhf@voyager.net)

In early spring of 1992, I was discussing June vacation plans with my father, Dave, Sr., K8WKZ**. As a newly licensed ham, I was exploring the prospect of including ham radio in my plans. That was all it took. Dad said that he needed only four grid squares to fill out the "EN" maidenhead block—EN87, 88, 97, and 98—all well up into Ontario (*the EN grid "field" covers all of Michigan, Wisconsin, Iowa, and Minnesota, plus parts of Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Nebraska, South Dakota, North Dakota, Ontario, and Manitoba—ed.*). Later conversations with Don Wilke, WW8M, led to Don's excitement at the prospect that I might also spend some time in EN99. He needed that one, too. My wife, Linda, and I started to make our plans (Photo A).

A well-planned trip would guarantee that all of our goals would be met and still leave time for recreation. I used *Callbook* addresses to make contact with hams in the area where we wanted to go. To my amazement, a response came in the mail from a very friendly young couple in EN-97. Al (VE3XAL) and Peggy (VE3PGY) Foley (Photo B) wrote back that they would like to help us find operating sites in the area. This turned out to be more than I had expected, especially since Al worked for the Canadian Forest Ministry and was able to get us access to a tower site that otherwise would not have been available.

Photo A. Linda and Dave (N8NQS) Bostedor. Linda was Dave's main logger during the trip, even during a massive pileup from stations in Europe. (Photos courtesy of the author)

Equipment for a Ham Vacation

I had a pair of ICOM radios for the talking, but Dad supplied most of the other gear. He purchased two TE Systems solid-state amplifiers, 350 watts and 400 watts, just for the trip. I sought the advice of many of the hams whom I'd had the privilege to work while they were out on the roads. We needed a 2-meter antenna, so feelers were put out on packet (this was before the Internet became "the thing"). A reply from Bryan Snyder, WA8MZQ, netted us a fine Cushcraft 215-WB at a very affordable price. The antenna for 6 meters was a five-element Cushcraft that Dad had in storage on the garage roof. The elements were telescoping, so that when they were pushed all the way in, they were no wider than my truck. I had them marked with magic marker so I knew how far to extend them at each stop.

My portable hamshack was a 1989 Chevy S-10 with 4-wheel drive to get into those hard to reach places (Photo C). It's a good thing we had 4WD because, without it, we never would have been able to reach some of the high spots from which we operated. The transceivers were mounted between the truck's bucket seats, and the amplifiers were secured to a platform in the back of the truck. We operated mobile, running 100 watts on 6 meters only. The VanValzah Squalo antenna was, and still is, a top performer in all weather conditions, so we mounted it to the back of the truck, 11 feet off the ground. With it, we were able to communicate back home to Dad in EN72

"My portable hamshack was a 1989 Chevy S-10 with 4-wheel drive to get into those hard to reach places....It's a good thing we had 4WD because, without it, we never would have been able to reach some of the high spots from which we operated."

**Dave Bostedor, N8NQS, is Editor and Publisher of the "Great Lakes VHF/UHF Newsletter," in which this article originally appeared. He and his wife (and logger), Linda, live in Jackson, Michigan.*

Photo B. Al (VE3XAL) and Peggy (VE3PGY) Foley were Dave and Linda's hosts during the major part of the trip, providing detailed maps, help getting to sites, and home-cooked food.

Photo C. Dave's pickup truck was "loaded for ham" as he and Linda set out on their Canadian DXpedition.

from all the way up in EN96. Once we got to where we wanted to erect the Yagis, we ran 50 feet of extension cord to a 2.2-kilowatt gas-powered generator and used two large Astron power supplies to power our portable station.

On the Road

On June 20, at 1840 UTC, Linda and I were on the road, headed north. Every once in a while we would check in with Dad and give him a progress report. Everything was going as planned. We worked him from EN72, 73, 74, 75, and 76 and then found a place to spend the night. Just as we rolled into the parking lot at the hotel, near the EN76 and EN86 boundary, 6 meters opened into Texas, EM00 and EM22. I noticed that, as conditions improved into one area on 6 meters, they declined elsewhere, frustrating efforts to make long-distance contacts that should normally have been possible. Our longest 6-meter domestic *E*-skip contact was with W5OZI in grid square EM00, 1,412 miles/2,274 km. After an hour or so, I dragged my tired body into the hotel room, and slept off the road fatigue. Linda was a trooper. She had everything all ready for the night's rest.

We got up early the next morning, and after a hearty breakfast, we were back on the road. Shortly after we left the hotel, we hooked up with Lefty Clement, K1TOL, and his father Armand, K1GPJ, both in Maine (FN44). Lefty joined Dad in keeping track of our progress, as he too needed those "rare" grid squares.

We finally arrived at a campground we had selected, checked in at the campground office, and drove a couple of hundred yards to the cabin that would be our home for the week. Our cabin rested well within the boundaries of EN-97. In order to not cause TVI within the campground, we planned to set up a portable site some miles away. Even so, for the first night, I put the Squalo up on a 10-foot pole and was able to make quite a few contacts back into southern Michigan with the 100 watts, right from the cabin (Photo D). Goal #1 was accomplished. I had given Dad a new grid square.

Meeting Al and Peggy

After our first night in the rented cabin, Al and Peggy invited us over for a terrific dinner that we all enjoyed! They lived only one mile from the campground. Meeting this friendly and helpful couple was one of the highlights of the trip. Al even had contour maps of the area, with grid squares clearly outlined. Al's involvement in VHF was limited to 2-meter FM, but he quickly became as excited as I was, when we shared the task of operating from one of the selected sites later in the trip. Since we were doing this through the work week, Al's responsibilities didn't allow him a lot of time during the day, but he did join us every evening. Peggy led us to each of the operating spots. What a couple!

The plan was to set up around noon each day and to operate each evening and the morning of the next day before moving again. But we found the mornings to be the time when propagation was best, so we shifted gears.

Our first set-up was at the top of a mountain in EN-97 (Photo E), one of those otherwise inaccessible spots for which Al had paved the way. A government communications tower resided there, and the access gate was locked—but Peggy had been entrusted with the key. What a view from up there! We were many hundred feet above the surrounding terrain, in every direction. We had to collect rocks and boulders from the final hundred yards of road, to ensure that we wouldn't damage the underside of the truck. Once at the top, we assembled the antennas and 24 feet of aluminum tower that we brought with us. The generator supplied the 110 volts for the equipment, as well as power for the rotator at the top of the tower.

Shortly after getting set up, we fired up the generator and made contact with Dad on 6 meters. He was in with a solid 5x5 signal. Then the first shadow was cast on our operation. While I had made sure to bring along extra gasoline for the generator, I had forgotten oil. I had also forgotten to check it. I learned that a generator will operate without oil for about eight minutes before seizing up. While the ladies ran back to town for oil, I allowed the generator to cool, and worked the engine shaft to free it up. I did no more

"After our first night in the rented cabin, Al and Peggy invited us over for a terrific dinner that we all enjoyed! They lived only one mile from the campground. Meeting this friendly and helpful couple was one of the highlights of the trip."

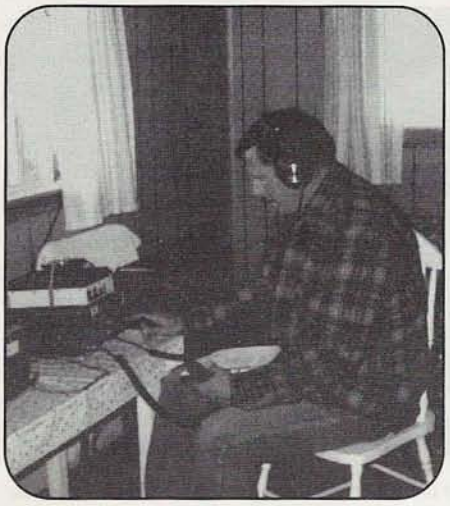


Photo D. While most of the operating was done from their truck at various hilltop locations, Dave managed to get in a few QSOs from their rented cabin as well.

until Linda and Peggy got back with the oil. I filled up the oil pan and it started on the first pull. Boy, did we dodge the bullet on that one! It ran well for the rest of the trip.

Wrong Direction?... RIGHT Direction!

Back on the air, my first contact was with Dad in EN72, and then K1TOL in FN44. In an effort to receive Lefty better, I swung the antenna to the east. We finished our QSO, and I pushed the wrong button on the rotor control box. Instead of swinging back south, I was beaming toward the north. Faint signals became stronger, as I heard stations in Europe beating down on our expedition. For the first time in my life, I was at the receiving end of a pileup any avid VHFer would be thrilled to work. Calls were being thrown at me quicker than I could think. I worked a few, and regained my senses to put out a call of my own, for friends I had worked from home and had become familiar with. Sure enough, I was able to catch some of them before the crowd piled up again.

On one occasion, the voices were too intermingled to separate, and I recognized the chirp of a single CW station. I keyed up and asked everyone to please stand by, and requested that the CW station call again. To my amazement, when I unkeyed, there were a dozen or so CW stations calling from Europe! We worked a couple of them, and then returned to

"Faint signals became stronger, as I heard stations in Europe beating down on our expedition. For the first time in my life, I was at the receiving end of a pileup any avid VHFer would be thrilled to work."

the patient phone operators. Nearly 100 Europeans were worked, in at least 12 grid squares (perhaps more; sometimes Linda simply logged in the signal report), before the band went out and I swung the antennas back around toward the south. Our longest multi-hop *E*-skip contact was with I4SJZ in grid square JN64, 4,274 miles/6,878 km. Our longest SWL report came from PA3249 in grid square JO22, 3,607 miles/5,805 km away. Over 200 stations were logged from our site in EN97.

The next afternoon, we went on to EN98. There would be no more mountain tops to operate from, but our host always made sure that we had a clear path to the east, west, and south. K8WKZ was *not* my first contact from this grid, but he was worked, and put in the log, less than 10 minutes into the effort. We logged almost 100 QSOs from EN98. All QSOs were from the U.S. and Canada (no openings to Europe this time). We worked our longest 6-meter scatter contact from this grid square, to KB4SCE in grid square EM94, 1,005 miles/1617 km. We were to hear no more Europe on this trip.

While we didn't operate from a mountaintop in EN87, we were near the continental watershed where we were above the horizon, looking both North and South. Here, K8WKZ was our second contact, right behind our dear friend Art Martin, W8IDU, in EN-83. We logged nearly 75 QSOs via scatter and aurora modes. Linda logged while I ran the sporadic pileups. By now, we were really getting the knack for listening hard for the weak stations. We made few contacts on 2 meters this trip, but that was to be expected with 6 meters hopping the way it was. After all, working Dad on six was my primary objective, and we were at the onset of the *E*-skip season.

Kickatush Road (EN88)

We were going far enough away the next day that Peggy, our hostess, would have to stay behind to take care of some chores. Linda and I took off on our own. In EN88, the thought came to mind that we were really "kicking butt" on 6 meters...especially since we were parked on *Kickatush Road*. We set up the tower against some piled-up logs, beside a logging operation (Photo F). While we didn't see any logging activity our first afternoon there, we did hear some heavy equipment noise the next morning. Guess who was finally our first contact from a new grid square? Sure enough, it was K8WKZ. Since it was early in the afternoon, I knew Dad was missing some work just to work us.

That afternoon, we were visited by a local VHFer, Rudy Benner, VE3BDR. He was familiar with the territory, and supported our site selection. We would meet Rudy again, the following year, on another trip north. Our longest 2-meter scatter QSO came while in EN88. It was with Hal, KC4YO, in grid EM75, 852 miles/1,371 km.

EN88 was far enough from our cabin that we decided to find lodging closer for the night. We hadn't planned on the night away so we weren't prepared. You sure do miss your tooth brush! That far north, most of the lodges are seasonal and focus on hunting and fishing traffic. It was a

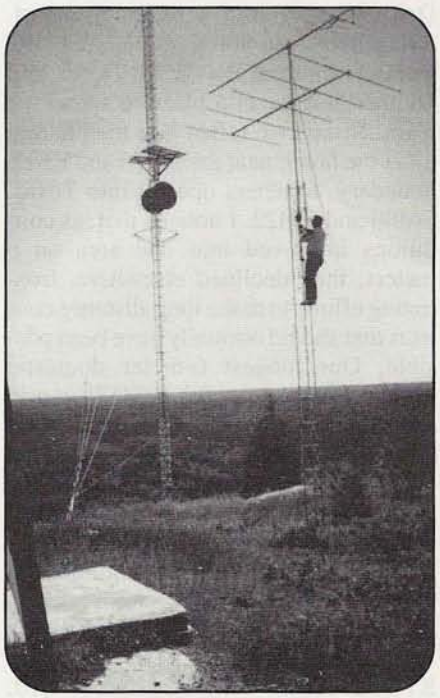


Photo E. The main operating location in EN97 was a mountaintop with a clear view in all directions. Al, VE3XAL, who worked for the Canadian Forest Ministry, was able to secure access to the site, which is home to a government communications tower.

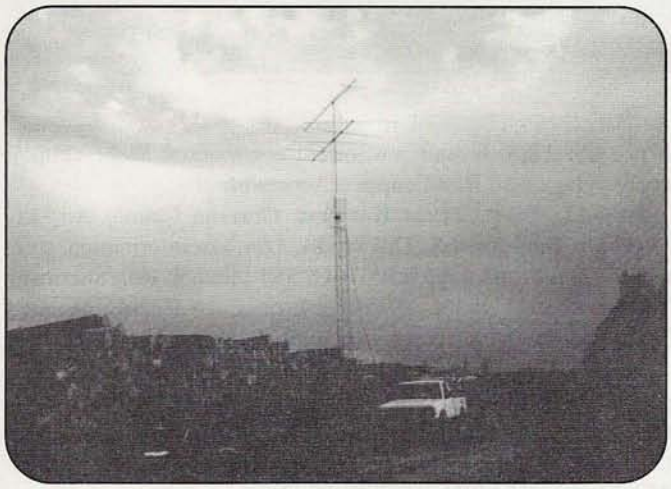


Photo F. No mountaintop for the operation in EN88, but it certainly was a great spot for logging a lot of contacts!

Photo G. Dave's dad, K8WKZ, was the first ham to get confirmations for the grid squares from which Dave and Linda operated—because they drove straight to his house when they came home and filled out QSL cards!

treat to see the moose heads and fish mounted on the walls. To be completely honest, we were getting pretty tired of ham radio by now.

The Final Effort—to EN99

After operating in the morning, we had to decide if we had enough energy left to take on EN99 for Don. We figured that we'd give it a go, but that we wouldn't take the time to erect the tower. After a nearly two-hour drive, we pulled into a parking lot near Cochran, Ontario, put the five-element beam on top of a 10-foot mast, and simply pointed it south. No one was expecting us there, and my CQs were falling short of netting us a single QSO.

Across the road was a truck stop. Linda and I walked over, and called home on the pay phone. Dad wasn't home, so I asked Mom to give Don, WW8M, a call to let him know we were on the air in EN99. By the time we got back to the truck, Don was there and he responded to my first CQ. Don got the grid square and Linda and I were thrilled for him. The sky was darkening to the north and the sound of distant thunder could be heard. A few other stations had heard Don work N8NQS/VE3 EN99, and got in the logbook just before we decided that it would be unsafe to wait any longer to take the antenna down. Don was our longest tropo contact for the trip, from EN72, 537 miles/864 km.

We drove three hours in the rain to get back to the cabin, where we nearly collapsed from exhaustion. That evening, we again went to the home of our hosts and enjoyed a good time with Al and Peggy, making memories that will last a whole lifetime.

Homeward Bound

We headed home early the next morning, again stopping halfway for an evening in a hotel. Along the way, we operated mobile and enjoyed a bit of *E*-skip, aurora, and scatter. Dad talked us in, with periodic QSOs, from Michigan's Mackinaw Bridge all the way back to Jackson (Photo G). Dad was the first to get all of those grid squares confirmed, and I watched with excitement as he colored in those four remaining EN grid squares on his map (*my* map of farthest QSOs per mode and band is Photo H; the distances themselves are in the Table).

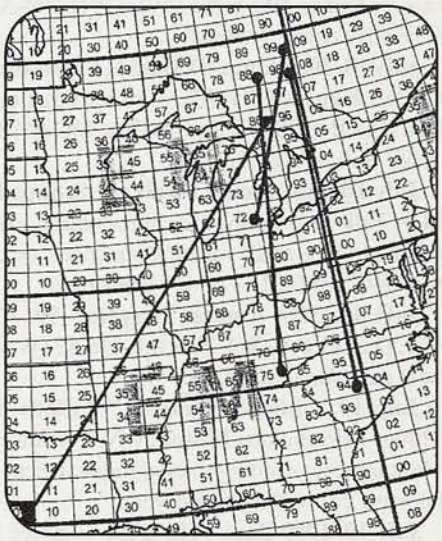


Photo H. Grid square map showing the longest-distance North American QSOs worked on each band and propagation mode. See Table for specifics.

We enjoyed the trip so much that we made another one, the following year, into another part of glorious VE land. But, that's another story... ■

Table.

Longest-distance North American QSOs, by band and propagation mode (see map in Photo H.):

2-meter scatter: KC4YO EM75 from EN88, 852 miles/1371 km
6-meter scatter: KB4CSE EM-94 from EN-98, 1,005 miles/1617 km
6-meter tropo: WW8M EN-72 from EN-99, 537 miles/864 km
6-meter *E*-skip (1 hop): W5OZI EM-00 from EN-86, 1,413 miles/2274 km

Longest QSO (not on map):

6-meter *E*-skip (multi-hop): I4SJZ JN64 from EN97, 4,274 miles/6878 km

**Dave's father became a Silent Key about a year after the trip described here, "but not before I got to make another trip to [Canada] with him," notes Dave, who will write about that trip for an upcoming issue. Today, Dave's mom, Patricia, formerly N8PYO, holds her late husband's callsign, K8WKZ.

Hamfest Calendar

The following hamfests are scheduled for July, 1999:

July 3, Monroe County ARC Hamfest, National Guard Armory on Hwy. 163, Tompkinsville, KY. Talk-in: 146.775. For information, contact David Welch, K4PL, 111 Pocahontas Trail, Glasgow, KY 42141; E-mail: <dwelch@glasgow-ky.com>.

July 4, 27th Annual Fore Cracker Hamfest & Computer Show, Emerick Cobort Park, **Bressler, PA**. Talk-in: 146.16/76 MHz & 146.52 MHz Simplex. For information, call (717) 939-4828, or e-mail: <n3njb@aol.com. **(exams)**

July 9–11, International Peace Garden Hamfest, International Peace Garden, **(US-Canadian border between Dunseith, ND, and Boissevain, MB)**. Talk-in: 146.85- or 146.52 IPG Hamfest Club Station VE4IHF. For information, contact Dave Snydal/VE4XN, (204) 728-2463, or e-mail: <dsnyfal@mb.sympatico.ca>, or Duane Hagen/KEØVF (701) 794-3309, e-mail: <dhagen@westriv.com>. **(exams)**

July 10, 30th Annual PHDARA Hamfest, Kansas City Market Center, **Kansas City, MO**. For information, contact PHD Hamfest, P.O. Box 28954, Kansas City, MO 64188-8954, or (816) 436-0069, Bob, WAØCLR.

July 10, 5th Annual SwetFest, Railroad Square, **Brunswick, MD**. Talk-in: 147.06+. For information, check <http://www.qsl.net/madra>, e-mail: <madra@qsl.net>, or call Voice BBS (301) 416-8447, or (301) 473-4151. **(exams)**

July 10, 30th Annual Swapfest '99, American Legion Post 434, **Oak Creek, WI**. Talk-in: 146.52 (WA9TXE). For information, call (414) 762-3235.

July 10, Ontario Hamfest '99 (25th Anniversary Event), Milton Fairgrounds, **Milton, ON**. For information, contact Alan Montgomery, <montgomery@bigwave.ca>; Web: <http://www.bigwave.ca/~ve3coj/barc/flyer>.

July 10, 1999 Batavi Hamfest, Genesee Fairgrounds, **Batavia NY**. Talk-in: W2RCX, 147.285 MHz[+]. For information, contact Harold Hay, Chairperson, at (716) 343-2844, or e-mail: <Wa2abq@aol.com>.

July 10, 23rd Annual Swap & Shop, Emmet County Fairgrounds, **Petoskey, MI**. Talk-in: 146.68-. For information, contact Tom, W8IZS, at (616) 539-8459, or Dirk, KG8JK,at (616) 348-5043, <kg8jk@qsl.net>. **(exams)**

July 11, Valley Forge Hamfest and Computer Fair, Fire Co. Fairgrounds, **Kimberton, PA**. Talk-in: 146.835/- and 443.80/+ CTCSS 131.8. For information, contact Bill Owen, W3KRB, 679 Malin Rd., Newton Square, PA 19073, (610) 325-3995, or MARC, P.O. Box 352, Villanova, PA 19085; E-mail: <hamfest-info@marc-radio.org>; Web: <http://www.marc-radio.org/hamfest.html>.

July 11, 16th Annual Hamfest '99, Will County Fairgrounds, **Peotone, IL**. Talk-in: 146.94. For information, contact Billie Kerouac, KF9IF, at (815) 939-7548 or <dkbk@megsinet.net>; Web: <http://geocities.com/capecanaveral/hanger/5711>. **Handicapped Accessible**

July 11, 14th Annual Hamfest, Northland Public Library, **Pittsburgh, PA**. Talk-in: 149.09, W3EXW. For information, contact Rey Whanger, W3BIS, 120 Cove Run Rd., Cheswick, PA, (412) 828-9383; E-mail: <w3bis@freewwweb>; Web: <http://nharc.pgh.pa.us>. **Handicapped Accessible**

July 17, North Texas Hamfest, Grayson County Airport, **Sherman-Denison, TX**. Talk-in: 147.00+. For information, contact Wilmer O. Kinsey, WB5DCU, 350 Mitchell Rd., Sherman, TX 75090-3223, (903) 893-5872; E-mail: <wb5dcu@gte.net>; Web: <http://home1.gte.net/wb5dcu/amrad.html>.

July 17, 20+ Years NOARSFEST '99, Lorain County Fairgrounds, **Elyria, OH**. Talk-in: 146.10/70. For information, contact, KC8AOX, John Schaaf, e-mail: <kc8aox@qsl.net>, call: (216) 696-5709 (leave message), or write to NOARSfest, P.O. Box 432, Elyria, OH 44036-0432. **(exams)**

July 17, Superfest '99, Larimer County Fairgrounds, **CO**. Talk-in: 145.115 (- offset, 100 Hz), or 146.85 (- offset). For information, call (970) 352-5304.

July 17, 27th Annual Mid-Summer Swapfest, Cary Community Center, **Cary, NC**. Talk-in: 147.15 + .6-. For information, write to: Cary ARC, P.O. Box 53, Cary, NC 27512. **(exams)**

July 18, 21st Annual Hamfest, Sussex County Fairgrounds, **Augusta, NJ**., talk-in: 147.300, 224.50 repeaters, 146.52 simplex. For information, contact Dan Carter, N2ERH, 8 Carter Lane, Branchville, NJ 07826; Phone: (973) 948-6999; E-mail: <N2ERH@EMAIL.COM>; Web: <http://www.scarcnj.org>.

July 18, 75th Anniversary Hamfest, Waubonsee Community College, **Sugar Grove, IL**. Talk-in: W9CEQ-147.210(+ 600) PL 103.5/107.2-AFAR repeater. For information, contact James Von Olnhausen, N9UZC, c/o FRRL, P.O. Box 673, Batavia, IL; Phone: (630) 879-3042; e-mail: <n9uzc@amsat.org>; Web: <http://www.frrl.org/hamfest.html>. **(exams)**

July 18, Tailgate Electronics, Computer & Amateur Radio Fleamarket, Albany & Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl2A - W1XM/R. For information, contact W1GSL, P.O. Box 397082 MIT BR., Cambridge, MA 02139-7082. **Handicapped Accessible**

Operating Notes

For Late June & July, 1999:

June	
26–27	ARRL Field Day
July	
3–4	European VHF Field Day Events (Multiple)
10–11	**CQ World Wide VHF Contest (see rules, this issue)**
10–11	Internet 6-meter Contest
29	Delta Aquarids meteor shower peak
31–Aug.1	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>.*

July 18, 12th Annual Van Wert Hamfest, Van Wert County Fairgrounds, **Van Wert, OH**. Talk-in: 146.85-. For information, contact Van Wert ARC, P.O. Box 602, Van Wert, OH 45891-0602, or e-mail Bob, WD8LPY, at barnesrl@bright.net; Web: <http://www.bright.net/barnesrl/w8fy.html>. **(exams)**

July 23–24, 26th Annual Ham Holiday '99, Oklahoma State Fair Park, **Oklahoma City, OK**. Talk-in: 146.82. For information, visit CORA web site at <www.geocities.com/heartland/7332>, or write Ham Holiday '99, P.O. Box 850551, Yukon, OK 73085-0551, or e-mail: <n1lpn@swbell.net>. **(exams)**

July 24, Hamfest, Diamond Oaks Career Development Campus, **Cincinnati, OH**. Talk-in: 146.67. For information, contact Dana Laurie, WA8M, 280 Hillcrest Dr., Cincinnati, OH 45215-2610; Phone: (513) 761-7388; E-mail: <wa8m@arrl.net>. **Handicapped Accessible**

July 25, Annual Hamfest and Computer Fest, Timonium Fairgrounds, **Baltimore, MD**. Talk-in: 147.03/+, 224.96, and 448.325 MHz repeaters. For information, contact BRATS Hamfest, P.O. Box 5915, Baltimore, MD 21282-5915; Web: <http://www.smart.net/~brats>; E-mail: <brats@smart.net>; Phone/Fax: (410) 461-0086. **(exams)**

VHF Conferences/Special Events

June 26–27, 1st Annual TAPR Technology Demo Day (*This was inadvertently omitted from last month's issue.*) Tucson Amateur Packet Radio (TAPR) is sponsoring a nationwide Technology Demo Day at ARRL Field Day sites around the country. The goal is to demonstrate the emergency communications abilities of packet radio, slow- and fast-scan ATV, spread-spectrum, ham-internet gateways (IGates) and other operating modes accessed via RF means only. For complete information, visit the TAPR Web site at <http://www.tapr.org/tdfd>, or contact TAPR, 8987-309 E. Tanque Verde Rd., #337, Tucson, AZ 85749; Phone: (940) 383-0000; Fax: (940) 565-2544; e-mail: tapr@tapr.org.

July 23–25, 33rd Central States VHF Society Conference, Cedar Rapids, Iowa. The 1999 Central States VHF Society Conference will be held July 23–25 at the Shearton Four Points Hotel in **Cedar Rapids, Iowa**. This is traditionally the nation's largest VHF/UHF technical conference. Sessions kick off Friday morning, for those who can be there early. A full slate of technical programs is planned, including sessions on digital signal processing, receiver design, VHF power amplifiers, aurora detection, EME dish construction, and more. There will also be noise-figure and antenna gain measurements, along with family activities and a Saturday night banquet. For more information, visit the CSVHFS Web site at <http://www.csvhfs.org>, or contact society President Rod Blocksome, KØDAS, 690 Eastview Dr., Robins, IA 52328, or via e-mail at kØdas@csvhfs.org.

July 24–25, Western States Weak Signal Society Conference, Flagstaff, Arizona. The 1999 WSWSS technical conference will be held July 24–25 in **Flagstaff, Arizona**, the same weekend as the annual Fort Tuthill hamfest, a major southwestern hamfest. For more information, visit the WSWSS Web site at <http://www.wswss.org>, or contact conference chairman Alf Green, NU8I, via e-mail to nu8I@home.com.

Sept. 18–19, Weinheim (Germany) VHF Conference (*We're running this early due to extra time needed to make arrangements if you want to go.*) The 44th annual Weinheim VHF Conference, the world's largest VHF conference, will be held September 18–19 at the "Mannheimer Maimarkthalle" **(Mannheim May Fair Centre) near Weinheim**. This is a new location for the event. Lectures may be given in either German or English. Speakers should confirm that they will be attending by June 30, 1999. Any contributions for the VHF Convention Script (Proceedings) must be submitted by 25th July 1999. For more information, please visit the Weinheim VHF Conference Web site at <http://www.hamradio.de/weinheim>. ■

Call for Papers, 18th Annual ARRL/TAPR Digital Communications Conference

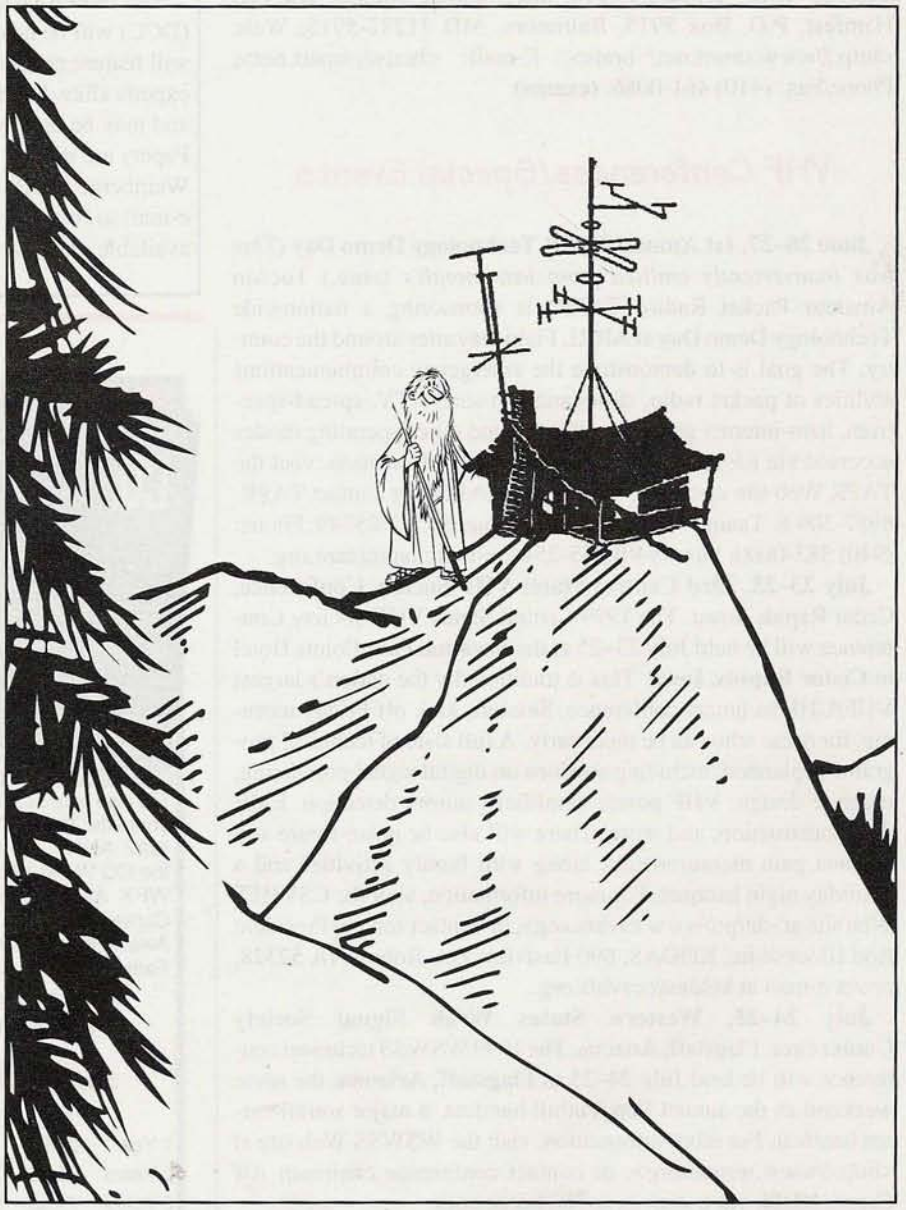
The 1999 ARRL/TAPR Digital Communications Conference (DCC) will be held September 24–26 in Phoenix, Arizona, and will feature programs for digital communication beginners and experts alike. Papers for the conference proceedings are invited, and may be on any topic dealing with digital communications. Papers are due by August 9, and should be submitted to Maty Weinberg, ARRL, 225 Main St., Newington, CT 06111, or via e-mail to lweinberg@arrl.org. Paper submission guidelines are available online at <http://www.tapr.org/dcc>.

SSB and the Meaning of Life

High atop the Mountain of Repeater Antennas, the wizened old radio guru patiently answers the questions of hams who have climbed the mountain in search of wisdom...and a good portable location for the next contest...

Is there life after death? Are there other modes on VHF beyond FM? The answers, respectively: maybe and most definitely! We'll leave the first great mystery to another forum, but the second one is something that we can tackle this month.

For the last 10 years or so, the most common path into ham radio has been via the Technician license. Without a doubt, the rig of choice of the newcomer has been an FM rig operating on one or more VHF/UHF bands. Many hams have come in at this level and stayed there. Today, though, it seems that more and more Techs are acquiring multimode rigs and trying out the other modes, particularly SSB (single sideband).



The Sideband Path

Perhaps you have been considering this path. Great! FM is a wonderful mode and a lot of fun, but it's not the only mode. Suppose you have cut your "radio teeth" on FM. As you begin to consider moving into SSB operation, you'll naturally become aware of the many differences in the two modes. It follows that these differences have significant implications to what is acceptable and desirable operating procedure. Let's take a look at a few of these differences.

VHF/UHF SSB and CW (Morse code) are often referred to as "weak signal" modes. That means just what it sounds like—there's a lot more noise and fading in SSB operation. For the most part, an FM signal is either there or not there. If you're driving along talking to someone, you briefly pass from conditions of a solid

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

signal to breaking up to gone. The gray area is narrow. FM tends to provide solid, easy communication, as if you were sitting in your living room talking to a friend. On the other hand, an SSB or CW signal may have a fringe area that extends out 90 miles or more. This depends on the terrain and weather conditions. Along the coast, it can be much farther than that, on a daily basis. A special case is the Gulf of Mexico, which is about 700 miles across in spots, where it's common for stations along the Florida coast to work daily into Texas and Louisiana! If FM had that sort of range, there'd be a lot less room for repeaters in this country.

Becoming a Good Listener

Old timers talked about "armchair" copy, meaning that you could sit back in an armchair, relax, and carry on the conversation. Presupposed in this is the idea that there's something other than "armchair" copy—in reality, normal copy. Also presupposed in this expression is the idea that this other form of communication requires more attention on the part of the listener. And it does. The more you understand and act on this, the more fun you'll have on SSB. Also, you'll be a better operator, and you'll tend to be recognized as such. More fun, more respect? That's something you would want, isn't it?

In addition, FM operation is channelized, while SSB is not. An FM signal has a carrier, while SSB does not. And there are no repeaters with courtesy tones. These are the other reasons why it's so important to be a good listener. Also, when you place yourself in the position of the listener, it programs you to use good habits while transmitting.

The demands of SSB operation on VHF/UHF differ little from those of HF SSB operation. So, the more proficient you become here, the easier it will be when you decide to migrate to HF.

A Typical Contact

Let's go through some of the dos and don'ts of a typical contact. The first thing to do is to make sure that you're in the right band segment. There are a number of "gentlemen's agreements" as well as some rules about where you can operate with specific modes. It's a good idea to stick within these band plans, FCC rule or not. You can find the band plans in a number of publications, including *The ARRL Repeater Directory* and *The ARRL Operating Manual*.

For instance, take a look at the plan for 2 meters. The national SSB calling frequency is 144.200 MHz, with general 2-meter SSB operation from 144.200 to 144.275 MHz. The idea is simple: if you hear no one after calling CQ, go to 144.200, call CQ, establish a contact, and then move to some other frequency in this range to conduct the contact. That is, if the band is quiet and conditions are good. How do you know what the conditions are? You know because you listen after turning the rig on and before grabbing the microphone.

Do you have to call exactly on 144.200? No, there are no channels. The only hard and fast rule is to stay in band. Once contact is established, is there a particular frequency to move to? No. Just stay within the segment and try not to interfere with other operators. At popular hours or when the band is open, that may not be easy. You may have to pick a frequency only four or five kHz away from other contacts. That's OK. Or maybe someone will establish a contact near you. This is not FM. Of course, if the band is quiet with only a handful of contacts in progress, you should attempt to pick a frequency that does not bother other established contacts.

Calling CQ

Suppose you have listened for a minute or two and know that the band is open; what do you do next? Call CQ. It's pretty simple and easy to do, but if your whole background is FM repeater operation, you may feel a little silly at first. If you did this on a repeater, people would throw rocks at you. However, on SSB it's expected! Just like on HF. This is not rocket science. Calling CQ would go something like this: "CQ, CQ, CQ. This is Whiskey Bravo Two Delta, WB2D, Whiskey Bravo Two Delta, calling CQ, CQ, CQ. Over." Lots of short transmissions with pauses in between work better than long ones with few pauses. That's just logical.

Once you've released the mic key, listen and tune around a little bit. Rigs are pretty stable these days, but the other station may not be exactly on your frequency. When someone answers you, jot down their callsign. This is the place to

Wanted: Simplex Net Listings

John L. White, N4IFC, writes:

I am currently working on a project to catalog, maintain, and present a listing of all VHF/UHF simplex nets in the USA. This information, in a tabulated, or searchable, database form, will be very interesting and useful to everyone who is interested in weak-signal work, or who is generally active on our VHF+ bands.

To date, we have had several hundred entries. But, this is far short of our goal. There are literally thousands of "Simplex Only" VHF+ nets out there. It'll be great if we can list them all and will do much to advance our hobby! To add your simplex net (or one for which you know you have accurate and current information), just follow the link from my site at: <http://www.materials.com/n4ifc.htm> to our project page. Add your info, then "tell a friend"! This will be a fun site for us all when complete.

New South African 6-Meter Web Site

From our South African correspondent, Johan Leroux, ZR1AEZ:

For those looking for ZS1 (and other) 50-MHz news, have a look at: <http://homepages.infoseek.com/~zr1ev/zsnews.html>.

Table. Standard Phonetic Alphabet

A	Alfa
B	Bravo
C	Charlie
D	Delta
E	Echo
F	Foxtrot
G	Golf
H	Hotel
I	India
J	Juliett
K	Kilo
L	Lima
M	Mike
N	November
O	Oscar
P	Papa
Q	Quebec
R	Romeo
S	Sierra
T	Tango
U	Uniform
V	Victor
W	Whiskey
X	X-Ray
Y	Yankee
Z	Zulu

Table. The standard phonetic alphabet, as adopted by the International Civil Aviation Organization, or ICAO. There are other standards in use by police and other agencies, but this is the phonetic alphabet that has been adopted by most hams in the U.S.

use phonetics as aids to making your callsign understood. I think it's a good idea to use the standard phonetics (see Table) to go back to the other operator repeating his callsign followed by yours.

As an example, suppose I have called CQ and hear a call that I believe to be WA6ITS. If I just say, "WA6ITS this is WB2D. Let's move up 20. Over," the other station may think that I have his callsign correct even though I do not. However, if my reply is "Whiskey Alfa Six Italy Tango Sierra, this is Whiskey Bravo Two Delta. Let's move up 20. Over," Bill will know that I have his callsign wrong and will correct me by saying something like, "Negative. My callsign is Whiskey Alfa Six Italy Tango *Foxtrot*. I'll listen for you up 20. Over." Incidentally, giving a specific frequency or saying something like "up 20"—meaning moving 20 kHz higher in frequency—are both accepted ways to handle this situation.

"...when you place yourself in the position of the listener, it programs you to use good habits while transmitting."

Use the standard phonetics, too. Years ago there was an HF operator who used these phonetics for the suffix of his call: Fuzzy Wuzzy Wabbit. He had a slight speech impediment and a short fuse, so those of us who worked him were never sure if we were working -FWW or –FWR. Also, the cute phonetics often make you seem ridiculous. Back in the '60s, there was a sitcom on TV called "McHale's Navy." Tim Conway played Ensign Parker, an inept nerd who wanted to be important. When anyone spouted military jargon, Parker would always comment, "Gee, I love that kind of talk." So, if you ever get the urge to use cute phonetics, just imagine that there are a bunch of us old buzzards out there comparing you to Ensign Parker. That ought to be enough to stop you.

Once communication is established, it should be pretty much like a conversation...with a couple of exceptions. The FCC only requires that you identify your station every 10 minutes and at the end of the communication. There is no need for excessive use of callsigns after communication is established. Giving your call every fourth or fifth round is more than enough.

But there *is* a need to say the word "over" at the end of each transmission, unless conditions are excellent. There is no carrier on SSB, so the S-meter just bounces up and down with your voice peaks. There is noise and, frequently, fading. So, it can be almost impossible to determine when the other station is "throwing it back to you" unless they give you this cue.

Also, the exchanges should be pretty short, at least to start with. Most people give their name, location, and a brief description of the station during the first round. Sometimes even that can be too much. Years ago, Chod Harris, VP2ML, and I were trying to work 10-meter meteor scatter from his station in Connecticut. The circuit that a meteor path opens lasts only about 20 to 30 seconds. Experienced meteor scatter operators make the most of these short but strong openings. I listened as Chod called CQ. A midwestern station came back and started to ramble on about what a great opening it was. He faded out as the hot gas from the meteor vapor trail dissipated—long before the QSO could be completed.

You probably won't work much meteor scatter above 2 meters, but there are a lot of propagation modes that come and go quickly at VHF/UHF. Your best bet is to get the contact essentials out of the way quickly and then move into the ragchew mode if all are agreeable to that course.

Bells and Whistles

You'll notice that an SSB rig has a few more controls than your FM box. These can be very useful, to say the least. First and foremost is probably the *RIT*, or *receive incremental tuning*, control. Although rigs are very stable these days, there's the possibility that a transceiver may transmit and receive on slightly different frequencies. Or the operator's hearing may be a little faulty. If you attempt to tune in that station with the main tuning dial, the two of you will "walk" across the band as each readjusts his operating frequency on each period of reception. The best approach is to get as close as you can and then do the fine tuning with the RIT control. You'll find an RIT control on virtually all SSB rigs these days.

Most SSB transceivers also have a *speech processor*. This is a device that modifies (distorts) the waveform of your voice to put more power into the transmitted signal. A little bit of this distortion can make the signal more readable on the other end. However, a lot of this distortion is exactly that—distortion! Where speech processors and compressors are concerned, remember *less is more*! Use them judiciously.

Going Horizontal

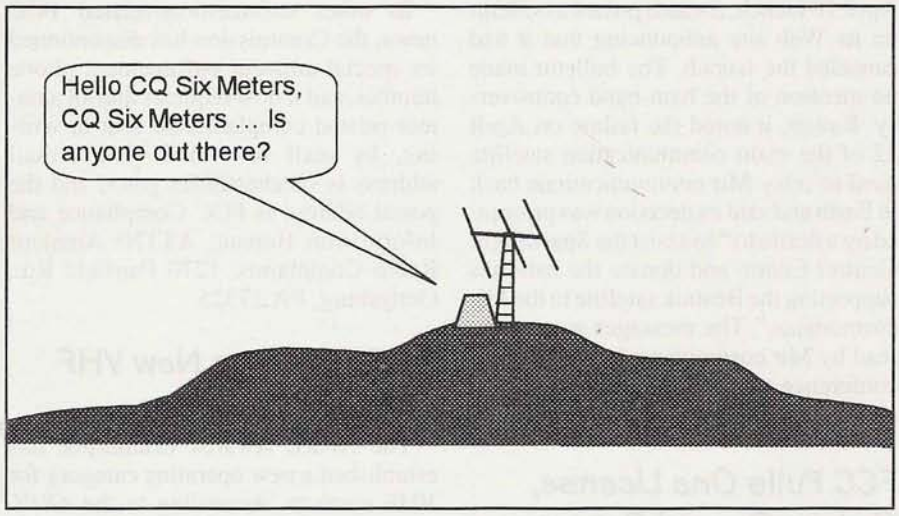
Remember, too, that by convention, SSB uses horizontally polarized antennas while FM utilizes vertical. If you're going to operate SSB, you need a different antenna than the one you've been using for FM. If you're thinking of a Yagi beam antenna, be sure to look for one that's designed to provide horizontal polarization. Also, make sure it's tuned to the appropriate part of the band.

As you try more and more things in ham radio, you're going to find more and more ways of having fun. I'll see you down the band. ■

Detective Story: Is It F_2 or Double-Hop Es?

In last month's "Weak Signal News" column, WB2AMU looked at the differences between F_2 and TEP, trans-equatorial propagation. Now, he examines another source of confusion—between F_2 and double-hop sporadic-E.

With the increase in F_2 activity on 6 meters during the higher sunspot count years, there's natural confusion as to which mode of propagation was responsible for a particular long-distance contact. Last month, writing in "Weak Signal News," I explored the differences between F_2 and trans-equatorial propagation, or TEP (which is actually a specialized form of F_2). Now, we'll move on to the similar question of figuring out whether a 6-meter QSO that covers a 2,000-mile range was the result of F_2 or double hop sporadic-*E* (*Es*). The following is a case in point.



Since the distances covered are about the same, it can often be difficult to distinguish between a double-hop sporadic-E contact and one made via single-hop F_2.

Making a Sick Day Worthwhile

On November 19, 1991, I had a horrible case of the flu and I ended up staying home in from work that day. I mostly stayed in bed, but was able to make an occasional visit to the basement shack to see what was happening on 6 meters. At 10:30 a.m., I heard the HC8SIX beacon from Galapagos Island coming in on my Swan 250. Despite many CQs, I could not raise any activity on the band and this was the only signal I heard. I went back to bed and at 4:30 p.m., I woke up and found that six was open to western Canada from my home grid of FN30 in New York. I worked VE5RA in Saskatchewan in grid DO62 and VE6BBM in Alberta (DO34) before the band dropped out after being open for 15 minutes.

Then the question came up: Were these QSOs made by an F_2 opening or via a double hop *Es* opening? The distance between Long Island and Saskatchewan was just right for either possibility. I asked the opinion of several VHF experts and the consensus seemed to be that it was probably F_2.

RF Detective Work

There were a few clues pointing toward this conclusion. One was the fact that, because of high solar activity, the band had been open that morning towards HC8SIX. Also, I heard no signals in between the Canadian stations (at single-hop *Es* distance) as you might sometimes hear during a double hop *Es* opening. Plus, double hop *Es*, while possible during the wintertime, is less common than during the summer months.

I had a few other QSOs that fell into a "is it double hop *Es* or F_2?" category, but those openings were long—on the order of several hours each—so that double-hop *Es* could be ruled out. A single-hop F_2 opening typically lasts longer than a

"I worked VE5RA in Saskatchewan in grid DO62 and VE6BBM in Alberta (DO34) before the band dropped out after being open for 15 minutes."

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

the "Swatch Beat" as a new "global concept of time." Swatch had named the project its "Beatnik" mission. AMSAT groups in France and Russia, which built the satellite, immediately distanced themselves from the Swatch plans, saying they had no knowledge of the agreement between the watch company and the Russian space agency.

The ARRL said the controversy over the use of amateur radio frequencies to transmit the messages had grown to international proportions in recent days, and the story was picked up by media ranging from "Wired News" and MSNBC to *The Sunday Times of London*.

Swatch AG, the Swiss watchmaker, maintained until the end that the messages were non-commercial and would not violate international law regarding transmissions on amateur frequencies. However, the day before the scheduled April 16 launch, Swatch posted a bulletin on its Web site announcing that it had canceled the launch. The bulletin made no mention of the ham-band controversy. Rather, it noted the failure on April 12 of the main communication satellite used to relay Mir communications back to Earth and said its decision was prompted by a desire to " to assist the Spaceflight Control Centre and donate the batteries supporting the Beatnik satellite to the Mir cosmonauts." The messages were to be read by Mir cosmonauts during a videoconference on April 22. Still uncertain in all this is the fate of Sputnik 99 itself.

FCC Pulls One License, Orders Several Retests

A newly licensed ham who allegedly had been operating without a license on a California repeater has had his license "set aside" by the FCC, the latest action in the Commission's continuing crackdown on abuses in the amateur service. Jeffrey Dressler of Cypress, California, was informed by FCC amateur enforcement chief Riley Hollingsworth, K4ZDH, that, "by this letter, we set aside the April 5, 1999 grant of your Amateur license KF6VOT, and your application remains in pending status" until the Commission decides what action to take regarding his alleged unlicensed operation.

In addition, several hams around the country were ordered to appear for retesting, either by Volunteer Examiners or at specific FCC field offices, and were warned that "your license will be canceled if you do not appear for re-examination." The FCC also sent out warning notices to several other hams accused of causing interference, both on VHF and HF, ordering them to stop immediately or face fines and revocation proceedings.

And, going a step beyond interference complaints, a May 7 letter from Hollingsworth to the net control station of the "Liberty Net" on 75 meters, asks Victor Misek, W1WCR, to "explain how the operation of this 'net' is justified." The Liberty Net is one of several so-called nets on 75 meters that seems to specialize in promoting the political views of its members. "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," Hollingsworth writes, adding, "Your group may wish to explore operation on the Internet or (if the FCC creates this service), a low power FM broadcast grant."

In other enforcement-related FCC news, the Commission has discontinued its special amateur enforcement phone number, and it now requests that all amateur-related complaints be sent in writing, by mail or e-mail. The e-mail address is <fccham@fcc.gov>, and the postal address is FCC Compliance and Information Bureau, ATTN: Amateur Radio Complaints, 1270 Fairfield Rd., Gettysburg, PA 17325.

ARRL Adopts New VHF Contest Category

The ARRL Awards Committee has established a new operating category for VHF contests. According to the *ARRL Letter*, a "Single Operator Low Power" category will be an option as of the January, 2000, VHF Sweepstakes. Power limits will vary by band, as follows: 200 watts PEP on 6 and 2 meters; 100 watts PEP on 222 and 432 MHz; and 10 watts PEP on 902 MHz and above. For more information, contact ARRL Contest Branch Manager Dan Henderson, N1ND, at <n1nd@arrl.org>.

RAC Proposes New 13-Centimeter Band Plan

The Radio Amateurs of Canada (RAC) has proposed a new band plan for the 2300- to 2450-MHz band. Highlights include a proposed CW/SSB DX calling frequency at 2304.10 MHz, a domestic SSB calling frequency at 2304.20 MHz, an FM calling frequency at 2305.20 MHz, and an innovative plan for split-frequency EME operation, depending on where in the world you're trying to reach via the moon. The complete proposal is available on the RAC Web site at <http://www.rac.ca/13cmrev1.htm>. Comments may be sent until June 23, 1999, to advisory committee chair Darrell Ward, VE1ALQ, at P.O. Box 576, Grand Bay, NB E0G 1W0, CANADA; or by e-mail to <ve1alq@fundy.net>.

ICOM America to Split Up U.S., Canadian Operations

Ham manufacturer ICOM America will divide into two separate corporate entities—one for the U.S. and one for Canada—as of July 1, according to the *ARRL Letter*. Current ICOM America President Bob Brunkow, K7NHE, will head up the new Canadian corporation, but will "maintain a consulting role with ICOM America after the split." The U.S.-only operation will be headed by Hiro Nakaoka, JK3UZC, who has been with ICOM since 1984, and with ICOM America since 1994. The company also reported its most successful business year ever in 1998–99.

"Were these QSOs made by an F_2 opening or via a double hop Es opening? The distance between Long Island and Saskatchewan was just right for either possibility."

double-hop *Es* opening and has a more consistent appearance.

High Probability

After having observed 6 meters for over 10 years (including the years of no F_2 activity), I can state with high probability that these contacts with western Canada were made via a single-hop F_2 skip. Even so, I cannot rule out the possibility of double-hop *Es*. But it's this uncertainty that helps add to the mystery of the Magic Band! I do know that we'll see more openings such as these over the next three or four years of higher sunspot activity, and it will be quite a challenge to try to figure out the most likely mode of propagation. ■

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.

Getting Started in ATV

If you haven't yet made the leap into amateur television—but we've gotten you thinking about it—here are some tips for getting started. #1: NEVER say, "Lights, Camera, ACTION!"

The last few "In Focus" columns have focused on such topical items as digital ham TV, 2.4-GHz equipment, and public service activities. I thought that this might be a good time to step back from the current and advanced topics and discuss some of the basics for those who might be considering amateur television (ATV) for the first time. A discussion of entry-level ATV can be quite complicated because different parts of the country use different bands and modes. It's always important to get in touch with some of the local ATVers in your area (see "Resources") and find out what they are doing so that you can join in the fun.

This month, I'd like to do a band-by-band analysis of what's going on so you'll have a good idea of what's required and how easy it might be for you to participate. Remember, just because there are many different things happening in ATV doesn't mean that you have to try and bite off the whole enchilada the first time. Start by getting an ATV receiver going and watch what's happening. After that first easy step, you can consider getting a transmitter and joining in.

70 Centimeters

This is the lowest frequency band in the U.S. on which full-bandwidth, fast-scan television is allowed. This band is shared with other amateur users, including FM repeater systems, remote-base FM stations, FM links, amateur satellites (both space-borne and terrestrial), weak-signal SSB and CW stations, and digital (packet) systems. Most of the U.S. has full access to 420 to 450 MHz. Some areas (mostly along the Canadian border) are limited to a smaller portion of the band because of special restrictions. Consult your latest FCC regulations (you *do* have a copy, right?) or a current *ARRL Handbook* for more specifics about your area.

This small transmitter that surfaced recently on the surplus market needs only minor modifications to serve as a very low-cost, introductory four-channel ATV transmitter on 33 centimeters. See text for details.

ATV has been active on this band for decades. Since the beginning of television, hams have been playing with ATV here, using old tube-type two-way radios converted to television. At that time, there wasn't much gear that would work above 70 centimeters, so this was the only real place for ATV to happen.

Receiving 70-centimeter ATV is relatively easy. Today, any modern TV or videocassette recorder that's "cable-ready" can directly receive AM ATV signals from this band. Often, ATVers simply get a 70-centimeter antenna (correctly oriented for the polarization used in their area) and run the cable down to the TV or VCR. The TV or VCR is then put in the "cable" position and tuned to the correct channel (see below for specifics). If the ATV signal is strong enough, that's often all that's required. If you're a good distance from the other station or the repeater system, you may need to add a mast-mounted receiving preamplifier to boost the signal before it goes down the feedline.

Remember that typical amateur coaxial feedlines have loss characteristics that increase with frequency. You can lose most of that tiny signal from the ATV repeater in lossy feedline before it ever reaches your receiver. If you happen to have an older TV that's not cable-ready, you can purchase a receiving down-converter. This device takes the 70-centimeter ATV signal and converts it to channel 3 or 4 of a conventional television for reception. Again, it's often necessary to put a pre-amplifier at the antenna, ahead of the feedline, to boost the weak signals before feeding them down to the converter. Usually, these receiving converters are tunable and cover the entire 70-centimeter band. They are frequently available used at flea markets from hams who started with these receiving converters and then retired them in favor of newer cable-ready equipment.

There are five primary frequencies for ATV work on this band: 421.250, 426.250, 427.250, 434.000, and 439.250 MHz. I'll talk about each one and what it's typically used for. Remember that not all frequencies are used in all areas. There's great competition for spectrum in the 70-centimeter ham band. Some areas find the choices extremely limited; others find they can utilize several of these frequencies.

Frequency by Frequency

421.250 MHz: This is the lowest frequency in the 70-centimeter band used for ATV. It's often used as the output for ATV repeaters. Traditionally, it was in a relatively unused part of the band, but, today, the spectrum from 420 to 430 is being heavily used in some areas for links between repeater systems. This frequency conveniently corresponds to cable

By Ed Manuel, N5EM (atv@cq-vhf.com)

"[On 434.000 MHz], it's easy to interfere—without even knowing it—with the* input *to a satellite that's receiving on this band. This is the real problem with using this frequency. One can be causing interference to stations in other parts of the world and be totally unaware of it."

channel 57 in modern cable-ready televisions and VCRs.

Remember that a standard television signal is amplitude-modulated. This creates a double-sideband signal. Without some special filtering, most of the lower sideband would fall *outside the ham band.* The use of a *vestigial sideband filter* that removes the lower sideband allows ATV repeater systems to use this frequency. However, very few individuals would have the technical expertise or equipment to use this frequency from their own ham shack. This is why it's primarily used as a repeater *output* frequency.

426.250 MHz: This frequency is also used for repeater outputs. It provides a second choice in the lower part of the 70-centimeter band and can support a second ATV repeater in some areas (depending on local band use and crowding). It corresponds to cable channel 58.

427.250 MHz. This frequency is also used on occasion in some locations as a secondary output for ATV repeaters. It's not the best choice, as the aural (audio) sub-carrier for this frequency falls at 431.750 MHz, just below the weak-signal band used by single-sideband, CW, and EME (moonbounce) stations. Care should be exercised to avoid interference to these stations if this frequency is in use. If received on a cable-ready device, channel 58 is used and usually can lock up on the higher frequency without difficulty.

434.000 MHz. This frequency is often used as an input for a repeater or as a direct (simplex ham to ham) ATV frequency. It corresponds to cable channel 59. One problem with this frequency is the location of the lower sideband. Recall that the lower sideband extends down from the main carrier frequency. This puts RF information in the area used by the weak signal folks (432 MHz). Also, the upper sideband extends up from the video carrier. The amateur satellite band is internationally allocated from 435 to 438 MHz. It's very easy to cause interference to a local satellite user who is trying to receive from a satellite that's transmitting in this band.

Also, it's easy to interfere—without even knowing it—with the *input* to a satellite that's receiving on this band. This is the real problem with using this frequency. One can be causing interference to stations in other parts of the world and be totally unaware of it. It's extremely unlikely that even a conscientious ATVer could or would keep track of all the amateur satellites using the 70-centimeter band that are above the horizon and in view. This is not to say that this frequency is not in use in different areas. It just isn't one that this writer feels comfortable recommending.

439.250 MHz. This is the highest frequency used for ATV in the 70-centimeter amateur band. When you consider that all the FM repeaters are allocated from 440 to 450 MHz, you see why it's a challenge to use this one in a major metropolitan area. Where demand for 70-centimeter repeaters is not as great, frequency coordinators can keep the repeater users higher in the band, allowing the ATVers to use this frequency. The use of horizontal polarization for ATV and vertical polarization for FM repeaters also goes a long way to reducing interference between these modes.

Another technique for using this frequency as a repeater input is to build a special receiving converter that uses the lower sideband instead of the normal upper sideband. This has proved useful in crowded areas. The ATVer must remember, however, that just because the repeater is avoiding interference from FM repeaters doesn't mean the individual's upper sideband isn't causing interference to FM repeater users. Care must be exercised, again, to make sure that different modes and users co-exist.

Transmitting equipment for the 70-centimeter band has been available from a number of suppliers for many years. Additionally, information on building your own ATV equipment has been in the handbooks as well. Many amateurs still fear building their own equipment. Admittedly, building your own 70-centimeter equipment from scratch is probably not something for the first-time builder. But, with some local assistance from an experienced ATVer, building a kit would not be too difficult for the serious amateur. The point is that there are plenty of choices for 70-centimeter ATV gear.

33 Centimeters

The 902-928-MHz band has only recently come into use in amateur television circles. This band is a shared band with lots of non-amateur users. It is full of license-free Part 15 devices, such as cordless telephones, wireless TV transmission devices ("Rabbits"), wireless speakers and headsets, and wireless telephones used in business locations. Additionally, this band has commercial users that include vehicle positioning systems, vehicle location systems, and a multitude of "wireless tags," such as toll-way tags and parking lot entrance tags. Some of these systems are very "noisy" from an RF standpoint, but many of them have priority as occupants of the band. So, 902-MHz ATV systems have to be deployed with an awareness of the condition of the band in a particular area (beginning to sound like a common thread?).

Thirty-three centimeters is the first band where FM television can be used. Here, you may find that the local preference may be AM or FM television (even both, in some areas like Houston). Exact frequencies are determined on a local basis. Often, 915 MHz is used for FM television, as it is in the center of the band. AM television supports several different channels, as the bandwidth requirement is smaller.

Equipment Options

Gear for this band can be extremely easy to find. The consumer Rabbit transmitter and receiver form a great starting point to experiment. Often, you can pick these up very inexpensively at garage sales or flea markets. The Rabbit was designed to take a video/audio source, such as the output of a DVD player or VCR, and transmit it to other rooms in your house. They were provided as a transmitter/receiver set with the option to buy additional receivers (for other rooms that had television sets). I know of a surplus shop in Houston that has a bin full of Rabbit receivers.

The term "receiver," by the way, is actually a misnomer when discussing these devices. They are actually receiving converters that receive the 902-MHz TV signal and convert them down to TV channel 3 or 4. The transmitter, on the other hand, is a complete transmitter, usually with a choice of three different frequencies to allow the user to dodge interference from a neighbor who might also be using one of these systems.

The Rabbit receive downconverters provide a starting point for an interested ATV group to use the 33-centimeter band as a repeater output. Likewise, a group might chose to use the Rabbit transmitters as user transmitters and create a repeater input in the 902-MHz band. Just make sure that the "channel" you pick on the Rabbit has both sidebands inside the ham band. You'll probably want to increase the power output and use a large external antenna. This modification is not difficult and can result in a very inexpensive ATV transmitter. You can, of course, purchase a commercial 902-MHz ATV transmitter as well.

If your interest is to receive 900-MHz FM television, some, but not all, satellite TV receivers can be modified to tune this band. Let the buyer beware.

Another source of 902-MHz equipment is the cellular telephone surplus market; 800-MHz cell systems used very linear amplifiers (both receive and transmit) to reduce internally generated interference products. They provide an excellent source of both receive preamplifiers and power amplifiers for your 902-MHz station. (*See this month's "Final Frontier" column for more on this topic.—ed.*)

You have to be on the lookout for these surplus finds as they're typically sold for the scrap metal value unless a group of amateurs is aware of the equipment and has the resources and technical expertise to purchase it and distribute it. My club recently distributed what seemed like tons of this equipment (at least it seemed like it when I had to box it and ship it) to amateurs all over the U.S. It was a real labor of love as the equipment is often large and heavy and not something that you can make much of a profit on.

One warning is appropriate for this band. We do share this band with services that are in it for the money. They use this band to sell something and any interference to their operations may result in our being told to cease operations. Many groups use this band without serious problem. Don't avoid it just because someday there "might" be a problem. Just be aware that it, like most of our microwave bands, is a shared resource.

23 Centimeters

This is one of the hottest ATV bands today. The availability of equipment for both AM and FM television systems has caused many groups to add this to their local operations. From here on up (as with 902 MHz), the exact frequencies used depend on local preference. The ARRL band plan calls for three ATV channels, at 1240–1246 MHz, 1252–1258 MHz, and 1276–1282 MHz, but, again, local coordinators and ATV groups have the last word. Check with ATVers in your local area to determine AM or FM and the exact frequencies.

One thing that originally sparked interest in this band for ATV was the availability of a commercial ATV accessory for ICOM's 1200-MHz equipment (IC-1271, IC-1275) and the Yaesu FT-736R. These add-on adapters allow 1200-MHz AM television operation on any frequency in the band. The downside of this is that these rigs are very expensive and not available any more. Still, for the AM ATV operator, they represent the "Cadillac" of commercially available ATV rigs. Of course, much less expensive equipment is available from our ATV equipment suppliers.

How's $70 to Get on the Air?

Recently, a small transmitter became available on the surplus market (for a very short time!). These transmitters sold for about $70 and provided four-frequency operation and approximately 100 milliwatts of output. A few modifications produced a very inexpensive entry-level transmitter (see Photo). As I mentioned, the surplus source dried up almost immediately. Fortunately, one of our long-time amateur suppliers has made arrangements to source these little transmitters and make them available to the amateur community. It's convenient that there are a number of ATV suppliers today that provide a wide range of equipment to the ATV community.

Use of this band is normally limited to repeater inputs and outputs (though ATV DX could be worked with the proper equipment and attitude!). In Houston, for example, we have an input on 1255-MHz FM. We've had an output on 1285 MHz, but this may soon change as a result of several sources of interference in the area. Other local groups use AM television to obtain more channels for their operations. As previously mentioned, reception of 23-centimeter ATV is most often accomplished with either a down-converter into a conventional television (AM ATV) or a satellite receiver that tunes the 1.2-GHz. band (FM ATV).

Looking Ahead...

I seem to have run out of space in this month's column, so I'll continue next time with a discussion of the bands above 1.2 GHz, and I'll try to include a report on the ATV activities at the Dayton Hamvention (due to the lead times required for publication, this column is being delivered before Dayton festivities, even though you're seeing it in July). Additionally, I'll provide a list of Web sites for ATV suppliers, where you can browse for equipment and ideas. ■

Resources

Finding local ATVers may take some digging. If you don't already know someone active in ATV, ask around on your local repeater or at a radio club meeting. You can also check out ATV-related Web sites on the Internet.

A good place to start is the still-under-construction Web links area on *CQ VHF*'s own Web site, at <http://www.cq-vhf.com/linksto.html>. Once you're there, click on "Amateur Television" and check out our extensive list of links for something in your area (*eventually, we'll have similar lists for just about any ham radio topic you can think of—ed.*).

If you can't find anything near you, check the link to Amateur Television of North America (ATNA), a growing ATV national organization. ATNA has links to regional coordinators in several call areas.

Putting Surplus Cellular Gear to Work on the Ham Bands

Start searching hamfests and surplus stores for "old" cellular phone network gear that's been put out to pasture. You might be able to put it back to work in a 900-MHz or 1.2-GHz ham setup.

In my first microwave column (March, 1998), I mentioned the incredible potential of cellphone parts, but that this potential was not in used cellphones themselves. Rather, it was in surplus equipment from cellular repeaters (cell sites). This month, I'm going to talk about using some of the tons and tons of 800- and 900-MHz surplus hitting the market. Third- and even fourth- generation mobile telephone cell sites are being scrapped at this time, and here are some of the more useful items to look for.

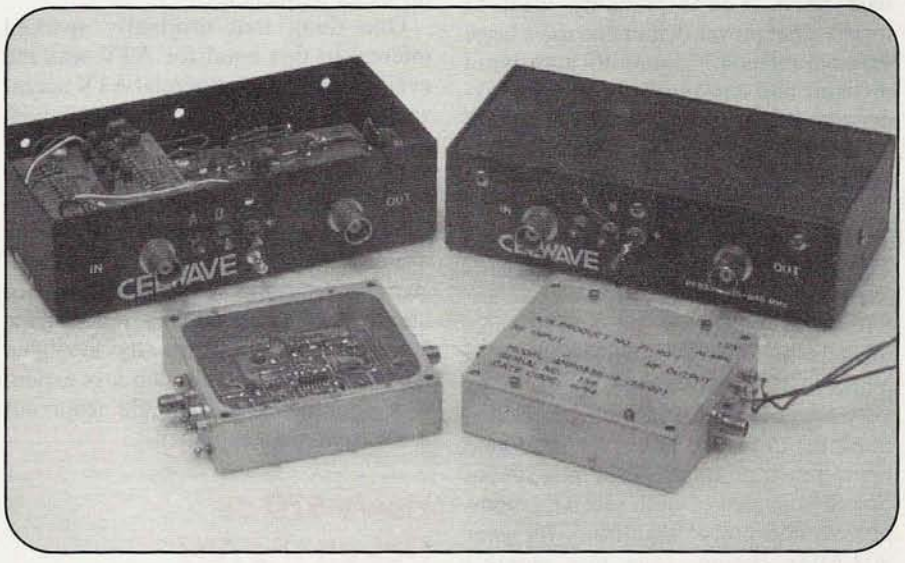


Photo A. CelWave PF833A cellular telephone preamplifiers that have been taken out of service. These require no retuning for use on either the 902- or 1296-MHz ham bands and can be used as either receive preamps or as transmit power amplifiers.

800-MHz Preamps

In Photos A and B, we have Celwave PF833A preamps used in 800-MHz cellular telephone cell sites. These preamps are showing up at many hamfests and deserve a close look. One of the last things the phone company wants is intermod in the front end of its systems. So this guy is designed to really handle strong signals. Plus, when you treat this "preamp" as a power amp, it can put out over 2 watts!

In the Figure, you can see that the PF833A is really two parallel amps, each with two stages. With this arrangement, the preamp can not only handle twice as much signal, it also makes the receive preamp redundant. If one side goes out, performance drops a bit, but the cell site keeps working. It also means that the amp will put out twice as much power when used on the transmit side.

The three feedthru connections are power and two logic outs. The logic outputs are alarm functions: if the preamp pulls too much current, one goes to logic level high. If there's too little current, then the other logic out goes high. In the commercial world, the alarm goes off and the cell site calls for a service call, but for ham use, we can just ignore these connections.

The frequency range printed on the case is 825-845 MHz, but the two internal amps are simple $^1/_4$-wave baluns. There are no tuned circuits to speak of, so no modification is necessary for 902 to 928 MHz use. To give you an idea of just how broad the amps are, they also work pretty well on 1296 MHz (see Table).

The Celwave is designed to run on 24 volts, but as you can see from the Table, it works better on receive when run with 12 volts (*the lower noise figure indicates better performance—ed.*). If you want to use it as a low power transmit amp, a very popular option among some ATVers (that's amateur television, not all-terrain vehicles), it puts out more power at its rated 24 volts.

I have tested many other cell site preamps and most also work great on 902 MHz. The A/S Products AMP0836-16 has less gain, about 16 dB, but still has a 2.2 dB noise figure and is designed for 12 volts DC. Power out is lower, about .2 watts, but it's a great receive preamp. The

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

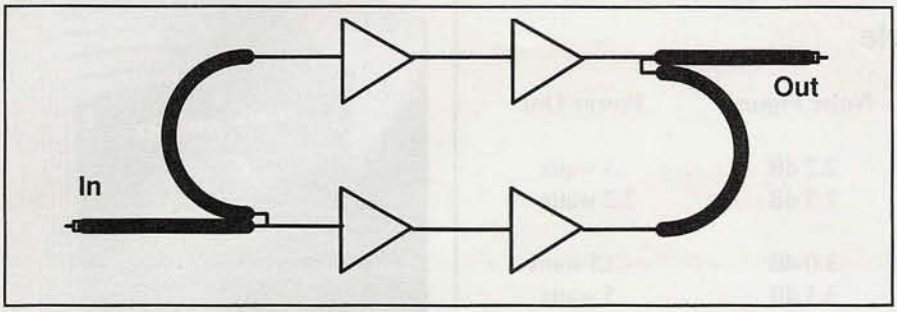


Figure. Schematic diagram of the PF833A amplifier. Note that each unit is actually composed of two parallel two-stage amplifiers.

Ericsson preamps also are lower power, but, again, offer a 2- to 2.5-dB noise figure and run on 12 VDC.

Power Amps

In Photos C and D, we have the quite common CMS-88 cell site power amp. There were a couple of hundred of these amps floating around Dayton last year and I expect to see a few pallet loads again this year (this column was written two weeks before Dayton). Unless the price is real good, you want the RR-xxxxx70s, as they put out twice as much power as the 60s.

Originally the CMS-88s were designed to put out 30 watts of extremely clean and linear RF. As is, they put out 40 to 50 watts on 902 MHz and over 20 watts anywhere between 750 and 950 MHz. A special square ceramic trimmer tool is necessary to re-tweak the driver and final stages, but you only lose 5 watts or so if you can't dig up a tuning tool and leave the caps as they are.

The modification itself is pretty easy. Take the lids off and find the blue wire going to the 15-pin connector on the back. Solder a jumper wire from ground to the blue wire. It's now in TX (transmit) mode any time there is power on the amp. Next, crank the "level" control on the front all the way to the right with a small screwdriver. Solder on some power wires to those big power pins (red to red and black to black) and you're ready to go! Bypassing the lowpass filter and circulator in the output will get a few more watts, but I really recommend leaving the filter and circulator in there. It makes the amp more "idiot resistant."

With five stages of gain, it only takes 1 or 2 milliwatts (that's .001 to .002 watts) to drive the CMS-88 to full output. The final is two 37-watt transistors, so you'd think we could get 75 watts out, but the driver stage poops out first. More typically, you'll get 40 to 50 watts out. DC requirements are 24 VDC at 5 to 6 amps.

If you have picked up a bunch of these amps, I know of at least two units that have been running for most of a year with 28 VDC and putting out well over 60 watts. SM6IKY/W5 gutted out a half dozen CMS-88 amps saving the output modules. He then wired them into a 1-driving-4 configuration with over 300 watts out on 902-MHz SSB!

There are lots more cell site parts in the garage...and lots more conversion articles in the works.

Myth: SWR Is Not Important on Receive

This is one of those statements that has been floating around the AMSAT community for some time. I'm not sure where it came from, but I suspect it's from someone confusing 160-meter reception with UHF reception.

"With five stages of gain, it only takes 1 or 2 milliwatts (that's .001 to .002 watts) to drive the CMS-88 to full output...typically, you will get 40 to 50 watts out."

On 160 or 80 meters, the atmospheric noise is so high that there's little difference between the Signal-to-Noise ratio of a 1/4-wave vertical with 120 radials and a coat hanger.

But higher up in frequency, antenna SWR can be very important for high-performance GaAsFET systems (Gallium Arsenide Field Effect Transistors). These high-performance amplifiers are designed and tweaked for a 50-ohm load. Different load impedances can change their gain, slew noise figures, and can even make the amplifier oscillate. A well-matched antenna is quite important for best performance on UHF and microwave systems—even on receive.

New Microwave Web Site

In the May column, Simon Lewis, GM4PLM, was a guest columnist covering European microwave equipment. Simon really has his finger on European microwave activity and keeps many of us up to date on what's going on around the

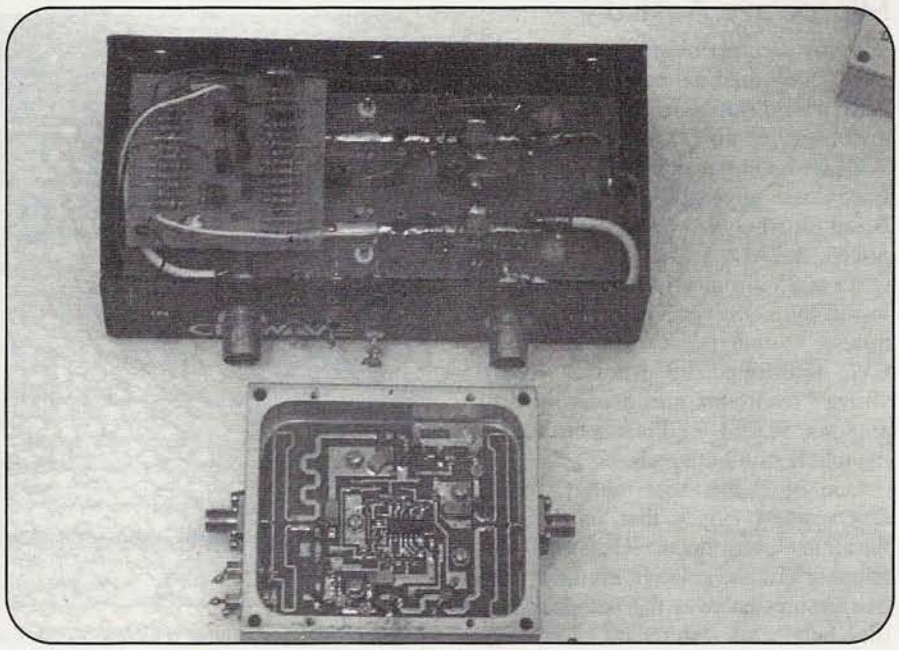


Photo B. Interior view of the Celwave PF833A preamps. These units are designed to resist intermod from even very strong signals.

Table

	Gain	Noise Figure	Power Out
902–928 MHz			
12 V	28 dB	2.2 dB	.5 watts
24 V	28 dB	2.5 dB	2.2 watts
1296 MHz			
12V	13 dB	3.0 dB	.15 watts
24V	13 dB	3.5 dB	.5 watts

Table. Typical performance of Celwave PF833A preamps at 902–928 MHz and at 1296 MHz. They may be used either as receive preamplifiers or transmit RF amplifiers (but not both at once). Noise figure readings are for receive use; power out readings are for transmit use.

world. Several of Charlie Suckling, G3WDG's projects were featured in the May column. Well, Charlie just opened a Web site at <http://www.geocities.com/CapeCanaveral/Station/7948>, showing many of his microwave units that are available for the experimenter.

I feel I must be careful mentioning Charlie's projects because he and I go back a long way. Charlie's family has been guests in my home in Texas, and I've been a guest at his home in England. Charlie built the .6-dB NF preamp I use on 10-GHz EME (Earth-Moon-Earth), and I dug up the 30-watt 10-GHz TWT (traveling wave tube) amplifier Charlie uses in his 10-GHz EME station. He designs some darn good stuff. Even I use it!

how far they can talk with 1 milliwatt and a diode mixer receiver!

Finally, over in France, we get word of a new world record of 286 kilometers (177.7 miles) on 47 GHz between F5CAU/P and F6BVA/P. The stations were DB6NT transverters at each end, with a 75-centimeter (29.5-inch) offset dish at CAU's end and a 120-centimeter (47.25-inch) offset dish at BVA's end. Signals were 51/51 on SSB and 59/59 on 24 GHz. While they were at it, they also beat the world ATV record for 24 GHz with a television QSO over 303 kilometers (188 miles). Now remember, everyone: microwave frequencies are useful only for line-of-sight contacts—just like short-wave frequencies were considered "useless" until hams showed the world what could be done there. ■

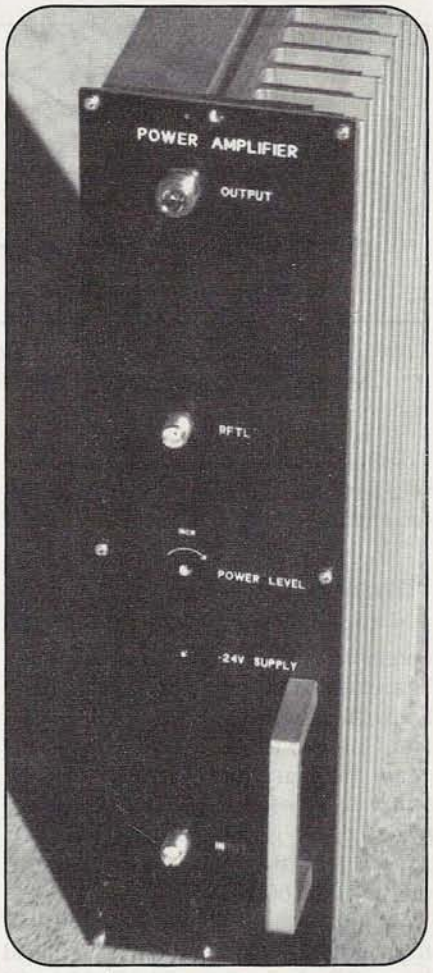


Photo C. The CMS-88 cell site power amplifier. Designed to put out 30 watts in cellphone service, a minor modification will produce 40 to 50 watts out on the 902-MHz ham band.

Microwave Activity

In my second column last year (May, 1998), I covered the new 76-GHz North American distance record of 12.7 kilometers (7.6 miles) by AA6IW and WØEOM. On April 5th of this year, the East Coast guys got into the act when Brian Justin, WA1ZMS, and Doug Sharp, K2AD, completed a 76-GHz QSO at 25 kilometers (15.5 miles), followed by a QSO at 34 kilometers (21.1 miles). Output power was 1 milliwatt CW, multiplied up from a 12-GHz "brick" oscillator into a one-foot dish antenna. ICOM R-7000s were used as tunable IFs on both ends.

One of things that makes 76-GHz QSOs noteworthy is that, on this band, the air itself absorbs the RF. Based on the temperature and relative humidity, oxygen absorption over the path was 3 dB (decibels) and water vapor absorption was another 5 dB. If any of your HF buddies make fun of this QSO, just ask them

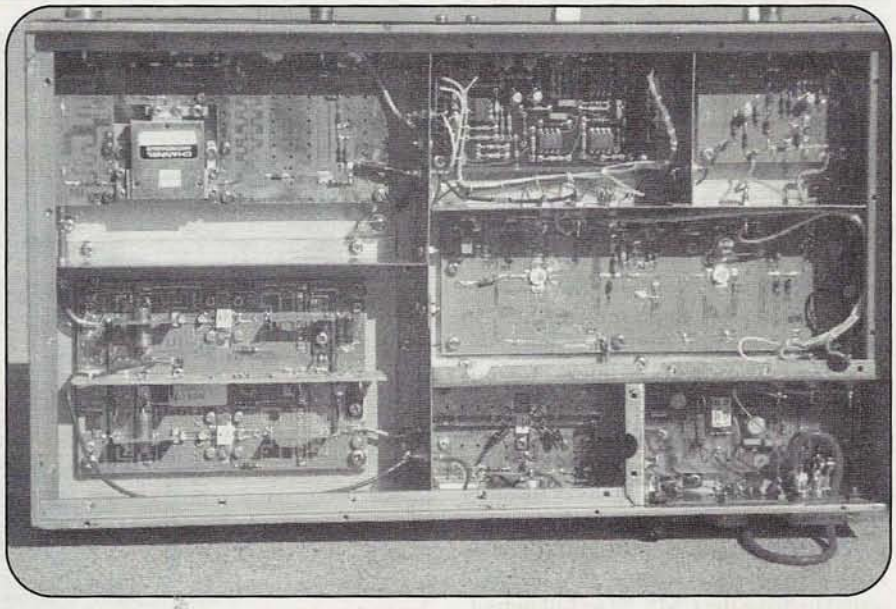


Photo D. Interior view of a CMS-88 power amp. These are showing up in large numbers on the surplus market. Unless the price is too good to pass up, you want the RR-xxxxx70 models, as they put out twice as much power as the older 60s.

Hitting the Trail with Ham Radio

In May, we took ham radio to the dogs. This month, with help from members of the Sierra Amateur Radio Club and the "Owens Canyon Phantom," we hit the trail of three horse endurance races.

In the desert hills south east of Ridgecrest, California, nine members of the Sierra Amateur Radio Club (SARC) provided communications for the Fire Mountain Fifty Horse Ride. The ride consisted of a 50-mile endurance contest and a shorter 30-mile course. There were three water stops, veterinarian stops, and a base camp. In all, 61 contestants finished the 50-mile ride and 40 did the 30-miler (Photo A). Riders and horses were of all ages, ranging from a seven-year-old girl on a pony to a rider on a 20-year-old horse.

Photo A. Riders in the middle of nowhere depend on ham radio for assistance. The Sierra Amateur Radio Club regularly provides communications for horseback endurance events. (Photo by Dave Stone, KC6UUR)

Communications organizer Dave Stone, KC6UUR, reported that all went well on a day that started before 6:00 a.m. and ended nearly 12 hours later. According to Stone, the hams were responsible for dispatching water, hay, and horse trailers along the course (Photo B), knowing the location of riders, expediting veterinary requests, and providing communications for a motorcycle race which was in progress in the area at the same time. In addition, they handled "myriads of other bits of information" about the course. The hams were able to ascertain a rider's location within a short distance, soothing worried team members at the main site.

Judy Burns, KC6UTF, worked one of the busier water stops. This was the first water stop for loop two and the second water stop for loop three. When a horse began to choke and the nearest veterinarian was three miles away, the horse was ministered to remotely by a veterinarian via third-party traffic set up by Judy at the location of the ailing horse, and Dave with the vet at base camp. The horse was kept moving and eventually was well enough to finish the contest.

Meanwhile, Bill Burns, WA6QYR, was monitoring contestants in the motorcycle race mentioned earlier. The motorcycles crossed the horse trails and, in one location, even used the same trail. Club member Elvy Hopkins, NØLV, commented, "Doesn't this bring into mind images from old black-and-white horse operas of rearing horses and upsetting carriages spilling occupants after being startled by one of those infernal, noisy horseless carriages?" The presence of a trail monitor with a radio, good horse sense, and the fact that contestants in both events had been forewarned by radio operators of possible conflicts avoided any serious incidents. However, Burns kept the nervous organizers at the main site apprised of conditions.

Using a Portable Repeater

The SARC portable repeater, originally assembled by Mike Hugo, KA6OIJ, is made from two Yaesu FT-727 handheld transceivers and a very simple controller in a large, covered chassis pan. Greg Roush, WA7IRW, designed and built the portable, collapsible mast and antenna system using a lot of plastic rain gutter hardware and antennas made of PVC pipe covered with aluminum foil. The receiving antenna is a collinear at the top of the mast and a vertical dipole halfway up does the transmitting. The portable kit includes guy lines, metal stakes, maul for setting stakes, folding shovel, duct tape for instant repairs, and instructions.

Greg and his son Ben, assisted by Hal Hazel, KM6JM, tended to the portable repeater, getting it set up and on the air before the first horse was very far into loop one. Greg and Ben then worked the nearby water stop on loop one until it was closed. They then relieved Mark Slay, KE6SMA, who was watching over a very busy point about a mile out from the start where loops one, two, and three split on the outbound leg of the course and then merged on the inbound leg.

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

Photo B. Dave Stone, KC6UUR, set up his dual-band vertical "Tram 1480" antenna to assist with communications. Dave says, "At eight feet long, I can just fit it under the back seat and passenger seat for transport." (KC6UUR photo)

Todd Evans, W6TOD, assisted by Pam Mathes, KC6UUS, worked checkpoint one on loop three. From this location, it was difficult to work the portable repeater, but Todd and Greg soon discovered that they could communicate successfully on 70 centimeters. Greg then set up his mobile radio as a cross-band repeater into the SARC portable repeater, allowing all the water stops and the base camp to communicate. Hazel covered the second water stop on loop two, also the third water stop for loop three, until Alex Higgins, KD6ZUV (Photo C), arrived. When loop one closed and Greg moved, Hal set up cross-band for Todd on loop three. Eventually, Hal took over at the loop three water stop, and by a combination of high power and a high-gain antenna, managed to get into the portable repeater.

In addition to the remotely located SARC portable repeater, the City of Ridgecrest's Multi-Purpose Van with its generator trailer was set up at main site for extended communications capabilities and protection from natural elements during this 12-hour event.

Near the end of the day, contestants (the human ones, that is) were asking about the threatening weather ominously spilling over the Sierra Nevada a few miles to the west and what road conditions might be for their drive home. Two Ridgecrest hams monitoring the local SARC 146.64-MHz translator were contacted and asked to check it out. That's not a misprint. This "machine" is not a repeater, but a *linear translator*. Ken Wetzel, WA6CAY, who help design and build the translator, explains that "a repeater is a transmitter with its audio input connected to the audio output of a receiver. A translator, on the other hand, heterodynes the received signal to the intermediate frequency, amplifies it, and then heterodynes it to the transmit frequency. In a translator, the signal never exists as audio."

He continues, "To keep the design simple the translator has very short squelch tail and no carrier tail at all. We were surprised to discover how many transient amateurs were confused by the lack of the usual carrier tail." Up-to-the minute weather and road conditions were supplied hot off the Internet by Jerry Brooks, KK6PA, and Elvy Hopkins, NØLV.

This event allowed SARC hams to get on-the-job experience in solving communications problems. Cross-band operation from a handheld to a higher-powered mobile transceiver was used by five hams as they roamed about their assigned check points. Cross-band was also used for a relay to the portable repeater.

How about 100 Miles?

Another event for which SARC provided communications was the annual Twenty Mule Team Endurance Ride in mid-February, starting at the Ridgecrest Fairgrounds. There were 46 100-milers, 59 60-milers, and 73 30-milers for a total of 178 rider/horse pairs. The entries included one mule and one Icelandic pony. The ride had six checkpoints, three of which had veterinarians on hand. Water was available at all points and hay at most. Three loops of 10, 30, and 60 miles crossed highway 395 twice and closely approached highway 14 north of Red Rock Canyon.

SARC President Larry Merwin, KE6YLG, describes the day as starting out dark and early with the hams gathering at 0600 to organize radio support for the ride. "Somehow, I found myself with the job of working the fairground base camp, a position that I had never tackled before," comments Merwin. "As it was, it took me a while to realize that this meant that I was net control and should act as one. Dave Stone, KC6UUR, did a great job of keeping things moving while I got up to speed."

Another radio gremlin that needed to be worked out was that the heart moni-

Photo C. Alex Higgins, KD6ZU (back to camera), makes sure all the tanks are full at one of the water stations along the event course. (KC6UUR photo)

Tools of the Trade

As space permits, we will feature tools that you are using to serve in the public interest. Bob Duran, N3ZRR, of suburban Philadelphia has assembled this "EOC on-the-run" package (Photos D and E) to help with communications for Montgomery County (PA) RACES. The water resistant fiber case includes an internal AC-DC power supply and external RF connectors. It contains both a trunk-tracking and conventional scanner, a 2-meter data radio with built-in TNC, a laptop computer, a power supply, and an assortment of RF, video, and audio adapters. The IBM Thinkpad laptop includes an MRT video and still-frame hi-res capture card, which can be used with the EOC's ATV system if needed.

From top to bottom, left to right, the gear consists of the following:

Top row, AOR-8000 .1K-2G Hz scanner/reaction tuner; Radio Shack 800-MHz Trunk Tracker; Optoelectronics Scout (frequency counter)/reaction tuner driver (this is used for remote emergencies, when other agencies arrive and little or no time is available for comparing notes. The Scout instantly tunes the AOR-8000 to whatever frequency is detected in use); 3 oz. bottle of BEANO (for those "close encounters" of the EOC kind); Kenwood TH-D7A 2-meter/440 HT with built-in 9600-baud TNC; Garmin 12XL GPS receiver with interface to the TH-D7A (APRS mode).

Bottom Row: Maha 2-meter/440 50-watt linear for packet/APRS; Adapters Kit BNC, 239, A/V, F, C, etc.); RACES/ARES Emergency Vest; dual 12-VDC cigarette lighter connector ports; multiple 12-VDC banana connector ports.

Case Bottom: ICOM 706Mk-II HF/6-meter/2-meter transceiver; RadioShack RS-2044 scanner; Astron 40A DC power supply

tors worn by some of the horses were interfering with the portable repeater. Greg, WA7IRW, added CTCSS to the portable repeater, which did a beautiful job of clearing up that problem. The radio problems were ironed out quickly.

Problems in Ridgecrest?

Horses don't always do what riders want them to do. One woman was thrown off her spooked horse while departing the fairgrounds to begin the ride. Despite her persistence, physical bruises (not to mention ego bruises) kept her from riding the course. One horse dumped its rider near a checkpoint and wandered off. It was not found until early Sunday morning.

At the far end of the 60-mile loop, a pre-positioned water tank had been "ventilated" by shotgun pellets and a replacement had to be quickly found, delivered, and filled. Dave, KC6UUR, reported that an uncommonly large number of horses was pulled from this event by the veterinarians. More than one horse required an IV for re-hydration. One horse had to be walked a mile or so through rough terrain to the old highway 395 for a trailer pick-up. This took longer than expected and caused anxiety for the crew. The ham communications crew was kept busy throughout the event until the wee hours of Sunday morning, when most riders had finished. The portable repeater was taken down and put to bed at 0515 hours, nearly 24 hours after operations began.

"Somehow I found myself with the job of working the fairground base camp, a position that I had never tackled before....As it was, it took me a while to realize that this meant that I was net control and should act as one."— Larry Merwin, KE6YLG

Net Control... Pretty Important Stuff

Merwin later said he didn't realize how valuable a training exercise this would be for disaster communications. As net control, Merwin said, "most of my time was spent chasing down the ride organizers to coordinate water, hay, vets, and horse trailers. It appeared as if there was not enough of any of them. Although at first this was a bit frustrating, as the day progressed, it slowly dawned on me that this was pretty relevant stuff."

"Gee!" he continued. "Experts and materials that needed to be moved from location to location on a time critical basis, limited personnel, transport and communications resources, leaders that need to be informed of developing situa-

"The crew had a scare when a riderless horse came trotting down the trail and tried to run right through a vet check without stopping for the mandatory 15-minute rest."

tions and to have their decisions communicated quickly and clearly and, of course, everything happening at once sounds like a disaster scenario to me."

He summed up the day by saying, "Now maybe this was old stuff to the other, more experienced hams who have worked this ride, but, for me, this particular 12-hour shift was the best training that I have had in a long time. Working the base camp was an exciting and enjoyable challenge. I am sure I made lots of mistakes. I appreciate the experience and patience of all the other hams that made this event a success and helped me to learn how to do it better next time." (We all can say that, can't we?—WA3PZO)

Finally, the Bun Buster!

The annual Geo Bun Buster 50-mile horse endurance ride conducted by the ARAB (Association of Ridgecrest Arabian Breeders) club was held on a blustery, cold, damp March day. The difficulties of communicating 25 miles through the deep, narrow Owens River canyon were overcome by elevated collinear antennas, strategic locations, and, at times, just plain RF power.

The "Owens Canyon Phantom" made several appearances again. Speculation as to the source of the burps, wheezes, chortling, and chirps ranged from "the ghosts of wagon train drivers robbed and killed by the Robbers Roost Gang" to rather more mundane sources, such as horse heart monitors or control signals on the electric power transmission lines which also travel the canyon. Nonetheless, the "Phantom's" signals kept things interesting.

There were also some interesting noises, touch-tone tunes, scratches, squealing, and an occasional "BASH," that were endured for a while until traced to a handheld that had been dropped, fumbled, and put into "hoo-noze-wott!!" mode by inappropriate button punches. The owner administered "programmer's first aid" to the errant transceiver, but the electronic anvil chorus and donkey serenade continued while the user, without manual, made many attempts to get the misprogrammed HT back into the real world of voice communications. Finally, he succeeded.

A Scare...

The crew had a scare when a riderless horse came trotting down the trail and tried to run right through a vet check without stopping for the mandatory 15-minute rest.

Photo E. N3ZRR's "EOC on the run" contains a full HF/VHF/UHF station, regular and trunk-tracking scanners, and a frequency counter that automatically tunes one of the scanners to any active frequency. See "Tools of the Trade" for specifics on what's "in the bag." (N3ZRR photo)

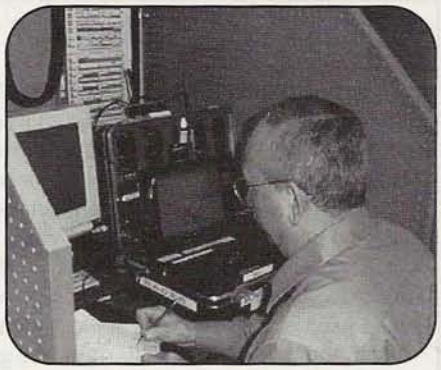


Photo D. Bob Duran, N3ZRR, operates his portable station at the Montgomery County, Pennsylvania, EOC. See "Tools of the Trade" and Photo E for details. (N3ZRR photo)

Lloyd Brubaker, WA6KZV, and the people running the vet check managed to stop the horse and put it in the penalty box. Lloyd then drove his 4WD, backtracking the course, looking for an injured rider. About a half-mile up the trail, other riders told Lloyd that the rider was leading the horse when it bolted, and, soon after, the horseless rider walked into view and confirmed that no emergency existed.

The safety of riders and horses is of prime concern to all involved in these horse endurance events. Hams keep a running record of horse/rider numbers as they pass through the check points. A rider's location on the course can be determined in a few moments by consulting the hams' lists at the various locations. Water, hay, heart monitor batteries, medications, and veterinarians are dispatched to wherever horses may need them. The logistics of caring for and keeping track of 50 to 100 contestants is greatly aided by the instantaneous communications provided by amateur radio. The ride organizers depend on the hams for communications and the riders really appreciate the fact that assistance is only a radio call away.

Let's Hear Your Story

We thank the members of the Sierra Amateur Radio Club for providing the material for this month's column. Have you served in the public interest? As always, we're looking for stories as to how you are providing public service communications. Send your information to wa3pzo@cq-vhf.com. ■

Fuji OSCAR Operating Notes

Fuji OSCAR 20 (FO-20) and Fuji OSCAR 29 (FO-29) offer some of the best opportunities for amateur satellite communications. If you want to know more about what these spacecraft have to offer you, read on.

FO-20 and FO-29 provide some of the best overall communications opportunities of the current amateur radio satellites. Both satellites have excellent coverage footprints for Low Earth Orbit (LEO) spacecraft. While some operator skill is needed to operate these satellites, you don't need all the latest and fanciest station equipment.

This article will give a brief description of these two satellites and their operating frequencies and modes. It will also tell you what kind of equipment you need and give you some key techniques for operating on these satellites.

Spacecraft Information

FO-20 and FO-29 (see Figure) are both roughly spherical, 50-kilogram (110-pound) spacecraft with dimensions of 44 centimeters (17.3 inches) wide by 47 centimeters (18.5 inches) high. Both were launched from the Tanegashima Space Center in Japan; FO-20 on February 7, 1990, and FO-29 on August 17, 1996. Table 1 shows catalog and orbital information for these two satellites. The satellites' altitudes are higher than most low-altitude amateur spacecraft. The higher altitude produces good ground coverage, and—particularly in the case of FO-20—this little bit of extra coverage makes transatlantic contacts a real possibility.

FO-20 and FO-29 are both in *nearly* sun-synchronous orbits (see "Orbital Elements" February, 1999, for more on *sun-synchronous orbits*.) Because the satellites are in nearly sun-synchronous orbits, the times they pass near your location (i.e., when they're usable to you) can be estimated within a few hours for all of July and August. These times will drift slowly, at a rate of about 20 minutes per month for FO-20, and about 10 to 15 minutes per month for FO-29.

Most middle-latitude stations will get two or three ascending passes and two or three descending passes each day for each of these satellites. Table 2 lists the average pass time (in local daylight time) for the next couple of months for a station located at 40 degrees north latitude (the actual central pass time can vary by about an hour or so). For more accurate pass times, you need to use satellite-tracking software.

Frequencies

FO-20 and FO-29 both use the same ranges of frequencies, with uplinks in the 145-MHz (2-meter) amateur band and downlinks in the 435-MHz (70-centimeter) band. Table 3 lists the frequencies and modes of operation for each satellite. You may notice that both satellites use the *exact same* frequencies for the analog transponder, digital modes, and beacons. Their orbits are designed so that they don't interfere with each other.

FO-20 operates continuously in the analog mode. FO-29 operates part-time in analog mode and spends the rest of its time in digital mode. The sections on the analog and digital modes give you the differences between the two satellites.

Doppler Shift

FO-20 and FO-29 have large Doppler frequency shifts when compared with "Mode A" satellites (145-MHz uplink and 29-MHz downlink), such as the Radio Sputnik, or RS, series. The Fuji satellites' 435-MHz downlink frequencies are 15 times higher than the 29-MHz Mode A frequencies. Since Doppler shift is directly proportional to frequency (and the orbits are similar), the downlink Doppler shift will be much larger. The Doppler shift on the Fuji satellites is high, so if you don't have computerized Doppler compensation, patience and practice will be needed.

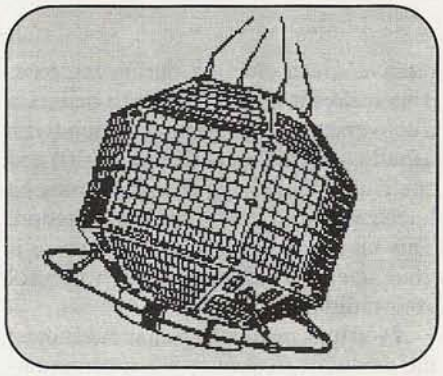


Figure. The surfaces of the FO-20 and FO-29 satellites are covered with hundreds of solar cells to recharge their batteries. The two satellites are identical on the outside—the same size, mass, and shape. The only difference on the inside is that FO-29 features 9600-baud packet and a "digi-talker," which are not available on FO-20. (AMSAT drawing)

Ideally, satellite operators should adjust *both* their uplink and downlink frequencies so they remain on a single frequency on the satellite. This is commonly known as *Full Doppler Tuning*. Full Doppler Tuning is best done by stations with computerized Doppler compensation. If you adjust only the uplink or the downlink, your frequency will drift through the transponder as the satellite's

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

Table 1. Fuji OSCAR Satellite Catalog Information

Name	FO-20	FO-29
Call Sign	8J1JBS	8J1JCS
Catalog Number	20480	24278
Launched	7 February 1990	17 August 1996
Inclination (deg)	99.0	98.5
Period (min)	112.4	106.6
Perigee (km)	910	804
Apogee (km)	1760	1334

Table 1. Catalog information, or basic facts about FO-20 and -29 and their orbits. The orbital information is necessary for tracking and predicting when each satellite will be in range of your station. Fortunately, satellite tracking software takes care of this for you automatically. If you don't have tracking software, see Table 2.

relative speed changes during the pass. This makes it more difficult to maintain a conversation with another station (who usually has a different Doppler shift) and could also result in your drifting into and interfering with a different conversation. This may be a necessary compromise if your tracking software doesn't control your radio tuning.

If you tune manually, you should adjust the *downlink frequency* when communicating through FO-20 and FO-29. The accepted practice (when not using Full Doppler Tuning) is to make Doppler corrections to the *higher* of the uplink or the downlink frequencies. This practice minimizes the drift and interference problems mentioned previously. A common misconception is that you tune the uplink frequency and leave the receiver alone. This is not correct. This misconception no doubt originated because the common "Mode A" and "Mode B" (435 MHz uplink; 145 MHz downlink) satellites had higher uplink frequencies than downlink frequencies. Always keep in mind that adjusting the higher frequency for Doppler shift minimizes problems.

Analog Mode

Both FO-20 and FO-29 have what's called an *inverting linear transponder*. A linear transponder has a receiver monitoring a segment of radio spectrum (i.e., receive passband) that re-transmits what it hears in a different segment (i.e., transmit passband) of radio spectrum. This is different from a standard repeater since the linear transponder doesn't demodulate the radio signal to the audio level, but rather retransmits the modulated signal with some frequency added or subtracted. This is how a linear transponder can retransmit more than one type of signal (i.e., SSB and CW) at the same time.

An inverting linear transponder adds one more kink: An inverting transponder re-transmits a "mirror image" of what it hears in the receive passband. This means the *low end* of the receive passband will be transmitted at the *high end* of the transmit passband and vice versa. This also means that for SSB modulation, the sideband is reversed. The amateur satellite convention for using inverting transponders is to uplink to the satellite on lower sideband (LSB) and receive the satellite's downlink on upper sideband (USB).

Digital Mode

Both satellites were designed to alternate digital mode operations with analog mode. FO-20 was designed for 1200-baud packet satellite operations, which was standard for the digital satellites at the time it was launched. However, FO-20 now only operates in the analog mode.

FO-29 has enhancements over and above FO-20's digital modes. These include 9600-baud packet, in addition to 1200-baud, and a digi-talker that sends digital voice messages on the 435.910-MHz digital downlink frequency.

What Kind of Radios You Need

Communicating via the Fuji OSCAR satellites is done most effectively with a full-duplex, dual-band satellite radio or a pair of all-mode (2-meter and 70-centimeter) transceivers. The minimum radio equipment for using the analog transponder is a 2-meter LSB/CW transmitter and a 70-centimeter USB/CW receiver. The minimum radio equipment for using the digital modes is a 2-meter FM transmitter and a 70-centimeter SSB receiver. (*You can even use a high-end scanner with SSB capability—such as the ICOM R-10, Alinco DJ-X10, or AOR AR-8200, which is reviewed elsewhere in this issue—as a receiver for these satellites.—ed.*)

Antennas

It's possible to work FO-20 and FO-29 using fixed antennas. However, this is somewhat of a challenge and can be frustrating to a beginning satellite operator. If you communicate through these satellites with fixed antennas, you'll probably need more than 25 watts of power on the uplink and should have a pre-amp mounted at the receive antenna. Consider using beam antennas for these satellites, and, ideally, an azimuth-elevation (az-el) rotor that can move your antennas up and down as well as side-to-side.

As with most amateur satellites, you'll get the most consistent signals in using circularly polarized antennas. However, with FO-20 and FO-29 the antennas *must* be switchable between right and left-handed circular polarity. If you can't switch polarity, a linearly polarized antenna is a better choice for these satellites.

Operating Techniques

It's always good operating practice to listen to any satellite's beacon before beginning any two-way communica-

Table 2. July 1999 Northern Hemisphere Mid-Latitude Pass Times

Satellite	Ascending	Descending
FO-20	0625	1935
FO-29	1410	0310

Table 2. Approximate pass times (local daylight time) for FO-20 and FO-29 during July (and most of August) for stations at 40 degrees north latitude. Ascending passes go from south to north, and descending passes go from north to south, so it shouldn't be hard to figure out whether the times for your location should be earlier or later.

Table 3. FO-20 and FO-29 Frequencies and Modes

Transponder	Uplink Freq. (MHz)	Uplink Mode[2]	Downlink Freq. (MHz)	Downlink Mode[2]	Comments
Analog	145.900 – 146.000	LSB/CW	435.800– 435.900	USB/CW	Inverting[1] Linear Transponder
Digital	145.850, 145.870, 145.890, 145.910	AFSK FM	435.910	BPSK (1200) or AFSK (9600)	1200 or 9600 baud[3]
Beacon	N/A	N/A	435.795	USB/CW	Morse Code

1. When using an inverting linear transponder, the downlink is like a "mirror image" of the uplink—the downlink repeats at the opposite end of the passband with the opposing sideband.
2. When using single sideband on a satellite transponder, the convention is to transmit (uplink) on the lower sideband (LSB) and receive on the upper sideband (USB).
3. FO-20's digital transponder is not accessible—the satellite is permanently in the analog mode.

Table 3. Frequency and mode information for the FO-20 and FO-29 satellites. Note that both satellites operate on the exact same frequencies, but there's never more than one in sight at a time, so there's no interference problem. See text for additional details on using an inverting linear transponder.

tions. The strength of the beacon tells you the *maximum* strength your own signal should be. Once you have good reception on the beacon, you can set your transmitter to an LSB frequency in the 145-MHz uplink passband and your receiver to the corresponding USB frequency in the 435-MHz downlink passband. Don't forget that the two frequencies should be approximately a "mirror image" of each other, relative to the centers of the two passbands.

As always, listen before transmitting to make sure you don't interfere with another conversation. If somebody is calling *"CQ-satellite"* feel free to answer him or her. If the channel is empty, you can make your own *"CQ-satellite"* call. If you're answering somebody else's call, adjust your transmit frequency until your voice sounds natural on their downlink frequency. Conversely, if you're making the call, adjust your receive frequency until your voice sounds natural on the downlink.

As mentioned in the antenna section, you'll get the most consistent signals with antennas that can be switched between right- and left-handed circular polarization. If you have circularly polarized antennas, you should switch the polarity of the downlink antenna for the best signal while monitoring the beacon. You should also switch the polarity of your uplink antenna for the best signal when you begin transmitting, ensuring that you have the best polarity match. This polarity setup will usually be good for only the first *half* of the pass. As the satellite passes through mid-pass, it's very common for signal strength to suddenly grow very weak. At this point you need to *reverse* the polarity settings of one or both antennas again for the best signal strength.

In Closing...

FO-20 and FO-29 offer the operator excellent analog and digital satellite communications. Both satellites have good coverage of the Earth's surface and can be used for transatlantic coverage. Because of their relatively high operating frequencies versus low altitude, Doppler shift is higher than for many amateur satellites.

While keeping up with Doppler shift is the most challenging part of using FO-20 and FO-29, this is easily overcome with computer control of your radios through satellite tracking software. Furthermore, all station equipment used for FO-20 and FO-29 will be usable "as is" on Phase 3D once that satellite is launched. And speaking of P3D, *CQ VHF* Editor Rich Moseson, W2VU, visited the satellite earlier this year in AMSAT's Orlando laboratory, and took lots of pictures. He'll be reporting on that visit in next month's issue, so stay tuned. ■

More Promoting, More Lasers

Success can be hard to find. Just after last month's column on promoting packet went to press, I found a real-life success story, which we'll look at this month. We'll also have our first in-depth look at the laser-to-the-shed project, now that I've finally got it working well.

In case you haven't been following it, early last winter, I decided that it would be easier to run a data link out to my backyard shed by laser than by burying a cable. Little did I know, it probably would have been easier to smelt the copper from ore, manufacture the wire, and then bury it in solid rock, but I'm the stubborn type, I guess. The story I use these days is that it would be cool to have such a link, which uses those cheap laser pointers with a visible red beam, and I'm sticking with that story (more on that in a moment).

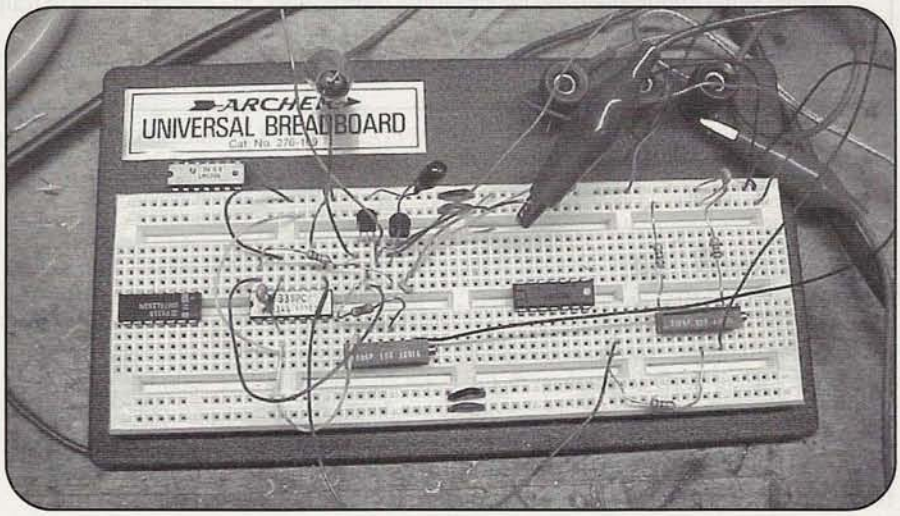


Photo A. The transmit circuit breadboard for N2IRZ's backyard laser link. Only the silver-top LM339 IC is used, the others are just being stored there. The next step is to combine this with the receive circuit (Photo B) on a single pc board.

A NEDA Success Story...

I've written before about NEDA, the North East Digital Association. It's the largest packet organization of its type, one whose purpose is to experiment with packet networking and spread information as widely as possible. NEDA doesn't own any network hardware; instead, it recommends standards and publishes a technical journal. Nearly every TheNET X1 network out there uses NEDA parameter recommendations, and these networks actually run very well, much better than with the defaults.

Lately, some members of NEDA have begun to investigate FlexNet with the same thorough research, publishing whatever they've learned. If you are, or want to be, involved with a FlexNet network, you really should consider joining NEDA to receive copies of their *Quarterly*, which is crammed full of useful and interesting information.

...After a Brush with Failure

Just a few months ago, though, the club was about to dissolve. The club charter requires six Board members, and there were only four people willing to serve. Membership was down from over 900 members a few years ago to under 120; enthusiasm was down, bickering was up, and it looked like the end.

But then one person, Tadd Torborg, KA2DEW, single-handedly renewed the enthusiasm, brought membership up sharply, and refocused the club on its core values. Reminds me of Chrysler in the '80s. What we have is a wonderful example of promoting packet, in which one person, with a moderate amount of effort, made a huge difference.

Tadd's Secret for Success

The first thing he did was to force everyone in the club to examine the club's purpose. He contacted everyone who might be slightly interested in sustaining the club, pleaded with them to attend "one last board meeting," and started a serious discussion on the group's purpose and goals.

The general conclusion was that NEDA exists to distribute information about packet networking, a task it had been doing better in the past than in recent times. Members joined NEDA for this information and, when they stopped getting it, didn't renew. So, saving the club meant publishing a better *Quarterly*, a task Tadd, as Editor, attacked with determination. He scoured every source he could find (including yours truly), putting together a *Quarterly* within a few weeks and simply sending it, free, to people who could make a difference.

With enthusiasm raised somewhat, finding material for the *Quarterly* be-

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

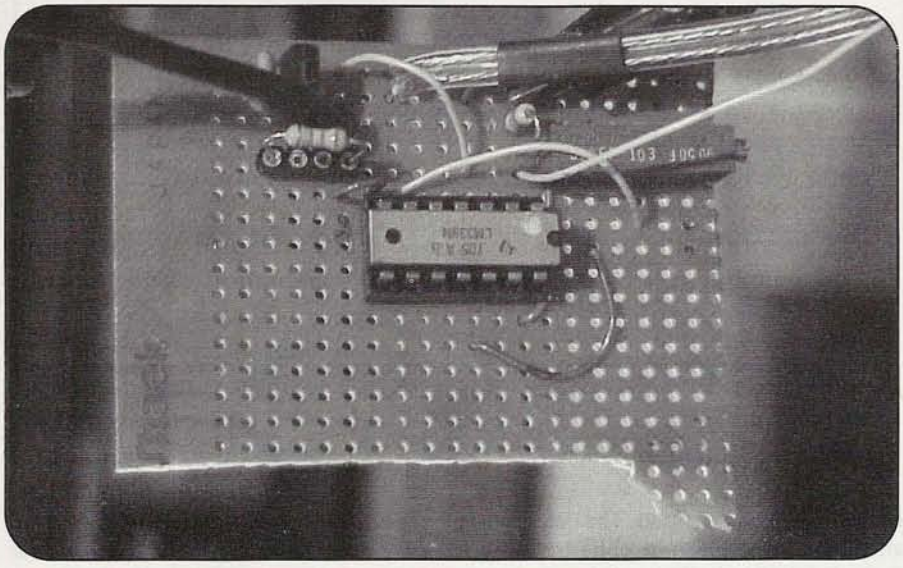


Photo B. The laser link receive circuit breadboard. Note how simple it is, with only a voltage regulator, LM339 comparator, and a few resistors.

"Just a few months ago, [NEDA] was about to dissolve....But then one person, Tadd Torborg, KA2DEW, single-handedly renewed the enthusiasm, brought membership up sharply, and refocused the club on its core values. Reminds me of Chrysler in the '80s."

came a bit easier, and he started on another issue while the club mailed out the first one to members. At the same time, he sent out a letter to everyone who was ever a NEDA member, explaining that things were getting much better again and asking them to take a chance and renew their membership. The results were astounding, with over 10% of former members taking him up on his offer.

As membership increased, so did enthusiasm, followed by more *Quarterly* material, which further built membership, enthusiasm, and so on, and so on... like a nuclear reaction, it feeds upon itself. The bottom line is that one person, with a little bit of effort, became a catalyst for a movement that will soon be self-sustaining. The final step is to find a handful of disciples who can continue the process and let Tadd relax a bit.

About five years ago, Greg Jones, WD5IVD, did almost the exact same thing for TAPR, Tucson Amateur Packet Radio. The system works and anyone can do it. You, perhaps?

Laser Update

Thanks to the suggestions of many readers, my laser-to-the-shed project is nearly complete. All that needs to be done is to fabricate some pc boards, get another laser and lens, and install the whole thing. Once I can honestly say that it works perfectly, I'll publish all the details. For now, let's have a look at the concept, the breadboarded circuit, and the early test results. You can actually build a link with what's here this month, but be prepared to tweak here and there.

The basic premise is simple: build a simple data link using an inexpensive laser pointer. I wanted to use a visible laser, not only to make aiming easier, but for the "WOW!" factor of being able to actually *see* and show off the link. Laser pointers are available for under $15 these days, and I wanted this system to use them "as is"—no modifications, just a stable mounting bracket and something to connect to the battery terminals. Lastly, the circuit needed to be extremely simple,

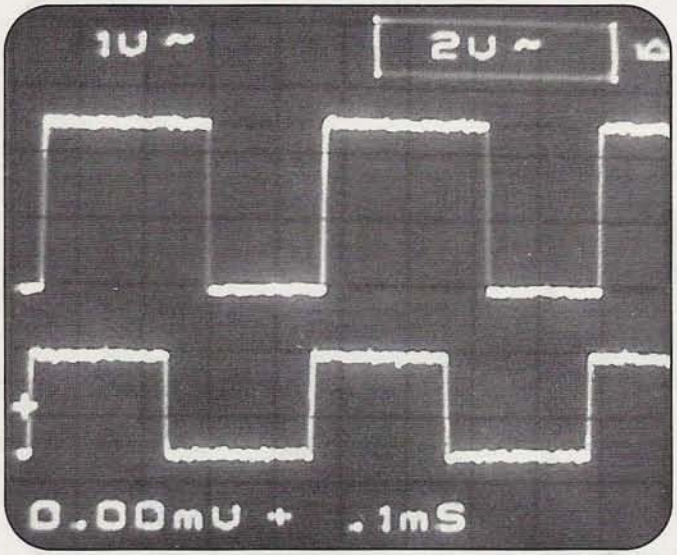


Photo C. The top waveform is the received laser signal, at 5 volts peak-to-peak (TTL level). The lower waveform is the transmitted signal, seen at the output of my signal generator.

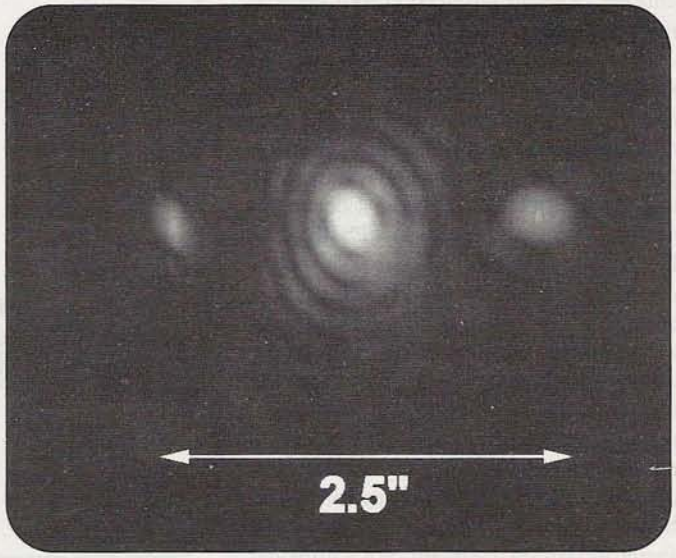


Photo D. This is what the laser beam pattern looks like 60 feet from the laser. Note the classic diffraction pattern. The pattern is essentially the same at 100 feet, only larger. This beam-spreading is what limits the distance over which a simple laser link will work.

with a minimum of components to allow a direct interface to any TNC (terminal node controller) or TTL (transistor-transistor logic) data source. An unofficial goal (also met) was to keep the price tag under $50 for both ends of the link.

Building the Link

Photos A and B show the transmitter and receiver breadboards, respectively. At first, I developed a single unidirectional link, because I had only one laser pointer, and these two circuits were independent of each other. Later, as the final full-duplex link was built, the transmit and receive functions were combined onto a single board. Photo C shows the received waveform on top and the transmitted waveform below at a distance of 100 feet, a distance obtained by bouncing the laser beam across the cellar with mirrors. Although this shows a frequency of only 2400 Hz, the signal looks the same at 7 kHz.

Photo D shows what the laser beam looks like at 60 feet. Note the classic Sin X/X diffraction pattern of the main beam, with the two dots to either side. At 100 feet, it looks about the same, except that the distance between the dots enlarges to four inches. Using a better laser can keep the beam a little bit tighter, but we really only need the bright dot in the center, which carries plenty of light energy, so let's stick to cheap and simple for now. I estimate that this link could go up to about 500 feet without modification. Aiming at that distance might be another matter entirely, with the slightest vibration causing the beam to bounce a few inches.

Figure 1 shows the detector and lens schematically. As light rays enter from the right, they are bent toward and concentrated at the focus. The lens is a simple convex lens, from a cheap magnifying glass (Photo E). I chose it because I had it. The detector (also in Photo E) is located at the focus, determined experimentally, not only to concentrate the received light, but to make aiming easier. As long as the laser hits the lens *somewhere*, the light will be bent towards the focus and the detector. It's a little bit better to have the laser beam hit the lens in the center, but it doesn't matter if you're off a bit. In retrospect, the detector should be about one-half inch forward of the focus, enlarging the beam spot a little and easing aiming requirements.

In Photo E, the detector and lens are shown assembled onto a carrier bar and mounted to a photo tripod. The detector is an inexpensive infrared phototransistor from RadioShack. This phototransistor quite sensitive to red light, and the output signal doesn't need amplification. I used an LM339 comparator to ensure a clean TTL-level signal.

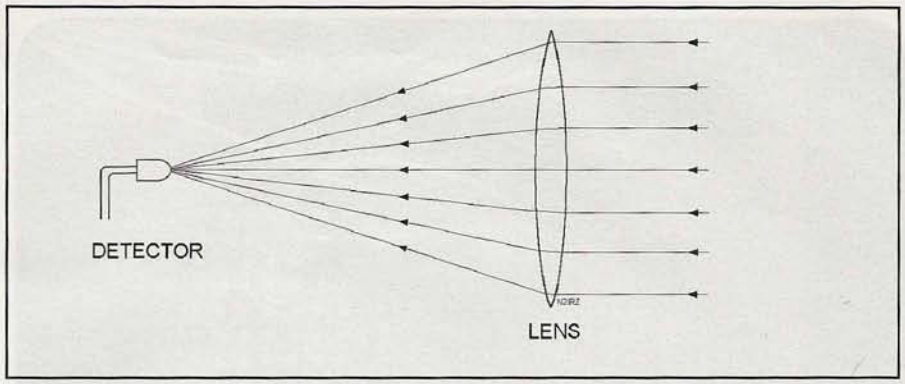


Figure 1. A schematic of the lens and detector. The laser light can hit the lens anywhere and still be redirected to the detector. Not only does the lens increase the maximum usable distance of the laser, it simplifies aiming a bit as well.

The detector holder is just a short piece of clear tubing, with the detector pushed into the center. It's easier to aim the receiver if you can see how the laser beam hits the detector. I found that lining up the beam vertically, using the front edge of the tubing as a "screen," and then swinging the receiver horizontally until I saw a good signal, worked the best for me. You'll need to adjust the comparator's "slice" level (using VR1) as the light becomes brighter or dimmer, but once it is set, it stays set.

When working near either end of the link, be careful of laser reflections—your eye can withstand a brief flash, but longer exposure can really cause some problems, even at these low power levels. (*For more information on laser safety, see the two-part article, "Lasers to the Limit," in the March and April, 1999, issues of* CQ VHF, *and particularly the "Laser Safety" sidebar by W5KQJ on page 11 of the April issue.—ed.*)

Figure 2 shows the circuit I'm using so far. It works fine, but it's not yet perfect, so I'm a little hesitant to call it final. There's also no protection from things like power glitches, and the filter capacitors need to be reviewed more carefully. It runs off a nominal 12 volts, and there's a 5-volt regulator for some of the circuitry (*due to a technical glitch, the regula-*

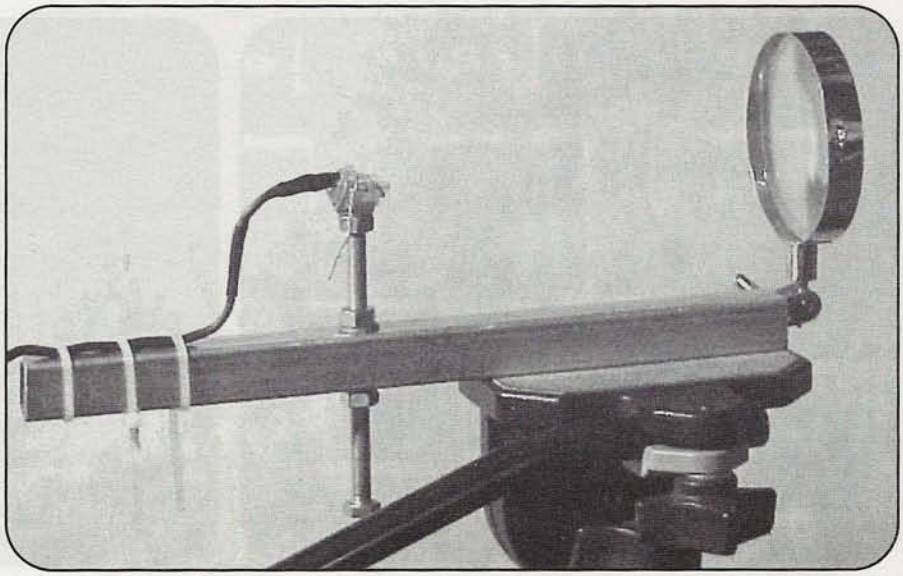


Photo E. The lens and detector in the flesh. The lens was liberated from a simple magnifying glass, and the detector is from RadioShack. I mounted the detector at the lens' focal point, which I determined experimentally.

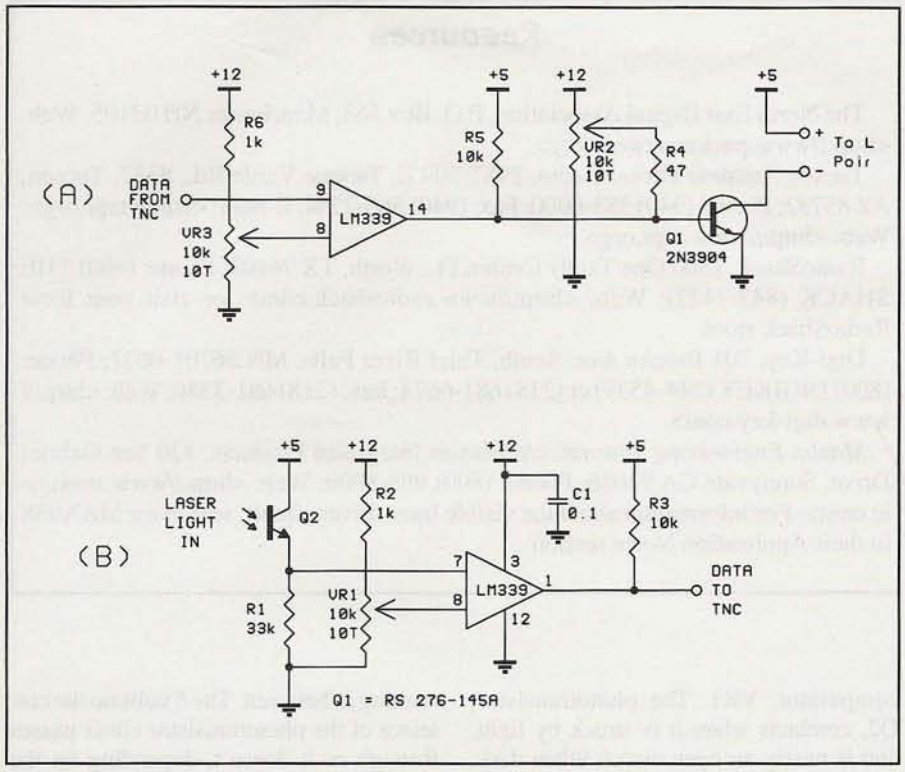


Figure 2. Section (A) shows the laser transmitter driver; (B) shows the receiver. This circuit is intended to drive an inexpensive visible laser pointer and was designed to be as simple as possible. It works up to about 10 kHz, high enough to implement a 9k6 (9600-baud) data link.

tor circuit is not shown—ed.). The data source is not really important, since you can adjust for most anything, but let's assume a TTL signal from the modem disconnect header of a TNC.

How It Works

The data signal enters the LM339 comparator (Figure 2A), and the voltage level is compared to the bias voltage set by the 10-turn trimpot, VR3. When the incoming signal is higher than the bias, the comparator's output goes high; and when the incoming signal is lower, the output goes low. The LM339 comparator was chosen for two reasons: first, it has an open-collector output, meaning that you use a pull-up resistor to set the output level; second, I happened to have a few dozen in the junk box. These are also available from RadioShack. By the way, you can do away with VR3 if you like and use a voltage divider of two fixed resistors, but I like the flexibility offered by the trimpot.

The comparator's output feeds the base of Q1, a common NPN switching transistor (I used a 2N3904 because I had a pile of them, but most any one will do). Designing for flexibility, I used another trimpot to set the bias on the base of Q1, but a fixed resistor should be sufficient here. If you don't bias the base of Q1, the transistor might not switch properly.

Q1 then switches the ground to the laser pointer on and off, causing the laser to flash, amplitude modulating the laser. Because of large capacitors within the pointer drive circuitry, the maximum rate at which the laser can be modulated is a bit over 10 kHz. One could buy an unmounted laser diode, build a simple drive circuit for it, and get well into the Megahertz region, but I decided against it, as I wanted to keep this as simple as possible. For those interested, Digi-Key sells laser diodes and mounting lenses, and a recent edition of the *Maxim Engineering Journal* describes a simple

"Thanks to the suggestions of many readers, my laser-to-the-shed project is nearly complete. All that needs to be done is to fabricate some pc boards, get another laser and lens, and install the whole thing."

"The detector is an inexpensive infrared phototransistor from RadioShack. It is quite sensitive to red light, and the output signal doesn't need amplification. I used an LM339 comparator to ensure a clean TTL-level signal."

circuit for controlling the modulation and power of a visible laser diode. See "Resources" for details.

I haven't even considered doing this with a higher-power, non-diode (gas, for example) laser. First of all, safety becomes an issue at higher power, as does the use of laser beams in the great outdoors ("free space"), which requires a special permit. Also, I haven't quite figured out how I'd modulate, say, a helium-neon gas laser. If anyone knows how, please drop me a note.

Switching to Receive

The receiver (Figure 2B) is just as simple. Again, we have a bias control for the comparator, VR1. The phototransistor, Q2, conducts when it is struck by light, and is nearly an open circuit when dark. There is a small linear region, in which the conductivity is directly proportional to the light intensity, but I decided to use it in the non-linear region—completely on or off, nothing in between. The 5 volts on the collector of the phototransistor either passes through or it doesn't, depending on the intensity of the laser beam, and the comparator "squares off" this signal.

One last point: remember that this is a full-duplex link. If you want to use it in half-duplex, as if it were a simplex radio link, you need to provide a DCD (Data Carrier Detect) signal to your TNC. This is usually done by the modem. I would hesitate to use this link at speeds over 9600 bits per second, but even 4800 bps will give you really impressive throughput because it's full duplex.

To date, I haven't actually run any data over this link, only the square wave output of a signal generator. The next step is to get two TNCs to talk in the cellar, then move one end out to the shed. I'll keep you posted.

PCs in the Great Outdoors

Well, that's it in a nutshell. Next month, we'll have another look at hardened PCs for outdoor service, along with a review of the new CompactFlash adapter from TAPR, which turns a solid-state memory card used in many digital cameras into an IDE hard drive with no moving parts. We'll also take a closer look at the TAPR Special Interest Groups (SIGs), which offer a wealth of information on nearly anything related to packet that there is. Until then, 73,

—N2IRZ

Resources

The North East Digital Association, P.O. Box 563, Manchester NH 03105; Web: <http://www.packetnetwork.org>.

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

RadioShack, 1500 One Tandy Center, Ft., Worth, TX 76102; Phone: (800) THE SHACK (843-7422); Web: <http://www.radioshack.com>; or visit your local RadioShack store.

Digi-Key, 701 Brooks Ave. South, Thief River Falls, MN 56701-0677; Phone: (800) DIGIKEY (344-4539) or (218) 681-6674; Fax: (218) 681-3380; Web: <http://www.digi-key.com>.

Maxim Engineering Journal, c/o Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale CA 94086; Phone: (800) 998-8800; Web: <http://www.maxim-ic.com>. For information about the visible laser driver circuit, search for MAX988 in their Application Notes section.

A Flash Course on CW and Keys

If you think there's no CW (Morse code) on VHF and UHF, you're just not looking in the right places. This month, Dave looks at an essential element of sending code—keys—and the choices you have among hand keys, "bugs," and electronic keyers.

If you're a regular reader of this column, you know that our previous three months' installments discussed various modes of voice communications and microphones used in amateur radio. Balancing out that "How It Works" study, our attention now turns to another popular mode and its related "human interfacing items": CW (Morse code) and keys.

Rather than jumping into a full three-part series on the subject, however, let's opt for a more low-key and interactive approach. I'll condense as much information as possible into this month's column and invite you to let me know if you would like to see more on CW and keys in future columns. Fair enough?

We have some very interesting ground to cover and some captivating types of keys lined up for discussion, so prepare for another big-time blast of amateur radio enjoyment! Let's get started with a quick peek at the many ways CW is used on today's VHF and UHF bands.

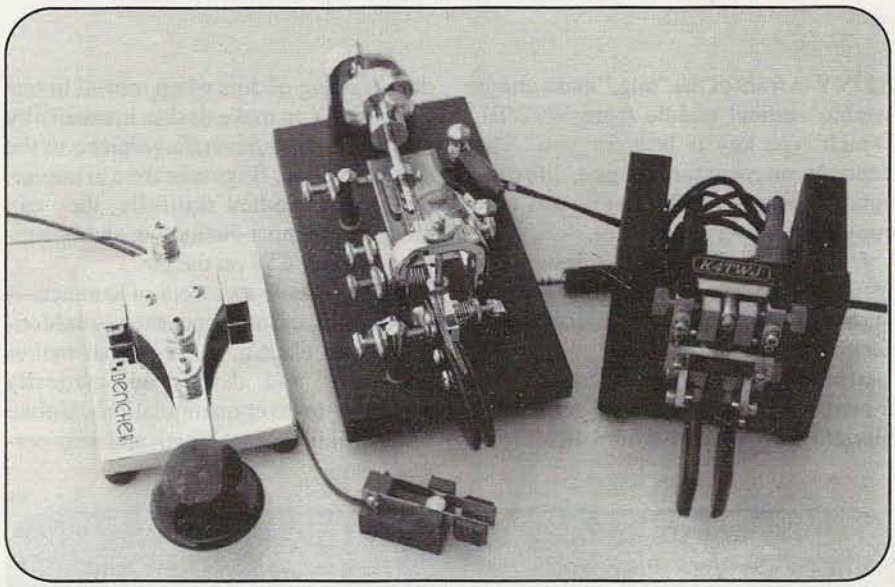


Photo A. Representing the four popular categories of keys are Bencher's new style and all-chrome hand key (left), Vibroplex's famous "Original" bug with new black base (center), W9WBL's unique vertical twin lever paddle (right), and a miniature dual-lever "Paddlette" (in front of the "bug").

CW on VHF and UHF? Yes, Indeed!

So you thought CW was a rather quaint and passé mode used only by a limited number of hearty devotees and low-band enthusiasts? Think again, friends! Even on today's progressive VHF and UHF bands, CW consistently proves its merit —for meteor shower DXing, contesting, moonbounce, and pioneering high-speed CW operations. (A complete and very interesting article on HSCW, incidentally, was written by Jim McMasters, KM5PO, and appeared in September, 1998 *CQ VHF*. Check it out!) The full duty-cycle and on/off nature of CW also proves more productive and reliable than SSB, FM, or packet for working over long or difficult signal paths. Really!

Do I sense one or two readers saying they are strict phone-only ops and the only keys in their shack unlock a vehicle in their driveway? Blistering black bugs, Batman...no one should lead such a sheltered life! Every amateur needs one or two special keys (or more!) to use with their rig for checking output power or SWR, for occasionally relating tales or views of our history to visitors, or to hone a new skill (once you find the right key for you, working CW can actually be glitz, glamour, and fun galore!). Try it for yourself and see! Doctor Dave speaks true facts!

Various Types of Keys

Let's begin our discourse on keys and telegraphy as we did with microphones, that is with a quick and simple overview of various keys and their general applications. Using a show 'n tell approach, I direct your attention to Photo A. The keys shown here include a deluxe all-chrome version of Bencher's new low-slung hand key, Vibroplex's well-known "Original" bug with classic black base, a miniature twin lever "Paddlette" from

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

Photo B. Would you appreciate something special and unique in a hand key for your desk, office, or auto? This new and totally authentic Titanic replica key from Alpha Delta Communications fills the bill in high style. It was used during the era of spark and truly represents a piece of radio history you can hold in your hand. It's a classic!

KI7VY in front of the "bug," and a unique iambic vertical paddle from W9WBL. Which type key is best for you? That depends on your preference, lifestyle, hand agility (or "CW fist"), and code copying/sending ability.

Hand keys are good for casual CW work up to around 12 or 15 words per minute. They are also the easiest type to set up and use.

Semi-Automatic Keys, or "bugs," have a center arm or lever that activates a vibrating pendulum to automatically produce a string of dots when moved in one direction. You make dashes manually by moving the arm/lever/fingerpiece in the other direction. Bugs take time to master, but, when handled skillfully, they can produce the most distinctive and beautiful sounding CW on the air.

Paddles have two sets of contacts—one for dots and one for dashes—and connect to an electronic keyer that makes both dots and dashes automatically according to lever manipulations. Unlike a bug, sending exact length and near-perfect code with a paddle and electronic keyer is a cinch, even when operating bicycle mobile on a rough road. You just bump the fingerpieces correctly and automatic dot/dash completion plus dot/dash memory does the rest.

Miniatures are available in both hand key and paddle varieties. They work just like their full-size equivalents, but are typically smaller, more portable, and less expensive. Miniature keys have also acquired the nickname of *spy keys*, as many types were used with disguised radios in the past.

Now let's take a more in-depth look at each of our highlighted categories.

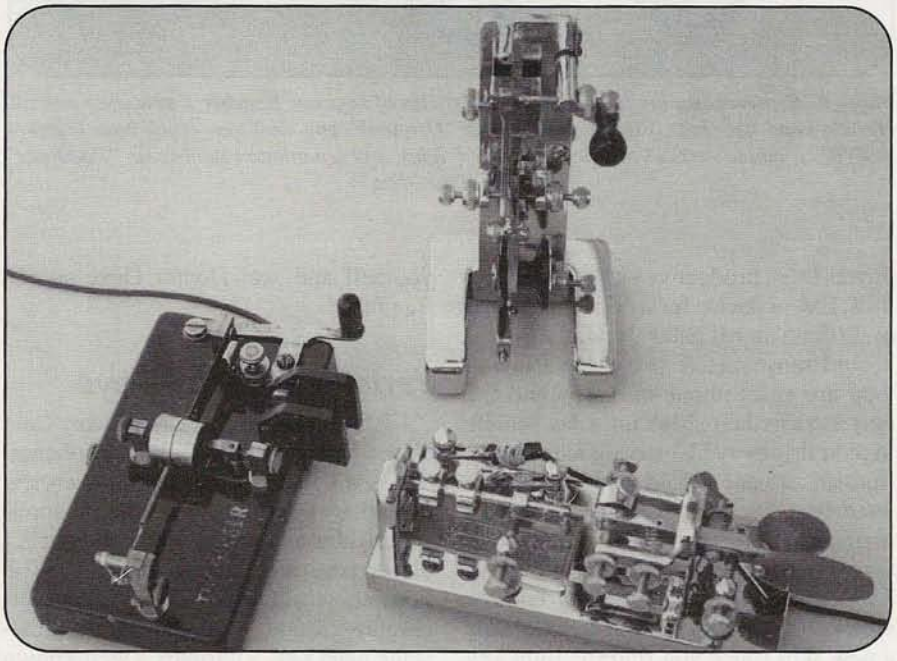


Photo C. Skillfully using a classic "bug" is the ultimate form of telegraphic self-expression, especially when it is a rare collectible like the used-daily samples shown here. They include the D & K "Dinger" (left), vertical or "Wirechief's bug" (rear), and the deluxe Vibroplex "Blue Racer" (right). True gems, each one!

Hand Keys

Over the years, hand keys have been produced in an endless number of styles and shapes, ranging from classic camelbacks to types with chrome, brass, or painted steel assemblies and even right or left hand models (don't ask!). They are easy to connect, convenient to use, and do not require external power or a battery for operation. Some vintage model hand keys used for testing and operating telegraph lines sport both front and rear contacts for "make" and "break" operations, and some models include three adjustments (tension, gap, and arm height) rather than the two usual adjustments.

When we delve into really studying hand keys and their mechanical designs, we find groups from different eras and areas have their own special signatures. German keys typically pivot from the rear, for example, while most other varieties lean toward center pivoting. British-made keys like the classic Titanic replica key (presently available from Alpha Delta Communications and shown in Photo B) use a tensioning spring pulling down on the arm from the rear. Conversely, U.S.-made keys (like the Bencher in Photo A) have a tension spring pushing up on the arm from the front (the end closest to the knob). Russian keys tend to have covers over their mechanism, Scandinavian keys lean toward long arms, Japanese keys have "Junior Mint"-shaped knobs, and...well, the list is endless!

Semi-Automatic Keys, or Bugs

Stepping up the (CW) pace a bit, we next spotlight the ever-popular and world-famous semi-automatic key, or

bug. Like hand keys, bugs have been produced in countless varieties by companies and individuals throughout the world. Among the more rare and exotic types are windup, motorized and three-lever bugs, vertically standing bugs, right-angle bugs, and even a bug adapter for a hand key.

Some types, like Vibroplex bugs, produce dots when pressure to initiate pendulum vibration is *applied* to their flexible mainspring (you move the fingerpiece to produce pendulum vibrations). Other types, like the right-angle D & K "Dinger" shown on the left in Photo C, *release* mainspring/pendulum pressure to produce dots (when you move the fingerpiece, a pawl pushing weights to an off-center stop moves free to allow the pendulum to vibrate). A third type is exemplified by the vertically standing or "upright" bug in the rear of Photo C. It has a single pair of pendulum-attached contacts to make both dots and dashes. When its fingerpiece is moved toward the right, it releases the contact to produce dots. When the fingerpiece is moved toward the left, another pawl applies pressure to the contact to make dashes. The third bug in Photo C, incidentally, is a deluxe all-chrome Vibroplex Blue Racer, which is unique because it resembles a sized-down version of the "Original" rather than its predecessor, the Vibroplex Mode 4 (which is recognized by its "U"-shaped rear damper).

What is the key...err...secret to sending beautiful code with a bug? First is selecting one to fit your "fist" and speed range. Flexibility of mainsprings vary slightly, even among bugs of the same type or model. Consequently, each has its own special feel or "personality" that may surface at 7 to 10 wpm, at 30 to 35 wpm, or anywhere between those ranges. Second, a bug needs more active handling and more wrist action than a paddle. Forget microscopic lever movements and feather touches. Double your fingerpiece's usual travel distance and triple its tension. If intimidated, steady the bug with your other hand to avoid tipping. Then with practice, you too can enjoy a CW rhythm, a special sound, and an on-the-air image unobtainable with any other type of key.

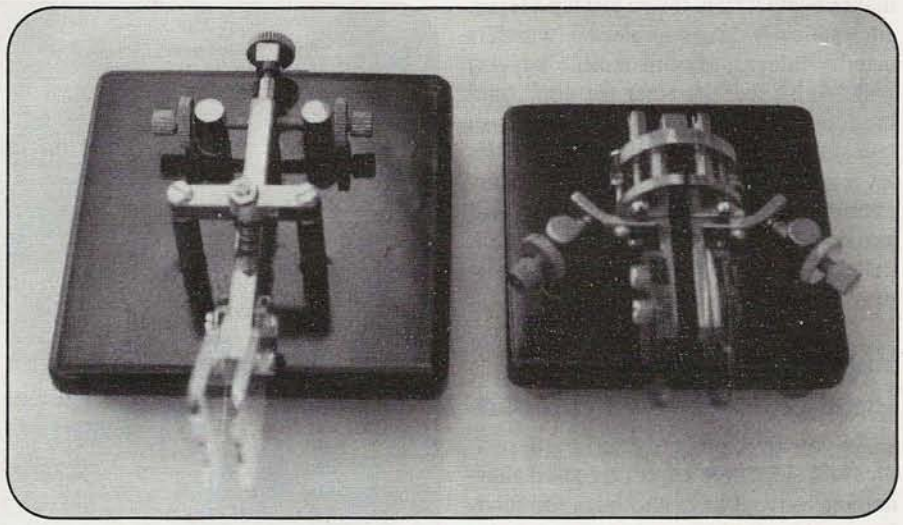


Photo D. Effortlessly sending near-perfect code is a cinch with a good paddle and electronic keyer. Single-lever paddles like the G4ZPY-made item on the left handle like bugs and are easiest to learn and use. Dual-lever paddles, like the G4ZPY "VHS" model on right, have the advantage of iambic action and auto dot/dash insertion, as discussed in text.

Paddles

Electrically, these items are similar to a pair of hand keys sharing a common ground and mounting base. Physically, they are produced in a variety of shapes, styles, and sizes—and, to a CW enthusiast, they are all beautiful. As illustrated by the two custom-made G4ZPY paddles in Photo D, there are two general categories of paddles: single-lever types and dual-lever types. What's the difference? A single lever can only move in one direction at a time. It's like a bug's lever: you move it one way to make dots and the other way to make dashes—simple, effective and easy to master. A dual-lever paddle is designed for *iambic* or "squeeze key" action. It has one lever for dots, one for dashes, and they work independently of each other. The layout or configuration of dual or twin levers is easy to spot on some paddles, but may require some study of mechanics on others (usually looking from their fingerpiece end, as shown in Photo D, is sufficient).

Iambic action produces alternating dots and dashes when you squeeze both levers at once, like a "C" (_ . _ .) or an "AR" (. _ . _ .), depending on which lever

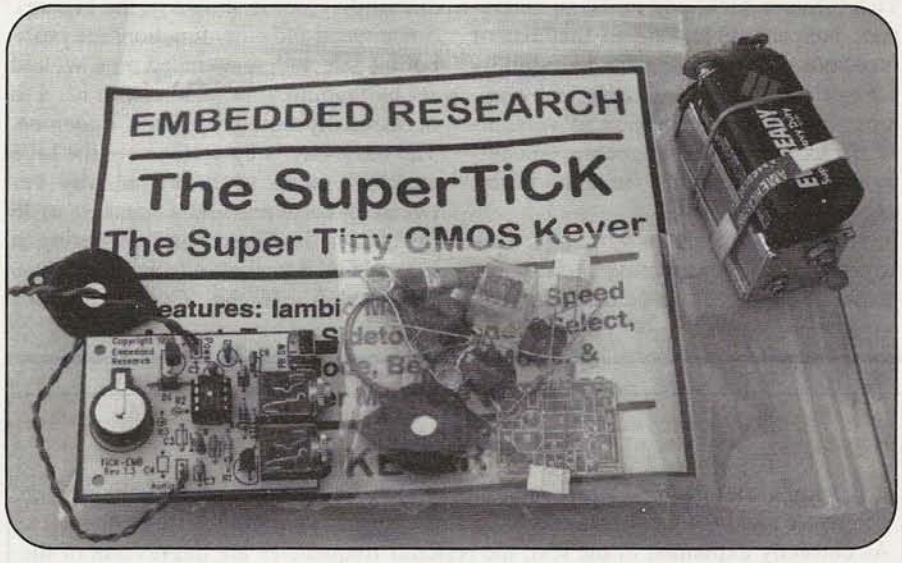


Photo E. Tick iambic keyer kits are available in a variety of styles and features to fit every need. The version on the left has all board-mounted parts. The in-bag version (center) is a one-inch-square pc board-type SuperTick kit. On the right is a SuperTick assembled and stuffed (literally!) in a tiny box for stand-alone use. All functions are accessed by its single front pushbutton.

makes contact first. If you just tap a lever, automatic dot/dash completion (which is usually integrated with iambic keyers) will "finish the character for you" (and produce an E, I, T, M, etc.). Hold the dash lever pressed, then quickly tap the dot lever and "auto insertion" (another fancy feature often included in keyers) will assist and make a "Q" (_ _ . _). Overall, that makes a "CQ" in only three wrist movements. Neat, eh?

Electronic Keyers: Ideal Quick-Brew Projects

As you have probably surmised, paddles and electronic keyers are good alternatives to hand keys and bugs for sending code. And yes, in case you're wondering, a single-lever paddle will work with an iambic keyer (but iambic action obviously will not be accessible). Dual-lever paddles, however, will usually "confuse" non-iambic keyers.

Electronic keyers are included in many top-line or near top-line transceivers, and they're also available in kits for those of us without ultra-fancy rigs or who prefer a stand-alone keyer for home, mobile, and portable use. A good example is the trio of Tick iambic keyers shown in Photo E. These mini keyers are small, low-cost ($5 to $35), surprisingly elaborate, and available as chip-only or full-kit packages. The basic Tick-1 keyer/chip features speed adjust (3 to 60 wpm), tune/keydown mode, sidetone on/off, left/right hand paddling, and hand key mode. Other versions (Tick 2, 2B, and Tick 3/Super Tick) add message memories, beacon mode, etc. to that list of functions. All functions are accessed by a single pushbutton and changed by tapping your paddle. In addition, all versions of Ticks are interchangeable (socket-mounting the chips makes future upgrades easy).

So what's involved in building a Tick keyer? Basically, mounting slightly less than a dozen parts on a pc board, or on a piece of perfboard if you choose the chip-only approach, does the trick (the keyer's circuit diagram is shown in the Figure). Since speed and other functions are push-button-selected, announced on CW, and set by tapping your paddle, you need to occasionally monitor the Tick's sidetone. The easy way is by connecting the kit's supplied piezo sounder (halfway between an earphone and a speaker) to J6 (again, see the Figure) and jumpering in R3 and C4. After setting speed, etc., you can switch off the Tick's sidetone. Alternately, you can connect the output from J6 to your rig's last audio stage for in-speaker monitoring. This will require experimenting with values for R2 (27k ohms is a good starting point) and R3 (1 meg is a typical value). Finally, mounting the completed Tick inside your rig or in a separate box is your choice. See "Resources" for information on purchasing these kits.

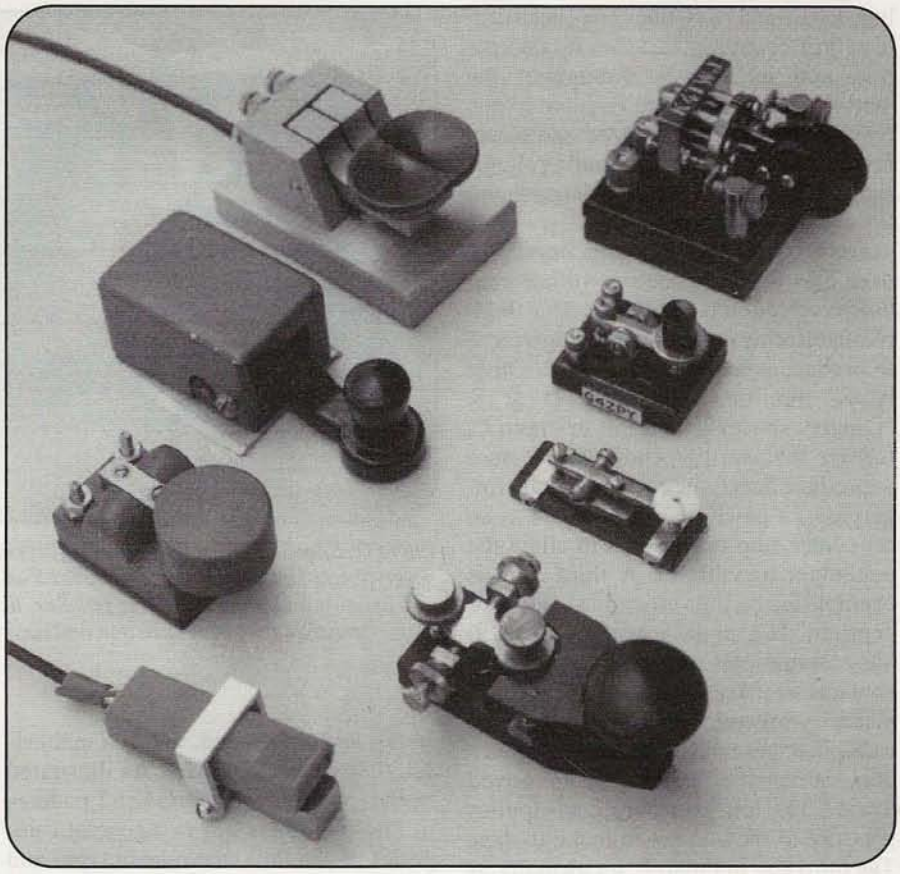


Photo F. Miniature keys and paddles are dandy collectibles. Here, we have (clockwise from 6 o'clock) the "Lilliput" key made by EA3DOS, the "Little Red Key" from The American Radio QRP Key Company, an enclosed Russian key, and the "Twinke" cricket paddle made by DK1WE. On the right top, at the 1 o'clock position, is a 3-in-1 paddle from G4ZPY, then a one-inch-square G4ZPY hand key, a homemade micro key, and a Japanese miniature hand key.

Miniature Keys and Paddles

These items are rapidly increasing in popularity, probably because they are so affordable and perfect for on-the-go hamming. Some miniatures are made by individuals, some are made by companies, and, as illustrated in Photo F, their designs are quite diverse.

Taking a quick look at Photo F, the top left item is a "Twinke" iambic cricket paddle available from DK1WE (see

Oops

In May's "Beginner's Corner" column, Figure 1 (page 46) inadvertently showed a repeater and two handhelds receiving and transmitting on the same frequencies. As correctly explained in the text, the repeater frequencies are the reverse of the user frequencies, with its receiver "listening" on the users' transmit frequency, and the transmitter "talking" on the users' receive frequency. In the diagram, the repeater's receive frequency should have been 146.34, and its transmit frequency should have been 146.94. Tnx to reader Terry Constant, WØTLC, for catching this "oops."

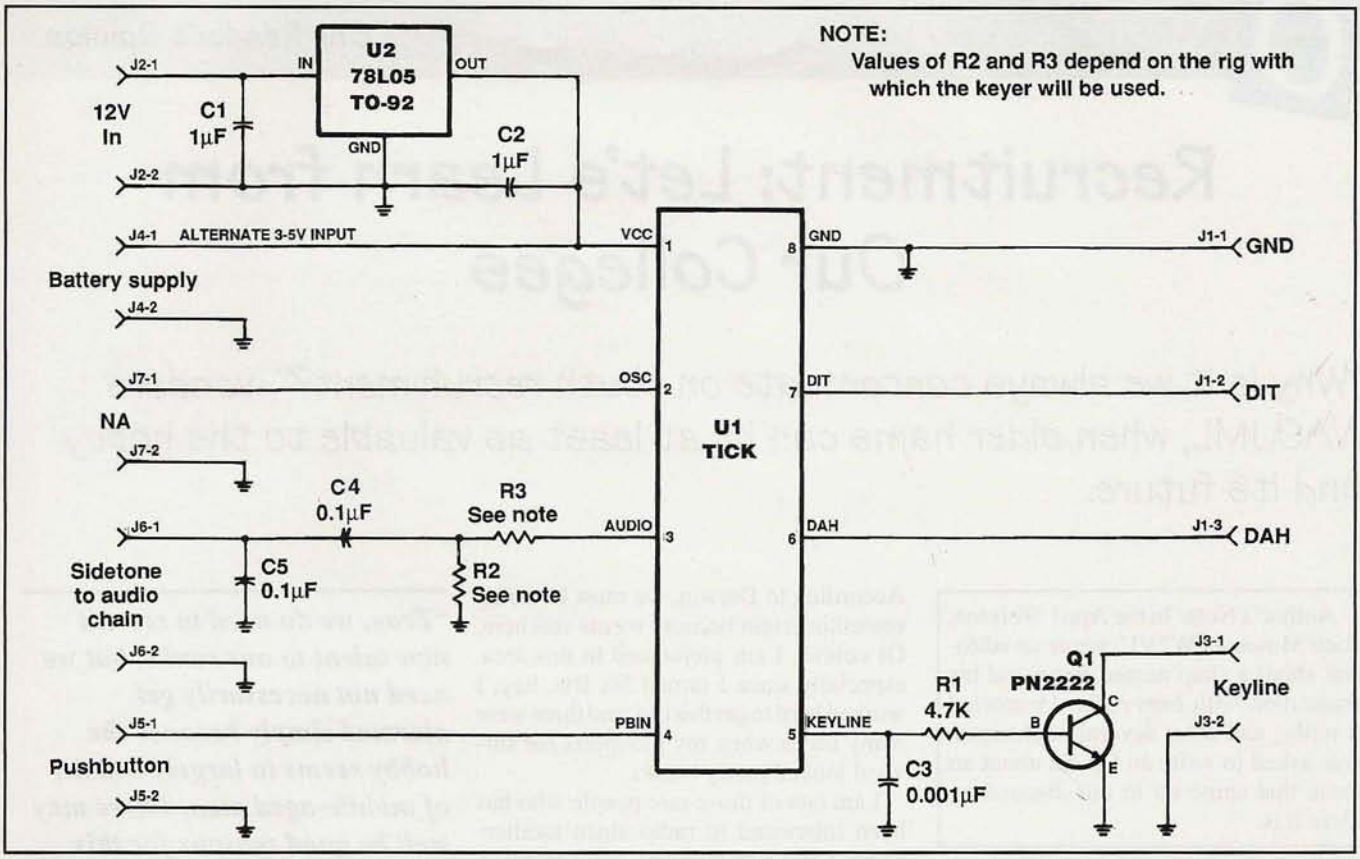


Figure. Circuit diagram of the Tick keyer kit. Variations in features are built into the Tick chip itself, simplifying assembly and making future upgrades a plug-in cinch.

"Resources" for contact info). This paddle may look like a hand key, but it actually has dual arms that move vertically rather than horizontally (it's ideal for busy fingered "tabletop drummers!"). The lower left item is a "Little Red Key" made by the American Radio QRP Key Company. Although 1.5 inches square, it feels like a big key. The right top item is a magnet-based and rather elite iambic paddle called the "3 in 1." It, plus the miniature hand key below it, is available from G4ZPY. Finding miniatures requires close hunting, often in want ad sections of magazines, but they are worth the hunt and fun to use.

Still "Keyed Up"?

Gracious goodness, we are again to the closing wire and we have only scratched the surface of this fascinating subject. Want to see more about collecting, refurbishing, and using keys? Drop us a note (include an SASE if you want an out-of-column reply) at 4941 Scenic View Dr., Birmingham, AL 35210, or c/o *CQ VHF*. Meanwhile, enjoy working CW and may the force of good signals be with you! 73,

—Dave, K4TWJ

Resources

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

Alpha Delta Communications, Inc. (titanic replica key), P. O. Box 620, Manchester, KY 40962; Phone: (606) 598-2029

American Radio QRP Key Company (miniature hand keys, paddles), 3710 Buckingham Rd., Baltimore, MD 21207; Phone (410) 484-7951

Bencher, Inc. (hand key), 831 N. Central Avenue, Wood Dale, IL 60191; Phone (630) 238-1183

DK1WE (Twinke, miniature keys, Chubbock key), Englmar Wenk, Hubenring 4, 88048 Friedrichshaven, Germany

EA3DOS Hispania CW Club (Lilliput key), Av. Roma, 10, 08015 Barcelona, Spain

Embedded Research (iambic keyer kits and ICs), P. O. Box 92492, Rochester, NY 14692; Phone: (716) 359-3941

G4ZPY (paddles), Gordon Crowhurst, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs, L40 7TG England; Phone: 011-44-1704-894299.

Paddlette Company (miniature iambic paddles), P. O. Box 6036, Edmonds, WA 98026; Phone: (425) 743-1429

Vibroplex (bugs, paddles, hand keys & accessories), 11 Midtown Park, E., Mobile, AL 36606; Phone (800) 840-8873

W9WBL (vertical paddles, right/left hand keys), Stan Hails, 6345 Coffman Road, Indianapolis, IN 46268; Phone: (317) 291-3502

For more information on keys and keyers, we recommend Dave's own book, *Keys, Keys, Keys,* available from the CQ Bookstore, 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926; E-mail: <cq@cq-amateur-radio.com>; Web: <http://www.cq-amateur-radio.com> (click on the "CQ Store" button).

Recruitment: Let's Learn from Our Colleges

"Why is it we always concentrate on youth recruitment?" wonders WA9JML, when older hams can be at least as valuable to the hobby and its future.

Author's Note: In the April '99 issue, Rich Moseson, W2VU, wrote an editorial about a chap named Ryan and his frustration with ham radio. I e-mailed a reply, and after several exchanges, was asked to write an Op-Ed about an issue that came up in our discussion. Here it is.

We are frequently exhorted to go forth and recruit new members for the Ham Radio community. All sorts of perils are imminent. The number of hams is dropping. We need to get more young people interested in ham radio. Our hobby is dying! We need to do something to stop these alarming trends!

Not so fast. True, we do need to recruit new talent to our ranks, but we need not necessarily get alarmed simply because the hobby seems to largely consist of middle-aged men. There may well be good reasons for this situation, and they are not necessarily bad.

What's Wrong with Being Middle Aged?

First of all, there is really nothing wrong with being a middle-aged guy. According to Darwin, we must be doing something right because we are still here. Of course, I am prejudiced in this area, especially since I turned 50. But, hey, I worked hard to get this old, and there were many times when my prospects for survival looked pretty bleak.

I am one of those rare people who has been interested in radio since toddlerhood. I used to read the 1942 Defense Edition of the *ARRL Handbook* the way most kids read comic books. I got my Novice ticket back in 1963. Following a failed attempt at a General exam, I became a Technician. I was having so much fun at VHF, that I did not even miss HF. The Army and then college intervened, and I was not active much for quite a while. There were other distractions. I discovered motorcycles, beer, political philosophy, the fair sex, and...is there anything else? Anyway, I gradually got back on the air and upgraded. Now I am having a ball again!

Reading Rich's editorial in the April issue of *CQ VHF* set me to thinking. That's dangerous. I asked myself a question. "Why is it that we always concentrate on youth recruitment?" Thinking about my checkered past, I realized something. Younger kids often do not have the time or interest to be active hams. Carefully observing my undergraduate students, I discerned a pattern in their interests: sex, drinking, partying, studying, partying, drinking, and sex. I was not surprised, since these were largely my concerns when I was an undergraduate. These are all very intense pursuits and do not leave much time for radios, other than cellphones.

"True, we do need to recruit new talent to our ranks, but we need not necessarily get alarmed simply because the hobby seems to largely consist of middle-aged men. There may well be good reasons for this situation, and they are not necessarily bad."

It does not get much better upon graduation. At that point in the human life cycle, student loans need to be repaid. Marriage frequently occurs. Then, there is buying the big house in the suburbs, buying the SUVs or BMWs, keeping in style, raising a family, and finally putting the kids through school, where the cycle starts to repeat itself.

At this point, the exhausted parents are...middle-aged. Now they have an empty nest. They are almost retired. They are sick of their jobs. They need a good hobby. Yes! This is when the average person is ripe for recruitment into our ranks! They are established, with a fair amount of money in many cases, and with the necessary leisure time to really enjoy ham radio.

But, you say, these are old duffers! The youth are our future! And so forth. All the same platitudes that come out of the woods when school referendums come up for a vote. But are they really true? Not anymore. In 1900, most people did not live much past 40. Before then, life expectancy was even less. Past 40, many

By Steve Berg, WA9JML (sberg1@niu.edu)*

Steve Berg, WA9JML, describes himself as "probably the champion non-traditional student in my department." A doctoral student in Public Administration at Northern Illinois University in DeKalb, Illinois, Steve has a wide range of experience in electronics and has been a ham since 1963.

"Thinking about my checkered past, I realized something. Younger kids often do not have the time or interest to be active hams."

people were disabled due to disease, accidents, and general wear and tear. Author Peter Drucker has described the revolution that has happened in the developed nations in this century.** Now, it is not uncommon for people to be active and relatively healthy up through their 80's. The young may be the future, but now, so are the rest of us.

A bit of an example: My friend, Jim Jarvis, W9KCM, got interested in ham radio in his late 40s. Now, according to conventional wisdom, ham radio would have been better served by recruiting someone younger. Fortunately, conventional wisdom was wrong. Jim was 92 when his key fell silent earlier this year. Jim was a superb Elmer and an active ham for most of his life. A half-century as a ham is certainly long enough to count as a "future." There are plenty of other active, contributing hams who are well up in years. They are an asset that any hobby would be proud to claim.

Learning from Colleges

We might learn from the difficulties of another institution faced with recruitment problems. For many years, universities concentrated on the 17- to 21-year-old age group. Huge facilities were built up to handle the baby-boomers. There were relatively few older, or so-called "non-traditional," students. Once the boom turned to bust, most universities did what ham radio has done. They lowered their admission standards in order to recruit people with marginal abilities.

Eventually, admission requirements were essentially a check in one hand and a pulse in another. Grading standards then needed to be lowered to retain such people, and much of the curriculum consisted of remedial work. When even that was not sufficient to fill classrooms, universities discovered the huge demand for continuing education. They built facilities convenient to working students and concentrated on recruiting older bodies. This is the cash cow that is now keeping many schools afloat. I propose that we learn from them and adopt some of their ideas. We, too, should concentrate on older people as recruits to our fine hobby.

A Perfect Match

It would be very difficult to find a better hobby for older folks than ham radio. It provides some of the best friendships around. It has many interesting activities to pursue. It provides opportunities for public service. It gives its participants a window to the world. It can also be very enjoyable when mobility and other faculties are limited. Now, I'm not saying that we should *only* be looking for middle aged guys. Women of any age are also a real asset to our hobby, and they gain great pleasure from it. If we can attract younger people too, that's fine. But that should not be our *primary* goal. Our hobby is not on the verge of dying off simply because many of us are past 40. There are people moving up into that age bracket all the time.

Ryan complained that most of what he heard on the Chicago repeaters was old men making lunch plans, and that was boring. Not so to the guys involved! If Ryan is fortunate enough to make it to their age, he might find that such activities are a great idea. He might even want to join their lunch groups *now*. I think he will find them to be a great bunch, and not at all boring. ■

**Drucker, Peter, The Age of Discontinuity: Guidelines to Our Changing Society, *Harper & Row, 1968/1969.*

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

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

Picture This! "Phun Photos"

Amateur Radio at Its Best

Larry Sanderson, KDØYZ, of Manchester, Iowa, shares the following story and photo with us.

In July, 1996, my wife Sonja, NØWLV, and I were visiting our granddaughter, Andrea, in Albuquerque, New Mexico. We had run through the usual tourist attractions and were looking for something to do when we saw an ad for sailplane rides. That appealed to us, and off we went.

I opted to go up first and took along the 2-meter HT, with Sonja and Andrea monitoring from the car. We were circling at 11,000 feet and had made contact briefly, "to see if it worked," when Sonja called and asked if there was aircraft frequency communications on board. There was, and I asked her what was up?

She said a plane was preparing to take-off with a cargo door hanging open and efforts to signal the plane weren't noticed. All the staff were up flying and no one was on hand to radio the plane and warn of their problem. My pilot then called on the aircraft frequency and passed the message. The plane stopped, the pilot got out, closed and locked the door, and radioed his thanks for the help.

My pilot stated that we may have averted a tragedy. The rest of the flight was uneventful but fun, and I managed several contacts on 2 meters out to about 150 miles. An HT with a couple of watts at 11,000 feet really gets out! We not only had fun that day, we also performed a public safety service. That's amateur radio at its best! ■

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!

Sonja Sanderson, NØWLV, at Moriarty, New Mexico Airport with HT in hand, ready to go sailplane flying. The pilot is on the far side. (KDØYZ photo)

Letters *(from page 8)*

2. Can we "grow" a radio organically?
3. Can x-rays and gamma rays be used for very high-speed communication?
4. Is it possible to build low-cost radio astronomy equipment for public use?
5. What would be the best ways to communicate between space stations and space craft?
6. What are the best ways to communicate in the ocean?
7. What are whales saying to one another? Can we use the ocean to broadcast our own information?
8. What might be worthwhile information to continually broadcast, besides geographic locations, weather, and beacons?
9. Can we build complete digital everything and connect to everything?

Finally, the entire licensing issue needs to be seriously revisited. I applaud the clear emphasis placed on safety and interference by the licensing process. As we push new boundaries into higher and lower portions of the electromagnetic spectrum, and connect with more diverse existing commercial and public technologies, we need to do so safely and without creating difficulties for others.

Each mode of operation may need a competency test, but there should be no cross-mode restrictions. By this I mean, if someone is competent to run packet on any frequency, he/she should not have to be certified for SSB or Morse. So, clearly we should be licensed, and constrained, by our knowledge of safety, operation, and understanding not by specific mode based competencies. Hope this helps.

Name withheld by request
Hamilton, Ohio

Thank you for your thought-provoking comments and ideas on pushing the boundaries of "traditional" radio communication. As "Beginner's Corner" editor Peter O'Dell said in his direct response to you, no idea is "too weird" when you're brainstorming.

You might be interested to know that the ARRL, at its January Board meeting, created a "Technology Task Force," to be made up of members "who have been actively involved in experimenting with or developing new technologies that may have some applicability to the amateur radio service," and whose job will include "developing a strategy and plan of work 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." ■

Soldering

Sooner or later, just about every ham needs to solder something. And while you don't have to know how to solder to get your license, it sure does come in handy for getting on the air. Connectors need to be soldered to wires and cables; wires break and need to be fixed, etc. Knowing the right way to solder is important, because poor soldering can cause all kinds of problems, including interference on your neighbor's TV set.

Let's start at the beginning: What type of iron do you need? Most irons are rated for both power and temperature. For amateur work, a 700° F tip is probably best. The wattage of the iron measures how quickly it will heat the surface you're going to solder—what we call the "work." A 45-watt iron is fine for most amateur projects. But it's handy to have a 100-watt soldering gun available when working on large materials and antenna connectors. *(Remember: Pick up a soldering iron* only *by its handle—700 degrees is HOT!)*

You'll also need a stand to hold your iron when you're not soldering, some rosin-core solder (never use acid-core "plumber's" solder), plus a small sponge and some type of solder remover. A vise or something else to hold the work still is also important.

Be Prepared

Before you start to solder, you need to prepare the tip of your iron for the best heat transfer. This is called "tinning." To prepare a new tip, plug in the iron and let it heat until the tip will melt solder. Then apply a liberal amount of solder all over the tip and a quarter to a half inch down as well. Clean off the excess with a damp sponge. The tip should now be shiny all over, and you are ready to solder.

Just keep a couple of rules in mind as you begin your work:

Rule 1. Solder is only for making electrical connections, not for physically holding things together. Make sure you have a good mechanical joint before you solder. Also, make sure the surfaces you're going to solder are clean.

Rule 2. Heat the work, not the solder. If the surface to be soldered isn't hot enough, the solder won't stick or will produce a "cold joint" (more on that later).

It's Hot!

Hold the soldering iron on an angle; about 45 degrees is best. This puts more of the tip in direct contact with the work—and transfers more heat—than holding it straight down. First, "tin" any wires you're going to solder by applying a small amount of solder to the wire itself. Now, heat the larger mass to make the connection—if you don't, the solder may not adhere to both surfaces.

Here's a hint: If you put a little bit of solder between the tip and the work while it's heating, it'll help maximize heat transfer and will also tell you when the

work is ready to solder. The solder starts out balled up on the tip of the iron. When it's hot enough, the solder "wets," or flows into the joint. Now, add more solder. Apply it to the work, not the tip.

Now Cool It!

When the joint is covered with solder, remove the solder first, then the iron. Clean off the tip with your damp sponge and put the iron in its holder. Now let the joint cool. Don't try to rush things. It usually takes a solder joint no more than 10 seconds to cool. If you move it or blow on it before it's cool, you'll cause a cold joint and you'll have to start again. Your finished joint should be shiny and smooth. You should be able to see the outline of the materials you've joined, and the solder itself should have a feathered, tapered shape.

Cool, Not Cold

If the joint looks dull and grainy, you've got a "cold solder joint." The solder here is brittle, may be a poor conductor, and will eventually fall apart. To "warm up" a cold solder joint, reheat the connection until the solder melts, then add a small amount of fresh solder and let it cool slowly.

Finally, check your connections with a V-O-M (volt-ohm meter) to make sure there are no shorts and that you have a solid connection to whatever's on the other end of what you've soldered. Use the "ohms" setting. On the meter, look for zero resistance in your continuity check and for infinite resistance when checking for shorts.

All Done!

It's really not that hard to solder well. In fact, if you're using the right iron and tip, have prepared the tip and work properly, and have the patience to wait while your work heats and then cools, soldering can be easy and fun. ■

CQ VHF Hamlink

CQ VHF "Hamlink" offers *free listings* of clubs, licensing classes, and exam sessions for up to four months at a time! *Plus*, for $1/month or $10/year, we also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings are $5/month or $50/year).

Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF "Weblink,"* Attn: Bernadette Schimmel, 25 Newbridge Road, Hicksville, NY 11801. Credit card orders are accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF* "Clublink," or via the Web at <hamlink@cq-vhf.com>. Be sure to say what it is in the subject line (e.g., Club Listing).

Club Listings

AL, Pell City, St. Clair County ARES: Meets 1st Monday of each month at 7 p.m. St. Clair County EMA Building basement, 1610 Cogswell Ave., Pell City. ARRL testing 3rd Monday of each month, same location. Repeater: 145.130-PL 103.5. ARES net Tuesday 8 p.m. Contact Rick Yuhas, 525-4669.

CA, El Cajon, Amateur Radio Club: Meets 2nd Thursday of each month at 7 p.m. La Mesa Church of Christ, 5150 Jackson Dr., La Mesa, CA. Visitors welcome. Repeater: 147.420 (output) 146.475 (input) 107.2 PL. Nets: WAMO/YL/Young persons (<16); E-mail: <KF6ILA@hotmail.com>; Web: <http://www.eylar.com/arcec/>.

CA, Fremont, South Bay Amateur Radio Association (SBARA): Meets 3rd Wednesday of every month (except June abd December) at 7:30 pm., Freemont Community Center, 40204 Paseo Parkway, Fremont, CA. For information about SBARA, see our club Web page: <www.qsl.net/sbara>; E-mail: <sbara@qsl.net).

CA, Fullerton Radio Club: Meets 3rd Wednesday of every month at Fullerton Senior Center at 340 W. Commonwealth Ave., Fullerton, CA at 7:30 p.m. PST. Tuesday night net repeater 147.975, 8 p.m. PST. Visitors welcome. For more info, visit Web site at: <http://ourworld.compuserve.com/homepages/kc6yhm>, or call Mike Cramer, KC6YHM, at (714) 996-4510.

CA, Sacramento Amateur Radio Club: Meets 2nd Wednesday of every month at 7 p.m., Sacramento Blood Bank, 1625 Stockton Blvd., Sacramento. Visitors welcome. Repeater W6AK 146.91- PL100. Info at P.O. Box 161903, Sacramento, CA 95816-1903 or Tom, KQ6EO, at (916) 722-9358; E-mail: <ke6eo@jps.net>; Web: <http://home.sprynet. com/sprynet/w6ak>.

CA, San Clemente, Beach Cities Wireless Society: Meets 2nd Thursday of each month at 7 p.m. Ole Hanson Beach Club at beach end of Ave Pico and PCH, San Clemente, CA. Visitors welcome. Open repeater 146.025(+) PL 110.9), net Wed. eves. 8 p.m.. For more info, visit club Web site at <http://www.qsl.net/bcws> or contact Tom (949) 661-4307, e-mail: <prmercury@earthlink.net>, or write to BCWS, P.O. Box 4016, San Clemente, CA 92674-4016.

CA, Santa Barbara Amateur Radio Club: Meets 3rd Friday of month September–May at 7:30 p.m., County Schools Auditorium, 4400 Cathedral Oaks Rd., Santa Barbara. For more info, see <http://www. sbarc.org>, or call (805) 569-5700.

CO, Bicycle Mobile Hams of America: National nonprofit club of bicyclists who use VHF radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at HamVention. Net: 14.253, 1st & 3rd Sundays, 2000 UTC. E-mail: <hartleyal@aol.com>. For info, sample newsletter, send SASE to BMHA, Box 4009-CV, Boulder, CO 80306-4009.

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 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, Clearwater Amateur Radio Society: Meets 7:30 p.m. 2nd Tuesday of each month, Clearwater Red Cross, 624 Court St. Linked repeaters: 146.97 (103.5), 224.94, 444.15 (103.5) and 444.575 (131.8) Club net: Wednesday at 8 p.m. Web: <www.fgcarc.org/cars>; E-mail: <k2sec@amsat.org>. Paul E. Knupke, Jr., KR4YL <pk@ij.net>.

FL, Englewood Amateur Radio Society: Meets 3rd Friday of each month at 7:30 p.m., Room 400 of Englewood United Methodist Church, 700 East Dearborn St., Englewood. Two-meter net at 7:30 p.m. all other Fridays (146.700). For more info, visit <http://www.flnet.com/~crosby/ears>, or call Jack, W4JS, at (941) 475-1929.

FL, Highlands County Amateur Radio Club: Meetings held 3rd Monday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Visitors are welcome. Repeaters at 147.045 +.6, 442.350 +5.0, with packet on 144.970. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

FL, Lakeland Amateur Radio Club, K4LKL: Meetings held first Monday of each month, 7 p.m. @ 2400 Buckingham Ave., at the Campfire Center in Lakeland. Talk-in on club repeater 146.685. Club net each Thursday at 7:30 p.m. For more info: <www.qsl.net/k4lkl>; E-mail: <aj4y@arrl.net> or <kf4dnw@juno.com>

FL, Lake Monroe Amateur Radio City (Greater Orlando): Meets 1st Thursday of the month at 7:30 p.m., Casselberry Senior Citizens' Center, Lake Triplett Dr., Casselberry, FL. Repeater 147.285. Contact KK4ND at <wayright@magicnet.net>; club Web site: <http://www.qsl.net/mars>.

MA, Falmouth ARA: Meets last Thursday of every month at 7:30 at Falmouth Town Hall. All levels of exams given at 9 a.m. 2nd Saturday of every month at Falmouth Town Hall. Rptr1446.655/70cm. 444.250pl141.3/. Boston link, 445.175pl.141.3. For more info, see our Web site: <http://www.falara.org>. Membership available on the Web.

MA, Franklin Couty Amateur Radio Club: Meets second Monday of everymonth at Greenfield High School small auditorim, Silver Street in Greenfield, MA at 7:15 p.m. Repeaters 146.985 - PL 136.5 and 448.875-PL 136.5. For info, e-mail Richard, KD1XP, at <kd1xp@arrl.net>

MB, Canada, Winnipeg Amateur Radio Emergency Service (WARES): Callsigns VE4YWG (Public Service Communications), VE4EOC (City Emergency Operations Centre). Meetings 3rd Tuesday of month, 1930h at Sir Wm Stephenson Library, 765 Keewatin St. Membership open to all licensed amateurs at least 18 years of age and living in or near Winnipeg and interested in emergency amateur communications. E-mail Jeff Dovyak, VE4MBQ, Emergency Coordinator at <ve4mbq@ve4umr.ampr.org>; Web: <http://www.geocities.com/CapeCanaveral/Hanger/1632/wares.html>.

MD, Baltimore Radio Amateur Television Society: Meets 3 p.m. 1st Saturday of the month at the Pikesville Public Library, 1301 Reisterstown Rd., Pikesville, MD. BRATS sponsored FM repeaters are 147.030/224.960/447.325 MHz linked system (main), 145.130, 224.800, and 443.350 MHz. Also sponsors second oldest ATV repeater in the country, the W3WCQ repeater, input 426.250/1253.250-output 439.250/911.250. Holds nets in the 147.03 system, Sunday 8 p.m. Listening Post, Monday 7:30 p.m. Horsetraders, 9 p.m. Traffic and information, Wednesday 8 p.m. Newsline, Thursday 9 p.m. ATV, Saturday 1 p.m. News Bulletin, 1:20 p.m. Answer Men. Club activities include public service events, field day, hamfests, ATV repeater linking, amateur classes. Membership open to all. For more info, write, BRATS, P.O. Box 5915, Baltimore, MD 21282-5915, call (410) 461-0086, e-mail: <brats@smart.net>; Web: <www.smart.net/~brats>.

ME, Milo Piscataquis ARC: Meets 4th Monday of each month at Piscataquis County Emergency Operations Center (EOC) at 7 p.m. For more info, contact Piscataquis ARC, c/o George R. Dean, P.O. Box 365, Brownville Jct., ME 04415; E-mail: <parc@qsl.net>; Web: <http://www.qsl.net/parc/>. (Also participates in a number of other club events).

MO, St. Louis, Gateway to Ham Radio Club (KBØUAB): A youth-focused club, meetings are held each month on Saturdays. Get on our new repeater at 443.225 (146.2 pl). For more information, visit our Web site at <http://www.iidbs.com/gateway/>.

NC, Onslow Amateur Radio Club, WD4FVO: The Onslow Amateur Radio Club (OARC) is a non-profit organization dedicated to the advancement and growth of the Amateur Radio Service. We provide services to our community and a forum for hams to meet other hams. OARC operates the 147.000 (-) repeater in Jacksonville, NC. OARC meets the 1st Tuesday of every month at 7 p.m. in the banquet room of the Fishermens Wharf restaurant, located on Hwy 17 on the bank of the New River in the heart of Jacksonville, NC. For more information, contact Ed Napoleon, KC4JKW, at <kc4jkw@gibralter.net> or Juan Lopez, AC6ZM, at < lopezfam@coastainet.com>, or visit our Web site at <http://www.qsl.net/wd4fvo>.

NC, Stanly County Amateur Radio Club: Meetings held every 4th Thursday at Stanly Community College. Two-meter nets held at 9 p.m. (local), Wednesday (146.985), and Friday (147.390). Six- meter rag chew each Thursday at 8:30 p.m. (50.135). For more info, visit Web site: <www.qsl.net/scarc>.

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 at <gsara@monmouth.com>, <http://www.monmouth.com/~gsara>, 145.485 -600 pl 151.4. Or call Bob, N2XR, at (732) 495-3437 for further information.

NY, Brooklyn, Kings County Repeater Association (KCRA): Meets 3rd Tuesday of the month (except July & August), 7:30 p.m., at Fort Hamilton Army Base, Building 213, Brooklyn, NY. Visitors welcome. Call Don, W2DON, at (718) 248-0752 for more information. Club repeater (WA2ZWP) 146.430, up 1 MHz, PL 136.5. Web: <http://www.qsl.net/kcra>. VE exam sessions last Tuesday of every month (except July, Aug., Dec.), 7 p.m. Pre-registration is a must. Call Harvey, KB2EA, at (718) 948-2290 to register.

OH, Cleveland Area, Cuyahoga Amateur Radio Society: Meets 3rd Wednesday of every month except December at 8 p.m. at Busch Funeral Home community room, 7501 Ridge Rd., Parma, Ohio. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Re-peaters are on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater at 145.07, and club simplex frequency of 146.475 MHz. For more info, contact club president, Tom Wayne, WB8N, at (440) 232-4193 or at <wb8n@en.com>.

OH, Hocking Valley ARC: Meets 1st Tuesday of every month at 7:30 p.m. in EMA building at 56 S. Market St., Logan, OH. Packet Node LOGAN: AA8BJ-2 on 145.53 MHz, club net Wednesdays at 9 p.m. on 147.345+. E-mail: <aa8bj@hotmail.com>

OH, Lawrence County, Amateur Radio Emergency Service: Meets 3rd Monday of every month at 7 p.m., EMA/911 building, 515 Park Ave., Ironton, OH. Net every Thursday night 9:30 p.m. local time on repeater 146.715. Info e-mail: <wn8f@wwd.net>, or visit web site at:

Books, Videos, Calendars, Cards!

Visit Our Web Site www.cq-amateur-radio.com

Fax us at 516-681-2926
Call us toll free at 1-800-853-9797

CQ Award Pins

If you've earned any of CQ's Awards, you can also display the corresponding CQ Award pin. Available for WAZ, 5 Band WAZ, 160 Meter WAZ, CQ DX, CQ DX Honor Roll, WPX, WPX Honor Roll, and USA-CA awards. **ONLY $5.00 EACH.**

Playing Cards

Top quality, plastic coated playing cards.
ONLY $9.95 per deck

1999/2000 Calendars

Summer Special!
~~$9.95~~ $5.95

Fifteen month calendars - January 1999 through March 2000

Please specify Amateur Radio or Classic Radio Calendar

FREE SHIPPING on orders over $50*

33 Simple Weekend Projects

by Dave Ingram, K4TWJ

Do-it-yourself electronics projects from the most basic to the fairly sophisticated. You'll find: station accessories for VHF FMing, working OSCAR satellites, fun on HF, trying CW, building simple antennas, even a complete working HF station you can build for$100. Also includes practical tips and techniques on how to create your own electronic projects.

Order No. 33PROJ.... $15.95

W6SAI HF Antenna Handbook

by Bill Orr, W6SAI

Inexpensive, practical antenna projects that work! Guides you through the building of wire, loop, Yagi and vertical antennas.

Order No. HFANT..... $19.95

The NEW Shortwave Propagation Handbook

by W3ASK, N4XX & K6GKU

A comprehensive source of HF propagation principles, sunspots, ionospheric predictions, with photography, charts and tables galore!

Order No. SWP $19.95

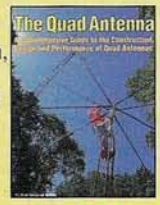
Amateur Radio Equipment Buyer's Guide

This 144-page book is your single source for detailed information on practically every piece of Amateur Radio equipment and accessory item currently offered for sale in the USA complete with specs and prices. Also includes the most comprehensive directory of Ham product manufacturers and dealers in the USA.

Order No. EBG..... $15.95

The Quad Antenna

by Bob Haviland, W4MB
Second Printing

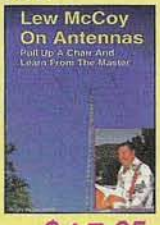


An authoritative book on the design, construction, characteristics and applications of quad antennas.

Order No. QUAD $15.95

McCoy on Antennas

by Lew McCoy, W1ICP

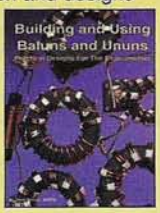


Unlike many technical publications, Lew presents his invaluable antenna information in a casual, non-intimidating way for anyone!

Order No. MCCOY $15.95

Building and Using Baluns and Ununs

by Jerry Sevick, W2FMI



This volume is the source for the latest information and designs on transmission line transformer theory. Discover new applications for dipoles, yagis, log periodics, beverages, antenna tuners, and countless other examples.

Order No. BALUN . . . $19.95

The Vertical Antenna Handbook

by *Paul Lee, N6PL*

Learn basic theory and practice of the vertical antenna. Discover easy-to-build construction projects.

Order No. VAH..... $9.95

Keys, Keys, Keys

by Dave Ingram, K4TWJ

You'll enjoy nostalgia with this visual celebration of amateur radio's favorite accessory. This book is full of pictures and historical insight.

Order No. KEYS $9.95

Getting Started Videos - "How-To," Tips, Techniques & More!

Ham Radio Horizons: The Video . . *Order No. VHOR*
Getting Started in VHF . . *Order No. VVHF*
Getting Started in Ham Radio . . *Order No. VHR*
Getting Started in DXing . . *Order No. VDX*
Getting Started in Packet Radio . . *Order No. VPAC*
Getting Started in Amateur Satellites . . *Order No. VSAT*
Getting Started in Contesting . . *Order No. VCON*

Only $19.95 each
Buy more and save!
Buy 2 or 3 for $17.95; Buy 4 to 6 for $15.95
Buy all 7 for your Club for only $99.95

Name _____ Callsign _____

Street Address _____

City _____ State _____ Zip _____

Qty	Item #	Description	Price	Total Price
U.S. and possessions - add $4 shipping/handling. *FREE S/H on orders $50 and over. Foreign - shipping/handling charges are calculated by order weight & destination. *A $4 credit will be applied for Foreign orders over $50.			Shipping/Handling	
			Total	

Method of payment ☐ Check ☐ Money Order ☐ Visa ☐ MasterCard ☐ Discover ☐ American Express

Credit Card No. _____ Expiration date _____

CQ Communications, Inc., 25 Newbridge Rd., Hicksville, NY 11801/516-681-2922; Fax 516-681-2926

<http://www.wwd.net/user/syrinix/ares.html>. Read our newsletter, "Hello Radio," at: <http://wwwwwd.net/user/wn8f>.

OH, Triple States Radio Amateur Club: Operates over a wide area with members in 50 states & 3 foreign countries. Meets 2nd Saturday of the month at 1 p.m. at Citzens Saving Bank, Colerain, OH, on Rte 250. Features Web 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, DXpeditions. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: lambda-arc@geocities.com.

TX, Greater Houston Area, Brazos Valley ARC: Meets 1st Thursday of each month at 7:30 p.m. at Sugar Land Community Center, 226, Matlage Way, Sugar Land, TX (across street from the Main Post Office). Talk in frequencies are 145.46 - (PL 123) and 444.55 + (PL 103). For info, contact B-VARC, Box 1630, Missouri City, TX 77459-1630; Irv Smith, KK5QQ, (281) 437-4803. <http://hal-pc.org/~bvarc>, <bvarc@hal-pc.org>.

UT, Rocky Mountain Radio Association (RMRA): Offers Utah, Wasatch Front, unique UHF to 6, UHF to 2, and UHF to HF remote gateways. Net Thursday at 9 p.m. on 447.900 PL 114.8 UHF/6-meter gateway open 24 hours on 448.700 PL 114.8. Visit Web site at <www.inconnect.com/~rmra>; or e-mail: <rmra@inconnect.com> for more info.

VA, Alexandria, Mt. Vernon ARC (K4US, MVARC): Meets 2nd Thursday of every month (except Dec.), 7:30 p.m. at Mt. Vernon Governmental Center, 2511 Parkers Ln., Alexandria, VA. Repeater frequency is 146.655. If interested, write to P.O. Box 7234, Alexandria, VA 22307, or contact Bob, KT4KS, at (703) 765-2313.

WV, Plateau Amateur Radio Association (PARA), Oak Hill, WV: Meetings held 1st Tuesday of every month, 7:30 p.m. New River Pawn Shop basement, 328 Main Street, Oak Hill, WV. Mailing address: PARA, P.O. Box 96, Fayetteville, WV 25840. Repeaters are 146.790-; 147.075- and 443.300+. For more info, contact Juddie Burgess, KC8CON, Secretary, at <kc8con@usa.net>.

Exam Sessions

CA, 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, Clearwater: Exams held 2nd Monday of each month (except December) at 7 p.m. at the Salvation Army at 1625 North Belcher Rd. For more info, contact John Townsley, AE4GB, at (727) 376-6705, e-mail: <ae4gb@gte.net>, or Mike Branda, K4HN, e-mail: <k4hn@amsat.org>. Paul E. Knupke, Jr., KR4YL <pk@ij.net>.

FL, Englewood: ARRL exams held 3rd Saturday of each month, 9:30 a.m., Englewood Chamber of Commerce Building, 601 South Indiana Ave., Englewood. Two-day advance reservation required. For info and reservations, call Jack, W4JS, at (941) 475-1929.

FL, Highlands County: Exams held 4th Tuesday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Walk-ins welcome. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio @strato.net>.

IN, Evansville: Exams held once a month on a Saturday morning starting at 9 a.m., local time at Evansville Red Cross, 111 Diamond Ave., Evansville, IN. No pre-registration for sessions. For more info, call Terry Brooks, AA9MM, at (812) 421-9135. (Exam dates: 4/24 (ARRL Nat'l Exam Day), 6/19, 7/31, 8/28, 9/25 (ARRL Nat'l Exam Day), 10/30, and 12/04).

NC, 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, at <kc4jkw@gibralter.net> or Juan Lopez, AC6ZM, at <lopezfam@coastalnet.com>, or visit our Web site at: <http://www.qsl.net/wd4fvo>.

NC, Wilmington: Azalea Coast Amateur Radio Club, VE testing sessions 2nd Saturday of even numbered months at UNCW Morton Hall at 10 a.m. All persons wishing to take amateur radio tests, please arrive before 10 a.m. Test candidates only. For further info, call (910) 791-1566.

NJ, The Garden State Association: Exams are on the 2nd Wednesday of every month at the MARS station at 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>.

OH, Cincinnati, OH-KY-IN Amateur Radio Society: Will offer exams in Cincinnati, OH, on Saturday, May 8th, at Salem Presbyterian Church in Western Hills. The church is located at intersection of Mozart and Higbee, just behind the White Castle restaurant at Harrison and Boudinot. Novice through Extra exams will be offered and will start promptly at noon. Walk-ins accepted, but pre-registration is appreciated as it speeds up registration process. For advance registration, send completed FCC 610 form and a check or money order payable to OH-KY-IN A.R.S. in the amount of $6.45, along with a copy of all certificates of successful completion and your current license (if any) to: Bill Simpson, KI4QJ, 10743 Palestine Dr., Union, KY 41097. For more info, call Carol Hugentober, K8DHK, at (513) 661-5323; E-mail <k8dhk@juno.com>; Web site: <www.qsl.net/k8sch>.

OH, Cleveland Area Cuyahoga Amateur Radio Club: Holds exam sessions on 2nd Sunday of each odd-numbered month (except May), at the Olde Independence Town Hall, 6652 Brecksville Rd. (Rte 21), Independence, OH. Sessions start 9 a.m. Fee is $6.95 and a valid ID and copy of your FCC license is required (if you are already licensed). For more info, contact Gary Dewey, NI8Z, at (216) 642-1399 or at <gdewey@en.com>.

PA, Monessen Amateur Radio Club: Test session 1st Sat. of even months (Feb, Apr, Jun, etc.) 10 a.m. at New Eagle Boro Bldg. Main St., New Eagle, PA. Walk-ins welcome but pre-registration preferred. For more info, contact Allan, N3UML, at (724) 852-6449, P.O. Box 26, Sycamore, PA 15364.

PA, Philadelphia: The Philmont Mobile Radio Club sponsors exams on 1st non-holiday Thursday of each month at Franklin Institute, 20th and Ben Franklin Pkwy, Philadelphia, PA. Walk-ins welcome. Exams start at 6:30 p.m. For more info, contact, Dusty Rhoades, ND3Q, at (215) 879-0505.

TX, Garland Area: Test sessions 4th Thursday each month except November. Exams begin promptly at 7:30 p.m. at Austin Street Church of Christ, 800 Austin St., Garland, TX. Contact W. H. (Bill) Reynolds, K8DNE, at (972) 475-9407 for recorded session information, or send e-mail to <k8dne@arrl.net>.

TX, Houston: Meets 2nd Tuesday of each month, 6:30 p.m. Strake Jesuit High School. Bellair @ S. Gessner (SW Houston) Pre-registration requested, walk-ins accepted. Sponsored by Brazos Valley ARC (B-VARC). Call Cass Germany, KG5IT, at (713) 682-6897; E-mail: <cassg@hal-pc.org>.

Personal Web Site Listings

"The Radio Picture Archive," URL: <http:// www.e-etc.com/rpa> (corrected). Speciality collection of pictures of radios.

"Telegraph Key/Museum/Collector's Guide" URL: <http://w1tp.com>. Collector of telegraph keys, old radios, microphones & apparatus history, appraisals, buying, trading.

Commercial Web Site Listings

Byers Chassis Kits: Aluminum chassis and cabinets kits, VHF & UHF antennas and parts. Catalog: Callbook address. E-mail: <k3iwk@herd.net>; <http://herd.net/byerschassiskits>.

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>.

KMA Antennas: VHF, UHF, HF log periodics, Yagis, and unique 6-meter antennas. Custom designs for commercial and private use also avaliable. Please mention *CQ VHF* when you visit <www.qsl. net/w4kma>.

MICRO COMMANDER

WORLD'S SMALLEST HIGH-POWER DUAL-BAND MOBILE!

Another Engineering Breakthrough from Yaesu : the FT-90R! Big Power, Big Performance, Micro-Miniature Size!

Actual Size

Features

- Frequency Coverage:
  RX : 100~230 MHz, 300~530 MHz,
  810~999.975 MHz (Cellular Blocked)
  TX : 144-146 MHz or 144-148 MHz (144 MHz)
  430-440 MHz or 430-450 MHz (430 MHz)
- 50 Watts Power Output (430 MHz: 35W)
- Ultra Compact: 100 mm x 30 mm x 138 mm WHD (3.9" x 1.2" x 5.4")
- AM Aircraft Receive
- Built-In CTCSS/DCS Encoder/Decoders
- Selectable TX Power: HIGH (50W), MID1 (20W), MID2 (10W) and LOW (5W)
- Programmable VFO Steps: 5/10/12.5/15/20/25/50 kHz per Step
- 186 Memories with 7-Character Alpha/Numeric Labels
- Direct Keypad Frequency Entry via MH-36A6J DTMF Microphone
- Smart Search™ Automatic Memory Loading
- Programmable Front Panel/Microphone Key Functions
- Battery Voltage Meter
- Auto-Range Transponder System (ARTS™)
- TX Time-Out Timer (TOT)
- Automatic Power-Off Battery Saver (APO)
- Remote-Head Operation using Optional YSK-90 Separation Kit
- 16-Digit 8-Memory DTMF Autodialer (requires MH-36A6J Mic)
- ADMS Windows™ PC Programmable
- Automatic Repeater Shift
- 1200/9600 bps Packet Compatible
- RF-Level Squelch for Quiet Monitoring of Busy Channels
- DCS Code # Search
- Versatile Scanning Features
- Priority Channel Monitoring
- Menu for Feature Customization
- Adjustable Display Brightness and Contrast
- Aluminum Diecast Chassis with Cooling Fan

MICRO COMMANDER

FT-90R

VHF/UHF Dual Band FM Transceiver

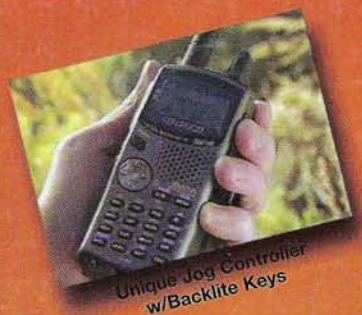
YAESU

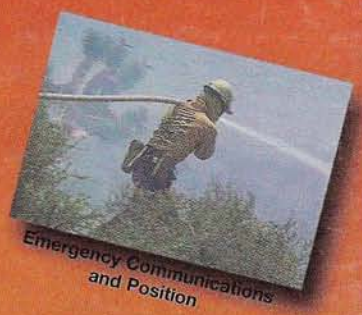
...leading the way.SM

For the latest news, hottest products:
Visit us on the Internet! http://www.yaesu.com

U.S. version includes MH-36A6J DTMF Microphone.

TH-D7A
DATA COMMUNICATOR
A NEW WORLD OF AMATEUR COMMUNICATIONS


Unique Jog Controller w/Backlite Keys


Emergency Communications and Position

Grid Square/Distance/Direction Information

Monitor DX Packet Clusters

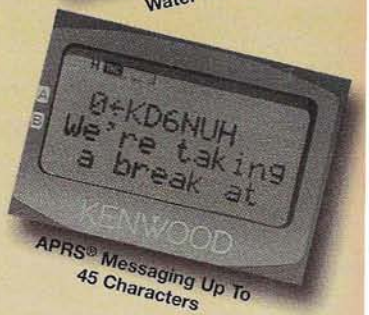

Complete Line of Accessories


PC Connectivity Used For Programming/APRS®/Packet


Advanced VC-H1 Controller

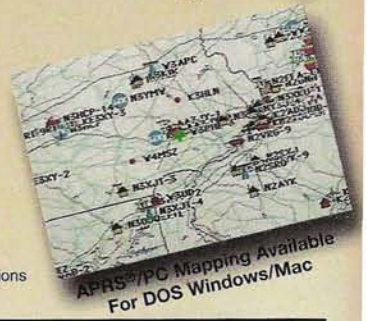

MIL-STD 810 C/D/E Water Resistance

Weather Station & PHG Data Reception



APRS® Messaging Up To 45 Characters


Remote Control HF Operation w/SkyCommand


APRS®/PC Mapping Available For DOS Windows/Mac

- FM dual-band (144MHz/440MHz) hand held
- 5.5 Watts @ 13.6 volts
- 200 memory channels w/8 alpha display
- Built-in CTCSS encode and decode
- Built-in 1200/9600bps TNC (AX.25 protocol)
- Unique cursor key for easy menu navigation
- Built-in APRS® (Automatic Position Reporting System) software
- GPS interface for position/directional data (NMEA-0813)
- Manual input of latitude/longitude (No GPS required)
- Large 12 digit x3 line dot matrix display
- 16 backlit keys (laser cut from inside)
- Dual RX on the same band for voice and data (VHF only)
- PC Programmable for frequency and name (PG-4W required)

- 16-digit 10-channel DTMF memory
- SkyCommand System (KSS) II for remote control of fixed HF transceivers
- Monitor DX Clusters
- DTMF remote control (TM-742A/TM-V7A)
- Dual receive on same band V+V/V+U
- AIP (intermod rejection)
- Free Operation manual at ftp://ftp.kenwood.net

ISO 9001
JQA-1205
Communications Equipment Division
Kenwood Corporation
ISO9001 certification

KENWOOD
Amateur Radio Products Group

KENWOOD COMMUNICATIONS CORPORATION
AMATEUR RADIO PRODUCTS GROUP
P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745, U.S.A.
Customer Support/Brochures (310) 639-5300 99ARD-1888/#050399

INTERNET
Kenwood News & Products
http://www.kenwood.net
Kenwood Bulletins
ftp://ftp.kenwood.net