Official Journal of
ARRL
The national association for AMATEUR RADIO

# QST

devoted entirely to
# AMATEUR RADIO

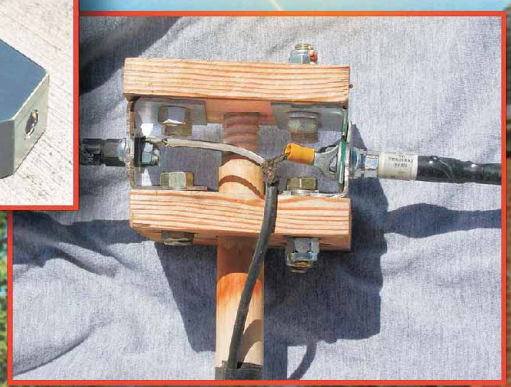
May 2003

## QST reviews

**Yaesu FT-897**
all-mode transceiver

**SteppIR** 3-element
Yagi antenna

May
Antenna
Issue



**IRLP—linking repeaters via the Internet**

**A Ham's Guide to London and the UK**

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# New IC-R5

Get winning performance with ICOM's new IC-R5. Crisp, clear audio. Super wide tuning range. A large, easy-to-read LCD display with the visual information you need – like operating status, signal strength, battery indicator, and alphanumeric naming for the 1250 memory channels (including 200 auto-write scan memories, and 25 scan edge pairs). Weather Alert keeps you informed of any weather emergencies. All in a compact, weather resistant package. ICOM. Setting a new standard in monitoring technology. See your authorized ICOM dealer today and join the winning team.

# Winning Performance!

**Wide Band Receive** 495 kHz - 1309.995 MHz*

AM/FM/WFM. Preprogrammed TV and HOT 100 Shortwave memories. Listen to AM & FM broadcast radio stations, police, fire, military, aircraft, various amateur bands, and more.

**Weather Alert** A first in handheld receivers!

The weather alert function helps keep you informed of any weather emergencies, so you can respond fast. Great for when you're out in the field! (USA version only)

**1250 Memory Channels** With alphanumeric naming

1000 memory, 25 scan edge pairs, 200 auto-write scan memory channels (Max.100 x 18 banks). Quickly tune to your favorite frequencies!

download frequencies right from the web

www.icomreceivers.com

**AM/FM/WFM**

**Large Backlit Display**
Shows the receive frequency, battery indicator, relative signal strength, etc...

**PC Programmable**
Connect to your PC for programming & cloning

Optional software (CS-R5) & cable (OPC-474) are required. USB type cable (OPC-478U) is also available.

**Rugged Construction**
Weather resistant construction makes the 'R5 great for active outdoor operation

**Large Function Keys**
For user friendly operation

**Internal Bar Antenna**
For improved AM sensitivity


**External DC Jack**
For simultaneous charging and AC operation

**Large Speaker**
For crisp, clear audio

**Small, Take-Anywhere Size**
Dimensions: 2 1/4"W x 3 3/8"H x 1"D
Weight: 6 oz. approx.

## IC-R5. Join the winning team.

100 kHz - 1309.995 MHz* • 1250 Memory Channels with Alphanumeric Naming • CTCSS & DTCS Decoder • Weather Alert • External Power Terminal • Internal Bar Antenna • Ni-Cd Power • Weather Resistant Construction • Auto Squelch • PC Programmable (Optional Equip. Req.)

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# The Ultimate Portable QRP Rig!


## Why do we call the '703 the ultimate portable QRP rig?

- **IC-706MKIIG Operations.** Anyone who has a '706 will know how to operate without the manual!
- **HF or HF & 6M only.** Icom's engineers focused on the bands that really mean the most to QRP operators. *A VHF/UHF rig is called a HT!*
- **Internal Antenna Tuner.** 160-10M or 160-6M, depending on the version. Internal, automatic and designed with latching relays so no current draw when the match is achieved.
- **DSP.** Thats right, Automatic Notch and Noise Reduction is included.
- **Smart Power Mode.** The '703 is one smart radio! It knows when to throttle back the current to prolong the life of your battery.
- **Low Current Consumption.** This QRP rig will rival some handheld radios, as the current drain is as low as 300mA when on 9.6VDC
- **CW Memory Keyer.** Contest QRP is so sweet with the internal CW Memory Keyer. 3 memories capable of holding 50 characters each.
- **Big Ears.** Sensitivity of 0.16uV at 10dB S/N rivals some of the big rigs. This helps compensate for antenna compromises when you're in the field!
- **Cold Hands.** Don't worry, the '703 comes with the TXCO, so your frequency will not drift when you touch the knob with cold hands. Ready for outdoors!
- **No Assembly Required.** The '703 is ready to go when you are!
- **Way Cool Optional Backpack.** A must have accessory! So cool, '706 owners will have to own one!

## *Call your authorized Icom dealer for details!*

Why not? You deserve it!

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# hy-gain Rotators

## . . . the first choice of hams around the world!

**Hy-Gain rotators are the first choice of hams around the world!**

*Hy-Gain's world famous Bell Shaped Rotator™ design is the standard that other rotators are measured against.*

*Its bell construction gives you total weather protection for super reliable operation. Its super heavy duty steel gear drive gives you years of superior and trouble-free performance. Many Hy-Gain rotators still provide excellent service after over 25 years of outstanding performance.*

*The last thing you want to fall apart is your rotator that's mounted on the top of your tower. You won't make any compromises when you buy and install high quality Hy-Gain rotators.*

*And we're the only manufacturer to offer a full line of rotators that are completely MADE IN THE USA.*

**HAM-IV, $559.95.** *The heavy duty Ham-IV is the most popular rotator in the world!* It is designed for medium size antenna arrays up to 15 square feet wind load area when mounted in-tower, or 7.5 square feet when mast mounted with an optional lower mast bracket. New alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. New low temperature grease permits normal operation down to -30 degrees Fahrenheit. New wire-wound potentiometer gives reliable and precision directional indication, new ferrite beads reduce RF susceptibility, new Cinch plug connector plus 8-pin plug at control box (no screwdriver needed). Dual 98 ball bearing race for load bearing strength. Strong electric locking steel wedge brake prevents wind induced antenna movement. Easy-to-use Control Box has illuminated directional meter with North or South center of rotation scale, separate snap-action brake and rotation switches. Uses low voltage control for safe operation. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $13^{1}/_{2}$Hx8D inches.

**T-2X, $649.95.** *Extra heavy duty Tailtwister antenna rotator!* For large antennas up to 20 square feet wind load when mounted in-tower, or 10 square feet when mast mounted with optional support bracket. Triple 138 ball bearing race, strong electric locking steel wedge brake. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $14^{1}/_{16}$Hx$9^{3}/_{16}$D in.

**CD-45II, $389.95.** *Medium duty antenna rotator.* Handles antenna arrays up to 8.5 square feet windload area when mounted in-tower, or 5 square feet when mast mounted with supplied lower support. Dual 48 ball bearing race, disc brake system. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches with disc brake release. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty lower mast support, Rotator size is $17^{3}/_{8}$Hx8 D inches.

**AR-40, $289.95.** *Lightweight antenna rotator.* Handles smaller ham antennas and large TV/FM antennas up to 3.0 square feet windload area when mounted in-tower, or 1.5 square feet when mast mounted using the supplied lower support bracket. Dual 12 ball bearing race, disc brake system. Silent, automatic control box -- just dial and touch for desired direction. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty mast support. Rotator size is $17^{3}/_{8}$Hx8D inches.

***Call your dealer for your best price!***

| *Rotator Specifications* | T2X | HAM-IV | CD-45II | AR-40 |
|---|---|---|---|---|
| Wind Load capacity (inside tower) | 20 sq. ft. | 15 sq. ft. | 8.5 sq. ft. | 3.0 sq. ft. |
| Wind Load (with mast adapter) | 10 sq. ft. | 7.5 sq. ft. | 5.0 sq. ft. | 1.5 sq. ft. |
| Turning Power (in pounds) | 1000 | 800 | 600 | 350 |
| Brake Power (in pounds) | 9000 | 5000 | 800 | 450 |
| Brake Construction | Electric wedge | Electric wedge | Disc brake | Disc brake |
| Bearing Assembly/How many | Tripl race/138 | Dual Race/96 | Dual race/48 | Dual race/12 |
| Mounting Hardware | Clamp plate | Clamp plate | Clamp plate | Clamp plate |
| Control Cable Conductors | 8 | 8 | 8 | 5 |
| Shipping Weight (pounds) | 28 | 24 | 22 | 14 |
| Effective Moment (in tower) | 3400 ft/lbs. | 2800 ft/lbs. | 1200 ft/lbs. | 300 ft/lbs. |

**HAM IV**

**$559.95**

Suggested Retail

**T-2X**

**$649.95**

Suggested Retail

**CD-45II**

**$389.95**

Suggested Retail

**AR-40**

**$289.95**

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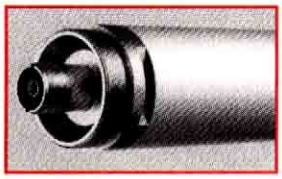
• Wide-band Performance • Factory Adjusted–No Tuning Required • Highest Gain
• UPS Shippable • High Wind Rating • Fiberglass Radome • DC Grounded • Stainless Hardware

## X500HA (UHF-Conn.)
## X500HNA (Type-N Conn.)

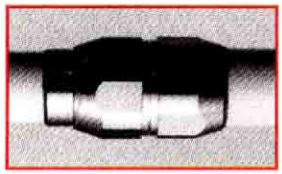
**Dayton Booth 365**

## Ruggedized Base/Repeater Antenna



COAX CONNECTION AT BASE END

HEAVY DUTY BASE/ RADIAL ASSEMBLY



STRONG JOINT COUPLINGS

### X50NA

The X50NA is an excellent choice where ruggedness is required in a medium–gain, dual-band, base/repeater application.

***Features***

- Wide frequency bandwidth
- Heavy duty fiberglass radome
- Stainless steel mounting hardware and radials
- Type–N Cable connection
- Compact size for easy mounting/ installation

***Specifications:***

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 135 MPH (no ice)
Height: 5.6 feet

### X500HNA

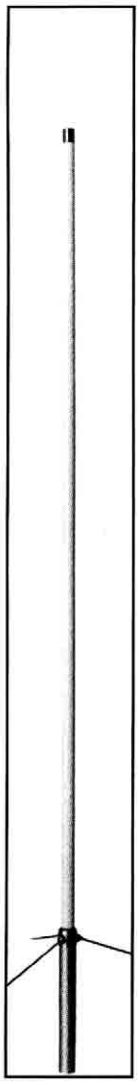
Diamond Antenna's best base station repeater antenna. Designed for strength and performance, the X500HNA is pretuned to achieve maximum gain in both the 2m and 70cm amateur bands.

***Features***

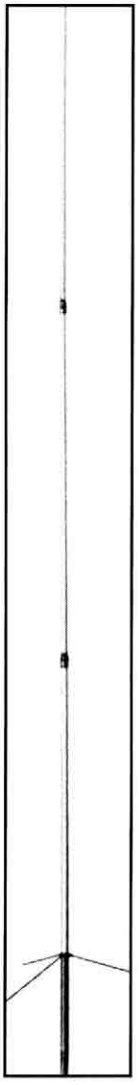
- Heavy duty fiberglass radome
- Overlapping outer shells for added strength
- Stainless steel mounting hardware and radials
- Strong–waterproof joint couplings
- Type–N Cable connection
- Wide band performance

***Specifications:***

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 90 MPH (no ice)
Height: 17.8 feet



***X50NA***



***X500HNA***

## DIAMOND Mono-Band Base/Repeater Antennas

| MODEL | BAND (MHz) | WATTS | CONN. | HT. FT. | RATED WIND MPH (No. Ice) |
|---|---|---|---|---|---|
| CP22E [1] | 144 | 200 | UHF | 9.0 | 90 |
| DPGH62 [1,6] | 50 | 200 | UHF | 21.0 | 78 |
| F22A | 144 | 200 | UHF | 10.5 | 112 |
| F23A | 144 | 200 | UHF | 15.0 | 90 |
| F718A [2] | 440 | 250 | N | 15.0 | 90 |

## DIAMOND Dual-Band Base/Repeater Antennas

| MODEL | BAND (MHz) | WATTS | CONN. | HT. FT. | RATED WIND MPH (No. Ice) |
|---|---|---|---|---|---|
| X50A | 144/440 | 200 | UHF | 5.6 | 135 |
| X50NA | 144/440 | 200 | N | 5.6 | 135 |
| X200A | 144/440 | 200 | UHF | 8.3 | 112 |
| X510NA [3] | 144/440 | 200 | N | 17.2 | 90 |
| X510MA | 144/440 | 200 | UHF | 17.2 | 90 |
| X500HNA | 144/440 | 200 | N | 17.8 | 90+ |
| X700HNA | 144/440 | 200 | N | 24.0 | 90 |
| X2200A | 144/222 | 150 | UHF | 11.5 | 112 |
| U200 | 440/1240 | 100 | N | 5.9 | 135 |

## DIAMOND Tri-Band Base/Repeater Antennas

| MODEL | BAND (MHz) | WATTS | CONN. | HT. FT. | RATED WIND MPH (No. Ice) |
|---|---|---|---|---|---|
| U5000A | 144/440/1240 | 100 | N | 5.9 | 135 |
| V2000A [4,6] | 52/144/440 | 150 | UHF | 8.3 | 110 |
| X3200A [5] | 146/222/440 | 100/200 | UHF | 10.5 | 112 |
| X6000A | 144/440/1240 | 100/60 | N | 10.5 | 112 |

1 Heavy duty aluminum construction.
2 F-718A: 440-450MHz., F718L: 420-430MHz.
3 X510NJ: 144-147/430-440MHz.
4 1/4λ. rated in dBi. Most requirement: 1.4"-2.4".
5 2m: 146-148; 100 watts
6 52-54MHz. only; DPGH62 adjustable from 50-54MHz.

BAND: 144=144-148MHz., 222=222-225MHz., 420=420-430MHz.,430=430-440MHz., 440=440 450MHz., 1240=1240-1300MHz.

**www.rfparts.com/diamond**
**Diamond Antenna Division of RF Parts Co.** Tel: (760) 744-0900 • FAX: (760) 744-1943 • E-mail: rfp@rfparts.com

QST

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# QST Workbench



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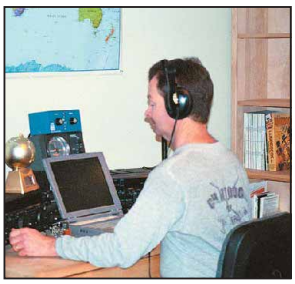

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# Operating



# Departments




**Our Cover**
This month's issue features three antennas you can build—a portable HF dipole that doesn't require trees, a portable 15-meter beam and a versatile VHF/UHF Discone. The fun begins on page 33. Photos courtesy Ron Herring, W7HD, and Allen Baker, KG4JJH.


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## See it at Hamvention 2003!

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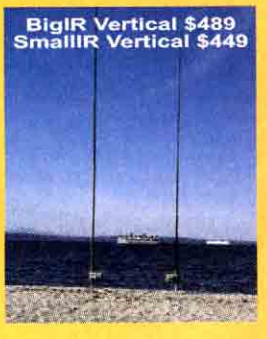



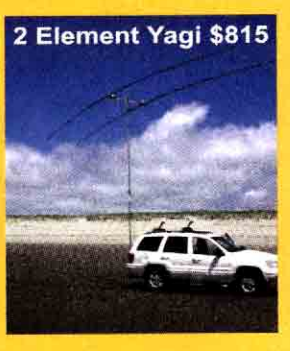


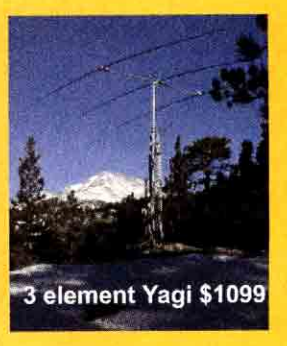


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Time marches on and your friends at Kenwood continue to build outstanding products with unparalleled performance and great value. It's not too late to own an "HF Legend," because we are still building them today.


TS-50S Compact Mobile


TS-870S 100% Digital IF DSP

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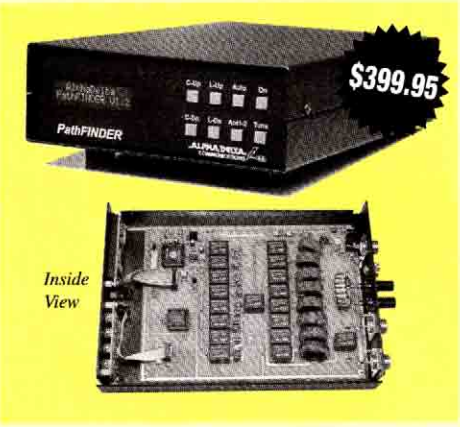
# *At Alpha Delta we do it Digitally!*

## *Tune it!*
## *the* ***PathFINDER*** AutoTuner




**All-in-One Features for a Clean Desktop: Digital AutoTuner, Complete Digital Readout, Front Panel Switched Outputs for Wire and Coax Fed Antennas! Eliminate Separate Boxes.**

The Alpha Delta Model ***PathFINDER*** Digital AutoTuner is the **ONLY** autotuner on the market that has front panel switching outputs and built-in circuitry for Hi-Z (wire type antennas) and Low-Z (coax fed antennas) and full Digital Readout! It is a true multi-function, all-in-one instrument designed for operating convenience.

The ***PathFINDER*** provides continuous coverage tuning from 1.8 thru 30 MHz + 6 meters. As a result, it is ideal for Amateur Radio as well as MARS, CAP and Commercial & Government uses. It runs totally under microprocessor control with an average tuning time of 3–4 seconds.

The Digital Readout is a precision Multi-function Bar Graph and Numerical Display that simultaneously reads Power (5 – 200 Watts), peak and average, VSWR and all tuner functions. The Digital Meter provides 5% accuracy plus 1 digit of ANY reading, not just full scale. In addition to the Digital Readout, there are Audio Beep responses for VSWR and various functions are provided for the visually impaired. Interface cables for popular transceivers are available which allow low power tune-up.

Huge, 10:1 SWR tuning range on HF and 3:1 on 6 meters. **Much wider than typical built-in transceiver tuners**. The ***PathFINDER*** will match coax outputs from 6 thru 800 ohms and long wire and balanced outputs from 24 thru 3200 ohms (HF). This wide range allows use of a wide variety of antennas.

Full 200 Watt Power Rating on HF, and 100 Watts 6-meters with a 50% duty cycle. Requires 12V DC @ 1 AMP – ideal for Base/Portable

## *Switch it!*
## *the* ***PathMINDER*** Coaxial Switch


**Alpha Delta's *Path*MINDER Digital 6-Position Coaxial Desktop Switch – the ultimate Microprocessor Controlled accessory for antenna switching, automatic station protection and operator convenience.**

An **Internal Microprocessor** and RF sensors protect against accidental "HOT SWITCHING" while transmitting. Hot switching can cause equipment or relay damage. A yellow "alarm" LED activates and flashes if the operator tries to switch antennas while transmitting, The ***Path*MINDER** will not switch when RF (above 50 Watts) is present.

**Three programmable operational modes provide the Ultimate in Station Protection.** The first mode is a standard coax switch with default to port 6 if power is removed or fails. All ports can also be manually grounded at any time, in any mode.

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"Of, by, and for the radio amateur," the ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A *bona fide* interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

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# "IT SEEMS TO US..."

## Getting Together

One of the great things about Amateur Radio is that it gives you the opportunity to meet people you may never have the opportunity to see in person. Even a brief on-the-air contact affirms a common bond.

After 40 years and literally hundreds of thousands of contacts I still thrill at the thought that at a particular instant in time someone in Sofia, or Novosibirsk, or whatever distant place you might care to name decided to tune his or her radio equipment to the same frequency I did and talk to whomever happened to turn up. Years ago a since-departed ARRL staff member who was not a DXer used to try to poke fun at DXing by saying that he could work "telephone DXCC" just by dialing random telephone numbers and talking to whomever picked up the phone at the other end. You can imagine the reaction he would have gotten had he tried. Today the same is true of the Internet. It's a great medium for communicating with people you already know or with whom you share another interest, but you would be foolish to trust a total stranger you met on the Internet to the same extent that you would another radio amateur you met on the air. Even if you could verify that they are who they claim to be, the sense of community, of shared interests and values, just isn't there.

Of course, it's even more special when you get to meet in person someone you've only worked on the air. More such meetings have occurred at the Dayton Hamvention® than anywhere else on Earth. Reflecting the growing diversity of radio amateurs' interests, Dayton has become the watering hole for many if not most of Amateur Radio's subcultures. Our next opportunity to make and renew Hamvention friendships is coming up, on the weekend of May 16-18. Given the world situation the attendance from overseas is likely to be down this year, but most of us here in the US (Dayton is within driving distance of a majority of the US population, which is one of its secrets of success) ought to be able to get there.

Whether you can make Dayton or not, you should have the weekend of June 20-22 marked on your calendar. That's the ARRL National Convention in Arlington, Texas, in the heart of the Dallas/Fort Worth Metroplex. The organizers of the annual Ham-Com always put together a great show but they really go out of their way for a National! This is the third time since 1989 that Ham-Com has been awarded the National Convention, so they have plenty of experience. Nationals recently have been held every three years instead of annually, so if you miss it this year you may have to wait a while for the next opportunity. You can find more information in the article beginning on page 46 of this issue, or visit **www.hamcom.org** for the latest news or to pre-register.

There are plenty of other opportunities closer to home for you to get together with your ham colleagues. The ARRL Web site has an up-to-date searchable database for hamfests and conventions. These events, many of which are growing in size despite the general condition of the economy, can be regional or national specialty conventions as well as the more traditional swap meets. At a convention that emphasizes its program and not just its commercial exhibits and flea market, the quality of the presentations may surprise you and may get your enthusiasm rekindled and your creative juices flowing again.

Another good way to get some "face time" with kindred spirits is to attend meetings of your local club. If you're like many long-time ARRL members you may have fallen out of the habit of going to local meetings. Field Day is just around the corner, so this is a good time for experienced hands to reintroduce themselves to their local clubs and offer their assistance. Club meetings are also a good way to get caught up on recent developments and to learn about public service communications activities.

As you strengthen your local relationships, don't miss any opportunities to do the same with your counterparts from other countries. In the past year I have been exceptionally fortunate, through a combination of IARU, ARRL and personal travel, to visit amateurs in Switzerland, the Czech Republic, Germany, Serbia, the Former Yugoslav Republic of Macedonia, Bosnia & Herzegovina and Armenia, as well as to attend the IARU Region 1 Conference in San Marino and the World Radiosport Team Championship in Finland. It has been my privilege to be able to get together with amateurs from more than 50 countries, and in several cases to see firsthand the extraordinary challenges they must overcome in order to pursue our shared passion for Amateur Radio. Part 97 of the FCC Rules calls for "continuation and extension of the amateur's unique ability to enhance international goodwill." With world events creating new barriers to human understanding it is more important than ever for each of us to answer the call.

*—David Sumner, K1ZZ*

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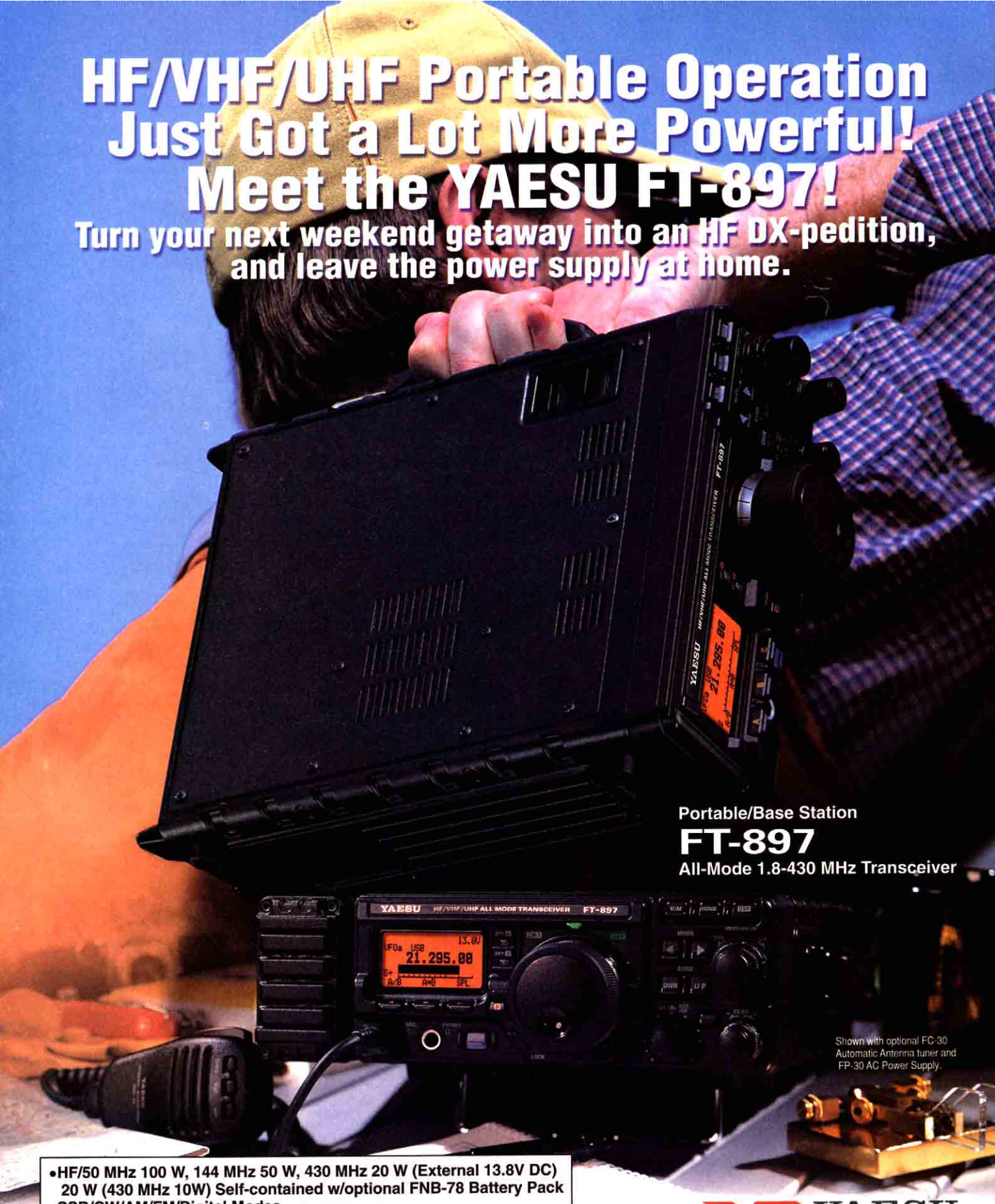


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# ARRL in ACTION

**YOUR membership at work**

By Dave Hassler, K7CCC, dhassler@arrl.org

## ARRL President Promotes Amateur Radio in Nation's Capital

ARRL President Jim Haynie, W5JBP, was in Washington the first week of March on a wide-ranging round of visits to government agencies and Capitol Hill on behalf of Amateur Radio. Haynie said he prefers to deal as directly as possible with the various departments and agencies that can affect Amateur Radio, and he left a copy of the *Amateur Radio Today* CD-ROM video presentation with everyone he called on. "The response [to the CD] has been outstanding," Haynie said.

Haynie stopped first at the FCC, meeting with Bill Cross, W3TN, who handles most of the FCC petitions involving Amateur Radio. They discussed proposals for new ham bands at 136 kHz and 5 MHz, and primary status at 2400 to 2402 MHz at the FCC Office of Engineering and Technology. Haynie also discussed unlicensed Part 15 devices proposed for use within amateur allocations. He then sat down with officials at the National Telecommunications and Information Administration (NTIA) to discuss questions NTIA raised late last year about the ARRL's 5 MHz band petition, a proposed worldwide "harmonized" 300 kHz allocation on 40 meters and the deployment of radio local-area network devices that could affect the amateur 5 GHz allocation.

Additionally, Haynie met with officials of the Federal Emergency Management Agency (FEMA), conferred with the staff of the ARRL's Washington, DC, office, and then met with AMSAT directors and representatives.

On Capitol Hill, Haynie met with legislative staffers of three members of the House Commerce Committee. He also stopped by to visit Rep Pete Sessions, a longtime friend and Amateur Radio supporter who, because of redistricting, now is Haynie's representative in Congress. Sessions is an original cosponsor of ARRL-initiated legislation to provide relief to hams prevented from installing outdoor antennas by private deed covenants, conditions and restrictions, known as CC&Rs.

While boosting Amateur Radio to various agencies in Washington, DC, ARRL President Jim Haynie, W5JBP (left), got a chance to meet with his own representative, Pete Sessions of Texas.

## Continuing Education Courses not only about EmComm

ARRL's Certification and Continuing Education Program sports as its flagship its emergency communications courses. But did you know that the C-CE Program offers a number of technically related courses, too? Elsewhere in this issue of *QST*, ARRL C-CE Coordinator Howard Robins, W1HSR, outlines the technical offerings of the program. C-CE courses take 20 to 25 hours to complete over an eight-week timeframe, although the antenna modeling course takes approximately 50 hours to complete.

Other technical courses include studies in RFI, HF digital modes, VHF/UHF work "beyond the repeater" and satellite communication. Courses in propagation studies (by Ian Poole, G3YWX, the 2002 Bill Orr Technical Writing Award winner), hands-on antenna building and ham radio troubleshooting are in the works. Students receive multi-media materials to enhance the learning process and each enrollee is assigned a volunteer mentor, someone who knows the subject inside and out, to provide guidance.

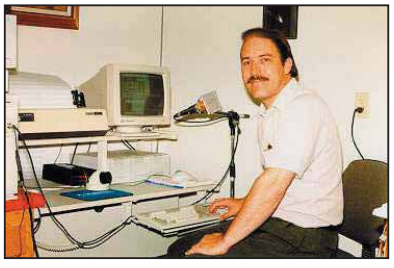
Be sure to check out Robins' article in this issue for an in-depth treatment of the C-CE Program, and don't forget to stop by the ARRL Web site for a look at the C-CE pages at **www.arrl.org/cce**.

## Digital Presentation at Georgia Tech Spurs Video Production

When is 30 more than 30? When *QEX* Editor Doug Smith, KF6DX, is video taped during a March 10 talk on new frontiers in ham radio technology at The Georgia Institute of Technology in Atlanta. Approximately 30 Amateur Radio operators gathered at Georgia Tech to hear Smith speak for 90 minutes on software-defined radio, digital voice and multimedia technology in ham radio. Larry Dodd, K4LED, videotaped the presentation and is producing an MPEG-format movie that he and Smith expect will soon be available from the Web, free for the downloading.

"I discussed the work of the ARRL Technology Task Force and its Digital Voice and Software Radio Working Groups," Smith said. "I illustrated state-of-the-art hardware and software, and what hams are doing with them and what the future holds." Speech coding, simultaneous data streams and the new DRM digital audio broadcast standard were all explained and demonstrated, followed by a question-and-answer session.

ARRL Southeastern Division Vice Director Sandy Donahue, W4RU, said the hams who attended from the Georgia Tech ARC, the campus IEEE chapter and the general Atlanta area were enthusiastic about the presentation and many carried it on to a local restaurant for several more hours of informal discussion. Donahue helped arrange for the presentation, hosted by GTARC president David Ziskind, KE4QLH.



Doug Smith, KF6DX, spoke to a group of Atlanta hams in March on the digital revolution in communication technology and how it may affect Amateur Radio. The presentation was filmed and will soon become an Internet-accessible video.

# Yes, You *Can* Talk Directly to Astronauts on the Radio!

Teachers at the International Technical Educators Association conference learned from ARRL Education Project Coordinator Jerry Hill, KH6HU, that it doesn't take a miracle for students in their classes to use Amateur Radio to talk with astronauts on the International Space Station. While working in the NASA/ARISS booth at the conference as the ARRL representative, Hill—a former industrial arts teacher—got to talk-up ham radio with his former colleagues.

The conference, held in Nashville, Tennessee March 13-15, welcomed about 5000 secondary-level teachers to a series of workshops and exhibits. Hill encouraged teachers to signup their schools for a future ARISS contact. "Once they understood why we [NASA and ARRL] were there, they got very excited and wanted their school to have that kind of opportunity," Hill said, adding that he also used the opportunity to talk to teachers about how Amateur Radio can be used as a valuable part of a technology curriculum.

"Amateur Radio covers many academic areas: math, physics, chemistry, geography, speech and communications, just to name a few," Hill pointed out. "We want to expose these teachers to the idea that Amateur Radio is an excellent educational resource."

Jerry Hill, KH6HU, and Ouppagarn Jeeraphanthu, E21AUD, met at the International Technical Educators Conference. Jeeraphanthu—a project coordinator with the Institute for the Promotion of Teaching Science and Technology in Bangkok, Thailand—saw Hill's call sign badge, introduced himself and the two technology-teaching hams struck up a conversation.

In addition to putting the finishing touches on the new curriculum for the ARRL Education and Technology Program, Hill traveled to Philadelphia for the National Science Teachers Association conference March 27-30. At the NSTA gathering, Hill teamed up with one of the Education and Technology Program teachers, Jim Kuhl, N2STK, of Central Square (NY) Middle School to help staff the NASA/ARISS booth.

# New Tech Pool Translated into Spanish

Spanish-speaking prospective hams in Puerto Rico now have an additional on-line resource to aid in studying for their FCC Amateur Radio Technician class exam. Puerto Rico Section Manager Victor Madera, KP4PQ, helped get the new Technician test pool translated and placed on the Puerto Rico Amateur Radio League Web site at **prarl.org/TechExam.html**. Both the new Technician test pool and a complete set of diagrams are freely downloadable in the PDF format. The new question pool goes into effect July 1, 2003.

"In 1994, after a scheme of illegal testing was discovered here, I started to investigate why people preferred improper means to get a license instead of taking the regular tests," Madera said. "The reason was mainly language difference. Today, thanks to the FCC and the exceptional help I received from ARRL, 90% of our new candidates can study for and take tests in Spanish."

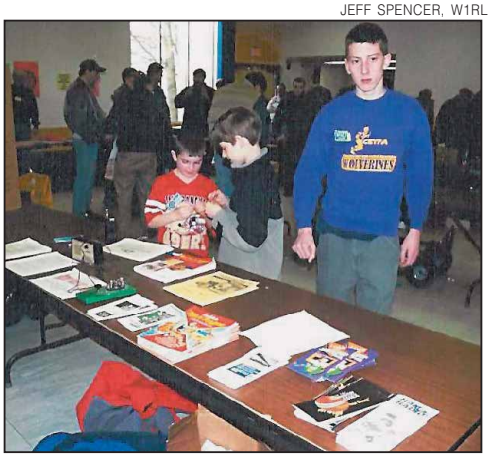
Working closely with ARRL Volunteer Examiner Coordinator Manager Bart Jahnke, W9JJ, through the mid 1990s, Madera prepared translations of the question pools with a special focus on Spanish as it is spoken in Puerto Rico. Terms that have no direct translation from English are emphasized and explained for the student. A 128-page study guide, similar to a Spanish version of *Now You're Talking!*, has been prepared to help budding hams. Madera noted that on-line practice exams are also available in Spanish for both Tech and General license classes at **prarl.lce.org**. He said that of the over 300 people who annually take the Tech and General exams through the Puerto Rico ARRL/VEC team, nearly all elect to take the Spanish versions of the tests. Practice exams for all three Amateur Radio license classes are also presented in English on the PRARL site.

# Vermont Ham Sets Out Special Kids Table

For the third year running, the Kids Table proved to be a popular fixture at the Northern Vermont Winter Hamfest and ARRL Vermont State Convention February 22, 2003. Jeff Spencer, W1RL, set up the display table in hope of attracting youngsters to the hobby. Aided in the setup and execution by his 15-year-old son Alex, N1ALX, and his 9-year-old son Colin, KB1GBF, Spencer spread out a variety of materials for young hopefuls, including the new *Leap Into Amateur Radio* flyer and a stack of the old Archie Amateur Radio comic books, which is no longer published. A code practice oscillator and a key were also on the table, along with other League publications and Vermont-specific information.

"We did have kids taking material," Jeff Spencer said. "Unfortunately, a lot of them are shy. They might hover around, but they are too shy to ask or chat with the other children." Several adults were also spotted around the hamfest towing out comic books with their treasures, presumably to pass off to their children or grandchildren. Adults who came without kids were also encouraged to take material from the Kids Table home to stimulate interest with their children on a one-on-one basis later.

JEFF SPENCER, W1RL



Colin Spencer, KB1GBF, his friend Chris Miller, and (right) Alex Spencer, N1ALX, staff the Kids Table February 22 at the Northern Vermont Winter Hamfest/ARRL Vermont State Convention.

ARRL Vermont Section Manager Paul N. Gayet, AA1SU, was also on hand at the hamfest, and noted that Spencer and his children always do a fine job putting the table together. "It is a real asset to the event and I hope that it returns next year," he said. "The attendees have gotten used to seeing it and stopping by." Setting up a Kids Table at a local hamfest is a breeze. If you or your club wants to put one together for a hamfest or convention, ARRL can help with materials and ideas. Also, visit **www.arrl.org/FandES/ead** on the Web for a list of Amateur Radio kids' activities, educational material and radio-related scouting information.

# Guide to ARRL Member Services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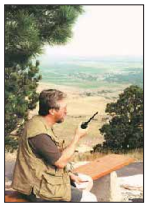



**www.arrl.org/services.html/** **860-594-0200**

## Technical and Regulatory Information Services

A wealth of problem-solving information is available to you on the ARRLWeb at **www.arrl.org/tis/**. Can't find the answer there? Call the Technical Information Service at 860-594-0214 from 9 AM to 4 PM Eastern Time, or e-mail **tis@arrl.org**.

Do you have a question about FCC Rules or local antenna restrictions? See the Regulatory Information Branch on the Web, call 860-594-0236 or e-mail **reginfo@arrl.org**.

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## ARRL News

The ARRL News service is the most credible source of news for the amateur community. Breaking stories are available on the ARRLWeb. You can also listen to ARRL Audio News on the Web, or by telephone at 860-594-0384. Have a news tip? E-mail **n1rl@arrl.org**.

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## Insurance

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## ARRL Foundation

This is your source for scholarships and other financial grant programs to support Amateur Radio. See **www.arrl.org/arrlf/** on the Web or call 860-594-0230.

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## Interested in Becoming a Ham?

Phone toll free 1-800-326-3942, or e-mail **newham@arrl.org**. We'll provide helpful advice on obtaining an Amateur Radio license. See **www.arrl.org/hamradio.html**.

## We're at *your* Service

ARRL Headquarters is open from 8 AM to 5 PM Eastern Time, Monday through Friday, except holidays. Call **toll free** to join the ARRL or order ARRL products: **1-888-277-5289** (US), M-F only, 8 AM to 8 PM Eastern Time.

If you're in Connecticut, stop by ARRL Headquarters for a visit and tour. Located at 225 Main St, Newington, CT 06111, HQ offers tours at 9, 10 and 11 AM, and 1, 2 and 3 PM Monday through Friday, except holidays. Bring your license and operate W1AW anytime between 10 AM and noon, and 1 to 3:45 PM.

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**Mary M. Hobart, K1MMH**
Chief Development Officer
**ARRL**
225 Main Street
Newington CT 06111-1494
**Telephone: 860-594-0397**
**Email: mhobart@arrl.org**


# ARRL Division Directors

As an ARRL member, you elect the directors and vice directors who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

### Atlantic Division

BERNIE FULLER, N3EFN*
17668 Price Rd, Saegertown, PA 16433
(814-763-1529); **n3efn@arrl.org**
*Vice Director*: Bill Edgar, N3LLR
22 Jackson Ave, Bradford, PA 16701
(814-362-1250); **n3llr@arrl.org**

### Central Division

GEORGE R. ISELY, W9GIG
736 Fellows St, St Charles, IL 60174
(630-584-3510); **w9gig@arrl.org**
*Vice Director*: Howard S. Huntington, K9KM
25350 N Marilyn Ln, Hawthorn Woods, IL 60047
(847-438-3452); **k9km@arrl.org**

### Dakota Division

JAY BELLOWS, KØQB
997 Portland Ave, St Paul, MN 55104
(651-238-4444); **k0qb@arrl.org**
*Vice Director:* Twila Greenheck, NØJPH
3333 Owasso Heights Rd, Shoreview, MN 55126
(651-483-1214); **n0jph@arrl.org**

### Delta Division

RICK RODERICK, K5UR*
PO Box 1463, Little Rock, AR 72203
(501-988-2527); **k5ur@arrl.org**
*Vice Director:* Henry R. Leggette, WD4Q
7335 Ginger Snap Cove, Memphis, TN
38125-4732 (901-757-0444); **wd4q@arrl.org**

### Great Lakes Division

JIM WEAVER, K8JE
5065 Bethany Rd, Mason, OH 45040-9660
(513-459-0142); **k8je@arrl.org**
*Vice Director:* Richard Mondro, W8FQT
800 Dover St, Dearborn Heights, MI 48127
(313-730-2111); **w8fqt@arrl.org**

*Executive Committee member

### Hudson Division

FRANK FALLON, N2FF
30 E Williston Ave, East Williston, NY 11596
(516-746-7652); **n2ff@arrl.org**
*Vice Director*: Stephen A. Mendelsohn, W2ML
318 New Milford Ave, Dumont, NJ 07628
(201-384-0570); **w2ml@arrl.org**

### Midwest Division

WADE WALSTROM, WØEJ
7431 Macon Dr, Cedar Rapids, IA 52411
(319-393-8982); **w0ej@arrl.org**
*Vice Director*: Bruce Frahm, KØBJ
PO Box DX, Colby, KS 67701
(785-462-7388); **k0bj@arrl.org**

### New England Division

TOM FRENAYE, K1KI*
PO Box J, West Suffield, CT 06093
(860-668-5444); **k1ki@arrl.org**
*Vice Director*: Mike Raisbeck, K1TWF
85 High St, Chelmsford, MA 01824
(978-250-1235); **k1twf@arrl.org**

### Northwestern Division

GREG MILNES, W7OZ
740 SE 24th Ave, Hillsboro, OR 97123-7286
(503-648-6990); **w7oz@arrl.org**
*Vice Director*: Jim Fenstermaker, K9JF
10312 NE 161st Ave, Vancouver, WA 98682
(360-256-1716); **k9jf@arrl.org**

### Pacific Division

BOB VALLIO, W6RGG
18655 Sheffield Rd, Castro Valley, CA 94546
(510-537-6704); **w6rgg@arrl.org**
*Vice Director:* Andy Oppel, N6AJO,
1308 Burbank St, Alameda, CA 94501-3946
(510-864-2299); **n6ajo@arrl.org**

### Roanoke Division

DENNIS BODSON, W4PWF*
233 N Columbus St, Arlington, VA 22203
(703-243-3743); **w4pwf@arrl.org**
*Vice Director*: Rev Leslie Shattuck, K4NK
2312 E Ashton St, Seneca, SC 29678
(864-882-3985); **k4nk@arrl.org**

### Rocky Mountain Division

WALT STINSON, WØCP
5295 E Evans Ave, Denver, CO 80222-5221
(303-770-3926); **w0cp@arrl.org**
*Vice Director*: Warren G. "Rev" Morton, WS7W
1341 Trojan Dr, Casper, WY 82609
(307-235-2799); **ws7w@arrl.org**

### Southeastern Division

FRANK M. BUTLER JR, W4RH
323 Elliott Rd SE, Ft Walton Beach, FL 32548
(850-244-5425); **w4rh@arrl.org**
*Vice Director*: Sandy Donahue, W4RU
222 Briarhill Ln, Atlanta, GA 30324
(404-315-1443); **w4ru@arrl.org**

### Southwestern Division

ART GODDARD, W6XD
2901 Palau Pl, Costa Mesa, CA 92626
(714-556-4396); **w6xd@arrl.org**
*Vice Director*: Tuck Miller, NZ6T
3122 E 2nd St, National City, CA 91950
(619-434-4211); **nz6t@arrl.org**

### West Gulf Division

COY C. DAY, N5OK
RR 1, Box 254, Union City, OK 73090-9726
(405-483-5632); **n5ok@arrl.org**
*Vice Director*: Dr David Woolweaver, K5RAV
2210 S 77 Sunshine Strip, Harlingen, TX 78550
(956-425-3128); **k5rav@arrl.org**

# ARRL Section Managers

The 15 divisions of ARRL are arranged into 71 administrative *sections*, each headed by an elected *section manager* (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists).Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the Web at **www.arrl.org/sections/**.

## Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA)

*Delaware:* Randall K. Carlson, WB0JJX, 121 Scarborough Park Dr, No. 10, Wilmington, DE 19804 (302-655-6179); **wb0jjx@arrl.org**

*Eastern Pennsylvania:* Eric Olena, WB3FPL, 284 Blimline Rd, Mohnton, PA 19540 (610-775-0526); **wb3fpl@arrl.org**

*Maryland-DC:* Tom Abernethy, W3TOM, PO Box 73, Accokeek, MD 20607 (301-292-6263); **w3tom@arrl.org**

*Northern New York:* Thomas Dick, KF2GC, 4 Jenkins St, Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**

*Southern New Jersey:* Jean Priestley, KA2YKN, 7158 Chandler Ave, Pennsauken, NJ 08110 (856-662-3587); **ka2ykn@arrl.org**

*Western New York:* Scott Bauer, W2LC, 1964 Connors Rd, Baldwinsville, NY 13027 (315-638-7551); **w2lc@arrl.org**

*Western Pennsylvania:* John V. Rodgers, N3MSE, 803 S Main St, Butler, PA 16001-6326 (724-287-0424); **n3mse@arrl.org**

## Central Division (IL, IN, WI)

*Illinois:* Sharon Harlan, N9SH, 5931 Alma Dr, Rockford, IL 61108 (815-398-2683); **n9sh@arrl.org**

*Indiana:* James S. Sellers, K9ZBM, 54676 County Road 8, Middlebury, IN 46540-8710 (574-825-5425); **k9zbm@arrl.org**

*Wisconsin:* Donald Michalski, W9IXG, 4214 Mohawk Dr, Madison, WI 53711 (608-274-1886); **w9ixg@arrl.org**

## Dakota Division (MN, ND, SD)

*Minnesota:* Randy "Max" Wendel, KM0D, 8539 Bryant Ave S, Bloomington, MN 55420-2147 (952-888-5953); **km0d@arrl.org**

*North Dakota:* Kent Olson, KA0LDG, 7702 Forest River Rd, Fargo, ND 58104-8004 (701-298-0956); **ka0ldg@arrl.org**

*South Dakota:* Richard L. Beebe, N0PV, 913 S Gordon Dr, Sioux Falls, SD 57110-3151 (605-332-1434); **n0pv@arrl.org**

## Delta Division (AR, LA, MS, TN)

*Arkansas:* Dennis Schaefer, W5RZ, 181 Schaefer Dr, Dover, AR 72837-7923 (479-967-4372); **w5rz@arrl.org**

*Louisiana:* Mickey Cox, K5MC, 754 Cheniere-Drew Rd, West Monroe, LA 71291 (318-397-1980); **k5mc@arrl.org**

*Mississippi:* Malcolm Keown, W5XX, 14 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**

*Tennessee:* Terry Cox, KB4KA, 110 Fisherville Rd, Collierville, TN 38017 (901-854-4191); **kb4ka@arrl.org**

## Great Lakes Division (KY, MI, OH)

*Kentucky:* John D. Meyers, NB4K, 218 Cory Ln, Butler, KY 41006-9740 (859-472-6690); **nb4k@arrl.org**

*Michigan:* Debbie Kirkbride, KA8YKK, Apt 1, 1315 Center Ave, Bay City, MI 48708-6107 (989-892-1212); **ka8ykk@arrl.org**

*Ohio:* Joseph J. Phillips, K8QOE, 2800 Jupiter Dr, Fairfield, OH 45014-5022 (513-874-0006); **k8qoe@arrl.org**

## Hudson Division (ENY, NLI, NNJ)

*Eastern New York:* Pete Cecere, N2YJZ, 378 Ohayo Mtn Rd, Woodstock, NY 12498 (845-679-9846); **n2yjz@arrl.org**

*NYC-Long Island:* George Tranos, N2GA, PO Box 296, Bellport, NY 11713 (631-286-7562); **n2ga@arrl.org**

*Northern New Jersey:* William Hudzik, W2UDT, 111 Preston Dr, Gillette, NJ 07933 (908-580-0493); **w2udt@arrl.org**

## Midwest Division (IA, KS, MO, NE)

*Iowa:* Jim Lasley, N0JL, PO Box 5, Chillicothe, IA 52548 (641-935-4337); **n0jl@arrl.org**

*Kansas:* Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-4455); **kb0dti@arrl.org**

*Missouri:* Dale C. Bagley, K0KY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org**

*Nebraska:* Bill McCollum, KE0XQ, 1314 Deer Park Blvd, Omaha, NE 68108 (402-734-3316); **ke0xq@arrl.org**

## New England Division (CT, EMA, ME, NH, RI, VT, WMA)

*Connecticut:* Betsey Doane, K1EIC, 92 Mohegan Rd, Shelton, CT 06484-2448 (203-929-7759); **k1eic@arrl.org**

*Eastern Massachusetts:* Phil Temples, K9HI, Apt. 803, 125 Coolidge Ave, Watertown, MA 02472-2875 (617-331-0183); **k9hi@arrl.org**

*Maine:* William Woodhead, N1KAT, 68 Madison St, Auburn, ME 04210 (207-782-4862); **n1kat@arrl.org**

*New Hampshire:* Al Shuman, N1FIK, PO Box 119, Goffstown, NH 03045-0119 (603-487-3333); **n1fik@nhradio.org**

*Rhode Island:* Bob Beaudet, W1YRC, 30 Rocky Crest Rd, Cumberland, RI 02864 (401-333-2129); **w1yrc@arrl.org**

*Vermont:* Paul N. Gayet, AA1SU, 124 Macrae Rd, Colchester, VT 05446 (802-860-1134); **aa1su@arrl.org**

*Western Massachusetts:* William Voedisch, W1UD, 240 Main St, Leominster, MA 01453 (978-537-2502); **w1ud@arrl.org**

## Northwestern Division (AK, EWA, ID, MT, OR, WWA)

*Alaska:* David Stevens, KL7EB, PO Box 113242, Anchorage, AK 99511 (907-345-6506); **kl7eb@arrl.org**

*Eastern Washington:* Kyle Pugh, KA7CSP, 5006 W Houston Ave, Spokane, WA 99208 (509-327-5039); **ka7csp@arrl.org**

*Idaho:* John J. Cline, K7BDS, 1475 Oriole Way, Boise, ID 83709 (208-376-6045); **k7bds@arrl.org**

*Montana:* Doug Dunn, K7YD, 216 Fiddle Creek Rd, Livingston, MT 59047-4116 (406-686-9100); **k7yd@arrl.org**

*Oregon:* Marshall D. Johnson Sr, KK7CW, 1645 9th Ave SE #171, Albany, OR 97322 (541-990-3127); **kk7cw@arrl.org**

*Western Washington:* Harry Lewis, W7JWJ, 10352 Sand Point Way NE, Seattle, WA 98125 (206-523-9117); **w7jwj@arrl.org**

## Pacific Division (EB, NV, PAC, SV, SF, SJV, SCV)

*East Bay:* Dennis G. Franklin, K6DF, 4658 Capitan Dr, Fremont, CA 94536-5448 (510-791-0954); **k6df@arrl.org**

*Nevada:* Dick Flanagan, W6OLD, 2851 Esaw St, Minden, NV 89423 (775-267-4900); **w6old@arrl.org**

*Pacific:* Bob Schneider, AH6J, PO Box 131, Keaau, HI 96749 (808-966-8146); **ah6j@arrl.org**

*Sacramento Valley:* Jettie Hill, W6RFF, 306 Saint Charles Ct, Roseville, CA 95661-5008 (916-783-0383); **w6rff@arrl.org**

*San Francisco:* Leonard Gwinn, WA6KLK, 2960 Blackhawk Dr, Willits, CA 95490-9704 (707-459-1871); **wa6klk@arrl.org**

*San Joaquin Valley:* Charles P. McConnell, W6DPD, 1658 W Mesa Ave, Fresno, CA 93711-1944 (559-431-2038); **w6dpd@arrl.org**

*Santa Clara Valley:* Glenn Thomas, WB6W, 502 Walnut Dr, Milpitas, CA 95035-4133 (408-263-9450); **wb6w@arrl.org**

## Roanoke Division (NC, SC, VA, WVA)

*North Carolina:* John Covington, W4CC, PO Box 1604, Belmont, NC 28012 (704-577-9405); **w4cc@arrl.org**

*South Carolina:* James F. Boehner, N2ZZ, 525 Barnwell Ave NW, Aiken, SC 29801-3939 (803-641-9140); **n2zz@arrl.org**

*Virginia:* Carl Clements, W4CAC, 4405 Wake Forest Rd, Portsmouth, VA 23703 (757-484-0569); **w4cac@arrl.org**

*West Virginia:* Hal L. Turley, KC8FS, 6 Ives Dr, Huntington, WV 25705 (304-736-2790); **kc8fs@arrl.org**

## Rocky Mountain Division (CO, NM, UT, WY)

*Colorado:* Jeff Ryan, K0RM, 6721 Northface Ln, Colorado Springs, CO 80919-1508 (719-260-6826); **k0rm@arrl.org**

*New Mexico:* Joe Knight, W5PDY, 10408 Snow Heights Blvd NE, Albuquerque, NM 87112 (505-299-4581); **w5pdy@arrl.org**

*Utah:* Mel Parkes, AC7CP, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); **ac7cp@arrl.org**

*Wyoming:* Jay Ostrem, W7CW, PO Box 1993, Gillette, WY 82717-1993 (307-682-7839); **w7cw@arrl.org**

## Southeastern Division (AL, GA, NFL, PR, SFL, VI, WCF)

*Alabama:* Bill Cleveland, KR4TZ, 2113 Wildwood Pl, Mobile, AL 36609-2583 (251-661-3892); **kr4tz@arrl.org**

*Georgia:* Susan Swiderski, AF4FO, 772 Camelot Way, Norcross, GA 30071 (770-449-0369); **af4fo@arrl.org**

*Northern Florida:* Rudy Hubbard, WA4PUP, PO Box 843, Milton, FL 32572-0843 (850-626-0620); **wa4pup@arrl.org**

*Puerto Rico:* Victor Madera, KP4PQ, PO Box 191917, San Juan, PR 00919-1917 (787-789-4998); **kp4pq@arrl.org**

*Southern Florida:* Sharon T. "Sherri" Brower, W4STB, 736 34th Ter, Vero Beach, FL 32968-1226 (772-562-3240); **w4stb@arrl.org**

*Virgin Islands:* John Ellis, NP2B, PO Box 24492, Christiansted, St Croix, VI 00824 (340-773-9643); **np2b@arrl.org**

*West Central Florida:* Dave Armbrust, AE4MR, 3024 Salem Ave, Sarasota, FL 34232 (941-685-2081); **ae4mr@arrl.org**

## Southwestern Division (AZ, LAX, ORG, SDG, SB)

*Arizona:* Clifford Hauser, KD6XH, 8741 N Hollybrook Ave, Tucson, AZ 85742 (520-744-9095); **kd6xh@arrl.org**

*Los Angeles:* Phineas J. Icenbice Jr, W6BF, 19323 Halsted St, Northridge, CA 91324 (818-349-3186); **w6bf@arrl.org**

*Orange:* Joe H. Brown, W6UBQ, 5444 La Sierra, Riverside, CA 92505 (909-687-8394); **w6ubq@arrl.org**

*San Diego:* Kent Tiburski, K6FQ, 1405 Greenbay St, San Diego, CA 92154 (619-575-1964); **k6fq@arrl.org**

*Santa Barbara:* Robert Griffin, K6YR, 1436 Johnson Ave, San Luis Obispo, CA 93401-3734 (805-543-3346); **k6yr@arrl.org**

## West Gulf Division (NTX, OK, STX, WTX)

*North Texas:* Roy Rabey, AD5KZ, 600 Morning Glory Ln, Bedford, TX 76021-2207 (214-507-4450); **ad5kz@arrl.org**

*Oklahoma:* John Thomason, WB5SYT, 1517 Oak Dr, Edmond, OK 73034-7408 (405-844-1800); **wb5syt@arrl.org**

*South Texas:* E. Ray Taylor, N5NAV, 688 Comal Ave, New Braunfels, TX 78130 (830-625-1683); **n5nav@arrl.org**

*West Texas:* John C. Dyer, AE5B, 9124 CR 301, Cisco, TX 76437-9525 (254-442-4936); **ae5b@arrl.org**

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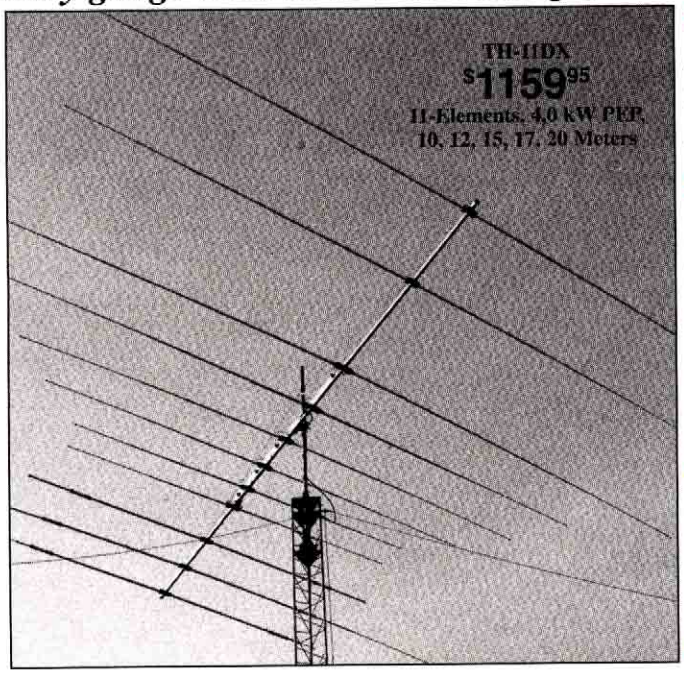


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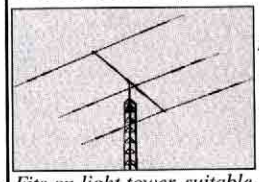

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TH-11DX | 11 | *For Gain and F/B ratio--See...* | | 4000 | 10,12,15,17,20 | 12.5 | 100 | 24 | 37 | 22 | 88 | 1.9-2.5 | T2X | $1159.95 |
| **TH-7DX** | **7** | | | **1500** | **10, 15, 20** | **9.4** | **100** | **24** | **31** | **20** | **75** | **1.5-2.5** | **HAM-IV** | **$869.95** |
| TH-5MK2 | 5 | • www.hy-gain.com • Hy-Gain catalog • Call toll-free 800-973-6572 | | 1500 | 10, 15, 20 | 7.4 | 100 | 19 | 31.5 | 18.42 | 57 | 1.5-2.5 | HAM-IV | $759.95 |
| **TH-3MK4** | **3** | | | **1500** | **10, 15, 20** | **4.6** | **95** | **14** | **27.42** | **15.33** | **35** | **1.9-2.5** | **CD-45II** | **$469.95** |
| TH-3JRS | 3 | | | 600 | 10, 15, 20 | 3.35 | 80 | 12 | 27.25 | 14.75 | 21 | 1.25-2.0 | CD-45II | $359.95 |
| **TH-2MK3** | **2** | | | **1500** | **10, 15, 20** | **3.25** | **80** | **6** | **27.3** | **14.25** | **20** | **1.9-2.5** | **CD-45II** | **$369.95** |
| EXP-14 | 4 | | | 1500 | 10,15,20 (30/40) | 7.5 | 100 | 14 | 31.5 | 17.25 | 45 | 1.9-2.5 | HAM IV | $599.95 |

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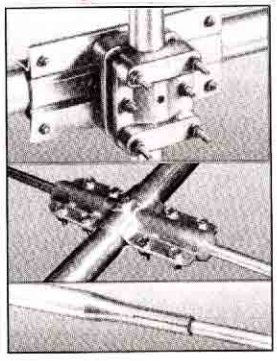
**2. *Tooled*** *Boom-to-Element Clamp*

**3. Thick-wall** *swaged* aluminum tubing



***Tooled*** *manufacturing* is the difference between Hy-Gain antennas and the others -- they just don't have it (it's expensive!).

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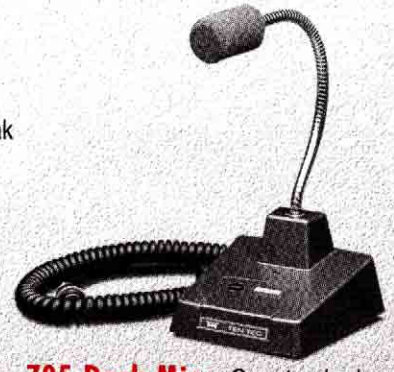

**705 Desk Mic** – Our standard communications desk mic comes ready to plug into any 4-pin-equipped Ten-Tec transceiver. Quality audio with plenty of punch. ***$99.95.***

**307 Speaker Series** – External front-firing communications speakers, available in light grey (307G), black (307B), or charcoal grey (307C), are a terrific addition to any receiver or transceiver. Cabinet and large 4-inch speaker designed specifically for amateur radio use. ***$98.***

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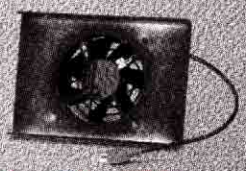
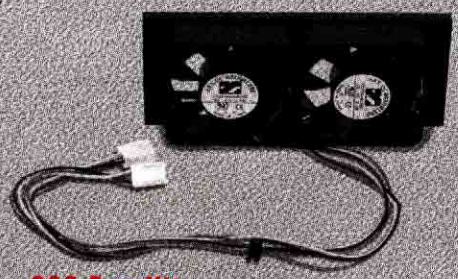


**310 Fan Kit** – NEW! Hole-free allen screw attachment to transceiver heat sink. 13.8 Vdc powered. Use with Orion, Jupiter, Pegasus, all Omnis, Corsairs, Tritons, Paragons. ***$39.95.***



**308 Fan Kit** – Slide-on attachment to the Argonaut V transceiver. ***$15.***

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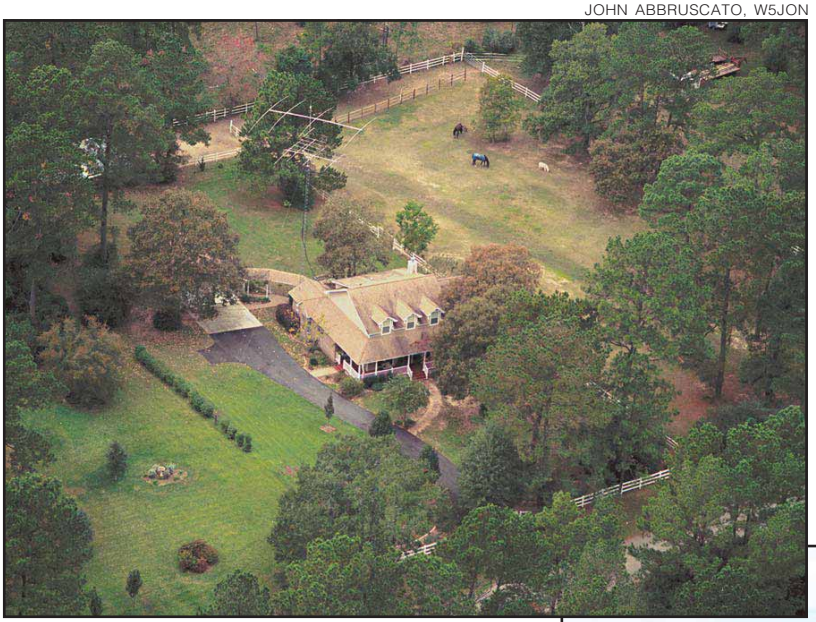
# Antenna Season

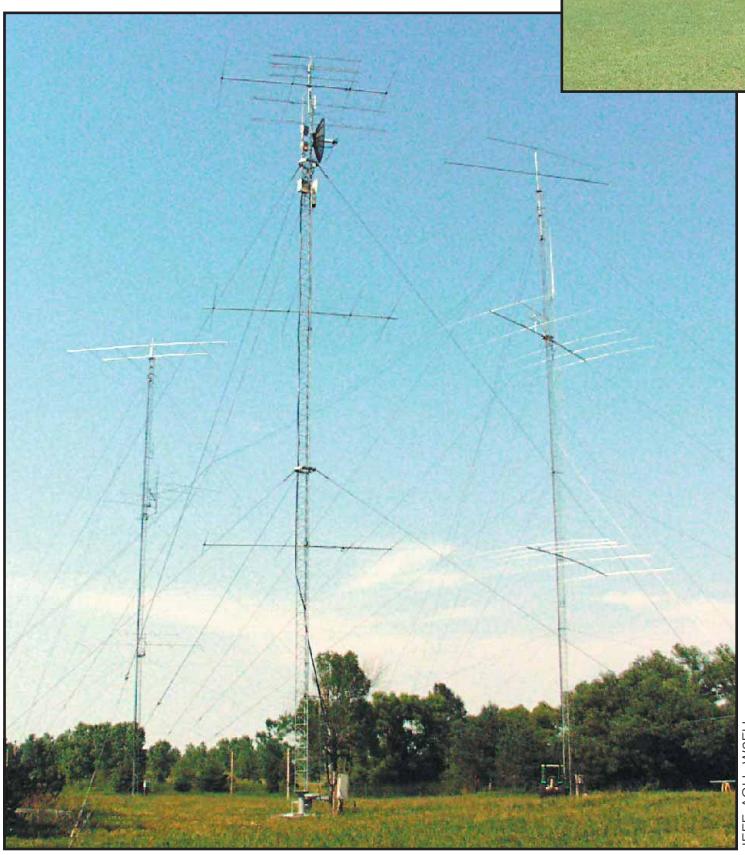
JOHN ABBRUSCATO, W5JON



John Abbruscato, W5JON, writes: "After 35 years of fighting homeowner associations, deed restrictions and local/municipal governments, we had enough. So, five years ago, wife Cathy, W5HAM, and I moved to Hockley, Texas (40 miles NW of Houston). As you can see, we have not regretted it for one second.

***Tough Duty:*** When it's winter on Kauai. . . who cares! Writes Robert Fuller, W7KWS: "The folks in the picture [below] are several friends from the Kauai ARC who helped move my tower to the magic spot at my house on Kauai and raise it into place. Elapsed time for the moving and raising was one hour seven minutes. Eating all the food afterward took several hours more." A SteppIR tunable Yagi will soon grace the top of the 50-foot tower.

SARAH SHIRAKI



JEFF ACH, W2FU

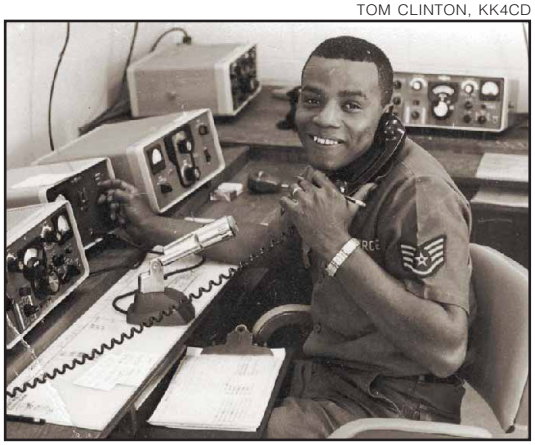
***Dream Farm:*** The 1.8 MHz through 10 GHz multiop antenna farm at W2FU, in the Rochester suburb of Webster, New York, is a contest station to reckon with. The UHF/microwave antennas reside on a rotating tower (below).

JEFF ACH, W2FU

COURTESY INTERNATIONAL SPY MUSEUM

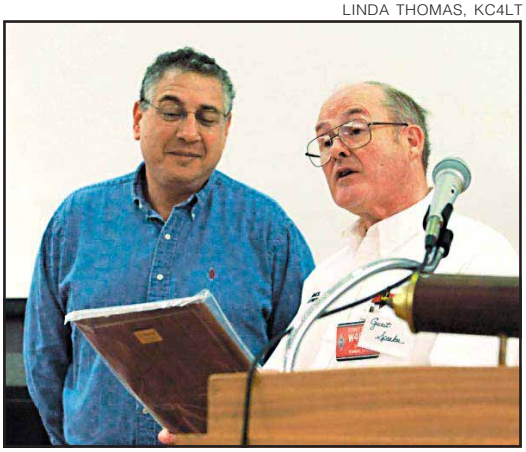

***1930s QSTs in Spy Museum:*** **Next time you're in Washington, DC, check out one of its newest museums, the International Spy Museum (www.spymuseum.org/index.asp). It's a fun way to learn about the techniques and people involved with international espionage. Was Chuck Barris a ham? We'll never tell! An exhibit of 1920s-'30s era magazines is our personal favorite. Why was *QST* chosen (second row from the bottom)? "First of all," writes Museum Media Relations Manager Jennifer Saxon, "the cover graphics are amazing. Also, I think it was chosen by our propmaster as a clever analogy to spy radios and how radio equipment made it easier for spies to transmit information."**

TOM CLINTON, KK4CD



**Back in September 1968, during the Vietnam conflict, Tom Clinton operated this well equipped Air Force MARS station, AI8AF, at Takhli Royal Thai Air Force Base in Thailand. Today, the Cassatt, South Carolina, resident is KK4CD.**

LINDA THOMAS, KC4LT



**At Winterfest03, in Annandale, Virginia, in February, Roanoke Division Director Dennis Bodson, W4PWF, presents the ARRL Technical Innovation Award to Stan Schretter, W4MQ, of Reston, Virginia, for his pioneering work on Internet control of remote HF stations. (The award was also given to Stan's collaborators, Keith Lamonica, W7DXX, and Bob Arnold, N2JEU.)**

BOB MAY II, K4SE


**Bob May II, K4SE, of Jonesboro, Tennessee, spotted this QST along I-75 in Ohio recently.**

GARRY HAMMOND, VE3XN/VE3GCO


**Garry Hammond, VE3XN/VE3GCO, writes: "For over a year I've been helping the Micro-Lite DXpedition Team that activated VP8THU and VP8GEO (see August 2002 *QST*, page 40). As QSL manager, I have now handled the contents of over 11,000 envelopes. As I looked over the incoming cards, I began to realize that WAS and DXCC for each call was a possibility..." Garry reports he has now received both WAS (the proof is in the photos) and DXCC certificates for the two DXpedition calls signs.**

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[1] Note that certain frequencies are unavailable. [2] 5W output

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We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

## MORE ON HSMM RADIO

♦ I would like to add a comment to N5KM's excellent microwave article ["High Speed Multimedia Radio," Apr 2003, pp 28-34]. Since this band is a shared resource, it would be very prudent for hams planning to use it to first read the FCC rules regarding "unlicensed" operation in the 2.4 GHz band. These are available on the Web at **www.fcc.gov/oet/info/rules/**. The "formal" name for the regulation set is "Title 47, Code of Federal Regulations, Part 15," which is typically shortened to "CFR 47, Part 15."

In particular, Section 15.9 should be noted. It is a prohibition against eavesdropping on Wi-Fi transmissions. No mention of WAP or other encryption techniques are noted. While one would not expect to see FCC agents peering into your shack window to see if you are reading the Wi-Fi mail, hams should be careful what they say, and especially what they write, concerning overheard information. You could easily find yourself in violation of federal regulations, with a none-too-happy mob of Wi-Fi users hot after your soul...and your wallet.

This Section seems to have been overlooked by the Electronics Industry press, where there have been articles providing detailed reports of eavesdropping for fun and profit. I haven't seen any widespread use of warnings in the trades, or even in the instruction manuals that accompany these Wi-Fi products.

Remember that non-ham users of these frequencies outnumber us by a wide margin, and that, as voters, they can influence the FCC, if enough examples of inconsiderate or illegal actions by hams are presented.—*Bill Parrott, W6VEH, Thousand Oaks, California*

♦ Sometimes I feel it might just be better to pick up the phone and punch in some random digits and talk to the other party. If I hear another person ask for a QSL card from an *EchoLink* or IRLP link QSO I am going to scream.—*Nick Chiarchiaro, N2QXF, Glenwood, New Jersey*

## SPARK VS ARC

♦ In the "Old Radio" column [Mar 2003, p 90], I find that the terms "spark" and "arc" are mixed without distinction. Unlike the high voltage spark transmitters, an arc transmitter worked at a more modest voltage, much as arc welders do today.

Quenching the arc during operation was improved by dribbling a few drops of alcohol into the arc chamber. The heat turned the alcohol into hydrogen and soot. The soot had to be cleaned out, but the hydrogen improved the operation of the set. Unlike spark, fixed gaps were the normal construction for arc.—*John L. Wright, KC2FLO, Cortland, New York*

## HATS-OFF

♦ Hats-off to the guys in Mississippi ["Mississippi Club Loads Up Brooklyn Bridge," Apr 2003, p 49]. I had always wondered where the term "full-wave-bridge" originated. Thanks so much for filling me in.—*Joe Papworth, K8MP, Delaware, Ohio*

## WHAT'S IN A NAME?

♦ I disagree with Mr Kolinsky's Op Ed piece [Feb 2003, p 95] suggesting we need to delete the word "Amateur," but I do suggest a cost-free and market-oriented solution to some of our public recognition problem.

The Amateur Radio Service has been known by that name in international treaties since 1927. The US is a signatory to those treaties.

Amateur Radio has been part of the public consciousness for nearly 100 years. The most common reaction I hear when publicly mentioning Amateur Radio is, "Oh, do they still have that?" They know what Amateur Radio is from our society's general awareness. We need to build on that general awareness. We lack the millions in funding needed to create and sustain a new awareness publicly and among US and international government officials.

The purpose of the ARRL jackets is not to gain spur of the moment professional acceptance. They identify a technical capability to emergency coordinators. This helps coordinators readily identify and apply capabilities to needs. The time to gain professional recognition, acceptance and training as part of the community emergency response team is long before a disaster.

Amateurs do more than communicate. Part 97.1, Basis and Purpose, lists five purposes of the Amateur Radio Service. Emergency communication is only one.

We don't need a new name. We need more publicity for the internationally accepted Amateur Radio Service.—*David Tancig, AB9DB, River Falls, Wisconsin*

## PROGRESS

♦ As "hams" we can participate in the hobby in many ways, whether it be for an event or in cases of emergency. Some want to utilize the digital modes while others prefer voice operation. Lately it's been more in the direction of linking through the use of computers, the Internet and repeaters. Every time there has been a new innovation within the hobby there have been those who would desire to keep things the way they are and others that forge ahead looking for and producing new ways to do the old thing—communicate.

Progress isn't always popular with some of us.

I first learned code, and used it before being able to use any voice modes. That was enjoyable, but then so was using voice modes. Now it's the computer and digital modes. I'm not sure I like it yet, but I know it's the way we all communicate day to day around the world, and it works. Perhaps some day I'll look back and say how I didn't want to change and then be glad I did.

Being a member of ARRL and a part of the ham community give me pride with a sense of belonging to a prestigious group of communicators that do things. ARRL is our national supporting organization. It supports us with such things as having the spectrum to use (and free to us). It supports us in national and local situations—for whatever reason. In turn, as members we support *our* national organization with our money, and also get to stay up-to-date with our world of communications through the monthly publication *QST* and the ARRL Web site. I know that without ARRL we would cease to exist.

I realize that this is going out to those

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**AMERITRON's** ATR-30 *True Legal Limit*™ roller inductor antenna tuner is ham radio's toughest! It'll handle 1500 Watts *continuous carrier output* on *all* modes and *all* HF bands into most antennas -- even on 160 Meters where most antenna tuners fail.

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**Roomy** extra-strong .080 inch thick aluminum cabinet gives highest efficiency and lowest loss. 13¼Wx5⅝Hx17½D inches.

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*with Eimac® 8877 ceramic tube*

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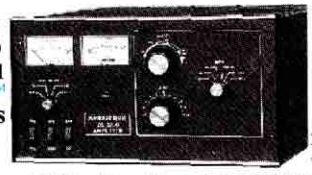
**Ameritron's** *most powerful* amplifier uses the herculean Eimac® 8877 ceramic tube. It's so powerful that 65 Watts drive gives you the full output power -- and it's just loafing because the power supply is capable of 2500 Watts PEP. All HF bands, all modes. 77 pounds, 18½Dx17Wx10H in.

### Ameritron's *toughest* Amp

*with Eimac® 3CX1200A7 tube*



AL-1200

**$2545**

Suggested Retail

*TrueLegalLimit*™

**Get** ham radio's *toughest* tube with AL-1200. The Eimac® 3CX1200A7 has a 50 Watt control grid dissipation and the lowest history of field replacement of any modern transmitting tube that we use. 90 Watts in gives you full power out. All HF bands, all modes. 76 pounds, 18½Dx17Wx10H in.

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*with 2 graphite plate Amperex® 3-500ZG tubes*

AL-82

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**Most** linears using 3-500s can't give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential. AL-82 is ham radio's *only* super 3-500 amp! 100 Watts in gives you full power out. All HF bands, all modes. Hefty 76 pounds, 18½Dx17Wx10H inches.

### 1.5 *plus* kW SSB HF Amp

*with 2 Eimac® 3CX800A7 tubes*

**AL-800H, $2595** suggested retail. Two Eimac® 3CX800A7 tubes produces 1500 *plus* Watts SSB PEP with 55 Watts drive. 52 lbs., 8½Hx16½Dx14¼W in. **AL-800, $1775** suggested retail, single 3CX800A7, 1250 Watts out with 70 Watts drive.

### NearLegalLimit™ Amp

*with four Svetlana® 572B tubes*

**AL-572, $1395** suggested retail. New class of *Near Legal Limit*™ amplifier gives you 1300 Watts SSB PEP power output (70 Watts drive) for 65% of price of full legal limit amps! Instant 3-second warm-up. 40 lbs. 8½Hx15½Dx14½W inches.

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*20 Years Of Defining Amateur Radio Communications*

By Paul Cassel, VE3SY

# From Ether to Ethernet

The merging of wired networks with radio has resulted in a more flexible, reliable and portable radio system. Make DX contacts and enhance your emergency communications with a hand-held radio.

It was the last night in December of 2002. Stations in many different time zones were being worked from North America, while amateurs worldwide were bringing in the New Year. Tony, VK3JED, in Melbourne, Australia was celebrating on the air at 6 o'clock in the morning (my time). As midnight approached in India, Sam, VU2SBB, was busy talking to North America, followed by South Africa; then Belgium and the UK. It was a thrill to talk to the world from home on a hand-held radio. Yes, talk to the world with a battery-powered VHF/UHF FM transceiver!

Amateur Radio has seen many technological changes in the last 85 years. First, the shift from spark to CW in the '20s; next, AM in the early '30s; followed by SSB in the '50s. In the '60s, when hams started to convert discarded taxi and police radios to 2 meters, VHF-FM became the rage, with repeaters following.

Change does not occur without controversy. "Spark Forever!" was heard in the '20s as crystal control and CW ushered in the then-new wireless technology. When AM first appeared, "brass pounders" felt their frequencies were being pirated by the new "upstart." Now that Internet linking of VHF/UHF Amateur Radio repeaters is becoming popular, change is again occurring, but not without controversy.

Early experiments linking FM repeaters using the Internet with Voice Over IP (VoIP) were, for the most part, unsuccessful and none (*iPhone* was one example) ever became popular. Then, in 1998, a ham in Vancouver, Canada designed a better, more reliable way to do that and it has rapidly embraced a worldwide following.

Dave Cameron, VE7LTD, of Vancouver, British Columbia began experimenting with what he called the Internet Radio Linking Project or simply IRLP. Dave and Michael Illingby, VE7TFD, of Vernon, British Columbia, became frustrated with the unreliable operation of *Windows*-based *iPhone,* VoIP software. At that time, all *Windows*-based Amateur Radio linking software used voice control (VOX) and it wasn't secure from non-amateur access.

Dave designed and developed the new IRLP system using *Linux*, resulting in an ultra-stable operating platform for the new software. It now has an installed base that is approaching 1000 active nodes and is worldwide in scope. With the release of Version 3.0 hardware and greatly enhanced software, IRLP continues to grow rapidly. (When the author first ordered IRLP interface hardware in February 2001, there were only 63 nodes.)

## What is Voice Over IP?

Telephone system companies and network infrastructure suppliers, such as Lucent and Nortel, have started promoting Voice Over Internet Protocol (VoIP). The telephone companies recognized that VoIP was an efficient way to merge their telephone voice and data traffic using the TCP/IP protocol. With an IP-based network, the telephone audio is sampled, compressed and wrapped into data packets that can be routed, bridged and switched alongside other data packets flowing through private networks and the Internet. With the great advances in computer soundcard-based software applications, it was just a matter of time before reliable VoIP applications would be generally available.

IRLP is not the only VoIP application making its way into Amateur Radio. Systems such as EchoLink, eQSO and Yaesu Wires II allow computer-to-computer or computer-to-radio links. IRLP continues to build on a philosophy that insists that a radio be at each end of an IRLP contact. Having said that, there is a need for PC-radio based networks that the other technologies provide.

## Using IRLP

The technology allows amateurs within range of a repeater or simplex station, equipped with an IRLP interface, to easily link a local repeater to one or more IRLP-equipped stations around the world. The local user simply requires a radio with DTMF capability and local access information.

The local linking station is termed a *node*. It's a good idea to contact the station operator before trying to use that station, as some nodes require a pre-access code, similar to a phone patch access. One should also support the local club or organization providing the IRLP link. Refer to the list of active nodes at **status.irlp.net** to find a node close to your location.

The default access requires dialing the destination node number. Within a second or two, the called node will identify in plain voice with its call sign and location. If the target node is connected, you will receive a recording telling you what node or reflector the repeater is connected to. Optionally, if the target node has enabled its Call Waiting feature, a form of voice enabled call display will announce that a call has been attempted from your node number.

Multiple repeaters can be linked utilizing one of over a dozen multi-channel

### What is a Reflector?

A reflector is nothing more than a robust PC accessing a large amount of bandwidth and used for a node connector or a bridge. These machines allow many nodes to be linked together in the form of a round table or a conference bridge. Only one node can talk at a time, although all connected nodes receive a copy of the received audio. No "doubling" is possible on an IRLP system, as the first packet to arrive "wins" and all other IP packets are ignored until the initial station drops the PTT circuit. The main reflectors have a primary channel and nine sub-channels, each with enough capacity for a large number of simultaneous connections. The main international calling channel reflector is 9200 in Indianapolis, Indiana. See **status.irlp.net** for a full listing of available reflectors.

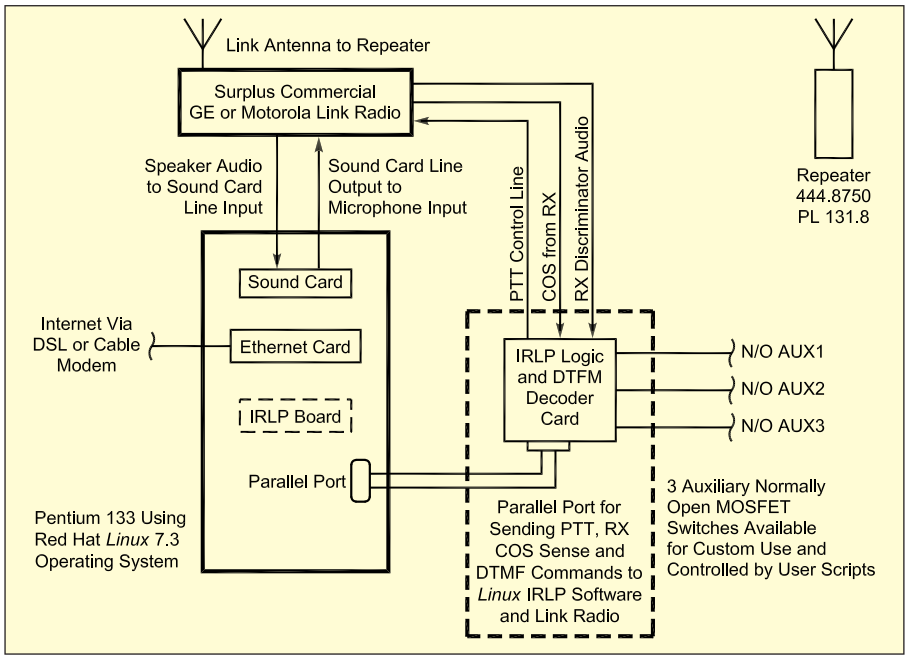



**Figure 1—A block diagram of an IRLP system, showing the PC controller, link radio IRLP interface card and repeater.**

IRLP reflectors spread around the world. (See sidebar, "What is a Reflector?")

## Audio Delays

As with any digitally voice-encoded system, some audio delays are encountered. PTT key-up delays are mainly caused by the delay it takes radios to decode the tone squelch information. The first thing users need remember is to wait about ½ second after pressing the PTT switch before talking. (To dispel Internet delay myths, once a call has been set up, the audio delay over the Internet is about the same as one experiences when using a digital cell phone.)

Using IRLP is similar to using your local repeater, except for the aforementioned PTT ½ second hold for each access. One should also pause about 5 seconds between transmissions, to allow for break-ins from other operators. Other than your local repeater's courtesy tone and ID, you will hear no courtesy beeps or CW IDs from the other station. This makes IRLP-linked calls very transparent and it's difficult to know if the other station is across town or across the world. The audio quality is just that good. A basic block diagram of the IRLP system can be seen in Figure 1.

## Audio Path to the Internet

Now that a connection has been established, the IRLP software takes audio from the receiver, which is then fed into the LINE IN connector of a PC sound card. As soon as a valid COS signal (carrier detect) is sensed (from the originating link radio), the received audio is converted into ADPCM (Adaptive Differential Pulse Code Modulation, a predictive audio compression encoding system) digital data. The software then converts this data into digital packets; each assigned an IP address for a destination node. These packets now flow through the Internet to the destination PC where the packets are decoded and then sent to the sound card LINE OUT jack. This audio is then fed to the link radio's transmitter audio input. The destination link transmitter is keyed the instant that valid TCP/IP packets start to arrive. As soon as the data stops flowing, the link radio automatically un-keys, and when the destination node replies, the process reverses.

## The Digital Audio Process

The underlying audio processing technology in IRLP is based upon a modified freeware application called *Speak Freely*.[1] The modified version of *Speak Freely* used by IRLP actually produces the VoIP data and decodes the audio. While some may be familiar with the *Windows*-based *Speak Freely* application, IRLP runs the *Linux* version. Since our VHF and UHF repeaters do not require anything even close to MP3 audio quality, IRLP is using VoIP at a low data bit-rate to communicate. With the vast majority of nodes using cable or DSL modems, the 32 kb/s data rate for ADPCM is a non-issue. Some nodes using dial-up with limited bandwidth use a CODEC to utilize GSM encoding. This encoding format requires a data rate of only 17 kB/s, albeit at the cost of some audio quality. It is also not as robust as ADPCM with respect to the handling of packet loss.

The interface between the radio and the PC is performed using a small custom logic board connected to the computer's parallel printer port. This board samples the received audio for DTMF signals, detects the link receiver COS (carrier operated squelch) for positive and instant remote keying, and generates the transmit PTT line for the link radio. All of the command I/O between the PC and the IRLP board is handled by a connection to the PC's parallel port.

The entire system is DTMF (tone) controllable. The control codes lay imbedded in a separate program that reads DTMF tones from a DTMF decoder located on the interface controller board. These codes activate various parts of the software. DTMF codes are used to enable/disable linking, to open/close links and set identifiers. Every site has the ability to connect directly to any other site, either by using direct connections or reflector sites.

The version 3.0 board also features three auxiliary outputs allowing simple scripting to command these switches ON or OFF. Several node owners have actually used the IRLP board and some basic bash scripts to write a simple repeater controller on the IRLP platform.

These outputs can sink 2 A of current, which is more than adequate for most solid-state applications. They can additionally drive a high current relay to control anything from tower lights to an air conditioner.

## Behind the Scenes

IRLP operates on a very robust distributed network infrastructure, which is rarely seen or heard from by users.

Even though the IRLP system is currently mature and reliable, the true spirit of Amateur Radio implies experimentation, including possible improvements and enhancement to the IRLP software. Unlike *Windows*-based systems, IRLP updates are automatically downloaded to each node *without* the need for a reboot.

All updates to IRLP software are distributed daily during the wee hours of the morning without the need for operator interaction. When updates are ready for distribution, they are simply uploaded to the root home IRLP server. The home server then notifies the five distributed machines around the world that new code is ready for download. This is performed via rsync, a program providing a very fast method for bringing remote files into

[1]Notes appear on page 32.

sync. It is accomplished by sending just the differences in files across the IRLP network, resulting in a very bandwidth-efficient updating process.

All network nodes can then be brought up to the latest software release during an early morning file update check. In addition, there is no need to re-boot after every update, a requirement so familiar to *Windows* users.

### IRLP_BIND for DNS Service

Most readers who are on the Internet will be familiar with the term DNS (Domain Name System). IRLP makes use of a custom application modeled after the Berkley Internet Name Domain (BIND) called IRLP-BIND. Written by VE7LTD, IRLP_BIND is similar to *Microsoft* DNS and handles all connect requests by instantly converting the 4-digit IRLP node request into an IP address (see sidebar, "What is an IP?") used to find the destination node. Before VE7LTD developed the IRLP-bind system, an ever-growing host file had to be constantly downloaded by each node every time the IP changed on any node in the system. This resulted in a tremendous waste of bandwidth on the IRLP server.

When any connection is attempted between IRLP nodes, the originating node does a routing lookup from one of five servers co-located with major reflectors distributed around the world. These five machines—besides serving as reflectors and providing the IRLP-bind service—also mirror all of the latest IRLP code updates and PGP (*Pretty Good Privacy*—an encryption code) key rings. Each local repeater node is assigned one of these five servers as a primary server based on its node number and geographic location in the world. If one server should go down, the node just looks at the next server down the list. This change shortened the time for new nodes to be recognized by the rest of the IRLP network and reduced the amount of traffic on the **irlp.net** server by many orders of magnitude. Additionally, no single server failure could then take down the routing.

Even if a route to all five servers were to fail, a host file is also stored locally with the current IP address of all nodes and can be accessed. To keep this local host file current, a new host file is downloaded whenever the node sees the IP lookup returning a newer address. Even if the node makes no calls, a new host file is downloaded by each node at 3 AM. To prevent a major bandwidth rush on the name servers, IRLP takes the difference of the *Node Number/Modulus 600* and uses that as a sleep time to avoid a backlog of the daily updates.

One of the IRLP install team, Pete, VK2YX, points out that the IRLP software designers have gone out of their way to accomplish a single goal…that is, to make nodes as "maintenance free" as possible. From the basic software design that handles changing IP addresses, to a server back-end that handles completely automated software upgrades, updates and installation (all during normal system operation), the nodes are designed to keep owners from worrying. In spite of this good design, Pete volunteers that, "Good ideas and new software are always welcomed by the software team."

Many of today's IRLP "standard" features were once just "good ideas" on the part of various system owners. Many software designers have "migrated" their ideas to the rest of the IRLP fraternity via software review and then release, through the back-end systems.

IRLP allows the node owner to customize the node in any way they see fit. One can add scripts to do almost anything, such as:

- Play ARRL or equivalent news broadcasts
- Play severe weather alerts with text to voice freeware
- Enable a local voicemail system
- Enable clock/time/date features with atomic clock accuracy
- Build your own features with simple scripting

### Authentication Security from Hackers

Unlike systems with minimal, if any, security, that allow users access from a PC, IRLP uses a system to ensure that each call setup is authenticated 100% and authorized to transmit on the amateur bands. The PGP encryption process is used so that when a connect request is made, the connecting node and the destination node exchange key challenges. These must authenticate or the connection is refused.

Some details of the IRLP connect request authentication are:

- IRLP uses public/private PGP key authentication to encrypt a random message with a 512 bit key.
- The calling node must authenticate with the node called.
- Once this is done, the called node has to prove to the calling node that it is in fact who it claims to be.
- The authentication is bi-directional insuring against falsification.
- The PGP key is created *only* by the IRLP installer and uploaded to the master IRLP key ring.
- If there is ever a compromised node, the ability to remove it from the key ring is only a keystroke away.

### What is an IP?

An IP is like a telephone number and is used to address and route packets around the Internet. An IP address can be recognized by four pairs of digits separated by periods such as 209.140.206.201. This sample IP is the actual numeric address for WWW.ARRL.NET and can actually be used in place of the label "www.arrl.net."

There are static and dynamic IPs; dynamic is the type consumers are provided with. Internet Service Providers (ISPs) never have sufficient IPs for every client, so they dynamically assign IPs when one connects to the Internet. Some ISPs set very short "lease" times so they can provide service to all subscribers with a fraction of the IPs actually required for continuous service. This means that, if a machine is idle for more than a set time, even though connected to the Internet, its IP is reassigned. As soon as access is attempted again, the ISP assigns a new IP. The IP leases can be as short as 10 minutes. This was a major challenge to be overcome with IRLP.

### Hosting your Own Node

The actual PC hardware requirements associated with this technology are usually found in most basements, left over from several previous computer upgrades. Almost anyone with Internet access can host an IRLP node; however, a 24/7 DSL or cable modem is recommended, in order to keep the node quickly abreast of updates.

IRLP can operate quite nicely on a P100 or faster machine equipped with 32 MB of RAM, a 1 GB hard drive, a *Linux* friendly network card and an ISA true *SoundBlaster16* sound card. Unless the node is co-located with the repeater, a link radio is also required.

Anyone thinking of hosting a node should visit the official IRLP Web site at **www.irlp.net** and review the FAQ sections.[2]

It is strongly recommended that, because of the duty cycles encountered in IRLP, you not use an amateur-class mobile transceiver for the link radio. When connected to a reflector, the link radio is in a key down state, as is the repeater. A robust surplus commercial transceiver is recommended. The GE *Phoenix* or the Motorola *M* or *GM* series radios with the 16-pin option connector make perfect link radios. All of these transceivers have CTCSS coding capability and they can be interfaced without internal access. All the required signals at the proper levels are available through the option plugs.

**Figure 2—A typical node with a commercial link radio controlled by a PC. This is node 3350, Denver, Colorado. The link radio shown is a surplus GE Mastr II.**

The most difficult task reported by new node owners using non-commercial radios is locating a place to take off a COS signal. A COS signal that follows the squelch activity is necessary in order to tell the IRLP node you have audio to send to another node. Since most nodes utilize CTCSS, this point must only change state with a valid CTCSS tone. The commercial equipment usually has a proper COS signal available from the system plug.

For receive audio it is necessary to pick a point unaffected by the local volume. This is usually a connection to the high side of the volume control or the discriminator output. Figure 2 shows a typical node with a commercial link radio controlled by a PC.

Without debating the virtues of flat or pre-emphasized audio, the transmit audio can be fed directly into the microphone input. The PTT switching connections should be obvious on most equipment.

All of these signals are accessible through the system plugs on most commercial radios as well as the packet ports on some of the newer amateur transceivers. However, the COS or CTS signal on a number of ham transceivers is usually taken off before the CTCSS decoder making the signal unsuitable for link radio purposes. With the relatively low cost of available surplus commercial equipment, that equipment would present a far better choice for fixed link radio service.

Most nodes are tested and de-bugged on a simplex frequency before being used to bring IRLP service to a local repeater. Before connecting with a local repeater, it is important that you devise a method to make sure that your repeater's hang timer, courtesy tones and CW/Voice IDs do not get sent to the IRLP network.

This can easily be accomplished by either modifying the way your repeater's CTCSS encoder follows receive activity or, if it uses a standard squelch circuit, by adding a basic CTCSS encoder. In either case, the encoder needs to be configured so that it generates tone only when the repeater's receiver is actually receiving a signal. This is easily accomplished by using the COR (carrier operated relay) or COS signal to also control the CTCSS encoder, in addition to controlling the repeater controller.

Then, with the repeater only sending CTCSS tones when a signal is being received at the repeater, the IRLP link radio will only generate a COS signal when a valid CTCSS tone is present. It is this level change that drives the COS input on the IRLP board.

With this simple change, the link radio will no longer pass the hang timer, the periodic station IDs or any courtesy tone when users drop their PTT. With these minor changes, those at the other end of the IRLP connection will have their repeater drop and generate a local courtesy tone at the same time the originating station drops PTT. There are then no superfluous beeps or waiting for the other repeater to drop before responding.

This muting of all such tones and hang timers is a hard and fast rule enforced on most reflectors. Imagine having 20 or more repeaters connected to a reflector and having to listen to various local IDs every 30 seconds…not a pretty picture.

Now that we've figured out the RF control interface, it's time to order the IRLP kit. This includes all of the main hardware and software. Transceiver interface cables are easily fabricated by the node operator.

Full ordering information can be found on the IRLP web site at **www.irlp.net**.

## The Installation

Once you have received your IRLP board and the *Red Hat* 7.3 CD you'll be ready to sacrifice an older *Pentium I* or *II* machine to operate under *Linux*. Don't be intimidated by *Linux*. The author had never used *Linux* before installing our group's first node back in the spring of 2001. At that time, IRLP was operating under *Red Hat* 6.2 and the install went very smoothly. Now, with *Red Hat* 7.3, there is even better support for sound and network cards. With the detailed systematic instructions furnished, the installation of *Linux* is quite straightforward and is usually accomplished within 30 minutes.

Once you are able to telnet out of the *Linux* box to the IRLP server, you are all set to download the latest IRLP software from the IRLP FTP server. Again, the installation is quite straightforward. Part of the installation process is the generation of the PGP encryption keys used for authentication. These keys are emailed to IRLP along with the answers to questions only the person ordering the IRLP node would know. This is used for authentication before the PGP keys are added to the IRLP key ring. Without the keys being installed in the key ring, the new node will be unable to place or receive calls. This feature is one of the major-selling security features with licensing bodies worldwide.

As soon as the PGP keys are added, the node is operational.

## Great Web Tools

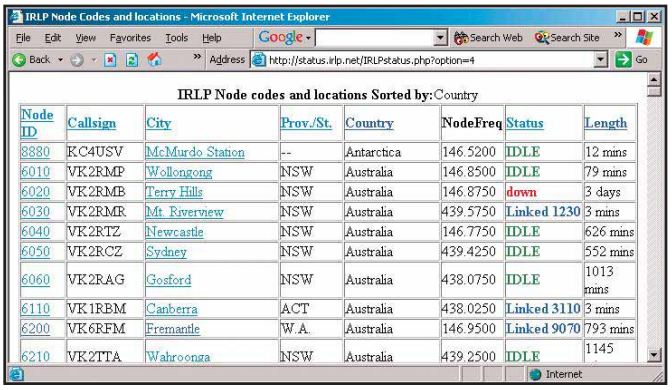
There are some very powerful Web based tools provided to assist the users determine real-time status of nodes. Point your browser to **status.irlp.net** and you'll see all current network activity showing node activity by country.

You can also see the reflector status at a glance. All reflectors and their subchannels are listed, showing the number of connected stations on each sub-channel. There is also a complete list of all nodes worldwide, showing their status. The page is dynamically created each time it is loaded. By clicking the hyperlink header on each column, you can sort the ever-growing list on any header. The sample listing seen in Figures 3 and 4 is sorted by country showing the status and the length of time each node has been in that status. It can be seen from the sample that node 8880 in McMurdo, Antarctica has only been idle for 12 minutes and node 6030 in New South Wales, Australia has been connected to node 1230 in Canada for 3 minutes. From this status page, one can click on the node city and view a detailed map showing the location of the node. By clicking the node number link, one can also view other details, such as a detailed description of the node owner, frequency and CTCSS tone used.

These user tools were originally designed by Richard Whitakker, VY1RW, and expanded to the current system by Kent, NØPSR, with input from Marcus, WA2DCI, and other IRLP users.

## Reflector Cops?

There are some basic rules that must be followed when connecting to a reflector in order to insure minimal disruption to users. For the user, these rules are basic, such as a 5-second delay between transmissions to allow other stations a break-in period. Technical problems on a node can cause difficulties for all con-



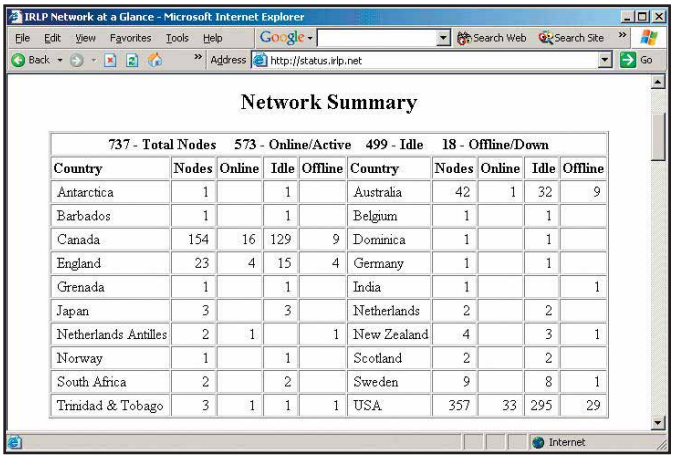
IRLP Node Codes and locations - Microsoft Internet Explorer

http://status.irlp.net/IRLPstatus.php?option=4

IRLP Node codes and locations Sorted by: Country

| Node ID | Callsign | City | Prov./St. | Country | NodeFreq | Status | Length |
|---|---|---|---|---|---|---|---|
| 8880 | KC4USV | McMurdo Station | -- | Antarctica | 146.5200 | IDLE | 12 mins |
| 6010 | VK2RMP | Wollongong | NSW | Australia | 146.8500 | IDLE | 79 mins |
| 6020 | VK2RMB | Terry Hills | NSW | Australia | 146.8750 | down | 3 days |
| 6030 | VK2RMR | Mt. Riverview | NSW | Australia | 439.5750 | Linked 1230 | 3 mins |
| 6040 | VK2RTZ | Newcastle | NSW | Australia | 146.7750 | IDLE | 626 mins |
| 6050 | VK2RCZ | Sydney | NSW | Australia | 439.4250 | IDLE | 552 mins |
| 6060 | VK2RAG | Gosford | NSW | Australia | 438.0750 | IDLE | 1013 mins |
| 6110 | VK1RBM | Canberra | ACT | Australia | 438.0250 | Linked 3110 | 3 mins |
| 6200 | VK6RFM | Fremantle | W.A. | Australia | 146.9500 | Linked 9070 | 793 mins |
| 6210 | VK2TTA | Wahroonga | NSW | Australia | 439.2500 | IDLE | 1145 |

**Figure 3—An example of IRLP Node ID codes and locations, sorted by country.**



IRLP Network at a Glance - Microsoft Internet Explorer

http://status.irlp.net

Network Summary

737 - Total Nodes 573 - Online/Active 499 - Idle 18 - Offline/Down

| Country | Nodes | Online | Idle | Offline | Country | Nodes | Online | Idle | Offline |
|---|---|---|---|---|---|---|---|---|---|
| Antarctica | 1 | | 1 | | Australia | 42 | 1 | 32 | 9 |
| Barbados | 1 | | 1 | | Belgium | 1 | | 1 | |
| Canada | 154 | 16 | 129 | 9 | Dominica | 1 | | 1 | |
| England | 23 | 4 | 15 | 4 | Germany | 1 | | 1 | |
| Grenada | 1 | | 1 | | India | 1 | | | 1 |
| Japan | 3 | | 3 | | Netherlands | 2 | | 2 | |
| Netherlands Antilles | 2 | 1 | | 1 | New Zealand | 4 | | 3 | 1 |
| Norway | 1 | | 1 | | Scotland | 2 | | 2 | |
| South Africa | 2 | | 2 | | Sweden | 9 | | 8 | 1 |
| Trinidad & Tobago | 3 | 1 | 1 | 1 | USA | 357 | 33 | 295 | 29 |

**Figure 4—A network summary display tool.**

nected stations. Each reflector typically has a small number of reflector "cops" ready to drop a node should anything interfere with normal system operation. Blocking a node takes but a few seconds and once blocked, the packets from that node are ignored. When a node is blocked, the system automatically e-mails the node owner, explaining the issues surrounding the block and the time of the block. When the node owner has rectified the problem, a reinstatement is requested and the firewall block is removed.[3]

## Is VoIP Legal?

Legality depends upon your location. US readers should refer to the article by Steve Ford, WB8IMY, "VoIP and Amateur Radio," *QST*, Feb 2003, pp 44-47. A sidebar in that article explains the possible implications of US Part 97 regulations when linking and using VoIP in an unattended mode.

The abbreviated response is that, for two repeaters linked via IRLP in unattended mode, no issue exists as long as control of the node is at 222.15 MHz or above (with the exception of the CW, SSB and amateur satellite portions of the 70-cm band).

In Canada, unattended VHF simplex or in-band linking is allowed. However, in Germany, linking of any kind, on any frequency, has been a regulation issue. Until recently, the only DL stations heard were those within range of the Belgium and Dutch nodes. DARC (the German national Amateur Radio society) is working to bring regulations in line with current enabling technologies. Recently, a node in Nuremberg, DBØVOX, became active, so progress is being made.

## Groups and Nets

The IRLP 4 Kids Net was formed in November 2001 to provide a common meeting place for young hams to communicate worldwide via Amateur Radio using the IRLP network.

The Kids Net meets each Saturday at 0100 UTC (Friday evening in North America). That net has been using the Las Vegas reflector (9508) that supports both dial-up and broadband users. A *Yahoo!* group has been set up at **groups.yahoo.com/group/irlp4kids/**.

A Canadian YL Net has been started using IRLP. This net was described by Diane, K2DO, in her *QST* "YL News" column in the January 2003 issue of *QST*, p 92. IRLP allows many groups to meet worldwide with no concern about propagation or antenna restrictions that would normally preclude HF operation. The YL Net meets on the 9000 Vancouver reflector.

## Listen to IRLP

Those outside the range of an IRLP node can listen-in via a streaming audio feed that this author maintains. The easiest way to access this is to go to the **www.irlp.net** Web site and click on the *Listen Live* link.[4] The audio stream is a duplicate of the main reflector 9200 channel in Indianapolis, Indiana. It allows anyone to monitor the reflector audio from anywhere an Internet connection is available.

## Synergy!

With the rapidly growing adoption of IRLP and other VoIP applications, a new world is opening up for both beginners and old-timers in Amateur Radio. The merging of hand-held radio operation with the adaptability and reliability of computers brings synergy. Marrying wired networks to radio empowers a system whose boundaries are limitless, for both emergency and routine communications. We've come full circle—merging wire with wireless to join our knowledge of radio and communications with the wired capabilities of the Internet. May that marriage prosper, bring many newcomers to Amateur Radio and enhance operation for all!

Thanks to the IRLP designer, Dave Cameron, VE7LTD, for his assistance in preparing this article and for his dedication to this project.

## Are You Interested?

If this article has piqued your interest, please browse the official IRLP Web site at **www.irlp.net** and feel free to contact the IRLP designer Dave, VE7LTD, at **dcameron@irlp.net** or the author at **ve3sy@arrl.net**.

### Notes

[1]**www.speakfreely.org/** The VoIP SpeakFreely Web site.
[2]**www.irlp.net/** Internet Radio Linking Project Web site.
[3]**www.kwarc.org/irlp/** IRLP user guidelines
[4]**www.kwarc.org/listen/** Streaming audio feed of IRLP.

*Paul Cassel, first licensed in 1961 as VE3AVY, spent most of his working career in the two-way radio, cellular and messaging industry. He is now retired and, between consulting projects, enjoys operating HF as well as mobile IRLP. Paul is married to Marg, VE3RE, licensed since 1973. He can be contacted at 1083 Notre Dame Dr, Petersburg, ON N0B 2H0, Canada, or at* **ve3sy@arrl.net**. *His Web site is* **www.ve3sy.com**.

By Ron Herring, W7HD

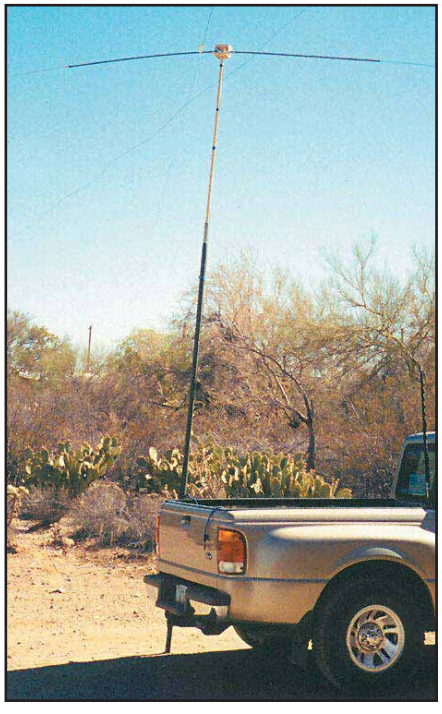
# A Small, Portable Dipole for Field Use

The title says it all—a practical, transportable antenna for Field Day and a valuable addition to your emergency kit.

This antenna came about because I wanted something small and portable that could be used on any band and would perform just like a dipole. Since I didn't want to have to find two trees the right distance apart (difficult to do in arid Arizona) for stringing up a regular dipole, something of a more "stand-alone" nature was needed. Looking through my accumulation of antennas, I discovered that I had a pair of Hamstick mobile antennas for 20 and 40 meters.[1] Needing something for my brand-new PSK20 rig for Field Day, I decided to try building something that would both fit the bed of my pickup truck and be quickly assembled and tuned at a site.

I hit on the idea of using two of these antennas to build a portable dipole. Since a single Hamstick antenna was designed as a mobile antenna and uses the vehicle as a counterpoise, a pair of these appeared ideal for my purpose. I made a quick trip to the local hardware store to pick up some nuts and bolts; a piece of ¾″ by 4″ hardwood (I used oak); a good quality wooden broomstick and some angle-iron with pre-drilled ³/₈″ holes. I then pro-

[1]Lakeview Company, 3620-9A Whitehall Rd, Anderson, SC 29626; 864-226-6990; **www.hamstick.com/**.



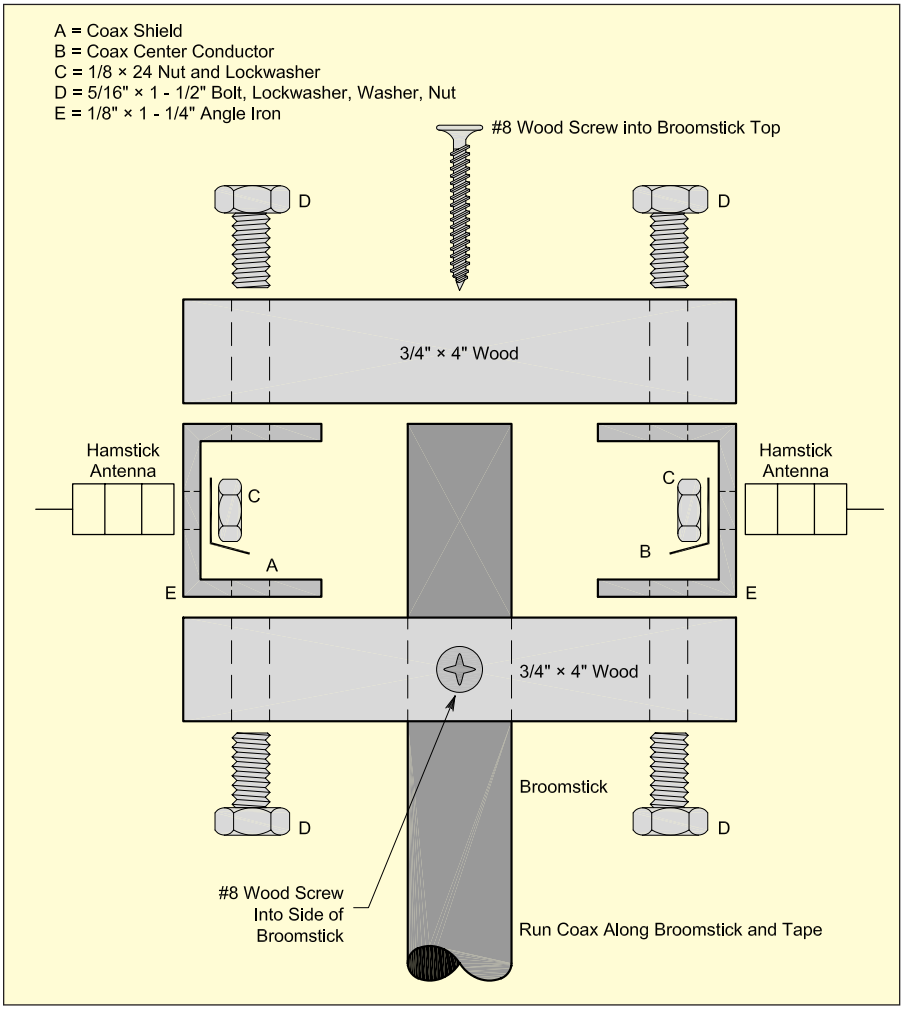



**Figure 1—Assembly details for the portable dipole.**

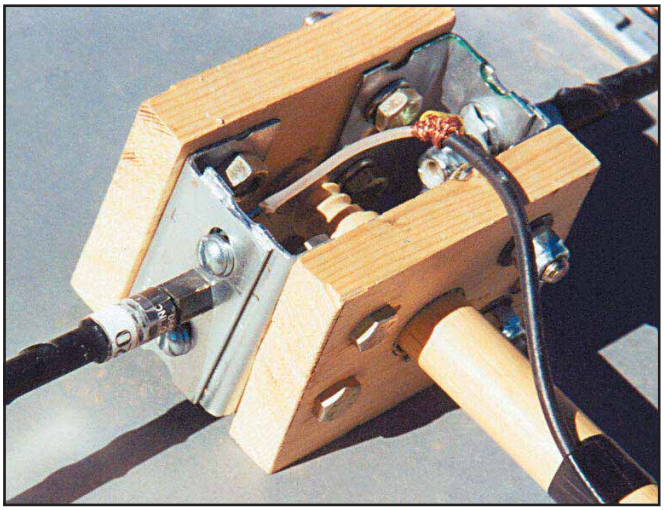


**Figure 2—The completed dipole center support showing the broomstick mast, the antenna mounts and the connected transmission line.**

**Table 1**
**Portable Dipole Parts list**

8—5/16 × 1 1/2″ bolts with lock washers, flat washers and nuts (nylon-type insert hold best) for mounting the angle iron "U" to the wood pieces.
4—5/16 × 1″ bolts with lock washers, flat washers and nuts for assembling the angle iron "U" pieces.
4— 1/8″ angle iron cut to 3″ lengths (cut so holes line up when mating).
2— 3/8″ × 24 nuts with lock washers and flat washers for the antenna mounts.
2— 3/4″ × 4″ piece hardwood about 5″ long.
2— 1/8″ × 1 1/2″ wood screws. (I used decking screws).
2— Mobile antennas that use 3/8″× 24 standard thread mounts (I used Hamsticks).
1—Coaxial cable (I used RG-58/U) stripped and tinned to allow connections about 5″ apart.

ceeded to drill, screw, tape, assemble and make it work. The total cost of materials, including $25 for each of the two Hamsticks, was about $90. Although the Hamstick was available, any suitable shortened (helically loaded) vehicular antenna can be used.

Using nothing more exotic than simple hand tools, a tape measure, power drill, wrenches and screwdrivers, the whole thing came together in about 3 hours. The best part was that it worked exactly as I had planned.

Some tips when you do your own assembly:

- Be sure to tune both antennas on the vehicle before mounting to the assembly.
- For safety, the radiating elements should be out of reach.
- Put a piece of tape on the Hamsticks, marked with the exact length of the "stingers" (the tuning rods) for ease of assembly at the site.
- Treat the wood support with waterseal, lacquer or marine varnish prior to assembly, to prevent deterioration. Just make sure that whatever you use for a coating is non-conductive at RF frequencies.

This antenna will even work on a balcony or supported by a couple of tree branches. My plan is to simply use bungee cords to attach it to the side of the camper at a Field Day site. Since it's a directional antenna, that mounting technique makes it easy to turn. For testing, I simply used bungee cords to attach the antenna to the side of my pickup truck. Table 1 lists the parts necessary to build your own version.

Figure 1 shows how the parts fit together. Figure 2 shows the completed mount. The assembly sequence I used was as follows:

1. Bolt two pieces of angle-iron together to form a "U," making sure that the hole for the antenna is properly aligned. Repeat for the other half.

2. Using the angle iron as a guide, drill two holes in each piece of 3/4″ × 4″ wood support to allow the bolts to pass through. Repeat this on both pieces of wood for each side. Make sure that the gap between the angle-iron pieces is more than an inch, since the broomstick has to pass through the gap.

3. Drill a 1″ hole in the bottom piece of wood for the broomstick to pass through. Additionally, drill a 1/8″ hole in the top piece of wood for a wood screw to secure the top of the broomstick. Drill a 1/8″ hole in the side of the top piece of wood for a second wood screw to anchor the broomstick so it doesn't turn in the mount.

4. Assemble as shown in the figure. Mount the angle-iron "U" pieces to the *inside* of each piece of wood. Be sure to attach the coaxial cable to the metal pieces—I just anchored the wire underneath the lock washers.

5. Stick the broomstick through the bottom hole and put the wood screws in place. (Drill a 1/16″ pilot hole in the broomstick before anchoring, so it won't splinter.)

6. Tape the coax to the side of the broomstick every 18″, leaving the coax free for approximately the bottom foot of the broomstick.

Okay… it's time to test! Place the antenna in the clear and attach your antenna analyzer or transceiver and SWR meter. Using a low power setting, check the bandwidth of the antenna. It should be about the same as when it was mounted on the mobile mount, perhaps slightly greater. Trim both sides for minimum SWR. Then check the SWR again using full power. Watch for arcing! If arcing does occur, your spacing is too close.

Put a label on the Hamstick giving the length of the "stinger" for the desired operating frequency. You may wish to do this for several favorite operating frequencies. This will save a lot of set-up time at your destination.

*Ron Herring, W7HD, has been licensed since 1967 and worked in engineering for the Heath Company in 1968-69 (SB-103, SB-303, MWW-18). While there, he took a two-year course in computer design, which inspired his future. Working for the Kellogg Co (later Michigan Bell) and then Pacific Northwest Bell (Oregon) he also played a role in the development of the RadioShack Model 100 laptop computer. Ron has taught computer classes at Portland State University, as well as a private school. Currently living in Arizona, he works for the Pima County Sheriff's Department in Tucson, where he is a Network Manager. Ron can be reached at 10270 W Mars Rd, Tucson, AZ 85743;* **w7hd@arrl.net**. QST

Visit the ARRL Web Site www.arrl.org

By Allen Baker, KG4JJH

# The Black Widow—A Portable 15 Meter Beam

Looking for a portable 15-meter antenna for camping or Field Day? Four fishing poles, 50 feet of wire, a few pieces of wood, some PVC and a painter's pole make a stinging portable performer.

## The Lure

There are a lot of excellent antenna designs available to the amateur, but few can combine light weight and portability with the significant gain and front-to-back ratio (F/B) of the Moxon Rectangle. All the materials necessary for building this portable antenna (including the mast) are available from your local Wal-Mart, Home Depot and RadioShack for under $125.

## The Moxon Rectangle

The Moxon Rectangle is a two-element beam with considerable gain, high F/B ratio, and a direct match to 50 Ω coax. [The Moxon-type antenna is named for its originator, L. A. Moxon, G6XN.—*Ed.*] The antenna is a derivative of the Moxon Square and it has been further optimized by L. B. Cebik, W4RNL.[1] Figure 1 shows the basic dimensions of the antenna.

I used the program *MoxGen*[2] to generate a model at 21.070 MHz for use with PSK and then fine-tuned it with *EZNEC*.[3] Since the Black Widow uses insulated wire (and *MoxGen* is based on bare wire), the final dimensions will change due to the insulation's effect on the wire's velocity factor.

I first built the antenna to the wire lengths in the *EZNEC* model: A = 203.25″, B = 31.25″, C = 4.88″ and D = 37.63″, which resulted in an actual resonant frequency of 20.180 MHz. I trimmed the wires to a final length = FM/FD × L, where FM is the measured frequency, FD is the desired frequency and L is the length before trimming. The final dimensions are A = 194.63″, B = 29.88″, C = 4.75″ and D = 36.0″. For an antenna centered in the middle of the 15-meter band: A = 193.75″, B = 29.75″, C = 4.63″ and D = 35.88″.

## Construction

Figure 2 presents an overview of antenna assembly. All of the necessary materials are listed in Table 1 along with sources for each. The antenna can be fash-

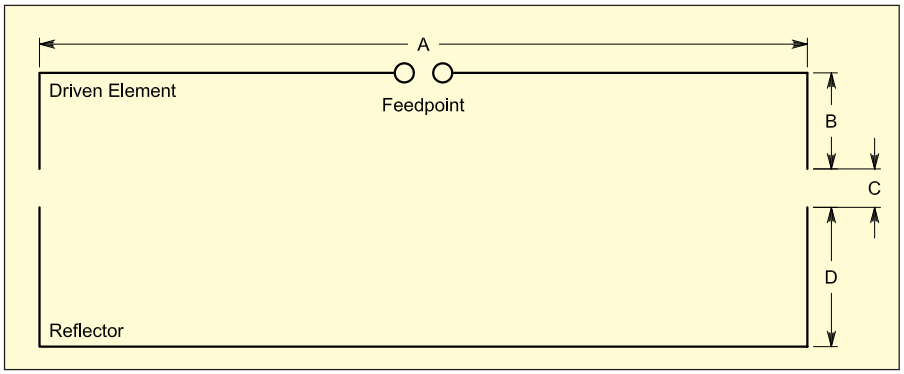



**Figure 1—The basic dimensions of the Moxon Rectangle.**

[1]Notes appear on page 39.

**Table 1**
**Materials List for the Black Widow Antenna**

| Item | Qty | Description | Source | Price Each ($) |
|---|---|---|---|---|
| 1 | 4 each | Crappie Master Fishing Pole, RCM-10LW, 3 sections, 10 ft | Wal-Mart | 6.96 |
| 2 | 1 roll | 20 AWG insulated stranded wire, 75 ft | RadioShack 278-1219 | 2.99 |
| 3 | 1 each | Terminal strip, 8-position | RadioShack 274-678 | 2.49 |
| 4 | 1 each | Connector, SO-239 | RadioShack 278-201 | 1.99 |
| 5 | 1 pkg | Soldering ring, #6 | RadioShack 64-3030A | 1.69 |
| 6 | 1 each | Epoxy, quick set | Home Depot | 2.97 |
| 7 | 4 each | Screw hook, 0.162″ wire diameter | Home Depot | 0.42 |
| 8 | 1 each | Wood, poplar, ½″ × 6″ × 36″ | Home Depot | 5.25 |
| 9 | 2 pkg | Three piece extension pole, Linzer RP503 | Home Depot | 3.79 |
| 10 | 1 each | Painter Pole, Mr. LongArm Model 2324 | Home Depot | 39.97 |
| 11 | 1 each | PVC coupling, 1½″ | Home Depot | 0.47 |
| 12 | 1 each | CPVC pipe, ½″ × 10 ft | Home Depot | 2.98 |
| 13 | 1 each | CPVC drop ear 90° elbow, ½″ | Home Depot | 0.68 |
| 14 | 1 each | CPVC 90° elbow, ½″ | Home Depot | 0.19 |
| 15 | 10 each | Sheet metal screw, self-drilling, #6 × ½″ | Home Depot | 0.17 |
| 16 | 230 ft | Nylon twine, #36 | Home Depot | 3.79 |
| 17 | 3 each | Clothesline tightener, Lehigh 7097 | Wal-Mart | 2.96 |
| 18 | 50 ft | Nylon rope, 3/16″ | Wal-Mart | 1.97 |
| 19 | 1 each | 2″ × 4″ × 8′, pine | Home Depot | 3.00 |
| 20 | 2 each | L-bracket, 3″ × 3″ × ¾″ | Home Depot | 3.00 |
| 21 | 5.5 ft | RG-8X coaxial cable | RadioShack 278-1313 or equiv | 0.32 per ft |

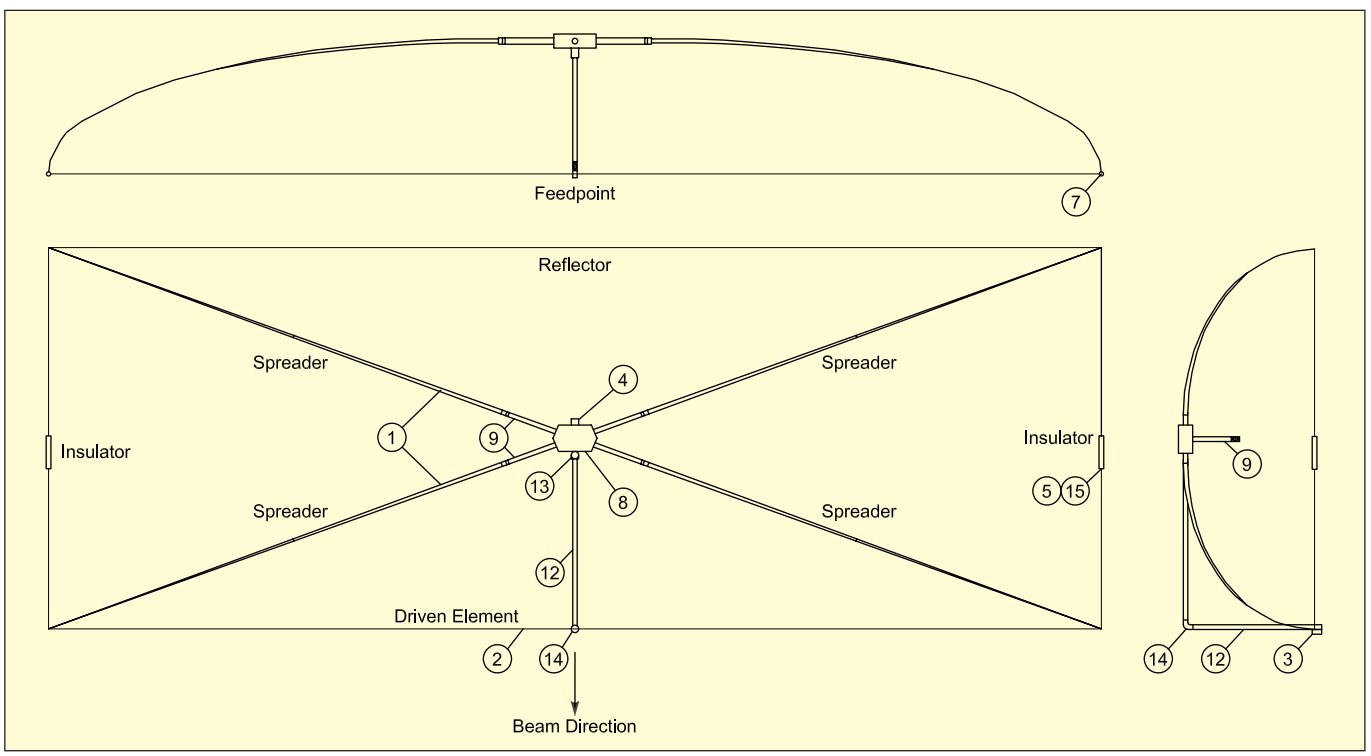



**Figure 2—Overview of the antenna and its components. Circled numbers refer to materials in Table 1. The mast and mast support bracket are not shown. Details are available at www.arrl.org/files/qst-binaries/black-widow.zip.**

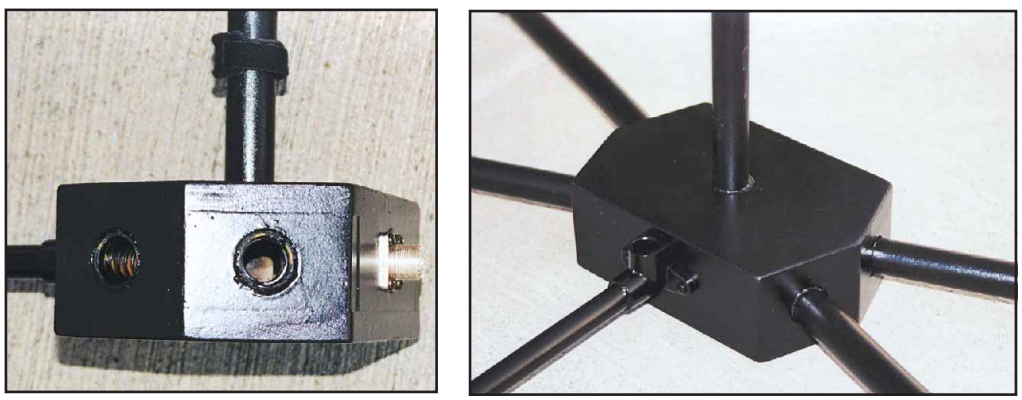


**Figure 3—The center hub (left). Note the glued-in (epoxy) threaded sockets for the spreaders. The completed hub (right) shows the mounting stub extending upward and the feed line support extending to the lower left.**

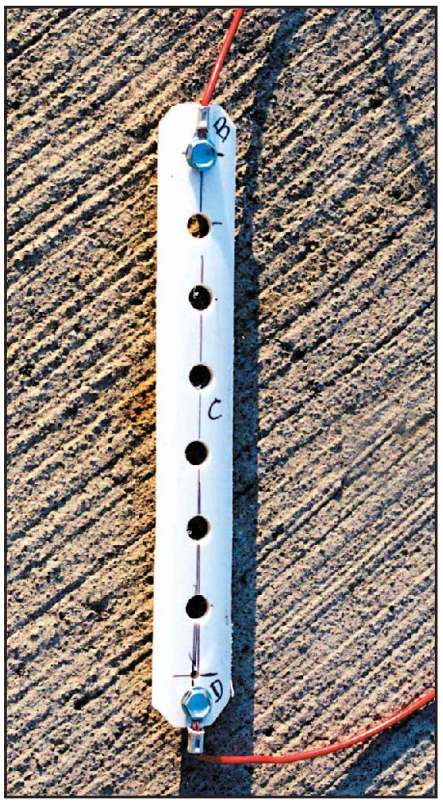



Figure 4—One of the two insulators for the wire elements.

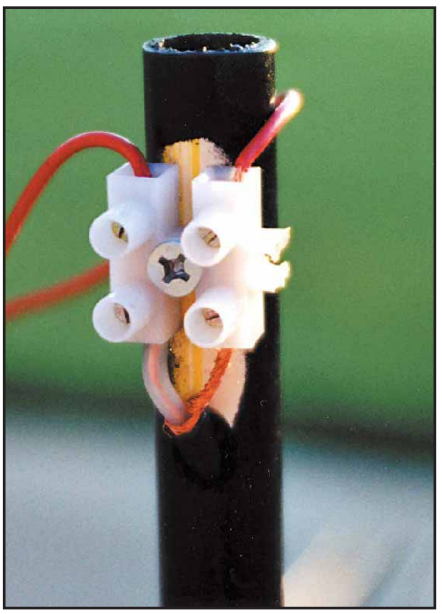


Figure 5—The mounted terminal strip on the feeder arm.


Figure 6—A view of the antenna mast support bracket.

ioned from the explanations contained here; however, detailed construction drawings for the antenna and the mast components are available at **www. arrl.org/files/qst-binaries/black-widow.zip**.

## Spreaders

Modify each of the four fishing poles as follows. Unscrew the handle cap, roughen two inches of the inside surface with sandpaper, and epoxy a 12″ wooden extension pole (threaded on both ends) into the fishing pole handle. The original pole is too flexible and does not exert enough tension to keep the wires tight, so a portion of the small end must be removed. Extend the pole to its full length, and trim the small end so that the total length from handle to tip (including the wooden pole) is 106.5″. Use a hacksaw or band saw to keep the fiberglass from cracking. Epoxy a screw hook into the end of the pole. (Note: If the screw hook diameter is too large to fit into the end of the pole, cut another 0.5″ to 1″ off of the pole until it fits. Make all four poles the same length.) Spray paint the bare wood with Krylon *Ultra-Flat* black spray paint, and when dry apply two coats of clear lacquer.

## Center Hub

The center hub is made from 0.5″ thick poplar wood to minimize weight. Cut the pieces on a table saw and glue them together with yellow wood glue. Cut two of the plastic extension-pole handle sockets in half so that two threaded sockets are produced from each. Drill 1″ diameter holes in the hub, and epoxy the sockets into each hole. I chose to permanently attach the mast mount (which is a wooden extension pole threaded on one end) by drilling a 0.875″ hole through the top and bottom and securing it with epoxy. Extend the non-threaded end through the hub and trim off the excess after the glue sets.

Drill a 0.625″ hole for mounting the SO-239 connector on one side of the hub. Drill and mount the CPVC drop ear elbow on the opposite side, and drill a 0.3125″ hole through the drop ear elbow into the hub. Sand and paint the hub the same as the fishing pole handles. Figure 3 shows a completed hub.

## Insulators

The ends of the antenna elements (within dimension C of Figure 1) are supported by a pair of insulators that maintain a fixed distance between the wire ends. The insulators are made from 6″ × 0.75″ pieces of scrap $1\frac{1}{4}$″ (nominal) PVC pipe cut lengthwise. Six 0.3125″ holes are drilled into the PVC insulators to reduce weight. Drill a small hole for a #6 thread-cutting screw to attach the element ends to the insulators. Include the diameter of the solder rings when spacing the holes in the insulators. A view of each of the insulators can be seen in Figure 4.

## Wire

Cut wires to the following dimensions (including 0.4″ for each loop of wire around a screw hook):

Two each, ½ Driven Element = ½ A + B + 1 Loop
= 97.315″ + 29.875″ + 0.4″ = 127.59″ or 127.625″

One each, Reflector Element = A + 2D + 2 Loops
= 194.625″ + 72″ + 0.8″ = 267.425″ or 267.5″

Mark the corners (Figure 1, dimension intersections A-B and A-D) on the wires using a permanent marker. Strip ½″ insulation from the wire ends at the feed point for the driven element. Attach solder rings at the ends that will attach to the insulators.

## Feed Point and Feed Line Support

Coax is carried to the feed point of the driven element from an SO-239 connector on the hub, through the hub, and

through an "L" made of CPVC pipe. The horizontal pipe length is 31.5″, and the vertical length is 24″. These lengths were determined with the antenna wires installed and the terminal block floating from its vertical support. To account for construction differences, cut the pipe pieces slightly long and trim them in small increments.

Connect the coax to the SO-239 connector first, then feed the coax through the hub, the drop ear elbow, the horizontal pipe, the 90° elbow, the vertical pipe, and out of a hole drilled in the pipe just above where the terminal block will be mounted.

Cut two terminals free from the strip. Clamp the driven element's feed point wire ends into each side of the terminal block. Then loop the wire around the open hooks at the corners using the permanent marker lines as an aid. Attach the wires to the insulators. Dry fit all pipe pieces until the terminal strip can be mounted to the lower end of the vertical pipe such that the driven element is straight and parallel to the reflector. Attach the two-terminal block with a small sheet metal screw. Figure 5 shows the mounted terminal strip.

Strip the coax and attach its shield and center conductor to the terminal strip. When complete, check all wire dimensions with a measuring tape and make adjustments as necessary within an accuracy of $^1/_8$″. Remark the position of the screw-eye mounting loops, if necessary. Align and glue the CPVC parts. (If you prefer not to glue the CPVC, leave enough slack in the coax to allow removal of the pipe and terminal block assembly, and attach the pipes and couplings with screws.) Paint the feed line support to match the hub.

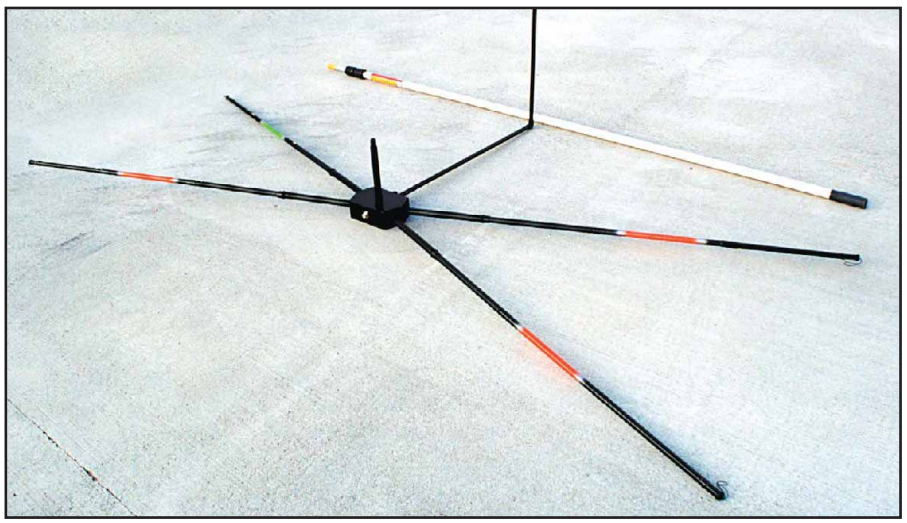
## Mast and Support

The painter pole can be supported in a variety of ways but should be guyed at three points. I fashioned my support from 2 × 4s to fit my trailer hitch and used the pickup truck tie points and a ground stake as guying anchors. The bed of the truck also serves as a convenient platform to raise and lower the mast. A PVC coupling, with holes drilled for twine guy lines slips over the pole. Be sure to drill and install a small screw into both ends of the plastic handle socket that connects the painter pole to the hub. This pins the antenna and prevents it from turning on the mast.

The finished Black Widow weighs less than 5 pounds and is stable at a height of 15 feet in windy conditions. On a calm day it could be extended to the full 23 feet, improving the gain and lowering the angle of radiation. Figure 6 is a view of the antenna support bracket and Figure 7 shows the erected antenna.

**Figure 7—The erected antenna. In the air, the antenna resembles a black spider with its legs hanging down.**

**(A)**



**(B)**

**Figure 8— (A) Broken down into its major components—spreaders, hub, feed line support and wire elements, the Black Widow is ready for transport. The partially assembled antenna (B).**

### Setup

Figure 8A shows the Black Widow ready for assembly. Remove the rubber stoppers from the ends of the fishing poles and extend them to their full length. Screw all four fishing poles into the hub. With the assembly upside down on the ground, attach the driven element wires to the feed point and wind the wires one loop around the screw hooks at the marks on the wire. As you progress, the fishing poles will begin to flex upward. Place the PVC pipe coupling with attached guy wires (nylon twine) over the top of the painter pole. Pick up the antenna, flip it over and screw the painter pole onto the mast. Secure the antenna by inserting a screw into the socket on both ends.

Connect a feed line to the SO-239 and secure it to the mast with Velcro or electrical tape. To help suppress RF currents on the outside of the coax shield, wind five turns of coax in a 6 inch coil near the antenna.

Place the antenna and painter pole mast into a suitable support. To prevent the painter pole from bending, raise the middle section first and adjust the guy wires as needed. Lower the middle section and raise and tighten the top section. Now raise the middle section again and tighten. Clothesline tighteners were used on all guy wires to allow adjustment without having to re-tie the twine.

### Results

The antenna was designed for PSK use at 21.070 MHz, but tests conducted with an MFJ antenna analyzer at heights of 15 and 23 feet reveal a fairly flat response of 1.2:1 to 1.3:1 across the entire 15-meter band. The *EZNEC* models predicted the antenna to have a gain of 9 dBi at the 15 foot level and 10.45 dBi at the 23 foot level. Likewise, the predicted SWR is 1.11:1 at 21.1 MHz.

Upon completion, I wanted to see if the Black Widow would perform as I had hoped. Tropical storm Isadore had just passed through our area, so it was clear but very windy. With an eye out for the wind, I mounted the antenna on the painter pole at a height of only 15 feet.

A good test for any antenna is to see how well it performs at QRP power levels. With 5 W from my FT-817, my first PSK contact was a station in San Diego, who gave me a signal report of 579. Not bad, considering that distance from my QTH in Tennessee is 1900 miles. Next, I swung the beam toward Europe and contacted a station in the UK who gave me an RST of 589 and an uninterrupted QSO for about 15 minutes. Wow, I was getting excited—that's over 4000 miles!

With the assistance of my brother (NG4T), further SSB/CW tests were conducted using his TS-2000 at power levels up to 100 W with great results. The Black Widow is easy to build, transport and set up. Figure 8A shows the antenna ready for transport and Figure 8B shows it partially assembled. It will outperform many portable 15 meter antennas. Good luck and have fun!

**Notes**

[1]**www.cebik.com/moxpage.html**.
[2]**www.qsl.net/ac6la/moxgen.html**.
[3]**www.eznec.com**.

*Allen Baker, KG4JJH, received his license in September 2000, after a lifelong dream of becoming a ham. He holds a BS in Industrial Engineering from Tennessee Technological University and works as an instrument and controls engineer with the Department of Energy in Oak Ridge, Tennessee. Allen is active on the digital modes (10 through 40 meters) and loves to experiment with antenna designs. He can be reached at* **kg4jjh@arrl.net**.

# NEW BOOKS

## THE NORTH GEORGIA QRP CLUB COMPENDIUM VOLUME 1

*Edited by Mike Boatright, KO4WX*

*Published by the North Georgia QRP Club. Spiral-bound paperback, 8½×11 inches, $12 + shipping; CD-ROM, $6 + shipping. No ISBN number. Available from North Georgia QRP Club, PO Box 173, Grayson, GA 30017;* **www.nogaqrp.org**.

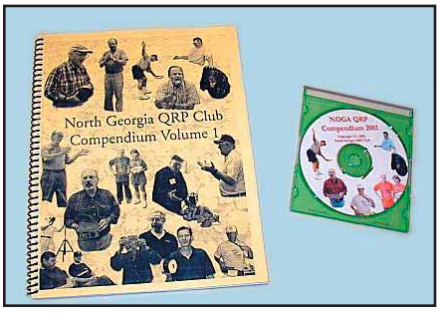
*Reviewed by Brennan Price, N4QX*
*Assistant Technical Editor*

◊ My introduction to QRP and kit construction came about four years ago, when I was living in Atlanta. I picked up a kit for an animal called the NOGAnaut at an Atlanta Hamfest. The cute little critter was billed as "a Y2K ready Amateur Radio transmitter." I assembled the rig in the shack of the Georgia Tech Amateur Radio Club one weekend afternoon, and proceeded to work Cleveland and Sparta on 80 meters. Granted, this was Cleveland and Sparta, Georgia, but the thrill of bringing the rig to life stays with me to this day.

The NOGAnaut is one of 14 projects described in the *North Georgia QRP Club Compendium Volume 1*. A number of receivers, transmitters and station accessories are documented with the beginning QRP enthusiast in mind. In addition to the 50 mW peanut-whistle rig I built (see


**The NOGAnaut 80-meter QRP transmitter, constructed by the author. This peanut whistle is described in the *North Georgia QRP Club Compendium, Volume 1*.**

photo), the *Compendium* offers a more substantial 80-meter transmitter as its first project, the NOGA80, which produces a healthy 1 W. New builders will particularly like the illustrations detailing the construction of the NOGA80, which show what the components look like when assembled in a "dead bug" manner above a ground plane. This presentation makes the project less daunting to the QRP novice. In several




other projects, construction tips are plentiful and helpful.

Station accessories include the North Georgia Power Indicator Guard (NoGaPiG), which is designed to protect one's rig from over-current, over-voltage and reverse voltage. As someone who fried his second QRP construction effort by applying reverse voltage, I can attest to the value of such a device. Fans of vintage radio will enjoy the NOGA Twin Tube 80, which, as its name implies, is a twin-tube 80-meter project that fits in an Altoids tin. Other projects include simple receivers and meters.

The North Georgia QRP Club offers the *Compendium* in both spiral-bound print and CD-ROM forms. Some of the figures and illustrations in the print version were difficult to read, but this is my only gripe about a relatively small club's effort to share the QRP projects they have developed with other hams. Even the hesitant reader will be moved to melt solder and have fun.

By Bob Patterson, K5DZE

# A VHF/UHF Discone Antenna

## A practical antenna for 144, 222 and 440 MHz and everything in between!

Amateur Radio will surely become more involved in Homeland Security communications. That will mean that the need for multiband operations on VHF and UHF will be more than a desired option; it will be a requirement. Likewise, we will likely have a need to monitor radio communications of other services that operate between and above our VHF/UHF frequencies. Amateurs could also be called upon to provide technical support to emergency services if they catastrophically lose all outside antennas. All of these situations make the Discone antenna a reliable design and a great option for Homeland Security as well as general amateur use.

This antenna design is not original with me. The original version appeared in a December 1978 *QST* article written by David Geiser, WA2ANU (now W5IXM)[1] [The earliest professional reference to the Discone appears in a 1946 paper by A. G. Kandonian, then of Federal Telephone and Radio Laboratories. Mr Kandonian appears to be the first to have coupled a disc with a cone.[2] The earliest published amateur reference is a 1949 *CQ* article by J. M. Boyer, W6UYH.[3]–*Ed.*]

I became familiar with it while stationed in Germany in 1979 as a US Signal Corps officer. We needed an antenna to cover several VHF frequencies, but we could not get one through the military supply system. I remembered this antenna design in *QST* and decided to build one for my unit's use. It worked so well that I wound up building several of them. Today's serious need makes this antenna an excellent multi-frequency radiator and an option to be aware of.

### The Discone Advantage

Discones have some unusual operational characteristics that can be distinct advantages as Homeland Security communications antennas. The antenna radiates like a quarter wave vertical above a ground plane. While there is little gain, the antenna shows extremely wide bandwidth—a major asset. Discone antennas behave like high-pass filters [or impedance transformers, coupling to free space.—*Ed.*] in that, *above* a designed cutoff frequency, the antenna radiates well. *Below* that cutoff frequency the SWR rises sharply and the antenna ceases to function. Above the cutoff frequency, the SWR can remain acceptable for up to 10 times that frequency. This means a Discone designed for a lower-end frequency of 144 MHz will operate at all frequencies up to and well past 450 MHz while maintaining a 2:1 SWR. [Kandonian presents data that shows the SWR to be about 3:1 at the cutoff frequency and rapidly approaching a value of 1.3:1 at 50% above the cutoff frequency, where the cutoff frequency is 200 MHz.[4] It appears best, therefore, to design a VHF-UHF Discone for a low-end cutoff frequency slightly below the operating frequency. The design formula in Figure 1 reflects that goal.—*Ed.*]

Geiser commented that his design worked at 1.3 GHz with a 5:1 SWR. While I haven't tried them at 1.3 GHz, the antennas I built for 144 to 444 MHz all had SWRs at or below 2:1, across that range. For Homeland Security operations this means that one antenna can transceive on the VHF/UHF amateur bands and also receive law enforcement, fire, EMS, government, military and other emergency service frequencies. The antenna could even be put into emergency backup service by those agencies.

### Construction

Simply stated, a Discone looks like an inverted cone with a round disc placed on its top and insulated from the cone. Amateur ingenuity will quickly bring to mind several ways one could construct such an antenna.

My first *test* antenna in 1979 was constructed not of metal, but from very heavy cardboard covered with heavy aluminum foil, appropriated from the military "mess hall." It worked like a charm and wound up sitting on the attic rafters of a German building for several years with good results. So much for the *test* model!

Geiser's design used "hardware cloth" or very stiff galvanized steel "chicken wire" that is manufactured as a ¼ inch square mesh. This design is based on the original version, but updated. This material does not need a lot of support if you intend to place the antenna inside an attic, out of the wind and weather. For outside use, a wood or PVC "tree" can be placed inside the antenna for rigidity and support. Here is how to do it.

Lay out a 5 foot long length of hardware cloth. Tack the corners down so it won't roll up. Use a felt tip marker pen to draw the cone and disc designs. Using a heavy metal shear, *carefully* cut out these antenna elements. Heavy gloves are recommended to protect hands from the sharp wire edges, which can inflict painful cuts. Fold the wire cloth into the cone shape. The height and diameter of the cone are about the same, about 110% of a ¼ wavelength at the lowest operating frequency, according to Geiser. The diameter of the disc is about 67% of the same parameter. Aluminum ground wire or nuts and bolts can hold the edges together to start. Some of the edge wires can be folded into hooks to give added strength to the seam. Use a heavy soldering iron to spot-solder the wire seam together. Figure 1 shows the general construction technique for the antenna, together with design formulas.

[1]Notes appear on page 41.

To feed the antenna, an inverted SO-239 coaxial connector can be used to screw or solder the top of the cone to the connector's mounting flange and then solder the top disc to the center conductor. I prefer to solder the cable directly to the antenna and not use a coax connector. If you use a 1½ inch × 3 foot long PVC pipe as the center support, the pipe can be pushed through the cone and out the small end. The hardware cloth can then be screwed around its top lip. A small hose clamp can work well here, if you desire.

Run the coax up the PVC pipe and out the top. Notch the pipe end to let the shield rest in the notch and solder the shield to the top of the cone. The center conductor of the coax should then stand straight up. Drill a small hole in the center of a 3 or 4 inch plastic disc or square. (I used a PVC coaster.) Place it on top of the PVC pipe and run the center wire of the coax through the hole. Using PVC cement, glue this PVC disc to top of the PVC pipe. Solder the center conductor of the coax to the center of the wire disc. Center the hardware cloth disc on the plastic disc and attach it with several screws. That's it.

Options for construction material and technique are as varied as one can imagine. For the cone and disc, copper window screen can be used with wood strips for inside cone support. For larger antennas, you might consider self-supporting wire for the cone and disc rather than the screen material. I have seen very large discone antennas for the HF spectrum and they looked like string lights on a pole at Christmas. Now there's a thought!

## On The Air

The VHF/UHF Discone is a lot more forgiving of construction techniques than are Yagi or quad antennas. Initial tests will surely be successful if you get the antenna in the clear and elevate it. For a first test, I had my antenna on my desk. I got a 59 report from a station about 3 miles away. Not spectacular, but I was inside the house with the antenna on a metal desk at ground level and it was being fed less than 10 W of RF. Once I put it up at 50 feet it worked well on every VHF/UHF frequency I tried. The SWR remained below 2:1 on both 146 MHz and 440 MHz.

Any good commercial $^5/_8$-wave antenna, small Yagi or homebrew VHF/UHF quad can beat this antenna at gain on a given design frequency, but none of these will have the gain-bandwidth product across the VHF/UHF spectrum that this performer has. If you need a high bandwidth, easy to construct antenna that's ideal for emergency communications, the Discone is worth a look.

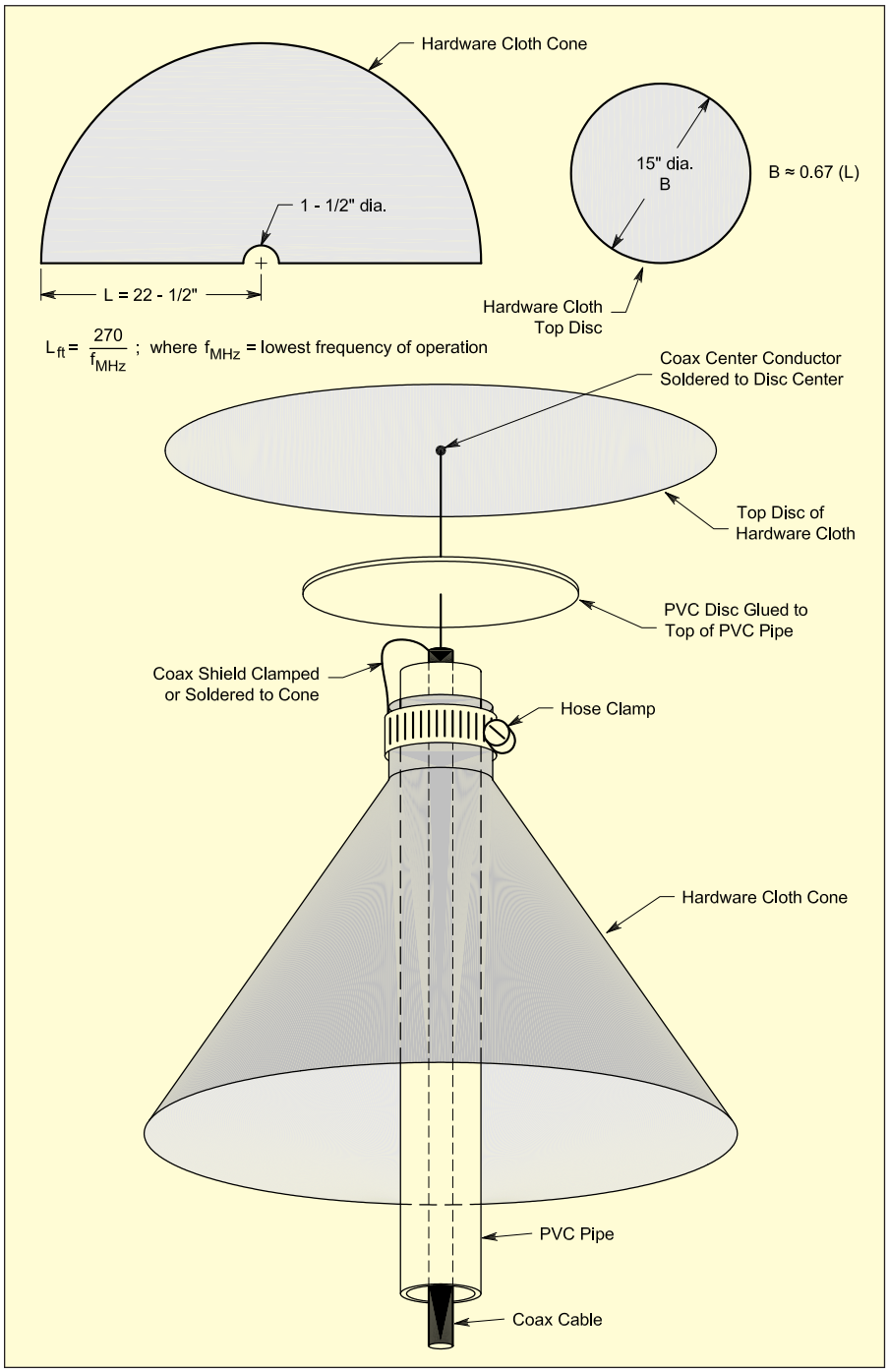



**Figure 1—Construction of the hardware-cloth discone antenna.**

**Notes**

[1]D. Geiser, WA2ANU, "An Inexpensive Multiband VHF Antenna," *QST*, Dec 1978, pp 28-29.

[2]A. G. Kandonian, "Three New Antenna Types and Their Applications," *Proceedings of the I.R.E.*, Vol 34, Nr 2, Feb 1946, pp 70-75.

[3]J. M. Boyer, W6UYH, "Discone—40 to 500 Mc Skywire," *CQ*, Jul 1949, p 11.

[4]See note 2.

*Bob Patterson, K5DZE, is an Amateur Extra class amateur and Life Member of ARRL with over 45 years of ham radio experience. He has operated across the country as well as overseas, where he has held the call signs HL9EZ and DA1EZ. Bob spent five years with the US Marines and 25 years with the US Army, retiring as a Lt Colonel. He holds a BS in Professional Aviation from Louisiana Tech University. Bob is currently vice president of Finance and Administration for Central Bible College in Springfield, Missouri. He is the faculty advisor and club trustee of the CBC ARC, W5CBC, which won the ARRL Achievement Award 2000 as top college/school club in the US. He is an active volunteer examiner and emergency coordinator, and is a former DEC. His operating interests include QRP, CW and DX. You can contact the author at 1280 W Burntwood St, Springfield, MO 65803;* **k5dze@arrl.net**.

By Steve Ford, WB8IMY

# You've Got...Spam!

## E-mail is commonplace in the Amateur Radio community. Unfortunately, so is *spam*.

Spam is spiced ham—at least that was the original meaning of the word as coined many years ago by the Hormel Corporation. Thanks to a Monty Python comedy skit extolling the virtues of spam to an unwilling restaurant patron, the computer community adopted "spam" as a term for something that is unwanted or forced upon you—usually e-mail. The new definition stuck, much to Hormel's chagrin, and now everyone with an e-mail account has heard the word, and probably muttered it under their breaths, even if they've never tasted the real thing.

It's important to define spam properly. The spam invective doesn't apply to all non-personal e-mail. If you have signed up to receive e-mail solicitations from various companies and organizations, those e-mails are not necessarily spam. After all, you *asked* to receive them. For example, the ARRL sends e-mails announcing new books or CDs and membership renewal reminders, but only to members who indicate their willingness to receive these e-mails when they register at the ARRLWeb site. Of all members registered on the ARRLWeb, about 75% have indicated that they want to receive these e-mail solicitations.

True spam is a different animal entirely. A spam e-mail is a solicitation you never asked to receive. These can range from fraudulent get-rich-quick schemes to advertisements from legitimate businesses. Spam is highly annoying because it can fill your e-mail in-box with dozens of messages every day. Each time you open your e-mail software, you have to carefully sort through the spam "noise" to find the e-mails you really want. Not only is this a tedious waste of time, it also exposes you or your family to things you'd really rather not see, such as X-rated content.

### Who is Sending All This Stuff?

We call them "spammers," but they prefer the term "commercial bulk e-mailers." Each day these individuals and corporations blast millions of e-mails into the Internet pipeline. Spam e-mail is so pervasive, one analyst estimated that it could account for as much as 39% of all Internet e-mail traffic.

Spammers rarely send these e-mails directly from their own computers. Spammers prefer to use other Internet-connected computers as relays because they can easily disguise their originating addresses. Spam can be relayed from computers in far-flung corners of the world such as Russia and China, but spammers are just as adept at hiding their tracks in this country as well.

Why do spammers spam? Because it's profitable. Bulk e-mailers receive kickbacks for every sale that results from an e-mail they've sent. Some also receive commissions every time a recipient clicks on an e-mail link to visit the sponsor's Web site (even if the visit doesn't result in a sale). Other businesses resort to spam because it has proven to be an effective sales tool.

Putting it simply, if spam didn't work, it wouldn't exist. The same is true of so-called "junk" postal mail.

### How Did They Get My E-Mail Address?

Bulk e-mailers are ingenious when it comes to obtaining addresses. They use special software to continuously prowl the Internet, looking for anything that appears to be an e-mail address. They check Web sites, Web site guest books, newsgroups, e-mail reflectors and everywhere else you can imagine. Some people attempt to fool these "spambots" by altering their posted e-mail address like this:

**bobNOSPAM@arrl.net** or
**bob-at-arrl.net**

If you need to send a message to Bob, you remove the NOSPAM part of the address, or substitute @ in the place of -at-. Otherwise, the address is invalid. This trick is known as *munging*. The spambots have become sophisticated, however, and many are now configured to recognize and *de-mung* e-mail addresses. They simply delete or repair the munged portion before the address is harvested.

It is important to point out that the "from" address in an e-mail message can be easily forged and, in the case of spam, usually is. Just because a message purports to come from a particular domain (the domain is the part of the address after the @) it doesn't mean it actually does come from there. The "from" address frequently isn't even a real e-mail address. Klez-type viruses take the same approach, using the "from" addresses from the address books of infected machines. The ability of the sender (virus or otherwise) to forge the "from" address is one of the things that makes spam so hard to suppress.

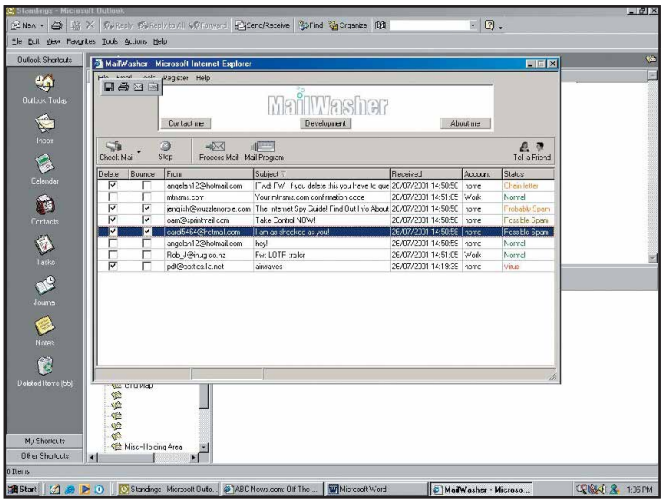
Spammers also use software that generates e-mail addresses on a randomized basis. This is known as a *dictionary attack*. If the spam e-mail doesn't bounce back, they assume it was sent to a valid address. Some spammers will store the addresses on CDs and sell them to other spammers. And then there are the less-than-ethical companies and Web sites that will sell your address to spammers or use it for their own bulk e-mailings without asking your permission. In case you're wondering, the ARRL *never* sells or distributes the e-mail addresses of its members to *anyone*.

### How Can I Avoid Spam?

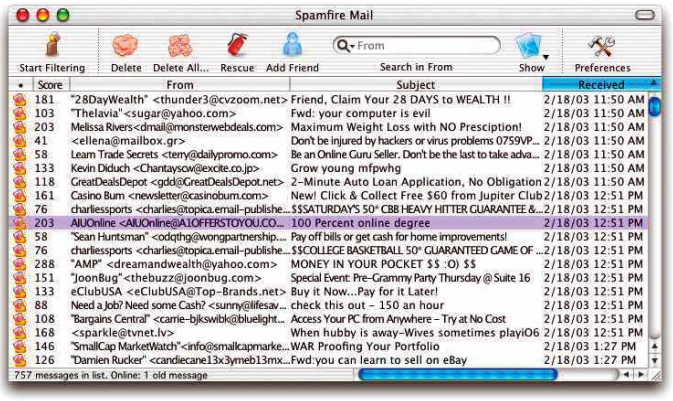
There are steps you can take to minimize the amount of spam showing up in your in-box. The first step is the easiest: Never, *ever,* respond to spam e-mail. Some messages include an invitation for you to remove yourself from the spam list, but in most cases, this is considerably less than truthful. When you respond to a spam, you've proven that your e-mail address connects with a live target—*you*.

Other treatments for the spam disease can be harsh. The side effects amount to less utility and enjoyment of the Internet. You have to decide if spam-avoidance is worth curtailing some of your Internet activities. For instance…

- Avoid posting comments to UseNet newsgroups. They are mother lodes when it comes to e-mail harvesting. Every time you post to a newsgroup, you are exposing your e-mail address to the spambots.




***Mailwasher* is popular anti-spam software for *Windows*.**




**Mac users may want to try *Spamfire*.**

• Cancel your subscriptions to e-mail reflectors (lists). Many are vulnerable to spambot snooping.

• If you have a personal or club Web site, duck the spambots by not listing e-mail addresses or providing e-mail links.

• Avoid giving your e-mail address to Web sites that do not have trustworthy privacy policies.

Obviously, several of these measures are draconian and unappealing. The alternative is to set up spam filtering on your own computer. This may be one of the best solutions in the near term. The February 25, 2003 issue of *PC Magazine* reviewed several anti-spam packages. The top four for *Windows* were…

• *MailWasher* (**www.mailwasher.net/**)

• MailShell *SpamCatcher* (**www.mailshell.com/spamcatcher/**)

• McAfee *SpamKiller* (**www.mcafee.com/myapps/msk/**)

• DeerSoft *SpamAssassin Pro* (**www.deersoft.com/**)

*Linux* users may wish to try *Mailfilter* (**mailfilter.sourceforge.net/**) or *ScanMail* (**www.scanmail-software.com/**). Mac owners should look at *Spamfire* (**www.matterform.com/**) or *SpamSieve* (**www.c-command.com/spamsieve/**).

The down side of anti-spam software is that it can block e-mail you *want* to receive—both personal and otherwise. The software scans each incoming message, looking for the telltale signs of spam. The algorithms are sophisticated, but not perfect. While I was trying *Mailwasher*, for example, it consistently blocked e-mail from my sister. Apparently, there was something in her e-mail formatting or content that caught *Mailwasher's* attention. *Mailwasher* also blocked e-mails I had signed up to receive from several airlines. Fortunately, the anti-spam programs allow you to set up "whitelists" that automatically pass messages from friends, family, e-mail lists and so on.

## What Can Be Done about Spam from ARRL.net?

The ARRL provides the ARRL.net forwarding service free of charge to our members. ARRL.net is simply a forwarding mechanism, not an Internet Service Provider. If you receive a spam e-mail at your ARRL.net address, it is because your Internet Service Provider allowed it to arrive, just as it does any other e-mail.

ARRL.net is a popular perk because it allows members to have e-mail addresses that never change, even if they change Internet providers. The League is able to offer the service free to members because the cost of maintaining it is relatively low. The e-mail coming to ARRL.net addresses shows up on our servers and goes right back out the door without human intervention.

Adding anti-spam software to our systems requires someone to maintain it. That means much higher costs here at Headquarters. We would have to begin charging members extra for their ARRL.net addresses—and you don't need to be a marketing genius to predict how unpopular *that* would be. Also, the person maintaining the anti-spam software couldn't manage whitelists for 65,000 people, so chances are some of the messages you'd want to receive would end up in the bit bucket.

Our computer managers have also explored the possibility of using off-site commercial spam-blocking systems such as those provided by Brightmail, but they are prohibitively expensive. Besides the cost, there is still the issue of deciding what is spam and what is not. If their software incorrectly identifies a message as spam, it is instantly deleted. This is tantamount to your postal carrier sorting through your mail and deciding what you should receive.

## Spam—A Fact of Modern Life

Like death and taxes, spam appears to be something that we will have to endure for the foreseeable future. There is an arms race going on between the spammers and the anti-spam software creators. The anti-spam software becomes more advanced and the spammers change their tactics to thwart it. It is a war without end.

Legislators are introducing laws that may prohibit spam, but the legal outcome is in question. Some believe that any law that broadly prohibits spam could be challenged on First Amendment grounds. Others counter that the First Amendment allows people the right to free speech, but it doesn't guarantee them the right to force others to hear their message.

Other anti-spam legislation would make it illegal not to remove an e-mail address from a spam list if requested. This type of law may stand a better chance of passing a constitutionality test.

If nothing else, send a letter to your state and federal representatives and demand that they support or sponsor anti-spam bills. You can also report spam to the Federal Trade Commission at **uce@ftc.gov** (just click the FORWARD button in your e-mail software and send the offending spam to this address). The Federal Trade Commission has an informative document on the subject at **www.ftc.gov/opa/2002/11/netforce.htm**. Until there is relief from technology or the law, the best we can do is arm ourselves with knowledge.

*Steve Ford, WB8IMY, is the editor of* QST. *You can contact him at* **sford@arrl.org**.

By Howard S. Robins, W1HSR

# Expand Your Mind—On-Line!

## The "classrooms" of the ARRL Certification and Continuing Education Program are as near as your keyboard.

Thanks to the Internet, you can broaden your educational horizons without ever leaving the comfort of your home. Your ARRL has created an entire catalog of fascinating and useful on-line courses written by experts in their fields. Despite the on-line aspect, you aren't alone during your studies. Each course includes "mentors" who are available to personally answer your questions. More about this later.

### What is CCEP?

ARRL's Certification and Continuing Education Program (CCEP) is a convenient and economical platform for hams of every experience level to learn about different aspects of Amateur Radio. The program includes the courses shown in Table 1.

The CCEP was created in 2000 with its flagship Amateur Radio Emergency Communications Course (ARECC). The original course has evolved into three levels: Level I—Introductory, Level II—Intermediate and Level III—Advanced. With a grant from United Technologies, more than 250 Connecticut hams have been certified in the Level I course in 2002. The Corporation for National and Community Service ("CNCS") has awarded ARRL a grant that will fund thousands of students over a three-year period that began in September 2002.

The Emergency Communications part of the CCEP is so widely publicized that many people are not aware of the fact that several technical and operating-oriented courses are also available. We have surveyed members to determine what additional topics they would like us to offer as courses. As a result, we plan to introduce four new courses this year.

### How On-Line Courses Work

You begin each class by logging onto your course area via the Web. Classes are accessible seven days a week, 24 hours a day. You can "attend" class in the middle of the night, if you feel like it!

Courses are typically presented in 10 to 20 "Learning Units." Most learning units also have activities that you'll be asked to do off-line to experience some aspect of the topic. For example, during the satellite course you may be asked to try receiving a signal from one of the FM repeater birds.

You'll work at your own pace and convenience. The only time constraint is that all work must be completed during the class period. You can count on spending a total of 20 to 25 hours over the 8-week period working on a typical course. Antenna modeling is a 16-week course that takes about 50 hours to complete. Graphics, photos, audio clips and movie clips are used throughout our courses to help illustrate specific points. Internet links to additional sources of information and related materials, e.g. downloadable software, are also commonly used.

Each Learning Unit ends with a quiz made up of five multiple-choice questions. At the end of the course, a 25-question "final exam" assessment takes place.

As I mentioned previously, you will be assigned a volunteer mentor. Mentors are dedicated hams that have taken the course they mentor and additional mentor training, and are usually very experienced in their topic. Some mentors were contributors to the development of their course(s). Volunteer mentors are key to the success of the CCE program. They review and comment on the results of student activities, and are there to help their students when needed. They also keep track of their students' progress. You will communicate with your mentor primarily by e-mail, but telephone contacts are also possible when necessary. You must pass the final assessment with a grade of at least 80%, and complete activities to the satisfaction of your mentor to achieve certification.

If you dread the prospect of staring into a computer monitor, you should know that you have the option of printing the information pages and reading them off-line. The emergency communications and antenna modeling courses also have printed, bound course books available as an option for additional cost.

### Registration

Classes open for registration every month on Mondays at 12:01 AM Eastern time. Registration remains open until

**Table 1**
**CCEP Courses**

| *Title* | *Course #* | *Opening Day* | *Duration (weeks)* | *Member Fee* | *Nonmember Fee* |
|---|---|---|---|---|---|
| ARECC Level I | EC-001 | 1st Monday | 8 | $45* | $65 |
| ARECC Level II | EC-002 | 2nd Monday | 8 | $45 | $65 |
| ARECC Level III | EC-003 | 3rd Monday | 8 | $45 | $65 |
| Antenna Modeling | EC-004 | 2nd Monday | 16 | $85 | $115 |
| HF Digital Communications | EC-005 | 3rd Monday | 8 | $65 | $95 |
| RFI | EC-006 | 4th Monday | 8 | $65 | $95 |
| Satellite Communications | EC-007 | 4th Monday | 8 | $65 | $95 |
| VHF/UHF—Life Beyond the Repeater | EC-008 | 3rd Monday | 8 | $65 | $95 |

*This fee is eligible for reimbursement upon successful completion.

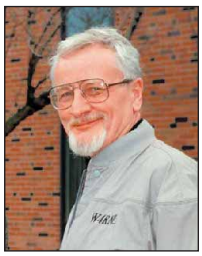
midnight on the following Sunday, or until all seats have been taken. Prospective students usually register for classes on-line. Visit the CCEP Web page at **www.arrl.org/cce**. You will find links there that will take you to course-specific information pages, which include links to registration instructions.

## CCEP Technical Courses

### *Antenna Modeling (EC-004)*

This course was written by L.B. Cebik, W4RNL, and edited by ARRL Senior Assistant Technical Editor—and antenna guru—Dean Straw, N6BV. It offers students a hands-on tutorial in computerized antenna modeling techniques, and is geared to assist students in mastering the art and science of antenna modeling. The course has 31 learning units, and takes approximately 50 hours to complete over a 16-week period. A sample lesson based on the actual Antenna Modeling course is available at **www.arrl.org/cce/sample-lesson/**.

### *HF Digital Communications (EC-005)*


L.B. Cebik, W4RNL

*QST* Editor Steve Ford, WB8IMY, authored this course. Steve's style is strictly conversational and down-to-earth, and he makes learning easy. If you haven't experienced the digital modes, you are missing an aspect of ham radio that is quite popular. Students with HF privileges will learn how to augment their stations to work RTTY, PSK31, MFSK, Hellschreiber, PACTOR, PACTOR II, WinLink2000, Clover, HF Packet, digital DX and digital contesting. You can build or purchase a device to interface your computer and HF transceiver. Downloadable software is readily available for little or no cost to operate each of the modes. This course has 14 learning units, and takes 20 to 25 hours to complete over an 8-week period.

### *Radio Frequency Interference (EC-006)*

Newly offered in February, this course is based on *The ARRL RFI Book*, edited by Ed Hare, W1RFI. In addition to Ed, Dave Zinder, W7PMD, Mike Gruber, W1MG, John Phillips, K2QAI, John Hennessee, N1KB, and beta testers too numerous to name contributed to this newest course. The latest information and investigation techniques on the topic are presented. In this course you will learn to identify sources and victims of interference. You will also get tips and suggestions for solutions and for handling those ticklish problems that crop up with difficult neighbors and other aggrieved parties. This course has 13 learning units, and is expected to take approximately 25 hours to complete over an 8-week period.

### *Satellite Communications (EC-007)*

*QST* Editor and space enthusiast Steve Ford, WB8IMY, also crafted our satellite communications course. Students will learn about the history of Amateur Radio in space; and how many of the "birds" can be utilized to communicate effectively using a wide range of modes and methods. Students download satellite-tracking software that is available at no, or little cost. You set up the software to let you know when satellites are within range of your location. It is very "neat" to tune in as a bird's *footprint* moves over your location and you hear its signal fade in, and then fade away as it moves out. It is even neater to make your first satellite contact with a hand-held transceiver. This course has 12 learning units, and takes 20 to 25 hours to complete over an 8-week period.

### *VHF/UHF—Life Beyond the Repeater (EC-008)*

Steve Ford, WB8IMY, steps up to the teacher's desk again with our newest course offering. Students will be introduced to VoIP Internet linking, amateur satellites, direction finding, APRS, SSB/CW operating, VHF contesting, microwaves, amateur television and high-speed multimedia radio. Both the newly licensed Technician and the more experienced Amateur Extra hams will find this collection of topics interesting and useful in exploring some of the lesser-used and more intriguing aspects of the hobby. This course has 10 learning units, and takes 20 to 25 hours to complete over an 8-week period.

## What's Ahead

You'll find more courses coming on-line throughout the year. Our objective is to introduce four new courses each year, and to refresh established courses on a routine basis.

Prolific writer and 2002 Bill Orr, W6SAI, Technical Writing Award winner Ian Poole, G3YWX, is currently writing a course on RF propagation. That course is expected to hit the streets shortly. Topics include: The ionosphere, the sun and sunspots, ground waves, sky waves and reflections, band conditions, ionospheric disturbances and storms, predicting conditions, gray line, sporadic E, tropospheric propagation, auroral propagation and meteor scatter.


Ian Poole, G3YWX

Later this year, we plan to introduce a course on antennas that will be a hands-on how-to course in which you'll learn about horizontal and vertical antennas, connectors, feed lines, SWR, radiation angle, grounding, simple antenna construction and radiation patterns. We even have a course in the works that will teach you how to diagnose and repair electronic circuitry commonly used in Amateur Radio equipment.

## Student Comments

- "Simply glad I took the course—I feel like I've just scratched the surface and I do want to keep on with the learning process in this area."
- "Thanks very much for offering the course!"
- "Excellent course. Lays a good foundation for doing the real world work which brings you from a theoretical know-a-lot to a real expert."
- "My mentor, Ben, was very helpful. I would definitely recommend this course to anyone who is interested in digital modes."
- "Course was good for me since my learning curve for digital is one of my weak points. I liked that it touched on all the modes and it has given me the incentive to pursue digital modes of operation in the future."

Visit the CCE Web site today at **www.arrl.org/cce** and sign up for a course. You never know what you'll learn!

*The author is ARRL Certification and Continuing Education Program Coordinator. He can be reached at* **hrobins@arrl.org**. QST

# NEW PRODUCTS

## MALDOL HVU-8 HF/VHF/UHF COMPACT ANTENNA

◊ The Maldol HVU-8 is a compact, omnidirectional HF, VHF and UHF antenna intended for limited-space installations such as apartments and condominiums, or for portable use. At less than 9 feet in height, the HVU-8 can be installed in many locations. Each band has its own independently tuned radiator and radial element. SWR bandwidths on all HF bands are 50 kHz or less. Power rating is 200 W PEP on HF; 150 W continuous on 6 meters through 70 cm. $349.95. For more information contact NCG Company, 1275 N Grove St, Anaheim, CA 92806-2114; tel 800-962-2611; **www.natcommgroup.com/**. QST

By Maury Guzick, W5BGP

# Ham-Com 2003 and the ARRL National Convention

## Make Dallas your destination and join thousands of your fellow amateurs in Texas on June 20-22.

If you've never heard of Ham-Com, you haven't been paying attention. Ham-Com ranks among the top 10 most popular Amateur Radio gatherings in the country. It draws thousands to Dallas each year and 2003 is special because this year Ham-Com hosts the ARRL National Convention.

This isn't the first time Ham-Com has been headquarters for the ARRL National. The first time was in 1989 when Ham-Com feted the National Convention during the ARRL 75th Diamond Jubilee. That convention was attended by hams from around the US and the world. Ham-Com played host again in 1994.

In 2003, Ham-Com hosts its third ARRL National Convention while celebrating its own 25th Jubilee year. We expect more than 5000 amateurs to show up in Dallas for the event.

Thousands of amateurs crowd the aisles of the Ham-Com exhibitor area.

### What's Going On?

At Ham-Com 2003 you'll be treated to an indoor flea market with over 400 tables in air conditioning (this *is* Texas in June, after all!). There is also an excellent outdoor tailgate flea market. The commercial exhibitor area has over 100 booths with all the latest and greatest goodies our hobby has to offer. When you're not shopping, you can enjoy special programs and forums, SKYWARN classes, the DXtravaganza and more.

Ham-Com isn't all there is to experience in Dallas. The convention is next door to the Texas Rangers Baseball Park, Six Flags Amusement Park and Hurricane Harbor Water Amusement Park. There is no need to leave the spouse and kids at home when you come to Ham-Com!

### How to Get to Ham-Com

Ham-Com 2003 takes place at the Arlington Convention Center, 1200 Ballpark Way, in Arlington, Texas (a suburb of Dallas/Fort Worth). The nearby Dallas/Fort Worth airport is served by all major airlines (see their Web sites for airline and rental car discounts). For driving directions, see the Ham-Com Web site at **www.hamcom.org/**. The Arlington Amateur Radio Club will provide talk-in on 147.14 MHz.

### Ham-Com History

It all began in 1977 when a small group of hams met to discuss the possibility of reinventing an Amateur Radio gathering that had been held in the Dallas area. This meeting precipitated the first annual Ham-Com in June 1978. It was held at a small Dallas hotel on the north edge of town called the Royal Coach Inn. (The Royal Coach has since burned.)

Approximately 800 persons attended this first show. The next year we moved the venue to the LeBaron Hotel, which had a five-story parking garage we could

### Ham-Com Hotels

*This is just a partial list of nearby hotels. See your travel agent. Check Ham-Com Web site at* **www.hamcom.org** *for more options.*

**Wingate** (HQ for DXers)
1024 Brookhollow Plaza Dr
Arlington, TX 76006
tel 800-228-1000

**Marriott Courtyard** (HQ for QRPers)
1500 Nolan Ryan Expressway
Arlington, TX 76011
tel 817-277-2774

**Country Inn and Suites**
1075 Wet 'n Wild Way
Arlington, TX 76011
tel 800-456-4000

**Howard Johnson**
2001 E Copeland Rd
Arlington, TX 76011
tel 817-461-1122

use for the flea market area. Well, as things would have it in Texas in the spring, a thunderstorm struck the city about eight weeks before the June date and the torrential rain and wind brought down the ceiling of the hotel ballroom. This necessitated a last-minute site change.

The NorthPark Inn on US 75 filled the bill. We had a parking lot for the outdoor flea market, a downstairs parking garage for the indoor flea market as well as ballrooms to house the commercial exhibit area. This became the home of Ham-Com for the next seven years. That original group of Ham-Com organizers, John, WA5OHG, and Ann, KA5TZD, Fleet; Dr Byron Landress, W5IBE; Don Smith, W5DS; Tom Gentry, K5VOU and wife Stephanie; Tom Eanes, K5AU; the late Jack Morgan, W5LQR; Walt Jackson, W5ZYA and Gordon Cathey were able to change the location and provide the backing for moving the event and getting everything ready. A number of others put in the time needed to keep the show going.

As Dallas and its surrounding Metroplex grew, so did Ham-Com. In June 1986, Ham-Com was moved from the NorthPark Inn, which was being razed for more office buildings (we have been hard on our host hotels!), to the newly constructed Arlington Convention Center where we have remained to this day. We were the first official group to hold our function at the Center.

Ham-Com has always been a volunteer effort, and that is its greatest strength. Thanks to the original volunteers and those who've kept it going, Ham-Com has grown through a quarter century to the position it holds today. The crew lineup has changed as life for each has changed, but new hams with the same vision and desire have stepped up to give the essential element to make it work…their time.

Ham-Com is a "communal" effort as well, with local clubs providing support. In 1984, a Ham-Com Steering Committee was formed. All the Amateur Radio clubs from around North Texas were enlisted to send a representative to a once-monthly meeting to help plan the event. Many of the clubs assisted by putting on programs, helping with security and holding transmitter hunts. This spirit of cooperation continues to this day and we hope it is an inspiration to others.

Mark your calendar and make your reservations today. We look forward to seeing you at the Ham-Com 2003/ARRL National Convention in Arlington, Texas on June 20, 21 and 22!

*You can contact the author at 10259 Chimney Hill Ln, Dallas, TX 75243;* **w5bgp@arrl.net**. QST

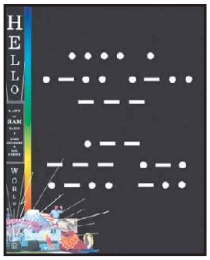
# NEW BOOKS

## HELLO WORLD: A LIFE IN HAM RADIO

*By Danny Gregory, KC2KGT and Paul Sahre, KC2KHN*

*Princeton Architectural Press, 37 E 7th St, New York, NY 10003; tel 212-995-9620;* **www.papress.com**. *First edition, 6¾ × 9¼ inches, softcover, 257 pages with color illustrations. $24.95 list. Available from* **www.amazon.com** *for $17.47.*

*Reviewed by Steve Ford, WB8IMY*
QST *Editor*




◊ Despite the title, *Hello World: A Life in Ham Radio* is not a book intended for hams. On the contrary, the target audience is that large portion of the public that has no idea what Amateur Radio is all about, or why anyone would want to purse such an avocation.

But *Hello World* is not an Amateur Radio tutorial in the traditional sense. Rather than banging the drum loudly for our technological or public-service achievements, *Hello World* gives its reader a glimpse of what it is like to be a ham from what I can only describe as a "spiritual" perspective. Specifically, *Hello World* communicates the unique joy of Amateur Radio by presenting a portrait of how it shaped the life of one deceased amateur—Jerry Powell, W2OJW. How does the book accomplish this? Through Jerry's collection of QSL cards.

Two years ago, Danny Gregory stumbled across Jerry's QSL cards at a public fleamarket. Neither Danny nor his friend Paul Sahre were hams at the time. In fact, they had barely heard of Amateur Radio. Still, this odd menagerie of paper intrigued them. Danny purchased the cards and both authors were soon launched on a journey of discovery that eventually found them obtaining ham tickets themselves.

Although Danny and Paul never met Jerry, he became a kind of ghostly Elmer. Through his QSLs the authors could feel the power of his love of Amateur Radio—a love that spanned eight decades of operation. (W2OJW became a Silent Key in 2001 at age 92.)

*Hello World* is a gallery of QSLs, both DX and domestic, in gorgeous color. This book is awash in color from cover to cover. Even the 80-year-old cards look like you could peel them right off the pages. In some cases, the QSLs are reproduced at full size (or larger) for an even greater effect. Through their research, the authors uncovered the stories behind the contacts and have included them with the cards. Clever design elements are used, such as enlarging photos of operators that appeared on some of the QSLs. You see a gallery of faces from decades past; old black and white images that once graced Jerry's QSLs. Since Jerry was active right up to the time of his death, there is a good chance that you'll see a QSL that is also in your collection (I saw several that are in mine).

*Hello World* is a visual treat for hams and nonhams alike. Not only are the QSLs vivid in their reproduction, there is even a colorful fold-out map of the world that shows all the countries Jerry worked during the various decades of his long ham career. But beyond the eye candy, *Hello World* tells a moving story of how Amateur Radio can be more than just a hobby. Through its retrospective of W2OJW's life, we can feel his sense of wonder. QST

# NEW PRODUCTS

## EMERGENCY FAMILY PREPAREDNESS VIDEO


◊ Apogee Communications Group has announced the debut of their Emergency Family Preparedness video. The 38-minute video discusses a number of emergency preparedness topics such as how to obtain safe drinking water, what foods to store and how to store them, alternative sources of heat and power and more. The video is available on VHS tape for $19.95 plus shipping and handling from Apogee Communications Group, 159 Alpine Way, Boulder, CO 80304; tel 800-210-5700; **www.apogeevideo.com**. VISA and MasterCard accepted. QST

By Barry Keating, WD4MSM

# A Radio Amateur's Guide to London and the UK

## What to do, what to see—and how to open UK repeaters with your funny accent.

So, you have planned a trip to London (or your spouse has planned one) and you wonder if there is something for you to look forward to other than the National Gallery, the National Portrait Gallery and Buckingham Palace. Just beneath the surface of "London for the tourist" there exists a wealth of places, people, and events for the radio amateur. But, you will not find any of these listed in *Fodor's, Frommer's* or any commercial travel guides. These guides are excellent for the general visitor but you have a special interest—Amateur Radio. What you need is a "Travel Guide for Radio Amateurs," and that is exactly what this article is about.

When you plan your trip to London leave some extra time for Amateur Radio activities, and leave some time before your trip to arrange the visits and contacts you would like to make while you are there. A little planning before you leave will work out quite nicely when you finally do arrive.

First, think about a practical matter. Consider taking a dual or tri-band handheld with you on the trip. The handheld will place you in immediate and direct contact with the local amateurs (who speak a language strangely close to our own). When I lived in London recently I had a Yaesu VX-5R with me. This radio is ideal because it has 2 meters, 70 centimeters and 6 meters, but also serves as a general purpose receiver (more on that a bit later). The entire UK is covered under the CEPT reciprocal licensing program, so there is no need for you to apply for a separate UK Amateur Radio license (see CEPT information in the sidebar). The ARRL recommends that you take three forms of documentation with you for operation in most European countries: (1) your original US license, (2) proof of US citizenship (your passport, for example) and (3) a copy (printed from the ARRL Web site) of the CEPT agreement itself. These documents will work for operating from most of the European countries. Remember that once in London the Continent is only a three-hour train ride away on the Eurostar through the Chunnel.

### Repeaters and Tones in the UK

The UK and the Continent rarely use CTCSS tones for repeater access; instead, they currently use a 1750 Hz "tone burst" to open the repeater. (They are, however, changing to CTCSS and DCS tones.) Luckily, some of the available handhelds sold in this country already have this feature built into the rig. The VX-5R is one of these. The tone burst is sent at the beginning of a repeater contact and is only sent once. After the repeater is "opened" by the tone burst you may identify yourself. If you join a conversation already in progress there is no need to send the tone burst because one of the other operators must have already sent the tone and opened the repeater.

What if your handheld does not support tone burst? This may not be as significant a problem as it appears. You could simply break into existing conversations or you can employ the mysterious and exciting "whistle technique." The whistle technique is implemented by keying and whistling into your mike. As you whistle, just run up and down through the entire musical scale. Sooner or later you will hit a note close to 1750 Hz and the repeater will open. I know this sounds

**The British Airways London Eye, the perfect place to extend the range of your handheld radio.**

**The Ilford Group—J. R., Alan and Robb. Just look at all those parts in the background!**

bizarre but it does work and you will get the hang of it quickly. I was caught in the act in an Oxford laundromat one day whistling into my older ICOM 24-AT. While my fellow laundromat inhabitants thought I was crazy, the technique worked as advertised. As soon as the repeater opened, I started a conversation; there was no further need to annoy my laundromat neighbors.

A list of all available repeaters, their offsets and maps of their locations is available from the Repeater Management Committee of the Radio Society of Great Britain (RSGB) Web site (see sidebar).

Right off the bat the small number of repeaters available both in London and the rest of the UK will surprise you. If you were in any American city of comparable size you would expect a large number of available open repeaters. In London there are only two amateur repeaters that you will be able to hit consistently. One is actually used by amateurs and you will hear quite a few conversations throughout the day (the R0 pair at 145.00 input and 145.600 output). The other repeater will sound different; the conversations will all be between "black cab" drivers (these conversations take place on the R7 pair at 145.175 input and 145.775 output). This second repeater is also an amateur repeater but it is used almost exclusively by the cab drivers while they are waiting for customers (ask for directions on this repeater and you will not be disappointed; the directions you receive will be accurate and detailed, since all London cab drivers must pass a grueling exam covering every street and alley in London).

There are relatively few frequency pairs in use in the UK (only 14 VHF pairs are used) and there is no need to worry about CTCSS tones. This means it is probably best to just program in all the pairs on your handheld before you leave the United States. In this way, you will be ready no matter where you travel in the UK. Remember, however, the UK is 220-V electric service and you'll need to be mindful of how you will recharge your handheld. I used my regular charger with a small voltage converter available at RadioShack to recharge mine (RS #273-1410). The converter is no larger than a small "wall wart" but note that it is only for intermittent use with small items. Also be sure to take a UK three-pronged plug with the voltage converter.

**The secret's out. Sign just outside the town of Kelvedon Hatch.**

### Step Back In Time...

To see how radio has developed in Britain take a step back in time. It's 1939, and you are a radio amateur in Great Britain. You may be 14 years of age or you could be 75. No matter, you possess a skill that your country needs. Adolph Hitler is in power in Germany and he has invaded Poland, leaving little for Britain to do but come to the aid of their allies and declare war on the Reich. Before the Poles are overrun, they manage to provide the British with an important gift—a working German Enigma code machine.

The skill you possess that is valuable to the war effort is your knowledge of radio operation and Morse code. Britain has secretly been cracking the Enigma code used by all the German armed forces in one way or another. The code key changes frequently and large numbers of intercepts are needed to keep the code breakers "in business." Britain sets up the famous Y-Stations. These are intercept stations and are primarily manned by Amateur Radio operators at the beginning of hostilities. The stations include little more than a short-wave receiver, antenna and someone who understands and can copy Morse code accurately. Some of these Y-Station employees are only 14-year-old, newly licensed, amateur operators. The Y-Stations are given either a frequency to listen to and copy all traffic from or a band spread on which to report all activity.

The Y-station operators, located throughout the UK, carefully logged all German radio messages before sending them to Bletchley Park by teleprinter or motorcycle courier. At peak times of activity, up to 3000 messages a day would arrive at Bletchley by courier.

### Bletchley Park in the 21st Century

You can re-live these accomplishments of the radio amateurs and even operate the famous Station X [Roman numeral 10]. Station X was the name given by Prime Minister Winston Churchill to the Government Code and Cipher School station at Bletchley Park. In reality the location was not a school at all; that was a subterfuge. It was, instead, the code breaking headquarters for Britain's best minds (including Alan Turing, one of the inventors of the modern computer).

An estate outside London that has been set aside as a national trust, Bletchley Park is a delightful place to visit any time of year. It is just a one-hour ride from London's Euston Station (Euston is also a Tube, or underground, station). Trains leave frequently and the ride is pleasant (see the sidebar for Railtrack information). The Milton Keynes Central rail station is a short walk from the front gate of Bletchley Park. There is even a sign in front of the station directing you to the footpath leading to Bletchley (10 minute walk). There is an entry fee to the grounds but it is one of the great bargains in the UK!

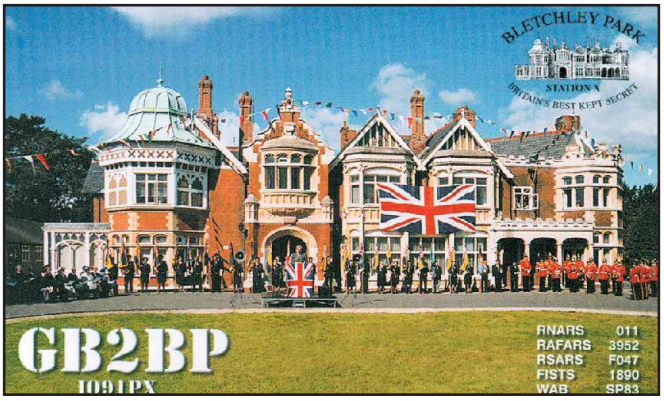

**The author at the controls of GB2BP.**

The Bletchley Park Trust is not just the former estate turned code school. It also houses more than 20 interest groups covering military vehicles, model railroads, vintage radio equipment, military reenactment groups, model aircraft enthusiasts and more. Your small entry fee (about $7) admits you to all the exhibits, which are manned by their members on most weekends. Your visit should include the current Station X run by the Milton Keynes Amateur Radio Society. If they are not too busy, you can operate the station. With the recognizable call sign, GB2BP, you'll be like rare DX!

Tours are given once you enter Bletchley Park and start in the mansion. GB2BP is part of the tour. Be sure to also leave some time for the displays of "spy radios" used by both the Allies and the German infiltrators. Unlike a typical museum, the atmosphere at Bletchley is casual and you are allowed to "look under the hood" of the rigs.

### GMT, Zulu and the Prime Meridian

Another short trip from the center of London will take you to the site of something all radio amateurs will recognize: GMT, Zulu and the Prime Meridian. You can reach Greenwich by Tube, or you can take a passenger ferry from the docks on the Thames near the Embankment Tube stop. The boat is by far the best way to see the Thames while you travel right to the dock at the Royal Observatory, the home of the Prime Meridian. The observatory is open for inspection and you may straddle the Prime Meridian, which is




**The attractive GB2BP QSL card.**


**HMS *Belfast* QSL card. The cruiser, built in 1938, saw service during WW II and the Korean War.**

marked by something that looks like a railroad track set in the pavement. While you are in Greenwich consider meeting with some local amateurs. Greenwich is the home to the Clifton Amateur Radio Society (see sidebar for their Web site). Their meetings are informal and take place in a community center. Visiting the community center is itself an experience.

### Local Clubs

Most UK Amateur Radio clubs meet in community centers. These are buildings owned by the local government council and used by many groups in any given week. One very accommodating club I visited does not meet in a community center. They started meeting "temporarily" some 25 years ago at the home of J. R. Hooper, and they are still meeting there today. The Ilford Group is a small but active club with a real interest in building.

Both the Clifton Amateur Radio Society and the Ilford Group were very accommodating when I rang up to see if they welcomed visitors. Give a call before hand and do try to arrange a visit with some amateurs during your visit.

The Barking Amateur Radio Society (Barking is accessible by Tube) has meetings in a community center as well but they also have one of the most unusual operating locations I have ever seen. Picture yourself operating a special event station while located three stories underground in a "secret" nuclear bunker. The Barking Society runs GBØSNB in the Kelvedon Hatch nuclear bunker (note the clever call sign mnemonics). Bill Chewter and his group have operated HF, VHF, UHF, packet and APRS from the bunker, which is located some 20 miles from the center of London (see the sidebar for the Web site). The Kelvedon Hatch bunker was to be used by government officials in the event of a nuclear attack. The site can be toured and includes an impressive array of Cold War memorabilia; it also has a small cafeteria. It may be a bit of a stretch to find, but just go to Kelvedon Hatch and look for the sign!

### Operate from the *Belfast*

The same club also has an association with a permanent operating location in the very heart of London and one you will surely not want to miss. Imagine operating from the radio room of a WW II cruiser. It's possible because the Royal Naval Amateur Radio Society and the Barking Amateur Radio Society keep the beautiful radio room aboard HMS *Belfast* in working condition. Where is the *Belfast* located? It is moored just next to Tower Bridge in the heart of London on the Thames. It is also a part of the National Trust and can be toured for a small fee.

For amateurs, the radio room will be the first place to go. Here there is modern HF equipment connected to some of the best antennas in London (as the tide rises, the ship rises and the antennas rise to a working height well above surrounding structures). When I operated the station, hosted by the Royal Navy Amateur Radio Society, the propagation was excellent for a downtown location. If you are a veteran of the Navy, you are even eligible for membership in the Society

### The RSGB

No visit to the UK would be complete for the radio amateur without a visit to the Radio Society of Great Britain (the UK equivalent of the ARRL). Getting to their headquarters involves only a short ride from Kings Cross Station (this is the station used in the first Harry Potter film—take a photo on the passenger platform and your grandchildren will surely recognize the gate to Hogwarts School). The train ride is about a half-hour and the station to look for is Potters Bar. It is a short walk from the train station to the headquarters and the RSGB will be glad to e-mail you exact directions. Check with the RSGB before visiting because the club station, GB3RS, is available for guest use only at certain hours. The headquarters also houses a small radio museum and the QSL Bureau for the UK. Pick up some reading material there as well since they sell all the RSGB publications.

### Rallies

Depending upon when you decide to visit the UK you might consider attending a "rally"—what we call a hamfest. Just this past year the RSGB has decided to stop sponsorship of the largest rally in the UK but that doesn't mean that rallies will cease to be held (see sidebar for a listing). Radiosport, a commercial firm that had cosponsored the rallies will continue to hold them in the London area.

When I attended last year's London Amateur Radio and Computer Show I was a bit surprised. Rallies in the UK operate on an entirely different scale than our hamfests. My local hamfest in South Bend is actually larger than the largest rally in the UK! There is also a difference in what one finds at the rally versus a hamfest. The UK London rally included only a few talks during its two-day event. The main attraction was the booths, but even here there was a surprise. The UK version of our flea market is the "bring-and-buy." But at the UK London show there were very few items for sale in the bring-and-buy corral—and the items that were there had been well used.

Our amateurs would also have missed some of the staples of our hamfests. Only one of the booths in London had any QRP equipment and that booth had very few pieces for sale. The largest booth at the rally was taken by the UK equivalent of our FCC. This was a surprise; they seemed to simply pass out general information relating to all the regulations

they enforce concerning frequency spectrum of all types. Few of the pieces of information had anything at all to do with Amateur Radio. The other shocker was located on the price stickers of the items for sale. I selected a few items to examine for comparison shopper purposes; in almost every case the UK price of an item identical to one purchased in the USA was 50 percent higher. Why? The import taxes on these items raised their street prices to levels we in the States would see as outrageous. This is not the place for you to look for bargains to carry back across the pond. My visit to the rally (I attended two) left me very appreciative of the competitive prices we face in the United States. It also left me with an appreciation of the immense selection we face at even our local hamfests, not to mention the Dayton Hamvention.

### Contact Points for Visiting London and the UK

***Bletchley Park Official Site***
By Rail: London Euston, Milton Keynes Central (Bletchley Park and GB2BP are located 200 yards from Bletchley railway station in Milton Keynes)
**www.project-x.org.uk/bletpark.html**

***GB2BP Amateur Radio at Bletchley Park***
**www.project-x.org.uk/bphamrp.html**
E-mail **gb2bp@geocities.com**

***Station X Information***
**www.bletchleypark.org.uk**

***WW II Codes and Ciphers***
**www.codesandciphers.co.uk**

***Imperial War Museum in London***
**www.iwm.org.uk**

***Barking Amateur Radio Society***
**ourworld.compuserve.com/homepages/billchewter**

***Secret Nuclear Bunker at Kelvedon Hatch, home of GBØSNB***
**www.japar.demon.co.uk**

***The Ilford Group, G3PCA (RSGB Club)***
**www.qsl.net/g3xrt/xrt-homepage.htm**

***Clifton Amateur Radio Society in Greenwich***
**myweb.tiscali.co.uk/cliftonars**

***Amateur Radio Clubs in the London Area***
**www.users.zetnet.co.uk/kama/soceast.htm**

***Scanner Frequencies for the UK***
**www.transmission1.net**

***HMS Belfast Home Page***
**www.iwm.org.uk/belfast/index.htm**

***GB2RN Amateur Radio on the HMS* Belfast**
**www.rnars.org.uk**

***Radio Society of Great Britain (RSGB) at Potters Bar, Home of GB3RS and the National Amateur Radio Museum***
Lambda House, Cranborne Rd, Potters Bar, Herts EN6 3JE
Phone: +44 (0) 870 904 7373
E-Mail **postmaster@rsgb.org.uk**
**www.rsgb.org**

***CEPT (European Conference of Postal and Telecommunications Administrations)***
**www.arrl.org/FandES/field/regulations/io/#cept**

***Amateur Radio Hamfests ("Rallies")***
**website.lineone.net/~harrison.elec/rallylist.htm**

***Explanation of Metropolitan Police MetRadio***
**www.metradio.co.uk**

***Radiosport: Sponsors of UK Rallies***
**www.radiosport.co.uk**

***UK Amateur Radio Frequently Asked Questions and Answers***
**www.r-clarke.org.uk/hamfaq1.htm**

***British Airways London Eye (take your handheld radio and cover the South of Britain)***
**www.londoneye.com**

***London Repeaters***
145.600 receive, 145.000 transmit, 1750 toneburst required;
145.7750 receive, 145.1750 transmit, 1750 toneburst required

***Repeater Management Committee of the Radio Society of Great Britain (lists all repeater pairs for the UK for all bands)***
**www.coldal.org.uk/channels.htm**

***Favorite Frequencies for Listening***
453.9250 and 456.3500—The National Gallery.
453.0625, 446.1125, 446.2750—The Tate Gallery.
444.4750—The Horse Guards—daily activity especially during the Buckingham Palace changing of the guard.
446.2875—Tower Bridge—busy when river traffic picks up.
462.3625—London Eye (Millenium Eye); hear them control the gigantic Ferris wheel.
152.5875—Palace detail of the Metropolitan Police; busy when the guard changes at Buckingham Palace.
156.0250, 160.6250, 156.0500, 160.6500, 160.7000—River traffic on the Thames near London.

***List of London Commercial Radio Stations (program them in before you visit)***
**homepages.enterprise.net/paulbaker/london_radio/am.html**

**The BBC online** (lists all the frequencies they use: shortwave, AM, FM and longwave)
**www.bbc.co.uk**

***UK Railtrack***
**www.railtrack.com**

### The Best Place to Use Your Handheld

Let me close by telling you the best operating position to use with that handheld radio you are bringing to London. By far the best location I found is one of the most popular tourist venues in London. The British Airways London Eye (also called the Millennium Eye) is an enormous Ferris wheel located on the South Bank, across from the Houses of Parliament. Take along your spouse (and your children and grandchildren). There's plenty of room in each of the fully enclosed glass pods; each pod is capable of holding up to 35 people. The wheel takes about an hour to complete one revolution and once you are clear of the tops of surrounding buildings your handheld will be able to hit quite a few repeaters cleanly.

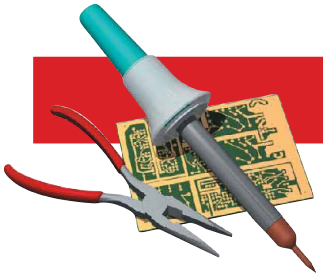
On my first trip on the Eye I pulled out my small handheld and began to identify quietly with the earphone and lapel mike. A gentleman standing next to me said, "Darn, I wish I had thought to bring my radio along!" The chap turned out to be a local amateur and we ended up sharing the radio and having a delightful hour speaking with a good part of the London amateur crowd.

### Have a Great Time!

Radio amateurs in the UK are a delightful group of people from every walk of life. You will miss the real flavor of London and the rest of the UK if you don't take the time and effort to meet a few of these terrific individuals. The contact information you need is in the sidebar. Plan your trip well in advance and have a great time in a very accommodating country.

*Photos by the author.*

*Barry Keating, WD4MSM, is an ARRL member and a member of an ARRL Special Service Club (the Michiana Amateur Radio Club). Barry is the Jesse H. Jones Professor at the Mendoza College of Business, University of Notre Dame. You can contact Barry at* **wd4msm@arrl.net**.



# QST WORKBENCH

PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

# The Doctor is IN

**Q Brent, WB8TRL, has a very short question with a long answer: What is the formula to convert a power level specified in dBm to watts?**

A The conversion formula for decibels to the equivalent power is: dB = 10 [ log ($P_1/P_2$) ]
where $P_2$ is the "reference" power. Note that $P_1$ and $P_2$ must be expressed in the same units (W or mW or μW). To convert from a dB figure to an actual power, you would solve the above formula for $P_1$ like so:

10 [log ($P_1/P_2$)] = dB or, dividing both sides by 10
log ($P_1/P_2$) = dB/10 and $P_1/P_2 = \log^{-1}$ dB/10 = $10^{(dB/10)}$
10 raised to a power is the "opposite" of a log (usually written as $\log^{-1}$).

Now, keeping track of the different base units can be tricky, but you can take advantage of a log characteristic with a special trick—every "factor of 10" change in power level gives a corresponding addition or subtraction of 10 dB when working with decibels (only for power, not voltage). Since zero gain is equal to 0 dB, a power increase from 1 W to 10 W would be +10 dB. An increase from 10 W to 100 W would be another +10 dB and an increase from 100 W to 1000 W would be another +10 dB, for a total of 10 dB + 10 dB + 10 dB = 30 dB or a 1000 W increase.

So if you have a figure in dBm (decibels relative to a milliwatt) and you want to know watts, your best bet would be to first figure what the dBW (decibels relative to a watt) value would be. Since 1 mW is 1/1000th of a watt, you would subtract 30 dB. Thus, a level of –120 dBm would be –150 dBW. Plugging –150 into the above equation, we get:

$P_1/P_2 = 10^{(-150/10)}$

which gives $P_1/P_2 = 10^{-15}$ W and since $P_2$ is 1 W, $P_1$ is $10^{-15}$ W.

As a second example—if the power level is +50 dBm, subtracting 30 dB gives +20 dBW. Plugging +20 into the equation gives $P_1/P_2 = 10^{20/10}$ which gives 100 W.

**Q From Richard, KC2HZW, comes an observation. I am interested in constructing the 40 meter Yagi as shown in *The ARRL Antenna Book*, 19th Edition.[1] It would appear that the taper schedule "D" is incorrect. After the 1″ × .058″ wall tubing, the next size would be ⅞″ and then ¾″ (not the ¾″ and ½″, as shown). Are the tubing sizes in the book correct, or do I have to use reducers to keep the tubing sizes as shown? Thanks!**

A Gee, I'm sorry to say that little boo-boo has been in the book for a long time, for almost 9 years!

It should be just as Richard says. The section labeled ¾″ should be ⅞″ OD, and the end (variable) tip should be ¾″ OD instead of ½″. The wall thickness should be 0.058″ for both, so they should telescope fine.

I'm working on rewriting chapter 11 as we speak, so Richard's timing is superb.—*Dean Straw, N6BV*

[1] *The ARRL Antenna Book*, 19th Ed, p 11-22, Fig 18 (D).

**Q Our club is putting a PL of 130.8 on the repeater. What are they talking about?**

A Many repeaters require the transmission of a continuous sub-audible tone or a short "burst" of tones for access. These are called CTCSS (continuous tone-coded squelch system) or PL (Private Line—PL—a Motorola trademark) tones. The reason for requiring access tones for "open" repeaters is to prevent interference from extraneous transmissions that might accidentally key the repeater. Sometimes a repeater receives interference from other nearby strong signals. For example, the repeater may be located at a commercial communications site. The repeater antenna may share tower space with many other antennas. If the repeater requires a certain CTCSS signal to activate the transmitter, then only the desired signals will be repeated.

Let us suppose your local repeater operates on the 146.67/146.07 MHz repeater frequency pair. There may be another repeater using this same frequency pair that is located 75 miles away. Normally, the operators using the two repeaters don't hear each other. Occasionally, however, some of the stations using the other repeater also key up your club's repeater. Operating through this interference can become more than a minor annoyance, especially if it occurs during a public service activity or some type of emergency. This is another example of why many repeaters use a CTCSS system. As long as the hams using the other repeater don't transmit the tone to access your club repeater, they won't key it up when they transmit. That PL your club is referring to is a 130.8 Hz CTCSS encoding-decoding access tone.

**Q Chester, KD5TFK, writes: I sometimes operate QRP at 5 W with my FT-817 using a telescoping whip antenna. Usually the proximity of the antenna to my body is fairly close. Would this be a hazard to me even though I am transmitting at a lowly 5 W?**

A At 5 W QRP with a typical "whip" antenna, you will be well below the exposure levels. Although a quick calculation estimates that on 10 meters or VHF, you must maintain 6 inches between the antenna and any controlled exposure for 5 W CW, the exposure limits are based on a "whole body" exposure and it would be nearly impossible for the antenna to be 6 inches from your entire body. This is part of the reason that the FCC doesn't require evaluations for stations that use less than 50 W. There is one good safety practice you may want to use, however: It is not a good idea to operate that rig if the antenna were located very close to your eyes and head.

**Q Again, from Chester, KD5TFK: If I am barely able to "hit" an out of town 2 meter FM repeater, would an amplifier help bolster my signal strength to bring up the machine? I am currently running 50 W and the amp is rated at 150 W with a 25 dB preamp. My antenna is a 2 meter mobile whip up about 15 feet on my roof.**

A That is hard for me to answer because you give no clue how far "out of town" you mean. 10 miles? 50 miles? Nor do you hint at what the terrain is like. Flat? Hills? Buildings? Rural?

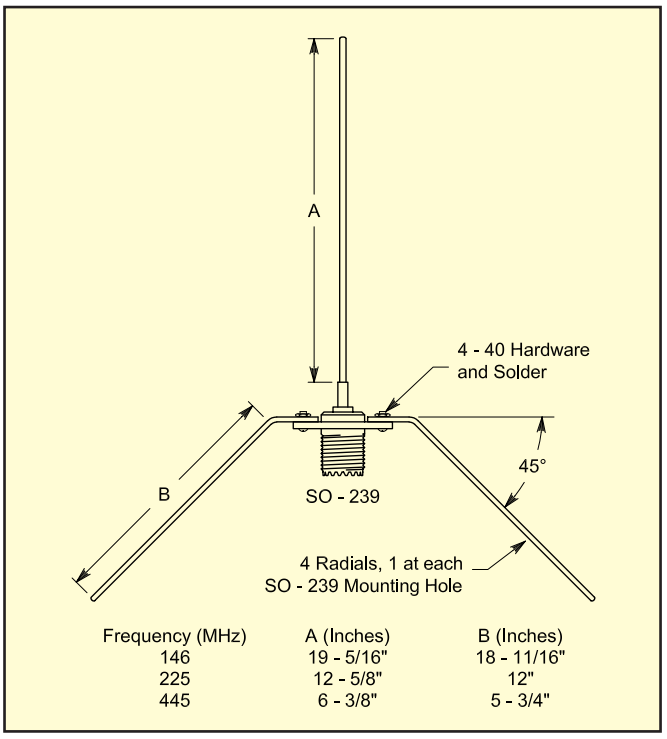



**Figure 1—A simple but effective ground plane antenna can be built with nothing more than an SO-239 connector and some heavy solid wire. Don't ignore the ground radials; they are critical to the antenna's performance.**

City? All these things make a big difference in 2 meter work.

So let's talk in generalities. If you are in an area like Connecticut, there are many small towns located in very broad river valleys running north/south; 50 W to a mobile whip might get you 15 to 20 miles away and that could cover several towns within your particular valley. But getting from the Connecticut River valley to the Naugatuck or Thames River valleys would be a problem. If, on the other hand, you live on one of the ridges between the valleys, your range would be increased.

Remember, no matter what, you can't get a 2 meter signal through a hill or a mountain (not through, but perhaps "over" a mountain using knife-edge refraction, which takes lots of power and an antenna with substantial gain). Your antenna and the repeater antenna have to, for the most part, be able to actually "see" each other (except for trees and a few buildings).

So, if you've relatively clear terrain between you and the repeater, it's possible that the other antenna is beyond the curvature of the earth for your 15 foot height… get it up higher… say 30 feet. RadioShack sells a relatively inexpensive 36 foot mast. While you're at it, an antenna with a little more gain, a better pattern or even a better match to your feed line might help—like a ground plane antenna. I'm not sure if you are working that whip against a counterpoise (RF ground) or not. Remember, a mobile whip antenna is designed to use the vehicle body as a counterpoise. If it's just up in the air without a ground plane, it won't match your transmission line very well. A ground plane could not be easier to build. For 2 meters all you'll need is an SO-235 coax connector and some solid copper wire or welding rod or even five metal coat hangers from the dry cleaner (see Figure 1).

**Q Ford, NØFP, says: I'm trying to organize a site plan for 2003 Field Day operations. We want to run multi-transmitter, and possibly more than one transmitter per band—a difficult task. I have been modeling different antenna designs and site plans, and can even model the amount of power present at the feed line of other antennas in the FD site. My question is, how much out-of-band or in-band signal can a typical rig tolerate before it starts to de-sense. What receiver testing parameter is appropriate?**

**We have several ICOM 746-class rigs that will show up during Field Day. The ARRL Lab has tested this radio and has even published an expanded report. Help me put this all in perspective. For example, if we intend to operate a station with 40 meter SSB, 40 meter CW and 40 meter PSK, simul-taneously, how much in-band interference can this radio tolerate before it is (a) dangerous to the radio, and (b) de-sensing from the other operating positions at the site?**

A The only out of band tests we perform on receivers are IF and image rejection measurements, plus the second-order intercept. However, these figures don't tell you anything about de-sense.

For bands that are adjacent, the de-sense performance will likely be similar to the wide spacing (200 kHz offset) blocking dynamic range shown in the expanded test result report. For situations where you have CW and phone rigs on the same band, the spacing can potentially be much less.

An easy way to improve isolation between rigs on different bands is to use band-pass filters. Ed Wetherhold, W3NQN, had a two-part article in *QST* on this topic.[2] Of course, you could also purchase commercial filters.

Implementing a filter for a portion of the band is much more difficult. Zack Lau, W1VT, published a pair of projects in his *QEX* column, "RF," for the 80 and 40 meter bands.[3] A much easier solution is to try for a 90° orientation between the antennas (assuming you aren't using beams) or try for as much physical separation as possible.

With 100 W class rigs and reasonable antenna spacing, you shouldn't get anywhere near the levels that would damage a receiver.

**Q Rob, KA1NHM, in New Hampshire asks: I am hitting a hamfest this weekend with the express purpose of finding a desk mike for my ICOM IC-718. I understand there is an impedance issue with ICOM rigs, and that only certain desk mikes will work properly without adjustment. Can you enlighten me a little on this? Will I be able to use a D-104, for instance? Or should I stick to trying to find a good, used ICOM mike?**

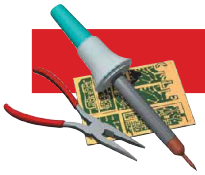
A An amplified D-104 will work fine, but a non-amplified one will not. Most modern rigs have the same nominal mic impedance (600 Ω), but if you pick up a mic intended for another brand, you will have to rewire it. A mic designed for a Kenwood transceiver will also need some attenuation to work with an ICOM radio (Heil sells an adapter for this purpose).[4]

[2]E. Wetherhold, W3NQN, "Clean Up Your Signals with Band-Pass Filters," Part 1, *QST*, May 1998, pp 44-48; Part 2, *QST*, Jun 1998, pp 39-42.

[3]Z. Lau, W1VT, "A Narrow 80 Meter Band-Pass Filter," *QEX*, Sep/Oct 1998, p 57, "A Narrow-Bandwidth 40 Meter Band-pass Filter," *QEX*, Nov/Dec 1998, p 58.

[4]**www.heilsound.com/**

**Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to: "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org; www.arrl.org/tis/. Add your comments: "The Doctor is On-line" at www.arrl.org/members-only/qst/doctor/.** QST



By Alan Bloom, N1AL

# A Modern GDO—The "Gate" Dip Oscillator

## Building an RF circuit? Use an updated version of an indispensable and legendary piece of equipment to test it—the "dipper."

I still have my first grid-dip oscillator, purchased at a flea market about 30 years ago. It's an Eico model 710 that covers 0.4 to 250 MHz with 8 plug-in coils. It weighs over 2 pounds and must be plugged into the wall to obtain power for its 6AF4 vacuum tube. It still works, although the coil socket has become intermittent over the years, which makes it a bit frustrating to use.

Amateurs have been using grid-dip oscillators (GDOs) at least since 1947.[1] While these days they no longer have a vacuum-tube "grid" to dip, the name seems to have stuck. A GDO is a tunable oscillator with the coil mounted outside of the chassis. The external coil allows you to measure the frequency of a tuned circuit without any electrical connection to it. Just bring the coil close to the tuned circuit's coil and tune the GDO while watching for a dip in its meter reading.

This "no connection" measurement capability is handy for other purposes as well. An example is measuring the parasitic elements of a beam antenna. Since the parasitic elements have no feedpoint, you can't measure the resonant frequency the normal way, with an SWR meter. A GDO is also perfect for tuning the traps to resonance on a multi-band Yagi.

A GDO can "sniff out" spurious resonances in the tank circuit of a high-power vacuum-tube RF amplifier. Be sure to turn off the high voltage first!

A GDO has other uses you might not think of. For example, it can measure inductance. Just temporarily connect a capacitor with a known value in parallel with the coil to be tested, measure the resonant frequency and use the formula $L = 1/(2\pi f)^2C$ or use the graph in *The ARRL Handbook*.[2] (L is inductance in µH, C is capacitance in µF and f is frequency in MHz.) It is just as useful for measuring unknown capacitors. Variable capacitors normally are not marked with their value. To identify that "bread slicer" you bought for a song at the local hamfest, just connect it in parallel with a known inductance, measure the frequency, and use the formula $C = 1/(2\pi f)^2L$.


**Figure 1—The "gate dipper" fits comfortably in the hand.**

When you are troubleshooting a receiver, a GDO can help isolate the fault. Tune the GDO to each of the IF frequencies, starting with the last and hold the coil close to that part of the circuitry. If you can hear a signal, then that IF and all the circuitry after it are working. This is especially handy on densely packed, surface-mount boards that are difficult to probe.

If the GDO has an RF output connector, it can be used as a "poor ham's signal generator" in applications where good frequency stability and calibrated level accuracy are not needed. An example is functional "go/no-go" testing of devices such as amplifiers, mixers and wide-band filters.

With the oscillator turned off, the instrument functions as a type of tuned RF detector known as an absorption frequency meter. The obvious use is to check if there is RF energy of the proper frequency in a tuned circuit. It also makes a handy frequency-selective field-strength meter using the capacity probe as an antenna. Another use is to check for feed line radiation. If you run the coil along the coax cable while transmitting, the meter will show the peaks and valleys of the standing waves of the unwanted RF current flowing on the outside of the coax shield. A GDO also makes an excellent "sniffer" to check for RF leakage from a shielded transmitter chassis, both at the

[1]Notes appear on page 58.

fundamental and harmonic frequencies.

Headphone output was indispensable in the "old days" to check the modulation quality of AM transmitters. Hams don't use AM very much any more, but headphones are still useful to listen for key clicks, hum and low-frequency parasitic oscillations. And, if you couple the coil to an antenna, you have a wide-range "crystal" set!

My favorite, literally "off-the-wall," application was mentioned in a comprehensive tutorial on grid-dip oscillators in January 1974 *QST*.[3] A GDO makes a sensitive detector of pipes and other metallic objects inside a wall. If you listen to the signal on a CW or SSB receiver, you can easily hear a change in frequency whenever the coil passes near a metal object.

## The Design

I got the idea for this design while reading an article in *Amateur Radio*, the journal of The Wireless Institute of Australia, by Lloyd Butler, VK5BR.[4] The nice feature of his circuit is that it uses two-terminal plug-in coils. One terminal is grounded so you can use a rugged, reliable coax connector for the coil socket. Most GDO designs require three connections to the coil or two connections that must both be insulated from ground.[5] Many of the latter also require a two-section tuning capacitor, which can be hard to find.

The old Heathkit "Tunnel Dipper" had two-terminal coils using a tunnel diode in a negative-resistance oscillator. Tunnel diodes are very hard to find nowadays, so VK5BR made a negative resistance element by connecting N-channel and P-channel JFETs back-to-back (gate to drain). I tried it and it oscillates beautifully. In fact, that is just the problem; it oscillates so strongly that it is difficult to get a good dip. VK5BR's solution was to connect a selected resistor in parallel with each coil to reduce the oscillation amplitude.

I decided to go a different route. The resistor kills the coil Q, which reduces the sensitivity and widens the bandwidth in wavemeter mode. Also, P-channel JFETs are becoming hard to find. Finally, I wanted to eliminate the internal calibration potentiometer that sets the operating point of the oscillator. Figure 1 shows the completed dipper, Figure 2 is a view inside the case and Figure 3 pictures the complete coil set. The schematic and parts list are shown in Figure 4. A pair of source-coupled N-channel JFETs (Q1 and Q2) form the oscillator portion of the circuit. Unlike some GDO designs, no RF chokes are required. Because of self-resonances, chokes don't maintain a high impedance over the wide range of frequencies required for a GDO.[6] This unit has no false dips anywhere in the frequency range.

Q4, a bipolar 2N3904 transistor, serves a dual purpose. Its base-emitter junction acts as the RF detector. Further, it amplifies the rectified current flowing in the base and sends it to emitter-follower Q5, a 2N2907 transistor. I used a 200 µA meter because that was what I found in my junk box. If you use another value, change the value of R5 using the formula $R5 = (1.5 / I_m) - R_m$, where $I_m$ is the full-scale meter current and $R_m$ is the meter resistance. Be careful when measuring meter internal resistance. Measure the test current of your ohmmeter (on the scale you will use) with another meter. A sensitive meter can be damaged by excessive measurement current, although most newer digital meters use test currents in the range of 50-200 µA for their ohmmeter scales. Transistor Q3 is a JFET source-follower amplifier for the RF output connector. The RF output may be used as a signal source or to drive a frequency counter for more accurate frequency readout.

In detector mode, the power to the oscillator and RF buffer is turned off. Q4 detects and amplifies any signals picked up by the coil. The meter sensitivity control works in both oscillator and wavemeter mode and also controls the volume to the headphones. Battery current is approximately 3 mA with the oscillator on and zero in wavemeter mode, when no signal is being received.

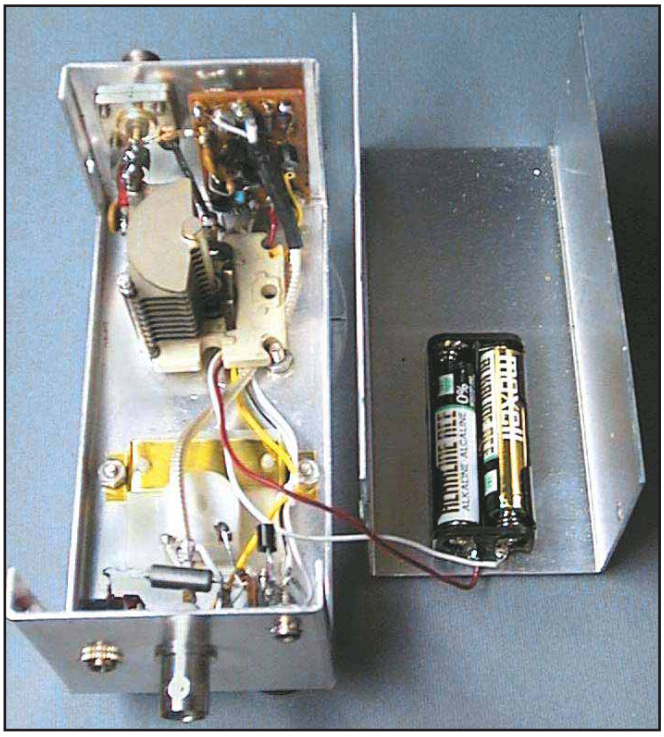


**Figure 2—Photograph of the GDO with the cover off. The tuning capacitor was oriented for the shortest possible connection to the coil connector.**

**Figure 3—This is how the coils looked before the heat-shrink tubing was applied. Small pieces of electrical tape hold the turns in place during construction.**

## Construction

This project was built almost entirely from junkbox parts. The parts list in Figure 4 consists of parts selected to be similar to those used in the prototype. Feel free to substitute what you have on hand. The exceptions are transistors Q1, Q2 and Q4, which should be the types specified or their equivalents.

The 2¼ × 2¼ × 5 inch chassis is a compromise; it's large enough to allow all parts to fit easily and small enough to fit comfortably in the hand. The coil was mounted off-center, both to allow the shortest connection to the tuning capacitor and to

afford easier coil coupling to an external circuit.

The prototype used a perforated test board for the RF portion of the circuitry and a solder tie strip for the meter circuitry. A printed circuit board pattern and parts layout are available at **www.arrl.org/files/qst-binaries/gdo.zip**, should you choose this construction route (the GDO can be hand-wired). Note that the battery is connected with the positive terminal to ground, backwards from the normal arrangement.

The coil forms were made from "3/8 inch" water tubing purchased at the local hardware store. The inside diameter is actually slightly less than 3/8 inch, which makes a nice force-fit onto the 3/8 inch mounting threads of a male chassis-mount BNC connector. The lowest-frequency coil is wound on a large pill bottle with two 1-inch diameter aluminum washers at the connector mount for added strength.

First run the wire through the center of each form and solder it to the BNC connector's center conductor. Then press the form onto the connector threads and cut a small notch in

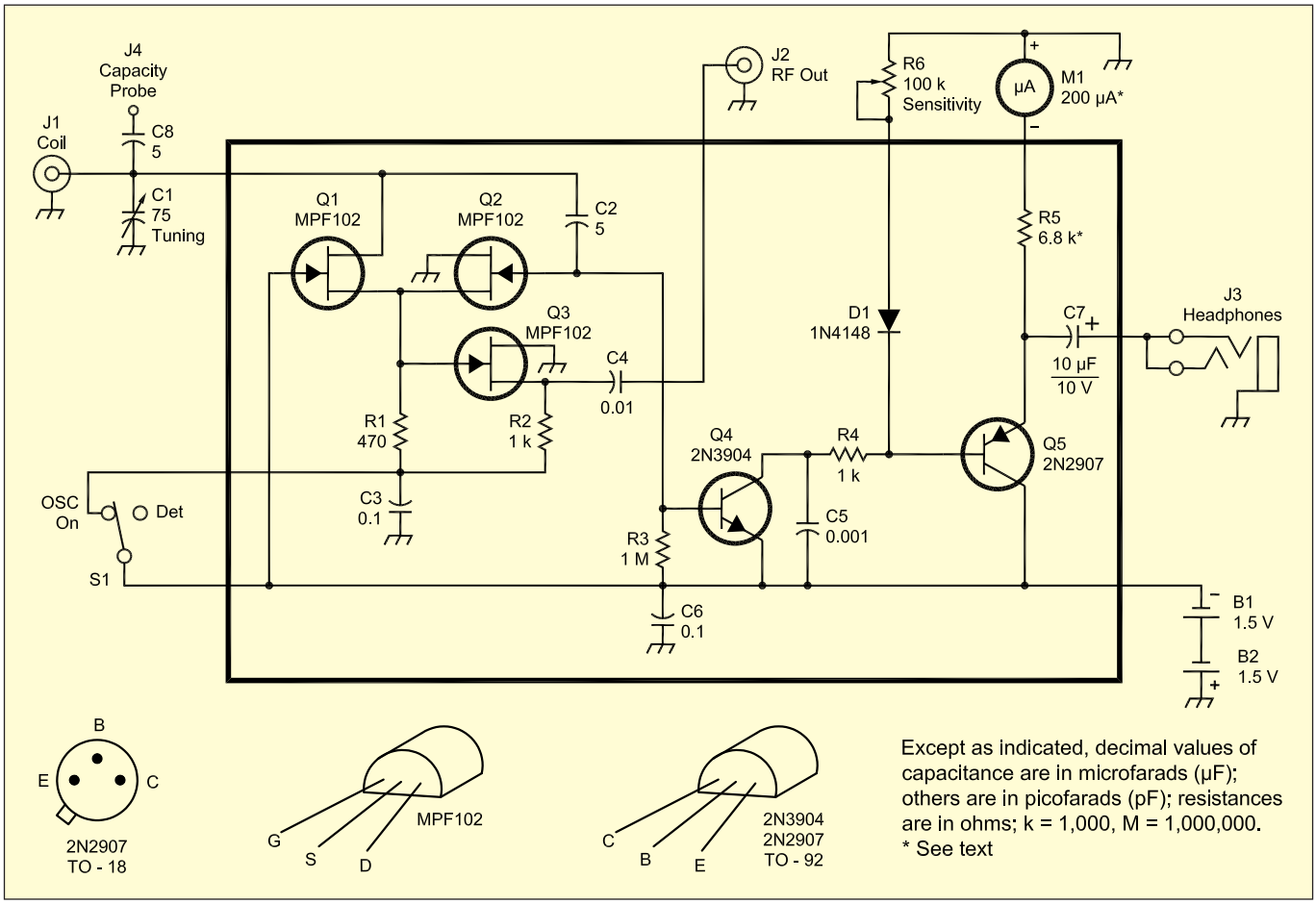



**Figure 4—Schematic diagram of the GDO. Part numbers listed are from Ocean State Electronics (OSE) (800-866-6626, www.oselectronics.com), Alltronics (408-847-0033, www.alltronics.com), Digi-Key (800-344-4539, www.digikey.com) and Mouser Electronics (800-346-6873, www.mouser.com). Resistors are available from all of the above sources.**

**B1, B2—1.5 V AA or AAA cell.**
**C1—75 pF variable, OSE AVC75 or 365 pF variable BC14400.**
**C2, C8—5 pF disc capacitor, Digi-Key P11408CT-NF, Mouser 75-10TCCV50, OSE CD5-5.**
**C3, C6—0.1 μF capacitor, Digi-Key BC1084CT-ND, Mouser 21RX310.**
**C4—0.01 μF capacitor, Digi-Key BC1078CT-ND, Mouser 21RX410.**
**C5—0.001 μF capacitor, Digi-Key BC1072CT-ND, Mouser 21RX510.**
**C7—10 μF, 10 V capacitor, Digi-Key P5134-ND, Mouser 140-XRL10V10, OSE CER10-25.**
**D1—1N4148 diode, Digi-Key 1N4148DICT-ND, Mouser 512-1N4148, OSE 1N4148.**
**J1, J2—BNC female chassis-mount connector, Alltronics CB122, Digi-Key ARFX1062-ND.**
**J3—3.5 mm stereo phone jack, Digi-Key SC1094-ND, Mouser 161-3402.**
**J4—Phone tip jack, Mouser 530-105-0802-1; phone tip plug, Mouser 530-105-0302-2.**
**M1—0-1 mA, 1 5/8 inch square panel meter, OSE 60-158 or 0-200 μA, 1 1/2 × 7/8 inch edge-mount panel meter MS200 (see text).**
**Q1, Q2, Q3—MPF102 transistor, JFET, Digi-Key MPF102-ND, Mouser 512-MPF102.**
**Q4—2N3904 transistor, Digi-Key 2N3904-ND, Mouser 610-2N3904.**
**Q5—2N2907A transistor, Digi-Key PN2N2907-ND, Mouser 610-2N2907A.**
**R1—470 Ω, ¼ W resistor.**
**R2, R4—1 kΩ, ¼ W resistor.**
**R3—1 MΩ, ¼ W resistor.**
**R5—See text.**
**R6—100 kΩ potentiometer, linear taper, Mouser 313-1000-100K.**
**S1—SPST toggle switch, Digi-Key EG2350-ND, Mouser 1055-TA1120.**

**Misc**

**#18, #22 and #26 gauge enameled wire, Mouser 501-MW18H-1LB, 501-MW22H-1LB, 501-MW26H-1LB, respectively.**
**10 BNC male chassis-mount connector (for coils), Alltronics CB111.**
**Dual AA or AAA battery holder, Digi-Key BC2AAAW-ND, BC2AAW-ND, Mouser 122-0421.**
**2¼″ × 2¼″ × 5″ chassis, Digi-Key HM611-ND, Mouser 563-CU-3004A, OSE 1411KU.**
**3 ft 3/8″ PVC water tubing for coils.**

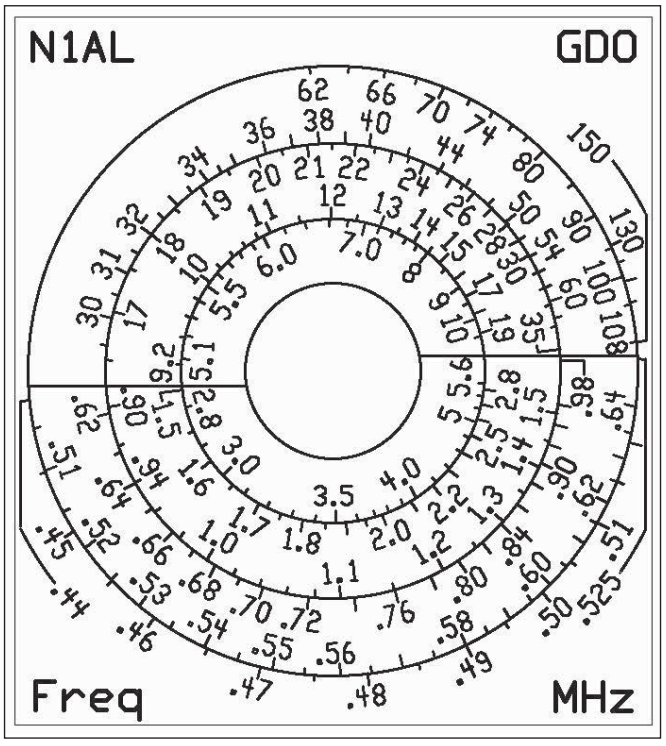



**Figure 5—The dial scale for the prototype GDO. If you make your own GDO you will almost certainly need to lay out your own scale.**

the other end for the wire to go through. After winding the coil, cut and tin the wire end and solder it to the ground lug mounted on the connector. I covered each coil with a layer of heat-shrink tubing or electrical tape to hold the turns in place and to protect the wire. Figure 3 shows the coils before the heat-shrink tubing was added.

Winding data is listed in Table 1. Unless you happen to duplicate my unit exactly, the frequency range of each coil is likely to be different. However, this data can be used as a starting point for figuring out your own coil designs.

The wire for the two highest-frequency coils is bare copper, salvaged from scraps of Romex house wiring. The other coils are wound with enamel-insulated magnet wire. The exact wire gauge is not critical (although it may affect the number of turns required). A good source for fine-gauge wire for the low-frequency coils is a deflection yoke removed from the cathode-ray tube of a defunct television set.

The three smallest coils (29.5-150 MHz) were space-wound to the lengths listed. The middle 4 coils (2.8-35 MHz) and the largest were close-wound. On the 0.9-1.5 and 1.5-2.8 MHz coils, there were too many turns to fit in a single layer so I "scramble" wound them by overlapping turns, a few at a time, as I wound the coil. It would be neater to lay the wire in two overlapping close-wound layers, but that increases the interwinding capacitance which can cause spurious resonances and reduced tuning range.

I extended the range of the lowest-frequency coil by connecting it to the GDO through a BNC "T" connector with a pair of 53 pF capacitors attached with clip leads. (Of course it also would have been possible to wind another coil, but I only had one large pill bottle.) Even for the other coils, adding extra capacitance is a useful trick because it slows down the tuning rate, handy for measuring narrow-band devices like crystals.[7]

With the smallest coil, the GDO oscillates over only a small portion of the capacitor tuning range. Fortunately, it happens to cover the two-meter ham band. With the second-smallest coil, the oscillation amplitude drops off at the low end, but it is usable down to about 62 MHz. The circuit would probably work better at VHF if it were constructed with a lower-inductance tuning capacitor.

The small 75 pF tuning capacitor gives only about a 2:1 tuning range. The advantage is that tuning is not so critical and the frequency dial is easier to read. The disadvantage is that it takes more coils to cover the desired frequency range. If you substitute a 365 pF AM broadcast radio tuning capacitor, you should get better than 3:1 tuning range from each coil.

The tuning dial was made from a circular piece of ¼ inch clear plastic glued to a knob. Making the diameter slightly larger than the chassis width allows one-handed operation using your thumb to adjust the tuning. The scale, cemented to the chassis under the clear plastic dial, was drawn using a computer graphics program. Measuring the calibration data and designing the scale were very time-consuming. A better solution would be to include a built-in frequency counter. A 4 or 5-digit readout would be accurate enough since a GDO's frequency stability is not good enough to make a high-accuracy readout useful. Figure 5 illustrates the homebrew dial.

## Operation

To measure the resonant frequency of a tuned circuit, switch to oscillator mode and adjust the meter sensitivity to about ¾ scale. Then orient the GDO coil close to, and approximately parallel to, the coil under test and tune the dial until you get a strong dip on the meter. Tune slowly or you may miss the dip. Overly close coupling to the circuit under test causes such a strong dip that the oscillator is pulled far off frequency. For the most accurate measurement, use close coupling to find the approximate frequency, but then move the GDO coil farther away until the dip is barely visible and retune. Figure 6 shows

**Table 1**
**Coil Winding Data for the GDO**

| *Wire Gauge* | *Form Diameter* | *Form Length* | *Coil Length* | *Number of Turns* | *Frequency Range* |
|---|---|---|---|---|---|
| #12 | 0.375" | — | 0.125" | 2 | 130-150 MHz |
| #14 | 0.5" | 1.5" | 0.5" | 3 | 62-108 MHz |
| #18 | 0.5" | 2.0" | 0.4" | 5 | 29.5-62 MHz |
| #18 | 0.5" | 2.5" | 0.5" | 10½ | 16.5-35 MHz |
| #22 | 0.5" | 2.5" | 0.6" | 21 | 9.2-19 MHz |
| #26 | 0.5" | 2.5" | 1.0" | 46 | 5.1-10.5 MHz |
| #30 | 0.5" | 2.5" | 1.5" | 100 | 2.8-5.6 MHz |
| #30 | 0.5" | 2.5" | 1.6" | 180 | 1.5-2.8 MHz |
| #30 | 0.5" | 3.9" | 3.3" | 390 | 0.9-1.5 MHz |
| #30 | 1.25" | 3.9" | 3.4" | 230 | 620-980 kHz |
| | | | | (+53 pF) | 505-640 kHz |
| | | | | (+106 pF) | 440-525 kHz |

the dip meter in use, measuring the frequency of an amplifier tank circuit.

Coupling to toroids or shielded coils can be difficult. One solution is to connect a wire from the capacitance probe to the "hot" end of the circuit to be tested. For looser coupling, just place the wire close to the circuit under test. When measuring the inductance of a toroid with a test capacitor, the capacitor leads often form enough of a loop to allow coupling to the GDO coil. Some authors recommend coupling the GDO to a one-turn loop through the toroid, but that makes the toroid act like a transformer with a shorted secondary and that changes its inductance.

Antenna measurements are best made at the high-current point of the antenna conductor. For a half-wave dipole, this is near the center. Orient the coil perpendicular to the conductor for maximum coupling. Be sure to short the feed point of the antenna before making the measurement. If you can't find the dip, make the shorting wire into a 1-turn loop for better coupling to the GDO coil. You should also see resonance at the odd harmonic frequencies as well as the fundamental.

To measure the electrical length of a transmission line, couple the GDO to a small wire loop; connect it to one end of the line and leave the other end disconnected. (For best accuracy use the smallest loop that gives sufficient coupling.) The line is ¼ wavelength long at the lowest resonant frequency, so the electrical length in meters is 75/f, where f is the resonant frequency in MHz. Again, you will also see resonance at the odd harmonics.

The voltage level at the RF output connector varies from coil to coil but typically runs about 250 mV RMS into an open circuit and 50 mV RMS into a 50 Ω load. That is sufficient to drive a typical frequency counter or serve as a test signal when troubleshooting.

A GDO is like a TV remote control—you don't know you need it until you have it, and then you wonder how you ever got along without it. One simple instrument can do many of the measurements of a bench full of expensive RF test equipment. I've only touched on a few of the many and varied applications for this versatile instrument.[3,7,8]

**Figure 6—N3SU grid-dipping her linear amplifier's tank coil. Note that the high-voltage power supply is not only off but is disconnected from the amplifier.**

**Notes**

[1]C. F. (Bud) Bane, W6WB, "...About Grid-Dip Oscillators," *CQ*, Mar 1947, p 13. This seems to be the first grid dip oscillator design in the amateur literature. It was a portable battery-operated unit using a type 3A5 vacuum tube.

[2]*The 2003 ARRL Handbook,* Fig 6.46—Inductive and capacitive reactance vs frequency, p 6.27.

[3]B. Clark, WB4OBZ, "The Art of Dipping," *QST*, Jan 1974, p 16.

[4]L. Butler, VK5BR, "A Dip Meter using the Lambda Negative Resistance Circuit," *Amateur Radio*, Jan 1997, p 15. *Amateur Radio* is the journal of The Wireless Institute of Australia. For North American readers who may not have ready access to this magazine, the article is posted at **users.tpg.com.au/users/ldbutler/NegResDipMeter.htm**.

[5]H. Olson, W6GXN, "A New Look at Dip Meters," *Ham Radio*, Aug 1981, pp 25-28. This is a good survey of different dip meter circuit designs.

[6]The difficulty of designing a wide-band choke is discussed in F. Lewis, W1LKV, "Anatomy of a Solid-State Dipper," *QST*, Dec 1972, p 23.

[7]This trick is one of several described in R. Johns, W3JIP, "Add-Ons For Greater Dipper Versatility," *QST*, Feb 1981, p 37.

[8]M. Bradley, K6TAF, "What Can You Do with a Dip Meter?" *QST*, May 2002, p 65. A good overview on how to use a dip meter.

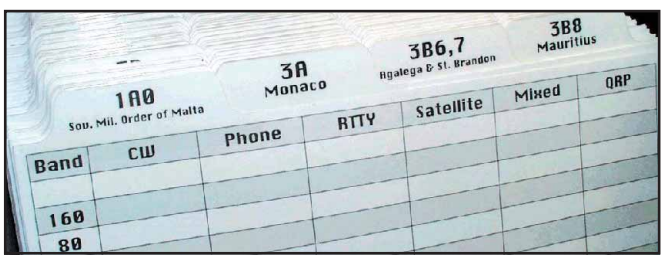
*Al Bloom, N1AL, was first licensed while in high school, in 1968. He received a Bachelor's degree in physics, then a Master's degree in electrical engineering, the latter while working as a W1AW operator. While at the ARRL he co-authored both the* License Manual *and the* Operating Manual. *He designed amateur and commercial equipment for the R. L. Drake Company and has spent the last 23 years at Hewlett-Packard, designing RF and microwave test equipment. Al has written several articles for* QST, *including two cover plaque award winners. Mainly a CW operator, Al is on nearly all of the amateur frequencies from 1.8 to 2450 MHz, including satellite operation. He is a life member of the ARRL and an ARRL Technical Advisor. You can contact the author at* **n1al@arrl.net**. QST

# NEW PRODUCTS

## QSL INDEX DIVIDERS FROM RADIO WAREHOUSE

◊ Attention award chasers: Radio Warehouse has introduced a set of QSL index dividers to sort your cards in a file. Radio Warehouse has also introduced a WAS set of dividers, produced in the same familiar format as the original DXCC edition (see photo). Both sets include Mylar reinforced tabs with a record keeping grid on each card. The dividers are sized to fit in any standard 5 × 8 index box, available at office supply stores.

Price: $19.95 + shipping. For more information, contact Radio Warehouse, PO Box 77001, Charlotte, NC 28271-7000; tel 704-321-2300; **www.radio-warehouse.com**. QST



# xperiment #4—Active Filters

Amplifiers are great, but where op-amps really prove their rth is in more advanced circuits that are difficult to execute n discrete transistors. A ham's radio shack is full of filters, ny of which are based on the op-amp. This month, we'll e a look at two of the simplest filters and one that's a little re complex.

## ms to Learn

- *Cutoff Frequency*—The frequency, $f_c$, at which the filter put voltage falls to $1/\sqrt{2}$ or 70.7% of its peak output. At this quency, the power of the output signal has been cut in half.
- *Low, High and Band-Pass Filters*—Low-pass filters at-uate signals with frequencies *above* the cutoff frequency. h-pass filters do the opposite (attenuate *below* cutoff). nd-pass filters pass a range of signal frequencies, but at-uate signals *outside* that range, called the passband.
- *Q*—The ratio of a filter's center frequency to the band-th of its passband. Higher-Q means a narrower passband a given center frequency.
- *Roll-off*—The gradual reduction in signal amplitude be-d a filter's cutoff frequency.

## e Low-Pass Filter

The amplifier circuits we built last month can amplify sig-s all the way from dc to the limits of the op-amp, more than MHz. But what if we don't want to amplify all those fre-ncies—perhaps just those in the communication audio ge below 3 kHz? That requires an amplifier whose gain nges with frequency, or a low-pass filter.

We'll start with the unity-gain amplifier (refer to Figure 3 ast month's column). Remember that the op-amp output st balance the input current ($V_{in}$ / $R_i$) with an equal current ough the feedback component, $R_f$. What if $R_f$ was replaced n components whose impedance changed with frequency? en the op-amp's output voltage would also have to change n frequency to keep the currents balanced.

That's just what is happening in Figure 1, where capacitor $C_f$ been placed across $R_f$. The reactance of $C_f$ ($X = {}^1/_{2\pi f_c}$) gets aller with frequency. That means the impedance of the feed-k path between the op-amp's inverting terminal and output gets smaller with frequency. The lower impedance means less output voltage equired to balance the ut current and the cuit's output will rease for high-quency signals. This low-pass filter.

We only want to am-fy communications io, so the cutoff fre-ncy, $f_c$, should be ut 3 kHz. In this cir-t, $f_c$ is reached when impedance in the feedback path (the parallel combination of $R_f$ and $C_f$) is o half of the input resistance, $R_i$. This occurs when the re tance of $C_f$ equals $R_f$. The design equations for our low-p filter are:

$C_f = {}^1/_{2\pi f_c R_f}$ and $f_c = {}^1/_{2\pi C_f R_f}$

Let's try it!

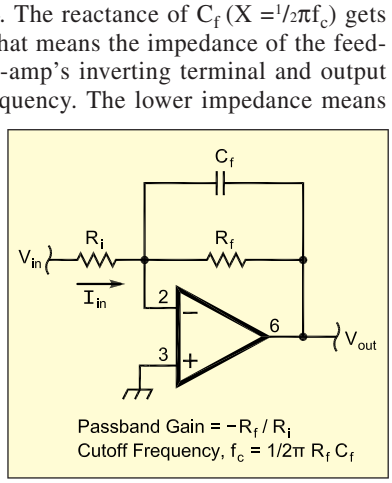



**Figure 1—A low-pass filter.**

## Testing the Low-Pass Filter

- Design the amplifier to have a passband gain of 1, $R_f = R_{in}$. Use a value of 10 kΩ. For an $f_c$ of 3 kHz, $C_f$ = (3 kHz)(10 kΩ) = 5.3 nF. Use the closest standard value 5.6 nF, which will result in an $f_c$ of 2.8 kHz. (Don't forget power supply bypass capacitors when building the circuit
- Confirm that the filter has unity-gain at dc by usin 1 kΩ potentiometer to apply a variable dc voltage as in previous experiment. Use a ±12 V power supply across potentiometer.
- Use the function generator to apply a 1 $V_{p-p}$ sine wav 10 Hz to the filter input. If you are using a DMM to meas signal voltage, this is 0.35 $V_{RMS}$. Measure the input and o put voltage at 10, 20, 50, 100, 200, 500, 1000, 2000 5000 Hz.
- Find $f_c$ by varying the signal frequency until output v age is 0.7 $V_{p-p}$ (or 0.25 $V_{RMS}$). It's unlikely that $f_c$ will exactly 2.8 kHz because the actual values of $R_f$ and $C_f$ are so what different than their labeled values.
- Change the filter's passband gain to 2.2 by increasing to 22 kΩ. Measure the output voltage from 1000 to 5000 What happened to $f_c$? As $R_f$ increases, the frequency at wh the reactance of $C_f$ balances $R_c$ decreases. To restore $f_c$, will have to be decreased by the same amount as $R_f$ increase to 5.6 nF / 2.2 = 2.5 nF. Replace $C_f$ with the closest stand value of 2.7 nF and see if $f_c$ is back where it belongs.

## High-Pass Filters

You can also make gain "roll off" at low frequencies w components that cause the balancing function of the op-a to reduce its output voltage below the cutoff frequency shown in Figure 2. As frequency decreases, the reactance Ci increases, reducing input current. Balancing current t takes less output voltage and the filter's output will decre along with input frequency. Following similar reasoning, design equations for the high-pass filter are:

$C_i = {}^1/_{2\pi f_c R_i}$ and
$f_c = {}^1/_{2\pi C_i R_i}$ [2]

Gain in the passband is still the same, $-R_f/R_i$.

## Creating a Band-Pass Filter

Continuing with the communications audio theme, it's usually desired to attenuate frequencies below

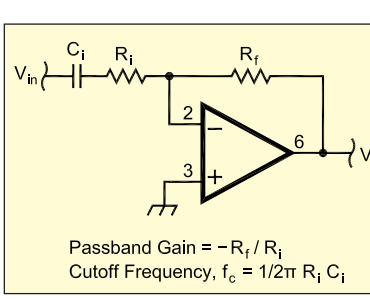



**Figure 2—A high-pass filter.**

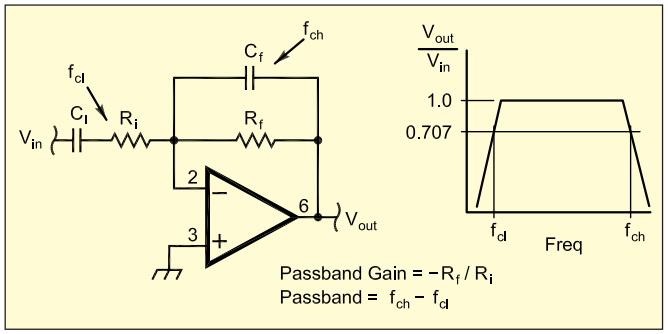



**Figure 3—A band-pass filter.**

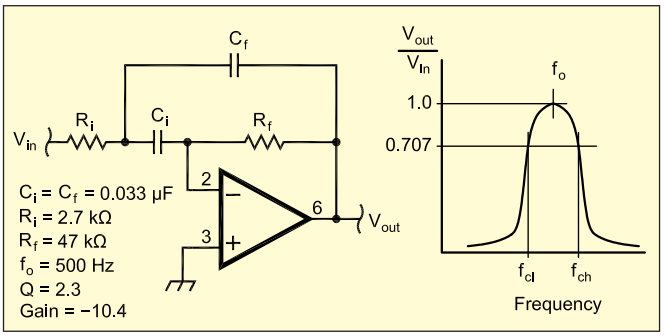



**Figure 4—A multiple-feedback band-pass filter.**

300 Hz. We can combine high-pass and low-pass functions as in Figure 3. This circuit has a cutoff frequency, $f_{cl}$ and $f_{ch}$, at each end of the passband. We already have $f_{ch}$ from our low-pass filter. For an $f_{cl}$ of 300 Hz:

$C_1 = {}^1/_2\pi(300\text{ Hz})(10\text{ k}\Omega) = 53\text{ nF}$

We'll use the closest standard value of 56 nF. Let's build it!

## Testing Band-Pass Filter #1

- Restore the low-pass filter circuit to its original configuration with two 10 kΩ resistors. Add the 56 nF capacitor in series with $R_{in}$.
- Measure input and output voltage between 10 and 5000 Hz. Determine the lower cutoff frequency as before.

## A Better Band-Pass Filter

More advanced designs have a much steeper rolloff above and below the cutoff frequencies. The passband can be narrowed, amplification can be combined with filtering functions. There are a number of filter types that achieve these goals.

Band-pass filters have two additional parameters that define how the filter affects the input signals. The first is the filter's frequency of peak response, also called the "center frequency," and abbreviated $f_o$. The second is a measure, called "Q" of the filter's passband relative to $f_o$. (The symbol Q is also used in other related measurements, but it only refers to the shape of the filter passband here.)

$$Q = f_o / (f_{ch} - f_{cl}) \qquad [3]$$

Higher values of Q mean that the filter's response is getting narrower or sharper. The quantity $f_{ch} - f_{cl}$ is the filter's bandwidth.

Figure 4 shows a "multiple feedback" band-pass filter, so-called because there are two feedback paths from the output through $R_f$ and $C_f$. Although there are many methods of designing this circuit, we'll use the "Equal-C" method in which both $C_i$ and $C_f$ are given equal values. After $f_o$ and Q are chosen, the resistor values are then calculated. The filter's gain is equal to $-2Q^2$. The circuit values shown set $f_o$ to 500 Hz, Q to 2.3, and gain to –10.4.

## Testing Band-Pass Filter #2

- Build the circuit and find $f_o$, $f_{ch}$ and $f_{cl}$ by measuring the input and output voltage of sine waves at frequencies from 50 to 5000 Hz. Calculate the filter's peak gain ($V_{out}/V_{in}$), bandwidth ($f_{ch} - f_{cl}$) and Q.
- Most filter responses are measured in decibels, or dB. Gain in dB = 20 log ($V_{out}/V_{in}$). Recalculate gain in dB. Gain at the upper and lower cutoff frequencies should be close to 3 dB below the gain of the filter at $f_o$.
- To change $f_o$, increase or decrease both capacitors, keeping their values the same. To increase $f_o$, decrease capacitance, and vice versa. $f_o$ is directly proportional to the value of the capacitors.

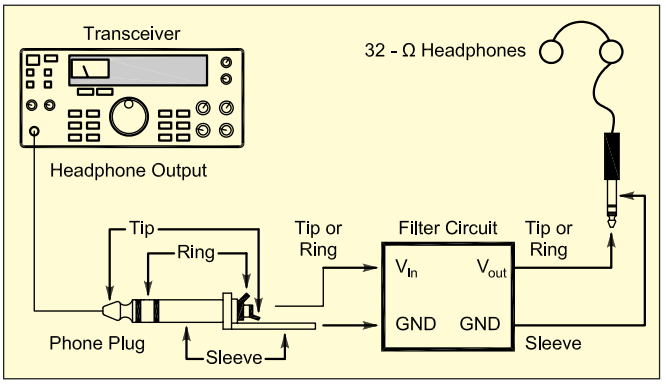



**Figure 5—Listening to your filter circuit.**

## Listening to Your Filters

All this measuring is fine, but it's more fun to actually use your circuits for a practical purpose. Figure 5 shows how to route your rig's received audio through the filter circuit so that you can hear the effect of the filter using headphones from a portable music player. Set your rig to use its widest filter (usually "AM") and then listen to the filter output. The op-amp can't drive a very big load, so keep the audio output level low to avoid distortion.

## Suggested Reading

*The 2003 ARRL Handbook*, pp 16.1-16.2, 16.28-16.29; Horowitz and Hill, *The Art of Electronics*, chapter 5, sections 5.01-5.05. One of the best books for hobbyists on active filters is Don Lancaster's *Active Filter Cookbook*.

The ARRL Web site for this series is **www.arrl.org/tis/info/html/hands-on-radio/**.

## Shopping List

- 741 op-amp
- ¼-W resistors of the following values: 2.2 kΩ, 10 kΩ (2 ea), 22 kΩ, 47 kΩ
- 1 kΩ potentiometer (single or multi-turn)
- 56 nF, 33 nF (2 ea), 5.6 nF, and 2.7 nF film or ceramic capacitors (1 nF = 1000 pF = 0.001 µF)
- 2—10 µF capacitors with a voltage rating of 25 V dc or higher

## Errata

Experiment #2 mistakenly equated 1 $V_{p-p}$ with 0.7 $V_{RMS}$. It should be 0.35 $V_{RMS}$. $V_{RMS} = 1/(2\sqrt{2})\ V_{p-p} = V_{p-p}/2\sqrt{2}$ .

## Next Month

Next month, we'll take a look at the popular "555" timer and use it as an oscillator, a pulse generator and maybe even as a timer!

## GROUND-ROD INSTALLATION, INEXPENSIVE AND EASY

◊ After being more or less absent from ham radio for many years, I have returned. It is an outlet for work stress and helps me re-learn my analog engineering skills. My first task in setting up a station was to install a ground rod and antenna system. Secondly, I reviewed *The Handbook*. I was a bit surprised to see a reference to flared end on a ground rod. Even 17 years ago, I installed ground rods with ease and without appreciably flaring the rod.

Having grown up around farms, I watched while steel fence posts were driven into the ground with a tool called a fence-post driver. A fence-post driver is actually some type of thin metal pipe with a weight on one end. This pipe was fitted over the post, lifted and then slammed downward. The weight acts as a hammer that is guided by the pipe assembly for a "perfect hit" every time.

With such a tool, it is possible for one person to install fence posts quickly and easily. A fence post has a T shape and is only driven a couple feet into the ground; otherwise, they are strikingly similar to ground rods in the way they need to be installed.

A weight attached to a pipe that fits over the ground rod can function as a driver for ground-rod installation. With a little effort and about $5 in materials, you can create your own ground-rod driver. The parts for my ground-rod driver are available from the local home-supply store and metal scrap yard.

My selection of materials started with a visit to the metal scrap yard. Look for a total of about 3 to 5 pounds of steel. The thickness of the metal is important because you will have to drill a hole through the metal weight for assembly. I chose two pieces of steel of a triangular shape. Both pieces were about $^3/_8$-inch thick and had a bump on one corner. I used a hacksaw to clean up the bump and then a grinder and file to remove any sharp edges.

The pipe for the project will likely be $^1/_2$-inch (ID) galvanized water pipe. It should easily slide over the ground rod. You should get two pipes: one about 30 inches long, and the other about 18 inches long. Both should be threaded on at least one end. You will also need a pipe flange to secure the steel weights to the pipe.

While you are at the home supply store, select some bolts that fit the holes of the floor flange. They should be long enough to go through the flange and the weights and secure them. It is a good idea to buy two nuts for each bolt so that you can "lock" the nuts to prevent accidental disassembly.

Refer to Figure 1. First, find and label the center of gravity on each steel piece. You can easily find the center of gravity by balancing the weight on the point of a small sharp rock. We need to mark the center of gravity so that we can mount the pieces with their centers of gravity near the center of the floor flange. With the weight centered, it will generate little sideways force when the weight hits the rod. The weight needs to exert force downward to drive the rod into the ground.

After marking the center of gravity, mark the holes where you will attach the weights to the floor flange. Punch the hole centers and drill holes in the steel to accept the bolts. I used only two bolts to attach the flange. The bolts actually only hold the pipe to the steel weight during use. You don't want the pieces to come apart, but you don't need a lot of bolt strength either. Use some form of locking on the bolts and nuts so that the driver will not fly apart and hurt someone during use. Once the weight is secured, you can thread the weighted flange assembly onto the short or long pipe as needed.

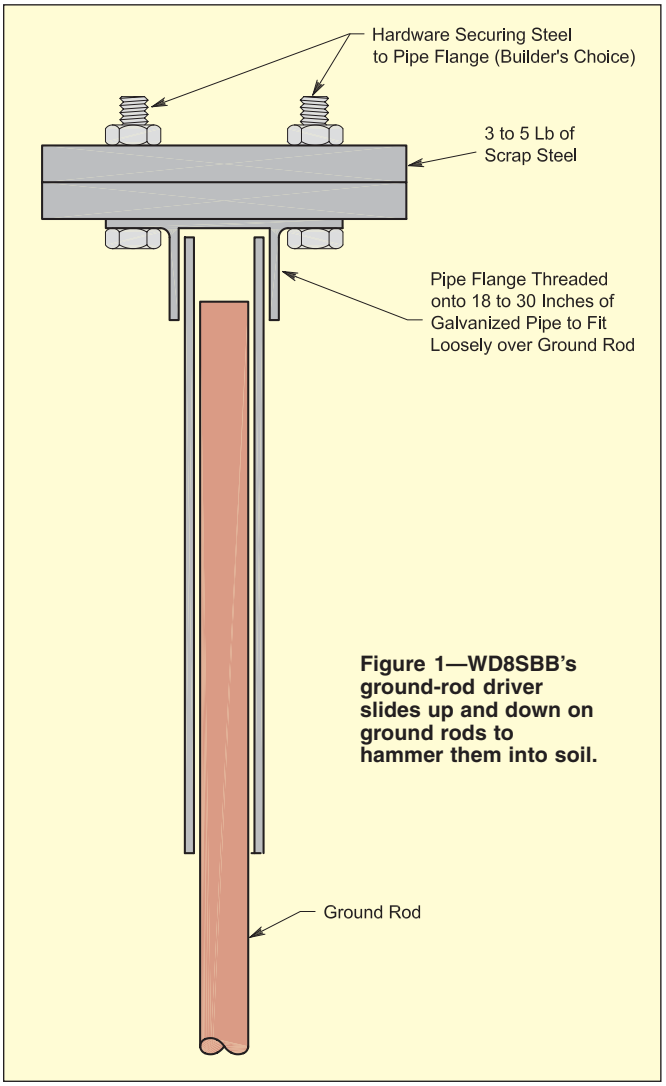



**Figure 1—WD8SBB's ground-rod driver slides up and down on ground rods to hammer them into soil.**

*Safety first! Wear safety glasses and leather gloves while using the driver. Keep your hands on the pipe, not the ground rod!* Start the process of installing a ground rod by digging a hole about 10 inches deep. You may remember the fence posts only went in a few feet, but the ground rod goes into the ground "up to its neck." The shortness of the rod left above ground means that the rod driver will end up driving itself into the ground with the rod. The hole allows the rod to reach the ground while preventing the driver pipe from penetrating the ground too deeply.

Install the weights and flange onto the longer section of galvanized pipe. Slip the driver over the ground rod, and set the ground rod into the hole. Based on the height of the rod, you may require a stepladder. Put the drive over the end of the ground rod. Lift the driver up and "slam" the driver down on the rod, making sure that your hands and fingers are on the pipe and away from the end of the pipe as it comes down. Let the weight drive the rod. You should not use muscle to propel the driver down-

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

ward. Weight and gravity should do the job; you need only raise the driver between blows.

After you get the ground rod almost installed, the long driver pipe will be hitting the ground. This is okay, but you may want to switch to the shorter pipe to continue driving the ground rod. Be careful when you change to the shorter pipe because it can more easily slide off the ground rod during the upward strokes.

The rods I have installed usually take about 5 or 10 minutes to drive about 10 feet. If you are unlucky enough to hit a rock, you have two options: either pull the rod back up and start again in another hole, or keep driving and see if you can break or displace the rock. I am not sure if I have ever broken a rock, but I have hit things and just kept driving until the rod again started downward.

There are limitations to this tool, the largest of which is hitting rocks. As I mentioned, I have had both good and bad luck with "solid objects." If you live in a very rocky location, consider other methods of driving ground rods.[1-4]

*Safety first always.* Always check the bolts to make sure they are tight and not damaged in such a way as to allow the driver to fly apart. Wear leather gloves. I was never so glad as the day I caught my hand in the driver and my gloves got cut, while my hand was only in mild pain. Keep your hands on the driver, not the ground rod. Watch the threads too, they are sharp. Always wear safety glasses.

Good luck. I think this will provide a lot of "bang for the buck" around a well grounded ham shack.—*Ron Wagner, WD8SBB, 5065 S Kessler Frederick Rd, Troy, OH 45373-9205;* **wd8sbb@arrl.org**

## NO ATTRACTIVE NUISANCE HERE (TOWER GUARD)

◊ Any ham using a tower must be careful, so as not to be sued for having an "attractive nuisance." That is anything that would draw the attention of a young child, who might then be injured as a result of their attraction. Because we do not want any child hurt by their attempt to emulate the ham they see climbing his radio tower and we do not want to be legally liable for an injury, we are obligated to prevent children from climbing our towers. Where allowed, a 6-foot fence works well. In my neighborhood, the tower is okay, but fences are not. So just a section of small-mesh wire fencing, wrapped around the tower up to about the 6-foot level, nicely takes care of the problem (see Figure 2). My 6-foot aluminum ladder in the garage makes my own access to the tower simple. From the liability aspect, the key phrase is "in the garage." Anyone able to get over the wire barrier is probably old enough to be held responsible for his or her actions—provided the ladder was missing at the time.—*Andrew Kilpatrick, WZ8A, 7330 Mallard Dr, West Chester, OH 45069;* **wz8a@arrl.net**

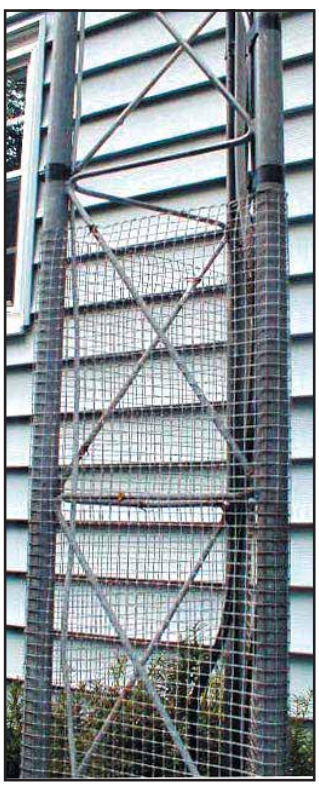


**Figure 2—Small-mesh wire fencing wrapped around the tower base prevents children from climbing WZ8A's tower.**

## SPEED PSK-31 TRANSMIT TIME WITH LOWER CASE LETTERS

◊ PSK-31 and its phase-shifted brethren are becoming very popular for ragchewing in the digital subbands. Yet, because its duty cycle is 100%, my trusty old ICOM 751's fan will roar to life to cool torrid transistor finals during particularly long—and enjoyable—PSK conversations.

While thinking about how PSK-31's Varicode (character set) is set up, I realized that the time-honored RTTY practice of sending upper-case letters is not the most efficient way to transmit. In the traditional Baudot code, all characters are five bits long. As the name implies, the PSK Varicode, invented by Peter Martinez, G3PLX, has characters that vary in length from two bits ("e") to 10 bits ("Z"). A glance at the Varicode character table shows that lowercase letters clearly use fewer bits than uppercase letters.

A little math showed me how much shorter. Lowercase letters average 5.96 bits in length, while uppercase letters average 8.23 bits. It sounded good, so I decided to make a "practical test." I disconnected the soundcard interface and just sent the phrase "The tired old ham lumbered over the lazy dog to get another 807" through the PC speakers. It took 21 seconds to send the phrase in uppercase; it took 16 seconds to send it in lowercase.

After that, I released the Caps Lock key on the computer. Sending all lowercase letters might look a little odd, but it's more efficient, and I can tell you that the final of my transceiver is 24% happier!—*Dave Hassler, K7CCC, ARRL Staff;* **k7ccc@arrl.org**

## A CURE FOR WORN LABELS

◊ I have one very well used handheld with the silk-screened labels worn off the keys. Because the key labels are gone, I could not figure out how to reprogram it when I decided to use it again. Several of the keys have multiple functions, so it is often necessary to refer to the manual when programming seldom-used functions. How could I read the keys and buttons? I went back through my old issues of *QST* to find the beautiful color advertisements for that model and clipped one out. I laminated it with clear plastic and presto! I can now look at the key labels on the picture while checking the manual and program the radio.

I have now done this for all of my equipment. I can read the labels now, but in a few years when those keys have the lettering rubbed off I will be able to check against the pictures from the advertisements.—*Avery M. Finn, KØHLA, PO Box 53, Hopkins, MN 55343-0053;* **k0hla@arrl.net**

## SWEEP-TUBE REPLACEMENTS—ANOTHER OPTION

◊ Sometimes identical tubes available use different filament voltages. Acquire the higher-heater-voltage versions of the tubes and modify the equipment to raise the heater voltage. For example, a 26JB6 (or the like) is often available for much less cost than a 6JB6.—*David M. Colburn, KD4E, 12847 Eden Ave, Hudson, FL 34667-7504;* **kd4e@arrl.net**

Hints and Kinks items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

*QST* invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **h&k@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing an item, please send the author(s) a copy of your comments. QST

[1]M. Goins, WB5YJX, "Another Way to Install Ground Rods," *QST*, May 1996, p 75.

[2]H. Brown, KC5EIY, "Installing Ground Rods in Heavy Clay," *QST*, Oct 1995, p 76.

[3]A.W. Edwards, K5CN, "Tips on Installing and Connecting to Ground Rods," *QST*, Jun 1994, p 76.

[4]R. Hinshaw, WD6L, "Water Makes Driving Ground Rods Easier," *QST*, Aug 1990, p 37.

# Yaesu FT-897 MF/HF/VHF/UHF All-Mode Transceiver

*Reviewed by Bob Schetgen, KU7G*
*Senior Assistant Technical Editor*


Yaesu seems determined to build an MF through UHF transceiver for every operator. The FT-897 is tailored for campers and backpackers who want more power than the FT-817 provides.[1] I borrowed an FT-817 for a vacation to Pennsylvania last summer, and it was great fun. Yet I want a rig for mobile use too, and 5 W is not enough power to yield many contacts through mobile antennas. I had decided to buy an FT-100D last year, when I saw an ad for the FT-897—it looked like just the thing for me. I let the Product Review Editor know of my interest and was soon carrying home the FT-897.

I like the look of the rig. It's a little larger than the FT-817 ($3^{3}/_{16} \times 7^{7}/_{8} \times 10^{5}/_{16}$″ HWD), but it does pack a full 100 W for 160-6 meters (50 W for 2 meters and 20 W for 70 cm). It's solid, and its military styling looks very rugged. That handle on the side just shouts, "Let's go!"

The FT-897 offers some great operating features, too. The DSP section is versatile, offering band-pass filtering, general noise reduction, a notch filter and microphone equalization.

For strong-signal environments, it has a 10-dB front-end attenuator and IPO (intercept-point optimization), Yaesu's term for bypassing the preamplifier. Both functions are arranged to suit typical band conditions. For example, the attenuator and IPO are not available on the 144-MHz and 430-MHz bands. The manual suggests that "as long as the S-meter is moving on background noise, additional front-end gain is not necessary."

## User Interface

It's amazing how many functions are controlled by the four knobs, 15 buttons and one LCD (see Figure 1) on the front panel! Yaesu accomplishes this by having most controls perform more than one function. The basic process is similar to that of the FT-100D and FT-817. A momentary press of the [F] key activates the MEM/VFO CH knob to select one of 17 menus for the three multifunction keys immediately below the LCD. Many of the functions are linked to underlying menus that set a parameter related to the function.

Holding the [F] key down for one second enters the menu mode, where the MEM/VFO CH knob selects from 91 menus that govern much of the rig's operation, including the functions of some knobs and buttons.

Consider the CW keying setup. By default, the internal keyer is switched off to allow keying by an external keyer or straight key. To activate the internal keyer (which includes three memories), momentarily press [F] and turn MEM/VFO CH to select Multifunction Row j, which is indicated by MFj at the left of the meter bar. The labels SPOT, BK and KYR appear over multifunction keys [A], [B] and [C], respectively. A quick press of [C] activates the keyer, as indicated by the display change to [KYR]. Holding key [C] down for one second opens Menu 030 [CW SPEED] to set the keying speed. To save the change and exit the menu mode, press [F] again and hold it down for one second. This procedure takes far longer to describe than it does to execute. The functions of Multifunction Row q can be set by the user through Menus 65-67 (PG A, PG B, PG C).

There are LEDs to indicate battery status, CW tuning, transmit or busy channel status and DSP on/off. The CW tuning indicator blinks in cadence with a CW signal that is precisely centered in the IF passband. This may seem hokey, but it solves the problem of inaccurately tuned CW signals that disappear when you switch to a narrow filter. With this indicator, you can be assured that the signal will still be in the passband when you switch on that wonderful 60-Hz DSP filter. This is a blessing to CW operators.

The main dial has a nice feel. Tuning with this rig is a pleasure. In the VFO mode, the main dial can be set for coarse (10 Hz) or fine tuning (≈1 Hz). The MEM/VFO CH knob can be set to a different channel spacing for each mode. On SSB, I left it at the 2.5-kHz default. This means that I can rapidly tune across a band in 2.5-kHz steps, which are sufficiently close together to hear any SSB signal present. Once a signal is found, it can be accurately tuned with the main dial. A momentary press of the power key or the FST button on the hand mic selects coarse tuning on the dial and doubles the selected channel spacing (although the menu display for channel spacing remains unchanged). The V/M key toggles the frequency control between the VFO and memory systems.

The CLARifier knob adjusts both the RIT *and* the IF shift. Both are activated by a small unlabeled key to the knob's upper left. A quick press toggles the RIT, while holding it down for one second

### Bottom Line

The FT-897 is a full-featured MF through UHF transceiver in a lightweight, rugged package that is well suited to traveling.

[1] R. Lindquist, N1RL, "Yaesu FT-817 Multiband Multimode Transceiver," Product Review, *QST*, Apr 2001, pp 75-80.

Brennan Price, N4QX ♦ Assistant Technical Editor ♦ n4qx@arrl.org

**Table 1**
**Yaesu FT-897, serial number 2N120204**

| Manufacturer's Claimed Specifications | Measured in the ARRL Lab |
|---|---|
| Frequency coverage: Receive—0.1-56, 76-108, 118-164, 420-470 MHz; transmit—1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54, 144-148, 430-450 MHz. | Receive[1] and transmit, as specified. |
| Power requirement: Receive, 1.0 A; transmit, 22 A (100 W output). | Receive, 0.9 A; transmit, 15 A. Tested at 13.8 V. |
| Modes of operation: SSB, CW, AM, FM. | As specified. |

| Receiver | Receiver Dynamic Testing |
|---|---|
| SSB/CW sensitivity, bandwidth not specified, 10 dB S/N: 1.8-30 MHz, <0.2 μV; 50-54 MHz, <0.13 μV; 144-148, 430-450 MHz, <0.13 μV. | Noise floor (MDS), 500 Hz filter:<br>1.0 MHz: *Preamp off* –129 dBm; *Preamp on* –134 dBm<br>3.5 MHz: –132 dBm; –137 dBm<br>14 MHz: –133 dBm; –137 dBm<br>50 MHz: –138 dBm; –142 dBm<br>144 MHz: see note 2; –140 dBm<br>432 MHz: see note 2; –139 dBm |
| AM sensitivity, 10 dB S/N: 0.1-1.8 MHz, <32 μV; 1.8-30 MHz, <2 μV; 50-54 MHz, <1 μV; 144-148, 430-450 MHz, not specified. | 10 dB (S+N)/N, 1-kHz tone, 30% modulation:<br>1.0 MHz: *Preamp off* 1.8 μV; *Preamp on* 0.86 μV<br>3.8 MHz: 1.3 μV; 0.69 μV<br>50 MHz: 0.83 μV; 0.43 μV<br>120 MHz: see note 2; 0.40 μV<br>144 MHz: see note 2; 0.46 μV<br>432 MHz: see note 2; 0.47 μV |
| FM sensitivity, 12 dB SINAD: 28-30 MHz, <0.5 μV; 50-54, 144-148, 430-450 MHz, <0.2 μV. | For 12 dB SINAD:<br>29 MHz: *Preamp off* 0.43 μV; *Preamp on* 0.26 μV<br>52 MHz: 0.28 μV; 0.17 μV<br>146 MHz: see note 2; 0.20 μV<br>440 MHz: see note 2; 0.21 μV |
| Blocking dynamic range: Not specified. | Blocking dynamic range, 500 Hz filter:<br>Spacing: 20 kHz *Preamp off/on*; 5 kHz *Preamp off/on*<br>3.5 MHz: 111/109 dB; 99/102 dB<br>14 MHz: 109/106 dB; 96*/89* dB<br>50 MHz: 114*/92* dB; 104/84* dB<br>144 MHz: note 2/102* dB; note 2/81* dB<br>432 MHz: note 2/99* dB; note 2/79* dB |
| Two-tone, third-order IMD dynamic range: Not specified. | Two-tone, third-order IMD dynamic range, 500 Hz filter:<br>Spacing: 20 kHz *Preamp off/on*; 5 kHz *Preamp off/on*<br>3.5 MHz: 91/90 dB; 68/67 dB<br>14 MHz: 89/86 dB; 67/65 dB<br>50 MHz: 89/85 dB; 68/65 dB<br>144 MHz: note 2/85 dB; note 2/64 dB<br>432 MHz: note 2/82 dB; note 2/63 dB |
| Third-order intercept: Not specified. | Spacing: 20 kHz *Preamp off/on*; 5 kHz *Preamp off/on*<br>3.5 MHz: +5.6/–1.9 dBm; –21/–29 dBm<br>14 MHz: +1.3/–6.7 dBm; –24/–32 dBm<br>50 MHz: –3.5/–12 dBm; –29/–39 dBm<br>144 MHz: note 2/–12 dBm; note 2/–40 dBm<br>432 MHz: note 2/–11 dBm; note 2/–38 dBm |
| Second-order intercept: Not specified. | Preamp off, +67 dBm; preamp on, +62 dBm. |

toggles IF shift. I found both facilities helpful in tuning. While the RIT and IF-shift functions can *act* simultaneously, the status of each is indicated by the same area of the display, so you can only see the status of one.

Several rear-panel connections are chassis mounted, so they are recessed slightly into the chassis ($^3/_8$″ diameter × $^3/_{16}$″ deep for ACC, KEY and EXT SPKR; ½″ diameter × $^5/_{16}$″ deep for CAT/LINEAR and DATA). This provides a little strain relief for the connectors, but requires that connectors fit inside the recesses. I normally use a $^1/_4$″ stereo phone plug on my paddle and keep a $^1/_4$:$^1/_8$ adapter on hand for smaller jacks. The adapter would not fit into the recess, so I wired a $^1/_8$″ stereo-plug pigtail in parallel with the $^1/_4$″ plug.

The back panel has a CAT connector, but that is also used to control an external power amplifier or automatic tuner.

### VFO System

The radio has two VFOs, A and B. The A and B VFO information is stored for

| Receiver | Receiver Dynamic Testing |
|---|---|
| FM adjacent channel rejection: Not specified. | 20 kHz channel spacing, preamp on: 29 MHz, 66 dB; 52 MHz, 65 dB; 146 MHz, 65 dB; 440 MHz, 68 dB. |
| FM two-tone, third-order IMD dynamic range: Not specified. | 20 kHz channel spacing, preamp on: 29 MHz, 65 dB; 52 MHz, 63 dB; 146 MHz, 62 dB; 440 MHz, 62 dB; 10 MHz channel spacing, preamp on: 52 MHz, 89 dB; 146 MHz, 90 dB; 440 MHz, 99 dB. |
| S-meter sensitivity: Not specified. | S9 signal at 14.2 MHz: preamp off, 16 μV; preamp on, 5.7 μV; 52 MHz, preamp off, 7.1 μV; preamp on, 2.5 μV; 146 MHz, preamp on, 2.2 μV; 432 MHz, preamp on, 2.3 μV. |
| Squelch sensitivity: SSB, 1.8-30 MHz, <2.5 μV; 50-54 MHz, <1 μV; 144-148, 420-450 MHz, <0.5 μV; FM, 28-30 MHz, <0.32 μV; 50-54, 144-148, 430-450 MHz, <0.16 μV. | At threshold, preamp on: SSB, 14 MHz, 1.6 μV; FM, 29 MHz, 0.16 μV; 52 MHz, 0.1 μV; 146 MHz, 0.09 μV; 440 MHz, 0.12 μV. |
| Receiver audio output: 2.5 W at 10% THD into 4 Ω. | 4.2 W at 10% THD into 4 Ω. |
| IF/audio response: Not specified. | Range at –6 dB points (bandwidth): CW (500 Hz filter): 385-971 Hz (586 Hz) USB: 250-2563 Hz (2313 Hz) LSB: 420-2588 Hz (2168 Hz) AM: 124-2379 Hz (2255 Hz). |
| IF rejection: 60 dB; image rejection, 1.8-30, 50-54 MHz, 70 dB; 144-148, 430-450 MHz, 60 dB. | First IF rejection, 14 MHz, 124 dB; 50 MHz, 96 dB; 144 MHz, 122 dB; 432 MHz, 123 dB; image rejection, 14 MHz, 90 dB; 50 MHz, 86 dB; 144 MHz, 96 dB; 432 MHz, 77 dB. |

| Transmitter | Transmitter Dynamic Testing |
|---|---|
| Power output: HF and 50 MHz: SSB, CW, FM, 100 W, AM, 25 W (carrier); 144 MHz, SSB, CW, FM, 50 W, AM, 12.5 W (carrier); 430 MHz, SSB, CW, FM, 20 W, AM, 5 W (carrier). | HF and 50 MHz: CW, SSB, FM, typically 102 W high, 3 W low; AM, typically 20 W high, <1 W low; 144 MHz: CW, SSB, FM, typically 50 W high, 4 W low; AM, typically 13 W high, <1 W low; 430 MHz: CW, SSB, FM, typically 19 W high, 1 W low; AM, typically 5 W high, <1 W low. |
| Spurious-signal and harmonic suppression: ≥50 dB on HF; ≥60 dB on VHF and UHF. | HF, 53 dB; 50 MHz, 63 dB; 144 MHz, 64 dB; 430 MHz, 61 dB. Meets FCC requirements for spectral purity. |
| SSB carrier suppression: >40 dB. | 60 dB. |
| Undesired sideband suppression: >50 dB. | 53 dB. |
| Third-order intermodulation distortion (IMD) products: Not specified. | See Figures 1 and 2. |
| CW keyer speed range: Not specified. | 4 to 57 WPM. |
| CW keying characteristics: Not specified. | See Figure 3. |
| Transmit-receive turnaround time (PTT release to 50% audio output): Not specified. | S9 signal, 6 ms. |
| Receive-transmit turnaround time (tx delay): Not specified. | SSB, 21 ms; FM, 15 ms. Unit is suitable for use on AMTOR. |
| Composite transmitted noise: Not specified. | See Figures 4 and 5. |
| Bit-error rate (BER), 9600-baud: Not specified. | 146 MHz: Receiver—BER at 12-dB SINAD, $1.7\times10^{-3}$; BER at 16 dB SINAD, $7.0\times10^{-5}$; BER at –50 dBm, $<1.0\times10^{-5}$; transmitter—BER at 12-dB SINAD, $1.0\times10^{-3}$; BER at 12-dB SINAD + 30 dB, $<1.0\times10^{-5}$. 440 MHz: Receiver—BER at 12-dB SINAD, $2.3\times10^{-3}$; BER at 16 dB SINAD, $8.0\times10^{-5}$; BER at –50 dBm, $<1.0\times10^{-5}$; transmitter—BER at 12-dB SINAD, $8.0\times10^{-4}$; BER at 12-dB SINAD + 30 dB, $<1.0\times10^{-5}$. |

Size (height, width, depth): 3.2×7.9×10.3 inches; weight, 8.6 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise-limited at the value indicated.
[1] Receive sensitivity is reduced below 350 kHz.
[2] IPO not available above 56 MHz.

each band, so the dual VFOs can serve as two dedicated memories for each band. A simple application of this might be leaving all VFOs A in CW subbands and leaving all VFOs B in the voice subbands. A complex application would be satellite operation, with A and B on different bands. The two VFOs may be on different modes. For split operation, the radio transmits on VFO A and receives on VFO B. You can also store separate transmit and receive frequencies in a single memory.

### Memory System

The FT-897 memory system includes the Quick Memory Bank (QMB), 200 regular memories, Home-channel memories and Smart Search memories. The Quick Memory Bank quickly stores the operating information for one frequency. To recall the frequency, you must use Multifunction Row c. Once recalled, the QMB frequency can be tuned and stored in a normal memory.

Regular memories can store single or split frequencies. They can be labeled

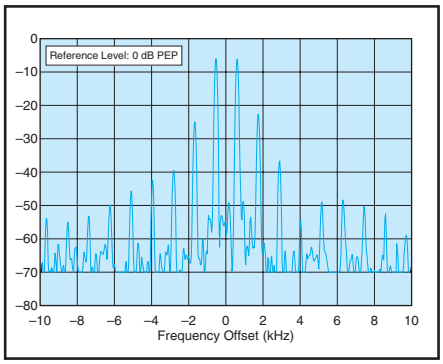



**Figure 1—Worst-case spectral display of the FT-897 transmitter during two-tone intermodulation distortion (IMD) testing on HF. The worst-case third-order product is approximately 23 dB below PEP output, and the worst-case fifth-order product is approximately 37 dB down. The transmitter was being operated at 100 W output at 28.350 MHz.**

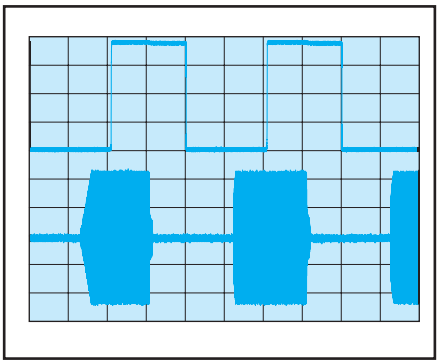


**Figure 3—CW keying waveform for the FT-897 showing the first two dits in full-break-in (QSK) mode. The equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transmitter was being operated at 100 W output at 14.2 MHz.**

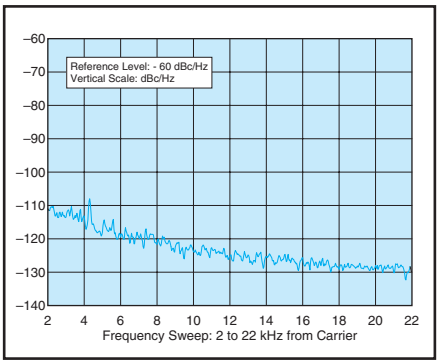



**Figure 4—Worst case spectral display of the FT-897 transmitter during HF composite-noise testing at 14.020 MHz. Power output is 100 W. The carrier, off the left edge of the plot, is not shown. The plot shows composite transmitted noise 2 to 22 kHz from the carrier.**

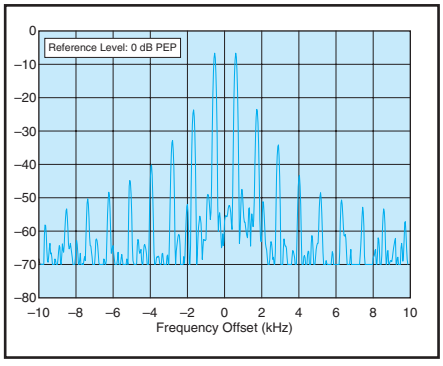



**Figure 2—Worst-case spectral display of the FT-897 transmitter during two-tone intermodulation distortion (IMD) testing on VHF. The worst-case third-order product is approximately 24 dB below PEP output, and the worst-case fifth-order product is approximately 33 dB down. The transmitter was being operated at 50 W output at 144.200 MHz.**

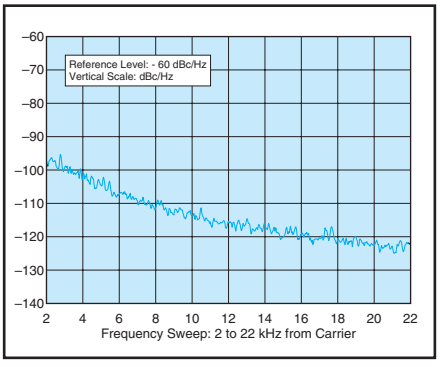



**Figure 5— Worst case spectral display of the FT-897 transmitter during UHF composite-noise testing at 432.020 MHz. Power output is 20 W. The carrier, off the left edge of the plot, is not shown. The plot shows composite transmitted noise 2 to 22 kHz from the carrier.**

with alphanumeric tags and hidden from memory scans. Memories can be grouped to simplify their management.

There are four "Home" memories, one each for HF, 6 meters, 2 meters and 70 cm. Each can hold frequency, mode, CTCSS, DCS and repeater-shift data as appropriate.

The Smart Search operation has a bank of 50 memories that hold results between searches. The Programmable Memory Scan function uses another five memory pairs (M-P1L/M-P1U through M-P5L/M-P5U).

## Battery and AC Power Systems

The provision for battery operation is one of the most attractive features of this radio. Removing the bottom cover reveals a compartment for two batteries or a 120-V ac switching power supply. Unfortunately, neither was available with the test radio, so information about them is taken from the operating manual.

The radio can hold two FNB-78 (13.2 V, 4.5 Ah) battery packs. Each should power the radio for about four hours of reception. Recharging also takes about four hours. The charger can charge one battery at a time and requires the operator to make charging-cable connections. The charger is simply a dc-dc converter that supplies 16.5 V from a user-supplied 12-V or 24-V source. The list price for two batteries and a charger is $360. (I've seen them on the Web for about $300.)

The ac power supply has its own switch. The manual instructs users to use both power switches in a specific sequence to operate the radio.

## A Look at the Numbers

An early unit of the FT-897 tested by the ARRL Lab did not exhibit a consistent dynamic range measurement, and transmit IMD performance was not good, even after a suggested alignment procedure. Yaesu attributes the failure of the alignment procedure to the absence of an "unrelated" design change in our early unit. This design change—a simple replacement of two resistors—was made early in production.

Subsequent units, representative of those currently on the market, performed quite well on the ARRL Lab bench—particularly well for a 100 W radio that retails for under $1000 without optional filters. Test results (with the optional YF-122C 500 Hz CW filter installed) are detailed in Table 1 and Figures 1 through 5.

The two-tone, third-order IMD dynamic range comes in at about 90 dB at 20 kHz signal spacing and the preamp off. When the spacing drops to 5 kHz, the IMD DR measurement drops to around 67 dB. Compare this 5 kHz measurement to Yaesu's other recent 100 W radio with a handle, the high-end and much heavier FT-1000 MP Mark V Field, and you will find similar performance. For a radio of its price class, the FT-897 does a very nice job of pulling out the weak ones in the presence of strong ones.

## Manual Disappointments

When I first received the'897, I thought it was broken. Although I set the dial tuning to fine and the SSB channel spacing to 2.5 kHz, the dial would only advance in 10-Hz and 5-kHz steps, respectively. I was very worried about this until I learned on the Web that it's an undocumented feature.

Based on this and some function descriptions that confused me, I think the manual needs more proofreading, explanations of how functions work and more

detail about how to operate them. One section explains how to use the fold-down feet, but the FT-897 does not have fold-down feet. It has a bail, as shown on drawings throughout the manual.

The manual also needs an image of the LCD showing all icons and their meaning. For example, there's a small animation of a running person at the right of the meter scale. It took me a long time to find that the icon indicates the fast tuning rate. It's replaced by a key symbol when the dial lock is active. Both of the symbols are described in updated versions of the manual, Yaesu says.

Although memory grouping is a feature of the radio, I found no mention in the manual of how to group memories or how to use them.

In addition to basic operating instructions, the manual gives rules of thumb and tips. Some of these are very helpful.

### Miscellaneous Features

- The Dual Watch feature periodically switches the receiver from the frequency/mode of one squelched VFO to that of the other VFO.
- Priority Channel scanning functions much like Dual Watch. Memory channel M-001 is periodically checked, while you listen to a VFO or another memory channel.
- CW Training provides CW receiving practice via the sidetone with five-letter random groups of either letters or letters and numbers.
- The Beacon Feature lets you automatically send the Beacon Text 1 repeatedly at intervals up to 255 seconds.
- The '897 LCD backlight can be different colors to reflect the status of many radio parameters: ARTS status, band, memory group, VFO/Memory/home/QMB status or the meter indication.
- The auto-range transponder system (ARTS) uses DCS signaling to determine when another ARTS-equipped station is within range.
- The Spectrum Monitor function lets you view activity on frequencies above and below the tuned receive frequency. The receiver audio and S-meter are disabled while the Spectrum Monitor is operating.
- Smart Search scans the current band and stores active frequencies in temporary memories.
- The transverter function allows the user to set the display frequency to any arbitrary frequency up to 99,999 MHz. When using the '897 to drive a transverter, one can tune to a beacon or known frequency standard, set the display to that frequency, and proceed.

*Manufacturer:* Vertex Standard USA, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.vxstdusa.com**. Price: $954. Optional accessories: YF-122S 2.3 kHz SSB filter, $169.95; YF-122C 500 Hz CW filter, $169.95; TXCO-9 high stability reference oscillator, $99; FP-30 clamp-on power supply, $209.95; ATAS-120 automatic antenna tuner, $329.95.

# SteppIR 3-element Yagi Antenna

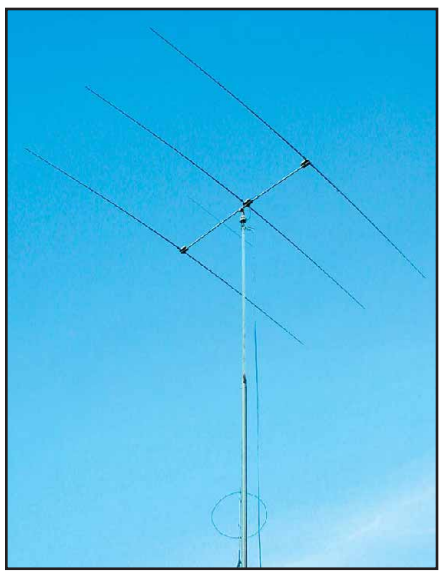
*By H. Ward Silver, NØAX*
QST *Contributing Editor*

At the 2001 Dayton Hamvention, the new SteppIR Yagi with its adjustable-length elements set tongues wagging amongst HF operators. Two years later, the antenna is selling to hams around the world and interest continues to grow. Does it really work? Is it reliable? Is it worth the price?

### Description of Antenna and Design

The SteppIR is available as a dipole, or as a 2-element or 3-element Yagi covering 14 through 50 MHz. The 3-element model was tested for this review, including the optional 6-meter element. The key to the design is that the antenna elements are adjustable in length. Each element is made from a pair of copper-beryllium strips inside telescoping fiberglass tubes. A microprocessor-based controller in the shack and a stepper motor for each element adjust how much the strips extend into the tubes. This allows the antenna to be adjusted for optimum performance at any frequency within its design range.

Figure 6 shows the internal construction of the motor/element spool housing with the metal tape feeding into the element tube coupling. The sprockets are driven by a stepper motor that pushes and pulls the metal tapes into and out of the fiberglass tubes. Machined nylon tracks guide the tape as it goes on and off the storage reels.



The driven element on each configuration is adjusted for approximately 22 Ω impedance. A 2:1 toroidal impedance transformer is contained in the driven element motor housing to match 50-Ω feed line.

**Bottom Line**

The SteppIR Yagi packs excellent performance into a mid-sized, three-element package. The antenna is well-suited for tight-quarters and moderate tower/rotator combinations.

Antenna modelers and manufacturers have traditionally struggled with the necessary compromises for Yagi designs. Fixed element lengths and placement on the boom make it difficult to come up with designs that have acceptable gain, front-to-back ratio and VSWR across the amateur bands.

The SteppIR, by allowing variable-length elements, allows some of the design compromises to be avoided. A narrow-band design with good VSWR, gain, and front-to-back ratio is now acceptable because the adjustable element lengths allow the design frequency to be shifted at will. In fact, the SteppIR controller is programmed with dozens of separate antenna configurations that cover 14 through 50 MHz.

The controller is operated manually by front-panel buttons. To move the antenna's center frequency, a BAND button can be pressed to cycle between the configurations stored for the band. Fine-tune buttons direct the controller to make 25-kHz adjustments that interpolate between the stored designs. Eighteen custom frequencies can also be stored.

The controller can be connected directly to a transceiver with a serial port, and the antenna will follow you around the bands auto-magically. The SteppIR data interface can also be used if a logging program is connected to the radio by using a Y-cable to acquire the radio's data. The controller ignores frequencies

from outside the range of the antenna, so if you are on 15 meters and jump to 40 meters, the antenna configuration stays as-is for when you come back.

## Special Features

Because the SteppIR's elements are adjustable, it offers two unusual features: "180° Mode" and "Bi-Directional Mode." 180° Mode allows the operator to reverse the beam pattern so that it "points" in the opposite direction from the Normal Mode configuration. Because the three elements are spaced nearly equally, performance is approximately equivalent to Normal mode when the pattern is reversed. Bi-Directional Mode changes the reflector element to a director so that the antenna beams power in both directions at once—like a pair of 2-element beams.

If you like, you can make adjustments to the stored configurations or even store your own antenna designs. Adjusting the factory-default element lengths is useful if nearby antennas or conductors raise the SWR or if the antenna height is low. If you use an SWR analyzer, you can adjust the antenna in real time while watching the meter.

Retracting the elements for disassembly or protection is also easily done from the controller front panel. Since the elements are internal to the fiberglass tubes, it doesn't change the mechanical shape of the antenna.

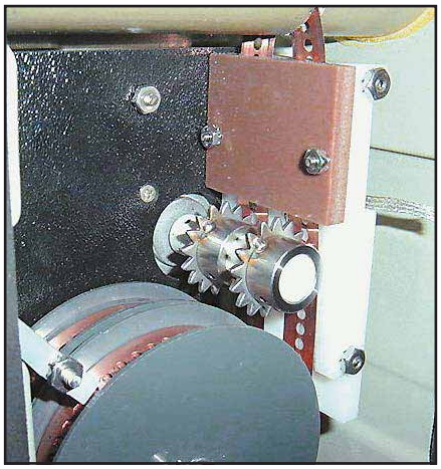


**Figure 6—The internal assembly of a SteppIR motor housing. You can see the motor drive sprockets, the copper-beryllium tape spools and the unwound tape feeding into the tube coupling.**


**Figure 7—The SteppIR controller and the Bird wattmeter used during testing.**

## Assembly Process and Instructions

The antenna I built and tested is a 3-element Yagi with the 6-meter fixed element, and a transceiver data interface. The antenna is mounted on a 55-foot crank-up mast with a HAM-IV rotator. The antenna is fed with 100 feet of RG-213/U.

I did not require optional the Boom Slide assembly fixture, which allows the antenna to be assembled on a tower or mast. The fixture would be very handy if sufficient assembly space was not available, but I used a portable workbench to hold a short piece of pipe on which I assembled the antenna.

Total assembly time was a little over three hours. Others report shorter times, but I was taking it slow to review the manual as well as get the antenna together. The antenna arrives in a carton a little over 5 feet long and with the various assemblies and hardware collections bagged or wrapped. Shipping weight of the antenna is about 50 pounds. The boom pieces are 48 inches long, so the antenna pieces should fit into a ski bag for transport.

No parts were missing or extra. Having assembled a number of Yagi antennas over the years, I was pleasantly surprised at the low number of parts. The hard part of the assembly—inside the motor housings, which are self-contained—is done by SteppIR.

Instead of a checklist of instructions, the instructions are part of a text description that provides some background and explanation. Personally, I would prefer that the text and specific instructions be separated, but the necessary information is all there. I recommend that the builder read through the entire process carefully and highlight significant procedures. Assembling this antenna is quite different from the usual plumber's-delight all-aluminum antenna.

The manual, currently under revision, includes useful color photographs that illustrate some of the more involved steps. There is a control cable for each motor housing, and these must be carefully dressed on the boom and around the boom-to-mast mounting plate. It helps to visualize how the cables and feed line will lie before taping them to the boom.

When the fiberglass tubes are completely extended, electrical tape and self-vulcanizing tape are used to seal the joints. SteppIR provides a premium brand of tape, and it's easy to wrap each joint with a clean-looking covering. If you haven't used the self-vulcanizing tape before (I hadn't on an antenna), it's not immediately

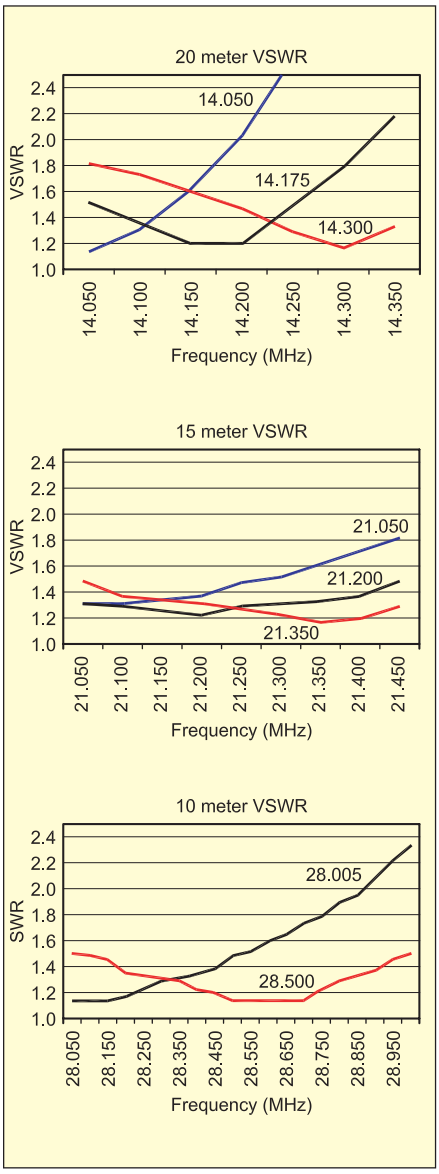



**Figure 8—SWR curves on 20, 15, and 10 meters for the SteppIR 3-element Yagi as assembled using the labeled factory default settings. VSWR on 12 meters was 1.1:1 across the band. VSWR on 17 meters was 1.4:1 at 18.100 MHz and was adjusted to 1.3:1 using the Modify function on the driven element.**

obvious how much to stretch the tape or how well it will self-adhere. You might want to get some of your own and practice, as it will be difficult to rewrap the joints once the antenna is in the air.

Getting the antenna onto the mast and rotator wasn't much of a problem, although one of the element tips had a disagreement with the roof that would likely have bent or broken an aluminum tube. There are some scratches on that tip, but it was undamaged. If any segment of the tubes is damaged, the entire telescoping assembly must be replaced—they cost $30 separately. The antenna was easy to lift into place with a gin pole and the job can be done single-handed.

## On the Air Performance

As of this writing, I've had the antenna up a little over three weeks and have several hundred contest QSOs (ARRL DX CW and SSB) in the log using the SteppIR. If there is a drawback at all, it's that using the 180° Mode and Bi-Directional Mode are so interesting that one tends to fiddle with them unnecessarily.

Figure 8 shows line graphs of VSWR versus frequency for several of the default antenna configurations. The graphs' legends show the frequency at which the configuration is optimized. Changing to 180° or Bi-Directional Mode raises SWR a small amount—not enough to consider retuning the antenna. Figure 7 shows the controller and my wattmeter.

As you can see, the SWR curves, while not broadbanded, are not so sharp as to require frequent re-tuning as one prowls the bands. In fact, were SWR the only criteria for performance, one setting would suffice on all bands except 20 meters. Changing the configuration frequency affects forward gain much less than an S-unit (6 dB) except for extremely wide changes. Antenna tuning really comes into play in the front-to-back ratio. This can be observed by tuning in a station off the front of the beam and then activating 180° Mode. After the antenna changes direction, changing the configuration frequency causes much bigger changes in front-to-back than in forward gain.

Forward gain was about equivalent to a three-element monoband Yagi. Front-to-back (F/B) ratio, which depends on the signal's angle of arrival, was unexpectedly good. The best performance was on 20 meters, where F/B ranges from 2 to 7 S units. On the remaining HF bands, F/B ranges from 2 to 5 S units.

The 180° Mode can almost make a signal disappear in a couple of seconds. This was really handy when I was trying to switch between working JA and Caribbean stations. Because those two parts of the world were obviously having trouble hearing each other, the interference at my location was often fierce. Instead of wearing out my rotator swinging the beam back and forth, it was easy to switch directions and work the desired station in a few seconds. At its peak, the SteppIR's front-to-back ratio is exceptionally good.

A very useful technique is to put the SteppIR in Bi-Directional Mode while tuning across a band and then switch to the desired direction when a station is found. Often, I could work the station in Bi-Directional mode without changing—it's like having a stack of 2-element Yagis.

How long does switching directions take? When switching from Normal to 180° Mode, the longest delay I experienced was 3 seconds on 20 meters, when changing element lengths took the most steps. The worst case HF frequency change—from 14.050 to 29.9 MHz—took 14 seconds. Changing the antenna configuration does create a low noise level while the motors are running.

An "unintended consequence" of a variable-length element, several SteppIR owners have discovered that the antenna can act as a "tunable top-hat." Changing the frequency of the SteppIR will affect the tuning of a shunt-fed tower or wire antenna attached to the tower. Depending on your situation, this can be either a bonus or a problem, but those reporting the effect have generally been able to make good use of it.

I have been unable to really put the 6-meter portion of the antenna to much of a workout, as I've been unable to find any sporadic-E openings here in the dead of winter. I've checked out the antenna on some local repeaters and some mobile stations. It acts like a beam and hears a lot better than the discone antenna I was using previously.

## Operating Manual

Given the amount of electronics involved with the SteppIR, the operating manual is not thick and is written in a conversational style. Assembly covers 9 pages and the instructions for using the controller fill another 10 pages. Each operating mode is explained in detail, with the operating instructions mixed in with the text. This is a bit of a drawback for finding the instructions once you've read the manual. (You do read the manual, don't you?) It would probably be more user-friendly to bundle the descriptions together and keep the actual instructions in a step-by-step format.

Sections on the antenna's design and modeling which discuss the design philosophy and how it affects the antenna's operating characteristics. Schematics of the controller or motor assemblies are not provided.

## Reliability

I contacted SteppIR owners in hot, cold, windy and salty places. One in New Brunswick and another in North Carolina both had experienced rather severe ice and snow loading under windy conditions without any mechanical problems. Both reported little effect on the antenna's electrical performance even when coated with ice and sagging 3 to 4 feet at the tips.

Another owner used his SteppIR dipole in San Diego for a year without the tip sections of the fiberglass tubes installed. The element tapes extended into the open air and hung down below the antenna. The resulting salt and dust exposure did not seem to affect it. He's purchased another one for use in Texas. A separate Texas owner reports that the antenna "ignores ice." Two local owners here in Washington near salt water have not experienced any degradation after a wet year of installation near Puget Sound.

What has not been conclusively answered is the antenna's ability to withstand prolonged periods of strong wind and exposure to ultraviolet radiation. We'll have to wait for some time to have a good answer to those questions. However, the materials and construction appear to be properly rated for those environments.

## Summary

Every antenna has a few "I wishes" and here are mine. I wish the feed line connector were offset from the control cable on the center housing so it would be easier to tighten and waterproof. I wish there were a little more self-vulcanizing tape so that I had a little extra for a practice wrap. I wish the fiberglass tubes had a more positive lock so that you could be sure you had them fully extended (you can measure, though). I wish the designers could make it beam sideways, too!

The SteppIR is not a cheap antenna compared to other tribanders. Is it worth the cost? The SteppIR provides good performance out of its physical package. Particularly for someone with restricted space and tower/rotator capabilities or replacing an older tribander, the SteppIR should get a close look.

*Manufacturer*: SteppIR Antennas, 14135 233rd Pl SE, Issaquah, WA 98027; tel 877-885-8700 or 425-456-0200, fax 425-391-6031; **sales@steppir.com**; **www.steppir.com**. Manufacturer's suggested retail price: 3-element SteppIR Yagi, $1099; Transceiver interface kit, $60; BoomSlide assembly fixture, $70; extended warranty, $35/year.

# Amateur Radio Spectrum Protection Act Now in Both House And Senate

The Amateur Radio Spectrum Protection Act of 2003 now has been introduced in both chambers of Congress. Idaho Sen Michael Crapo introduced the Senate version of the bill, S 537, on March 6. Florida Rep Michael Bilirakis introduced a House version of the bill, HR 713, on February 12. The measures, an ARRL initiative, have been introduced twice before in Congress. ARRL President Jim Haynie, W5JBP, believes this third time could be the proverbial charm.

"Actually, this is the best opportunity that we've ever had to get this bill through, because more members of Congress than ever before are paying attention to ham radio now," said Haynie, who spent a week in Washington in early March to talk Amateur Radio with lawmakers and regulators. In addition, Haynie pointed out, the House and Senate will be considering major spectrum reform bills, and the Amateur Radio Spectrum Protection Act could serve as an amendment to that sort of legislation.

**ARRL President Jim Haynie, W5JBP, and Sen Michael Crapo (R-ID), sponsor of the Senate version of the Amateur Radio Spectrum Protection Act of 2003.**

HR 713 and S 537 are aimed at ensuring the availability of spectrum to Amateur Radio operators. They would amend the Communications Act to require the FCC to provide "equivalent replacement spectrum" to the Amateur Radio and Amateur-Satellite services in the event of a reallocation of primary amateur allocations, any reduction in secondary amateur allocations, or "additional allocations within such bands" that would substantially reduce their utility to amateurs.

As of press time, the two measures had garnered 10 cosponsors—eight in the House and two in the Senate. HR 713 cosponsors include Representatives John Boozman (R-AR), Patrick Tiberi (R-OH), Mike McNulty (D-NY), Jim Leach (R-IA), Charles Taylor (R-NC), Dave Weldon (R-FL), Ted Strickland (D-OH), and Barbara Cubin (R-WY). Senators Daniel Akaka (D-HI) and Larry Craig (R-ID) were original S 537cosponsors.

The House bill has been referred to the Committee on Energy and Commerce; the Senate bill is under consideration of the Commerce, Science and Transportation Committee. Haynie encouraged ARRL members to contact their senators and representatives to urge their cosponsorship, which lends support to legislation at the committee level. In addition, although more members of Congress than ever understand and appreciate the benefits of Amateur Radio, some lawmakers are reluctant to sign onto a technical piece of legislation without some indication of support from their constituents.

"The League is doing all it can, but we know the success or failure will be in the hands of the amateur community," said Haynie, who pledged the ARRL's continuing efforts to get the bill enacted. "Letters and e-mails are the key to getting legislation passed."

The text of HR 713 and S 537 is available on the Thomas Web site, **thomas.loc.gov/**. A sample letter is available on the ARRL Web site, **www.arrl.org/govrelations/arspa.html**. Those writing their lawmakers are asked to copy their correspondence to the League via e-mail to **specbill03@arrl.org**.

# ARRL Expresses Concerns about 70-cm Changes

The ARRL says two FCC-proposed actions could negatively affect Amateur Radio. One would substantially expand the geographical area in the US subject to power limitations on 70 cm. The other would deploy National Weather Service wind-profiler radars in the band's top two megahertz.

"The Commission has proposed two actions that have a potentially substantial adverse impact on a large number of Amateur Radio operators in this proceeding," the ARRL said in comments filed in February in ET Docket 02-305. "In each case, the Commission can minimize that impact."

In a *Notice of Proposed Rule Making* (*NPRM*) late last fall, the FCC proposed on behalf of the National Telecommunications and Information Administration (NTIA) to, among other things, more than double the size of the geographical area in New Mexico and Texas where amateurs in the 420-450 MHz band would be limited in power to protect military radiolocation service operations. Amateur transmitters in certain geographical areas already are limited to 50 W PEP unless, according to §97.313(f), "expressly authorized by the FCC after mutual agreement, on a case-by-case basis" between the FCC district director and the applicable military frequency coordinator. The *NPRM* also reflects NTIA action specifying the operation of federal government wind profilers in the band 448-450 MHz.

Acknowledging that the Amateur Service is secondary to government services in the band, the ARRL nonetheless asked the FCC to ensure that the affected zone in Texas and New Mexico "is minimized as much as possible, consistent with protection of military facilities." The ARRL also requested the FCC to create "a streamlined procedure for case-by-case exemptions" from the power restrictions.

"It is difficult for ARRL to address the contention of the Army that amateur power in excess of 50 W PEP in the additional

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

protected areas requested by the Army would cause interference to military radiolocation facilities involved in missile tracking," the League said in its comments, "because the claim made by the Army is not substantiated by any technical information." The proposed area would include all of New Mexico and all of Texas west of 104º W longitude. The ARRL said it was "not intuitively obvious" that such a large restricted area is necessary.

The ARRL concluded that a 50-W power restriction could mean having to reduce the outputs of some critical repeaters used for emergency and public service work or taking them off the air altogether. It also could affect "weak-signal," experimental and Earth-Moon-Earth operations, the ARRL said.

The League also said it had understood that the National Weather Service—which operates the wind-profiler radars—would notify ARRL of their locations as they're selected. "Ideally," the League said, "since the amateur repeaters are incumbent in the band now, the National Weather Service should select sites that minimize the effect on those repeaters."

The text of the ARRL's comments, the FCC *NPRM* and other documents are available via the FCC's Electronic Comment Filing System (ECFS), **www.fcc.gov/cgb/ecfs/**. Click on "Search for Filed Comments" and enter "02-305" in the "Proceeding" field.

### HAMVENTION HOPES TO CONTINUE CALLING HARA ARENA HOME

Although 2003 marks the last year of a five-year contract to hold Hamvention at Hara Arena, organizers hope to keep the show there for the indefinite future. Rumors persist that this year's event will be the last to take place at the venerable venue that's served as Hamvention's home since 1964. Negotiations on a new contract to retain Hara for future shows remain in the offing. Billed as "the world's largest Amateur Radio gathering and trade show," Hamvention 2003 takes place May 16-18. Hamvention's 2003 theme is "Year of the Youth," and the show will focus on young hams and on attracting 12 to 18 year olds into Amateur Radio.

Hamvention Production Manager Garry Matthews, KB8GOL, says no decisions have yet been made regarding a new contract between Hamvention and Hara. "We want to get this year's show under our belt and then renegotiate the contract." Matthews, who's been producing Hamvention for about three decades, predicted that any new contract to hold Hamvention at Hara likely would be for no more than two years.

**Hara Arena is the only facility in the Dayton area that can accommodate Hamvention at its present size.**

Matthews says there are no plans to go elsewhere, nor is Hamvention under any threat or pressure to relocate. "There's nothing planned to move," he said. "But," he conceded, "we've looked at alternative locations in case something happens. Anything could happen to Hara."

Matthews says the sponsoring Dayton Amateur Radio Association has explored several other possible locations for Hamvention, which has quietly dropped "Dayton" from the show's official name. That's in part because Hara Arena is no longer within Dayton city limits but in Trotwood—an Ohio municipality in its own right. The change also leaves open the possibility—remote as it is—that

## In Brief

- **Arkansas gets new Section Manager:** ARRL Field and Educational Services Manager Rosalie White, K1STO, has appointed Robert D. "Dennis" Schaefer, W5RZ, of Dover as Arkansas ARRL Section Manager. Schaefer served as a Section Communications Manager (SCM) from 1968 until 1970 and as an Assistant SM. He now serves as a Delta Division Assistant Director and as a District Emergency Coordinator. Schaefer succeeds SM Bob Ideker, WB5VUH, who first served as SM from 1991 through 1995 and who returned to office in 2001. Ideker decided to not run for another term, and Eldon Bryant, K7ZQR, was nominated and elected to replace him. Bryant subsequently decided not to assume the office, however. Schaefer's SM term began April 1.
- **Vote On *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for December 2002 was Dick Stroud, W9SR, for his article "Try Copper for 2 Meters—the CuLoop." The January 2003 winner was Paul Wade, W1GHZ, for his article "A 222-MHz Transverter for the Yaesu FT-817." The February 2003 winner was David A. Rosenthal, N6TST, for his article "Portable in Paradise: Cruise Ship DXing." Congratulations, Dick, Paul and David! The winner of the *QST* Cover Plaque award, given to the author—or authors—of the best article in each issue, is determined by a vote of ARRL members. Voting takes place each month on the *QST* Cover Plaque Poll Web page, **www.arrl.org/members-only/qstvote.html**.
- **Viewing and commenting on petitions to the FCC:** The public may comment via the Web or e-mail on any *Petition for Rulemaking* that the FCC has put on public notice and assigned a rulemaking (RM) number. Visit the FCC's Electronic Comment Filing System (ECFS) page, **www.fcc.gov/cgb/ecfs/**, which includes detailed instructions. To view a petition and/or any comments filed, click on "Search for Filed Comments" on the right-hand side of the page and enter the RM number in the "Proceeding" field. You must enter "RM" in upper-case letters and include the hyphen followed by the appropriate five digits. To file comments, click on "Submit a Filing" on the right-hand side of the ECFS page or see the instructions on how to file comments via e-mail. A typical comment period runs 30 days from the date the FCC puts a petition on public notice.

### FCC SAYS STRENGTHENED RULE WILL HELP ENFORCEMENT

The FCC has strengthened its requirements to submit truthful statements. The Commission has amended §1.17, which prohibits written and oral statements of fact that are intentionally incorrect or misleading. The revision also covers written statements of fact made without reason to believe that a statement is true and accurate.

"The new rule is a clearer, more comprehensive, and more focused articulation of the standards for truthful statements than the old rule," the FCC said in a *Report and Order* released March 10. "The new rule will also enhance the effectiveness of our enforcement efforts."

The amended rule applies to "investigatory and adjudicatory" matters and to tariff proceedings but not to general rulemaking or declaratory ruling proceedings.

The FCC also broadened the scope of individuals affected beyond applicants and Commission licensees. The new rule also applies to any person undertaking an activity that requires FCC authorization, even if the activity is *not* authorized, and to any recipient of a citation or a letter of inquiry from the FCC or who is the subject of a Commission investigation. The revised rule also applies to anyone expressing interest in a proceeding to amend the FM or television *Table of Allotments* (§73.1015) and to any cable operator or common carrier (§73.939).

"The revised rule would simply enable the Commission to impose sanctions more effectively in those instances where people intentionally or negligently submit incorrect or misleading information," the FCC said. The Commission acted in the proceeding on March 4. Its vote was unanimous.

## *Amateur Enforcement*

♦ **FCC proposes fine for ham accused of intentional interference:** The FCC has proposed fining a Nebraska Technician-class Amateur Radio operator, Scott E. Kamm, NØUGN, of Waterbury, $12,000 for alleged willful and repeated interference, broadcasting of music and failing to identify with his call sign. The FCC's Kansas City office released the *Notice of Apparent Liability for Forfeiture* (*NAL*) January 24.

Responding to complaints of continuing interference on the input of a 2-meter repeater, FCC agents monitored the frequency last December 9. They observed "very strong signals on the frequency 146.31 MHz consisting of music, sound effects and unmodulated carriers" and no station ID. The FCC said the transmissions were "interfering with existing communications in progress" between other amateur stations.

Using direction-finding techniques, the FCC determined that the source of the signals was Kamm's residence. The next day, an FCC agent monitored the same sorts of transmissions, tracked the source to Kamm's residence, and inspected Kamm's amateur station, which included a transceiver capable of operating on 146.31 MHz, the FCC said. Kamm claimed no transmissions were made from his station and that he used the unit to receive only.

Based on its evidence, however, the FCC Kansas City office determined that Kamm "willfully and repeatedly" violated Part 97 by causing intentional interference, broadcasting music and failing to identify.

Kamm already was the target of several FCC Enforcement Bureau letters and a *Warning Notice* during 2002. Last fall, responding to complaints about Kamm's station operation and questions about his qualifications to be a licensee, the FCC's Wireless Telecommunications Bureau set aside a renewal application for his amateur license, which has since expired. His renewal application is pending.

♦ **Michigan pirate broadcaster banned from ham radio for five years:** The FCC has canceled the license of a Michigan Amateur Radio operator and told him he may not apply for another ham ticket until 2007. The Commission took the action against Thomas A. Brothers, ex-KI8BE, of Berkley, because he'd been the operator of an unlicensed FM "pirate" radio station.

FCC Special Counsel Riley Hollingsworth wrote Brothers February 14 to confirm receipt of his amateur license—which Brothers had agreed to surrender. The FCC also had imposed a $10,000 fine against Brothers, but rescinded the forfeiture last December because of his demonstrated inability to pay. Brothers' Advanced class ticket was cancelled December 5, 2002.

FCC sources say the Commission's Detroit Field Office became aware as early as 1998 that Brothers was operating an FM pirate radio station on 88.3 MHz from his home. On multiple occasions, an FCC agent used direction-finding gear to track the signal to Brothers' residence and sent Brothers a *Warning Notice* ordering him off the air. Brothers ceased the pirate broadcasting in 1998, but by 2000 he was back on the air and again attracting FCC attention.

In January 2002, the FCC issued Brothers a *Notice of Apparent Liability* for $10,000 for operating an FM station without a license. In a subsequent *Petition for Reconsideration*, Brothers did not dispute that he willfully and repeatedly has violated Section 301, but he asked the FCC to cancel the fine because—among other factors—of his inability to pay. The Detroit Field Office turned the case over to Hollingsworth late last year to consider sanctions against Brothers' Amateur Radio license.

Hamvention might one day be held in an altogether different place.

Hamvention has at one point or another considered the Nutter Center—where the Hamvention banquet has been held in the past—as well as various fairgrounds in the Greater Dayton area. "None of these will serve the purpose that Hara does," Matthews said. "None of the other venues will support the show at its current size." Hamvention is the only show that makes use of the entire facility, and Hara Arena has been expanded over the years solely to accommodate Hamvention's needs.

Hamvention reported attendance for last year's 50th anniversary event at 24,832—down about 5 percent from 2001's crowd of 26,151 and the second year in a row that Hamvention's attendance dipped.

Attendance climbed to 28,804 in 2000, the year of the ARRL National Convention at Dayton. Matthews has said that any crowd larger than 28,000 starts to push the envelope as far as Hara Arena is concerned—especially the human comfort factor. Hamvention attendance peaked in 1993 at 33,669—before the event date changed from April to May.

Matthews points out that Hara Arena has never been sold, is not for sale now and never has been for sale. He anticipates talks with Hara's long-time owners—the Wampler family—to get under way around June 1. "We'll evaluate the show after June 1, and we hope to improve some things," he said, without revealing any details.

In the meantime, he's pouring his energy into the arrangements for this year's show, but, he reports, things have been

slower to come together in terms of advance sales to visitors and vendors. Matthews chalked it up to unfortunate uncertainty over hostilities in the Middle East and terrorism. "And it's not just us," he added. "If we go to war, people might not want to travel."

"It's just the times we're living in," he said. "There's nothing to panic about, but it's tougher this year."

Hamvention 2003 will replace its annual banquet and after-dinner entertainment at the Nutter Center with a more low-key award winners' reception at Hara Arena Saturday evening. A few layout changes also are on the table for the 2003 show that include "some bigger vendors" in the outside exhibits area—more commonly known as the flea market. One economy begun last year was to sell show programs instead of giving them away.

Between now and show time, Matthews says Hamvention will—among other moves—boost its advertising and promotion to counteract the sluggish advance sales. "We're going to have a good show," he predicted confidently.

For additional insights and information on Hamvention, see "How Hamvention Happens," in April 2000 *QST*. Hamvention 2003 details are on the Hamvention Web site, **www.hamvention.org**.

### DRAFT GENERAL CLASS SYLLABUS RELEASED FOR COMMENT

The Question Pool Committee of the National Conference of Volunteer Examiner Coordinators has released a draft syllabus for the Element 3 (General) Amateur Radio examination. This syllabus will be used to develop a new General class question pool that will become effective July 1, 2004. The QPC is inviting comments on the document as well as suggested questions for the General-class question pool.

Comments and questions may include, but are not limited to, such things as new material in terms of technology or operations, topics that might be deleted as no longer relevant and corrections involving grammar, spelling and technical details.

The General class syllabus outlines 10 question-topic areas—called subelements—from which actual Element 3 examination questions will be developed. These include FCC rules, operating procedures, radio wave propagation, Amateur Radio practices, electrical principles, circuit components, practical circuits, signals and emissions, antennas and feed lines, and RF safety. A question pool based on the revised syllabus will be released later this year. A new Technician class question pool released last November takes effect in the exam room on July 1.

The draft General (Element 3) syllabus, **www.arrl.org/arrlvec/gp-syllabus-2004.html**, is available on the ARRL Web site, which also includes all current question pools. E-mail comments to the Question Pool Committee by July 15 at **qpc@arrl.org**.

## Media Hits

■ *Electronic Design* Editor-in-Chief David Bursky editorialized on the subject of volunteering and honed in on the efforts of ham radio volunteers during times of emergency. After a previous editorial on the World Trade Center disaster, Bursky reports that several readers commented on the role that ham radio played. His more recent editorial goes on to explain what hams do during emergencies.

■ *The News-Register* of McMinnville, Oregon, featured local resident Ken Kyle, KC6PFQ, and his interest in collecting weather data—something he's done for more than 30 years. It's a hobby for Kyle, but it's also come in handy during his work with ARES during storm emergencies. The article also mentioned Kyle's many other interests outside of ham radio.

■ Stan Vandiver, W4SV, was interviewed for a sidebar in *The Indianapolis Star*. The article highlighted Vandiver's February 27 contact with International Space Station Science Officer Don Pettit, KD5MDT, and mentioned QSOs W4SV has made during a dozen shuttle missions. The piece also noted the 2002 Amateur Radio on the International Space Station (ARISS) contact between students at Stanley Clark School in South Bend and astronaut Peggy Whitson, KC5ZTD.

■ Illinois' *Shaw News Weeklies* published an article featuring Art Blazier, WB9PPK, and Tom Rogers, W9ZS. It covered a variety of ham radio topics including emergency communications, digital communications, satellites, how repeaters work, the MARS program, ARES and ARRL. Blazier is an ARRL Emergency Coordinator and MARS member. Rogers, a retired airline pilot, uses ham radio in his private airplane.

### SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Colorado, Eastern Washington, Georgia, Los Angeles, Sacramento Valley, San Francisco, South Texas, Western Washington and West Virginia sections. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are *not* acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms (FSD-129) are available on request from ARRL Headquarters but are not required. We suggest the following format:

(Place and Date)

Field & Educational Services Manager
ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the _____ ARRL section of the _____ division, hereby nominate _____ as candidate for Section Manager for this section for the next two-year term of office.

(Signature___ Call Sign___ City__ ZIP__)

Any candidate for the office of Section Manager must be a resident of the section, a licensed amateur of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination. Petitions must be received at Headquarters by 4 PM Eastern Time on June 6, 2003. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before July 1, 2003, to full members of record as of June 6, 2003 which is the closing date for nominations. Returns will be counted August 19, 2003. Section Managers elected as a result of the above procedure will take office October 1, 2003.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning October 1, 2003. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the October 2003 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Field & Educational Services Manager. You are urged to take the initiative and file a nomination petition immediately.—*Rosalie White, K1STO, Field & Educational Services Manager*

# LIFE MEMBERS

**ELECTED MARCH 15, 2003**

Deborah A. Abernethy, KA3VNF; Mark J. Abrams, WA6DPB; Marvin L. Achterhof, K4SM; David G. Adams, K4DA; Francisco Aguilar Jr, N5QXP; Michael D. Albers, KØFJ; Mark S. Allen, W6PC; Michael Allsup, WB4LXP; Gary L. Altig, N7UVL; Donn M. Ambrose, K9DA; Makoto Amemiya, JH1OXX; Jaime A. Ananko, N3ZSS; Stephan M. Anderman, K2SMA; Kay O. Anderson, K6KO; Richard J. Artuso, WA2AEL; Carlyle R. Ashburn Jr, WA3SKQ; Sidney C. Ashen-Brenner III, NØOBM; Bruce M. Ashley, KC8BWJ; Steven Atterberg, K9UL; Frederick Baguhn, W9GOC; Henry M. Bailey, W8HB; Ross Baker, N5HHS; Kenneth W. Bankston, W5KWB; Glen Barney, KC3FH; Calvin B. Bayley, KC5ABR; William D. Beaty, KLØPN; Robert S. Bedoian, KB1FQX; Gregory J. Beeck, KD7IIQ; William R. Beggs, N5RR; Kenneth H. Behrens, KBØYLN; Richard J. Belt, KGØHA; R. Lowell Bennington, WD4DJW; Stanley M. Berkner, KAØJWH; Nicholas A. Bernice, W2NAB; Yavuz Birturk, N1YB; Dennis E. Blair, ND4U; Daniel D. Bogle, KI7JO; William K. Bonilla, AF4LL; Arthur Booten, N2ZRC; James B. Boswell, KA5SIW; Ralph E. Bowen, N5RZ; John R. Bowers, KAØSER; Michael J. Brennan, KC2EGL; Dan Briggs, KD6OKR; Bill Brimhall, K7KST; Paul A. Brinkley, NC4AB; Luther W. Brisky, KC7KVL; James R. Brown, NA7G; David M. Buending, AD2B; Teresa K. Burkey, KA8YRL; Cathy B. Burnette, KE4EWK; James C. Burnette, KD4BAM; Robert F. Burns, K1RB; Matt Burt, KFØQ; Travis W. Burton, KB5ILY; Pete Cabral, KG6EBU; Roger G. Callewaert Jr, W9ROG; William B. Calvert, N7KS; John J. Casale, W2NI; Kimo C. Chun, KH7U; Edgar P. Clark III, AH6MD; Carl A. Clements, W4CAC; Andrew Comas, N2ZT; Mark Connelly, WA1ION; William Y. Conwell, K2PO; Alan V. Cook, N7CEU; Steven J. Cook, KD7IQL; Edward Craig, N1TV; Seth T. Craine, K4LAW; Donald D. Cripe, KE3MM; John F. Croft Jr, K3NJ; Katherine A. Croft, KC3T; K. M. Cunningham, KE6OEK; L. D. Cunningham, KE6OEJ; Wayne L. Curley, WA6NRB; Everett W. Curry Jr, W6ABM; Fred Dahnke, WB6IQV; William L. Dale Jr, N2RHV; Eric I. Dana, N1YSS; Dan Dankert, N6PEQ; Jon R. Dearbaugh, N4JON; David M. Delakas, KB9YOZ; Victor E. Dewitt, W9KIT; Samuel Dobson, KB2SLN; Gregory K. Doerschler, N1DEM; John W. Dooley, AD5JU; Norton B. Doran, W8LNI; Lawrence R. Doutherd Sr, KD6SWL; Kent H. Duffy, KA7BHK; Mark J. Dulcey, KE1L; Thomas E. Durfee, WI8W; Alex Dutkewych, N2PIG; Debra Dutkewych, K2PIG; William C. Edgar, N3LLR; James L. Edwards, KB5DSE; Robert G. Eggleston Jr, N1GE; John H. Elder, KO6X; Mike Elders, AD7W; Mark E. Erbaugh, N8ME; Paul A. Esposito, N3PE; Linda S. Evans, NØEPO; Dr. Ali Fant, WB5WAF; Bradley A. Farrell, N3BF; Thomas J. Fegan, KB2ZAM; Adam I. Fine, AB2IZ; Mark A. Fischer, W6MAF; John E. Fisher, K3GL; Frederick E. Fitte, WA2MMX; Russell E. Fitzgerald, N8FZ; Dave A. Flack, AH6HY; Frederick Forgey, K7SCX; Jimmie R. Fouts, AA4JF; Edward J. Franklin Jr, AB4OG; Geoffroey-Allen S. Franklin, KE4IGD; Nancy J. Freitas-Klein, K6NAN; Jose R. Fuentes Benejam, KP3R; Robert G. Fuller, W1HX; Danny R. Fullerton, KC7RUF; James L. Funk, N9JF; William A. 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Johansen, K6AY; Billy D. Johnson, K5BIL; Carl T. Johnson, N3TJ; Linda L. Johnson, KCØKZN; Theodore H. Johnson Jr, KG6EJO; Gary L. Johnston, KI4LA; David R. Jones Jr, N4JED; Jay H. Jones, WB9FPM; Walter R. Jones Jr, KC7HEX; Adam G. Kabasakalian, KB2ZHJ; Andrew S. Kabasakalian, WB2WZC; Peter Kahn III, K6PSK; Stanley Kaplan, WB9RQR; Matthew J. Kastigar, WØXEU; Andrew M. Kessel, KD5FLM; Frank M. Kibbish Jr, WB6MRQ; Lloyd Chuck Kimball, NØNHJ; David P. Kleindl, NØKP; Walter J. Klinger, W9BEA; Lynn R. Knapp, K7IKO; Kenneth D. Knudson, N5TY; Kevin F. Koby, K5OBY; Kelly Kohls, N5TLE; Eric D. Kosko, WA7YSU; Kraig Krist, KG4LAC; Nancy C. Krizan, K5NCK; Rolf G. Krogstad, NRØT; Philip J. Kroth, M.D., KA2QIK; Steve Kumm, WBØSIN; Bruce A. Lane, KC7GR; Gregory W. Lanham, WA4VE; Matthew A. Larson, N3MCZ; James R. Latham, KE6QJV; Neil H. Lauritsen Sr, W4NHL; Benoit Lavigne, VA2NNC; Elvin D. Lawson, N5PDX; Damion Leafey, N3MGT; Robert A. Leasko, WB8PAF; Michael J. Leasure, AA3WV; Craig F. 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Morgante, N2GGY; John A. Morley, KA1JMF; Caroline P. Morris, W4VNE; Michael G. Morris, KC7OVF; James F. Moss, KC1AA; Ronald D. Mott, W4RDM; Francesco Munari, IW3SKQ; Chris Munson, KG6MOZ; Erich P. Muschinske, KA6AMD; William S. Newman, AE4YZ; Lynn B. Nickerson, K9NQW; James L. Noble, K2ZP; Geri A. Norris, N5RIG; Adam P. Nowik Jr, KC2DAA; Tony Nuetzi, KF4EOH; Mark G. Obermann, AG9A; Daniel F. O'Donovan, W4DOD; Kent R. Olson, KAØLDG; Nils (Nick) R. Olson, N7BCV; Robert L. Olson, W6BO; Robert M. Orndorff, W4BNO; Timothy R. O'Rourke, W4YN; Jeff Pangborn, KD6TDX; James R. Parker, W4EKB; Jay Parks, N8JP; David C. Patton, NT1N; Robert W. Patton Jr, W4DFW; Charles D. Percy, N7FZ; Virginia J. Periat, WA6PUV; Mark A. Perry, K4EZS; Fred L. Peters, WB3IUG; Darrel G. Peterson, WAØKHH; William L. Peterson, N9LL; John P. Petrowicz, KB1NU; Joanne M. Phillips, K6NUT; Mark A. Phillips, KC2ENI; Raymond R. Pick, W8MFU; Michael W. Pinkawa, KA9CLP; Richard E. Polivka, N6NKO; Richard C. 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Underwood, AD6NE; T. B. Underwood III, W4NK; Thomas P. Vaccaro, W2CRG; Eduardo Victor J. Valdez, N9EV; Michael S. Varga, NR3C; Chris T. Vincent, W5CTV; Thomas D. Vogel, N7AFB; Patrick J. Volkmann, WB9JIC; James E. Von Olnhausen, N9UZC; Irene M. Vrabel, KQ6KD; Daniel M. Vrooman, KC2JTM; Jane E. Vrooman; Joseph A. Walc Jr, K2JAW; Mark Walsh, KM6XU; Martin D. Watt, N5NW; William O. Weatherford, KM5FT; Robert D. Weaver, K6RDW; Deborah P. Weir, WA2LGZ; Joseph W. Weisse, W1HAI; Jerry E. Wellman, W7SAR; Michael T. Wember Sr, W9IWZ; Julian T. Wheeler, K6POI; Daniel W. Whelan, N2UD; William B. Whiddon, NM6X; Mark C. Whitaker, KD7KUN; Gregory P. Widin, KØGW; Todd E. Wiggins, W4MMA; Paul J. Wilkinson, KB6LLB; Eric P. Williams, KF4YEP; Frank C. Williams, KG4UYP; Kent A. Williams, KK9Z; Milton F. Willis, W4FWP; Norman E. Wilson, KD7HHB; S. Wilt, KC5ZHF; Garth L. Wiscombe, W7PS; William G. Witt, K6WGW; David C. Wolf, KC5KJE; Lawrence W. Wolf, KJ4UY; Terry D. Womack, AD5TW; Thomas G. Wood, K6FJ; David A. Woolweaver, K5RAV; Colin R. Wright, K4SSO; Seiichi Yamazaki, AA4JA; David A. Yanke, N9SSG; John M. Yarbrough Jr, AE4PX; Matthew F. Yellen, KB7TSE.

# Central Kentucky Amateurs Respond to Ice Storm

*By Pat Spencer, KD4PWL*
*ARRL Kentucky Assistant Section Manager and Fayette County ARES Co-Coordinator*

ROB NEUZEL

**A look at the devastation two miles south of downtown Lexington.**

On February 15 precipitation began falling in Lexington, Kentucky. It ended 48 hours later with a total of 2.88 inches of liquid and 2 inches of freezing rain. Trees and limbs were crashing down throughout the community, blocking roads, snapping power, cable and phone lines and poles, crushing cars, and damaging homes and businesses. Ice falling from commercial TV and radio station towers crashed through their roofs, temporarily knocking them off the air. Icy surfaces slowed the response time of emergency crews and made pedestrian traffic hazardous.

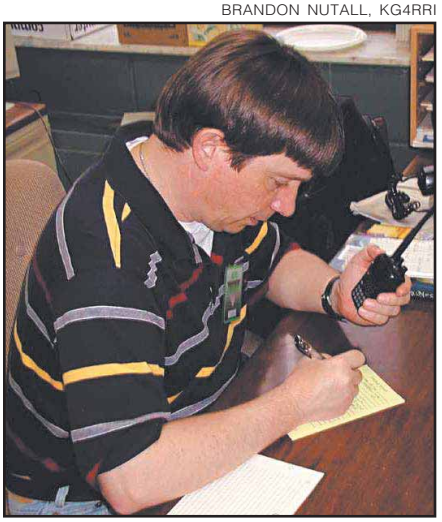
Sixty-two of the city's 64 electrical circuits failed, and 115,000 households lost power. The city was dark and cold and was summarized by one police officer as a "wintery war zone." Amateur Radio operators were also faced with the loss of long wire, vertical and beam antennas and feedline. The KC4DUU 444.550+ repeater and LEX/TCP packet node were knocked off the air when its tower collapsed.

## ARES Activation

Overnight, Amateur Radio operators were discussing the conditions, and trying to predict how bad the storm was going to be. At 9:48 the next morning, their questions were answered as emergency management pagers worn by two ARES members brought the message that the Emergency Operation Center (EOC) was being activated. A net or other operations immediately started on four of the city's repeaters: 146.760 (K4KJQ), 147.165 (WA4HBM), 444.550 (KC4DUU), and the 444.125 (KB8QLC). The EOC primarily used the 444.125 repeater along with the others serving in different roles in the operation. As the disaster continued, there were operators on 146.520, which is fairly active in Lexington, seeking relief operators for the next day.

Enroute to the EOC, Ron Nutter, KA4KYI, informed net control to position operators at Kentucky Utilities (KU) the local electric utility, the Senior Citizens Center Shelter, and the Department of Streets and Roads. Volunteers responded to those locations and established communications. Over the course of the next week, stations were set up at two additional shelters.

BRANDON NUTALL, KG4RRI



**Brandon Nuttall, KG4RRI, of Frankfort, was stationed at Kentucky Utilities and is shown copying a message from the Emergency Operations Center.**

RON NUTTER, KA4KYI

**Janice, KG4TVX, and Ron Goodpaster, AG4TY, Kentucky Assistant SEC, helped with communications from the EOC. Ron is operating the ARES "Boom Box," constructed by Ron Nutter, KA4KYI, that served as the EOC's Amateur Radio station for all eight days of the emergency.**

Over the next 24 hours, the need for emergency communications became apparent. Ron Dodson, KA4MAP, Kentucky Section Emergency Coordinator, assisted in this effort. "Upon request of Fayette County ARES for an emergency communications declaration for their repeaters, I first went to Bob Stephens, Information Systems Branch Manager for KyEM (Kentucky Emergency Management) and obtained his approval that this needed to be done. While not mandatory, I felt that the added weight of state EM's support would expedite and validate the process. With KyEM's concurrence, I then went to SM John Meyers, who took the request through ARRL and FCC channels to have the declaration made official. The whole process took just under two hours."

Amateur Radio operators in the EOC also serve as the Communications Branch for the facility. Their other duties included reports, receiving calls from police and fire dispatch, and when the public call-takers' phones were overwhelmed taking calls for assistance and logging them for action by the EOC.

## Keeping Served Agencies in Touch

From the beginning, Amateur Radio operators where charged with establishing the primary pathway between the EOC and KU. The major focus of the emergency was

the restoration of electricity to the city. The lack of heat was a priority, but even more importantly power needed to be restored to nursing homes, and private homes that rely on power for medical devices, and lifesaving machines. This link was maintained at all costs. The use of Amateur Radio in this role demonstrated the confidence government officials have in Fayette County ARES operators.

Of the 4369 Amateur Radio messages logged in the EOC, the majority of them went to KU. These messages ranged from routine reports of power outages, lines down, trees on lines, to emergency calls for structure fires, live wires sparking, and transformer explosions. Another common priority message to the utility was to inform KU of generators used throughout the city. This helped to ensure the safety of line technicians working in those areas.

With no electricity or heat, many Lexingtonians were forced to seek refuge in one of the many shelters. Amateur Radio operators staffed the Dunbar High School, Senior Citizens Center, and YMCA shelters. In the first few hours, they were the primary communications pathway. As the infrastructure came together, they served as a secondary communications pathway for logistical and emergency information. Operators were involved in two medical emergencies at one shelter when one resident suffered a heart attack. The other was an elderly man who fell and injured himself. Both were transported to local hospitals after operators contacted the EOC. It was also reported that the operators in the shelters assisted the Red Cross with their setup needs as well.

Operators were also stationed as a secondary communications pathway with Streets and Roads Department. This traffic included requests for salting to make streets safer and debris removal where trees, telephone poles and the like blocked roads. Operators at those locations also provided a link for transportation system status reports needed by the EOC staff.

During the disaster in Lexington, there was an explosion at an industrial plant in Corbin, Kentucky. Severe burn casualties were airlifted to Lexington and other major regional medical facilities. Amateur Radio operators were requested to establish a link with operators in that community to determine the nature of the chemicals involved or other additional information to be used by the hospital staff.

Statistically speaking, the operation lasted for 194.25 hours, and accounted for 6798.75 manhours. Adding the estimated $34,327 of equipment used, the response contributed $102,315 to the citizens of Lexington, Kentucky, for the disaster.

### Training and Preparation Paid Off

Ron Ritchie, N4MOM, Fayette County ARES Emergency Coordinator, evaluated the operation with the cardinal rule of the organization, "Home and family first" in mind. "What can you say to people that are in the cold and still give their time to help others? Everyone who was without heat and electric, many for over a week felt the impact of the ice storm and kept coming for 10-24 hour shifts. Everyone was at their best; real professionals. We have trained to do everything that we could and it paid off this past week. I feel we have the best people that ham radio has to offer. To the owners of the repeaters that we used, 'thank you and we could not have planned or paid for better communications.'"

During the previous two years, Assistant Emergency Coordinator and Local Government Liaison Nutter, KA4KYI, has worked diligently to establish a working relationship between the Amateur Radio community and the Lexington-Fayette Urban County Government (LFUCG) with a great deal of success. For these efforts, he received the 2002 KY ARES Operator of the Year Award. This was the first full-blown emergency activation with the city government.

Nutter commented on the operation:

> What happened to Fayette County ARES during this disaster is something that we have been training for, but prayed would never happen. This is where all the public service events and disaster drills with the city paid off. Up until now, we had participated in a couple of drills and our limited response to the events of 9/11. We were the first to respond to the EOC, followed by the mayor, and maintained a presence in the EOC and other locations 24/7 for the duration of the emergency. This had to be a team effort for things to have been successful as they came out to be!

Lexington Mayor Teresa Isaac, who was also present at the EOC for long periods, spoke of the Amateur Radio role in the disaster, "Their presence around the clock gave us a reliable method of getting information to the areas where it was most needed."

Patricia Dugger, director of the LFUCG Division of Environmental and Emergency Management, expressed respect for the Amateur Radio operation:

> The usefulness and professionalism of the Amateur Radio operators for the ice storm disaster was invaluable. Their presence in the EOC and at the utility company provided the direct line of communication that was severed at various times during the event using traditional means of communication. They also served in the shelters. They are now a permanent part of the community's disaster plan.

ARES Coordinators received praise for the group's efforts at the official debriefing in March.

Operators involved in the operation were: AD4YJ, AF4OI, AG4CM, AG4LB, AG4TY, K4RBH, KA4KYI, KA4MKG, KA6KJP, KB8QLC, KD4PWL, KD4SN, KE4FFQ, KE4LGL, KE4MAI, KF4EXW, KF4MPM, KF4URQ, KF4WBS, KF4WMT, KG4IOR, KG4LXR, KG4NNJ, KG4OQH, KG4QFW, KG4QFY, KG4RRI, KG4TVX, KN4S, KQ4ZZ, NØMH, N4DIT, N4KU, N4MOM, WA4UIV, WA4WWH and WD4EJA. Operators from five Central Kentucky counties are represented in this list.

One group that is often overlooked in emergency operations also deserves credit for the success of the Amateur Radio operation. As many of us were working our shifts, these people were supporting the hams, ensuring they were okay. We would like to recognize the husbands, wives, fathers, mothers, children and other relatives who solved "home and family" problems while their loved ones served the community.

## MISSING IN VILLAGE CREEK

*By Terry Busby, W5ARS*
*ARRL Arkansas Section Emergency Coordinator*

A group of Boy Scouts visited the Village Creek State Park in Northeast Arkansas, on a warm Saturday in November. It was the ninth of November, the second Saturday of the month, and they were going to be playing an outdoor game called "capture the flag." Village Creek is an excellent park, ideal for this type of game. For one thing, it is the largest state park (7000 acres) in Arkansas. It is located in southern Cross County on a ridge 5 miles wide and over 100 miles long. Crowley's Ridge, as it is called, is heavily covered in forest with only a limited number of roads crossing it in the Cross County area.

Late that morning, after the game had started, Chad (age 16) decided to move in behind everyone and capture the flag on his own. It was at that point that the young man ended up getting lost.

When he failed to return at the designated time, the scout leader realized that he was missing and contacted the Park Ranger. The Park Ranger's first step was to make a quick search for the young man. However, he soon realized that he was going to need a lot of help if Chad was going to be found any time soon. The Park Ranger then contacted the Cross County Sheriff's Office and asked for help in locating the missing person. The Sheriff's Office then placed a general call to all volunteers for help with the search and rescue. The young man had last been seen just before 12 PM. The call for help came at about 3:45 PM.

### Radio Amateurs Help in Search

The first members of the Cross County Amateur Radio Club began to arrive at the Village Creek State Park's Information Center about 4:30 PM. The Operations Center for the search and rescue was being set up at the park's Information Center. Buddy Busby, KD5NUB, Assistant EC for Cross County ARES and

RACES teams, was the first volunteer to arrive.

After arriving at the operations center Buddy began by putting two steps into motion. First, he provided four all-terrain vehicles that were placed into use by the Cross County Department of Emergency Management for the initial search. His second step was to start a net on the club's repeater (147.375 MHz), located a few miles south of the park near Forrest City, Arkansas.

As information about the missing young man continued to spread and the search continued without success, other volunteers from the local Amateur Radio Community joined the search and rescue team. Joining the search were Matt Utley, KD5HAO, Robert Utley, KD5JVR, Clint Marlin, KD5RZY, Ben Andrews, KD5RZX, and Murray Clark, KD5BHJ. Also checking on the net and available if needed, were Phil Dunavan, KD5HDT, and Preston Koelling, NØHNQ.

### Severe Weather Hampers Situation

The search was being hampered by darkness and by severe weather that was moving into the area. A decision had been made to call in a number of dog teams and they didn't want the other search teams to cover up Chad's scent.

At 8:35 PM, Terry Busby, W5ARS, having returned from Jonesboro, Arkansas, contacted the net. After talking to Buddy, it was determined that his help was needed at the park, so Terry was soon en route to Village State Park. While on his way to the park from Cherry Valley, Terry came upon a severe storm with hailstones approximately one inch in diameter and had to contact Marion Busby, KC5DQS, and have her relay a SKYWARN report to the National Weather Service in Memphis, Tennessee.

Within minutes, Shirley Outlay, KD5HPV, serving as the team's weather alert station, reported that the National Weather Service in Memphis had issued a tornado warning for northern Cross County and the township of Cherry Valley. After the storm struck, it was evident that damage was limited and the Cross County ARC's help would not be needed in Cherry Valley. At that point, the group's full attention was again directed to the missing person's search that was still going on at the Village Creek State Park.

### Ham Radio Becomes Key for Agencies

At about 10:30 PM and still having no success finding the missing youth, the Cross County ARC's emergency response team set up a more versatile communications station at the command center to serve the growing needs of as many as five agencies now involved. This list included Cross County and St Francis Sheriff's Departments, the Cross County Department of Emergency Management; the Wynne Fire Department's Rescue Squad and the Arkansas State Police.

Gerald Briton, Coordinator of the Cross County Department of Emergency Management, served as the Incident Commander, and he began the second phase of the search and rescue by briefing the first dog team. Around 10:30 PM, with the first team already in the field and searching for the youth, Gerald began to brief the second team on the search situation. During the briefing of the second team, a problem with communications arose. The search teams had been using the park's handheld radios, but the batteries were running down. This meant that the various agencies now could no longer communicate with each other because their own equipment operated on different frequencies.

Having expected this development, the Cross County ARC's Emergency Response Team was able to step in and provide communications for the search and rescue personnel. While working out the communications details with the second dog team, it was determined that it would be best to send a shadow (an Amateur Radio operator equipped with the proper radio equipment) with them to ensure that communication was maintained.

With the entire search teams actively looking, all that we could do was to wait and pray for the best. Shortly after midnight, the young man was found several miles south of the park walking down Highway 284. He was very tired and hungry, but unharmed and happy to have the ordeal over.

The Cross County Amateur Radio Club would like to join the Cross County Department of Emergency Management, Village Creek State Park, and Sheriff's Department in saying "thanks" to all of its volunteers who helped with the search and rescue efforts.

# Field Organization Reports

*Compiled by Linda Mullally, KB1HSV*

### Public Service Honor Roll
### February 2003

This listing is to recognize radio amateurs whose public service performance during the month indicted qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1.) Participating in a public service net, using any mode. — 1 point per net session; maximum 40.
2.) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3.) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. — 10 points for each position; maximum 30.
4.) Participation in scheduled, short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies. - 5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5.) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation. - 5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6.) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service — 10 points per item.
Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24 month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

619 AD4BL
572 K6SOJ
565 N5NAV
538 N9TVT
510 W2MTA
420 N9VE N2LTC
375 W7TVA
360 N2CCN
325 AD5KE KA2ZNZ
245 KD5SWI W2LC
242 NN2H
237 K4FQU
230 KB2SNP
225 AB2IZ
220 W5ZX K9JPS KB2KOJ
217 KA2GJV
210 N8IO KB2CCD
205 WI2G
204 N8JAT
200 AG9G
198 KB2ETO
195 N2HQL
193 N2OPJ
184 KB2RTZ
169 N2IKR
165 WB1CHU
158 W6IVV
155 WNØY KB8ZYY
152 WA1QAA
150 KE4JHJ
KK3F
140 K9FHI W9RCW
139 KG9B
138 KE3FL WB2LEZ
135 KD4GR WA2YL NB4K
134 WB2UVB N1IST
133 K4DND AC5Z
130 W3YVQ WB5ZED KD1LE NØBN
126 AC5VN
125 KB2VRO KK1A K4BEH
121 N3WAV KAØDBK
120 K4RLD W4EAT K4IWW AC5XK W3BBQ WA4DOX KØIBS W8YS K5UPN KA4FZI KC4ZHF W4ZJY W1GMF KW1U AB4XK WX4H WX4J W6QZ WBØTAQ
118 N4TAB
116 N2JRS
115 N2GJ KL5T WJ2F W2GUT
113 N3RB KB8NDS
111 W5IM
110 WA1JVV W5GKH KA5KLU N3SW N2AKZ K2UL KC5OZT KG4CHW WA2MSU K5MC N1LKJ N1IQI WA1FNM N7YSS KD4EFM N7YSS W7ZIW AG4DL NR2F W6DOB KF5A N5IKN NJ5M W7GB K8AE K8GA WØLAW KG4FXG AF4NS
109 WB2KNS N5GG
105 WD4LSS K3CN KE4UOF K9LGU KB9KEG
104 W5JYJ KA2YKN WA5LQZ K5DPG KA2IWK
102 N8NMA
101 KO4OL KA2BCE
100 K9PUI
N9KNJ KG4OQA W1ALE W1QU AF4QZ KA4UIV KG4OTL K3SS WB2GTG KB2KLH WW8D KBØYTM KB5TCH WA4EIC WA9VND KD4CQJ W9CBE WA9ZTY WØWWR W4DLZ K5IQZ N5KWB KF4OPT K4SCL WA8SSI N8OD W7ARC W7LG N9MN WA5OUV WØHXB K4DZM W7GHT K7GXZ WØHXB AA8SN AF2K KC2EOT WB2QIX NØUC WAØTFC
99 K5ER W5PY
98 W2CC KBØDTI
97 KV4AN KJ7SI
95 K8VFZ
93 NØSU W4FAL KC3Y W7EP
91 WB9OFG AL7N N6NKO
90 K9GBR AA3GV K2VX K2BCL KA8WNO WD8DHC AA2SV WA2CUW W5OMG WB4PAM W7TC W4CKS W4PIM NG1A N8DD W8IM K1JPG K8KV KF4WIJ K6IUI KK5GY KG2D WB2IJH W4WXA WB4GGS K4FUM
89 K1CFI W5RXU K8ZJU
88 K2PB N3KB W9YCV K4WKT
87 WB5NIC KE2SX N2VQA W4DGH
86 N8FXH KC7SGM
85 KB8GFC WA2YOW W5ARS WB4BIK
84 N6NKO NF5B
82 W4NTI
81 N3WK WA8RCR
80 K4WWV W4CC AA4YW KF6OIF K1TSV KJ5YY KA9IKK KG4MLD W5NK WD9F WA8DHB
79 WA2GUP
78 N3OR
77 KC5LFB
76 W5XX AA4BN K8SH W4AUN
75 WA9JWL
74 AC5SU
73 N1LAH KC6SKK AK6DV
72 KB4KA N3WKE KG4MLC KG4QIP WB7VYH
71 KF4OCU N7LV
70 K1VDH W3CB KU6Z KC6NBI N2ECR W4QAT AB0WR W7DPW K4BG KD1SM

The following stations qualified for PSHR points in previous months, but were not recognized in this column: (Jan) K1CFI 98, N6NKO 84, KC6SKK 77.

### Section Traffic Manager Reports
### February 2003

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, EPA, EMA, EWA, GA, IA, ID, IL, IN, KS, KY, LA, MDC, ME, MN, MI, NC, NFL, NH, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SC, SBAR, SD, SDG, SFL, SJV, STX, SNJ, TN, VA, VT, WCF, WI, WMA, WNY, WPA, WV, WWA.

### Section Emergency Coordinator Reports
### February 2003

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, EWA, IA, IL, IN, KS, KY, LA, MDC, MO, NC, NFL, NLI, NNJ, NV, SFL, SNJ, STX, SV, TN, WMA, WNY, WPA, WV.

### Brass Pounders League
### February 2003

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

| *Call* | *Orig* | *Rcvd* | *Sent* | *Dlvd* | *Total* |
|---|---|---|---|---|---|
| W1GMF | 0 | 1521 | 2548 | 15 | 4048 |
| W4ZJY | 0 | 1085 | 1137 | 1 | 2223 |
| KK3F | 26 | 886 | 850 | 36 | 1798 |
| N2LTC | 0 | 857 | 845 | 57 | 1759 |
| WB5ZED | 22 | 404 | 384 | 17 | 875 |
| W4EAT | 0 | 437 | 428 | 0 | 865 |
| W0WWR | 0 | 120 | 700 | 9 | 829 |
| K7BDU | 6 | 327 | 487 | 2 | 822 |
| W6DOB | 0 | 169 | 539 | 23 | 731 |
| W6IVV | 0 | 322 | 334 | 0 | 656 |
| K2BCL | 12 | 282 | 283 | 57 | 634 |
| K5MC | 228 | 47 | 266 | 4 | 545 |
| WB1CHU | 26 | 237 | 32 | 231 | 526 |
| K5UPN | 19 | 258 | 243 | 4 | 524 |
| KF5A | 0 | 244 | 268 | 0 | 512 |
| WB2IJH | 0 | 251 | 249 | 1 | 501 |

BPL for 100 or more originations plus deliveries: W9RCW 218, K9GU 196, N9VE 195, N1IQI 175, NJ5M 160, W9IHW 158, KØEZ 134, KK5GY 127, AK6DV 106, K8CQF 106. (Jan) W9IHW 124.

# EME in the Digital Age

The past few years has seen the exciting development of new digital modes that allow completion of EME contacts by stations with hardware much less daunting than has heretofore been required for EME using analog modes. The first of these is PUA43 developed by Bob Larkin, W7PUA, a digital system with 43 tones using incoherent averaging in a 2.5-Hz bandwidth running on a DSP-10 transceiver (see **www.proaxis.com/~boblark/dsp10.htm**). More familiar is JT44, developed by Joe Taylor, K1JT. This FSK system uses the 43 PUA43 tones plus a 44th tone for frequency and time synchronization (see **pulsar.princeton.edu/~joe/K1JT/**). JT44 runs on any sound card in an MS Windows environment.

### *International EME Conference—Prague 2002*

With the advent of these digital modes come questions about how they should be integrated into the overall use of EME. Attempts were made to develop consensus positions about frequencies, sequencing and awards during the 10th International Amateur Radio Moon-Bounce Conference held in Prague in the summer of 2002. Initially, there was no dispute about the basic premises. By digital communications, the participants addressed three characteristics in common: designed for DX, narrow bandwidth and computer decoding (as opposed to human ear and brain). There was no objection to the validity of digital EME work and acknowledgement that everywhere else in Amateur Radio, digital-mode contacts have always been accepted.

Sequencing was relatively straightforward and a consensus on frequencies was adopted after discussion. The situation with awards was much more complicated. The draft of the conference proceedings (**www.emecz.cz/convent/digital.htm**) contains the following section on Acknowledgements; from an opinion poll, it was supported in principle by a wide margin:

> The solution looks to be very simple. Let's try to distinguish ANALOGUE (CW, SSB contacts) and DIGITAL (contacts using digital protocols). This can be the case of Awards with available endorsements. In Initial contacts there could be DIGITAL, ANALOGUE and MIXED achievements recognized. The HF operators have applied this without any problem.

**This Month**

| | |
|---|---|
| May 3 | Microwave Spring Sprints 6 AM-1 PM local (see April WA50) |
| May 10-11 | 50-MHz Spring Sprints 2300Z Saturday-0300Z Sunday |
| May 11 | Very good EME conditions* |
| May 16 | Dayton VHF Banquet |

*Moon Data from W5LUU

Yet, this vote did not actually appear to cover all points of view. At the meeting, several means of separating digital and analog contacts emerged. Some wished to combine digital and analog contacts in the mixed DXCC award and the EME Standings using asterisks to mark those totals that involve both types of contacts. Others supported the draft resolution desiring a combination in the mixed DXCC but wanted a separation on initials reported in the Standings. Another group argued that digital and analog contacts and initials should be reported completely separately. The arguments raised by the various factions are well worth considering in detail because they raise significant philosophical and technical issues. As indicated by the EME Conference notes, this discussion supersedes digital modes and EME, and represents a good example of how Amateur Radio handles developments while still respecting traditional skills and experience. While these types of questions are not surprising for a cutting-edge technology like EME, their consideration could well be instructive for other areas of the VHF+ world and ham radio in general. I am indebted to the discussions outlined for the International EME Meeting at **www.emecz.cz/convent/digital%20eme%20communication.pdf** and personal and published communications, from WA1JOF, K1SG, K2UYH, W3EME, K5JL, K6QXY, AA7A, W7GJ, KØYW,

**Figure 1—Large and small EME arrays. Left is the 9-meter dish at KØYW. Right is the 4x18XXX Yagi array at K1IM.**

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

DL9KR, G3SEK and VE7BQH.

### Advantages of Digital EME Modes

Regardless of where they stood on the issue of displaying contacts using digital versus analog EME modes, essentially all EME operators believe that JT44/PUA43 contacts are real and fulfill the definition of a legitimate contact. There's no question that they allow modest stations running much less than legal-limit power and smaller antennas to make EME contacts. It is thus likely that the digital EME modes will increase EME activity, perhaps substantially. Given the recent slow but steady decline in the number of entries in the ARRL EME contest, anything that increases activity should be applauded. Starting this year, the rules have been changed so that JT44/PUA43 digital mode contacts are allowed in the ARRL EME contest. While it will be of the greatest advantage to small stations, it will also benefit the bigger stations because they will still be the first to work these new recruits. A certain percentage of operators who get their start on JT44 will also probably be induced to upgrade their stations so that they become capable of analog EME operation. Finally and almost without exception there is no opposition to the use of digital EME modes. Most who wish to keep their listings for the modes separate are using either JT44 or intend at some point to use JT44.

### The Case for Separation

In an editorial in the *432 and Above EME News* (Feb 2003, Vol 32, #2), Jan, DL9KR, raises the critical points for separating digital and analog EME contacts for both listings and awards. Jan argues that JT44 and other digital modes are a completely different species of cat from the analog modes and to lump them together would be an inequity. The results, the output and the data processing are produced by computer rather than by human senses (whether aided by computer or not) and the human brain. In this instance, the computer software is more powerful than its putative human master: These digital modes can detect and copy signals that our senses cannot detect even with computer assistance. As participants in the EME Conference noted, "Weak-signal CW is not just a technology—it is a human operating skill. Many people actually want to listen to the signals, and make themselves part of the decoding system." and "If JT44 is better than CW, then it is unfair to mix the lists." Bruce, KØYW, probably summarizes these thoughts most clearly when he says the difference between the JT44-like modes and the other digital modes is that the former provide digital signal enhancement over 'traditional' modes like CW and SSB, whereas the latter provide no such advantage. Bruce does not argue for completely separate awards and listings but suggests that stations using these enhanced digital technologies to make contacts have their listings note that some of their contacts were made using the new technologies.

EME stations employing analog modes have traditionally needed to represent the state-of-the-art in all aspects of station design and operator performance. EME path losses are so great that anything less than maximum legal-limit transmitters, heroically large antenna systems, receivers with front-end noise measuring a few tenths of a decibel, the lowest-loss transmission lines and an operator with trained hearing and the experience to differentiate whisper-weak signals from the noise will preclude making a contact in many cases. On the other hand, digital EME contacts can be made with much more ordinary stations, less power, lesser preamplifiers, simpler antennas and little of what we might call radio-operating talent on the part of the operator beyond the ability to operate the powerful software. As Jan says, "Inclusion of nonaural modes into the CW/SSB mixed count for DXCC, VUCC would render decade-long efforts of many EMEers worthless because "EME" would become feasible with marginal radio systems." For many of those who support separate listings of digital and analog modes for awards, the latter sentiment is based in part on the status of EME on the upper bands like 70 cm, where the top stations now have over 80 countries in their quest for DXCC. For instance, Jay, K5JL, notes that digital-mode users could readily catch the current 70-cm EME leaders like Jan and him with substantially lesser stations, destroying years of effort. One could argue that this is the price of progress, yet one wonders, for instance, what the community would have thought of the rediscovery of the Beverage receiving antenna denying Stew Perry, W1BB, the first 160-meter DXCC.

### The Case for Inclusion

In the February *432 and Above EME News,* Al, K2UYH, in response to DL9KR observes that the basic mixed-mode DXCC recognizes digital RTTY contacts and by analogy should recognize weak signal digital modes such as JT44/PUA43 as well. WSJT and JT44 are both counted towards VUCC. Special mode-specific awards recognizing DXCC exclusively on SSB or CW are available. He also notes that the current discussion will grow even more complex with the appearance of newer technologies like narrow-band digital voice that may offer better performance and S/N than SSB. Furthermore, in his summary of the Conference *Proceedings* in the September 2002 *432 and Above EME News,* Al notes that JT44 contacts do not appear to violate the definition of a QSO (see WA50 for Sep 2002) and that time delay is not a factor because contacts can occur in less time than a typical CW contact. Likewise, it is difficult to define any difference between a purely digital mode like JT44 and the use of fast Fourier transforms, as in the AF9Y software, that allow you to see a signal that you cannot hear. Yes, the final decoding is then done with your eyes on usually very slow speed CW, but how this differs much from software decoding an FSK signal on JT44 and presenting it on a computer screen is not obvious. Probably few CW EME operators have not used that, or some form of advanced DSP, at some point in their operations.

### Awards and Standings

Ian, G3SEK, makes the important point that *the award sponsor makes the rules*. In most programs, the combination of CW and JT44 would qualify for a mixed-mode award. Sponsors usually do distinguish between modes and offer mode-endorsed certificates. As I write this column, the ARRL has not yet made an interpretation about awards, although this interpretation appears imminent. I will follow the dictates of that ARRL interpretation. If the interpretation is to combine these digital contacts with other contacts for mixed-mode awards like DXCC and WAS, that is what the World Above 50 MHz will do in the Standings. If the interpretation is to separate them, I will maintain separate lists. However, in the tradition started with WAS listings that contain contacts by EME as well as terrestrial propagation modes, I will mark those listings containing contacts using the new digital-enhancement modes.

One of the key boxes in the EME Standings is the list of initials. Here, I am persuaded that there would be valuable information provided by keeping separate lists of analog and enhanced digital initials. The most obvious is that a new station wishing to try EME using enhanced digital modes can find a station using those modes from the listing. He or she would be able to do so by locating someone in the listings with a reasonable number of enhanced digital initials. This is in the same way that he would notice that W5UN or KB8RQ might be good bets to choose for analog EME schedules, based on their large number of analog

EME initials. I would envision three initial boxes—analog, enhanced digital and total. You would be able to list the same station as both an analog and enhanced digital initial, but the total initials would of course count each station only once. Unless I hear from many EME operators that listing initials in this way is a bad idea, the EME standings for March 2004 will be so structured, and the EME Standings boxes will be so modified after October 1 of this year.

The EME Standings were last published in March 2003. They followed the usual World Above 50 MHz rules—stations not reporting within two years prior were dropped from the listings. I was not particularly pleased with the EME Standings as an accurate record of EME activity. Neither were some EME operators who contacted me. In part, many EME operators do not submit their totals to the Standings because several venues here and overseas maintain these numbers. However, the records in the ARRL EME Standings could be better—a lot better. So, with the help of W5LUA and K5JL, I am pleased to announce that I have convinced Bruce Clark, KØYW, to help see that the EME Standings list will better reflect active EME stations and their current operations. If Bruce contacts you and asks you to submit your totals to **Standings@arrl.org**, please do so. If he asks you to give him your numbers, please do. Bruce and I hope to be able to integrate the biggest scores throughout the world in the Standings. The most complete standings for different parts of the world may still be found elsewhere in EME-related newsletters and Web sites. Yet we hope the ARRL EME Standings will become more reflective of the actual level of EME activity on the various bands.

## ON THE BANDS

Maybe I have been spoiled by the good 6-meter F2 conditions of the previous winter. Yet, with a few notable exceptions, this February did not produce much in the way of enhanced propagation. One of the coldest and stormiest winters in recent memory over much of the eastern and southern US didn't help. Let's see what there was.

### Tropospheric Ducting

A slow moving high-pressure system over the Gulf of Mexico produced some real excitement at the beginning of the month. Beginning on February 2, 2-meter contacts between Georgia/Florida, the Gulf Coast, as far westward as AE5B (EM02, Texas) and W5CIA (EM04, Oklahoma) and north to KØAZ (EM37, Missouri) and W5MRB (EM35, Arkansas) appeared on the propagation bulletin boards. The longest North/South contact appears to be NØPB (EM39) to WA5IYX (EL09). Later that evening (Feb 3 GMT) Hal, W4HF (EM75hf), reports a huge tropo' opening from his location atop Signal Mountain, Tennessee, with 2-meter contacts to 17 grids as far westward as N5SVK (DM91). Ken, AC4TO, notes nine far-away grids after 0230Z including AA5XE (EL29) and NN5DX in DM80 (west Texas). K5SW (EM25) reached the Gulf coast (EL59) from Oklahoma and into Florida (EL96, EL87).

Meanwhile the UHF and microwave bands were also hopping. A new 3456-MHz North American record was set (see the description below). W4HP reports a dozen grids on 432, including N5SVK as well. On the morning of Feb 3, W5LUA (EM13qc) reached W4ZRZ (EM63) in Alabama on 1296 MHz. K5VH (EM00) also worked KØAZ on 432. Gary, KE8FD, who recently transplanted to western South Carolina (EM84), notes contacts to all parts of Florida on Feb 3 as far as KF4YOX (EL96) on 222 MHz, W4WHN (EL94) on 432, KØVXM (EL96) on 903 through 2304 and K9KNW (EL95) on 1296 MHz. W4HF shows a dozen grids on 432 again as far westward as N5SVK in DM91.

### Aurora

Rex, KØKP, reports a strong aurora into EN36 (Minnesota) beginning late on Feb 1 and extending to just after 07Z the following day with 67 contacts on 6 meters and 5 Qs on 2 meters. This one appeared to favor the northern latitudes. Rex worked no further south than 39.5°N. Six-meter contacts were made eastward to Maine (K1TOL, FN44) and westward to Saskatchewan (VE5SWL, DN79) along with what was probably an auroral-E contact with KL7NO (BP54). Two-meter contacts were all relatively local in the 900-km range, or less.

### 6 Meters

Six meters has been relatively quiet this month with negligible $E_s$ or F2. Jon, NØJK (EM17), notes a short $E_s$ opening to Southern California on Feb 6 off a cloud apparently over northern New Mexico. At the same time, Larry, NØLL, was working XE2EED (DM12) in Baja California, and later the next day he worked a few stations in EM82, 83 and 84 around midday. On Feb 26, Jon noted an $E_s$ opening in the Midwest over some short distances (as little as 900 km), which is unusual for late February. Inveterate 6-meter DXers Bob, K6QXY, and Ted, G4UPS, report little or nothing of interest in February. However, NØJK reports the first F2, from HC8GR/B, into the Midwest on the 27th. Does this mean a shot at Ducie Island in March? I wouldn't bet on it.

## HERE AND THERE

### New North American Record on 3456 MHz—Breaking the Old Record 1-km at a Time

The spectacular tropo' opening in early February has yielded a new 3456 MHz North American record. Al Ward, W5LUA (EM13qc), reports contacting Ron, WA8TTM/4 (EL98dp), around 04Z on Feb 3. He, Ron and Dave, WW2R (EM13qd), report working each other on 222, 432, 902, 1296, 2304 and finally 3456 MHz. Based on 6-digit grid squares, the distance from EM13qc to EL98dp is 1508 km. This broke Al's old 3456-MHz record of 1507 km to KQ4PI. When WW2R tail-ended him and worked WA8TTM, Dave broke Al's new record by 1 km extending it to 1509 km. They had no success on 10 GHz.

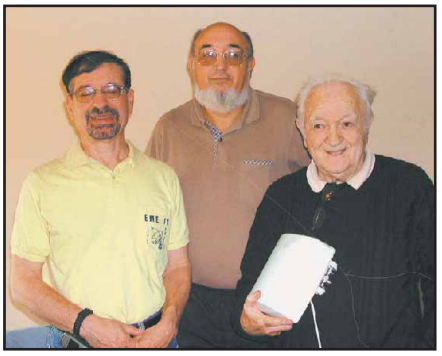


**Figure 2—F9FT (right) holds a patch antenna with his son Franck, F5CE, and Al, K2UYH (left).**

To underscore the quality of the opening, Al was running 240 W to a 5-ft dish, whereas Dave was running only 5 W output.

### F9FT SK

It is with great sadness that we report that VHF/UHF/EME pioneer Marc Tonna, F9FT, passed away on March 2, 2003, at the age of 91. Marc's was the first French station on 432 and he was well-known for development of the 2-meter and 70-cm Tonna Yagis. Thanks to Al, K2UYH, for a relatively recent picture of this VHF+ icon.

### High Scores in the EME SSB Contest

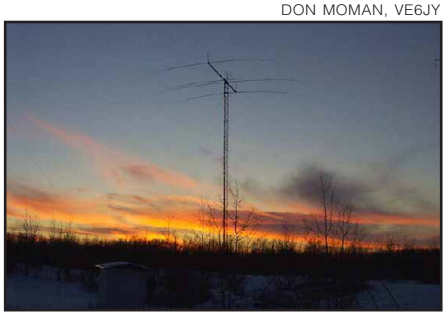
From the *432 and Above News* comes word that the top score in the EME SSB Contest is HB9BBD with 756 points. The next scores in order were HB9Q with 580 points followed closely by G4CCH with 561 points and F2TU with 405 points. Conditions could have been better, but activity was reasonably good. Congratulations all!

### Dayton VHF Banquet

Going to the Dayton Hamvention? Meet your friends and see who is behind that disembodied voice reflecting off a random meteor Friday night May 16 at the annual banquet sponsored by the Weak Signal Group. Look for details at **www.wa8wzg.com**. QST

## STRAYS

DON MOMAN, VE6JY



***Sunset at VE6JY:*** **Don Moman, of Lamont, Alberta, sent us this impressive view of his "4-elephant" full size 80 meter Yagi. The numbers are equally impressive: wide band design at 150 feet, 76 foot boom, reflector 144 feet across, total weight around 1200 pounds, ground mounted custom-made rotator with 145 feet of 4.5 inch pipe mast.**

# East Middle School ARC Grows with VICYIP Grant

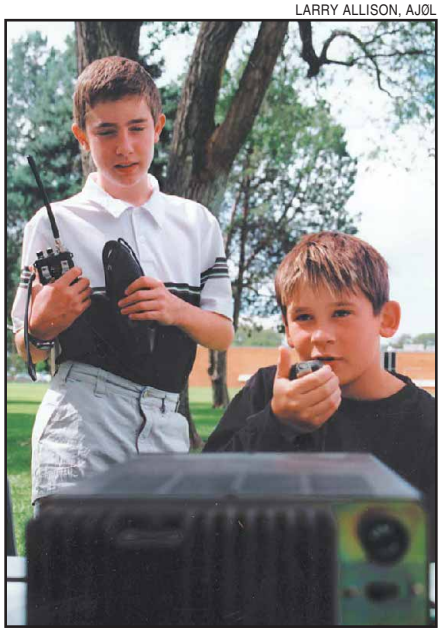
*By Larry Allison, AJØL*
*Trustee for KØEMS*

Three years ago, a student asked about becoming a ham radio operator and East Middle School wasn't prepared to offer guidance or assistance. The student's request eventually led to a series of wonderful and helpful contacts culminating in the creation of KØEMS—East Middle School Amateur Radio Club of Grand Junction, Colorado. Assisted by a local kids group called Amateur Radio For Youth (ARFY) WØYH, with Bill Nesbitt, KGØZI, station KØEMS was up and operational in September 2001.

The school club applied for a Victor C. Clark Youth Incentive Grant in the spring of 2002 and was awarded $1000 during the summer. The grant has allowed the station to develop and expand so more students can become involved. KØEMS has been able to upgrade to a better transceiver, acquire a key and paddle, and to develop digital capabilities. Most important is the acquisition of books, videotapes and code tutors to assist students in becoming hams or upgrading their licenses. The club also bought 2-meter handheld transceivers for our new hams to borrow.

Through the support of many hams and the ARRL Foundation, East Middle School has licensed several students including Jordan Flukey, KCØLEH; Lisa Truong, KCØLRH (now a General!); Ethan Beyenhof, KCØLRI; Taylor Blanscet, KCØLRY; Zachary Castle, KCØNHM; Amanda Lange, KCØOCT; and most recently, Eric Flukey, KCØOJV. These young hams and other interested students have been able to use the station during lunchtime, after school, on weekends, and during holidays. They have enthusiastically participated in School Club Round-up, Kid's Day, Field Day and special events.

LARRY ALLISON, AJØL



**Zachary Castle, KCØNHM, with radio in hand is control operator for student Max O'Rourk during this KØEMS field activity.**

The Victor C. Clark Youth Incentive Program has provided direct and immediate benefits to the East Middle School students by enabling station purchases; but the true and lasting value of Amateur Radio is in the development of confidence, character and leadership among our youth. For the hams who have worked our students over the radio waves, your kindness, courtesy and encouragement via your QSOs are indeed appreciated.

Thanks to the ARRL Foundation and for the fine support of hams locally and across the frequencies. East Middle School students have a new opportunity available—Amateur Radio!

## Contributor's Corner

We wish to thank the following for their generous contributions to:

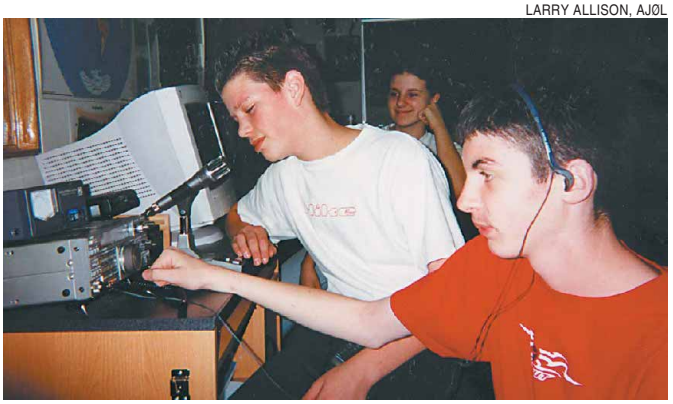
*The Victor C. Clark Youth Incentive Fund*
John M. Austin, N4CFA and Family, in fond memory of Garret C. Jensma, KT4QB
Robert F. White, K1RLY, in fond memory of his Elmer, Anthony "Tony" Sorrentino, W1EOO

*The Jesse Bieberman Meritorious Membership Fund*
Steel City ARC, Inc (Pennsylvania), in fond memory of Ulysses G. "Sonny" Shaffer, K3LIP

*The General Fund*
Mark J. Mokoski, WA1ZEK/VK2IFH
Ian A. Elliot, W7JMX, in fond memory of Earl W. Hawley, W7LBK
Beach Cities Wireless Society (California)
Hiawatha ARA of Marquette, Inc (Michigan), in fond memory of Donald Loven, KC8BAL
Morris Radio Club, in fond memory of William Rawson, K2AX
Hamfesters Radio Club, Inc (Illinois), in fond memory of their members who became Silent Keys in 2002

As received and acknowledged during the months of **January** and **February.**

LARRY ALLISON, AJØL



**Jessica Short (rear) watches as Ethan Beyenhof, KCØLRI (middle) and Taylor Blanscet, KCØLRY (right) operate school station KØEMS.**

LARRY ALLISON, AJØL

**Amanda Lange, KCØOCT, keys the mike as Brian Lange and Lisa Truong, KCØLRH, listen in during a school station field activity.** QST

Mary E. Lau, N1VH ♦ Secretary, ARRL Foundation Inc. ♦ n1vh@arrl.org

# International Foundation QSL Collection

The International Foundation QSL Collection is the world's largest collection of Amateur Radio and broadcast stations' QSL cards and awards. This organization, which is based in Vienna, Austria, has over three million QSLs on file from the early pioneer days to the present. The group not only collects QSLs but also has done some unique research to help preserve ham radio history. Recent research projects and interviews of note include Ed Giorgadze, P5/4L4FN; Don Miller, AE6IY (ex-W9WNV), and Danny Weil, VP2VB. Another project they are working on is that of Martti Laine, OH2BH, which they expect to be completed around March 15, 2003. You can check out these projects at **www.qsl.at/**. The group is seeking help and support to help with other projects.


**VP5LP, during the ARRL SSB DX Contest. From the left: Dave, K3LP, team captain; Steve, N3SB; Jim, WX3B, and Larry, N7DD.**

## DX Conventions and Gatherings

Get out your calendars and mark them now for the following DX conventions:

54th Annual International DX Convention will be held in Visalia on the weekend of May 2, 3 and 4. Details can be found at **ncdxc.org/Ncdxc/Convention/**. Once again your editor will be at this one. I'll be giving the AH3D presentation and look forward to see all in attendance.

The Lynx DX Group will hold their annual DX Convention this year in Cehegin, Spain. The event is also scheduled for May 2, 3 and 4. Chris, DL5NAM; Roberto, EA4DX, and Kan, JA1BK, are just some of the DXpedition forum speakers who are scheduled to attend. For more information check out **www.lynxdxg.com/cehegin2003/** (in Spanish).

Members of the Salento DX Team have organized the 4th Friendship Meeting for May 17 and 18 near Porto Cesareo, Italy. DXCC cards will be checked by Mario, I2MQP, and IOTA cards can be checked by Mauro, I1JQJ. DXpedition operators YT1AD and IK7JWX will be in attendance. For more information you can contact Alfredo, IK7JWX, at **adenisi@tiscali.it** or by checking out their Web page at **www.malpensa.it/iphg/index.htm**.

DXtravaganza III will be held at HamCom 2003, which is the ARRL's National Convention, on June 20, 21 and 22. The Lone Star DX Association (LSDXA) is once again sponsoring this great event, which will take place in Arlington, Texas. As of press time some of the presenters are KU9C, W5SJ (PRØF), K9LA, W5GAI, N7NG, K4UEE (XT2DX) and W3UR (AH3D). For complete details, see the article elsewhere in this issue and keep an eye on the LSDXA Web page at **www.dxer.org/lsdxa/**.

## IRCs OR GREENSTAMPS

Bill, W9OL, has updated his IRC and Greenstamp Web page. This is an excellent tool to determine how many IRCs or Greenstamps to send to certain countries. Check it out at **www.qsl.net/w9ol/ircchart.txt**.

## WB2RAJ ADDRESS CHANGE

Longtime QSL Manager WB2RAJ has a new QTH and a new mailing address. Send all QSL requests to Dick "KASH" Kashdin, 4591 West Overlook Dr, Williamsville, NY 14221. WB2RAJ is QSL Manager for EM3W, FK5DX, FK8GM, J39BW, LZ2TU (1992 only), ST2/G4OJW, ST2AA (up to February 25, 1995), STØK, UZ3AYR and WB2RAJ/VP9.

## DX NEWS FROM AROUND THE GLOBE

### *5H—TANZANIA*

We may see more activity from Tanzania, 5H, soon with the announcement of a new entry-level novice license. It has reduced requirements, reduced frequencies and reduced power. The basic license is no code but allows code operation on the air as a stepping-stone to full privileges. Ralph, 5H3RK, says he's proud that Tanzania may have "an unprecedented critical mass of indigenous radio amateurs."

### *5T—MAURITANIA*

Frank, DL8YHR, will be heading to Mauritania in early summer. He'll be mostly active on 2 (EME) and 6 meters with some HF from June 28 to July 7. Frank will be operating from the QTH of 5T5SN. No mention of call sign was made. Equipment will include a FT-920 and an IC-706MKIIG. QSL via ON4ANT.

### *9N—NEPAL*

Dov, 4Z4DX, is heading to Nepal for work and to visit his son Mat, 4Z5DX. During his free time he will be QRV as 9N7DX from April 22 to May 15. He plans to take his IC-746 and IC-706MKIIG. He'll take a laptop for use on RTTY and PSK. Look for him on 6 through 160 meters. QSL via 4Z4DX.

### *CO—CUBA*

Look for the following Cuban special event stations to be QRV in the near future: COØE—May 10-11; COØM—June 14-15; COØA—July 12-13; COØR—August 8-9; COØT—September 13-14; and COØI—October 11-12. QSL via CO2FRC or via the bureau.

### *D2—ANGOLA*

Joao, CT1BFL, will be QRV as D2U from Angola until February 2004. He'll be active on CW and SSB on 10 through 160 meters. QSL via CT1BFL.

### *FO—MARQUESAS ISLANDS*

Silvano, I2YSB, updates us on his upcoming trip to the Marquesas Islands. The group will be QRV from April 25 to May 9. Team members will include I2YSB, IK2DIA, IK2GNW, I2MOV, IK2WXV, IK1AOD and IK1PMR. They will have three stations on HF and one on 6 meters. Plans are to have a beacon on 50.105, which will be active every hour and every half hour for 5 minutes. The call sign is still not known. QSL via I2YSB either direct or via the bureau. There are two addresses that can be used. They are: Silvano Borsa, PO Box 45, 27036 Mortara (PV), Italy, or Silvano Borsa, Viale Capettini 1, 27036 Mortara (PV), Italy. They also have a Web page at **digilander.libero.it/i2ysb/marquesas/marq.htm**.

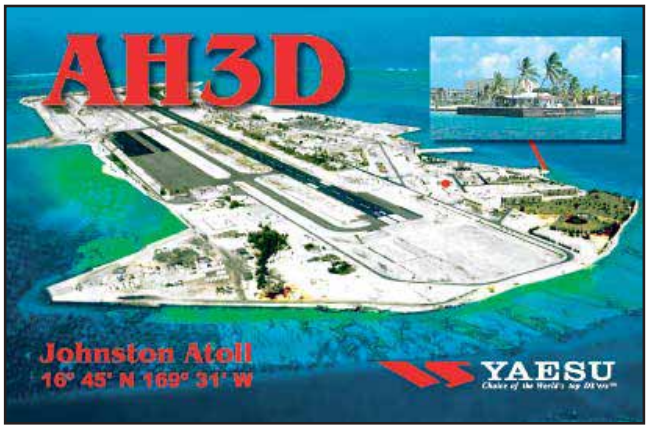
### *GM—SCOTLAND*

GZ7V will be on from the Shetlands in the CQWW CW. Stewart, GM4AFF, will be the operator. For more, go to **www.gm7v.com**.

### *HS—THAILAND*

Thailand's "RAST" congratulates Chartchai

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org




**Here is a sample of the AH3D QSL card, which will be sent out starting this month.**

Varavisudthsarakul (Chai, HS1NGR) on making DXCC Phone Honor Roll. Chai is the first Thai ham to confirm over 300 entities. He's worked 327. Says Ray, HSØZDZ, "He has certainly proved himself to be a world-class radio operator."

### *JA—JAPAN*

Taka, JR3TVH/6, will be on Myako Island (AS-079) again from 09Z May 1 to 10Z May 5. He plans to be on 20-6 meters SSB and CW. QSL to his home call.

Toshi, JM1PXG/6, will be operating from Tokara Kuchino-shima (AS-049) starting around 0100Z on May 3 until around 0200Z on May 4. He will be active on 10, 12, 15, 17, 20 and 40 meters CW only. QSL via JARL or direct to his home call.

### *J2—DJIBOUTI*

Look for Karsten, DL2LAH, to be on from Djibouti now through the beginning of June. He expects to be active as J2ØLA on HF and 6 meters. The call sign is not known as of yet. QSL via DL2LAH.

### *JD—OGASAWARA ISLANDS*

Fukushige, JM6DZB, will operate from Iwo Jima (AS-030), Ogasawara until the end of this year. Look for JM6DZB/JD1 on 15, 40 and 80 meters SSB. He will operate in his spare time. QSL via QRZ.COM.

### *JW—SVALBARD*

Terje, LA3OHA, is organizing a trip to Prins Karls Forland (EU-063), Svalbard. The Arctic summer 2003 trip is expected to take place from July 27 to 30.

### *KHØ—MARIANA ISLANDS*

AL5A/NHØ will be on from the Mariana Islands in the WPX CW contest in May, single op all band. The operator will be Kuroi Kazuhiko, JHØMGJ. QSL via JHØMGJ.

### *KH8—AMERICAN SAMOA*

Ulli, DL2AH, has planned his first DXpedition from American Samoa from July 16 to 23. He will take an FT-1000MP and use a Gap Titan and Windom antennas. Look for activity on 10 through 40 meters SSB, RTTY and PSK.

### *KH9—WAKE ISLAND*

Bruce, AC4G, has had to postpone his planned May operation from Wake, KH9. He still hopes to get there in August or September, though. The runway is being rehabbed. If that isn't done by the August-September timeframe, it will mean another postponement. Meantime, Chuck, N4BQW/KH9, may be active from time to time from Wake. He goes to Wake to handle medical emergencies and routine medical checkups for personnel there. Dianna, KB6NAN, Chuck's QSL manager, will let us know when such a trip and operation by Chuck is imminent. When AC4G gets there, he is expected to do his own QSLing, since that's what he's done for past operations.

### *NCDXF*

For over 30 years, NCDXF has provided financial aid, equipment and QSLs to support DXpeditions, as well as having established a worldwide HF Beacon Network. Donate radios and radio related equipment to NCDXF, an IRS approved 501(c)(3) Foundation, for tax deduction purposes. Your donations will help NCDXF continue its support of DXpeditions and the Beacon Network in the years ahead. Contact Chuck Ternes, N6OJ, for more information: tel 707-763-2528; **n6oj@sbcglobal.net**, PO Box 1328, Los Altos, CA 94023-1328. See their Web site at **www.ncdxf.org**.

### *SV9—CRETE*

Costas, SV1XV, says, "There will be a DXpedition to Gavdos Island (EU-187), which counts as SV9 (Crete) for DXCC on 1-10 June 2003." Look for activity on RTTY on 10, 12, 15, 17, 20, 40 and 80 meters. QSL direct only via SV2DGH.

### *VK9X—CHRISTMAS ISLAND*

VK9XD will be on from Christmas Island next October in the CQWW SSB. Operator David, VK2CZ, says to QSL direct only, to his home call.

### *VP9—BERMUDA*

Jon, NØJK, will be operating from VP9GE's Tarrafal Apartments on Bermuda between June 12 and 16. His main emphasis will be the June VHF QSO Party in the single op low power category. Equipment will include an IC-706MKII with 100 W and a 5 element $M^2$ on 6 meters and 100 W and a 9 element $M^2$ on 2 meters. He wants only those who need VP9 to call outside of the contest, but during the contest anyone can call.

### *YA—AFGHANISTAN*

Nick, G4KUX, is back in Kabul, Afghanistan until April 2004. He has erected a GAP Titan antenna, which he can use on all bands from 10-80 meters as YA4F. He has been showing up on a net on 40 meters on 7047.2 usually around 1800 to 1930Z. His primary interest is 6 meters but when that band is closed, Nick will operate on whichever HF bands are the most active. Nick says there are at least two other hams also in country. They are YA1CQ, who is mainly on 10 meters, and a French op who has a YA call. Nick has some really nice photos of himself and the local area at **www.xs4all.nl/~gouwelee/**. Click on the YA4F button. Some of the photos are very impressive.

### *YN—NICARAGUA*

YN2EJ will be on from Nicaragua with Frosty, K5LBU, and Ed, W5GCX, operating, in the CQWW phone October 25-26, multi-single. They arrive Wednesday night in the lead-up week, put up antennas Thursday, then get on the air some. Ed sometimes does some 12 and 17 meter operating and likes CW. QSL via K5LBU.

### *ZK1—SOUTH COOK ISLANDS*

Jun, VK4SJ (XYL), and Doug, VK4BP, plan to be active as ZK1AYL and ZK1SIM from the South Cook Islands during late April and most of May. First stop is expected to be from Aitutaki Island (OC-083) starting around April 26 or 27. Next stop will be from Rarotonga Island (OC-013) on May 15 for about 12 days of operation. QSL both via VK4SJ.

## WRAPUP

That's all for this month. Don't forget to send any DX news, photos, newsletters, etc, to your editor. Until next month, see you in the pileups!—*Bernie, W3UR* QST

# FEEDBACK

◊Yes, you're seeing double and no, it wasn't an April Fool's joke. If you look closely at the photo of the Rock-Mite transceiver ["The RockMite—A Simple Transceiver for 40 or 20 Meters," pp 35-38] on the cover of the April 2003 issue of *QST*, you'll see that the board contains two 12C508A PIC microcontrollers. It should have only one, of course. The other IC should be an LM1458N and it's the one closest to the board center. Thanks to Geert Jan de Groot, PE1HZG, for pointing this out. While we're at it, in the text on page 37, diode D6 was called out as the final amplifier clamp diode. It should be D8.

◊A diligent reader pointed out a reversal of roles in the article "The ARRL Field Organization: Something for Everyone" [Mar 2003, pp 50-54]. The first paragraph of the second column on page 51 should read "The SEC oversees a number of DECs," not the other way around. QST

# Give Me Power

Signals on the microwave bands come from stations that run considerably lower power than is common on HF and VHF. In general, this is sufficient because with the relatively short distances and high gain antennas that microwavers use, not much power is needed.

Experienced microwavers have mastered the art of low noise receivers and are using as large an antenna as practical (and believe me, there are many impractically large ones out there). For them, the next step in station improvement is to increase transmitted power. When trying to make a difficult contact with imprecise frequency control and direction information, having "lots of smoke" at one end of an attempt helps to get the weaker station to optimize its antenna and frequency before transmitting.

There are several sources for power on the microwave bands. Much of the development has been spurred by the military requirements for radar transmitters; some by telephone and video circuits carried by microwaves, satellite links, and more recently, mass marketed cellular and digital commercial applications.

The operation of a Magnetron is not described here. They are not generally useful as amplifiers, but rather are oscillators, and so see very little use in Amateur Radio. Microwave ovens and marine radars most often use Magnetrons as their RF source.

In 1937 the brothers Sigurd and Russell Varian invented the Klystron. These tubes can deliver power in the hundreds of kilowatts at UHF through 10 GHz, and special versions have been developed up to 240 GHz! Klystrons are very expensive and rarely found in amateur applications, and so I won't use space to describe the internal operation. Their narrow operating frequency range, and very high efficiency make them ideal for UHF TV transmitters, tropospheric communications links and some types of radar.

In the early 1940s Pierce and Shepherd of Bell Labs invented the reflex Klystron, a low-power device often used as a local oscillator in radar receivers. Some amateurs used these for bands from 10 GHz through 47 GHz prior to the advent of the Gunn.

## The Traveling Wave Tube

In1944 Kompfner invented the TWT (Traveling Wave Tube). Continuous wave TWT amplifiers can be constructed for power levels from 1 W to hundreds or even thousands of watts. They range in frequency from 1 GHz to over 40 GHz.

Because TWTs are available surplus, and because they are true amplifiers, giving lots of gain and at useful power levels, amateurs often employ them as amplifiers in home stations. Their weight, high power consumption and exceedingly high internal high voltages make them impractical for hill-topping expeditions.

## How does the TWT Work?

As shown in Figure 1, an electron beam in the TWT is focused and injected into the "slow-wave" circuit where it interacts with the propagation RF wave. This wave is presented to the beam through a helical winding. The helix slows the phase-velocity of the RF wave such that its velocity matches the electron beam's. The electron beam is velocity-modulated at the beginning of the helix. As it passes through the tube, the velocity modulation changes gradually to density modulation, and then induces an amplified RF wave at the output section of the helix. Usually an attenuator is placed around the center of the tube to prevent feedback. The efficiency is low but the TWT is inherently broad band, often having more than an octave, and in some designs over a decade of bandwidth. Gains can be as high as 40 dB. Example units that deliver tens to hundreds of watts are shown in Figure 2.

## Are Triodes used on Microwave Bands?

The planar triode tube has been developed for amplifier use in the 400 MHz to 1 GHz range. Amateurs have made many Q5 1296 QSOs over the years with the 7289/2C39 tube. It is common to produce over 100 W from an air-cooled pair (see Figure 3) and 250 W from a water-cooled pair of these tubes. There have also been successful designs that use up to six of these tubes to generate over 500 W. The same tube, in a single configuration has been used by some amateurs on 2304 MHz, with reports of between 15 and 40 W of output.

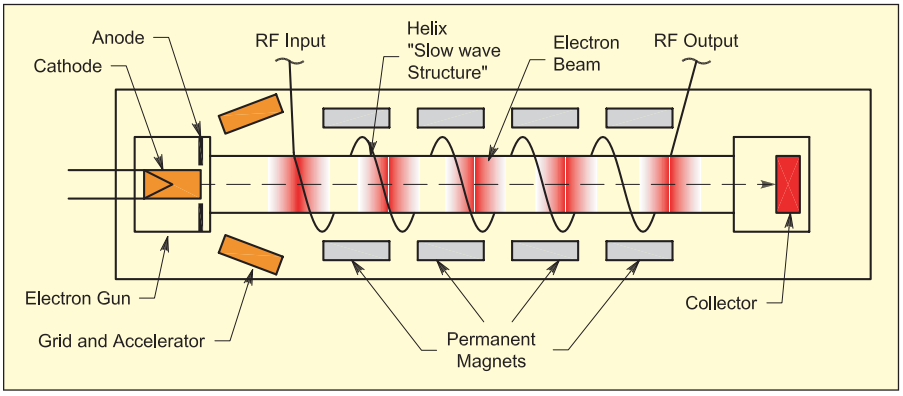



**Figure 1—Simplified schematic of a Traveling Wave Tube.**

**Figure 2—Here is Dick, K2RIW discussing two TWT amplifiers with the author.**

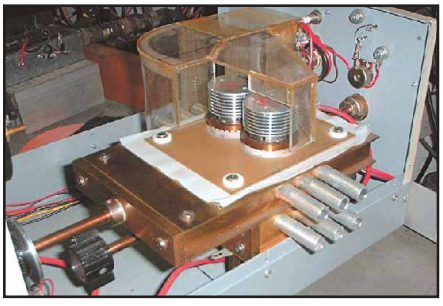


**Figure 3—A two tube 100 W, 1296 MHz amplifier. The air-cooling fins can be seen here with a plenum made from Plexiglas.**

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

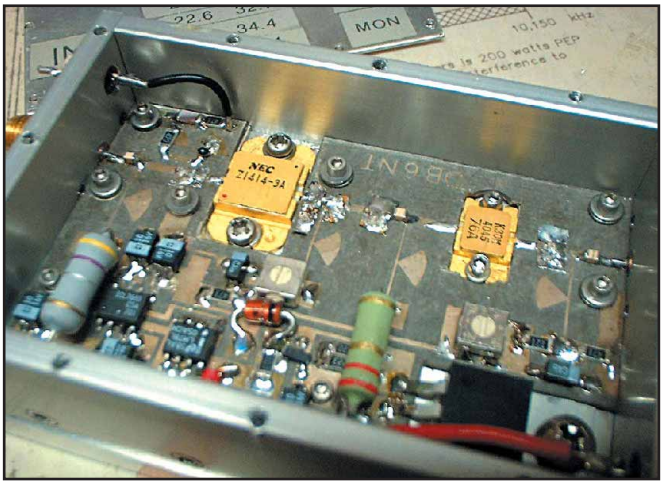



**Figure 4—A 3-W, 10 GHz amplifier using FETs. The author constructed this from a DB6NT board and FETs removed from surplus 14 GHz satellite uplink systems. It is usually easy to retune FETs to frequencies lower than their original design.**

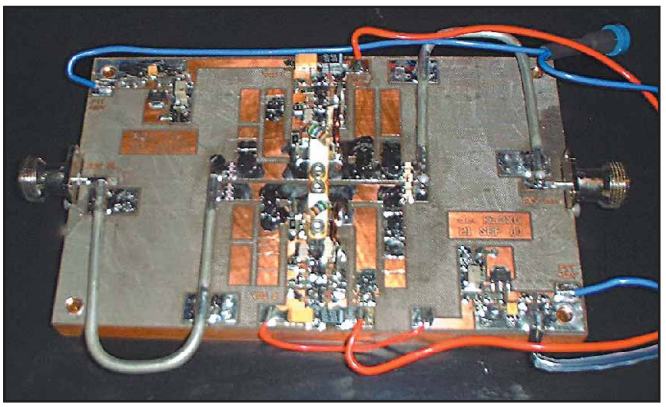


**Figure 5—An LDMOS 100 W, 1296 MHz power amplifier, designed and built by John, KB3XG (see *Microwave Update 2000*). The transistors are the white objects in the middle. Most of the rest is matching network.**

There have been several other, higher power tubes available (notably the Gs9b and Gi7b) at reasonable cost that can produce several hundreds of watts on 1296 MHz. EMEers have put these tubes into service with good results.

### Solid State

Solid-state amplifiers have the advantage of no warm-up, lower voltage than tubes, and generally smaller completed units. This has resulted in more power in portable stations, and the ability to place reasonable power level amplifiers on the mast to deliver most of the RF to the antenna.

### Gunns and IMPATTs

The Gunn diode is a device originally investigated by (and named after) John B. Gunn in the early 1960s. In a resonant circuit and dc biased it will oscillate and produce some RF power. Typical power levels are 5 or 10 mW, but there are 100-mW devices available.

Gunns and IMPATTs can be configured as amplifiers when connected to a circulator. If the device is biased carefully and matched properly to its cavity, it will oscillate at the frequency of incoming RF. Although not linear in its response, such amplifiers can operate over sufficient frequency and power range to be useful as amplifiers in some communications systems. Because these are quite difficult to tune and because there are alternatives with competitive cost, they are relegated by amateurs primarily to EHF bands (47 GHz and above).

### Bipolar Transistors

Bipolar transistors are useful as power amplifiers into the 2 GHz range, but at higher frequencies they become difficult to match and keep stable. Many affordable bipolars for the 1.2 GHz and 2.3 GHz bands are designed for class C operation. They can provide plenty of efficient power (100 W is not uncommon) for CW but have too much distortion for SSB communication. Fortunately, some can be biased into class AB operation, sufficiently linear for an undistorted SSB signal, but at about $^1/_3$ the class C power. This biasing requires two power supplies and a biasing network that is bulkier than most FET designs.

### FETs

Gallium Arsenide and Indium Phosphide Field Effect Transistors are useful up to and beyond 100 GHz. They can be effective power amplifiers as they are inherently linear devices and fairly easy to bias with two voltages. Although individual FET dice do not produce much power, many elements are often placed into one component along with internal matching. This allows easy development of circuits based on 50 Ω striplines. Figure 4 shows a 3 W 10,368 MHz amplifier using internally matched FETs. Single devices with ratings of over 20 W at 5 GHz and over 10 W at 10 GHz are available, but not cheap. FETs are often used in RF ICs called MMICs for Monolithic Microwave Integrated Circuit. There are units on the market that combine several stages of amplification to provide for both low noise and medium power at EHF bands. Examples include 1 W at 24 GHz, 300 mW at 47 GHz, and 50 mW at 80 GHz.

### LDMOS

Various formulations of enhancement mode power MOSFETs have been developed for cellular industry base stations that produce 100 to 200 W of linear power at the 900 MHz and 2 GHz bands. These are somewhat difficult to match, but once mastered, very effective solid-state amplifiers developing over 100 W on the 1296 MHz band can be constructed. Figure 5 shows a 1296 MHz 100 W power amplifier with these devices.

### How Can I Get a Solid-State Amplifier?

There are plenty of choices. Published designs, kits, boards and fully constructed packages are available from several vendors. There are many surplus amplifiers found at hamfests, for auction on the Web, and occasionally listed for sale in Amateur Radio newsletters. Some of the boards and kits require skill in surface-mount soldering and tuning striplines. Also, to properly tune up a home made amplifier you will need an RF source, controllable power supplies, a reliable power meter and a load appropriate for the band. If you don't have these items, get some help from someone in your club or group.

Don't forget—high power is not the first thing to concentrate on when assembling a station. Get good frequency control, a sensitive receiver and a good antenna before trying go QRO. Once you hear the weak ones you may want to get on another band rather than trying more power. But if you do want more power, talk to other hams and you may be surprised just how easy it can be.

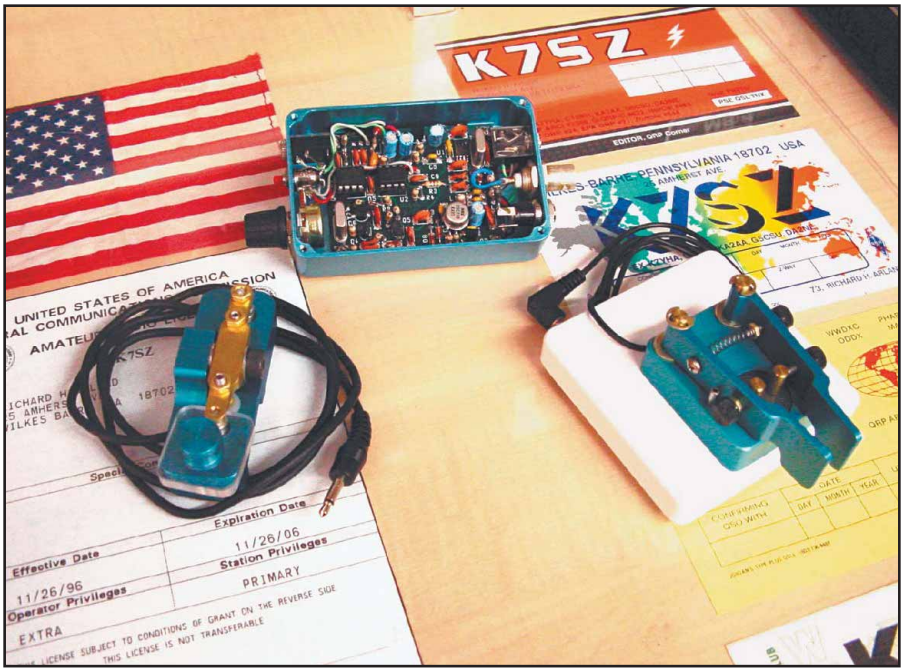
### Resources

Links to appropriate information and vendors can be found at **www.wa1mba.org/interest.htm/**.

Visit **www.arrl.org** to find a variety of microwave books and *Proceedings of Microwave Update* that include designs for several of the amplifiers shown in this column. QST

# The RockMite

Dave Benson, K1SWL, of Small Wonder Labs, **www.smallwonderlabs.com**, is both a gifted engineer and a very practical man with an excellent sense of timing. Dave loves the QRP hobby and consistently provides us with innovative low power rigs to build and use. His early success with the 40-40 transceiver kit (November 1994 *QST*) spurred him to greater heights. A succession of very interesting kit rigs poured forth from his Connecticut lab. Among them were the SW 40+, the DSW series of direct digital synthesis rigs, and several variants of PSK31 transceivers including the amazing New Jersey QRP Club's 80 Meter Warbler (March 2001 *QST*, page 37).




**My 40 meter RockMite flanked by two of Doug Hauff's, KE6RIE, other creations: Left, the KE6RIE Straight Key and at right, the Porta-Paddle. Nothing like a nice key or paddle set to complement a great little rig like the RockMite.**

## My Pet Rock(Mite)

Last summer I had a conversation with my good friend and fellow QRPer, Chip Morgan, N3IW, who told me about the RockMite 40 meter transceiver kit from Small Wonder Labs. [A construction article on the RockMite appears in April 2003 *QST*, page 35.—*Ed.*] This little "one evening kit" has a whopping $25 price tag! The RockMite features a direct conversion receiver based on a Gilbert Cell mixer/oscillator (SA-612). The transmitter will deliver about 500 mW into a 50 Ω load. The transmit frequency offset can be toggled to provide limited frequency agility. A push of the button reverses the receive and transmit frequencies, a total deviation of about 700 Hz.

Current requirements are very low; about 25 mA on receive and 200 mA key down on transmit using a 13.8 V dc supply, which is a very manageable power budget for operating portable from the bush. A 10-cell "AA" alkaline battery pack will last a long time. Since the RockMite had the Small Wonder Labs' stamp on it, I was immediately interested. A visit to the SWL Web site followed by an e-mail to Dave, and my RockMite was on the way.

The kit arrived in a couple of days, and I promptly started construction. The instruction manual (4 pages with a 10 page download from the SWL Web site) was a bit Spartan, but if you have several kit projects under your belt, you can safely tackle the RockMite with confidence. Most of the diodes and resistors are vertically mounted to save PC board space. Two of the three ICs are socketed. U1, the SA-612, is the only surface mount component in the kit. It is easily installed, so don't be intimidated—just be careful with your soldering iron. The board is very small (2.375 × 1.875 inches) with above average component density. Care must be taken when soldering and the usual disclaimers about being sure that the proper components are in the right holes apply.

Total build time (less case installation) was around three hours. Since speed is the enemy of every homebrewer, it's not how fast you build the rig, but how fast you can get it to work once it is built! As I grow older, I also notice that it takes me longer to stuff and solder a PC board on a kit radio. The eyes aren't what they use to be, and it is very easy to misread the tiny ¼ W resistor color codes, so I have begun using a jeweler's loupe to ensure that the proper components find their way into the correct holes. Call me crazy, but I like to have the rig work the first time power is applied!

## Rock *ON*, Dude!

My 40 meter RockMite worked from the get-go and I had the little rig on the air quickly, using the 40 meter Extended Double Zepp antenna. The first thing I noticed was that the volume of the receiver was not exactly ear-shattering. Selectivity was a bit broad, but that was understandable. In order to test and measure RF output, you need to get the RockMite to transmit a steady carrier. Pressing one of the keyer paddles on power-up bypasses the normal keyer function and places the RockMite into the manual key mode. Closing the paddle will generate a continuous key-down condition for testing.

Default keyer speed is 16 WPM. By pressing the pushbutton switch longer than 250 ms the Morse letter S is heard, placing the keyer into the "speed select mode." Pressing or tapping the dot paddle increases the keyer speed (max of 40 WPM), while pressing or tapping the dash paddle reduces keyer speed (min of 5 WPM). Once in the speed select mode, if no paddle input is detected in 1.5 seconds, the keyer emits a low tone and reverts to standard keyer operation.

## Psssssss! Wanna Extra 3dB?

With the stock 2N2222A PA transis-

Rich Arland, K7SZ ♦ 25 Amherst Ave, Wilkes Barre, PA 18702 ♦ k7sz@arrl.org

tor RF output was slightly under ½ W. There was a lot of discussion on the RockMite Internet reflector (**rockmite@yahoogroups.com**) regarding replacing the PA with some other type of transistor. I had a spare 2SC799 in the junque box, so out came the 2222A and in went the 799. Man, what a difference! My output power jumped up to just under 1 W output (990 mW, actually)! Of course, the transmit current more than doubled, but hey….less than ½ W to almost 1 W: that's a 3 dB increase and at *these* power levels a gain of 3 dB can definitely make a difference. Listening to the output on an airlocal via my Drake 2B, the RockMite sounded very clean with no chirp or clicks.

## Throwing Rocks

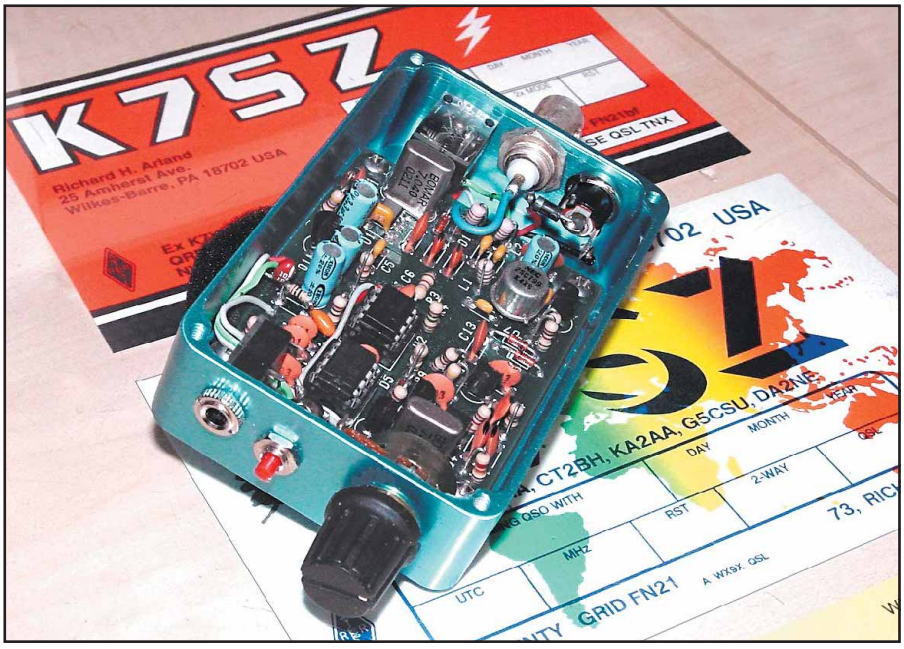
Saying that the frequency agility of the RockMite is a "bit limited" is akin to stating that the sinking of the *Titanic* was a "boating accident." The RockMite is designed to operate on or about 7040 kHz. Period. Momentarily pressing the pushbutton switch will move the frequency approximately 700 Hz by reversing the transmitter offset, but 7040 is pretty much where you are going to operate. The direct conversion receiver selectivity is wide enough to hear people calling off frequency with no problem. Actually 7040 kHz is a good choice since it is the primary QRP calling frequency on 40 meters. The 20 meter RockMite is centered on the QRP watering hole frequency of 14,060 kHz.

The first QSO with my new RockMite netted Ohio. Not exactly riproaring DX, but it did prove that this cute little rig was capable of making contacts. Subsequent Qs stimulated my interest in milliwatt QRP. For those of you who've never tried milliwatting, you really don't know what you're missing. During the late 1980s I ran 980 mW most of the QRP ARCI QSO parties and had a ball. My scores weren't too bad, either!

## A Box for the Rocks

The RockMite is a unique radio that begs for a unique enclosure. Doug Hauff, KE6RIE, of American Morse Equipment (**www.americanmorse.com**), offers such an enclosure, specifically engineered and machined for the RockMite. Doug's creation, the MityBox, is an aluminum T-6061 CNC hog out that has been anodized a striking blue color. This thing is *beautiful*! Doug sells the MityBox for $23 which includes postage.

The RockMite PC board fits snugly inside the MityBox. Three holes on each end of the box accommodate the controls and connections to the transceiver. On the front panel there are holes for the AF gain control, VFO switch and headphones. The back panel includes holes for the key/paddles, a BNC antenna connector and the dc power connector. The MityBox has a mating cover that makes the enclosure extremely robust. Once buttoned up, your RockMite is ready for the bush. Add a set of headphones (or ear buds), a paddle or key, antenna and small battery pack (I use a 10 "AA" cell pack with resetable fuse) and you are ready for some fun!




**A ¾ front view of the RockMite in the MityBox enclosure. You can see the size comparison with the standard size QSL cards under the Plexiglas below the rig. When encased in the MityBox, this rig makes a great, highly robust "bush radio."**

## Options and Mods

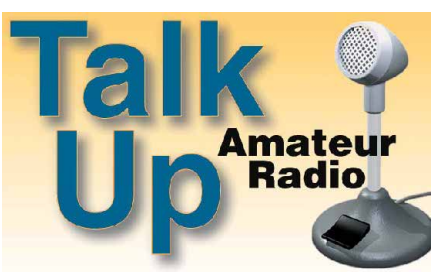
At times it can be handy to reduce the AF gain of the RockMite, especially when you're getting hammered by a nearby QRO station. By replacing R5, a 1 MΩ fixed 1/8 W resistor, on the circuit board with a 1 MΩ linear pot (Mouser 31JN601), you can control the audio gain of the receiver.

I had previously mentioned the replacement of the PA transistor. The RockMite Internet reflector has a lot of information on this mod in their archives, so take a good look to get the full picture before diving in and replacing the final amp.

The RockMite sidetone is a bit raspy and raw and excessively loud. Varying the value of C3, a 1 µF monolithic cap (I used a 0.47 µF tantalum), will alter the sidetone level. Adding one or more RC networks between U3, pin 5 (the PIC12C508A) and C3 will soften this tone. The manual recommends a 10 Ω/10 µF combination is a good starting point and worked well in my unit.

A diode in the positive supply line will prevent reverse polarity connection problems. Any silicon diode similar to a 1N4001, or even a Schottky diode (1N5819) will work. Actually, the Schottky is preferable due to its much lower forward voltage drop. Be sure that the cathode (the banded end of the diode) goes toward the RockMite board. The RockMite can operate from a 11-14 V dc source using a battery or regulated power supply. If you desire to operate the RockMite from a 9 V transistor radio battery, change R1 to 1 kΩ and R9 to 470 Ω.

For field outings, camping/business trips or when find yourself on the road, the RockMite offers a complete HF station in a tiny package. Presently the RockMite is offered in 40 and 20 meter versions and costs only $25 plus shipping. *What a deal!* While the frequency range is very limited, you can still have a lot of fun with this radio. Hats off to Dave Benson, K1SWL, for providing yet another innovative fun kit project to keep us at our workbenches. Now all I need is a small tuner/SWR bridge. Hmmmmm…did someone say "Rainbow Tuner"? Stay tuned. QST



# The National NC-183D

Just after the war, in early 1947, the National Company introduced the NC-173 receiver with a price lower than their popular HRO-5A1 and NC-2-40D models. It was considered a better receiver by many and had a new look with its smooth painted gray finish. This radio had one stage of RF and a single 6V6 tube producing 3.5 W of audio.

In December 1947 National introduced the NC-183 with an additional RF-stage, circuit and shielding improvements and a greatly improved 8-W audio output stage using a pair of 6V6 tubes in push-pull.

National announced an all-new design in 1952, the NC-183D. It had the appearance of the earlier models, NC-173 and NC-183, but it was a significant improvement. It's said the "D" was to denote "Dual Conversion."

The description from the National manual really explains why hams bought these radios:

> The new NC-183D is a deluxe radio receiver featuring performance and versatility 'plus'. Two R.F. stages, three I.F. Amplifier stages and two frequency conversion stages give this new series that extra measure of sensitivity and image rejection so often needed to insure uninterrupted reception at the high frequencies. A double diode noise limiter reduces interference caused by external noise pulses and a voltage regulated converter and C.W. oscillator circuits assure a minimum of frequency drift for both phone and code reception. The selectivity characteristic of the NC-183D is adjustable over a wide range from broadcast requirements to sharp amateur single signal reception. The push-pull audio system delivers the utmost in audio frequency response and undistorted power output from the built-in output transformer.
>
> Fifteen tubes, plus a voltage regulator and a rectifier, are utilized by the NC-183D in a superheterodyne circuit for the reception of phone and code signals throughout its frequency range of 540 khz. to 31 mhz. and 47 to 55 mhz. Calibrated bandspread tuning is furnished for the main amateur bands i.e., 6, 10-11, 15, 20, 40 and 80 meters. Separate directly-calibrated dial scales and associated controls are used for general coverage and bandspread tuning, respectively. An S meter, with a semi-permanent sensitivity adjustment at the back of the receiver, is mounted on the front panel for signal strength readings of both phone and code signals.
>
> An accessory socket is mounted on the receiver chassis to accommodate such accessories as a National Type SOJ-3 Select-O-Ject, a National Type NFM-83-50 FM adaptor, etc. At the rear of the receiver a socket is available for external use of a battery power supply. Other highlights include a six-position crystal filter, maximum bandspreading of the amateur bands, a quick-action band switch, a phonograph input jack and a terminal panel to permit series or parallel remote standby-receive switch connections.
>
> The NC-183D features a push-pull output amplifier using inverse feed-back. The matching transformer located inside, the receiver provides two audio output circuits as follows:
>
> (1) The transformer secondary leads are brought out to a three-terminal output board located at the rear of the receiver, having both 8 and 500-ohm terminals and a common ground terminal. The 8-ohm terminal provides output for the speaker voice coil and the 500-ohm terminal is available for connection to a 500-ohm line. Approximately 8 watts of undistorted audio output power is available while the maximum power is 11 watts. The audio output terminal board is located on the back of the receiver cabinet and is shielded by a metal cover, which must be removed to gain access to the screw-type terminals.
>
> (2) A headphone jack is mounted on the front panel and is wired so as to silence the loudspeaker on the insertion of a phone plug. The headphone load impedance is not critical allowing a wide range of headphone types to be used.

The NC-183D is one of the finest general coverage and ham band receivers made by National. It was impressive to see and easy to use. This is one radio that many hams held on to as they moved up into SSB and bought transceivers during the 1960s and 1970s. They continued to use this for shortwave listening because it really sounded good. And many of the early SSB transceivers were ham band only; they didn't cover the shortwave bands.

## Profile W2LS

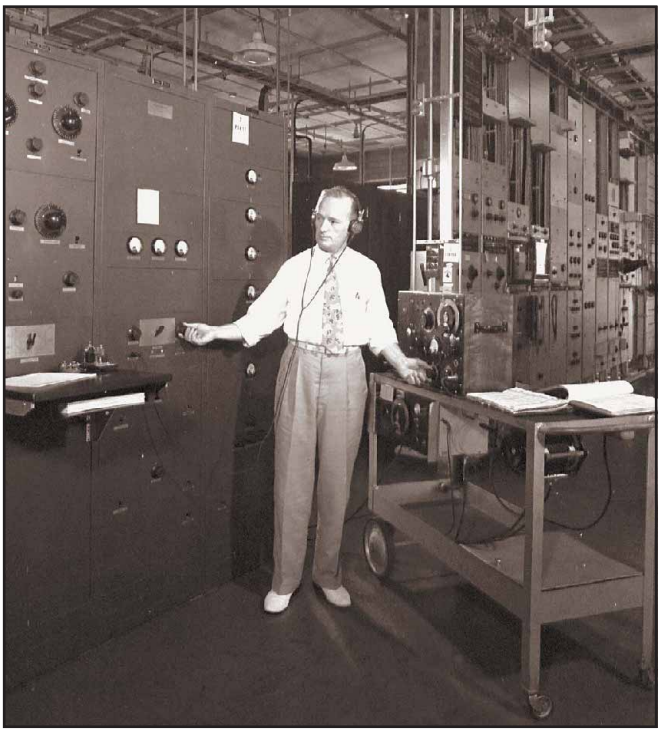
My first Elmer was Bill Savell, W2LS. He purchased a NC-183D new in 1952. He had some television interference issues with it and National had him return it to the factory for troubleshooting. Unable to locate the exact problem, in 1953 National offered him another new one with some upgraded circuits in exchange, which Bill gladly accepted. He talked about this for years, about how professionally National had treated him. He treasured this radio until last year when he gave it to me.

Bill is almost 95 years old now and is in fairly good health. Except during WW II, he has been licensed continuously since September 8, 1923—that's almost 80 years in ham radio. He was awarded a nice 75-year plaque by the QCWA in 1998.

He was introduced to ham radio while listening on a crystal set and heard his Sunday School teacher's voice. The next

**QCWA "75th Year in Ham Radio" plaque presented by Robert Buus, W2OD.**

John Dilks, K2TQN ♦ 125 Warf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org



**Bill Savell at work adjusting the LC receiver. The 3-bay double conversion Western Electric receiver covered 4-28 MHz. It was tuned to frequency using a chart. It received 4 channels, 2 USB and 2 LSB. AT&T had 15 of these 3-bay receivers in Manahawkin. (This receiver matches the LD-2 transmitter featured in last month's column.)**

**W2LS with two visitors during the 1947 Atlantic City International Radio Conference.**

**Bill's 1954 station: receiver NC-183D, transmitter behind his shoulder is a Stancor model 69. The BC-221 frequency meter was used as a VFO and also was used for ARRL frequency measuring contests and when Bill was an Official Observer.**

Sunday he asked all the right questions and was pointed to a hobby that would later become his career.

He quickly became an accomplished builder and operator. I have one of his early "3CJJ" QSL card confirmations from station "F-1BX" in Paris, France. The date was December 14, 1924. (That's not long after the Transatlantic tests.)

His father was a school photographer and they relocated a few times, moving between the Atlanta area and Virginia while he was growing up. Eventually he moved back to southern New Jersey bringing his new bride, India, with him.

He went to work in the telephone industry, first with Western Electric, then with AT&T. He was assigned to the Manahawkin, New Jersey, radio-receiving site, station WOO. His duties were to maintain the receivers and to set them to the required frequencies for point-to-point communications with countries all over the world. They were used for overseas telephone conversations.

One night while I was waiting for my Novice license to arrive, Bill took me and my NC-81X receiver to work with him. After he set up AT&T's receivers he had a couple of hours to go over my radio. Using the finest test sets available, he carefully aligned my receiver until it was as good as new. Of course I was overwhelmed with the enormity of all the Western Electric and AT&T equipment there.

Outside the building, it was even more impressive. There was a huge field of Rhombic antennas pointing around the world at every 14 degrees. Bill would switch antennas by patching some cords in the control bay to pick the proper antenna for the country he was working with. I made up my mind that night; that was the kind of work I wanted to do.

Bill was very active chasing DX most of his life. Always a gracious host, he made many friends through ham radio and always-invited foreign hams to visit and stay with him when they were in the area. And they did.

In 1947 Atlantic City hosted the International Radio Conference where representatives from many countries would meet and decide the future spectrum use. (ARRL was an active participant throughout the proceedings. You can read the reports in many of the 1947 *QST* magazines.) Bill and other local hams were assigned as hosts to the visitors.

Many who were in town to attend the international conference were also hams. And many of them visited Bill's station and stayed for a home-cooked dinner expertly prepared by Bill's wife. A few hams also stayed overnight with Bill during the weekends and when they had time off.

The year 1947 also brought forth the "First Annual Hamfest" in Atlantic City. With so many hams already in the area, it was a popular event. In the photo of the Hamfest there are 65 hams, with Bill in the front row, right in the center.

Bill retired from AT&T in the 1970s to enjoy his hobbies. Besides ham radio, he was a member of the Audubon Society and enjoyed bird banding. Bill is now residing in an adult care facility. I enjoy visiting him and talking about the old days.

You can visit my Web site for some additional photos: **www.eht.com/oldradio/arrl/index.html**. See you at the hamfests. Look for my hat and say hello. —*K2TQN*

# COMING CONVENTIONS

## THE ARRL NATIONAL CONVENTION

**June 20-22, Arlington, TX**

Join hams and League officials from across the country at the 2003 ARRL National Convention to be held June 20-22 at the Arlington Convention Center in Arlington, TX. The event is sponsored by Ham-Com. For information, call 214-361-7574; e-mail **chairman@hamcom.org**; **www.hamcom.org**.

## ROCKY MOUNTAIN DIVISION CONVENTION

**May 30-June 1, Estes Park, CO**

The Rocky Mountain Division Convention, sponsored by HAMCON Colorado, will be held at the Holiday Inn and Estes Park Conference Center, 101 S Saint Vrain Ave; located at the junction of Hwy 36 and CO State Hwy 7; 70 miles NE of the Denver International Airport, and 5 miles from Rocky Mountain National Park. Features include kick-off speaker Rosalie White, K1STO (ARRL Field and Educational Services Manager, Friday eve), many exhibitor and vendor displays, Section and Divisional leadership meetings (Friday afternoon), multitude of technical sessions (Saturday 9 AM to 5 PM and Sunday 9 AM to noon; including a 2-hr ARES "Lessons Learned" forum), free AR Emergency Communications Course Seminar (Friday, 10 AM to 2 PM; contact Dan Miller, K3UFG, 860-594-0340), Ladies Luncheon (Saturday; featuring Cheryl Muhr, NØWBV), VE sessions (Saturday, 9-11 AM), ARRL Open Forum (Saturday, 1 PM), banquet (Saturday eve; with special guest speaker ARRL President Jim Haynie, W5JBP), Wouff Hong ceremony (Saturday at midnight), DX/Contest Breakfast (Sunday, 7:30 AM; featuring Wayne Mills, N7NG; Bob Allphin, K4UEE; and Rick Dougherty, NQ4I), Special Event Station W1AW/Ø will be operating on HF, T-hunt (Sunday, 10 AM), RV camping (near Conference Center) . Talk-in on 146.685, 145.31 (123 Hz). Admission is $10 in advance by May 15 ($5 for under 18), $12 at the door or after May 15 ($6 for under 18). Contact Jerry VerDuft, ADØA, c/o HamCon Colorado, Box 463, Kiowa, CO 80117-0463; 719-634-8066; **ad0a@arrl.net**; **www.hamconcolorado.org**.

## EMCOMMWEST CONVENTION

**May 31, Reno, NV**

The EMCOMMWEST Convention, co-sponsored by the ARRL Nevada Section and the Northern Nevada AR Services, will be held at the South Reno Baptist Church Auditorium, 6780 S McCarran Blvd; from Hwy 395 S of Reno, exit at Del Monte Ln, go W 1 block to Kietzke Ln, go N on Kietzke to S McCarran Blvd, go W on S McCarran Blvd about 2½ blocks to Church. Doors are open 9 AM to 5 PM. Features include vendors, Emergency Communications forum (conducted by ARRL Hq ARECC Manager Dan Miller, K3UFG), speakers and presentations, classes, VE sessions (all class licenses). Talk-in on 146.61 (123 Hz). Admission is $10 in advance, $15 at the door. Contact Melissa Flanagan, KK7AA, 2851 Esaw St, Minden, NV 89423-9059; 775-267-4900; **kk7aa@arrl.net**; **www.cvrc.net/emcommwest/**.

## GEORGIA STATE CONVENTION

**June 7, Marietta**

The Georgia State Convention (75th Annual Hamfest), sponsored by the Atlanta Radio Club, will be held at Jim Miller Park, Cobb County, 2245 Callaway Rd; just N of downtown Atlanta, located minutes from Interstates 75 and 285; from Atlanta go N on I-75, take Exit 260 (Windy Hill Rd), go W 6 miles, turn left on Austell Rd, then right on Callaway Rd. Doors are open for setup on Friday 10 AM to 6 PM, Saturday 6:30 AM; public 8:30 AM to 3:30 PM. Features include indoor air-conditioned flea market, exhibitors, new and used equipment dealers, computers, demonstrations, major vendors, displays, club tables, educational forums, large tailgating area ($10 per space, includes 1 paid admission), VE sessions (register at 8:45 AM, testing begins promptly at 9 AM; First United Methodist Church, 56 Whitlock Ave, a few miles N of the event location), DXCC card checking (Bill Barr, N4NX, 770-399-0824; **n4nx@arrl.net**), RV camping with full hookups ($10 per night), plenty of free parking, refreshments. Talk-in on 146.82 (146.2 Hz). Admission is $5, under 18 free. Tables are $15 (by May 1, includes 1 paid admission), $20 (after May 1). Contact John Talipsky, KA4VQH, 385 Madison Chase Dr, Lawrenceville, GA 30045; 770-995-6446; **johnka4vqh@aol.com**; **www.atlantahamfest.com**.

**April 25-26**
**Southeastern VHF Conference, Huntsville, AL***

**April 25-27**
**SETI Symposium, Trenton, NJ***

**May 2-3**
**Midwest Division, Lebanon, MO***

**May 2-4**
**International DX, Visalia, CA***

**May 3**
**South Carolina State, Greenville***

**May 3-4**
**Alabama State, Birmingham***
**West Texas Section, Abilene***

**May 31-June 1**
**Atlantic Division, Rochester, NY**

**June 13-14**
**Iowa State, Sioux City**
**Tennessee State, Knoxville**

**June 14**
**Eastern Pennsylvania Section, Bloomsburg**

**June 14-15**
**Northwestern Division, Seaside, OR**

**June 20-22**
**San Francisco Section, Ferndale, CA**

***See April *QST* for details.**

### Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

**Note:** Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance. QST

# HAMFEST CALENDAR

*Attention:* The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **May 1** to be listed in the **July** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

**(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)**

**†Arizona (Pinetop/Lakeside)—Jun 7**, 6 AM to 6 PM. *Spr:* Kachina ARC. Blue Ridge High School, 1200 E White Mountain Blvd; from Show Low take SR 260 S for 12 miles to High School, turn left at stoplight into grounds. 1st Annual White Mountains Hamfest, paved tailgating, indoor commercial area, VE sessions, transmitter hunt, free RV parking. *TI:* 145.31 (110.9 Hz). *Adm:* $1. Tables: $5 per space. Cris McBride, KB7QXQ, Box 3396, Pinetop, AZ 85935; 928-367-6607; **kb7qxq@arrl.net**; **www.whitemtnhamfest.com**.

**†California (Sacramento)—May 18**, 6 AM to noon. *Spr:* North Hills RC. Bella Vista High School, 8301 Madison Ave; from I-80 go E on Madison Ave for 5.8 miles to school; from Hwy 50, take Hazel Ave N for 2.6 miles to Madison Ave, turn left on Madison Ave, go W for 1.4 miles to school on right. Refreshments. *TI:* 145.19 (162.2 Hz). *Adm:* Free. Tables: $10. Kim Scheidel, KE6RKX, Box 41635, Sacramento, CA 95841-0635; 916-417-4864; **scheidel@inreach.com**; **www.k6is.org**.

**Colorado (Estes Park)—May 30-Jun 1**, Rocky Mountain Division Convention. See "Coming Conventions."

**†Connecticut (Goshen)—Jun 7**; set up 6 AM; public 8 AM to 1 PM. *Spr:* Southern Berkshire ARC. Goshen Fairgrounds, 150 Old Middle St (Rte 63), ½ mile S of Rte 4 traffic circle. Vendors (Hennie Horvay, KA1JVN, 860-491-3129), tailgating ($5 per space, includes 1 admission), VE sessions (9:30 AM, walk-ins welcomed), free parking, refreshments. *TI:* 147.285. *Adm:* $3, under 12 free with adult. Tables: $10. Edward Rubin, N2JBA, 3475 Rte 343, Amenia, NY 12501; 845-373-8903; **n2jba@arrl.net**.

**†Connecticut (Newington)—Jun 1**; set up 8 AM; public 9 AM to 1 PM. *Spr:* Newington AR League. Newington High School, 605 Willard Ave (Rte 173); from Rte 175 N, go ¼ mile on left. Flea

†ARRL Hamfest

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

market, tailgating ($10, up to 2 admissions with 2 parking spots), forums, VE sessions (noon, walk-ins welcomed; preregister with special needs; Dan Miller, K3UFG, 860-206-3379; **k3ufg@arrl.net**), Special Events Station N1C (31st; 1st; Nomar Vizcarrondo, NP4H; **np4h@arrl.net**), refreshments. *TI:* 145.45, 224.84, 443.05. *Adm:* $5 (indoor and outdoor). Tables: $15. Make checks payable to NARL and send with SASE to Bob Stanwood, KB1EYZ, 21 Stuart Dr, Bloomfield, CT 06002; 860-242-2784; **kb1eyz@arrl.net**.

**†Connecticut (Vernon)—May 24**, 9 AM to 1 PM. *Spr:* Natchaug ARC. Tolland Agricultural Center, on Rte 30; I-84 to Exit 67, follow signs, approximately ½ mile. Flea market, dealers, tailgating, ATV, refreshments. *TI:* 145.11. *Adm:* $4. Tables: $15. Wayne Rychling, N1GUS, 59 Clint Eldredge Rd, Willington, CT 06279; 860-487-1921; **n1gus@arrl.net**; **hometown.aol.com/natchaugarc/**.

**Florida (St Petersburg)—May 4.** Dee Turner, N2MNC, **n2mnc@arrl.net**.

**Georgia (Marietta)—Jun 7**, Georgia State Convention. See "Coming Conventions."

**†Illinois (Beardstown)—May 18**; set up 6 AM; public 8 AM to 5 PM. *Spr:* Illinois Valley ARC. UFCW Union Hall, Local No 431, 8612 Arenzville Rd; W on Rte 125 from Springfield, left at first stop light, go 1 mile to hall on left. Swapfest, vendors, electronics, computers, tailgating (free with paid admission), VE sessions, free parking, refreshments. *TI:* 146.715 (103.5 Hz). *Adm:* $3, under 13 free. Tables: $10. Charles Bailey, W9HUX, 1101 Clay St, Beardstown, IL 62618; 217-323-1243; **w9hci@yahoo.com**.

**†Illinois (Chicago)—May 25**; set up 7 AM; public 8 AM to 1 PM. *Spr:* Chicago ARC. DeVry University, 3300 N Campbell. Vendors, tailgating, free paved parking. *Adm:* $6. Tables: $5. Melissa Meneely, KB9QWZ, Box 410535, Chicago, IL 60641; 773-908-5331; **w9caf@chicagoarc.com**; **www.chicagoarc.com**.

**†Illinois (Decatur)—May 4**, 7 AM to noon. *Spr:* Cenois ARC. Richland Community College, One College Park; corner of Rea's Bridge and Brush College Rds. Free flea market, VE sessions (10 AM; walk-ins only). *TI:* 147.1, 442.25 (103.5 Hz). *Adm:* $5, under 16 free. Tables: $1 per foot (6-ft minimum). Spencer Carter, N9LVW, Box 245, Blue Mound, IL 62513; 217-692-2460; **n9lvw@msn.com**; **www.cenois.com**.

**Illinois (Effingham)—Jun 8.** Russ Thomas, WI9B, 217-342-3054.

**†Illinois (Granite City)—Jun 8**; set up 6 AM; public 8 AM. *Spr:* Egyptian RC. Southwestern Illinois College Campus, Rte 203 and Maryville Rd; I-55, I-70 to I-270 to IL Rte 203 S, ½ mile to Maryville Rd, go E on Maryville Rd for about 300 ft, turn left into College. Hamfest/Computer Exposition, special seminars, huge flea market, commercial vendors, VE sessions, refreshments. *TI:* 146.79 (127.3 Hz), 442.4 (127.3 Hz), 146.76. *Adm:* advance $2 each or 3 for $5, door $4 each. Tables: $10 (indoors only; flea market space $5 each, bring your own tables). Patrick Riley, W9PAT, 258 W Union St, Edwardsville, IL 62025-1061; 618-655-0527; **w9pat@arrl.net**; **www.w9aiu.org**.

**†Illinois (Princeton)—Jun 1**, 8 AM. *Spr:* Starved Rock RC. Bureau County Fairgrounds, 811 W Peru St, ½ mile W of IL Rte 26; Exit 56 off I-80, S to Rte 6 (Peru St), W 2 blocks to Fairgrounds. Hamfest/Computer Show, flea market, dealer displays, vendors, excellent parking, refreshments. *TI:* 146.955 (103.5 Hz). *Adm:* advance $5 (2 stubs), door $7 (1 stub). Tables: 8-ft $10 (before May 15), $15 (after May 15); electricity available, bring your own drop cords. Matt Weaver, KB9VZH, 320 Desoto St, Ottawa, IL 61350; 815-431-1446 or 815-867-0044; **kb9vzh_gov@yahoo.com**; **www.qsl.net/w9mks/**.

**†Illinois (Springfield)—May 31**, 6 AM (flea market pavilion); 8 AM (building opens). *Spr:* Sangamon Valley RC. Illinois State Fairgrounds, Cooperative Extension Building; from I-55 take Exit 100B, go W on Sangamon Ave for 3 miles to Fairgrounds, enter Gate 11 at 8th St (off Sangamon Ave). Giant covered flea market (no additional charge for space; bring your own tables), commercial exhibits, vendors, dealers, VE sessions (9 AM, walk-ins accepted, no registrations accepted after 10 AM; $12 fee). *TI:* 146.685. *Adm:* $5. Ed Gaffney, KA9ETP, 13997 Frazee Rd, Box 14A, Divernon, IL 62530; 217-628-3697; **egaffney@family-net.net**.

**†Illinois (Wheaton)—Jun 8**, 7 AM to 2 PM. *Spr:* Six Meter Club of Chicago. DuPage County Fairgrounds, 2015 Manchester Rd, 25 miles W of Chicago; N of Rte 38 (Roosevelt Rd), E of County Farm Rd. All-weather hamfest, 3 buildings and large outdoor flea market, dealer displays, ARRL, VE sessions (9-11 AM). *TI:* 146.97 (107.2 Hz), 146.52. *Adm:* advance $5, door $6. Tables: 8-ft $12 (without electricity); $15 (with electricity). Joseph Gutwein, WA9RIJ, 7109 Blackburn Ave, Downers Grove, IL 60516-3925; 708-442-4961 (24-hr infoline); **wa9rij@mc.net**; **www.qsl.net/k9ona**.

**†Indiana (Wabash)—Jun 8**, 6 AM. *Spr:* Wabash County ARC. Wabash County 4-H Fairgrounds, located on State Rd 13N. 35th Annual Hamfest and Computer Show, indoor floor space, free overnight camping, refreshments. *TI:* 147.03, 442.325. *Adm:* advance $5, door $6. John Netro, KB9NSO, 495 Stitt St, Wabash, IN 46992; 260-569-1191; fax 260-569-9912; **jknetro@kconline.com**.

**†Iowa (Newton)—Jun 7**, 8 AM to noon. *Spr:* Newton ARA. Woodland Park Shelter House, 201 N 19th Ave E; Exit 168 off I-80, go N on beltline around the N side of Newton until you come to Woodland Park. *TI:* 147.03. *Adm:* Free. Roger Heglund, WDØGUY, 1103 S 14th Ave W, Newton, IA 50208; 641-791-7088; **rogerh@pcpartner.net**.

**†Kentucky (Independence)—Jun 7**, 7 AM to 2 PM. *Spr:* Northern Kentucky ARC. Summit View Middle School, 5002 Madison Pike; I-275 to Exit 80 (KY 17), go S 5¼ miles to traffic light, turn right, go ¼ mile on right, look for signs. Flea market, vendors, VE sessions (8:30 AM), ARRL forum (10 AM), foxhunt (11 AM), refreshments. *TI:* 147.255. *Adm:* $5, under 13 free. Tables: $15 (each table includes 1 admission ticket); outside flea market $2 per space plus admission ticket. Robert Blocher, N8JMV, 2061 St Rte 125, No 10, Amelia, OH 45102; 513-797-7252; **n8jmv@arrl.net**; **home.fuse.net/dom/**.

**†Maine (Hermon)—Jun 7**; set up 6:30 AM; public 8 AM to 1 PM. *Spr:* Pine State ARC. Hermon High School, Rte 2; I-95 to Exit 44 N to Rte 2, go W 1½ miles to High School. Dealers, VE sessions. *TI:* 146.94, 146.52. *Adm:* $5. Roger Dole, KA1TKS, Box 852, Bog Rd, Hermon, ME 04401; 207-848-3846; **rdole@hermon.net**; **www.n1me.com**.

**†Maryland (West Friendship)—May 25**, 8 AM to 2:30 PM. *Spr:* Maryland FM Assn. Howard County Fairgrounds, 2210 Fairgrounds Rd; take Exit 80 off I-70 to Rte 32, S to Rte 144, turn right, go W on Rte 144 approximately 1 mile to Fairgrounds. Tailgating ($5 per space). *TI:* 146.76, 224.76, 444.0. *Adm:* $5. Tables: advance $25, door $30. John Elgin, WA3MNN, c/o MFMA, Box 351, Hanover, MD 21076; 301-641-5313 (6-10 PM); **wa3mnn@arrl.net**.

**Massachusetts (Cambridge)—May 18.** Nick Altenbernd, KA1MQX, 617-253-3776.

**†Massachusetts (Whately)—May 12**, 5 PM to 9 PM. *Spr:* Franklin County ARC. Whately Elementary School Gymnasium and parking lot, 273 Long Plain Rd; I-91 to Exit 24, S on US 5 for 1.7 miles, turn left on Christian Ln, go 1.2 miles, take left onto Long Plain Rd, 0.7 miles to school on left. Flea market, tailgating, refreshments. *TI:* 146.985 (136.5 Hz). *Adm:* $3. Tables: $5. Walton Congdon, W1ZPB, 16 Warwick Rd, Northfield, MA 01360; 413-498-2729; **w1zpb@arrl.net**; **www.fcarc.org**.

**†Michigan (Chelsea)—Jun 1**, 8 AM to 3 PM. *Spr:* Chelsea ARC. Chelsea Fairgrounds, M52 and Old US 12; from I-94, take Exit 159 (this is M52), go N into Chelsea, turn W on Old US 12 at first traffic light to Fairgrounds. Good Old-Time Swap. *TI:* 145.45. *Adm:* advance $4, door $5. Tables: $10. Derek Sheehan, W7REX, 7515 Lake St, Dexter, MI 48130; 734-424-0130; **w7rex@arrl.net**.

**†Minnesota (Duluth)—May 3.** See "**Wisconsin (Superior)**."

**†Minnesota (St Paul)—Jun 7.** *Spr:* TwinsLan ARC. St Paul College parking lot, 235 Marshall Ave; I-94 into St Paul, S from Marion St Exit (241A), go around College, go W on Marshall Ave to Swapfest entrance. Tailgate Swapfest ($10 per space for sellers). *TI:* 146.76 (114.8 Hz). *Adm:* $6 (buyers). Steve Huntsman, KØSDH, 12013 Summerset Ln, Burnsville, MN 55337; 952-894-3341; **tailgate@twinslan.org**; **www.twinslan.org/tailgate.html**.

**†Mississippi (Pascagoula)—May 23-24**; set up Friday noon; public Friday 5-9 PM, Saturday 8 AM to 2 PM. *Spr:* Jackson County ARC. Jackson County Fairgrounds Civic Center, 2309 Shortcut Rd; Exit 69 off I-10, Hwy 63 S to Hwy 90, W to Singing River Hospital, turn right on Hospital Rd to Fairgrounds behind hospital. Hamfest/Computer Show, numerous dealers and vendors, VE sessions (Saturday, 9 AM; $10, bring picture ID, latest license and/or all applicable CSCEs and 1 copy of each; copies must be legible), forums (ARRL/MS Section, ARES/RACES, others), refreshments. *TI:* 145.11. *Adm:* $4, under 12 free ($10 max per family). Tables: $8 (8-ft; tables must be paid in advance to assure reserved space). Ira Groff, NN5AF, 17200 Spring Lake Dr W, Vancleave, MS 39565; 228-826-5095; **nn5af@arrl.net**; **www.angelfire.com/ms3/jcarc**.

**†Missouri (Macon)—Jun 7.** *Sprs:* Macon County, Nemo, Tri-County, and Schuyler County ARCs. Macon Vo-Tech School, Hwy 63 and Maffry St; 1 mile S of US Hwy 36, on US Hwy 63, turn on Maffry St, building on right. Forums, VE sessions. *TI:* 146.805. *Adm:* $3. Tables: $10. Dale Bagley, KØKY, 1402 Eastern Dr, Macon, MO 63552; 660-385-3629; **k0ky@arrl.org**; **www.qsl.net/n0pr/hamfest.html**.

**Nevada (Reno)—May 31**, EMCOMMWEST Convention. See "Coming Conventions."

**†New York (Bethpage)—Jun 8**; sellers 7:30 AM; buyers 8:30 AM. *Spr:* Long Island Mobile ARC. Briarcliff College, 1055 Stewart Ave; LIE to Exit 44S (Seaford-Oyster Bay Expressway-Rte 135), go S to Exit 9 (Broadway, Bethpage), turn right onto Broadway, bear right onto Cherry Ave, go past Bethpage High School, turn right at light onto Stewart Ave, go past flashing light, College on left. Outdoor Hamfair and Electronics Show, equipment dealers, computers, ARRL info, tailgate spaces ($15, bring your own table, chair, umbrella; each space admits 1 person), VHF tune-up clinic, free parking, refreshments. *TI:* 146.85 (136.5 Hz). *Adm:* $6, nonham sweethearts and under 12 accompanied by a paying adult free. Brian Gelber, WB2YMC, 46 Forest Dr, Plainview, NY 11803; 516-822-0673; **hamfest@limarc.org**; **www.limarc.org**.

**†New York (Queens)—Jun 1**, 9 AM to 2 PM. *Spr:* Hall of Science ARC. New York Hall of Science Museum Parking Lot, 47-01 111th St (Flushing Meadow Corona Park). Electronics and computer equipment, tailgating ($10 per space), VE sessions, tune-up clinic, free parking, refreshments. *TI:* 444.2 (136.5 Hz), 146.52. *Adm:* $5. Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Jackson Heights, NY 11372; 718-898-5599; **wb2kdg@arrl.net**; **www.qsl.net/hosarc**.

**North Carolina (Durham)—May 10.** Joseph Fields, KF4QYY, 919-596-3738.

**North Carolina (Greenville)—May 24.** Herman Schnur, K4CTG, 252-752-2264.

**†North Carolina (Winston-Salem)—Jun 7**, 6 AM to 1 PM. *Spr:* Forsyth ARC. Dixie Classic Fairgrounds, Coliseum Dr; I-40 to US 52 to Akron Dr; follow signs to Fairgrounds, enter Gate 5 off Deacon Blvd. Flea market, tailgating, VE sessions, camping. *TI:* 146.64, 145.47. *Adm:* $5. Tables: $15. Raymond Taber, KG4NTC, 165 Gloria Dr, Mt Airy, NC 27030; 336-786-8241 or 336-723-7388 (club); **wshamfest@yahoo.com**; **www.w4nc.com**.

**†Ohio (Dayton)—May 16-18**; Friday 8 AM to 6 PM, Saturday 8 AM to 5 PM, Sunday 8 AM to 1 PM. *Spr:* Dayton ARA. Hara Arena Complex, 1001 Shiloh Springs Rd. Hamvention's 2003 theme is "Year of the Youth," exhibitors and vendors showing their latest products and equipment, huge outside vending area, forums on all facets of

Amateur Radio, VE sessions (held within Hara Arena all three days, Technician through Extra class; reservations highly recommended, walk-ins accepted), Special Events Station. *TI:* 146.94, 146.91. *Adm:* advance $17, door $22, (good all 3 days); under 13 free. Jim Trangenstein, KB8OUO, c/o Dayton Hamvention, Box 964, Dayton, OH 45401; 937-276-6930; **info@hamvention.org**; **www.hamvention.org/**.

**†Ohio (Hilliard/Columbus)—May 25**; set up 7:30 AM; public 9 AM. *Spr:* Franklin County Hamfest Committee. Franklin County Fairgrounds, Columbia St; take the I-270 outerbelt to W side of Columbus, exit at Cemetery Rd (Hilliard), go 1.5 miles W on Cemetery Rd to Norwitch St, turn right (just before R/R overpass), go 0.5 mile N on Norwitch (look for Fairgrounds signs), turn right onto Columbia St, straight ahead to Fairgrounds entrance. Electronics flea market (buy, sell, trade), equipment, computers, antique radios, free parking. *TI:* 147.06 (94.8 Hz). *Adm:* $5. Tables: $5 (8-ft). Chris Lind, KC8BUO, Box 14281, Columbus, OH 43214; 614-267-7779; fax 614-263-7934; **clind2@juno.com**.

**†Ohio (Suffield)—Jun 8**; set up 7 AM; public 8 AM to 2 PM. *Spr:* Goodyear ARC. Goodyear Wingfoot Lake Park; from OH Rte 43, 1 mile S of OH Rte 224. Flea market, vendors. *TI:* 146.985. *Adm:* advance $4, door $5. Tables: $10. Rich Kuster, N8ZDQ, 1341 Whippoorwill Tr, Stow, OH 44224-2327; 330-688-3589; **RichJKuster@aol.com**.

**†Ohio (Wauseon)—Jun 8**, 8 AM to 1 PM. *Spr:* Fulton County ARC. Fulton County Sportsmen Club, County Rd 14, between County Rd H and State Rte 2; just 1.5 miles SE of the OH Turnpike Exit 34 (formerly Exit 3). Flea market, vendors, AR equipment, computers, software and supplies, outdoor trunk sales ($5 per space), VE sessions, overnight camping available, free parking. *TI:* 147.195. *Adm:* advance $4, door $5 (under 11 free with paying adult). Tables: $10. Angela Infante, KB2AVN, 7649 County Road L, Delta, OH 43515; 419-822-4382; **lindsay@powersupply.net** or **fcarc@hotmail.com**; **www.fcarc.8m.com**.

**†Pennsylvania (Butler/Pittsburgh)—Jun 1**, 8 AM to 3 PM. *Spr:* Breezeshooters ARC. Butler Farm Showgrounds, PA Rte 68, W of Butler. Hamfest/Computer Show, large indoor and outdoor flea market, computers, electronics, vendors, tailgating ($5 per vehicle space), VE sessions (noon, CB Ranger Bldg), plenty of free parking, handicapped parking, refreshments. *TI:* 147.36. *Adm:* $5. Tables: $20. Jack Stoner, K3JAS, 343 Woodberry Dr, Apollo, PA 15613; 724-845-8698; **k3jas@arrl.net**; **www.breezeshooters.net**.

**†Virginia (Manassas)—Jun 1**, 7 AM to 3 PM. *Spr:* Ole Virginia Hams ARC. Prince William County Fairgrounds, 10624 Dumfries Rd (Rte 234). 4th Call Area QSL Bureau Reps, DXCC QSL card checking, "Virginia QSO Party" Awards Ceremony, VE sessions. *TI:* 146.97, 224.66, 442.2. *Adm:* $6. Tables: $25 (includes electricity, chairs, and admission ticket). Jack McDermott, N4YIC, 7977 Deward Ct, Manassas, VA 20109-3120; 703-335-9139; fax 703-330-7987; **n4yic@arrl.net** or **patnjack@erols.com**; **www.qsl.net/olevahams**.

**†Wisconsin (Cedarburg)—May 3**, 8 AM to 1 PM. *Spr:* Ozaukee Radio Club. Circle B Recreation Center, 6261 Hwy 60; 10 miles W of I-43. 25th Annual Hamfest, VE sessions. *TI:* 146.97 (127.3 Hz). *Adm:* advance $4, door $5. Tables: $10 (8-ft). Vic Shier, KB9UKE, 702 S Silverbrook Dr, West Bend, WI 53095; 262-338-3227; **kb9uke@arrl.net**; **www.qsl.net/orc**.

**†Wisconsin (Superior)—May 3**; set up 7 AM; public 9 AM to 2 PM. *Spr:* Arrowhead RAC. Head of the Lakes Fairgrounds, Multi-Purpose Building, 4700 S Tower Ave; WI Hwy 35, next to Superior Airport. New and used radio and PC equipment, dealers, vendors, personalized ham items available, VE sessions (on site, 4-H Building; Doug Nelson, **aa0aw@chartermi.net**), RV parking ($10 with electricity, $5 without electricity), free parking, refreshments. *TI:* 146.94. *Adm:* $5, under 13 free. Tables: $10 (8-ft), $8 (6-ft), $5 (4-ft). Robert Schulz, KCØNFB, 115 Eden Ln, Duluth, MN 55805-1533; 218-724-6957; **arac_hamfest@charter.net**; **www.qsl.net/w0gkp**.

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# STRAYS

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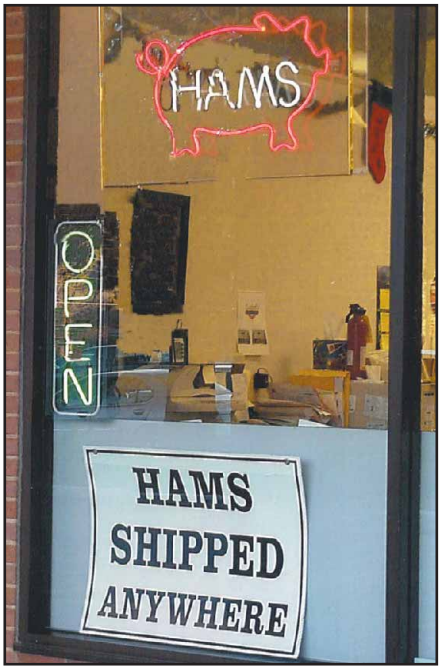


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N1TPA, Lawrence J. Boucher Jr, Easthampton, MA
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N2DLZ, Blanche Mannino, Palisades Park, NJ
KC2DYT, Marion Brown, Peekskill, NY
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KA4HSL, Allan L. Kamerow, Alexandria, VA
W4HUW, Max Silvers, Raleigh, NC
AB4KT, Jay Evin, Lake Worth, FL
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N7XCV, Chester J. Howarth, Spokane, WA
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W8DA, Ernest R. Longman, Hickory Corners, MI
N8DEF, Mark R. Humphreys, Grand Ledge, MI
N8DEH, Marilyn M. Humphreys, Grand Ledge, MI
KE8FI, Donald W. Kesselring, Moundville, WV
N8HBA, Donald E. Pomeroy, Millersburg, MI
W8KEV, Don D. Fetzer, Toledo, OH
N8MCB, Mark R. Hureski, Livonia, MI
WA8NED, Norman O. Weber, Tuppers Plains, OH
N8RCT, Allen Dill, Decatur, MI
N8RVG, Charles L. Conley II, Weslaco, TX
W8UFS, Nelson K. Hurst, Grand Rapids, MI
W8WRR, Howard W. Lorson Sr, Dover, OH
KC9DAU, Nyla R. Dossett, Alton, IL
KA9EFT, Arthur G. Fowler, Friendship, WI
WA9EWD, Bert E. Cadney, Hampshire, IL
K9IHV, Charles R. Sauer, Sun City, AZ
W9IIN, Sigmund Stryjewski, Bellwood, IL
W9IZO, Thomas R. Gettelman, Elm Grove, WI
WB9KOY, Michael J. Murphy, Oak Lawn, IL
W9NAX, Douglas R. Magill, Terrebonne, OR
WB9NJP, Donald L. Wilson, Owensville, IN
WA9OWK, Richard C. Mott, Arlington Heights, IL
N9QAH, Margaret J. Bouhl, Lake Geneva, WI
WA9VVY, Virgil L. Gochee, Shabbona, IL
WØDQM, Donald V. McClenny, Des Arc, AR
WØECD, Bill Bidwell, El Dorado, KS
KCØGGF, Tyler N. Trujillo, Fort Collins, CO
KØGWK, Robert E. Casey, Lancaster, CA
WØIQS, Robert C. Anderson, Hazelwood, MO
WØNV, Gerald Gray, Raytown, MO
WØOA, James D. Fahnestock, Evergreen, CO
WØOGR, Fred W. Haaland, South Saint Paul, MN
WØQYX, William H. Ebeltoft, Clearwater, FL
KBØUEN, Reinhard B. Michels, Laurel, NE
NØZRQ, Douglas A. Koontz, Kansas City, MO
PJ7EF, Erwin W. Ferrier, St Maarten, Netherlands Antilles
VE3RRU, Robby Robinson, Windsor, ON

*Life Member, ARRL
**Charter Life Member, ARRL
‡Call sign has been re-issued through the vanity call sign program.

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator ♦ n1gzo@arrl.org

# STRAYS

**I would like to get in touch with . . .**

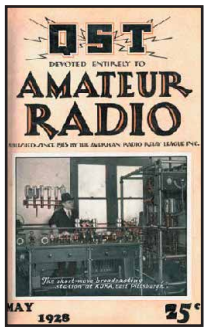
◊ anyone who can provide contact information for Irvine R. Miller, a high speed CW operator with the 145th AACS Squadron on Christmas Island in the South Pacific during WW II. I believe his home was Brooklyn, New York.—*Hulen F. Girdler, 1067 Somerset Rd, London, KY 40741*

TOM PARK, W7EGN


**It may look that way, but Jody Jackson, KD7TUE, and his father-in-law, Tom Park, W7EGN, are in actuality making final adjustments to a newly installed 80-meter horizontal loop in Victor, Montana. Jody (on the left) and his wife, Eileen, KD7TUF, received their licenses on Christmas eve. W7EGN was licensed a little earlier—in 1934.**

# 75, 50 AND 25 YEARS AGO

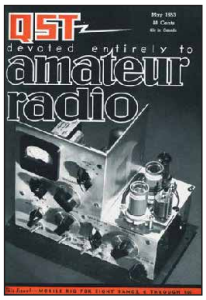
## May 1928




♦ The cover photo shows "the short-wave broadcasting station at KDKA, East Pittsburgh." The editorial continues to discuss the new radio regulations that will go into effect the first of the new year, addressing the need for accurate wave-meters.

*QST* Technical Editor Robert Kruse tells about "Getting Started at 30 Megacycles," while J. T. McCormick discusses "Ten Meters and the Ultraudion." "Recent Changes in Radio Law and Regulations" tells about the 10-meter band being opened, phone subbands being changed, and "amateurs" defined. The Old Man weighs in, with "Rotten DX" his topic of the moment. Paul Thomsen discusses "Amateur Television," that latest experiment mode being broadcast by General Electric in Schenectady, and how nearby hams can pick up the pictures. L. W. Hatry describes "Practical Audio Filters." "The Twin City Vigilance Committee," by Carleton Kohler, tells how interference to broadcast reception from ham signals in the Minneapolis and St Paul area became so bad that hams set about solving the problem—in order to avoid "silent hours" being imposed on their operation. A.R.R.L. President Hiram Percy Maxim weighs in on the problem of dyed-in-the-wool C.W. ops having disdain for amateur phone ops, in "Let's Be Tolerant." Atlantic Division Director Gene Woodruff, 8CMP, presents "A Combination Fieldmeter-Wavemeter-Voltmeter."

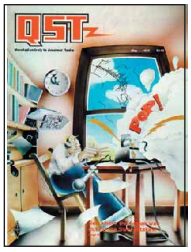
## May 1953




♦ The cover photo shows a small transmitter that W1JEQ built to produce 15 watts of phone and CW on 160 through 6 meter. The editorial retells the story of the Wouff Hong, recommended reading for hams of all ages and experience levels.

Vern Chambers, W1JEQ, describes the cover rig, "An Eight-Band Mobile Transmitter," which uses three 5763's as oscillator, multiplier, and final amplifier, and two dual triodes as the speech amplifier and modulator. George Grammer, W1DF, describes a "Class $AB_1$ Modulator for the Small Transmitter" that provides 40 watts of audio using a pair of 807's. Gus Treuke, W6DSR, tells how he built "A Single-Control Transmitter-Receiver" using a BC-453, in which the transmitter frequency tracks the receiver frequency as it is tuned along the band. Don Mix, W1TS, uses "Multiband Tuning for the 6146 Amplifier" in a compact and shielded transmitting unit that covers six bands. Jack Riggs, W7HAD, tells how he built a rotary beam with wire elements, in "Six Vertical Elements on 21 Mc." Roy Wolfskill, W2RPU, describes "A Hand-Carried Portable Rig for 220 Mc." G. Franklin Montgomery takes a look into a futuristic contesting station for Sweepstakes, in "The Man Who Broke the Bank" (this article is *absolutely* required reading!).

## May 1978




♦ The cover cartoon shows a ham being plagued by equipment failure, antenna tower collapse, etc—during the 44th Sweepstakes. The editorial, written by Dave Bell, W6AQ, is a modern fable, "The Fox Control Committee Boo-boos."

Bob Shriner, WAØUZO, describes "A Modular Control Unit—Just for Repeaters." Doug DeMaw, in Part 1 of "Transmitter Design—Emphasis on Anatomy," discusses whether it's best to duplicate a published circuit or to understand how a circuit works so you can design your own. Terrence Rogers, WA4BVY, describes his Doppler scanning antenna, in "A DoppleScAnt." In the "Product Review" column, the Bencher paddle is reviewed. Stephen Place, WB1EYI, tells how he presents "OSCAR in the Classroom." Steve also collaborates with Peter O'Dell, N1UM, to write about "Marconi Station Reborn on Cape Cod." That article tells how Whitey Doherty, K1VV, led the effort to operate a Special Event station, KM1CC, at the site of the original Marconi station (call sign CC). Casimir Harris, WB6HBI, urges hams to learn CPR, in "CPR—It's a Lifesaver!" In "Happenings," the announcement is made that 10-meter amplifiers are now banned by the FCC, because so many CBers use them on 11 meters. QST

Al Brogdon, W1AB ♦ Contributing Editor

## W1AW Schedule

| PACIFIC | MTN | CENT | EAST | MON | TUE | WED | THU | FRI |
|---|---|---|---|---|---|---|---|---|
| 6 AM | 7 AM | 8 AM | 9 AM | | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 7 AM-1 PM | 8 AM-2 PM | 9 AM-3 PM | 10 AM-4 PM | VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH) | | | | |
| 1 PM | 2 PM | 3 PM | 4 PM | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 2 PM | 3 PM | 4 PM | 5 PM | CODE BULLETIN | | | | |
| 3 PM | 4 PM | 5 PM | 6 PM | TELEPRINTER BULLETIN | | | | |
| 4 PM | 5 PM | 6 PM | 7 PM | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 5 PM | 6 PM | 7 PM | 8 PM | CODE BULLETIN | | | | |
| 6 PM | 7 PM | 8 PM | 9 PM | TELEPRINTER BULLETIN | | | | |
| $6^{45}$ PM | $7^{45}$ PM | $8^{45}$ PM | $9^{45}$ PM | VOICE BULLETIN | | | | |
| 7 PM | 8 PM | 9 PM | 10 PM | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 8 PM | 9 PM | 10 PM | 11 PM | CODE BULLETIN | | | | |

W1AW's schedule is at the same local time throughout the year. The schedule according to your local time will change if your local time does not have seasonal adjustments that are made at the same time as North American time changes between standard time and daylight time. From the first Sunday in April to the last Sunday in October, UTC = Eastern Time + 4 hours. For the rest of the year, UTC = Eastern Time + 5 hours.

♦ **Morse code transmissions:**
Frequencies are 1.818, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 wpm.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 wpm.

Code practice text is from the pages of *QST*. The source is given at the beginning of each practice session and alternate speeds within each session. For example, "Text is from July 2001 *QST*, pages 9 and 81," indicates that the plain text is from the article on page 9 and mixed number/letter groups are from page 81.

Code bulletins are sent at 18 wpm.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. See "Contest Corral" in this issue. At the beginning of each code practice session, the schedule for the next qualifying run is presented. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. The fee structure is $10 for a certificate, and $7.50 for endorsements.

♦ **Teleprinter transmissions:**
Frequencies are 3.625, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz. Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:**
Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Miscellanea:**
On Fridays, UTC, a DX bulletin replaces the regular bulletins.

W1AW is open to visitors from 10 AM until noon and from 1 PM until 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy.

In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

Headquarters and W1AW are closed on New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and the following Friday, and Christmas Day and the following day. QST

# CONTEST CORRAL

**W1AW Qualifying Runs** are 7 PM EDT Friday, May 2 (10-40 WPM), and 9 AM EDT Wednesday, May 21. The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, May 14. Check the W1AW Schedule elsewhere in this issue for details.

## Abbreviations

SO—Single-Op, M2—Multiop—2 Transmitters, MO—Multi-Op, MS—Multi-Op, Single Transmitter, MM—Multi-Op, Multiple Transmitters, AB—All Band, SB—Single Band, S/P/C—State/Province/DXCC Entity, HP—High Power, LP—Low Power, Entity—DXCC Entity, HP—High Power >150 W, LP—Low Power >5 W and <150 W, QRP is <5 W.

### May 3-4

**MARAC County Hunters Contest**—CW—sponsored by the Mobile Amateur Radio Awards Club from 0000Z May 3-2400Z May 4. Frequencies (MHz): 3.575, 7.050, 14.050, 21.050, 28.050, work fixed stations once/band and mobiles once for each county and band. Categories: Mobile, Portable, Fixed. Exchange: RST and county or SPC. County line QSOs count as one QSO but separate multipliers. QSO Points: Fixed stations in NA—1 point, Mobile/Portable—15 points, DX—5 pts, one station must be in a US county. Score is QSO Points × US counties (count only once). Mobile/Portables sum score from each state. For more information—**www.countyhunter.com**. Logs due June 10 to **w3dya@juno.com** or Norm Beavers, W3DYA, 3320 McMillan Dr, Tyler, TX 75701-8239.

**10-10 International Spring Contest**—CW—from 0001Z May 3-2400Z May 4, logs due May 19 (see Feb *QST*, p 112 or **www.ten-ten.org/**).

**Microwave Spring Sprint**, 0600-1300 local, May 3 (see **www.etdxa.org/vhf.htm**).

**Indiana QSO Party**—CW/SSB—sponsored by the Hoosier DX and Contest Club from 1300Z May 3-0500Z May 4. Frequencies (MHz): CW—1.805 and 40 kHz above the band edge on 80-10 meters, SSB—1.845, 3.850, 7.230, 14.250, 21.300, 28.450, try 160 at 0200 and 0400Z, no repeater or crossband QSOs. Categories: SOAB (HP, LP < 100 W, QRP < 5 W), MS (incl use of spotting assistance), Mobile (SO only). Exchange: RS(T) + S/P or IN county (DX stations send RS(T) only). QSO Points: SSB—1 pt, CW—2 pts, contact stations once per band/mode and once per county. Score is QSO Points × IN counties or S/P/C counted once per mode. For more information—**www.hdxcc.org/inqp/**. Logs due June 15 to **inqp@hdxcc.org** (Cabrillo format preferred) or HDXCC, c/o Mike Goode, N9NS, 10340 Broadway, Indianapolis, IN 46280-1344.

**ARI International DX Contest**—CW/SSB/Digital—sponsored by ARI from 2000Z May 3-1959Z May 4. Frequencies: CW/SSB—160-10 meters; Digital—80-10 meters, change bands or mode no more than once per 10 min. Categories: SO-CW, SO-SSB, SO-Digital, SO-Mixed, MS-Mixed, SO-SWL-Mixed. Exchange: RST and Italian Province or serial number. QSO Points: own country—0 pts (mult only), own continent—1 pt, different cont.—3 pts, Italian stations—10 pts. Score: QSO points × Italian Provinces + DXCC entity (except I, ISØ, IT9, IG9/IH9) counted once per band. For more information—**www.ari.it/contest.html.** Logs due June 4 (Cabrillo format is encouraged) to **aricontest@ari.it** (Cabrillo format is encouraged) or to ARI Contest Manager, I4UFH, Fabio Schettino, PO Box 1677, 40100 Bologna, Italy.

**New England QSO Party**—CW/Phone—2000Z May 3-0500Z May 4 and 1300Z-2400Z May 4. New England is ME, NH, VT, MA, CT and RI. Frequencies (MHz): CW—40 kHz above band edge; Novice/Tech—3.705, 7.130, 21.130, 28.130; SSB—3.880, 7.280, 14.280, 21.380, 28.130; no crossmode or crossband QSOs, all CW QSOs in CW band segments. Categories: SOAB (HP, LP, and QRP), MS (includes stations using any kind of spotting assistance), mobiles use same categories. Exchange: RS(T) and S/P (non-US/VE sends "DX") or NE county/state. Work stations once per band/mode and mobiles in each county. County lines logged as two QSOs. QSO Points: phone—1 pt, CW and Digital—2 pts. Score: Non-NE stations—QSO points × NE counties; NE stations—QSO points × S/P/C; mobiles total QSO points from all counties and count multipliers only once. For more information—**www.neqp.org**. Logs due 30 days after the contest to **logs@neqp.org** (Cabrillo format preferred) or NEQP, PO Box 3005, Framingham, MA 01705-3005.

### May 10-11

**Nevada QSO Party**—CW/SSB/RTTY—sponsored by the Frontier Amateur Radio Society from 0000Z May 10-0600Z May 11. Frequencies: 160-6 meters, CW 15 kHz and SSB 25 kHz above General class band edge. Exchange: RST and S/P/C or Nevada county. QSO Points: SSB—1 pt, CW/RTTY—2 pts. Score is QSO Points × Nevada counties or S/P/C counted only once. Logs due June 15 to **nw7o@arrl.net** or Jim Frye, NW7O, 4120 Oakhill Ave, Las Vegas, NV 89121-6319.

**Oregon QSO Party**—CW/SSB—sponsored by the Central Oregon DX Club from 1400Z May 10-0200Z May 11. Frequencies (MHz): 80-10 meters, CW—40 kHz above band edge, SSB—3.870, 7.270, 14.270, 21.370 and 28.470, no repeater QSOs. Exchange: RS(T) and OR county or S/P/C. QSO Points: SSB—1 pt, CW—2 pts. Score: QSO points × OR counties (OR stations add S/P/C), mults counted only once. One extra multiplier for every 8 QSOs with the same county. 100 bonus points for working K7O. For more information—**www.codxc.com**. Logs due June 10 to **k4xu@arrl.net** or to Oregon QSO Party, c/o CODXC, 19821 Ponderosa St, Bend, OR 97702.

**FISTS Spring Sprint**—CW—sponsored by the FISTS International CW Club from 1700Z-2100Z May 11 (see Feb *QST*, p 109, or **www.fists.org/sprints.html**).

**Alessandro Volta RTTY DX Contest**—sponsored by COMO and ARI from 1200Z May 10-1200Z May 11. Frequencies: 80-10 meters. Categories: SOAB, SOSB, MS, SWL. Exchange: RST, serial number, CQ Zone. QSO Points: see table on Web site. Score: QSO points × DXCC entities + W/VK/VE/JA/ZL call areas × Total QSOs. For more information—**www.contestvolta.com/**. Logs due July 31 to **log@contestvolta.com** or to Francesco Di Michele I2DMI, PO Box 55, I-22063 Cantu, Italy.

**CQ-M International DX Contest**—CW/SSB/SSTV–sponsored by the Krenkel Central Radio Club from 2100Z May 10-2100Z May 11. Frequencies: 160-10 meters including satellites, which count as a separate band; remain on a band for at least 10 min. Categories: SOSB (CW, SSB, Mixed, Satellites), SOAB (CW, SSB, Mixed, QRP must sign "/QRP"), MS-Mixed, SWL-Mixed, WW II Veteran, SSTV, Victory. Exchange: RS(T) and serial number. QSO Points: Using P-150-C award countries, own country—1 pt, same cont—2 pts, different cont—3 pts. Score: QSO points × countries counted once per band. For more information—**www.mai.ru/~crc/cq-m/cqmain_e.htm**. Logs due July 1 to **cqm@mail.ru** or to CQ-M Contest Committee, Krenkel Central Radio Club of Russia, PO Box 88, Moscow, 123459, Russia.

**50 MHz Spring Sprint**, sponsored by the Eastern Tennessee DX Association from 2300Z May 10-0300Z May 11 (see **www.etdxa.org/vhf.htm**).

### May 17-18

**His Majesty King of Spain Contest**—CW—sponsored by the Union de Radioaficionados Españoles (URE) from 1800Z May 17-1800Z May 18 (SSB is June 21-22). Frequencies: 160-10 meters using IARU Region 1 band plan. Categories: SOAB, SOSB and MS. Exchange: RST and serial number or EA province. QSO Points: 1 pt/QSO. Score: QSO points × EA provinces counted once per band. For more information, send e-mail to **ure@ure.es.** Logs due June 25 (SSB by July 30) to **ure@ure.es** or **ea5al@ure.es** or Vocalia Concursos URE, Apartado Postal 87, 12200 Onda, Castellon, Spain.

**US Counties QSO Party**—SSB—sponsored by The Mobile Amateur Radio Awards Club from 0000Z May 17-2400Z May 18. Frequencies (MHz): 3.880, 7.240, 14.275, 21.340, 28.340. Work fixed stations once/band and mobiles once for each county and band. Categories: Mobile, Fixed. Exchange: RST and county or S/P/C. County line QSOs count as one QSO but separate multipliers. QSO Points: US fixed stations—1 point, US mobile—15 points, all others—5 pts, one station must be in a US county. Score is QSO Points × US counties (counted only once). Mobiles sum score from each state. For more information—**www.stpaulisland.net/countycontest.html**. Logs due June 18 to (US logs) **d.e.traver@worldnet.att.net** or Duane Traver, WV2B, 99 Oregon Hill Rd, Lisle, NY 13797-1002; non-US logs to **snichols@mvosprey.com** or Scott Nichols, VE1OP, 387 Rudderham Rd, Point Edward, NS B2A 4V6, Canada.

### May 24-25

**CQ WW WPX Contest**—CW—sponsored by *CQ* Magazine from 0000Z May 24-2400Z May 25 (see Mar *QST*, p 97, or **home.who.rr.com/wpx/**).

**QRP ARCI Hootowl Sprint**—CW—sponsored by the QRP ARC International from 2000 local-2400 local May 25. For rules, see Dec 2002 *QST*, p 93, or **personal.palouse.net/rfoltz/arci/arcitst.htm**.

### May 26-27

**MI QRP Memorial Day CW Sprint**—sponsored by the MI QRP Club from 2300Z May 26 to 0300Z, May 27 (see Jan *QST*, p 97 or **www.qsl.net/miqrpclub/**).

### May 30-June 2

**Six Club WW Contest**—sponsored by the Six Club from 2300Z May 30-0200Z June 2. Frequencies: 6 meters. Exchange: 4-digit Grid Square and Six Club member number if available. QSO Points: own country—1 pt, other country—2 pts, add 1 pt if QSO with Six Club member. Score: QSO points × grids. For more information—**6mt.com/contest.htm**. Logs due June 30 to **w4wrl@aol.com** or Wayne Lewis W4WRL, Contest Director, 3338 South Cashua Dr, Florence, SC 29501-6306.

**Great Lakes QSO Party**—Phone/CW/RTTY/PSK31—sponsored by the Michigan DX Association, from 0000Z May 31-2359 June 1, SO stations work 36 hours max. Frequencies (MHz): 160-2 meters, no repeater or satellite, CW—3.560, 3.720, 7.090, 7.135, 14.075, Phone—3.870, 7.260, 14.270, 21.370, 28.450. Categories: A (>100 W), B (5-100 W), C (<5 W), D (Club and MO), E (CW only), F (Mobile), G (Digital, one of RTTY or PSK31). Great Lakes are MI, IL, IN, WI, MN, OH, PA, NY, VE2, VE3. Exchange: Name, S/P/C, Great Lakes stations also send county. QSO Points: Phone—1 pt, CW/Digital—2 pts, QRP or mobile—3 pts. Score: QSO Points × Great Lakes counties (counted only once). Bonus points: 500 pts for QSO with W8DXI (once only), mobiles add 100 pts for each county with at least 10 QSOs. For more information—**www.mdxa1.org/1aglqp.html**. Logs to **bripaw@yahoo. com** (Cabrillo format) or Brian Pawloski, W8BRI, PO Box 140012, Grand Rapids, MI 49514-0012.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

# SPECIAL EVENTS

**Aquinah, MA:** Fall River Amateur Radio Club, W1ACT. 1400Z **May 2**-1700Z **May 4**. 10th Annual Martha's Vineyard Gay Head Lighthouse DXpedition. 28.460 21.260 14.260 146.550. QSL. Roland Daignault, 19 Davis Rd, Westport, MA 02790.

**Smithfield, NC:** Triangle East Amateur Radio Association, WA4UQC. 1500-2300Z **May 3**-1500-2300Z **May 4**. "Ham" and Yam Festival. 14.250 7.250 3.875. Certificate. Holt Thornton, 1537 Colston Crossing, Zebulon, NC 27597-9549.

**Liberty, MS:** Southwest Mississippi ARC, KD5QNC. 1500Z-2200Z **May 3**. Liberty Heritage Days at the Ethel Vance Park. 14.270 7.270. QSL. KD5QNC, Southwest Mississippi ARC, 1545 Friendship Ln NW, Brookhaven, MS 39601.

**Louisville, KY:** Amateur Radio Transmitting Society, W4CN. 1100Z-1600Z **May 3**. Run For The Roses, the 129th Kentucky Derby. 7.200. Certificate. Shelby Summerville, K4WW, 6506 Lantana Ct, Louisville, KY 40229.

**Peekskill/Cortlandt, NY:** Peekskill/Cortlandt Amateur Radio Association, N2T. 1300Z-1900Z **May 3**. PCARA 3rd Anniversary Special Event Station. 28.350 21.350 14.280 7.240. Certificate. PCARA, PO Box 146, Crompond, NY 10517.

**Richmond, KY:** Eastern Amateur Radio Society, KE4YVD. 1600Z-2200Z **May 3**. At Fort Boonesborough—Discovery of Kentucky by Daniel Boone. 14.245 14.235 7.245 7.235. QSL. Eastern Amateur Radio Society, 156 Norton Dr, Richmond, KY 40475.

**Richmond, RI:** Pawtuxet Valley Amateur Radio Club, WA1USA. 1300Z-2100Z **May 3**. Scout Spring Camporee and Disaster Drill. 28.425 14.310 7.240. QSL. Ken Carr, KB1AWV, 19 Centennial St, Coventry, RI 02816.

**Springfield, OH:** Westcott Wireless Preservation Association, W8AGA. 1400Z-2200Z **May 3**. Frank Lloyd Wright's Westcott House/FLWBC meeting. 28.320 28.120 14.320 14.120. QSL. Matt Cline, KB8WFH, 825 S Tecumseh Rd, Springfield, OH 45506. **www.westcotthouse.org/w8aga**.

**Batesburg-Leesville, SC:** Ridge Amateur Radio Club, W4RRC. 1300Z-2200Z **May 10**. South Carolina Poultry Festival. 14.255; Gen 20 m phone. QSL. Clifton W. Gantt, W4CWG, 1254 Holly Ferry Rd, Leesville, SC 29070.

**Washington, DC:** Federal Bureau of Investigation ARA, K3FBI. 1300Z-2200Z **May 10**. Honoring National Police Week and the National Law Enforcement Memorial. 28.480 21.280 14.280 7.280. Certificate. Jay Chamberlain, AE4MK, 27 Fox Run Ln, Fredericksburg, VA 22405.

**Fairmont, WV:** Montaineer Amateur Radio Club, W8SP. 0000Z **May 10**-2400Z **May 11**. Commemorating the first official observance of Mother's Day at the International Mother's Day Shrine, Grafton, WV. Gen 80, 40, 20 15 m, Nov 10 m. Certificate. Charles T. McClain, K8UQY, Rte 4 Box 161, Grafton, WV 26354.

**Springfield, MO:** Southwest Missouri Amateur Radio Club, KØS. 1500Z **May 10**-2400Z **May 11**. Kurt Sterba Strange Antenna Challenge. 28.500. Certificate. SMARC, c/o KØS, PO Box 11363, Springfield, MO 65808. **www.leafwerks.net/n0ew/StrangeAntennas/k0s.html**.

**Sioux Falls, SD:** Sioux Empire ARC, WØZWY. 1400Z **May 16**-2200Z **May 17**. Space Day observation at Washington Science Pavillion. 14.250. Certificate. Will Gravning, Sioux Empire ARC, PO Box 91, Sioux Falls, SD 57101.

**Dayton, OH:** Centerville Amateur Radio Society, K2BSA. 1700Z **May 16**-1300Z **May 18**. Scouting's Celebration of 100 Years of Flight Camporee. 28.390 21.360 14.290 7.260. QSL. David G. Reichard, 9078 Mandel Dr, Centerville, OH 45458.

**Dayton, OH:** Dayton Amateur Radio Association, W8BI. 1300Z **May 16**-1700Z **May 18**. Dayton Hamvention Celebrating show no. 52 in 2003. 147.55 28.670 14.270 7.270. QSL. DARA W8BI, PO Box 44, Dayton, OH 45401.

**High Point, NJ:** Sussex County Amateur Radio Club, W2LV. 1200Z-2400Z **May 17**. The 25th anniversary of the Sussex County Amateur Radio Club. 28.370 21.370 14.270 7.270 50.170. QSL. Sussex County Amateur Radio Club, PO Box 11, Newton, NJ 07860.

**Wheaton, IL:** DuPage Amateur Radio Club, W9DUP. 1600Z-2300Z **May 17**. Commemorating Armed Forces Day. 145.25/144.65 28.400 14.290 7.250. Certificate. Robert B. Beatty, DuPage ARC, PO Box 71, Clarendon Hills, IL 60514.

**Chehalis, WA:** Chehalis Valley Amateur Radio Society, W7A. 1200Z **May 23**-0300Z **May 24**. 100th Anniversary of President McKinley's whistle stop. 28.500 21.250 14.250. QSL. W7A c/o Terry Neumann, PO Box 1324, Chehalis, WA 98532.

**Caldwell, NJ:** West Essex Amateur Radio Club, W2EF. 1400Z-1900Z **May 24**. Operating from President Grover Cleveland's birthplace. 28.350 21.330 14.250 7.250. Certificate. West Essex ARC, PO Box 54, Essex Fells, NJ 07021.

**Fort Wayne, IN:** Fort Wayne Radio Club, **May 24**-**May 26**. Memorial Day. Robert E. Hilton, N9SJV, 5809 Heatherview, Fort Wayne, IN 46818.

**Lancaster, TX:** Southwest Dallas County Amateur Radio Club, W5AUY. 1800Z-2200Z **May 24**. Live@Library! Celebrating Library's 2nd anniversary. 14.250. QSL. SWDCARC, PO Box 381023, Duncanville, TX 75138-1023.

**Monroe, LA:** Twin City Ham Club, W5EA. 1300Z-2200Z **May 24**. Memorial Day at the Avation Historical Museum of Louisiana. 28.400 21.350 14.250. QSL. Twin City Ham Club, PO Box 1871, West Monroe, LA 71291. **www.aresnela.org/specialevent.htm**.

**Vincennes, IN:** Old Post Amateur Radio Society, W9R. 1400Z-2000Z **May 24**. Celebration of the 25th Annual Vincennes Rendezvous. 7.260. Certificate. OPARS, PO Box 834, Vincennes, IN 47591.

**San Antonio, TX:** Alamo DX Amigos, W5BE. 0000Z **May 24**-2400Z **May 25**. 29th Anniversary of the Alamo DX Amigos ARC. 50.150 28.450 21.350 7.250. QSL. Don Hinte, KA5EYH, 12430 Cannonade, San Antonio, TX 78233. 5-band certificate available.

**Belleville, MI:** Yankee Air Force Museum, W8YAF. 1200Z-2000Z **May 26**. Observing Memorial Day at the Yankee Air Museum at Willow Run Airport. 7.270. Certificate. Frank A. Nagy, N8BIB, 24315 Waltz Rd, New Boston, MI 48164-9167.

**Fort Monmouth, NJ:** Robert D. Grant United Labor Amateur Radio Association, N2UL. 1200Z-2400Z **May 26**. Labor remembers those who made the supreme sacrifice. 28.420 21.360 14.260. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

**West Brookfield, MA:** Radio Operators for Missing Children, KB1HGK. 1500Z-2000Z **May 26**. 3rd Annual Missing Child Day Special Event. 21.325 14.250 7.225. Certificate. Sheree Greenwood, K1SQ, Radio Operators for Missing Children, PO Box 649, Warren, MA 01083. **www.lyceumpress.com/ham_radio.htm**.

**Baton Rouge, LA:** USS *Kidd* ARC/Baton Rouge ARC, W5KID. 1400Z-2200Z **May 30**. Memorial Day. General class bands, 14.250 to 14.320; CW QRP subbands. QSL. W5KID, c/o USS *Kidd* Museum, 305 S River Rd, Baton Rouge, LA 70802.

**Estes Park, CO:** HamCon Colorado, W1AW/Ø. 1800Z **May 30**-1800Z **Jun 1**. ARRL Rocky Mountain Division Convention 2003. 28.320 21.320 14.245 3.875. QSL. W1AW, 225 Main St, Newington, CT 06111.

**Windsor Locks, CT:** BEARS of Manchester, W2N. 1300Z-1900Z **May 31**. Dedicating the 58th Bomb Wing Hanger at the NE Air Museum. 21.362 14.262 14.052 7.052. QSL. Jonathan H. Allen, 33 Dogwood La, Ellington, CT 06029.

**Grosse Ile, MI:** Motor City Radio Club, W8MRM. 1400Z **May 31**-2100Z **Jun 1**. Annual Spring Island Fest, US Island #MI005R. 28.375 21.375 14.244 7.244. Certificate. MCRC, PO Box 337, Wyandotte, MI 48192. **www.w8mrm.org**.

**Newington, CT:** Newington Amateur Radio League, Inc, N1C. 1700Z **May 31**-2300Z **Jun 1**. Celebration of Annual NARL Hamfest. CW 28.030 21.030 14.030, phone 28.550 21.300 14.250. QSL. NARL, PO Box 31013, Newington, CT 06111.

**Certificates and QSL cards:** To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

**Special Events Announcements:** For items to be listed in this column, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form. Copies of this form are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). You can also submit your special event information on-line at **www. arrl.org/contests/spevform.html**. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **Jul** *QST* would have to be received by **May 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

# STRAYS

## OHIO BICENTENNIAL EVENTS

◊ The North East Ohio Bicentennial ARC, KO8HIO, in Stow, OH, will be hosting several bicentennial special events throughout the year. Watch for them on 28.485 14.200 7.285 and 7.035. For a QSL, send contact information to Anthony Luscre, K8ZT, 5441 Park Vista CT, Stow, OH 44224-1663. This year-long celebration will also include various awards for working KO8HIO and other Ohio stations and counties. For more information and specific event dates and times, go to **www.qsl.net/k8zt/ko8hio.html**. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

# Results, 2002 ARRL November CW Sweepstakes

By **Randall A. Thompson, K5ZD**
11 Hollis St, Uxbridge, MA 01569
**k5zd@contesting.com**

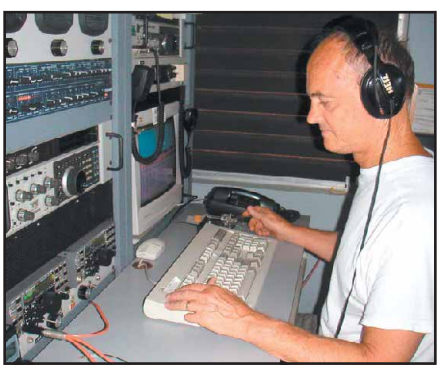
Listen carefully and you can hear the contest approaching. The sounds are brief. A string of dots, a continuous whistle, the signal strength rising and falling as the perfect match is sought—created by amplifiers, antenna tuners, and all manner of RF generators being tuned. Rapid-fire exchanges occur as stations confirm their readiness and say hello to friends. The CW seems to be at light speed, driven by the nervous energy of the operators.

For those who are fully prepared and ready, the clock slows to an imperceptible crawl. It seems the contest start time of 21Z will never come. Others, struggling with radio failures, antenna repairs, and software glitches, see time accelerating. In this strange world of pre-contest relativity, it is a race to see if everything will be ready in time.

Finally, there is only time to wait, a moment of calm before the storm of CW fills the bands. For radio amateurs across the United States and Canada, the weekend of November 2-3, 2002 was time to renew an enjoyable annual tradition of traffic handling, multiplier chasing, and competition in the 69th ARRL November Sweepstakes, CW.

There were 1319 official entries submitted. The log-checking database shows 2584 calls were active in the contest. With the top scorer only working 1468, there is plenty of opportunity for even bigger scores in the future.

What is the profile of a top SS player? A look at the Top Ten scorers in each single operator category gives some clues. Ages ranged from 33 to 64, implying a bit of experience is required. Occupations were varied, but with a strong bias toward the technical. There were engineers in everything from software development to television to mining. There was a physicist and a mathematician. Sprinkle in a few sales and marketing people. Some worked for the federal or state government. Others were teachers, professors, accountants, and investment advisors. NØKK had the best job, listing his occupation as husband and father. One thing we do know—they all share a competitive nature!



**Bob, N4BP, operated NP2B to second place overall in the Low Power category.**

## QRP Category

Measured in watts, it's a long way from 5 to 1500. But on an S-meter, it's only 25 dB or about 5 S-units—a welcome challenge for those who choose to enter the QRP category. After all, they argue, how much power do you really need to work across the country?

After years of high power Top Ten finishes from W5WMU, N6TR decided to "do something different" and see what could be done with 5 W plugged into some big antennas. The result was an amazing score and new all time record for the category. Tree made almost 1100 contacts and missed only VY1 to have the clean sweep. Despite giving up 25 dB in power, his score was only "1.3 dB" behind the top score in the contest!

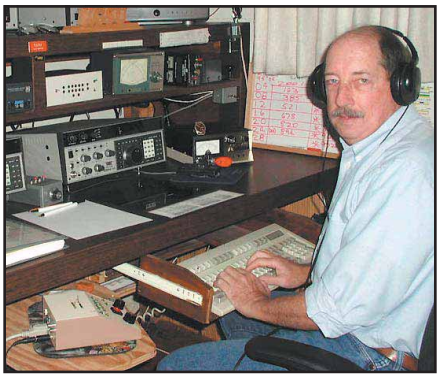
Despite a power failure with two hours to go, K7UP in New Mexico lead the rest of the QRP pack with a nice score that would have been a winner in many other years. John used a pair of Elecraft K2's and monoband Yagis to rack up his second place finish.

K4AO in Kentucky only operated 21 hours and missed 4 sections, but had enough contacts to take third place. Returning to the QRP Top Ten for the second year in a row, K7MM in Eastern Washington used just one radio to make 771 QSOs. He missed VY1 and nearby MT in his chase for the sweep.

Things tightened up for the rest of the QRP Top Ten with just 40 contacts separating the next 6 scores. KG5U in South Texas led the parade despite only operat-

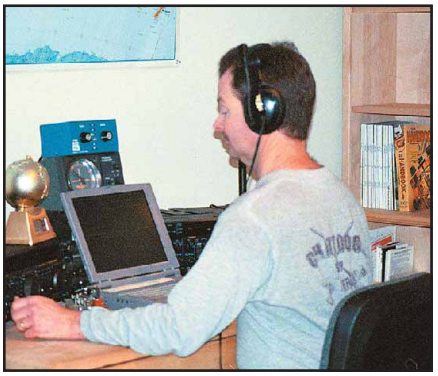
### 2002 CW Sweepstakes Sponsored Plaque Winners

| *Division* | *Plaque Category* | *Plaque Sponsor* | *Winner* |
|---|---|---|---|
| Overall | Single Operator High Power CW | Trey Garlough, N5KO | WP3R (KE3Q, op) |
| Overall | Single Operator Unlimited CW | Eric Hall, K9GY | K6LL |
| Overall | Multioperator CW | Terry Hackworth, K5HP | KØRF |
| Overall | School Club College Division CW | Mark Smith KD4JLC Memorial | W2CXM (N2YX, op) |
| Atlantic | Single Operator High Power CW | North Coast Contesters | K3MM |
| Atlantic | Single Operator Low Power CW | Potomac Valley Radio Club | K3WU |
| Atlantic | Multioperator CW | North Coast Contesters | WR3L |
| Central | Single Operator High Power CW | In Memory of Richard Harper, W9RW by SMC | N9RV |
| Central | Single Operator Low Power CW | In Memory of Mike Corke, N9AEJ by SMC | AG9A |
| Central | Single Operator Unlimited CW | In Memory of Robert Heytow, K9YA by SMC | K9NR |
| Central | Multioperator CW | Don Haney, W9WW | K9NS |
| Dakota | Single Operator High Power CW | Minnesota Wireless Association | WØSD (WDØT, op) |
| Dakota | Single Operator Low Power CW | Minnesota Wireless Association | NØAT (NØKK, op) |
| Dakota | Single Operator QRP CW | Tod Olson, KØTO | NØUR |
| Dakota | Single Unlimited CW | Minnesota Wireless Association | KTØR |
| Dakota | Multioperator CW | Minnesota Wireless Association | KØJE |
| Great Lakes | Single Operator High Power CW | North Coast Contesters | W5MX |
| Great Lakes | Single Operator Low Power CW | Mad River Radio Club | W8MJ |
| Hudson | Multioperator CW | Stuart Silverstein, K3UEI, Memorial | N2XI |
| Midwest | Single Operator Low Power CW | Society of Midwest Contesters | KØDI |
| Midwest | Multioperator CW | Lincoln Amateur Radio Club | KØWA |
| New England | Single Operator QRP CW | QRP Club of New England | K1TR |
| Pacific | Single Operator Low Power CW | Robert A. Wilson, N6TV | N6NF |
| Roanoke | Single Operator High Power CW | Potomac Valley Radio Club | N4AF |
| Roanoke | Single Operator Low Power CW | Raleigh Amateur Radio Society - W4DW | W4OC |
| Roanoke | Single Operator QRP CW | Bill Harding, K4AHK | K4MX |
| Roanoke | Multioperator CW | Tidewater Morse Code Society | K4IX |
| Southwestern | Single Operator Low Power CW | Larry Serra, N6NC | N7CW |
| Southwestern | Single Operator QRP CW | Ray and Donna Day, N6HE & N6HTH | N7IR |
| West Gulf | Single Operator High Power CW | Ken Adams, K5KA | N5RZ |
| Canada | Single Operator Low Power CW | Don Haney, W9WW | VE7CC |



**Dale, KG5U, an active QRP contester finished fifth nationally.**

**Dave, K6LL, at the controls during his victory in the Unlimited category.**



**Don, W4OC finished third overall in the Low Power category.**

ing 21 hours. Just 222 points back was W9WI from Tennessee. Next was N7IR in Arizona who had the QSOs, but missed 3 sections. K4RO was talked into going QRP by W4PA, and managed to finish eighth. Not bad for his first try at the category. NØUR in Minnesota and N2CU in Western New York finished out the box.

One place power does make a difference is in capturing those final sections for a clean sweep. Out of 200 QRP entrants, only K1AM and N9NE were able to pull it off.

## Low Power Category

Add another 12-15 dB or so and you reach the 150-W limit for the Low Power category. With 701 logs received, it was the most popular entry category by far.

Don, K4WX, returns to the Low Power category winner's circle with a solid 9000-point margin of victory. A veteran of many SS contests, you may remember Don under his previous calls of N4ZZ or K4PUZ. Don took advantage of the short skip on 20 meters to make over 600 QSOs on that band.

Recently retired, Bob, N4BP put on his traveling shoes to visit the Virgin Islands and borrow the station of NP2B. Bob used an Elecraft K2/100 and simple antennas to make nearly 1200 contacts. Just 13 contacts back in third is Don, W4OC, from South Carolina. A veteran of many Sweepstakes contests since his first in 1965, Don chose low power due to its requirement for "less complex station operation."

Fourth place went to perennial low power top ten resident KØEU in Colorado. Randy would have moved up a spot if he could have just found Newfoundland for the sweep.

Last year K7BG and KØEU battled for the category win. This year K7BG again came up just a bit short due to missing two sections. One of them was VY1JA who he heard, but never at a time when propagation was favorable.

Mark, AG9A, represented the Black Hole of the upper Midwest by finished sixth from Illinois. Operating from the station of K9RS, Mark really pounded 20 and 40 meters for most of his contacts. Next up, and leading a close pack of four, was NØAT in Minnesota operated by NØKK. Just two contacts back was K5WA in South Texas. Bob only operated 23 hours, so could have easily moved up a place or two with a bit more time in the chair. KØLUZ made his annual visit to N4WW to take ninth place. KØDI helped fulfill the demand for Nebraska to finish tenth.

## High Power

With another 10 dB, you join the ranks of the super heavyweights, the high power category. Not to say these guys are overweight, but they do have big signals.

KE3Q continued his string of victories from WP3R in Puerto Rico. He has now won four years in a row.

On another island far to the southwest, KH6ND was using the call KH7X from the station of KH7R. Mike was struggling with a different challenge. "Very tough to make it through this one after the death of close friend KL7Y just a few days beforehand. Dan was with me for the weekend, and helped me to press on during many difficult moments. His departure has left a big hole in the lives of those of us that knew him well." You honored him well OM with a second place finish over-

## Top Ten

### Single Operator, QRP

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| W5WMU (N6TR, op) | 173,168 | 1096 | 79 | 24 |
| K7UP | 137,144 | 868 | 79 | 24 |
| K4AO | 122,208 | 804 | 76 | 21 |
| K7MM | 120,276 | 771 | 78 | 24 |
| KG5U | 118,248 | 758 | 78 | 21 |
| W9WI | 118,026 | 747 | 79 | 20 |
| N7IR | 116,578 | 757 | 77 | 24 |
| K4RO | 116,288 | 736 | 79 | 22 |
| NØUR | 114,192 | 732 | 78 | 23 |
| N2CU | 113,444 | 718 | 79 | 24 |

### Single Operator, Low Power

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| K4WX | 199,200 | 1245 | 80 | 24 |
| NP2B (N4BP, op) | 190,240 | 1189 | 80 | 24 |
| W4OC | 188,160 | 1176 | 80 | 24 |
| KØEU | 186,756 | 1182 | 79 | 24 |
| K7BG | 183,924 | 1179 | 78 | 24 |
| AG9A | 180,000 | 1125 | 80 | 24 |
| NØAT (NØKK, op) | 174,080 | 1088 | 80 | 24 |
| K5WA | 173,760 | 1086 | 80 | 23 |
| N4WW (KØLUZ, op) | 173,120 | 1082 | 80 | 24 |
| KØDI | 171,520 | 1072 | 80 | 24 |

### Single Operator, High Power

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| WP3R (KE3Q, op) | 234,880 | 1468 | 80 | 24 |
| KH7X (KH6ND, op) | 225,280 | 1408 | 80 | 24 |
| N2IC | 223,200 | 1395 | 80 | 24 |
| N5RZ | 220,640 | 1379 | 80 | 24 |
| WØSD (WDØT, op) | 218,400 | 1365 | 80 | 24 |
| K6LA | 216,160 | 1351 | 80 | 24 |
| W4PA | 215,680 | 1348 | 80 | 24 |
| WXØB (K5GA, op) | 214,720 | 1342 | 80 | 24 |
| W6EEN (N6RT, op) | 213,600 | 1335 | 80 | 24 |
| N9RV | 212,960 | 1331 | 80 | 24 |

### Single Operator, Unlimited

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| K6LL | 216,800 | 1355 | 80 | 24 |
| K6XX | 194,880 | 1218 | 80 | 23 |
| W4MR (AA4NC, op) | 193,280 | 1208 | 80 | 24 |
| KD4D | 176,960 | 1106 | 80 | 24 |
| WA6O | 170,400 | 1065 | 80 | 24 |
| K7OX | 168,800 | 1055 | 80 | 24 |
| N5NA | 166,400 | 1040 | 80 | 22 |
| N2WW | 162,266 | 1027 | 79 | 24 |
| N2MM | 162,240 | 1014 | 80 | 24 |
| K9NR | 152,960 | 956 | 80 | 24 |

### Multi-Operator

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| KØRF | 217,120 | 1357 | 80 | 24 |
| K6AM | 213,280 | 1333 | 80 | 24 |
| N6VR | 212,320 | 1327 | 80 | 24 |
| K9NS | 211,040 | 1319 | 80 | 24 |
| W6YX | 210,240 | 1314 | 80 | 24 |
| K8CC | 192,640 | 1204 | 80 | 24 |
| W5TM | 182,332 | 1154 | 79 | 24 |
| WR3L | 181,920 | 1137 | 80 | 24 |
| KØWA | 181,858 | 1151 | 79 | 24 |
| W7CT | 178,880 | 1118 | 80 | 24 |

### School Club

| | | QSOs | Mults | Hrs |
|---|---|---|---|---|
| W2CXM (N2YX, op) | 117,552 | 744 | 79 | 21 |
| WA5BU (K5LH,op) | 108,878 | 707 | 77 | 20 |
| K2CC (KC2BMG, op) | 46,620 | 333 | 70 | 9 |
| WF4DD | 12,084 | 114 | 53 | 5 |

## Top Five

Boxes list call sign, score and class (Q = QRP, A = Low Power, B = High Power, U = Unlimited, M = Multioperator)

| Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections) | | | Southeast Region (Delta, Roanoke and Southeastern Divisions) | | | Central Region (Central and Great Lakes Divisions; Ontario Section) | | | Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections) | | | West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT/Yukon Sections) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N2NT (N2NC, op) | 212,194 | B | WP3R (KE3Q, op) | 234,880 | B | N9RV | 212,960 | B | N2IC | 223,200 | B | KH7X (KH6ND, op) | 225,280 | B |
| K5ZD | 211,720 | B | W4PA | 215,680 | B | W9RE | 201,760 | B | N5RZ | 220,640 | B | K6LA | 216,160 | B |
| W2RQ | 192,640 | B | W4AN | 207,840 | B | K9DX | 186,720 | B | WØSD (WDØT, op) | 218,400 | B | W6EEN (N6RT, op) | 213,600 | B |
| K3MM | 189,916 | B | (K4BAI, op) | | | W5MX | 183,680 | B | WXØB (K5GA, op) | 214,720 | B | K6KM (N6TV, op) | 203,188 | B |
| AA3B | 186,880 | B | WP2Z (K9TM, op) | 206,400 | B | KE9I | 183,520 | B | WBØO | 212,000 | B | N6RO | 202,720 | B |
| | | | N4AF | 198,606 | B | | | | | | | | | |
| K3WU | 157,368 | A | K4WX | 199,200 | A | AG9A | 180,000 | A | KØEU | 186,756 | A | K7BG | 183,924 | A |
| NY3A | 155,472 | A | NP2B (N4BP, op) | 190,240 | A | W8MJ | 163,214 | A | NØAT (NØKK, op) | 174,080 | A | VE7CC | 166,080 | A |
| K1HT | 150,720 | A | | | | N9CK | 159,580 | A | K5WA | 173,760 | A | N7CW | 163,200 | A |
| W2TZ | 147,730 | A | W4OC | 188,160 | A | VE3DZ | 156,160 | A | KØDI | 171,520 | A | K4XU | 163,200 | A |
| K1VUT | 146,940 | A | N4WW (KØLUZ, op) | 173,120 | A | K8BL | 153,760 | A | KØSR | 170,976 | A | N6NF | 158,158 | A |
| | | | NA4K | 169,376 | A | | | | | | | | | |
| N2CU | 113,444 | Q | W5WMU (N6TR, op) | 173,168 | Q | K4AO | 122,208 | Q | K7UP | 137,144 | Q | K7MM | 120,276 | Q |
| K1TR | 110,760 | Q | | | | N9NE | 98,880 | Q | KG5U | 118,248 | Q | N7IR | 116,578 | Q |
| K1AM | 106,560 | Q | W9WI | 118,026 | Q | N9CIQ | 88,312 | Q | NØUR | 114,192 | Q | N7OU | 110,880 | Q |
| K3TEJ | 99,022 | Q | K4RO | 116,288 | Q | VE3XAX | 88,296 | Q | K5WO | 109,186 | Q | W6JTI | 110,126 | Q |
| K3AJ | 78,292 | Q | K4MX | 95,942 | Q | K8SB | 77,844 | Q | KØRI | 103,272 | Q | W6IO | 68,068 | Q |
| | | | W2CS | 93,024 | Q | | | | | | | | | |
| KD4D | 176,960 | U | W4MR (AA4NC, op) | 193,280 | U | K9NR | 152,960 | U | N5NA | 166,400 | U | K6LL | 216,800 | U |
| N2MM | 162,240 | U | | | | KI9A | 150,240 | U | N2WW | 162,266 | U | K6XX | 194,880 | U |
| VE1OP | 143,148 | U | W4MYA | 152,800 | U | K9MOT (N9EP, op) | 149,760 | U | W7UT | 146,720 | U | WA6O | 170,400 | U |
| K2FU | 135,722 | U | W4NF | 152,312 | U | | | | K5HP | 135,680 | U | K7OX | 168,800 | U |
| AA2EQ | 133,036 | U | KO7X | 146,080 | U | N8BJQ | 148,000 | U | N5YA (N5UM, op) | 134,880 | U | AD6E | 108,960 | U |
| | | | W4ZW | 123,040 | U | W9SN | 130,880 | U | | | | | | |
| WR3L | 181,920 | M | W5DDX | 125,580 | M | K9NS | 211,040 | M | KØRF | 217,120 | M | K6AM | 213,280 | M |
| N2XI | 127,520 | M | K4IX | 112,800 | M | K8CC | 192,640 | M | W5TM | 182,332 | M | N6VR | 212,320 | M |
| NK1L | 97,812 | M | W4ZYT | 96,160 | M | N4GN | 162,080 | M | KØWA | 181,858 | M | W6YX | 210,240 | M |
| K2NNY | 70,200 | M | W8OP | 64,834 | M | W8FT | 149,942 | M | W7CT | 178,880 | M | K7IR | 171,840 | M |
| N2POS | 52,704 | M | K4AJX | 56,250 | M | K8JM | 148,836 | M | KBØVVT | 158,880 | M | W6UT | 123,556 | M |

## Division Leaders

**Single Operator High Power**

| | | |
|---|---|---|
| Atlantic | K3MM | 189,916 |
| Central | N9RV | 212,960 |
| Dakota | WØSD (WDØT, op) | 218,400 |
| Delta | W4PA | 215,680 |
| Great Lakes | W5MX | 183,680 |
| Hudson | N2NT (N2NC, op) | 212,194 |
| Midwest | KØOU | 170,080 |
| New England | K5ZD | 211,720 |
| Northwestern | K7MI | 186,400 |
| Pacific | KH7X (KH6ND, op) | 225,280 |
| Roanoke | N4AF | 198,606 |
| Rocky Mountain | N2IC | 223,200 |
| Southeastern | WP3R (KE3Q, op) | 234,880 |
| Southwestern | K6LA | 216,160 |
| West Gulf | N5RZ | 220,640 |
| Canada | VE6JY (VA6WGO, op) | 131,140 |

**Single Operator Low Power**

| | | |
|---|---|---|
| Atlantic | K3WU | 157,368 |
| Central | AG9A | 180,000 |
| Dakota | NØAT (NØKK, op) | 174,080 |
| Delta | K4WX | 199,200 |
| Great Lakes | W8MJ | 163,214 |
| Hudson | N2GA | 134,616 |
| Midwest | KØDI | 171,520 |
| New England | K1HT | 150,720 |
| Northwestern | K7BG | 183,924 |
| Pacific | N6NF | 158,158 |
| Roanoke | W4OC | 188,160 |
| Rocky Mountain | KØEU | 186,756 |
| Southeastern | NP2B (N4BP, op) | 190,240 |
| Southwestern | N7CW | 163,200 |
| West Gulf | K5WA | 173,760 |
| Canada | VE7CC | 166,080 |

**Single Operator QRP**

| | | |
|---|---|---|
| Atlantic | N2CU | 113,444 |
| Central | N9NE | 98,880 |
| Dakota | NØUR | 114,192 |
| Delta | W5WMU (N6TR, op) | 173,168 |
| Great Lakes | K4AO | 122,208 |
| Hudson | K2UY | 48,576 |
| Midwest | NØSS | 94,556 |
| New England | K1TR | 110,760 |
| Northwestern | K7MM | 120,276 |
| Pacific | W6JTI | 110,126 |
| Roanoke | K4MX | 95,942 |
| Rocky Mountain | K7UP | 137,144 |
| Southeastern | W4DEC | 67,792 |
| Southwestern | N7IR | 116,578 |
| West Gulf | KG5U | 118,248 |
| Canada | VE3XAX | 88,296 |

**Single Operator Unlimited**

| | | |
|---|---|---|
| Atlantic | KD4D | 176,960 |
| Central | K9NR | 152,960 |
| Dakota | KTØR | 133,036 |
| Great Lakes | N8BJQ | 148,000 |
| Hudson | W2GDJ | 98,080 |
| Midwest | NUØQ | 53,088 |
| New England | W1TO | 69,888 |
| Northwestern | K7OX | 168,800 |
| Pacific | K6XX | 194,880 |
| Roanoke | W4MR (AA4NC, op) | 193,280 |
| Rocky Mountain | N2WW | 162,266 |
| Southeastern | W4ZW | 123,040 |
| Southwestern | K6LL | 216,800 |
| West Gulf | N5NA | 166,400 |
| Canada | VE1OP | 143,148 |

**Multioperator**

| | | |
|---|---|---|
| Atlantic | WR3L | 181,920 |
| Central | K9NS | 211,040 |
| Dakota | KØJE | 54,760 |
| Delta | W5DDX | 125,580 |
| Great Lakes | K8CC | 192,640 |
| Hudson | N2XI | 127,520 |
| Midwest | KØWA | 181,858 |
| New England | NK1L | 97,812 |
| Northwestern | K7IR | 171,840 |
| Pacific | W6YX | 210,240 |
| Roanoke | K4IX | 112,800 |
| Rocky Mountain | KØRF | 217,120 |
| Southeastern | K4AJX | 56,250 |
| Southwestern | K6AM | 213,280 |
| West Gulf | W5TM | 182,332 |
| Canada | VE6AO | 47,570 |

**School Clubs**

| | | |
|---|---|---|
| Atlantic | W2CXM (N2YX, op) | 117,552 |
| Roanoke | WF4DD | 12,084 |
| West Gulf | WA5BU (K5LH,op) | 108,878 |

all and new Pacific Division record.

In third place, just 13 contacts behind, was N2IC in Colorado. This was Steve's last SS CW from Colorado as he packs his station up for a move to New Mexico, but it probably won't be his last visit to the Top Ten. A few hundred miles south, N5RZ handed out West Texas to everyone he could find to take fourth place. Ralph added a 40 meter beam to his station and moved up from seventh place in 2001. WDØT again operated from WØSD in South Dakota to also move up a few places from last year.

Just 20 contacts separated the second half of the Top Ten. K6LA turned in an excellent effort to win West Coast honors and take sixth place. "My goal has always been to make the top ten in high power. With the high bands looking good, I thought this might be the year." It was!

After winning the QRP category for the past four years, Scott, W4PA, decided to move up a few dB and enter the high power race. It paid off as he drove the K4JNY station in Tennessee to seventh place, just 3 contacts behind K6LA. K5GA managed to operate the full 24 hours this year from WXØB in North Texas to finish eighth. N6RT pushed the big station of W6EEN to ninth.

In 2000, N9RV finished 12th overall. In 2001, Pat moved up to number 11. This year he made it to number 10, a fantastic accomplishment from the Midwest. After falling behind on Saturday, Pat had a big day on Sunday to move up against the competition. As with others in the middle of the country, it was the short skip on 20

### The Value of Accuracy

It is generally agreed that the goal of a contest is to test and measure each competitor's ability to correctly exchange information with others. It is the need to verify the information exchange that requires us to submit logs as part of our entry.

The tables below provide some insight into the log checking results as they applied to members of the Top Ten in each category. A few terms are necessary to help understand the tables:

**Raw Qs**: The number of contacts found in the log submitted by the entrant.

**Dupe:** Contacts that are found as duplicates in the log. There is no penalty for duplicate contacts.

**Bust**: Contacts where some element of the exchange was copied incorrectly. Busted contacts result in loss of that QSO.

**Pnlty**: Number of contacts where the callsign was copied incorrectly or the contact could not be found in the other station's log. The result is loss of that QSO plus one penalty QSO.

**%Bad**: The percentage of contacts that were busted in this log.

**Time**: The number of minutes of operating time calculated from the log. 1440 minutes is the maximum allowed and any contacts logged after that amount of time are removed from the final score.

You can view your own log checking results by visiting **www.arrl.org/members-only/contests/lcr.html** in the member's only area of the ARRL Web site.

**High Power Category**

| Call | Raw Qs | Dupe | Bust | Pnlty | Mlt | Score | %Bad | Time |
|---|---|---|---|---|---|---|---|---|
| WP3R (KE3Q, op) | 1538 | 27 | 38 | 5 | 80 | 234,880 | 2.5 | 1437 |
| KH7X (KH6ND, op) | 1448 | 7 | 27 | 6 | 80 | 225,280 | 1.9 | 1434 |
| N2IC | 1419 | 0 | 21 | 3 | 80 | 223,200 | 1.5 | 1434 |
| N5RZ | 1417 | 3 | 28 | 4 | 80 | 220,640 | 2.0 | 1444 |
| W0SD (WD0T, op) | 1421 | 3 | 41 | 14 | 80 | 218,080 | 2.9 | 1420 |
| K6LA | 1380 | 13 | 15 | 2 | 80 | 215,840 | 1.1 | 1441 |
| W4PA | 1377 | 0 | 26 | 3 | 80 | 215,680 | 1.9 | 1437 |
| WX0B (K5GA, op) | 1359 | 2 | 12 | 3 | 80 | 214,720 | 0.9 | 1431 |
| W6EEN (N6RT, op) | 1349 | 0 | 12 | 2 | 80 | 213,600 | 0.9 | 1437 |
| N9RV | 1363 | 0 | 18 | 7 | 80 | 212,960 | 1.3 | 1445 |

**Low Power Category**

| Call | Raw Qs | Dupe | Bust | Pnlty | Mlt | Score | %Bad | Time |
|---|---|---|---|---|---|---|---|---|
| K4WX | 1260 | 0 | 12 | 3 | 80 | 199,200 | 1.0 | 1428 |
| NP2B (N4BP, op) | 1199 | 1 | 7 | 2 | 80 | 190,240 | 0.6 | 1440 |
| W4OC | 1221 | 3 | 34 | 6 | 80 | 188,160 | 2.8 | 1441 |
| K0EU | 1219 | 3 | 28 | 6 | 79 | 186,756 | 2.3 | 1439 |
| K7BG | 1215 | 11 | 17 | 8 | 78 | 183,924 | 1.4 | 1440 |
| AG9A | 1142 | 1 | 13 | 3 | 80 | 180,000 | 1.1 | 1429 |
| K5WA | 1115 | 10 | 16 | 3 | 80 | 173,760 | 1.4 | 1366 |
| N0AT (N0KK, op) | 1108 | 1 | 18 | 5 | 80 | 173,440 | 1.6 | 1432 |
| N4WW (K0LUZ, op) | 1146 | 6 | 48 | 10 | 80 | 173,120 | 4.2 | 1436 |
| K0DI | 1090 | 4 | 13 | 1 | 80 | 171,520 | 1.2 | 1432 |

**QRP Category**

| Call | Raw Qs | Dupe | Bust | Pnlty | Mlt | Score | %Bad | Time |
|---|---|---|---|---|---|---|---|---|
| W5WMU (N6TR, op) | 1105 | 1 | 6 | 2 | 79 | 173,168 | 0.5 | 1432 |
| K7UP | 881 | 0 | 10 | 3 | 79 | 137,144 | 1.1 | 1435 |
| K4AO | 814 | 0 | 9 | 1 | 76 | 122,208 | 1.1 | 1283 |
| K7MM | 793 | 6 | 13 | 3 | 78 | 120,276 | 1.7 | 1431 |
| KG5U | 772 | 0 | 10 | 4 | 78 | 118,248 | 1.3 | 1257 |
| W9WI | 761 | 0 | 10 | 4 | 79 | 118,026 | 1.3 | 1171 |
| N7IR | 765 | 0 | 7 | 1 | 77 | 116,578 | 0.9 | 1438 |
| K4RO | 771 | 5 | 22 | 8 | 79 | 116,288 | 2.9 | 1318 |
| N0UR | 752 | 0 | 14 | 6 | 78 | 114,192 | 1.9 | 1409 |
| N2CU | 725 | 0 | 4 | 3 | 79 | 113,444 | 0.6 | 1435 |

**Unlimited Category**

| Call | Raw Qs | Dupe | Bust | Pnlty | Mlt | Score | %Bad | Time |
|---|---|---|---|---|---|---|---|---|
| K6LL | 1376 | 2 | 14 | 2 | 80 | 216,800 | 1.0 | 1445 |
| K6XX | 1281 | 21 | 36 | 6 | 80 | 194,880 | 2.9 | 1401 |
| W4MR (AA4NC, op) | 1249 | 5 | 30 | 5 | 80 | 193,280 | 2.4 | 1441 |
| KD4D | 1145 | 26 | 10 | 3 | 80 | 176,960 | 0.9 | 1437 |
| WA6O | 1128 | 14 | 39 | 7 | 80 | 170,400 | 3.5 | 1444 |
| K7OX | 1136 | 9 | 50 | 22 | 80 | 168,800 | 4.4 | 1435 |
| N5NA | 1060 | 0 | 18 | 2 | 80 | 166,400 | 1.7 | 1324 |
| N2WW | 1103 | 4 | 64 | 7 | 79 | 162,266 | 5.8 | 1441 |
| N2MM | 1088 | 0 | 63 | 11 | 80 | 162,240 | 5.8 | 1434 |
| K9NR | 1033 | 4 | 61 | 12 | 80 | 152,960 | 5.9 | 1419 |

**Multioperator Category**

| Call | Raw Qs | Dupe | Bust | Pnlty | Mlt | Score | %Bad | Time |
|---|---|---|---|---|---|---|---|---|
| K0RF | 1400 | 11 | 30 | 2 | 80 | 217,120 | 2.2 | 1430 |
| K6AM | 1374 | 2 | 36 | 3 | 80 | 213,280 | 2.6 | 1439 |
| N6VR | 1396 | 4 | 58 | 7 | 80 | 212,320 | 4.2 | 1433 |
| K9NS | 1418 | 20 | 71 | 4 | 80 | 211,040 | 5.1 | 1445 |
| W6YX | 1366 | 23 | 25 | 4 | 80 | 210,240 | 1.9 | 1439 |
| K8CC | 1246 | 2 | 36 | 4 | 80 | 192,640 | 2.9 | 1439 |
| W5TM | 1210 | 0 | 47 | 9 | 79 | 182,332 | 3.9 | 1436 |
| WR3L | 1198 | 0 | 51 | 10 | 80 | 181,920 | 4.3 | 1437 |
| K0WA | 1235 | 6 | 65 | 13 | 79 | 181,858 | 5.3 | 1435 |
| W7CT | 1175 | 10 | 41 | 6 | 80 | 178,880 | 3.5 | 1439 |

meters that made the difference.

Pat had a little luck as well. N2NC and K5ZD both had enough QSOs to make the Top Ten, but each missed NL for the sweep.

### Unlimited Category

The Single Operator Unlimited category continues to grow with 140 logs submitted this year. It is the category of choice for operators who want to use packet to search out new contacts and make sure they get the sweep.

K6LL operated his modest single-tower station in Arizona to a dominating victory and a new all time category record score.

K6XX moved up from fifth place last year to take second spot this time. Only 10 contacts behind, AA4NC operated W4MR to extend his Southeast Division record. KD4D used the impressive antenna system at N3HBX in Maryland to take fourth. WA6O just got by K7OX for fifth.

### Expanded Results, Line Score Printouts Available

For complete contest results on-line, please visit **www.arrl.org/contest.results/**. ARRL members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

### Multioperator Categories

KØRF and operating partner WØUA won the multioperator category for the second year in a row. Chuck was frustrated with their start; "We had about 100 computer crashes and took ½ hour off time in the first 3 hours because of crashes." He credited George with keeping them going, "We were 100 QSOs behind the pack. George did an outstanding job on 40 to bring us back to respectable."

The battle for second place was between two California stations. K6AM, operating from W6KP, managed a 6 contact lead over N6VR. K6AM summarized their effort, "Great conditions from the West Coast this year. Everything worked great. No computer crashes." Only 8 contacts back, the multiop powerhouse at K9NS achieved another Top Ten result. The Stanford University club station, W6YX, was a close fifth.

The next running of the Sweepstakes CW will be the weekend of November 1-2, 2003. Be there and bring a friend! QST

# ARRL Field Day Announcement

**1800 UTC June 28, 2003 - 2100 UTC June 29, 2003**

***How to obtain full information:*** The full Field Day rules and information packet may be downloaded at **www.arrl.org/contests/forms**. You may also request the full packet by sending an SASE with 4 units of postage to Field Day Packet Request, ARRL, 225 Main St., Newington, CT 06111.

***What is Field Day?*** Field Day is an operating event designed to test emergency preparedness in less than optimal conditions. It is the largest on-the-air operating event sponsored by the ARRL. Field Day gives both experienced operators and neophytes a chance to share ideas and new experiences. Each year tens of thousands of amateurs and guests join in the excitement and camaraderie.

***How to participate***: There are six operating categories for Field Day. Class A is made up of any group or club of at least three persons which operate "in the field" away from a normal station location. Class B is for one or two person operations also operating away from a traditional station location. Class C is for Mobile stations. Class D is for home stations operating on commercial power. Class E is for home stations operating on emergency power. Class F is for stations operating from an established Emergency Operations Center.

***What to say:*** All stations will exchange the number of transmitters they have in simultaneous operation, their entry category, and their ARRL / RAC Section. For example, a station in West Texas operating as Class A with 3 transmitters would send the exchange *3A West Texas*. DX stations will use the term DX in lieu of an ARRL/RAC section designator.

***Quirks:*** Stations that begin setting up their Field Day operation before 1800 UTC Saturday may operate only 24 consecutive hours. Stations that do not begin set up until 1800 UTC Saturday may operate the full Field Day time period.

***Rules changes this year:*** The biggest addition is the new Class F category. Be sure to read the special FAQ Sheet on Class F stations included in the 2003 Field Day packet if your group is considering trying a Class F operation. Also, the number of QSOs that must be completed by the GOTA station in order to claim the additional 100-point bonus has dropped from 400 QSOs to 100. Finally your group may claim a 100-point bonus if visited by an invited elected governmental official and a second 100-point bonus if visited by an invited representative of a served agency.

***Best reason to participate:*** Field Day is FUN! Whether you are a hard-core contester, someone who likes to build antennas, a casual operator, or someone just curious about the hobby, there are enough things happening at most group Field Day sites to capture your interest and get you involved. If you have never operated, make sure you visit your group's GOTA station (if it chooses to operate one). After a few contacts with a control operator, we bet you get hooked!

***Relative challenge:*** The most challenging part of Field Day rests in the planning, preparation and set-up of the event. By the time you actually start operating, you will find stations on pretty well every HF band and mode to keep you busy. VHF / UHF activity and satellite operation also present unique challenges that will keep your group testing its limits of creativity.

***Scoring:*** Each CW and Digital QSO counts two points each, Phone QSOs count one point. You may work each station once per band and mode—CW, Phone and Digital. Your multiplier is determined by the maximum amount of power used by any transmitter at your site. Make all QSOs running 5 W or less, with a power source other than commercial mains or a motor driven generator and your multiplier is 5. Make all of your QSOs using 150 W or less and your multiplier will be 2. If you use more than 150 W your multiplier is 1.

***Bonus Points:*** Because Field Day is really about amateur radio demonstrating its emergency communications capability, there is a wide range of bonus points available. You can earn additional points by setting up in a public place, having an information table available, trying to secure media publicity, passing formal National Traffic System style messages, and more. The complete list of available bonus points is found in Field Day Rule 7.3.

***How to report your score:*** Your entry must be postmarked by July 29, 2003. A complete entry includes an official Field Day summary sheet (completely and accurately filled out), documentation or proof of any bonus points that your group claims, and a list of stations worked broken down by band and mode. Full logs are not required for reporting Field Day. The Cabrillo file format is not designed to handle the various bonus points and extra information necessary to report Field Day entries. Regardless of your logging method, paper or electronic, you must still submit a summary sheet in the official format.

***For more information:*** Contact the ARRL Contest Branch at **contests@arrl.org** or by phone at 860-594-0295. QST

# ARRL June VHF QSO Party Contest Announcement

**1800 UTC June 14 - 0300 UTC June 16, 2003**

***How to participate:*** Any amateur station on any band above 50 MHz may be worked. The entry classes for Single Operator are high power, low power or portable. A Limited Multioperator station may either use four bands or less. A Multioperator Unlimited uses more than four bands. A Rover is a 1 or 2 person station that moves and operates from two or more grid squares. Any station may be worked once per band, regardless of the mode. You may re-work a rover station each time they move to a new grid square. Use of a spotting network makes your station a Multi-operator entry. DX stations may only work W/VE stations for credit.

***What to say:*** All stations give their call sign and 4 digit grid square locator (such as W1AW FN31). Information on how to determine your grid square is found on page 86 of the April 1994 issue of *QST* or online at **www.arrl.org/locate/gridinfo.html**.

***Special interest:*** If the solar flux index is high, be sure to check out activity on 50 MHz. The June VHF QSO party frequently has great coastal tropospheric propagation, so if you live near a coastal region, stay alert—you can get some great conditions for operating.

***Quirks:*** Summer conditions always present a challenge. The higher the concentration of amateurs in a region the larger pool of potential QSOs. A Single Operator Portable station operates from a single location away from home and must use a portable power supply, portable station and a maximum of 10 W PEP output.

***Rule changes this year:*** The total transmitter output power for a high power entry in any category is either 1500 W PEP or the maximum allowable power level established by the national licensing authority of your country, whichever is lower. This event is now an Affiliated Club Competition event.

***Best reason to participate:*** This contest is a good way to build up totals for the ARRL VHF/UHF operating awards such as VUCC. A band opening on 50 MHz could also present the opportunities to find new states for an ARRL Worked All States award or add countries to a DXCC total.

***Relative challenge:*** VHF / UHF / Microwave operation presents unique challenges that test the best equipped operators, but it is also possible for someone to participate in this event with modest stations. You will get better results utilizing SSB or CW instead of FM. The more bands you are able to utilize the better your results.

***Scoring:*** QSOs count one point each on 50 and 144 MHz, two points on 222 and 432 MHz, three points on 902 and 1296 MHz and four points each on 2.3 GHz and higher. On each band, every time you work a different grid square, you receive a multiplier. Your multiplier total is the sum of grids you worked per band. The final score is your QSO point total times your multiplier total.

***How to report your score:*** You must send in your entry by July 16, 2003. E-mail Cabrillo format log to **JuneVHF@arrl.org** or send paper logs and complete summary sheet to June VHF QSO Party, ARRL, 225 Main St, Newington, CT 06111.

***Complete rules:*** The complete rules may be found at **www.arrl.org/contests/forms**. You will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands above 50 MHz (VHF) and other forms and operating aids, log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending an SASE with postage for 2 oz to June VHF QSO Party Rules, ARRL, 225 Main St, Newington CT 06111.

***For more information:*** E-mail **contests@arrl.org** or phone 860-594-0295. QST

**ANAHEIM, CA**
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
**(800) 854-6046**
Janet, KL7MF, Mgr.
**anaheim@hamradio.com**

**BURBANK, CA**
2416 W. Victory Bl., 91506
(818) 842-1786
**(800) 854-6046**
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
**burbank@hamradio.com**

**OAKLAND, CA**
2210 Livingston St., 94606
(510) 534-5757
**(800) 854-6046**
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
**oakland@hamradio.com**

**SAN DIEGO, CA**
5375 Kearny Villa Rd., 92123
(858) 560-4900
**(800) 854-6046**
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
**sandiego@hamradio.com**

**SUNNYVALE, CA**
510 Lawrence Exp. #102
94085
(408) 736-9496
**(800) 854-6046**
Mark, WI7YN, Mgr.
So. from Hwy. 101
**sunnyvale@hamradio.com**

**NEW CASTLE, DE**
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
**(800) 644-4476**
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
**newcastle@hamradio.com**

**PORTLAND, OR**
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
**(800) 854-6046**
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
**portland@hamradio.com**

**DENVER, CO**
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
**(800) 444-9476**
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
**denver@hamradio.com**

**PHOENIX, AZ**
1939 W. Dunlap Ave., 85021
(602) 242-3515
**(800) 444-9476**
Gary, N7GJ, Mgr.
1 mi. east of I-17
**phoenix@hamradio.com**

**ATLANTA, GA**
6071 Buford Hwy., 30340
(770) 263-0700
**(800) 444-7927**
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
**atlanta@hamradio.com**

**WOODBRIDGE, VA**
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
**(800) 444-4799**
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
**woodbridge@hamradio.com**

**SALEM, NH**
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
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## FT-8900R Quadband Transceiver

- 10M/6M/2M/70CM • Wires capable
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- Auto repeater • 107 alphnumeric memories

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- Enhanced Rx performance
- SSB/CW Syncronous tuning
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- Advanced CW functions
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- 32 bit IF-DSP+ 24 bit AD/DA converter
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- Enhanced Rx performance

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- 160-10M @ 100W
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- One Touch Band Switching
- Direct frequency input
- VOX Built-in
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- 6W output
- CTCSS encode/decode w/tone scan
- Auto repeater
- Easy operation!
- Mil spec 810, C/D/E*1

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- 5.5W output
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- 2M, & 70CM @ 5W
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- 6M/2M/70CM @ 5W
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- Dynamic memory scan
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- Weather Alert

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- Cool dual display
- 50 watts
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- Backlit remote control mic
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- 113 alphnumeric memories

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- 212 memory channels
- Remote Mounting Kit Included

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- 75 watts
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- Weather alert
- Weather channel scan
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- 200 Memories • Built In 1200/9600 baud TNC
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- 500 kHz - 2.45 GHz*
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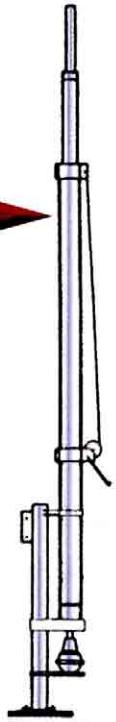

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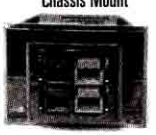

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- Built in power / SWR Meter
- Automatic or semiautomatic operation
- Tunes in 0.1 to 5 seconds (3 seconds average)
- 11 - 14 VDC @ 15 to 500 mA (250 mA average)
- Interfaces available for Icom, Alinco, Yaesu FT-100/857/897, and Kenwood TS-50


**Z-11 QRP Autotuner - $179**

- 0.1 to 30 watts continuous (60 watts peak)
- Tunes in 0.1 to 3 seconds (1.5 average)
- Latching relays, holds tune with power off
- 11 -20 VDC @ 10 to 190 mA (75 mA Av.)
- Interface available for the Yaesu FT-817

**All LDG Autotuners Feature:**

- Switched "L" matching network
- Precision microprocessor control
- 1.8 to 30 MHz continuous coverage
- Will match impedences of 6 to 800 ohms
- Designed for coax-fed dipoles, verticals, beams
- Optional Balun for long wire or Ladder Line

**RT-11 Remote Autotuner - $219**

- Perfect for mobile, marine, or remote tower mounting
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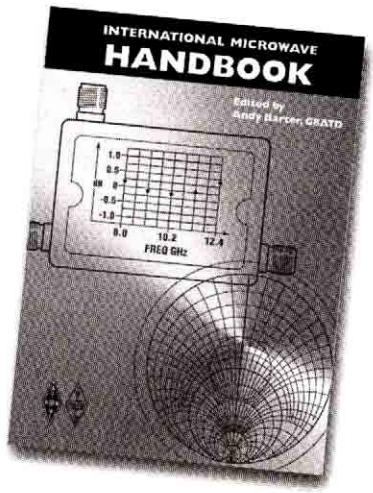


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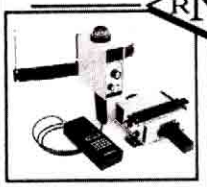

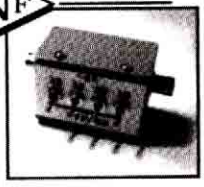

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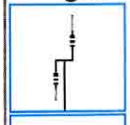

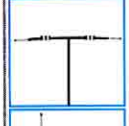

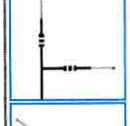

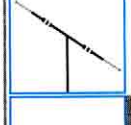

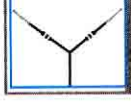

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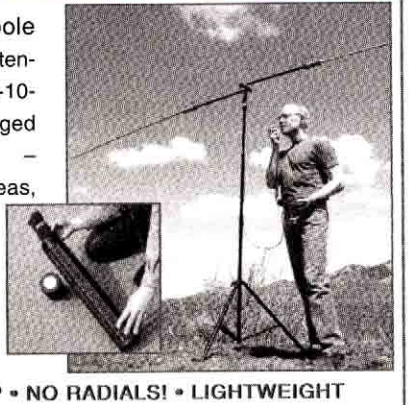

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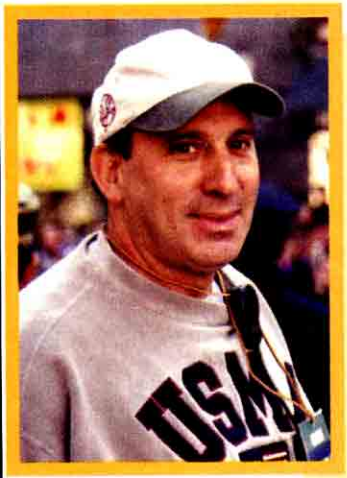

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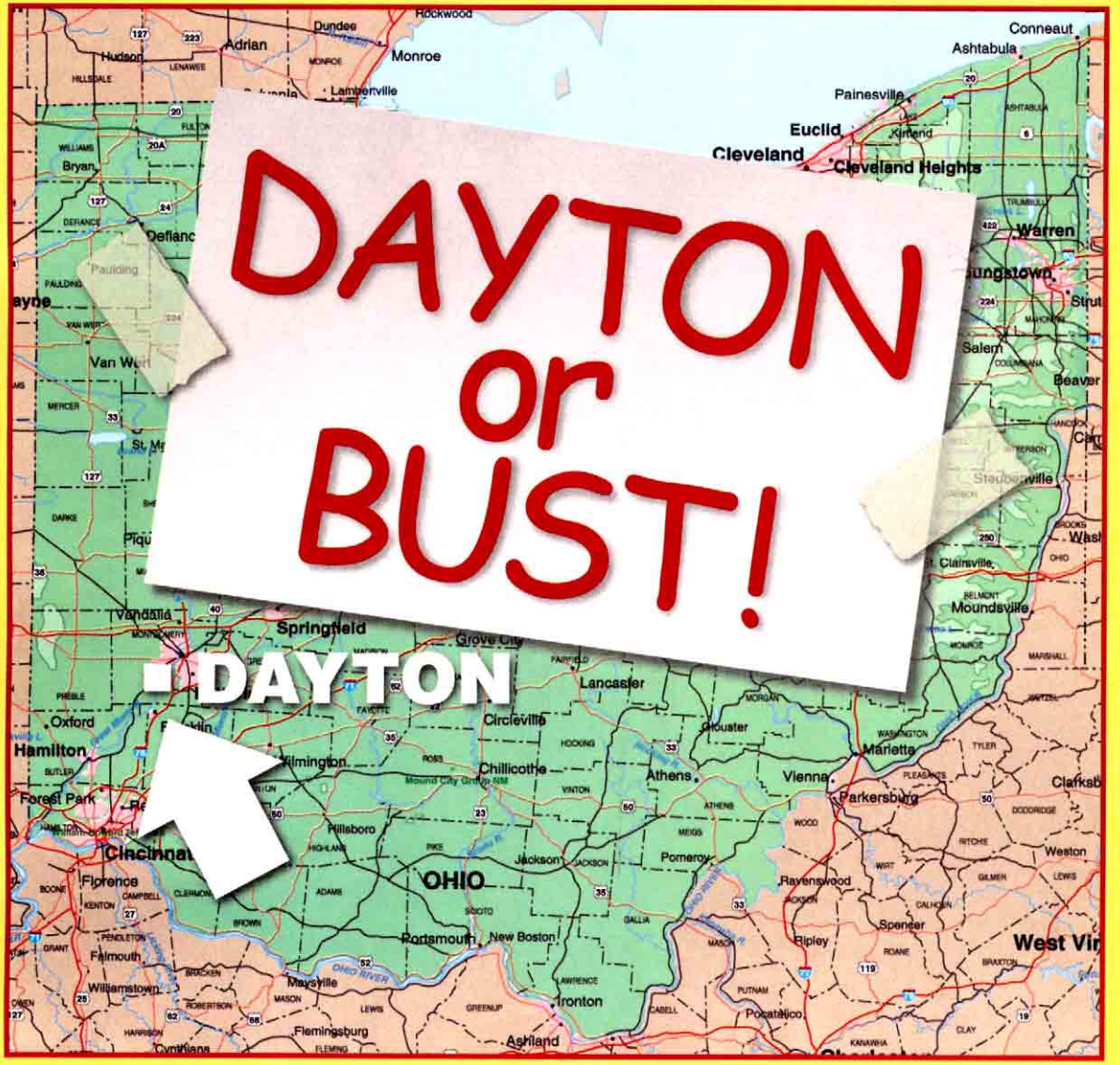


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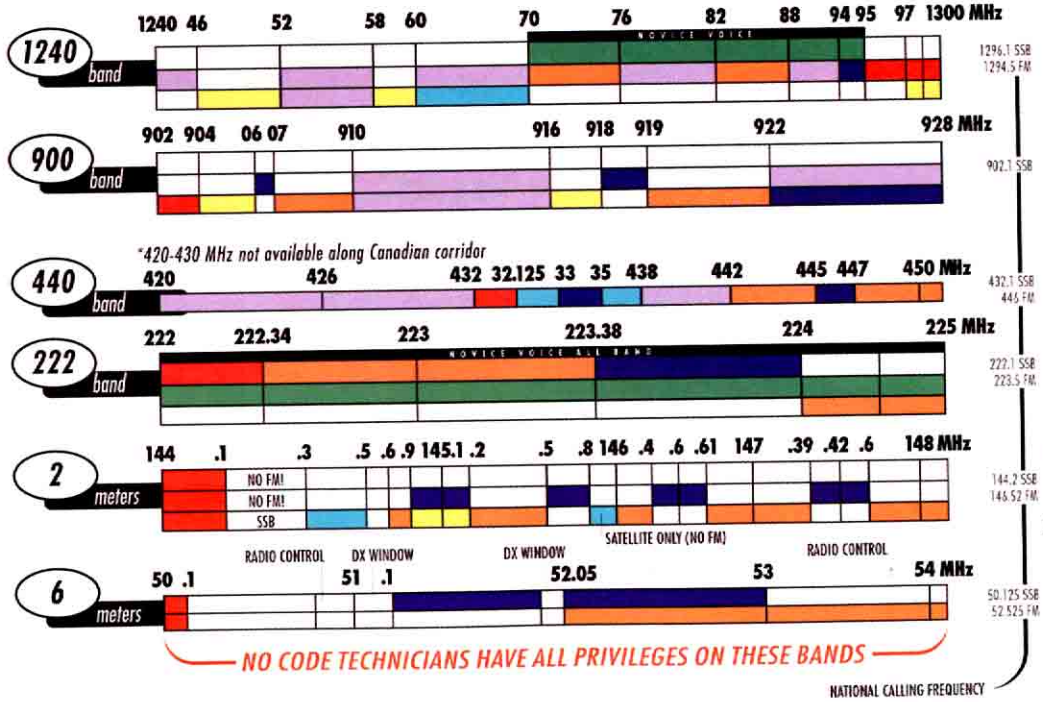


**ID-1**
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FM, FM-N, SSB, CW/**2M, 440, 1240**

**IC-706MKIIG**
AM, FM, SSB, CW, RTTY/**HF, 2M, 6M, 440**

**IC-746PRO**
AM, FM, SSB, CW, RTTY/**HF, 2M, 6M**

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- ADVANCED VOICE, CW, SSTV, FAX*
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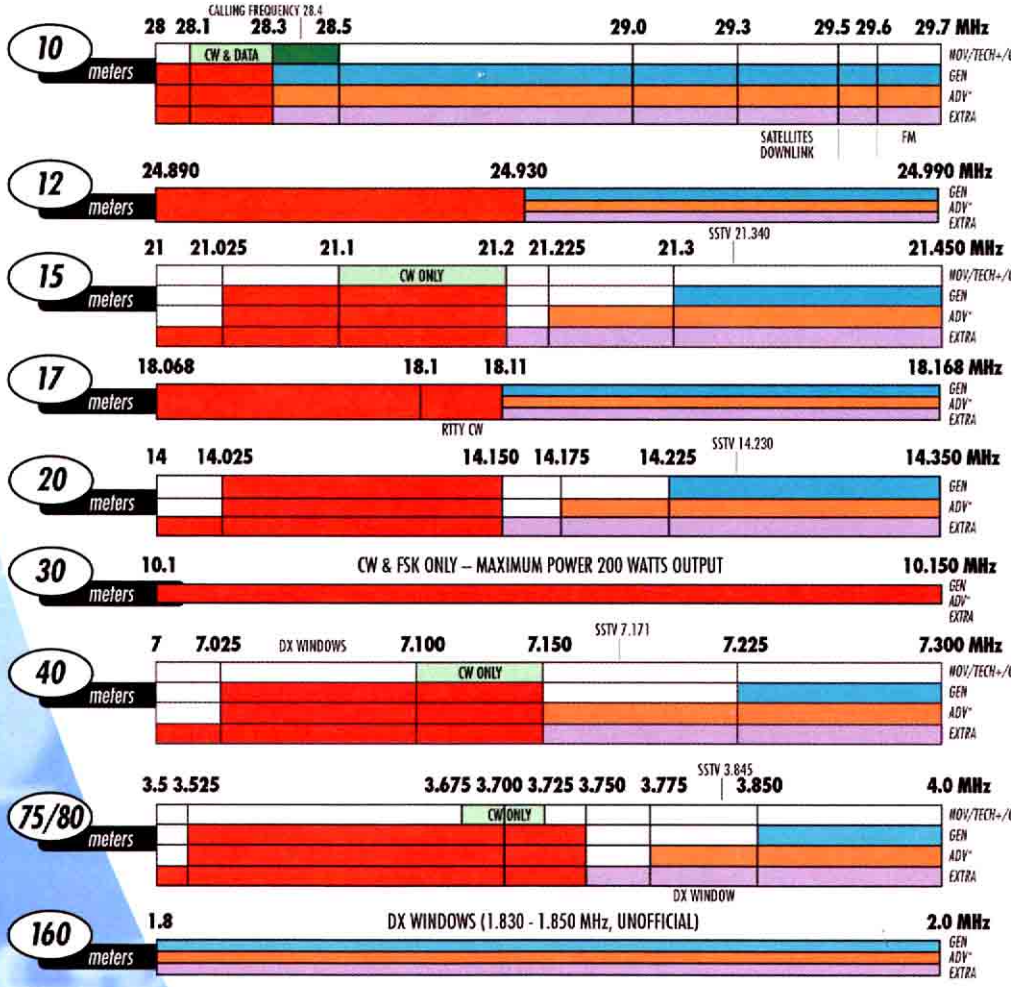


IC-756PROII
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IC-746PRO
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IC-706MKIIG
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IC-703
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**Developed by Gordon West, WB6NOA, RADIO SCHOOL, INC., for exclusive use by ICOM America, Inc., February, 2002.**

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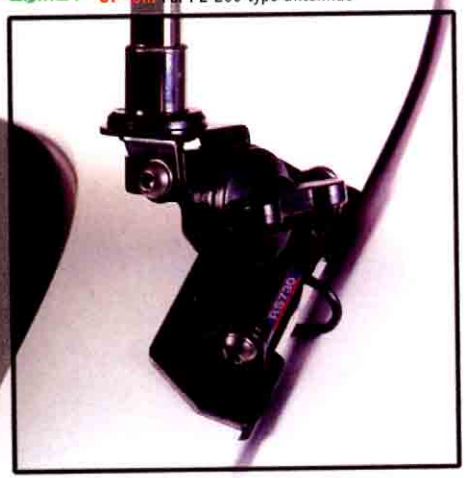

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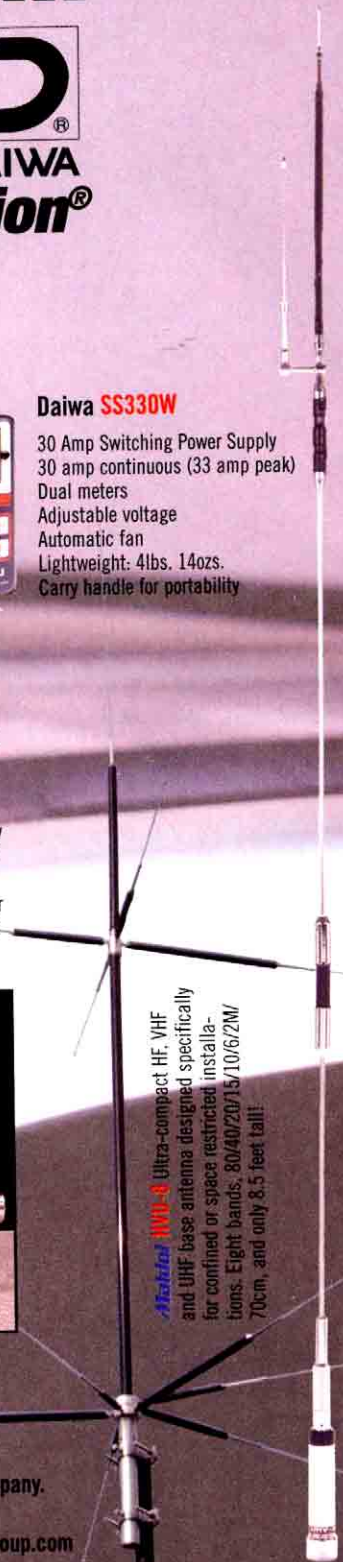

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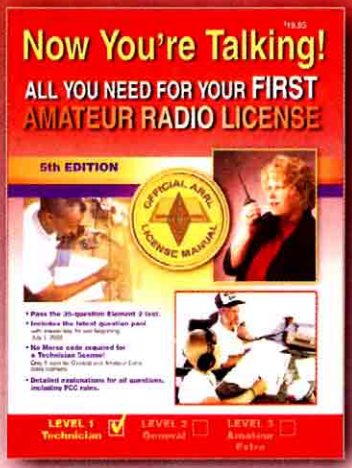


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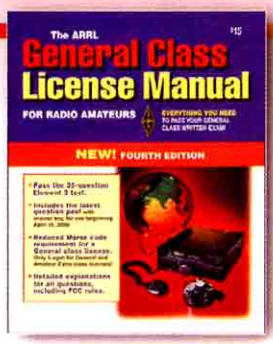


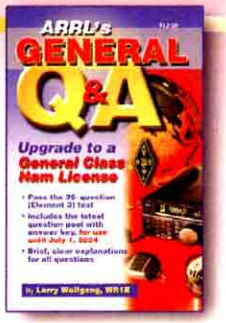


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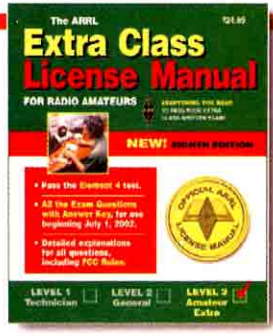


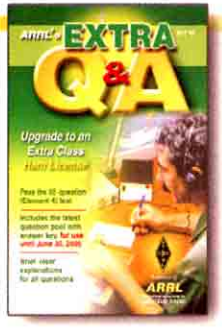


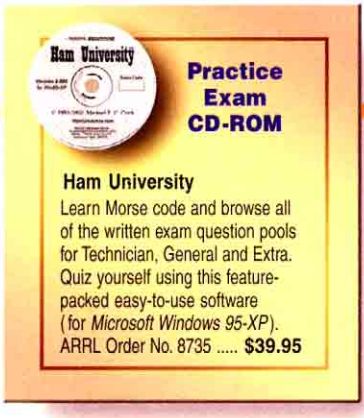


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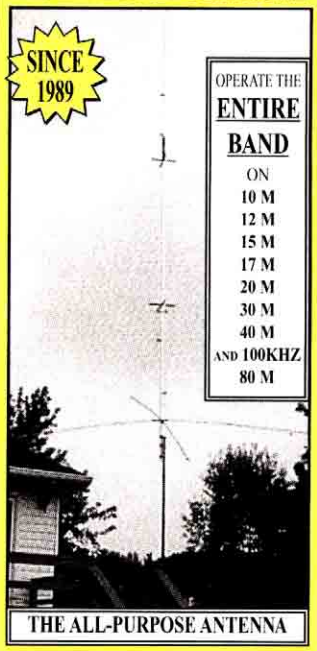


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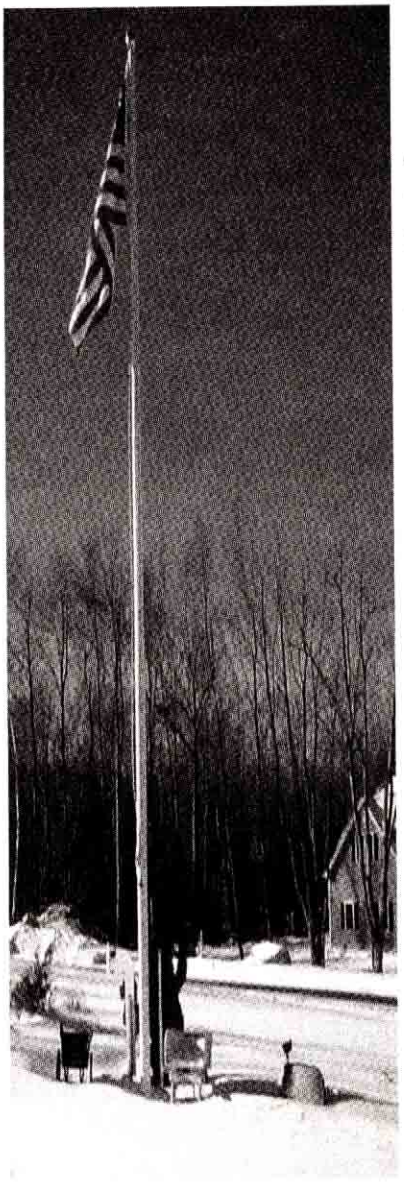

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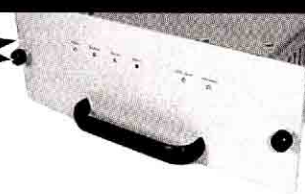

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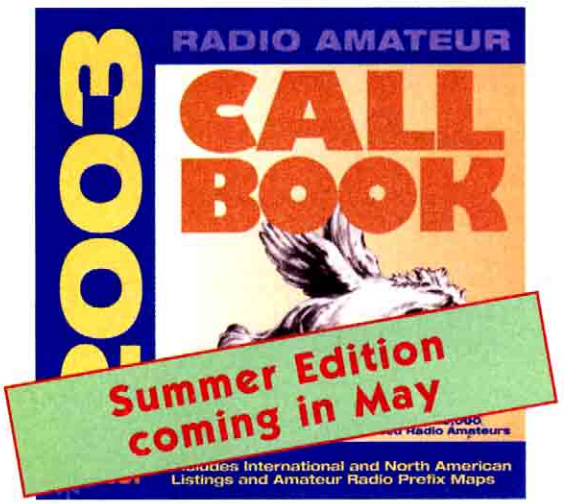


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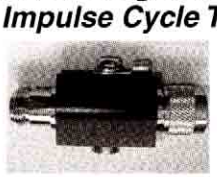

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**TH-22ATH Tailored for utmost efficiency, Palm-Sized!** (middle) The 144MHz, 5W, FM 22AT is so small and slim, it easily slips into a shirt pocket. Yet, it delivers impressive performance and does not compromise on sound quality with its large speaker, ensuring loud and clear audio. Features include luminescent DTMF keypad, 40 memories plus 1 call, multiple scan functions, DTSS and page. 2.19"w x 4.63"h x 1"d, 10.2 oz **$219.99**

**TH-G71A Sharp Distinction: The brighter side of handy communications.** (right) This FM dualbander (144/440MHz) boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with its memory name function, menu mode, PC compatibility and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz ..... **$229.95**

**TH-F6A Unique features the competition is still scratching their heads over.** The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and no fewer than 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, lithium-ion battery, and a MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz ..... **$329.95**

**TM-261A Fully equiped, supremely user-friendly 2M mobile.** The 261A puts out an impressive 50 Watts with mid- and low-power settings. For quick access, essential data can be stored in 62 "memory name function" memory channels. Other features include DTSS selective calling, multi-scan capability, and a case built to MIL-STD. 5.5"w x 6.56"h x 1.56"d, 2.2 lbs ..... **$149.99**

**TM-G707A The essence of ease.** From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily user-friendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs ..... **$269.95**

**TM-V7A Cool Blue: The look of mobile communication.** The V7A 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel and reversible LCD. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, and dual receive on one band make it a pace-setter. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs ..... **$399.95**

**TM-D700A Harnessing APRS®, GPS and SSTV.** This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. However, the brightest spot of the 50/35W D700A is its ability to enable APRS® without a computer. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs ..... **$519.95**

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**IC-V8 Quality, simplicity, anywhere.** (right) This 144MHz FM transceiver's front panel and chassis are constructed of tough polycarbonate and die-cast aluminum for durability. The 5.5W V8 offers a 16-button keypad and 100 alphanumeric memories. CTCSS, DTCS and DTMF encoder are standard. 2.13"w x 5.19"h x 1.38"d, 12.3 oz ..... © **CALL**

**IC-T7H Powerful output and ample receive audio.** (left) A 6W amp circuit provides superior transmit on both VHF and UHF when 13.5 V DC is supplied. In addition, a full 500mW of AF is output from the speaker -- easy to copy in noisy environments. Separate CTCSS tone encoder and encoder/decoder are standard. Single push action makes it simple. This 2M/440MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz ..... © **CALL**

**IC-T90A Surprisingly compact, full featured.** The T90A 50/144/440MHz HT offers wideband receive with 5W of power. It features 555 alphanumeric memories with DMS scanning technology. The T90A also provides DTCS/CTCSS, DTMF encode, PC programmability and weather resistance. 2.53"w x 3.44"h x 1.16"d, 8.47 oz ..... © **CALL**

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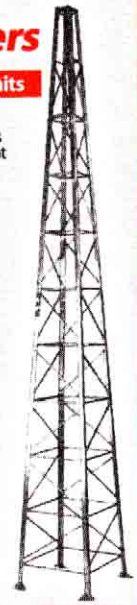

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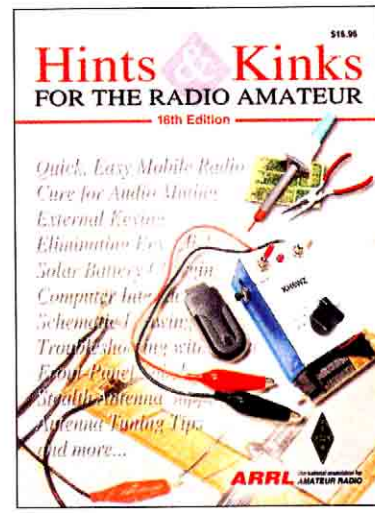


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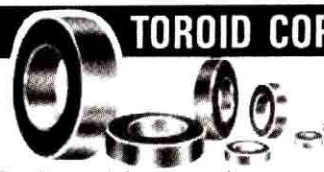

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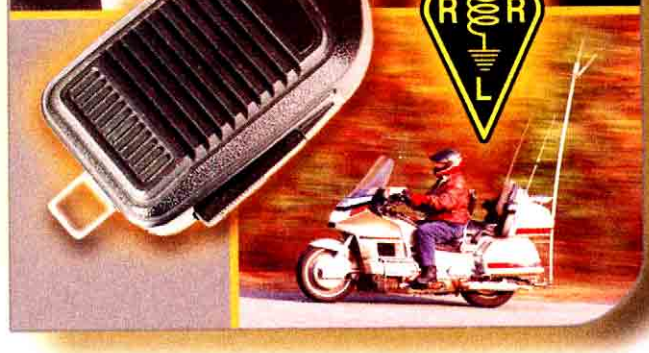


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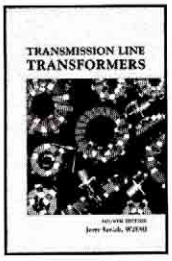


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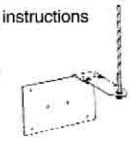

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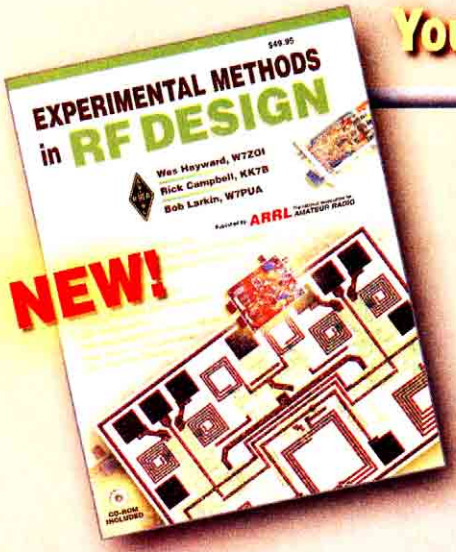


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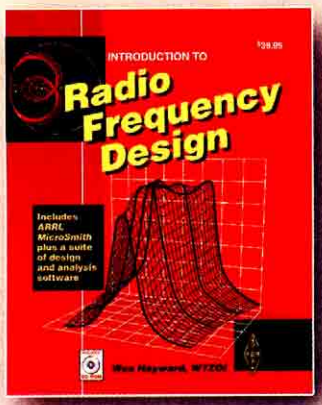


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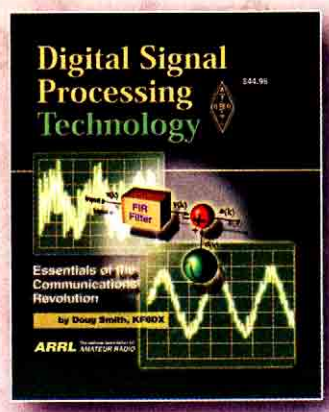


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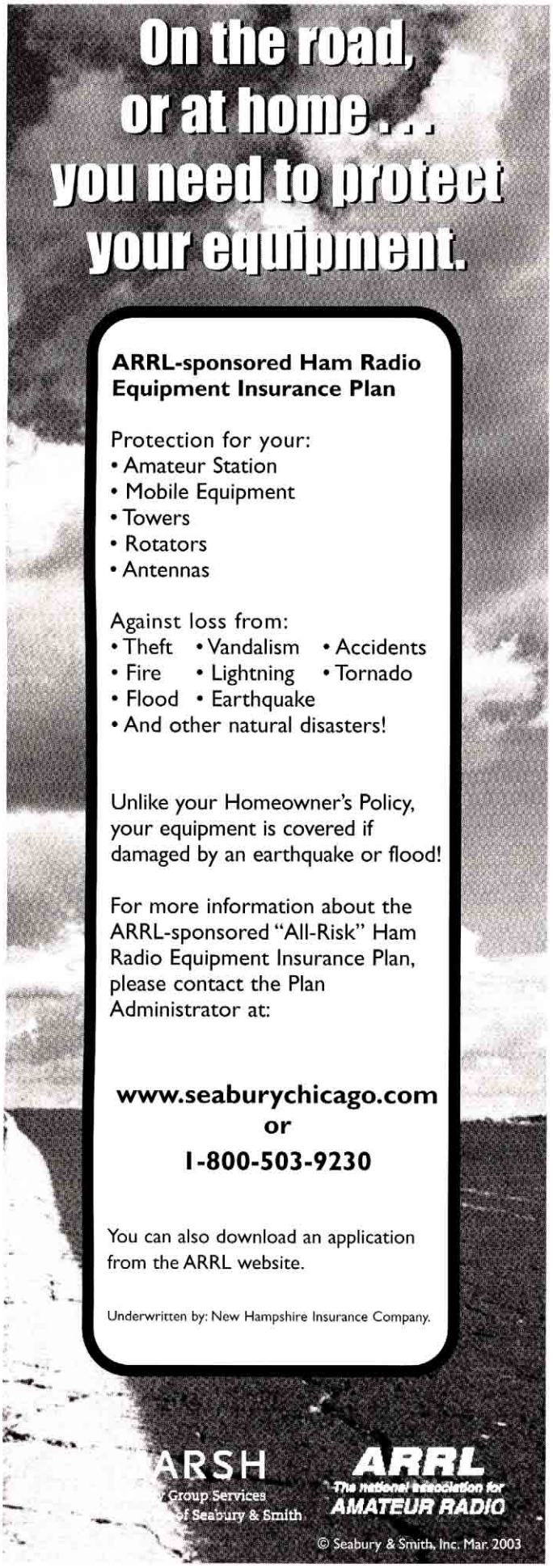


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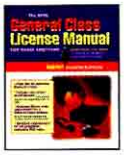


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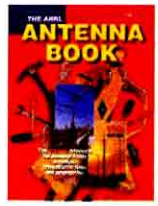


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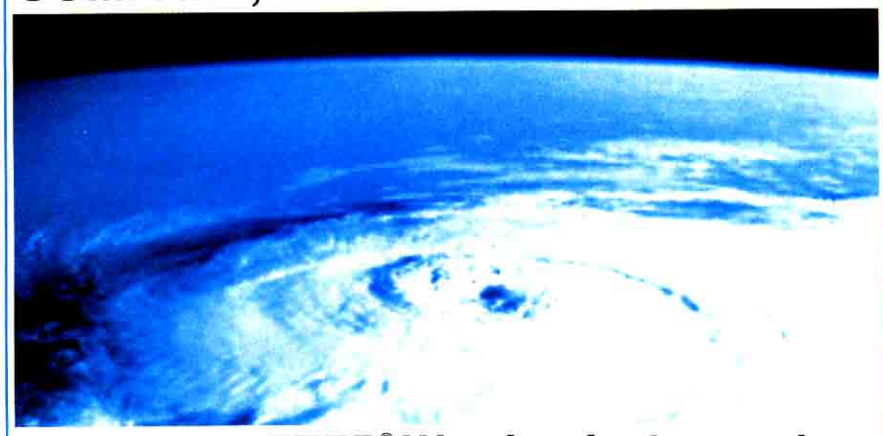

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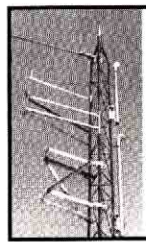

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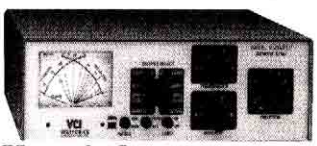

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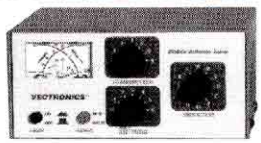

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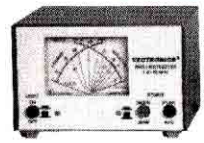

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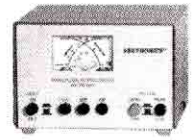

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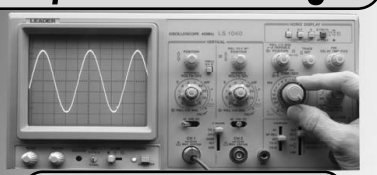

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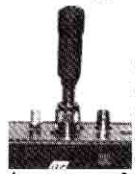

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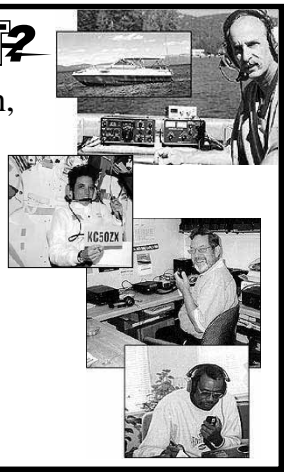


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# MFJ TUNERS

## MFJ-989C *Legal Limit* Antenna Tuner

***MFJ uses super heavy duty components to make the world's finest legal limit tuner***

***MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.***

**The** rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

**MFJ's** *AirCore*™ roller inductor, new *gear-driven* turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

**You** can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax, random wire or balanced lines.


MFJ-989C **$359.95**

**You** get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, *TrueCurrent*™ Balun, *scratch-proof* Lexan front panel -- all in a sleek compact cabinet (10¾Wx4½Hx15D in).

***MFJ AirCore*™ *Roller Inductor*** gives high-Q, low loss, high efficiency and high power handling.

**MFJ's** exclusive *Self-Resonance Killer*™ keeps damaging self-resonances away from your operating frequency.

**Large**, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

**MFJ *No Matter What*™ Warranty**

**MFJ** will repair or replace your MFJ-989C (at our option) *no matter what* for one year.

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MFJ-986 **$329.95**

***Two*** knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10¾Wx4½Hx15 in.

### MFJ-962D *compact* Tuner for Amps

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### MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$199.95**

**Superb** *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

### MFJ-949E *deluxe* 300 Watt Tuner

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***More*** *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 3½Hx10⅝Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

### MFJ-941E *super value* Tuner

MFJ-941E **$119.95**

***The*** *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek 10½Wx2½Hx7D in.

### MFJ-945E HF+6 Meter *mobile* Tuner

MFJ-945E **$109.95**

**Extends** your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $4.95,** mobile mount.

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MFJ-971 **$99.95**

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MFJ-901B **$79.95**

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MFJ-16010 **$49.95**

**Operate** all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

### MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$79.95**

**MFJ-906** has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

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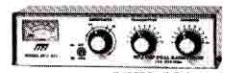

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**MFJ-921** covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 inches. Simple 2-knob tuning for mobile or base.

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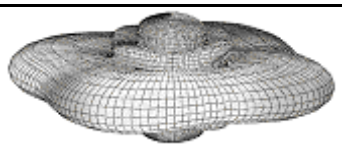

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# 10 Bands -- 1 MFJ Antenna!

## *Full size performance . . . No ground or radials*

### *Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna*
### *Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .*

**Operate** 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

**Full** size performance gives high efficiency for more power radiated. Results? Stronger signals and more Q-5 QSOs.

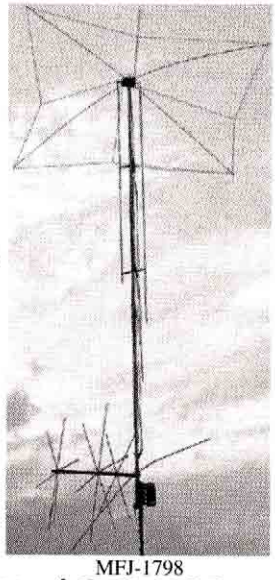
**Full** size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

**Full** size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

**Get** very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

**MFJ's** unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

**It's** easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.



MFJ-1798
**$289.95**
Ship Code F

**Self-supporting** and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

#### *Separate Full Size Radiators*

**Separate** *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

**The** active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

**This** forms a very large equivalent radiator and gives you incredible bandwidths.

**Radiator** stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

#### *End Loading*

**On** 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

**MFJ's** unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

**Tuning** to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

#### *No Ground or Radials Needed*

**You** don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

**You** can mount it from ground level to roof top and get awesome performance.

#### *No Feedline Radiation to Waste Power*

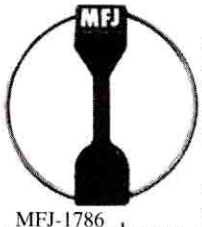
**The** feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

#### *Built to Last*

**Incredibly** strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

**Efficient** high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

## *MFJ's Super High-Q Loop™ Antennas*




MFJ-1786
**$379.95**
Ship Code F

**MFJ's** *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

**Ideal** for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

**Enjoy** both DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

**Super** easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto-tunes to desired band, then beeps to let you know. No control cable is needed.

**Fast**/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

**All** welded construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- not a lossy thin flat-strip -- *gives you highest possible efficiency.*

**Each** plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning.

**Heavy** duty thick ABS plastic housing has ultraviolet inhibitor protection.

***NEW!*** **MFJ-1788, $429.95.** Same as MFJ-1786 but covers 40 Meters-15 Meters continuous. Includes super remote control.

**MFJ-1782, $339.95.** Like MFJ-1786 but control has only fast/slow tune buttons.

**MFJ-1780, $249.95.** *Box Fan* Portable Loop is about the same size (2x2 foot) as a box fan, complete with handle. Covers 14-30 MHz. Control has fast/slow tunes.

### *MFJ Portable Antenna*

MFJ-1621 **$89.95** Ship Code A

**MFJ-1621** lets you operate in most any electrically free area -- apartment, campsite, hotel, the beach, etc. DXCC, WAZ, WAC, WAS have been won with MFJ-1621! Work 40, 30, 20, 17, 15, 12 and 10 Meters with a telescopic whip that extends to 54 inches. Mounted on a sturdy 6x3x6 inch cabinet. Built-in antenna tuner, field strength meter, and 50 feet of RG-58 coax cable. Handles 200 Watts.

### *MFJ's G5RV Antenna*

MFJ-1778, Ship Code A **$39.95**

**Covers** all bands, 160-10 Meters with antenna tuner. 102 feet long, shorter than 80 Meter dipole. Use as inverted vee or sloper to be more compact. Use on 160 Meters as Marconi with tuner and ground. Handles full legal limit power. Add coax feedline and some rope or other nonconductor and you're *on the air!*

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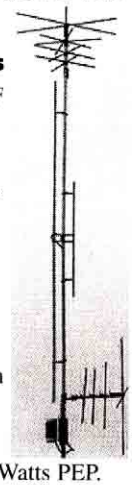
***6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed***



MFJ-1796
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**Only** 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments,small lots, trailers. Perfect for vacations, field day, DXpedition, camping.

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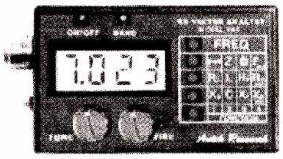

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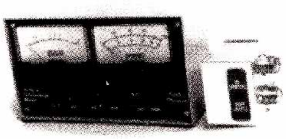

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MFJ1275/M/T
**$99.95**

*New!* *Includes AC power supply, RS-232 cable!*


***Plug this new MFJ-1275/M/T sound card interface between your transceiver and computer and enjoy operating all digital modes.***

***Everything you need is included -- software, audio cables, RS-232 serial cable and AC power supply.***

***Provides fully automatic operation with audio and push-to-talk control. It matches sound card audio, eliminates ground loops and provides microphone override.***

***Models available for all transceivers with 8-pin round, 8-pin modular (RJ-45) or 4-pin round microphone plugs.***

***Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, high speed CW Meteor Scatter and many others. Also use as Contest Voice Keyer and CW Contest Memory Keyer.***

### *Digital Modes or Normal Operation*

**Select** the ON digital mode -- all connections are made between your rig and computer for instant digital operation.

**Select** BYPASS normal mode -- your transceiver and computer connections are restored for their normal operation.

### *Audio Isolation Transformers*

**Audio** isolation transformers and relay eliminate ground loops, audio hum, noise and distortion.

### *RFI-Proof*

**Extensive** RF suppression and line isolation eliminates RF feedback problems.

### *Automatic Microphone Override*

**Transmit** mic audio at any time by pressing PTT to override digital modes -- great for SSTV and Contest Voice Keyer.

### *More Impressive Features*

**Serial port** -- lets computer control radio to override/interrupt digital transmissions.

**VOX Control** -- lets you use VOX control when not using computer serial port control.

**Level Controls** -- for transmitter drive and for receiver-to-sound card drive level. No need to adjust microphone gain or sound card level when you change modes.

**Stereo or Mono Audio Input** -- A front panel switch selects left, right, or both sound card audio output channels to accommodate various programs.

**Off-the-air recording** -- for replaying or for use with spectrum analyzer programs.

**Monitor** on/off switch lets you have a normal QSO and receive SSTV pictures at the same time in the *"monitor on"* position. This is great for modes like SSTV and Voice Keyer operation that may require listening to receive audio during operation.

**Rugged Construction** -- All aluminum cabinet and surface-mount construction gives you years of trouble-free service.

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### *Plug and Play!*

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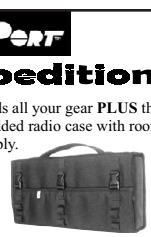

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**2.** Same as **1**, without speed display -- gives you maximum text display.

**3.** Top line scrolls, bottom line displays speed in Words-Per-Minute.

**4.** Both top and bottom lines scroll.

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### *More Features*

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| **UTM-1200-DLX** | 15 W MAST-MOUNT 1268 TX-UPCONVERTER | **A** |
| **UTM-1200-1** | 1 W 1268 MHz. TX-UPCONVERTER | **L** |
| **GaAsPA20** | 20 Watt 2304 /2400 MHz. Amplifier | **L** |
| **UEK-3000S** | 2400MHz. MastMount Mode "S" Converter 0.8db | 460.00 |
| **LT230S** | 1296MHz 30W Transverter NF < 0.9 dB | 1400.00 |
| **AS-3000** | 2 port Antenna Switch High Power DC - 3.0 GHz | 180.00 |
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| **TLA1275MC** | 100 Watt Solid State 1250-1296 MHz. Linear Amplifier | Call! |
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| **MKU23G2** | 2304 MHz. Transverter NF <0.8dB 1 W output | **499.00** |
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| **MKU57G2** | 5760 MHz Transverter NF <1.0dB 200mW output | **580.00** |
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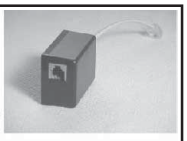

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***"What did you say?" Can you hear but . . . just can't always understand everything people are saying?***

**As** we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

**Research** shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

**On** the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

**To** dramatically improve your ability to understand speech, you must:

***First***, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

***Second***, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

**The** MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

**A** balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

**By** boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

**Even** if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

**Here's** what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

**Immuned** to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

**MFJ-1316, $19.95.** For 110 VAC operation. Provides 12 VDC/1.5 Amps.

**MFJ-72, $58.80.** *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

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## MFJ Contest Voice Keyer

***Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .***


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**Let** this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

**Store** frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

**Record** and play back five natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed.

**You** can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

**You** can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

**A** playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

**Has** jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

**Your** mic's audio characteristics do not change when your MFJ-434 is installed.

**All** audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

**It's** easy to use -- just plug in your 8 pin mic and plug the MFJ-434 cable into your transceiver. Internal jumpers let you set it to your rig. Use your mic or its built-in mic for recording.

**Built-in** speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $14.95. 6½Wx2½Hx6½D in.

**MFJ-73, $29.95.** MFJ-434 Remote Control with cable.

## 60 dB Null *wipes out* noise and interference

MFJ-1026
**$179.95**

**Wipe** out noise and interference *before* it gets into your receiver with a 60 dB null!

**Eliminate** all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

**It's** *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

**It** works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

**You** can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

**Use** the MFJ-1026 as an *adjustable phasing network.* You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

**Easy-to-use!** Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

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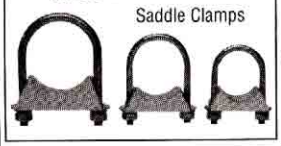

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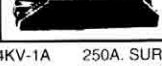

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**These** super clean MFJ *MightyLites*™ meet all FCC Class B regulations.

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***No RF Hash!***

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**MFJ** *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

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**A** whisper quiet internal fan efficiently cools your power supply for long life.

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***Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .***

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**MFJ's** heavy duty conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

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***New!***
MFJ-1117
**$54.95**

**MFJ-1118, $74.95.** This is MFJ's most versatile and highest current *Deluxe Multiple DC Power Outlet*. Lets you power two HF and/or VHF transceivers and six or more accessories from your transceiver's main 12 VDC supply.

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| SP-2000 | 144 | <.8 | 20 Adj. | 750/200W | 250.00 |
| SP-220 | 222 | <.9 | 20 Adj. | 650/200W | 250.00 |
| SP-7000 | 70cm | <.9 | 20 Adj. | 500/100W | 250.00 |
| SP-23 | 1296 | <.9 | 18 | 100/10W | 360.00 |
| SP-13 | 2304 | 1.2 | 18 | 50/10W | 380.00 |
| LNA | 144 | <.4 | 18 | NA | 220.00 |
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| SLN | 1296 | <.4 | 30 | NA | 290.00 |
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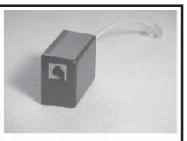

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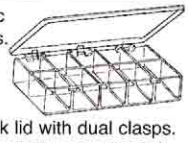

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We had tried to give our amateur customers the best lead times that we could predict under the circumstances we were operating under. Some of these forecasts were right on, some were way off due to shortages of materials and lead times due to others needing their antennas more urgently.

We had an obligation to our country before anything else. Most understood, some didn't. In any event, all were told of the questionable lead times and we did our best to come as close as we could with the resources that were available at the time.

The world still has many concerns and we have not slowed down, however it is not like before where everything hit us all at once.

Because of the need for everyone here at the company working on special projects, we will not be attending the Dayton Hamfest. It will be the first time in 20+ years. To try and make up for this, we are having a "Not going to Dayton Special".

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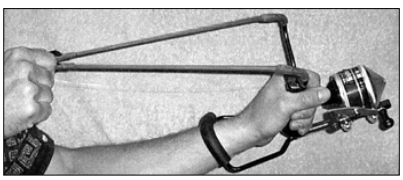

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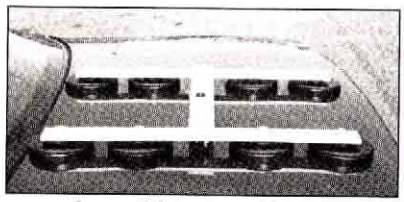

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# TECH TALK

*Filters: To buy or not to buy?*

If there is one particular aspect or trait most radio amateurs have in common, it is seeking out the best possible performance-versus-cost ratio in an HF transceiver. The quest holds good merit, but remember to factor options responsible for that high performance (like IF filters and DSP) into the equation before making a buying decision. Adding optional IF filters (up to seven for competitive model transceivers) noticeably increases overall cost, yet excluding such optional filters shortchanges one's full radio enjoyment. What to do? Go first class right from the start with Icom's world famous IC-756PROII, naturally!

**FILTERS, SKIRTS AND DSP.** Two of the IC-756PROII's leading assets are its extensive digital IF filters and its 32 bit floating point DSP. Combined, they produce over 50 different built-in filter widths and response curves to mate with operating needs and band conditions of the day. There are no optional filters needed! These DSP-based filters, incidentally, utilize computer-type concepts to clock signals in and out of the processor. Further, Icom's 32 bit DSP can process data with less noise than a 16 bit DSP system. That's why its filter curves can be wide for full-bodied audio yet ultra steep-skirted (only 200Hz difference between its –6 and –60dB points in CW) for incredible selectivity. Crystal filters are good and mechanical filters are better, but neither type compare to Icom's DSP filters. It's that simple!


IC-756PROII

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| *For KENWOOD TH-235A etc. (Hard-to-find products !) :* | | | |
| **PB-37** (Kenwood-brand) | **12.0v** | **950**mAh | **$29.95** |
| **PB-36** (Kenwood-brand) | **7.2v** | **950**mAh | **$22.95** |
| *For KENWOOD TH-78A / 48 / 28 / 27 etc :* | | | |
| **PB-13** Std. NiCd pk. | **7.2v** | **1100**mAh | **$29.95** |
| **PB-17x** 5W NiMH pk. | **12.0v** | **1300**mAh | **$39.95** |
| **BC-15A** KENWOOD brand Fast Charger | | | **$39.95** |
| *For KENWOOD TH-77A, 75, 55, 46, 45, 26, 25 etc :* | | | |
| **PB-6x** (NiMH, w/chg jack) | **7.2v** | **1500**mAh | **$34.95** |
| **PB-8xh** (NiMH, w/ jack) | **12.0v** | **1650**mAh | **$44.95** |
| *For KENWOOD TH-205 / 215 / 225 / 315 etc :* | | | |
| **PB-2h** (NiCd, w/chg jack) | **8.4v** | **800**mAh | **$29.95** |
| *For KENWOOD TR-2500 / 2600 : EXCLUSIVE !* | | | |
| **PB-25s** (NiCd, w/ jack) | **8.4v** | **800**mAh | **$29.95** |
| *For ALINCO DJ-V5 / DJ-V5TH : ( includes belt clip )* | | | |
| **EBP-46h** NiMH pk. | **9.6v** | **1100**mAh | **$39.95** |
| *For ALINCO DJ-195,HP,R / 196 / 446 / 493 / 496 / 596 etc :* | | | |
| **EBP-48h** NiMH pk. | **9.6v** | **1650**mAh | **$39.95** |
| *For ALINCO DJ-G5TD,TH,TY / 190T,TD,TH / 191T,TD,TH:* | | | |
| **EBP-36** 5w NiMH pk. | **9.6v** | **750**mAh | **$36.95** |
| *For ALINCO DJ-580 / 580T / 582 / 180 / 280T / 480 etc :* | | | |
| **EBP-20n** NiCd short pk | **7.2v** | **1100**mAh | **$24.95** |
| **EBP-22n** 5W NiCd pk | **12.0v** | **1100**mAh | **$36.95** |
| **EDH-11** 6-Cell AA case | | | **$14.95** |
| *For ADI HT-600 & REALISTIC HTX-204 (for 5-Watt TX):* | | | |
| **ADI-600x** 5w NiMH pk. | **12.0v** | **1100**mAh | **$39.95** |
| *For STANDARD C228, C528, C558; ADI HT-201, 401 etc:* | | | |
| **CNB-151x** NiMH pk | **7.2v** | **1650**mAh | **$28.95** |

*NEW- the IQ-9000 Charger & Conditioner for AA & AAA batteries!* **$22.95**
*(1) Desktop unit can charge or condition up to 4 NiMH or NiCd cells!*
*(2) Has selectable conditioning feature !*
*(3) Provides safe, quick charge for cells!*
*(4) Automatic shut-off at end of charge!*
*(5) UL-listed power supply included!*

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| | | |
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| June Issue | Deadline: April 17, 2003 | Ships Mid May 2003 |
| July Issue | Deadline: May 16, 2003 | Ships Mid June 2003 |

# SAVE BIG ON ANTENNAS, TOWERS & CABLE

## TELESCOPING ALUMINUM TUBING

DRAWN 6063-T832

| | | | |
|---|---|---|---|
| .375 | $.70/ft | 1.375" | $1.75/ft |
| .500" | $.80/ft | 1.500" | $1.95/ft |
| .625" | $.90/ft | 1.625" | $2.25/ft |
| .750" | $1.00/ft | 1.750" | $2.50/ft |
| .875" | $1.10/ft | 1.875" | $2.75/ft |
| 1.000" | $1.20/ft | 2.000" | $3.00/ft |
| 1.125" | $1.35/ft | 2.125" | $3.50/ft |

**In 6' or 12' lengths, 6' lengths ship UPS. Call for 3/16"& 1/4" rod, bar stock, and extruded tubing.**

## CUSHCRAFT ANTENNAS

| | |
|---|---|
| 13B2/A148-10S | $149/85 |
| A270-6S/A270-10S | $79/99 |
| A3S/A4S | $449/539 |
| A50-3S/5S/6S | $95/169/259 |
| A627013S | $189 |
| AR2/ARX2B | $49/69 |
| AR270/AR270B | $85/99 |
| R6000/R8 | $319/449 |
| X7/X740 | $679/289 |
| XM240 | $719 |

**Please call for more Cushcraft items**

## FORCE 12–MULTIBAND

| | | |
|---|---|---|
| C3 | 10/12/15/17/20m, 7 el | $599 |
| C3E | 10/12/15/17/20m, 8 el | $649 |
| C3S | 10/12/15/17/20m, 6 el | $539 |
| C3SS | 10/12/15/17/20m, 6 el | $559 |
| C4 | 10/12/15/17/20/40m, 8 el | $759 |
| C4S | 10/12/15/17/20/40m, 7 el | $679 |
| C4SXL | 10/12/15/17/20/40m, 8 el | $979 |
| C4XL | 10/12/15/17/20/40m, 9 el | $1119 |
| C19XR | 10/15/20m, 11 el | $959 |
| C31XR | 10/15/20m, 14 el | $1299 |

**Please call for more Force 12 items**

## TRYLON "TITAN" TOWERS

**SELF-SUPPORTING STEEL TOWERS**

| | | |
|---|---|---|
| T200-64 | 64', 15 square feet | $1099 |
| T200-72 | 72', 15 square feet | $1299 |
| T200-80 | 80', 15 square feet | $1499 |
| T200-88 | 88', 15 square feet | $1769 |
| T200-96 | 96', 15 square feet | $2049 |
| T300-88 | 88', 22 square feet | $1989 |
| T400-80 | 80', 34 square feet | $1899 |
| T500-72 | 72', 45 square feet | $1799 |
| T600-64 | 64', 60 square feet | $1699 |

**Many more Trylon towers in stock!**

## BENCHER / BUTTERNUT

| | |
|---|---|
| Skyhawk, Triband Beam | $1129 |
| HF2V, 2 Band Vertical | $239 |
| HF5B, 5 Band Minibeam | $349 |
| HF6VX, 6 Band Vertical | $329 |
| HF9VX, 9 Band Vertical | $349 |
| A1712, 12/17m Kit | $54 |
| CPK, Counterpoise Kit | $129 |
| RMKII, Roof Mount Kit | $159 |
| STRII, Roof Radial Kit | $125 |
| TBR160S, 160m Kit | $119 |

**More Bencher/Butternut–call**

## M2 VHF/UHF ANTENNAS

**144–148 MHz**

| | |
|---|---|
| 2M4/2M7/2M9 | $95/115/125 |
| 2M12/2M5WL | $159/209 |
| 2M5-440XP, 2m/70cm | $169 |

**420–450 MHz**

| | |
|---|---|
| 440-70-5W/420-50-11 | $135/93 |
| 432-9WL/432-13WL | $175/229 |
| 440-18/440-21ATV | $125/145 |

**Satellite Antennas**

| | |
|---|---|
| 2MCP14/2MCP22 | $175/229 |
| 436CP30/436CP42UG | $229/269 |

## ROHN TOWER

| | |
|---|---|
| 25G/45G/55G | $89/189/239 |
| 25AG2/3/4 | $109/109/139 |
| 45AG2/4 | $209/225 |
| AS25G/AS455G | $39/89 |
| BPC25G/45G/55G | $75/99/110 |
| BPL25G/45G/55G | $85/109/125 |
| GA25GD/45/55 | $68/89/115 |
| GAR30/GAS604 | $35/24 |
| SB25G/45/55 | $39/89/109 |
| TB3/TB4 | $85/99 |

**Please call for more Rohn prices**

## US TOWER

| | |
|---|---|
| MA40/MA550 | $849/1399 |
| MA770/MA850 | $2359/3649 |
| TMM433SS/HD | $1139/1379 |
| TMM541SS | $1499 |
| TX438/TX455 | $979/1579 |
| TX472/TX489 | $2459/4579 |
| HDX538/HDX555 | $1269/2269 |
| HDX572MDPL | $5899 |

**Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!**

## COMET ANTENNAS

| | |
|---|---|
| GP15, 6m/2m/70cm Vertical | $149 |
| GP6, 2m/70cm Vertical | $139 |
| GP9, 2m/70cm Vertical | $179 |
| B10NMO, 2m/70cm Mobile | $36 |
| SBB224NMO, 2m/220/70cm | $69 |
| SBB2NMO, 2m/70cm Mobile | $39 |
| SBB5NMO, 2m/70cm Mobile | $55 |
| SBB7NMO, 2m/70cm Mobile | $75 |
| Z750, 2m/70cm Mobile | $55 |
| Z780, 2m/70cm Mobile | $69 |

**Much more Comet in stock–call**

## M2 ANTENNAS

**50–54 MHz**

| | |
|---|---|
| 6M5X/6M7 | $209/299 |
| 6M7JHV/6M9KHW | $259/469 |

**HO LOOPS**

| | |
|---|---|
| 6M/2M/222/432 | $95/45/45/45 |

**HF ANTENNAS**

| | |
|---|---|
| 10/15M4DX, 4 Element | $389/439 |
| 20M4DX, 4 Element 20m | 529 |
| KT36XA, Triband Beam | $1249 |

**More M2 models in stock–please call**

## GLEN MARTIN ENGINEERING

**Hazer Elevators for 25G**

| | |
|---|---|
| H2, Aluminum Hazer, 12 sq ft | $359 |
| H3, Aluminum Hazer, 8 sq ft | $269 |
| H4, HD Steel Hazer, 16 sq ft | $339 |

**Aluminum Roof Towers**

| | |
|---|---|
| RT424, 4 Foot, 6 sq ft | $159 |
| RT832, 8 Foot, 8 sq ft | $239 |
| RT936, 9 Foot, 18 sq ft | $389 |
| RT1832, 17 Foot, 12 sq ft | $519 |
| RT2632, 26 Foot, 9 sq ft | $869 |

## UNIVERSAL ALUMINUM TOWERS

| | |
|---|---|
| **4**-40'/50'/60' | $539/769/1089 |
| **7**-50'/60'/70' | $979/1429/1869 |
| **9**-40'/50'/60' | $759/1089/1529 |
| **12**-30'/40' | $579/899 |
| **15**-40'/50' | $1019/1449 |
| **23**-30'/40' | $899/1339 |
| **35**-30'/40' | $1019/1569 |

**Bold in part number indicates windload capacity. Please call for other Universal models. Shipped factory direct to save you money!**

## DIAMOND ANTENNAS

| | |
|---|---|
| D130J/DPGH62 | $79/139 |
| F22A/F23A | $89/119 |
| NR72BNMO/NR73BNMO | $39/54 |
| NR770HBNMO/NR770RA | $55/49 |
| X200A/X3200A | $129/210 |
| X500HNA/X700HNA | $229/369 |
| X510MA/X510NA | $189/189 |
| X50A/V2000A | $99/149 |
| CR627B/SG2000HD | $99/79 |
| SG7500NMO/SG7900A | $75/112 |

**More Diamond antennas in stock**

## MFJ

| | |
|---|---|
| 259B, Antenna Analyzer | $219 |
| 269, Antenna Analyzer | $299 |
| 941E, 300W Antenna Tuner | $109 |
| 945E, 300W Antenna Tuner | $99 |
| 949E, 300W Antenna Tuner | $139 |
| 969, 300W Antenna Tuner | $169 |
| 986, 3KW Antenna Tuner | $289 |
| 989C, 3KW Antenna Tuner | $309 |
| 1798, 80–2m Vertical | $249 |
| 1796, 40/20/15/10/6/2m Vert. | $189 |

**Big MFJ inventory–please call**

## COAX CABLE

| | |
|---|---|
| RG-213/U, (#8267 Equiv.) | $.36/ft |
| 8X-MINI, Mini RG-8 Foam | $.19/ft |
| RG-213/U Jumpers | Please Call |
| RG-8X Jumpers | Please Call |

**Please call for more coax/connectors**

## TOWER HARDWARE

| | |
|---|---|
| 3/8"EE / EJ Turnbuckle | $11/12 |
| 1/2"x9"EE / EJ Turnbuckle | $16/17 |
| 1/2"x12"EE / EJ Turnbuckle | $18/19 |
| 3/16" / 1/4" Preformed Grips | $5/6 |

**Please call for more hardware items**

## TIMES MICROWAVE LMR® COAX

| | |
|---|---|
| LMR-400 | $.59/ft |
| LMR-400 Ultraflex | $.89/ft |
| LMR-600 | $1.19/ft |
| LMR600 Ultraflex | $1.95/ft |

## HIGH CARBON STEEL MASTS

| | |
|---|---|
| 5 FT x .12" / 5 FT x .18" | $35/59 |
| 10 FT x .18" / 11 FT x .12" | $129/80 |
| 16 FT x .12" / 16 FT x .18" | $119/179 |
| 20 FT x .25 | $315 |
| 22 FT x .12" / 21 FT x .18" | $149/235 |

## GAP ANTENNAS

| | |
|---|---|
| Challenger DX | $289 |
| Challenger Counterpoise | $29 |
| Challenger Guy Kit | $19 |
| Eagle DX | $299 |
| Eagle Guy Kit | $29 |
| Titan DX | $329 |
| Titan Guy Kit | $29 |
| Voyager DX | $409 |
| Voyager Counterpoise | $49 |
| Voyager Guy Kit | $45 |
| Quick Tilt Ground Mount | $75 |

## LAKEVIEW HAMSTICKS

| | | |
|---|---|---|
| 9106 ... 6m | 9115 ... 15m | 9130 ... 30m |
| 9110 ... 10m | 9117 ... 17m | 9140 ... 40m |
| 9112 ... 12m | 9120 ... 20m | 9175 ... 75m |

**All handle 600W, 7' approximate length, 2:1 typical VSWR ... $24.95**

## HUSTLER ANTENNAS

| | |
|---|---|
| 4BTV/5BTV/6BTV | $129/169/199 |
| G6-270R, 2m/70cm Vertical | $169 |
| G6-144B/G7-144 | $109/179 |

**Hustler Resonators in stock–call**

## ANTENNA ROTATORS

| | |
|---|---|
| M2 OR-2800PDC | $1249 |
| Yaesu G-450A | $249 |
| Yaesu G-800SA/DXA | $329/409 |
| Yaesu G-1000DXA | $499 |
| Yaesu G-2800SDX | $1089 |
| Yaesu G-550/G-5500 | $299/599 |

## ROTATOR CABLE

| | |
|---|---|
| R62 (6, #18) | $.32/ft. |
| R81/82 | $.25/.39 |
| R84 | $.85/ft |

## PHILYSTRAN GUY CABLE

| | |
|---|---|
| HPTG1200I | $.45/ft |
| HPTG2100I | $.59/ft |
| PLP2738 Big Grip (2100) | $6.00 |
| HPTG4000I | $.89/ft |
| PLP2739 Big Grip (4000) | $8.50 |
| HPTG6700I | $1.29/ft |
| PLP2755 Big Grip (6700) | $12.00 |
| HPTG11200 | $1.89/ft |
| PLP2758 Big Grip (11200) | $18.00 |

**Please call for more info or help selecting the Phillystran size you need.**

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**PW-1 ..... New Lower Price!**

The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.

**IC-746PRO ..... In Stock!**

The Icom IC-746PRO is an all mode HF/6m/2m trasceiver with 32-bit IF level DSP. The radio features a built-in auto tuner, built-in RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied with up/down hand mic and DC power cord.

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All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with up/down hand mic and DC power cord.

**FT-1000MP-V ..... Yaesu Special!**

Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

**FT-1000MP-V Field ..... New!**

Low power (100W) version of the FT-1000MP-V, with built-in power supply.

**FT-920 ..... Yaesu Special!**

All mode HF/6m XCVR featuring DSP, automatic tuner, and more. With up/down hand microphone and DC power cord.

**Quadra System ..... Lower Price!**

Solid state 1 kW autotuning amplifier.

**FT-897 ..... Now In Stock!**

"Backpack" all-mode HF/6m/2m/70cm XCVR offering 100 watts of output power! The radio can be run from optional internal batteries with reduced output of 20 watts, or an optional internal power supply can be installed instead. An optional bolt-on external auto tuner is also available. The FT-897 is a truly self-contained portable!

**FT-847 ..... Yaesu Special!**

Great all-mode XCVR covering HF/6m/2m/70cm! The radio is perfect for satellite operation, and features DSP, CTCSS tone encode/decode, and more. Supplied with up/down microphone and DC power cord.

**IC-706MK2G ..... Icom Special!**

The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode transceiver with digital signal processing, automatic repeater offset, built-in CW keyer, built-in CTCSS tone encode/decode/scan, 107 memory channels and more. A detachable front panel offers convenient mounting, even in compact vehicles.

**IC-718 ..... New Lower Price!**

The Icom IC-718 is an all mode HF transceiver featuring a front panel mounted speaker, IF shift, optional DSP module, multiple scanning modes, noise blanker, RIT, and more.

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Dual band 2m/70cm FM XCVR. Features removeable control panel, CTCSS tone encode/decode/scan, cross band repeat, 1200/9600 bps data jack, dual RX, extended RX, 212 memory channels, and more. Supplied with DTMF hand microphone, mounting brackets, and power cord.

**IC-V8000 ..... New, In Stock!**

Great 75W 2m mobile XCVR. Features CTCSS tone encode/decode/scan, 207 memories, front panel mounted speaker, and more. Supplied with a DTMF hand mic, mounting bracket, and DC cord.

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Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat, tone encode/decode, and removable control panel for remote mounting.

**FT-90R ..... Great Low Price!**

Ultra-compact 2m/70cm mobile XCVR. With removeable control head.

**FT-2800M ..... New!**

Rugged 2m mobile XCVR, built to MIL-STD 810, with 65 watts RF output.

**FT-100D ..... Yaesu Special!**

Ultra-compact all mode XCVR for HF/6m/2m/70cm.Features DSP, CW memory keyer, tone encode/decode, 200 memories, VOX, and more. Supplied with a DTMF hand mic, DC power cord and mounting bracket.

**FT-817 ..... Now In Stock!**

A truly tiny self-contained all mode HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memories, VOX, and more! With hand mic, DC cord and bracket.

**IC-T7H ..... Icom Special!**

Small 6W 2m/70cm, with full CTCSS tone.

**IC-T2H Sport ..... Great Price!**
**IC-T90A ..... New, In Stock!**
**IC-V8 ..... New, In Stock!**
**IC-W32A ..... In Stock!**

**IC-207H ..... Great Low Price!**

A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 182 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

**IC-2100H ..... Great Low Price!**

Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memory channels, and more.

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**IC-R2/R3/R10 ..... In Stock!**

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Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

**G-1000DXA ..... $499**
**G-800SA/DXA ..... $329/409**
**G-450A ..... $249**
**G-5500 ..... $599**
**G-550 ..... $299**

**FT-50RD ..... New Lower Price!**
**VR-120D ..... Yaesu Special!**
**VR-500 ..... Yaesu Special!**
**VX-1R ..... New Lower Price!**
**VX-5R ..... Yaesu Special!**
**VX-150 ..... Yaesu Special!**
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# Leading the Way in FM Mobile Design... From the Engineers at Yaesu!

## You'll never think about mobile radios the same way. Instead of a dual-bander, enjoy the versatility and performance of the FT-8900R Quad Bander!

Crafting the "perfect" dual-band FM transceiver is a difficult task, requiring engineering expertise in the latest areas of high-tech design. Adding other bands is an even greater challenge, calling for a delicate touch so as not to upset the original performance of the dual-bander. The FT-8900R is the crowning achievement in our proud FM mobile design history, bringing together the best features of Yaesu electrical, ergonomic, and mechanical design know-how in a compact, versatile Quad Bander with leading-edge features like VHF/UHF full duplex, cross-band repeat, independent operation on two bands, and six "Hyper Memory" keys that store complete transceiver configuration settings. Quite simply, the FT-8900R has no peer among mobile transceivers.

**Features**

- 29/50/144/430 MHz FM Quad Bander
- V+U/V+V/U+U Dual Band Reception
- V+U Full Duplex Operation
- Cross-Band Repeater Operation
- Independent Dial for Each Band
- Heavy-Duty Construction
- Remote-Head Mounting Capability (requires optional YSK-8900)
- High-Power 50 W (430 MHz: 35 W) and Heavy-Duty PA Design
- User-Programmable Microphone Keys
- Huge Illuminated Display
- 50-Tone CTCSS/104-Code DCS Tone Systems
- ARTS™ (Auto-Range Transponder System)
- Smart Search™ (Automatic Memory Loading System)
- Hyper Memory (stores and recalls six complete sets of transceiver configuration data)
- Huge 800-Channel Memory Capacity
- Versatile Scanning Selections
- RF Squelch
- Internet Key for Instant Access to WIRES™ (Wide-coverage Internet Repeater Enhancement System)
- 1200/9600 bps Packet Operation

# FT-8900R

**29/50/144/430 MHz Quad Band FM Mobile**


Actual Size

*Simulated LCD.

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**Built-In Keyer**
**100W Output on HF + 6M**
**Voice Synthesizer** *(Optional)*
**General Coverage Receiver**
**CW Auto Tune**
**Optional Filters**
**PC Control Program**
**Easy-To-Use**

## TS-870S

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**DSP Noise Reduction**
**Built-In Auto Tuner**
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**IF Stage Auto-Notch**
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