Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

devoted entirely to
AMATEUR RADIO

April 2004

QST reviews

The Elecraft KX1
CW Transceiver Kit

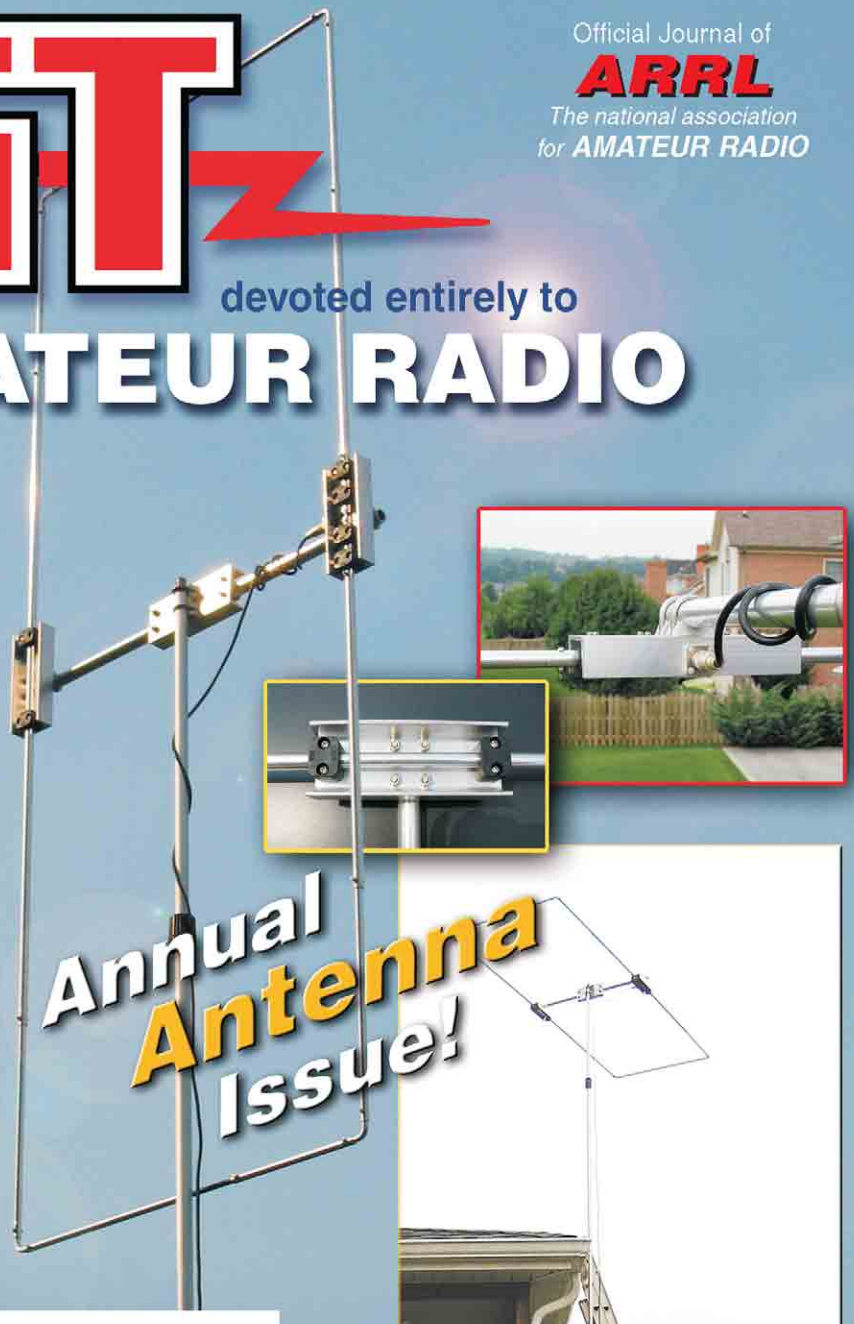
The Yaesu FT-7800
Dual Band
FM Transceiver

A 6 Meter Moxon

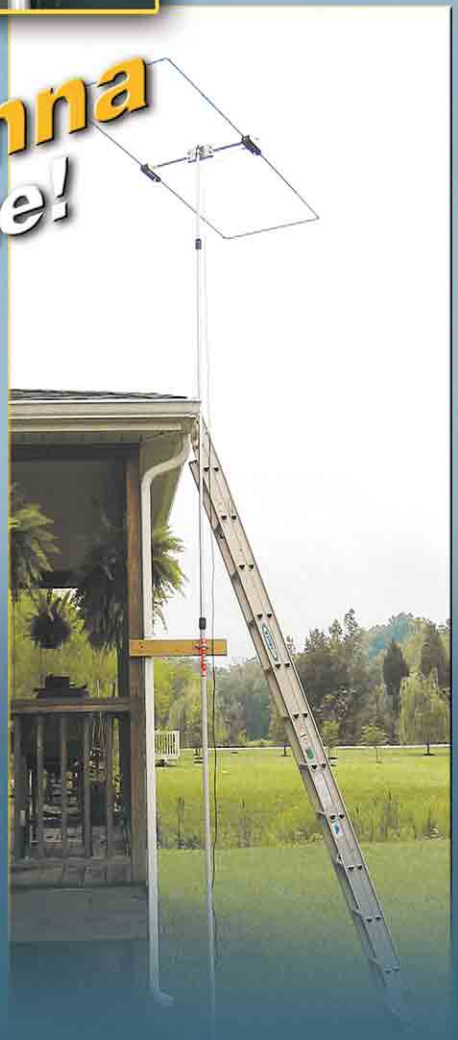
An 80/160 Meter Half Square

Open Wire Feed Line

Special ARRL 90th Anniversary Operating Event



Annual Antenna Issue!



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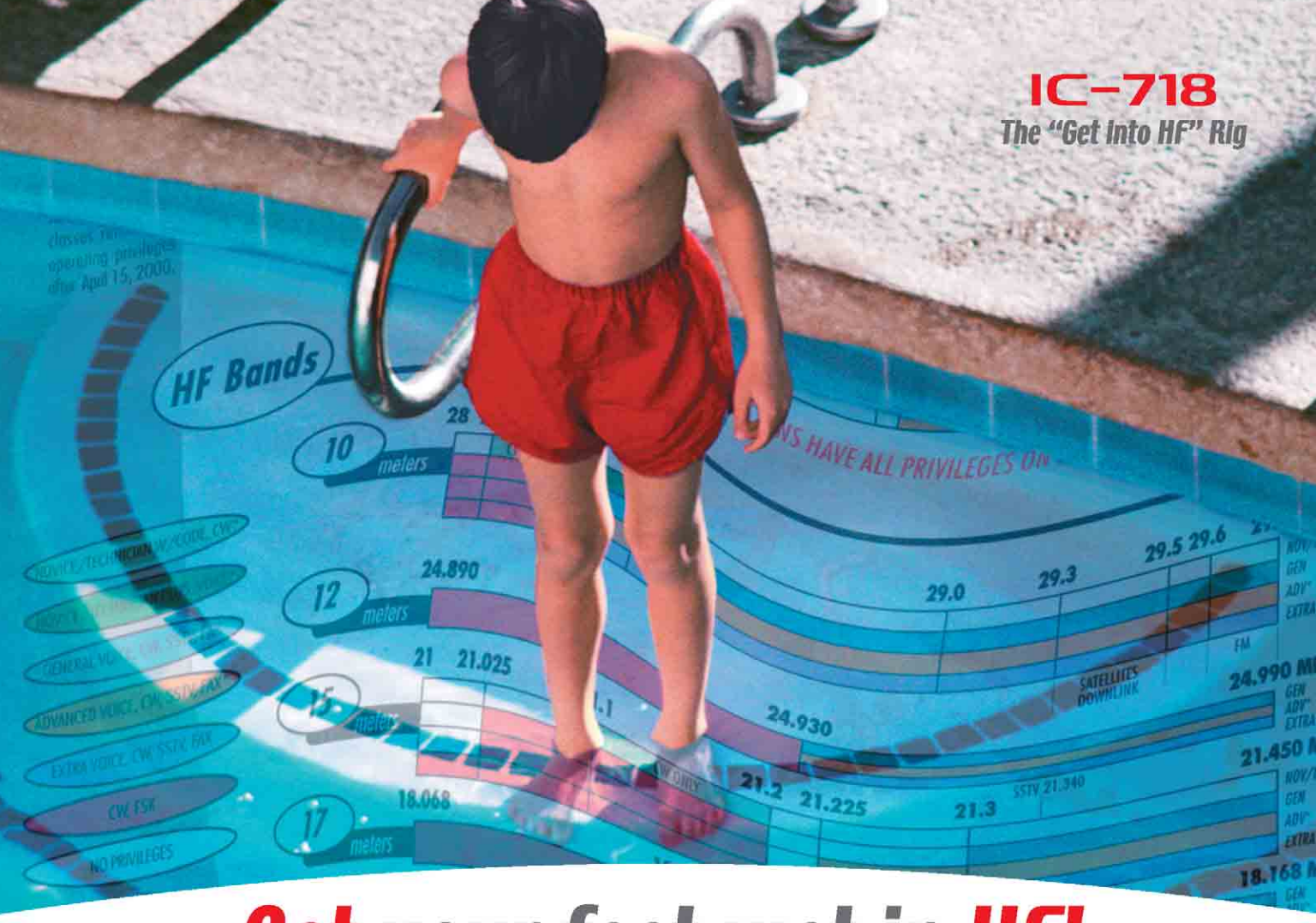

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Want to get your feet wet in HF, without getting soaked? The '718 is the rig for you! Straight forward operation, user friendly features, and low, low price make this one rig you can grow with. Jump in at your authorized Icom dealer.

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"The Icom IC-718 offers a nice collection of the more desirable features that are typically absent from transceivers in its price class."

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"Operating RTTY or PSK31 with the IC-718 was a breeze."

"The IC-718 provides 100W on SSB, RTTY, and CW and 40W on AM. The RF power output is continuously variable between approximately 5 and 100W (from 2 to 40W on AM)."

QST, Product Review, July 2000

160-10M Coverage* • 100W Output Power (40W on AM) • RX Coverage 0.03 - 30MHz • 101 Memories • Multiple Scanning Functions • Front Mounted Speaker • IF Shift • Mic Compressor • RF Gain Control • Noise Blanker • RF Attenuator & PreAmp • Auto Notch Filter • Ample CW features including Electronic Keyer • VOX • Digital S/RF Meter • Flexible Filter Selection • Optional DSP • Optional Voice Synthesizer • And much more!

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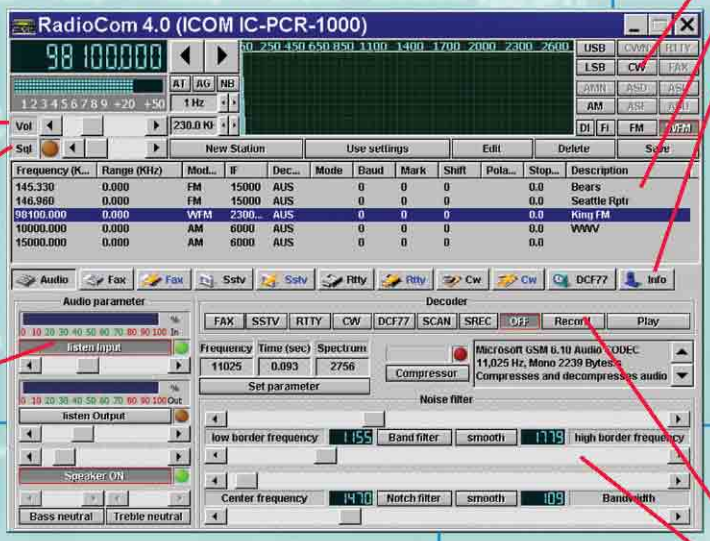

- 100 kHz – 1.3 GHz†
- AM, FM, WFM, USB, LSB, CW
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- Real Time Band Scope
- IF Shift
- Noise Blanker
- Digital AFC
- Voice Scan Control
- Attenuator
- Tunable Bandpass Filters
- AGC Function
- S Meter Squelch
- CTCSS Tone Squelch
- Computer Controlled DSP

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Computer Controlled DSP for tailoring your audio with separate bass & treble controls

Filter Smoothing for the upper and lower ends of the audio spectrum

Notch Filter reduces annoying pops, buzzes, & other interference for a crisp, clear signal. Use the power of your computer's sound card DSP to bring out the beauty of the signal for hours of enjoyable listening

Digital Decoding Package transforms your computer into a decoding machine. You no longer have to purchase an external decoder for receiving non-encrypted digital modes. Digital Decoding allows you to decode: **RTTY**, **FAX** *with Zoom, Synchronize, Slant Correction, Cut a Picture, Picture Invert and Rotate*, **CW**, **SSTV** *with Auto Sync, Slant Corrections*, **Sitor-B**, **PSK31**

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HAM-IV

HAM-IV
$559.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum readability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of 2 1/16 inches.

HAM IV and HAM V Rotator Specifications	
WindLoad capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power (in lbs.)	800
Brake Power (in lbs.)	**5000**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	26
Effective Moment (in tower)	**2800 ft/lbs.**

TAILTWISTER SERIES II

For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/ Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, 2 1/16 inch max. mast.

T-2X
$649.95

T-2XD
$1029.95
with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power (in lbs.)	1000
Brake Power (in lbs.)	**9000**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	31
Effective Moment (in tower)	**3400 ft/lbs.**

CD-45II

CD-45II
$389.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to 2 1/16 inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power (in lbs.)	600
Brake Power (in lbs.)	**800**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	22
Effective Moment (in tower)	**1200 ft/lbs.**

HAM-V

HAM-V
$949.95
with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

AR-40

AR-40
$289.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. 2 1/16 inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power (in lbs.)	350
Brake Power (in lbs.)	**450**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight (lbs.)	14
Effective Moment (in tower)	**300 ft/lbs.**

HDR-300A

HDR-300A
$1379.95

For ***king-sized*** antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power (in lbs.)	5000
Brake Power (in lbs.)	**7500**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight (lbs.)	61
Effective Moment (in tower)	**5000 ft/lbs.**

ROTATOR OPTIONS

MSHD, $99.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $39.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

Digital Automatic Controller

DCU-1
$649.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1 degree accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35
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For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.

RBD-5
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Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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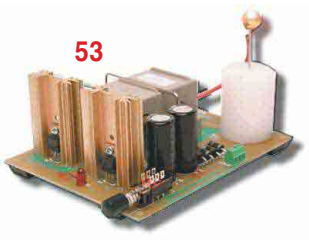

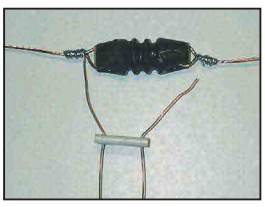

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QST Workbench

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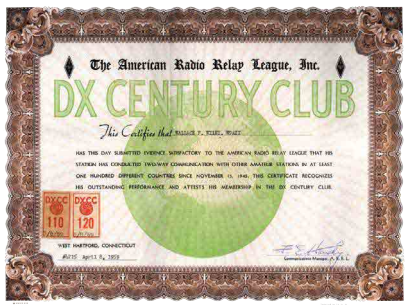

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Operating

Departments

Our Cover
Our annual antenna issue brings an array of ideas for the upcoming season. There's a rundown of the basics by W6BNB, a low band half square, a nifty (and small) HF vertical, a tutorial on how to make the most of the multiband dipole and a three-band dipole that includes (surprise!) 6 meters. The cover article, describing a 6 meter Moxon, begins on page 65. Photos by the author, Allen Baker, KG4JJH.

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4 band Vertical

4BTV

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Special price good through 4/15/04 or until stock is depleted, Limit 2

- 10, 15, 20 and 40 meters
- SWR: 1.6:1 at band edges
- Length: 21'5" long
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5 band Vertical

5BTV

$129.95

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- 10, 15, 20, 40 and 75 or 80 meters
- SWR: 1.6:1 at band edges (up to 100kHz on 75/80 meters)
- Length: 25'1" long
- Weight: 17 lbs.
- Mounting: Ground mount with or without radials, roof or tower mount with radials. Vertical support up to 1.75 in OD pipe.

6 band Vertical

6BTV

$159.95

Special price good through 4/15/04 or until stock is depleted, Limit 2

- 10, 15, 20, 30, 40 and 75 or 80 meters
- SWR: 2:1 at band edges (up to 100kHz on 75/80 meters)
- Length: 24' long
- Weight: 16.5 lbs.
- Mounting: Ground mount with or without radials, roof or tower mount with radials. Vertical support up to 1.75 in OD pipe.

"IT SEEMS TO US..."

The ARRL Licensing Petition

Predictably, the ARRL Board's decision in January to petition the FCC for further streamlining of the amateur licensing structure and the creation of a new entry-level license has precipitated a lot of discussion. The petition was filed on January 28 and eventually will be assigned an RM-number, at which point comments will begin piling in to the FCC.

The petition seeks to bring to a logical conclusion, in light of changes to the international regulations adopted at the 2003 World Radiocommunication Conference, a process that was begun by the FCC in 1998. At that time there was broad agreement that the amateur license structure was overly complex and placed too much emphasis on Morse code skill as a requirement for advancement (although there was certainly no consensus for dropping it entirely, which would not have been possible anyway—at the time, maintaining some Morse requirement for HF operation was still necessary in order to conform to the international regulations).

Effective April 15, 2000, the FCC reduced the number of license classes available to new applicants to just three, Technician, General, and Amateur Extra, and reduced the maximum Morse requirement to 5 words per minute. Older Technician licenses were automatically upgraded to General, reflecting those licensees' having passed the same written exam as many Generals. However, the old "legacy" license classes of Novice and Advanced were not merged into this structure. The ARRL petition proposes a new three-level structure starting with a new entry-level license and progressing through General to Amateur Extra, and the merging of the other existing license classes into the new structure. There are more details in last month's *QST*; the petition itself can be viewed on-line at the ARRL Web site.

Reactions to the proposal vary widely depending on individual perspective. Last month's editorial discussed the shortcomings of the Technician license as the point of entry into Amateur Radio; members who recognize this problem generally support the concept of a new entry-level license, if not all of its details. Converting present Novices to the new entry-level license seems to be a non-issue. At the "high end," no significant changes are proposed for the Amateur Extra license. Requirements would remain the same, which disappoints those who view the WRC-03 results as an opportunity to drop the Morse requirement once and for all (as well as those who would like to turn back the clock and reimpose a higher-speed requirement, something the FCC is not about to consider). Merging Advanced and Amateur Extra makes sense to those who are knowledgeable about what it took to obtain an Advanced license when it was available, vs what the requirements for the Amateur Extra are today.

Most of the controversy seems to revolve around the proposal to merge the Technician and Tech Plus licenses (the latter indicative of passing a 5-WPM code test) into General, and to a lesser extent, the proposal to drop the Morse requirement for a General license. Where you come out on this issue depends upon whether you view the proposal as providing a framework for the growth and advancement of the Amateur Radio Service for the next 10 to 15 years—in other words, its effect on future licensees—or whether you see it in more immediate terms.

If you share the Board's assessment of the problems now facing Amateur Radio—declining levels of interest and activity coupled with increasing threats to our radio spectrum access—and its vision for a brighter future, you're likely to support the proposal (or something like it). If you like the status quo (or how you recall things were in the "good old days") and want to perpetuate it for as long as possible, you're more likely to focus on the proposal's immediate effect on present licensees. This leads to thoughts that merging license classes "gives people something for nothing" or "cheapens a license I worked hard for"—understandable emotions, but not useful in addressing the longer-term issues.

Earning additional privileges by demonstrating progressively greater qualifications is an important part of Amateur Radio in the United States, and will remain so under the ARRL proposal. However, comparing the relative difficulty of exams over a period of decades is a tricky business. There is no way to equate the effort required; what's easy for one person is hard for another. Unlike many of us, nearly all current Technician and Tech Plus licensees have passed an examination since 1987. If the date of your last FCC exam was long before then, their exam covered topics that were not included on yours. Thanks to advances in technology and the allocation of new bands, all of us who are long time amateur licensees can use privileges for which we have not been examined.

For a bright future, Amateur Radio needs a route of entry that provides useful and interesting privileges in exchange for passing an exam covering what you really need to know as a beginner, and not burdened with esoteric vocabulary. Amateur Radio also needs rules that are not cluttered with references to classes of license that are no longer available and subbands that no longer make sense.

But the license is the beginning, not the end. What you do with the license is far more important than the class of license you hold. And while completing the streamlining begun in 1998 is important for the future, even more important is what we do as individuals and groups to train and mentor a new generation of radio amateurs. Once in a while we hear the complaint about new amateurs, "They can't even solder a coax connector." If true, the exam system is not the place to look for a solution. We should look a bit closer to home.—*David Sumner, K1ZZ*

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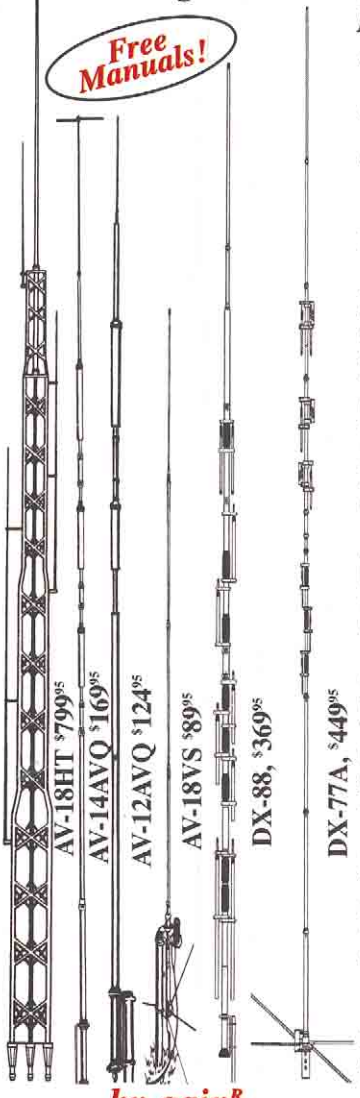

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AV-14AVQ, $169.95. (10,15,20,40 Meters). 18 ft., 9 lbs. The Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

AV-12AVQ, $124.95. (10, 15, 20 Meters). 13 ft., 9 lbs. The AV-12AVQ also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, $89.95.

AV-18VS, $89.95. (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. High quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs. All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $189.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs. *No ground radials required!* Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$799.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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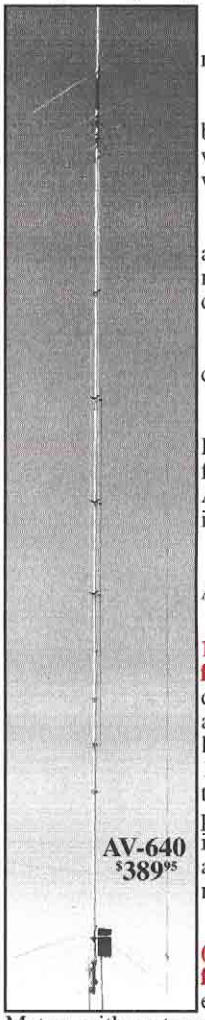

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AV-620, $289.95. (6,10,12,15,17,20 Meters). 22.5 ft., 10.5 lbs. The AV-620 covers all bands 6 through 20 Meters with no traps, no coils, no radials yielding an uncompromised signal across all bands.

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ARRL in ACTION

YOUR membership at work

By Dave Hassler, K7CCC, dhassler@arrl.org

Library Display Generates Interest in Amateur Radio

MIKE DUFF, KG4SLH

Mike Duff, KG4SLH, Assistant Public Information Coordinator in the South Carolina Section, has hit upon a way to reach a lot of people with the ARRL message cheaply and effectively: public library displays. "I wanted a way for youth and the general public to be exposed to Amateur Radio and get them interested in it," Duff said. "Almost all public libraries have a display case for clubs or individuals to use to promote their hobby or organization... at no cost."

A Hallicrafters SX-99 and a Heathkit DX-35 anchor an Amateur Radio display at the Darlington County Library in South Carolina. Mike Duff, KG4SLH; Jack Jackson, N4JJ, and Cynthia Duff, KG4ZLE, made the display.

So far, Duff has put up displays at four different libraries in his area. He stocks the displays with League literature and local information, as well as some ham gear. "All of the libraries have loved the displays," he reported. "Most have asked to keep the displays for two months instead of the usual month. I think the displays have brought a lot of attention to Amateur Radio and the ARRL-affiliated Florence Amateur Radio Club."

North Texas Section Volunteers Attend *Columbia* Remembrance

North Texas Section Manager Roy Rabey, AD5KZ, spoke at a Space Shuttle *Columbia* shuttle recovery remembrance event hosted by the Nacogdoches Amateur Radio Club the weekend of February 1. "I thanked everyone on behalf of the ARRL for demonstrating how valuable Amateur Radio communications can be," he said. "In the midst of a terrible tragedy, in an area that was inundated with a myriad of government agencies all needing help with communications, the local EmComm groups and the hams that came in to help really did incredible things."

North Texas Section Assistant SM Army Curtis, AE5P, a member of the Nacogdoches ARC who coordinated a number of ham activities during the recovery effort, related how valuable the ARRL Emergency Communications Courses were.

ARRL Staff, Officer Bios Available

Need to know a bit more about key ARRL Staff and Officers? A set of personal biographies of those who regularly attend ham radio events is up on the ARRL Public Relations Web pages at **www.arrl.org/pio/bios/**. The information, compiled by ARRL Media Relations Manager Jennifer Hagy, N1TDY, may be used in convention brochures, handouts, club newsletters or promoting an upcoming speaker.

ARRL Affiliated Club Makes a Difference for Retired Ham

This past Christmas, North Carolina ham Doug Lee, W9SPC, was concerned about a friend back home in Indiana, who was about to enter a retirement home with little hope of getting back on the air. Too far away to help himself, Lee jumped onto the ARRL Web site's Affiliated Clubs Search page at **www.arrl.org/FandES/field/club/clubsearch.phtml**. He found the nearby ARRL-affiliated Mid-State ARC, e-mailed the club's president and explained the situation.

MARC president Jerry Schantz, W9JJS, said he would do his best to make Lee's friend, Gerald Wood, WA9SAR, feel at home and begin operating again. Club member Chuck Moser, KB9TEO, found that a previous resident had once had a dipole up. "Gerald told me that they were welcoming him in 'the old ham radio fashion,'" Lee said. By January 11, Wood was on the air on HF and 2 meters, with, as Schantz wrote to Lee, "a bit more sparkle in both his eyes and voice."

JERRY SCHANTZ, W9JJS

Chuck Moser, KB9TEO (right), a member of the ARRL-affiliated Mid-State ARC, helped Jerry Wood, WA9SAR, set up a shack at Wood's retirement home residence.

ARRL Technical Relations Office Eyes WRC-07

While it may seem like WRC-03 just concluded, the ARRL Technical Relations Office in Washington is already participating in a new cycle of meetings to prepare for the next World Radiocommunication Conference (WRC), tentatively scheduled for 2007. ARRL Chief Technology Officer Paul Rinaldo, W4RI, said that ARRL's involvement has taken two forms: the FCC WRC-07 Advisory Committee and its Informal Working Groups, and regular meetings of various International Telecommunication Union working parties. "Technical Relations Specialist Walt Ireland, WB7CSL, has been particularly active as vice chairman of the working group on broadcasting and amateur WRC-07 agenda items, and as convener of US Working Party 6E," he added.

Moore Over Miami

ARRL DXCC Supervisor Bill Moore, NC1L, checked QSL cards at Tropical Hamboree in Miami February 7-9 with the help of DXCC Card Checker Don Search, W3AZD. The pair went through 27 DXCC applications (2487 credits), eight Worked All States awards and a VUCC application. Moore also participated in the DX forum and fielded questions regarding Logbook of The World and other DXCC issues. Several League Directors and section officials were also on hand to meet fellow amateurs and answer questions.

BILL MOORE, NC1L

Southeastern Division Director Frank Butler, W4RH (left), and Vice Director Sandy Donahue, W4RU, were part of the ARRL presence at the Tropical Hamboree in Miami.

ARRL VP Heyn Notes Trends at CES

ARRL Honorary Vice President Fried Heyn, WA6WZO, visited the 2004 International Consumer Electronics Show in Las Vegas this January, surveying trends that could have an impact on Amateur Radio. There were 2491 companies represented in 1.38 million square feet of exhibit space. Heyn attended presentations by Microsoft's Bill Gates and FCC Chairman Michael Powell. In his remarks, Powell forecast less FCC regulation in order to promote market creativity and competition, although BPL was not specifically mentioned. Amateur Radio manufacturers ICOM and Kenwood had booths at the show with ham gear.

League Keeps the FAQs Straight

♦ ARRL Regulatory Information Specialist John Hennessee, N1KB, researched and compiled a new FAQ (Frequently Asked Questions file) for the ARRL Regulatory Web Pages on repeaters, including auxiliary operation, ancillary uses, types of control and similar issues. He also added new information to the Antenna and Zoning Restrictions "How To" Chart.

Another new FAQ, chiefly written by *QST* Senior News Editor Rick Lindquist, N1RL, and ARRL VEC Manager Bart Jahnke, W9JJ, covers ARRL's license restructuring proposal. Hennessee said that in the first three weeks after the ARRL Board of Directors approved the restructuring proposal, he fielded over 100 phone calls and 300 e-mails from members asking him about the nuts and bolts of the plan. He dispelled rumors and copied each member's Director. "Once we got the FAQ up, there were a lot fewer questions, as members could clearly see how the proposal would work," Hennessee said.

Dorff, 11, Appointed Alabama Assistant SM

Looking to get more veteran operators involved in more youth activities, Alabama Section Manager Greg Sarratt, W4OZK, made a logical move: In January he appointed a youthful Assistant SM for Youth Activities, Rebekah Dorff, WG4Y. Rebekah is an 11-year-old net control operator with a DXCC Award on her shack wall.

COURTESY REBEKAH DORFF, WG4Y

Alabama Assistant Section Manager for Youth Activities Rebekah Dorff, WG4Y, age 11, says she will work hard to encourage more kids in her section to get involved with Amateur Radio.

"Rebekah will help us to bridge the generation gap within the Amateur Radio ranks in Alabama," Sarratt said. "She will also highlight and promote more youth Amateur Radio activities." Dorff said she's excited about being an ASM. "I hope that, with Mr Sarratt's help, we can come up with ways to get more kids interested in Amateur Radio. It is a great hobby and I would love to see more youth get involved." Dorff's ham Web site is at **www.qsl.net/wg4y/**.

Hagy Represents League at MS Convention

ARRL Media Relations Manager Jennifer Hagy, N1TDY, served as the ARRL Headquarters representative at the Mississippi Section Convention February 7. The event was held in conjunction with the Capital City Hamfest, sponsored by the Jackson ARC.

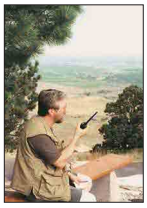
"I spoke with a number of members and took membership applications from new and renewing members," Hagy said. In addition, she put on a public relations forum to show members and other interested hams how the national public relations effort works from HQ, and what local volunteers can do to get involved with spreading the good message of Amateur Radio in their area. Hagy said the place to start is by contacting your Section Manager, whose contact information is on page 16.

ARRL

ARRL Media Relations Manager Jennifer Hagy, N1TDY, shared successful public relations strategies with Mississippi hams.

Guide to ARRL Member Services

ARRL, 225 Main Street, Newington, CT 06111-1494



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**.

ARRLWeb www.arrl.org

Log on for news, information and ARRL services. Members have access to special ARRL Web site features. Place free classified ads. Download and view *QST* product reviews and search the on-line periodicals index.

ARRL E-mail Forwarding

Life in cyberspace is easier when you have your own **arrl.net** e-mail address. When you switch Internet Service Providers, all you have to do is let us know and we'll change your e-mail forwarding automatically. You're spared the hassle of having to tell everyone that you've changed addresses! Sign up on the Web at **www.arrl.org/members-only/emailfwd.html**.

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**.

QSL Service

The most economical way to send and receive QSL cards throughout the world is through the ARRL QSL Service.

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A complete line of educational materials are available to schools, clubs and individuals.

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You can rely on ARRL for the very best publications and products: license manuals, circuit design and project resources, antenna construction ideas, and more. Shop online or locate a dealer near you at **www.arrl.org/shop**. What's the secret for making great publications even better?**—We listen to you!** E-mail your publications feedback, suggestions and product ideas to **pubsfdbk@arrl.org**.

Insurance

The ARRL "All Risk" Ham Radio Equipment Insurance Plan provides protection from loss or damage to your amateur station and mobile equipment by theft, accident, fire, flood, tornado, and other natural disasters. Antennas rotators and towers can be insured too. Call 860-594-0211.

DXCC/VUCC

The DX Century Club and VHF/UHF Century Club award programs are among the most popular Amateur Radio awards in the world.

Volunteer Examiner Coordinator (VEC)

Are you looking for a place to take your license exam? Do you have questions about the examination process? The ARRL VEC network is the largest in the nation.

Trust in Advertising

ARRL's advertising acceptance process is a unique and respected service provided to both members and advertisers. The ARRL Lab regularly evaluates products for acceptable construction quality, safety, compliance with FCC requirements and performance claims. Members rely on *QST* and other ARRL publications to locate reputable suppliers of Amateur Radio equipment and services.

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 860-594-0397.

Write for *QST*

We're always looking for articles of interest to amateurs. See our Author's Guide at **www.arrl.org/qst/aguide/**. If you have questions, or wish to submit an article for consideration, send an e-mail to **qst@arrl.org** or simply mail your article to *QST* c/o ARRL Hq.

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), Monday-Friday only, 8 AM to 8 PM Eastern Time. From outside the US, call 860-594-0355. The fax number is 860-594-0303 (24 hours a day, 7 days a week).

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.

If you have a question, try one of these ARRL Headquarters departments . . .

	Contact	*Telephone*	*Electronic Mail*
Joining ARRL	Membership Desk	860-594-0338	**membership@arrl.org**
***QST* Delivery**	Circulation Desk	860-594-0338	**circulation@arrl.org**
Permission Requests	Maty Weinberg	860-594-0229	**permission@arrl.org**
Publication Orders	Sales Desk	860-594-0355	**pubsales@arrl.org**
Amateur Radio News	Rick Lindquist	860-594-0222	**n1rl@arrl.org**
Regulatory Info	John Hennessee	860-594-0236	**reginfo@arrl.org**
Exams	VEC	860-594-0300	**vec@arrl.org**
Educational Materials	Educational Services	860-594-0267	**ead@arrl.org**
CCE/EmComm Courses	Dan Miller	860-594-0340	**dmiller@arrl.org**
Contests	Dan Henderson	860-594-0232	**contests@arrl.org**
Technical Questions	ARRL Lab	860-594-0214	**tis@arrl.org**
DXCC	Bill Moore	860-594-0234	**dxcc@arrl.org**
Awards/VUCC	Eileen Sapko	860-594-0288	**awards@arrl.org**
Development Office	Mary Hobart	860-594-0397	**mhobart@arrl.org**
Advertising	Advertising Desk	860-594-0207	**ads@arrl.org**
Media Relations	Jennifer Hagy	860-594-0328	**newsmedia@arrl.org**
QSL Service	Martin Cook	860-594-0274	**buro@arrl.org**
Scholarships	Development Office	860-594-0397	**foundation@arrl.org**
Emergency Comm	Steve Ewald	860-594-0265	**emergency@arrl.org**
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DX on 160—Mobile

What do you do for a challenge when you don't have a home station? If you're Don Stribling, KH6DX, of Val Verde, California, you pursue DX Mobile on 160. Don's persistence has brought him confirmations with more than 100 DXCC entities, and his QSL cards have been checked by the ARRL DXCC Branch. It's a first, and Don was kind enough to share some photos with us. [Editor's Note: DXCC is not issued with a mobile endorsement. Don will be receiving a 160 Meter CW DXCC award.]

The pickup and antennas: **Don's 1995 Dodge diesel pickup, with homebrew screwdriver whip (note the 160 meter auxiliary coil. This has since been replaced with a Predator 4 inch diameter Screwdriver. On the cab roof is a 160/80 meter coaxial loop for receive. It can be rotated from inside the cab. In the bed is a modified tool box that houses the amplifiers and other remote equipment. Not visible under the bed cover are the battery box, which contains two 1200 AH batteries in parallel used for the amplifiers and one 800 AH battery for the transceiver and accessories. At the antenna base is a box containing the matching network and the motor control circuits for raising and lowering the antenna.**

***The remote equipment box*: Inside the toolbox are the amplifiers and antenna tuner. Don's Ten-Tec Hercules amp, which puts out about 400 W, is completely remoted to the front operator's position. At the far end of the box is the Ten-Tec antenna tuner, which Don doesn't normally use. The big white box is a homebrew solid state amp that uses eight each 200 W amp modules that are combined to produce an output of 900 W. It is also completely controlled from the operator's position.**

The box between the two amps is a remote band-pass filter for the big amp. To the front right is the remote RF amp selector, which allows Don to select either one from the operator's position, depending on band conditions.

Not visible are the fuse panel with 200 A fuses feeding each amplifier and 70 A fuse feeding power to the operator's position. There is a copper ground buss along the bottom of the box, and all equipment is grounded to this buss, which is in turn grounded to the truck ground system.

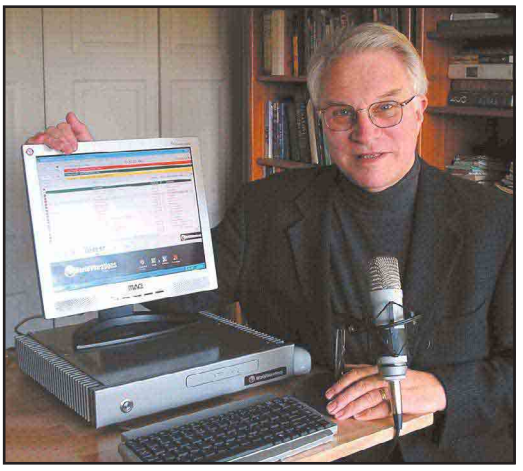
The station: **Inside, Don uses a Ten-Tec OMNI VI transceiver (not your typical mobile rig), an MFJ DSP audio filter, an Array Solutions P-3000 power and SWR meter, and an antenna control panel that controls the remote amplifiers and band-pass filters. To the right are the inverter ON/OFF switch and a map light for use after dark. To the left is Don's laptop, which he uses for logging and contesting. It mates with a GPS receiver mounted on the dash to give a map display of where he is headed. On the fold-down arm rest are his keyer, paddle and the most commonly used controls such as TX/RX, amp in/out and auto message start switch. He also has a paper pad for logging on the move; information is later transferred to the PC.**

Not visible under the seat is a 12 V to 110 V ac inverter used to power the laptop and a switching 12 V dc power supply used to provide a 13.8 V supply to these items, even when the battery output power has sagged.

Also not visible is a control and junction box mounted behind the seat where all cab-mounted items are interfaced with the rear toolbox items. Don also ran large ducting from the truck air conditioner to the toolbox for cooling the amplifiers in warm weather, and heat can be run into the box when it is cold. Don says he doesn't normally need the heat because the amplifiers produce plenty.

Congratulations! **ARRL President Jim Haynie, W5JBP, was inducted into the QCWA Hall of Fame at the 2004 Tropical Hamboree in Miami in early February. That's former FCC official John Johnston, W3BE, doing the honors.**

ADAM SCULL, KG4PSN

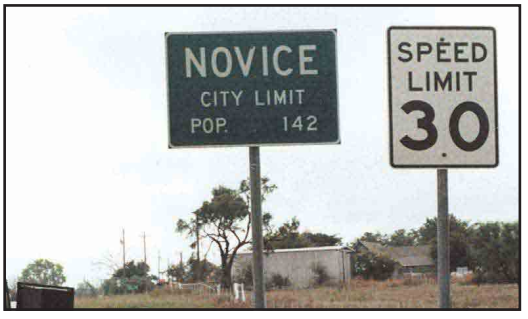


Russ Johnson, W6NFC, gives full credit to Amateur Radio for launching his careers as a broadcaster, writer and media producer working in 56 sometimes-exotic DX destinations around the world. He is the inventor of the WorldVibrations Radio Station (www.worldvibrations.com). The stereo component-sized WVRS is a turnkey, fully automated or live Internet "radio station in a box" that can be put on the air, if licensed, with the addition of a transmitter, EBS generator and antenna. "We're getting interest from parties ranging from small religious missions in Africa to United Nations agencies," says Johnson.

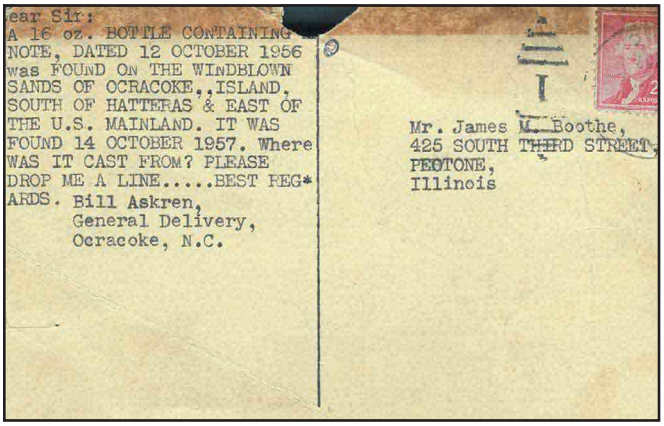
SoCal club helps fight BPL: The Associated Radio Amateurs of Long Beach donated $1600 to the ARRL Spectrum Defense Fund at the club's annual banquet in January. "The ARALB strongly supports and appreciates the ARRL's leadership and initiative in defending the HF spectrum from the menace of BPL," said ARALB President Dennis Kidder, WA6NIA. On hand to receive the donation was Southwestern Division Director Art Goddard, W6XD. ARALB is an ARRL-affiliated club that is deeply involved in nearly all aspects of Amateur Radio, including public outreach at events such as Scout-O-Rama and the W6RO operation on the *Queen Mary*.

MICHAEL J FOX, W6MJF

Outgoing ARALB President Dennis Kidder, WA6NIA (left), presents a $1600 donation for ARRL's Spectrum Defense Fund to Southwestern Division Director Art Goddard, W6XD.



Small town signs: **Russell W. Anderson, N8EEA, of Livonia, Michigan, spotted this interesting juxtaposition of signs on Highway 84 south of Abilene, Texas.**



His first QSL card: **Jim Boothe, KB9VR, of Monee, Illinois, received his first QSL card in an unusual manner. As he tells it: "The year was 1956 and I was a young sailor aboard the destroyer USS *Fred T. Berry* DDE858. We were steaming back from a Mediterranean cruise and were about in the middle of the Atlantic, on our way back to Newport, Rhode Island. I got the position report from the charthouse and added it to a note that I wrote describing the ship and some particulars of myself, stuffed it in a bottle and heaved it over the side. One year after its lanuching, Bill Askren, W3EYB/4 was out beachcombing and found my bottle. He sent me one of his QSL cards, which showed a map of Ocracoke, and inked in a pirate's X on the map side and described how he found it on the letter side. So that's how I got my first QSL card."**

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CASUAL RTTY CONTESTING

♦ My first taste of RTTY [see "Zen and the Casual RTTY Contester," Jan 2004, pages 50-51] was during the ARRL RTTY Roundup. I'm a dedicated PSK operator, so when I got on 20 meters to do PSK, all I saw on my screen were RTTY signals. I had downloaded *MMTTY* software, but had never used it. I thought, let's see how those ops on RTTY have fun. I only have a barefoot transceiver with a homebrew vertical antenna.

Setting up the macros and tuning up my radio, I searched for RTTY signals. Although I only caught the last four hours of the Roundup, my first contact was CN8KD in Morocco. From there, I worked into Europe, South America and most of the East and West Coasts. Although I only made 36 contacts, the experience of working the contest was great. To all of the small gun stations, don't let the fact that you don't have a beam and a kW amp stop you from working your share of DX. Just fire up that rig and go for the gusto.—*Harold Broomfield, KC2BPP, Long Island City, New York*

MISSED THE POINT

♦ I found the letter by K3YZ in the March 2004 issue ["Correspondence," page 25] quite interesting and revealing. Prospective amateurs are failing tests because they have studied obsolete question pools. Perhaps he is missing the point. The purpose of testing is to see if the applicant has a basic understanding of the material. Learning the answers to a specific list of questions proves nothing, if this basic understanding is not achieved. If applicants are failing because they study an obsolete question pool, this proves only one thing: It is wrong to publish these question pools. Applicants should be studying from another information source, such as the *ARRL Handbook*. —*Ted Bergstrom, W1IQW, Mashpee, Massachusetts*

ELMER/ELMERS

♦ In the many years I have been involved in Amateur Radio, I have read many articles about Elmer—the person who got you interested and started in this wonderful hobby of ours. I have no difficulty remembering my Elmer, John Vitale, K2LUG. In the years after I became licensed, I met many other hams, each with different ideas and operating styles. I call them my Elmers also, as each brought something different into Amateur Radio. I got my first license (WB2CHY) during the long seven month strike against New York Telephone Company.

Shortly after I received my license, I got a call from Charlie, W2BFN, who worked in the Central Office with me. I was told to come to his house, where he proceeded to help me load into my car a Heathkit TX-1 Apache transmitter, a homebrewed receiver and wire, along with instructions on how to make a dummy load with a 200 W light bulb and how to hook up the wire to a homemade LC network. He gave me a lot of instructions over the phone and I did get on the air.

Charlie spread the word to the other guys who worked in the Central Office, and I started getting calls during the strike. This led to my first trip to a Suffolk County Radio Club meeting, with Wayne (Dick), W2UNS, and another gentleman who had a Yaesu HF mobile rig in his car. He was on 10 meters and making contacts—this was before 2 meters and repeaters. W2UNS also took me to a meeting of the Massapequa Radio Club; I went with them on my first Field Day. I still have the QSL card from W2UNS; it has the Suffolk County Radio Club 10 meter frequency on it.

Recently, I happened to see the call sign W2UNS in the "Silent Keys" column in *QST*. The majority of hams I met when I first started with the phone company have since become silent keys. Each one was different, each had a different story to tell and each influenced me in some way in Amateur Radio. Each was an Elmer.

Have we in some way been an Elmer to someone else?—*John H Smale, K2IZ, Copiague, New York*

[Editor's Note: In January, the ARRL Board of Directors approved a comprehensive, four-level Mentoring program designed to encourage hams to assist newcomers and less experienced hams. Stay tuned to *QST* and the ARRLWeb for more information as the program gets off the ground.]

TO CONTEST OR NOT TO CONTEST?

♦ It seems Amateur Radio is under attack, continuously. Whether it's commercial interests clamoring for our frequencies or Broadband over Power Line zealots who refuse to see the overwhelming potential for interference to HF communications, rarely a day goes by without some mention of the League or other entity advocating for the protection of our frequencies.

For the longest time, use it or lose it has been the mantra for Amateur Radio, particularly on HF, where activity levels can be low. There are several weekends a year when activity levels, particularly on phone, get so high it's hard to get a word in edgewise. A reasonable person listening to those levels of activity couldn't help but come to the conclusion that we do use, we do cherish the frequencies we have been given.

Those weekends are contest weekends.

There aren't that many that affect phone operation, really. For one weekend in March, the ARRL DX Contest will descend on the bands. A few weeks later, CQ WPX is on. July brings the IARU Radiosport. In October, there's CQ World Wide. In November, there's Sweepstakes, which doesn't start until 2100Z on Saturday, in any case. Those are the biggies—the ones with the most potential to take up most of the phone bands.

Even in these major contests, at the peak of sunspot activity, there are bands wide enough that they don't get filled up. Contest activity on 75, for instance, usually stays below 3850 and rarely strays above 3900. Ten meters is similarly spread out. Owing to the limited spectrum, 15 and 20 do fill up, though generally there's room for casual ops above 14.300 and above 21.400. Forty does get full, but you can blame broadcasters for that as much as you can contests.

But even if there's no room to ragchew, there's still plenty of fun for those open-minded enough to find it. DX contests provide the best opportunity to go looking for new ones or work on search-and-pounce technique and pileup timing (good for those major DXpeditions). Perhaps it's a good weekend for antenna maintenance, or for tracking down that intermittent in some piece of jumper coax. Heavens—perhaps you could even venture into the CW subbands and give your vocal cords a rest.

Contest weekends bring the Amateur Radio community together in ways no other on-air endeavor can. Thousands from around the world compete in the big ones. They fill up the bands like nobody's business. And in emergencies, the contest community has proven time and again that it's up to the task of stepping aside while emergent matters are dealt with.

We can't take for granted the frequencies we have. We owe it to ourselves, to future generations of Amateur Radio operators (if there are going to be future generations), to embrace activities that demonstrate our love for our frequencies, even those activities we may not particularly enjoy ourselves. We owe it to ourselves to look beyond narrow views of what constitutes appropriate on-air activity and realize that any activity, particularly high-participation events like contests, is good for Amateur Radio. *—Kelly Taylor, VE4XT, Winnipeg, Manitoba*

THEY WORK!

♦ I enjoyed seeing the question "Indoor Antennas: Do They Work?" on the cover of the March 2004 issue of *QST* [the article is on pages 28-30]. I chuckled and then answered to myself with a resounding "*yes!*" I've been promoting simple indoor wire antennas for some eight years on my Web site. It is a delight to see the topic broached in *QST*.

I returned to ham radio about 10 years ago after being off the air for several years due to the pressures and time consumption of work. Since then, using 100% CW and 100% QRP for my hamming activities, I've worked 203 DX entities without really trying all that hard. I've worked a total of 934 band-entities on 160-10 meters, including over 100 on 40 through 10, except for 12 where I have "only" 95. Of the 450 band-states needed for 9BWAS, I've worked 403. I've worked over 2000 prefixes. I have 36 of the 40 zones worked toward WAZ with Southeast Asia being my stumbling block.

All of the above was done with a random wire in the attic, a 20 meter dipole in the attic, a 15 meter vertical dipole mounted on the side of my house, and a 10 meter sloping dipole on my porch roof. Now you see why I answered the question with a resounding *yes!* If you're still skeptical after reading the *QST* article and this letter, visit my Web site to see just what all can be accomplished with only 5 W and simple wire antennas. It's at **home.alltel.net/johnshan/**. Drop me an e-mail when you visit.*—John H. Shannon, K3WWP, Kittanning, Pennsylvania*

RADIO OPERATOR VOLUNTEERS?

♦ There has been some discussion in the Correspondence column about the use of the word "Amateur" in Emergency Services contexts. I find nothing negative about the word "Amateur"; in fact I am proud of that designation.

However, in the context of working as a volunteer radio operator with Police, Fire and Officials of many other agencies during drills or actual emergency events, there is a problem. These salaried professionals are "put off" by working with "amateurs" in these situations. Though in most cases our communication skills and experience far exceed those we are assisting, we are not given full credit for these skills.

This is a mistaken perception, of course, but our own use of the word "Amateur" feeds into this mistaken perception. I propose that we call ourselves *Radio Operator Volunteers* in these situations. These words and the acronym ROV should be displayed on the front and back of a jacket. The prominent letters ROV would have the words Radio Operator Volunteer written directly beneath them. The jacket should be one of uniform style and color, and could be used throughout the country whenever we work with emergency services.

In addition to the ROV, there should be a FCC logo on the jacket. Under or around the logo should be the words: Federally Licensed Operator.*—Murray Goldberg, KD2IN, Toms River, New Jersey*

NEW CALL SIGN

♦ With the ITU introduction of a new Morse character for the @ sign I will have a new call on CW. At 10 wpm and above I am now @3P. Now to get those new QSLs and ham tags.*—Frank Stone, @3P, aka AC3P, Middle River, Maryland*

[Editor's Note: There's more about the proposed new @ character, currently being considered by ITU member-states, on page 89 of this issue.]

STILL WITH US

♦ I read the article "We Had Crystals" [Jan 2004, pages 43-45] and Tom Webb's letter [Mar 2004, page 25]. I find it remarkable that in articles and letters about crystals, everyone refers to them in the past tense as if they no longer exist or have an application in communications and electronics today. Nothing could be further from the truth.

Crystals are still very prevalent in electronics; the applications for and configurations of crystals have changed dramatically over the past several decades, however. I doubt there is a piece of communications gear out there both new and old that does not contain at least one quartz crystal. Military, industrial and commercial use of quartz crystals has not diminished; it has grown over the years. Every telecom cell-site contains at least one quartz-based high-precision frequency reference, not to mention the plethora of crystal controlled fixed frequency, voltage controlled and temperature compensated oscillators that are building blocks of today's telecom and communications systems.*—Dave Smith, W3SOX, Director of Sales, Anderson Electronics* QST

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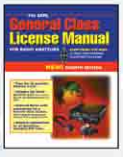

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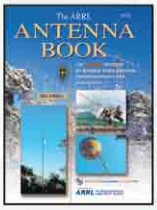

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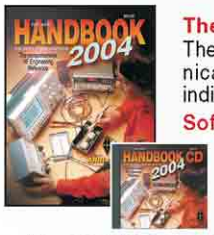

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By Bob Shrader, W6BNB

The Skinny On Antennas

W6BNB gives us the basics (and what we should all know!).

There are many excellent articles written on all of the ins and outs of antennas, particularly the more advanced types—how they work on receiving and transmitting; all about voltage standing-wave-ratios (SWR); how they radiate the most energy; how much better they are if increased in height; how to erect antenna poles and towers; how signals can be effected or reflected by nearby objects; and so on and so on. For all of this there are reams of pages in magazines and textbooks carrying the many necessary formulas that are important in the engineering attack on antenna theory. But—how can an amateur check out a new rig on a HF ham band with minimum difficulty? Let's look at a *simplified* explanation of antennas.

Types

First, there are only two basic types of antennas. One requires connection to the ground, is basically a 1/4 wavelength long, and is known as a *Marconi* type antenna. The other does not have to be connected to ground, is basically a 1/2 wavelength long and is known as a *Hertz* type antenna.

Let's look at the Marconi antenna first. Figure 1A shows a basic Marconi type 1/4 wavelength vertical antenna. Looking straight down on a vertical antenna, the radio-frequency (RF) radiation pattern would be a circle around the antenna, as shown in Figure 1B. This essentially means that the antenna radiates or receives equally well in all directions. In Figure 1C, the Marconi antenna has been bent into an "L" shape. If the flat-top part is considerably longer than the vertical part it would be known as a horizontal Marconi antenna and it would radiate or receive best at right angles to the flat-top. In Figure 1D, the Marconi antenna looks like a "T" shape. It uses the two top parts to "top load" the antenna to make it work as if were much longer or taller. It is still considered a vertical antenna because the horizontal parts have equal and opposite currents flowing in them at any instant and therefore they should not radiate. In general, for the 7 MHz (40 meter) amateur band, the Marconi antenna would be a 1/4 wavelength long, about 33 feet, whether vertical or bent, but not if top-loaded. The antenna length can be computed with a simple formula used to determine the length of a 1/2 wavelength antenna: *A 1/2 wavelength antenna length in feet = 468/MHz*. For the 7 MHz amateur band, which covers the frequency range of 7.0 to 7.3 MHz, the mid-frequency would be 7.15 MHz. The length in feet would thus be 468/7.15, or 65.5 feet. But, if a Marconi antenna is only a 1/4 wavelength long, the 1/2 wavelength value has to be cut in half, making the formula 234/MHz, and the length would then be about 32.7 feet long.

A disadvantage of Marconi antennas is that they require a good ground connection. Old Mother Earth, or something else, must make up the 1/2 wavelength needed for the Marconi or any other antenna to work properly. Instead of trying to make a ground connection, a group of 1/4 wave wire "radials" can be used, perhaps 4 to 30 of them, laid out on the ground, tied together at the base of the antenna, and radiating outward from it. A radial system is usually a much better technique to use than trying to get a good RF connection to the earth. The radial wires can be buried a bit in the ground; they can be lying on top of the ground; or perhaps even suspended seven feet above the ground.

Connecting the Marconi

Wait a minute! These illustrations show just a basic Marconi antenna *wire*. How can such a wire be coupled to a receiver or transmitter to make it a useful antenna? The way they *used* to do it messed up the computed length a bit. The old way of coupling a Marconi antenna to the input coil of a receiver or the output coil of a transmitter was to use a foot or two of the bottom of the antenna wire to make a small 2 or 3 turn coil loop; couple this loop to the receiver or transmitter coil and ground the bottom, as indicated in Figure 2A. When a wire is looped it adds inductance to the wire. This means that the wire now works as if it were longer. So, such a loop would require that the antenna length be cut to some shorter length—determined by how

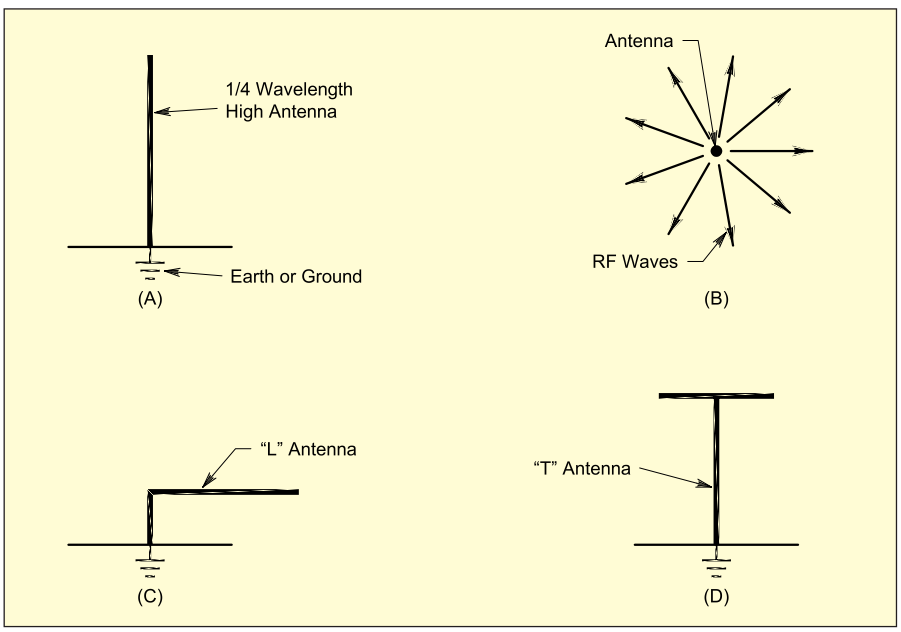


Figure 1—(A) A 1/4 wave vertical antenna. (B) The radiation pattern looking down at the vertical antenna's top. (C) A bent vertical becomes an "L" antenna. (D) A top-loaded vertical "T" antenna.

many turns are in the loop, their spacing, and their diameter—for which there is no simple answer.

There is a simple, more modern method of coupling a Marconi antenna to a ham rig. But first, let's look at the length of the 1/4 wavelength wire and see what its voltages, currents and impedances might be. There is one sure thing about all antennas—the highest RF voltage point will always be at its far end, so that is where to start. Moving back a 1/4 wavelength, the voltage will decrease to a minimum. Another 1/4 wavelength and it will increase to maximum again, and so on. Where the voltage is greatest, the antenna current will be least. So, the current flowing at the end of the antenna is almost zero… but a 1/4 wavelength back from the end, a maximum RF current will be flowing. The power the antenna is carrying is always, P = VA, or volts × amperes, so the computed power at any point should be essentially constant all along the wire. The voltage (V) curve in Figure 2A represents the relative *voltage* values developed along the line. If you touched the far end of a 100 W transmitter's antenna, at its highest voltage point, it would give you a nasty RF burn. (Don't try to prove this to yourself, just believe me!) But, if you touched it at a point 1/4 wavelength from the end (which would be the ground end of a Marconi antenna and its low voltage point) you would have no problem.

The current (I) curve in Figure 2A represents the relative amount of *current* that an RF ammeter would read if connected in series with the antenna wire at any point. It also indicates the relative value of the RF magnetic field. It is best to stay away from the high magnetic fields of an antenna where the RF currents are at a maximum. How about being near the high voltage ends—would your body have the greatest currents induced in it there? Let's just keep away from transmitting antennas.

It can also be said that the "impedance" along an antenna will be essentially proportional to the voltage along the antenna. That means that the end of an antenna has the highest impedance (usually above 2000 Ω) and at 1/4 wavelength "down" the antenna, at the lowest impedance point, it will be about 50 Ω.

It has been found that the properly grounded end of a basic Marconi antenna has an impedance of about 37 Ω. Have you noticed that most of the transceivers today specify that they have a "50 Ω impedance" output? So, instead of using a part of the Marconi antenna as a coupling loop, it would be possible just to push the 37 Ω ground end of a 7 MHz 1/4 wavelength bare wire into the output connector of a rig, as shown in Figure 2B. This produces a 50/37 Ω mismatched impedance connection. This mismatch will produce an SWR of 50/37.5, or 1.3:1, not too far from the lowest possible ratio of 1:1. Any SWR below 2:1 allows most transmitters to put out their rated power. The antenna should work with this simple connection over the entire 7 MHz band.

To work phone on the 7 MHz band, the antenna might do a bit better if the wire were cut to about 32 feet. For CW, it might work better if cut to 33.3 feet. Actually, this small length difference for a narrow band such as the 300 kHz, 7 MHz band is not going to make too much difference in the SWR. When using the wider bands, such as 1.8, 3.5 and 28 MHz, the correct antenna length becomes much more important.

It is worthwhile to note that if the high-impedance part of any antenna is brought close to any kind of a solid object, such as a wall, a tree, or a building, it will increase its capacitance to ground, making the antenna appear longer. This will detune the antenna and its length may require a slight shortening.

Rather than using different length antennas for different portions of a wide band, it pays to use an antenna-to-transmitter impedance matching device. Such devices contain coils and capacitors that allow the operator to increase or decrease inductances and capacitances to make the antenna's impedance match a transmitter's output impedance. However, if the antenna is too far from a proper length these devices may not be able to bring the SWR down to a sufficiently low value. Such impedance-matching devices are commonly known as "antenna tuners." They may not actually tune or vary the length of an antenna—they just make up for mismatched impedances when coupling a feed line to a transmitter.

The Hertz Antenna

A Hertz antenna is normally thought of as a horizontal 1/2 wavelength wire some distance above the earth—its radiation pattern is shown in Figure 3. Looking down on such a horizontal Hertz antenna, the RF radiation pattern from the wire would look something like the number 8, with its maximum radiation "lobes" of RF energy going outward from the wire's direction. In general, the higher a Hertz antenna is, the better. Actually, the radiated energy that is received at a distant receiver is not only the RF wave radiated directly from the antenna wire, but is also partly from the RF waves reflected off the ground. This will accompany the direct wave. The time or "phase" differences between the direct and reflected waves result in maximum and minimum radiations at different angles upward from

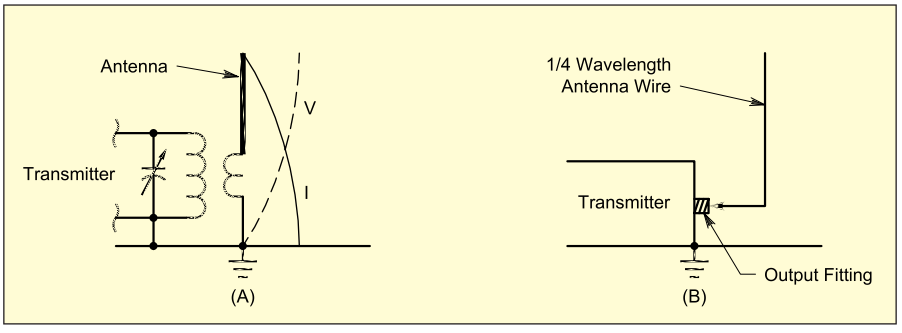


Figure 2—(A) Coupling the "old" way, through an inductive loop. Note that the current in a 1/4 wave vertical radiator is highest at its base and the voltage is at a minimum. (B) Modern 50 Ω output impedance transceivers can accept a 1/4 wave Marconi antenna directly, if their chassis are grounded.

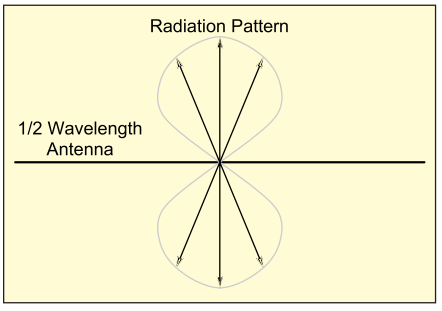


Figure 3—The radiation pattern of a 1/2 wavelength antenna.

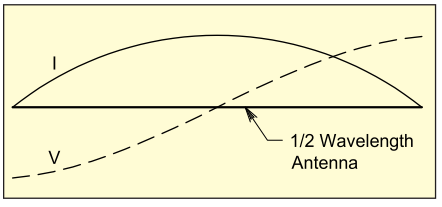


Figure 4—The voltage and current distribution along a 1/2 wavelength antenna.

the antenna. As a result, various skip distances will be produced where the signals returning to ground from the ionosphere are weak or strong.

Raising a Hertz antenna wire from ground level, where its center impedance would be essentially zero, to a 1/4 wavelength height, raises its center impedance to about 73 Ω. Raising it higher increases its center impedance to about 90 Ω, but it returns to 73 Ω at a height of 1/2 wavelength. Every 1/4 wavelength increase in height returns the center impedance to 73 Ω. At highest heights, its center impedance will remain close to 73 Ω.

Unlike the Marconi antenna, the Hertz antenna system is usually not connected to ground. To prevent the pick-up of very high electrostatic charges from the atmosphere, it is usually wise to provide some leakage path for electrons. If the lead-in wires do not go to ground, an atmospheric charge can be bled by connecting a high value resistor (1 MΩ, 1 W) between the antenna lead-in wires and ground.

Figure 4 shows the relative values of voltage and current along a 1/2 wavelength antenna wire. The relative impedance values will also tend to follow the voltage curve. The center-impedance of such an antenna must match the impedance of any "transmission line" coupled to the antenna at any point. Transmission lines usually consist of 2 parallel conductors that connect the transmitter to the antenna. If a transmission line is connected to the end of a Hertz antenna, the line would have to be of high impedance to match the end impedance of the antenna. If coupled to a low impedance point, such as at the center of a 1/2 wavelength antenna, the line should be a low impedance type. These statements infer that such transmission lines can have different impedance values, which is true.

The common "coaxial" cable transmission line consists of a single wire running down the center of a metallic pipe of some sort. It can be made to have impedances from tens to several hundreds of ohms. The usual "coax" used by hams has an impedance in the 50 to 70 Ω range. If a 50 Ω cable is connected to the 73 Ω low impedance point at the center of a 1/2 wavelength Hertz antenna it will produce an SWR of 73/50, or 1.46:1, an acceptable value.

To connect a coaxial cable to the center of an antenna the antenna is cut in the middle and the two wires are looped through a glass or ceramic insulator as shown in Figure 5. The braid of the coax can be unbraided back about 3 or 4 inches; twisted into a stranded wire and soldered to one of the antenna wires. The cable's solid internal insulation can be removed

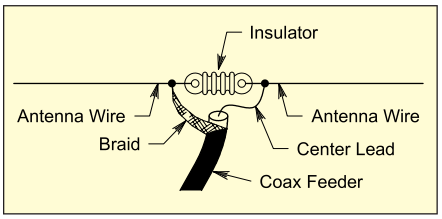


Figure 5—Coupling a coaxial transmission line to a dipole.

to leave about 3 or more inches of the center-wire, which is then soldered to the other antenna wire, as shown. Not shown, but a good idea, is to tie a strong weatherproof twine or rope around the center of the insulator and also tie it near the top of the coaxial cable to take any strain off the two coaxial leads to the antenna wires. The whole end of the coaxial cable should be coated with some weatherproofing insulating substance, such as liquid electrical tape, to keep water from getting into the braid. When a 1/2 wavelength antenna is cut and fed at its center like this it is often called a "dipole" or "doublet" antenna.

Just as an antenna wire will go from a high impedance to a low impedance in a 1/4 wavelength, a length of coaxial cable can do the same if not terminated in its characteristic impedance. Because of the capacitance between the center wire and outer conductor braid and because of the dielectric constant of the solid insulating material surrounding the center wire, an RF wave slows down to perhaps 70% of its speed along a conductor in free space. If a 7.15 MHz antenna were to be fed by a 1/2 wavelength coaxial cable, the cable's length in feet would be only about 0.70 × (486/7.15), or about 45.8 feet instead of about 65.5 feet. Such a length of 1/2 wavelength coax may be desirable because it repeats the impedance it looks into at one end at the other end. As such, it makes it easy to measure the true antenna impedance from the comfort of the shack. Theoretically, a 1/4 wavelength of coax cable might go from the 50 Ω output impedance of a rig to a relatively high-impedance, possibly coming close to matching the end impedance of a 1/2 wavelength Hertz antenna. The transmission line losses could be excessive, however.

The Zepp Antenna

The normal high impedance transmission line is one which has two parallel wires separated a few inches by some form of insulating material or by insulators. If the wires are held about 2 or 3 inches apart they form a transmission line of impedance of about 300 or 400 Ω. The actual value of impedance depends on the wire size or gauge and the separation between the conductors. If the two wires are about 6 inches apart they form a line of an impedance of about 600 Ω. Such a transmission line may also be termed a "ladder line." The transmission line that the *Graf Zeppelin* used in its trailing-wire antenna back in the 1930s was such a ladder line.

Had the radio operators on the *Graf* wanted to use our 7 MHz band for their communicating they could have used a 33 or 66 foot open-wire "tuned" (meaning some multiple of a 1/4 wavelength) transmission line with a 1/2 wavelength Hertz antenna connected to the end of one of the two transmission line wires. They could also have used other tuned transmission line lengths and the antenna wire might also have been 1, 1.5, 2, etc wavelengths long. All such lengths have high impedances at both their ends and they would match the impedance at the end of a tuned length transmission line. This is why, when amateurs construct a Hertz antenna and feed it at one end with a tuned open wire line, it is said to be a "Zepp" antenna.

While the Marconi antenna has been discussed as a 1/4 wave antenna, it can be increased in length by adding one or more 1/2 wavelength wires to make it 3/4 wavelength, or another 1/2 wave to make it 1 1/4 wavelengths long, and so on. Similarly, a Hertz is considered as a 1/2 wavelength antenna, but it will also work if its length is increased another 1/2 wavelength, making it a full wavelength, or by adding another 1/2 wavelength making it a 1 1/2 wavelength antenna. When lengthened, the low-impedance point of antennas increases somewhat, but not greatly.

And...Finally

If a 264 foot, 1.8 MHz 1/2 wavelength Hertz is fed at its center with a 1/2 wavelength open wire transmission line it forms a dipole and can be coupled to the rig by an antenna tuner having a balanced output. It will tune to a minimal SWR on all amateur frequencies between 1.8 to 30 MHz.

A similar, but shorter antenna that might fit better on a more common lot size, would be a 132 foot long center-fed 3.5 MHz Hertz antenna with a 1/2 wavelength open-wire transmission line. This will also work on 7 MHz, on 10 MHz and so on, up through all of the other bands. If a 132 foot flat-top is a bit too long, perhaps 15 feet at each end can be dropped down toward the ground, with little loss of radiation. This raises the operating frequency of the antenna, however, requiring a few additional feet of antenna wire. A 3.5 MHz Zepp as in Figure 6 will also operate on all amateur HF bands using an antenna tuner between its transmission line and the rig. A still shorter antenna would be a 7 MHz, 66 foot antenna with a 33 foot open wire

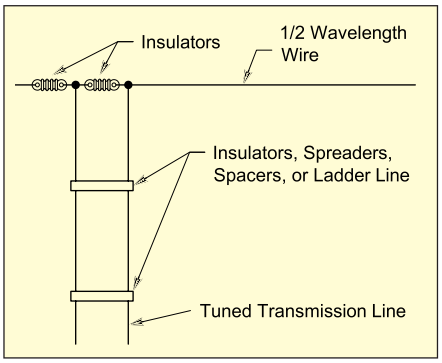


Figure 6—The "Zepp" antenna.

feeder. These are all remarkably effective antennas for amateur HF use, but they do require an antenna tuner to couple the transmission line to the rig. The 7 MHz antenna, however, is not an efficient radiator on the 80 and 160 meter bands and should not be used with high power on these bands.

How can an amateur check out a new rig on a HF ham band with minimum difficulty? The answer is: 1. Cut a piece of *insulated* wire, almost any gauge, to make a 1/4 wavelength Marconi antenna for the working frequency desired, using 234/MHz to compute wire length. 2. Shove the bare indoor end into the RF output fitting of the rig and dangle the rest of the wire out the window; over some nearby bushes or over a nearby tree limb. Or, attach a piece of fishing line to the far end and tie that to as high a point as possible on some pole, tree or house. 3. Make sure that the insulation is not broken where the antenna goes through the closed window. 4. Be sure to ground the chassis of the rig.

That's it. If it is a 33 foot, 7 MHz Marconi antenna, it will also work on its 3rd harmonic, the 21 MHz band (15 meters). Or, if you would prefer to put up a better simple antenna, use 468/MHz to determine the antenna length in feet for a Zepp at the lowest frequency band you want to use and end feed it with a tuned open-wire line and with an antenna tuner. Antennas don't have to be complicated—put one up and get on the air!

Licensed since 1931, Bob Shrader, W6BNB, has been a sea-going radio operator, a deputy sheriff, a teacher, author and a firefighter. He taught electricity to cadets at the US Merchant Marine Academy in 1942 and radio communication at Laney College in Oakland, California. Bob retired from teaching in 1969. He has published over 46 articles in QST, CQ, 73, Ham Radio *and* Worldradio. *In addition, Bob is the author of* Electronic Communication, Electrical Fundamentals for Technicians *and* Electronic Fundamentals for Technicians, *all published by McGraw-Hill, with* Electronic Communications *now in its sixth edition. W6BNB has held an Amateur Extra class ticket since 1952 and he can be contacted at 11911 Barnett Valley Rd, Sebastopol, CA 95472;* **w6bnb@aol.com**.

NEW PRODUCTS

SHERRILL ARBORIST SUPPLY BIG SHOT SLING

◊ Designed for tree workers, the Sherrill Big Shot is a solution for any of us wanting to get a line over a tall tree. It is said to provide the capability to allow accurately placing a line, using the Bow Hunter reel with a light line, to 150 vertical feet and up to 200 feet with limited practice. The Big Shot head is designed to fit into the end of an 8 foot, heavy-duty, fiberglass pruner extension pole. The complete Big Shot system weighs less than 10 pounds. The sling head and other accessories are available from Sherrill Arborist Supply. Search for *big shot* using the search feature at **www.wtsherrill.com** or call 800-525-8873 for more information.

THE Z-100 AUTOTUNER FROM LDG ELECTRONICS

◊ LDG Electronics has announced the release of their Z-100 autotuner. The Z-100 was designed with to be a low cost and high performance tuner suitable to be used with nearly all HF radios. The Z-100 features latching relays so that current draw is virtually 0.0 A once tuning is complete.

The Z-100 is specified to handle 0.1 to 125 W from 1.8 to 30 MHz continuous and 50 W on 6 meters. This tuner is rated to tune antenna systems with an SWR of 10:1 or less. An external balun is available to terminate balanced loads. Power requirements are 7 to 18 V dc. The front panel features a tune/bypass button and status LEDs. The enclosure measures 5.5 × 5.5 × 1.5 inches and the weight is 14 ounces. Price $149. For more information, contact LDG Electronics, 1445 Parran Rd, Saint Leonard, MD 20685; tel 410-586-2177; Fax 410-586-8475; **www.ldgelectronics.com**.

By Peter Koehler, KJ7WY

A Half-Square for 80 and 160 Meters

Get on 160 with an antenna that works well on both of the "top bands."

A few years ago I was approaching the achievement of DXCC on 80 meters and felt that my current station would not finish the job. I gave serious thought to the best way to make contact with the Eastern European countries I needed for the award. Because of cost, antenna improvements seemed the best option. My antenna was then a ladder line, center-fed, 160 meter dipole, 75 feet high, in an inverted-L configuration. With 400 W of RF this antenna showed good performance on 80 meters and tuned on all the other bands.

But, I wanted something better. A vertical seemed the obvious choice with its low-angle radiation pattern but the ground radial problem surfaced its ugly head. Searching the Internet, I came across the Web site of L.B. Cebik, W4RNL,[1] and an album of self-contained vertically polarized wire antennas. I discovered that loops and "bobtails" generally have a low angle of radiation, along with some gain and, a big plus—they didn't have need for a ground radial system.

I had some experience with a 20 meter loop antenna and liked it very much and my friend W7YS had a bobtail curtain for 40 meters. Locating a site for the antenna began. I live in a forested region, so tree supports are not much of a problem. I like the loop antenna, but, placed vertically, the loop would present a problem, as the bottom segment would be only about 10-15 feet off the ground. That might raise the curiosity of the neighborhood kids and the occasional elk. The half-square antenna became a stealthier alternative.

The half-square antenna is the little brother of the bobtail curtain, and is basically made of two quarter-wave vertical elements phased by a half-wave horizontal element. This broadside array does not need an extensive ground system. Being a vertical antenna, however, its performance is mirrored by the quality of the ground. Traditionally, half squares are voltage fed through 50 Ω coax to a vertical element through an LC matching network at the low point near the ground. Several articles mentioned a 50 Ω current feed point near an upper corner where the vertical element meets the horizontal element.[2,3,4] W4RNL also mentioned that a half-square could perhaps be fed with ladder line at the current point and matched with a tuner at the shack. Figure 1 shows the basics of the half-square antenna.

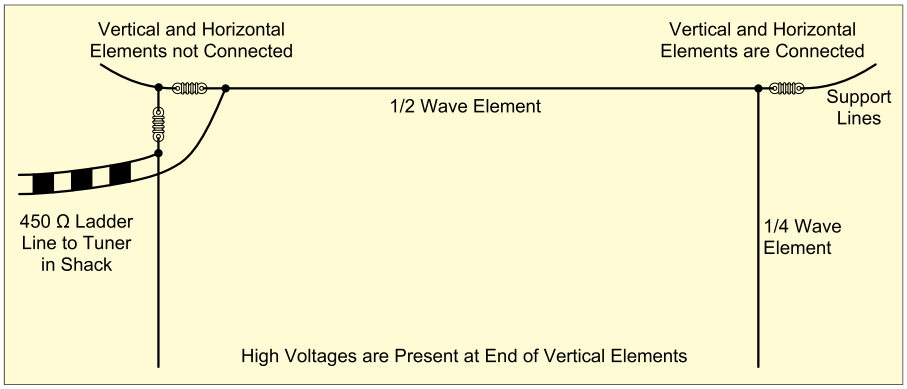


Figure 1—The basic "half-square" for 80 and 160 meters as outlined in the text.

The idea of feeding the antenna with ladder line intrigued me. The run from shack to antenna is some 350 feet and the attenuation of coax could steal any potential antenna gain. I modeled several scenarios with the *EZNEC*[5,6] demo antenna modeling program with particular concern for my poor ground situation. I came up with some element lengths slightly different than the traditional 1/4 wave vertical element and 1/2 wave horizontal element. *The ARRL Antenna Book*[7] and *The ARRL Antenna Compendium*[8] also provided insight on variations of the half-square setup. It suggested that the top horizontal section be placed parallel with the ground and that some variation in plumb of the vertical elements would not significantly reduce antenna performance.

With all of this background, I hung the half-square between two 80 foot trees. The horizontal element is 137 feet of 14 gauge copperweld wire and the 2 vertical sections are 73 feet tall and of 12 gauge wire. The upper corner is fed with 350 feet of 14 gauge ladder line to the top of a vertical element and the horizontal element, separated by a high voltage insulator. The other vertical element top is connected to the opposite end of the horizontal element. A 350 foot run is made back to the shack, where it is matched through an antenna tuner. As with all antenna construction, antennas should be built for safety. Here in northern Arizona, we experience healthy 40-60 MPH winds during the spring and fall months. The two trees that I've hung my antenna from do sway appreciably with wind gusts, so 3/8 inch haul line and copperweld wire are a necessity.

The greatest threat with half squares

[1]Notes appear on page 33.

(and bobtails) is that vertical elements contain very high voltages near the ends that are close to the ground. This can be dealt with in two ways. Either insert the lower ends of the vertical elements into PVC tubing or keep the vertical elements high enough such that nothing will come into contact with them. I used the latter approach, as my vertical legs fan out a bit and they are about 15 feet above ground level.

How does it work? My first contacts were on 75 meters with an EI and a G station and they observed a 1 to 2 S-unit increase with the half square over my 160 meter inverted L dipole. That compares favorably with the 3 dB or so of modeled gain the antenna exhibited. This is consistent with reports from stations broadside (the primary gain direction) to the antenna. The antenna helped me work several new Eastern European countries and satisfied my need for 80 meter DXCC contacts. Though the antenna was cut for the CW portion of 80 meters, feeding the antenna with ladder line allowed the antenna to be easily tuned for other frequencies. Surprisingly, it tunes very well on 160 meters and I prefer it to my 160 meter inverted L (whose location is not as good). On 160 meters the radiation is high-angle and omnidirectional; this is due to the close spacing of the 1/8 wave vertical section. Despite this, it has proved its worth on 160 when working Southeast Asia and Africa. It also performs well on 40 and 30 meters. On 20 meters and above, the antenna produces a very high angle of radiation and the 160 meter inverted L performs better. The antenna does have very quiet receive characteristics.

The benefits of the 80 meter ladder line fed half-square are that it works well on the lower bands (160 through 30 meters) and that it only takes up the space of that of an 80 meter dipole. My antenna is fairly high and its vertical elements are nearly perpendicular to the ground. *The ARRL Antenna Book* supports the fact that maximum height and straight vertical elements are not necessary for good performance. It suggests that a 40 foot high 80 meter dipole might be fitted with V-shaped 1/4 wave vertical elements for better broadside performance.

Current feeding this antenna in an upper corner with ladder line through an antenna tuner might be the ticket for those who want 160 meters included in their antenna's characteristics. One of the problems that the antenna solves is the need for a ground radial system, although the half-square is somewhat dependent on absolute soil characteristics. I do find that the antenna works best when my local soil moisture is high. Give the 80 meter half-square a try—it's an effective antenna!

Notes

[1]L.B. Cebik, W4RNL, "Self-Contained Vertically Polarized Wire Antennas: A Family Album Parts 1-6"; **www.cebik.com/scv0.html**.

[2]P. Del Negro, N2PD, "A Half-Square Array for 40 Meters" *QST*, Jan 1998, pp 46-49.

[3]H. Kennedy, N4GG, "The N4GG Array" *QST*, Jul 2002, pp 35-39.

[4]*The ARRL Antenna Book,* 20th edition, Chapter 6. Available from your local dealer or the ARRL Bookstore. Order no. 9043. Telephone toll-free in the US 888-277-5289 or 860-594-0355; fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[5]*EZNEC* is available at **www.eznec.com**.

[6]L.B. Cebik, W4RNL, "A Beginner's Guide to Modeling with NEC," *QST*, Nov 2000, pp 34-38.

[7]See Note 4.

[8]*The ARRL Antenna Compendium, Volume 5*. Available from your local dealer or the ARRL Bookstore. Order no. 5625. Telephone toll-free in the US 888-277-5289 or 860-594-0355; fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Peter Koehler's interest in radio dates to 1969, when he was an active shortwave listener. First licensed in 1996, KJ7WY now holds an Amateur Extra class license. Peter is a member of the Northern Arizona DX Association and, not surprisingly, enjoys DXing on the low frequency bands. He has an AS degree in electronics and an MS degree in Quaternary Studies. Peter teaches geology and does research at Coconino Community College and Northern Arizona University. He can be reached at 45 Ponderosa Dr, Flagstaff, AZ 86001; **kj7wy@arrl.net**.

NEW PRODUCTS

MILOG V6.4 LOGGING/ CONTESTING/STATION CONTROL SOFTWARE

◊ Hamtoys has recently released *miLog version 6.4*, an integrated *Windows*-based logging and station control program for general users, DXers, contesters and award chasers.

Features include rapid all-band/mode tracking and searching functions for DXCC, WAS, WAZ, WPX, IOTA, grids and counties. There are user-defined fields; multiple Telnet/direct *DXCluster* connections including e-mail and pager messaging of needed spots; QSL card and label printing; QRZ, *Callbook* and Buckmaster support; ADIF conversion; detailed country data and sunrise/sunset tables, plus extensive help files, all accessible via a user-friendly interface.

Contest modules support major contests and include CW and voice keyers, control of up to eight rotators, *MMTTY* support for RTTY operation, station/multiplier/band trackers, SO2R controls as well as LAN and Internet control of up to 25 computers, Cabrillo file-conversion and post-contest analysis.

Price: $59 via download, $69 on CD. Full details and a free demo are available at **www.hamtoys.com**. Orders and inquiries: **info@hamtoys.com**, tel 800-436-9013.

NEW LOW POWER AUTO TUNER FROM SGC

◊ SGC has announced the SG-211 MiniSmartuner antenna coupler for low power use. A unique feature of this tuner is that there is no need for an external power source. SGC has kept the current requirements so low that it is rated to run for five years on a single set of four alkaline AA batteries.

The unit is designed to meet the requirements for a lightweight, portable antenna coupler for low power applications. The SG-211 is rated to handle from 1 to 60 W of input power over a frequency range of 1.8 to 60 MHz. It is rated to match a wide range of antenna types and loads to an SWR of 2:1 or less. As with larger SGC tuners, the SG-211 remembers previous settings by frequency and recalls them from memory when returning to a previously tuned frequency. The operating instructions are silk screened on the case. Price: $179.95. For more information, contact SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; fax 425-746-6384; **www.sgcworld.com**.

Z ANTENNA SYSTEMS COMPACT LOOP ANTENNAS

◊ Z Antenna Systems has introduced a line of compact loop antennas for the 30 to 10 meter amateur bands. These square loops are only 0.06 λ (49 inches for 20 meters) on a side. The loops are rated at an input power up to 200 W CW.

The loops (except the PL-30) are "backpacker friendly" and can be assembled with no tools (after the first time). The loop spreaders are made of PVC-40 plastic pipe. The antennas may be hung by the lanyard, or strapped to a nonconductive mast. The loop antennas consist of two active elements: an outer loop carrying real current to produce a magnetic field through the loop, and an inner electrode (looking like a loop) that produces a radial electric field between the electrode and the outer loop. Power is split (in phase) between the two elements with a multi-winding toroidal transformer. The outer loop contains an adjustable linear capacitor so that the center frequency may be raised or lowered. No coils are used in the loop antennas.

For more information see **home.cogeco.ca/~zantenna** or contact Z Antenna Systems at **np4b@arrl.net**; tel 905-525-3189.

By Paul Danzer, N1II

Open Wire Feed Line—A Second Look

Put up the longest dipole you can fit, feed it with open wire line, connect it to the balanced output of your tuner and—poof! Instant multiband antenna. Is life really that simple?

The answer is yes…this actually works. But there are a few things that should be considered before you dump that G5RV, cut down all your other antennas and replace them with just one dipole. A few practical considerations may change the way you build, tune or use a single, multiband dipole.

Open wire line has a very large advantage. By open wire line, we mean both commercial ladder line as well as two parallel wires with plastic or ceramic insulating bars. The *TLA* program, included on a disk with the 17th through the 19th editions of *The ARRL Antenna Book*[1] gives us a way to see the primary advantage of open wire line quickly and directly. (The 20th edition has a newer program, *TLW* for *Windows*.)

This program lets us pick a transmission line and impedances (and therefore the SWR on the line) and presents us with the losses on the line. The few numbers given here will be sufficient for an understanding of what's going on, even if you aren't mathematically inclined.

Open Wire Versus Coax

Using *TLA*, four sets of calculations were run. Each was for 100 feet of transmission line at 28 MHz. Ladder line, the 450 Ω variety, was connected to an imaginary perfectly matched antenna of some sort. The total transmission line loss was 0.201 dB, so small as to be silly. (A 3 dB loss would mean you have lost half of your power.) But, since we are interested in multiband operation, on other bands the antenna will be mismatched.

In order to use nice, round numbers, a new antenna was imagined that looked like 1000 Ω resistive and 1000 Ω inductive. All transmission lines will show an increased loss when the SWR is not 1:1, and in this case the additional loss was again only 0.270 dB—small enough to be ignored.

This was not true with coax…in this case 75 Ω, RG-59/U, and a perfect 75 Ω dipole. At 28 MHz the loss was about 2.01 dB. That's noticeable, but perhaps acceptable if you chose to use a lightweight, small-sized transmission line. But with the same 1000 Ω resistive and 1000 Ω inductive imaginary load, the additional transmission line loss *TLA* tells us is 6.797 dB. Wow—too much already!

That is why open wire line has been suggested many times for a multiband dipole. With a mismatch, the increased line loss does not amount to very much.

Figure 1—A few hours in the wind and you are no longer connected.

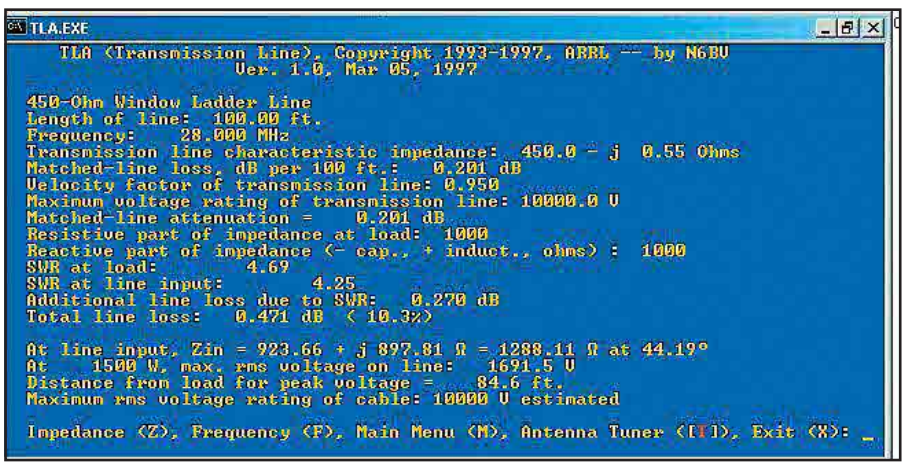


Figure 2—The *TLA* program output reveals losses and voltages.

[1]Notes appear on page 36.

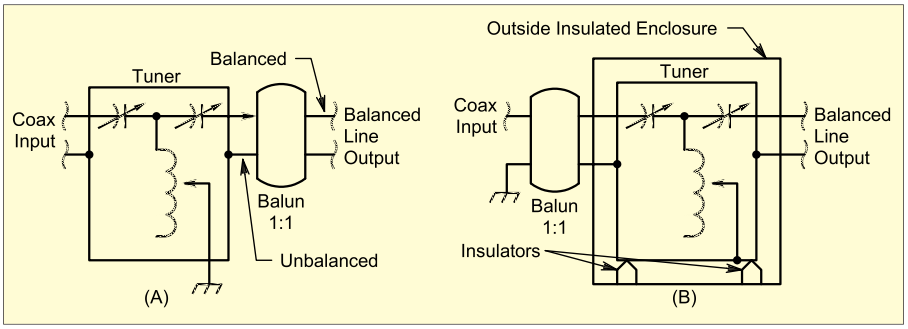


Figure 3—The A solution shows the conventional approach, and B the high-efficiency, practical approach.

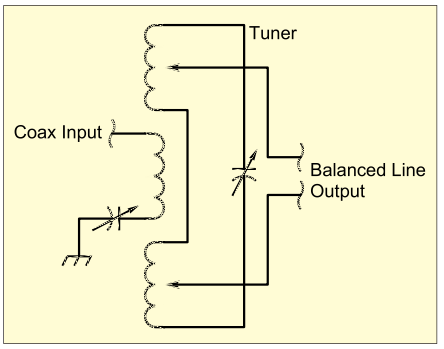


Figure 4—This tuner design predates coaxial cable, but is still practical for balanced line today.

A 100 Foot Test Dipole

To see what the results with a real antenna would be, a 100 foot long dipole, 40 feet in the air, was analyzed using *EZNEC* (to find its input impedance) and *TLA* (to find the transmission line losses and voltages). When fed with 600 Ω open-wire line, the dipole, as expected, was a reasonable choice for all bands except 160 meters, and perhaps a bit questionable for 80 meters.

Frequency (MHz)	*Complex Impedance Z_{in} (Ω)*	*Voltage (V)*	*Total Loss, Including that due to SWR (dB)*	*Additional Loss due to SWR Alone (dB)*	*SWR at Input of 600 Ω Line*
1.82	3.5963 –*j*1694.1	3700	7.66	7.64	39.71
3.6	20.156 – *j*466.45	1550	0.769	0.737	7.13
7.1	413.41 + *j*1155.7	650	0.154	0.107	9.15
10.1	2551.4 – *j*2804.4	750	0.259	0.202	9.15
14.1	106.41 – *j*181.65	600	0.221	0.152	5.90
18.1	1168 + *j*1674	600	0.249	0.170	5.97
21.1	567.29 – *j*1630.7	750	0.424	0.338	8.85
24.9	144.27 + *j*151.09	500	0.212	0.117	4.25
28.1	1498.1 + *j*1610.1	550	0.276	0.175	5.27

As you can see, the total loss for this feed line was less than 1 dB for all bands, except 160 meters. With 100 W delivered to the feed line, the voltage seen (only the peak value is shown here) is a bit high on 80 meters, but it goes out of sight on 160. As expected, with open-wire feed line, the additional losses due to SWR remain remarkably low for SWR values up to 9:1. Only on 160, where the SWR climbs to almost 40:1, do the additional losses due to SWR become important.

Don't let numbers like *j*1630.7 and 3.5963 throw you. The number of significant figures shown here are artifacts of the computer calculation, and the actual accuracy is nowhere as precise as shown. If you use another simulation program, or make other assumptions, you own figures may vary from this table by 20% or more.

There are, however, a few problems with this approach.

Problem #1: Mechanical

Before you even start, consider how you are going to connect the open-wire line to the dipole. Ladder line is not much of a problem; there are commercial connectors available. For most other lines, you will have to fabricate a clamp. If you can imagine soldering the line to the dipole, as shown in Figure 1, also imagine the line breaking off after few months of flexing in the wind. It's a problem you should be aware of.[2]

Problem #2: How Damp is My Shack?

The *TLA* program output for mismatched 450 Ω line is shown in Figure 2. The fourth line from the bottom of the screen print is an indicator of another problem. Almost 1700 V_{rms} is floating around. This voltage jumps, in the practical case, when you try to feed a short dipole, such as one cut for 80 meters, on a lower frequency band, such as 160 meters. Keep your fire extinguisher handy!

Problem #3: Baluns Work, But Only Sometimes

Most commercial and homebrew tuners consist of a T or other configuration that is essentially an unbalanced input to unbalanced output. Simple and straightforward.

Many years ago, in school, I was taught an interesting concept: "For every complex problem, there is invariably a very simple solution and invariably that simple solution is absolutely wrong!"[3] Taking the unbalanced (coax) output of a rig, putting it through a tuner, and then to a balun to take advantage of the low loss of a balanced open wire transmission system is a very simple solution, but it does not take into account the balun.

Strangely enough, the balun problem has been known "forever," and until only recently it has been ignored. In the 10th edition (1964) of *The ARRL Antenna Book*, the following was printed on this topic:

> The principles on which balun coils operate should make it obvious that the s.w.r. on the transmission line to the antenna must be close to 1 to 1. If it is not, the input impedance of each bifilar winding will depend on its electrical characteristics and the input impedance of the main transmission line…and the transformation ratio likewise will vary over wide limits.

Translated, this means that if the balun is not operated under matched conditions, it does not operate as the simple unbalanced to balun device you might imagine. Moreover, from a practical point of

view, the balun core will get hot. This means that some of the power you thought you were sending to the antenna is actually going to raise the temperature of your tuner and your shack. There are easier ways to heat the radio room!

What are the Solutions?

Figure 3 shows one neat and perhaps elegant solution. The normal, but not desirable approach is shown in Figure 3A. But, if you reverse the flow, and put the balun first, then the tuner can operate as 50 Ω in and whatever is needed out, while the balun stays as 1:1.

This is the approach shown in Figure 3B. A practical, elegant high power tuner with this configuration designed by Dean Straw, N6BV, was included in the 1998 through 2002 editions of *The ARRL Handbook for Radio Amateurs*.[4] It was put together to squeeze every last watt out of the tuner. Any reasonable tuner, however, mounted on insulators, within a second enclosure, can be used in this mode. Each knob shaft would have to be extended with an insulated section, and a good quality 1:1 unbalanced to balanced balun used between the rig and tuner.

A second solution dates back to the 1930s, and is shown in Figure 4. The small winding is called a "link," and the configuration is referred to as "link coupled." The unbalanced input for the rig goes to the link, and the balanced transmission lines tapped off symmetrically from the tuned circuit. The link could be fixed and adjusted with a small variable capacitor as shown, or it could actually be moved mechanically in and out of the main inductor to achieve a match.

Open Wire Lines—Not a Bad Idea

As long as your open wire feed system is really matched, and the balun is used under reasonable SWR conditions, open wire does allow you to use one dipole on many bands with reasonable transmission line efficiency. Unfortunately, it is not as simple as connecting the line to the two terminals marked "balanced" on the back of your tuner. But with a little care, one dipole will serve all.

Notes

[1]Available from your local dealer or the ARRL Bookstore. Order no. 9043. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]One solution to the breakage problem is to strain relieve the ladder line by passing the conductors through the insulator holes first and then looping and soldering them to the antenna wires. This has worked for the editor for many years.—*Ed.*

[3]Attributable to H. L. Mencken: "…there is always a well-known solution to every human problem—neat, plausible, and wrong."—*Ed.*

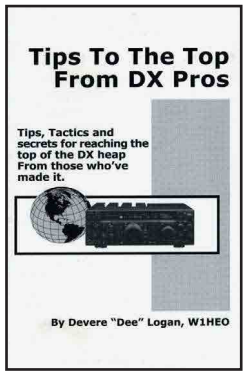
[4]It is also included in the current (20th edition) of *The ARRL Antenna Book* on p 25-15.

Paul Danzer, N1II, has been a licensed ham for over 50 years. Paul has both Bachelor's and Master's degrees in EE, and after many years as an electronic engineer, he now teaches at Housatonic Community College in Connecticut. When he was on the ARRL HQ staff, Paul wrote and edited ARRL books. He is also an ARRL Technical Advisor. He can be reached at 2 Dawn Rd, Norwalk, CT 06851; **p.danzer@ieee.org**.

NEW BOOKS

TIPS TO THE TOP FROM DX PROS

◊ The new book *Tips To The Top From DX Pros* describes dozens of DX success factors and operating tips collected in a survey of 100 outstanding DXers. Written by Devere "Dee" Logan, W1HEO, a veteran DXer and DXCC Honor Roll member, the 32-page book contains details of a survey of leading DX operators listed in the DXCC Honor Roll, Worked All Zones and CQ DX rankings, plus a number of key DXpedit-ioners. The 10 chapters include suggestions for equipment, antennas, pileup strategies, locating the DX, getting the QSL, tips for reaching the top and more. *Tips To The Top From DX Pros* is available for $9 plus $1.50 shipping and handling (check or money order only—payable to D.E. Logan) from D.E. Logan Public Relations, 9901 Cypress Circle, Mentor, OH 44060.



STRAYS

BYRON LICHTENWALNER, W3WKR

Byron Lichtenwalner, W3WKR, of Stroudsburg, Pennsylvania, searches the bands from this impressive station. It features an ICOM IC-765, PK900 TNC, Alpha amplifier, IBM PC running *Writelog* and a Mosley PRO-57B at 65 feet on a crankup tower.

LARRY ROBBINS, W3CEI

SKN aficionado: **When Larry Robbins, W3CEI, of Middletown, Pennsylvania, sent us this photo of his straight key collection (and Heath SB-313 receiver and Knight T150A transmitter), he included a note that said, "I am looking forward to a 24 hour swing cycle of brass type music, hand-crafted with care and skill." The results of the 2004 running of Straight Key Night appear on page 110 of this issue.**

By Brian V. Cake, KF2YN

The "C Pole"—A Ground Independent Vertical Antenna

KF2YN takes the vertical to new heights with this folded design that doesn't require a counterpoise.

When I moved to my new home on the coast of northeast Florida, it was into a deed-restricted community, where "unsightly antennas" were forbidden. I enjoy occasional operation on the HF bands (principally 14 MHz and above) and the location was just begging for the use of vertical antennas, where the proximity to the water would help with good low radiation angles. The verticals could be hidden in the upper deck support structure and everybody would be happy, including my wife.

Unfortunately, the old saw about vertical antennas radiating equally poorly in all directions has a lot of truth to it and losses in the ground system can eat up much of your power. I made the mistake of attempting to measure the ground conductivity in my backyard. That was after I compared the on-air performance of a vertical half-wave dipole for 10 meters with a simple quarter-wave vertical with no radials. I was shocked at the quarter-wave vertical performance. I was even more shocked when I measured 30 kΩ between deep rods spaced 2 feet apart in my back yard.

Conventional solutions to this problem involve the use of radials or counterpoises, but I didn't want to sprinkle the lawn with wires. A full-size vertical dipole, at 30 plus feet for 20 meters, is too high for this location.

With all of these considerations in mind I went looking for another solution, and found an interesting configuration. It is ground independent, has a ground-level 50 Ω feed point, is less than half the height of a full-size half wave dipole, is very efficient, and has a 2:1 SWR bandwidth of about 3 percent. It can be suspended from any convenient support, rolls up into a tiny space and makes a good Field Day antenna.

Basics

The antenna consists of a vertical half-wave dipole that has been folded virtually in half, as shown in Figure 1. By erecting this just above ground level the ground currents are reduced dramatically over those of a quarter-wave ground-mounted monopole. The H-plane radiation pattern for this antenna is virtually omnidirectional.

As shown in Figure 1, the antenna is symmetrical about the feed point and is known as an open folded dipole. The feed-point impedance can be altered by changing the ratio of the diameters of the vertical wires. My intention, however, was to use suspended wire as the elements. The antenna can be analyzed in much the same way as a conventional folded dipole, and it turns out that it can be treated as a short dipole loaded by means of a short-circuited length of transmission line. I decided to take the easy way out and model it using *EZNEC*, however.

There are two practical problems with the antenna in Figure 1: The feed-point impedance is too low and the feed point is in the wrong place. The feed-point impedance depends on the geometry, but for spacing between the vertical wires of about 20 inches on 15 meters the feed-

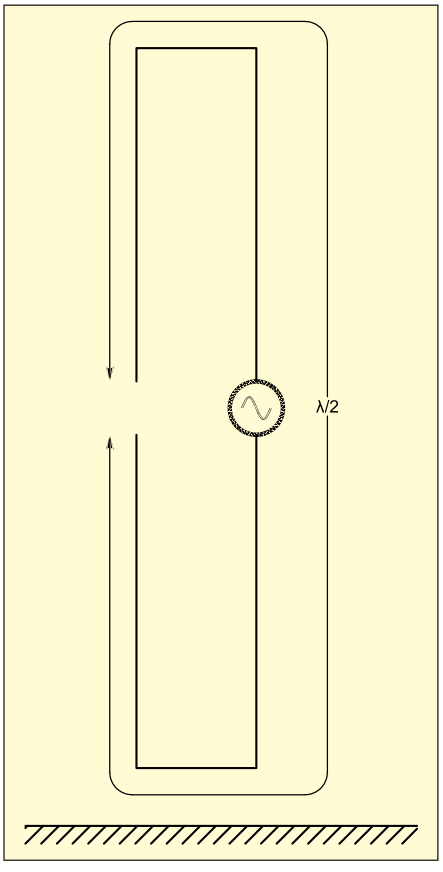


Figure 1—A vertical half wave dipole bent virtually in half.

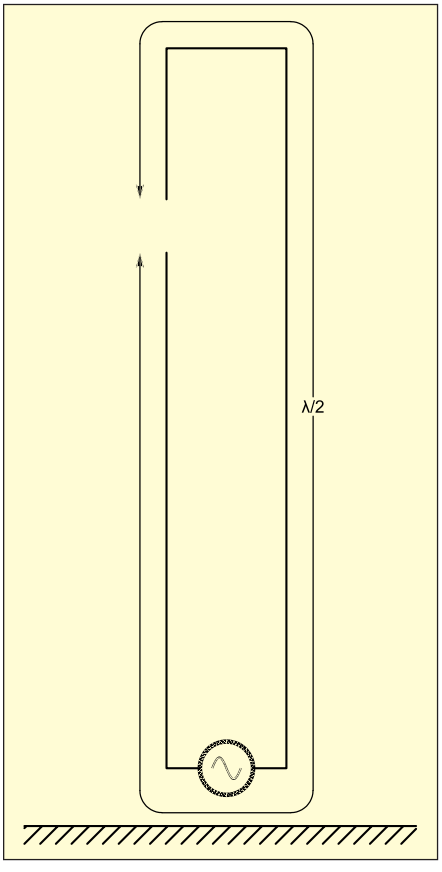


Figure 2—The bent dipole with a shifted feed point.

Table 1
Dimensions (in Inches) of the Modeled Antennas
Wire diameter is 1/16-inch.
Height of lower horizontal wire is 12 to 24 inches (non-critical).
See Figure 3 for dimensional details.

Band (Meters)	*2:1 SWR Bandwidth (kHz)*	*Dimension* A	*Dimension* B	*Dimension* C	*Dimension* D	*Dimension* E
20	400	177	85	84	8	40
17	540	137	66	67	4	31
15	600	124	60	60	4	20
12	800	100	53	43	4	23
10	800	87	46	37	4	20

point impedance is about 25 Ω. This has to be transformed up to 50 Ω. Also, it is highly desirable to have the feed point at ground level, since otherwise the feed cable has to be dressed away from the antenna such that currents are not induced into the feeder. These currents can lead to undesirable effects of RF in the shack and a modification of the radiation pattern. A ground-level feed point is nicer too, because the cable can be buried a short distance under the lawn.

Both of these problems can be fixed by rearranging the antenna as shown in Figure 2. Moving the feedpoint away from the voltage node at the antenna center increases the feed point impedance and an exact match to 50 Ω can be obtained by shifting the position of the gap at the dipole ends. Unfortunately, doing this places the feed point at a position where there is a substantial common-mode potential. That is to say, the two antenna feed-point terminals have the same potential on them relative to ground (in addition to the normal differential potential across the feed point), and this potential can be several hundred volts for an input power level of 100 W. If the coax is connected directly to the feed point, the natural resonance of the antenna is destroyed and it becomes useless. There are several ways to solve this problem, including the use of an inductively coupled loop, but I chose to use a balun.

The Balun

The only problem with the balun is that it has to work with a high common-mode potential at the feed point and this can lead to trouble. In particular, some baluns that use ferrite cores can cause power loss and intermodulation distortion under conditions of high common-mode potential. This fact is not emphasized in the balun literature, but is important for all antennas with a feed point that is not at a voltage node, such as unbalanced dipoles, off center fed dipoles and multi-band long wires. I have designed two different baluns for these antennas:

1) A simple air-core balun consisting of 60 turns of RG-58/U close-wound on a 2 inch diameter length of PVC pipe (about 33 feet of RG-58/U total) provides excellent choking action and reduces the line current to about 1/10 of the feed point current. This will work fine from 14 MHz to 30 MHz, but soaks up a fair bit of power, mostly in cable losses. The total losses are about 14% (about 0.6 dB) on 20 meters and rise to about 18% (about 0.8 dB) on 10 meters. This balun does have the advantage that a quick trip to RadioShack and your local hardware store can provide the materials you need.

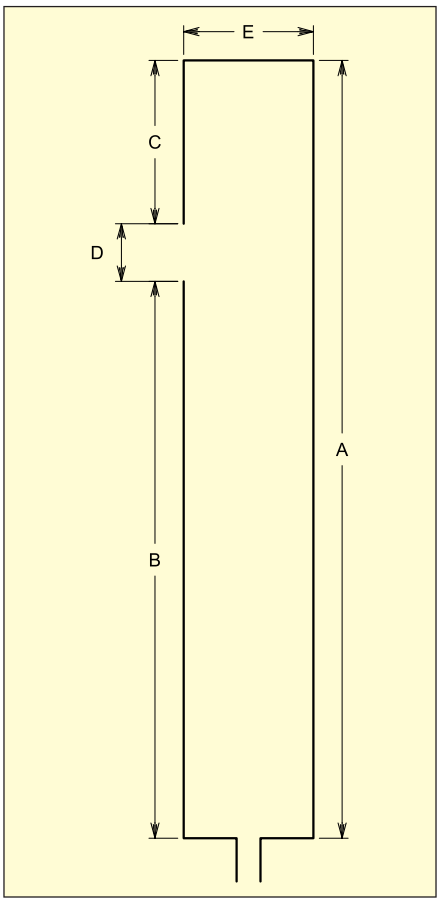


Figure 3—Dimensional details of the antennas. See Table 1.

2) An alternative design using ferrite toroids reduces the power loss by over a factor of two to <7% (0.3 dB) on all bands. Two different designs, one for 20 meters and the other serving 17 meters and above, are needed in order to keep the core power loss low. The 20 meter balun consists of 19 turns of RG-174/U coax on an FT-240-61 core. For higher frequencies use 15 turns of RG-174/U on an FT-240-67 core. It is possible that a close-spaced winding of the same number of turns of 14 gauge or similar wire will give lower loss than the RG-174/U and will also handle higher power, but I have not tried it.

Antenna Construction

The dimensions for the 20, 17, 15, 12 and 10 meter bands are shown in Table 1. Refer to Figure 3 for the dimensional key. You will note that the spacing between the vertical wires is 20 inches for 15 and 10 meters, but 40 inches for 20 meters. This is because I wanted to squeeze the antenna into available space. Twenty inches would also work fine for 20 meters as long as you adjust the vertical length of the wires.

The dimensions given are those used in the models. Note that the actual dimensions will vary from these. This is because of the effects of support structure, the proximity to objects nearby and the effects of ground on the feed point impedance. My antennas for both 15 and 20 meters resonated too low in frequency and had to be shortened quite a bit. This was partly because I used PVC covered wire and partly because they were hung close to the upper deck. The dielectric constant of the wood reduced the antenna's resonant frequency.

The antenna element can be made of anything from thin, PVC covered copper wire up through aluminum tubing, with suitable small changes in the element lengths. Thin wire will have higher losses than fat wire and will also have a higher common mode potential at the feed point. On 15 meters the loss attributable to the element resistance is 0.57 dB (14% power loss) when 32 mil (20 gauge) copper wire is used. This drops to 0.3 dB (7% loss) when using 1/16 inch copper, and to 0.15 dB (3.5% loss) for 1/8 inch copper. I used PVC covered wire because bare copper wire looks ugly after exposure to a beach

atmosphere for even a short while. Also note that the balun choke reactance will change the resonant frequency of the antenna somewhat. An inductance of 25 µH on 20 meters will shift the resonant frequency upward by about 1.7%, or 250 kHz.

Assembly

The assembly method I used is shown in Figure 4. Here, suitable lengths of ¾ inch schedule-40 PVC pipe are used as the top and bottom spreaders, with the element wire simply pushed through the tubes. The spacer in the gap is a 6 inch piece of the same tubing, with holes drilled right through at 4 inch spacing (10 inches and 8 inches respectively for the 20 meter version). Start construction by cutting each piece of the element wire to the dimensions shown, plus 2 feet or so. This additional length allows for securing the wires to the spacer and for adjustment of the resonant frequency and of the SWR. Make the spreaders and the spacer as shown. Drill suitable holes in the top spreader for a suspension cord, if that is the way you are supporting it. Drill two holes near the center of the lower spacer to allow the wires to exit the spreader at the feed point. It is also advisable to drill a few holes in the spreaders to allow water to exit.

Lay the spreaders out in their approximate positions on the ground and thread the wires through them. Temporarily secure the wires at the feed point with tape. Make the balun and solder the feed point wires to the balun cable. Once you have made any adjustments necessary you should seal these joints against the ingress of water. Hoist the antenna into position, and pull on either vertical wire in order to get the lower spreader horizontal. The base of the antenna can be anything from 1 foot or so off the ground to as high as desired. The ground rod shown is not essential—it is useful for anchoring the balun so the base of the antenna doesn't flap in the breeze.

You can now test for resonant frequency and SWR. It is unlikely that you will get it exactly right the first time but, if you are using bare copper wire and the antenna is in the clear, then with the dimensions given it should be pretty close. If the resonant frequency is too low, lower the antenna (or use a stepladder), untwist the wires above and below the spacer, and shorten the element by an equal amount on either side of the spacer, then retwist the wires.

Once the resonant frequency is right, check the SWR. If your SWR meter indicates that the feed-point resistance is too high, then it is necessary to raise the position of the spacer. This is easily done by untwisting the wires, and moving the spacer farther up the top wire. Be sure to keep the total wire length unchanged, or the resonant frequency will shift. Then retwist. A low feed-point resistance will require the spacer to be lowered. If your SWR meter does not indicate whether the resistance is high or low, you will have to guess which way to move the spacer.

This sounds like an arduous setup procedure but it is actually very quick and easy to do, especially where the spacer is easily accessible from the ground. With the antenna vertical it should be possible to get an SWR of very close to 1:1 on your favorite frequency. If you can't get the SWR down below 1.5:1 then suspect that something is wrong. Also, once you have the antenna in position, check the 2:1 SWR bandwidth. It should be roughly that shown in the dimension table. If it is substantially wider than this, you should suspect that losses are higher than they should be. Finally, when all appears well, find an unused frequency and apply power for a minute or so, then check that the balun is not getting hot. This is a big advantage of a ground-mounted feed point!

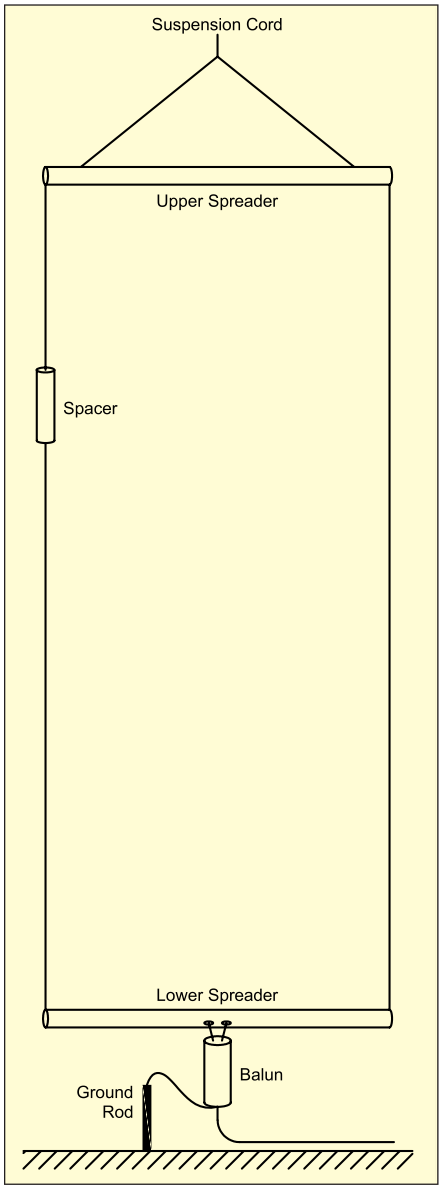


Figure 4—The antenna constructional details.

Additional Notes

It is likely that a "sloper" version will work well and it is obviously easy to support, but I have not tried it.

If you are running more than 100 W out I suggest you use air-core baluns. As pointed out earlier, ferrite-core baluns can be problematic in situations where there is considerable common-mode potential. The hysteresis losses are strongly dependent on frequency and on the flux density. For a given frequency, the hysteresis losses are proportional to somewhere between the square and the cube of the flux density. This can cause distortion and heating problems. The ferrite-cored baluns described here will loaf along at 100 W but I wouldn't recommend that you go too much above that.

The name I came up with for this antenna is the "C pole," because of its shape and because the popular "J pole" is so-named for its resemblance to the shape of that letter.

Does it Work?

The evidence I have that this is an effective antenna is part scientific and part observational. The scientific part refers to the observation that the antenna Q, as measured by the 2:1 SWR bandwidth, is as expected, and the expected Q includes the effects of identifiable loss mechanisms. The observational part is simple—it is very easy to work DX stations, even though I never run more than 100 W out. Part of that is no doubt because of my excellent location, but the antenna does play a significant role. I'm sure you can tell when you are using a good antenna system—with an effective antenna, operating is a pleasure, not a struggle. That is the way it has been with this antenna design, and if you put it together carefully I'm sure you will get the same enjoyment out of it that I have.

Brian Cake, KF2YN, was born in England and first licensed as G8AFH. He received an EE degree from City University, London. Brian is now retired after 15 years as Chief Technical Officer at LeCroy Corporation, where he was manager of the Advanced Development Group. He now lives on the Matanzas Inlet, near St Augustine, Florida where he designs and tests new antenna ideas and builds miniature live-steam locomotives. Brian can be reached at 248 Barrataria Dr, St Augustine, FL 32080; **bcake@bellsouth.net**.

By Doug Hedin, WØYF

Dollars and Decibels

You get only the decibels you pay for—but some are worth more than others. Put your dollars in the right places!

Working more stations involves much more than just hardware. Hardware can be a major limiting factor, however, because you can't work a station you can't copy or that can't copy you. For a given location and set of propagation conditions, it's predominantly hardware that determines whether or not you can make a contact! And, for most of us, it's the size of our pocketbooks that controls the hardware that makes up our stations.

To a large extent what we get in station performance for what we spend depends on where we put those dollars, because some hardware dollars just naturally improve signal levels more than others.

The Basics

If you look at the block diagram of a typical amateur station (see Figure 1), you will notice that most of its major components are common to both transmitting and receiving. Only the power amplifier (if you have one) is used exclusively for transmitting.

Knee-jerk reaction might lead one to immediately quote the old saw: "If you have any extra money, put it into your antenna first." It might be true, but have you ever tried to prove it? What about a better (lower loss) transmission line? Or a tower (or higher tower). Which is *really* the best place to put your first dollar, or your second, etc? Helping you make those decisions is what this article is all about.

Before we go any further, let's clarify the ground rules used in preparing this article. First of all, everything that is frequency dependent will be based on the 20 meter band.

Secondly, while I have tried to present reasonably accurate values wherever numbers are given, some are estimates, some may be out of date, and some are for products whose prices can vary considerably from manufacturer to manufacturer and quality to quality. It doesn't matter whether the values used here are nitpicky accurate or not because the purpose of this article is not to provide a basis for making hardware purchase decisions. Rather, the idea is to show you how to make your *own* decisions using *your* prices, values and equipment, based on *your* priorities, circumstances and personal preferences.

Our Benchmark Station

Working with decibels is a process of comparison, so we will use a common, modest station setup as our comparison benchmark. We'll say that it consists of a 100 W HF transceiver (no power amplifier) feeding a 35 foot high dipole through 65 feet of RG-8X coaxial cable.

Presenting: The "SLI" and "SLI/$k"

This article is all about the amount of signal level improvement, or "SLI," that can be achieved versus the amount of money it costs to get it. SLI represents the signal level improvement, in decibels, that a component will provide, with respect to the corresponding signal level that would be experienced, with a similar component, in our benchmark station.

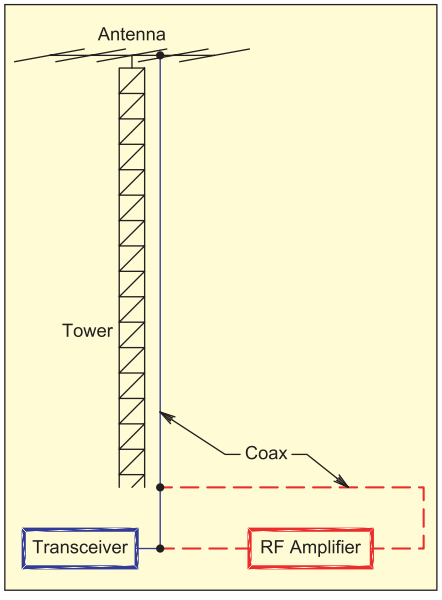


Figure 1—System components that are common to both receive and transmit are shown in blue. The amplifier (in red) is only used in transmit.

The SLI of a transmitter or amplifier is the difference, in decibels (dB), between its output power and the (presumably) lower output power of the benchmark transmitter or amplifier. The SLI of an antenna is the difference, in dB, between its forward gain and the lower forward gain of the benchmark antenna. The SLI of a coaxial cable is the difference, in dB, between the loss in that cable and the higher loss in the comparison benchmark cable. Note that these losses assume a perfectly matched load or SWR of 1:1. For a higher SWR, the difference will be greater. See Chapter 24, Figure 14 of *The ARRL Antenna Book*.[1]

Here's an example. A beam with a forward gain of 7.8 dBd (with respect to a dipole—the antenna of our benchmark station) would have an SLI of 7.8 dB. That's simple enough. But knowing the beam's SLI gets us only halfway to our primary goal, which is to determine how much SLI we get for the money we spend. We will express that using the term "SLI/$k," or SLI (in dB) per $1000 of cost.

Back to the beam. If that beam costs $1275, its SLI/$k is 7.8 dB/$1.275 k = 6.1 dB per $1000, which means it provides 6.1 dB of signal level improvement per $1000 of cost. To compare the performance of one component with that of another, we simply calculate and compare the SLIs of the components under consideration. To determine which component gives us the most performance for our money, we go one step further and calculate and compare the components' SLI/$ks.

Keep in mind that what we are trying to do here is demonstrate an *approach* to decision making. For the sake of convenience and information flow, however, I

[1] *The ARRL Antenna Book*, 20th edition, p 24-10. Available from your local dealer or the ARRL Bookstore. ARRL order no. 9043. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

have taken a few technical liberties that would ruin an engineering professor's dinner. So don't make a buying decision solely on the basis of the SLI or SLI/$k values you see here.

I'm also aware that the accuracy of the result of any calculation depends on the value in the calculation that has the fewest significant digits, and have also taken a few liberties with that rule. The most common reason for doing it is so the reader can trace the flow of values through the calculations.

Antennas

Antennas are a good place to start when looking at SLIs because, when we crunch the numbers, we discover that one of the best places to improve a station's transmit and receive performance *may* indeed be its antenna. If the benchmark antenna is a dipole, the antenna is virtually a slam-dunk as the first place to put your money. If the benchmark antenna has more gain than a dipole, however, that might not be true. This approach gives us a tool to find out.

To make things short and (hopefully) simple, we'll work out our sample comparisons only with beams. We also will assume that the performance ratings claimed by antenna manufacturers are accurate (don't snicker, please!). Finally, we will consider only commercially manufactured antennas.

We'll base our comparisons on forward gain, or just plain "gain." Beams offer a certain amount of gain for a certain amount of money. Typically, the higher the gain the more they cost. Table 1 shows the costs and claimed gains of five different beams having three to seven elements. Notice that as gain increases, the SLI/$k decreases.

Coaxial Cable

Now let's compare several different types of coaxial cable with the RG-8X used at our benchmark station. Coax requires us to readjust our thinking cap because we have to work with losses instead of gains and because the simple procedure we have used heretofore works only if we are comparing different cables of the same lengths. Comparing different cables of different lengths requires an additional step.

We won't consider RG-58 because its losses are higher than those of RG-8X, and that would be going backward. We will limit our possible choices to:

- Foam-dielectric RG-8 (wherever RG-8 is mentioned here we will be referring to RG-8 with foam dielectric).
- Times Microwave LMR-400.
- Times Microwave LMR-600.

The SLI for RG-8 is the difference between the loss per 100 feet of our benchmark station's RG-8X in dB and the loss per 100 feet of RG-8. The losses in RG-8X appear to vary from 1.1 to 1.3 dB per 100 feet, depending on the manufacturer. We will use 1.2 dB per 100 feet. The SLI of 100 feet (note that we are specifying a particular length) of RG-8, with respect to 100 feet of RG-8X is therefore 1.2 – 0.59 = 0.61 dB.

So far so good. But what if we want to determine the SLI and SLI/$k of 100 feet of LMR-400 with respect to 65 feet of RG-8X? First, we must calculate the loss in the 65 feet of RG-8X, which, at 14 MHz, is 0.65×1.2= 0.78 dB. Then we subtract 0.48 (the loss in the 100 feet of LMR-400) from 0.78 (the loss in the RG8X). The SLI of 100 feet of LMR-400 is therefore 0.78 – 0.48 = 0.3 dB with respect to 65 feet of RG-8X.

Table 2 shows SLIs and SLI/$ks for several types of coax. Note that, though losses in LMR-400 are noticeably lower than those in RG-8, the SLI/$k for LMR-400 is about the same as that for RG-8, whereas the SLI/$k for LMR-600 is only about 58 percent of that for RG-8.

Amplifiers

A power amplifier differs from the other basic station components in that it does not affect the levels of signals we receive. It affects only the level at which another ham receives our signal. In this article the SLI of an amplifier is the difference, in dB, between its maximum output power level and that (100 W) of the benchmark system. Table 3 shows the SLIs and SLI/$ks for a number of different amplifiers that are popular today.

Towers

By now we understand that the SLIs of antennas, coax and amplifiers depend on their gains or losses. But what about towers? Can towers have gains or losses? Maybe not, but we can sure give them SLIs.

A tower can be given an SLI because it determines, or at least limits, the height at which we can put our antenna. And, the height of a horizontally polarized antenna determines the levels at which the antenna receives signals coming in at different angles. The height-versus-angle relationship is the same for transmit as it is for receive, so the receive and transmit SLIs for a particular antenna height are the same.

Optimum antenna height up through 30 MHz depends on the angles at which the largest number of signals or the most desired signals are received. Once you determine the optimum antenna height (how to do that would require a separate article), the SLI/$k of the tower necessary to provide it depends on the tower's height and cost. We can say with reasonable certainty that the optimum height for any horizontal HF antenna for long distance communication, and therefore the tower on which it is mounted, will be greater than the benchmark's 35 feet.

SLI comparisons for some representative different towers, based on maximum tower height plus a modest mast, are shown in Table 4.

How to Use SLIs and SLI/$ks

Now that we've learned to calculate SLIs and SLI/$ks, let's practice using them. Comparing one component with another is relatively simple. Let's use the age-old question of whether to buy a beam or an amplifier as an example. From Table 2 we see that a four-element beam gives us an SLI of 6.6 dB for $595, whereas a 500 W amplifier gives an SLI of 7 dB for about the same cost ($600). The beam's SLI/$k is 11.1 dB, the amplifier's 12 dB. What this tells us is that for about the same price we get about the same SLI from either, but with the

Table 1
Forward Gains and Costs for some Representative 20 Meter Beams

Elements	*SLI (dBd)*	*Cost ($)*	*SLI/$1000 (dB/$k)*
3	5.3	400	13
4	6.6	600	11
5	7.3	900	8.1
6	7.8	1300	6
7	8.4	2000	4.2

Table 2
Costs and Relative Losses for Some Coaxial Cables versus RG-8X at 14 MHz

Cable	*Loss in 100 feet (dB)*	*SLI[1] for 100 feet (dB)*	*Cost/1000 feet[2] ($)*	*SLI/$k for 100 feet (dB/$k)*
RG-8X	1.20	—	—	—
RG-8 Foam	0.59	0.61	500	1.2
LMR-400	0.48	0.72	600	1.2
LMR-600	0.38	0.82	1190	0.69

[1]The amount by which its loss is less than that of RG-8X.
[2]In short (100 foot) lengths.

beam we get it on both receive and transmit whereas with the amplifier we get it only on transmit.

Let's now look at comparing complete systems. Most of us fall into one of three different financial categories:

1. We have a very limited amount of money to spend and have to squeeze the most benefit we can out of every nickel.

2. There is a limit to what we can spend, but we don't have to buy the lowest cost of every type of component, and we can afford to invest in things that offer good value.

3. We are willing, and able, to spend whatever it takes to get the best of everything.

For those of us who fall into category 1, the lowest cost system would consist of a $400 three-element beam, a $1380 56 foot economy tower and 100 feet ($50 worth) of RG-8 coax. The total cost would be $1830. Table 1 shows that, with respect to our benchmark system, the antenna's SLI would be 5.3 dB. Table 4 shows that the tower SLI would be 2.5 dB.

Table 2 shows that the loss in the benchmark system's 65 feet of RG-8X would be 0.65×1.2 or 0.78 dB, whereas the loss in 100 feet of RG-8 would be 0.59 dB. The SLI of our RG-8 would therefore be 0.78–0.59 or 0.19 dB.

System receive and transmit SLI would be the antenna's 5.3 dB plus the tower's 2.5 dB plus the coax's 0.19 dB, for a total of 8 dB. Signals received with this system would be 8 dB stronger than with the benchmark system. Ignoring any propagation anomalies, the level of the transmitted signal when received by another ham would be 8 dB higher than if it came from the benchmark system.

The system would cost $1830, so the receive/transmit SLI/$k would be 8 dB/$1.830 k or 4.3 dB per $1000. For casual ragchewing and less than frenetic DX chasing, this system could be all you would ever need.

You could improve the transmit SLI by adding a power amplifier. Many hams with basic 100 W rigs and three-element beams 50 to 60 feet high score respectably in contests and eventually make it through pileups to work most rare DX stations. Even some QRP stations manage to do it with antennas that high. But it will enhance the probability of making a contact if you send more than 100 W up the coax.

The $600, 500 W unit fits the "lowest possible cost" criteria of the category 1 operator. With the amplifier, total system cost would be $2430.

The amplifier would add 7 dB (just above one S unit) to the transmit SLI, so the transmit SLI would increase to 8+7 or 15 dB. The transmit SLI/$k would become 15 dB/$2.430 k or 6.2 dB per $1000.

The amplifier would not improve the receive SLI, which would therefore remain 8 dB. The receive SLI/$k is dependent on total system cost, however, so it would drop to 8 dB/$2.430 k or 3.3 dB per $1000. System receive/transmit SLI/$k would thus be a somewhat unbalanced 3.3/6.2 dB per $1000.

Table 3
RF Amplifier SLIs and SLI/$ks with Respect to 100 W

Output Power (W)	*SLI (dB)*	*Cost ($)*	*SLI/$k (dB/$k)*
500	7	600	12
600	8.8	750	12
1000	10	1200	8.3
1250	11	1600	7
1500	12	2550	4.7

Table 4
Costs Versus Relative Receive and Transmit Gains for Representative Towers

Height	*Antenna Height Feet*	*Tower Only Cost ($)*	*Mast, Base, Access, Ship Cost ($)*	*Total Cost ($)*	*SLI (dB)*	*SLI/$1000 (dB/$k)*
56' Economy Free-standing Non Crank-Up + Mast	58	630	750	1380	2.5	1.8
60' Guyed + Mast	65	1300	500	1800	2.7	1.5
100' Guyed + Mast	105	1600	1000	2600	7.5	2.9
55' Freestanding Crank-Up + Mast	58	1600	50+750+ 120+400	2920	2.5	0.86
72' Freestanding Crank-Up + Mast	75	2450	50+1000+ 165+600	4265	5.6	1.3
89' Freestanding Crank-Up + Mast	92	4600	50+1500+ 235+875	7260	6.8	0.94

Table 5
Gains and Costs for Lowest and Highest Cost Systems Considered

Tower	*Beam*	*Coaxial Cable*	*RX/TX SLI (dB)*	*Cost ($)*	*RX/TX SLI/$1000 (dB/$k)*
56' "Economy" Freestanding No Amplifier	3 Element	100' Foam RG-8	8/8	1830	4.3/4.3
56' "Economy" Freestanding 500 W Amplifier	3 Element	100' Foam RG-8	8/15	2430	3.3/6.2
56' "Economy" Freestanding 1500 W Amplifier	3 Element	100' Foam RG-8	8/20	4380	1.8/4.6
89' Crank-Up No Amplifier	7 Element	150' LMR-600	15/15	9400	1.6/1.6
89' Crank-Up 1500 W Amplifier	7 Element	150' LMR-600	15/27	12,000	1.3/2.3

Signing Off

In case all these numbers have left you goggle-eyed, the figures for five different systems, including some of those for which SLI and SLI/$k values were calculated in the text, are shown in Table 5. I strongly recommend that you use a similar table to help you make your own evaluations.

By the way, you don't have to have an IRS agent's eye for missing items to notice that we haven't included costs for rotators, sales taxes, connectors and other things that go into setting up a station. Be sure to include them when you evaluate the systems and components in which you are interested.

Doug Hedin was first licensed in 1958 as KNØOFB. He helped pay his way through the University of Minnesota (BA in English) as a transmitter technician and chief engineer for several radio and television stations. Following college he managed the technical sales literature department for Collins Radio Co, and was technical writer/editor of aerospace documentation for General Electric Co. Doug has been an ARES county EC and DEC for the central third of Minnesota, and is a Volunteer Examiner. WØYF can be contacted at 17180 705th Ave, Dassel, MN 55325; **dougnbev@hutchtel.net**.

By Charles W. Pearce, K3YWY

A 3-Band No Trap Dipole for 40, 15 and 6 Meters

A quick mod for that 40 meter dipole can turn you into a "magic band" aficionado.

Many modern rigs now come with 6 meter capability, but that may be just another unused feature of your radio because of the lack of an antenna. Even if you had a desire to work the "magic band," you may not have had a way to erect a beam antenna, thinking that was what was needed to work 6 meters. You can now transform your existing 40 meter dipole into an antenna for 6 meters with the simple addition of two capacitance hats.

The Theory

Using a 40 meter dipole on its 3rd harmonic is a time-tested technique to work 15 meters. In looking for a way to get on 6 meters, it occurred to me that 6 is more or less the 7th harmonic of 40 meters. My 40 meter dipole is resonant around 7.25 MHz and has capacitance hats, as described in *The ARRL Handbook*, to improve its characteristics on 15 meters.[1] The seventh harmonic should have been a resonant point of 50.75 MHz. In fact, I measured a resonant point of about 51.8 MHz at an SWR of 1.55:1. The resonant point was about 1 MHz or 2% higher than simple harmonic theory would have predicted. Consultation with the *Handbook* indicated that this effect is to be expected and is due to the end effect. The effect is implicit in an empirical equation for long wire antennas in the *Handbook* and is also modulated by the effect of finite wire size on antenna reactance.[2] To investigate this phenomenon further, the antenna was modeled with *MININEC*, the antenna-modeling program.[3]

I first modeled a free-space dipole similar in length to my own. Table 1 contains the results of those calculations. As expected, the feed point impedance at resonance is close to the theoretical value of 72 Ω and, using a 50 Ω feed line, should yield an SWR of 1.43:1. Notice, however, that the resonant point of the 3rd harmonic is higher by 1.8% than that predicted by a simple tripling of the 40 meter resonant point. The same is true at 50 MHz, where the resonant point is 2.5% higher than would be predicted by multiplying the 40 meter resonant point by 7 and is consistent with the experimental observations.

The modeling was repeated with the dipole 5 meters above a perfect ground to approximate my actual installation. The 40 meter resonance point did shift downward, but the upward shift of the nominal 3rd and 7th harmonic resonant frequencies above the simple expectation of tripling and septupling did repeat and was even somewhat accentuated. The shifts were now 3.6% and 4.9%. Table 1 contains these results along with those calculated from the *Handbook* formula. This formula does provide a good estimate of the resonant frequency, as well. Also, notice the rise in feed-point impedance with increasing frequency, in all cases. This places some practical limitations on using the 7th harmonic, depending on your tuner and feed line.

The increase in resonant frequency is an interesting aspect of the antenna system, but it poses an obstacle to using it in the more favored section of the band, especially if you don't have an antenna tuner. To remedy this, I decided to try capacitive loading, like that used to alter the 15 meter point.

Figure 1—Temporary attachment of capacitance wires to the antenna using an alligator clip.

Capacitance Loading Modification

Using alligator clips, as shown in Figure 1, I positioned 18 inch wires approximately a quarter wavelength or 4.5 feet on either side of the feed point, following what had been done for the 15 meter optimization. This lowered the resonance below 50 MHz. Further pruning of the wires and subsequent measurements indicated that the resonant point would shift at the rate of about 122 kHz/

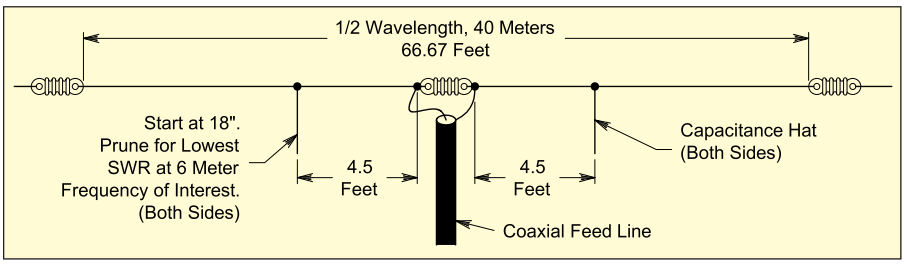


Figure 2—The modified 40 meter antenna with 6 meter capability.

[1]Notes appear on page 44.

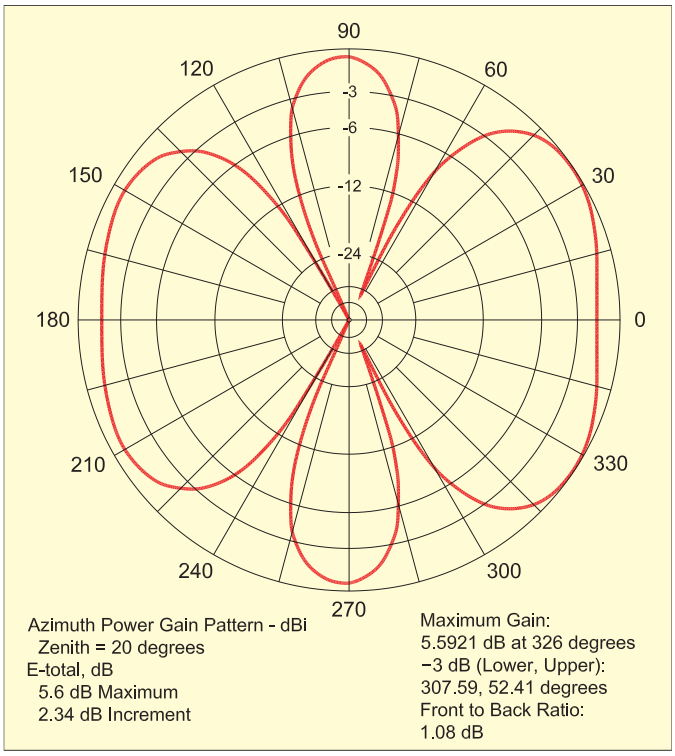


Figure 3—Radiation pattern at 20° elevation.

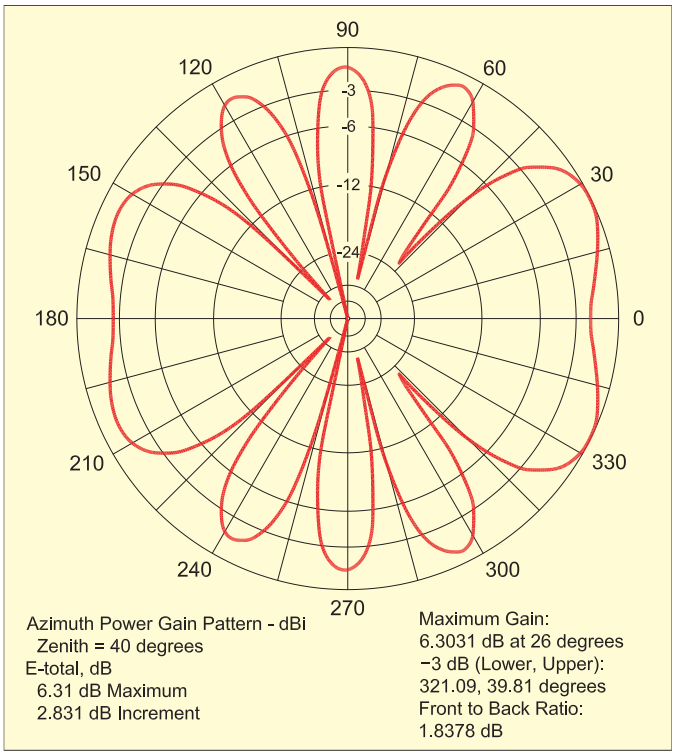


Figure 4—Radiation pattern at 40° elevation.

Table 1
40 Meter Half-Wave Dipole with a Wire Radius of 0.0005 M Using *MININEC*

Model (Harmonic)	*Free Space Resonance (MHz)*	*Free Space Impedance (Ω)*	*5 Meters Above-Ground Resonance (MHz)*	*Above-Ground Impedance (Ω)*	*Modeling Segments Used (Number)*	*Handbook Formula Resonance (MHz)*
1st	7.24	71.6	7.08	27.5	6	7.05
3rd	22.12	105.0	22.01	125.5	18	21.90
7th	51.93	127.0	51.99	143.0	48	51.60

inch of wire length. I finally settled on a length of 12 inches for a resonant frequency of about 50.5 MHz. The measured SWR was 1.65:1. Figure 2 shows a drawing of the modified 40 meter antenna.

Performance

The addition of the wires had no discernable effect on the 40 meter or15 meter characteristics. *MININEC* predicted a 3:1 SWR bandwidth of 0.41 MHz at the feed point. I measured something in excess of 1.6 MHz in the shack at the end of the feed line. So, if you use a tuner, it should not be too difficult to achieve operation over a wide fraction of the band.

MININEC also predicted a number of side lobes, as would be expected for operation at such a high harmonic. Figures 3 and 4 show the azimuthal patterns at zenith elevations of 20° and 40°, respectively.

Fortuitously, the band was open when I first went to use the antenna, and I was able to work California. Since then, I have worked more DX, including North Dakota and some locals, as well. This may not be the best antenna for 6 meters, but it will get you on the band with a minimum of fuss.

What Needs Doing

The end effects, ground plane effects and finite wire size will all impact your actual installation, but it is likely that even with a dipole having a resonant point at the low end of 40 meters, the 6 meter resonant point will be above 51 MHz.

Assuming you already have a 40 meter dipole, measure the SWR on 6 meters to determine where your antenna is resonant or use an antenna analyzer. If the resonant frequency is above the point at which you would like to operate, proceed as follows: Solder 18 inch lengths of wire, to points 4.5 feet on either side of the feed point and remeasure the SWR. Prune as necessary to move the resonant point to your desired location using the rule of thumb of 122 kHz/inch. If you have a feed line with high loss at 50 MHz such as RG-58/U, you may want to consider replacing it with something at this frequency. Welcome to 6 meters!

Notes

[1]See, for example, *The ARRL Handbook,* 1996 edition, Chapter 20, pp 20.17 and 20.18 and *The ARRL Handbook*, 2004 edition, p 20.17. Also see *The ARRL Antenna Book*, 20th edition, Chapter 6, p 6-23. Both current editions are available from your local dealer or the ARRL Bookstore. Order nos. 1964 and 9043, respectively. Telephone toll-free in the US 888-277-5289 or 860-594-0355; fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

[2]R. G. Brown, R. A. Sharpe and W. L. Hughes, *Lines, Waves and Antennas*, New York: The Ronald Press Co, 1961.

[3]*MININEC* is available at **www.emsci.com**.

Chuck Pearce, K3YWY, was first licensed in 1963 and received a PhD in Electrical Engineering from Lehigh University in 1988. He retired from Agere Systems after 33 years as a semiconductor process engineer and now divides his time between consulting and teaching. Chuck's current Amateur Radio interests include VHF-UHF contesting and homebrewing. He can be reached at 410 S 12th St, Emmaus, PA 18049; **cpearce@fast.net**.

By Bill Meara, CU2JL/N2CQR/MØHBR

Junk Box Sideband from the Azores

Like a conspiracy in a spy novel, the bits and pieces of my homebrew 17 meter SSB transmitter came together from distant parts of the globe, over a period of many years.

In 1973, in the suburbs of New York City, I found a nice milliammeter in the back room of the Crystal Radio Club. I put it in my junk box.

In the fall of 1986, Frank Lee, G3YCC, wrote an article about a simple 20 meter SSB transmitter. The article was published in SPRAT*, the journal of the G-QRP Club.*

In 1995, in the Dominican Republic, Pericles Perdomo, HI8P, gave me a seriously defunct Swan 240 transceiver. I salvaged the crystals from the oscillator and the four crystals that made up the filter.

In 1998, at a hamfest in Northern Virginia, I purchased a very messed-up Heathkit DX-40. I thought it might be useful someday.

In September 2000 I moved to the Azores, bringing with me all of the above-mentioned items. It was in these Atlantic islands that the plot would be hatched.

My initial experiences on 17 meters were a bit "broadband." Using a homebrew double sideband transceiver (see *QST*, Oct 2003, pp 43-45), I made great friends on 18 MHz, but occasionally felt guilty about making them struggle to hear my 5-W DSB signal. I wanted to run a bit more power, but I was reluctant to do so while using more than twice the needed spectrum. Clearly, one of the sidebands had to go. It was time to take a technological leap into the 1950s. It was time to go SSB.

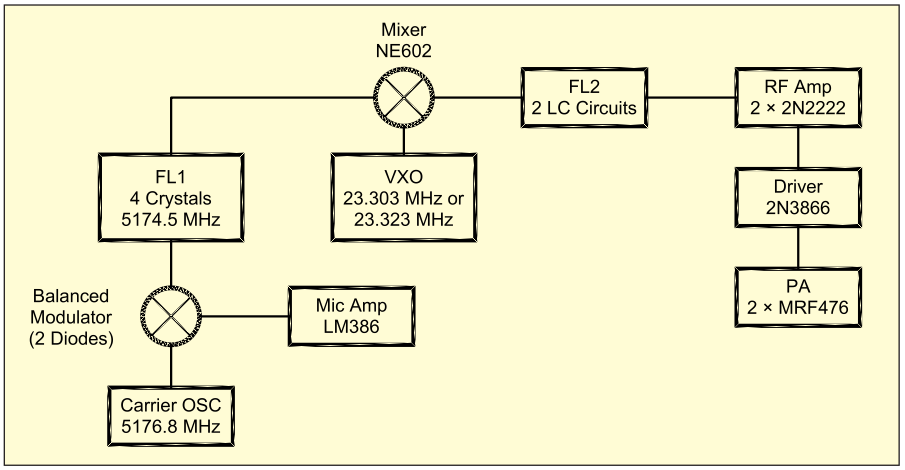


Figure 1—Block diagram of my 17 meter SSB transmitter.

Between the Homebrewing Extremes

I think there are degrees of sophistication in homebrewing. At one end of the spectrum, the homebrewer is reproducing circuits designed by others, sticking very closely to the prescriptions of the designer. At the other end, the homebrewer designs the circuit himself, then

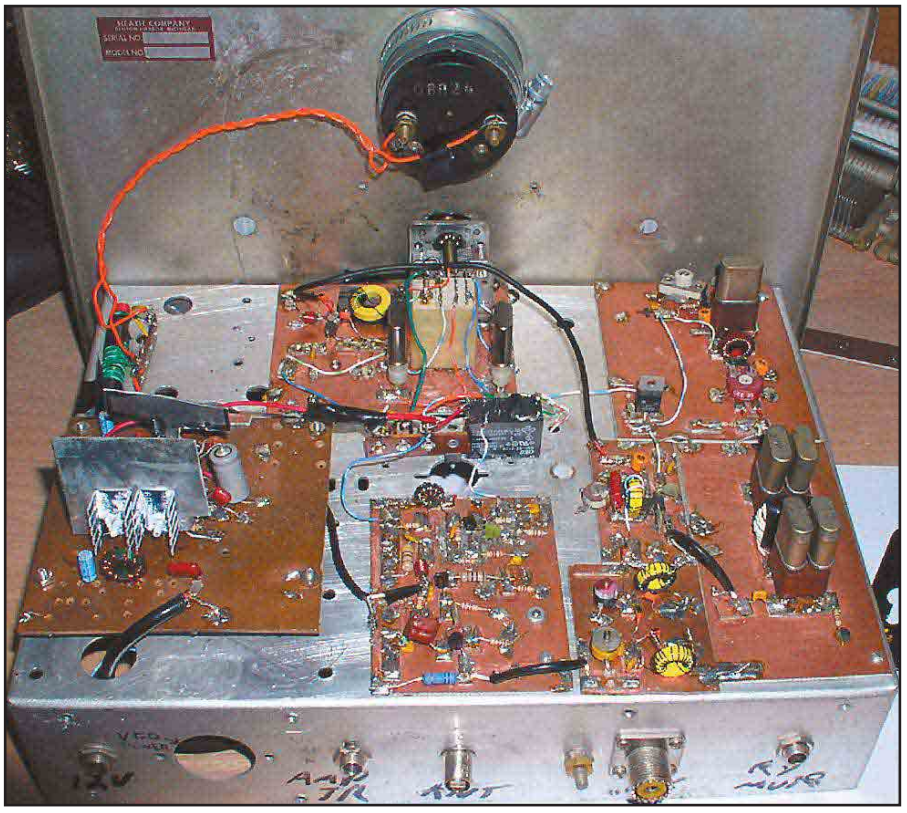


Figure 2—Not all homebrew projects have to be beautiful!

builds it. I'm somewhere between the two extremes: I don't yet have the ability to completely design my own rigs, but after about 10 years of building I can now borrow bits and pieces of circuit design from others, and make them work together. I've also grown comfortable about substituting parts—I'm no longer afraid about not using exactly the component called for by the designer—I can pull a "close-enough" part out of my junk box and use it with confidence.

Moving across this spectrum is one of the joys of homebrewing: You learn something with each project, and over time find yourself getting better at it, better able to tackle more sophisticated tasks.

While I wasn't going to build an exact copy of G3YCC's rig, his article provided inspiration and an overall framework for the project. Frank described "a simple TX which could be made cheaply, mainly from junk box bits." His transmitter used only 13 transistors and no ICs. I borrowed ideas and bits of circuit design from Frank and from others.[1]

Using the Manhattan method,[2] I built this rig one stage at a time, moving from the carrier generator on through to the RF amplifier, testing each stage as it was completed, then working on the interface with other stages. Completed boards were mounted on the old DX-40 chassis.

The carrier oscillator (5.173 MHz) and balanced modulator stages went together very easily (or so I thought). For the filter, I had to consult the literature in an effort to figure out how to use crystals from the Swan 240 (they were made in December 1962). I ended up using a toroidal core and some "twisted pair" wire from an old earphone to make the bifilar coil in the center of the filter.

G3YCC used two discrete transistors in his audio (mic) amplifier. Other designers use a 741 op amp. I had some LM386 audio amplifier chips on hand and decided to try to use one of these to feed audio into the balanced modulator. It worked fine, and helped keep the parts count lower than it would have been with the alternative circuits.

Feeding the Filter

While G3YCC used a passive mixer, I had some NE602 chips on hand and used one of these. My original circuit had a variable crystal oscillator at around 12.9 MHz mixing with the 5.173 MHz SSB energy to produce the desired 18 MHz signal. I tried to feed the mixer output right into the RF amplifiers, but quickly learned why G3YCC had included a "preselector" filter after the mixer: You really need to knock down the unwanted sum or difference product.

Like Frank, I used two loosely coupled parallel LC circuits. This stage provided some practical experience with the effects of loading on circuit Q: I found that when I ran this filter into the low impedance input of a bipolar junction transisor RF amplifier stage, I didn't see a very sharp peak when tuning the second LC circuit. But when I fed this filter into the high input impedance of JFET amplifier, the increased Q resulting from the lighter loading was very apparent.

I thought that once I had an SSB signal at 18 MHz, RF amplification would be the easiest part of the project. I was wrong. As had occurred with my double sideband rig, I had real difficulty getting the RF amplifiers to function with stability. As I was struggling, I came across a comforting article by C. F. Rockey, W9SCH. OM Rockey noted: "It is the development of clean RF power in appreciable quantities that is the greatest challenge in this field for the average amateur." Amen to that, Rock! W9SCH went on to suggest ways to surmount the difficulties (including the possible need to sacrifice chickens to Papa Legba), but conceded that success is not guaranteed.

No Chickens Died in the Making of this Radio

I didn't have to kill any chickens, but a 20 meter CW transmitter was sacrificed. After several frustrating attempts to get RF amplifiers working, I resorted to the maneuver that I used in the double sideband project: I pulled a working broadband 5 W amplifier out of a transmitter that I'd built several years ago and modified it for linear service.

The transmitter was now working and I started making contacts. I had already made many friends on 17 with the DSB rig, and it was great fun to meet up with the same people using the new rig. Ed, W6KOK, provided one of the most memorable of these early QSOs. He was listening to my signal, and—as he'd done when I was using the DSB rig—was switching back and forth from upper to lower sideband. Before I could tell him I'd gone SSB, in a surprised voice he told me that I'd lost my lower sideband. Just what I wanted to hear!

But of course, there were still problems. I was only able to "pull" the 12.9 MHz crystal in my VXO about 9 kHz. Believe me, being restricted to 9 kHz is no fun. I started looking at alternatives. Getting a VFO stable at 12.9 MHz seemed difficult. So I decided to get crystals for around 23.3 MHz and take the difference frequency out of the mixer (instead of the sum). The 23.3 MHz rocks would be a lot more "pull-able"—I figured that with two of them, I'd be able to cover most of the phone portion of the band.

[1]Notes appear on page 47.

I was in for a disappointment when the package arrived from JAN Crystals. The 23.323 rock worked well, but the 23.303 crystal seemed to have problems. When I tried to "net" the transmitter with the receiver (put the transmitter on the receiver's frequency), instead of one nice peak, I was hearing multiple peaks. It was difficult to tell which was the real operating frequency. I thought the rock was bad, and sent it back to JAN. They very kindly checked it out and told me it was good. They were right.

After much hair pulling and consultations on the Internet, I sat down one Saturday morning with a notebook and made some detailed observations. I noticed that there seemed to be sum and difference frequencies around the operating frequency. These spurs got closer to the operating frequency as I reduced frequency down to about 18.116. Looking at lists of harmonic frequencies, I concluded that the 18 MHz energy was interacting with a harmonic from the carrier oscillator and producing another signal in the passband of the 5.174 MHz filter.

Soldering in a Suit

I considered a lot of painful filtering and shielding, but then it occurred to me that if I could just reduce the level of the harmonics coming out of the carrier oscillator, I might be able to solve the problem easily. I looked at G3YCC's Pierce oscillator circuit. From the junction of the crystal and the transistor base, Frank had a 30 pF capacitor to ground. I guessed that by increasing the value of this cap, I could decrease the amount of feedback in the oscillator and—I hoped—reduce the harmonic output.

This idea came to me as I was getting dressed for a diplomatic reception. I was set to go a few minutes before my wife was ready, so with suit and tie on, I rushed down to the shack and soldered a 30 pF compression trimmer in parallel with the 30 pF fixed cap that was already in the circuit. Then, while listening to the problematic harmonic on a general coverage receiver, I tightened the trimmer cap. It was as if I was squeezing the life out of that evil harmonic. The desired fundamental output was still there, good and strong, but the harmonics were now greatly reduced. As time grew short, I quickly checked the transmitter for the hated spurs—they were gone. I went to the reception with a smile on my face (and with a slight scent of solder smoke in my hair).

I don't like to be constantly plugging in and pulling out crystals, so I put a DPDT relay on the VXO circuit board that allows me to change crystals with the flip of a switch.

The old Simpson meter from my 1973 visit to the Crystal Radio Club fit nicely in the meter hole in the front panel of the DX-40 cabinet, and gave the rig something of a connection to my ham radio roots. That meter had been bouncing around in my junk box for almost 30 years! It just goes to show you: *Never throw anything out!*

Figure 3—The 17 meter SSB rig again, this time in the Azores. The small box to the left is a linear amp (which takes it to 20 W PEP) based on a Ramsey kit. The solar panel is of the type being supplied with new Volkswagens—I use it to top off my gel cell (even here in London!). The copper colored box is my homebrew 20 meter DSB portable rig.

It Works!

The transmitter works very well, putting out 5 W PEP SSB, and allowing me to tune over some 36 kHz of the 17 meter phone band. I used it with my trusty Drake 2-B receiver and a rotatable dipole made of wire antenna elements strapped to two fiberglass fishing poles. Contacts with Australia were very common, and the transmitter made copy a bit easier for my buddies on 17. With my bandwidth now down to socially acceptable levels I could contemplate the possibility of running higher power.

As happens in many spy novels, when you get to the end many of the protagonists are no longer around. Sadly, that is the case with this radio conspiracy. Both G3YCC and HI8P are now silent keys. But I'm sure they'd both be very pleased with their role in this plot, pleased to know that they contributed to the construction of a transmitter that allowed a fellow ham on a remote island to reach out across the seas.

Notes

[1]After I completed this project I came across Doug DeMaw's excellent series of *QST* articles on simple SSB transmitters. Printed in five parts from September 1985 to January 1986, this treasure trove of information is available on the ARRL "Building Equipment" Web Site (**www.arrl.org/tis/info/bldgeqp.html**) and should be considered mandatory reading for would-be transmitter builders.

[2]The Manhattan method uses a copper-clad board as the base, with isolation pads glued to it to support junctions in the circuit. Connections to ground go directly to the copper-clad base.

All photos by the author.

Bill Meara built this rig while serving as the American Consul in the Azores archipelago. He is now posted to the American Embassy in London. Previous government assignments have taken him to the Dominican Republic, Spain, Honduras, El Salvador and Panama. He got his start in ham radio as a teenager in New York in the early 1970s. Lately he's been using HB rigs, but he also still makes use of a Drake 2-B and a Hallicrafters HT-37 that he picked up in 1975. You can contact the author at **n2cqr@arrl.net**. *His Web site is at* **planeta.clix.pt/n2cqr**.

FEEDBACK

◊ At the risk of a malpractice suit, the Doctor needs to clarify the question of speaker impedance raised in his December column ("The Doctor is IN," Dec 2003, p 52) and the related Feedback item (Feb 2004, p 54). The original proposition of using a 5 Ω, 2 W series resistor between the speaker and the transceiver is actually a much better solution than a 250 Ω to 3.2 Ω transformer, which is wrong. The peak power delivered from a transformer of that impedance ratio would only be about 150 mW, while the series resistor would deliver about 1 W to the speaker. Still, nearly half the total power output would be dissipated by the resistor. The best solution, and one the Doctor stands by (presented in February's Feedback) is to use an autotransformer, made from a common 70 V line to voice coil transformer (RadioShack 32-1031) with an open primary. Thanks to all who wrote in, but especially to Hans Glista, WA1LWS.

◊ In "The Doctor is IN" of Feb 2004, the television horizontal sweep frequency should be 15,750 Hz, not 15,750 kHz, as printed. Thanks to Steve Bird, WS7R, for catching it. As an aside, the current NTSC TV horizontal sweep frequency is 15,734.5 Hz, although it is frequently referenced as 15,750 Hz (a carryover from the old monochrome TV days).

◊ In the article by Luiz Lopes, CT1EOJ, "Designing a Shortened Antenna" (Oct 2003, pp 28-32), there is some question about the value of the quarter-wave transformer at the bottom of page 32, first column. The length given was 27 feet. This is correct for cables having a velocity factor of 0.83, such as Belden 1426A or 1694A. For cables with a velocity factor of 0.78 (Belden 8212), it will be 26 feet, and for cables having a velocity factor of 0.66 (Belden 8215 and 8241), it will be 22 feet.

By Kay Craigie, N3KN

From Whence Came WAS, WAC and DXCC?

What started as routine research for a club talk turned into a fascinating history lesson.

Instead of the usual "ARRL Update" talk, I wanted to do something different for my 2003 speech at my home radio club. I thought it would be fun to talk about the major ARRL operating awards—Worked All States, DX Century Club, DXCC Challenge and the VHF-UHF Century Club—along with IARU's Worked All Continents.

Chasing awards has been a personal interest since I became a ham in the early 1980s, and I thought the presentation was something I could throw together in a couple of hours. Just fire up *PowerPoint*, grab the rules and some graphics from the ARRL Web site, toss in a plug for Logbook of The World and click on "Save." I'd be done in a snap, I thought.

But what if someone in the audience asked me when these awards began? I realized I didn't know much about that beyond the fact that DXCC had been restarted from scratch after World War II. So I consulted the on-line periodicals index on the ARRL Web site and got out the back issues of *QST* on CD-ROM. The historical threads were so interesting to follow through the old *QST*s that a few hours of work turned into several days, with some surprises along the way.

I didn't mind. I was back with the pioneers of Amateur Radio, savoring their exhilaration at achieving things never done before on the ham bands.

You probably know that the DXCC Challenge is a new award that started with the 21st century. But do you know which of the older awards came first: DX Century Club, VHF-UHF Century Club, Worked All States or Worked All Continents? When did each begin? How about 5-Band DXCC and 5-Band WAS? Follow me on a quick trip through award-hunting history.

Worked All Continents

Imagine you're an ARRL member in January 1924. Your operations are confined to short wavelengths that scientific experts know to be a wasteland useless for meaningful communications work. Those experts are certain that ham radio will just dry up and blow away any day now, and good riddance. But hams have been challenging the conventional wisdom and you open your first *QST* of the new year to read: "Transatlantic Amateur Communication Accomplished!" On November 27, 1923, two American hams worked 8AB in Nice, France, on 100 meters in the first transatlantic two-way QSOs on the ham bands. The excitement jumps off the page of *QST*:

> For years we have dreamed of this; for over a year we have seen it coming . . . . It has been done, fellows; we are actually in back-and-forth contact with Europe over our amateur sets. For the first time in history we have worked a European amateur, and for the first time the amateurs of distant foreign countries have sat by their respective firesides and talked to each other with ease.[1]

Ham radio DXing exploded over the next few years. In early 1926, *QST* announced on behalf of the International Amateur Radio Union (IARU) "A New International Brass Pounder's Club" called the Worked All Continents Club, to "furnish some more adequate means of recognition for the gang of International DX hounds…Hop to it, gang," said *QST*. "Here is some *high class* wallpaper!"[2] See Figure 1.

Three months after the award was announced, eight hams—

A NEW INTERNATIONAL BRASS POUNDER'S CLUB

One of the most famous DX men in the country has proposed the formation of the W. A. C. Club—a club primarily international in its purpose and mode of operation; a club composed of brass pounding ether burners; an aggregation of key punchers collected from all parts of this old world. The Worked All Continents Club, hereafter known as the WAC Club, will serve to furnish some more adequate means of recognition for the gang of International DX hounds. The requirements for membership are few and brief. To become a member the applicant must have carried on two-way communication with at least one station in all six of the continents; Australia, Africa, Asia, Europe, South America and North America. In addition to having done the work a letter or card should be sent to A.R.R.L. headquarters from each continent showing the date of QSO. Merely send in QSL card from these countries. The cards will be returned together with the Official WAC certificate endorsed by the Grand High Wacker himself. Until the WAC members get as thick as hen's teeth, the list of members of the club will appear in the I.A.R.U. News section each month. Hop to it, gang. Here is some *high class* wallpaper! Address The WAC CLUB, care A.R.R.L. Headquarters, Hartford, Conn.

Figure 1—By 1926, only three years after the first two-way transatlantic contact, DX-oriented hams were presented with a heady challenge: The Worked All Continents Club. This announcement appeared in the April 1926 issue.

[1]Notes appear on page 52.

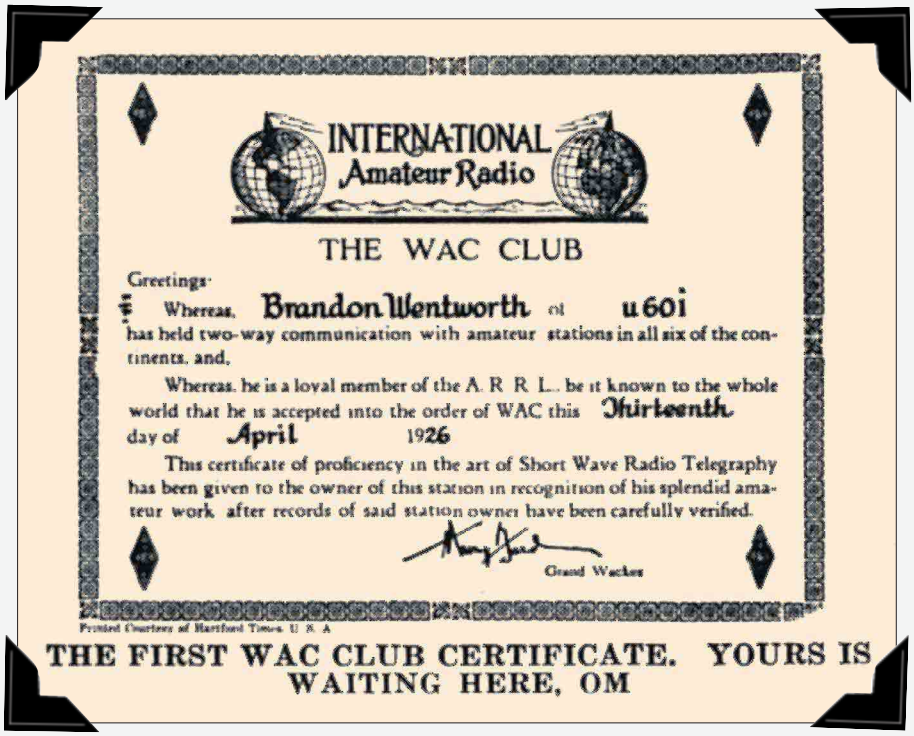


Figure 2—The June 1926 issue of *QST* showed the first WAC Club certificate, awarded to Brandon Wentworth, u6OI.

half of them from the USA—had qualified for WAC. The first was Brandon Wentworth, u6OI (see Figure 2).[3] Call signs were certainly different back then! Prefixes were a new idea—they hadn't been necessary in the days before international QSOs—and "u" was the prefix for the USA.

Think about it. Less than three years after hams worked two-way across the Atlantic for the very first time, there were enough hams on six continents with stations sufficiently advanced to allow eight amateurs to earn WAC. That's amazing technical progress in a short period of time. It must have done hearts good to send a chorus of raspberries to the experts who thought they had banished ham radio to the spectrum desert to die!

Worked All States

Ten years later—in January 1936—*QST* announced introduction of a new award for hams who could prove they had worked all 48 US states. *QST* said: "Get going, gang! Check up *to-day* on the states you have worked and those from which you have received acknowledgments. List the missing ones and aim your 'signal squirter' in their directions" (see Figure 3).[4]

In his "Operating News" column, ARRL Communications Manager F. E. Handy W1BDI, beat the drum for the new award and for the technical innovations and cooperative spirit hams would need in order to achieve it:

> Probably one or two WAC's will find they can't qualify, and will suddenly take a new interest in signals beginning with "W." Perhaps it encourages us to build crystal-switching or band-switching into the "heap." At any rate it sharpens our perceptions in tuning the band over in looking for the elusive station, and therefore makes us better equipped to tackle a particular communication job when a wire tie-up or flood emergency develops . . . . ARRL members are bonded together in an organization dedicated . . . to *the maintenance of fraternalism and a high standard of conduct.* It is entirely in keeping with that purpose that we devote regular time conversing by amateur radio with each other over this whole great country; that we cement the bond of friendship by exchanging some memento or record of our contact. Many old-timers (along with the amateurs boasting brand-new tickets) find it again a heart-warming experience to greet the mailman with outstretched hand for the hammy tokens of the amateur brotherhood that also serve as stepping stones to WAS."[5]

The original WAS rules differ very little from the WAS rules of today, though of course we have two more states to confirm and many endorsements to chase for various bands and modes.

April *QST* listed the 95 charter members of Worked All States in the order they qualified.[6]

I was surprised to find that I was acquainted with the second ham to earn WAS. William G. "Gerry" Mathis, W3BES, later W3GM (SK), was ARRL Section Communications Manager for Eastern Pennsylvania for many years. When I became EPA Section Manager in 1986, I telephoned him to introduce myself. An eminent contester and Elmer to many of today's top competitors, Gerry also earned DXCC number 121 before World War II and DXCC number 16 after the war.

By September 1937, WAS had been earned by hams from all states except Nevada, Oklahoma, Oregon, South Carolina and Utah. Some hams from outside the US and Canada had earned the award. A few operators had even done it using only phone.[7]

DX Century Club: Before the War

"With the world WACing at a terrific rate these days," wrote Clinton B. Desoto, W1CBD, in October 1935, "the number of countries worked is increasingly becoming the criterion of excellence among outstanding DX stations."[8]

In his 1935 article "How to Count Countries Worked," DeSoto (who was about 23 years old at the time) set down the principles that evolved into the DXCC List Criteria. Then as now, what constitutes a country—or entity, as we say today—for the purpose of ham radio DXing was a subject of dispute and controversy. This led to publication of a list of countries in January 1937. In September, the DX Century Club award was announced, based on the 1935 principles and the 1937 list. "For those who have suggested that W.A.C. is 'too easy,' here is something new to shoot at."[9] See Figure 4.

ARRL members got their first look at the new three-color award DXCC certificate in November 1937, along with the first DXCC membership list (see Figure 5). Just five call signs appeared, with the 112 countries of Frank Lucas, W8CRA, putting him on top. *QST* even took a little poke at DXers who may have been telling some tall tales and fish stories: "One fact is outstanding—of the scores of operators who *claim* contacts with 80, 90, 100 countries, etc, only a comparative few have proven their accomplishment!"[10] At the end of 1937, DXCC had two more members, with H. A. Maxwell Whyte, G6WY, on top with 114 confirmed.[11]

Sit down or hold onto something before you read further: The pre-war DXCC Rules actually allowed credit for QSOs without paper QSL cards in some cases! If you worked a DX station in the ARRL DX Contests, and if the DX submitted a log so that his score was published in

QST, you could send the QSO data to HQ and request DXCC credit for the contact. If your log data matched what was in the DX's contest log, you got the credit. It was kind of like a . . . hmm . . . logbook of the world.[12]

The number of amateurs who joined DXCC grew steadily over the next few years, but world conditions changed all that. As someone who was both born and licensed after World War II, I mistakenly supposed it was December 7, 1941, and the total shutdown of ham radio that ended the pre-war DXCC program. DXing, however, stopped some time before the USA's entry into the war. The FCC's Order No. 72, effective June 4, 1940, prohibited exchanging communications "with operators or radio stations of any foreign government or located in any foreign country." *QST* explained that the "primary reason for the Commission's action was to prevent American amateurs from being used unwittingly as the instrumentality of alien agents."[13] Effective June 7, hams were also prohibited from operating portable and mobile below 30 MHz, though the ARRL was able to get an exemption for Field Day 1940 (see how these historical researches will lead you off on tangents?).

The League comforted DXers in the December 1941, "How's DX?" column by saying that "cards will still be checked and certificates awarded to those who can hit one hundred or more with cards and other confirmations, sent in all at one time." Once these awards were issued, the DXCC program ended and the listings disappeared from *QST* for the duration, while hams applied their skills acquired through chasing the DX to matters having nothing at all to do with fun.

DX Century Club: After the War

In December 1945, with American hams coming back on the air but not yet able to work DX, the "Operating News" column announced plans for a new DXCC. "There will be hams at innumerable spots we just dreamed of before. The fact is, it looks like we may have an almost new amateur radio so far as DX is concerned." Consequently, "we are going to wipe the slate clean and make a fresh start. Everyone will start on an equal footing. Only contacts made after V-J Day will count."[14]

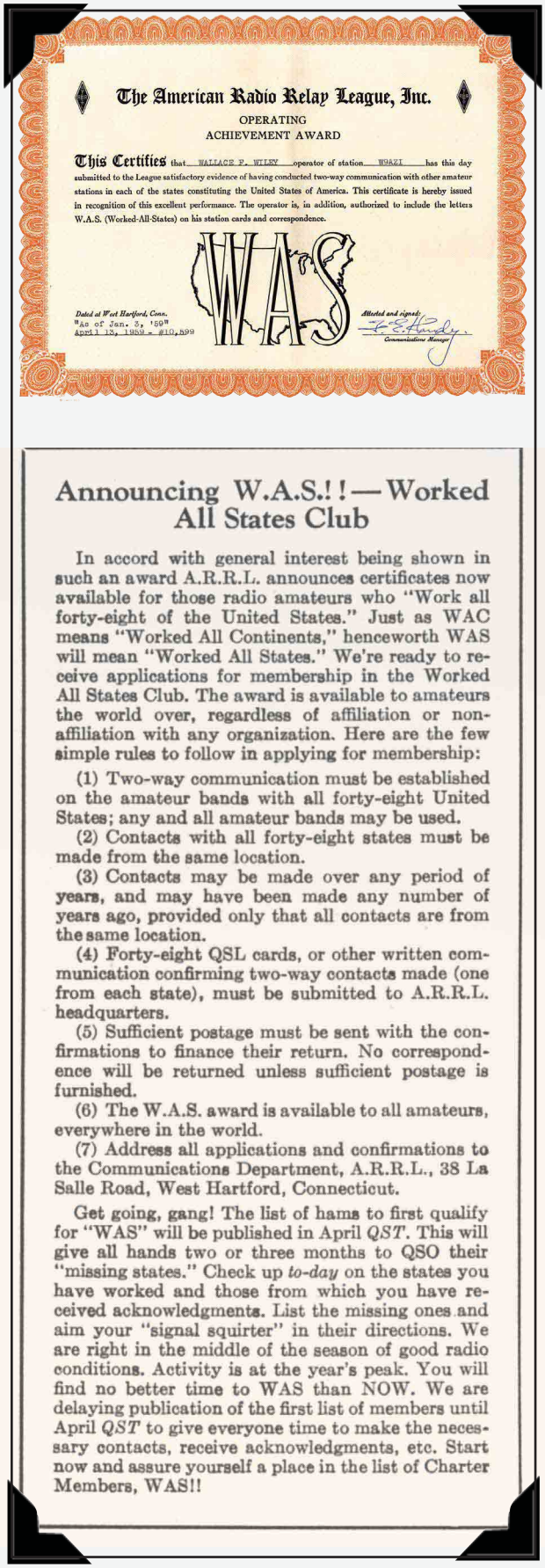
Some pre-war DXCC members complained that something was being taken away from them, but plans for the new DXCC proceeded. Grandfathering rules allowed hams who hadn't quite made DXCC before the war to complete their pre-war DXCC's with QSOs made after the war but following the old rules and using the old DXCC List.[15]

The new DXCC List appeared in February 1947, followed by the new award rules in March. The rules still permitted claiming credits based on ARRL International DX Contest logs under certain circumstances. Apart from that and the fact that you would probably have to start DXCC all over again if you moved to a different call area, the first post-war rules have a lot of philosophy in common with today's DXCC rules.[16]

The new DXCC opened for business with a new twist: certificate endorsement stickers for working more than the basic 100 countries, in increments of 10. The "Operating News" column in March 1947, indicated that pile-up control was already an issue and encouraged foreign operators to smile upon The Deserving:

> We think this DX pursuit should be a sporting proposition, operating skill and good will combined . . . . While amateurs in certain new spots have been in much demand, leading to some regrettable . . . shoving around on the part of a few, it is increasingly apparent that orderly awaiting one's turn and decent courtesy in operating will pay off. Operate to inspire the good will of the foreign DX operator. He can set the pace and he should insist on rewarding those who operate with common sense and courtesy, if he will.[17]

In July 1947, the first post-war DXCC member list of nine stations appeared in *QST*, with Charlie Mellen, W1FH, at its top. He qualified not only for the first post-war DXCC with 137 coun-



The American Radio Relay League, Inc.

OPERATING
ACHIEVEMENT AWARD

This Certifies that WALLACE F. WILEY operator of station W9AZI has this day submitted to the League satisfactory evidence of having conducted two-way communication with other amateur stations in each of the states constituting the United States of America. This certificate is hereby issued in recognition of this excellent performance. The operator is, in addition, authorized to include the letters W.A.S. (Worked-All-States) on his station cards and correspondence.

WAS

Dated at West Hartford, Conn.
"As of Jan. 3, '59"
April 15, 1959 - #10,899

Attested and signed:
K. E. Handy
Communications Manager

Announcing W.A.S.!!—Worked All States Club

In accord with general interest being shown in such an award A.R.R.L. announces certificates now available for those radio amateurs who "Work all forty-eight of the United States." Just as WAC means "Worked All Continents," henceforth WAS will mean "Worked All States." We're ready to receive applications for membership in the Worked All States Club. The award is available to amateurs the world over, regardless of affiliation or non-affiliation with any organization. Here are the few simple rules to follow in applying for membership:

(1) Two-way communication must be established on the amateur bands with all forty-eight United States; any and all amateur bands may be used.

(2) Contacts with all forty-eight states must be made from the same location.

(3) Contacts may be made over any period of years, and may have been made any number of years ago, provided only that all contacts are from the same location.

(4) Forty-eight QSL cards, or other written communication confirming two-way contacts made (one from each state), must be submitted to A.R.R.L. headquarters.

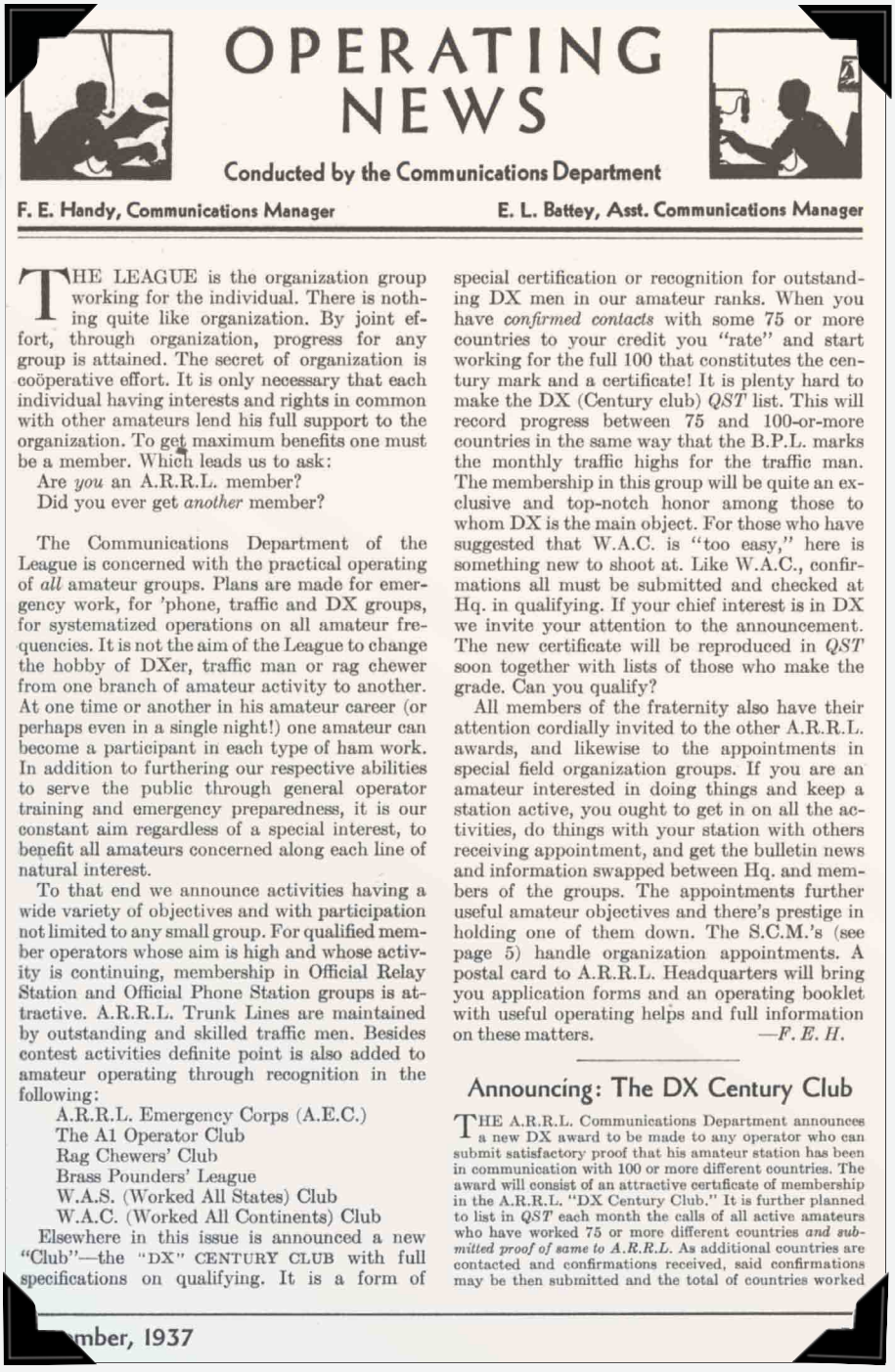
(5) Sufficient postage must be sent with the confirmations to finance their return. No correspondence will be returned unless sufficient postage is furnished.

(6) The W.A.S. award is available to all amateurs, everywhere in the world.

(7) Address all applications and confirmations to the Communications Department, A.R.R.L., 38 La Salle Road, West Hartford, Connecticut.

Get going, gang! The list of hams to first qualify for "WAS" will be published in April *QST*. This will give all hands two or three months to QSO their "missing states." Check up *to-day* on the states you have worked and those from which you have received acknowledgments. List the missing ones and aim your "signal squirter" in their directions. We are right in the middle of the season of good radio conditions. Activity is at the year's peak. You will find no better time to WAS than NOW. We are delaying publication of the first list of members until April *QST* to give everyone time to make the necessary contacts, receive acknowledgments, etc. Start now and assure yourself a place in the list of Charter Members, WAS!!

Figure 3—By 1936, it was time for another challenge: Worked All States. One of the only changes to the WAS award in all that time has been the addition of Alaska and Hawaii to the roster of states!



OPERATING NEWS

Conducted by the Communications Department

F. E. Handy, Communications Manager — E. L. Battey, Asst. Communications Manager

THE LEAGUE is the organization group working for the individual. There is nothing quite like organization. By joint effort, through organization, progress for any group is attained. The secret of organization is coöperative effort. It is only necessary that each individual having interests and rights in common with other amateurs lend his full support to the organization. To get maximum benefits one must be a member. Which leads us to ask:

Are *you* an A.R.R.L. member?

Did you ever get *another* member?

The Communications Department of the League is concerned with the practical operating of *all* amateur groups. Plans are made for emergency work, for 'phone, traffic and DX groups, for systematized operations on all amateur frequencies. It is not the aim of the League to change the hobby of DXer, traffic man or rag chewer from one branch of amateur activity to another. At one time or another in his amateur career (or perhaps even in a single night!) one amateur can become a participant in each type of ham work. In addition to furthering our respective abilities to serve the public through general operator training and emergency preparedness, it is our constant aim regardless of a special interest, to benefit all amateurs concerned along each line of natural interest.

To that end we announce activities having a wide variety of objectives and with participation not limited to any small group. For qualified member operators whose aim is high and whose activity is continuing, membership in Official Relay Station and Official Phone Station groups is attractive. A.R.R.L. Trunk Lines are maintained by outstanding and skilled traffic men. Besides contest activities definite point is also added to amateur operating through recognition in the following:

A.R.R.L. Emergency Corps (A.E.C.)
The A1 Operator Club
Rag Chewers' Club
Brass Pounders' League
W.A.S. (Worked All States) Club
W.A.C. (Worked All Continents) Club

Elsewhere in this issue is announced a new "Club"—the "DX" CENTURY CLUB with full specifications on qualifying. It is a form of special certification or recognition for outstanding DX men in our amateur ranks. When you have *confirmed contacts* with some 75 or more countries to your credit you "rate" and start working for the full 100 that constitutes the century mark and a certificate! It is plenty hard to make the DX (Century club) *QST* list. This will record progress between 75 and 100-or-more countries in the same way that the B.P.L. marks the monthly traffic highs for the traffic man. The membership in this group will be quite an exclusive and top-notch honor among those to whom DX is the main object. For those who have suggested that W.A.C. is "too easy," here is something new to shoot at. Like W.A.C., confirmations all must be submitted and checked at Hq. in qualifying. If your chief interest is in DX we invite your attention to the announcement. The new certificate will be reproduced in *QST* soon together with lists of those who make the grade. Can you qualify?

All members of the fraternity also have their attention cordially invited to the other A.R.R.L. awards, and likewise to the appointments in special field organization groups. If you are an amateur interested in doing things and keep a station active, you ought to get in on all the activities, do things with your station with others receiving appointment, and get the bulletin news and information swapped between Hq. and members of the groups. The appointments further useful amateur objectives and there's prestige in holding one of them down. The S.C.M.'s (see page 5) handle organization appointments. A postal card to A.R.R.L. Headquarters will bring you application forms and an operating booklet with useful operating helps and full information on these matters. —*F. E. H.*

Announcing: The DX Century Club

THE A.R.R.L. Communications Department announces a new DX award to be made to any operator who can submit satisfactory proof that his amateur station has been in communication with 100 or more different countries. The award will consist of an attractive certificate of membership in the A.R.R.L. "DX Century Club." It is further planned to list in *QST* each month the calls of all active amateurs who have worked 75 or more different countries *and submitted proof of same to A.R.R.L.* As additional countries are contacted and confirmations received, said confirmations may be then submitted and the total of countries worked

mber, 1937

Figure 4—The September 1937 issue of *QST* announced still another DX goal: The DX Century Club. To make the list of stations published monthly in *QST*, ARRL members needed to submit proof of contact with at least 75 different countries.

tries confirmed but also for the first all-phone post-war DXCC with 101 confirmed.[18] With the exception of one English ham, all nine DXCC members on the first list were Americans.

By October, the list had grown longer and included stations from New Zealand, South Africa, Switzerland, the Netherlands and England.[19] By November, 48 hams had earned DXCC,[20] and something new had been added: DXCC Honor Roll, composed of the "top ten DX men." The first Honor Roll included nine Americans and one New Zealander. The top of the list was still occupied by Charlie Mellen, W1FH, with 168 confirmed.

The Five-Band Awards

Time passed, skills grew, technology improved, and by the late 1960s the existing WAS and DXCC programs just weren't enough to keep the chronic award-hunters happy any more.

The *QST* "Operating News" for October 1968, said: "A brand new challenge for avid DXers comes into being officially on January 1, 1969 with the inauguration of the Five-Band DXCC award. This is a start-from-scratch achievement. You can't use any of your present DX cards. You can't use contest logs." The column went on to say, "Okay, DXers? Let's get those antennas up for 80 and 40 meters, and maybe also that ten-meter beam, so you'll be ready to dive into this grind come the first of the year. Making the contacts will be hard enough; getting the cards to confirm them will be something else!"[21] The award rules were published in that issue.[22]

In October 1969, an article by Ellen White, W1YYM, on "ARRL Awards" announced that the 5-Band Worked All States would begin January 1, 1970. To increase the challenge, 5BWAS was like 5BDXCC a "start from scratch" award. Only QSOs dated January 1, 1970, and thereafter were valid.

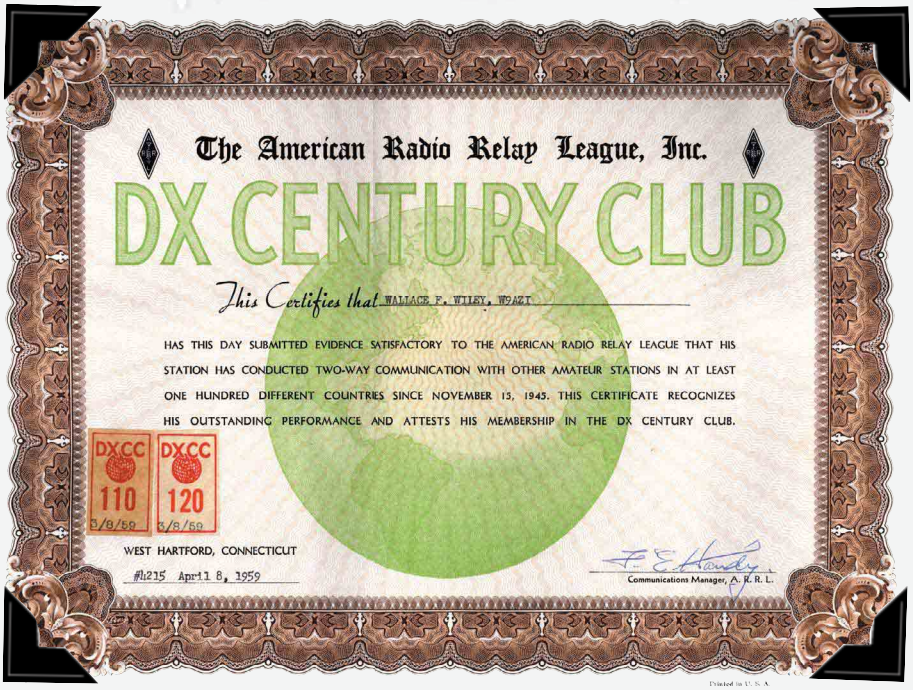
In predicting it would take a long time for someone to earn a 5-band award, the ARRL underestimated the abilities of award-hunters. The first 5-Band DXCC award was presented to Bob Eshleman, W4QCW, at the Roanoke Division Convention in mid-October 1969. Remember, Bob had to submit 500 confirmations for QSOs made on January 1, 1969 and afterward![23] Today, by the way, we can submit QSLs for 5BDXCC for contacts made on or after November 15, 1945, the same start date as the post-war DXCC.

The first 5BWAS award was issued a little over a month after the award's start date of January 1, 1970. Roger Corey, W1AX—whose accomplishment struck the ARRL HQ staff as miraculous—received 5BWAS number 1 on February 4, 1970. He had already received 5BDXCC number 7.[24]

Today, we have a long list of versions and endorsements for WAS, DXCC and the 5-band awards, but the original 5-band awards are still challenging goals for many operators—myself included.

VHF-UHF Century Club

The story of the VHF-UHF Century Club is well told by my friend Anthony R. Curtis, W3RXK, in his article "VUCC—20 Years and Counting," in the February 2003 issue of *QST*.[25] The first VUCC awards were conferred in 1983, the year the award began. When the Morse code requirement was dropped from the Technician class license in the 1990s and


The American Radio Relay League, Inc.

DX CENTURY CLUB

This Certifies that WALLACE P. WILEY, W9AZI

HAS THIS DAY SUBMITTED EVIDENCE SATISFACTORY TO THE AMERICAN RADIO RELAY LEAGUE THAT HIS STATION HAS CONDUCTED TWO-WAY COMMUNICATION WITH OTHER AMATEUR STATIONS IN AT LEAST ONE HUNDRED DIFFERENT COUNTRIES SINCE NOVEMBER 15, 1945. THIS CERTIFICATE RECOGNIZES HIS OUTSTANDING PERFORMANCE AND ATTESTS HIS MEMBERSHIP IN THE DX CENTURY CLUB.

DXCC 110 3/8/59 DXCC 120 3/8/59

WEST HARTFORD, CONNECTICUT

#1235 April 8, 1959

Communications Manager, A. R. R. L.

Figure 5—The "handsome, three-color certificate" had been issued to a grand total of five stations when the design was revealed in the November 1937 issue.

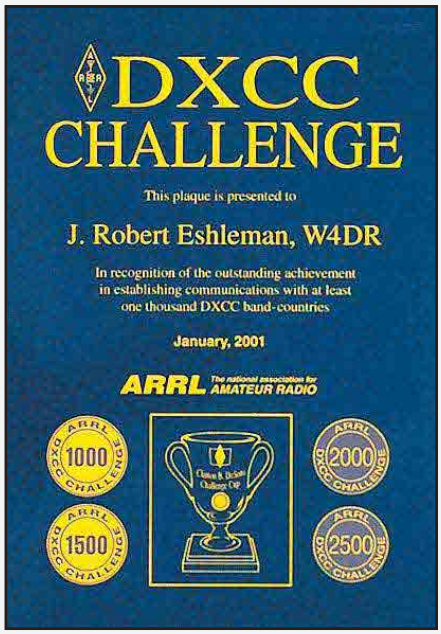


Figure 6—As 1999 became 2000, a new award made its appearance—The DXCC Challenge. The first was issued to Bob Eshleman, W4DR, who had distinguished himself back in 1969 by earning 5-Band DXCC no. 1.

Technician became the entry-class license in the US, VUCC became the DX award attainable by new hams and old-timers alike.

The DXCC Challenge

Just as award-hunters were growing antsy in the late 1960s and needed a new outlet for their energy in the form of 5BDXCC and 5BWAS, they were showing signs of need in the late 1990s, too. The ARRL Board approved creation of a new, even more challenging DX award program—the DXCC Challenge. It was introduced by Bill Kennamer, K5FUV, in "New DXCC Awards for the New Millennium," published in December 1999.[26] If you're interested in the DXCC Challenge award, be sure to check out the current requirements on the ARRL Web site (**www.arrl.org/awards/dxcc/rules.html**), because they are somewhat different from what was published originally in *QST*.

The DXer who is on top of the annual DXCC Challenge list receives a cup named for Clinton B. DeSoto, who wrote the key article back in 1935, had a brilliant career on the ARRL HQ staff, and died at the tragically young age of 37. The initial DeSoto Cup, for the year 2000, was awarded to Bob Eshleman, W4DR—wait a minute, that's a familiar name! Sure enough, it's the same person who earned the first 5BDXCC award in 1969, when his call sign was W4QCW. See Figure 6.

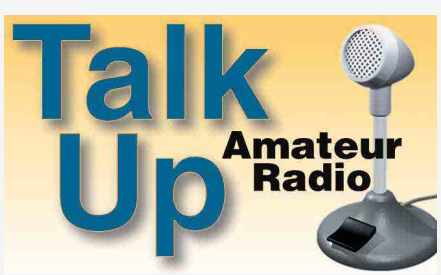
"But Wait, There's More!"

The ARRL operating awards program will continue to evolve as long as there are hams who relish achievement and seek a personal challenge. For me, knowing about the history of the awards I'm chasing increases the fun, because it helps me feel like one of the characters in a story that's been going on since the Amateur Service began.

Notes

[1] *QST*, Jan 1924, p 9. If you would like access to this page, along with every other page published in *QST* from 1915 through 1999, see the set of *QST View* CDs. They are available from your local dealer or from the ARRL Bookstore, telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.
[2] *QST*, Apr 1926, p 54.
[3] *QST*, Jun 1926, p 54.
[4] Jan 1936, p 33. Let's forgive the *QST* columnists their slangy bumptious-boy lingo! According to *200 Meters and Down*, in 1936, the average ham was a man 25 years of age, and young fellows didn't want to read stuffy geezer-speak.
[5] *QST*, Mar 1936, p 37.
[6] *QST*, Apr 1936, p 69.
[7] *QST*, Sep 1937, p 60.
[8] *QST*, Oct 1935, p 40.
[9] *QST*, Sep 1937, p 59.
[10] *QST*, Nov 1937, p 51.
[11] *QST*, Dec 1937, p 54.
[12] *QST*, Nov 1937, p 51.
[13] *QST*, Aug 1940, p 17.
[14] *QST*, Dec 1945, pp 73, 130 and 132.
[15] *QST*, Jun 1946, p 74.
[16] *QST*, Mar 1947, p 69.
[17] *QST*, Mar 1947, p 65.
[18] *QST*, Jul 1947, p 64.
[19] *QST*, Oct 1947, p 69.
[20] *QST*, Nov 1947, pp 76, 79.
[21] *QST*, Oct 1968, p 108.
[22] *QST*, Oct 1968, p 110.
[23] *QST*, Dec 1969, p 103.
[24] *QST*, Apr 1970, p 112.
[25] pp 48-51.
[26] *QST*, Dec 1999, p 47.

Kay Craigie, N3KN, is serving her third term as ARRL Second Vice President. She lives in Paoli, Pennsylvania, with her husband Carter Craigie, N3AO, and their Jack Russell Terrier, Frodo. Originally from Atlanta, Kay graduated from Georgia State College (now Georgia State University) in 1968 and then moved to Pennsylvania to earn a PhD from the University of Pennsylvania. First licensed in 1983, Kay soon became the editor of her home radio club's newsletter, a position she continues to hold. She's also a Volunteer Examiner with the club's VE team. In 1986, she became ARRL Section Manager for Eastern Pennsylvania, moving up to Atlantic Division Vice Director in 1990. Six years later, she became Atlantic Division Director, and in 2000, she was elected a Vice President of the ARRL. On the air, Kay enjoys DXing, award-hunting and contesting. She holds VUCC on 6 meters, DXCC on 6 bands, the DXCC Challenge award, WAZ and WAE Class 1 CW. She enjoys digital modes such as RTTY and PSK31, as well as CW and phone. You can reach Kay at **n3kn@arrl.org**.



By Bruce Orand, N4ZXI

ESE—A New Frontier

A long-awaited report on CDMECS and a Corona-Com (Coronal Discharge Modulation Error Correction System), which promises to make Earth-Sun-Earth communication a reality.

About 30 years ago, an article came out in an electronics magazine with a title something like "Communicate Over a Sun Beam." It was designed around the premise of vibrating a mirror connected to a voice coil of a speaker, and thereby angularly reflecting the sun's light to a photo-resistor some distance away. The photo-resistor was then connected to an op-amp, and then to an audio amplifier in order to hear the voice over the sunbeam.

Over the years, technology enabling light communication has increased impressively. Mirrors have been replaced with fiber, analog with digital and light with laser. But Amateur Radio operators still strive to employ non-wired communications. So, a group of us in the Tampa Amateur Radio Club (TARC) started working on cutting the strings and seeing what we could do in the 640-650 nm range—where your laser pointer typically resides.

Chuck, KP4DJT, had done the pioneering work for us with lasers. Chuck had determined that the visible laser was much more susceptible to atmospheric conditions than infrared. So he started working with low-power IR lasers and has achieved data communications in Central and South America of distances just over 12 miles. And all under 10 mW. We had jokingly discussed the possibility of doing a laser EME, bouncing the signal off the Lunar Rover's communication dish, or even one of the LEM bases.

Our discussions turned rather radical when we were contacted by a group of four-letter engineers from the other side of Florida who refused to give us the coordinates of the Rovers or the LEM bases. In fact, we were asked not to pursue such an experiment because of calculations they had made that showed with the power of the IR laser we would have to use, if our tracking calculations were off as much as a terrestrial micron we could, if we were lucky, just miss and create a bit of Lunar glass. However, they were afraid we would cause a high-speed come-apart on pieces deemed National Treasures. So, we turned our thoughts and sights a bit higher. We went 93 million miles high.

Power in a Beam of Light

We began our "light talk" by going back 30 years and building the sunbeam communicator of old. It was a lot of fun, but in

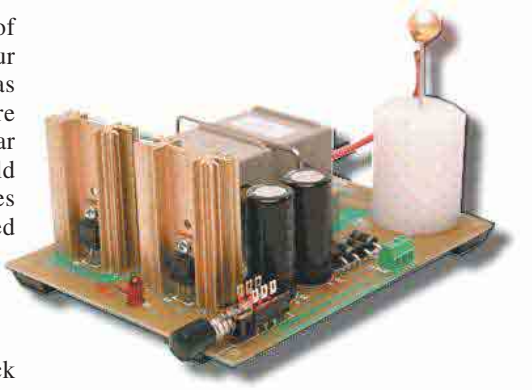


Figure 1—Our Plasma Generator started as a $139 kit.

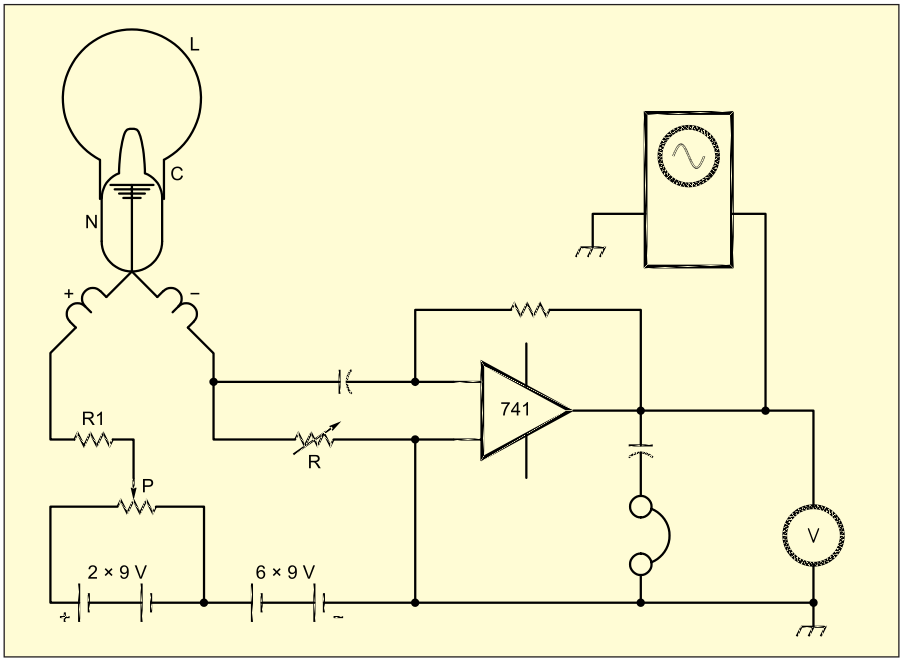


Figure 2—The Plasma Detector circuit was adapted from an existing design. As the text explains, it uses an innovative LN (loop-neon) design.

the process we found many issues. It was *very* line-of-sight. We attempted to use a third position reflector and had some success. We were asked to discontinue using this particular spot because our selected third position was one of the mirrored buildings in downtown Tampa. Apparently, those mirrors don't reflect all the light and we were using a rather large reflector array at that time. This brought our first visit from our local fire department.

Our reflectors are 1 inch mirrored triangular tiles made in Mexico using perpendicularly polarized glass on a torsion control 8 foot dish designed by a former race-car mechanic and engineer, Bart, AF4TK. The air-controlled torsion adjustment of the dish has allowed us to move the focal point from 22 inches from the dish to a 10° expansion without the need for any kind of focusing lens. And utilizing an az-el positioning system modified by Jim, AA4MD, who placed #1 in the nation during Field Day 2003 for satellite communications, we were able to aim our "sun spot" anywhere we wanted in moments.

We initially used a modified sub-woofer mounted directly beneath the dish to modulate the sunbeam. The system produced a sufficient vibratory effect on the dish, but we had a lot of problems in the "tone quality" of the signal. This was to be changed later to a Plasma Generator that we found in kit form for $139. We finally had a component we did not have to design and build! See Figure 1.

We soon had quite a few discussions with the Local FD31 captain when we accidentally ignited one of the shiny 140 foot light poles off the Interstate. We now understand why we were asked to leave the Lunar Rovers alone.

We soon found limitations in distance, as there were very few suitable points to reflect our sunbeams over to communicate to any distance. One day during our experiments, we attempted a three station communication and noticed that the boosted light being returned to us carried a second harmonic that really distorted our signal. We soon figured out that we had inadvertently adjusted the third station to be a solar regenerator and that we were modulating the regenerated light as well as passing our own signal through it. Pardon the pun, but the lights went on. We all looked at each other, had a good laugh and said, "Why not?"

Hello? Uncle Sol? Are You There?

We aimed our flex-dishes directly to the Sun and adjusted our focal length to 93 million miles. The computer tracking algorithm had to be recalibrated to focus that far, but after a couple of hours of tweaking, we were back on the air, or light. We soon discovered that our mirrors were not going to be enough, and the Sun's own coronasphere reflected our beams back. Fortunately, we maintained near-perfect alignment and suffered very little loss of equipment. It did help us to understand the difference between true silver mirrors and that stuff you get at the local home center. Anyone want to buy a 600 pound blob of warped glass and aluminum?

Figure 3—The Plasma Detector, in all its glory.

We also learned more than we originally wanted to know about the fourth state of matter, plasma. Plasma is when the gasses are heated beyond 3000°C (5000°F). By adjusting the outer 7 inches of our reflector at a closer focal point, 30 meters in fact, we had a beautiful fireball of plasma about 3 mm across. Watching a handful of guys with welding masks trying not to bump into each other as they quickly backed off was entertaining. Though there was some concern about igniting the atmosphere, we were happy to discover that we did not have enough heat generated to push it over that threshold. By the way, this thing is one heck of a bug-zapper.

We were more successful once we replaced the sound-induced system with a Plasma Generator on the transmitting dish. The plasma ball resonated in RF to nearly the exact frequency of the transmission from the other dish. It was easy to pick up using the plasma detectors we built, but rather than having them mounted at the focal point in the dish as we had before, we placed them about 10 meters away and aimed them at the plasma ball. That is about as close as we could get, even in the silver suits we got from the fire department.

Our circuit for the Plasma Detector is based on the work done by Dr Harry E. Stockman of Sercolab in Arlington, Massachusetts. Figure 2 shows the circuit we adopted. We were surprised that a neon bulb could be used for this purpose, but were very happy that it does work. The LN (loop-neon) construction was probably the most interesting. The loop is cut to 2 wavelengths of our transmitting frequency, 103.45 GHz, about 6 mm in length, and mounted on the neon bulb with epoxy, but bent outward 90°. See Figure 3.

Sunshine on My Pillow Makes Me Happy

We actually did it. Though it has taken us several months to figure out how to de-

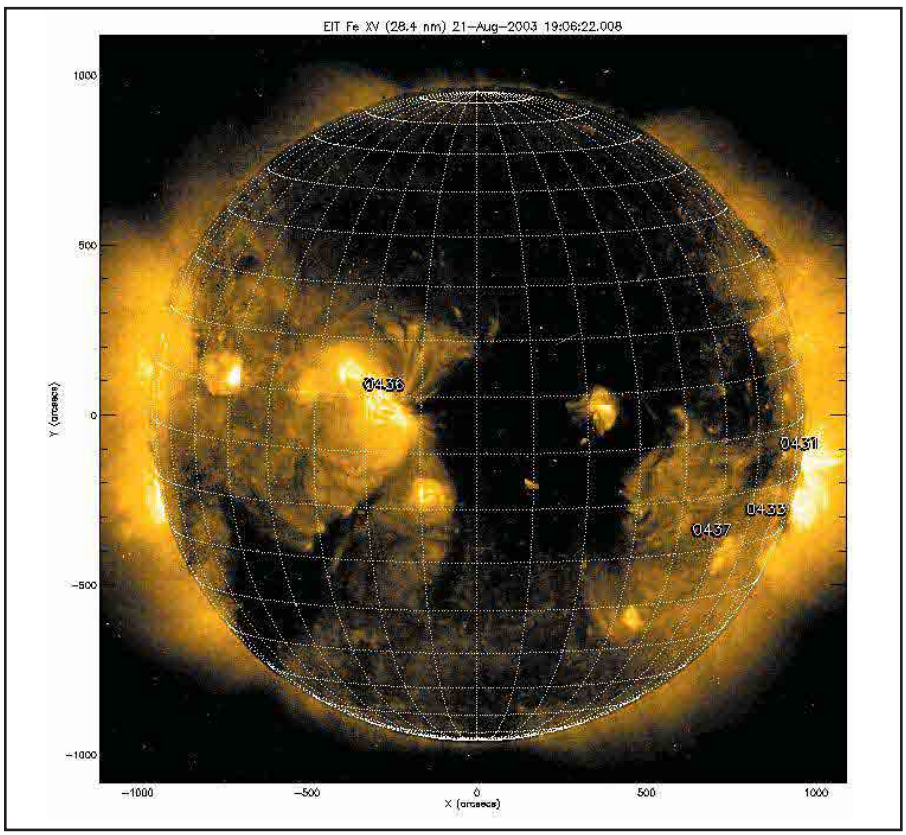


Figure 4—An impressive view of the sunspots we were working with.

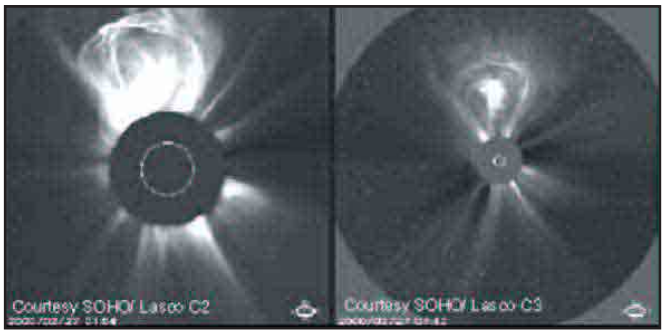


Figure 5—Coronal Mass Ejections such as these caused us some difficulties, but we were able to overcome them.

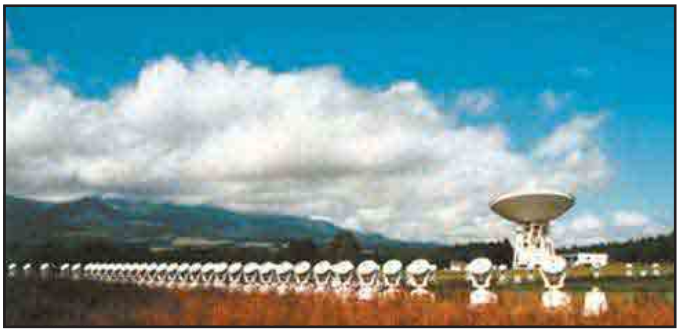


Figure 6—The world renowned Nobeyama Radio Observatory supplied some essential data for our work.

code our own signal, we have learned that the distance really needs to be taken into consideration for our aiming. Since it takes about 500 seconds for our modulated corona to be detected on the coronasphere and another 500 to come back, we have learned to lead our tracking. (Depending on the time of year, the actual time/distance to the sun is between 490.3 to 507.0 seconds.) Our first true voice transmission over this path took the ever famous lead of "Mary had a little lamb…" Though the return audio sounded more like the robot from "Lost in Space" underwater with firecrackers going off every couple of seconds, we were quite happy.

And, thus, the Corona-Com was created. We programmed our receiver, a laptop with an ESS sound system built in, to process the signal. We call our software the Coronal Discharge Modulation Error Correction System or CDMECS. There are a few bugs to get rid of yet, like the buffer overruns from trying to filter out the companded signals superimposed in the first, second and third harmonics, but our programming geek, Brian, AF4SR, assures me we will be ready long before Field Day.

We found that our communication window is when Sol is at apogee ±15º. Beyond that our tiny plasma ball begins to distort in shape and it becomes more difficult to decode its resonance. We also found that increasing our focal point for the plasma ball to a distance of 100 meters allowed us to get quite a bit closer. It does, however, at that altitude cause quite a bit of concern from the FAA and the MPs from MacDill AFB. When Sgt Donahue "suggested" that we keep our little light show out of their air space, we said, "No problem!" I doubt any of us slept that night.

We Shot an Arrow into the Air

Using the BBSO Disk Reports we have learned that focusing on the dark spots actually increases our communication delay by nearly 3 seconds and the phase distortion is rotated about –32º. We thought it was rather strange that our signal would appear to be retarded like this. Someone brought up the possibility of space, gravity and time all playing in the same ballpark that we might actually be transmitting 3 seconds into the future. But that's something beyond our ability to calculate. Our response was just *Wow*! However, this might explain why we gain 2 to 5 seconds when we focus our beams back onto the arc of a solar flare. See Figure 4.

Our First Oops

We were aiming our dishes near Sol spot #431 in mid August and could not get much of a signal for some reason. So we took our third dish and tried to parallel transmit with our transmitting dish. On August 19 we brought both transmission reflectors online, coordinated to the same tracking computer. Thanks again to Jim "Doc," AA4MD, for his expert guidance in tracking. We also observed a Coronal Mass Ejection that was absolutely huge about 20 minutes after we locked on. We are not sure if we caused the explosion or if it was just a coincidence, but everyone here noticed the discharge on the 21st, even though the cloud missed us. We have not used both dishes like that again.

Communication Problems

The first problem we have yet to overcome is the distortion of signal images from CMEs (such as those shown in Figure 5). Since the launch of the Solar and Heliospheric Observatory (SOHO) in December 1995, the Extreme-Ultraviolet Imaging Telescope (EIT) has recorded numerous instances of wavelike disturbances during the onset of CMEs observed with Large Angle and Spectrometric Coronagraph (LASCO). The "EIT waves" (as they are commonly called) move away from or near flaring active regions with a typical speed of ~200-500 km/s. Each CME lasts for approximately 13 minutes, during which time the noise floor is raised 40 to 73 dB over nominal. With a standard S/N ratio of only 60 dB, signals are often lost. However, using a simple data-recreation algorithm we have been able to recreate the missing data in 92% of the transmitted packets before the need of a packet resend request.

Next we suffer from a time-compression and expansion of frequency during Quasi-Periodic-Pulsations (QPPs). During a QPP the hard X-ray and microwave distortion nearly obliterates any transmitted signal. One of our colleagues, Dr Ramzi Uhbudai, using data gathered from the Nobeyama Radio Observatory (Figure 6), is working on the use of a Solar X-ray and γ-ray (gamma ray) dual-band loop to apply a negative phase time-altered mix into the received signal to attempt to selectively "notch" the QPP distortion. Though his work is only in the prototype phase, Dr Ramzi has had some success. The largest problem to overcome now with QPPs is calculating the time-base of the compansion before the transceiving subroutines time-out, set to a whopping 1007 seconds, and force a data-packet rerequest. Dr Ramzi feels that he will have these problems satisfactorily corrected prior to Field Day 2004.

Future Expansion

Currently we are entirely privately funded for everything we have done. The mirrored dishes are the most expensive component of the systems, followed by the pile of fire safety equipment we have been lugging around. We are looking for a sister site across the country, preferably in California, the other West Coast, where we can light up the sky in style.

So, if you are ever in Tampa Bay stop by and check out our excellent clubhouse. Talk-in every Monday on 147.105 MHz. If you would like a demonstration of CDMECS, our plasma ball or the Corona-Com system, however, you just might be a bit disappointed—this is April.

Bruce Orand, N4ZXI, can be reached at 4825 W Flamingo Rd, Tampa, FL 33611; **n4zxi@hamclub.org**.

By Paul G. Schreier, AA1MI/HB9DST

Swiss Museum Features Impressive Ham Station

Next time you're in Lucerne, drop in on HB9O, the well equipped station at a popular museum.

Whether you're traveling for business or pleasure, it's always nice to be able to do some operating from another country. While some of us pack a small radio and string up a wire near a hotel room, many of us perhaps bring a handheld transceiver at most. Many cities—including Lucerne, a picturesque city in central Switzerland—have public institutions with ham radio stations where you can drop in to operate or just make contact with local hams.

HB9O, at the Swiss Museum of Transport and Communication (**www.verkehrshaus.ch/en/home.htm**), is easy to find with public transportation. Licensed hams from abroad are permitted to operate the station as long as they are in the company of a Swiss ham authorized to open the station; for special arrangements, send an e-mail to **hb9o@uska.ch**. Switzerland is a CEPT (European Conference of Postal and Telecommunications Administrations) country, so you don't need anything except the required paperwork. For more on operating from abroad, see **www.arrl.org/FandES/field/regulations/io/**.

HB9O is run by USKA (the Union of Swiss Shortwave Amateurs) to help the general public understand and appreciate Amateur Radio. The equipment and physical setup were paid for through the generosity of hams throughout Switzerland. The station is officially open on Tuesdays, Saturdays and Sundays. There are generally two hams on hand—one to run the equipment, and another to inform visitors about the station and ham radio. If you want to see what's going on at the moment, check out the Webcam at **http://212.243.95.82/**.

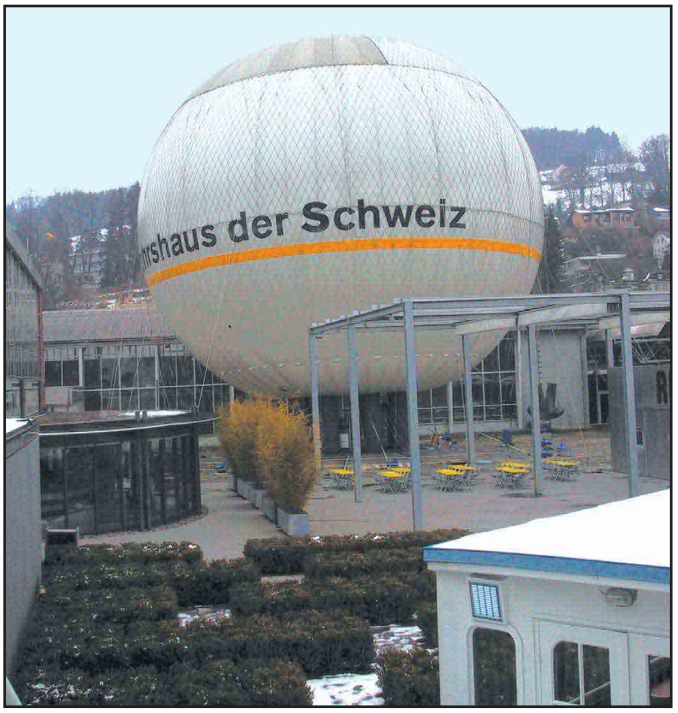
At the front of the station area is a greeting desk with PCs running interactive slide shows that explain Amateur Radio when no operators are present. There's a display case with antiques and ham paraphernalia, while the walls have posters giving general information about radio propagation and ham radio.

That very first QSO is always special, but Jules, KI4ADW/HB9DWV (right), had a particularly interesting experience: he conducted his first contact from HB9O, the permanent station at the Swiss Museum of Transport and Communication. He ended up running a number of stations from Great Britain and Wales. Jules is an 8th grader at the Zurich International School and president of the school club, HB9ZIS. The author, who serves as technical advisor for the club, is at the left.

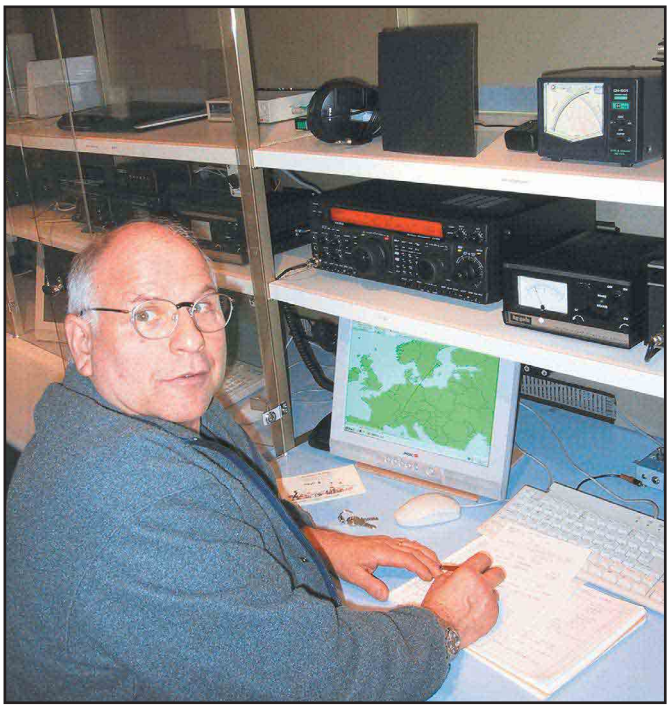
The Gear

There are four operating positions, each highlighting a different mode. In all, there are 7 transceivers and 15 antennas for bands from 3.5 MHz to 2380 MHz. These are accessible from the four positions:

1) The HF position has both a Yaesu FT-920 and a Drake TR7. Both connect to either a multiband dipole for 80/40/30 meters, or for 10 to 20 meters, a Hy-Gain TH-11DX 11-element Yagi. This rotatable beam sits atop a 10 story building in the museum complex. This position is intended primarily for SSB and CW operation. It's the ring of CW echoing throughout the hall that attracts many people to stop by, but they also enjoy listening to a phone QSO with a DX station. For logging, the position's PC—which also appears on three overhead monitors—runs



While you're visiting HB9O, the family can enjoy the rest of the museum. One major attraction is the helium balloon HiFlyer, which takes passengers as high as 150 meters, giving them a spectacular view of Lake Lucerne and the Alps.



One of the HB9O volunteers, Ernst, HB9IRI, sits at the HF position, catching up with QSLing and other paperwork between spurts of inquisitive visitors.

Swisslog, which can show a world map with the location of the other station.

2) The digital position, equipped with an ICOM IC-746, it is set up for use with the dipole and Yagi. It is intended for almost every digital mode including CW, PSK31, RTTY, MFSK16, Hellschreiber, MT63, AMTOR, PACTOR and SSTV. And to demo packet radio, a PC is connected to a modem that links to a Kenwood TM-D700E and a vertical antenna on the roof.

3) At the heart of the VHF/UHF setup is an ICOM IC-910H triband transceiver tied to a 2 meter/70 cm/23 cm vertical along with a VHF/UHF beam. In addition, a Kenwood TM-D700E is connected to a mag-mount antenna on top of a cabinet. That rig is intended for monitoring local repeaters.

4) The final position has equipment for ATV and also provides power/antenna hookups where operators can use their own equipment. The ATV station consists of an ICOM IC-3210E, which can use signals from a rooftop camera as a video source. Also located on that roof is a 13 cm omnidirectional antenna for reception of FM-ATV signals as well as a 90 cm parabolic dish for reception of satellite weather pictures.

Club Volunteers Man the Station

Recently I joined Ernst, HB9IRI, as the two man delegation from HB9D, the club for the Lake Zurich Section of USKA. Like most clubs, HB9D has committed to run the station several days each year. Museum staff does their part to encourage participation by local hams. For instance, the museum covers their transportation costs; each ham receives the cash equivalent of a second class train ticket from his hometown as well as a voucher for a hot lunch at the museum restaurant. All hams get free admission into the museum—as do up to four immediate family members.

Upon arrival, we stopped at the reception desk and filled in paperwork so they could prepare our reimbursement. Then we went to a security office to pick up the station keys and museum-staff badges. Finally we made up our way to HB9O, opened the glass cases at each operating position and got the equipment warmed up.

This particular day at the museum wasn't terribly busy, noted Ernst, but even so we had a steady stream of visitors. We spent most of our time on the HF station, as I was anxious to see how many QSOs I could make with hams back in New England. Given the 6 hour time difference, it wasn't until afternoon that I started hearing any W1 stations.

Meanwhile, especially given the great equipment, I had no trouble working many stations all over Europe and often ended up with mini-pileups. Ernst, meanwhile, was busy explaining to visitors what I was doing. In no time at all it was 1600 and time to wind down. We locked up the station, turned in the keys and badges, picked up our travel reimbursement and drove home to Zurich.

Besides sitting in front of such a nice station, it was also nice to spend the day with Ernst. Ham radio clubs make it easy for an expatriate to get to know the locals and integrate into the mainstream. Most Americans find it difficult to break into Swiss society, but as I explain to my family, hams always have instant friends. All the people I've met at various clubs in Switzerland have been extremely welcoming, and I'm grateful for their warmth.

A ham since 1968, Paul Schreier, AA1MI, is a former editor of trade magazines including EDN *and* Personal Engineering. *He now operates a technical-marketing consulting firm called Amitech Marketing GmbH from Kilchberg, near Zurich. He lives there with his wife, Marjorie, and their two daughters, Jenna and Antonia. Since moving to HB-land, he has been assigned the call HB9DST. He is active primarily on QRP CW. Paul is a member of several Swiss clubs, including HB9D (Lake Zurich section of USKA), HB9RF (Zug section of USKA) and HB9HC, the Helvetia Telegraphy Club. He's also technical director at HB9ZIS, the ham radio club at the Zurich International School. You can reach Paul at* **aa1mi@arrl.net** *or at* **www.amitechmarketing.com**.

By Dave Patton, NN1N

ARRL 90th Anniversary WAS Award and W1AW/90 Operating Event

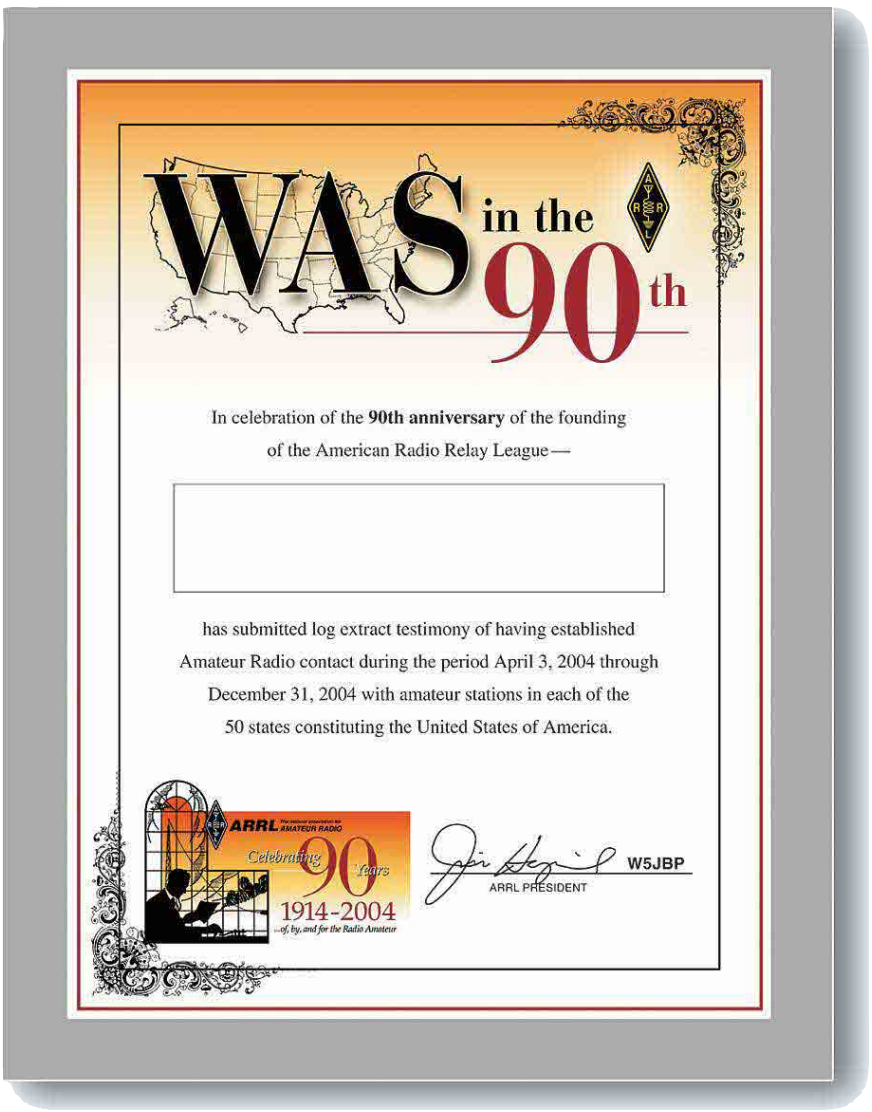
Maxim Memorial Station to sign W1AW/90 from early April to year-end.

In the Foreword to *Fifty Years of A.R.R.L.*, John Huntoon, W1RW(then W1LVQ) wrote: "In May 1914, a small band of radio amateurs led by the late Hiram Percy Maxim, W1AW, and the late Clarence Tuska, started a national organization and named it the American Radio Relay League. Since that time, the story of Amateur Radio has been the history of the League—the chronicle of amateurs working together for the public welfare and for their common good."

In commemoration of the 90th anniversary of the ARRL (the official birth date is May 18, 1914), we invite amateurs everywhere to make contact with W1AW/90 during the period of 0001Z April 3, 2004 until 2359Z December 31, 2004. W1AW/90 will be used only from the Maxim Memorial Station and ARRL Headquarters during this time. All bands and modes will be used. Special QSL cards will be available as well as the use of Logbook of The World to confirm contacts.

In addition, a special 90th Anniversary Worked All States Award will be offered. This award will be available for $10 to any station that submits a list of stations worked in each of the 50 United States during the period of 0001Z April 3, 2004 until 2359Z December 31, 2004. Forms for sending the application via postal mail or fax (860-594-0259—be sure to include credit card information) are available on-line at **www.arrl.org/awards/was/**. Also available on this Web page is an on-line form that may be filled in and submitted electronically.

Dave Patton, NN1N, is Special Assistant to the ARRL Chief Executive Officer. You can reach him at **dpatton@arrl.org**.



This special 90th Anniversary WAS certificate will be available to anyone who contacts all 50 states from April 3-December 31, 2004 UTC.

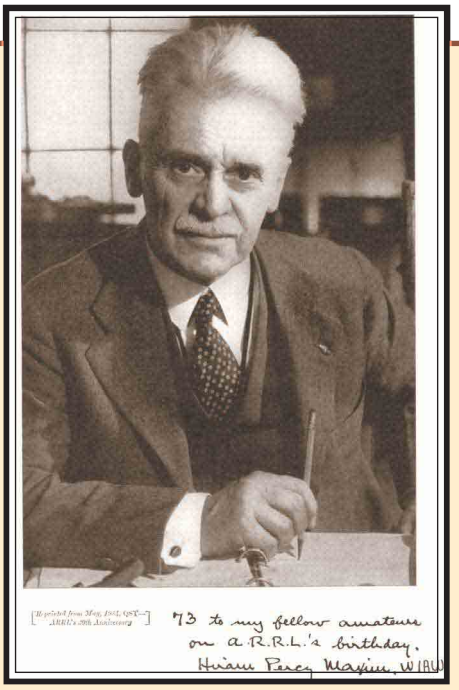
The Reason Why

By Hiram Percy Maxim, President A.R.R.L.
(Reprinted from September 1927 QST*)*

Sitting back in the old arm chair, with the last issue of *QST* read from cover to cover and with everybody else in the house asleep hours ago, I fell to thinking of amateur radio today and amateur radio of other days. As the blue smoke curls slowly upward from the old pipe, visions of early ARRL Directors' Meetings float before me. I see those old timers grappling with problems of organization, with QRM, with trunk line traffic and rival amateur leagues. I see sinister commercial and government interests at work seeking to exterminate amateur radio. They were dark days, those early ones.

Today I see Amateur Radio an institution, recognized by our American government and on the road to recognition by the other governments of the world. I see a fine, loyal ARRL membership of 20,000 standing shoulder to shoulder and believing in each other and still blazing the way in radio communications. I see a rapidly developing world-wide amateur radio brotherhood taking shape, in the form of our IARU.

And as the last embers of the old pipe turn to grey ash, I ask how it all came about; that the ARRL should have succeeded and all its opponents failed. The answer is clear. It is because with our opponents there was always some kind of a selfish motive to be served for someone, whereas in our ARRL we insisted from the beginning that no selfish motive for anybody or anything should ever prevail. Everything that ARRL undertakes must be 100% for the general good. That policy bred loyalty and confidence. With those two things an organization can prosper forever.



The photo and birthday greetings from HPM first printed in May 1934 *QST*. QST

STRAYS

PAUL REED, VE2LR/VE3BZO

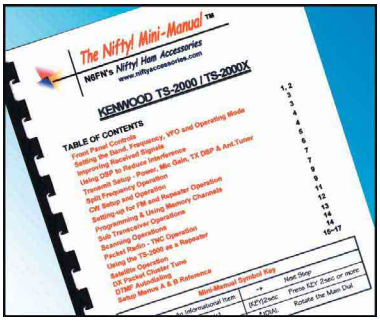
Hard to tell which is old and which is new: **Paul Reed, VE2LR, of Gatineau, Quebec, can take his choice of new gear (Yaesu FT-1000D, Kenwood TM-741A, Alpha linear, to name just some) or the collection of round-emblem Collins gear, which includes a 75S3C receiver, 32S3A transmitter, 30S1 linear, KWM2 transceiver, two 30L1 linears, 312B4 station control and (of course) two Collins speakers. His equally impressive antenna farm consists of four HF beams on two support structures, a 160-10 meter horizontal loop, 2 VHF beams, a discone and a Carolina Windom.**

NEW PRODUCTS

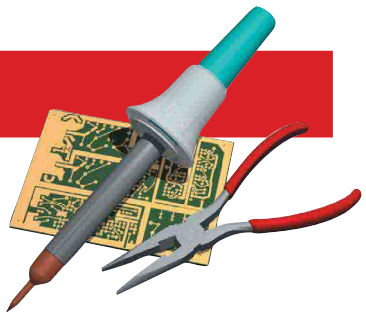
TS-2000 MINI-MANUAL FROM NIFTY HAM ACCESSORIES

◊ Nifty Ham Accessories has recently added the TS-2000 Mini-manual to its series of quick reference guides, providing complete coverage for Kenwood's '2000 and '2000X models.

All controls and menus are fully explained. Condensed step-by-step instructions simplify operation of the TS-2000's many features. Annotations and operating hints are interspersed throughout the guide.



The guide is printed in color and laminated. The 18 page, 4.5 × 8 inch Mini-manual is designed to be kept with the radio. Price: $18.85. For further information see **www.niftyaccessories.com**, or contact Nifty Ham Accessories, 1601 Donalor Dr, Escondido, CA 92027; tel 760-781-5522.



The Doctor is IN

QKØJDW asks: Would there be an advantage in placing a 1/4 wave vertical HF antenna in shallow lake water (with or without ground radials) as opposed to dry land with ground radials?

A The Doctor advises you to see Chapter 3 of *The ARRL Antenna Book*,[1] which discusses this topic in detail.

The RF waves behave like sunlight striking a reflecting plane, as on a lake surface. The angle at which the reflected wave is 90° out of phase with respect to the direct wave is known as the pseudo-Brewster angle (PBA). The vertically reflected wave subtracts from the direct wave at angles below the PBA and adds to it above the PBA, and the in-phase addition is what is desirable, because it enhances the signal strength. The PBA tends to increase with frequency, assuming other conditions remain equal. Thus, where low radiation angles are valuable for DX work (the higher frequencies), the PBAs are, unfortunately, the highest. Also poorer earth conductivities yield higher PBAs, as you would expect.

Above 7 MHz, fresh water is a better reflecting surface than very good soil, while it is slightly worse below 7 MHz. Typically, you will get good results down to a PBA of 6.4° with fresh water, while the PBA varies between 30° and 9° with soil at 14 MHz. Thus, for most hams (those that don't have access to salt water), fresh water is better than soil (above 7 MHz). Figure 1 shows PBAs at various frequencies for different soil qualities. The bottom line is—for frequencies above 7 MHz, the vertical antenna is better off above fresh water than most soils.

Radials are still needed, however, even over fresh water. While you can get away with only two radials if you're fortunate enough to have your vertical located over *salt water*, which has very high conductivity, you need (arguably) at least four (and preferably eight or more) radials over fresh water. A vertical over regular soil requires a minimum of eight and preferably 16 or more, radials for decent efficiency. AM broadcast stations often use 120 or more radials for their high-efficiency vertical systems.

[1]Available from your local dealer or the ARRL Bookstore. ARRL order no. 9043. Tel 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

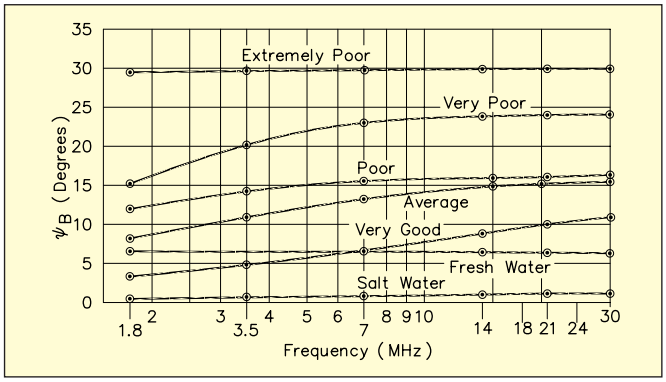


Figure 1—The pseudo-Brewster angle (PBA) versus frequency for various soil qualities.

QJim, AC7PO, writes: I have two problems I need assistance with, one relating to an RFI problem and the other about commenting on a proposed power line. The first is with regard to a battery charger in my motor home. When hooked up to the 120 V ac line and charging the batteries, there is interference from the charger. It is a sharp buzzing noise that interferes with the AM broadcast radio and my HF band radio. It also causes interference with AM radios in the house while hooked up to the house wiring and in the car radios when I drive past the motor home. The charger is a Heart 2000. Is it my responsibility to resolve the problem or is it the manufacturer's responsibility?

The second question has to do with a proposed power line. North Western Energy is proposing a new 161 kV high voltage line that will run about 200 feet from my house and about 80 to 100 feet from the end of one of my antennas.

I need some advice as to how to comment on this proposal. The only avenue open to me is to comment on an environmental impact basis under Montana law. The property owners on the right of way have the ability to refuse the right of way but I cannot count on this.

A Let's tackle your charger question first. According to the FCC Rules, it is the responsibility of the "operator" or user to correct "harmful interference" caused by a Part 15 device. In your case, the battery charger is considered a Part 15 device, so you would be responsible for correction, as you are the operator or user. In practice, many manufacturers do assume some of that responsibility as a service to their customers. That responsibility also speaks to the manufacturer's integrity and credibility, so it wouldn't hurt to check with the equipment maker. Many modern high current tri-state (so-called *bulk*, *absorption* and *float* mode) battery chargers use digital circuitry to pulse the battery under charge and some are prone to cause RFI. I'd suggest contacting the manufacturer first. He may have an RFI filtering technique already designed for the charger. You might also try using a "brute force" toroidal filter at the ac input and at both output lines. They are easy to make and they have been shown to be effective.[2]

Regarding the second question: As a rule, most high voltage transmission lines do not cause RFI. Utilities are usually careful about avoiding arcing in high-tension lines, as arcing equates to losses and losses mean money. They use special anti-corona insulators and supports just to avoid the problem. Usually, it's the low voltage distribution lines that are the culprits as they, generally, are older, and they tend to receive less maintenance attention. There is one caveat, however, that might be of interest to you.

In a case in California, the FCC ruled that an antenna located in close proximity to high-tension lines could receive interference as a result of "corona discharge." The FCC further said that corona was a normal and expected phenomenon with regard to high voltage lines and the Commission failed to take action in that case.

[2]J. Hallas, W1ZR, "Emergency Power at W1ZR," *QST*, Dec 2003. See note 6, p 44.

Note that corona discharge is rarely a source of RFI and the reality is that it may not be a problem, but if it is—the FCC may decline to intervene. Especially in the case of a newly constructed high voltage line, using modern corona suppression devices, the power company will usually be receptive to resolving problems, if there should be any. The bottom line is that a modern, well-constructed, high voltage transmission system, designed to minimize losses, may not pose a threat to amateur operations at all. Good luck!

Q Here's a question from Paul, W5PDA: Recently, I tried to charge a deep-cycle marine battery as my primary power supply had failed. The battery had been sitting for about five months without being charged. When I last charged it, all went well. But when I tried to charge it this time, my battery charger's "reverse polarity" light came on. I've charged many batteries with this charger, but never encountered this problem, as I'm careful about observing polarity. Do you have any ideas?

A The first thing I would try is a dc voltmeter on both the charger and the battery to make sure that the polarities are what you think they are. A reverse hookup should be readily apparent when you check for polarity on both the battery and charger. Assuming there are no discrepancies between your attempted hookup and what the meter tells you, the charger may be improperly recognizing something like a shorted cell or a very low terminal voltage as a reversed polarity condition. Alternately, the battery may just be very depleted and drawing a larger than expected charge current, which the charger isn't able to furnish.

You said the battery had been last charged 5 months ago. Lead-acid batteries don't do well when left for extended periods without a "float" charge and your 5 month interval definitely qualifies as an "extended period." That's a long time for a lead-acid storage battery to be idle, especially at warmer room temperatures. A warmer temperature will tend to accelerate the formation of lead sulphate crystals in the electrolyte and on the plates, and that can permanently damage the battery. I would bet that your battery terminal voltage has now dropped below 12 V, or even lower. Generally speaking, lead-acid storage batteries don't like their terminal voltage to drop below 10 V (about 1.7 V/cell) or irreversible battery damage can occur.

A float charger should be placed across the battery (a dc power supply that can be accurately adjusted to 2.23-2.25 V dc/cell or 13.4-13.5 V dc, in the case of a 12 V battery) and left on the battery while it is in long-term storage. A station dc power supply will provide a suitable float charge if the output voltage can be measured accurately with a digital voltmeter and set to 13.4-13.5 V dc. Don't rely on a power supply without measuring and setting the voltage first. Some station dc power supplies put out in excess of 13.8 V dc—this is too much voltage to use as a float charger for an extended period. The float voltage should be below the voltage that causes significant battery gassing, and most battery manufacturers recommend 2.20 to 2.25 V per cell. Incidentally, excessive float voltage may account for some premature standby battery failures at repeater locations.

Make sure the float-charged battery is in a well-vented area. Charging all lead-acid batteries (even float charging) produces hydrogen and oxygen, which vents (except for special sealed *AGM [absorbed glass mat]* or *VRLA [valve-regulated lead-acid]* batteries) and the combination can be highly explosive. Modern battery types are clearly the best way to go. These produce almost no external gassing and recombine most of the hydrogen with oxygen within the battery. Figure 2 shows a new design AGM lead-acid battery.

I would try your charger on another known good battery and see how it reacts. Also, accurately measure the open-circuit terminal voltage of the battery. If the terminal voltage is low (less than 12.5 V), try charging the battery at an elevated voltage (about 14.8 V dc) and monitor the voltage and charge current carefully. If the charge current doesn't drop after 2 hours (deep cycle marine batteries may need even more time) of charging at that elevated voltage, the battery may be beyond saving. The battery will be venting hydrogen and oxygen during this time, so be sure to provide adequate ventilation. If the charge current has dropped, lower the charge voltage to about 14.2 V dc. Continue to charge, while monitoring the charge current (the charge current should level to below 1 A) or until the terminal voltage of the battery reaches about 13.2 V dc open-circuit with the charger disconnected. Keep the terminal voltage in float at 13.4-13.5 V dc when the battery is idle for an extended period of time (longer than 3 weeks).


OPTIMA BATTERIES

Figure 2—A modern design AGM lead-acid battery. Battery technology has come a long way!

As I mentioned earlier, it's possible that your charger cannot supply the initial current that the battery is demanding because of the battery's discharged state—the charger may be clamped at its maximum voltage with the battery still demanding more current. As such, the charger could be shutting down—falsely indicating a "reverse polarity" condition. Modern 3-state chargers provide an initial "bulk" voltage to bring a discharged battery back to about 75% capacity, a so-called "absorption" voltage to bring the battery to full charge and final nance or "float" voltage to maintain the battery at its designed terminal voltage. These modern chargers automatically set the charge levels by monitoring battery terminal voltage and charge current. Some older "trickle" type chargers can damage a battery, as their float voltage levels are either too high or, if they shut down completely, there's no float voltage at all. Few, if any, maintain a proper float voltage. A modern 3-state charger is shown in Figure 3.

Figure 3—A newer tri-state lead-acid battery charger. These are completely automatic and will maintain the battery in a safe, "float" charge condition.

By the way, an old trick for "reviving" a badly sulphated lead-acid battery is to hit the battery with a rubber mallet several times. This will sometimes dislodge and break up the lead sulphate crystals. It's only a temporary fix, however, as unless the electrolyte is thoroughly replaced, the lead sulphate will remain in solution. Even electrolyte replacement is a marginal fix for a badly sulphated battery. So don't rely on this. Make sure that battery is properly maintained to begin with and you won't have to worry about sulphation and battery damage.

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/. QST

Antenna and Tower Safety

Many amateurs enjoy building and installing their antennas and consider this one of the most enjoyable aspects of their hobby. Since antennas are generally found outdoors, they are affected by such potentially hazardous weather as wind, ice and lightning. Learning about the potential hazards of towers and antennas and how to do antenna work safely will pay dividends.

Any heavy, large and permanent structure that fails or collapses can potentially hurt or even kill somebody. The complete installation *must* comply with all applicable structural and building codes. Professional engineers design towers to withstand code loadings—that is, dead weight, wind and ice loadings that are applicable to the environment at your particular location. The latest revision of the EIA-222 standard is the document from which professional engineers work to ensure that their tower designs are structurally safe.

To ensure structural safety and integrity, you must demonstrate that your tower has been designed by a qualified engineer to withstand EIA-222 loadings at your specific geographic area. Remember: A properly designed, installed and maintained tower should be as safe as a building or a bridge!

For a full understanding of the specific hardware you will be working with, consult the manufacturer or supplier. You should discuss your antenna plans with a qualified engineer. The ARRL Volunteer Consulting Engineer program can steer you to a knowledgeable engineer (**www.arrl.org/FandES/field/regulations/local/vcei.html**).

In addition, your town or city will probably require that you obtain a building permit to erect a tower or antenna. This is their way to help ensure that the installation follows good practices and that the installation is safe. Wise amateurs realize that an independent review of drawings and site inspections are beneficial and can result in fewer problems in the future.

Towers must have a properly engineered support, both for the tower sections themselves as well as guy wire attachments. Sometimes towers are braced to buildings for added support. The Antenna Supports chapter of *The ARRL Antenna Book* covers this subject in greater detail. Towers are available commercially in both guyed and self-supporting styles, and constructed of both steel and aluminum materials. Masts may be wood or metal.

Trees are sometimes pressed into service for holding one end of a wire antenna. When using slingshots or arrows to string up the antenna, be sure no one is in range before you launch.

N6BV

A single tower (this one's at N6RO) can support quite a number of antennas, but care and caution need to be taken when raising the support structure and antennas.

Tower Tips

- Towers have design load limitations. Make very sure the tower you consider has the capacity to safely handle the antenna(s) you intend to install in the kind of environment that is applicable to your location.
- The antenna must be located in such a position that *it cannot possibly tangle with power lines, both during normal operation or if the structure should fall.*
- Sufficient yard space must be available to position a guyed tower properly. A rule of thumb is that the guy anchors should be between 60% and 80% of the tower height in distance from the base of the tower.
- Provisions must be made to keep children from climbing the support.
- Soil conditions at the tower site should be investigated. The footings need to be designed around actual soil conditions, particularly on a rocky site.
- Beware of used towers. Have them professionally inspected and contact the manufacturer for installation criteria.
- Check with your local building officials.
- Liability may be increased with a tower installation. Check with your insurer to ensure your coverage is adequate.
- Make sure you have all the tools needed before starting. Some specialized tools (such as a gin pole) may be required.
- The assembly crew as well as those climbing the tower during erection must wear hard hats and use appropriate personal protective equipment including gloves, boots, climbing belt or harness. Don't forget that lifelines are needed when the belt is unattached from the tower while moving.
- Assign someone in the erection crew to monitor the use of safety equipment.
- Avoid metal ladders if there are any utility lines in the vicinity. Assume that any line is energized—including cable television and telephone lines.

Power Lines

Hundreds of people have been killed or seriously injured when attempting to install or dismantle antennas. In virtually all cases, the victim was aware of the hazards, including electrocution, but did not take the necessary steps to eliminate the risks. Never install antennas, towers and masts near power lines. How far away is considered safe? Towers and masts should be installed twice the height of the installation away from power lines. Every electrical wire must be considered dangerous.

If, for some reason, your tower starts to fall, get away from it immediately. If it touches energized lines it may be a lethal hazard if you are in contact with the antenna. If a coworker becomes energized, do not touch the person. Instead, use an insulated wooden pole to knock the energized conductor away from them. Don't become a victim yourself! If the person is not breathing, immediately start CPR and call for emergency assistance.—*excerpted from Chapter 9 of the* 2004 ARRL Handbook QST

Arrow Antenna CB 148/450 Corner Beam

What's the benefit of a dual-band corner-reflector beam antenna? Why not simply stack a pair of standard 144 and 450 MHz Yagi antennas?

In a word: *space.* A corner reflector jackknifes the traditional long-boom Yagi design and "squeezes" approximately the same gain and front-to-back into less than half the length. For hams with limited real estate (like me), this is highly attractive. In the case of the CB 148/450, Arrow Antennas has taken the concept a bit further, creating a dual-band design that offers substantial gain on both 2 meters and 70 cm. The CB 148/450 accomplishes this while occupying an area of about 5 × 4 feet, either horizontally or vertically (depending on how you mount the antenna to the mast). As you can guess, the turning radius is quite small.

The CB 148/450 is essentially two corner reflector beams nested within each other. The reflectors are arranged along two 48 inch booms. The center boom supports the driven elements for each band with an N connector for 70 cm and an SO-239 connector for 2 meters, along with corresponding gamma matches.

A side view of the CB 148/450.

Assembling the CB 148/450

The 2 meter elements are stored *inside* the square booms for shipment. The 70 cm elements are packaged separately. The instruction sheets warn that assembling the elements can be tricky. They aren't kidding.

In the middle of each element there is a tiny threaded hole. You have to slide the element into the boom, and then position the element hole so that it lines up with a corresponding hole in the boom. The problem is that you cannot eyeball the alignment; you must determine the position of the element hole by dead reckoning or touch. The instructions recommend using a stiff wire to probe the boom hole for correct alignment of the element (I used a paperclip). Once you're on target, you insert a slender screw and tighten.

The process is extremely tedious and requires steady hands. I was never able to get the holes aligned on the first try. The element would slip out of position when I attempted to thread the screw and I'd have to try again…and again. Overall, it took about two hours to assemble all the elements.

Assembling the remaining parts of the antenna was a breeze by comparison. The instructions recommend that you enlist a helper when the time comes to join the reflector booms and the center boom, but I managed to accomplish this juggling act on my own. Once everything was securely bolted together, I clamped the CB 148/450 to a temporary mast and tripod. Total time: 2 hours and 30 minutes.

On the Air

The specifications state the CB 148/450 2:1 SWR bandwidths as 143 to 149 MHz and 440 to 450 MHz. By adjusting the gamma matches, I was able to achieve a 1.2:1 SWR at 144.200 MHz and a 1.1:1 SWR at 432 MHz.

The performance was remarkable. On 2 meters I hooked up with a station that was nearly 100 miles distant. We switched to 70 cm and continued without difficulty. Considering the low elevation of my test installation, I was impressed.

I used distant repeaters as beacons for some of my tests, rotating the CB 148/450 and listening to the results. The antenna appeared to have a sharp pattern and the front-to-back ratio seemed considerable.

Great for the Space-Challenged

The CB 148/450 proved itself to be a good antenna, especially considering its relatively compact profile. This corner beam would probably fit in a large attic and would certainly find a place in a modest outdoor installation.

The CB 148/450 might be mistaken for a TV antenna, which is a good thing when you're looking for something with a bit of "stealth." Set up the CB 148/450 on your roof with a small rotator and your neighbors will never know what you're really up to.

Manufacturer: Arrow Antenna, 911 East Fox Farm Rd, #2, Cheyenne, WY 82007; tel 307-638-2369; **www.arrowantennas.com**. *$165 (plus $8 shipping and handling).*

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

Wonder Pole Telescoping Poles

By Clarke Greene, K1JX
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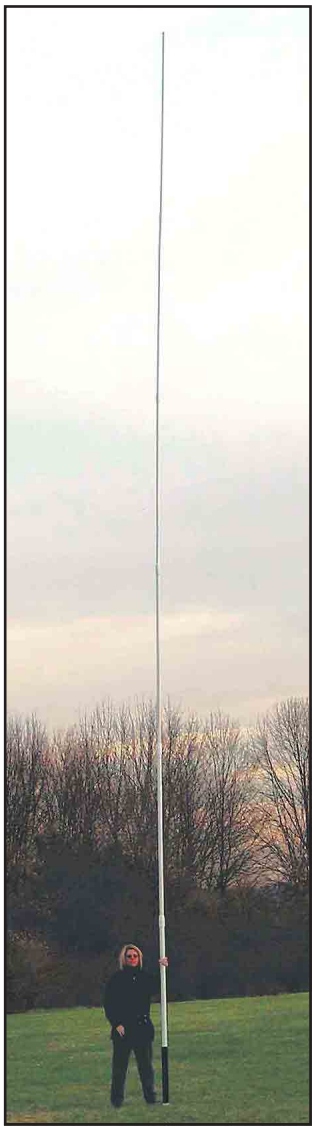
Four people are standing in a parking lot near the town square. One is an avid football fan, as evidenced by the program he's holding for this Saturday's big game for his alma mater. Another is a model airplane flyer, as shown by the new propeller she has sticking out of her backpack. The third is the Mayor of the town, as everyone in the town plainly knows. The last is a ham, with a copy of this issue of *QST* in his hand. After several minutes of animated conversation, three of them look at each other and say, "Hey, that's just what I've been looking for!" The fourth walked away.

What did they discover, and why did one person walk away?

Give up?

The football fan learned that he could buy a telescoping fiberglass pole he could use to hold the school banner at the tailgate party before the football game. The model airplane pilot needed a support for the windsock she uses at her model airport to show the wind direction. The ham had been looking for an antenna support for a "special project" he is working on.

The Mayor walked away, because he thought the group was conducting a poll. He hates being wrong in public.



The author's wife, WB1AVA, posing with the 40 foot Wonder Pole.

The Wonder Pole is the item that excited the football fan, the flyer and the ham. Available in various sizes, the Wonder Pole is a telescoping pole made from sections of six-ply fiberglass tubing. The fiberglass is impregnated with a UV inhibitor, and covered with a special material that keeps the fibers from flying all over the place and embedding into your fingers. The standard poles are white, but other colors are available.

The tubing sections are held together by "Sure Lock" grips. Grips are firmly attached to the larger diameter section where two sections mate. In order to loosen the lock on the smaller section of tubing, you only need to twist the grip. Tightening requires twisting the same piece in the opposite direction. This means that you can stand a retracted pole up where you plan the base to be and extend the entire mast by yourself. One hand pushes up the top section, while the other holds the pole. When the section being extended hits the stop lock, you just tighten the grip holding that section in place. Then, you go onto the next section, and continue until the mast is fully extended. The whole process takes about a minute.

The tubing sections are held together by "Sure Lock" grips.

Up to the Test

My friend John Lindholm, W1XX, and I tried two different Wonder Pole models. The bottom section for each is 2 inches outside diameter. Each subsequent section going up the pole is 1/4 inch smaller in diameter (1/8 inch wall thickness) with each tubing section nested inside the next lower section. Each of these poles has sixsections, so the top section is 3/4 inch outside diameter. The difference between the two poles is that one has 4 foot sections, while the other has 7 foot sections. This gives a retracted length of 57 inches and an extended length of 21 feet for the shorter pole. The longer pole is about 8 feet retracted and extends to 40 feet, maximum. The weight for each pole is 8.5 and 18 pounds, respectively. Other sizes are available as well, but these two had the largest diameter base section for holding the biggest wind load.

So, how might you use one of these gadgets? We took the 21 footer to Mohawk Mountain for the September 2003 ARRL VHF Contest. The pole easily held a 6 meter Moxon loop antenna at the very top and a 7 element 2 meter Yagi just above the Sure Lock grip for the top section. Using a contraption made from plastic parts from the hardware store and a RadioShack guy ring, we guyed the antenna just below the 2 meter beam. The pole hardly flexed with gusts up to around 30 MPH. The guy ring allowed for rotation of the whole system, and did help the pole hold the load in the wind. We found these Wonder Poles to be strong, yet lightweight—perfect for many ham applications.

Manufacturer: American Flag & Banner Co, 5220 Lardon Rd NE, Salem, OR 97305; tel 800-707-3524; **www.wonderpole.com/**. *Manufacturer's direct price for the 21 foot Wonder Pole: $129. Manufacturer's direct price for the 40 foot Wonder Pole: $250.*

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

By Allen Baker, KG4JJH

A 6 Meter Moxon Antenna

Discover 6 meters for the first time or enhance your existing operation with a rugged but portable version of this novel 2 element antenna.

I was amazed by the response to my Black Widow antenna in the May 2003 *QST*.[1] I subsequently helped quite a few builders locate the hard-to-find fishing pole spreaders and I also addressed several details about its construction. Many had never heard of this antenna configuration and enjoyed building it. While the wire version of the Moxon rectangle is a proven performer, a tubular version provides broader bandwidth and slightly more gain. The two antennas presented here are based on an article by L.B. Cebik, W4RNL.[2] The first is horizontally polarized for CW and SSB use at the low end of the 6 meter band (50-51 MHz) and the second is vertically polarized for FM use at the upper portion (52-54 MHz). For ease of reference, I refer to the first as H-POL and the second as V-POL. All materials have been chosen to withstand the elements and are available locally or via the Internet for under $100.

The Moxon Rectangle

I used the program *MoxGen*[3] to generate models at 50.5 and 53.0 MHz, using $^5/_8$ inch OD aluminum tubing. I then fine-tuned them with *EZNEC*[4] to allow for the different tubing sizes. The 6 meter Moxon is built from $^5/_8$ inch OD and $^1/_2$ inch OD aluminum tubing with $^3/_8$ inch OD solid aluminum for the corners. The detailed construction drawings, sheets and *EZNEC* models for both versions are available at **www.arrl.org/files/qst-binaries/6 meter moxon.zip**. A basic outline drawing of the antenna is shown in Figure 1, while the full material list is available on the Web site. I built the antenna to the dimensions in the *EZNEC* model listed on Sheet 1.

[1]Notes appear on page 69.

Construction

Drawing Sheet 1 presents an overview of the antenna assembly. Each component of the antenna is identified by a letter designation (A_0, A_1, A_2, etc). After choosing which version you want to build, follow the Material Cutting Schedule

Figure 2—A bottom view of the completed antenna clearly shows the fiberglass insulators separating the driven element from the reflector.

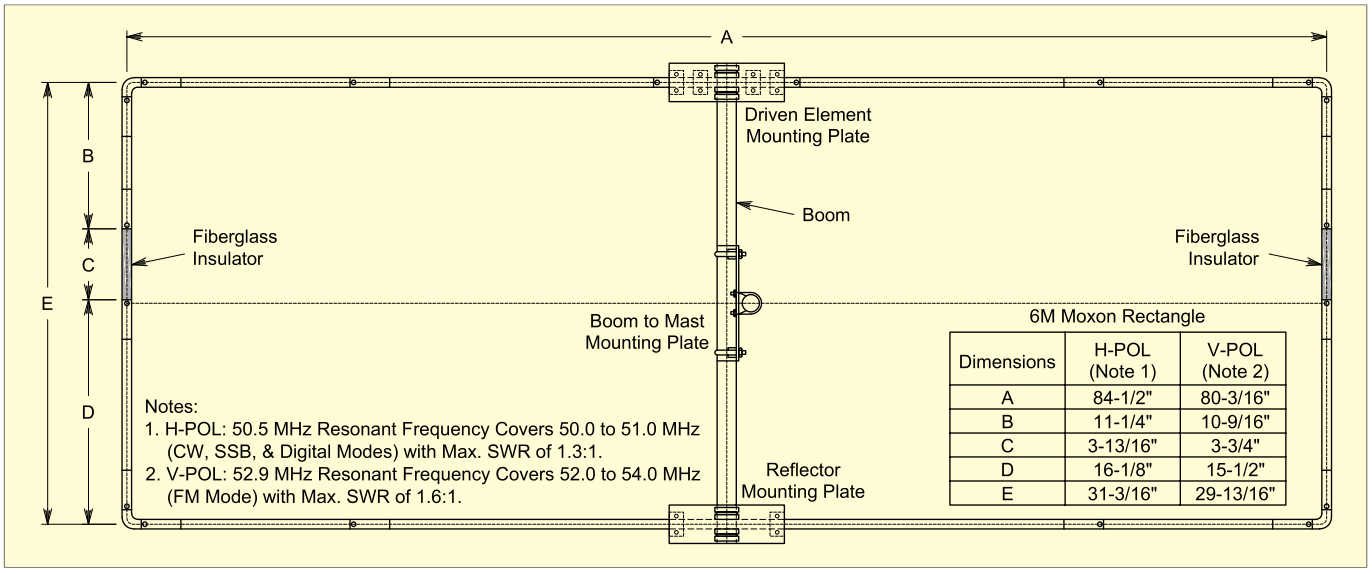


Figure 1—The 6 meter antenna design is based on a Moxon rectangle. Its basic dimensions are shown. Definitive construction details can be found on the ARRL Web site (www.arrl.org/files/qst-binaries/6 meter moxon.zip).

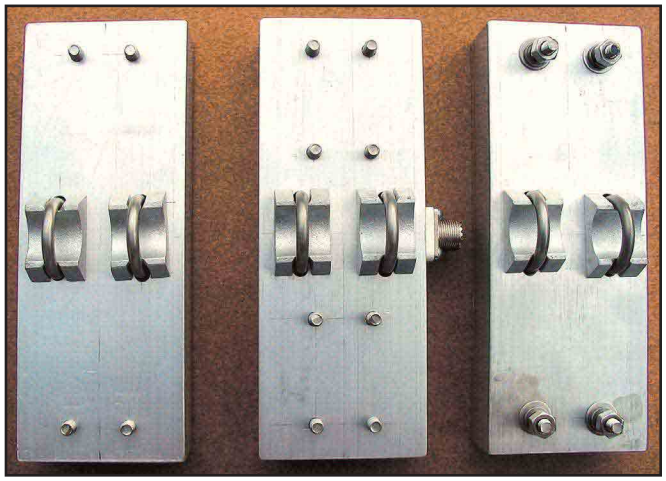


Figure 3—A top view of the antenna mounting plates.

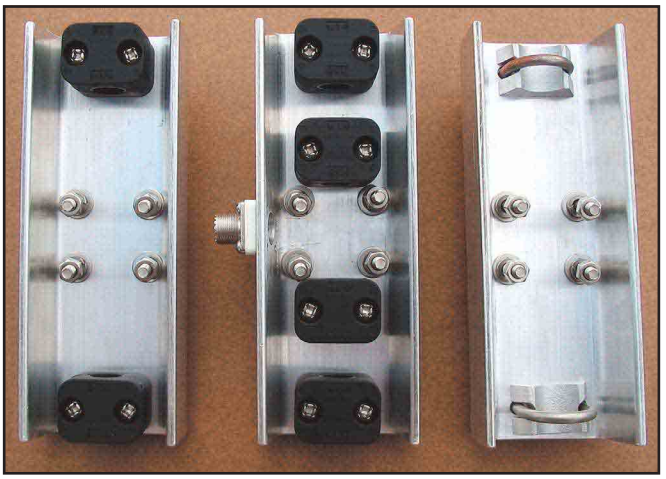


Figure 4—A bottom view of the mounting plates. Note the insulated element support blocks that are discussed in the text.

Figure 5—One of the insulators that separates the reflector from the driven element.

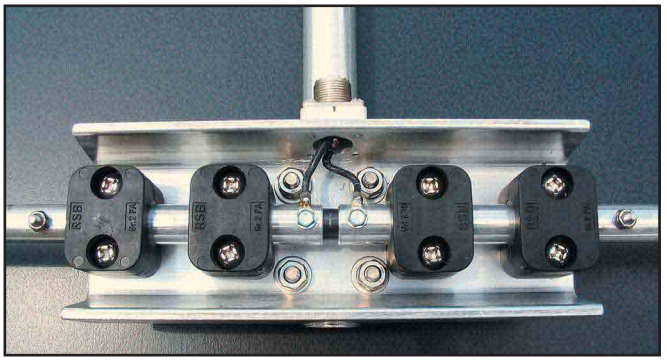


Figure 6—The driven element SO-239 wiring details. The driven element can also be wired directly, as outlined in the text.

to get the correct quantity, material and length. All materials are easily cut with a tubing cutter, hacksaw or band saw. After cutting, use a 3/4 inch countersink bit and a file to deburr the inside and outside edges of the tubing. Add the common components (such as channel and stainless steel hardware) and you will be ready to begin assembly. All of the necessary materials are listed on Sheet 7 along with sources for each. Figure 2 gives a view of the completed antenna, without the mast.

Mounting Plates

The driven element, reflector and boom to mast plates are fashioned from structural aluminum channel. This material is overkill for this application, but this method of mounting is sturdy enough to be used on tubular Moxons up to 20 meters or more (by scaling the mounts and tubing upward). There is absolutely no flexing or bending of the mounts and the finished antenna is very solid.

The channel is easily cut with a band saw and a metal cutting blade. Cut three pieces 8 inches long and lay out all holes according to the dimensions shown on Sheets 4 through 6. It's a good idea to smooth all sharp edges on the channel with a file. I use a center punch and a drill press with a 1/16 inch bit to get accuracy, then go back and enlarge each hole to its final dimension. Be sure to size the mast saddle clamps to match your mast and use the chart on the drawing for a drill guide. Tap the holes as specified and assemble using the stainless steel saddle clamps and radio support blocks listed. This was my first encounter with the support blocks and they provided a great way to support the elements rigidly while providing isolation from the metal brackets and boom. These blocks, actually industrial insulated tubing clamps, may also be found at hydraulic and piping distributors. Figures 3 and 4 show top and bottom views, respectively, of the completed mounting plates.

Insulators

A pair of insulators that maintain a fixed distance between the tubing ends supports the ends of the antenna elements (within dimension C on Drawing Sheet 1). The insulators are made from 3/8 inch OD × 10 inch solid fiberglass and slide inside the 1/2 inch OD aluminum tubing. Similarly, a 1/2 inch OD × 10 inch solid fiberglass rod is used to join the 5/8 inch OD tubing at the feed point. (Because tubing and fiberglass materials are usually sold in 6 foot lengths, the shipping costs can be more than the material itself. I recommend ordering enough material for a group of builders to keep the costs down.) An installed insulator can be seen in Figure 5.

Feed Point

The installation of an SO-239 coax connector on the 6 meter Moxon adds a bit of reactance to the feed and it is best to attach the coax directly to the driven element.[5] Unfortunately, this was not practical for me, as I use this antenna for portable use and prefer to separate the coax from the antenna. I tried several methods and ended up using the channel as a mount for the SO-239 connector. In the interest of isolating the feed from the antenna, I made an insulator from the end of a 1 1/2 inch PVC cap and fastened this and the connector to the channel using nylon screws. Short pieces of 14 gauge insulated wire connect the SO-239 to the driven element. Apply a weatherproof sealant to the solder joints. Figure 6 shows the driven element connection.

An alternate method is to fabricate a bracket that mounts the SO-239 directly on the driven element (see Drawing Sheet 7 for details). The brackets are made from 1 1/2 inch × 1 1/2 inch × 1/8 inch aluminum angle. The connector is mounted on one bracket, which is attached to one side of the driven element. Cut the head off of a 6-32 × 1 inch copper screw, file one end down to fit inside the SO-239 center pin and solder. Use 6-32 nuts on either side to clamp the second bracket, which is attached to the other side of the driven element. Apply a weatherproof sealant to the solder joint and copper materials.

Corners

Cut the 3/8 inch OD aluminum rod into four 8 inch lengths and chuck each into your drill or drill press. While rotating the rod, use a file to smooth the edges to ensure a smooth fit inside 1/2 inch OD aluminum tubing. The 3/8 inch OD solid aluminum rod is fairly soft and easy to bend. My method is to mark the center and place a scrap piece of 1/2 inch OD × 12 inch aluminum tubing over each end (to give some leverage) and slide it near the mark. I then place the 3/8 inch rod over a vise-mounted 1/4 inch drill bit and smoothly push the tubing down until I have a 90° bend. See Sheet 7 for a corner detail. A completed corner can be seen in Figure 7.

Fasteners

The 6-32 stainless steel fasteners were chosen to provide reasonable strength and corrosion resistance without having to drill very large holes in the tubing. The stop nuts provide a vibration-proof fastener without using lock washers.

Assembly

I prefer to assemble the antenna parts loosely and then go back and install the fasteners. Mark the center of the 1/2 inch OD fiberglass rod (A_0) and 1/8 inch on either side. Slide the fiberglass inside both pieces of 5/8 inch OD tubing (A_1) up to the 1/8 inch marks and place inside the radio support blocks on the driven element mounting bracket. Center the assembly in the bracket and drill holes and install the feed line screws. Mark the center of the 5/8 inch OD aluminum tube (A_3) and mount it in the Reflector Mounting Bracket. Place a line 3 inches from the end on the four 1/2 inch OD tubing lengths (A_2) and slide each into the previously mounted 5/8 inch OD tubing (A_1 and A_3) up to the mark. Place a mark 1 inch from the centerline on each of the four 3/8 inch OD bent corners (A_4) and insert each inside the 1/2 inch OD tubing (A_2) up to that mark. Mark the centerline and a point 3 inches from each end on the 3/8 inch OD fiberglass (C_1) and insert each into the 1/2 inch OD aluminum (B_1 and D_1).

At this point you should have a complete antenna layout. Referring to the Moxon dimensional chart, check each ABCDE measurement and adjust the assembly until you are satisfied. Keep in mind that there should be at least a 3 inch overlap on all tubing-to-tubing and rod-to-tubing transitions. When you are satisfied, clamp the tube positions (I used tape) and drill straight through, installing the stainless steel hardware as you go. Disassemble and clean all metal-to-metal joints. Then, apply an aluminum antioxidant compound to the joints to maintain good electrical contact by preventing oxidation. Reassemble and use an ohmmeter to ensure feed-point isolation from the boom and mounting brackets.

Antenna Models

H-POL—The resonant frequency is 50.5 MHz at a height of 15 feet. This antenna is intended to cover the lower end of the 6 meter band with less than a 1.3:1 SWR, and tests conducted with an MFJ-259B antenna analyzer verified this. The *EZNEC* model predicts the antenna to have a gain of 11 dBi and front-to-back ratio of 25 dB at resonance. The H-POL antenna completed and mounted is shown in Figure 8.

V-POL—The resonant frequency is 53 MHz at a height of 15 feet. This antenna is intended to cover the upper end of the 6 meter band with less than a 1.6:1 SWR. The *EZNEC* model predicts the antenna to have a gain of 6.7 dBi and front-to-back ratio of 36 dB at resonance. The completed V-POL antenna is shown in Figure 9.

SWR Measurement

Upon completion of the H-POL version, I wanted to compare the SWR curve predicted by *EZNEC* with my MFJ-259B analyzer. At first, I was completely baffled by the results. The analyzer showed a much broader curve than I thought possible. W4RNL provided the following explanation:

"If you made the measurements at the end of a length of coax, they will be flatter than at the antenna itself, due to losses in the coax. These losses increase with thinner coaxes and are less with 1.2 inch diameter low loss coax cables. Hence, RG-58/U will show a flatter SWR than some of the latest coax types. This is normal behavior. As well, the longer the coax run, the greater the losses and, hence, the flatter the curve. If you are measuring the low SWR at the antenna terminals, then it becomes more likely that the flat curve is a function of equipment limitations."

Armed with this knowledge, I replaced the 50 feet of RG-8X coax that I had been using with a 3 foot run and got much better results with the analyzer. Figure 10 shows the antenna mounted and ready for testing.

Figure 7—A corner of one of the elements.

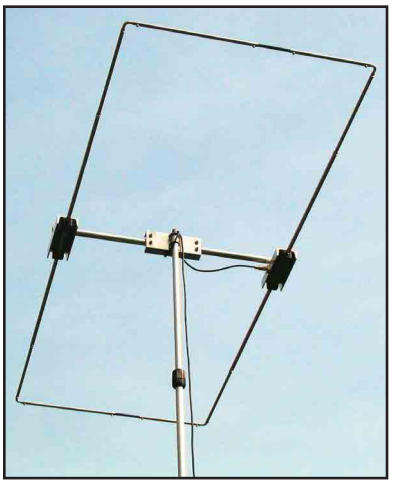


Figure 8—The completed 6 meter Moxon in the horizontal position.

Mounting

The finished antenna weighs 8 1/2 pounds and is light enough for my trusty painter's pole at a height of 15 feet. The antenna will mount horizontally or vertically by loosening the boom to mast plate saddle clamps and rotating the antenna (see Sheets 2 and 3). If you're industrious, you could mount the H-POL and V-POL on the same boom with different feeds.[6]

6 Meter Activity

Listen for beacons at the lower end of the band. If you hear one, chances are the band is open. Here is a short list of where I have found the most activity:

CW	50.000 to 50.100 MHz
SSB	50.100 to 50.200 MHz
PSK	50.290 MHz
FM	52.000 to 54.000 MHz (simplex and repeaters)

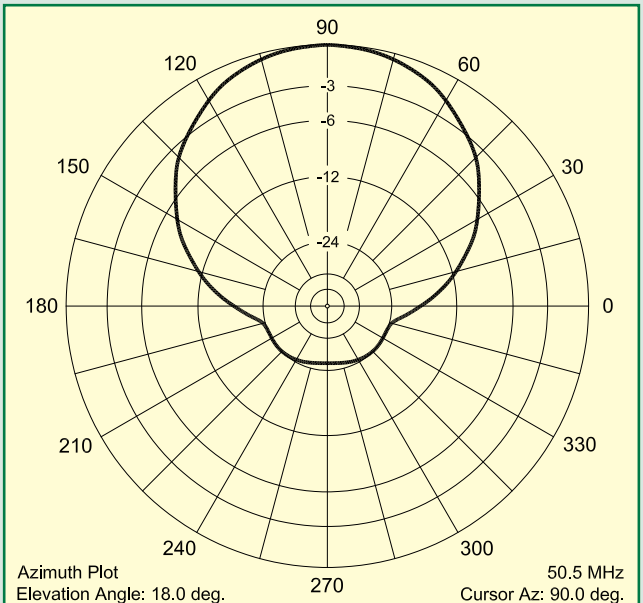
Testing

I decided the best way to test the antenna was to go camping

Antenna Patterns and SWR Plots

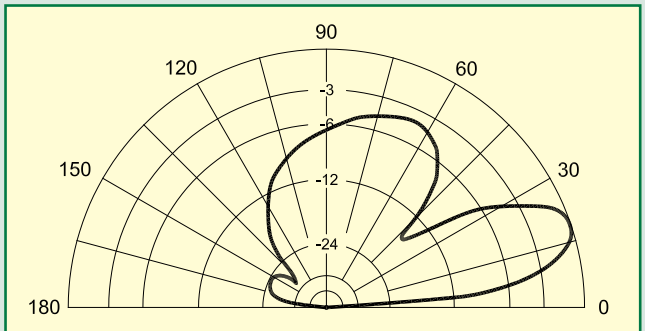
Here are the both azimuth and elevation antenna patterns for the 6 meter Moxon antenna, including the SWR plots. These are presented for both the vertically and horizontally polarized antennas and were made at a modeled test height of 15 feet. All of the plots were made using *EZNEC* software.

EZNEC predicts a gain of 11.06 dBi for the horizontally polarized Moxon and the constructed antenna appears to verify that model. The SWR has, likewise, been confirmed.



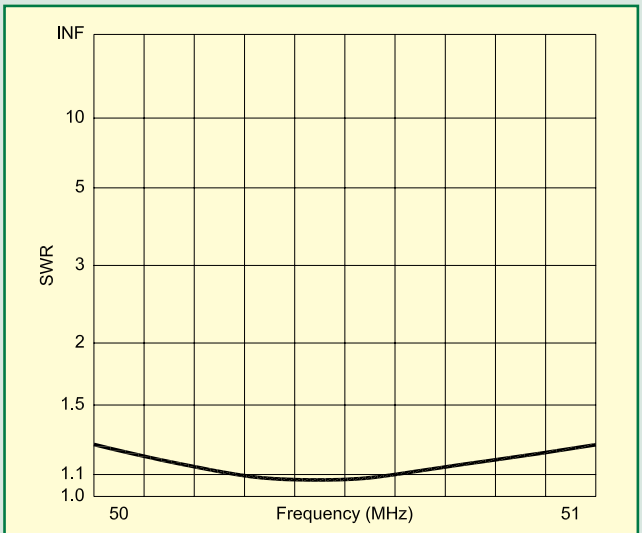
Azimuth Plot — 50.5 MHz
Elevation Angle: 18.0 deg. — Cursor Az: 90.0 deg.
Outer Ring: 11.06 dBi — Gain: 11.06 dBi
3D Max Gain: 11.06 dBi — 0.0 dBmax
Slice Max Gain: 11.06 dBi @ Az Angle = 90.0 deg.
Front/Back: 25.18 dBi
Beamwidth: 79.8 deg.; −3 dB @ 50.1, 129.9 deg.
Sidelobe Gain: −12.3 dBi @ Az Angle = 318.0 deg.
Front/Sidelobe: 23.36 dB

Figure A—The 6 meter horizontally polarized Moxon azimuth plot at 15 feet.



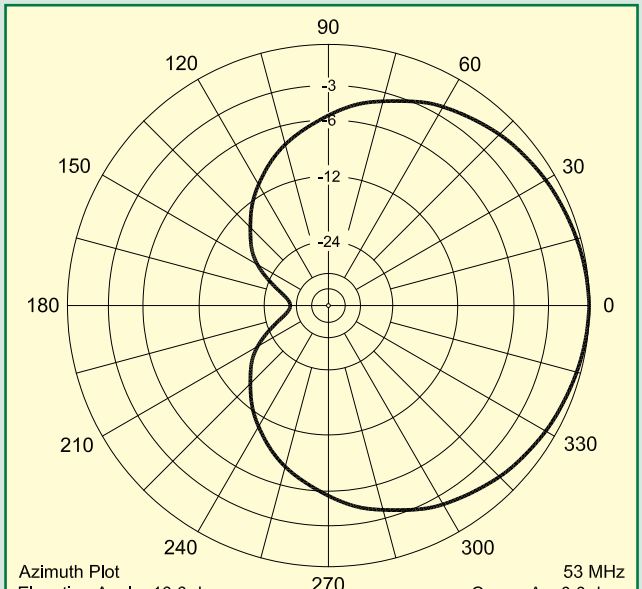
Elevation Plot — 50.5 MHz
Azimuth Angle: 90.0 deg. — Cursor Elev: 18.0 deg.
Outer Ring: 11.06 dBi — Gain: 11.06 dBi
3D Max Gain: 11.06 dBi — 0.0 dBmax
Slice Max Gain: 11.06 dBi @ Elev Angle = 18.0 deg.
Beamwidth: 19.4 deg.; −3 dB @ 8.7, 28.1 deg.
Sidelobe Gain: 7.16 dBi @ Elev Angle = 64.0 deg.
Front/Sidelobe: 3.9 dB

Figure B—The elevation plot for the horizontally polarized Moxon at 15 feet.



Frequency: 50.5 MHz — Z_0: 50 ohms
SWR: 1.074
Z: 48.78 + *j* 3.305 ohms
Refl Coeff: 0.03563 at 108.29 deg.

Figure C—The SWR of the horizontally polarized Moxon at 15 feet at 50.5 MHz.



Azimuth Plot — 53 MHz
Elevation Angle: 10.0 deg. — Cursor Az: 0.0 deg.
Outer Ring: 6.75 dBi — Gain: 6.75 dBi
3D Max Gain: 6.75 dBi — 0.0 dBmax
Slice Max Gain: 6.75 dBi @ Az Angle = 0.0 deg.
Front/Back: 36.4 dBi
Beamwidth: 143.6 deg.; −3 dB @ 288.2, 71.8 deg.
Sidelobe Gain: < −100 dBi
Front/Sidelobe: > 100 dBi

Figure D—The 6 meter vertically polarized Moxon azimuth plot at 15 feet.

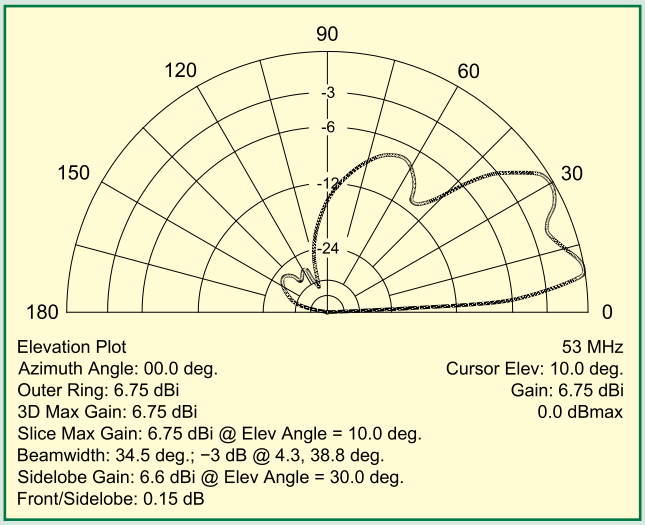


Figure E—The elevation plot for the vertically polarized Moxon at 15 feet.

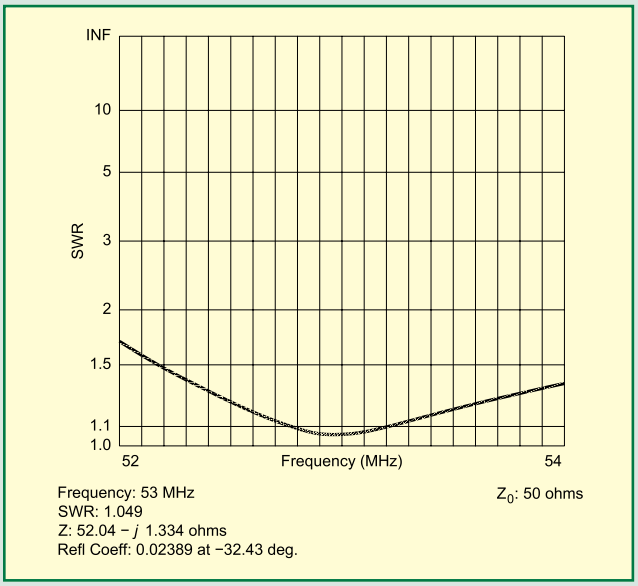


Figure F—The SWR of the vertically polarized Moxon at 15 feet at 53 MHz.

during the July 4 holiday. As luck would have it, tropical storm Bill was passing through our area, so it was raining heavily. We set up camp in a light drizzle and then mounted the Moxon on the painter's pole. A quick check with NG4T (about 50 miles away) told me that the antenna was working. I was S7 on his dipole while running 30 W SSB. Our contact was quickly joined by WB4GBI, who gave me a 20 dB over S9 report. It continued to rain throughout the night and the next day brought some welcome sunshine and NG4T (my brother) to the campsite. Thanks to an unusual 6 meter opening that weekend, we logged numerous contacts to California, Colorado and Texas on SSB and PSK. On FM, 6 meter repeaters were easily worked with full quieting. I am still on the lookout, however, for that first 6 meter DX contact!

Figure 9—The Moxon mounted for vertical polarization.

Figure 10—A temporary lash-up for testing and adjustment purposes at the author's location.

Results

The antenna easily withstood the wet weather and the performance was flawless, with excellent gain, directivity and F/B ratio. The fact that the assembled antenna is small enough to fit in a pickup truck makes it a great portable for camping, Field Day, or an afternoon in the park. So start building—and discover why 6 meters is called the "Magic Band."

Acknowledgments

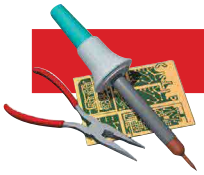
I would like to thank L.B. Cebik for his advice and expertise, my wife Ann for her continued encouragement and support, and the late Oddis Baker, my father, for his quest for knowledge that he passed on to me.

Notes

[1]A. Baker, KG4JJH, "The Black Widow—A Portable 15 Meter Beam," *QST*, May, 2003, pp 35-39.
[2]**www.cebik.com/6m.html**.
[3]**www.qsl.net/ac6la/moxgen.html**.
[4]**www.eznec.com**.
[5,6]See Note 2.

All photos by the author.

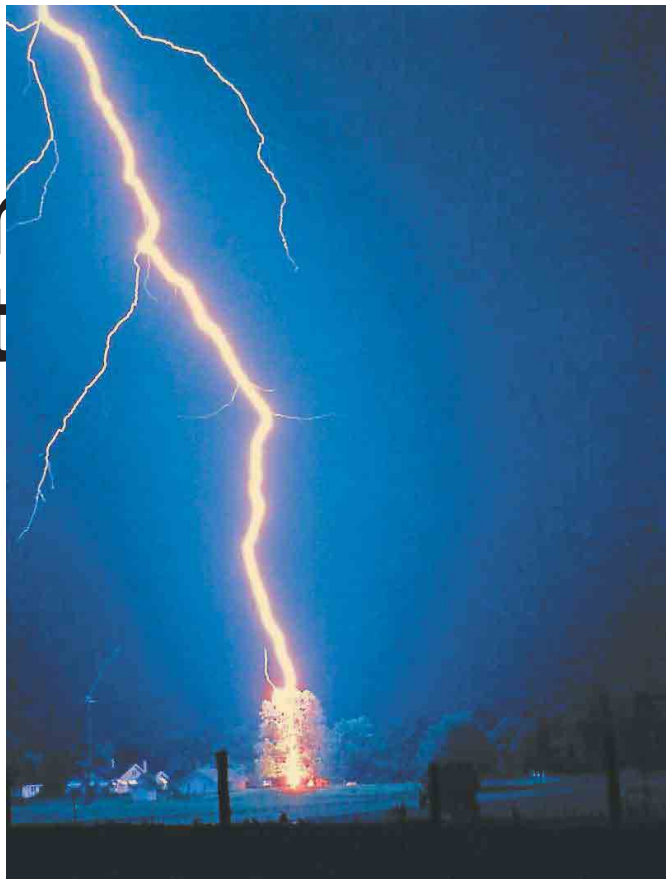
Allen Baker, KG4JJH, received his license in September 2000, after a lifelong dream of becoming a ham. He holds a BS in Industrial Engineering from Tennessee Technological University and works as an Instrument and Controls Engineer for the Department of Energy in Oak Ridge, Tennessee. Allen is active on the digital modes (6 through 40 meters) and loves to experiment with antenna designs. He can be reached at **kg4jjh@arrl.net**.



By Mike Tracy, KC1SX

Questions and An Lightning Protect

Protect your station from one of nature's most powerful forces.



Q: I haven't had any lightning problems yet. Why do I need protection?

A: When most hams think of lightning protection, they immediately think about ways to protect their station equipment. Although that is certainly important, you should have far more concern for the health and welfare of yourself and your family. Each year, lightning is responsible for the deaths of over 400 people in the US.

Q: How much of a threat do I face?

A: The number of local thunderstorm days per year in this country ranges from 1 to 100, depending on where you live. If you live in a location with a single thunderstorm day, that means that you have at least one opportunity for disaster to strike. The total number of strikes per year is more than 40 million. However impressive these statistics may seem, keep in mind that they do not include all lightning strikes. Lightning can occur even without a thunderstorm—whenever and wherever there is a sufficient charge buildup.

Many things are involved in determining the likelihood of a strike at your home. A brief list includes the type of structure, the materials it's made of, the location relative to other structures and so on.

Other reasons for lightning protection include fire prevention and protection of sensitive electronic equipment. Property damage statistics indicate that lightning causes over 40 million dollars damage annually to buildings and equipment in the US.

In addition, your equipment can also be damaged by other electrical disturbances such as power line switching transients and voltage surges, as well as static buildup on outside wires and antennas.

Q: But I already have lightning protection. My station is grounded and I added a lightning arrestor to the coax.

A: Your situation is typical of many hams: a single copper rod driven into the earth as a station equipment ground and an in-line coax lightning arrestor, often mounted in the shack at the operating position. While it may prevent damage from surges, this type of installation is not adequate for optimum lightning protection.

Q: What steps should I take first to add protection to my shack?

A: The most important thing to do is to keep lightning outside of your home. This includes disconnecting your equipment from the feed lines and power sources, providing a proper station ground and adding protective devices to your installation.

As *The ARRL Antenna Book* states, "The best protection from lightning is to disconnect all antennas from equipment and disconnect all equipment from power lines." When lightning strikes, it will always try to find the shortest electrical path to ground. Unless you disconnect your station equipment, the strike may well find a good return path through your equipment!

The easiest way to remember to do this is to disconnect your station whenever you're not using it. To prevent lightning from using your feed lines as a sneak path into your shack, disconnect them outside. If you disconnect your coax and leave it lying on the floor, lightning can jump a gap of several feet to your grounded equipment. Remember that it has already traveled quite a distance through the air. A few more feet of atmosphere won't stop it (this phenomenon is known as a "side flash").

The slick approach is to install an entrance panel for your feed lines and control cables. Place the panel ground connection on the outside of your home. Don't attach it to an inside source such as the power company ground or a cold water pipe. This panel will provide a convenient disconnect point for your equipment, as well as a place to mount feed line and control cable transient protectors.

Q: I can do that. But what about my station ground system?

A: Proper grounding is critical to lightning protection. Lightning contains energy in a wide range of frequencies (which is why you can hear "static crashes" on an AM radio when a storm approaches). You must provide a low-impedance path to ground for the energy. A single ground rod will not suffice as a lightning ground. The basic idea is to give the strike energy a place to dissipate.

For more information, see the lightning-protection page on the ARRLWeb at **www.arrl.org/tis/info/lightning.html**.

Mike Tracy, KC1SX, is an ARRL Laboratory engineer. You can contact him at **kc1sx@arrl.org**.

Experiment #15: Switchmode Regulators—*Part 1*

In case you hadn't noticed, the dc power supply has undergone a radical transformation. A 20 A, 12 V dc supply now weighs just a couple of pounds and is about the same size as a couple of good sized paperback novels. These are *switching* supplies that are much more efficient in delivering power. This month, you'll meet the *switchmode regulator*.

Terms to Learn

- *Buck* and *boost*—regulators that configure the inductor to subtract from and add to the input voltage, respectively
- *Commutating diode*—a diode that provides a path for inductor current to flow when the switch is turned off

Background

A power supply with a linear regulator (see Experiment #8)[1] acts like a smart resistor that constantly changes its value to drop the output voltage by just the right amount. This is inefficient, dissipating the unwanted power as heat. Neither can a linear regulator create an output voltage higher than its input.

The pass transistor in a linear regulator is operated in its *linear region* between cutoff (zero collector current, I_C) and saturation (minimum collector-to-emitter voltage, V_{CE}), and the power it dissipates is equal to $I_C \times V_{CE}$. For example, if I'm drawing 5 A at 12 V from the regulator output and the input voltage is 18 V, the pass transistor must dissipate (18–12) × 5 = 30 W. No wonder such big heat sinks are required! 60 W (12 V × 5 A) output for a total of 90 W supplied means only 67% efficiency.

Instead of using the pass transistor as a resistor, the switchmode regulator takes advantage of the fact that when either the current through or the voltage across a device is low, power dissipation (I × V) is also low. This allows the regulator to act more like a power bank, doling out power in small packets, through a switch, at low loss.

Switchmode regulators also make use of the relationship between inductor voltage and current shown in Equation 1:

$$V = L\,\Delta I / \Delta t = L \times \text{change in I per unit time} \qquad \text{[Eq 1]}$$

We can also turn Equation 1 around to find inductor current. For a constant applied voltage, current increases linearly with time according to this equation:

$$I = V \times t / L \qquad \text{[Eq 2]}$$

This is just what a switchmode supply does—apply voltage to an inductor for a fixed amount of time (a quantity measured in *volt-seconds*) in order to build up a certain amount of current. For example, 12 V applied for 10 µs to a 100 µH inductor results in a current that ramps up to 1.2 A. From the equation for energy stored in an inductor:

$$E = {}^1\!/_2\,(LI)^2 \qquad \text{[Eq 3]}$$

substitute Equation 2 for current into Equation 3 and come up with:

$$E = {}^1\!/_2\,L(V \times t / L)^2 = {}^1\!/_2\,(V \times t)^2 / L \qquad \text{[Eq 4]}$$

This means that for a specific value of inductor, the volt-seconds of the pulses determines the rate at which energy is delivered, which is power. With the pulse rate constant, you

[1]"Hands-On Radio," *QST*, Sep 2003, p 53.

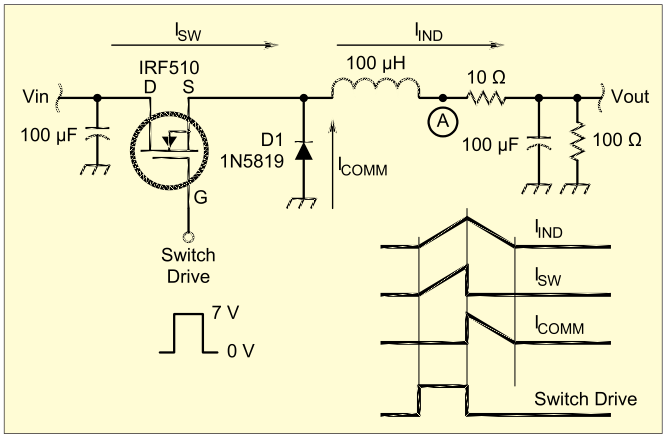


Figure 1—The basic buck regulator circuit including an FET as the switch. Note the commutating diode, D1, which keeps the inductor current flowing between switch drive pulses and avoids the voltage transient at the FET switch.

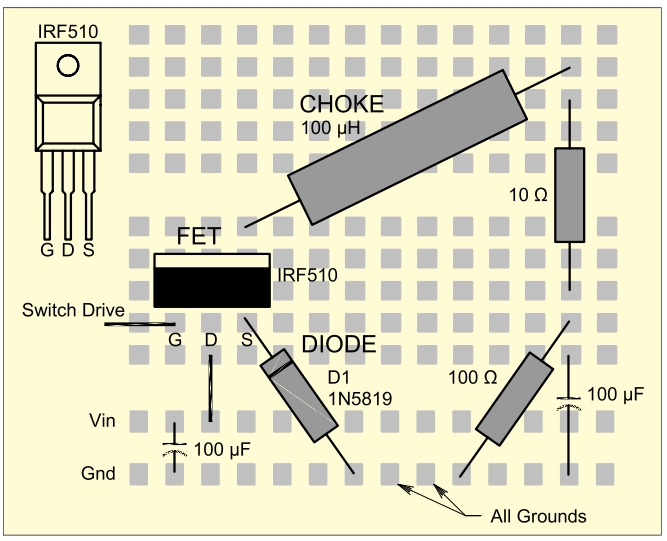


Figure 2—Recommended layout for the buck regulator of Figure 1 on a common prototyping board.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

can vary power by controlling pulse width, and vice versa. Voilà! We have a power supply...almost. We still need a way of smoothing out the current, and we need to take care of one other problem.

The problem is that current through an inductor cannot change value instantaneously. Equation 1 says that if I try to change the current through an inductor, a voltage will be developed across the inductor that resists the change in current. For example, if I try to suddenly interrupt the current, a very large voltage will appear across the inductor. This is why *kickback diodes* are required across relay coils.

To avoid having to deal with these high-voltage transients, it's better to figure out a way to let the inductor current keep flowing between pulses when the switch is off. The regulator in Figure 1 accomplishes this with a *commutating diode* (D1). The switch transistor applies voltage to the inductor for a fixed length of time. This causes the inductor current to "ramp up" until the transistor is turned off. A high voltage transient would then appear at the FET source because the output capacitor holds voltage on its end of the inductor constant. Instead, a diode is connected from ground to the inductor. When the transistor turns off, the inductor current just switches over to flow through the diode. The current doesn't change and so no big voltage transient is generated. Current continues to flow into the output capacitor, producing an easy-to-filter triangular current waveform as shown in Figure 1. The current in the diode is called *commutating current* because it switches with each cycle of operation. When the input switch is turned off, the inductor gradually "discharges" its current into the output capacitor and then waits for the next pulse. The 10 Ω resistor acts as a current sampling resistor so you can look at current with an oscilloscope.

This configuration is called a "buck" regulator because the inductor voltage will *oppose* or *buck* the power supply voltage when it is turned off. The output voltage of a buck regulator is simply:

$$V_{OUT} = V_{IN} \times \text{switch duty cycle} \qquad \text{[Eq 5]}$$

The output voltage of the buck regulator is less than that at the input.

Working with Switchmode Regulators

Let's build a buck regulator. You can reuse the power FET from Experiment #12.[2]

- Start by building the circuit of Figure 1 using Figure 2 as a layout guideline. Since we are talking about creating rapid current rise and fall times, it's a good idea to keep leads and connection lengths short. Be sure the inductor you use is adequately rated and not a low-power choke that will either saturate or burn out. The commutating diode must be a fast-recovery type so that it can switch current quickly.
- Set your generator to output pulses at 10 kHz with a 10% duty cycle by using the "symmetry" control on the square wave setting to skew the waveform to produce narrow pulses. If you can only generate a 50% duty cycle square wave, increase the frequency to around 50 kHz. See the previous experiment for a way to create a 0 to 7 V signal from a generator with no dc offset capability.
- Apply 3 V (you can also use a pair of D cells in series) to the input of the regulator. We're only using 3 V at the input in order to be able to apply sufficient voltage to the gate of the FET. 4 V between the gate and source is required.

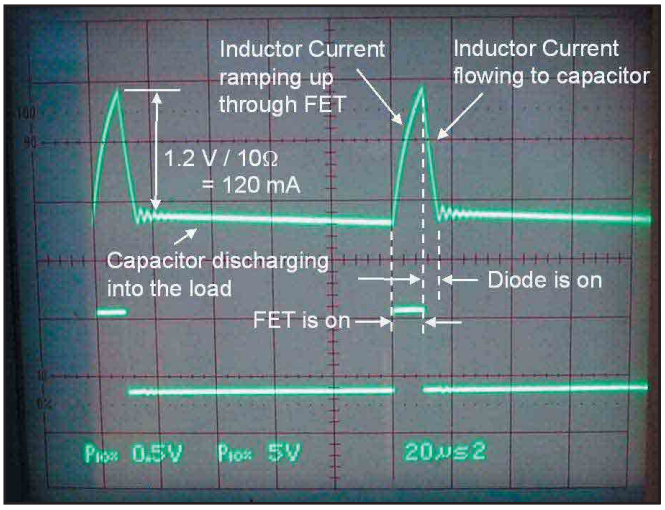


Figure 3—The top trace is the voltage at point A of Figure 1, showing current through the inductor. The bottom trace is the FET gate signal.

- Put one scope probe on the SWITCH DRIVE signal and one at point A. You should see waveforms like those in Figure 3. The current (top trace) through the inductor ramps up during the time that the switch is ON and back down when the switch is OFF. The peak current in my circuit is about 120 mA—or 1.2 V across the 10 Ω current sample resistor.
- Remove the output capacitor and measure the output voltage with a voltmeter. You should see a voltage that is close to 10% of the input voltage. Adjust the pulse duty cycle to see if you can verify Equation 5.
- Reconnect the output capacitor and experiment with the pulse duty cycle to see the effect on output voltage. Change the load resistor value to see how much load the regulator can supply without a big change in output voltage.

Suggested Reading

Not much information on switching supply operation is available in the ham radio press, which is surprising, considering their popularity. Ray Mack, WD5IFS, wrote a detailed two-part article "Understanding Switching Power Supplies" in the Sep/Oct 2002 and Jan/Feb 2003 issues of *QEX*. There is also a good on-line tutorial about switching regulators at **www.web-ee.com/primers/files/webex9.pdf**.

Shopping List

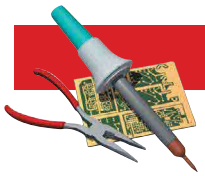
- 100 µH choke capable of handling 1 A, RadioShack 273-102 or equivalent
- IRF510 transistor (RadioShack 276-2072)
- 1N5819 fast-recovery rectifier (available from Jameco, Digi-Key and other vendors)
- 2—100 µF, 25 V tantalum capacitors
- 10 Ω, 100 Ω, 1/4 W resistors

Next Month

Continuing with the switchmode theme, next month we'll investigate the boost converter that can create a higher output voltage than its input.

Hands-On Radio Web site: **www.arrl.org/tis/info/html/hands-on-radio/**.

[2]"Hands-On Radio," *QST*, Jan 2004, p 61.



HINTS & KINKS

MOUNT PANEL CONTROLS PROPERLY

◊ Okay, call me a nitpicker. Ham equipment should not only work well, but should also look attractive. There is a right way and wrong ways to panel-mount components such as toggle switches, push buttons and jacks. Today for some reason, much ham-built equipment is assembled incorrectly. I have ignored the problem for a long time, but when I discover three prime examples of the same error in one copy of *QST*, I think it's time to speak out.

Components are to be mounted so that any unused portion of the threaded barrel is hidden behind the panel, not showing in front of it. In my opinion, the way it's often being done is just plain ugly. See Dec 2002 *QST*, pp 28, 39 and 62. These are examples of what I am sure is otherwise excellent home-built equipment. As supplied from the manufacturer, panel components usually come with three items: a front nut, which is either knurled or hex-shaped, a lock washer and a rear hex nut. Sometimes there is also a decorative flat washer or perhaps an ON-OFF indicator plate as well. Figure 1 shows the right and wrong mounting methods. For proper mounting, the assembler should first screw on the rear hex nut so that the front of the barrel will end up just slightly protruding from the front mounting nut. Some trial-and-error may be needed. Then add the lock washer, and insert the component through the panel from the rear. Mount the washer or plate (if supplied), and finally the front mounting nut. Be careful not to mar the panel when tightening the front nut. When the rear is accessible, I tighten the rear hex nut after installing the front nut, using a small, flat hex wrench, to avoid scratches on the front. That's all there is to it. As a guide, most (but not all) commercially built equipment is done correctly.—*Sumner Weisman, W1VIV, 43 Agnes Dr, Framingham, MA 01701;* **w1viv@rcn.com**

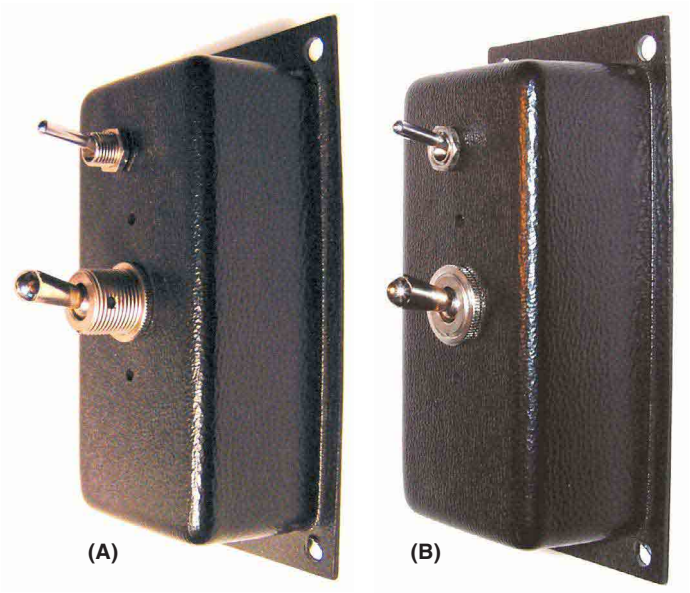


Figure 1—A shows the wrong way to mount controls, and B the right way. Any unnecessary control shaft length belongs behind the panel.

AN EASY HOMEBREW BURGLAR ALARM

◊ How about a neat little circuit, easily built, to protect your Amateur Radio gear? This is actually good for any place needing protection: swimming pool, gate area, etc. The project (see Figures 2 and 3) simply uses a low-cost motion-detector light fixture that is modified to power a 12 V wall transformer rather than its normal lamp. Choose a 12 V siren and the transformer to power the siren.

Figure 2—A photo of the W7VEW system at work.

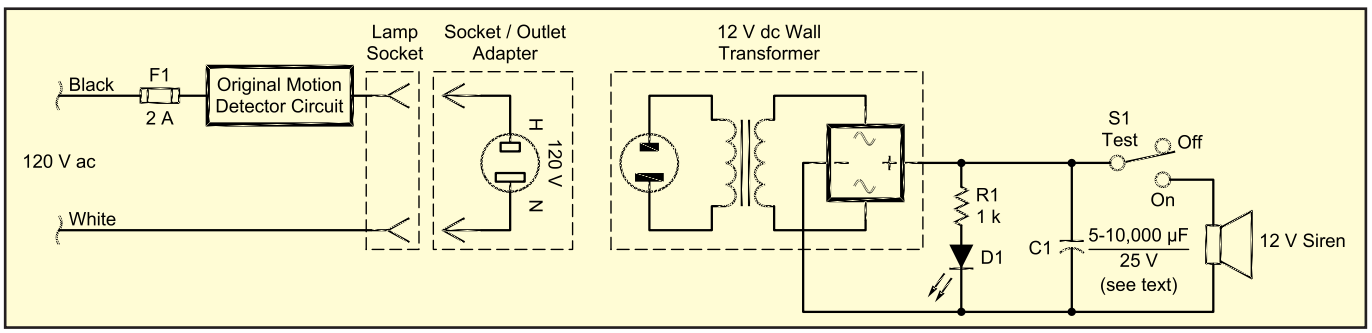


Figure 3—A schematic of W7VEW's homebrew motion-detector alarm system.

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

Here are the modifications:

1. Remove both black and white wires from one socket.

2. Fill the socket with strong and hard putty. Let the putty harden, then mount the siren to the putty-filled socket.

3. Leave the red and white wires connected to the other socket, screw a lamp-to-ac-socket adapter into it and plug the 12 V "wall wart" into the adapter.

4. Connect the wall-wart output to the siren's power terminals.

Mount the modified fixture to a standard deep octagon electrical box and add a cord set for power. Plug it into a nearby outlet.

With the motion detector switch in the normal position, the alarm will operate only in the dark and when triggered it will sound for the interval you select. With the switch in the TEST position, it will operate with lights on and sound for about 15 seconds. Mount the alarm so that S1 is hidden from view, away from the protected area.

This alarm system prevented a robbery only two weeks after installation at my son's construction office. The criminals defeated the door switches, but this ham project got 'em. *—Steve Kimber, W7VEW, 670 Garfield St, Lander, WY 82520;* **w7vew@arrl.net**

SAND PAINT SMOOTH BEFORE LETTERING AND DECALS

◊ Gloss paint is a good surface for lettering but getting a glass-smooth surface is tough. Conversely, flat paint is easy to apply and flows out smoothly, but rub-on lettering doesn't adhere to it very well. My clever solution is to paint the panel with flat paint, then sand it down with ultra-fine 600-grit sandpaper. The sanding technique also works with metallic paint, which often dries to a rough finish. For a really smooth finish, I've purchased 1000 and 2000-grit sandpaper in the auto-finishing sections of big retail stores.

After applying rub-on labels, I protect the panel with a coat of spray clear acrylic, which produces a shiny finish. (Remember, paint compatibility varies as a function of how long the base coat has to dry—applying a top coat too soon can cause problems with otherwise compatible paints.) You can also use waterslide decal film labels—they can be protected with Future floor wax, a thin acrylic, after application.[1] Unlike rub-on lettering, decals are easily replaced if damaged. A sanded-smooth finish can make a good surface for peel-and-stick decals with clear areas—a notoriously difficult challenge. *—Zack Lau, W1VT, ARRL Staff;* **zlau@arrl.org**

MORE ON WORN KEYPAD LABELS

◊ Do you have an old radio with the keypad lettering worn off? Here is a solution for that predicament with possible applications for other projects where you need a neat, professional looking label for your radio equipment.

Go to your local stationery story and purchase a pack of self-adhesive labels (in whatever color you prefer) that are slightly larger than the size of the label you intend to make. Next, go to your computer and type out the label that you want to make, using a word processing or spreadsheet program. Adjust the word spacing and sizing of the label to suit your needs.

Here's the new twist: Go to the "Font Color" portion of the word processor menu and select white for the color of the type. Now go to the processor's "highlight text" portion of the menu. Select "black" and drag the highlighter through the text of your label. This should result in white letters on a black background. Now, load a sheet of the label paper into your laser printer and print your label onto it, and you will have a *black*-background label with type that is the color of the label you selected. A great variety of font and type sizes are available using this approach.

Now, carefully cut out the label (leaving a little margin around the perimeter of the text), position and mount the label, and voilá you have a neat, professional label (see Figure 4). If your label will be in a heavily used environment, cover it with a strip of glossy-surfaced, clear vinyl or Mylar tape and you have a durable, readable label.*—Allan M. Hale, WA9IRS, 1580 Basswood Ct, Florence, KY 41042;* **wa9irs@arrl.net**

Figure 4—W9IRS repairs keypad labels with color.

Figure 5—N2ERN repairs a whole keypad with well-placed cutouts.

◊ KØHLA's approach (Hints & Kinks, May 2003) to worn keypad identifiers doesn't really address the issue, since you're still left with a radio that has no identifying data on the keypad.

I used a different approach. I laid out the keypad on my Mac in a simple drawing program, printed the facsimile on peel-off label stock, put clear tape over the whole thing, and then cut out the holes with an X-Acto knife and stuck it on the face. The repair is fast, effective and fairly waterproof. You can print several copies and replace them as needed.

Draw the layout as large as you can—double, triple or quadruple size—and reduce it appropriately when printing. This will reduce your letters, "jaggies" and measuring errors to minuscule proportions when printing and give a *very* professional job. Figure 5 shows my old IC-2GAT.*—Harris Ruben, N2ERN, 64 Apple Tree Row, Berkeley Heights, NJ 07922;* **n2ern@arrl.net**

CLEANING ANTENNA WIRE

◊ Regarding the cleaning of old antenna wire (see The Doctor is IN, Mar 2004 *QST*): An old-timer gave me this advice years ago, and it's proven invaluable over the years. Vinegar and salt cleans copper. Create a mixture of vinegar and salt and insert the section of wire to be soldered. After a few minutes it will be shiny and in like-new condition (even the individual strands will be clean)—and it will take solder like a new wire. *—Bill Arnold, WV8WVA, PO Box 1, Cabins, WV 26855-0001;* **wv8wva@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]One supplier of waterslide decal media for ink-jet printers is Bel Inc, 10913 NW 30th St, Ste 103, Miami, FL 33172; tel 305-406-9507, fax 305-593-1011; **www.beldecal.com**.

Elecraft KX1, An Ultra-Portable Multiband CW Transceiver Kit

Reviewed by Bruce Prior, N7RR
ARRL Technical Advisor

Wilderness trekkers have enjoyed a revolution in lightweight equipment during the last decade—shelters, clothing, footwear, backpacks, watercraft and even mountaineering gear is now much lighter. Elecraft has made a new contribution to radio amateurs who travel away from civilization—a versatile multiband CW transceiver in a very small and lightweight package.

The basic KX1 kit covers all of the 40 and 20 meter amateur bands. The KX1 transmits up to 4 W on CW, but it will receive LSB or USB with a variable band-pass three-pole crystal filter, making CW/SSB crossmode communication possible with a radio that is small enough to hold easily in one hand. In order to keep its weight and bulk down, the KX1 was designed for use with tiny stereo earphones, but can also handily drive a small speaker.

Think about the possibilities for an HF radio that could be operated from a living room couch or a backyard lawn chair. Since the KX1 is so utterly portable, it can be carried anywhere. You could lose it in a school knapsack, and it won't begin to fill a briefcase. It's also an ideal emergency HF radio.

Wide Coverage

Besides its diminutive size and weight, the big difference between the KX1 and its older sibling, the Elecraft K1, is that the new radio uses a stable Direct Digital Synthesis (DDS) oscillator. This makes it possible to transmit over the entirety of each of the amateur bands covered, as well as to receive well beyond the amateur band limits. With the optional 30 meter module installed, the KX1 will receive the 49, 39, 31, 25, 22 and 19 meter shortwave broadcast bands, with decreased sensitivity the farther removed they are from the installed KX1 amateur bands.

Tuning Versatility—Ergonomics

The KX1 allows wide tuning speed choices. In the two coarse tuning modes (5 kHz and 1 kHz per step), the encoder will move 400 kHz or 80 kHz in one revolution. 100 Hz and 10 Hz tuning steps are easily selected by tapping the encoder. At the slowest tuning rate, one encoder revolution covers 800 Hz so smoothly that it sounds like an analog VFO. Changing tuning speed is very simple, and I take advantage of that facility frequently.

Wilderness operating is usually awkward. That's why design engineer Wayne Burdick, N6KR, placed controls on the top rather than on the side of the enclosure. The top panel controls are all directly connected to the main circuit board, and are nicely spaced out. Small as it is, the widely spaced KX1 controls can be operated more easily with gloved hands than those of either the Elecraft K1 or the K2.

In a pinch, top-panel push buttons will do double duty as iambic or straight keys. Another feature that helps operating in an iffy environment is the frequency lock function, avoiding an accidental frequency change when a tent-mate gets tired of staring at the east tent-wall and rolls over to face west.

Bottom Line

The Elecraft KX1 packs a lot of features in a small, light and easy to use box that trekkers may find irresistible.

Suite of Features

Check out these KX1 features: low-current three digit LED scrolling frequency display with adjustable brightness, AF gain control, RF gain control, variable crystal IF band-pass filter, logging light, bar-graph S-meter RF output meter, adjustable CW sidetone volume and pitch, receiver incremental tuning and four frequency memories per band. With the optional KXAT1 automatic antenna tuner installed, a power and SWR meter is also provided. The receiver is a very low-current single conversion superheterodyne design with active mixers and a 4913 kHz intermediate frequency.

The KX1 is not limited to its current array of features. The firmware that controls the radio is stored in the replaceable 28 pin microcontroller on the main board and by another replaceable 18 pin microcontroller on the KXAT1 board. Manual control of the internal tuner and a single long hold of the RIT button to implement frequency lock were added

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Table 1
Elecraft KX1, serial number 206

Manufacturer's Specifications[1]	*Measured in ARRL Lab*
Frequency coverage: Receive 5-16.5 MHz, transmit, 6.997-7.304; 10.099-10.151; [2] 13.997-14.355 MHz.	Receive and transmit, as specified.
Modes of operation: CW.	As specified.
Power requirement: 7-14 V dc,[3] receive, 35 mA (typical), 40 mA max; transmit, 0.7 A, at 13.8 V.	Receive, 40 mA (max volume, no signal); transmit, 0.65 A (max), tested at 13.8 V.
Size (height, width, depth): 1.4×5.8×3 inches; weight, 9 oz.[4]	
Receiver	***Receiver Dynamic Testing***
CW sensitivity: 10-dB S/N, 0.2 μV.	Noise floor (MDS), 500 Hz filter: 7 MHz –131 dBm 10 MHz –121 dBm 14 MHz –126 dBm
Blocking dynamic range: Not specified.	Blocking dynamic range: Spacing: 20 kHz/5 kHz 7 MHz 109/111 dB 14 MHz 108/109 dB
Two-tone, third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range: Spacing: 20 kHz/5 kHz 7 MHz 87/83 dB 14 MHz 88/82 dB
Third-order input intercept point: Not specified.	7 MHz +0.5/+0.5 dBm 14 MHz +5.0/+5.0 dBm
Second-order intercept point: Not specified.	14 MHz, +55 dBm.
S-meter sensitivity: Not specified.	Max indication: 50 μV.[5]
Receiver audio output: 0.1 W into 8 Ω, THD not specified.	0.1 W into 8 Ω.[6]
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW: 379-878 Hz (449 Hz)[6]
IF rejection: Not specified.	86 dB.
Image rejection: Not specified.	58 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output: CW, 3-4 W with 12 V dc; 1.5-2 W with 9 V dc.	As specified.
Spurious-signal and harmonic suppression: 30 dB.	37 dB. Meets FCC requirements for spectral purity.
CW keyer speed range: 8-50 WPM.	8-51 WPM.
CW keying characteristics: Not specified.	See Figure 2.
Composite transmitted noise: Not specified	See Figure 3.

[1]Specifications per KX1 Manual Errata Rev. B-3, Jan 21, 2004.
[2]With KXB30 option. Receive range without KXB30 is 5-9.5, 12-16.5 MHz.
[3]Recommended minimum of 8 V.
[4]Excluding options.
[5]Builder adjustable.
[6]Filter bandwidth adjustable, nominally 500 Hz-2 kHz.

with the first revision.

In my view, a shortcoming of the KX1 for some wilderness trek operators is its lack of coverage of the 80 meter band. That band is the home of many CW and SSB traffic nets, which enable amateurs far away from local VHF/UHF repeaters to exchange messages reliably with friends and loved ones back in civilization. A possible future firmware revision could expand the DDS system of the KX1 to cover the entire 3.5-4.0 MHz band with some decreased receive sensitivity. An external low-pass filter would also have to be added to attenuate second harmonic emissions enough to meet FCC requirements. Other suggestions for future firmware enhancements include XIT, CW offset/sidetone pitch tracking, programmable automatic power-off and frequency scanning.

Figure 1—Walter Hendrickson, VE7BGJ, totally blind from birth, is operating the KX1 using the audio feedback and frequency announce facilities.

Audio Feedback

A significant advance of the KX1 over both the K2 and K1 is its audio feedback interface system. With audio feedback engaged, the KX1 is completely controllable by a visually disabled operator. The same facility allows a sighted operator to use the radio without reference to the LED display. Just as top push buttons can be used to key CW on the KX1 in case of a malfunctioning key or keyer paddles, so the Morse feedback system is a backup in case of LED display system failure or a temporary visual disability such as snow blindness.

Here's how it works. Audio feedback is controlled by these choices on the CFb menu: OFF, 10, 15, 20, 25, 30, 35 and 40. The numbers represent the Morse feedback speed in words per minute. Within the menu mode, as the rotary encoder is rotated, the menu label is enunciated. Whenever the BAND push button is tapped while audio feedback is engaged, the KX1 gives a readout in Morse of the MHz digits, then a pause, and then all integer kHz digits. In LSB mode the readout begins with a Morse L, and in USB Mode the readout begins with U. If RIT is active, R

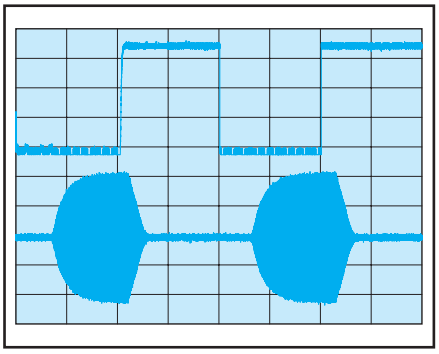


Figure 2—CW keying waveform for the Elecraft KX1 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure (when low); the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 4 W output at 14.2 MHz.

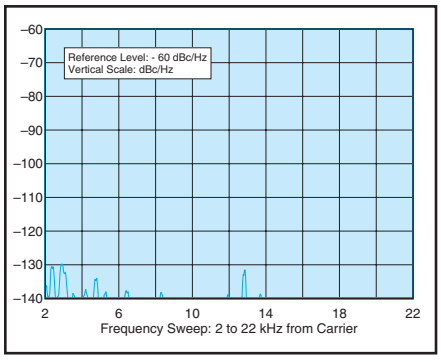


Figure 3—Worst-case spectral display of the Elecraft KX1 transmitter output during composite-noise testing. Power output is 4 W at 7.02 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

follows the frequency.

Frequency Announce Audio Mode is an enhancement of the audio feedback system that makes the interface even more useful. The audio feedback differs depending on the rotary tuning encoder speed mode. This mode gives readouts with Morse and chimes and ticks, allowing the operator to keep accurate track of frequency via audio feedback as the KX1 tuning encoder is rotated.

Powering the KX1

The basic KX1 includes a battery compartment that has room for six internal AA cells. The KX1 can also be powered by an external source, and the input voltage can range from 7.0 to 14 V dc. Eight volts is the minimum recommended by Elecraft. The output power is reduced with lower supply voltages, but the fact that the transceiver will function at low voltages considerably enhances its utility under difficult operating circumstances. The supply voltage can be monitored by a built-in voltmeter. A programmable low-voltage warning is also included. Since the KX1 operates either from the internal or an external power supply, depending on which is delivering more voltage, the internal battery holder can be loaded with AA cells before a trip and kept as a backup while an external source is in use.

Building the KX1

Because of fine engineering and excellent instructions, the KX1 is easy to build and would be an appropriate choice for a builder with only modest experience at soldering and assembling kits. The KX1 kit comes with a small bag of parts and a large owner's manual, which is also the step-by-step construction guide. Those instructions are exquisitely detailed. Here's just one example:

Install capacitor C2, 27 pF (270) between capacitor C55 and diode D4 on the lower edge of the board

The kit is built in three stages. In stage one, the control, LED display and audio circuits are constructed and then tested. After a few hours, I got the satisfaction of seeing the LED display light up, and then I explored some of the KX1 menu options, including making the LED display dimmer and brighter. I also programmed the LED display to turn off after 5 seconds to save battery capacity in the field. I also powered up the logging light, which is a built-in flashlight with a bright white LED. It could double as a trail light with the KX1 internal AA cells aboard without having to turn the radio on. A red LED can be installed instead if you want to preserve your night vision and discourage insects from joining you for CW practice! All this was just part of testing stage one construction.

Stage two is devoted to assembling and testing the receiver. I must have been overconfident, because I soldered one 8-pin integrated circuit into the wrong place, so I got the free entertainment of using solder wick to remove the offending IC. It was silly mistake, because the manual was very clear at that point, as usual. It was gratifying to find that the receiver worked fine after I had finished stage two. I could have chosen to do a precise frequency calibration by changing two menu parameters, but I decided to wait until the transceiver was finished for that final touch.

In stage three the transmitter, low-pass filter and battery compartment are constructed and tested before final assembly in the enclosure. That was my only component failure in the construction of the KX1. I somehow made an error in the assembly of the final amplifier heat-sink assembly, and found that the B+ voltage on the transistor collector was shorted to ground when I was finished. The folks at Elecraft were most helpful and patient, coaching me through diagnostics and promptly shipping me replacement parts.

In spite of the fact that the KX1 is a truly tiny rig, the double-sided main circuit board is surprisingly roomy and easy to construct. The three surface-mount components were pre-installed. The main circuit board installs just below the top of the rig, where the controls protrude. In addition, the optional 30 meter module stacks above the main circuit board. This vertical proximity requires the builder to pay attention to keeping the components at a low profile during construction. Wherever mistakes could be made by making a component stand too tall, the owner's manual includes a builder's alert.

The optional automatic internal tuner is beautifully engineered and a breeze to build and mount onto the main KX1 board. The 30 meter adapter is a tiny circuit board with only a few components, but simultaneously attaching five of seven wires from the board to the KX1 main board made me wish for a few more fingers. Once those five wires found their proper holes, it nestled very nicely as a low-profile package. I had wrongly assumed that the keyer paddles could be assembled with no fuss, but some of the wiring was cramped enough that it took me almost an hour to finish that job.

Little Touches

Much of the beauty of the KX1 is in the little things. The three rubber feet on the bottom instead of four makes the rig more stable in a variety of operating situations. My only quibble about them is that taller ones would provide more bottom clearance on the ground or on a rough-hewn picnic table. An interesting variation for the KX1 is to install one higher-profile rubber foot in the rear. This simultaneously solves the rough-surface clearance problem and tilts the transceiver slightly forward. The tuning knob is rubber-rimmed making tuning easy, especially with gloved fingers. The keyer paddle is secured with a hand-screw that is captured by the keyer bracket when unscrewed to prevent loss. The battery compartment in the KX1 can be opened and shut via two hand-screws. It is much easier to manipulate in the field than the optional internal battery holder on the K1.

Operating the KX1

In an awkward operating situation, eliminating guesswork is important. The KX1 will normally be used for CW to CW contacts. For that situation NORMAL re-

ceive operating mode is appropriate. For CW to SSB contacts, LSB or USB modes usually work better. In LSB and USB receive modes the KX1 frequency readout does not adjust for the CW offset, although the KX1 allows CW transmission in those modes. An operator wishing to find an LSB net, say, on 7228 kHz, can tune in LSB mode to exactly that frequency on the LED display or by audio readout. Then, when transmitting on CW, the appropriate offset is injected so the transmission can be heard by others on the net.

The KX1, especially with the 30 meter option, makes an excellent shortwave receiver with the band-pass filter at its widest setting. Double sideband AM transmissions can be detected by zero-beating the AM carrier in LSB or USB modes. The 40 meter band allows reception from 5.0 to 9.505 MHz; the 30 meter band yields a range from 8.0 to 12.505 MHz and the 20 meter band allows shortwave tuning from 12.0 to 16.505 MHz. The firmware prevents accidental transmission very far outside of the amateur bands, but be careful since it is possible to move one increment outside.

Since most shortwave broadcast stations transmit on frequencies evenly divisible by 5 kHz, the very coarse 5 kHz/step tuning speed makes tuning convenient. To calibrate the steps properly in LSB or USB modes, begin in the finest tuning speed and tune until 0.00 or 5.00 is displayed, then push and hold the encoder knob until the decimal marker disappears. The entire 4.505 MHz range can be covered in 11¼ rotations of the tuning encoder at 5 kHz/step tuning speed. In addition to shortwave broadcasting, there's lots more to listen to outside of the amateur bands with the KX1, including commercial aviation and time and frequency standard stations.

Options

At press time, three options were available for the KX1: the detachable keyer paddles, the 30 meter module and the internal automatic tuner.

The KX1 enclosure also serves as a holder for the optional KXPD1 keyer paddle assembly designed to mount on the KX1 case. This unit plugs into the transceiver directly with no connecting cable required and is secured with a thumbscrew. An operator can easily hold the KX1 with the non-keying hand. The paddles can be oriented for convenient operation by right-handers or left-handers; the dit/dah assignments of the paddles can also be switched.

Since the KX1 is carefully designed to be lightweight, in the field I secure the KX1 onto some backpacking gear with a light piece of line tied with a scaffold hitch in order to operate the paddles comfortably without having to hold onto the KX1. The slightly moveable parts of the keyer are thin spring steel levers covered by rubber sleeves. When pressed, the levers contact tiny silver wires which are soldered onto the underlying printed circuit board backing. The paddles work best when operated very close to the end of the rubber sleeves. Since the action of the KXPD1 is unique, operating with it is an acquired taste. The marketplace offers other lightweight keyer paddles that could be used if your tastes dictate.

An inexpensive optional internal adapter board KXB30 is available for 30 meter band coverage. This tiny unit not only yields one more amateur band, but it considerably improves reception of the non-amateur spectrum below 14.0 MHz, including time/frequency standard stations WWV, WWVH and CHU, as well as shortwave broadcasting bands.

The optional KXAT1 is a small 7 element internal antenna tuner with latching relays, which consume essentially no extra current to stay in place after completing the tuning routine. The KXAT1 is very easy to build and utterly reliable. Anyone who wants to save total station weight will want to build the tuner, since it makes a variety of very lightweight antennas practical, including a vertical wire and a simple counterpoise which is capacitively coupled to the ground. The ATU not only improves transmit impedance matching, but receive sensitivity perks up as well.

Although designed primarily to be used in automatic mode, the KXAT1 can also be controlled manually through its menu system, allowing proper settings without transmitting, and enabling optimum receiving outside of the amateur bands. Unlike the KXB30, which is wired permanently onto the KX1 main board, the KXAT1 hangs below the main board by tightly gripping inserted pins, so the unit can be easily removed and reinstalled. A menu setting allows the operator to bypass the KXAT1 when using a resonant antennas or an external tuner.

Summary

The KX1 is a truly innovative portable transceiver with ergonomic and electronic features that we would normally expect in larger and heavier radios. Since the KX1 can be carried easily in a backpack, a knapsack, a briefcase, a glove compartment or a coat pocket, owners will probably carry it frequently on trips away from home. Its frequency versatility makes the Elecraft KX1 a fine economical rig for home use as well. Only omission of 80 meter coverage keeps this from being a spectacular transceiver for the wilderness trekker.

K1/KX1 Comparison

The KX1 can be considered a smaller and in some ways more refined version of the earlier K1 with a different control layout. In many respects the KX1 is superior, particularly for the visually impaired and for those who enjoy shortwave broadcast listening. The K1 also has some advantages such as a built in speaker, an included noise blanker and more flexible band coverage. Since they both have a similar base cost, look over the features carefully to decide which one best fits your needs.

Manufacturer: Elecraft, PO Box 69, Aptos, CA 95001-0069; tel 831-662-8345; fax 831-662-0830; **www.elecraft.com**. Price: KX1 $279; KXB30 30 meter adapter: $29; KXPD1 paddle assembly: $69; KXAT1 antenna tuner module: $79.

The Yaesu FT-7800R Dual Band FM Transceiver

Reviewed by Joe Carcia, NJ1Q
W1AW Station Manager

There are two categories of operators in the market for dual or multiband FM transceivers. Some want crossband, full duplex and all possible options and flexibility. Others just want to have access to repeaters on multiple bands, and want a radio that is as straightforward as possible, so they don't have to reach for the manual every time they want to do something. To its credit, Yaesu has radios to satisfy both in their lineup. If you want the former, see the FT-8800R; for the

Bottom Line

The Yaesu FT-7800R provides a solid 2 meter and 70 cm FM mobile capability in a convenient package with all the features most amateurs need.

latter the FT-7800R, the subject of this review, provides the functions that most hams will want for successful 2 meter or 70 cm FM operation.

At First Glance

The '7800R is well sized for both mobile and base station use. If one is short on desktop space, its relatively small size makes setting it up on an operating desk an easy task. As with most mobile rigs, the '7800R comes prepackaged with a mounting bracket and complete hardware. If you wish to mount the front panel at the operating position and remote mount the body of the transceiver, this can be done with the optional YSK-7800 separation kit. As provided, the remote-head can be operated about 3 inches away with the short pigtail that separates the body and head, but most who want separate operation will opt for the separation kit.

The '7800R has receive capabilities from 108 to 520 MHz and 700 to 999.990 MHz, less cellular channels. Modes of operation are FM and AM—receive only. Although the receive mode selection is automatic, you can change this if desired.

It transmits from 144 to 148 MHz and 430 to 450 MHz. There are four power levels: 50, 20, 10 and 5 W on 2 meters, and 40, 20, 10 and 5 W on 70 cm. You don't see the actual power level on the display; rather you get the indication *High*, *Mid1*, *Mid2* and *Low*, respectively.

When you first see the radio, the myriad of buttons might be a bit intimidating, especially if you're "new" to this game. There's the standard fare of knobs: VOLUME, SQUELCH and DIAL (tuning/selection). Thirteen backlit buttons on the bottom and sides of the display allow for selecting the HYPER MEMORIES, MHZ TUNING, CTCSS TONE, POWER LEVEL, BAND, VFO or MEMORY, SCANNING, SMART SEARCH and WIRES. These buttons serve multiple functions and these labels are the default use of each button.

The Tuning (DIAL), VOLUME and SQUELCH knobs are non-rubber coated plastic and have a good feel to them. The DIAL knob is detented, but the feel is light for my touch. On a few occasions when I needed to use the DIAL for function or settings selection, I found I went right past my target. This may take some getting used to.

To the right of the DIAL knob you'll find four buttons. The top one controls the Internet connection feature, provided by their *WIRES* function. Next are two "Hyper Memories" and then the SMART SEARCH function. The POWER button is located above the DIAL. This button is not backlit, however, so in dim light you might find yourself feeling around for it.

To the left of the VOLUME and SQUELCH knobs you will find four buttons used to control three Hyper Memories and the MHz tuning. Below the display the other five buttons (controlling the functions mentioned above) round out the front panel. A release latch for the remote head is on the main body of the transceiver, located to the right of the VOLUME and SQUELCH knobs.

Looking right to left on the rear of the radio, are the 1/8 inch jack for an external speaker and the miniature 6 pin DIN used for 1200/9600 baud packet (depending on which pin you use). Next to that is the power line pigtail that terminates in a two pin standard locking power plug. In the center is the small cooling fan with heat sink fins. The chassis-mounted antenna connector (a standard SO-239, UHF type) located on the opposite side of the fan rounds out the back. The speaker is located on the top cover of the radio. The bottom part of the chassis is a large aluminum heat sink.

The amber LCD display is approximately $2\frac{1}{2} \times \frac{3}{4}$ inches, and displays all the various functions, including signal strength on both transmit and receive. The display has clear, easy to read letters and numbers. You can vary its brightness with the DIM menu setting.

Apply Power and Let's Go!

When the power switch is depressed, you're greeted with a reading of the current dc supply voltage and then the last frequency in use. Since this radio came to me from the ARRL Laboratory, I reset the CPU to make sure it would be in the condition you will receive it in. The radio defaults to the 70 cm band when first activated. A simple push on the BAND button and I'm on 2 meters. Since the automatic repeater shift defaults to on, I tuned to my favorite repeater (located about 11 miles away), gave a call and received a very good report. The receive audio sounded good, too—it was clear and readable. I always do the "crank up the volume" test, and even with it up quite high, the station was clear and easy to understand. Trips to other 2 meter and 70 cm repeaters yielded similar audio results. I ran simplex on 2 meters and found just a few of the local folk. Audio reports were quite good here as well.

The '7800 was shuffled back and forth between my truck and home station. When operating mobile, the rig performed as expected. Despite road and truck noise, I was still able to hear stations easily, and they didn't hear any degradation of my audio. I should mention that I'm taking power directly from the truck battery and going through a line filter. So if the radio were susceptible to alternator whine or "hash," I didn't hear any, nor did other stations hear it from me.

When it came to the viewing angle of the display, I found it was a bit critical. While I can see the display clearly when looking down at it or head on, it appears to "wash away" when viewing from the side. At what I estimated a 45° angle, the letters and numbers on the display disappeared altogether. So, as is often the case, the display viewing angle must be taken into account when selecting a mounting location.

While running at 10 W (*Mid2*), after awhile the heat sink got just noticeably warm. During heavy mobile operation at *Mid1*, I noticed it got warmer still (which it should, given the higher power). The cooling fan should take care of any additional heat buildup. Unlike some other radios that have an adjustment for the on and off times of the fan, this one starts at the beginning of a transmission, and will continue to run for about 30 seconds to a minute or so after you stop transmitting. Given its small size, you hardly hear it.

What is *Your* Function?

The '7800R includes the standard fare of functions found in many transceivers of similar design: Time-Out-Timer, Automatic Power Off, Channel Skip, Dual Watch function, Priority Channel Scanning, regular band scanning, etc. In the menu department, this rig's got 48 of them. You can change nearly everything from the tuning step (5, 10, 12.5, 15, 20, 25, 50 and 100 kHz) to the CTCSS tone scan and so on. The scanning function is accomplished by setting band scan lim-

Table 2
Yaesu FT-7800R, serial number 3L010228

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 108-520, 700-999.99 MHz (cell blocked); transmit, 144-148, 430-450 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 0.5 A (squelched); transmit, 8.5 A (high power).	Receive, 0.37 A; transmit, 7.6 A. Tested at 13.8 V.
Modes of operation: FM, AM (receive only).	As specified.
Receiver	***Receiver Dynamic Testing***
AM sensitivity, 10 dB S/N: 108-137 MHz, 300-336 MHz, 0.8 μV.	AM, 10 dB S+N/N: 120 MHz, 0.9 μV.
FM sensitivity, 12 dB SINAD: 137-150 MHz, 420-520 MHz, 0.2 μV; 150-174, 222-300 MHz, 336-420 MHz, 0.25 μV; 174-222 MHz, 0.3 μV; 800-900 MHz, 0.4 μV; 900-999.99 MHz, 0.8 μV.	For 12 dB SINAD, 144, 0.19 μV; 222 MHz, 0.2 μV; 430 MHz, 0.17 μV.
FM adjacent channel rejection: Not specified. 55 dB; 440 MHz, 57 dB.	20 kHz channel spacing: 146 MHz,
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 146 MHz, 55 dB*; 440 MHz, 57 dB*; 10 MHz channel spacing: 146 MHz, 94 dB; 440 MHz, 78 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	85 dB.
S-meter sensitivity: Not specified.	Max indication: 146 MHz, 6.5 μV; 440 MHz, 8.0 μV.
Squelch sensitivity: < 0.16 μV.	At threshold: 146, 440 MHz, 0.06 μV.
Receiver audio output: 2 W at 10% THD into 8 Ω.	2.3 W at 6% THD into 8 Ω.[1]
Spurious and image rejection: Not specified.	First IF rejection, 146 MHz, 115 dB; 440 MHz, 116 dB; Image rejection, 146 MHz, 100 dB; 440 MHz, 74 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output (H/M1/M2/L), 144 MHz: 50/20/10/5 W; 430 MHz, 40/20/10/5 W.	146 MHz, 54/19/9.1/4.2 W; 440 MHz, 38/18/9.3/4.4 W.[2]
Spurious-signal and harmonic suppression: 60 dB.	VHF, UHF, 67 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 146 MHz, 98 ms; 440 MHz, 108 ms.
Receive-transmit turnaround time (tx delay): Not specified.	146, 190 ms; 440 MHz, 180 ms.
Bit-error rate (BER), 9600-baud: Not specified.	146 MHz: Receiver: BER at 12-dB SINAD, 1.5×10^{-3}; BER at 16 dB SINAD, 1.4×10^{-4}; BER at –50 dBm, 2.1×10^{-5}; transmitter: BER at 12-dB SINAD, 4.1×10^{-3}; BER at 12-dB SINAD + 30 dB, 3.5×10^{-5}. 440 MHz: Receiver: BER at 12-dB SINAD, 1.4×10^{-3}; BER at 16 dB SINAD, 1.0×10^{-4}; BER at –50 dBm, 1.7×10^{-5}; transmitter: BER at 12-dB SINAD, 1.9×10^{-3}; BER at 12-dB SINAD + 30 dB, $<1.0\times10^{-5}$.

Size (height, width, depth): 1.6×5.5×6.6 inches; weight, 2.2 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]Maximum output.

[2]All measurements within instrument tolerance of specification.

its, memory or VFO scan or programmed scanned frequencies. There are also three *Scan Resume* limits.

It's safe to say that most of today's radios of this nature have some form of smart search. (This is a function by which you can have the radio scan a band or segment for local activity and store this information in memory.) I love running the smart search because I'm always curious as to what the radio picks up. Sure enough, like most others, the radio does a fine job of picking up activity all over the place. What I mean is that the '7800R will store in a repeater frequency, including 5 kHz up and 5 kHz below the actual frequency. If there were also bursts of noise or squelch tails, the radio stored them, too. This does not mean the radio has poor rejection or is susceptible to near-channel interference. Rather, the function is going about doing exactly what it's supposed to. So if one decides to use this (as opposed to leafing through the *ARRL Repeater Directory* to find local repeaters), then some consideration must be given to the fact that much more information may be stored in memory than is useable.

I like the automatic repeater shift function. Although it defaults to on, this function is user-changeable. The radio is shipped with certain frequency offsets already programmed for the country in which it's being sold. In the US, the 2 meter default offset is +600 or –600 kHz depending on the band segment. For 70 cm, it is ± 5 MHz. As long as this function is on, the '7800R will automatically determine the correct shift to use. If it becomes necessary to alter the default shift, it can be changed manually. You just need to first turn off the default repeater shift, and then set the new shift. This is all done via the menu system.

Never does a review go by that I don't listen to NOAA broadcasts. The '7800R has 10 preset NOAA weather channels, with a weather priority option. This option monitors selected weather channels for the emergency tone alert broadcast by NOAA during severe weather. This function can be deactivated through the use of the front panel buttons.

As with most current radios, the CTCSS encode and decode functions are built into the '7800R, along with digital coded squelch encoding and decoding, DTMF tones, pocket beep (similar to paging). If your repeater system supports a phone patch, then the DTMF autodialer function is a time saver. You can program in up to 16 different telephone numbers, each up to 16 digits in length. Most autopatch systems require activation tones and these tones can be placed in front of the telephone number so that activating the patch, and dialing the number, are all

done in one step.

The FT-7800R contains the *Auto Range Transponder System* (*ARTS*). This system allows for two (or more) parties to determine if they're within range of each other. As mentioned in the manual, this is a useful feature during search and rescue situations when parties need to be in close proximity to each other. In a nutshell, when activated, the radio will transmit a tone with a DCS code at regular intervals. If the radio does not receive a reply signal from a similarly programmed radio (because it's out of range), then the user is notified of that fact when the radio beeps and displays the message OUT RNG, meaning, out of range. Within *ARTS*, you can set the polling time as well as the CW identifier.

If you wish to "clone" the programmed information from one FT-7800R into another, you may do so via the packet connectors using a homemade cloning cable (instructions are included in the manual) and firmware is internal to the radio.

Which Brings Us to Programming

Programming the radio or memories can be a bit tedious at first. Read the manual carefully and once you get the hang of it, you'll find that it's not bad at all.

For example, to program in a repeater, you first punch in (using the microphone up/down buttons) or dial-up, the desired frequency while in VFO mode. Press and hold the V/M (MW) key for $^1/_2$ second until a memory number blinks in the upper left-hand corner of the display. Use the DIAL or mic UP/DOWN buttons to select a channel. When this is done, press the V/M (MW) button again to store the information. (Obviously, there's a little more to do depending on what else needs storing, such as CTCSS tones, but that's the general idea.)

Memory channels can also have alphanumeric tags appended to them. What's neat about this is that you can name the repeater or desired frequency. It sure beats having to try and remember what repeater 14x.xxx MHz was intended for! You assign an alphanumeric title to a memory channel by using the dial and BAND(SET) key to pick letters and numbers. You get the full complement of uppercase letters, numbers and some symbols.

Thanks for the Memories

The '7800R has a total of 1055 memory channels. There are 1000 "regular" channels, 5 "Home" channels, 50 sets of band-edge memories used for programming "scan" edges, 10 weather channels, 5 "Hyper Memory" channels (access via the front panel) and 20 memory banks. (The five "Hyper Memory" channels allow a user to program in up to five of one's favorite frequencies, and assign them to buttons on the front panel. Access to these frequencies is accomplished at the push of a button.)

The memory function is also handy in that it allows the user to program independent transmit frequencies. In other words, say you have a repeater that has an input on 70 cm, but an output on 2 meters (or, an FM satellite operating in Mode B). Within the memory programming, you select the receive or downlink frequency and store it in a particular memory channel. Then, you select the transmit or uplink frequency. Next, press the V/M (MW) button. Within 10 seconds of doing so, select the receive channel previously programmed. Then press and hold the PTT switch and the V/M (MW) button to store the transmit frequency. (Don't worry; you're not transmitting at this point.) The display will indicate "–+" when you are operating split in this manner.

The *Versatile* Microphone

The supplied microphone is the standard Yaesu DTMF MH-48. The keypad allows for direct frequency entry. Since the receiver coverage goes beyond the regular 2 meter/70 cm spread, your entire operating frequency must be keyed in. Unlike some older, or single band, radios, the 14x.xxx MHz is not automatic.

The coiled microphone cable can extend about 5 feet and terminates in an RJ45 plug. The buttons are backlit, and this can be toggled on and off with a switch on the side of the microphone. There is also a microphone LOCK switch located beneath the LAMP (backlight) switch. The PTT switch is large enough. I did find that the keypad buttons were easy to use, even though they are slightly recessed. Other buttons include P1, P2, P3 and P4. These buttons can be programmed to handle various functions, including mimicking some of the front panel buttons. If you decide to use another Yaesu type microphone (such as the MH-42) you will need to change the mic setting via the menu system.

Finally, the Manual

The 76 page manual is laid out in an easy to read format. You begin with the table of contents, general instructions, radio specs, and then a number of pages devoted to installation. Next comes basic operating. The manual starts off with the general functions, and leads the user into the more advanced features. The latter pages are devoted to menu functions and programming.

The Overall Appeal

I like that the FT-7800R is not so overwhelmed with additional features that it becomes too intimidating to use. Those extra functions are great for those hams who enjoy using them. For most of us who are looking for a straightforward dual-band FM transceiver with just enough bells and whistles, this rig fits the bill. Sure, you might not have full duplex or other "gee-whiz" features but that certainly doesn't detract from a solid radio that will meet your everyday needs.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.vxstdusa.com**. Price: $279.99; YSK-7800 Remote Separation Kit, $54.99.

Going Once, Going Twice . . .

In order to present the most objective reviews, ARRL purchases equipment off the shelf from dealers. ARRL receives no remuneration from anyone involved with the sale or manufacture of items presented in the Product Review, Short Takes or New Products columns.—*Ed.*

The ARRL-purchased equipment listed below is for sale to the highest bidder. Prices quoted are the minimum acceptable bids, and are discounted from the purchase prices. All equipment is sold without warranty.

Details of equipment offered and bidding instructions can be found on the ARRL members' Web page at **www.arrl.org/prauction**. Equipment for auction at this time:

Heil Pro-Set Plus (see "Product Review," Dec 2003 *QST*).

Heil HS-706 Headset for ICOM-706 series (see "Short Takes," Jun 2001 *QST*).

ICOM IC-703 QRP HF Transceiver (see "Product Review," Jul 2003 *QST*).

ICOM IC-703 Plus QRP HF/6 meter Transceiver (see "Product Review," Nov 2003 *QST*).

Yaesu FT-897 Portable HF/VHF/UHF Transceiver (see "Product Review," May 2003 *QST*).

Ten Tec Titan III HF Legal Limit Amplifier (see "Product Review," Mar 2004 *QST*).

Yaesu VR-500 handheld receiver (see "Product Review," Sep 2003 *QST*).

ICOM IC-R10 handheld receiver (see "Product Review," Sep 2003 *QST*).

SGS ADSP2 High-level audio Processor (see "Product Review," Dec 2003 *QST*).

SGS ADSP2 Low-level audio Processor (see "Product Review," Dec 2003 *QST*).

TECHNICAL CORRESPONDENCE

EXTENDED-RANGE MEASUREMENTS

By Colin Lamb, K7FM, 29830 NE Mountain Top Rd, Newberg, OR 97132; **k7fm@teleport.com**

◊ I love to build and repair radios, and I therefore have a pretty good assortment of test equipment. Yet, sometimes it is desirable to measure above the limits of that equipment. A few days ago, I wanted to test an electrolytic capacitor marked 200 µF. I have a digital voltmeter that measures only up to 20 µF, so I was out of luck—until I thought about it for awhile. A few years ago, I ran into the same limitation measuring resistance. I wanted to measure a resistance of about 50 MΩ, but my digital voltmeter had a maximum measurement of 2 MΩ.

Fortunately, I was saved by Ohm's Law and the formulas set forth in the trusty *ARRL Handbook*. In the case of the resistors, I realized that if I took a 2 MΩ resistor and placed it in parallel with the unknown resistor the resulting resistance would be less than 2 MΩ—thus measurable with the DVM. It would be simple to make a graph of the resulting resistance or calculate the unknown resistance using Ohm's Law. The formula for parallel resistance is:

$$R_{total} \quad \frac{R1 \times R2}{R1 + R2} \qquad \text{[Eq 1]}$$

In my case, using a 2 MΩ resistance, I calculated that my DVM would read as shown in Table 1 with the parallel unknown resistance. Using only Ohm's Law and one resistor, the measurement capability of the DVM was increased from 2 MΩ to over 100 MΩ.

It took me another two years to realize that I could do exactly the same thing with capacitors. Using a similar formula for series capacitors, I took a 20 µF capacitor and made sure it could be measured by the DVM. This time, however, I connected the two capacitors in series, rather than parallel. Be sure to watch polarity if you are using electrolytic capacitors in series. The formula for series capacitors is:

$$C_{resulting} \quad \frac{C1 \times C2}{C1 + C2} \qquad \text{[Eq 2]}$$

Using a 20 µF electrolytic capacitor, I calculated that the DVM would read as shown in Table 2 with the unknown series capacitor.

For both resistors and capacitors, it is possible to multiply the useful range of an inexpensive meter to measure components that would not otherwise be measurable using only one resistor or capacitor. Neither the resistor nor capacitor needs to be exactly the upper limit of the DVM. Simply choose a value as close as possible to the upper limit, measure the value and use the measured value in the formula. For convenience, you can use a spreadsheet to calculate numerous values and draw a graph that you can carry with the DVM.

Last weekend I was rebuilding an old radio and needed to measure inductance. My meter goes to 200 H but it was over that. I used the same procedure to measure inductance greater than my meter read.

Table 1

Actual versus measured resistance (in parallel with 2 MΩ)

Resistance of Unknown	*Measured Resistance*
2,500,000	1,111,111
5,000,000	1,420,000
10,000,000	1,666,666
20,000,000	1,818,000
100,000,000	1,960,000

Table 2

Actual versus measured capacitance (in series with 20 µF capacitor)

Actual C (µF)	*Measured C (µF)*
20	10
50	14.29
100	16.66
200	18.8
500	19.23
1000	19.6

POWER FACTOR

[Editor's Note: Several readers sent comments about Stu (N1SC) Cohen's "Power Factor" sidebar in "Could You Use a Low Power AC Wattmeter?" *QST*, Jan 2004, pp 56-59. N1AL's is representative.]

By Alan Bloom, N1AL, 1578 Los Alamos Rd, Santa Rosa, CA 95409; **n1al@arrl.net**

◊ The simple low-power ac wattmeter by W6BNB in January *QST*[1] is a nice construction project. However, while the recommended method of calculating power is correct for resistive loads such as light bulbs and heaters, it is incorrect for most electronic devices.

The sidebar by N1SC correctly points out the error with inductive loads due to the non-unity power factor. However, any power supply that uses a rectifier and capacitive filter to generate dc also has a non-unity power factor. That includes nearly all electronic devices in use today, such as computers, televisions, transceivers and dc power supplies.

The error is typically more than a factor of two. With a capacitor-input filter, the current through a full-wave rectifier flows only for relatively brief pulses at the positive and negative peaks of the voltage sine wave. (See Figure 1.) Assuming short rectangular pulses, the true rms power is approximately:

$$P_{rms} \quad I_{peak} \times E_{peak} \times DF \qquad \text{[Eq 3]}$$

where

E_{peak} = peak voltage,
I_{peak} = peak current and
DF = duty factor (the fraction of time that current is flowing).

$$I_{rms} \quad \sqrt{\left(I_{peak}^{2} \times DF\right)} = I_{peak} \times \sqrt{DF} \qquad \text{[Eq 4]}$$

$$E_{rms} \quad \frac{E_{peak}}{\sqrt{2}} \qquad \text{[Eq 5]}$$

The power factor is:

$$PF \quad \frac{P_{rms}}{\left(I_{rms} \times E_{rms}\right)} = \frac{I_{peak} \times E_{peak} \times DF}{\left(I_{peak} \times \sqrt{DF} \times \frac{E_{peak}}{\sqrt{2}}\right)} = \sqrt{2 \times DF} \qquad \text{[Eq 6]}$$

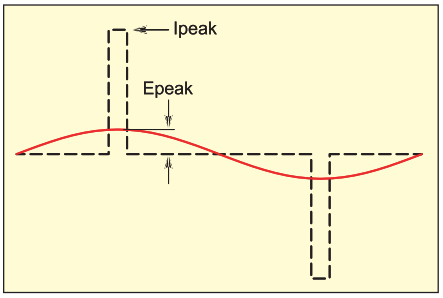


Figure 1—Waveforms for voltage (E) and current (I) for a rectifier circuit with a capacitor-input filter. The current through a full-wave rectifier flows only for relatively brief pulses at the positive and negative peaks of the voltage sine wave.

[1]R. Schrader, W6BNB, "Could You Use a Low Power AC Wattmeter?" *QST*, Jan 2004, pp 56-59.

For example, if the duty factor is 0.1 (10%), then PF is 0.45.[2]

If a true-rms voltmeter is used in W6BNB's circuit, the rms power will typically read high by more than 100%. However, most inexpensive ac voltmeters do not measure true rms but rather measure the average value of the current magnitude. For sine waves, that is slightly less than the rms value, so the meter display is scaled by the proper factor, $\pi/(2\sqrt{2})$, to indicate rms. Yet, that is only accurate when measuring sinusoidal waveforms.

Fortunately, when measuring the pulse-like currents associated with most power supplies, the error is such as to make the calculated power less inaccurate. It can be shown that the rms power as calculated in the article is too low by a factor $\pi/4$ (0.785), assuming short rectangular current pulses.[3] That does not include the power loss and stray inductance of the power transformer (if any) or other power-supply components, and it ignores the effect of finite rectifier conduction angle. However, I think reasonable accuracy can be obtained by applying a correction factor of 1/0.8 = 1.25 to the values calculated as described in the article.

By Stu Cohen, N1SC, QST *Technical Editor;* **n1sc@arrl.org**

◊ Power factor can be a complex issue and N1AL has addressed the power supply issue well. I'm glad we raised the issue of power factor; the subject of reactive power is glanced over lightly in residential electric service, but it can be significant. Significant enough, apparently, to warrant the design of power-factor correction ICs that compensate a switching supply's conduction angle to bring a device's power factor closer to unity. It would be interesting to measure the power factor of some of our modern higher power amateur equipment. I think we'd all be enlightened with regard to all those VARs!

[2]Those interested in more detail should download 04TC03.zip from the ARRLWeb at **www.arrl.org/files/qst-binaries/**.

[3]The average current magnitude is $I_{avg} = I_{peak} \times DF$. The value displayed by the meter is: $\frac{\pi}{2\sqrt{2}}$ times that value, so the calculated power is:

$$P_c = I_{peak} \times DF \times \frac{\pi}{2\sqrt{2}} \times E_{rms}$$

$$= I_{peak} \times DF \times \frac{\pi}{2\sqrt{2}} \times \frac{E_{peak}}{\sqrt{2}}$$

$$= I_{peak} \times E_{peak} \times DF \times \frac{\pi}{4}$$

so that $P_c / P_{rms} = \pi/4$.

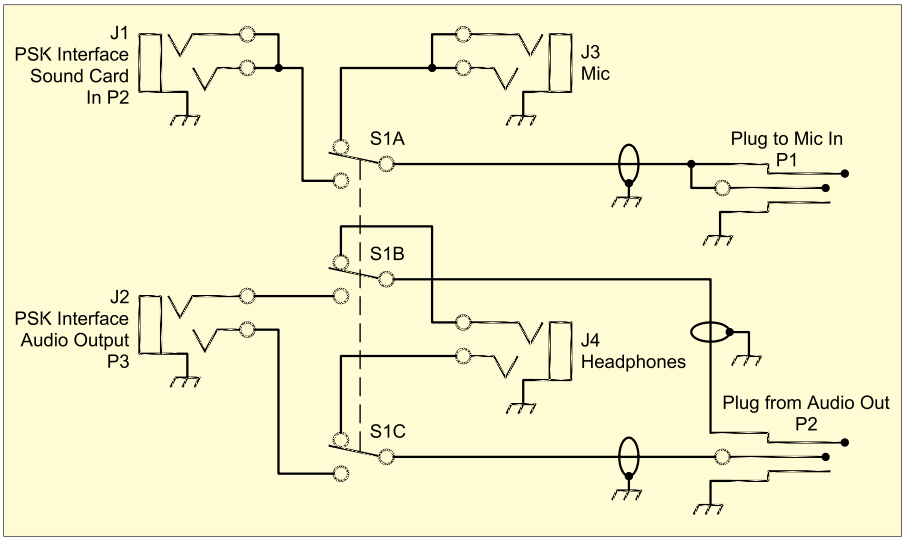


Figure 2—A schematic of K8AXW's PSK31 switch box. Remember that J1 is the *interface* input, which connects to the sound card output. Similarly, J2 is the interface output, which connects to the sound card input.

J1, J4—Enclosed open-circuit jacks (RS274-249).
S1—3PDT or 4PDT (one unused) toggle switch, or use a SPDT and a DPDT toggle switch (RS275-625) and (RS275-626).
1—Aluminum enclosure (RS270-235).
4—1/8-inch stereo phone plugs (RS274-284).
Cable—RG-174 RadioShack audio cable (RS278-512).

A PSK SWITCH BOX

By Allen T. Polland, K8AXW, 1335 Ludwick St, Keyser, WV 26726; **k8axw@arrl.net**

◊ After successfully building the PSK-31 interface from the February 2001 Technical Correspondence article, I faced the next obstacle to effortless PSK operation. How could I eliminate the need to make and break connections at the sound card jacks when I wanted to operate PSK?

The answer is obvious and rather straightforward: A switch-box! While anyone who knows how to use a soldering iron can design and build such a simple device, it is much easier if one has a schematic (Figure 2) and a list of part numbers from RadioShack.

I built the switch-box using RadioShack's aluminum P-box enclosure to help preserve system shielding. I mounted all jacks and the switch on the top of the box to give easy access to the plugs and switch.

Two jacks are mounted on each end of the top and the switch is mounted in the center. When the switch handle is leaning toward a pair of jacks, these jacks are in service—simple.

I painted the box before mounting and wiring the hardware to make it look presentable. Instead of labeling, I followed the color coding of sound card jacks: green for Audio Out and red for Mic In. I used a cotton swab and model paint to put a drop of paint next to each jack and on each plug.

Remember that the audio output of the sound card is stereo. Keep in mind that one must wire the box so the "ring" and "tip" is wired through the plugs, jacks and switch without crossing them. I wired the audio output jacks so that I would have the option of using either end of the cable for PSK31 or the computer. The PSK31 interface uses only the "tip" and ground of the stereo plug so the "ring" wires to the PSK jacks can be eliminated if you wish.

The sound card mic output uses a stereo plug but the "ring" and "tip" are connected together. This should be done on both ends of the mic circuit. Make up two cables to go from one end of the switch box to the Audio Out and Mic In connectors on the computer sound card. The PSK31 interface is plugged into the appropriate jacks on one end of the box and the computer speakers and mic are plugged into the opposite end. It is now a simple matter of flipping a switch to go between PSK31 and the computer sound.

Technical Correspondence items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given idea will work for your situation, we make every effort to screen out harmful information.

Letters for this column may be sent to Technical Correspondence, ARRL, 225 Main St, Newington, CT 06111, or via e-mail to **tc@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 a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents. QST

FCC Okays BPL Proposal

FCC

FCC Commissioners (from the left) Kevin Martin, Kathleen Abernathy, Michael Powell (chairman), Michael Copps and Jonathan Adelstein.

The FCC unanimously approved a *Notice of Proposed Rule Making* (*NPRM*) February 12 to deploy Broadband over Power Line (BPL). The *NPRM* marks the next step in the BPL proceeding, which began one year ago with a *Notice of Inquiry* (ET 03-104) that attracted nearly 5200 comments—many from the amateur community. The FCC did not propose any changes in Part 15 rules governing emissions from unlicensed devices, but said it would require BPL providers to apply "adaptive interference-mitigation techniques." An ARRL delegation that included President Jim Haynie, W5JBP, attended the FCC open meeting in Washington and later expressed disappointment in the FCC action.

"The Commission clearly recognized that the existing Part 15 emission limits are inadequate to stop interference," ARRL CEO David Sumner, K1ZZ, said, "but it's placing the burden of interference mitigation on the licensed user that's supposed to be protected."

Sumner said that if the FCC really believed current Part 15 emission limits were sufficient, it would not have had to require that BPL providers institute interference mitigation systems. At press time the FCC had not released the actual *NPRM*, and a presentation by the FCC's Office of Engineering and Technology (OET) revealed only its broad outlines. Sumner said the League would not take a formal position until it had reviewed the full *NPRM*.

Anh Wride of the OET staff spelled out the scope of the *NPRM*, which only addresses so-called "access BPL"—the type that would apply radio frequency energy to exterior overhead and underground low and medium-voltage power lines to distribute broadband and Internet service. She said the OET staff believes that interference concerns "can be adequately addressed." Wride said the FCC's BPL *NPRM*:

- applies existing Part 15 emission limits for unlicensed carrier-current systems to BPL systems. Part 15 rules now require that BPL systems eliminate any harmful interference and "cease operation if they cannot," she noted.
- requires BPL systems to employ "adaptive interference-mitigation techniques, including the capabilities to shut down a specific device, to reduce power levels on a dynamic or remote-control basis and to include or exclude specific operating frequencies or bands."
- subjects BPL providers to notification requirements that would establish a public database to include the location of BPL devices, modulation type and operating frequencies.
- proposes guidelines to provide for consistent and repeatable measurement of the RF emissions from BPL and other carrier-current systems.

Mirroring his colleagues' enthusiasm, FCC Chairman Michael Powell called BPL "tremendously exciting," although he conceded that BPL has "a long way to go." Powell also said the FCC's OET has worked very hard to try to "get their hands around" the issue of interference and that the FCC would continue its vigilance in that area.

The FCC has posted additional information, including a public notice, on its Web site, **www.fcc.gov**. The Commission was expected to issue the complete *Notice of Proposed Rule Making* within a few days of the February 12 approval of the *NPRM* and invite comments on it sometime after its publication.

Additional information about BPL and Amateur Radio is on the ARRL Web site, **www.arrl.org/tis/info/HTML/plc/**. To support the League's efforts in this area, visit the ARRL's secure BPL Web site **https://www.arrl.org/forms/development/donations/bpl/**.

League Files "Plan for the Next Decade" with FCC

The ARRL in late January filed a *Petition for Rule Making* asking the FCC to amend its Part 97 rules to create a new entry-level license, reduce the number of actual license classes to three and drop the Morse code testing requirement for all classes except for Amateur Extra (see "ARRL Board Seeks Major FCC License Restructuring," *QST*, Mar 2004, p 42). The ARRL says its petition follows in the footsteps of changes in Article 25 of the international Radio Regulations adopted at World Radiocommunication Conference 2003 (WRC-03). Among those changes, WRC-03 left it up to individual countries to determine whether or not to mandate Morse testing for HF access. While several countries—including Germany, the UK and Australia—already have dropped their Morse requirements, the ARRL emphasized in its petition that Morse code is *not* the central issue.

"Changes in Morse telegraphy are one aspect of the proposal, and it would be insufficient for the Commission to address those issues in a vacuum," the League said in its petition, which it called "a plan for the next decade." The ARRL said that plan's overall intention is "to encourage newcomers to the Amateur Service and to encourage those who enter its ranks to proceed further on a course of technical self-training and exposure to all aspects of the avocation."

As of press time, the FCC had not yet assigned a Rule Making (RM) number to

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

the ARRL's petition. The FCC has requested that individuals not contact or attempt to comment to the FCC on the ARRL's restructuring proposal before that happens.

Last fall, a total of 14 Morse-related petitions were filed with the FCC. Several called on the Commission to drop the Morse requirement altogether, while others proposed to keep and even expand the requirement or put forth various license restructuring schemes of their own. The petitions, RM-10781-10787 and RM-10805-10811, attracted thousands of comments from the amateur community.

Beyond the Morse question, the ARRL says, the time is right—now that WRC-03 has finished its work—to follow through on the restructuring process the FCC began with its 1999 restructuring *Report and Order*, WT 98-143. Among other things, that landmark *Order*, which became effective April 15, 2000, reduced the number of Morse code test elements from three to a single 5 WPM requirement for all license classes offering HF privileges.

Simply dropping the Element 1 (5 WPM) Morse requirement, the ARRL asserted, would fail to address the critical need for an entry-level ticket other than the Technician. Calling the Technician license "a dead end" for many people, the ARRL said its proposed entry-level license—being called "Novice" for now—would offer newcomers a much wider sampling of Amateur Radio. It would require passing a 25-question written examination—but no code test—and would offer limited HF phone, image, CW and data privileges at modest power output levels.

"This structure provides a true, entry-level license with HF and other operating privileges which will both promote growth in the Amateur Service and integrate newcomers into the mainstream of Amateur Radio," the ARRL told the FCC. "It will better introduce newcomers to more seasoned licensees who will assist them."

The League proposal also would consolidate current Technician and General licensees into General class without further examination. Future General applicants would not have to pass a code test, but the written exam would remain the same. Current Advanced licensees would be merged into Amateur Extra class without further testing, and the Extra exam would remain intact. The ARRL proposal would retain the Element 1 Morse exam for Extra class applicants.

The ARRL said its overall plan dovetails with the FCC philosophy and goals stated in its 1999 *Report and Order*—to simplify the license structure and streamline the licensing process. The League said its plan would implement licensing requirements and privileges that are in harmony with each other. The plan is designed to attract and retain "technically inclined persons, particularly the youth of our country" and encourage them to advance in areas "where the United States needs expertise."

"Now, the issue is not merely whether there should or should not be Morse telegraphy as an examination requirement," the ARRL said, "but rather what is the best overall approach for positioning the Amateur Service for future growth and incentive-based self-training."

A copy of the ARRL's *Petition for Rule Making* is available on the ARRL Web site, **www.arrl.org/news/restructuring2/restrux2-petition.pdf**.

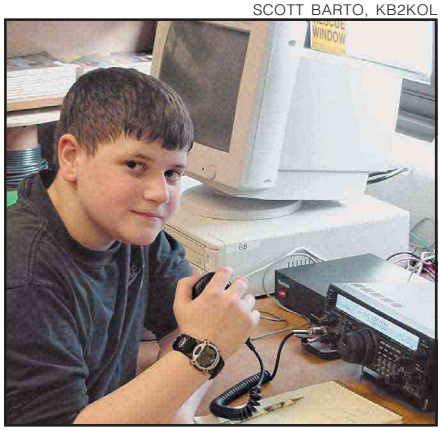
AMATEUR RADIO EDUCATION & TECHNOLOGY PROGRAM'S RANKS, ENTHUSIASM EXPAND

Since becoming ARRL Amateur Radio Education & Technology Program (ETP) Coordinator in June 2003, Mark Spencer, WA8SME, has seen the number of the program's pilot schools rise from 50 to 70. Fourteen schools came aboard last fall, while another three schools already in the program received progress grants of up to $500 to help them continue their program activities.

"The new schools coming onboard are approaching this program with a lot of enthusiasm that I hope will continue," Spencer said. He's also hoping their upbeat attitude will be infectious, and that other schools will follow the lead of the ones that have experienced the greatest success.

"The success of a program school boils down to the teacher, community and administration support and local Amateur Radio club support," Spencer says. "Schools that can get all these things together are really doing well."

SCOTT BARTO, KB2KOL



This young man is a student at Gowanda Middle-High School in Gowanda, New York—an ETP school since May 2002. The Gowanda Central School District Amateur Radio Club's call sign is KC2KJN.

The ARRL program subsidizes the cost of an Amateur Radio station for each participating school—typically about $2800, Spencer says. To better spell out the League's expectations, lead teachers and principals now must agree in writing to make a good-faith effort to integrate Amateur Radio and wireless technology into their curricula for at least three years. "We have a responsibility to our donors," Spencer explains.

Spencer sees his role as supporting pilot schools by helping teachers to integrate the Education and Technology Program's curriculum into their classroom pursuits. "This has to be a grassroots activity," he says. The program curriculum is available on the ARRL Web site, **www.arrl.org/FandES/tbp/Curriculum-Materials.html**.

On the other hand, he recognizes that schools in recent months have faced heavy budget cuts that have compelled school administrators to pull back on enrichment activities. "Our program has mitigated the costs for schools," Spencer points out. But since the ARRL cannot provide much more than initial seed money for equipment, affiliation with a local club becomes all the more essential.

Not just money but time is at a premium for today's educators, especially for extracurricular activities. "Teachers are already stretched too thin," Spencer says. That's where local Amateur Radio clubs come in. "The clubs can do a better job than we can do from here in supporting a participating school's program." Some clubs have provided additional equipment to the schools too. Even more important: Club members often offer their ham radio experience and expertise to mentor youngsters in participating schools.

Spencer says it's hard to put a price tag on that kind of contribution.

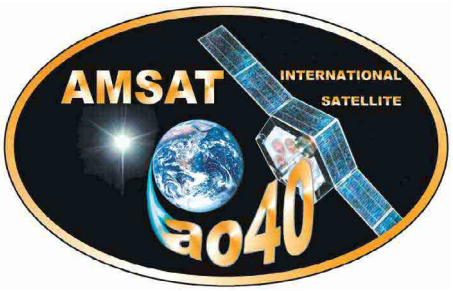
While the Amateur Radio Education and Technology Program typically is an after-school activity, Spencer says more and more schools are integrating Amateur Radio into their science curriculum. Although licensing students is not a primary program goal, many youngsters have become Amateur Radio operators as a result of their program involvement. More important to Spencer is the exposure to technology the program provides. "They're spending an average of five hours per week talking about wireless technology and Amateur Radio," he says.

There's more information about the ARRL Amateur Radio Education & Technology Program on the ARRL Web site, **www.arrl.org/FandES/tbp/**. The ARRL Development Office invites support for

this initiative via its secure Web site, **https://www.arrl.org/forms/development/donations/education/index.html**.

AO-40 COMMAND TEAM PLAYS WAITING GAME

At press time, ground controllers for the AO-40 satellite were waiting for something to break aboard the spacecraft, which went dark in late January. Specifically, they were looking for one of the cells of the main battery bank to open up and "unshort" the power bus. That open circuit then could mean the command team would be able use the auxiliary batteries—tied in parallel with the main battery bank—to restart the satellite. The command team hypothesizes that a failure within the main battery was clamping the bus voltage low. In the hope that a receiver still was operating despite the low voltage,



the command team was continuing to signal AO-40 to turn off its main batteries and turn on the auxiliary batteries and the 2.4 GHz "S2" downlink transmitter.

AO-40 went silent January 27 (UTC) following a precipitous voltage drop. The satellite's controllers believe that one or more shorted battery cells are at the root of the problem.

There's some conjecture that the problem may be related to the near-catastrophic incident that occurred onboard AO-40 in December 2000, less than a month after its launch during testing of the 400-newton propulsion system. Following that incident, the AO-40 command team was able to restore some of the satellite's functionality.

Additional information on AO-40 is on the AMSAT-NA Web site, **www.amsat.org**.

MUSICAL CHAIRS FOR NEXT ISS CREWS

Not long after replacing the commander of the next International Space Station crew in January (see "Chiao to Replace McArthur as Next ISS Commander," *QST*, Mar 2004, p 79), NASA and its ISS partners announced the assignment of an altogether new crew. The Expedition 9 crew, which heads for the ISS this month

FCC News

FCC CORRECTS CALL SIGN GOOF

The FCC in January ordered that a Chesapeake, Virginia, amateur would have to give up the vanity call sign it erroneously granted him in August 2002. In an *Order of Modification*, the FCC said it would modify the license of Richard L. Smith, KC4USH, to return his call sign to KG4UKV—his former call sign. The change had not occurred by press time, however.

The FCC concluded that the grant of KC4USH as a vanity call sign "was defective because the call sign is included in the call sign block KC4USA through KC4USZ, which is available to the Department of the Navy for the use of amateur stations at US Navy Antarctic stations," the *Order* said. The FCC said it was unable to simply set aside the grant because it did not become aware of its error until more than 30 days after making the grant.

After the FCC indicated its intention to pull back the call sign Smith protested, saying that he'd picked KC4USH because it was used at Cape Hallett Station, Antarctica, when his father was there during "Operation Deep Freeze 60." Smith further argued that he'd applied for the call sign in good faith and that he'd spent considerable personal funds to make others aware that he was assigned this call sign. He also pointed out that the US Navy had not used KC4USH for 30 years.

Although it apologized to Smith, the FCC turned him down anyway, reaffirming that modifying his license to reflect his previously held call sign would serve the public interest by ensuring that the call sign block KC4USA-KC4USZ is only used to identify amateur stations that are located at US Navy Antarctic stations. The FCC said the reason a licensee requests a particular vanity call sign "is not a sufficient basis to allow a licensee to retain a call sign that is otherwise unassignable to the licensee's station" under the FCC rules.

Amateur Enforcement

♦ **FCC goes after alleged 10 meter scofflaws:** The FCC in January was working on at least two fronts to eliminate unlicensed operation from the 10 meter band. FCC Special Counsel Riley Hollingsworth sent warning notices to two shipping companies regarding reports to the Commission that some of the companies' vehicles may be the source of illegal radio transmissions on the amateur band. One of the companies, UPS, promptly offered its full cooperation.

"Many truckers use CB radio, which does not require a license," Hollingsworth pointed out in letters to UPS offices in Ohio and Indiana and to R&L Transfer Inc of Ohio. "However, any person using a radio transmitter on the Amateur Radio bands must possess a station and operator license." Hollingsworth asked the over-the-road shippers to advise their drivers that such radio operation could subject them to heavy fines and seizure of their radio equipment.

UPS Attorney Daniel N. Tenfelde responded to assure Hollingsworth that his company was taking its *Warning Notice* seriously. "We discovered that some employees had obtained CB radios that contained a mechanism allowing them to switch frequencies into the 10 meter Amateur Radio band," he told Hollingsworth in a January 28 letter. "It is not UPS policy to allow equipment such as this to be used in our vehicles." He said UPS' contract with the Teamsters Union allows only for CB radios.

Tenfelde said UPS was working with its transportation and labor groups to let drivers know that such unlicensed operation violates both UPS policy and FCC regulations.

In a parallel development, the FCC issued a *Citation* to Jonathan Edward Stone, doing business as Omnitronics/Pacetronics for alleged violation of §302(b) of the Communications Act and §2.803(a)(1) of the Commission's rules. An investigation by the FCC's Dallas field office led the Commission to allege that Omnitronics/Pacetronics was offering more than two dozen uncertificated "Citizens Band" transceivers via its Web site. The FCC says Omnitronics/Pacetronics was marketing the units as Amateur Radio equipment, which does not require FCC certification (formerly known as "type acceptance").

"The Commission has evaluated radio frequency devices similar to those listed and concluded that the devices at issue are not only amateur radios but can easily be altered for use as Citizens Band devices as well," said the FCC Citation from FCC Dallas District Director James D. Wells. The FCC said it concluded that the devices fall within the definition of CB transmitters that "cannot legally be imported or marketed in the United States."

NASA

Astronaut Mike Fincke, KE5AIT.

NASA

Cosmonaut Gennady Padalka, RN3DT.

aboard a Russian *Soyuz* vehicle, will consist of astronaut Mike Fincke, KE5AIT, and cosmonaut Gennady Padalka, RN3DT. Padalka, 45, will serve as Expedition 9 commander and *Soyuz* commander, while Fincke, 36, will be the NASA ISS science officer and flight engineer. Fincke and Padalka have been training together as a space station crew for nearly two years, NASA said, and their experience as a team was cited as a primary reason for the personnel shift. The Expedition 10 crew assignments also will change.

"After a very thorough evaluation by our partners, I'm confident that these assignments make the very best use of our crew resources and skills and will ensure the flights' full success," NASA Chief Astronaut Kent Rominger said.

Fincke passed his Amateur Radio Technician class exam February 12, and his call sign arrived less than a week later—in plenty of time for Expedition 9's April 18 launch. Having an US Amateur Radio licensee aboard is necessary if the Amateur Radio on the International Space Station—or ARISS—program is to continue its schedule of school group contacts via NA1SS.

Last November, NASA and Russia had decided on William McArthur Jr, KC5ACR, as Expedition 9 crew commander and cosmonaut Valery Tokarev as flight engineer for the six-month mission. In January, however, NASA swapped McArthur for Leroy Chiao, due to a temporary medical issue affecting McArthur. Chiao and Russian cosmonaut Salizhan Sharipov now have been assigned to Expedition 10. Chiao also has been studying for his ham radio license while undergoing training in Russia.

This will mark Fincke's first space flight. It's the second for Padalka, who lived aboard the Russian *Mir* space station for 198 days in 1999.—*NASA*

LAST YEAR'S YOUNGEST GENERAL NOW THIS YEAR'S YOUNGEST EXTRA

An Oregon girl considered a little more than a year ago the youngest General class licensee in the US now may be the country's youngest Amateur Extra ticket holder. Seven-year-old Mattie Clauson, AD7BL (ex-KD7TYN and ex-KD7SDF), of Roseburg passed her Extra examination January 14 during a Valley Amateur Radio Club ARRL-VEC volunteer examination session in Eugene. The FCC granted her new ticket and Extra-appropriate call sign January 20.

"I DID IT! I DID IT! I DID IT! I PASSED MY EXTRA CLASS EXAM!!!!! YIPPEEE!!!" Mattie exclaimed loudly on the QRZ.com Web site. She also announced her accomplishment in a message routed via the RSØISS packet system on the International Space Station. Mattie says she'd like to talk with one of the ISS astronauts some day. She's also a member of the ISS FanClub and enjoys digipeating through RSØISS.

TIM CLAUSON, AC7SP

Mattie Clauson, AD7BL, at her station. Her jumpsuit reflects her intense interest in the International Space Station.

Mattie's proud papa, Tim Clauson, AC7SP, says his daughter missed only four of the questions on the Element 4 test, which Mattie described as "really, really hard!" Whether she is the youngest Extra in the US is difficult to determine since the FCC no longer makes date-of-birth information public.

Several of the very youngest amateur operators in the US have been female. In 1948, Jane Bieberman, W3OVV (now Jane De Nuzzo and still holding the same call sign), made the December cover of *QST* for getting her General ticket when she was just barely 10 years old. Rebecca Rich, KBØVVT—a very active amateur—got her Extra ticket in 1997 at age 8. The parents of both girls were amateur licensees.

Mattie's own ham radio heritage also may have been a big plus. Her late great grandfather, S. A. "Sam" Sullivan, was W6WXU; his daughter, Joan Brady—Mattie's grandmother—now holds his former call sign. That makes Mattie a fourth-generation Amateur Extra class licensee. Mattie concedes that she would not have made it to Extra without a lot of study help and guidance from her parents (her mom, Charlotte, is AC7XM) and practice examinations on the QRZ.com Web site. The Clausons all are ARRL members.

Mattie says she continues to enjoy working HF SSB, especially DX. In addition to various HF nets, she also regularly checks into the Douglas County Amateur Radio Emergency Service Net as a visitor. Aside from ham radio, her dad says, Mattie—who is home schooled with two younger sisters—is "a regular kid who likes riding her bike, playing with her sisters and friends and flying her toy airplanes. She even likes to play in the mud."

Mattie hopes to be sporting a new vanity call sign soon. Her father says she's applied for AE7MC—*A*mateur *E*xtra *7* (year-old) *M*attie *C*lauson, her dad explained.

SSB, RADAR PIONEER MIKE VILLARD, W6QYT, SK

Renowned RF engineer, Stanford University researcher and author Oswald Garrison "Mike" Villard Jr, W6QYT, of Palo Alto, California, died January 7. He was 87. A pioneer of Amateur Radio single sideband (SSB) and meteor-scatter techniques, Villard authored some two dozen *QST* articles between 1946 and 1994. He also was the author of more than 60 technical papers and held a half-dozen patents.

"His technical achievements were leg-

endary," Dave Leeson, W6NL, a consulting professor of electrical engineering in Stanford's Space, Telecommunications and Radioscience Laboratory (STARLab), told Stanford University News Service. "Stanford and the entire engineering community were enriched by his person and his accomplishments."

The son of O. G. Villard Sr, a noted publisher and editor (*The New York Evening Post* and *The Nation*), Mike Villard developed an interest in radio while still a youngster. He was first licensed as W1DMV in 1932, while living in Connecticut. His father wanted him to follow in his footsteps, so the younger Villard earned a bachelor's degree in English from Yale in 1938. He then headed to Stanford University to pursue his first love—electrical engineering. While at Stanford, he studied under Professor Frederick Terman (ex-6FT and 6AE), later regarded as the "father of Silicon Valley."

During World War II, Villard followed Terman to work at Harvard University's Radio Research Laboratory on enemy countermeasures research. He returned to Stanford after the war, joined the school's electrical engineering faculty in 1946 and completed his PhD in 1949. He taught and carried out research at Stanford for five decades, and he headed STARLab's predecessor—The RadioScience Laboratory—from 1958 until 1972.

Among his Amateur Radio accomplishments, he experimented with and championed single-sideband, suppressed-carrier modulation in 1947, and the Stanford Amateur Radio Club's W6YX is said to have been the first ham station to use SSB transmission. While a student, he also served as the club's president, and from the 1950s through the early 1980s he was the trustee of W6YX. An ARRL member for many years, Villard was also a past scientific advisor to the Northern California DX Foundation.

During his career at Stanford (and later at Stanford Research Institute—SRI), Villard pioneered the concept and development of a program to design and build an over-the-horizon radar system to detect incoming military aircraft and high-altitude missiles. In addition, he demonstrated the feasibility of the "stealth aircraft" concept by using specially treated low-impedance surfaces. Among his awards were a

In Brief

- **President Bush thanks ham radio volunteer:** Shortly after stepping off Air Force One February 5 during a visit to South Carolina, President George W. Bush took a few moments to express his appreciation to ARRL member and Charleston County ARES Emergency Coordinator Charlie Hall, K4AOT. "For all Charlie has done for ham radio and the community, he certainly deserves to be put in the spotlight," said his friend Alex Krist, KR1ST. A member of the Charleston Amateur Radio Society (CARS) and a retired US Army sergeant, Hall, 64, volunteers with a newly formed Community Emergency Response Team (CERT), a Citizen Corps program. The president shook Hall's hand and thanked him for his efforts on behalf of the community. ARRL is a Citizen Corps affiliate, and in a growing number of localities, Amateur Radio emergency response activities are being incorporated into CERTs. Hall, who also volunteers with the American Red Cross and a SKYWARN team, was tapped as Charleston County's "official greeter" for the presidential visit mainly because of his Citizen Corps/CERT activity. CARS President Kenneth Bible, AF4ZV, called Hall "a great asset" to the club who assists in many public service events. "He is always an enthusiastic volunteer in our communications team," he said, adding that Hall has helped CARS to experiment with and implement non-voice modes for public service and emergency work, such as packet and APRS.—*some information from Alex Krist, KR1ST, and Jim Boehner, N2ZZ*

- **New Jersey amateurs promote ham radio to youngsters:** Amateurs in the Trenton, New Jersey, area were out in force over the January 10-11 weekend to promote Amateur Radio at the New Jersey State Museum's "Super Science Weekend." It marked the first time ham radio was included in the annual event, which attracts nearly 10,000 children and parents. Super Science Weekend this year included a large Amateur Radio display and working HF and VHF stations. "Many of the children liked learning to send their names in Morse code using a straight key and code practice oscillator," said ARRL PIO Gary Wilson, K2GW, who coordinated the event. Visitors saw the ARRL's *Amateur Radio Today* video, which showcases Amateur Radio's role in emergencies. They also could get literature on how to get started in Amateur Radio, including information on licensing classes. Contacts were made on SSB and PSK31 using the Delaware Valley Radio Association's W2ZQ call sign. Taking advantage of record cold temperatures, the ingenious hams used gallon jugs filled with water and frozen to the pavement to provide antenna support guy wire anchors. Led by the Delaware Valley Radio Association, hams from the Warminster Amateur Radio Club and the David Sarnoff Radio Club also pitched in to provide 15 hours of continuous coverage over the course of the two-day event. The amateurs now hope ham radio will become a regular feature of the Super Science Weekend. "Only by introducing kids to Amateur Radio can we assure a solid future for our hobby and our ability to serve the nation," Wilson concluded.

- **AMSAT announces ECHO launch delay:** AMSAT-NA President Robin Haighton, VE3FRH, announced in February that due to a delay in the delivery of the primary payload to the launch site in Kazakhstan, the launch of the ECHO satellite will not take place until early summer. "The 'official' launch date is now June 29, 2004," Haighton said. "I assume that this new date is the start of the new launch window, which may last several weeks." A sculpture of the now-ailing AO-40 satellite sold January 31 in an eBay auction for $1225. The proceeds, less sales fees, will benefit the AMSAT ECHO satellite project.—*AMSAT-NA*

- **Vote on *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for January is Rod Vlach, NNØTT, for his article "The Challenge of Being a Little Pistol." Congratulations, Rod! 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**.

Meritorious Civilian Service Award from the Department of the Air Force and the Secretary of Defense Medal for Outstanding Public Service.

Another accomplishment was the design of a simple, small high-frequency receiving antenna that aided in nulling out signals that jammed broadcasts of the Voice of America, the BBC and others. Among his ham radio designs was the Select-O-Ject marketed by National Radio.

The family requests donations in support of the Mike Villard Memorial Fund to SRI International, 333 Ravenswood Ave, AD-114, Menlo Park, CA 94025. *—some information from Stanford News Service*

Media Hits

■ Some hams may have thought they'd left their transceivers turned on Tuesday, February 17, when the popular National Public Radio afternoon news magazine *All Things Considered* ran a piece about the pending addition of the @ symbol to the official international Morse code lexicon. That's because NPR introduced and closed the nearly four-minute segment with actual CW, catching the ear of many hams. ARRL Chief Technology Officer Paul Rinaldo, W4RI, conceived of the new character, necessary for transmitting e-mail addresses in CW, among other possible applications. Assuming approval by International Telecommunication Union member-states, the new character—the first added to the code in many, many years—will be "AC" run together (· – – · – ·). The new character, Rinaldo says, is both unique in the Morse world as well as a mnemonic (think of an 'a' wrapped in a 'C'). ATC co-host Robert Siegel interviewed ARRL Senior News Editor Rick Lindquist, N1RL, for some background on the change. The short feature, "Morse Code Enters Cyber Age," remains available in the *All Things Considered* archive on the National Public Radio Web site, **www.npr.org/**.

■ The University of Florida alumni magazine *Florida* recently featured the school's Gator Amateur Radio Club, W4DFU. The author gave Amateur Radio credit for its part in the development of advanced technologies, and said that it "still provides a valuable service to the international community." The article focused on the club's public service activities, and the enjoyment ham radio offers to students. Interviewed were Gator Club officers Matthew Henry, KE4VEM; Andrew Lilly, KG4VUH, and Nicole Favreau, KG4TGI.

■ Ham radio is more fun than the Internet or cell phones, according to 16-year-old ARRL member Zac Backlin, KB9RRD, and his 15-year-old sister Marissa, KB9UMZ, of Monee, Illinois. Tinley Park's *Daily Southtown* featured a story on the teens, introduced to ham radio by their dad, Gene Backlin, KB9RNM, and both licensed since age 10. Tri-Town Radio Amateur Radio Club President Todd Schumann, KA9IUC, and his son Matt, N9OTL—both League members—were also interviewed for the article and expressed their optimism about a healthy future for Amateur Radio.

■ Chico, California's *Enterprise-Record* recently ran a human interest feature on ARRL member Forrest "Bart" Bartlett, W6OWP. The article covered Bartlett's long history in ham radio—he's been licensed since 1930—and his interest in communicating via Morse code. Bartlett got hooked on the hobby as a youngster in Colorado after visiting another youngster who had a home-built radio. Bartlett, who turned 90 in March, says ham radio is a great hobby for senior citizens. Many ARRL members will recall that W6OWP aired the West Coast Morse code practice and qualifying runs for more than 50 years. The article gave a plug for meetings hosted by the Golden Empire Amateur Radio Society (GEARS).

■ A February 1 article, "Operators hone radio skills," in the *Capital-Journal* of Topeka, Kansas, extolled the virtues of Amateur Radio's communication capabilities during severe weather and emergency situations. The article quoted Steve Hamilton, KBØJYL, and John Zobel, KCØADP, on ham radio's "When all else fails" role in emergencies, including the aftermath of the September 11, 2001, terrorist attacks. Hamilton a day earlier had coordinated a special event at the National Guard Museum to honor Kansas National Guard members and to spotlight "the valuable service ham operators provide." The report also mentioned the work of Amateur Radio Emergency Service members as storm spotters and as emergency communicators. It referred those interested in becoming licensed to the ARRL Web site.

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Connecticut, Idaho, Minnesota, North Dakota, Ohio, Oklahoma, Southern Florida, Western New York, Puerto Rico and Virgin Islands 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 4, 2004. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before July 1, 2004, to full members of record as of June 4, 2004, which is the closing date for nominations. Returns will be counted August 24, 2004. Section Managers elected as a result of the above procedure will take office October 1, 2004. 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, 2004. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the October 2004 *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*

Mid-Atlantic Amateur Radio Club Traffic Net Certificate Program

By Carter Craigie, N3AO, and Kay Craigie, N3KN

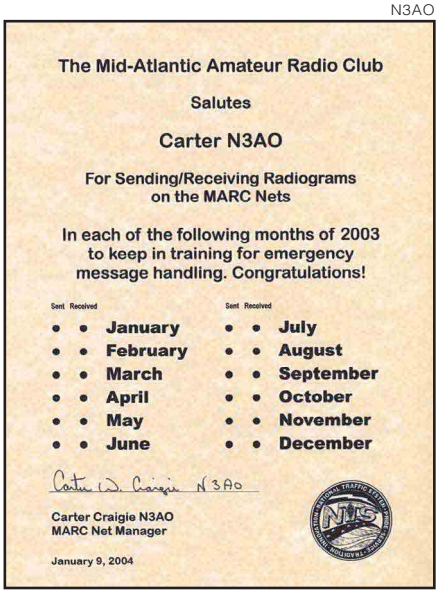
Knowing how to compose, send, receive and deliver formal message traffic is an important skill for Amateur Radio Emergency Service (ARES)/ Radio Amateur Emergency Service (RACES) operators in Philadelphia's western suburbs. We are required to relay formal messages every year in drills related to the nuclear generating stations in our area. Three Mile Island isn't one of them, but the memory of the TMI accident in 1979 is always with us. We take nuclear generating station drills very seriously in southeastern Pennsylvania!

The messages we handle are usually not in ARRL radiogram format, but once you've mastered the use of one message format, switching to another format preferred by a served agency is not a stretch. The key thing for ARES/RACES operators to understand is that message handling is something you just can't learn from a book, a Web site, a tabletop drill, or the occasional PowerPoint presentation or chalk talk. You have to learn it by doing. And doing. And doing.

In 1980, not long after Three Mile Island, the Mid-Atlantic Amateur Radio Club started the first VHF message handling net in the Philadelphia area. Today, the net meets three nights a week on our two linked 2-meter repeaters, and we get check-ins from Pennsylvania, New Jersey and Delaware. Affiliated with the National Traffic System at the local level, the Mid-Atlantic Amateur Radio Club (MARC) traffic net offers instruction in formal message handling for club members and non-members alike. Leadership officials of three suburban counties' ARES/RACES organizations are club members, and they refer people to the MARC nets for training.

Over the years, we've tried a variety of things to promote interest, such as a series of training messages based on those used on the Maryland Slow Net. That was okay as far as it went, but we wanted to stimulate net members to originate messages to be sent on the net and to have plenty of meaningful incoming messages to receive and deliver.

N3AO



The Mid-Atlantic Amateur Radio Club traffic net certificate promotes traffic handling and training.

A yearlong net certificate program has done the trick. Every net participant who sends and/or receives at least one radiogram during the calendar year receives a personalized certificate endorsed for the months in which messages were sent and received. The list of recipients for 2003 was published in the January 2004 club newsletter.

Net control stations' reports are entered into an *Excel* spreadsheet to keep track of who sends and receives messages each month. The certificate form was created with *Microsoft Publisher*, and at the end of the year the who-did-what data are merged with the certificate form. The certificates are printed on fancy paper, and the net members love them. One certificate winner who doesn't have HF privileges started talking about upgrading so he could check in to public service nets on HF.

To keep the interest high, we will recognize people who have qualified for certificates every few months in 2004, not wait until the end of the year. That way, people who haven't already gotten involved may be encouraged to start sending and receiving messages.

As a resource for newcomers, we published hints on message handling in the club newsletter and posted a version of the article on-line at **home.comcast.net/~n3kn/traffic/traffic.html**.

You may hear there is a lack of traffic on the nets these days, but the MARC traffic net handled 519 messages in 2003, including over 100 messages in December. The outgoing radiograms were all personal messages to friends, family members and fellow hams.

The net certificate project takes some effort on the part of net management and participants, but the resulting improvement in morale and skills are well worth all we put into it.

NTS METHODS AND PRACTICES GUIDELINES

The *NTS Methods and Practices Guidelines (NTS MPG)*, is the working reference manual on traffic net and message handling proce-dures in the ARRL National Traffic System (NTS). You'll find this on-line refer-

Looking for a Net on the Air?

The *ARRL On-line Net Directory* shows Amateur Radio nets that have been registered in the net directory database. It primarily covers nets that are of interest to Amateur Radio operators in the United States and Canada. Worldwide coverage nets and maritime service nets are featured (as are National Traffic System Area and Region Nets) in the database. You can search the database, register a net or update information for an existing net at **www.arrl.org/FandES/field/nets/client/index.html.**

One focus of the directory is toward public-service oriented nets that support the ARRL National Traffic System (NTS) and the Amateur Radio Emergency Service (ARES). Further information about NTS and ARES activity in your area may be obtained through your ARRL Field Organization leaders. See page 16 of *QST* and check the ARRL Section Web pages at **www.arrl.org/sections/**.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

ence at **www.arrl.org/FandES/field/nts-mpg/**. The *NTS MPG* also serves as an appendix to the *ARRL Public Service Communications Manual* (**www.arrl.org/FandES/field/pscm/**).

According to the manual's editor, Al Nollmeyer, W3YVQ, "The methods presented are a reasonably accurate snapshot of current practices. They are indeed practices, and not strict rules, but the beginner, Section, Region, Area, and Transcontinental Corps net operators and management alike will find it beneficial to have a uniform protocol reference to be used by operators." Thanks go to the many traffic handlers and NTS leaders and participants that had a guiding hand in the production of this manual.

Content Highlights

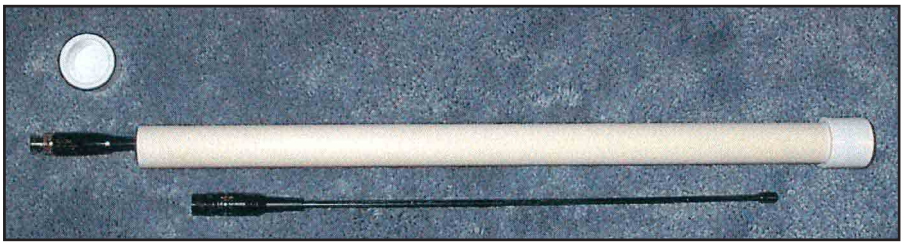
In nine chapters, the manual presents details on how to format a standard ARRL formal radiogram that's used throughout Amateur Radio for written message traffic. Additional chapters focus on the procedures and guidelines for transmission of formal written traffic by voice, CW and digital modes. The NTS Digital Guidelines for the system are included.

Net management and operation along with net control station duties are also covered. You'll find tips for delivering messages to addressees, sending service messages back to the station of origin to report on progress or problems, and notes on originating messages from the public.

In addition to reading the manual directly from the ARRL Web site, the *NTS Methods, Practices and Guidelines* is available for viewing/download via PDF Files (and *Adobe Acrobat* is required) and in text documents (in *MS Word* format).

"To assure opportunities for all amateurs to enjoy the rewards of public service traffic handling, it is essential to pass along the knowledge developed over the years, and to introduce newcomers to this particular subset of Amateur Radio activity," Al, W3YVQ, said. "Everyone can participate. Formal traffic handling is an essential part of Amateur Radio emergency communications public service as well."

K7RQN



Robert Fairfield, K7RQN, of Peoria, Arizona, has found that polyvinyl chloride (PVC) pipes are a practical storage container for those extra antennas for handhelds. The container also provides a convenient and safe way to transport extra antennas as part of an emergency equipment "go kit." The PVC pipe may be easily cut to the length necessary and secured by end caps.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
January 2004

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.

570 KC2HUV
530 W7TVA
515 W2MTA
507 KB2DQ
502 KB2RTZ
422 AB2IZ
418 N9VE
371 N2YBB
350 KA2ZNZ
315 KB2ETO
249 KC2DAA
248 KA2GJV
241 NN2H
240 KB2KOJ
W2LC
230 KB2SNP
226 N2YJZ
210 K2ABX
KB2CCD
W7ARC
200 KK3F
196 WA1QAA
181 N2IK
177 K9JPS
175 WI2G
170 WB5ZED
N5IKN
165 K7BFL
160 WA9ZTY
158 N2ECR
155 KZ7T
KB5ILY
147 N1IST
145 W3YVQ
143 NF5B
140 WB2UVB
WB1CHU
KE4UOF
139 KB5JBV
138 N2JBA
135 KB8GFC
134 NN7H
131 KC0HOX
130 AG9G
KB2VRO
K4RLD
KA5KLU
AC5XK
W3ZQN
128 KA0DBK
126 KG9B
125 N2GJ
K4FQU
KD4GR
122 W2DWR
121 KA2BCE
WB2KNS
120 AB4XK
N5BSD
K4BEH
K5DPG
W4EAT
K4IWW
AD4XV
WX4J
KA4FZI
W6IVV
N1LKJ
W1GMF
KW1U
W8YS
W6QZ
K0IBS
W3BBQ
N5WSW
K6YR
118 W8MMN
117 N3WAV
116 K7EAJ
115 N7DRP
WX4H
N7EIE
N5OUJ
112 W3NJ
111 N2JRS
N3RB
110 AD5IS
AD8NI
N8IO
K9LGU
W9BHL
W4NTI
N7CM
KW7DSP
N7YSS
KC5OZT
K5UPN
AF4NS
K2UL
N2LJD
WA2ZCM
K5MC
KE4JHJ
AG4DL
N2JWW
N1IQI
W7QM
K3JL
W7GB
N8NMA
W5GKH
K8AE
N7TOD
N3SW
109 W5ZX
108 KB9KEG
WA2YL
107 WD4LSS
106 KA9RZL
WA1JVV
W5PY
105 W4ZJY
W7ADZ
KD1LE
WA9JWL
104 N8JAT
KD5YMW
AC5VN
103 KB0DTI
102 N4JBP
101 K4DND
100 K4SCL
WA8SSI
N3YTD
AB0WR
K9FHI
W9CBE
AF2K
KC2EOT
WB2QIX
KD4CQJ
W7RRC
KB5TCH
W9NXC
WA2WMJ
W2FPG
WA2YBM
W1ALE
K5IQZ
KK5GY
NR2F
N9MN
WA4EIC
KG4MLC
KG4MLD
WN0Y
W7DPW
W7GHT
K7GXZ
KB8NDS
K3SS
KG4OTL
KV4AN
N5SIG
KB2KLH
N2AKZ
KC2GOW
W0HXB
AA8SN
KA4UIV
99 KG4OQA
N8FXH
W3CB
W7TC
98 W5IM
95 KC8VIF
W7VSE
K7UGT
K3CN
AA3SB
94 W0UCE
KJ7SI
93 KD5PGY
92 W2CC
AA4BN
91 W2QOB
W5CU
90 WB2LEZ
KC8UIL
N3KB
KG2D
WB2IJH
W4CKS
KC7SGM
AD5KE
K2YYF
W4WXA
K4FUM
K4WKT
WB4GGS
WA2CUW
N1JX
W4DLZ
KD1SM
W8IM
K1JPG
KF4WIJ
W5UYH
WD8DHC
KA8WNO
W8CPG
K2VX
AA3GV
N3OR
KF6OIF
WB8RCR
KA4LRM
W3TWV
89 AC5SU
KG4CHW
K8ZJU
88 KD5ONS
N2RTF
K4KAM
WB6UZX
N1TPU
W6JPH
N3WK
87 KO4OL
W2DSX
85 KL7OR
KF4OCU
KE0XQ
84 WB7VYH
83 W4AUN
81 WA2GUP
WD9F
80 KC4ZHF
WD8Q
K4GA
W2MTO
AA4YW
K8KV
KF7GC
K7MQF
K4DZM
N3ZOC
WA0LYK
79 AG4AC
KK7TN
K8CQF
78 W5OMG
K4BG
WB4BIK
N0ZIZ
76 N8DD
W4DGH
75 W5XX
KC2IYC
KA0O
74 N5KWB
73 K2PB
KC6SKK
K8VFZ
72 WD9FLJ
W5NK
W4LN
WA0KAQ
KA4YEB
71 KD6FWD
KC6NBI
AB0UY
70 K5ER
WA5OUV
W1PLW
KC8BTE
KC8VOA

The following stations qualified for PSHR in previous months, but were not recognized in this column: (December) N2LTC 425, KB2DQ 252, N0JL 135, W1QU 100, KL7OR 85. (November) KL7OR 85, N0JL 84. (October) N0JL 87.

Section Traffic Manager Reports
January 2004

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, DE, EB, EMA, ENY, EPA, EWA, GA, IN, ID, KS, KY, LA, MDC, MI, MO, MS, NC, NE, NFL, NH, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SB, SC, SD, SDG, SFL, SJV,SNJ, STX, TN, VA, VT, WCF, WI, WMA, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
January 2004

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, CO, EWA, GA, IL, IN, KY, LA, MDC, MI, MN, MO, NC, NLI, NV, SD, SFL, SJV, SNJ, SV, TN, WMA, WNY, WPA, WTX, WWA. *Note*: New York City-Long Island SEC reported December 2003 activity, but it was not listed in this column last month.

Brass Pounders League
January 2004

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.

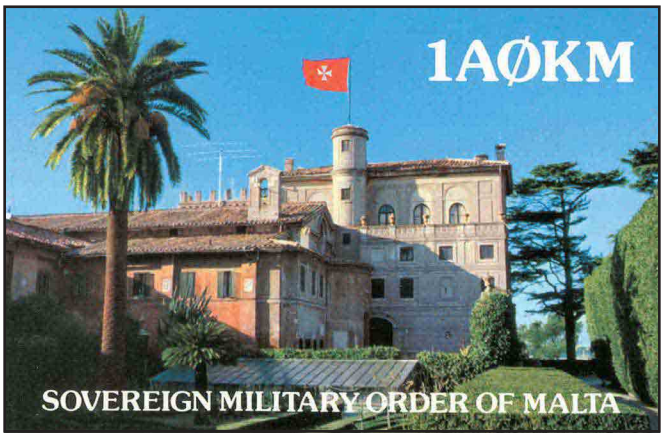
Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
KK3F	34	1936	1892	44	3906
WB5ZED	36	1355	982	24	2397
W1GMF	0	559	1760	15	2334
KA5KLU	0	936	1298	20	2254
W4ZJY	0	1037	972	0	2009
KW1U	0	824	699	6	1529
WB5NKC	22	126	1271	9	1428
N2LTC	0	659	651	49	1359
W4EAT	0	572	565	1	1138
N1IQI	0	288	819	4	1081
WX4H	0	629	413	6	1048
K7BDU	18	452	444	6	920
N5SIG	6	395	476	19	896
W7QM	1	380	347	6	734
AK6DV	0	350	331	15	696
K9JPS	0	335	33	320	688
WB5NKD	26	44	493	0	563
AB0WR	0	275	272	0	547
WB4GGS	0	269	265	4	538
WX4J	0	293	229	15	537
K5UPN	17	239	253	7	516
W6DOB	0	196	297	21	514

BPL for 100 or more originations plus deliveries: KK5GY 207, N9VE 194, W9IHW 156.

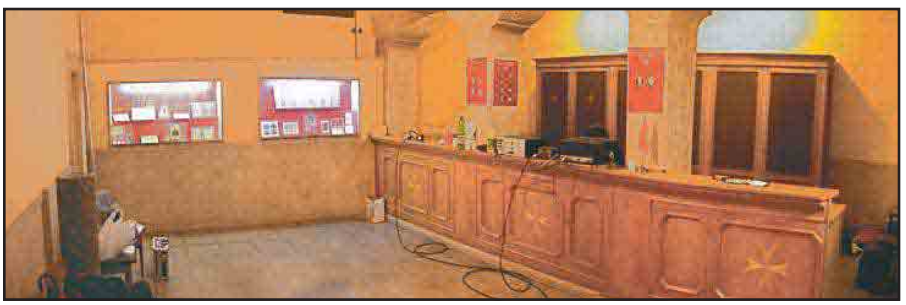
The following station qualified for BPL in November, but was not recognized in this column: W0SS 533.

1AØKM SMOM: DX with a Thousand Years of History

By Francesco Valsecchi, IKØFVC (HVØA, 1AØKM)



During the first operation of 1AØKM the team was permitted to install a beam on the roof. This is the QSL card from the first operation of the Sovereign Military Order of Malta (SMOM).



The SMOM Post Office was used as one of the operating rooms for the January 2004 1AØKM operation.

Making a DX contact with the Sovereign Military Order of Malta (SMOM) is like connecting to the past, glorious and millenarian. In fact, the prestigious Order was founded before the conquest of Jerusalem, in 1099, by the Crusades. SMOM was recognized by Pope Pasquale II in 1113. From 1310 to 1522 SMOM obtained sovereignty on the island of Rhodes. Between 1530 and 1798 it was transferred to the island of Malta. Finally in 1834 SMOM was established indefinitely in Rome, site of the extraterritorial area of the Villa Magistrale all'Aventino. This is located on one of the seven hills of Rome, and hosts the periodic ham radio activity with the call sign 1AØKM.

SMOM functions as an actual country, lacking only the actual country. It maintains diplomatic relations with almost 70 countries, and has its own stamps and its own currency. In addition, it boasts a hospital available for those who are in need as well as relations with the United Nations.

These are all the aspects that made SMOM recognized as a country by the DXCC in November 1980. Before 1994 SMOM was managed by another group of DXers. Our first actual team activities started in 1994 and after the initial operation SMOM went on air again in 1995, 1996, 1998 and 2000.

In a hypothetical classification of different countries, 1AØ would be classified as unique since it is located in a green garden area in the middle of a busy city. This villa represents a kind of quiet "island" in the chaotic Roman metropolis. Inside the villa, in addition to administrative offices, there is also the Vatican and Italian Embassy.

According to various surveys SMOM was ranked in 18th place on the most wanted lists, and is ranked even higher for the JA and NA west coast.

The logistics of the DXpedition, according to the "country" location, is not difficult. All that is needed is a bit of organization and systems capable of working temporarily with other close by antennas. The biggest challenge that exists is managing the relations between the authority of the Order, which is done by always being careful about the location and preserving it. For many reasons it is difficult to install towers and large antennas; otherwise the roofs are easily ruined. The recommendation is always the same one: to operate in a discreet way and not to ruin the roof!

In the summer of 2000 I took a three year break due to work and a growing family. However, I was inspired to begin again because of the insistence of Sergio, IKØFTA, manager of the Web site **www.sixitalia.org**. I requested and obtained the authorization to operate from the 2nd through the 5th of January. The team involved in the operation was the same I had worked with previously, consisting of Luciano, IØJBL; Ugo, IØCUT; Roberto, IKØPRG, and Sergio, IKØFTA.

The first working meeting was held on the evening of December 20 at Roberto's home. With large portions of typical home- made Italian pizza, we spent the evening sharing DX stories of the past and also discussing how to achieve our goal, which was to provide a new one for as many as possible: An activity similar to previous operations, with three active stations.

Then the world of DXers was put into action by a press release issued by Bernie, W3UR, editor of *The Daily DX*, and Mauro, I1JQJ, editor of the *425 DX News*. On December 27, we publicized information on the Web site **www.sixitalia.org**, which was created for this project, and we received many messages of encouragement and various requests.

On January 1, the final details were agreed upon so that we could be ready to meet the following day in front of the historical "Villa Magistrale all'Aventino." On the 2nd, we began to install the first station to go on air, which was composed of a Kenwood TS-850 and a Hy-Gain 14AVQ. The other stations were installed later.

We also had an ICOM IC-746, a Yaesu FT-897, a couple of TL-922s and one Heathkit SB-200. Also we had a Windom

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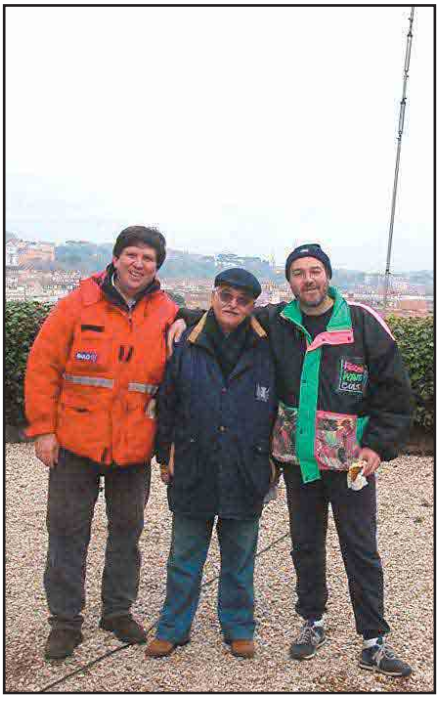
Roberto, IKØPRG, operates one of the 1AØKM stations while Francesco, IKØFVC; Luciano, IØJBL; Ugo, IØCUT, and Sergio, IKØFTA, look on from the background.

Francesco, IKØFVC, getting the first station set up before going on the air as 1AØKM. Francesco's first QSO for the January operation was DJ3VW.

This tree made a good support for the dipole over the garden.



From the left: Luciano, IØJBL; Ugo, IØCUT, and Roberto, IKØPRG, in the garden after setting up the 14AVQ vertical antenna.

antenna installed on a 12 meter pole and another vertical for the 30, 17 and 12 meter bands. As usual, it was necessary to consider the unexpected. In fact the first panic did arrive. Nothing worked; the system, the power supply and the linear amplifier failed to turn on. Everything remained in complete silence!

Precious minutes were lost, with 20 meters well open toward the Pacific. However, someone thinks of measuring the power supply voltage and as a result it is discovered that part of the connection is still at 125 V, a voltage that is not used in Italy anymore. After finally discovering a 220 V connection, it takes a second to go on the air. DJ3VW was able to make the first contact.

After the euphoria, came the second instance of panic. It was discovered that all the cell phone lines of Rome had gone down right at the same time that we were initiating our job, and the people started to complain. Fortunately, it was a fault in the entire Roman network! After having fixed the inconvenience, the activity went on as usual, with a tremendous laborious pileup to work with, even with a split of 20/30 kHz.

After the first 10 QSOs, the questions began to arrive, which contributed to our loss of concentration and time. These included "When will you be on 24?" "What about RTTY?" "What is the QSL info?" and "Will you respond via the bureau?"

As it always happens, other than official activity, there is also pirating, especially on CW. For the pirates there is excitement of some QSOs with a bit of a pileup while for others a disappointment with the "not in log." These, however, are the rules of the game. After almost three days of intense activity, at the end, the results were 8421 QSOs with 167 band zones and 535 band countries.

Almost 10 years have passed since my first time at SMOM. In between I have gotten married, have had three children (the oldest named Athos after his grandfather, not Monk Apollo) and developed a career where responsibilities have only increased. The same series of events has been shared by those who have been on the team. You would think this would be a reason to stop. DX calls to us with its magnetic force, however. Every time we find ourselves together again, we want to work and give new operators the opportunity to add another country to their score.

Particular thanks to Sergio, IKØFTA, whose tenacity resulted in my decision to renew the authorization for operating 1AØKM. Although I thank him for his insistence, with this is associated a responsibility—he has the hard job of being the QSL manager, responding to everyone, directly or through the bureau. Thanks also to Luciano, IØJBL, who handled the logistical aspects with his usual skill and care. Thanks also to Roberto, IKØPRG, and Ugo, IØCUT, for their tireless operation. A big thanks to all who worked us.

For those who weren't able to, don't despair: There will be a next time.

WRAP-UP

Well, that's it for this month. A special thanks to IKØFVC and IØJBL for the article and photos. Don't forget to continue to send your DXpedition announcements, photos and club newsletters to your DX editor. Until next month, see you in the pileups!—*Bernie, W3UR* QST

Hallicrafters HT-4, to War and Home Again

Also known as the BC-610 (military), the HT-4 started life as an amateur transmitter in 1938. It was immediately popular with hams who wanted a well-built powerful rig, which was easy to operate. It was designed using the best parts, all heavy duty, and it was well constructed. It was capable of 450 W on CW and 325 W on AM phone, 100% modulated. At a cost of nearly $700, only hams who had a good income could afford it. Nevertheless, Hallicrafters sold hundreds right away and they started to talk all over the world.

Before Pearl Harbor, during 1940, the US Signal Corps recognized that they would need better communications to control the rapid coordination and movement of troops, and to reach tanks under way or in battle. Additionally, the radios they needed would have to be rugged and powerful, work on a wide spectrum of frequencies, and be able to do so in a fixed location or on the move. A search was launched to find suitable equipment. As the need was immediate, they turned to the Amateur Radio market to see if what was already available might fill their needs. After looking at over 20 different transmitters, the Hallicrafters HT-4 was selected. It would become the BC-610.

The famous "Duce and a Half" carrying the SCR-299 hut.

The SCR-299

That wasn't all that was needed. The transmitter needed to be part of a complete station, so the SCR-299 was designed. This included two receivers, spare parts, antennas and a powerful ac generator set.

In early 1942 the SCR-299s were built into a 1½ ton capacity truck designed by the Signal Corps in Fort Monmouth. A trailer was also designed to haul the Onan PE-95 generator set. This was placed on a trailer so it could be located at some distance from the radios when in a fixed location, or hooked up for operation while driving. The operator could turn it on or off as needed, by remote control.

It was first deployed in northern Africa. It did a great job when the success of the African campaign was hanging in the balance. General Dwight Eisenhower credited the SCR-299 in his successful reorganization of the American forces and final defeat of the Nazis at the Kasserine Pass. It was also successful in the invasion of Italy.

Thousands of SCR-299s were built during the war. Some versions would be built into small huts, and could be fastened on the famous "Duce and a Half," a 2½ ton truck and trailer combination. The Navy and other branches of the ser-

AL KLASE, N3FRQ

Station W9WZE, from the movie *Voice of Victory*.

The beautiful construction makes the BC-610 very desirable to Boatanchor collectors.

John Dilks, K2TQN ♦ 125 Wharf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

Profile: Joe Cro, N3IBX

Known best as "Vortex Joe," N3IBX says, "Anything within a 500-mile radius of my house, that has a vacuum tube in it, gets sucked into my basement shack—never to see the light of day again!"

Joe lives near Philadelphia; and enjoys collecting, working on, modifying, restoring, and using vintage Amateur Radio equipment and old broadcast transmitters. He loves to bring something back to life that has remained forgotten or neglected, and use it on the air again. He says he runs a "Boatanchor Hospice."

Joe operates mostly on AM in the following bands: 160 (1885 kHz), 75 (3875-3885) and 40 (7290-7295). He has 15 operating positions in his cellar, each with its own separate transmitter and receiver. Each is linked to a variety of antenna tuners for every band. His antenna lineup is a 260-foot 160-meter flattop at 85 feet, a 61-foot 1/4-wave ground plane at 85 feet for 75 meters, a 61.5-foot 1/2-wave sloper for 40 meters, a homebrew G5RV, a 20 meter dipole, a 17.5 foot vertical for 10 meters, a 4 element quad for 6 meters and a 7 element quad for 2 meters.

His big antenna is a military inverted V, 110 feet total length, center fed through a 9:1 balun. Each leg is terminated into a 150 Ω resistor driven into the ground. It is resonant from 1500 kHz to 46 MHz.

Joe's motto is: The bigger it is, and the more it weighs, the better it will work!

AL KLASE, N3FRQ

Joe Cro, N3IBX, after a long night on 75 with his HT-4 model H.

vice also used the BC-610. Sometimes they used SCR-299 and sometimes the equipment was removed and relocated to ships, airplanes and buildings.

After the war, Hallicrafters continued to manufacture the BC-610 for the military, until about 1952. The versions went from –A through –I. They continued to be used by the Army, Navy and Air Force in the Korean Conflict and later in Viet Nam.

In 1946 Hallicrafters once again started to produce the HT-4 for amateur use. The HT-4 models went from –A to –F, with F being the newest.

The MARS Program

The Military Affiliate Radio System continued to use the BC-610 in both fixed (base locations), and in remote locations like the jungle or island outposts. Instead of voice transmissions, they were used primarily for radioteletype (RTTY), for sending written messages. They could literally run all day and all night transmitting RTTY at 400 W; they were that rugged.

During 1968 I was stationed at Langley AFB in Virginia. We had a BC-610-I RTTY circuit. We were the primary circuit for Germany and backup station for AIR in Washington, DC. Our BC-610 had just come from being refurbished and needed to be installed and tested. My ham radio background came in handy here. I found it easy to hook up and put on line with an R-390 receiver and some other surplus gear.

After several months my NCOIC received a telephone call from the MARS director at Andrews AFB, wondering if we had any local MARS members who wanted a BC-610, as they had one they needed to get rid of. I was one of only two ham MARS members attached there. I volunteered and eventually was told to go pick it up.

This turned out to be a dream come true for me and another source of irritation for my wife, who thought she was rid of ham radio while I was on active duty. The BC-610 was an "I" model, and it was brand new. I had to take all of the spares, and all of the accessories. They were the OS-39 RTTY frequency shift keyer (FSK) and VFO, the BC-614 speech amp, and the BC-729 antenna tuning unit. I also got all of the crystal oscillator plug-ins and all of the coils.

I had to take it all apart and haul it to the second floor attic of our rental home; it weighed 400 pounds. The whole operation of taking it apart to putting it together only took a couple of hours. In one more hour I had it on the air, on CW. It was easy to work on.

In no time at all I had a Model 15 Teletype that I picked up in the local junk yard, chugging away during the evenings. I used to bring home some of the messages from the MARS station, so I could send them out on the evening Southern Net. Then I would monitor the net all night to see if I could pick up some messages to take back to the station in the morning.

One evening I went down stairs to watch some TV, as the net was real slow that night. After a few minutes I heard a thunderous sound coming from above. Startled, I jumped up and declared, "What was that?"

My wife knew. She said, "That's your teletype machine running. Maybe now you'll realize just how noisy it is down here."

The RTTY was on auto-start and had come to life and was happily typing away. The problem was, I had the TTY machine sitting directly on a metal teletype table, and the metal table sitting directly on the wooden floor. I swear it wasn't that noisy upstairs.

In a few minutes I added some carpeting between the machine and the table, and added two layers of carpet between the table and the floor. Problem solved—and one marriage saved.

Voice of Victory, the Movie

Hallicrafters produced a wonderful movie early in the war, all about the HT-4, the BC-610 and the SCR-299. I have a copy and it has renewed my interest in this beautiful transmitter. The movie shows a prewar ham station, W9WZE, on the air using the HT-4 and SX-28 and a wonderful, early, 2 element beam on an old-style tower. Then in great detail the movie shows exactly how the '610 was built, piece-by-piece. It also shows the production line and exactly how the SCR-299 was assembled, tested, and then shipped by boxcar. It runs about 1/2 hour.

If you would like to get a digital copy, I'll have the links installed on my Web site where you can download it. I'll try to make arrangements for those who can't download it, to be able to get a copy on CD or on VCD (not DVD). Visit my Web site for the information: **www.eht.com/oldradio/arrl/index.htm**.

It's hamfest season again. Look for my hat and say hello.—*K2TQN*

VHF Aerials

At last year's contest forum at the International DX Convention in Visalia, California, I asked how many in the room owned HF+VHF radios of the IC-706/FT-100 type. Almost 100 of the 125 people present raised their hands. When I asked how many had ever used them on SSB or CW on bands above 10 meters, about 10 hands went up. When I asked how many had ever entered a VHF contest of any kind, about six hands remained up. That's dismal. Besides the usual complaint that VHF contests are boring for those used to rates exceeding 100 per hour in HF contests, many were using verticals of some kind and suspected that they might be missing even nearby stations.

The lack of suitable VHF antennas is a big problem in increasing VHF activity. On the HF bands you can always throw a wire out the window and use a tuner. You won't be strong but you will hear many signals and be able to work a surprising number. A simple dipole hung between two trees is a good antenna. Many commercial multiband beams, especially the older ones, have little more gain than a dipole, if that. On VHF, such simple antennas may not work very well unless you can get the equivalent of a dipole up and clear of all the local clutter. Even small beams need supports and rotators, and many HF-only operators are unwilling to make such a commitment for a new band they may not enjoy. The good news is that the supports need not be massive, and small rotators work well for a beginning.

So, the first part of this month's column is dedicated to HF operators with an HF/VHF radio and will talk about getting on VHF and in particular the entry bands, 6 and 2 meters, with things that you have. The second part will discuss a philosophical approach to buying new or used commercial antennas that should be useful whether this is your first VHF antenna or you are thinking of upgrading. Let's start with using what we already have.

Figure 1—The N1DPM antenna stack in FN32. Notice how Fred tower-mounts transverters for his 903, 1296, 2304 and 3456 MHz and his 10 GHz 2 foot dish. Notice also that all antennas and gear can be serviced by climbing on the tower, without removing anything else to reach it.

HF Antennas on VHF

Many HF stations have some kind of triband (20/15/10) beam anywhere from 8 to 18 meters high and some kind of single-wire antenna, usually a dipole, for 80 and 40 meters. Most of them have space for one or two small VHF beams mounted above the tribander, but want to be sure they will enjoy operating on one or more VHF bands before going to the trouble and expense of working on their tower. What to do?

Figuring that the most interesting thing on VHF is E-skip propagation, let's concentrate on 6 meters first. I have one of those typical HF stations—a four-meter-boom Hy-Gain Explorer tribander and a couple of quarter-wave slopers. Using the local beacon, W3VD/B as a test point, I checked each one of these antennas against my 6-meter antenna, a C3i C7-50 with a 9-meter boom. The slopers neither loaded very well (~2:1 SWR) nor heard the beacon well. This is not surprising because they are mostly vertically polarized (most 6 meter SSB/CW stations use horizontal polarization). The tower with its 4-meter-plus stack of Yagis above it probably presents a very complex image (ground) for the wires.

The tribander is a different story—it hears the beacon well and has a 1.4:1 SWR. This morning I used it to work K9VNM/4 in EL89. The 6-meter beam is about two S units better, but Al answered my CQ on the tribander. He uses a 100-W IC-746 to a coax-fed dipole cut for the MARS frequencies just above 75 meters. His was about the only signal from Florida I heard at this time. The sole caveat about tribanders is that some, like the Hy-Gain TH6, use baluns near the feed point that act like low-pass filters; these beams work very poorly at VHF. Most, like my Explorer, work just fine. The SteppIR HF Yagis can be tuned to 6 meters. You can read more about using HF antennas on 6 meters in "Using that New HF + 6 m Rig on 6 Meters," by Phil Krichbaum, NØKE, in the Nov/Dec 1998 issue of *NCJ*.

If you use one of these HF/VHF radios as a mobile rig, you have an easy way to get on 6 meters if you have a 2 meter $^5/_8$ λ whip. These antennas work very well on 6 meters as a straight quarter wave. Of course, they work better on E skip than on tropo, where they are cross polarized. Dual-band 2 m/70 cm whips generally do not work.

How well will the infamous "wire out the window" really work on 6? Doug, N8WWM (EN81), e-mails to tell me of a recent E_s contact on 6 meters with C6AGN in FL16. That card will be his 100th grid confirmed on 6 meters since June of 2003 running 100 W from an urban lot with a tuned 20 meter end-fed wire 8 meters high strung between two houses. The antenna comes from the UK Six Metre Group (UKSMG) Web site (**www.uksmg.org/longwire.htm**). So VUCC on 6 meters is more than possible

This Month

April 4	Good EME conditions*
April 5	Spring Sprint 144 MHz
April 13	Spring Sprint 222 MHz
April 16-18	Eastern VHF/UHF Conference, Enfield, Connecticut
April 21	Spring Sprint 432 MHz
April 24-25	SVHFS Conference, Marietta, Georgia

*Moon Data from W5LUU

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

in six months with a very simple antenna.

What About 2 Meters?

The vertical antenna you use on FM or packet works on SSB, but the polarization is wrong. Here there is essentially no E skip so you should try to use a horizontally polarized antenna. Again your horizontal dipoles are a good idea and even your tribander may work well. You must try them to know. If your radio loads them properly, you should try them. You should listen between 7 and 10 PM local time for the most activity. Activity nets detailed in this column in November 2003 are another place you can look.

Selecting Commercial VHF Antennas

What if you have already decided that you want an antenna dedicated to a particular VHF band? There are a number of good commercial antennas out there designed specifically for weak-signal operation on 6 and 2 meters. This is not intended to be an exhaustive list of all the available 6 and 2 meter antennas, but rather those that I'm familiar with. There are other manufacturers of 6 and 2 meter antennas that may work very well for you, but I didn't include them because I have no experience with them. Check out the ads in *QST* or the advertisers' list on the ARRL Web site (**www.arrl.org/ads/adlinks.html**) for more leads.

Rather than give you a litany of what's available out there, let's see what should go into such a decision. Let's start with some basics. Most fixed-station VHF antennas are directional Yagis. They require a support of some kind that gets them above the "clutter" level—houses, other buildings, trees if possible and a rotator to turn them.

Choosing a beam requires assessing several parameters: size, design and mechanical construction. First comes size. Commercial VHF beams come in a variety of lengths. You need to decide what fits your situation—and remember, the laws of physics still apply. Modern computer-designed Yagis tend to have roughly the same gain for a given boom length. If you double the boom length, in practice, you gain a little more than 2 dB.

The best way to find a good design is to ask at least three active VHFers. You can do that locally, or ask on one of the VHF reflectors. Just like HF, the reputation of the antenna maker is an important feature in making a choice. Table 1 provides a list of most of the VHF antenna manufacturers with their URLs. Manufacturers either design their antennas in-house or use published, non-proprietary designs.

It is instructive to know who specifically designed the antenna you buy. C3i uses established designs by K1FO and K1JX while Directive Systems uses K1FO designs. The others all use internal designs. Mike Stahl, K6MYC, at M² has been a well-respected and successful HF and VHF antenna designer for many years. Most of the Cushcraft VHF weak-signal antennas are computer designs dating back a number of years to a period when three well-known VHFers, Joe Reisert, W1JR; Dave Olean, K1WHS, and Bob Morton, VE3BFM, were associated with the company. The Hy-Gain VHF antennas are less known, but based on the fact that Roger Cox, WBØDGF, probably designed them, they will be quite good.

For those of you who want to go beyond recommendations and reputation, several factors define the quality of a particular design. These include gain, front/back ratio (F/B), drive impedance and gain-bandwidth product. For a VHF Yagi, bandwidth is less important because the bandwidth covered in the SSB/CW portion of the VHF bands is relatively small. Thus, rather than a 2.5% bandwidth at 20 meters, you need only cover a 0.15% (2 meters) or 0.33% (6 meters) bandwidth with a reasonable SWR.

Of course, the designer must avoid excessively high Q. This may look good on paper, but it is highly unlikely to work very well in practice. It is more important to make sure the gain is reasonable for the boom length and that the pattern is clean. That is, side lobes are suppressed and there is a good F/B. All the 6 and 2 meter beams from the manufacturers in Table 1 meet those criteria well.

The last factor is mechanical construction. Unless you are a mechanical engineer and can get exact drawings of the antenna you want to buy, you really must depend on recommendations of those who are using the particular antenna. Better yet, try to see it up close and personal. Be aware that not all antennas from the same manufacturer are necessarily built to the same mechanical specifications. You need to inquire specifically about the antenna you want.

Table 1
Selected Manufacturers of 6 and 2 Meter Yagis

Company	*Web Site*
C3i	**www.c3iusa.com/antacces.phtml**
Cushcraft	**www.cushcraft.com/amateur/thumbs.asp**
Directive Systems	**www.directivesystems.com/**
Hy-Gain	**www.hy-gain.com/catalog.php**
M²	**www.m2inc.com/**

Table 2
Selected Manufacturers of 6 and 2 Meter non-Yagi Antennas

Company	*Type*	*Web Site*
KB6KQ	Loop	**www.kb6kq.com/**
M² HO loops	Loop	**www.m2inc.com/**
Par Electronics	Triangle	**www.parelectronics.com/omnis.htm**
	Moxon	**www.parelectronics.com/stress_moxon.htm**
QHtenna	Turnstile	**www.qth.com/qhtenna**
WIMO	Big Wheel	**www.wimo.com/frameset_e.html**

Non-Yagi Antennas

I would be remiss if I did not mention two other kinds of antennas: horizontal loops and Moxons. The horizontal loop is the antenna of choice for mobile and portable operation. It has a low SWR and takes up a relatively small amount of space, so it is an excellent choice for portable and mobile operations. Several companies make such antennas (see Table 2). These take on a variety of shapes: loops, triangles and the Big Wheel (which looks like three loops in one). They have roughly the gain of a dipole but with an omnidirectional pattern. Par Electronics sells an interesting, compact 6 meter rectangle antenna, the Moxon designed by G6XN, which has the gain and performance of a two-element Yagi. You can look at a review of the Par Moxon in the March 2004 issue of *QST* on p 66, and learn more about Moxons at **www.cebik.com/moxpage.html**.

You may have noticed that I have not covered quad antennas. Users of HF quads have claimed all kinds of magical qualities for them, but remember those laws of physics. Particularly with more than four elements, not even the supporters of HF quads claim any significant advantage for full-wave loop elements over linear half-wave elements. Many quads in various configurations are available from Cubex, Cushcraft, Dunestar (designed for rovers) and Lightning Bolt (well-known for their small handheld satellite Yagis) if you are interested in using quads.

Used Antennas

While all currently available Yagis are modern computer designs, some antennas

more than 15 years old are not so good. If you are a newcomer looking to buy a used antenna, make sure you know what model it is. For instance the old-design five and six-element Cushcraft 6 meter beams on 12 and 20 foot booms, respectively, were not particularly good antennas. I know; I had one. Yet, newer models on the same boom lengths—containing an "S" at the end of their model numbers—are modern designs that work well.

Do It Yourself

Antenna homebrewing has been a favorite amateur pastime for many years. If you are going to copy published Yagi designs, make sure that you copy them accurately: dimensions, including the boom, the method for mounting the elements, the element spacing, etc. If you're going to modify any dimensions, no matter how little, make sure you put the changes into modeling software—your element lengths will change. There are well-known designs from K1FO, W1JR and K5GW here in the US and from DL9BV and DL6WU in Europe. My final suggestion for those who want to do it yourself and spend next to no money is once again to point to WA5VJB's cheap Yagis at **www.fredspinner.com/W0FMS/CheapYagi/vjbcy.html** and/or **www.clarc.org/Articles/uhf.htm**. When Kent says cheap, he means cheap materials (wooden booms and wire elements) and they work very well. What more could you want? [There's an article on a 6-meter Moxon beginning on page 65, this issue.—*Ed*.]

The bottom line in VHF antennas is straightforward: Be horizontal. Start by using your HF tribander or wires. When you are ready to select a permanent beam antenna, decide on the size, look at the design and go with a well-constructed antenna. The summer VHF season is coming—join the fun.

ON THE BANDS

January marks the second half of the winter E_s season. While conditions are not as good as in the summer, they can get interesting.

6 Meters

The propagation loggers and the OH2BUA cluster reported evidence of E skip in the US on at least 21 of the 31 days of January. The best/most widespread openings appeared to be on the 11/12th, on the 19th and during the VHF contest on the 24th and 25th. Thanks to Jon, NØJK, for several more detailed reports. Most of this activity was single-hop with rather narrow reflecting clouds, except for double-hop contacts between KØGU (DN70) and the Northeast coast on the 18th; between California and Florida a few hours later on the 19th; and Bill, KØHA (EN10), and VP9GE (FM72) on the 20th.

The VHF contest featured much E_s both Saturday and Sunday. Roger, K6LMN, took time off from enjoying the sun to find two significant openings from C6A: one up the East Coast from FL06 on the 24th from 2220 to 0015Z (25th). The second from FL16 on the 25th (0015Z) west mainly to Louisiana, Texas and Oklahoma, with best DX to W3XO (EM00) and K5TE (EM28). His tapes indicate some mighty loud signals into the Bahamas. Pete, N6ZE, completed another transcontinental rove with 125 QSOs in 15 grids from five locations (FN30, 31; EL96; DM03, 04). Dave, N3DB (FM18), had perhaps the most interesting contacts during the contest, with three PYs and two LUs around 2330Z on the 24th, while missing a CX. E_s to TEP links are not very common in January, but Dave alertly caught this one. Most of the rest of the DX was to South/Central America particularly on the 27/28th to TI/TG and V31 as reported by KØHA and NØJK. DX propagation westward was slim, but K6QXY (CM88) worked KH6/K6MIO on the 1st, N6XQ (DM12) worked ZL2TPY on the 7th, K6QXY worked VK2BN on the 12th and KØGU worked JE2PMC at 2324Z on the 17th.

Aurora

Several minor storms occurred during the month on January 7/8, 22, 24 and 27. Almost all reports were for 6 meters, with only a few 2 meter spots. Perhaps the best session was on the 27th, where Brandon, N8PUM (EN66), reports contacts with KØAWU (EN37) on 2 meters through 70 cm. Considering the lack of other reports and the slim pickings on the propagation loggers, I am surprised to see the contact on 70 cm. In fact, all four openings appear to have been restricted to stations like Brandon at high latitudes.

Meteor Scatter

The Quadrantids appeared to generate SSB activity only on 6 meters. Al, K7CW (DM26), reports a noticeable peak between 1750 and 2015Z on the third. Reports from the propagation logger at **dxworld.com** showed sporadic MS contacts around that time both on the third and the fourth. Shelby, W8WN, reports that the digital crowd got plenty of contacts spread more evenly over both days on both 6 and 2 meters. Overall, the Quads are yet another example of the advantages of *WSJT* in a shower with short but repeated bursts.

EME

Of particular interest are the first contacts with Japan on 6 meter EME following lifting of restrictions at 1500Z on January 12. Lance, W7GJ, reports a JT65B contact shortly thereafter with Yasu, JH2COZ. While transmissions ended at 1532Z, Yasu apparently did not decode the final "RRR" from Lance until he reset his parameters sometime shortly after 1600Z. In the meantime, Ray, WA4NJP, completed a JT65B contact with Han, JE1BMJ, at 1548Z. Ray also reports that he completed what should be the first 6 meter CW EME contact with Japan at 0042Z on the 24th with JE1BMJ. Congratulations to all four of these operators! Via Moon-Net, Stan, OK1MS, reports that he has received DXCC#14 on 2 meters. Again, congratulations are in order!

HERE AND THERE

W6PO SK

It is with great sadness that I learn of the passing of Bob Sutherland on January 11. Bob was Director of the Advanced Projects Lab at EIMAC and a giant in the VHF world. We knew him as a pioneer moonbouncer, as a world-class amplifier designer, as editor of "EIMAC EME Notes," but most of all for the many, many VHFers he helped with his sage advice. As Bill Smith, W5USM, one of my predecessors in this column, so rightly suggests, "Look towards the moon and say, 'Thank you, Bob, well done.'"

Terahertz Allocations

Discussions are beginning with US and IARU officials about possible amateur allocations in the area above 275 GHz. ARRL Chief Technology Officer Paul Rinaldo, W4RI, is seeking information about technical, band use and regulatory issues for the frequencies above 1 THz. If you are knowledgeable in any of these areas, please look at the detailed request at **www.arrl.org/qst/worldabove/TH2.pdf** and send your information to **prinaldo@arrl.org**.

Spring Sprints

The East Tennessee DX Association is the sponsor of the 2004 Spring VHF/UHF Sprints. These are short-duration contests ideal for checking out your radios. The first three on 144, 222 and 432 MHz are in April. Try to get on and support these worthwhile events. Rules and details are in "Contest Corral" this issue and at **www.etdxa.org/vhf.htm**.

Eastern VHF/UHF Conference

The 30th annual Eastern VHF/UHF Conference sponsored by the North East Weak Signal Group will be held at the Radisson Hotel in Enfield, Connecticut, on April 16, 17 and 18. Notice the new time for this convention, which was formerly held in late August. More information can be found at **www.newsvhf.com/vhfconf.html**.

SEVHFS Conference

The 8th Annual SVHFS Conference will be held at the Holiday Inn in Marietta, Georgia, on April 24 and 25. VHFers throughout the south attend this convention sponsored by the Southeastern VHF Society. Additional details can be found at **www.svhfs.org/conf_2004.htm**.

W4TRH Web Page

As we begin the summer VHF season, I would like to make my readers aware of this wonderful resource at **www.dxers.info**. The site contains an enormous amount of information about 6 meters (and other bands as well) and a members-only real time chat page at **chat.dxers.info/** that is invaluable when the band is open. Check this one out—you will enjoy it.

Units

I have been using metric units, in particular kilometers, for distance since I took over the column. One of my readers comments that he doesn't understand metric units and that the English system—miles and degrees—is used in the US. While I think we should use metric units because the entire rest of the world uses them, I am willing to revert to using a dual measure, miles (kilometers), if that is what the community wants. What do you think? QST

OP-ED

Why Isn't Safety First?

By Alan R. Applegate, KØBG

The ARRL has always stressed safety to its members and for good reason. The average amateur works around high voltage ac and dc circuits, fairly substantial RF voltages, climbs to towering heights (no pun intended), and works with hot soldering irons. Without due caution, an amateur risks electrocution, RF exposure, debilitating falls, severe burns and possible death. Just this past year, two well-known amateurs were killed while pursuing amateur-related activities. The real toll is difficult to assess, as specific amateur-related injuries are not cataloged by any federal agency. This includes the NHTSA (National Highway Traffic Safety Administration, **www.nhtsa.gov**).

I mention the NHTSA because a trend toward amateur mobile operation is increasing by all accounts. And the majority of this operating is done while in motion. Whether or not these mobile operations (called *telematics* by the NHTSA) are causing accidents is far from moot. While only two states require listing of telematics use on accident reports, a growing number of cities and counties are requiring the data, and the preliminary results are alarming. Unfortunately, these early reports do not specifically list two-way or Amateur Radio use. Nonetheless, our city fathers and mothers are listening and responding by passing laws against all matter of telematics use, including Amateur Radio. We have several instances of this here in my home state of New Mexico.

In a letter presented to the NHTSA, Mrs Joyce White, a registered nurse, presented a case that is very much related. (The letter can be found at **www-nrd.nhtsa.dot.gov/PDF/nrd-13/WhiteJ_doc.pdf**.) Here is an excerpt.

> I came to Washington today, as a concerned citizen, to share my views on driver distraction and telematics in hopes that you will walk away with a deeper understanding of the problem and what you can do to help.
>
> I have a personal interest in this issue because almost three years ago my 21-year-old daughter, Angela, along with one of her friends, was killed in a crash in which the driver of the other vehicle was using a cell phone. This driver was unaware that she was speeding and did not see the car in which my daughter was a passenger prepare to make a turn, both classic examples of driver distraction.

While this example deals with cell phone use, it could have been Amateur Radio. As a personal example, in 1975 I received a speeding ticket in Arizona, and I openly admit it was a lack of attention caused by talking on my Amateur Radio.

Of late there seems to be another trend that is less evident: The lack of safe operating conditions while mobile. With some 30-plus years of mobile operation, I have never temporarily mounted a piece of amateur gear in any vehicle I have operated from. When it comes to safe operating and safe operating conditions, the phrase "throw the rig in the car" has no merit.

Last year while attending a hamfest, I overheard a conversation between two amateurs, one of whom was discussing his recent HF mobile installation. Curious, I just had to look to see why he was so proud of his handy work. Well, he had used Velcro to attach the face plate of his ICOM IC-706 right in the center of his steering wheel, and on top of the SRS (supplemental restraint system). Yes it was convenient, but potentially very deadly!

It is distracting enough to talk on Amateur Radio and drive without adding further distraction caused by poor installation practices. While the above example is an extreme case, it is by no means unique. In its "Up Front In *QST*" column, the ARRL recently published a picture of a mobile installation that used Velcro as an attachment method. In the case of an accident, Velcro and bungie cords allow rigs to become airborne missiles. And the same can be said for mag-mount mobile antennas.

Every state in the union has passed laws that specifically address such safety concerns as child safety seats and seat belt use. All of these devices must meet specific NHTSA standards. Hundreds of drivers have been stopped and ticketed for not meeting the requirements of the law. But I'll bet not one single amateur has ever been ticketed for a sloppy installation.

In the absence of laws requiring proper installations, it is up to us amateurs to set a safe operating environment level, as free of distraction as possible, and ones that will ensure that we remain out of the public limelight with respect to safety. Let's all work toward ensuring our continued use of our favorite form of telematics.

QST Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to two-thirds of a *QST* page in length (approximately 900 words).

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel or slander will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111.

STRAYS

I would like to get in touch with...

◊ others who restore Model A Fords. I am presently finishing the restoration of a 1929 Model A phaeton—as well as putting up a new tower.—*Peter Krulewitch, W2YG;* **epetek1@att.net**.

◊ operators of the UN Field Service, Dutch Communication Staff, who operated as ZC6UNJ from Jerusalem in April 1958, in particular one Paul Altorf. Please contact Werner H. Berli, HB9US,at **hb9us@arrl.net**.

◊ former members of the Alexandria (VA) Radio Club, which is marking its 50th anniversary this year. Tell us when you were in the club and share your stories with us. Please contact ARC Secretary Alan Wormser, N5LF, at **n5lf@arrl.net**, or write to the Alexandria Radio Club, PO Box 30721, Alexandria, VA 22310.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1BWM, Ralph C. Powell, Damariscotta, ME
N1CPG, Anthony F. Tino, Mary Esther, FL
*W1DL, Julius M. Hoffer, Framingham, MA
K1DR, Richard Rosevalt, Ridgefield, CT
WB1DUU, Herbert E. Cantwell, Lewiston, ME
WB1ESS, Irving Warner Jr, Vineyard Haven, MA
N1GLK, Wasiley Kisley, Colchester, CT
W1GTS, Austin Chadwick, Cranston, RI
W1HCJ, James D. Hunter, Westford, MA
KD1HH, Frederick F. Carroll Sr, Swanville, ME
KA1LJ, George C. Brackett, Salem, MA
K1PJQ, Warren Thurnauer Sr, Manchester, CT
K1PRR, Robert L. Robinson, Yarmouth, ME
WX1R, Warren A. Grimes, Rowley, MA
N1VVG, Robert Blackwood, Turner, ME
W1YTK, Paul K. Simmons, Cambridge, MA
WD2AEL, S. Dey Wells, Naples, NY
W2HVW, Wallace F. Cantoni, Landisville, NJ
N2JUZ, Joseph G. Ferdinand, Ocala, FL
W2KNJ, Paul Belmonte, Emerson, NJ
WB2MNE, Lewis W. Bimble, Bridgewater, NJ
WZ3G, Garrett C. Klein, Nashville, TN
W3MK, Donald E. Dahl, Montgomery, AL
K3NCB, Manuel L. Gochin, Lakeland, FL
W3PCZ, Henry N. Spears, Newark, DE
W3ZBF, John P. Stager, Erie, PA
W3ZOC, Couver L. Mullin, Allentown, PA
AD4CY, Larry E. Byrd, Talladega, AL
WB4DQD, James E. Sandlin, Sugar Tree, TN
W4EGK, Joe B. Batchelor Jr, Jersey, GA
*K4EZ, Bennett R. Adams Jr, Cincinnati, OH
N4JH, Julian T. Harvey, Chesapeake, VA
N4JT, Jeff Hutchinson, Merritt Island, FL
K4JTW, Charles W. Jordan, Roanoke, AL
K4KS, Walter L. Miller, Columbus, GA
*W4LAN, Eiland Helms, Bonifay, FL
W4LOG, Leslie N. Woods, Winchester, VA
WA4LQN, Billy J. Moore, Dalzell, SC
KC4MR, James A. Vernon, West Columbia, SC
N4OCL, Janice A. Secrist, St Petersburg, FL
N4OYV, William E. Gilbert, Fort Payne, AL
WA4QCD, James R. Patrick, Rossville, GA
KF4QZP, Scott H. Church, North Wilkesboro, NC
K4RMX, Clarence H. Lamp, Winchester, VA
WA4RUD, Champ D. Pinner, Hartsville, SC
K4TJN, A. D. Nason Jr, Phenix City, AL
K4WHJ, Wilfred E. Mowrey, Winchester, VA
*N4YR, Albert P. Jones, Charlotte, NC
W5AJA, Raymond D. Watson, Venus, TX
WD5BSP, William V. Minchew, Newellton, LA
W5EKR, Karl Rushing, Indianola, MS
KC5GG, Jerry N. Broderick, Wardell, MO
KC5RCU, Allen Coe, Cleveland, TX
*KB5RK, Robert C. Daigh, Corrales, NM
WB5TGH, Charles E. Lowe Sr, Austin, TX
N6DIW, Steven E. Dorfman, West Hollywood, CA
N6EQW, Bernard M. Boress, Redlands, CA
W6FRZ, Stephen A. Locks, Henderson, NV
ex-K6GTI, Harold R. James, Fresno, CA
K6MXM, Earl A. Chico, Escondido, CA
WA6MZL, Mary F. Lancaster, Mi Wuk Village, CA
W6PO, Robert I. Sutherland, San Mateo, CA
W6QYT, Oswald G. Villard Jr, Palo Alto, CA
W6SCL, Frank J. Mullen, Pebble Beach, CA
W6UBK, Theodore Kizirian, Fresno, CA
*WA6VYD, Burr T. Chambless Sr, Brunswick, GA
WA6WBZ, Edward F. Baldus, Tualatin, OR
KD7AKA, Margaret N. Mulkey, Nordland, WA
K7AZI, Glenn A. Welsh, Renton, WA
KA7GXB, Frances L. Jacobs, Kanab, UT
N7IJI, John W. Anderson, Charlotte, NC
W7IWU, Alan K. Ross, Meridian, ID
W7JAT, Vernon E. Gallinger, Kingman, AZ
KJ7KN, Russell H. Iverson, Peoria, AZ
W7LME, Charles R. Sewell, Phoenix, AZ
W7OPR, Ronald R. Kimm, Spokane, WA
W7OVP, Albert Klein, Salt Lake City, UT
WA7PME, Reuben Sparby, Seattle, WA
K7PU, Kenneth E. Gulley, St George, UT
N7SJK, Clyde P. Glover, Sequim, WA
KC7UET, Edgar Dodd, Kanab, UT
WG7U, Jake H. Hitt, Nampa, ID
N7VVF, Norm Watkins, Tucson, AZ
K8BI, William J. Mondeau, Howell, MI
N8CDN, Terrence K. Callahan, Lorain, OH
W8CF, Morton C. Benson, Fairborn, OH
W8CSU, Edward C. Gammeter, Cadiz, OH
N8ES, Elmer L. Shafer, Pepper Pike, OH
W8HMU, Robert J. Steiger, Brecksville, OH
WA8IZG, Charles J. Police, Wadsworth, OH
W8JSE, Wendell G. Suffron, Fairborn, OH
WA8KER, Bryce C. Petersen, Charleston, WV
WA8MRT, Harold W. Littell, Akron, OH
W8NCD, Ernest S. Moore, Charleston, WV
W8NXD, Ronald A. Mann Sr, Muskegon, MI
KA8QBW, Donald V. Yoxthimer, Sharonville, OH
W8SUO, Edward J. Wolf, Loveland, OH
W9CCL, Charles L. Perkinson, Indianapolis, IN
N9CFL, Robert L. Kitzinger, Tucson, AZ
WB9EJE, Frank E. Burt, Ocala, FL
WA9FHS, Daniel Pauls, Whiting, IN
N9FLP, Leo A. Beckman, Madison, WI
N9JST, Frank C. Hurst, Lebanon, IN
W9OWT, Floyd A. Sarwinski, Glenarm, IL
*W9PQO, Harold H. Gibson, Yorba Linda, CA
K9UBJ, Wilbur C. Godare, Vincennes, IN
KA9VBW, Maynard D. Peterson, Frederic, WI
KB9VTS, Jack D. Robinson, Richmond, IN
WØAAU, Alfred H. Hammond, Fergus Falls, MN
WDØARL, Edward C. Gordon, Boonville, MO
NØBJM, Carl R. Henrici, Cedar Rapids, IA
KBØGBL, Clayton M. Sillerud, Fergus Falls, MN
WØGC, Gary Carlson, Gary, SD
WØHLU, Roger C. Medlin, Manhattan, KS
WØJO, Joseph Kaniuk, North Lauderdale, FL
KAØKTD, Gordon A. Carpenter, Hawarden, IA
WØLLC, Loyd E. Mealy, Florissant, MO
WØLOW, Ralph H. Jain, Colby, KS
WØNI, Stanley P. Skwarlo, Shawnee, KS
WØOMV, John W. Hays, Davenport, IA
*KØPUX, John A. Campbell, Independence, KS
WØSWS, G. Russell Freymuth, Colorado Springs, CO
WØSZX, Lawrence A. Solberg, St Paul, MN
WØUWF, H. Darrell Shanklin, Montezuma, IA
*WØXH, Harvey L. Sachau, Rapid City, SD
ON5YO, Andre Biset, Charleroi, Belgium

*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

QST congratulates . . .

◊ FCC engineer Michael J. Marcus, N3JMM, of Cabin John, Maryland, who was recently conferred as a Fellow by the IEEE for members with an extraordinary record of accomplishment. Dr Marcus joined the FCC's OET in 1979 and currently serves as Associate Chief for Technology. For much of that time, he has specialized in spectrum management policy, focusing on technological issues. He championed changes in Commission rules that enabled spread spectrum, use of unlicensed devices in certain spectrum bands, and use of upper millimeter wave technologies.

◊ Norman Harrill, N4NH, who was profiled in the February 2004 issue of *Carolina Country* magazine. The article "On Top of Mt Pisgah" chronicles Norm's adventures spanning 45 years as an engineer maintaining equipment (including broadcast transmitters and antennas) atop one of North Carolina's most hazardous mountain peaks.—*tnx G. Stewart Tyler, WA4JUO*

◊ Chuck Rexroad, AB1CR, of Bolton, Connecticut, who has been named "Technician of the Year for 2003 IBM Software Group Americas Field Sales."

In the March/April issue:

• John Miles, KE5FX, and Richard Hosking, VK6BRO, bring us a versatile hybrid synthesizer design. It is intended chiefly for UHF and microwave work, although we suppose it could be adapted elsewhere. Al Buxton, W8NX, writes about loaded dipoles designed using a technique he calls the dominant-element principle. It's a way to produce multiband dipole antennas without losing efficiency or bandwidth. Check it out.

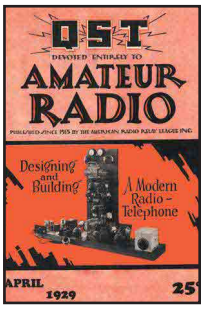
• Brian Cake, KF2YN, returns with a follow-on to his article about Twin-C antennas in the last issue. This time, the subject is what he calls "Boxkite" Yagis. Ample data and discussion are accompanied by construction details of arrays based on Twin-C elements. Randy Evans, KJ6PO, discusses tapped-capacitor matching circuits. Rod Green, VK6KRG, weighs in on the issue of receiver dynamic-range testing. Rod presents some examples using his own Dirodyne design, which was introduced recently (Jul/Aug 2002) here in *QEX*. In RF, Contributing Editor Zack Lau, W1VT, presents two signal sources for 1296 work.

QEX is edited by Doug Smith, KF6DX (**dsmith@arrl.org**) and is published bimonthly. The subscription rate (6 issues) for ARRL members in the US is $24. For First Class US delivery, it's $37; elsewhere by surface mail (4-8 week delivery) it's $31. In Canada by airmail it's $40. Elsewhere by airmail it's $59. Nonmembers add $12 to these rates.

Would you like to write for *QEX*? It pays $50/printed page. Get more information and an *Author's Guide* at: **www.arrl.org/writing.html**. If you prefer postal mail, send an SASE with postage for 1 ounce to Maty Weinberg, ARRL, 225 Main St, Newington, CT 06111-1494, and request an *Author's Guide*.

75, 50 AND 25 YEARS AGO

April 1929

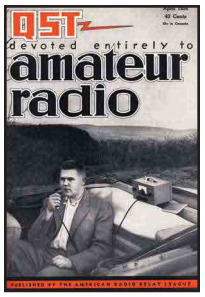


♦ The cover photo shows the result of "Designing and Building a Modern Radiotelephone." The editorial discusses the question, now before Congress, of whether the Federal Radio Commission will continue for another year as the licensing authority, and concludes that it likely will do so.

Ross Hull discusses "Modern Practice in High-Frequency Radiotelephony" (the cover story), a 14-page comprehensive overview. James Lamb describes "A General Purpose Audio-Frequency Power Amplifier." There's more on audio, in "Notes on Distortion in Audio Frequency Amplifiers," by J. R. Nelson. R. J. Kryter tells about "Alternating Rectification as Applied to Radio," the first article of a two-part series. In "Dress," C. J. Paddon explains how to make the amateur station look neater by bundling and dressing the wires and cables. O.W. Pike and E. E. Spitzer tell about "A New Low-Power Screen-Grid Transmitting Tube," the UX-865. George Grammer, W3AIH, discusses "Calibrating the Heterodyne Frequency Meter or Monitor." J. E. Smith tells about "Wired Wireless," a modern new technique used by power companies for multichannel communication over their power lines using "carrier-current systems."

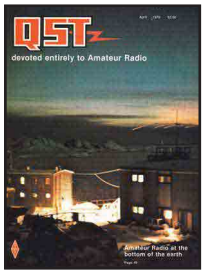
April 1954

♦ The cover photo shows W1VLH operating his one-package 2-meter station from his convertible auto as he sits on top of West Peak, Connecticut. The editorial discusses TVI checking, amateur growth, and ARRL membership growth (an all-time membership high of 43,614).



In "A One-Package Station for Two Meters," Mason Southworth, W1VLH, tells how he built a complete 2-meter station in a 5×6×9 package—a marvel of miniaturization. "W9NZZ Wins Edison Award" tells about Stan Surber's being honored for his work in handling 12,000 radiograms last year for the military and scientific personnel stationed at five Arctic weather stations. Stan is also featured in the Collins Radio ad a few pages earlier, sitting at his Collins station. G. L. Countryman, W3HH, describes "The Pygmy Powerhouse," his very small 40-watt bandswitching VFO rig. Lew McCoy, W1ICP, says, "Let's Go VFO," with his modification of the "Novice 35-Watter" published earlier in *QST*. George Grammer, W1DF, presents "The Case for the AB1 Linear," and illustrates his points with a homebrew linear using four surplus 1625 tubes in push-pull/parallel. (Those tubes can be found advertised in this issue for 25¢, or four for $1.) Loren Norberg, W9PYG, tells about "Transmitter Hunting with the D.F. Loop" on 10 meters. Noted radio authority Larson E. Rapp, WIOU, enlightens us with "A Radical Approach to Improved 'Phone Reception," using simple circuit tricks for better receiver performance. Well-known DXer Katashi Nose, KH6IJ, describes "A Lightweight 21-Mc. Three-Element Beam." ARRL National Emergency Coordinator George Hart, W1NJM, reports on "The 1953 SET Shindig."

April 1979



♦ The cover photo by K1KI shows "Amateur Radio at the bottom of the earth." The editorial tells about the League's Long-Range Planning Committee and its work.

Robert Shriner, WAØUZO, tells how to build "A Low-Cost PC-Board Duplexer" for 2 meters. Jim Bartlett, K1TX, describes "A Simple CW Audio Filter." Leroy Stockemer, KØWOL, discusses "The SHARC Audible Current Meter," a radio aid for blind hams. Doug DeMaw, W1FB, looks at "The Whys and Hows of Bifilar Filament Chokes," and then discusses how to "Save Money—Build Your Own RF Choke." David Hollander, N7RK, tells how he puts out "A Big Signal from a Small Lot," using a 60-foot bandswitched vertical. Tom Frenaye, K1KI, tells the story of "Amateur Radio at the Bottom of the Earth," drawing upon his experience as communications coordinator and Amateur Radio operator of KC4AAC, Palmer Station, Antarctica, 1975-76. Brian Peters, WD4EPR, recognizes hams who are helping watch for tornadoes and violent storms, in "Public Service before Disaster Strikes." 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 1.8175, 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 10 AM to noon and 1 PM to 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, Presidents' Day (Feb 16), Good Friday (Apr 9), Memorial Day (May 31), Independence Day (Jul 5), Labor Day (Sep 6), Thanksgiving and the following Friday (Nov 25-26), and Christmas Day (Dec 24). QST

April 18 Marks the Annual Amateur Radio Day

World Amateur Radio Day 2004 theme designated: The theme for World Amateur Radio Day 2004 is "Radio Amateurs: Pioneers in Bridging Barriers to World Understanding." Commemorating the anniversary of the founding of the International Amateur Radio Union (IARU), World Amateur Radio Day takes place each year on April 18. This year, the IARU marks its 79th anniversary. The 2004 theme is intended to emphasize the IARU's long history of bringing people together across geographic, cultural and political barriers. Created in Paris, the IARU has been the watchdog and spokesman for the world Amateur Radio community since 1925. The worldwide federation of national Amateur Radio organizations represents some 3 million radio amateurs in 159 countries. The IARU is organized into three administrative regions of the International Telecommunication Union (ITU).

The IARU home page on the Web, at **www.iaru.org**, contains a great deal of information about the IARU, including its meeting summaries, activities, band plans for each region, a calendar of upcoming events, contest information, club station NU1AW information, list of member societies, monitoring system, QSL bureaus throughout the world, statistical data and links to each Region's Web site. The IARU has been instrumental in coordinating and representing amateur radio at each of the World Radiocommunication Conferences, and at many regional ITU meetings.

P43P

Figure 1—Bridging barriers to world understanding is always an underlying theme at the World Radiosport Team Championships. This shot from WRTC 2000 shows hams from 10 countries celebrating their commonalities and making lifelong friendships. From the left: P43P, KT3Y, 9A2AA, G4BUO, S56MM, N5KO, VK2IA, YL2KL, AI6V, JE1JKL, OK1FUA, S5ØA, OK2RZ and OH6DO.

Poland World Amateur Radio Day 2004 Award

The WARD 2004 Award is designed to commemorate the World Amateur Radio Day celebrated by IARU on April 18 each year. It is issued by the MK QTC Polish Amateur Radio Journal, with support of PZK, Polish Amateur Radio Union. WARD 2004 will be granted for making the minimum number of contacts: *either 10 QSOs on the HF bands, or 5 QSOs on the VHF bands*. All contacts must be made between *0000 and 2400 UT on April 18, 2004*. Send a standard application form (log extract) including the list of QSOs on or before May 31, 2004 and fee of €5 or US$5 to Redakcja MK QTC, ul. Wielmozy 5b, 82-337 Suchacz-Zamek, Poland. The WARD Award is available also for SWLs.

UK Call Sign Prefix History

There is significant new activity from the United Kingdom on the HF bands since the UK dropped its Morse requirements. Much of the activity is from the Foundation Class licensees and the Intermediate Class licensees, many of whom are using calls with prefixes never before seen on the HF bands. The following table does not include regional identifiers used within the UK (that is, GM or MM for Scotland, or GW or MW for Wales), but shows the general prefix letters and numbers and the corresponding years of issuance (thanks *Radcom*).

Advanced Class (previously Class A)	
G2 plus two letters	1920-1939
G3 plus two letters	1937-1938
G4 plus two letters	1938-1939
G5 plus two letters	1921-1939
G6 plus two letters	1921-1939
G8 plus two letters	1937-1937
G2 plus three letters	pre-1939
G3 plus three letters	1946-1971
G4 plus three letters	1971-1985
GØ plus three letters	1985-1996
MØ plus three letters	1996-present
M5 plus three letters	1999-2001
2EØ plus three letters	1991-present
Intermediate Class (previously Class B)	
G8 plus three letters	1964-1981
G6 plus three letters	1981-1983
G1 plus three letters	1983-1988
G7 plus three letters	1988-1996
M1 plus three letters	1996-present
2E1 plus three letters	1991-present
Foundation License	
M3 plus three letters	2002-present

Briefs

Canadian hams may lose 220-222 MHz segment: After studying the spectrum needs of various services over the past 18 months, the Radio Advisory Board of Canada (RABC) plans to recommend to Industry Canada (IC) that the 220-222 MHz band segment be transferred from the Amateur Service to the Mobile Service. The RABC recommended allocating 219-220 MHz to amateurs in Canada on a secondary basis, in harmony with a similar allocation for US amateurs, who lost the 220-222 MHz band segment in 1991. In addition, the RABC asked that IC continue 222-225 MHz as a primary exclusive amateur allocation. It also recommended grandfathering amateur repeaters in the 220-222 MHz segment, to continue operation for a period of time that the IC would determine, and designating 150 kHz of spectrum for the Amateur and Mobile services to share for certain public safety and disaster communication applications. Radio Amateurs of Canada (RAC) has vigorously opposed the proposed changes without success. The RAC has posted additional information on its Web site, **www.rac.ca/news/canada.htm**. —*RAC bulletin*

Croatia benefits from WRC-03 40-meter expansion: Croatia has become the first country in Region 1 to benefit from the expansion of the 40 meter band agreed at World Radiocommunication Conference 2003 (WRC-03) last summer. Croatian amateurs also now enjoy new privileges at 70 and 3400 MHz and no longer have to pass a Morse code test for HF access. New amateur radio regulations went into effect December 26. In addition to the normal Region 1 allocation of 7000 to 7100 kHz, amateurs in Croatia may operate between 7100 and 7200 kHz on a secondary basis with a maximum power of 1 kW PEP. On 4 meters, Croatians may operate 70.000 to 70.450 MHz with up to 10 W. The new 3400-3410 MHz band permits a maximum power of 150 W. Croatia now has only two license classes—the full license and a beginners' license.—*RSGB*

Upcoming Events: *Ham Radio 2004* in Friedrichshafen, Germany, will be held June 25-27 at the one-year-old convention center on the North Shore of Lake Constance/Bodensee. See **www.darc.de/referate/ausland/hamradio/**.

The JARL's *Amateur Radio Festival—"Tokyo Ham Fair"*—will be held August 21-22 at the Tokyo Big Sight, the Tokyo International Exhibition Center. See **www.jarl.or.jp/English/4_Library/A-4-1_News/jn0309.htm**.

COMING CONVENTIONS

EASTERN VHF/UHF CONFERENCE

April 16-18, Enfield, CT

The Eastern VHF/UHF Conference, co-sponsored by the Eastern VHF/UHF Society and the North East Weak Signal Group, will be held at the Radisson Hotel, 1 Bright Meadow Blvd, off Rte 5; from Springfield take I-91 to Exit 49, left off ramp, take second right; from Hartford take I-91 to Exit 49, right off ramp, take first right. Features include lectures, lab sessions, noise figure and antenna measurements, card checking (VUCC, WAS, DXCC), banquet, outdoor flea market (Sunday morning only). Admission is $25 in advance, $30 at the door. Table space is $5 for buyers, $10 for sellers; bring your own tables. Contact Bruce Wood, N2LIV, 3 Maple Glen Ln, Nesconset, NY 11767; 631-265-1015 (home) or 631-293-9600 (work); **bdwood@erols.com**; **newsvhf.com**.

SOUTHEASTERN VHF CONFERENCE

April 23-24, Atlanta, GA

The Southeastern VHF Conference, sponsored by the Southeastern VHF Society, will be held at the Holiday Inn Hotel and Suites, 2265 Kingston Ct; I-75 and Delk Rd. Features include kick-off lunch (Friday at noon), seminars, noise figure and antenna gain measurements, technical program and presentations, flea market, manufacturer exhibits, auction, grand banquet, awards. Admission is $25 in advance, $30 at the door. Contact Dick Hanson, K5AND, 7540 Williamsburg Dr, Cumming, GA 30041; 770-751-1461; **k5and@arrl.net**; **www.svhfs.org**.

INTERNATIONAL DX CONVENTION

April 23-25, Visalia, CA

The International DX Convention (55th Annual DX Convention), sponsored by the Southern California DX Club, will be held at the Holiday Inn Hotel and Conference Center, 9000 W Airport Dr; located at the intersection of State Hwys 99 and 198. Features include vendors, exhibitors, forums, programs, technical sessions, QSL card checking, banquet. Admission is $70 in advance, $75 at the door. Contact Don Bostrom, N6IC, 4447 Atoll Ave, Sherman Oaks, CA 91423; 818-784-2590; **n6ic@arrl.net**; **scdxc.org/visalia**.

LOUISIANA STATE CONVENTION

April 30-May 1, Baker

The Louisiana State Convention, sponsored by the Baton Rouge ARC, will be held at the Baker Civic Auditorium, 3325 Groom Rd; from Baton Rouge take I-110 N to the Baker Exit (Hwy 19), continue on Hwy 19 to Groom Rd (Burger King on right), turn right onto Groom Rd and continue for 1 block to Auditorium on left (parking in rear). Doors are open Friday 3-8 PM, Saturday 8 AM to 2 PM. Features include forums, vendors, VE sessions, refreshments. Talk-in on 146.79. Admission is $5. Tables are $15. Contact Ed Laughery, AD5JV, Box 4004, Baton Rouge, LA 70821; 225-686-1450; **ad5jv@arrl.net**; **www.brarc.org**.

March 19-20
Oklahoma Section, Claremore*

March 20-21
West Texas Section, Midland*

March 26-27
Maine State, Lewiston*

March 27-28
Maryland State, Timonium*

April 4
North Carolina State, Raleigh*

May 29-30
Wyoming State, Casper

June 4-6
Atlantic Division, Rochester (Henrietta), NY

June 5
Georgia Section, Marietta

***See March *QST* for details.**

MIDWEST DIVISION CONVENTION

April 30-May 1, Lebanon, MO

The Midwest Division Convention, sponsored by the Lebanon ARC, will be held at the Cowan Civic Center, 500 E Elm St. Features include huge indoor flea market; commercial vendors; new and used equipment vendors; forums (ARRL, FCC, Digital, Antennas, ARES); sessions (QCWA, MARS); special guest ARRL President Jim Haynie, W5JBP; VE sessions; buffet-style picnic dinner. Admission is $6 in advance by Apr 15, $8 at the door. Tables are $10 with additional tables $5 each if reserved in advance by Apr 15; after Apr 15 $15 (Mike Edwards, WB9M, 417-532-9111 days or 417-588-1535 eves; **wb9m@earthlink.net**). Contact Bill Wheeler, KØDEW, 500 E Elm St, Lebanon, MO 65536; 417-532-4642; **bwheeler@socket.net**; **home.earthlink.net/~wb9m**.

SAN JOAQUIN VALLEY SECTION CONVENTION

April 30-May 2, Fresno, CA

The San Joaquin Valley Section Convention, sponsored by the Fresno ARC, will be held at the Ramada Inn University, 324 E Shaw Ave; Hwy 41 to Shaw Ave Exit. Features include commercial vendors, forums (Tech, HF Propagation Prediction, Weak Signal Modes, Contesting, Antennas, Emergency Communications, ARRL, SKYWARN/Weather Service), keynote speaker, contests, foxhunt, hospitality room, luncheon ($15), auction, VE sessions (May 2). Talk-in on 146.94. Admission is $10 in advance, $12 at the door; under 12 free. Tables are $5 (swap), $30 (commercial). Contact Gene Davis, W7POR, 35329 Ave 13¼, Madera, CA 93638; 559-645-6849; **gdavis@gotnet.net**; **www.qsl.net/w6to**.

SOUTH CAROLINA SECTION CONVENTION

May 1, Greenville

The South Carolina Section Convention, sponsored by the Blue Ridge ARS, will be held at the Piedmont Interstate Fairgrounds, 275 Fairgrounds Rd (Spartanburg); 3 miles S of Business I-85, Exit 4 (Hearon Circle), Hwy 56 S, follow signs. Doors are open 8 AM to 2 PM. Features include large outdoor tailgating area, indoor exhibitors, vendors, dealers, ARRL info table, forums, QCWA table, DXCC Card Checking, foxhunt, RV camping with full hookups (Friday night, $10), VE sessions (11 AM, off site), handicapped accessible, refreshments. Talk-in on 146.61, 146.82. Admission is $5 in advance, $6 at the door; under 12 free. Tables are $11, electricity $5, chairs $1. Contct John Hoyt, W5UGD, 125 Wyatt Oaks Ct, Easley, SC 29642; 864-859-8316; **hamfest@brars.org**; **www.upstatehamfest.org**.

ALABAMA SECTION CONVENTION

May 1-2, Birmingham

The Alabama Section Convention, sponsored by the Birmingham ARC, will be held at the Zamora Temple, 3521 Ratliff Rd; I-20 to Exit 135 exiting westbound turn left, go to stop sign, turn left, follow signs; exiting eastbound turn right, go to stop sign, turn left, follow signs. Doors are open Saturday 9 AM to 5 PM, Sunday 9 AM to 4 PM. Features include flea market, commercial vendors, exhibitors, tailgating, forums, VE sessions (Saturday, 9 AM and 1 PM sharp; Sunday 9 AM only), banquet (Ed Pitchford, KD4AY, 205-823-4373). Talk-in on 146.88. Admission is $5 (good both days); under 12 free when accompanied by a paying adult. Tables are $20 (flea market). Contact Glenn Glass, KE4YZK, 8368 Country Circle, Pinson, AL 35126; 205-368-7361; **ke4yzk@bellsouth.net**; **www.w4cue.com**.

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.

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 **April 1** to be listed in the **June** 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.)

Alabama (Birmingham)—May 1-2, Alabama Section Convention. See "Coming Conventions."

†**Arizona (Phoenix)—Apr 17,** 6 AM to 2 PM. *Spr:* Arizona ARC. DeVry University, 2149 W Dunlap Ave; I-10 to I-17 N, take Dunlap Ave Exit in N Central Phoenix, go E approximately 1 mile, follow signs to S parking lot. Commercial vendors, tailgating ($5 per space), refreshments. *TI:* 147.28 (162.2 Hz). *Adm:* $1. Tables: $5. George Cooney, KQ7C, 21 E Coulter St, Phoenix, AZ 85012; 602-274-6212; **kq7c@arrl.net**; **www.qsl.net/w7io**.

†ARRL Hamfest

†**Arizona (Sierra Vista)—May 1,** 7 AM to 1 PM. *Spr:* Cochise ARA. Green Acres, 2756 Moson Rd; from the intersection of Fry Blvd and State Hwys 90 and 92 (at the Target store), go E on Hwy 90 (an extension of Fry Blvd), 4 miles to Moson Rd, go S (right) on Moson Rd for 2 miles, Antenna

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

Farm on right. Tailgating ($5 per space), MARS Meeting (8:30-10 AM), ARCA Meeting (11 AM), VE sessions (10 AM), free parking. *TI:* 146.76 (162.2 Hz). *Adm:* Free. Tables: $7. Pat Thies, KD7HAB, 5041 S Santa Aurelia Ave, Sierra Vista, AZ 85650; 520-378-6829; **kd7hab@earthlink.net**; **www.qsl.net/k7rdg**.

†Arkansas (Fort Smith)—Apr 3, 8 AM. *Spr:* Fort Smith Area ARC. Columbus Acres, 10201 Columbus Acres Rd; from the intersection of I-540 and Hwy 71, go S towards Texarkana, travel S 1.2 miles past Guesthouse Inn, turn right at McDonald's onto Brooken Hill, turn left onto Columbus Dr to hamfest. Flea market, major dealers, free tailgating, free forums, VE sessions, free RV parking, refreshments. *TI:* 146.64. *Adm:* $5. Tables: $10. Jimmie Lowrey, W5JNL, Box 6622, Ft Smith, AR 72906; 479-649-7249; **w5jnl@arrl.net**; **www.HangingJudgeHamfest.com.**

†Arkansas (Little Rock)—Apr 23-24; Friday 4-8 PM, Saturday 8 AM to 4 PM. *Sprs:* Arkansas Radio Emergency Service and other central AR clubs . Little Rock Expo Center, Exit 128 off I-30 in SW Little Rock, near the Pulaski County line. Flea market, computer and equipment dealers, vendors, tailgating, demonstrations, meetings, forums, technical table (test your own equipment), contests, VE sessions, NWS Storm Spotter Course (9-11 AM), handicapped accessible. *TI:* 145.13. *Adm:* $7. Tables: $30 (dealers), $20 (flea market); electricity ($5 per outlet). Jim Blackmon, K5VZ, 1008 Pine St, Arkadelphia, AR 71923-4919; 870-246-6734 or 870-246-7833; fax 870-246-6736; **k5vz@ezclick.net**; **www.aristotle.net/~hamfest/**.

California (Fresno)—Apr 30-May 2, San Joaquin Valley Section Convention. See "Coming Conventions."

†California (Sonoma)—Apr 24; set up 7 AM; public 8 AM to noon. *Spr:* Valley of the Moon ARC. Sonoma Valley Veteran's Memorial Building, 126 First St W, 1 block N of the central Sonoma Plaza, Hwy 12. Indoor and outdoor electronics swapmeet ($10 per space; no charge for Amateur Radio organizations for informational tables and displays), VE sessions (walk-ins, register 9 AM, exams 10 AM, all license elements), operating QRP station, AMSAT display, display of homebuilt equipment, beginner's DF transmitter hunt, QRP To The Field contest, full breakfast (8-10 AM, $5). *TI:* 145.35 (88.5 Hz). *Adm:* Free. Darrel Jones, WD6BOR, 358 Patten St, Sonoma, CA 95476; 707-996-4494; **wd6bor@vom.com**.

California (Visalia)—Apr 23-25, International DX Convention. See "Coming Conventions."

Connecticut (Enfield)—Apr 16-18, Eastern VHF/UHF Conference. See "Coming Conventions."

†Connecticut (Southington)—Apr 25; set up 6:30 AM; public 9 AM to 1 PM (Early Bird Special: doors open at 8:30 AM and admission is $10 until 9 AM). *Spr:* Southington ARA. Southington High School, 720 Pleasant St; I-84, Exit 32, go S on Rte 10 for 1 mile, take left onto Flanders St, go 1/2 mile to Pleasant St on right. Flea market, ham radio equipment, electronics, computers, vendors, meetings (annual spring ARES, CT Spectrum Management Assn), VE sessions (all classes; must pre-register, no walk-ins), refreshments. *TI:* 145.49, 147.345, 224.8, 444.25 (77 Hz). *Adm:* $5, under 12 free. Tables: 6-ft, advance $12, door $18 (half off if you bring your own table). Make checks payable to SARA and send with SASE to Alex Joyce, KB7HCO, c/o SARA, Box 873, Southington, CT 06489; 860-214-3013; **1ogic555@aol.com**; **www.chetbacon.com/sara.htm**.

†Connecticut (Waterford)—Apr 3; set up 9 AM; public 10 AM. *Spr:* Radio Amateur Society of Norwich. Waterford Senior Center, Rte 85; from Hartford take Rte 2 S to Rte 11 to Rte 85 S; from the shoreline take Rte 95 to Rte 85 N. Amateur equipment auction (bring your gear to sell; 10% commission to RASON), VE sessions, handicapped accessible, free parking. *TI:* 146.73 (156.7 Hz). *Adm:* Free. Tables: Free. Gary Divan, WT1SND, 102 Plain Hill Rd, Baltic, CT 06330; 860-884-4218; **witsend@portone.com**; **www.rason.org**.

Florida (Coral Gables)—Apr 17. Bill Moore, WA4TEJ, 305-264-4465.

†Florida (Gainesville)—Apr 24-25; set up Friday 4-8 PM; public Saturday 8 AM to 4 PM, Sunday 8 AM to 2 PM. *Spr:* Gainesville ARS. Alachua County Fairgrounds, 3400 NE 39th Ave (SR-222); ½ mile E of SR-24 (Waldo Rd). Hamfest/Computer Show, vendors, tailgating ($7, plus admission; 6 AM both days), demo, forums, VE sessions (1 PM both days; pre-registration required, no walk-ins), camping ($10 per night), free parking. *TI:* 146.82. *Adm:* $5 for both days, under 12 free. Tables: $8 (plus admission). Ray Forrester, W4YTC, 4010 NW 35th St, Gainesville, FL 32605; 352-371-0654; **w4ytc@arrl.net**; **www.gars.net/hamfest**.

†Florida (Tampa)—Apr 17; set up 7 AM; 8 AM to 1 PM. *Spr:* Tampa ARC. TARC Amateur Radio Operations Center, 7801 N 22nd St; I-4 to US 92 (Hillsborough Ave) Exit, go right at 22nd St to end of road or I-275 to Sligh Ave Exit, go E on Sligh to 22nd St, turn left on 22nd St to end of road. Tailgating, indoor tables, VE sessions, refreshments. *TI:* 147.105. *Adm:* $2, under 13 free. Tables: $15. Biff Craine, K4LAW, 13515 Greenleaf Dr, Tampa, FL 33613; 813-265-4812; **k4law@arrl.net**; **www.hamclub.org**.

Georgia (Atlanta)—Apr 23-24, Southeastern VHF Conference. See "Coming Conventions."

†Georgia (Calhoun)—Apr 24, 8 AM to 2 PM. *Spr:* Cherokee Capital ARS. Sugar Valley Community Center, Hwy 136; from I-75 take Exit 320, travel W on Hwy 136 to Connector, turn left onto Connector, travel approximately 5 miles to hamfest site on left. Free tailgating (with paid admission), VE sessions, free parking, refreshments. *TI:* 146.745, 443.675 (100 Hz). *Adm:* $5. Tables: $5. Felton Floyd, AF4DN, 1054 Mountain Loop Rd NW, Sugar Valley, GA 30746; 706-629-0369; **af4dn@arrl-ga.org**; **www.qsl.net/k4woc**.

†Idaho (Caldwell)—Apr 24. *Spr:* Snake River ARC. Vallivue Middle School, 16412 S 10th Ave; Exit 35 off I-84, turn towards Sugar Beet Factory, at light turn left onto Karcher Rd (Hwy 55) toward Marsing to 10th Ave, at light turn right to Middle School on right. Hamfest/Vendor Fair, VE sessions. *TI:* 147.2. *Adm:* $2. Tables: $10. Scotty Scott, W5RWS, 711 2nd St, Nampa, ID 83651; 208-466-3155.

†Idaho (Idaho Falls)—Apr 17; set up 7 AM; public 8 AM. *Spr:* Eastern Idaho UHF Society. National Guard Armory, 575 W 21st St. Hamfest/Computer Swapmeet, variety of talks, VE sessions. *TI:* 147.15, 443.0 (123 Hz). *Adm:* advance $3, door $5. Tables: $7. Jay Greenberg, WA4VRV, 2470 Harold Dr, Idaho Falls, ID 83402; 208-521-1628; **wa4vrv@arrl.net**; **myweb.cableone.net/wa4vrv/hamfest.htm**.

†Illinois (Arthur)—Apr 25. *Spr:* Moultrie ARK. Moultrie/Douglas County Fairgrounds, Rte 133; SE edge of Arthur, just off Rte 133, behind High School. 42nd Annual Hamfest. *TI:* 146.655 (162.2 Hz), 444.925 (103.5 Hz). *Adm:* $5. Tables: $10. Ralph Zancha, WC9V, Box 55, Lovington, IL 61937; 217-873-5287; **rzancha@one-eleven.net**.

†Illinois (Galva)—Apr 25. *Spr:* Area AR Operators. Galva High School, 950 N 1st St; 20 miles S of I-80 (Galva-Atkinson Exit); 15 miles E of I-74 (Galva-Woodhull Exit); 20 miles N of I-74 (Rte 78 Exit) to Rte 34, go W 5 miles. Flea market, VE sessions, handicapped accessible. *TI:* 145.49 (88.5 Hz). *Adm:* advance $5, door $7. Tables: $10. Matt Bullock, W9SIX, 419 E College St, Kewanee, IL 61443; 309-856-7111; **mbullock@bwsys.net**; **www.qsl.net/aa9ro/index.html**.

†Illinois (Godfrey)—Apr 24, 7 AM to Noon. *Spr:* Lewis and Clark RC. Lewis and Clark Community College (River Bend Arena), 5800 Godfrey Rd; 25 miles N of St Louis, MO on Rte 67, 4 miles N of Alton, IL. Commercial vendors, VE sessions, free parking, refreshments. *TI:* 145.23. *Adm:* advance $2, or 3 for $5, door $3 or 2 for $5. Tables: $10. Chris Holland, N9WHH, 965 N Woodriver Ave, Wood River, IL 62095; 618-254-9465; **n9whh@ezl.com**; **k9ham.cargodog.net**.

†Illinois (Sandwich)—May 2; set up 6 AM; public 8 AM to 1 PM. *Spr:* Kishwaukee ARC. Sandwich Fairgrounds, just N of Rte 34 intersection of Suydam and Gletty Rds; from Chicago area take US 34/Ogden Ave W, 7 miles W of Rte 47 to Gletty Rd, go N over RR tracks to Fairgrounds; from the W take US 34 E to Gletty Rd, go N over RR tracks to Fairgrounds, follow signs. Flea market, commercial vendors, free tailgating, overnight camping (electric hookup $15), free parking, refreshments. *TI:* 146.73 (100 Hz), 146.52. *Adm:* advance $5 (double stub), door $6 (single stub). Tables: $10. Make checks payable to KARC and send with SASE by Apr 20 to KARC, Box 371, DeKalb, IL 60115; or contact Tom Lower, KC9DDA, 815-754-2558 (days) or 815-739-7752 (eves); **kc9dda@arrl.net**; **www.qsl.net/wa9cjn**.

†Iowa (Des Moines)—Apr 24. *Spr:* Des Moines RA Assn. Iowa State Fairgrounds, Hall of Law, E 30th and Grand; lower level of Grandstand, E end. SKYWARN Meeting, VE sessions. *TI:* 146.94. *Adm:* $5. Tables: $10. Dan Miller, KCØFRL, 1040 Rittenhouse St, Des Moines, IA 50315; 515-285-7981; **kc0frl@arrl.net**; **www.qsl.net/dmraa/**.

Louisiana (Baker)—Apr 30-May 1, Louisiana State Convention. See "Coming Conventions."

†Maine (South Portland)—Apr 17; set up 6:30 AM, public 8 AM to noon. *Spr:* Portland Amateur Wireless Assn. American Legion Hall, 413 Broadway; from Maine Tnpk, Exit 7, turn N on Main St (US Rte 1), at Cash Corner turn right on Broadway, continue to site. Electronics flea market, consignment table, limited tailgating, VE sessions. *TI:* 147.09 (100 Hz). *Adm:* $5. Tables: advance $8, door $10. Bryce Rumery, K1GAX, 75 Ocean House Rd, Cape Elizabeth, ME 04107; 207-799-1116; **k1gax@juno.com**; **www.qsl.net/pawa/fleamarket.html**.

†Maryland (Grasonville)—May 1, 6 AM to 1 PM. *Sprs:* Kent Island and Anne Arundel RCs. VFW Post, VFW Ave; Rte 50 E, Exit 43B or Rte 50 W, Exit 44. QLF and CW contests. *TI:* 146.94 (107.2 Hz), 147.105 (107.2 Hz). *Adm:* $5. Tables: $5. Fred Koester, K3LMR, 300 Drovers Way, Stevensville, MD 21666; 410-643-2020; **fkoester@friend.ly.net**; **www.w3vpr.org**.

†Maryland (Hagerstown)—May 2, 6 AM to 3 PM. *Spr:* Antietam Radio Assn. Washington County Agricultural Center, MD Rte 65 S (Sharpsburg Pike); I-70, Exit 29 S on MD Rte 65 for 6.5 miles, facility on left. Covered tailgating, vendors, VE sessions. *TI:* 147.09. *Adm:* $5. Tables: $15. Carl Morris, WN3DUG, 5670 Lincoln Way E, Fayetteville, PA 17222; 717-352-2865; **cwmorris@pa.net**; **www.w3cwc.org**.

Massachusetts (Cambridge)—Apr 18. Nick Altenbernd, KA1MQX, 617-253-3776 (9AM to 5 PM).

†Massachusetts (Framingham)—Mar 28, 9 AM to 1 PM. *Spr:* Framingham ARA. Walsh Middle School, 301 Brook St; Rte 9 to Edgell Rd, go N 1.3 miles to Brook St, right onto Brook St, go approximately 1 mile to school on left, follow green signs. Flea market, VE sessions. *TI:* 147.15. *Adm:* $5. Tables: advance $10, door $15. Beverly Lees, N1LOO, Box 3005, Framingham, MA 01705; 508-626-2012; **b-blees@juno.com**; **fara.org/fleamarket**.

†Massachusetts (Whately)—May 10, 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. Bill Boutwell, N1EWK, 18 Freeman Dr, Greenfield, MA 01301; 413-774-4669; **n1ewk@arrl.net**; **www.fcarc.org**.

†Michigan (Cadillac)—May 1, 8 AM to 1 PM. *Spr:* Wexaukee ARC. Cadillac Jr High School, Chestnut St; US 131 to Exit 177, Mitchell St to Pine St, turn W, continue ½ mile to School. Amateur Radio/Computer Swapmeet, commercial vendors, various meetings, VE sessions (pre-register 8:30 AM, testing 10:30 AM), QCWA Luncheon, free parking, refreshments. *TI:* 146.98. *Adm:* $5. Tables: 8 ft $8. Brian Polk, KC8TXT, 13826 Serenity Dr, Marion, MI 49665; 231-743-6860; **bandb@netonecom.net**; **members.fortunecity.com/wexaukee**.

†Michigan (Highland/Milford)—Apr 17; set up 6 AM; public 8 AM to 1 PM. *Spr:* Milford ARC.

Milford High School, 2380 Milford Rd; from I-96 take Exit 155, go N through the village of Milford, go 7.2 miles, turn left (W) into High School N parking lot. Swap-n-Shop, vendors, Amateur Radio gear, computers, electronics equipment, VE sessions, refreshments. *TI:* 145.49 (67 Hz), 146.55. *Adm:* advance $5, door $6; spouses and under 12 free. Tables: 8 ft $10. Rose Mary Moore, KC8NQJ, 1383 Sylvan Dr, Hartland, MI 48353; 810-632-5174; or Mike Board, WA8WOQ, **mboard3106@aol.com**; **www.qsl.net/w8ydk**.

Michigan (Tawas City)—Apr 24, Ray Knuth, KB8ZYY, 989-739-2896.

†Minnesota (Faribault)—Apr 24, 8 AM to 1 PM. *Spr:* AR Emergency Response Team. Moose Lodge 2098, 1810 4th St NW; take I-35 to Hwy 60 (Exit 56), go E on Hwy 60 about 2 blocks to stoplight, go past Faribault West Mall to stop sign, turn left at stop sign onto 4th St NW, go 1/2 mile, stay left at fork, Lodge is on left. Tri-State ARC Communications Van, Rice County Emergency Management Trailer, VE sessions. *TI:* 146.79 (100 Hz). *Adm:* $3. Tables: $5. Larry Schmidtke, NØZXH, 2004 4th St NW, Faribault, MN 55021; 507-334-3870; **larryschmidtke@yahoo.com**.

†Missouri (Kansas City)—Apr 17, 8 AM to 2 PM. *Spr:* Ararat Shrine ARC. Ararat Shrine Temple, 5100 Ararat Dr; from I-70, take I-435 S to Eastwood Tfwy, turn right on Ararat Dr. Large swap area, commercial vendors, forums, VE sessions. *TI:* 145.13. *Adm:* advance 3 for $5, door $3 each. Tables: $15. Steve Dowdy, WJØI, 12411 Olive St, Kansas City, MO 64146; 816-941-3392; **sdowdy@kc.rr.com**; **www.shortyland.com/hambash**.

Missouri (Lebanon)—Apr 30-May 1, Midwest Division Convention. See "Coming Conventions."

†New Jersey (West Orange)—Apr 17, 8 AM to 1 PM. *Spr:* Roseland ARC (IRAC). West Orange High School, 600 Pleasant Valley Way; from N and S take Garden State Parkway to I-280, Exit 7; turn right, 2 lights to High School on right. Commercial vendors, VE sessions, free parking, refreshments. *TI:* 146.415 + 1 MHz (85.4 Hz), 447.875 (156.7 Hz). *Adm:* $5. Tables: advance $15 (first table), $12 (each additional table); door $20 (first table), $15 (each additional table). Harvey Moskowitz, W2YWC, 7 Burlington Rd, Livingston, NJ 07039; 973-994-0637; **harvmosk@aol.com**; **www.qsl.net/k2gq**.

†New York (Owego)—May 1, 8 AM. *Spr:* Binghamton ARA. Marvin Park, Main St, Rte 17C; once on 17C W in downtown Owego, approximately 1/2 mile there will be a traffic light in front of TOPS Supermarket, entrance to Park is just past light on right. Flea market, vendors, tailgating (6 AM, $2 per spot), VE sessions, refreshments. *TI:* 146.76. *Adm:* $5. Tables: $10. Robert Mess, WS2U, 69 E Catherine St, Binghamton, NY 13904; 607-777-6039; **rmess@binghamton.edu; www.wtsn.binghamton.edu/bara/hamfest.htm**.

†New York (Poughkeepsie)—Apr 18. *Spr:* Mt. Beacon ARC. Tymor Park, Tymor Park Rd, Unionvale; Rte 55 E to County Rte 21 (approximately 3.6 miles), turn left onto Rte 21 (Bruschell Rd) to Duncan Rd, Park is on right. VE sessions, refreshments. *TI:* 146.97 (100 Hz). *Adm:* $5, spouses and kids free. Tables: $10. Ken Akasofu, KL7JCQ, 8C Hudson Harbor Dr, Poughkeepsie, NY 12601; 845-485-9617; **kl7jcq@arrl.net**; **www.qsl.net/mbarc**.

†North Carolina (Morganton)—Apr 17; set up 6:30 AM; public 8 AM. *Sprs:* McDowell ARA, Western Piedmont ARC. Burke County Fairgrounds, 145 Bost Rd, Hwy 181 N; from I-40 take Exit 100, proceed N on Jamestown Rd for 1.5 miles crossing US Hwy 70, proceed 1.3 miles (road name changes to Independence Blvd) to NC Hwy 181, turn left on Hwy 181 (Green St), turn right on Bost Rd at 1st traffic light, Fairgrounds are 1/4 mile on left. Catawba Valley Hamfest and Computer Fair, flea market, tailgating (free with paid admission), dealers, forums, VE sessions. *TI:* 147.15. *Adm:* advance $4, door $5. Tables: $10. Larry Withrow, AF4HX, 2583 Nix Creek Rd, Marion, NC 28752; 828-652-4195; **af4hx@arrl.net**; **cvhamfest.org**.

†Ohio (Athens)—Apr 25, 8 AM to 1 PM. *Spr:* Athens County ARA. Athens Recreation Center, 733 E State St; take US 33 to Athens, take East State St Exit, travel E on East State St for 1/4 mile, entance marked with signs. Outdoor and indoor flea markets. *TI:* 145.15. *Adm:* $5. Tables: $10. Drew McDaniel, W8MHV, 61 Briarwood Dr, Athens, OH 45701; 740-592-2106; **mcdanied@ohiou.edu**; **www.ac-ara.org**.

†Ohio (Canfield)—Apr 25, 8 AM to 2 PM. *Spr:* Twenty Over Nine RC. Mahoning County Career and Technical Center, 7300 N Palmyra Rd; 2 miles W of the Square on US Rte 224, go N 1/4 mile to School. ARRL activities, VE sessions (10 AM). *TI:* 145.275, 442.75. *Adm:* $5. Tables: $10. Don Stoddard, KI8SS, 55 Whitney Ave S, Youngstown, OH 44509; 330-793-7072; **n8lne2@juno.com**.

†Ohio (Coalton)—Apr 17, 8 AM to 1 PM. *Spr:* Jackson County ARC. James Rhodes Community Center, St Rte 93, between Jackson and Wellston. Hamfest/Computer Show, flea market, VE sessions (11 AM; all classes of license, walk-ins accepted), auction (following hamfest for any items not sold), handicapped accessible, refreshments. *TI:* 146.79. *Adm:* $5. Tables: $5 (first-come, first-served basis). Edgar Dempsey, KD8XL, 110 Morton St, Jackson, OH 45640; 740-286-3239; **edempey@netpenny.net**; **clik.to/kx8n**.

†Ohio (Cuyahoga Falls)—Apr 18; set up Saturday 1-3 PM, Sunday 6-8 AM; public Sunday 8 AM to 2 PM. *Spr:* Cuyahoga Falls ARC. Emidio and Sons Party Center, 48 E Bath Rd, at corner of State Rd; State Rte 8 N to Graham Rd Exit, travel 1.2 miles W on Graham Rd, turn right onto E Bath Rd and go W for 1 mile. Hamfest and Electronics/Computer Show (50th Annual Event), vendors, free parking. *TI:* 147.27. *Adm:* $5. Tables: 8 ft advance $12, door $15; plus 1 admission. Ted Sarah, W8TTS, 239 Bermont Ave, Munroe Falls, OH 44262; 330-688-2013; **w8tts@arrl.net**; **www.cfarc.org**.

†Oklahoma (Woodward)—May 1; set up 6 AM; public 8 AM. *Spr:* Tri-State AR Group. Northwest Inn, Hwy 270 and 1st St; SE edge of Woodward, N side of Hwy 270 and 1st St intersection, opposite Wal-Mart Supercenter. Dealers, VE sessions, QLF contest, ARES Meeting. *TI:* 147.36 (88.5 Hz), 444.275 (88.5 Hz), 146.52. *Adm:* $3. Tables: Free. Jay Kruckenberg, K5GUD, Rte 2, Box 31, Mooreland, OK 73852; 580-334-3093; **k5gud@arrl.net**; **www.tsarg.org**.

†Pennsylvania (Fredericksburg)—May 8, 8 AM to 1 PM. *Spr:* Appalachian AR Group. Fredericksburg Fireman's Park, Rte 343; from Rte 22 turn S on Rte 343, go 1.3 miles to site on left. Tailgating ($5 per space, plus admission). *TI:* 146.64. *Adm:* $5, under 16 free. Tables: $15 (plus admission; with electricity). Neil Shatto, N3JQM, 1452 Mumma Rd, Harrisburg, PA 17112; 717-469-7357; **n3jqm@juno.com**; **web.aa3rg.org:81/**.

†Pennsylvania (Wrightstown/Bucks County)—May 2, 6 AM to 1 PM. *Spr:* Warminster ARC. Middletown Grange Fairgrounds, Penns Park Rd; vicinity of Rtes 413 and 232, 25 miles N of Philadelphia. Unlimited tailgating ($10, plus admission), 70 indoor spaces with electricity, VE sessions, equipment check-out table, free parking, refreshments. *TI:* 147.09 (131.8 Hz), 146.52. *Adm:* $5. Tables: $15. Heather Leabman, KB3JUY, 2061 Durham Rd, New Hope, PA 18938; 215-794-1360; **hamfest2004@k3dn.org**; **www.k3dn.org**.

Pennsylvania (York)—Apr 18. John Shaffer, W3SST, 717-764-4805.

South Carolina (Greenville)—May 1, South Carolina Section Convention. See "Coming Conventions."

†Texas (Abilene)—May 1-2; Saturday 8 AM to 5 PM, Sunday 9 AM to 2 PM. *Spr:* Key City ARC. Abilene Civic Center, 1100 N 6th St; I-20 to Pine St Exit, S on Pine to the intersection of Pine and N 6th, Civic Center on NW corner. VE sessions, limited RV parking (nominal fee), handicapped accessible, free parking. *TI:* 146.76. *Adm:* advance $8 (must be received by Apr 26), door $9. Tables: $8. Peg Richard, KA4UPA, 1442 Lakeside Dr, Abilene, TX 79602; 325-672-8889; **ka4upa@arrl.net**; **www.qsl.net/kcarc/hamfest.html**.

†Virginia (Chesapeake)—Apr 24, 8 AM to 3 PM. *Spr:* Chesapeake AR Service. Hickory Ruritan Club, 2752 Battlefield Blvd S (Hwy 168 S); from I-64 take Exit 291B to Rte 168 S towards Nags Head (this is the 168 Bypass), take 2nd Hillcrest Parkway Exit ramp, follow Hillcrest to 168 Business S, Club is approximately 2 miles on right. Flea Market, tailgating, vendors. *TI:* 146.82. *Adm:* $6. Tables: Free (1st table is free with admission); additional tables $6. Ruth Bigio, KB4LIF, Box 6867, Chesapeake, VA 23323-6867; 757-483-1703; **ruthis23505@yahoo.com**; **www.qsl.net/cars**.

†Washington (Selah)—Apr 17, 9 AM to 4 PM. *Spr:* Yakima ARC. Selah Civic Center, 2165 1st St; take Exit 30 or 30A off I-82, stay on 1st St for 1.4 miles, 1 block before 2nd light turn left into Civic Center parking lot. Flea market, VE sessions, breakfast (7-10 AM), lunch (11 AM-1 PM). *TI:* 146.66 (123 Hz). *Adm:* $5. Tables: $10. Ken Kester, K7IJB, 11808 Bristol Ct, Yakima, WA 98908; 509-965-5967; **k7ijb@arrl.net**; **eagle.ykm.com/~W7aq**.

†Washington (Spokane)—Apr 3; set up 7-9 AM; public 9 AM to 5 PM. *Sprs:* Lilac City ARC and Lilac City Chapter of 10-10 International. St Ann's Parish Hall, E 2120 First Ave; I-90, Exit 282, going E go to 1st light (Altamont St), turn left and go 2 blocks to 1st Ave, turn left onto 1st Ave, go 2 blocks to event. 13th Annual Inland Northwest Hamfest/Computer Show, local and commercial vendors, VE sessions (Friday, Apr 2, 7 PM; Betsey Ashelman, N7WRQ, 509-448-5821), free parking, refreshments. *TI:* 146.52. *Adm:* $3, age 12 and under free when accompanied by paying adult. Tables: 6 ft $10. Make checks payable to Lilac City ARC and send by Mar 29 to Warren Kelsey, KJ7BB, S 1405 Crestline St, Spokane, WA 99203; 509-534-8443.

†West Virginia (Ripley)—May 2, 8 AM to 2 PM. *Spr:* Jackson County ARC. Ripley Middle School, School Rd off Klyondyke Rd; Exit 33 off ramp from Charleston turn right, go to 3rd stop light, turn right on Klyondyke Rd to first left at Ripley Middle School. Flea market, VE sessions, refreshments. *TI:* 146.67. *Adm:* $4. Tables: $4. Valerie Hunter, KC8PPT, Box 62, Cottageville, WV 25239; 304-273-3497; **salamander54_25239@yahoo.com**; **www.hamevents.com**.

†Wisconsin (Stoughton/Madison)—Apr 18; set up Saturday 6-9 PM, Sunday 6-8 AM; public Sunday 8 AM to 1 PM. *Spr:* Madison Area Repeater Assn. Mandt Community Center, 400 Mandt Parkway; enter Stoughton on Hwy 51 (Main St), turn S on 4th St, cross bridge, Mandt Center is on left. Dealers, VE sessions, free parking. *TI:* 147.15 (123 Hz). *Adm:* advance $4, door $5. Tables: advance $15, door $20. Paul Toussaint, N9VWH, c/o MARA Swapfest, Box 8890, Madison, WI 53708-8890; 608-245-8890; **w9hsy@execpc.com**; **www.qsl.net/mara/**.

†Wisconsin (Superior)—May 1; 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, located on SW edge of Superior Airport. New and used radio and PC equipment, dealers, vendors, personalized ham items available, VE sessions. *TI:* 146.94. *Adm:* $5. Tables: $10 (8 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/**.

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, handouts, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111. Or send e-mail to **giannone@arrl.org**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to advertise your event in *QST* at special rates. Make your hamfest a success by taking advantage of this great opportunity. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

CONTEST CORRAL

Feedback

The following clubs were added to the 2003 Field Day results after publication:

K1BKE, Contoocook Valley RC; K2AE, Schenectady ARA; K4TN, Brandon ARS; K8JV (+N8KV); K9AVE, Illinois Valley Radio Assn; KC3KAX, East Coast Long Wire Association; KD1MW, Sakonnet 49'ers; KY4L, KY4L et al Contest Group; N4EH, Lake Monroe ARS; N7A, Coyote Ridge Radio Group; N8NN; N8SL, South Lyon ARC; W1TU, Ellsworth Amateur Wireless Assn; W2GSA, Garden State ARA; W2GSB, Great South Bay ARC; W4AWM; W4OVH, Ole Virginia Hams ARC; W4ULH, Florence Amateur Radio Club; W5WA, Jackson County ARA; W6OTX, Palo Alto Amateur Radio Assn; W6SF, Stockton Delta ARC; W7Q, Hoodview ARC; W7VJD, Lewis-Clark ARC; W8COL, Chain O' Lakes ARC; W8DF, Southern Michigan ARS; W9ATG, Hancock ARC; W9EOC, Old Post ARS; WA4JUK; WC2EM, Warren Cty RACES EMCOMM; WC4DC, Dickson County ARC; WJ5J, Ham Association of Mesquite; WV8T, Plateau ARA; WØOGS, Rolla Regional ARS.

W1AW Qualifying Runs are 9 AM EST Friday, Apr 2 (1400Z Apr 2) (35-10 WPM QRSR), and 4 PM EDT Thursday, Apr 22 (2000Z Apr 22). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, Apr 14 (0400Z Apr 15) (10-40 WPM). Check the W1AW Schedule elsewhere in this issue for details.

SO—Single-Op, M2—Multi-Op—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

No contest activity on 30, 17 and 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. In order to publicize the maximum number of contests, readers will be referred to an earlier issue of *QST* if the rules have been published within the past year.

April/May

VHF Spring Sprints—CW/SSB—sponsored by the Eastern Tennessee DX Association as follows: 50 MHz—2300Z May 8-0300Z May 9; 144 MHz—7-11 PM local time Apr 5; 222 MHz—7-11 PM Apr 13; 432 MHz—7-11 PM Apr 21; Microwave—902 MHz and higher—6 AM-1 PM May 1. Fixed and Rover categories. Exchange is grid square only, count 1 pt per QSO. Score is QSO Points × Grid Squares, score each sprint separately. Rovers and Microwave sprints total all points and all grids worked from each grid. For more information—**www.etdxa.org/vhf.htm**. Logs must be e-mailed or postmarked within four weeks of the contest to **springsprints@etdxa.org** or ETDXA/WU4O Jeff Baker, 2012 Hinds Creek Rd, Heiskell, TN 37754.

April 3-4

Missouri QSO Party—CW/SSB—sponsored by the Boeing Employees Amateur Radio Society of St. Louis (BEARS) from 1800Z Apr 3-0500Z Apr 4, and 1800Z-2400Z Apr 4. Frequencies (MHz): CW—40 kHz from band edge and 1.810; Phone—1.850, 3.980, 7.280, 14.280, 21.380, 28.310, work MO stations once per band and mode. Categories: Fixed, MO Mobile, MO Rover. Exchange: RST, serial number, and MO county or S/P/C. QSO Points: CW—2 pts, Phone 1 pt. Score: MO stations—QSO Points × States + Provinces + MO counties + 1 for DX; non-MO stations—QSO Points × MO counties. Multipliers count only once. QSOs with WØMA count additional 100 QSO points. For more information: **www.qsl.net/w0ma**. Logs due 30 days after the contest to **n0aj@arrl.net** or James L Kinser, NØAJ, 2147 Encino Dr, Florissant, MO 63031-7627.

Montana QSO Party—Phone/CW/Digital—sponsored by the Flathead Valley Amateur Radio Club from 2300Z Apr 3-2300Z Apr 4. Frequencies: 160 meters-70 cm, no categories, repeaters and IRLP are permitted. Exchange: RST and S/P/C or MT county. If a station changes counties, it can be worked again. Score: QSOs × S/P/C + MT counties (counted only once). Logs due May 10 to **kj7iz@bresnan.net** or FVARC, 117 Rainbow Dr, Kalispell, MT 59901.

EA RTTY Contest—sponsored by the Unión de Radioaficionados Españoles (URE) from 1600Z Apr 3-1600Z Apr 4. Frequencies: 80-10 meters, according to IARU band plan. Categories: SOAB, SOSB, MOAB, SWL. Exchange: RST and serial number or EA Province. QSO Points: 10-20 meters: own continent—1 pt, diff cont—2 pts; 40 and 80 meters: own cont—3 pts, diff cont—6 pts. Score is QSO points × DXCC entities + EA provinces + W/VE/JA/VK call areas counted once per band. If operating portable, sign /call area. Logs due May 8 to **ea1mv@ure.es** as ASCII text or Cabrillo format or Antonio Alcolado, EA1MV, PO Box 240, E-09400 Aranda de Duero, (Burgos) Spain.

48th Annual QCWA QSO Party—CW/Digital/SSB—sponsored by the Quarter Century Wireless Association from 1900Z Apr 3-1900Z Apr 4. Frequencies (MHz): CW—1.910, 3.540, 7.035, 14.040, 21.050, 28.050; Phone—1.810, 3.890, 7.244, 14.262, 21.365, 28.325 plus all VHF/UHF bands, no crossband or repeater QSOs. 15 QSOs with each station maximum and only one QSO with stations in home QCWA chapter. Exchange: Last two digits of year licensed and QCWA chapter or S/P/C. QSO Points: Phone—1 pt, CW/Digital—2 pts. Score: QSO Points × QCWA chapters + S/P/C counted once per band. W2MM counts as a 3 point multiplier on each band. For more information: **qcwa.org/2004-qso-party-rules.htm**. Send logs to **w0hxl@cox.net** or Dick Newsome, WØHXL, 2924 North 48th St, Omaha NE 68104-3726.

SP DX Contest—CW/SSB—sponsored by the PZK Polish Amateur Radio Union and the SP DX Club from 1500Z Apr 3-1500Z Apr 4. Frequencies: 160-10 meters, according to the IARU Region I band plan, no crossmode QSOs. Categories: SOAB and SOSB (CW, SSB, or Mixed), SO-Three Band Mixed, SO-QRP, MS Mixed (incl nets, packet, Internet), SWL Mixed. Exchange: RS(T) and serial number or Polish province abbreviation. QSO Points: 3 pts for each SP contact, SP stations count 3 pts outside EU, 1 pt for EU (no pts for SP-SP QSOs). Score is QSO points × provinces (counted once per band and mode) or DXCC entities (for Polish stations). For more information: **www.contest.spdxc.org.pl/en/index.php**. Logs due Apr 30 to **spdxc-logs@pzk.org.pl** (Cabrillo format preferred) or to Polski Zwiazek Krotkofalowcow, SPDX Contest Committee, PO Box 320, 00-950 Warszawa, Poland.

April 7-9

DX YL to North American YL Contest—CW—sponsored by YLRL from 1400Z Apr 7-0200Z Apr 9, work 24 hours max. (Phone—April 14-16) Frequencies: all HF bands. Exchange: RST, serial number and ARRL Section, province, or DXCC entity. QSO Points: 1 pt/QSO. Score: QSO Points × S/P/C counted only once × 1.5 (<100 W CW, 200 W SSB). For more information: **www.ylrl.org**. Logs due 30 days after the contest to **wx4mm@tm-moore.com** or WX4MM, 216 Lee Rd 343, Salem, AL 36874.

April 10-18

Lighthouse Spring Lites QSO Party—all modes—sponsored by the Amateur Radio Lighthouse Society from 0001Z Apr 10 through 2359Z Apr 18. Frequencies (MHz): CW—1.830, 3.530, 7.030, 14.030, 21.030, 28.030; SSB—1.970, 3.970, 7.270, 14.270, 21.370, 28.370. Exchange: ARLHS member/lighthouse number or year first licensed, name, and S/P/C. Score: 1 pt/QSO except—2 pts for ARLHS member, 3 pts for ARLHS lighthouse. For more information: **arlhs.com**. Logs due May 15 to Dave Ruch, NFØJ, PO Box 20696, Bloomington, MN 55420-0696.

April 10-11

QRP ARCI Spring QSO Party—CW—sponsored by the QRP ARCI, from 1200Z Apr 10-2400Z Apr 11. (Same rules as Fall QSO Party, see Oct 2003 *QST*, p 90, or **2hams.net/ARCI/index.htm**.)

CIS DX Contest—SSB, sponsored by the Scottish-Russian ARS from 1900Z Apr 10-1900Z Apr 11 (CW Dec 5, RTTY Sep 4-5) Frequencies: 80-10 meters. Categories: SOAB and SOSB (HP, LP <100 W, QRP < 10 W), MS, MM. Exchange: RST and serial number, CIS stations send CIS region code. QSO Points: Own DXCC entity—1 pt, same continent—2 pts, different cont—3 pts, CIS stations—5 pts. Score: QSO points × CIS regions + DXCC entities on each band. For more information: **www.srars.org/cisdxc.htm**. Logs due 30 days after the contest to **srars@srars.org** or Scottish-Russian ARS, PO Box 7469, Glasgow, G42 ØYD, Scotland, UK.

EU Spring Sprints—SSB: Apr 10—managed by G4BUO, CW: Apr 17—managed by I2UIY, from 1500Z-1859Z. Frequencies (MHz): SSB—14.250, 7.050, 3.730, CW—14.040, 7.025, 3.550. SO category only (results list LP with *), EU stations work everyone, non-EU stations work EU only. Exchange: your call, the other station's call, serial number starting at 001, your name—both stations must repeat both call signs. If any station initiates a call (CQ, QRZ?, etc) he is permitted to work only one station on the same frequency and must move at least 2 kHz before he may call another station or before he may call CQ again. Score is the total QSOs (1 point/QSO). For more information or contest software—**www.qsl.net/eusprint**. Logs due 15 days after the contest to **eusprint@kkn.net** (ASCII format) or to (SSB) Dave Lawley, G4BUO, Carramore, Coldharbour Rd, Penshurst, Kent TN11 8EX, England, UK, or (CW) Paolo Cortese, I2UIY, PO Box 14, 27043 Broni (PV), Italy.

Japan International DX Contest (JIDX)—CW—sponsored by *Five-Nine* Magazine from 0700Z Apr 10-1300Z Apr 11. (Phone—Nov 13-14) Frequencies: 80-10 meters. Categories: SOAB and SOSB (HP >100 W, LP), MO, Maritime Mobile. Exchange: RST + JA prefecture number or CQ Zone. QSO Points: 80 or 10-meters—2 pts, otherwise 1 pt. Score: QSO Points × JA prefectures + JD1 provinces (JA stations use DXCC entities). For more information: **je1cka.jzap.com/jidx**. Logs due May 31 to **jidx-cw@jidx.org** or JIDX "PHONE/CW" Contest, c/o *Five-Nine* Magazine, PO Box 59, Kamata, Tokyo, 144-8691 Japan.

Georgia QSO Party-CW/SSB-sponsored by SECC and SEDXC from 1800Z Apr 10-0359Z Apr 11 and 1400Z-2359Z Apr 11, no time limit. Frequencies: 80-10 meters. Categories: SOAB, MS, MM, Rover, Novice/Tech, HP (>150 W), LP or QRP (<5 W). Rovers must activate at least six GA counties. Mobiles and portables must move the complete station including antennas at least 100 yards to change counties—no county line operations. Exchange RST and GA county or S/P/C. QSO Points: SSB—1 pt, CW—2 pts. Score: QSO Points × GA counties (GA station use states and provinces) counted only once per band and mode. For more information: **gqp.contesting.com**. Logs

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

due May 11 to **ku8e@bellsouth.net** or Jeff Clarke, KU8E, 98 Mobley Ct, Hamilton, GA 31811.

April 12

Low Power Spring Sprint—CW—sponsored by the Slovak Amateur Radio Association (SARA) from 1400Z-2000Z Apr 12. Frequencies: 160-10 meters. Categories: A (1 W), C (5 W), Q (25 W), × (50 W), Y (100 W), SOSB, SO-2 or 3 bands, SOAB. Exchange: RST, grid square, and power category. (RST-only okay from non-contest stations.) QSO Points: with own continent—3 pts, diff cont—9 pts, OM station—18 pts. Score: QSO points × grid squares + WPX prefixes (counted once per band). Logs due 30 days after the contest to **om3kfv@zoznam.sk** or Radioklub OM3KFV, PO Box 3, 038 61 Vrutky, Slovakia.

April 14-16

DX YL to North American YL Contest—Phone (see April 7-9).

April 17-18

Michigan QSO Party—CW/SSB—sponsored by the Mad River Radio Club, from 1600Z Apr 17-0400Z Apr 18, no time limit. Bands: 80-10 meters. Frequencies: CW—45 kHz from band edge, Phone (MHz)—3.850, 7.225, 14.250, 21.300, 28.450. Work stations once per band and mode, MI-to-MI QSOs allowed, mobiles and portables can be worked from each county. Categories: SO, MO, and Mobile. Exchange: serial number and MI county or S/P/C. QSO Points: CW—2 pts, Phone—1 pt. Multipliers for MI stations are states, provinces and MI counties; multipliers for non-MI stations are MI counties. Multipliers count once per mode. Score: QSO points × multipliers. For more information: **www.miqp.org**. Logs due 30 days after the contest to **logs@miqp.org** or Mad River Radio Club, c/o Dave Pruett, 2727 Harris Rd. Ypsilanti, MI 48198.

YU DX Contest—CW/SSB—sponsored by SRJ (Amateur Radio Union of Yugoslavia) and YUDXC (YU DX Club) from 1200Z Apr 17-1200Z Apr 18. Frequencies: 160-10 meters. Categories: SO-CW, SO-SSB, SO-Mixed, MS. Exchange: RST + ITU Zone. QSO Points: with own zone—1 pt, own continent—3 pts, diff cont—5 pts. Score: QSO points × ITU zones + YU prefixes (counted once per band). For more information: **solair.eunet.yu/~yu1ab/awards/rules.htm**. Logs due 30 days after the contest to **2004@yudx.net** or Savez radioamatera Jugoslavije, YU DX Contest, PO Box 48, 11001 Beograd, Yugoslavia.

GACW DX Contest "Mr Samuel Morse Party"—CW—sponsored by the Grupo Argentino de Radiotelegrafia (GACW) from 1200Z Apr 17-1200Z Apr 18. Frequencies: 80-10 meters, everyone works everyone format. Categories: SO-SB and SO-AB (HP, LP and QRP), MS and MM categories, no time limit. MS category subject to 10-min band change rule—see Web site. Exchange: RST and CQ Zone. QSO Points: same continent—1 point, diff cont—3 pts, DX-to-South America add 2 points, own country—0 pts (but counts for zone and country credit). Score is QSO points × DXCC, WAE and GACW countries + CQ Zones from each band. For information and software—**gacw.no-ip.org**. Logs due May 30 to **uranito@infovia.com.ar** (ASCII text) or GACW DX Contest, PO Box 9, B1875ZAA Wilde, Buenos Aires, Argentina.

TARA Skirmish—Digital Prefix Contest—sponsored by Troy ARA, 0000Z-2400Z Apr 17. Frequencies: 160-6 meters, work stations once per band. Categories: High, Low (<100 W), Great (<20 W), QRP (<5 W), SWL. Exchange: Name and Prefix. Score: QSOs × WPX prefixes × power multiplier. (High ×0.5, Low ×1, Great ×2, QRP ×3) Multipliers count once per band. For more information: **www.n2ty.org/seasons/tara_dpx_rules.html** or **skirmish-manager@n2ty.org**. Logs due May 15 via the contest score entry form at **n2ty.org/seasons/tara_dpx_score.html**.

Holyland DX Contest—CW/SSB—sponsored by the Israel Amateur Radio Club from 0000Z-2359Z Apr 17. Frequencies: 160-10 meters according to IARU Region I band plan, work Israeli stations once per band and mode. Categories: SO (Mixed Mode, CW, SSB), MS, MM, SWL. Exchange RST and serial number or Israel district. QSO Points: 1.8 or 3.5 MHz—2 pts; other bands 1 pt. Score: QSO Points × districts counted once per band. For more information: **www.iarc.org**. Logs due May 31 to **4Z4KX@iarc.org** or Contest Manager 4Z4KX , Israel Amateur Radio Club, Box 17600, Tel Aviv, 61176, Israel.

ES Open HF Championship—CW/SSB—sponsored by the Estonian Radio Amateurs Union from 0500Z-0859Z Apr 17. Frequencies: 80 and 40 meters. Categories: SO (SSB, CW, Mixed), MS, SWL. Exchange: RST and serial numbers, Duplicate QSOs allowed once per hour (see Web site). QSO Points: SSB—1 pt, CW—2 pts. Score: QSO Points × ES prefixes counted once per band and mode. For more information: **www.erau.ee/index.php? newlang=eng**. Logs due Jun 1 to **esopen@erau.ee** or Toomas Soomets, ES5RY, PO Box 177, Tartu, 50002 Estonia.

Ontario QSO Party—CW/Phone—sponsored by the Ontario DX Association from 1800Z Apr 17-1800Z Apr 18. Frequencies (MHz): SSB—1.870, 3.735, 3.860, 7.070, 7.260, 14.130, 14.265, 21.260, 28.360; CW—30 kHz above band edges; VHF-SSB: 50.130, 144.205, 432.105; VHF-FM 52.540, 146.550, 446.1, no repeater QSOs. Categories: SOAB and SOSB (HP, LP <150 W HF and 50 W VHF, QRP <5 W) in CW, Phone, and Mixed Modes, SO VHF FM QRP (<5 W), MS, SWL, Mobile, Rover. Exchange: RS(T) and S/P/C or Ontario QTH. QSO Points: HF SSB—1 pt, HF CW—2 pts, VHF—5 pts (work stations once per VHF band), 10 bonus pts for each QSO with VE3ODX and VA3RAC. Score is QSO Points × Ontario QTHs (non-VE3 stations) or S/P/C + Ontario QTHs (mults count once per band). For more information: **www.odxa.on.ca/oqphome.html**. Logs due May 31 to **ve3agc@rac.ca** or Ontario QSO Party, Ontario DX Association, PO Box 161, Station "A," Willowdale, ON M2N 5S8, Canada.

EU Spring Sprint—CW—see April 10.

EA QRP Contest—CW, sponsored by the EA QRP Club from 1700Z Apr 17-1300Z Apr 18. Frequencies: 80-10-meters (see Web site for operating periods). Categories: QRP (< 5 W) and QRPp (<1 W). Exchange: RST and EA province or EA QRP number or serial number. QSO Points: QRP—1 pt, QRPp—2 pts. Score: QSO points × EA provinces + EA QRP members + DXCC entities on each band. For more information: **www.eaqrp.com**. Logs due 30 days after the contest to **ea1bp@yahoo.es** or Vocalia de concursos (Concurso CW), PO Box 73, E-46182, La Canada (Valencia), Spain.

April 24-25

Florida QSO Party—sponsored by the Florida Contest Group from 1600Z April 24-0159Z April 25 and 1200Z-2159Z April 25, 20 hours max, work FL stations. Frequencies (MHz): CW—35 kHz from band edges, Phone—7.260, 14.260, 21.335, and 28.485, no 160 or 80 meters, VHF/UHF. Categories: SO, MS, MM (one signal per band), Mobile (SO and SO+driver), School Club, SWL, all categories can enter as HP/LP (150 W) or QRP (5 W) and Mixed Mode/CW/SSB (except MM and SWL). Exchange: RST and FL county or S/P/C. QSO Points: CW—2 pts, SSB—1 pt. Score: FL stations—QSO points × S/P/C (W/VE/KH6/KL7 do not count as DXCC entities) × power multiplier; non-FL stations—QSO points × FL counties × power multiplier. All multipliers count once per mode. Power multiplier—HP ×1, LP ×2, QRP ×3. For more information: **www.floridaqsoparty.org**. Logs due May 25 via the Web log entry page at **www.b4h.net/cabforms/flqp_cab.php** or to **logs@floridaqsoparty.org** (ASCII text or Cabrillo format) or Florida QSO Party, c/o Ron Wetjen, WD4AHZ, 5362 Castleman Dr, Sarasota, FL 34232.

Nebraska QSO Party—CW/SSB—sponsored by the Heartland DX Association 1700Z Apr 24-1700Z Apr 25. Frequencies (MHz): 160-2 meters; CW—1.805 and 35 kHz above band edge; Phone—1.915, 3.865, 7.265, 14.265, 21.365, 28.465, 146.460; Novices/Technicians—10 kHz above band edge and 28.460. Categories: SO, MS, Mobile. Work stations once per band/mode and NE mobile stations can be worked again in each county. County lines count as one QSO. Exchange: RST and NE county or S/P/C. QSO Points: CW—2 pts, Phone—1 pt. Score is QSO Points × S/P/C for NE stations or NE counties (multipliers count once only) × Power Multiplier (QRP ×3, LP ×2, HP ×1). For more information: **www.qsl.net/hdxa**. Logs due May 31 to **NEQP2004@alltel.net** (ASCII text) or Nebraska QSO Party, PO Box 375, Elkhorn, NE 68022-0375.

Kentucky QSO Party—CW/SSB/RTTY/PSK31—sponsored by Bullitt Amateur Radio Society from 1600Z Apr 24-0400Z Apr 25. Frequencies (MHz): SSB: ±20 kHz above General class band edge; CW: 3.55, 7.05, 14.05, 21.05 and 28.05. Categories: Entries will be SO-Single Mode (SSB, CW, Digital), SO-Mixed, Rover. Work stations once on each mode and band (RTTY and PSK31 are considered separate QSOs). Work Rover stations in each county. Exchange: Name and KY county or S/P/C. QSO Points: SSB—1 pt, CW/Digital/Rover—2 pts. Score: QSO Points × KY counties (KY stations count S/P/C) + QSO with KY4KY. For more information: **www.qsl.net/ky4ky/kyqsopartyrules.html**. Logs due 10 days following the contest to **kc4wq@arrl.net** or KY QSO Party, c/o KC4WQ, 1229 Zoneton Rd, Shepherdsville, KY 40165.

Helvetia Contest—CW/SSB/Digital—sponsored by Union of Swiss Short Wave Amateurs (USKA) from 1300Z Apr 24-1300Z Apr 25. Frequencies: 160-10 meters. Categories: SO-Mixed, SO-QRP, SO-Digital, MO-Digital, MO-Mixed, SWL. Exchange: RST and serial number (Swiss stations add canton abbreviation). QSO Points: 3 pts/QSO. Score: QSO points × Swiss cantons (Swiss stations also count DXCC entities). For more information: **www.uska.ch/html/en/index_e.htm**. Logs due 31 days after the contest to **contest@uska.ch** or USKA HF Traffic Manager, Hermann Stein, HB9CRV, Brüelmatten 13, 4410 Liestal BL, Switzerland. QST

STRAYS

IRLP CONFERENCE APRIL 17-18

◊ The 2004 IRLP Conference will be held April 17-18, 2004, at the Imperial Palace Hotel and Casino in Las Vegas. The conference, which is technical in nature, is sponsored by Nevada Amateur Radio Repeaters, Inc. For more information, contact Nevada Amateur Radio Repeaters, Inc, Att: Kent B. Johnson, W7AOR, 395 Peaceful St, Las Vegas, NV 89110, **w7aor@narri.org**; **www.narri.org/2004_Meeting_Registration_Form.html**.

QST congratulates...

◊ Gregg Hendry, W8DUQ, an ARRL Life Member from Barboursville, West Virginia, who has been selected as an Operations Supervisor at the Huntington Tri-State Airport Air Traffic Control Tower, Huntington, West Virginia. Gregg has also been appointed Cabell County Assistant Emergency Coordinator for the SKYWARN program.

SPECIAL EVENTS

Brampton, ON, Canada: Peel/Mississauga Amateur Radio Clubs, VE3XR. 1300Z-1700Z **Mar 20**. HAM-EX Annual Hamfest. 14.240 7.240. QSL. Michael Brickell, 2801 Bucklepost Cres, Mississauga, ON, Canada L5N 1X6.

Timonium, MD: Baltimore Amateur Radio Club, W3FT. 1300Z **Mar 26**-2000Z **Mar 27**. Celebrating the Greater Baltimore Hamboree and Computerfest and Maryland State ARRL Convention. 14.265 7.265. Certificate. W3FT c/o GBH&C, PO Box 95, Timonium, MD 21094. **www.gbhc.org**.

Saginaw, MI: Saginaw Valley Amateur Radio Association Inc, K8DAC. 1200Z **Apr 1**-0200Z **Apr 2**. Ojibway Island DXpedition. 21.325 14.225 3.530. Certificate. SVARA Ojibway Island DXpedition, PO Box 1785, Saginaw, MI 48605.

Dillon Beach, CA: Friends and Amateur Radio Communications Enthusiasts, KF6NNM. 2342Z **Apr 2**-0742Z **Apr 4**. Inaugural Founders non-Field Day & Beach party. 28.450 14.250 7.250. QSL. FARCE non-Field Day, 4225 Galewood Way, Carmichael, CA 95608. **www.kf6nnm.org**.

Terre Haute, IN: Wabash Valley Amateur Radio Association, Inc, W9U. 0000Z **Apr 2**-2359Z **Apr 11**. WVARA 70th year of ARRL affiliation. 28.470 21.370 14.270 7.270. Certificate. WVARA, PO Box 81, Terre Haute, IN 47808-0081. **www.w9uuu.org**.

Tulsa, OK: Tulsa Health Department Amateur Radio Club, K5THD. 0000Z-2400Z **Apr 3**. Tulsa Health Department/OK-1 DMAT Joint Readiness Exercise. 28.365 21.365 14.265 7.265. Certificate. Tulsa Health Department Amateur Radio Club, Attn: Dave Cox, 5051 S 129th E Ave, Tulsa, OK 74134. **www.tulsa-health.org/k5thd**.

Peoli, OH: Tusco Radio Club, W8ZX. 1700Z-2300Z **Apr 5**. 1st day of baseball season, operating from Cy Young's home town. 14.275 7.250 3.925. QSL. Jim Foote, K8KSN, 3015 Larson Rd SE, Uhrichsville, OH 44683.

Schenectady, NY: Union College Amateur Radio Society, W2UC. 2300Z **Apr 9**-0100Z **Apr 10**, and Schenectady Amateur Radio Association, K2AE. 1400Z **Apr 10**-1800Z **Apr 10**. Birthday of Charles P. Steinmetz, Engineer and Professor. 28.435 7.250. QSL. George H. Williams, Steinmetz Hall 210, Union College, Schenectady, NY 12308. **w2uc.union.edu**.

Outer Banks, NC: ARLHS, N4L. 1400Z-2400Z **Apr 10**. North Carolina Light Houses of the Outer Banks, 192 years. 21.260 14.260 7.260. Certificate. Gary Tilton, 131 Almond Tr, Pinnacle, NC 27043. **www.n4jne.com**.

Bellevue, NE: Bellevue Amateur Radio Club, WØWYV. 1300Z **Apr 10**-0500Z **Apr 11**. Celebrating 45 years of service to Bellevue and Sarpy County. 28.345 21.345 14.245 3.945 147.39 50.125. QSL. Tom Huber, WDØBFO, 7518 Chandler Hills Dr, Bellevue, NE 68147.

Indianapolis, IN: RCA Amateur Radio Club, W9RCA. 1300Z **Apr 10**-2200Z **Apr 11**. 50th Anniversary of 1st production RCA color TV set. 28.450 21.350 14.250 7.250. QSL. RCA Amateur Radio Club, 624 Lexington Blvd, Carmel, IN 46032.

Indian Orchard, MA: Titanic Historical Society, Inc, W1MGY. 1330Z **Apr 10**-0527Z **Apr 15**. Commemorating the 92nd anniversary of the *Titanic* disaster. 14.260 14.033 7.260 7.033. QSL. W1MGY/Titanic Historical Society, Inc, PO Box 51053, 208 Main St, Indian Orchard, MA 01151-0053. **www.titanichistoricalsociety.org**.

Ames, IA: Cyclone Amateur Radio Club, WØISU. 0600Z **Apr 15**-0600Z **Apr 19**. VEISHEA Celebration at Iowa State. 28.460 14.260. QSL. Skip Walter, ADØH, 132 Broadmoor Cir, Ames, IA 50010-4851.

Lexington, KY: Aviation Museum of Kentucky, KY4AMK. 0300Z **Apr 16**-2200Z **Apr 17**. Scoutworld 2004. 28.450 21.070 14.070 7.070. QSL. Aviation Museum of Kentucky, PO Box 4118, Lexington, KY 40544. **www.aviationky.org**.

Jacksonville, TX: Cherokee County Amateur Radio Club, K5JVL. 1500Z **Apr 17**-0500Z **Apr 18**. 3rd Annual Drakes on the Lake Special Event Station. 21.375 14.275 7.275 3.875. Certificate. Cherokee County ARC, 840 Henderson St, Jacksonville, TX 75766. **www.k5jvl.org**.

Hawthorne, NJ: Bergen Amateur Radio Association, K2BAR. 1300Z-2000Z **Apr 17**. 11th Annual Earth Day Celebration. 28.350 21.350 14.250. Certificate. Fred Buchner, 202 10th Ave, Hawthorne, NJ 07506.

Piscataway, NJ: Piscataway Amateur Radio Club, K2VOA. 0000Z-2400Z **Apr 18**. Former Voice of America relay station WBOU. 28.370 21.370 14.270 7.270. Certificate. Bill Toth, 6 Rivercrest Dr, Piscataway, NJ 08854.

Millville, NJ: Millville Army Airfield Museum, N2M. 0401Z **Apr 20**-1600Z **May 3**. 2004 AmExpo and Wheels & Wings Air Show. 448.525 146.655 14.275 3.925. QSL. Millville Army Airfield Museum "AMEXPO," Bldg 1 Millville Airport, Millville, NJ 08332. **www.p47millville.org**.

Brainerd, MN: Brainerd Area Amateur Radio Club, WØUJ. 1400Z-2200Z **Apr 24**. Crosby MN—Birthplace of the Space Age? 28.450 21.350 14.250. Certificate. BAARC, PO Box 801, Brainerd, MN 56401. **www.brainerdham.org**.

East Meadow, NY: Nassau Amateur Radio Club, K2VN. 1500Z-2000Z **Apr 24**. Commemorating Scout Walk 2004. 14.240 7.240. Certificate. Jim Mezey, W2KFV, 38 Appletree Ln, Carle Place, NY 11514. **www.nassauarc.org**.

Guelph, Ontario, Canada: Quarter Century Wireless Association, VE3HC. 1300-2100Z **Apr 24** and 1300-2100Z **Apr 25**. 30th anniversary of Fred Hammond Chapter 73 QCWA. 28.325 21.365 14.263 7.244 3.890. QSL. Hammond Museum of Radio VE3BJ, 595 Southgate Dr, Guelph, ON, Canada N1G 3W6. **www.qcwa.ca**.

Manitowoc, WI: USS *Cobia* Radio Club/Mancorad Radio Club, N9BQV. 1400Z **Apr 24**-2200Z **Apr 25**. WWII USS *COBIA* AGSS-245 sub radio reactivation. 28.343 21.343 14.243 7.243. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220. **www.qsl.net/w9dk**.

Wells County, IN: Grant County Amateur Radio Club, W9EBN. 1700Z-2200Z **Apr 25**. McNatt United Methodist Church Ham Radio Fellowship Event. 146.79 28.410 14.226 7.228. Certificate. L. B. Nickerson, 517 N Hendricks Ave, Marion, IN 46952. **www.grantarc.com**.

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 **Jun** *QST* would have to be received by **Apr 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

VHF/UHF CENTURY CLUB AWARDS

Compiled by Eileen Sapko Awards Manager

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in *italics*) for each band listing. The numbers preceding call signs are the assigned award numbers, issued in order of date received. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from December 6, 2003 to February 6, 2004.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. If you have questions relating to VUCC, send an e-mail to **vucc@arrl.org**.

50 MHz
100

1348	WØTF
1349	KKØCQ
1350	N9UDX
1351	KT1J
1352	W4LIA
1353	CT1AHU
1354	AA4S
1355	WA1NYV
1356	KM5OL
1357	W1NG
JF1IRW	325
N3KN	300
W3HHN	400
N4MM	850
KF4LVF	250
K5RLA	200
W5CIA	400
WA5LFD	250
AE5B	500
W5WVO	150
W6OMF	375
WA9PWP	400

144 MHz
100

626	KM5OL
627	WB9WHQ
W6OMF	150
AA7A	425
W8WN	400

222 MHz
50

118	AA4ZZ
119	K9SM

432 MHz
50

306	AA4ZZ

902 MHz
25

W5LUA	60

3.4 GHz
5

W5LUA	35

5.7 GHz
5

W5LUA	35

10 GHz
5

W5LUA	55

24 GHz
5

24	N2EZS
W5LUA	10

Satellite
100

133	AA9NF
134	JN1BPM

QST

2004 IARU HF World Championship Contest

Date: 1200 UTC July 10-1200 UTC July 11, 2004

What is it: A worldwide 24-hour Amateur Radio contest on HF bands sponsored by the IARU and administered for them by the ARRL.

How to participate: Amateurs across the globe work as many amateurs as possible on 160, 80, 40, 20, 15 and 10 meters. Single Operators participate as Mixed Mode, CW-Only or Phone-Only. All Multioperator stations participate as multi-single Mixed Mode only.

What to say: Most stations send a signal report and their ITU zone. If you use standard abbreviations and phonetics, you will find yourself being asked for fewer repeats. *The ITU zone is different from the CQ Zones, so be careful.* A list of ITU zones and call sign prefixes is found at **www.arrl.org/contests/announcements/prefixtable.html** and an ITU zone map is found at **www.iaru.org/ituzonesc.gif**

Special exchange abbreviations: Stations designated as IARU society headquarters will be sending a signal report and their society abbreviations (ARRL, IARU, RSGB, etc). Stations representing members of the IARU Administrative Council and the three IARU regional executive committees will send a signal report and either AC, R1, R2 or R3.

Rules changes: Single Operator stations are now separated into 3 power levels: QRP—5 W or less, Low—greater than 5 up to 150 W, and High—greater than 150 W. All stations involved in an IARU Headquarters Station operation for a member society must operate from within the same ITU zone.

Quirks: Stations may be worked on both CW and phone for QSO credit on each band. However, multipliers only count once per band, not once per band and mode. For example, if you work the IARU HQ multiplier NU1AW on 20 meter Phone and 20 meter CW, it counts as only one multiplier on the 20 meter band.

Best reason to participate: Since it is only a 24 hour contest, you can have fun contesting and still enjoy time with friends and family during the weekend. With many ITU member societies making a special effort to be on the air, it is relatively simple to earn the IARU "Worked All Continent" or 5-Band WAC in one weekend. Experience what summer DX propagation is really like with activity worldwide.

Relative challenge: DX contesting in the Northern Hemisphere in the summer can be challenging, but you will find lots of stations to work. Watch for those nighttime summer openings on 20 meters. Remember that it's winter below the equator and those stations will be looking for you on 80 and 40 meters, even though it's noisy during summer in the north. Being on the downturn of Cycle 23, the lower bands will likely be more crowded, but remember to look for openings on the higher bands.

Scoring: Contacts within your own ITU zone or with an IARU society HQ station count for 1 point each. Contacts within your own continent but with a different ITU zone count 3 points. Contacts with a different continent and ITU zone count 5 points. Multipliers count only once per band. HQ stations are a special multiplier and are counted separately from ITU zone multipliers. Final score is total QSO points × multipliers.

How to report your score: You must send in your entry by August 10, 2004. E-mail a log in Cabrillo format to **iaruhf@iaru.org**. E-mailed and diskette logs must be in Cabrillo format. Send paper logs and a complete summary sheet to IARU HF World Championships, Box 310905, Newington, CT 06111.

Complete rules: The complete rules may be found at **www.iaru.org/contest.html**. Contest forms and rules may also be obtained by sending an SASE with 2 units of postage (2 air-mail units for non-US delivery) to IARU HF World Championships forms, Box 310905, Newington, CT 06111.

For more information: E-mail **n1nd@iaru.org** or phone 860-594-0232. QST

STRAYS

JIM MCDONALD, KB9LEI

What's in a name?: **Jim McDonald, KB9LEI, of Muncie, Indiana, writes, "I know we send a lot of *QST*s, but I didn't know we had our own fleet. Nor did I think we had to ship under an alias to prevent theft."**

TWO HAMS ON CHAMPIONSHIP 4-H HORSE TEAM

◊ Mark (NØMJ) and Melissa (K1MJ) Johnson of Bemidji, Minnesota, were members of the National 4-H Horse Knowledge Bowl Championship team held at the National Western Stock Show in Denver, Colorado, in January. Over 1200 kids from all over the US and Canada competed in various equine events. Melissa, a recent recipient of an ARRL General Fund Scholarship, placed second overall for individual points. Mark is a student at the University of North Dakota ma-joring in Commercial Aviation and Air Traffic Control.—*Glenn Johnson, WØGJ, Bemidji, Minnesota*

GLENN JOHNSON, WØGJ

Left to right: Mark Johnson, NØMJ; Tessa Drevlow (coach); Jenna Wright; Melissa Johnson, K1MJ; Kristen Rodgers, and Emily Rodgers.

By **Dan Henderson, N1ND**
Contest Branch Manager

Simply Magic—Straight Key Night 2004

We're not quite sure of the source, but there was magic in the air January 1, 2004—ARRL Straight Key Night '04.

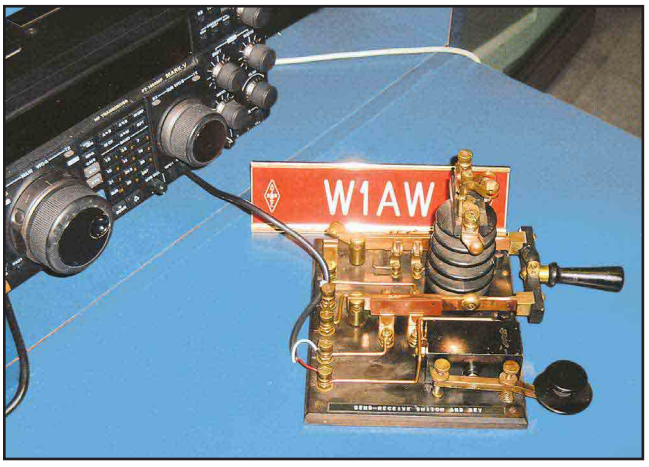
Two things always seem to come together during SKN. One is the result of the memories of the operators. The mystical feel of their old reliable friend—the straight key—stirs the ghosts of QSOs past in their mind's eye. Be it for a single QSO or for many, the mesmerizing allure of times gone by brings out the best in so many participants. Whether an old reliable J-38, or some homebrew derivative, the sound of brass pounding in the shack stirs the senses of many an operator.

I have noticed a second thing in looking at SKN these past few years. It is not only for pounding brass, it is also a time to light up the ether with electrons generated by the old reliable gear of our youth. For some the youth is decades ago. For others now is the time of their youth in our hobby. When you visit the Straight Key Night On-line Soapbox at **www.arrl.org/contests/soapbox** you will find over 50 stories and numerous photographs from some of the 2004 participants. Many highlight not only straight keys but vintage equipment as well. Perhaps SKN is evolving into Vintage Radio Night?

Yes, you probably heard a couple of key clicks and perhaps a few signals that tended to drift, but that is simply part of the magic of SKN—along with a lot of history. Each operator has a story to tell—about the key they are using, the rig they dusted off, or perhaps the contacts they were making.

If you had one of the 22 contacts made with W1AW, or if you heard the Maxim Memorial Station on the air, indeed there was history. ARRL HQ staffer Mark Spencer, WA8SME, used the straight key of the Old Man himself—Hiram Percy Maxim. W1AW station manager Joe Carcia, NJ1Q, made the key from Maxim's "Old Betsy" spark-gap transmitter available for Mark to use during SKN. There are those that claim the presence of the original 1AW is still around. Read Mark's soapbox entry and decide for yourself.

A record number of submissions were received for SKN 2004, as 227 stations submitted summaries totaling 2264 contacts. That turnout breaks the previous high total of submissions by almost 40%! Perhaps the magic *is* contagious…



The key from Hiram Percy Maxim's spark-gap transmitter "Old Betsy" was put to use for SKN 2004 at W1AW.

The quality of the fists and QSOs was high as always. An outstanding 147 different stations received votes for "Best Fist," with **K6KPH** garnering the admiration of 4 different operators while **N4QA's** magical fist impressed 3 participants. One hundred thirty one different stations received consideration from their peers for "Most Interesting QSO" with **KL7V/5, KB3AAY, W7ZMD, W9AVM, KA7SKN, W1DV/2, K9VKY, KO6YG, K1DC, AC5P, WW3K** and **N4QA** all receiving votes from two stations. Congratulations to these outstanding and interesting brass pounders!

Whatever their motivation, SKN night participants unanimously seem to relish the opportunity to relax and enjoy a vanishing part of our hobby. Whether your code speed is 5 or 50 WPM, why not set aside some operating time the next time SKN rolls around. You won't regret it!

Participants

AA4ZS, AA8PW, AB7MP, AB8FJ, AC7PB, AD4E, AD6FR, AE3A, AE4MZ, AF4JD, AK4RB, AL7JK, HP1AC, HP1IBF, I1MQ, IZ4FHT, JJ1BDX/3, KØJW, KØKEY, KØLWV, K1DC, K1FP, K1GUP, K1PDY, K1RV, K1YA, K2GBH, K2PQ, K3KYR, K3MD, K3SEW, K3XT, K3YZ, K4AAL, K4BYF, K4DRQ, K4HJN, K4JYS, K4NCG, K4RDU, K4RT, K4TP, K4UY, K6DF, K6ETM, K6FFY, K6KPH (W6AWO, KK6PR, ops), K6LQ, K6PBQ, K6YR, K7HP, K7TFW, K8BBM, K8PUJ, K8QLM, K8SOM, K8WIW, K9DGS, K9KEU, K9LA, K9LCK, K9QH, K9UQN, K9VKY, K9YKL, KA4JQZ, KA5BOU, KA7T, KB2KDV, KB2QIU, KB3AAY, KB3HJQ, KB8GOY, KB8TXZ, KCØPBY, KC1TX, KC2HRP, KC8VCB, KDØRC, KD5JOM, KD5RFC, KD5UZJ, KD5VRK/4, KD7LEE, KE6QR, KF3DC, KF4PD, KF6PVY, KG2OR, KG4QDH, KG6TH, KH6/W3GW, KIØG, KI6ZX, KJ6CA, KK5FX, KN6YD, KO6YG, KS5V, KW3U, KX5F, NØEID, NØFP, NØJL, NØOA, N1WH, N2KZ, N2OH, N3AWS, N3IW, N3MVX, N3NZ, N3RK, N3ZOC, N5AF, N5BF, N6ZFO, N7CFO, N7EIE, N7ORS, N7TOD, N8GU, N8KC, N8KV, N8XMS, N9BLK, N9NM, NBØZ, NC5K, NJØE, NJ7C, NMØL, NN7A, NO6E, NU7T, OH3WD, ON6ZJ, VE1GM, VE7BQO, WØCGV, WØKIZ, WØROE, WØRTK, W1AMZ, W1AW (WA8SME,op), W1DV/2, W1RO, W1TPB, W1TS, W1TW, W1VR, W1YT, W2AGN, W2GDJ, W2III, W2LID, W2LJ, W2OBJ, W2RJJ, W2TI, W2WIL, W2WSC (W2USF,W2KH, ops), W3CB, W3CEI, W3HQ, W3TZW, W3UHP, W4ARM, W4BNO, W4RQ, W4WYD, W4YE, W5ETK, W5WAX, W5XW, W6MTC (KS6CW,op), W6PRI, W6VNR, W7BMI, W7DRA, W7IZE, W7ZMD, W8JZI, W8WTS, W9MVB, W9RSX, W9YK, W9YO, W9ZC, WAØHQQ, WA1ABI, WA1CFX, WA1VQY, WA2FDK, WA2JON, WA2QQF, WA2VQV, WA4GIR, WA4GLH, WA5ZJK, WA6BOB, WA7GSN, WA9EKQ, WA9PWP, WA9QWX, WA9S, WBØCNK, WBØTRA, WB1FLA, WB2AWQ, WB3CQD, WB3DSJ, WB3EFP, WB6CGJ, WB6IYM, WB8DQT, WB8LZG, WB8P, WB9HFK, WB9MII, WB9UEZ, WB9WHG, WD4CBZ, WD8NVN, WN7Y, WP4LNY, WW3K

By **Russ Pillsbury, K2TXB**

2003 ARRL International EME Competition Results

EME on the rebound.

2003 was the 26th year of the ARRL International EME Competition and judging from the results, this contest is rebounding in popularity. The 2003 installment saw an almost 25% increase in entries received by the ARRL over 2002. With the inclusion of digital modes, including the rapidly increasing use of *JT44*, we seem well on the way to returning to the record participation levels of a few years ago.

The big news in 2003 is a new record high score set in the Multi-operator Multiband class. The team of K5GW (+ W5LUA and WD5AGO) shattered the previous multi-op score of 2,921,100 set in 2001, coming up with 3,684,400 points in an eight band effort. That outstanding score has raised the bar of competition to a new standard, one that will take quite a commitment and effort to surpass. Who's up for the challenge? It could well be the team of HB9Q (+ HB9CRQ and HB9DBM) that came in a very close second with 3,180,000. The previous high score for the category was set by HB9Q in 2001.

In the single operator class the high score this year was set by Stig, OZ4MM, who achieved 1,198,800 points in a 4 band effort, closely followed by Ernst, OE5EYM, with 1,156,200 points. For other classes, the number 1 and 2 stations for each class were:

Single Operator Single Band

144 MHz: Dave, W5UN, and Claude, F3VS

222 MHz: Ray, WA4NJP

432 MHz: Jan, DL9KR, and Jukka, OH2PO

1296 MHz: Jay, K5JL, and Dominique, HB9BBD

2304 MHz: Erich, OE9ERC, and Yoshiro, JA4BLC

10 GHz: Josef, OK1UWA, and Pietro, I5PPE.

Multi Operator Single Band

144 MHz: I2FAK + IK2LZT and KB8RQ + N8DFN

432 MHz: DL7APV + DL7AIG

1296 MHz: W2DRZ + (K2DH, K2TXB, KA2ONY, NY2Z) and HA5SHF + (HA5BGL, HA5BMU)

10 GHz: DLØEF + (PA3GLB/DL5FAB, DK2UO, DK2KA, DF3GL, DD9ZL, DH9FAG) and IQ4DF + (I4BER, I4TTZ, I4TMA, I4QIG, I4ZAU, IZ4BEH, IW4BYP, IW4APQ, IW4CJM).

The 16 foot dish used at W2DRZ's 1296 Multiop.

A spectacular view of the K5GW EME station.

Congratulations to all the winners and runners up!

This year there were 152 logs turned in for the contest, an increase of 30 from 2002. Activity seemed brisk on all bands, although there were a number of complaints of difficult conditions, particularly on the 2 meter band. The well equipped station has always ruled the realm of EME communications, but the emergence of *JT44* has allowed many smaller stations to participate. The rules of the contest were changed this year to allow this mode for the first time, and it appears *JT44* made an impact. While it is not possible to determine just how many contacts were made using *JT44*, soapbox comments indicate that there were many.

One perplexing problem facing *JT44* operators is that they often cannot hear the signals of the stations they want to work, even though it is possible to complete a contact once the signal, buried under the noise, is found. It will take some time before good contest strategies for working with such weak signals are developed. I found that announcing a CQ frequency (before the contest), and listening on the announced CQ frequencies of others, was quite effective. It will be interesting to see how digital EME communication modes will affect EME contest scores in future years. For soapbox comments, individual scores and pictures, visit the ARRL Web pages at **www.arrl.org/contests/results**.

The dates for the 2004 running of this event, which is generally considered to be the most challenging ARRL-sponsored contest, will be announced in an upcoming issue of *QST*, as well as on the ARRL Web. Challenging? You bet! Fun? Without question! See you on the Moon this fall!

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- CTCSS encode/decode w/tone scan
- Auto repeater • 107 alphanumeric memories

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- Two completely independent receivers
- +40dBm 3rd order intercept point

IC-746PRO All Mode 160M-2M

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- Selectable IF filter shapes for SSB & CW
- 102 alphanumeric memories
- Enhanced Rx performance

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- Direct frequency input
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- Enhanced Rx performance
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- Multiple DSP controlled AGC loops
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IC-V8 2M Transceiver

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- 107 alphanumeric memories
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- PC Programmable
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- Drop-in trickle charger included

IC-T7H Dual Band Transceiver

- 2M/70CM
- 70 alphanumeric memories
- 6W output
- CTCSS encode/decode w/tone scan
- Auto repeater
- Easy operation!
- Mil spec 810, C/D/E*1

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- Dynamic memory scan
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- Weather channel scan
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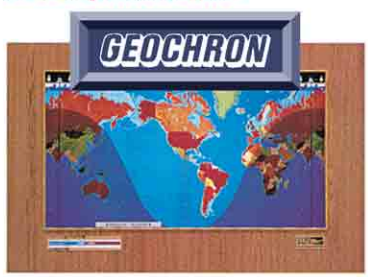

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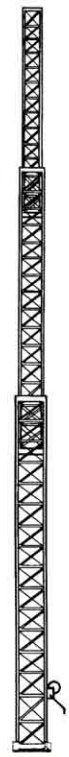

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IC-T90A Surprisingly compact, full featured. (right) The T90A 50/144/440MHz HT offers wideband receive with 5W of power. It features 555 alphanumeric memories with Icom's new DMS scanning technology. The T90A also provides DTCS/CTCSS, DTMF encode, PC programmability and weather resistance. 2.53"w x 3.44"h x 1.16"d, 8.47 oz ..... © **$249.99**

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 en/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..... © **$169.99**

IC-V8 Quality, simplicity, anywhere. (middle) 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 © **$114.99**

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IC-2720H Twice the versatility, twice the fun! The 2M/440MHz, 50/35W 2720H offers simultaneous receive capability, independent controls for each band, and Dynamic Memeory Scan with 212 memories. It also features CTCSS and DTCS, wideband receive, weather alert, auto repeater, remote control microphone, and compact remote control head. Mount controller to main unit with the optional MB-85. 5.5"w x 1.56"h x 7.38"d, 3 lbs (main) ..... © **$349.99**

IC-208H High power dualbander, wideband receive. This 2M/70cm mobile provides 55/50W for long distance contacts, plus reduced power for local. The 208H covers 118-173, 230-549 and 810-999MHz (cell blocked) rx as standard. With improved DMS, detachable front, and 500 memories, mobile communications just got better. 5.56"w x 1.56"h x 7.31"d, 2.65 lbs..... © **$299.99**

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IC-703 For the QRP enthusiasts. The 160-10M 703 is capable of 5/10W and focuses on QRP performance. A portable HF unit, it features a relay-type antenna tuner, low current consumption, DSP, memory keyer and 105 memories. Ideal long distance communications when normal set up is absent. 6.56"w x 2.28"h x 4.88"d, 4.4 lbs ..... © **$599.99**

IC-746PRO 32-bit DSP takes you even higher. All-mode operation, 100W, 102 alphanumeric memories, and a multi-function LCD are impressive in the HF/50/144MHz 746PRO. Its floating point DSP and 24-bit AD/DA converter make it a must-have. Also has memory keyer, built-in antenna tuner and digital noise reduction. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz ..... NOW! FREE PS-125 included © **$1379.99**

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TH-K2AT A triumph of advanced engineering and design. (middle) This 2M 5W HT is equipped with internal VOX, weather alert/RX, auto simplex checker, auto repeater offset and multiple scans. The K2AT also offers built-in CTCSS, DCS and 1750Hz tone burst. The K2AT charges up to 3X faster than others and meets MIL-STD-810 for resistance to rain, vibration, shock and humidity. 2.44"w x 4.38"h x 1.13"d, 12.5 oz .....© **$139.99**

TH-F6A Head-scratching, unique features. The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and 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.....© **$309.99**

TH-G71A The brighter side of handy communications. (right) This FM, 144/440MHz boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with menu mode, PC compatible and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz.....© **$209.99**

TM-271A All-terrain performance. On or off road, the 144MHz, 60W 271A delivers powerful mobile performance and other features such as multiple scan functions, 200 memories, NOAA weather rx, and CTCSS/DCS. Yet, this MIL-STD transceiver goes easy on you, providing high quality audio, illuminated keys and large LCD .....© **$169.99**

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..... **$269.99**

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.....© **$349.99**

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.....© **$494.99**

TS-480SAT New compact all-mode. This 100W HF/50MHz can operate on DC 13.8V and offers two power terminals. The 480SAT also features AF DSP, RX dynamic range, separate LCD control panel with speaker, auto tuner and 100 alphanumeric memories. Can be controlled from a PC and is PSK31 compatible .....FREE jacket* © **$1269.99**
TS-480HX 200W, without tuner.....FREE jacket* © **$1399.99**

TS-2000 Distinctive, packed for performance. The all-mode, HF, 2M, 6M, 70cm 2000 is serious about DSP. Its advanced digital technology converts analog waveforms into digital data, enabling digital processing like IF filtering, slope tune, and auto notch. 10.63"w x 3.75"h x 12.5"d..... © **$1499.99**

TS-570D(G) Affordable DSP without compromise. High-end technology doesn't mean a high-end budget. With 16-bit DSP, untouchable digital filtering, heavy-duty transmitter design, and central frequency control system, the 570D(G) provides powerful 160-10M operation. 10.63"w x 3.75"h x 11"d, 15 lbs.....© **$939.99**

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VX-150 Designed to perform under the most difficult conditions. (left) This 2M 5W HT provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 150 is constructed to MIL-STD, with commercial-grade speaker and Omni-Glow™ keypad. 4.3"h x 2.3"w x 1"d, 11.5 oz..... **$119.99**

VX-2R Smallest HT dualband! (mid-left) This 1.5/1W dualband (144/440MHz) handheld offers VHF, UHF, shortwave, marine and aircraft bands, or WIRES™ linking. The 2R's wide band receive includes the AM broadcast band, continuous HF shortwave, VHF/UHF up to 729MHz, plus 800-960MHz (cell blocked). It also includes over one thousand memories (20 groups), CTCSS/DCS encode/decode and auto repeater shift. 1.9"w x 3.2"h x 0.9"d ..After *Rebate! **$129.99**

VX-5R/VX-5RS Setting water resistance standards. (mid-right) Offering 5W (4.5W on 430MHz), the 5R/5RS cover 50/144/430MHz while providing short to microwave reception. Great for outdoors with optional barometric pressure unit. Black or silver. 2.3"w x 3.4"h x 1.1"d, 8.9 oz .....After *Rebate! **$209.99**

VX-7R/VX-7RB The first submersible amateur HTs. (right) Water protected, the 50/144/430MHz, 5W 7R/7RB are rated for 3', 30-minute submersions. Magnesium bodies make them ideal for outdoors. Include dual/wideband rx, status strobe, and WIRES™ key. Silver or black. 2.4"w x 3.5"h x 1.1"d, 9.2 oz .....After *Rebate! **$299.99**

FT-2800M Cool and quiet 65W operation. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. The 2800M also features NOAA with weather alert, WIRES™ access, SmartSearch™, and excellent receive performance. With a bullet-proof front end and direct keypad entry, it's a dream come true. 6.3"w x 2"h x 7.3"d, 4 lbs ... **$159.99**

FT-7800R Get "back to basics." This FM, 144/430MHz mobile boasts 50/40W output and 1000 memories. It also offers one-touch hyper memories, full-featured CTCSS/DCS, WIRES™ internet linking and wide receiver coverage. The 7800R has a large LCD and NOAA weather alert. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$279.99**

FT-8900R Leading the way in FM mobile design. Quite simply, the 29/50/144/440MHz 8900R has no peer among mobiles. It offers leading-edge features like VHF/UHF full duplex, cross band repeat, independent operation on two bands, and six "Hyper Memory" keys to store configuration settings. The 8900R also provides 50W (35 on 440MHz), access to internet linking systems, over 800 memories, CTCSS/DCS, built-in duplexer, and versatile scanning. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs .....After *Rebate! **$389.99**

FT-920 Dedicated to the enhancement of Signal-To-Noise ratio. The 160-6M 920 is optimized for noise reduction, wide dynamic range and audio tailored to the operator's voice. This 100W rig also features dual watch, extensive menu, keyboard frequency entry, 127 alphanumeric memories and versatile scanning. 15.2"w x 5.3"h x 12.5"d, 24 lbs. FREE FM1 included, while supplies last (limited quantity).....After *Rebate! **$989.99**

MK V FIELD Reach the HF Summit! The Mark V Field brings the technology of the 1000D and Mark V to you in a 100W, self-contained design. This HF all-mode features Class-A (25W) PA operation, interlocked digital bandwidth tracking, a variable RF front-end filter and the ergonomics of the Mark V along with an auto antenna tuner and internal switching-regulator power supply. 16"w x 5.3"h x 13.7"d, 33 lbs.....After *Rebate! **$1719.99**

FT-1000MP MK V Improving the 1000 series Elite-Class. Building on the success of the 1000 series, the Mark V offers five new developments. This HF all-mode adds 200W of output power and features Class-A PA operation, interlocked digital bandwidth tracking system, a variable RF front-end filter, and enhanced ergonomics. 16"w x 5.3"h x 13.7"d, 31 lbs.....After *Rebate! **$2039.99**

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IC-7800

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your engines.
All four of them.
Let the Q's log in!

2 Buckle up. You're about to go for a ride. Not an ordinary ride. But probably the best ride of your life. The vehicle? Like no other: IC-7800. Ever driven a rig with four engines?

3 The '7800 runs on four 32-bit floating point DSP units with 24-bit AD/DA converters, one each for the main RX, second RX, TX, and spectrum scope. Each engine accelerates data processing to whiplash speeds.

Raw engine performance is moot if it's not matched with an experienced driver. Icom engineering has 40 years experience in pushing the analog envelope. Cutting edge digital meets the best of world class analog. 7

8 Together, analog and digital now result in an amazing 110dB of receiver dynamic range and a +40dBm IP3 in the HF bands. Another Icom ham radio first!

Interference from RF sources such as beat signals and ignition noise is a thing of the past. In recent years, HF operators have marveled at how well DSP reduces interfering signals and noise. The '7800 takes noise reduction to a whole new level. 12

The front-panel adjustable Digi-Sel pre-selector automatically tracks signals, keeping the pre-selector's bandwidth centered on the operating frequency. Reject virtually all unwanted out-of-band interference from multi-multi ops or strong broadcast stations. 11

13 Signals such as heterodyne carriers are virtually eliminated with the '7800's Auto Notch filter technology. Additionally, the filter width of the Manual Notch can be adjusted in three steps with more than 70dB of attenuation!

IC-7800

THE ULTIMATE HF!

5 With the '7800's two roofing filters and ultra-linear design throughout the signal chain, blocking and intermod are left in the dust. Plus, it has a separate front-end designed specifically for 6M.

4 Severe crowding (and pile-ups) are contest realities. Ham radio contesters share the challenge of crowded conditions, especially when strong signals block a rare multiplier or the next country on your DXCC honor roll.

6 To reduce internal distortion, the '7800 uses mechanical relays for Band Pass Filter (BPF) switching, instead of non-linear semiconductors. The relays eliminate 2nd order distortion from the input stage.

9

Log on. The '7800 has two identical, independent receiver circuits. Receive two different bands simultaneously on different antennas, with no adverse effects from one receiver to the other. Take your band hopping and contesting to the next level!

10 Like in the '756PROII, the '7800's AGC time constants have 3 presets (slow, medium, fast), adjustable from 0-6 sec. delay. The addition of AGC VR control enables the user to fine tune the AGC reaction time. The '7800 accommodates both "on-the-fly" operators and avid "tweakers".

15 The scope's 80dB dynamic range owes much to its dedicated DSP driver. A 7-step (±2.5 to ±250kHz) scope span allows up to 500kHz of spectrum. Quickly find the action, then cut through the crowd.

16 Make your move. Newly designed, push-pull, power amplifiers using MOS-FET transistors work on 48V DC. They provide a powerful 200W output power at full duty cycle and low transmit IMD. Power your way to front of the pack.

14 On the track, a spotter is indispensible when it comes to getting the upper hand. The '7800 packs its own spotter; a 7" TFT, real-time color spectrum scope. It's of the same grade as commercial test equipment. Seeing is believing.

Congratulations! You've reached the

FINISH

and, with the IC-7800, you're ready to enter the winner's circle!

(Wondering where #1 is? It's you, with an IC-7800!)

ICOM

Independent AGC Settings: Multiple AGC settings for each receiver. On-the-fly adjustment for either preset AGC settings, or a completely variable AGC control.

DUAL RECEIVER CONTROLS

Dual Receive Controls: Separate key receiver controls are available for each receiver. Whether in a contest, or just hopping around the bands, easy access to receiver controls such as volume, RF gain, and AGC adjustments are at your fingertips.

DUAL RECEIVER CONTROLS

Multiple Meter Readouts: See the latest in meter technology with the '7800's virtual meter system. These digital meters are visually superior to and of a higher performance than analog. Don't believe it? Log on to www.icomamerica.com/7800 and see for yourself!

Headphone Jack: Stereo headphone connector. The stereo jack supplies either a combined audio or separate receiver audio for stereo headphones.

CF Card Slot: The ultimate way to "take your rig with you". Just pull your CF card from your '7800, slide it into another '7800, and you now have your rig!

Retractable Controls: Pull out a knob, make your setting, then push the knob out of the way. As simple as this may seem, this feature keeps your radio "clean" looking and the controls out of the way.

Digital Voice Recorder Controls: Simple record and play controls for the internal DVR. Great for quick recording and playback of a call, great for reducing the number of broken calls in your log.

IC-7800

THE ULTIMATE HF!

Multiple Spectrum Displays: "It's like having a piece of test gear on your desk" is one of the comments overheard when we first operated the '7800. You can select a standard spectrum display either centered on your operating frequency or a fixed range to view the band! You choose how you want to SEE the band, and then tune to what signals you see. (Photo shows the fixed range spectrum display.)

Triple Band Stack Registers: Memorizes the last 3 used frequencies – quick recall for band hopping, provides the ultimate in multi-mode flexibility.

DUAL RECEIVER CONTROLS

Independent Digi-Sel Controls: Incorporated into the IC-7800 is a newly designed digital pre-selector, with separate controls for each receiver.

DUAL RECEIVER CONTROLS

Dual Digital Twin PassBand Tuning: Only Icom brings you Digital Twin PassBand tuning. Adjustments can be made for each receiver without affecting the other receiver.

DUAL RECEIVER CONTROLS

Independent Auto Tune: Automatically zero beat your CW or AM carrier signals. The '7800 makes sure you're right on the proper frequency for these modes. Each receiver has a separate control.

DUAL RECEIVER CONTROLS

Dual VFO Tuning Knobs: Independent-tuning knobs for each receiver. Change your receiver's operating frequency just by turning the knob. There's no mistake about which receiver you are adjusting, as the size difference allows for "no-look" operation!

DUAL RECEIVER CONTROLS

More Dual Receive Controls: In addition to the left side controls for volume, RF gain, and DSP controls, the '7800 also has independent controls for the Digital Twin PassBand tuning as well as the 70 dB Manual Notch filters.

DUAL RECEIVER CONTROLS

ICOM®

RS-232C and Remote: Direct computer connection or CT-17 operation is possible with these two connections. CT-17 required when using remote jack.

Multiple Antenna Matrix: No external antenna switching required! The '7800 automatically selects the right antenna for TX or RX.

Ref I/O: Connect single or multiple '7800 to an external 10MHz time base. Or use internal precision time base as your station frequency standard.

External Display: If the internal display is not large enough, you can connect to an external display. (Note: '7800 does not include 60 inch plasma screen!)

USB Keyboard: In addition to decoding RTTY and PSK31, attach a USB keyboard and you can carry out your QSO. Computer not required!

IC-7800

THE ULTIMATE HF!

Ext Keypad: Remote control of the DVR and CW memory keyer.

X-Verter I/O: For the VHF/UHF aficionados, the '7800 has a transverter I/O port.

Meter: For those who want to see a true needle meter!

ALC ADJ: Adjustment for ALC control for non-Icom amplifiers.

Dual Accessory Ports: Independently connect station accessories to each receiver. Use the Set Menu to adjust signal levels.

Dual External Speakers: Independent speaker outputs, one for each receiver.

ICOM

IC-7800
THE ULTIMATE HF!

SPECIFICATIONS

GENERAL

Frequency coverage*1:
U.S.A. Version
Rx 0.030–60.000MHz*2
Tx 1.800–2.000MHz*2 3.500–3.999MHz
5.332, 5.348, 5.368, 5.373, 5.405MHz
7.000–7.300MHz*2 10.100–10.150MHz*2
14.000–14.350MHz*2 18.068–18.168MHz*2
21.000–21.450MHz 24.890–24.499MHz*2
28.000–29.700MHz 50.000–54.000MHz

*1 Frequency ranges are varies depending on version.
*2 Some frequency bands are not guaranteed.

- Mode: USB, LSB, CW, RTTY, PSK31, AM, FM
- Number of memory Ch.: 101 (99 regular, 2 scan edges)
- Antenna impedance: 50Ω unbalanced (Tuner off)
- Antenna connector: SO-239x4 and BNCx2
- Power supply req.: 85–265V AC
- Temperature range: 0°C to +50°C; +32°F to +122°F
- Frequency stability: Less than ±0.05ppm (0°C to 50°C after warm up)
- Frequency resolution: 1Hz (minimum)
- Power consumption: Tx Max. power 800VA
  Rx Stand-by 200VA (typ.)
  Max. audio 210VA (typ.)
- Dimensions: 424(W)x149(H)x435(D) mm;
  (projections not included) 16 11/16(W)x5 7/8(H)x17 1/8(D) in
- Weight (approx.): 25kg; 55lb

TRANSCEIVER

- Output power (continuously adjustable):
  SSB, CW, RTTY, PSK31, FM 5–200W
  AM 5–50W
  137kHz More than –20dBm
- Modulation system: SSB DPSN modulation
  AM Digital low power modulation
  FM Digital phase modulation
- Spurious emission: More than 60dB (HF bands)
  More than 70dB (50MHz band)
- Carrier suppression: More than 63dB
- Unwanted sideband suppression:
  More than 80dB
- ΔTX variable range: ±9.999kHz
- Microphone impedance: 600Ω (8-pin connector)

RECEIVER

- Receive system: Double conversion superheterodyne system
- Intermediate frequencies: 1st 64.455MHz (Main receiver)
  64.555MHz (Sub receiver)
  2nd 36kHz
- Sensitivity (typical):

Freq. Range (MHz)	SSB, CW, RTTY, PSK31 (at 2.4kHz BW)	AM (at 6kHz BW)	FM (at 15kHz BW)
0.1 – 1.7999	0.5μV*1	6.3μV*1	—
1.8 – 27.999	0.16μV*1	2μV*1	—
28.0 – 29.999	0.16μV*1	2μV*1	0.5μV*1
50.0 – 54.999	0.13μV*1	1μV*1	0.32μV*1

10dB S/N for SSB, CW, RTTY, PSK31 and AM, 12dB SINAD for FM.
*1 Pre-amp 1 is ON, *2 Pre-amp 2 is ON.

- Squelch sensitivity (Pre-amp: OFF):
  SSB, CW, RTTY, PSK31 Less than 5.6μV
  FM Less than 1μV
- Selectivity (representative value):
  SSB (BW: 2.4kHz) More than 2.4kHz/–3dB
  Less than 3.6kHz/–60dB
  CW (BW: 500Hz) More than 500Hz/–3dB
  Less than 700Hz/–60dB
  RTTY, PSK31 More than 360Hz/–6dB
  (BW: 350kHz) Less than 650Hz/–60dB
  AM (BW: 6kHz) More than 6.0kHz/–3dB
  Less than 15.0kHz/–60dB
  FM (BW: 15kHz) More than 12.0kHz/–6dB
  Less than 20.0kHz/–60dB
- Spurious and image: More than 70dB
  rejection ratio
- Audio output power: More than 2.6W at 10% distortion
  with an 8Ω load
- RIT variable range: ±9.999kHz
- PHONES connector: 2-pin connector 6.35 (d) mm (1/4")
- EXT SP connector: 2-pin connector 3.5 (d) mm (1/4")/8Ω

ANTENNA TUNER

- Matching impedance range:
  HF bands 16.7–150Ω unbalanced*1
  50MHz band 20–125Ω unbalanced*2

*1Less than VSWR 3:1; *2Less than VSWR 2.5:1

- Minimum operating input power :
  HF bands 8W
  50MHz band 15W
- Tuning accuracy: VSWR 1.5:1 or less
- Insertion loss: Less than 1.0dB (after tuning)

SEE YOU IN THE WINNER'S CIRCLE!

ICOM

The dream is Still Alive...

W1AW endures as the strongest historic symbol of Amateur Radio. Generations of hams have thrilled at a first contact with W1AW.

Your financial commitment to the Hiram Percy Maxim Memorial Station will ensure a bright future for W1AW.

Send your contribution or make your pledge to the W1AW Endowment Fund by mail or on the web at **www.arrl.org/endoww1aw.html**

The dream began with a 1936 flood...

...with the 1937 purchase of seven acres of land in Connecticut...

...to the inaugural CQ in July 1938...

...through the radio silence of World War II...

...the post-war code practice sessions...

...the renovations of the 1960's and 1980's...

...to 21st century technology.

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

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the radio amateur

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City _____ State _____ ZIP _____

Sign up my family members, residing at the same address, as ARRL members too! They'll each pay only $8 for a year's membership, have access to ARRL benefits and services (except QST) and also receive a membership card.

Family Member Name _____ Call Sign (if any) _____

Family Member Name _____ Call Sign (if any) _____

❑ Sign up _____ family members @ $8 each = $ _____ .

❑ Total amount enclosed, payable to ARRL $ _____ .

❑ Enclosed is $ _____ ($1.00 minimum) as a donation to the Legal Research and Resource Fund.

❑ Charge to: ❑ VISA ❑ MasterCard ❑ Amex ❑ Discover

Card Number _____ Expiration Date _____

Cardholder's Signature _____

❑ If you do not want your name and address made available for non-ARRL related mailings, please check here.

Please check the appropriate one-year[1] rate:

- ❑ **$39 in US.**
- ❑ **Age 65 or older rate, $36 in US.**
- ❑ **Age 21 or younger rate, $20 in US** (see note*).
- ❑ **Canada $49.**
- ❑ **Elsewhere $62.**

Please indicate date of birth _____ .

(US funds drawn on a bank in the US).

[1] 1-year membership dues include $15 for a 1-year subscription to QST. International 1-year rates include a $10 surcharge for surface delivery to Canada and a $23 surcharge for air delivery to other countries.

Other US membership options available: Blind, Life, and QST by First Class postage. Contact ARRL for details.

*Age 21 or younger rate applies only if you are the oldest licensed amateur in your household.

International membership is available with an annual CD-ROM option (no monthly receipt of QST). Contact ARRL for details.

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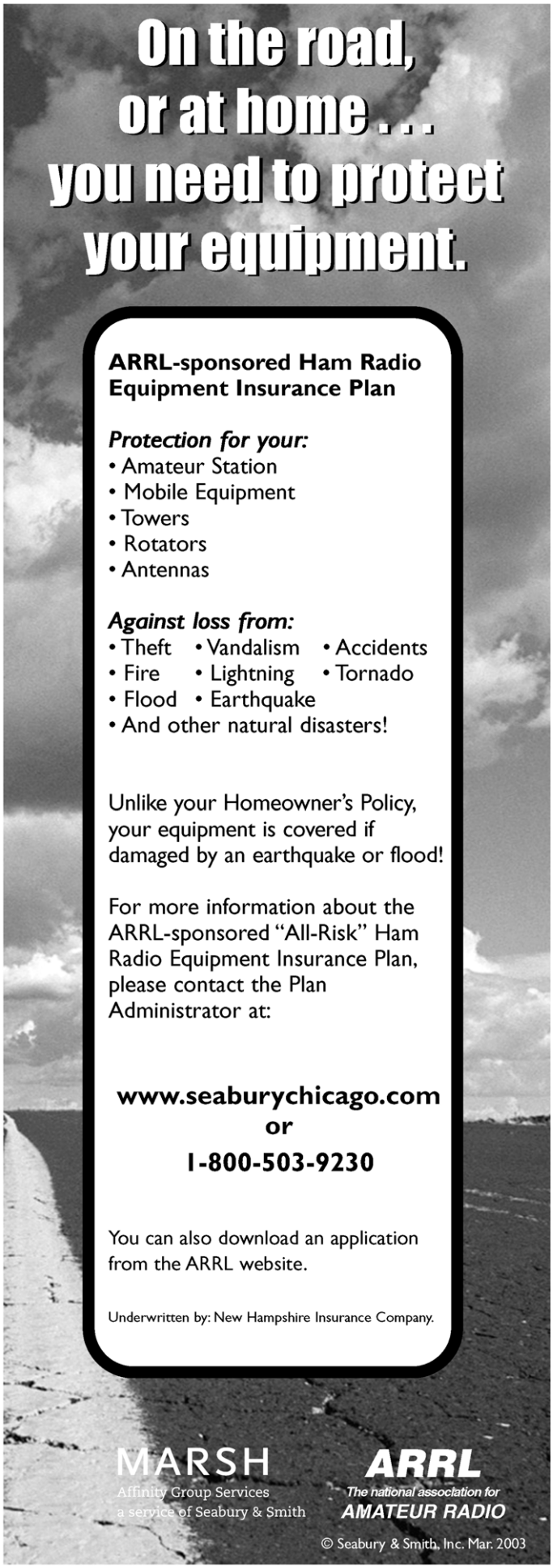

Don't Let a Lightning Strike Keep You Off The Air!

ARRL offers its Members Ham Radio Equipment Insurance.

How much time and money have you spent on your ham radio equipment? What if a natural disaster strikes, forcing you off the air? You'd want to be up and running again as soon as possible with the least amount of financial worry.

With the ARRL-sponsored "All-Risk" Ham Radio Equipment Insurance Plan, you can enjoy peace of mind knowing that your valuable equipment will be covered if it's damaged or stolen. Plus, your equipment and accessories are covered while in your car, as well as at home.

With this program, you pay the low annual rate of just $1.50 per $100 of replacement cost value! You'll find this to be significantly lower than comparable plans. If you rely solely on your homeowner's coverage, be prepared to pay a high deductible. With the ARRL-sponsored plan, you pay the low deductible of just $50 per claim. How much longer can you afford to go without coverage?

Marsh Affinity Group Services administers the ARRL-sponsored Ham Radio Equipment Insurance Plan. They have been providing insurance programs for professional organizations for over 50 years, and their strength and expertise make them a leader in the industry.

Don't wait for lightning to strike and leave you with damaged equipment and high replacement costs. Get protection now so you can avoid the financial burden of rebuilding your station. For more information, contact Marsh Affinity Group Services toll-free at 1-800-503-9230. Or, visit them on the web at www.seaburychicago.com.

VECTRONICS RF Accessories

300 Watt Antenna Tuner

VC-300DLP
$159.95

VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and 1000 Volt variable capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

300 Watt Mobile Tuner

VC-300M
$109.95

The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna, any HF transceiver and fits in the smallest car. It can also be used at home with any coax fed antennas -- dipoles, vees, verticals, beams or quads.

Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. 3.4 pounds.

SWR/Power Meters

PM-30
$79.95
PM-30UV
$89.95

PM-30, $79.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.

144/220/440 MHz, 30/300 SWR/Wattmeters
PM-30UV, $89.95, SO-239 connectors.
PM-30UVN, $89.95, N connectors.
PM-30UVB, $89.95, BNC connectors.

1.5 kW *dry* Dummy Load

DL-650M, $74.95
100 Watts continuous 1500 W/10 seconds to 650 MHz. *Ceramic* resistor. SWR less than 1.3. SO-239s. **DL-650MN, $79.95** has N connectors.

Low Pass TVI Filter

LP-30, $69.95
Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. 1.5 kW.

High Pass TVI Filter

HPF-2, $29.95
Installs between VCR/TV and cable TV/antenna cable. Eliminates or reduces interference caused by nearby HF transmitters.

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MIRAGE. . .160 Watts on 2 Meters!

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $45. Remote Control. On/Off, preamp On/Off, selects SSB/TM. 25 ft. cable.

Power Curve *-- typical output power in Watts*

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

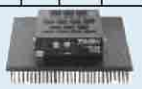
6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

Repeater Amps



11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base*. **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $289**, 60W out/2W in, for *handhelds*.

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W. In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $139*	*MastMount, $195*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $439**, 82W PEP out/2W in. (without sync compression).

Accurate SWR/Wattmeters

Read SWR directly and Forward/ Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

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1. Advertising must pertain to products and services which are related to Amateur Radio.

2. The Ham-Ad rate for commercial firms offering products or services for sale is $1.25 per word. Individuals selling or buying personal equipment: ARRL member 65¢ per word. Non-ARRL member $1 per word. **Bolding** is available for $1.75 a word. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

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FRIEND OF BILL W.?? - Join HAAM net Saturdays at 12:30 Eastern on 14.290; Sundays at 09:30 Pacific on 14.340/2. K6LX

MARCO The Medical Amateur Radio Council Ltd. is a charitable non-profit group of health care professionals who meet weekly at 10:00am Eastern on Sunday for "Grand Rounds" 14.308 MHz. All are welcome. Membership inquiries to WE1MD@arrl.net or CBA. SASE for newsletter to: MARCO, 144 Head of the Tide Road, Belfast, ME 04915. http://www.marco-ltd.org

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.

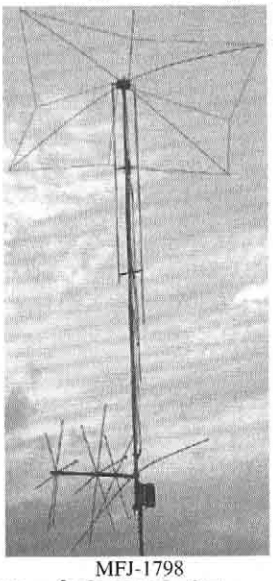
Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

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.

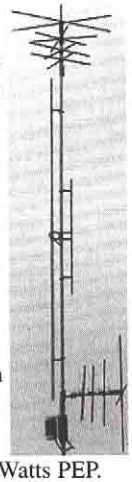
MFJ's G5RV Antenna

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!*

MFJ halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed



MFJ-1796
$209.95
Ship Code F

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.

Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

MFJ-1792, $169.95. Full size 1/4 wave radiator for 40 Meters. 33 feet, handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $189.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

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and Nearest Dealer . . . 800-647-1800

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METRO-COMM. INC MID-ATLANTIC Echo-Link Node #119660 W3CH-R Wide Area repeater net work NY, PA, NJ and Delaware. Come join us 24 hours a day. Weekly nets: Sunday 20:00 (Local 00:00 UTC) KB3FPM hosts a rag chew net. Monday 20:00 (Local 00:00 UTC). The Over The Hill Gang net. For a list of all the repeaters in the system e-mail w3publicservice @aol.com. Everyone is always welcome to join in on the fun - 24 hours a day! 73 Metro-Comm, Inc W3PS

MID-ATLANTIC QSO Party May 8-9, 2004. www.qsl.net/maqso WA3EOP

RAINBOW AMATEUR RADIO ASSOCIATION Serving the gay/lesbian community. ARRL affiliated. Privacy respected. Active weekly HF nets, monthly newsletter, e-mail server, chat room, VE teams, Dxpeditions. Web site: www.rara.org. Information: PO Box 18541, Rochester, NY 14618-0541.

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COLORADO CHALET with ham gear, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

CURACAO - PJ2T Oceanfront 2BR house, 11 yagis, all watersports. ghoward@kent.edu http://www.pj2t.org

DXshack FG, J6, 3W, XU, XW TRX+kWAMP+Beam ANT & Bed. URL: //qth.com/dxshack email: xu2a@fsinet.or.jp

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MFJ *IntelliTuner*™ Automatic Tuner

Automatically tunes any antenna balanced or unbalanced . . . Ultra fast . . . 2000 memories . . . Antenna Switch . . . Efficient L-network . . . Matches 6-1600 Ohms at 300 Watts . . . 1.8-30 MHz . . . 4:1 current balun . . . Cross-Needle and Digital SWR/Wattmeter . . . Aural SWR meter . . . Backlit LCD . . . Remote control port . . . Radio interface . . .

MFJ-993
$259.95 **New!**

The MFJ-993 *IntelliTuner*™ lets you tune any antenna *automatically* balanced or unbalanced -- *ultra fast*.

It's an automatic antenna tuning *console* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJs exclusive *IntelliTuner*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you *ultra fast* automatic tuning with over 2000 *non-volatile* revolving memories.

You get a highly efficient L-network, wide 6-1600 ohm matching at *full* 300 Watts SSB/150 Watts CW, 1.8-30 MHz coverage, Cross-Needle and *digital* meters, aural SWR meter, *backlit* LCD display, remote control port, radio interface, heavy-duty 16 amp/1000 volt relays and more.

It learns while you're having fun

As you're ragchewing, contesting or DXing, *your MFJ-993 is learning!*

When you transmit, the MFJ-993 automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!*

Each of two antennas can learn and remember over a thousand frequencies and tuner settings. They are safely stored in *non-volatile* revolving memory.

Highly Intelligent ultra fast tuning

MFJ *InstantRecall*™ first checks its memory to see if you have operated this frequency before. If so, tuning is instantaneous and you're ready to operate.

If not, MFJ's *IntelliTuner*™ algorithm - - based on MFJ's famous SWR Analyzer technology - - kicks in. It *measures* the complex impedance of your antenna. Next, it *calculates* the components it needs and instantly *snaps* them in. Then, it fine tunes to minimize SWR -- you're ready to operate. It's all done in a *fraction* of a second.

When the impedance is within its measurement range, the MFJ-993 is the *fastest automatic antenna tuner in the world.*

If it can't accurately determine impedance, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for ultra-fast tuning.

For even faster searches, you can set the target SWR to 2 (settable 1.0 to 2.0).

You can manually tune when you can't transmit (for listening out of ham bands).

Cross Needle and Digital Meters

Lighted Cross-Needle and *digital* SWR/Wattmeters lets you accurately read SWR, forward and reflected power at a glance.

An *aural* SWR meter lets you *hear* the tuned SWR when you can't see or read the meters.

Turn on a highly visible, instant response SWR LCD bargraph when you need it.

Backlit LCD Display

An easy-to-read *backlit* LCD displays SWR, forward/reflected power, frequency, antenna 1 or 2, L and C tuner values, on/off indicators and other information.

Remote Control Port

Plug in the **MFJ-990RC, $39.95**, remote control and put your tuner at your antenna or elsewhere and control it remotely.

The MFJ-993 supports radio tuner interfaces such as the ICOM 706 series. *Interface cables are available.*

The MFJ-993 is a compact 10Wx2¾ Hx9D inches. Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $19.95**.

Tune any Antenna

You can tune any antenna -- dipoles, verticals, beams, phased arrays, inverted vees, quads, random wires, mobile antennas, limited space antennas -- any antenna.

A 4:1 true current balun lets you tune any *balanced* antenna -- horizontal loops, vertical loops, multi-band doublets, quads, folded dipoles, Zepps.

150 Watt Automatic Tuner

New!
MFJ-991,
$219.95

MFJ-991, *150 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 150 Watts SSB/100 Watts CW, matches 6-3200 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines.

600 Watt MFJ Automatic Tuner

MFJ-994,
$359.95
New!

MFJ-994, *600 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 600 Watts SSB/300 Watts CW, matches 12-800 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines. Tuning must be done at low transceiver power with the amplifier bypassed.

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Ham Ads continued on Page 162

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.

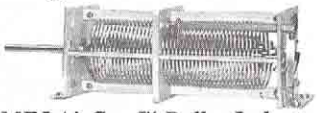
MFJ-989C **$359.95**

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.

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.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

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

MFJ-962D **$269.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10¾x4½ x10⅞ in.

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

MFJ-949E **$149.95**

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.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$99.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x6½x2½ inches.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$79.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-16010 *random* wire Tuner

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.

MFJ-921/924 VHF/UHF Tuners

MFJ-921 or MFJ-924 **$69.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 inches. Simple 2-knob tuning for mobile or base.

MFJ-922 144/440 MHz Tuner

MFJ-922 **$79.95**

Ultra tiny 4x2½x1¼ inch tuner covers VHF 136-175 MHz and UHF 420-460 MHz. SWR/Wattmeter reads 60/150 Watts.

MFJ-931 *artificial* RF Ground

MFJ-931 **$89.95**

Creates artificial RF ground. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire. Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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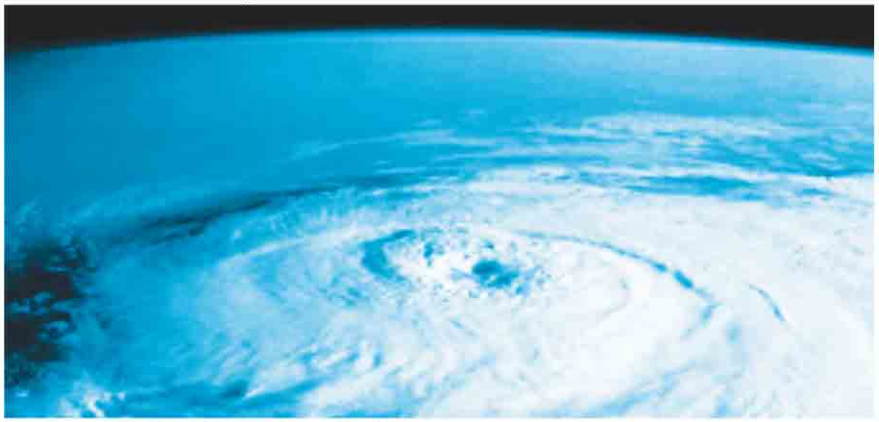

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- **32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER.** At the heart of the '756PROII, the DSP is an incredible tool for handling the QRM found on the bands.
- **SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW.** Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity & signal fidelity, soft for readability, or somewhere inbetween - it's your choice! Change on the fly & compare the difference!
- **IMPROVED 3RD ORDER INTERCEPT POINT.** The newly designed 4 element system delivers a measurable improvement in the 3rd Order Intercept Point, resulting in less distortion from strong signals.
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IC-746PRO Features:

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- 160 to 6 meters
- LED Bargraphs for Power/SWR/Status
- Two antenna jacks; >4000 memories

$219

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AT-1000 Hi Power Autotuner

- Up to 1000 watts SSB, 750 watts CW, 500 watts Digital
- 160 to 6 meters
- Analog Power/SWR meter

$599

RC-1000 Remote Control

- Remote Control Head for the AT-1000
- Controls Power Bypass, Tune, and Fine Tuning
- Includes ten foot interface cable

$99

NEW!

Z-100 Low Cost Autotuner

- 0.1 to 125 watts
- 160 to 6 meters
- Latching relays
- LED status and SWR indicators
- 200 fast memories

$149

NEW!

AT-897 Autotuner

- Bolts on Yaesu FT-897
- 160 to 6 meters
- Powered from CAT Port
- Latching relays, no fan

$199

RT-11 Remote Autotuner

- 0.1 to 125 watts peak
- 160 to 6 meters
- Water resistant case
- Optional Remote Head **RT-11 RH**
- Perfect for remote installation

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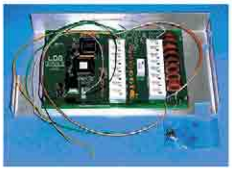

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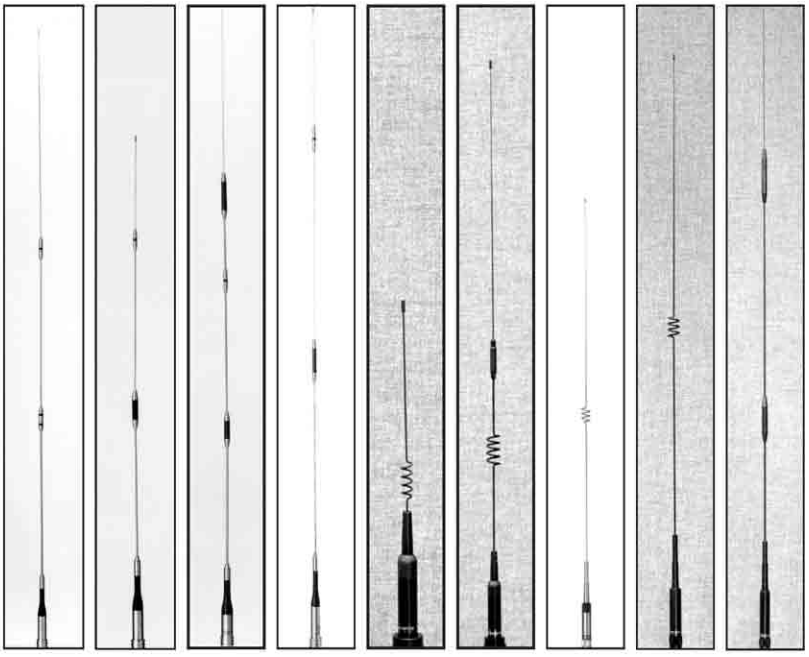


SG2000HD | SG7500A SG7500NMO | SG7900A SG7900ANMO | SGM911 | NR72BNMO | NR73BNMO | NR770HA NR770HB | NR770HNMO NR770HBNMO | CR627B CR627BNMO

HV7A Mobile Antenna System

For New HF/VHF transceivers

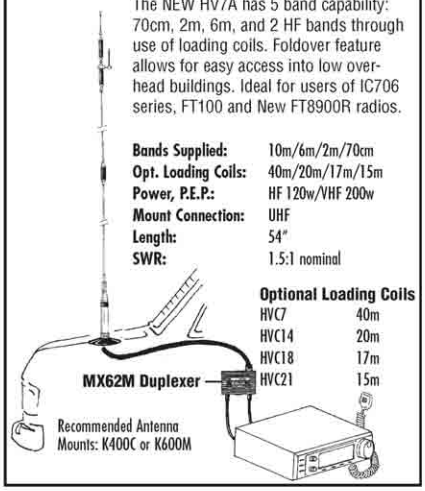
(Such as: IC706 series, FT100 & NEW FT8900R)

The NEW HV7A has 5 band capability: 70cm, 2m, 6m, and 2 HF bands through use of loading coils. Foldover feature allows for easy access into low overhead buildings. Ideal for users of IC706 series, FT100 and New FT8900R radios.

Bands Supplied:	10m/6m/2m/70cm
Opt. Loading Coils:	40m/20m/17m/15m
Power, P.E.P.:	HF 120w/VHF 200w
Mount Connection:	UHF
Length:	54"
SWR:	1.5:1 nominal

Optional Loading Coils

HVC7	40m
HVC14	20m
HVC18	17m
HVC21	15m



MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
MR77	2m/70cm	70	MAG	20	1/4λ, 1/2λ
MR77SMA	2m/70cm	70	MAG	20	1/4λ, 1/2λ
NR72BNMO*6	2m/70cm	100	NMO	13.8	1/4λ, 1/2λ
NR73BNMO	2m/70cm	100	NMO	33.5	1/2λ, 1-5/8λ
NR770HA7	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO8	2m/70cm	200	NMO	38.2	1/2λ, 2-5/8λ
NR770RA	2m/70cm	200	UHF	38.6	1/2λ, 2-5/8λ
NR7900A*	2m/70cm	300/250	UHF	57	1/4+1/2λ, 3-5/8λ
SG7000A*6	2m/70cm	100	UHF	18.5	1/4λ, 6/8λ
SG7500A	2m/70cm	150	UHF	40.6	1/2λ, 2-5/8λ
SG7500NMO	2m/70cm	150	NMO	41.0	1/2λ, 2-5/8λ
SG7900A*	2m/70cm	150	UHF	62.2	7/8λ, 3-5/8λ
SG7900ANMO*	2m/70cm	150	NMO	62	7/8λ, 3-5/8λ
SGM510	2m/70cm	100	UHF	37	1/2λ, 2-5/8λ

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
CR8900A*6, 11	10m/6m/2m 70cm	60	UHF	50	1/4λ, 1/4λ 1/2λ, 2-5/8λ
SG2000HD*	2m	250	UHF	62.6	1/2λ+3/8λ
CR320A*6	2m/1-1/4m 70cm	200/100 200	UHF	37.4	1/4λ, 1/2λ 2-5/8λ
CR627B*6,9 CR627BNMO*6,9	6m/2m 70cm	120	UHF/NMO	60	1/4λ, 1/2+1/4λ 2-5/8λ
HF6FX*6	6m	250	UHF	40	1/4λ
HF50CX*6	6m	200	UHF	75	3/8λ
NR22L*	2m	100	UHF	96.8	2-5/8λ
NR2000NA	2m/70cm 23cm	100	N	39	1/2λ, 2-5/8λ 5-5/8λ
M285*10	2m	200	UHF	52.4	5/8λ
M685*6	6m	200	UHF	52.4	1/4λ
MG200	2.4GHz	-	N	23.6	3-1/2λ
SGM911*6,9	6m/2m/70cm	60	UHF	41	1/4λ, 1/2λ,2-5/8λ
NR124	23cm	100	N	25	4-5/8λ

FOLD-OVER

Patented One-Touch Fold-Over Feature.
(Not available on M285, M685, MG200, MR77, MR77SMA, NR72BNMO & NR73BNMO)

* Not recommended for Magnet Mount
6 Grounding required
7 NR770HB same specs but in black finish.
8 NR770HBNMO same specs but in black finish.
9 52-54MHz only
10 Tunable from 140-174MHz
11 FM only

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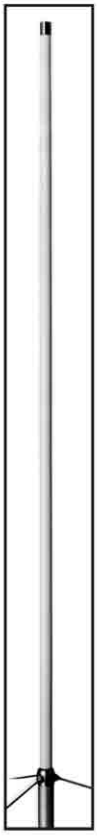
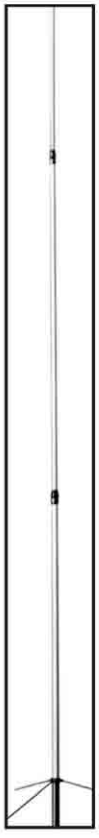


X50NA



X500HNA

X500HA (UHF-Conn.)
X500HNA (Type-N Conn.)
Ruggedized Base/Repeater Antenna

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

COAX CONNECTION AT BASE END

HEAVY DUTY BASE/ RADIAL ASSEMBLY

STRONG JOINT COUPLINGS

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	70
DPGH62 [1]	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
G200	2.4GHz	–	N	4.8	135

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
U200	440/1240	100	N	5.9	135

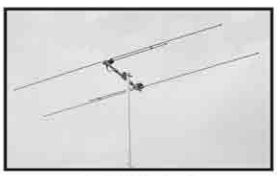
DIAMOND Tri-Band Base/Repeater Antennas

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

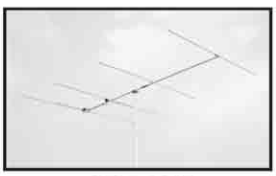
Most requirement: 1.4"-2.4"

DIAMOND Yagi Antennas

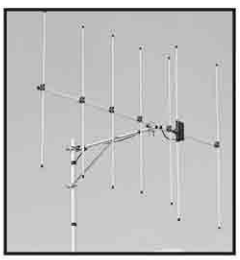
MODEL	BAND (MHz)	WATTS (PEP)	CONN.	BOOM LNTH.	ELEMENT PHASING
A502HB	50	400	UHF	2.6'	2 element
A504HB	50	400	UHF	10.7'	4 element
A144S5	144	100	UHF	37.5"	5 element
A430S10	432	100	UHF	43"	10 element
A430S15	432	100	UHF	89"	15 element



A502HB



A504HB



A144S5

NOTES:

1. Heavy duty aluminum construction.
2. F-718A: 440-450MHz., F718L: 420-430MHz.
3. X510NJ: 144-147/430-440MHz.
4. 2m: 146-148; 100 watts
5. 52-54MHz. only

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

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- Selectable IF filter shapes for SSB & CW
- Enhanced Rx performance
- SSB/CW Synchronous tuning
- Multiple DSP controlled AGC loops
- Advanced CW functions
- 101 alphanumeric memories

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All Mode Transceiver

COMING SOON!

- 160-6M @ 200W
- Four 32 bit IF-DSPs+ 24 bit AD/DA converters
- Two completely independent receivers
- +40dBm 3rd order intercept point

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IC-746PRO

All Mode 160M-2M Transceiver

- 160-2M* @ 100W
- 32 bit IF-DSP+ 24 bit AD/DA converter
- Selectable IF fi lter shapes for SSB & CW
- 102 alphanumeric memories
- Enhanced Rx performance

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FREE DSP UT-106 ✦

- 160-10M* @ 100W
- 12V Operation
- Simple to Use
- CW Keyer Built-in
- One Touch Band Switching
- Direct frequency input
- VOX Built-in
- 101 memories

FREE SEPARATION KIT RMK-706 ✦

IC-706MKIIG

All Mode 160M-70cm

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- Proven Performance
- 160-10M*/6M/2M/70CM
- All mode w/DSP
- HF/6M @ 100W, 2M @ 50W, 440 MHz @ 20W
- CTCSS encode/decode w/tone scan
- Auto repeater offset
- 107 alphanumeric memories

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HF QRP Transceivers

$60 ICOM COUPON!

- HF or HF/6M versions
- 10W~0.1W @ 13.5V SSB, CW, RTTY, FM 4W~0.1W @ 13.5V AM
- Internal antenna tuner
- Detachable control panel
- DSP w/ auto notch filter & notch reduction

* Except 60M Band. ✦ Limited time only. Check with HRO for details or restrictions on any offers or promotions.

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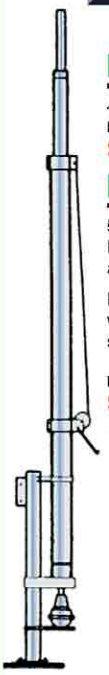

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***Measures:** SWR...Return Loss...Reflection Coefficient...Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) ... Coax cable loss(dB) ... Coax cable length ... Distance to short or open in coax ... Inductance ... Capacitance ... Resonant Frequency ... Bandwidth ... Q ... Velocity Factor ... Attenuation ... **Has:** LCD readout ... frequency counter ... side-by-side meters ... Ni-MH/Ni-Cad charger circuit ... battery saver ... low battery warning ... smooth reduction drive tuning ... One year No Matter What™ warranty...*

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You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

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Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

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New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

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Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

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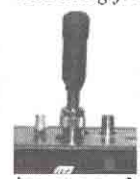
MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.

Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for frequency display and cutouts for knobs and connectors -- use your MFJ *SWR Analyzer*™ without ever taking it out of your case. *Authentic MFJ leather logo distinguishes the real thing from imitators!*



MFJ-66, $19.95.

Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer*™.

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MFJ tiny Travel Tuner

Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

MFJ brings you the *world's smallest* full power 150 Watt 80-10 Meter Antenna Tuner. Extra wide matching range lets you tune nearly any antenna.

It's no toy, its got guts! Built with real *air* variable capacitors (600 Volt, 322 pF) and *three* stacked powder iron toroids to handle real power -- not just QRP. Bypass switch lets you bypass tuner when you don't need it.

You can use nearly any transceiver at full power with nearly any coax fed or random wire antenna for portable, home or mobile operation.

It's perfect for compact rigs like Icom IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50, QRP rigs and others with a built-in SWR meter.

Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

MFJ-902 is so small and handy, you'll rely on it wherever you go! It's easy to pack away in your briefcase, suitcase, backpack, glove compartment or desk drawer. It's tiny enough to slide in your back hip pocket! 4½Wx2¼Hx3D in.

MFJ-902
$79.95 **New!**

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$99.95

MFJ-902H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun* for balanced lines and 5-way binding posts for balanced lines and random wire. 5¾Wx2¼Hx 2¾D inches.

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904
$109.95

MFJ-904, same as MFJ-902 *Tiny Travel Tuner* but has *Cross-Needle SWR/Wattmeter.* Read SWR, forward and re-flected power all at a glance in 300/60 and 30/6 Watt ranges. 7¼Hx2¼Hx2¾D in.

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

MFJ-904H
$129.95

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

Long 10/12 foot Telescoping Whips

MFJ-1954
$19.95
10 Feet

MFJ-1956
$29.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $19.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $29.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

MFJ RF Isolator

MFJ-915 *RF Isolator*

MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod

MFJ-1918
$39.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

40-10M G5RV Junior **MFJ-1778M, $34.95.** *Half-size* 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$39.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

Glazed Ceramic Antenna Insulator

MFJ-16C06
$3.95
Package of six. (69 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

MFJ-918
$24.95

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*® coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974H is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

The MFJ-974H is its successor. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974H gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974H tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974H is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to unbalanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

MFJ-974H **$199.95**

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974 **$179.95**

MFJ-974, $179.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $49.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ *High Current* DC Multi-Outlet Strips

Choose super versatile 5-way binding posts AND/OR Anderson PowerPole® connectors

Anderson PowerPole® is a registered trademark of *Anderson Power Products.*

Provide multiple high current DC outlets for transceivers and accessories from your main 12 VDC power supply – keeps you neat, organized and safe. Prevents fire hazard. Keeps wires from tangling up and shorting. Outlets are fused and RF bypassed.

All MFJ DC power strips have *built-in* six foot, eight gauge, flexible color-coded cable with ring tongue terminals -- *no extra cost. RF-tight* aluminum cabinet has mounting ears and ground post with wing nut.

Choose MFJ's *super versatile* super heavy duty 5-way binding posts (spaced for standard dual banana plugs) and/or *Anderson PowerPole®* outlets.

Each *Anderson PowerPole®* is individually fused as needed. Standard color coded automobile fuses plug in externally. Extra *PowerPole®* connectors, contacts, fuses are included at *no extra cost.*

Versatile 5-Way Binding Posts

MFJ-1118 **$74.95**

Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter.* Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts with master fuse, ON/OFF switch, and "ON" LED provide 15 Amps for accessories. 12½x2¾x2½ in.

All PowerPoles®

MFJ-1128 **$99.95**

12 outlets, each fused, 40 Amps total. Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter.* Includes *extra* 12 pairs of *PowerPole®* contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost.* 12Wx1¼Hx2¾D in.

MFJ-1126 **$79.95**

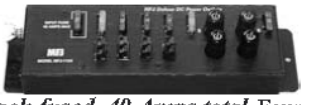
8 outlets. each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *Built-in 0-25 VDC Voltmeter.* Includes *extra* 6 pairs of *Anderson PowerPole®* contacts and *extra* 5 fuses (1, 5, 10, 25, 40A) -- *no extra cost.* 9Wx1¼Hx2¾ inches.

PowerPoles® AND 5-Way Binding Posts

MFJ-1129 **$109.95**

The best of both worlds! ***10 outlets, each fused, 40 Amps total.*** Three high-current outlets for rigs -- 2 *PowerPoles®* and 1 versatile high-current 5-way binding post. Seven *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 versatile binding posts. Mix and match included fuses as needed (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *Built-in 0-25 VDC Voltmeter.* Includes *extra* 7 pairs of *PowerPole®* contacts, and 10 fuses (2 each,1,5,10, 25, 40A) -- *no extra cost.*12½Wx1¼Hx2¾D in.

MFJ-1124 **$59.95**



6 outlets, each fused, 40 Amps total. Four *PowerPoles®* and two high-current 5-way binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes 4 pair *PowerPole®* contacts, and 5 fuses -- *no extra cost.*

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MFJ Dummy Load/Wattmeter

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

World's most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

MFJ-267 **$149.95**

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

High accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

RF tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with MFJ-1312D, $14.95.

Find Power Line Noise Fast!

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MFJ-852 **$99.95**

Field Strength Meters

Shows radiated antenna relative field strength. Determine radiation pattern. **MFJ-802** has huge 3 inch meter. Telescoping dipole reduces influence of surrounding objects and is more reliable, repeatable than monopole. Sensitivity control. Jack for remote sensor, MFJ-802R, $24.95. **MFJ-801** has 1¾ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

MFJ-802 **$39.95**

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81 dB Step Attenuator

MFJ-762 **$69.95**

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MFJ-888 **$184.95**

MFJ Wireless Weather Station . . . $59.95!

Display

Remote Sensor

MFJ-192 **$59.95** *New!*

You're ragchewing with a G3 in England . . . *"Temperature outside is a cool 53 degrees with falling barometric pressure -- looks like a rainstorm may be coming. Humidity here is 73%."* . . . while noticing it's 1900 hours GMT.

This informative MFJ Wireless Weather Station receives and displays outside temperatures from up to 3 remotes every 30 seconds up to 100 feet away.

You'll get barometric pressure trends, weather forecasting, severe storm detection with visual and audible alarms -- great for severe weather nets.

You can read inside and outside F/C degrees, relative humidity, forecast icons, pressure trend, hour, minutes, seconds, day, date and month *simultaneously*.

Has upper/lower temperature limit alarms, backlight. Read time in two zones -- local and GMT or other -- in 12/24 hour format.

Display (4x7x1") uses 2 AA, remote (2¼x3½x1") uses 2 AAA batteries, not included. *Includes one remote*, extra **MFJ-192S** remotes are $19.95 each.

MFJ CW Reader/Keyer

MFJ-464 **$179.95**

(Keyboard, paddle not included.)

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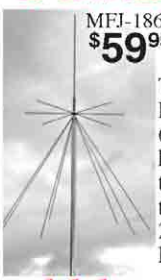

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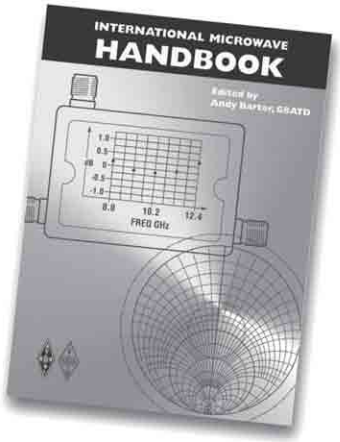

Edited by Andy Barter, G8ATD

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ROHN TOWER

25G/45G/55G	$89/189/239
25AG2/3/4	$109/109/119
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	$999/1549
MA770/MA850	$2599/3999
TMM433SS/HD	$1349/1649
TMM541SS	$1789
TX438/TX455	$1279/1749
TX472/TX489MDPL	$2899/7299
HDX538/HDX555	$1499/2549
HDX572MDPL	$6669

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	$169
B10NMO, 2m/70cm Mobile	$36
SB14, 6m/2m/70cm Mobile	$59
SBB224NMO,2m/220/70cm	$69
SBB2NMO, 2m/70cm Mobile	$39
SBB5NMO, 2m/70cm Mobile	$49
SBB7NMO, 2m/70cm Mobile	$69
UHV4/UHV6	$109/135

Much more Comet in stock–call.

M2 ANTENNAS

50–54 MHz

6M5X/6M7JHV	$209/269
6M2WLC/6M9KHW	$459/499

10/12/15/17/20m HF

10M4DX, 4 Element 10m	$399
12M4DX, 4 Element 12m	$399
15M4DX, 4 Element 15m	$449
17M3DX, 3 Element 17m	$399
20M4DX, 4 Element 20m	$529

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 shows wind-load capacity. Please call for more Universal models. All are 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, 2m/70cm Vertical	$129
X500HNA/X700HNA	$229/369
X510MA/510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock.

MFJ

259B	$219
269	$299
941E	$109
945E	$99
949E	$139
969	$169
986	$289
989C	$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
RG-8X, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Ple ase Call

Please call for more coax/connectors.

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

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" Big Grips	$5/6

Please call for more hardware items.

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 .18" / 17 FT x .12"	$179/129
20 FT x .25" / 21 FT x .18"	$315/235
22 FT x .12" / 24 FT x .25"	$149/379

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

Please Call for Delivery Information.

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/G7-144B	$109/179

Hustler Resonators in stock–call.

ANTENNA ROTATORS

M2 OR-2800P	$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 (#18)	$.32/ft.
R81/82	$.25/ft./.39/ft.
R84	$.85/ft

PHILLYSTRAN 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 help selecting the Phillystran size for your application.

WEEKDAY HOURS:
9 AM–5 PM CST

SATURDAY HOURS:
9 AM–12 NOON CST

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HUGE ICOM DEALS ★ HUGE YAESU DEALS

IC-756PROII..... Icom Special!
The Icom IC-756PROII is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, auto antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with hand mic and DC power cord.

PW-1..... In Stock!
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 XCVR 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 hand mic and DC power cord.

IC-910H ..... In Stock!
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 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 .....Special!
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, auto tuner, and more. With up/down hand microphone and DC power cord.

Quadra System ..... In Stock!

FT-897..... 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 microphone and DC power cord.

IC-703 ..... New, In Stock!
IC-703PLUS..... New, In Stock!
The Icom IC-703 is a compact HF XCVR, with built-in auto tuner, DSP, and more! The IC-703PLUS adds 6m coverage.

IC-706MK2G..... Icom Special!
The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode XCVR with DSP, CW keyer, built-in CTCSS encode/decode/scan, 107 memoriess and more. A detachable front panel offers convenient mounting, even in compact vehicles.

IC-718 ..... New Lower Price!

IC-2720H.....New!
Dual band 2m/70cm FM XCVR. Features remote control panel, CTCSS tone encode/decode/scan, cross band repeat, data jack, dual RX, extended RX, 212 memories, and more. Supplied with a DTMF hand mic, separation cable, mounting brackets, and a fused DC power cord.

IC-V8000..... 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.

FT-8900R..... In Stock!
Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat.

FT-8800R..... New, In Stock!
Great 2m/70cm dual band mobile, 45/35 Watts, removable front panel, and more!

FT-7800R..... New, Please Call!
New, 2m/70cm dual band mobile XCVR.

FT-2800M ..... In Stock!
Rugged, 50W 2m mobile transceiver.

FT-857.....Now In Stock!
Ultra-compact all mode XCVR for HF/6m/2m/70cm. Features CW memory keyer, CTCSS encode/decode, 200 memories, optional DSP, and more. Supplied with a hand microphone, a fused DC power cord and mounting bracket.

FT-817..... In Stock!
A truly tiny self-contained all mod e HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memory channels, VOX, and more! With hand microphone.

IC-T2H Sport... Great Low Price!
IC-Q7A..... Great Low Price!
IC-T7H..... Icom Special!
IC-V8..... Great Low Price!
IC-W32A..... Now In Stock!
IC-T90A ..... New, In Stock!

IC-208H..... Great Low Price!
A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 500 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 memories, and more.

IC-PCR1000 ..... In Stock!
IC-R8500/R75..... In Stock!
IC-R3/R5/R10..... In Stock!

G-2800DXA.....$1089
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 ..... In Stock!
VR-500 ..... In Stock!
VX-2R..... New, In Stock!
VX-5R..... New Lower Price!
VX-7R ..... New Lower Price!
VX-150..... New Lower Price!

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60 m Band

FT-897D

HF/50 MHz/144 MHz/430 MHz 100 W (144 MHz 50 W/430 MHz 20 W)
20 W (Optional baterry FNB-78)

DSP
DIGITAL SIGNAL PROCESSING
Included

ULTRA COMPACT
ALL MODE MOBILE TRANSCEIVER

60 m Band

FT-857D

HF/50/144/430 MHz 100 W
(144MHz 50 W/430 MHz 20 W)

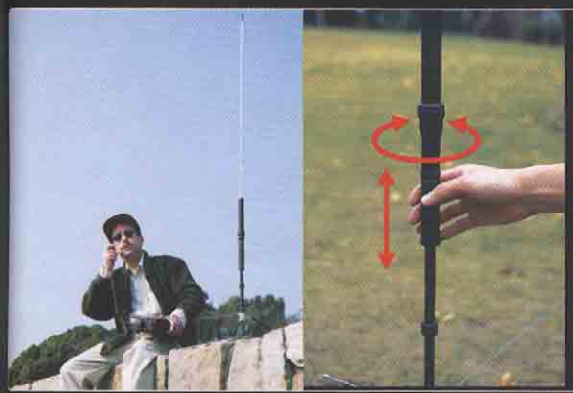
FNB-85 1400 mAh Long-Life Ni-MH Battery and NC-72B Charger Included

ULTRA COMPACT
ALL MODE PORTABLE TRANSCEIVER

60 m Band

FT-817ND

HF/50/144/430 MHz 5 W



ATAS-25 Manually-Tuned Portable Antenna

The ATAS-25 is a manually-adjusted portable antenna ideal for field use with the FT-817. Designed for mounting on a standard camera tripod (1/4" stud), the ATAS-25 is tuned by sliding the shorting ring of the loading coil up or down and selecting the appropriate number of top sections. Counterpoise wires are supplied.

The ATAS-25 is constructed of high-grade materials for maximum efficiency, and it's the perfect traveling companion for your FT-817!

Freq. Range: Amateur Bands 7-450 MHz.
Max. Power: HF/50 MHz: 100 W SSB/CW
(50% Duty, 1 min. TX/RX)
AM/FM: 50 W
144/430 MHz: 50 W
Size: Max. Length 7'3" (2.2 m)
Min. Length for Carrying: 2' (0.6 m)
Weight: 2.1 lb. (930 g)

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