ISSN 1085-0708

CQ VHF

Ham Radio Above 50 MHz

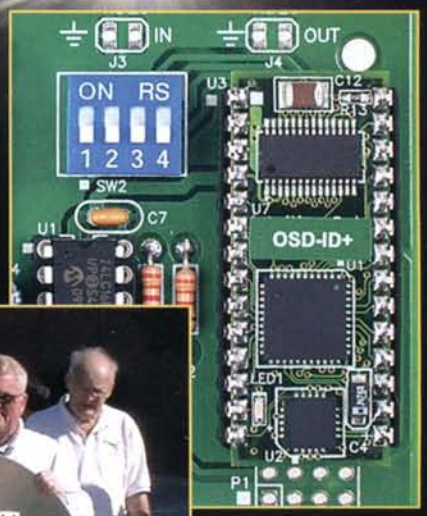
www.cq-vhf.com

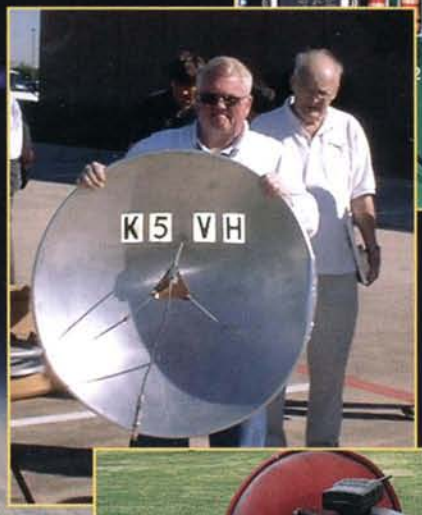
Spring 2011

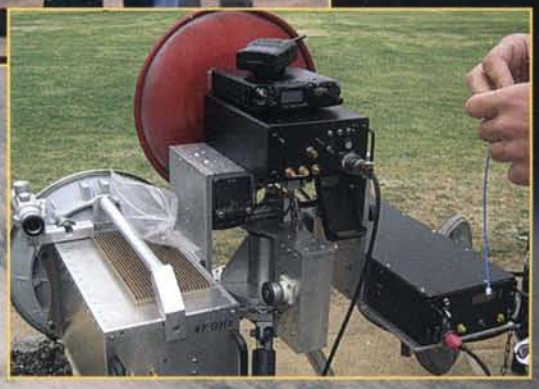
$7.50

Antennas:

- A Horn for 23-cm EME
- A Yagi for 222 MHz
- Portable "Cheap Yagis"







The Rise of Sunspot Cycle 24

Journey to the High End of 2 meters

- VHF/UHF Weak Signal
- Projects
- Microwaves
- Packet Radio
- Repeaters
- Amateur Satellites
- Interviews
- Plus...Reviews, Product News, and much more!

The perfect combo, without compromise.

HF/6m/2m/70cm/23cm[1] Transceiver

IC-9100

For years, the attention to receiver design focused on the HF bands, leaving the upper bands a bit neglected. Icom changed the ham world with the introduction of the IC-7800, which incorporated a new front-end design just for 6m. Now, Icom's introducing the newly FCC approved IC-9100, extending the latest in front-end technology up to more of the VHF/UHF bands. 2m, 70cm, and 23cm[1] enthusiasts can now benefit from high-end IF-DSP performance too!

100/100/100/75/10[1] Watt Output[2]

AM, FM, SSB, RTTY, CW, & DV[1]

Satellite (Mode B/J/L[1])

Independent Receivers

3kHz/6kHz 1st IF "Roofing" Filters[1] (HF/6m)

Two Independent 32-bit IF-DSP Systems

Double Conversion Superheterodyne with Image Rejection Mixer (HF/6m/2m/70cm)

Type B USB for Rig Control and Audio

USB
Control Audio

ICOM

Shown with optional desktop microphone SM-30 and additional third party accessories. Optional unit required. See manual for AM output power.

SEE US AT DAYTON HAMVENTION BOOTHS 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

World's LARGEST HAM RADIO INVENTORY in stock for quick delivery

DISCOVER THE POWER OF DSP WITH ICOM!

IC-9100 The All-Round Transceiver

• HF/50MHz 144/430 (440) MHz and 1200MHz*3 coverage • 100W on HF/50/144MHz, 75W on 430 (440) MHz, 10W on 1200MHz*3 • Double superheterodyne with image rejection mixer

IC-7000 All Mode Transceiver

SEPARATION KIT RMK-7000 included with your purchase

• 160-10M/6M/2M/70CM
• 2x DSP • Digital IF filters
• Digital voice recorder
• 2.5" color TFT display

DSP INSTALLED included with purchase

IC-718 HF Transceiver

• 160-10M* @ 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories

IC-V8000 2M Mobile Transceiver

• 75 watts • Dynamic Memory Scan (DMS) • CTCSS/DCS encode/decode w/tone scan • Weather alert • Weather channel scan • 200 alphanumeric memories

D-STAR READY

IC-2820H Dual Band FM Transceiver

• D-STAR & GPS upgradeable 2M/70CM • 50/15/5W RF output levels • RX: 118-173.995, 375-549.995, 810-999.99 MHz** • Analog/digital voice with GPS (optional UT-123) • 500 alphanumeric memories

IC-7800 All Mode Transceiver

• 160-6M @ 200W • Four 32 bit IF-DSPs+ 24 bit AD/DA converters • Two completely independent receivers • +40dBm 3rd order intercept point

IC-7600 All Mode Transceiver

• 100W HF/6m Transceiver, gen cov. receiver • Dual DSP 32 bit • Three roofing filters- 3, 6, 15khz • 5.8 in WQVGA TFT display • Hi-res real time spectrum scope

IC-7700 Transceiver. The Contester's Rig

• HF + 6m operation • +40dBm ultra high intercept point • IF DSP, user defined filters • 200W output power full duty cycle • Digital voice recorder

D-STAR UPGRADEABLE

IC-2200H 2M Mobile Transceiver

• 65W Output • Optional D-STAR format digital operation & NEMA compatible GPS interface • CTCSS/DTCS encode/decode w/tone scan • 207 alphanumeric memories • Weather alert

D-STAR READY

IC-92AD Analog + Digital Dual Bander

• 2M/70CM @ 5W • Wide-band RX 495 kHz - 999.9 MHz** • 1304 alphanumeric memories • Dualwatch capability • IPX7 Submersible*** • Optional GPS speaker Mic HM-175GPS

IC-PW1 HF + 6M Amplifier

• 1.8-24MHz + 6M Amp • 1KW amplifier • 100% duty cycle • Compact body • Detachable controller • Automatic antenna tuner

IC-7200 HF Transceiver

• 160-10M • 100W • Simple & tough with IF DSP • AGC Loop Management • Digital IF Filter • Digital Twin PBT • Digital Noise Reduction • Digital Noise Blanker • USB Port for PC Control

ID-880H Analog + Digital Dual Bander D-STAR

• D-STAR DV mode operation • DR (D-STAR repeater) mode • Free software download • GPS A mode for easy D-PRS operation • One touch reply button (DV mode) • Wideband receiver

IC-V80 2M Handheld Transceiver

• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation

D-STAR READY

IC-80AD Analog + Digital Dual Bander D-STAR

• D-STAR DV mode operation • DR (D-STAR repeater) mode • Free software download • GPS A mode for easy D-PRS operation

IC-T70A Dual Band FM Transceiver

2M + 70CM • 5/2.5/0.5 Watts Output Power • RX: 136-174, 400-479 MHz** • 302 Alphanumeric Memory Channels • 700mW Loud Audio • Ni-MH 7.2V/1400mAh Battery

ICOM®

*Except 60M Band. **Frequency coverage may vary. Refer to owner's manual for exact specs. ***Tested to survive after being under 1m of water for 30 minutes. *1 AA Alkaline batteries not included, radio comes with a AA alkaline battery tray. *2 For shock and vibration. *3 Optional UX-9100 required. Contact HRO for promotion details. CQ May 2011. The Icom logo is a registered trademark of Icom Inc. 50271

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you, if the first line you call is busy, you may call another.

West.....800-854-6046
Mountain.....800-444-9476
Southeast.....800-444-7927
Mid-Atlantic...800-444-4799
Northeast.....800-644-4476
New England..800-444-0047

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

#1 in Customer Service

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Bl., 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jose, XE2SJB, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Chuck, N1UC, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave., 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave. & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
NEW Expanded Store!
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr.
22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

A publication of

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

Offices: 25 Newbridge Road, Hicksville, New York 11801. Telephone: (516) 681-2922. FAX: (516) 681-2926. E-mail: cq-vhf@cq-vhf.com. Website: http://www.cq-vhf.com. CQ VHF (ISSN 1085-0708) is published quarterly (4 times a year) by CQ Communications, Inc. Periodical postage paid at Hicksville, NY and additional offices. Subscription prices (all in U.S. dollars): Domestic—one year $25.00, two years $50.00, three years 75.00; Canada/Mexico—one year $37.00, two years $74.00, three years 111.00; Foreign—one year $48.00, two years $96.00, three years 144.00. Government Agencies: Subscriptions to CQ VHF are available to agencies of the United States government, including military services, only on a cash with order basis. Requests for quotations, bids, contracts, etc., will be refused and will not be returned or processed.

Printed in the United States of America.
Postmaster: Please send change of address to CQ VHF, 25 Newbridge Road, Hicksville, NY 11801.

contents

Spring 2011
Vol. 15 No. 1

FEATURES

COLUMNS

DEPARTMENTS

On The Cover: A stratospheric view of a thunderstorm; for details see "Up in the Air" column by WB8ELK on p. 58. Insets top to bottom: Generating On-Screen Diplay, an OSD device, "ATV" column by KB1JIJ, p. 80. Testing the K5VH dish, "Antennas" column by WA5VJB, p. 62. DSP and 47-GHz systems, "Beacon Monitoring Without the Noise," by WB6NOA, p. 30.

CQ VHF Ham Radio Above 50 MHz

EXPLORE NEW HORIZONS

with this feature rich GPS-equipped portable.

Kenwood's dual-band transceiver with full APRS® and EchoLink® support. Featuring the SiRFstar III™ high-performance GPS receiver.

The TH-D72A is perhaps the most technology advanced, feature rich portable offered to the Amateur market. Easy to use, yet affordable. You be the judge!

TH-D72A

144/440 MHz FM Dual Bander

- 1200/9600 bps packet TNC
- Sky Command II
- Stand-alone Digipeater
- USB port (mini B)
- MIL-STD810 and IP54 weatherproofing
- 1000 memory channels
- Cross-tone

The TH-D72A comes with the PB-45L a 1,800 mAH lithium-ion rechargeable battery. A single charge will power the transceiver for approximately 6 hours of normal use at the 5W Transmit level.To save battery power the Output can be set at 5, 0.5, or 0.05 Watts.

The GPS and its logging functions can be used for up to 35 hours by turning off the transceiver functions and running in the GPS only mode. Store up to 5000 points of track data, there are three ways to save track data: Interval, Travel Distance or APRS® Beacon.

Free MCP-4A software will convert log data to the KML file format.

SiRFstar III™ is a trademark of CSR plc.
APRS® is a registered trademark of Bob Bruninga. see www.aprs.org
EchoLink® is a registered trademark of Synergenics, LLC in the USA. see www.echolink.org

Contact your local dealer today for more information.

KENWOOD
Listen to the Future

KENWOOD U.S.A. CORPORATION
Communications Sector Headquarters
3970 Johns Creek Court, Suite 100, Suwanee, GA 30024
Customer Support/Distribution
P.O. Box 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745
Customer Support: (310) 639-4200 Fax: (310) 537-8235 ADS#18111

www.kenwoodusa.com

ISO9001 Registered

QUARTERLY CALENDAR OF EVENTS

Current Contests

European Worldwide EME Contest 2011: Sponsored by DUBUS and REF. The EU WW EME contest is intended to encourage worldwide activity on moonbounce. Information for this contest is available at the following website: <http://www.marsport.org.uk/dubus/EMEContest2011.pdf>.

Spring Sprints: These short-duration (usually four hours) VHF+ contests are held on various dates (for each band) during the months of April and May. For specific dates, please see the Southeast VHF Society website at: http://www.svhfs.org.

2 GHz and Up World Wide Club Contest: Sponsored by the San Bernardino Microwave Society, this contest runs the second weekend of May. Rules are available at the following URL: <http://www.ham-radio.com/sbms/2011_2ghz-up_test.pdf>.

Six Meters Marathon: OH3AG invites you to participate into the Seventh Global Six Meters Marathon. The objective of the Marathon is to work as many DXCC countries as possible between Saturday May 7 at 0000 UTC and Sunday August 7 at 2400 UTC on 6-meter band. You can follow this contest online at <http://6m.dy.fi>. Go to the Six Meters Marathon 2011 rules link on the website.

ARRL June VHF QSO Party: The dates for this contest are June 11–13. Complete rules are in the May issue of *QST*. Rules can also be found on the ARRL website (http://www.arrl.org). Many are making plans to activate rare grids. For the latest information on grid expeditions, check the VHF reflector (vhf@w6yx.stanford.edu) on the Internet. This is by far the most popular VHF contest. For weeks in the run up to the contest postings are made on the VHF reflector announcing Rover operations and grid expeditions. It is a contest that will create for you plenty of opportunities to introduce the hobby to your friends who are not presently working the VHF plus bands or are not hams.

SMIRK Contest: The Six Meter International Radio Klub (SMIRK) will hold its annual contest from 0000 UT Saturday June 18 umtil 2359 UT June 19. Contacts must be made on the 50-MHz (6-meter) band. Any licensed amateur in any country may participate Exchange is grid square and SMIRK Number for operators who have one. Points are 1 for contacts with stations not having SMIRK Numbers and 2 points for contacts with stations having SMIRK numbers. Logs should go to the Secretary, Paul (Mick) McBride, W3FJ, 10 Longview Dr., Williamsport, PA 17701, or via e-mail to <mickpdm@hotmail.com>. They must be received by August 1, 2011.

Field Day: ARRL's classic Field Day will be held on June 25-26. Complete rules for this contest can also be found in *QST* and on the website: <http://www.arrl.org>. In years past tremendous European openings have occurred on 6 meters. Also, as happened in 1998, tremendous sporadic-*E* openings can occur. Certainly, this is one of the best club-related events to involve new people in the hobby.

CQ WW VHF Contest: This year's CQ WW VHF Contest will be held from 1800 UTC July 17 and 2100 UTC July 18. A short summary of the rules can be found on page 67 or the complete rules in the June issue of *CQ* magazine.

August: There are two important contests this month—The **ARRL UHF and Above Contest** is scheduled for August 7–8. Complete rules can be found in the July issue of *QST*. The first weekend of the **ARRL 10 GHz** and above cumulative contest is scheduled for August 21–22. The second weekend is September 18–19. Complete rules for this contest also can be found in the July issue of *QST*.

Quarterly Calendar

The following is a list of important dates for EME enthusiasts:

May 3	New Moon
May 5	*Eta Aquarids* meteor shower
May 10	First quarter Moon
May 15	Moon perigee
May 17	Full Moon
May 24	Last quarter Moon
May 27	Moon apogee.
June 1	New Moon. Partial eclipse of Sun
June 9	First quarter Moon
June 12	Moon perigee
June 15	Full Moon. Total eclipse of Moon
June 23	Last quarter Moon
June 24	Moon perigee
July 1	New Moon. Partial eclipse of Sun
July 7	Moon apogee
July 8	First quarter Moon
July 15	Full Moon
July 21	Moon apogee
July 23	Last quarter Moon
July 28	*Southern Delta Aquarids* meteor shower
July 30	New Moon
Aug. 2	Moon perigee
Aug. 6	First quarter Moon
Aug. 12	*Perseids* meteor shower
Aug. 13	Full Moon
Aug. 18	Moon apogee
Aug. 21	Last quarter Moon
Aug. 29	New Moon
Aug. 30	Moon perigee

Current Conferences and Conventions

May: Dayton Havention®: The Dayton HamVention® will be held as usual at the Hara Arena in Dayton, Ohio during May 20–22. For more information, please see the Hamvention® website at <http://www.hamvention.org>. As usual, TAPR and AMSAT are sponsoring a joint banquet on Friday evening. For more information, see the AMSAT website: <http://www.amsat.org>. At the same time the Weak Signal Group is sponsoring a banquet. For more information, contact Tony Emanuele, WA8RJF, at: <wa8rjf@arrl.org>.

June: The annual **Ham-Com Hamfest** will be held June 10-11 in Plano, Texas. As always, the North Texas Microwave Society will present a microwave forum. For more information, see the Ham-Com website at <http://www.ham-com.org/>.

July: This year's **Central States VHF Society Conference** will be held July 29–30, in Irving, Texas, at the Westin DFW Hotel, which is located at 4545 W. John Carpenter Freeway, Irving, TX 75603. For more information, please see the URL: <http://www.csvhfs.org/>.

August: The annual **Huntsville, Alabama, Hamfest** will be August 20–21 in the usual South Hall of the convention center. There are several VHF-related forums scheduled. For more information, see: <http://www.hamfest.org/>.

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' *Proceedings*, or both. For more information, questions about format, media, hardcopy, email, etc., please contact the person listed with the announcement. The following organizations and/or conference organizers have announced calls for papers for their forthcoming conferences:

Technical papers are solicited for presentation at the **30th Annual ARRL and TAPR Digital Communications Conference** to be held September 16–18 in Baltimore, Maryland, and publication in the conference *Proceedings*. Presentation at the conference is not required for publication. Submission of papers is due by July 31, 2011 and should be submitted to: Maty Weinberg, KB1EIB, ARRL, 225 Main Street, Newington, CT 06111, or via the internet to <maty@arrl.org>. For suitable topics and submission guidelines also contact Maty via e-mail; also check <http://www.arrl.org>.

Meteor Showers

May minor showers include the following and their possible radio peaks: May 6; *η-Lyrids*, May 9; *ε-Arietids*, May 9; May *Arietids*, May 16; and *o-Cetids*, May 20.

June: June minor showers include the following and their possible radio peaks: June *Arietids*, June 7*; *zeta-Perseids*, June 9*; June *Boötids*, June 27, 2100 UTC; and *β-Taurids*, June 28. An asterisk (*) indicates that the shower may have multiple peaks.

July: This month there are a number of minor showers. The *Piscis Austrinids* is expected to peak July 28. The *δ-Aquariids*, is a southern latitude shower. It has produced in excess of 20 meteors per hour in the past. Its predicted peak is around July 30. The *α-Capricornids* also is expected to peak on July 30.

August: Beginning around July 17 and lasting until approximately August 24, you will see activity tied to the *Perseids* meteor shower. Its predicted peak is August 13 between 0100–1330 UTC. The *ê-Cygnids* meteor shower is expected to peak on August 18. The visually-impossible *γ-Leonids* is expected to peak August 25, around 1600 UTC. However, this shower may have gone dormant. The *α-Aurigids* is expected to peak around September 1.

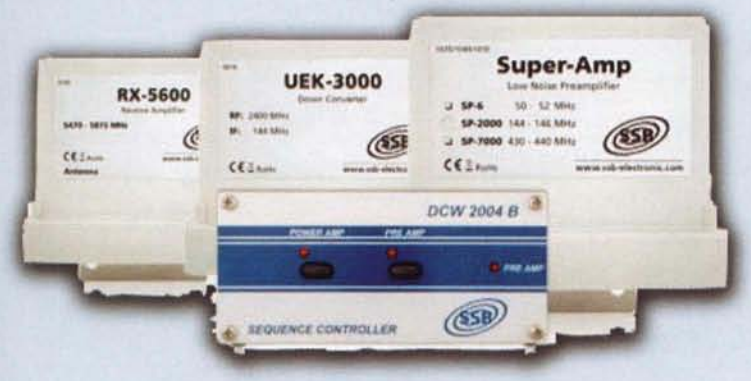
For more information on the above meteor shower predictions see Tomas Hood, NW7US's propagation column. Also visit the International Meteor Organization's website: <http://www.imo.net/calendar/2011>.

Array Solutions Your Source for Outstanding Radio Products

Top ranked equipment from Array Solutions

SSB

...creative solutions in radio frequency design



High performance preamps, sequencers and antenna switching up to 3 GHz. See the Array Solutions website for more details along with our other VHF and UHF products including the popular 6 Meter Stack Match, Power Master watt meters and others. Array Solutions is your source for top quality VHF gear.

6 Meter Super-Amp

Technical Data
Frequency range 50-52 MHz
Noise figure, typ. 0.9 dB
Amplification internally adj. 10 - 20 dB
Uses. Remote powering coupler DCW 2004 B

SSB

Array Solutions introduces the complete line of VHF, UHF & SHF products from SSB Electronics in Germany.

ARRAY SOLUTIONS

www.arraysolutions.com

Sunnyvale, Texas USA
Phone 214-954-7140
sales@arraysolutions.com
Fax 214-954-7142

Array Solutions' products are in use at top DX and Contest stations worldwide as well as commercial and governmental installations. We provide RF solutions to the DoD, FEMA, Emcomm, UN, WFO, FAA and the State Dept. for products and installation of antennas systems, antenna selection, filtering, switching and grounding. We also offer RF engineering and PE consulting services.

Low-Cost Horn Antennas for 23-cm EME

With the recent increase in 23-cm EME activity, WD5AGO challenged himself to build cheap and effective antennas to demonstrate to his students. In this article he describes how he built and analyzed two large horn antennas.

By Thomas Henderson,* WD5AGO

What is the best antenna for EME (Earth-Moon Earth) contacts? This is an online topic that crops up from time to time. "Lowest cost" was added to another posting. The band of interest is 23 cm. Looking at the station log sheets, the most commonly used antenna for this band is the parabolic reflector (dish) followed by the Yagi. Common is not quite accurate, as out of the hundreds of EME contacts on this band only a couple were made with Yagi antennas. The only other antenna tested for 23-cm EME, in the receive mode only, was a mid-size 15-dBi horn. It appears then the dish wins out, and with a high-efficiency feedhorn it is tough to beat.

Which is the easiest, lowest cost antenna to construct? Value analysis of each of the antennas noted above was made. A starting point would be to determine the antenna gain needed to make EME contacts. Over fifty 23-cm EME stations have excess gain and power levels to communicate with low-power stations. This includes the small, commonly used 3-m dish. Over a dozen of those high-gain/high-power stations will have over 10 dB gain to spare when communicating with the 3-m dish. This would place a minimum receiving antenna gain targeted around 20 dBi. At this gain level, reception of larger EME stations should be possible, and with 250 watts or more of power, contacts could also be made. For a 20-dBi gain antenna to have a higher EME success rate, though, the ability to use circular polarization would be desirable. Communication from linear to circularly polarized antennas encounters a loss of about 3 dB, which cuts into our margin of success.

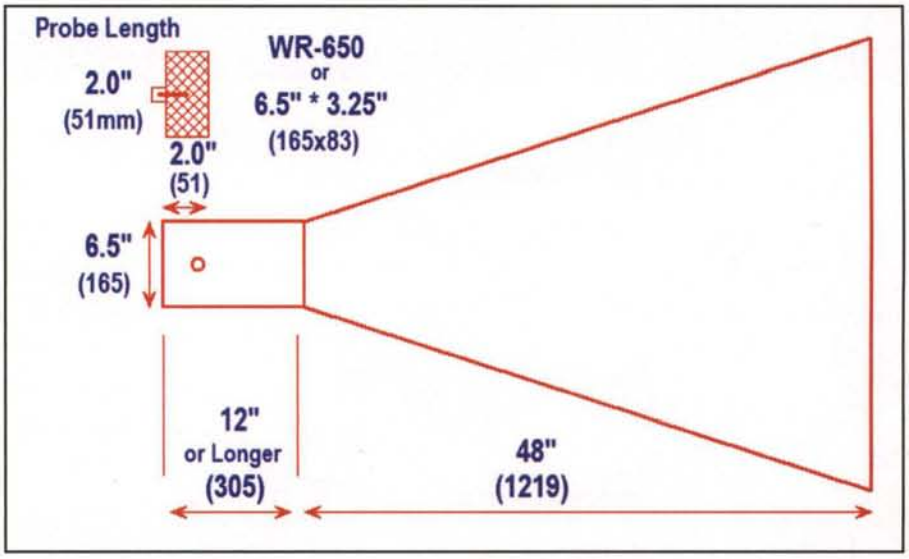


Figure 1. 23-cm linearly polarized 20-dBi horn antenna.

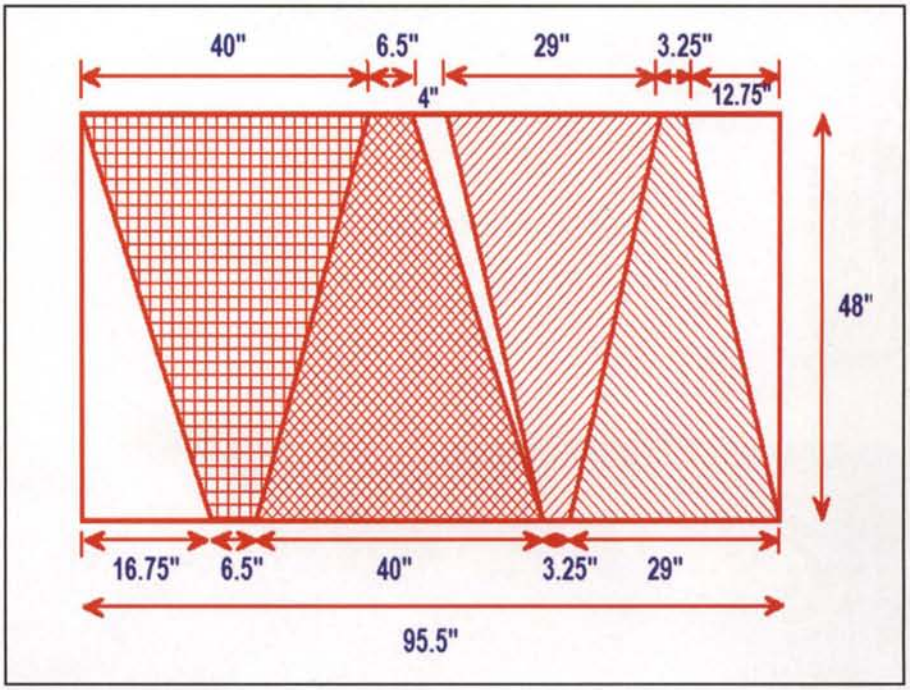


Figure 2. Pattern for linear horn construction from a single sheet (48" × 96") of material.

*3017 N. 2nd Street, Broken Arrow, OK 74012
e-mail: <THenders@tulsacc.edu>

DIGITAL

ALINCO

Simple-Clean-Dependable

440MHz FM MOBILE TRANSCEIVER
DR-435TMkIII

220MHz FM MOBILE TRANSCEIVER
DR-235TMkIII

144MHz FM MOBILE TRANSCEIVER
DR-135TMkIII

50MHz FM MOBILE TRANSCEIVER
DR-06T

29MHz FM MOBILE TRANSCEIVER
DR-03T
(Digital mode not supported.)

144/440MHz FM FULL-DUPLEX MOBILE TRANSCEIVER
DR-635T

HF 100W SSB/CW/FM/AM
DESK-TOP TRANSCEIVER
DX-SR8T

SSB/AM/FM/CW and I/Q
LW/MW/SW 150KHz to 30MHz
DESK-TOP RECEIVER
DX-R8T

Whatever your favorite operating frequency, Alinco has a radio that's perfect for making the most of your budget. With a wide selection of easy-to-operate, multi-band desktop,handheld and mobile radios, Alinco delivers maximum value for your amateur radio enjoyment.

See you in Dayton!

Please visit Alinco at booth # 440, also visit booth #451-#454 to see America's best-selling handheld receivers of GRE America".

144MHz FM HANDHELD TRANSCEIVER
DJ-V17T

440MHz FM HANDHELD TRANSCEIVER
DJ-V47T

222MHz FM HANDHELD TRANSCEIVER
DJ-V27T

IPX7 Water-resistant

144MHz FM
HANDHELD TRANSCEIVER
DJ-175T

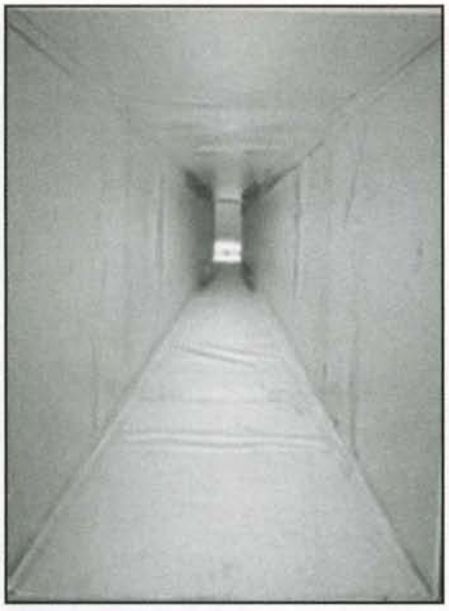
144/440MHz FM DUAL
HANDHELD TRANSCEIVER
DJ-C7T

144/440/1200MHz FM FULL-DUPLEX
HANDHELD TRANSCEIVER
DJ-G7T

IPX7 Water-resistant

Distributed in North America by GRE America, Inc., 425 Harbor Blvd. Belmont, CA. 94002 USA.
Ph: (650) 591-1400 Fax: (650) 591-2001 email: alinco-sales@greamerica.com Website: http://www.greamerica.com

www.ALINCO.com



Figures 3 & 4. Inside of foam/aluminum horn with taped seams. Outside of low-cost horn antenna.

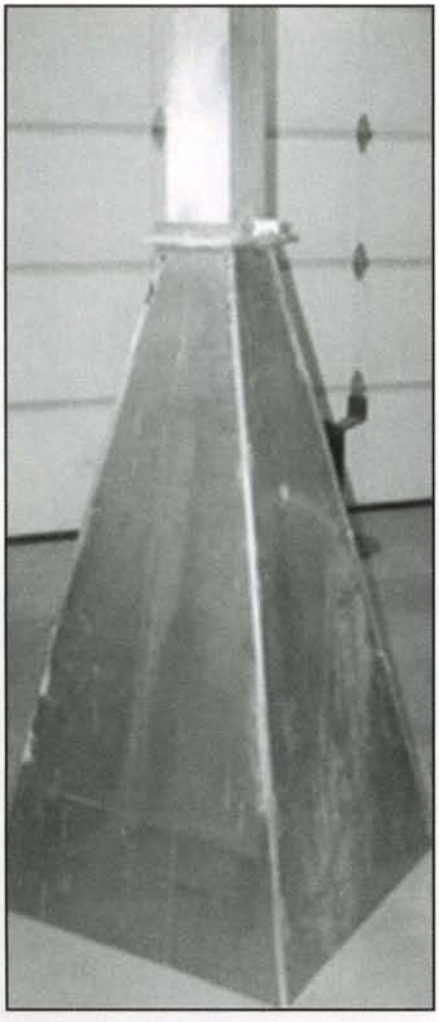


Figure 5. CP horn antenna using all-aluminum construction.

The prime focus dish is well understood. With advancements in feedhorn designs, efficiencies up to 67% are possible with antenna temperatures (Ta) in the range of 30°K as calculated and measured on a 20λ diameter dish.[1] With a dish diameter of 10λ (about 2.4 m on the 23-cm band), gain is approximately 28 dBi. At a diameter of 1 m, the dish offers about 20 dBi of gain, which is the planned target. As the dish's diameter is reduced, though, Ta will rise due to a higher percentage of feedhorn blockages. Building and mounting the dish is where the labor and cost come into play. Despite the added mechanical construction, if a small used dish is available, then the dish is the value winner.

Yagis were also analyzed. The antenna temperature for the Yagi was much higher than other antennas tested, but its light weight and portability have advantages. The success of students at Tulsa Community College (where I am the manager and an operator of the college's amateur radio club) was noted in building 70-cm Yagis for the EME test with Arecibo in Peurto Rico last year. A 23-cm test Yagi was built, but it was determined that this was not the way to go for the beginning builder. Constructing and tuning Yagis on 70 cm is far easier than on 23 cm. Besides, one criterion is for the antenna to be easily converted to circular polarization with low losses, which is where the Yagi falls short at higher frequencies.

The horn is one of the oldest antenna designs from which to choose. The horn antenna is known for having a low-noise temperature but lower efficiency for its size and material usage as compared to a properly illuminated dish. A look at optimum-gain charts for a 20-dBi horn illustrates a horn size of 4 feet long and an aperture of approximately 3 feet square. This gain is assuming 50% efficiency. This is about the same gain per aperture size as a 1-m dish, although more surface material is needed for a horn. After further research, it was decided to build and analyze two large horn antennas.

The first horn was constructed by students with the design goals of simplicity and low-cost construction. To keep the horn simple, linear polarization was utilized, therefore allowing nearly any horn shape to be used. After evaluating the horn length versus construction techniques of round, square, and rectangle waveguide sizes, the rectangular horn was favored. This is also known as a pyramidal horn. A set of dimensions for an optimized 20-dBi gain horn were given.[2, 3] Suitable materials to be used for the horn ranged from plywood coated with a conductive paint to galvanized hardware cloth (cage mesh wire). The lowest cost and easiest approac, though, was to use a single 48" × 96" sheet of foam-siding insulation backed with aluminum film. The sheet cost under $15. The original horn aperture dimensions were adjusted in order to cut four complete patterns from the single sheet. The new dimensions (figures 1 and 2 shown in inches and mm) should produce a gain of about 20 dBi. A $10 roll of aluminum tape from a home-improvement store was used to hold the seams together with the aluminum film placed on the inside of the horn (figure 3). Duct tape was used to reinforce the outside edges (figure 4). The project took less than one hour to complete.

The second horn antenna construction design goal was to use circular polarization (CP). A horn with symmetry is needed. Round and square horn prototypes were constructed. There are round, dual-mode horn designs that have very low antenna temperatures. After constructing round prototypes, noting higher than an aperture size of 20 inches, a larger square horn was easier to construct. In an effort to test and analyze antenna temperature, the square CP horn was made slightly longer than the standard optimized size pyramidal horn. The horn input is 6" × 6"

inches to match the CP section. Some gain is added by using a longer horn with the same aperture, so the aperture was reduced to 32 inches. This horn also has approximately 20 dBi of gain. The large CP horn was designed to be used more as a test instrument using welded and bolted joints built from 64- and 125-mil 6061-T6 aluminum. With a square septum CP waveguide section bolted to the input the total weight is 55 lbs (figure 5). It would take two sheets of aluminum/foam insulation to build this horn. Figure 6 is the horn dimensions in inches and millimeters.

Transition construction (see graph 1): The 6.5" × 3.25" waveguide input was chosen, as it is a standard waveguide size number, WR-650. Trying to find this waveguide size, though, may be a problem. Several different rectangular coax to waveguide transition sections were built to feed the horn (figure 7). The first waveguide transition built used 7-inch wide by 20-mil thick aluminum folded into an open box A). The 7-inch long transition measured the poorest return loss with several probe positions and lengths tested. It was determined that the waveguide section should be greater than 12 inches long. Using some 1/4-inch hardware cloth (B) we formed a new transition which measured a lower return loss. The small holes in the hardware cloth do not hinder the waveguide's operation, as they are smaller than one-tenth the operating wavelength.

A fun experiment with the hardware cloth waveguide is to move the location of the coax coupling probe and note the changes in return loss. Highest performance was observed with probe placements from 2 to 2.7 inches away from the closed section of the waveguide using a probe 2 inches long. About 1 inch of the hardware cloth waveguide was used to fold and tape down to the inside of the horn. Total cost for the waveguide transition was under $15 including the N connector and #12 wire probe.

One advantage of the low-cost horn antenna project was that it is light, weighing in at only 5 lbs, but the antenna becomes a kite on windy days. The hardware cloth flexed too much. A third waveguide transition was made which would have more strength. Waveguide (figure 7C) was made by welded and bolting together aluminum, which provided a mechanically stable transition. This coax-to-waveguide transition was made 18 inches long to test effects on return

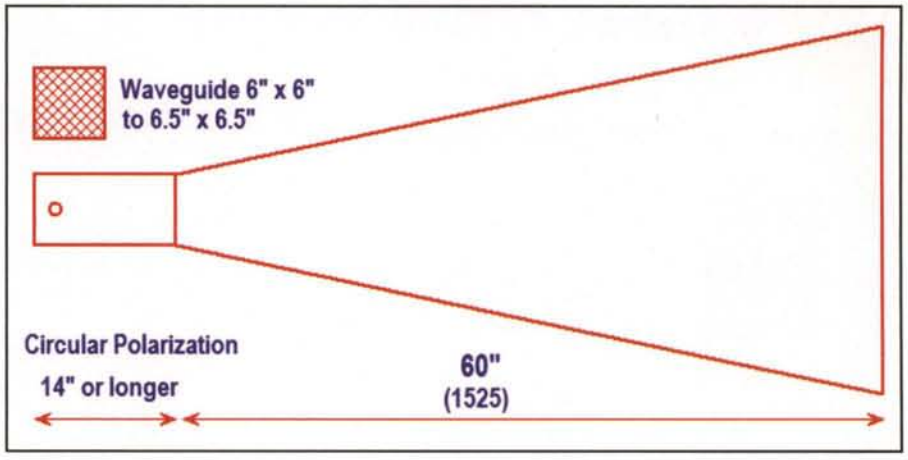
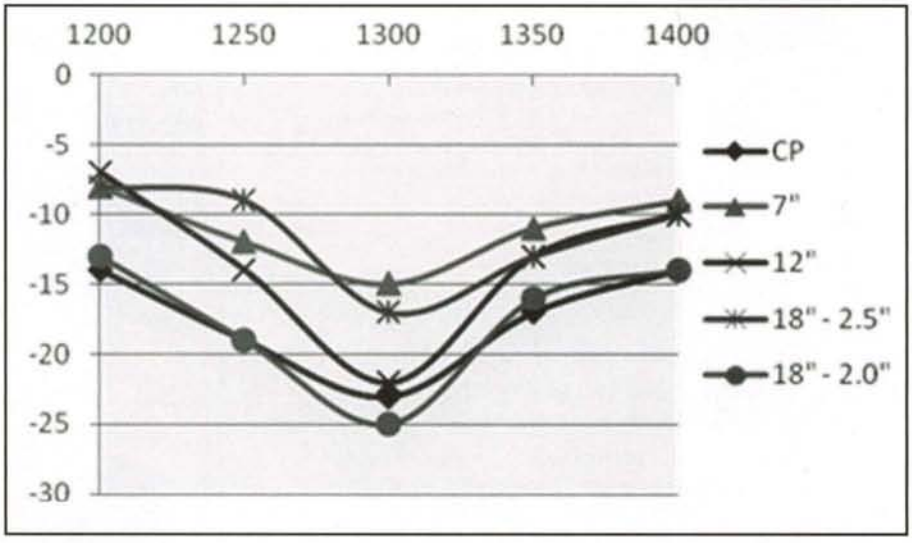


Figure 6. 23-cm square aperture horn antenna. Designed for adaptation to circular polarization (CP). The CP horn antenna can also be built with low-cost materials as with the linear horn antenna.



Graph 1. Performance of several lengths of transitions. Lengths of 12 inches and greater appear to have higher performance, which is closer to a guide wavelength (λg). Probe placement should be optimized while connected to the horn antenna. A probe distance of 2 inches from the back performed the best.

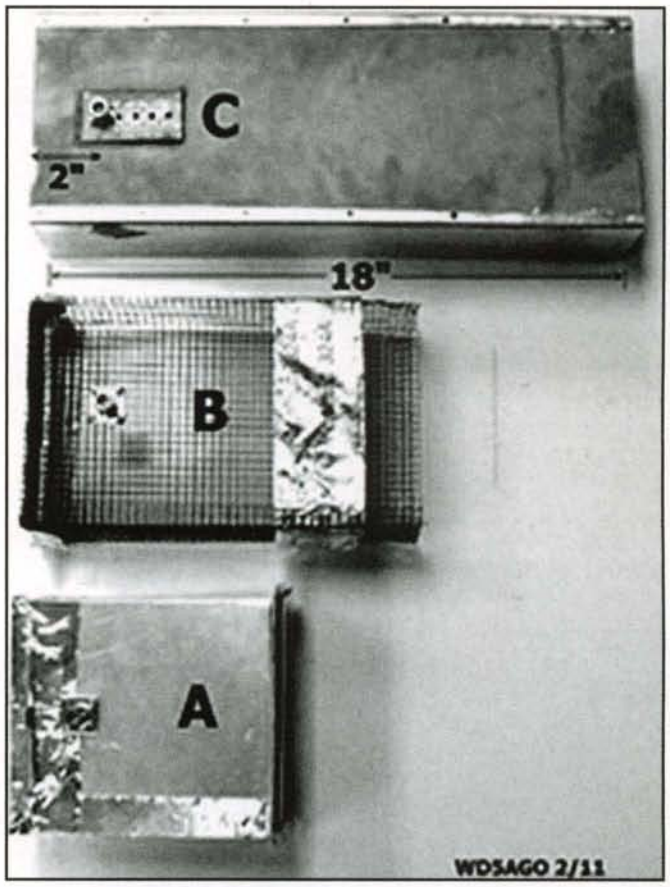


Figure 7. Several methods to construct a coax to waveguide transition.

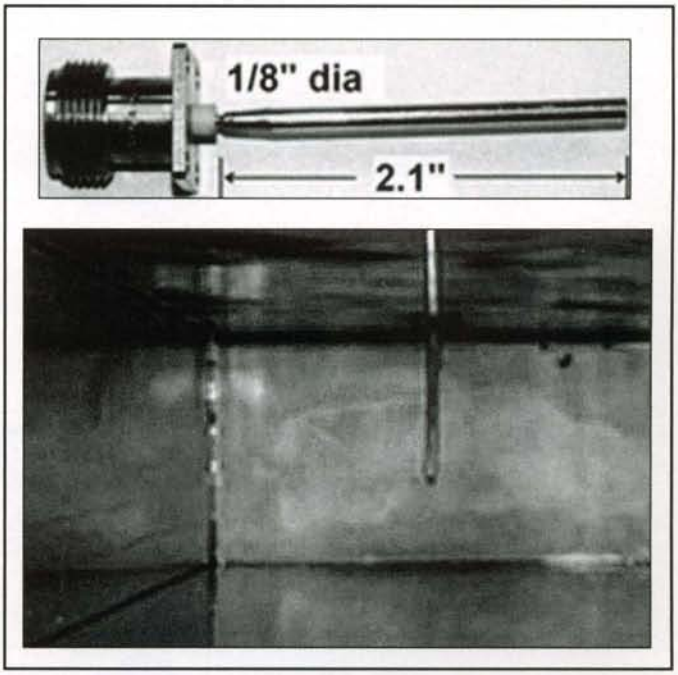
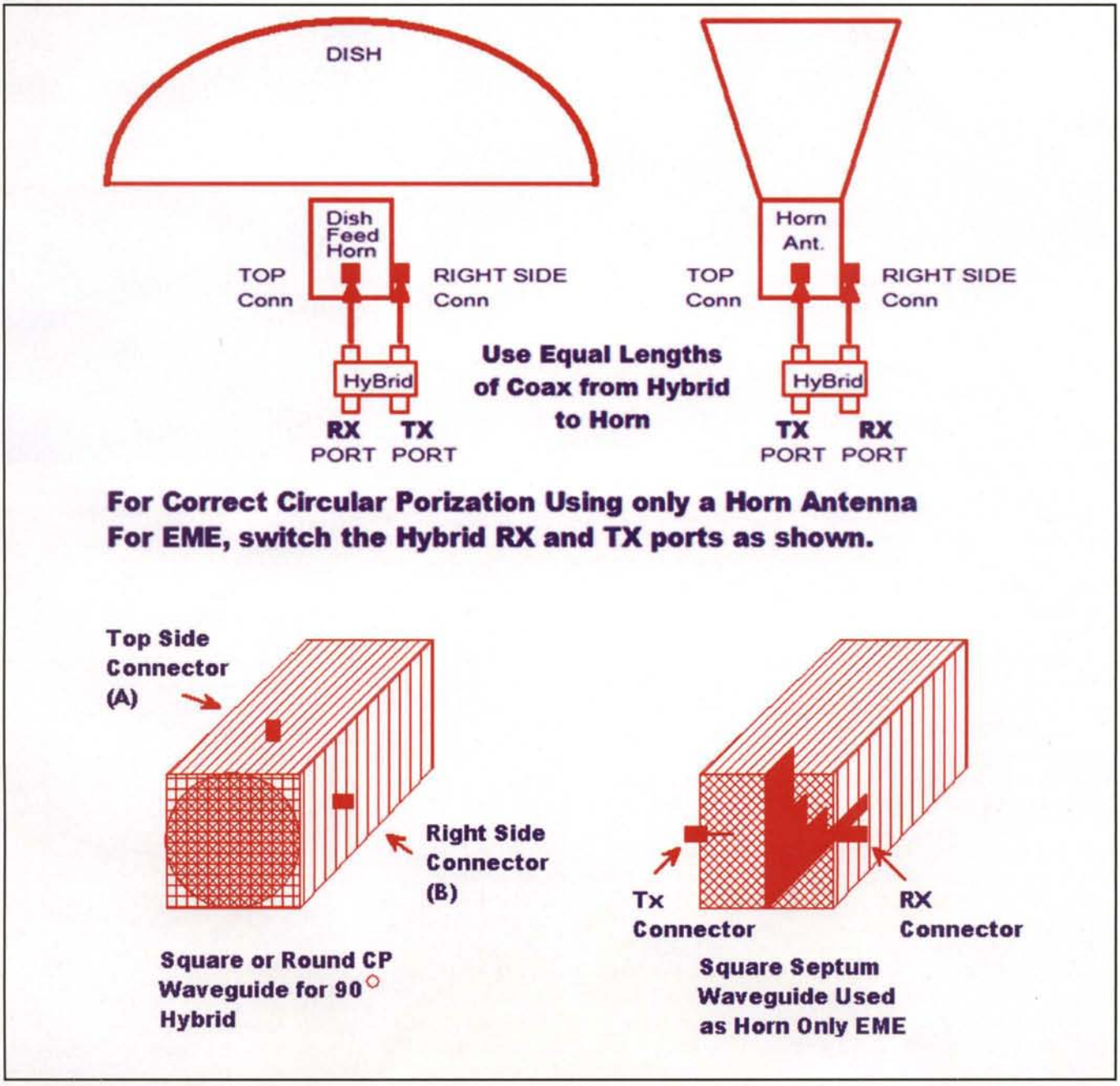


Figure 8. Inside solid-aluminum coax to waveguide transition. The waveguide is drilled and tapped for the N connector shown. The length of the probe is measured from the inside of the waveguide. Maintan a 50-ohm line from the connector pin and the probe.

loss as compared to the shorter transition sections. With the waveguide open, the best return loss (–30 dB) was with the probe 2.5 inches from the back. With the waveguide connected to the pyramidal horn, the best return loss favored the probe to be 2 inches from the back (went from –17 to –25 dB). A plate with holes tapped allowed the probe to be moved in 1/2-inch steps. Probe length should start at 2.2 inches and trim down to about 2.1 inches as measured from the inside waveguide wall (figure 8). A larger diameter probe may offer broader bandwidth, where a smaller diameter may offer lower return losses at a given frequency. AWG #12 to 1/8-inch brass will work fine. The CP, 12-, and 18-inch transitions performed satisfactory with the winner going to the 18-inch transition. Graph

Horn Antenna	Long CP	Standard Linear
Gain Calculated	20.0 dBi	20.0 dBi
Gain Measured	19.8 dBi	19.3 dBi
Beamwidth Calculated	16.5°	16.5°
Sun Noise Calculated	5.8 dB	5.0 dB
Sun Noise Measured	5.0 dB	4.0 dB
CS/G Measured	10 dB	9.2 dB
CS/50Ω	9.9 dB	9.9 dB
Ta	11.0°K	16.0°K

Table 1. Horn antennas.



Figures 9A & 9B. Methods of using CP for EME.

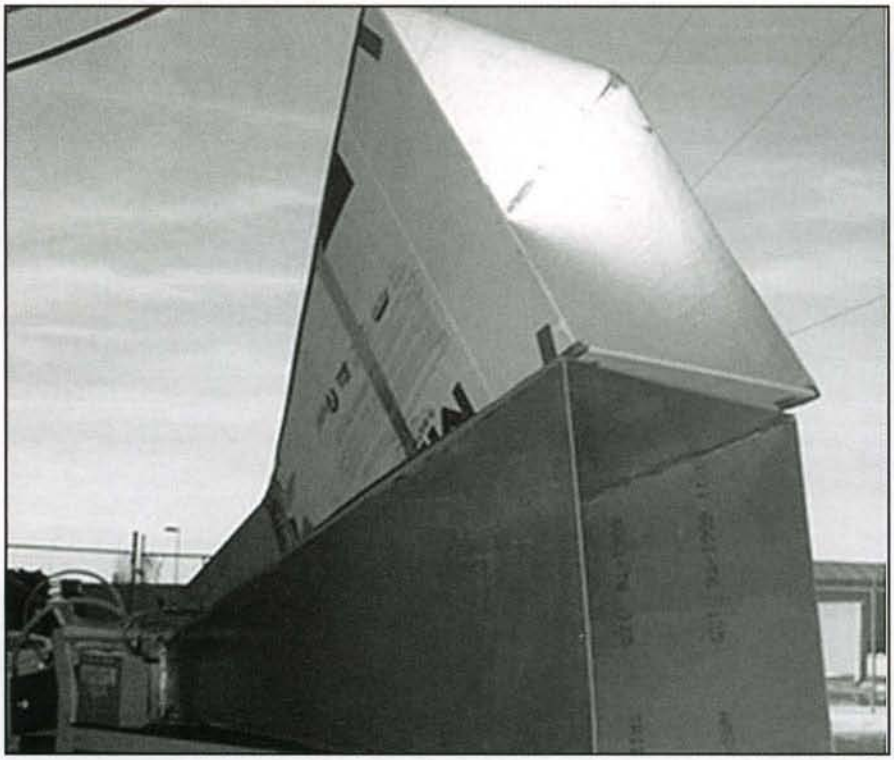


Figure 10. Low-cost linear horn antenna and CP horn antenna shown during one of many EME receiving tests.

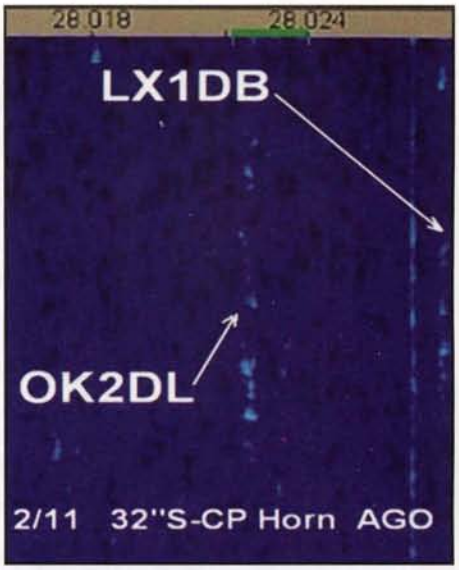


Figure 11. Signals from the 23-cm EME SSB Contest. RX on CP horn antenna.

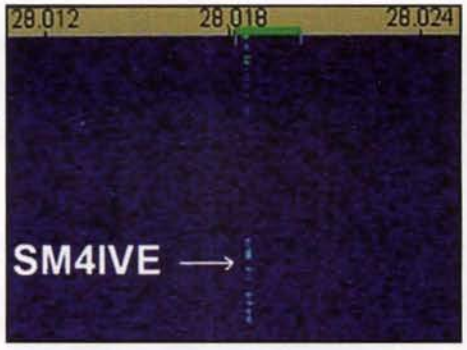


Figure 12. Signals from the 23-cm EME SSB Contest. RX CW on linear horn antenna, among other signals.

1 illustrates a swept frequency response of the coax transitions from 1.2–1.4 GHz.

There are several methods to obtain circular polarity for EME. Assuming receiving and transmitting is desired, transmitting is right-hand circular when the wave leaves the antenna and receiving is left-hand circular. There are commercially available square septum polarizers that can be used for the transition section for the horn. Another alternative, with slightly higher insertion losses, is to use a 90-degree hybrid combiner as in figures 9A & 9B. *Note:* If a coaxial port on a commercial CP section used for EME is marked as TX or RX, then these ports are normally designated for usage in a parabolic reflector. When a dish is using the CP feedhorn, CP changes; therefore TX is actually connected to the left-hand port. The ports will reverse in CP usage as a horn antenna is used for EME. Of course, for the linear-polarized horn it is just plug-and-play.

Results: Both horns were tested over a two-month period (figure 10). Sun noise and cold sky to ground (CS/G) measured results were close to calculated for each horn as shown in Table 1. Measurements varied over the testing period by ±0.2 dB. The low-cost linear horn did average about 0.5 dB less gain than the CP horn, but both horns were successful in receiving EME signals. The smallest CW station detected was using a 5-m dish and 500 watts. During the *432 MHz and Above EME Newsletter* 23 cm SSB contest, several stations were received on SSB (figure 11). Figure 12 is SM4IVE's CW signal received on the linear horn. Both of these signals were heard after down-conversion on an IC-706 and SDR-IQ receiver. The CP horn was 2 to 4 dB better on receive, which should be expected with transmitting stations using CP. The LNA designed and used measures 14°K (0.2 dB n/f) at 40 dB gain. The measured Ta is 16°K for the linear horn and 11°K for the CP horn.[4]

The VK3UM system calculator is a valuable tool in comparing measured and calculated results. These horns were also compared to a low-noise, round, dual-mode horn that measured approximately 8°K Ta.[5] For a club or student organization, the linear (less than $50) horn antenna should offer plenty of 23-cm EME and radio astronomy signals to be received.

All that is needed is a low-noise amplifier and receiver. If EME communications are desired, adding circular polarization to a square horn should help reduce the power needed to be successful. As illustrated in this article, the total cost including the CP transition section was under $200. This amount could be reduced by using the construction methods as described for the linear horn antenna.

References

1. Henderson, T., and P. Wade, "High Efficiency Feedhorns in Low f/D Parabolic Reflectors," *40th CSVHFS Proceedings*, 2006, ARRL.

2. Kraus, J., and R. Marhefka, *Antennas, Third Edition,* McGraw-Hill, 2002, pp. 330–338

3. Turrin, D., "Horn Antenna for EME," Technical Report #4, Crawford Hill VHF Club, 1969, also reprinted in the *Proceedings* of Microwave Update 1999.

4. McArthur, D., VK3UM EME Calculator, <www.vk3um.com>.

5. Skobelev, S., "Optimum Geometry and Performance of a Dual-Mode Horn Modification," *IEEE Antennas and Propagation*, February 2001, pp. 9093.

Does Your Rig Speak Digital?

Explore the exciting world of digital mode communication with the leader in sound card interfaces. RIGblasters are the easiest way to interface your radio and computer. Operate in more than 20 digital modes with over 150 radio sound card software programs.

RIGblaster Duo

A complete dual-radio station Integration console

$349.00

RIGblaster Pro

Our top of the line single radio interface

starting at: $289.95

NEW!

RIGblaster Advantage

Internal Sound card with only one USB cable for rig control and all audio.

$200.00

RIGblaster Plus II

Automatic switching between voice and digital modes with CAT/CI-V

$159.95

RIGblaster Nomic

Small, simple, rugged, portable and inexpensive

$59.95

RIGblaster Plug & Play

Direct USB to radio data jack connections

$119.95

WEST MOUNTAIN RADIO

Learn about digital mode communications at: www.westmountainradio.com/cqdigital

sales@westmountainradio.com ***262-522-6503***

Amateur Radio and the Cosmos Part 8 – Ahnighito

For centuries star gazers have been fascinated with the "sky falling." Here WA2VVA discusses the important application of falling stars to amateur radio, while documenting the work of some of the pioneers of meteor-scatter communications.

By Mark Morrison,* WA2VVA

My name is Ahnighito and I have traveled far. I arrived in America in 1897, leaving my Inuit family behind in Greenland and making my way across the Atlantic under difficult circumstances. Our ship struggled through icebergs, its heavy timbers straining under the load, and once in open waters our compass proved useless, adding a bit of uncertainty to the voyage.

*5 Mount Airy Rd., Basking Ridge, NJ 07920
e-mail: <mark1home@aol.com>

Upon reaching New York Harbor, as with many other immigrants of the day, I was processed into society but found myself without a home. For seven years I lived on the streets of Brooklyn, where a makeshift shelter provided a modest home. In 1904, thanks to a kind person, I was given a new home in Manhattan, where I have been ever since. On the day that I arrived it seemed as if the whole city came out to see me. People lined the streets as a parade of 28 horses brought me through town. Over the years many people have come to visit me, but I have outlived them all, for I am Ahnighito, the Cape York meteorite.

It was Arctic explorer Robert E. Peary who traveled to Greenland in the late 19th century in search of the "Iron Mountain" used by the Inuit Indians to create metal spear points. Called the Cape York meteorite after the area where it was "discovered," Peary learned of its existence in 1894 and returned in 1897 with *The Hope* to transport three pieces of this giant meteorite back to New York City. The

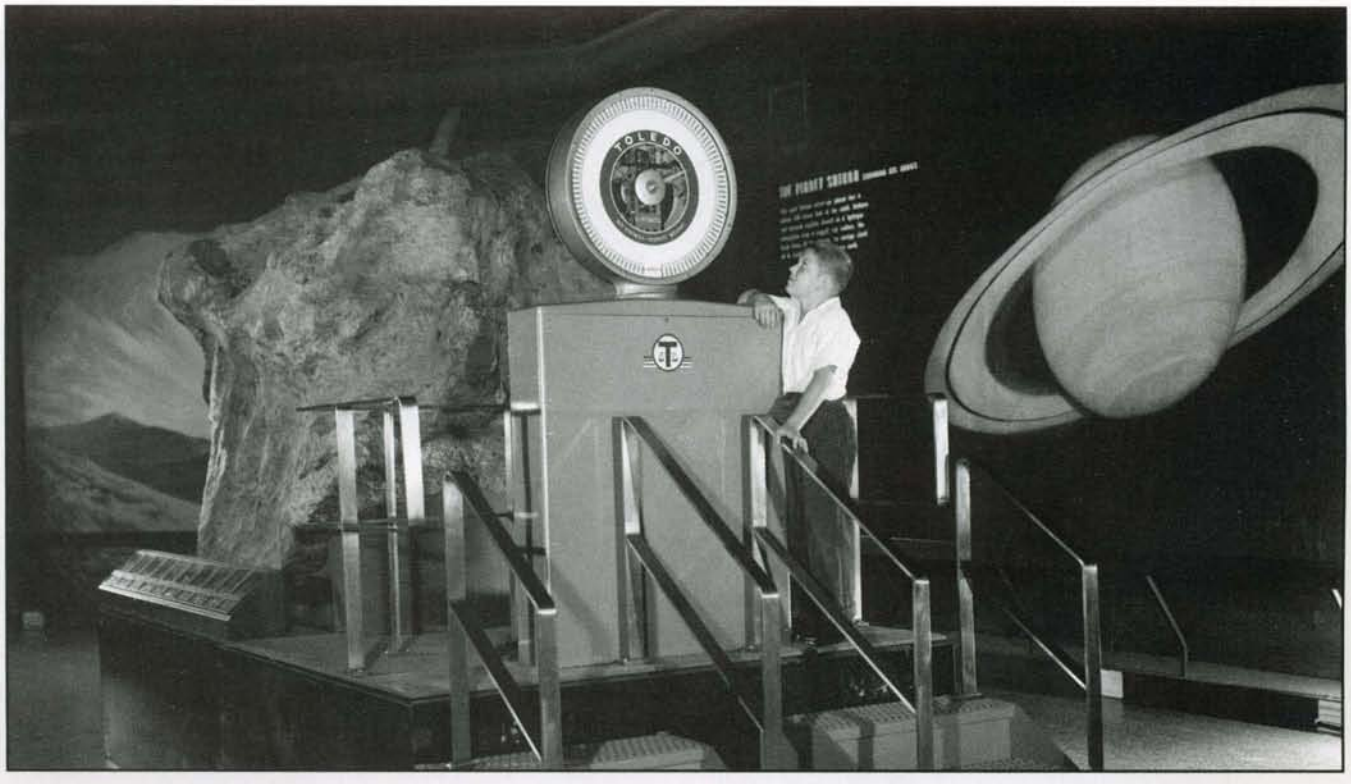


Photo 1. The iconic image of Ahnighito, where a specially prepared Toledo scale revealed its weight of 69,000 pounds! (Courtesy of the American Museum of Natural History)

Photo 2. Brooks' Comet as it appeared over North America in October of 1911. Taken at the Yerkes Observatory in 1911. (Courtesy of the Special Collections Research Center, University of Chicago Library)

Photo 3. Oswald G. Villard, Jr., W1DMV, later W6QYT (known to friends simply as Mike), was a Stanford University electrical engineer. This is Mike's QSL card from 1922. (Courtesy of the Stanford Amateur Radio Club, W6YX)

massive load required special preparations to stabilize the ship for safe passage through icebergs, and required "coasting" much of the way due to a compass rendered useless by the large amount of iron on board.

Ahnighito, the largest of the three meteorites recovered, would lie on a dock near the Brooklyn Naval Yard for seven years before finding a permanent home at the American Museum of Natural History, where it has been ever since. School children who visited the museum in the late 1950s still remember the iconic image of Ahnighito shown in photo 1, where a specially prepared Toledo scale revealed its weight—69,000 pounds!

When people speak of meteors, they usually refer to the "shower meteors" associated with debris streams trailing comets which long ago traced out those same paths. These are the showers that return year after year as the Earth travels around the sun. Photo 2 shows Brooks' Comet as it appeared over North America in October of 1911. This image, taken from a 100-year-old Chlorobromide print, was captured by Yerkes Observatory. Within its tail are the seeds of past and future meteor showers.

In addition to the shower meteors are the sporadic meteors which appear at random any time of the year. For many years the source of these sporadic meteors was unknown. Were they debris of ancient comets long evaporated by the sun's rays, or possibly visitors from interstellar space? To answer this question required some knowledge of the meteor's orbit. A parabloidal or elliptical orbit would suggest these meteors were part of our solar system, while a hyperbolic orbit would suggest they were just passing by our corner of the galaxy. The development of photography in the late 19th century provided some clues, but such methods were limited to nighttime studies and good weather. Also, due to their fleeting nature, a certain amount of luck was required. However, as luck would have it, something else appeared on the horizon in the early 1900s that would ultimately provide some answers.

In 1901 when Guglielmo Marconi succeeded in transmitting radio signals across the Atlantic, he demonstrated that radio waves could follow the curvature of the Earth. In 1902, Arthur Edwin Kennelly and Oliver Heaviside both predicted how this was possible by way of a layer of ionized gas at the top of Earth's atmosphere. Such a layer, they reasoned, could be used to reflect radio waves. In 1924, E. V. Appleton measured the height of this "ionosphere" using interference effects between direct and reflected radio waves. As time went by, radio would become standard equipment on solar-eclipse expeditions, first as a means of synchronizing chronometers between different observing sites, and then for measuring the height of the ionosphere. It was radio that would eventually provide answers about those mysterious meteors.

In 1936, a group of Harvard and MIT scientists brought radio equipment on a solar-eclipse expedition to Ak-Bulak, a small town lying on the path of totality in far-off Siberia. There were two groups, the radio men and the astronomers. The former stayed in town, using their radios to measure the height of the ionosphere before, during, and after the eclipse. Of interest was the influence of the Sun's ultraviolet rays on the level of ionization in the *K-H* layer. By observing the height of the ionosphere as the Moon progressively blocked the Sun's rays, it would be possible to observe these effects in real time. Members of the radio group included J. A. Pierce, W1JFO; Paul B. King, Jr., W2BWF/W1GSH; Harner Selvidge, W9BOE; and Edward P. York (callsign unknown). The astronomers camped some eight miles away, performing spectrographic studies of the solar corona. Together these two groups communicated using radio, both with each other as well as Cruft Laboratory (W1XJ) back at Harvard. The leader of this expedition was Donald H. Menzel, W1JEX, who was also its lead astronomer. Selvidge documented his experience in the January 1937 issue of *QST*, one of the

earliest scientific expeditions involving radio amateurs who also filled scientific roles.

In September 1938 Pierce, W1JFO, anxious to continue his studies of the ionosphere, recognized the potential for amateur radio to supplement the two or three ionospheric observatories that existed at that time. The year 1938 was a banner year for 5-meter DX, with a 2500-mile opening between Connecticut and California getting particular attention, and there were plenty of reports to go through. In an article appearing in the September 1938 issue of *QST*, Pierce revealed how records collected by the ARRL could be used to deduce the conditions in the ionosphere that year. An editorial comment appearing within that article called this work "a brilliant example" of how careful observation and reporting by amateurs could be used to make a basic contribution.

This article appears to be one of the earliest to solicit amateur radio participation in any scientific study. In 1941, while reviewing ionospheric sounding records, presumably those of earlier Harvard expeditions, Pierce reported that reflections from meteors were found. That same year, two Indian radio engineers, Chamantal and Venkatamaran, reported hearing interesting Doppler effects also thought to be meteor related. These tantalizing clues suggested that radio might be a useful tool not only for studying the ionosphere, but for understanding meteors, as well. As it turns out, laboratories that supported the war effort were filled with hams who could help out.

In 1944 at least 30 licensed amateurs were working at the Harvard Radio Research Laboratory in Cambridge, Massachusetts. Among them were two Stanford University engineers quickly making names for themselves in the world of radio. One was Fred E. Terman, 6AE, ex-6FT, who was first licensed around 1917 and actually grew up on the Stanford campus. In 1944 he became the head of Harvard's Radio Research Laboratory. The other was Oswald G. Villard, Jr., W1DMV, later W6QYT, known to friends simply as Mike, and a Stanford University electrical engineer. Photo 3 shows Mike's QSL card from 1922. (Courtesy of the Stanford Amateur Radio Club, W6YX).

Photo 4. Villard, W6QYT (seated), and Manning, W6QHJ, preparing to photograph the screen of an oscilloscope tracing out a Doppler whistle on the night of October 9, 1946, when the meteor count suddenly jumped from the normal rate of just a few sporadic meteors an hour to thousands of shower meteors an hour. (Courtesy of Stanford University Archives)

As the story goes, Mike's interest in meteors began while listening to Voice of America broadcasts from his home at 61 Foster Street, Cambridge. Occasionally, he'd notice these odd whistling sounds followed by strong bursts of signal coming through his radio speaker. In January of 1946, Villard documented his observations in a *QST* article entitled "Listening in on the Stars." Later that same year Villard and Terman returned to Stanford, where their influence led to significant changes, both locally and nationally.

For his part, Terman encouraged bright, young engineering students to start their own technical companies, and two who followed this advice prior to the war were Bill Hewlett and Dave Packard, co-founders of the Hewlett-Packard Company. Terman is sometimes called the "Father of Silicon Valley" for his contributions to the area surrounding Stanford. It is interesting to note that Hewlett-Packard's first product was an audio oscillator purchased by the Walt Disney Company for use in the movie *Fantasia*. According to the HP Virtual Museum, a total of eight model 200B oscillators were purchased by Disney as a means of checking the audio systems of 12 specially prepared theatres where *Fantasia* was shown in 1940. The very first prototype of this device was actually purchased by Villard, who, coincidentally, donated it back to the HP museum years later. Villard was also closely associated with the development of single-sideband radio technology, but that's another story! It was during these postwar years of technical innovation when Villard decided to pursue an advanced degree in electrical engineering, and for his dissertation he chose the radio study of

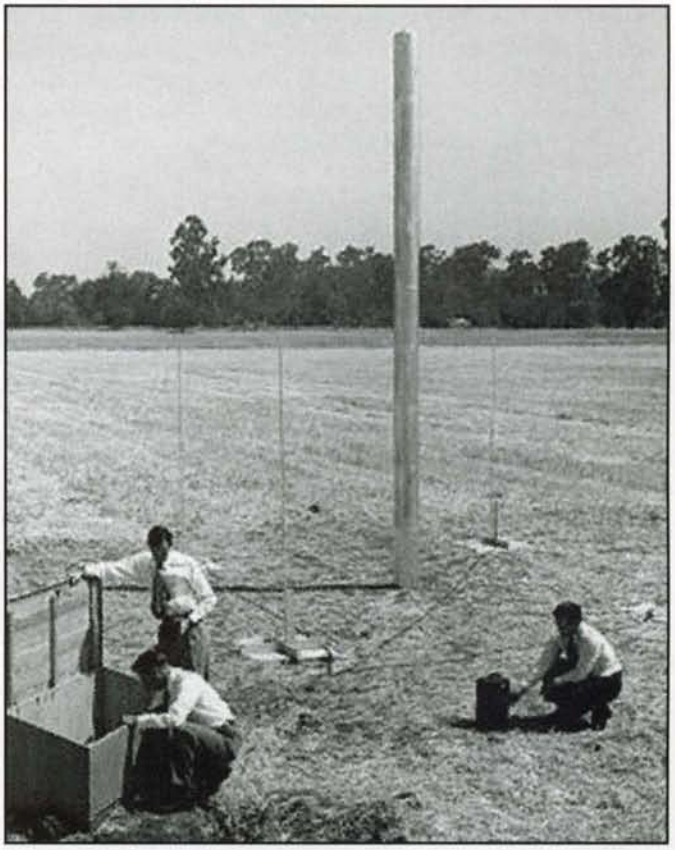


Photo 5. Villard, W6QYT (on the right), adjusting the transmitter to the Stanford meteor direction finder, along with Manning, W6QHJ, and Allen M. Peterson, W6POH. (Courtesy of Stanford University Archives)

SAVE SOME GREEN

WORLD CLASS PRODUCTS

Everyday we hear about the Economy and how it impacts our day to day lives, including our Hobbies. For the last two years, M2 has worked very hard to produce better tooling, develop new fabrication techniques and to acquire several new machines. Our ultimate goal has always been to supply the best products for the best price available.

We are extremely excited about this venture as it gives us the ability to actually bring down the cost on over 45% of our Ham Radio line.

If you have ever thought about M2 products in the past, but they were just out of your price range, we suggest you have another look at M2. We think you will be pleasantly surprised !

GET STARTED WITH THE M2 SATELLITE STARTER PACKAGE

PURCHASE THE EB-144 AND THE EB-432 ANTENNAS AND GET THE CROSSBOOM & HARDWARE KIT FOR FREE. A $ 40.00 VALUE !

A PERFRECT STARTER SATELLITE PACKAGE TO GET YOU UP AND RUNNING FOR LOW EARTH ORBIT SATELLITES.

PACKAGE PRICE
$ 378.00

PLUS GREAT PACKAGE DEALS FOR THE ADVANCED SATELLITE USER

PURCHASE THE 2MCP14 & 436CP30 WITH HD FIBERGLASS BOOM KIT AND GET $50 OFF THE HD BOOM KIT

PACKAGE PRICE
$ 647.00

PURCHASE THE 2MCP22 & 436CP42UG WITH HD FIBERGLASS BOOM KIT AND GET $50 OFF THE HD BOOM KIT

PACKAGE PRICE
$ 821.00

Dayton Hamvention®
Sponsored by Dayton Amateur Radio Association
Since 1952

COME SEE US AT THE 2011 DAYTON HAMVENTION BOOTHS 627 & 628

M2 Antenna Systems, Inc.
4402 N. Selland Ave.
Fresno, CA 93722
Phone (559) 432-8873 Fax (559) 432-3059
www.m2inc.com

M2 Offers many HF Logs, Monobanders and Multiband products.
Not to mention our full line of VHF, UHF and Microwave antennas.
We are your one stop shop for all of your High Quality Antenna needs.
Check us out on the web at www.m2inc.com

Photo 6. In the summer of 1953, Ross Bateman, W4AO, and Paul Wilson, W4HHK (at the controls), were attempting to work each other on a 144-Mc. tropospheric opening. When they noticed unexpected signal bursts, it occurred to them that meteors might be involved. (Courtesy of TBD)

Photo 7. By the time the Perseids meteor shower of 1954 arrived, both Jim, W2NLY, and Carl, W2AZL, would add their names to the list, becoming only the third and fourth stations in history to do so. This photo shows Jim Kmosko at the controls of W2NLY in the 1950s. (Courtesy of W2NLY)

Photo 8. Perhaps the crowning achievement of the early meteor-scatter pioneers came during the Perseids meteor shower of 1972, when Carl Scheideler, W2AZL, and John Fox, WØLER, completed the first meteor-scatter QSO on 432 MHz, good for 1641 miles! This photo shows Carl at the controls of W2AZL, one of the all-time great VHF stations of its day, located in Holmdel, New Jersey. (Courtesy of Carl's son Tom)

meteors, making him an early standout in the field.

While all this was going on, a radio amateur back on the East Coast was following in Villard's footsteps, having read his *QST* article earlier that year. During the *Perseids* meteor shower of 1946, Gordon R. Abell, Jr., W2IXK, was tuning his SX-25 receiver across the shortwave band, listening for stations within a 75-mile radius of his QTH in Poughkeepsie, NY. As he later reported in the November 1946 issue of *QST*, noticeable "yoops, chirps, and grunts" started coming from his speaker and his S-meter began "flying up sharply and sagging back in a generally logarithmic manner." Curious about the higher frequencies, Gordon turned on his 144-Mc. receiver and noted bursts of distant phone signals, suddenly increasing before dropping off slowly. And while listening to both his shortwave and 144-Mc. receivers at the same time, he observed how both responded in like fashion. Villard later commented on this report, saying it could indeed have been reflections from meteors! Abell's report in *QST* is perhaps the first documented account of 144-Mc. meteor scatter in any of the radio journals.

In the late 1940s some still doubted that meteors could have any significant effect on radio communications, believing that cosmic rays might produce similar results. However, as it turns out, a unique astronomical event came along that changed all that belief in cosmic rays.

In the fall of 1946 the Earth was expected to pass through a region of space which only days before had seen the nucleus of a comet known as Giacoboni-Zinner. With such a close encounter, the stream of dust and rock trailing the comet was expected to create a spectacular meteor shower and a real opportunity to observe the effects of meteors on radio-wave propagation. So it was that on the night of October 9, 1946, the meteor count suddenly jumped from the normal rate of just a few sporadic meteors an hour to thousands of shower meteors an hour, and all manner of people were watching.

One group was a team of Harvard astronomers who watched the meteors from New Mexico, where visual observations benefitted from nearly ideal viewing conditions.

Key to the Harvard expedition was a specially designed camera with a rotating shutter that could "chop" the light of a blazing meteor onto the film within. Using such cameras in different loca-

tions, it was possible to determine the upper height at which a meteor began to burn, the lower height at which it disappeared, and the speed of the meteor. By combining the records of several such cameras at different locations, it was possible to determine a meteor's trajectory, and ultimately its orbit.

The lead astronomer of this group was Fred L. Whipple (callsign unknown), the person who later revolutionized the study of comets by theorizing they were "icy conglomerates," something later confirmed with the return of Halley's Comet in 1986. Others involved were Donald Menzel, W1JEX, the same astronomer who led the 1936 solar expedition to Ak-Bulak and later became a well-known writer on the subject of space and astronomy. Finally, there was J. A. Pierce, W1JFO, veteran scientist of earlier Harvard expeditions and by now well known for his studies of the ionosphere and meteors. As a result of this event, Pierce reported that a 3.5-Mc. ionosphere sounder had detected the formation of a reflecting layer at 90 km lasting several hours, the result of so many meteors entering the ionosphere over such a short period of time.

Another group interested in the meteors that night were engineers from Stanford University, many of whom were also radio amateurs. One was Oswald G. Villard, Jr., who by this time had taken a new callsign, W6QYT. Others involved were Lawrence A. Manning, W6QHJ; R. A. Helliwell, W6MQG; and W. E. Evans, Jr. (callsign unknown). The Stanford group used a combination of commercial shortwave stations and their own continuous-wave transmitter to elicit the so-called Doppler whistles and signal bursts. It was estimated that such techniques provided 30,000 times more sensitivity than astronomical cameras and had the added benefit of working both day and night. The pitch generated in the receiver's speaker, and photographed on an oscilloscope CRT, could be used to estimate the speed of the meteor, while the amplitude and duration of the signal could be used to estimate its size. Also, using directional techniques it was possible to determine the trajectory of the meteor. An interesting account of Villard's work later appeared in the December 1949 issue of *Popular Mechanics* magazine. Photo 4 shows Villard, W6QYT, seated and Manning, W6QHJ, preparing to photograph the screen of an oscilloscope tracing out a Doppler whistle. Note the HP audio oscillator on the far right of the picture. Could it be the prototype mentioned earlier?

As it turns out, the trails of ionized gas created by meteors persist, continuing to reflect radio waves even after the meteor has long burned out. Since these clouds of ionized gas move in response to winds present in the ionosphere, they can be followed with radio from the ground below, thus revealing the weather 55 to 80 miles above the Earth. Photo 5 shows Villard, W6QYT, on the right adjusting the transmitter to the Stanford meteor direction finder, along with Manning, W6QHJ, and Allen M. Peterson, W6POH,

In addition to scientists watching the skies that evening, word reached the amateur radio community and alert hams made history en masse by completing what appear to be the first ever QSOs via meteor scatter on 50 Mc. The December issue of *QST* reported on this event, one that ushered in a new era in VHF radio communications. Ed Tilton, W1HDQ, described meteor communications as having "a peculiar rumble" and bringing "a level of QRM never before experienced." He went on to list all the stations reporting contacts that night, which totaled more than 50.

Also watching the skies that night were members of the U.S. Army Signal Corps, but it was not the meteors they were after. It was the comet itself! A total of 21 radar units had been set up across the nation, including installations in Texas, New Mexico, Idaho, and New Jersey. It is interesting to note that the New Jersey installation was the same one used earlier that same year to bounce 100-Mc. radar signals off the Moon—a first! The National Broadcasting Company provided live coverage of the meteor event from Belmar, New Jersey, and although the comet itself was not detected, the meteors trailing behind it were.

Another group of scientists, one associated with the National Bureau of Standards, also were monitoring the meteors that night. Key to this group was Ross Bateman, W4AO, the ham who, along with Bill Smith, W3GKP, would later be credited with hearing the first amateur radio echoes off the Moon in 1953. And finally, British scientists at Jodrell Bank, under the guidance of astronomer Sir Bernard Lovell, not only detected the meteors that night but started a two-year study to determine the origin of the sporadic meteors.

With the success of all these groups detecting meteors there was little doubt remaining that meteors could affect the ionosphere. However, perhaps even more significant was how it opened a door to the future of meteor-burst communications. In July 1947, Mike Villard's *QST* article entitled "Meteor Detection by Amateur Radio, A New Field of Observation" got things started. But it may have been Villard and Peterson's April 1953 *QST* article entitled "Meteor Scatter" that really got the ball rolling. In that article they described how the constant impact of meteors on the ionosphere, albeit small, left behind enough residual ionization to provide extended range operation on the 15- and 20-meter bands, even at night, long after the primary source of ionization, the Sun, had set. They reported how this effect was "newly discovered" and similar in some ways to another recent discovery—ionospheric scattering. Using a low-noise receiver, it was soon "discovered" that even higher frequencies could be put to use for meteor-scatter communications that were higher than ever thought possible.

It happened in the summer of 1953, when Ross Bateman, W4AO, and Paul Wilson, W4HHK, were attempting to work each other on a 144-Mc. tropospheric opening. When they noticed unexpected signal bursts, it occurred to them that meteors might be involved. Photo 6 shows Paul Wilson at the controls of W4HHK.

Ross and Paul began long-term testing, but when Ross got called away, presumably to work on the secret ionoscatter tests between the Bureau and Collins Radio, it was Ralph "Tommy" Thomas, W2UK, who took over for Ross. Soon Tommy was joined by Jim Kmosko, W2NLY, Carl Scheideler, W2AZL, and Ed Tilton, W1HDQ, all working schedules with Paul, W4HHK, attempting to complete that first meteor-scatter QSO on 144 Mc.

History was made in 1954 when Tommy completed the first-ever meteor-scatter contact on 2 meters with Paul, something for which they both received the ARRL Merit Award in 1955. By the time the *Perseids* meteor shower of 1954 arrived, both Jim, W2NLY, and Carl, W2AZL, would add their names to the list, becoming only the third and fourth stations in history to do so. Photo 7 shows Jim Kmosko at the controls of W2NLY in the 1950s.

Over the next few years, more and more operators got onto meteor scatter and articles about low-noise 2-meter converters began to appear in the journals. Arguably the most significant was that of Carl Scheideler, W2AZL, the young Bell Laboratories engineer whose 417A converter would become a VHF classic. Although Carl designed his popular 2-meter converter around the scarce Western Electric 417A tube, not commonly available to amateurs, somehow those tubes became available to anyone who needed one!

One person who benefited from the friendship of Carl was Walt Morrison, W2CXY, who built many of Carl's converters and teamed up with him on several occasions. It is interesting to note that during the 1956 *Perseids* meteor shower Walt's signal demonstrated something of the potential for long-haul meteor work when W7LEE reported hearing it from Parker, Arizona, an amazing distance of 2200 miles! Also, in April 1957 meteor-scatter pioneer Walt Bain, W4LTU, published his classic *QST* article entitled "V.H.F. Meteor Scatter Propagation," which is still considered a valuable resource for the serious meteor-scatter enthusiast.

Perhaps the crowning achievement of the early meteor-scatter pioneers came during the *Perseids* meteor shower of 1972, when Carl Scheideler, W2AZL, and John Fox, WØLER, completed the first meteor-scatter QSO on 432 MHz, good for 1641 miles! Photo 8 shows Carl at the controls of W2AZL, one of the all time great VHF stations of its day, located in Holmdel, New Jersey.

What about those sporadic meteors? Well, in 1950 the researchers at Jodrell Bank concluded their two-year study of the subject and found no evidence of sporadic meteors following hyperbolic orbits. It appears that these meteors belong to our solar system after all, ancient debris separated from the parent comets that seeded them. Also, what about all the meteorites, such as Ahnighito, which actually find their way to Earth? It appears that these have a different origin—the asteroid belt!

In some ways, the scientists and engineers who studied meteors during the 20th century were like the meteors themselves. Each appeared on the horizon long enough to get our attention. Each illuminated our minds with a brilliance uniquely their own. And each brought a personal story, just like Ahnighito. It is to these stories that Ahnighito's Hall of Fame is dedicated.

The ARRL VHF Contests
The Scoring Rules – A Commentary

Since the inception of the use of grid locators for contest scoring and awards purposes, VHF+ operators have been challenged on how to best exploit their use. WB2AMU describes how they are presently used and offers come suggestions for improving their use.

By Ken Neubeck,* WB2AMU

The three ARRL VHF Contests that are held in January, June, and September each year are major events that generate a lot of fun for VHF operators in the U.S. and Canada. Throughout the years, it has been a very tricky process for the ARRL to try to balance the rules for these events, where the ultimate goal is to promote VHF activity on the VHF, UHF, and microwave bands.

Each of the three events represents different band conditions that may be present during that time of year—in particular, the lower four bands of the VHF/UHF spectrum (50, 144, 220, and 432 MHz). Typically, June is the optimum time of year for sporadic-*E* activity, which can dominate activity on 6 meters and sometimes on 2 meters. September is a good month for tropo activity on many of the bands, particularly on 144, 220, and 432 MHz. January can be a rough month in general for propagation, although sporadic-*E* is possible for an hour or two during the contest time period, and sometimes during peak sunspot activity, *F2*-layer activity is possible as well (2002 was the last one).

It is not too much of a reach to make this statement, but is pretty much well known that the playing field is not level throughout the entire United States and Canada with regard to the number of stations that can be worked from a certain area, both because of population limitations and propagation-dependent conditions. Thus, it is a major challenge in these ARRL contests for stations to make the top ten in the U.S. and Canada in any category, whether it is single operator, multi-operator, rover, or portable. Likewise, it is very hard for stations that are located in certain areas of the United States to become the top station in a category for the coveted plaques. Indeed, a plaque winner for a particular category in the ARRL VHF contests may not fully tell the story in terms of effort or conditions.

In addition, the VHF contests started using the grid square as a multiplier in the 1980s, and this led to a change in strategy for many stations. Also, the introduction of the rover category brought about clever use of situations. I may get in trouble for stating this, but I believe that some of the nuances of the way the rules can be interpreted may lead to seemingly unfair advantages for some stations if they address them in a certain way. This article will show some of the ways in which this can happen and suggest some potential areas for improvement.

VHF Population Centers

The ARRL VHF contests have become regional-based contests where stations in the northeast U.S., parts of the middle of the U.S., and areas of southern California generally can take advantage of a significant number of VHF stations being available in their nearby area for at least line-of-sight contacts. It is not surprising to see stations in the Northeast, parts of the Midwest, and California able to score well enough to place in the top ten or even take the top spot in a particular category.

As seen in the grid map, shown in figure 1, the Northeast has some advantage over many areas in that there are major population centers that are sprinkled over a few grids, such as Boston (MA) in FN42, the Albany (NY) area in FN32, Hartford (CT) in FN31, New York City (NY) in FN30, New Jersey in FN20 and

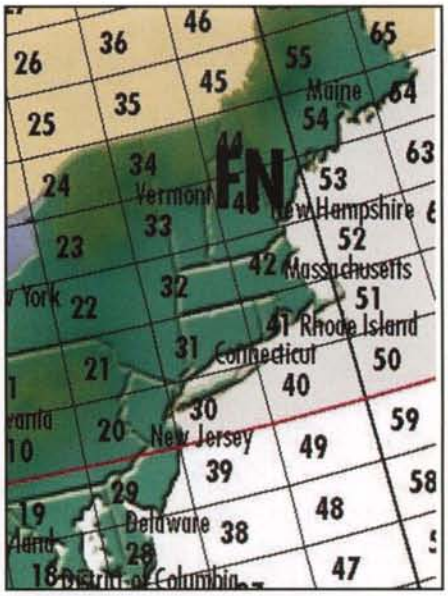


Figure 1. The Northeast corridor contains a significant number of VHF operators, particularly in the tri-state area of New York, Connecticut, and New Jersey. Grid FN31 is one of the more popular grids on 6 meters and the other VHF bands for the ARRL VHF contests.

FM29, and the Philadelphia (PA) area in FN20. The general proximity of a lot of stations makes it moderately straightforward to work a good number of stations in these areas via line-of-sight.

The state of California is another area where there is significant VHF activity, with several large population centers around the Los Angeles, San Diego, and San Francisco areas as seen in the grid map, figure 2. However, as seen by the grid map in figure 3, much of the middle of the U.S. covers a wide area of minimal population. Thus, for those stations, as well as some of the more remote western states, a top-ten finish in the U.S. or

*CQ VHF Features Editor, 1 Valley Road, Patchogue, NY 11772
e-mail: <wb2amu@cq-vhf.com>

Canada is not even possible in most categories, unless the two coasts should be hit by a major power blackout.

However, it is not just the population that matters. The rules for the ARRL VHF contests favor the higher bands in terms of QSO points. While it is recognized that it requires a considerable amount of effort to get on the higher UHF and microwave bands, the points per QSO considerably dwarf the points for the 6- and 2-meter bands! Scoring per QSO is as follows:

1. One point for 50-MHz and 144-MHz QSOs
2. Two points for 222-MHz and 432-MHz QSOs
3. Four points for 902-MHz and 1296-MHz QSOs
4. Eight points for 2304-MHz, 3456-MHz, 5760-MHz, and 10-GHz and above QSOs

Propagation remains the wild card for the lower four bands (50 MHz up to 432 MHz), where modes such as sporadic-*E*, aurora, and *F2* can help out 6 meters, and tropo-related modes can help all of the four lower bands. However, because of the low QSO point totals for each of these four bands, any four-band effort could easily be overtaken by stations in other areas that have the higher bands and stations to work as well in this range.

Mega-score Efforts Change the Balance

The rover category has spawned the most controversy and rule changes over the history of the ARRL VHF contests, leading to controversy that has been the subject of discussion on many websites. This has led to the current rover final-score calculation for each rover entry, which consists of the total number of QSO points from all bands times the sum of unique multipliers (grid squares) worked per band (regardless of which grid square in which they were made), plus one additional multiplier for every grid square from which a participant successfully completed a contact. The use of the additional multiplier for each grid from which a rover makes a contact will put the rover in a different class from the different fixed-station classes.

The use of rovers in areas such as southern California works out well for clubs and groups because of the generally good weather conditions and the decent number of VHFers in that area. However, in recent years some of these rovers have enhanced their efforts by grouping together to form what is known as "pack rovers," and while they work many other stations, they concentrate on working other pack rovers in the group. Thus, it is very easy for five or more rover stations from a general area to dominate the rover category, particularly if each of them is equipped with ten bands. It is a clever use of resources to score well.

As reported on the N6NB rover website pages, rover scoring rules have been the source of some experimentation and controversy:

> The response was a rover scoring system, introduced in 1991, that some have called "megascoring." The contacts and multipliers from all locations were aggregated and the sums were then multiplied, producing much larger total scores. Even though that produced an enormous increase in rover activity, the higher scores stirred controversy, too.
>
> To dramatize what they saw as the unfairness of that system, four amateurs (two father-and-son teams) in New England went roving in the January 1993 ARRL VHF contest in two vehicles, working each other on nine bands as they circled around the point where four grid squares came together. Then they did the same thing at another convergence of four grid squares. When the contest was over, each of the four had amassed one-and-a-quarter million points: *four people in two vehicles had scored five-million points*. The highest fixed-station score in that contest was about 300,000 points. Then the four added their scores with those of fixed stations in their radio club, the Hampden County Radio Assn., creating a club aggregate score more than *triple* that of the perennial winner, the Mt. Airy VHF Club in Philadelphia. The Mt. Airy Pack Rats had won the club aggregate competition every year for more than 30 years, but the rover scoring system ended that tradition. Fixed stations simply could not compete.

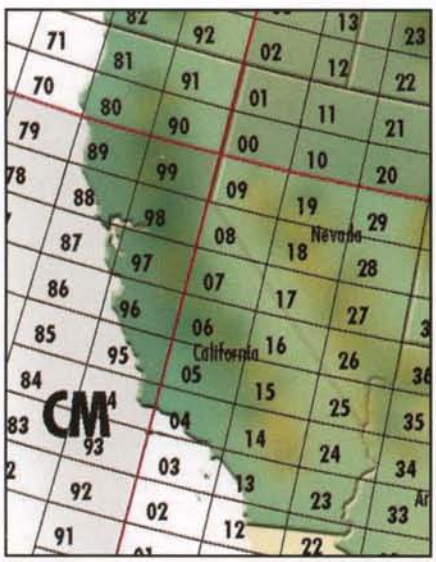


Figure 2. California has many grids that are fairly reachable by rover stations through the combination of good weather and good roads. The Los Angeles area encompasses grids DM04, DM03, DM14, and DM13, with San Francisco area encompassing CM87, CM88, CM98, and CM97.

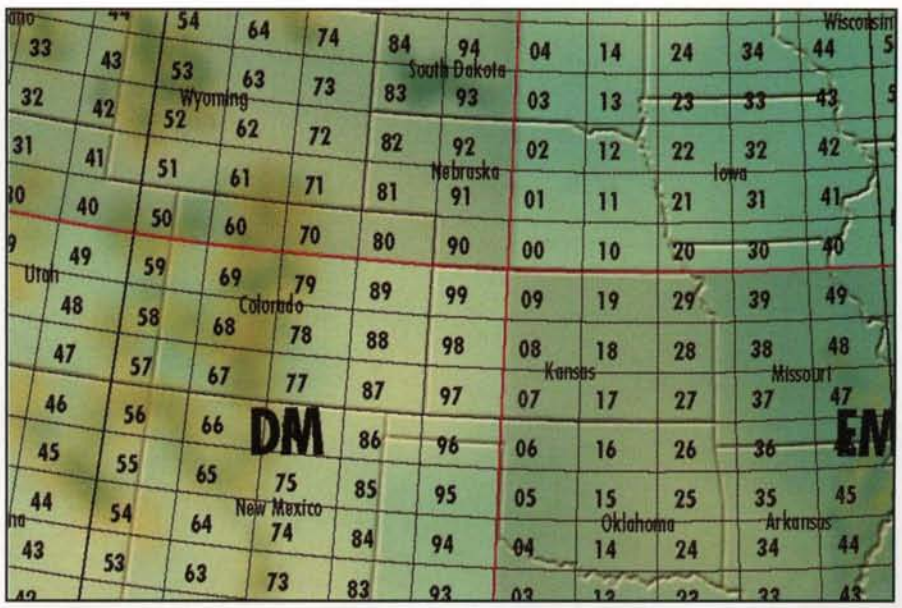


Figure 3. There are large areas of space with minimal VHF operator population in the Midwest and western states in the U.S. This is in stark contrast to the East and West Coast U.S. population centers shown in figures 1 and 2.

powerwerx.com

The most Powerpole related products anywhere!

Wouxun Radios

NEW!

Wouxun KG-UV3D

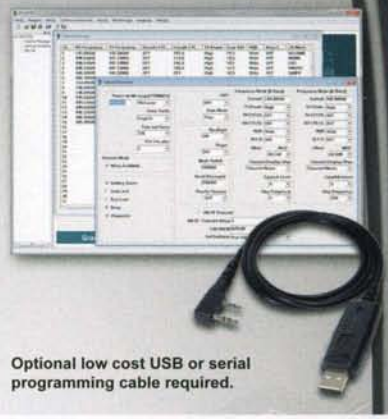
Full featured, compact, 2M/440Mhz Dual-Band Handheld for under *$120*

- Full 5 Watt Output on VHF, 4 Watts UHF
- High capacity (1700 mAh) Li-ion battery pack included
- Dual-band monitor (VHF/UHF, VHF/VHF, UHF/UHF)
- 3-4 hour desktop rapid charger included
- Dual Alpha-Numeric Backlit Display w/ Channel Name
- Built-in Ultra Bright LED Flashlight function

2M/220Mhz model also available.
Visit www.powerwerx.com/wouxun

FCC Certified

Windows PC programmable
Free software available



Optional low cost USB or serial programming cable required.

Anderson Powerpoles & Accessories

All Amps, Gauges & Colors in Stock!

Wouxun Radio Optional Accessories

USB Prog. Cable | Speaker Microphone | BNC RF Adapter | Car Charger

AA Battery Pack | UHF RF Adapter | Dual Slot Rapid Charger | Battery Eliminator

Adapter & Extension Cables

OEM Connectors & Filters

Fuse Holders & Fuses

Cooper Bussmann Circuit Breakers 50, 70, 150 Amp

powerwerx.com

Order online at www.powerwerx.com
Order toll free 888-321-0073

Follow us on Facebook
facebook.com/powerwerx

Follow us on Twitter
twitter.com/powerwerx

The high-scoring foursome (Stan Hilinski, KA1ZE, and his son Kevin, NR1L; and Robert Cohen, K1CPJ, and his son Scott, KA1QAS) revolutionized VHF rovering and demonstrated what was possible. But because their monster scores overwhelmed the traditional club competition, there was an outcry for still another change in the scoring system, although many rovers defended the "mega-scoring" system by arguing that it made the contests a lot more fun and stimulated activity in many parts of the country. The debate raged at club meetings and conventions, in petition-gathering efforts and on the air.

This website, along with other sites, mentions some of the controversial operating practices that some rover stations do but are legal under the rules of the contest. These include:

1. *Captive rovers:* These are rovers that seek out only one or a few stations while they're in each grid square and making little effort to be available to the general amateur community.

2. *Grid circling:* Two or more rovers travel together and work each other as they move around a point where four grids converge. Some object to rovers working each other in several grid squares even if they don't engage in "grid circling."

3. *Pack roving*: Two rovers will often travel together and work each other only once in a given grid square and then they move on together to the next grid square.

The website also mentions another high-scoring effort that took place with the Grid Pirates multi-operator contest group, signing N3IQ/R, scoring 1,391,942 points during the 1999 VHF Sweepstakes. Operators ND3F and WD8ISK operated N3IQ/R and they roved in tandem with K8GP/R, operated by K6LEW and KA3QPG, who posted a score of 827,372 points. The two teams visited 15 grid squares and worked each other on an incredible 12 bands—and then set out to work everyone else they could hear in the activity-rich Northeast corridor.

Likewise, other categories such as QRP are impacted by such practices. One scenario occurs when a QRP portable station can win the QRP category by setting up on a high hill or mountaintop location in a busy area of southern California that is somewhat centrally located, and the station concentrates on working several pack rovers that ride in neighboring grid squares. The centrally located QRP station can work each pack rover station from each grid across the 10 bands, resulting in a total of 46 points just for that station in one grid! If you multiply this by 10 stations, and, say, five different grids for each band, you easily are in the 10,000-point range, and with a bit more effort could go into the 100,000-point range similar to what is shown in the second scenario shown in figure 4. Thus, by coordinating the band activity on the different VHF bands between the centrally located QRP station and the pack rovers, mega-scoring efforts have been introduced to the QRP category as well as the rover category. This situation occurred with the September 2010 results and the January 2011 results, where N6NB operated as a QRP portable in grid DM13 and worked a group of 10 rover stations across the 10 bands when they traveled throughout several grids, resulting in a 170K or greater score for the two events!

The sheer numbers of these contacts will easily overwhelm any major sporadic-*E* opening that might occur on 6 meters. Indeed, if a QRP station or even a non-QRP station from an area in the U.S. was able to make 500 contacts and 100 multipliers on 6 meters during the June VHF contest, primarily via sporadic-*E*, and about 100 contacts and 50 multipliers on the other three lower VHF bands, that would result in a score of 90,000, a very good effort. However, this score is easily dwarfed by the scenario described in the previous paragraph of a single-operator station that is operating portable (QRP or otherwise) where 150,000 or more points can be achieved through the benefit of coordinated pack rover club activity.

With the introduction of the mega-scoring phenomenon, the VHF contests will never be the same again because of

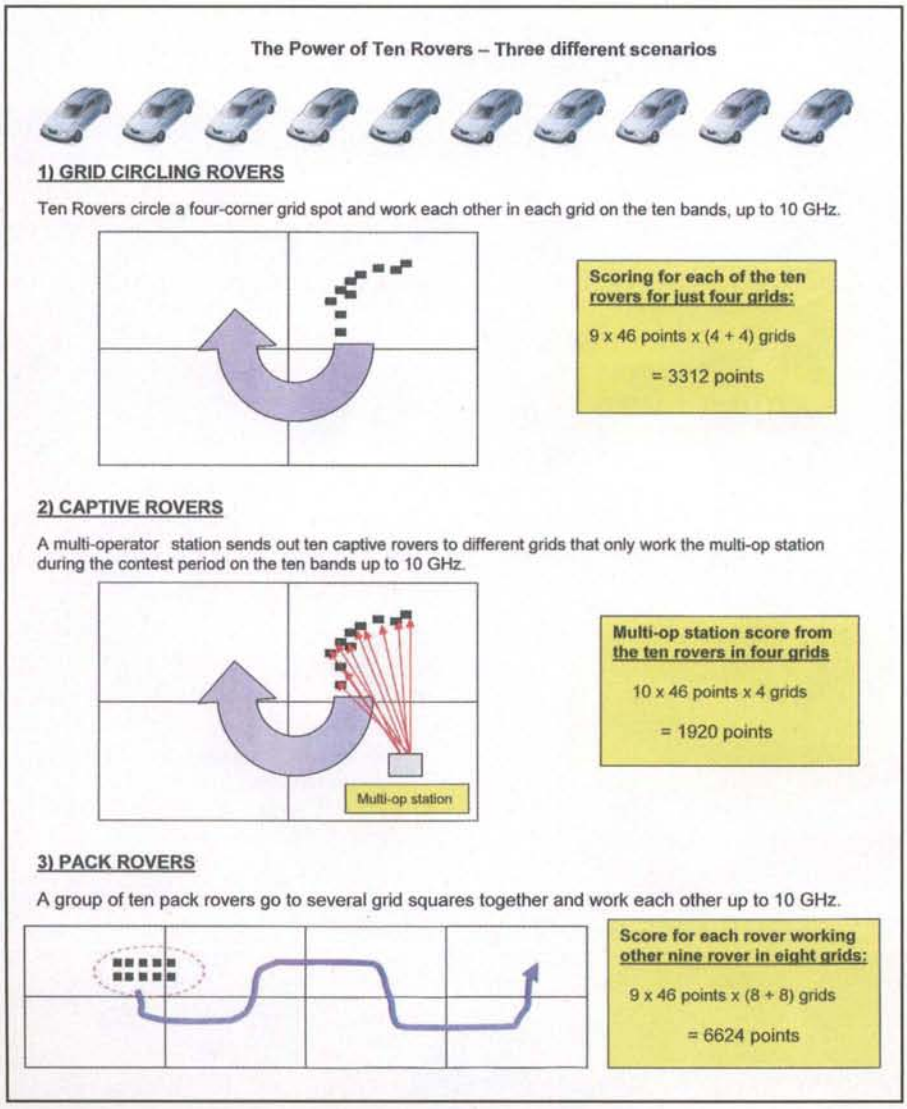


Figure 4. The power of ten rovers, three different scenarios.

ARRL 2010 VHF Contest	Total Logs	50-MHz Logs	% of 50-MHz Logs
January VHF Sweepstakes	820	754	92.0%
June VHF QSO Party	1202	1190	99.0%
September VHF QSO Party	488	466	95.5%
Totals	**2510**	**2410**	**96.0%**

Table 1. Tabulation of logs submitted for the three ARRL VHF contests held in 2010.

the way that the rules are currently constructed. It is pointed out that there is nothing wrong with this approach in concert with the rules, and it does encourage hams to coordinate club activity for maximum results. Unfortunately, though, it points out how unbalanced the idea is when comparing different areas of the U.S. and Canada within the same category, whether it be rover, QRP portable, or the "regular" single operator. The use of rovers in this manner changes the playing field. Essentially, at times pack rovering ends up like a radio check across 10 bands for the stations participating as they travel to different grids.

Now one could say that a club located anywhere in the U.S. could get 10 members to go full bore with regard to the equipment used in the car and work each other dozens of times across the band from different grids. In the end, if everyone did this we would end up with an event that should be called the "Great VHF plus Rover Bash Event." Who could argue with this approach, as it encourages club activity using portable station setups and good road-rally skills!?

Other Scenarios

The rules governing rovers have always been tested and often have been tweaked a bit based on circumstances that have arisen. A few years back, this rule was tested when certain rover stations made maximum use of the practice of grid circling, with two or more rover stations.

Other practices that have been used by some multi-operator stations include the use of captive rovers, where club members go out in their cars and use unusual frequencies, such as above 50.3 MHz, and work only the other multi-operator stations and no one else, essentially giving many points to only that station. Obviously, this particular practice of captive stations only working other specific stations inherently would be unfair and certainly not in good spirit of the hobby.

As mentioned earlier, grid circling was another high-scoring process in which rover station groups find the four-corner spot between four grids using maps and GPS and drive to the four different grids during the contest period. When situations like this occur, it makes for tremendous scores for these rover stations, particularly if they are well-equipped with radios and transverters covering the bands up to 10 GHz. Because two or more rover stations that are grid-circling may be less than 20 miles apart, covering the VHF, UHF, and microwave bands, generally can make contacts quickly on 10 bands in less than a half hour.

And More . . .

All of the practices mentioned here are acceptable within the contest rules they way they currently are constructed. Now when I think of QRP portable stations such as WØSTU and KØNR in Colorado, or NØJK in Kansas, going to remote hilltop locations in the month of September or January, I see that their operation is much different than the ones described previously and may actually be more in tune with the original spirit of the creation of the QRP category. These stations will not have the advantage of others in populated areas which may have the advantage of many rover stations being around because of a lesser population from which to draw well-equipped portable/rover stations, as well as dealing with worse weather conditions (particularly in January). And while these stations in the quiet areas may have some equipment available for the very high bands, they may not have many other stations around to work. It does seem unfair that one's location would have such a major impact when participating in a VHF contest, not only because of propagation and the ham population, but also with regard to the availability of equipment, too!

Then it really becomes an issue of comparing apples and oranges, yet I think that the latter stations in lesser populated areas probably get more enjoyment and appreciation working a handful of contacts under less-than-ideal conditions. Thus, a 500-point effort during a 33-hour contest period for a QRP station located in a remote area in the Midwest is pretty good, yet that station's score will be significantly dwarfed by a QRP station in California getting over 150,000 points with the benefit of many more rover stations available and on many bands! Figure 3 shows the Midwest U.S. grid map, and there are not many populated areas in the mountains to aid in making a lot of contacts. It is not easy to simply state, "If you want a higher score, you need to add more frequencies." What if the next possible VHF-plus station is over 200 miles away? It becomes who is available to work unless a rover is driving by? This would seemingly make microwave QSOs unfeasible unless portable stations are entered into the picture.

I want to point out that the reason many stations go the QRP route is due to the enjoyment of going to outdoor locations, as well as the fact that there may be some big-gun VHF stations located in their section that they cannot compete with from their homes because of things such as antenna height restrictions or area covenants.

If one examines the altruistic goals of ham radio contests in general, it is to help increase activity on the different amateur radio frequencies, not only for the contest period but also for other times as well. Therefore, some hams go to extremes during VHF contests to boost their scores and win using means such as pack rovers, captive rovers, or grid circling. However, in the end, if the activity level on the VHF, UHF, and higher bands is not increased during non-contest periods, this truly would not serve a long-term purpose toward the bigger picture of the active use of these frequencies.

Thus, while I can make four or five contacts on 222 MHz during the contests, this does not mean more activity for the band during the rest of the year. This will not translate well for the overall success of the band and the hobby as well. What about 1296 MHz and 902 MHz as well? Is activity spilling over to non-contest periods to the point that hams can justify the allocation of these frequencies?

Low day-to-day activity on these bands may result in closer scrutiny by Congress and other federal agencies. They may say, "These bands are always quiet and underutilized; why not auction them off?" Witness the current efforts in Congress by Representative Peter King in which the 420–440 MHz amateur radio allocation is being considered for auction to commercial users in order to

compensate for the allocation of the 698–806 MHz range being assigned to public safety radio. Part of this issue may be because hams do not "make enough noise" on these bands, such that non-amateurs become aware of the availability of these frequencies.

Additional Observations

The importance of 6 meters becomes very clear by analyzing the logs that are submitted for the three ARRL VHF contests. Indeed, 6 meters is the gateway for many hams to enter the VHF spectrum. Using the data collected by the ARRL on its website (www.arrl.org), a summary of the number of stations that use 6 meters in its VHF contests is shown in Table 1, which shows the tabulation of logs submitted for the three ARRL VHF contests held in 2010. Six meters is the most popular band for the VHF contests, with over 90 percent of the logs submitted having 6-meter contacts.

Figure 5. Compared to the various porcupine trucks that have 10-band capability, many hams doing portable or rover operations concentrate on the lower four VHF bands. A new car with a sunroof proved to be very useful for WB2AMU's QRP portable setup on the lower four during the 2011 January VHF contest with the feed lines going from the various antennas through the opening to the radio in the car. (Photo by Ken Neubeck, WB2AMU)

During the June 2010 event, there were two single-operator stations that broke the 1000 QSO mark on 50 MHz: Ivars, KC4PX, with 1507 QSOs, and Lefty, K1TEO, with 1121QSOs. Yet these stations only received certificates for their efforts when it would seem like a plaque would be appropriate to recognize the significant efforts made by them.

It is also noted the June VHF event is the one in which many of the stations that are located in the remote areas of the Midwest and the West can be more competitive with the appearance of regular sporadic-*E* activity. Another interesting observation from the June 2010 event is that none of the log entries from the western states of Montana, Nevada, and Wyoming included contacts made above 432 MHz, which further illustrates the difficulty for stations in these states to make contacts on the frequencies that are above 432 MHz because of the distance between stations and the number of stations available on those frequencies.

Possible Solutions

You could have a room full of VHF contest operators all from the same region and not have any consensus with regard to making changes to the ARRL VHF contests. It would be worse if the room was filled with VHFers from a wide range of locations with different contest experiences. Thus, there appears to be no easy answer when it comes to balancing the scoring for the ARRL VHF contests with regard to the way it now is set up.

The ARRL HF contests generally do not have these issues because skywave propagation conditions tend to be the dominating factor; in general, stations at some distance from one another can be worked via a skywave propagation mode, and thus the opportunity to work many stations. It is noted that one of the ARRL's more popular contest is the 10 Meter contest, and as popularity grew over the 30-plus years of its existence, there were additional categories added. It may be the right time for the same thing to happen for the three ARRL VHF contests, where new categories are added, along with some restructuring to encourage more VHF activity.

It would appear that now is the right time to add another plaque category: Top 6-Meter Single Operator for the U.S. and Canada. This certainly would be a major step for the contest, and it is within reach of even those stations located in quiet areas, particularly for the June contest because of sporadic-*E* activity. I think that with the over 90-percent 50-MHz participation rate in all ARRL VHF contests, it can be justified to add a plaque for 50 MHz. Keep in mind that the two top-scoring 50-MHz stations during the June 2010 event were K1TOL in Maine and KC4PX in Central Florida, which are not particularly busy areas for the UHF bands above 432 MHz.

Part of the problem may be that the name of the contest seems to be a paradox. It is called a VHF sweepstakes or VHF QSO party, yet it includes all of the amateur radio frequencies above 50 MHz (and those above 300 MHz, which is the beginning of UHF and into microwave frequencies). Technically speaking, the VHF amateur radio frequencies are 50 MHz, 144 MHz, and 220 MHz. The granting of 8 points for each 2304-MHz, 3456-MHz, 5760-MHz, and 10-GHz QSO seems to be fair given the effort it takes to get equipment for these bands in the first place and then to get them working. Yet any 8-point QSO dwarfs a QSO that is made on the lower four bands (which are technically the true VHF bands) and is really where most contest activity takes place (remember, 6 meter contacts are in over 90 per-

cent of the logs submitted). Perhaps the focus of the contest is too broad in the way that it is structured.

Thus, there could be two ways to deal with this inequity. The first way would be to modify the all-band category setup by adding an additional category for each single operator class—the lower four bands (50, 144, 220, and 432 MHz) and the existing all-band category for single operator; 50 MHz and above. Adding this would seem to make sense from a survey of the logs that have been received for these contests.

Another more radical proposal would be to make the three ARRL VHF contests just strictly on the lower four bands and spin off the higher frequencies into another UHF contest event to supplement the current ARRL August UHF contest. This would be similar to how CQ structures its CQ WW VHF Contest, which is held in July for 6 and 2 meters (where multipliers on 6 and 2 meters are one point each). I think that this proposal would have little chance of occurring for the ARRL contests because of the overwhelming status quo; many stations focus on trying to work as many bands as they can during these three contests, so when activity slows down on one band, other bands can be used.

It sometimes is very hard for hams to change, and that is why I think the latter option is dead on arrival. I recall that in the past a number of surveys were conducted in the VHF community with regard to possible rule changes, but because there is such a wide range of opinions it was hard to get a consensus. This is understandable, because as illustrated in this article, different locations in the U.S. and Canada have different VHF experiences. As a result, only minor tweaking of rover rules has occurred in recent years. The current process of sending letters or comments to the rules committee has remained very slow. It is important to realize, though, that activity on 6 meters has exploded during the past 10 years and needs to be recognized (hence, the 6-meter plaque idea proposed earlier).

It is food for thought to consider where newer operators in the hobby are going to come from in the future. Is it really fair to have new hams who would most likely enter a contest on one of the lower four VHF bands, compared to the higher bands, to have their QSO scoring dwarfed by those stations that are able to generate many QSOs on the upper bands that have higher QSO point totals? It would seem that a new ham initially is going to be using commercially available equipment when starting out, and while commercially made HF equipment is plentiful, only some of the VHF bands are covered. As mentioned before, the 6-meter band is the gateway to VHF activity for many hams in the U.S. and Canada.

If no changes are made to adding categories in these contests, it may make sense to review the QSO point total per band. It would appear that the point differential is too great. Maybe the higher bands QSO point value should be reduced from 8 to 4, and a band such as 220 be increased to 3 points per QSO. As it is, many of these bands (some VHF and some UHF and above) are quiet during non-contest periods, particularly the VHF band 220 MHz! If the goal of the ARRL VHF contests is to spark activity on the VHF bands and above, then it is successful, but only for the contest periods, since the rest of year many of these bands are quiet.

The last proposal that could be considered is to break up the U.S./VE region by time zones to capture the regional aspect of the contest. Thus, the Pacific time zone would be on an even playing field with other Pacific time zone stations, and likewise, the same for the Mountain time zone, the Central time zone, and the Eastern time zone. A solution could be to split each time zone into north and south, but I think that the four zones, at least, make the most sense for a starting point. Perhaps the elimination of the plaque for top scorer in U.S./VE in each category might make sense, based on the issues brought out in this article.

Even the QRP category could be broken down further: (1) lower four VHF bands and (2) all bands. Thus, the lower four bands would fit the "frontier QRP" approach for those who hike to hills in colder climates and operate the bands that fit their expectations of what is available.

From a personal viewpoint, I enjoy these three events because of the different settings that occur during the fall, summer, and winter when these contests take place. I will continue to operate in the QRP category, going to the hills of Long Island, New York (see figure 5) on the lower four bands during these contests for as long as I can, and I am reasonably sure that I will not be getting much help in the way of pack rovers going through the New York tri-state area, as the traffic will kill them!

Beacon Monitoring Without The Noise

Save your ears and spare your family from the incessant background hash of beacon monitoring. Gordo tells you how.

By Gordon West,* WB6NOA

The beacon is in! This is a welcomed phrase over the air, announcing favorable skip or tropospheric-ducting conditions arriving at your end of the circuit.

VHF/UHF Propagation Beacons

Following is the list of beacon frequencies from 10 meters to 10 GHz:

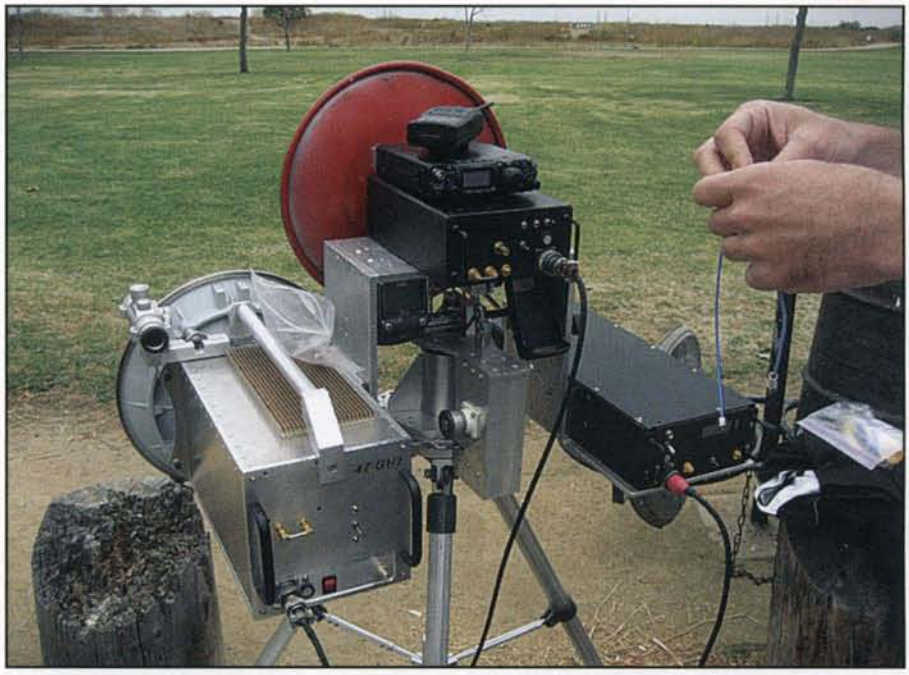
X band: 10.3683–10.3684 GHz
5 GHz... 5760.3–5760.4 MHz
3 GHz: 3456.3–3456.4 MHz
2.3 GHz: 2304.3–2304.32 MHz
1.2 GHz: 1296.070–1296.080 MHz
900 MHz: 902.100 MHz
70 cm: 432.300–432.400 MHz
222 MHz: 222.050–222.060 MHz
2 meters: 144.275–144.300 MHz
6 meters: 50. 060–50.080 MHz
10 meters: 28.200–28.300 MHz
(Courtesy ARRL band plan)

For those of you on high-frequency, 14.100 MHz is the spot to tune 18 beacons throughout the world, thanks to management by the Northern California DX Foundation, with additional HF beacons at 18.110, 21.150, 24.930, and 28.200 MHz, all part of the International Beacon Project (http://www.ncdxf.org).

Weak-signal operators will tell us that the best way to hear skywave or tropo beacons coming out of the noise is to listen with the squelch wide open. This may be a good approach for *some* operators, but for those who may be around you in your home, listening for hours to background noise takes some real dedication (or tolerance)!

Weak-signal operators all may agree that using the radio's squelch circuit is generally unacceptable to detect a tropo beacon band opening.

*CQ VHF Features Editor, 2414 College Dr., Costa Mesa, CA 92626
e-mail: <wb6noa@cq-vhf.com>



These 47-GHz systems need all the receiver DSP they can get!

"Running squelch to detect 6-meter sporadic-*E* openings may work okay, because signals coming out of the noise will sometimes peak as high as S-9," comments Ken Neubeck, WB2AMU, a master of the Magic Band, "but no squelch for tropo beacon monitoring!"

Ken's favorite 6-meter propagation websites are <http://www.dxinfocentre.com/tropo.html>, <http://www.vhfdx.info/spots>, <http://www.dxworld.com/50prop.html>, and <http://www.spaceweather.com>.

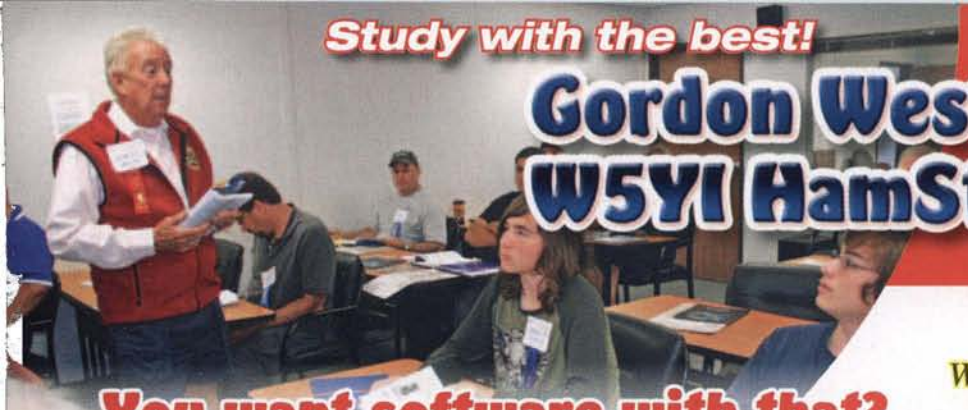
Some HF radio manufacturers have added the 2-meter and 432-MHz bands, multimode, in addition to high-frequency bands and 6 meters:

Elecraft with transverters
FlexRadio with transverters
ICOM IC-7000
ICOM IC-9100 (soon)
Kenwood TS-2000
Ten-Tec with transverters
Yaesu FT-817
Yaesu FT-857
Yaesu FT-897

Thanks, HF radio manufacturers for including VHF and UHF multimode operation!

On most of these newer rigs, monitoring with squelch ON may require many microvolts of signal strength to gate the squelch circuit. These newer rigs may feature "hard squelch" that may gate a transistor on or off, depending on incoming signal strength. This is fine for strong 6-meter openings, but squelch ON could easily mask the very subtle, slow building of signals appearing just out of the noise on 6 meters, 2 meters, and 432 MHz via tropospheric ducting.

"Tropo signals don't pop out of the noise like sporadic-*E* on VHF," adds Neubeck, my co-author of the book *VHF*



Study with the best!

Gordon West, WB6NOA and W5YI HamStudy® Software

NEW LOW PRICING!!

We're making ham study more affordable

You want software with that? How about 1-on-1 with Gordo, too!

You get more than a simple software CD when you study with Gordon West and W5YI HamStudy Software. Each of our Technician, General, and Extra Class book + software packages includes a host of feature-packed benefits that makes study for your first ham license or upgrade a true learning experience!

All of Gordon's books reorganize the Q&A into logical study groups that help you better learn the ins-and-outs of rules, repeaters, propagation, operating procedures, antennas, safety – all in one place. Each question is followed by Gordo's simple, educational explanation of the correct answer. No going back-and-forth from the engineering text to the question pool searching for the correct answer.

In our book, you get it all on one page in easy to understand terms and explanations! W5YI HamStudy Software reinforces your learning, providing an interactive experience that focuses your study and understanding of amateur practices and procedures and what you need to know to pass your FCC exam!

- No subscription or Internet connection required
- No PC installation required – software runs directly from the CD
- Answer a question wrong and Gordo's answer explanation from the book appears on screen to reinforce learning with highlighted key words in the question and correct answer
- The software scores your practice exam and tells you which questions you've mastered and those that need more study
- Study by sub-element to focus on areas where you need more study – stop answering questions you already know
- Color bar graph shows your progress and lets you know when you're ready to pass the real exam
- Print out practice tests and score yourself or a friend
- When you start passing multiple practice exams using our HamStudy Software you'll go to the VE session with confidence knowing you're going to pass and get your first ham license or upgrade!
- Package includes a **FREE** *FCC Part 97 Rules Book* ($3.95 value) – a helpful reference for your study and ham shack

MOST IMPORTANT you get Gordo, TOO!

Stumped on questions? Need some encouragement? **Just give Gordo a call** from *10 a.m. to 4 p.m. Monday thru Friday, California time. 714-549-5000*

Don't want or need software? *SAVE!* Just buy Gordo's book. **You still get to talk with Gordo, FREE!**

Get your Gordo book+software package from your local ham radio dealer or W5YI.org

ORDER YOURS TODAY! Mention this ad and get discounted shipping and a FREE GIFT!

order on-line at w5yi.org or call 800-669-9594

Technician Class
Book + Software–
(NCS) $29.95
Book only– $20.95

General Class
Book + Software–
(GUS) $34.95
Book only– $24.95

Extra Class
Book + Software–
(ECS) $39.95
Book only– $24.95

The bhi 10-watt DSP speaker is loud!

The push-button DSP level adjustment on the bhi speaker.

Propagation, A Practical Guide for Radio Amateurs, available from CQ Communications.

"Only a couple of older, dedicated VHF and UHF rigs offer a "soft-squelch" circuit," comments Julian Frost, N3JF, a regular on the California-Hawaii every July tropo circuit. By "soft-squelch" we mean the ability to set the squelch so losing that half microvolt of noise or signal will poke through the silence without the hard squelch—"clunk." Listed here are some of those older rigs:

Kenwood TR-751/TR-851
Very old KLM/KDK VHF/UHF single banders
Yaesu FT-726R

However, there is a better way to monitor for VHF/UHF band openings—digital signal processing! All of the new rigs have exquisite DSP (digital signal processing) circuits built in, either in IF or AF. For your older rigs without internal DSP, there are excellent add-on DSP amplified speaker systems that are ideal for hushing the hiss.

Gordo needs loud DSP audio in the buggy.

Noise reduction in most DSP circuits may begin with sampling the incoming signal in the analog-to-digital converter. An adaptive speech filter is designed to extract meaningful signals from the background hiss (noise). Unwanted background noise remains relatively stable as compared to the human voice, or CW signals with ever-changing spectral variations.

It takes about two seconds for white noise to be stripped from meaningful signals, and it is the meaningful signal that is then transformed from digital back to analog and passed through to your headphones or speaker.

Typically, constant white noise may be reduced more than 10 dB and a constant heterodyne uninterrupted tone up to 75 dB—a great way to cancel out a birdie on your favorite beacon frequency.

Fourier transforms are generally considered one of the most effective ways of separating signal from recurring background noise.

With the newer equipment, with built-in IF or AF DSP noise-reduction circuits, dial in your favorite beacon frequency, squelch OFF, and then go to the menu setting for reducing the constant background hash coming over your radio's audio stage. When monitoring for a band opening, either voice or a CW beacon, aggressively hush the hash until your radio is nearly silent. As soon as a signal pokes through, get into the menu, reduce your DSP setting, and stand by for some DX!

Some VHF/UHF weak-signal operators prefer the simplicity of add-on DSP speaker modules and systems:

bhi 10-watt amplified DSP noise-eliminating speaker
West Mountain Radio 3-watt amplified DSP noise-eliminating speaker
GAP "Hear It" DSP amplified speakers
GAP "Hear It" DSP in-line and PCB modules
W4RT bhi DSP noise-elimination modules
MFJ "Brick Wall" DSP filter boxes

For just hushing the background hash on VHF and UHF, the add-on DSP speaker systems will work well. However, for qui-

West Mountain DSP speaker, with rotary DSP level adjustment, and green LED showing incoming reception of a signal.

eting power-line noise, buzzing florescent lights, fans, pumps and motors, touch lamps, and nearby noises coming out of a commercial building down the street, you may need a DSP add-on system that not only varies DSP levels, but also has adjustable DSP noise-filter parameters such as pulse length and pulse repetition rates, and DSP bandwidth settings.

I have worked with the MFJ-1026 which goes in line with your transceiver's antenna system, with secondary input from an external wire antenna, to null out interference. It works from MF up to 6 meters.

The MFJ MFJ-784b "brick wall" programmable DSP filter plugs in between your transceiver's speaker out and headphones/base speaker, and gives you full programming of five individual filters, plus a myriad of adjustable DSP settings with several band-pass filters, along with the automatic notch filter with manual override. This is the ultimate DSP device from MFJ!

From TIMEWAVE Technologies, the DSP-599zx has an LCD readout of the selectable audio DSP processing points, along with plenty of automatic filtering that goes well beyond just level setting. This is a *serious* mil-spec DSP add-on signal processor.

The TIMEWAVE ANC-4 phases out the QRN using DSP with adjustable controls for the sense antenna. The quality of this TIMEWAVE gear could be considered lab standard!

Many DSP add-on speakers tested for this article on Gordo's test bench.

Use the same procedure for setting these DSP speakers and filter assemblies in action: Tune to the frequency of the incoming expected beacon or when calling DX, advance the DSP filtering to the point the background noise nearly disappears, up your volume, and stand by for even the faintest signal blasting through. No squelch!

The DSP circuits, external or built-in, may have added capabilities for the following:

Automatic notch filters for birdies and heterodynes

Adaptive noise reduction, multiple levels

Pre-set filtering levels

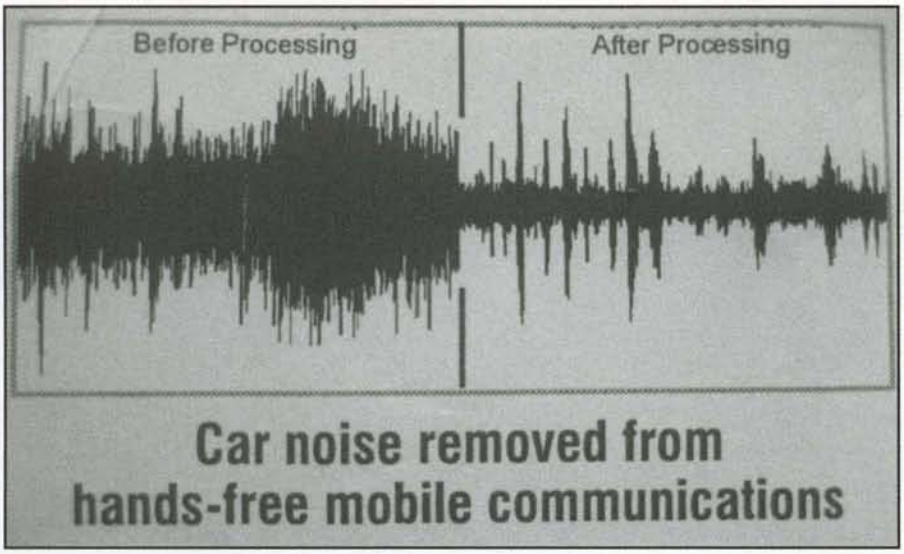
Band-pass filtering

Level input indicator LED

Provision for external base station "favorite" speaker

Built-in transmit filtering

This last item, transmit filtering, is an



This is what DSP can do mobile!

absolute necessity for any add-on DSP speaker. If your transmit RF gets into the amplified speaker's circuitry, it will drive you nuts. One advantage of the built-in DSP rig's circuitry is its *immunity* to passing a transmit signal back through the headphones or rig's speaker. However, when considering external speakers, that's a big problem that both West Mountain Radio and bhi have addressed quite well.

"Our bhi (GAP) 10-watt DSP speaker underwent exhaustive design and testing to keep transmit RF out!" comments Graham Somerville, M3ZGS, from the UK. He indicates the bhi/GAP "Hear It" DSP systems rarely pick up transmit RF, but it was a job to get transmit RF from getting into the plastic enclosures of the 2-watt and 10-watt mobile/base amplified speakers. The new desktop "Noise Away" base-station speaker with 4-inch base driver and 1-inch tweeter unit, 2.5 watts output, also underwent aggressive design techniques to mitigate transmit noise coming over the speaker system.

The amplified DSP speaker helped during a recent outside ham class at Gordo's QTH.

West Mountain Radio, now under new ownership, may have a new, redesigned amplified DSP speaker coming soon, and I've always enjoyed good success with tits original 2-watt amplified speaker with copious internal filtering.

I am a knob-twirler, so I enjoy the West Mountain Radio KNOB level adjustment control. bhi offers up to eight selectable settings, accomplished by pushing a small button with additional possibilities to memorize favorite settings. This way you don't need to cycle through all the settings to get to a couple of popular "full on" or "QSO" settings.

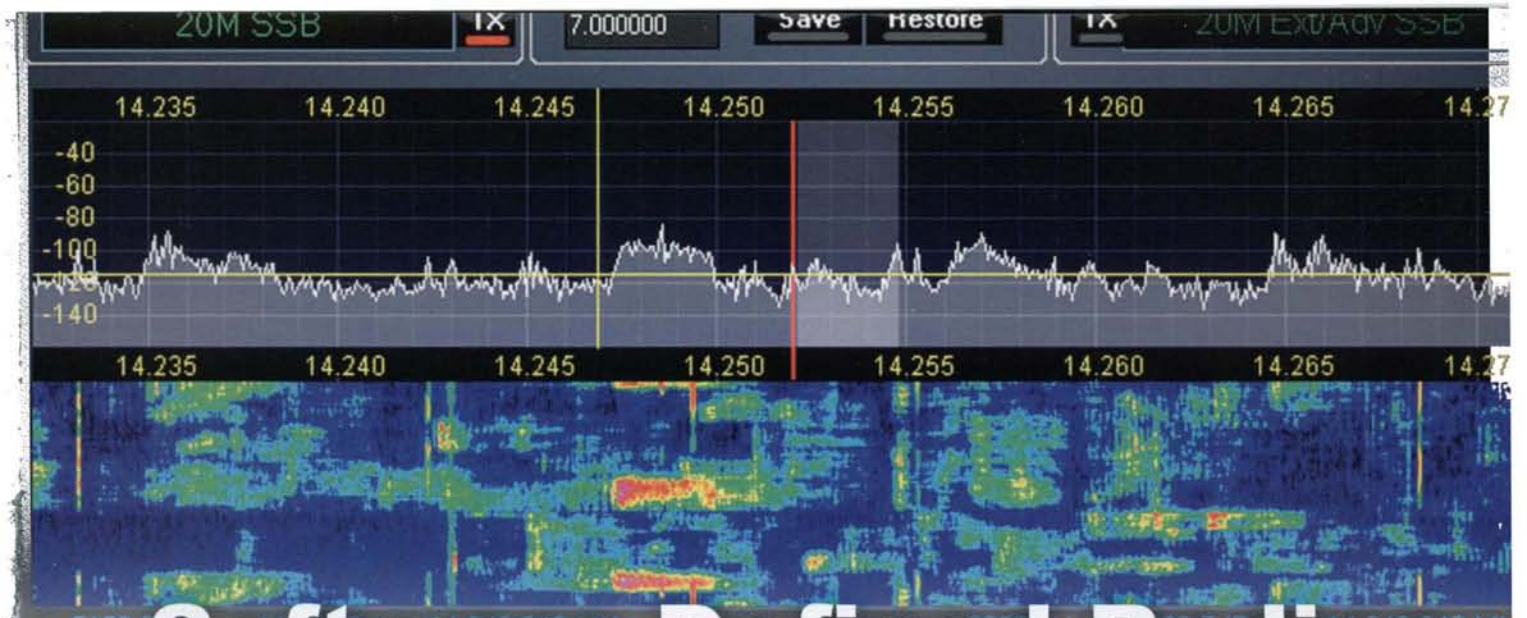
What happens when you use external DSP speakers with the rig's own built-in DSP function? No improvement that I have found over what a rig's DSP circuit can do, other than I like the ability of a simple knob or push-button to pre-set DSP levels as opposed to going into the rig's DSP memory circuit. Adding DSP on top of the rig's DSP is not suggested.

Is the exernal DSP speaker system better than the internal IF or AF? I would consider IF rig DSP as the ultimate, with a close match between rig internal AF and external AF DSP, if the rig is like my old Kenwood 950, where its DSP internal circuit is not quite equal to my external DSP amplified speaker.

For noisy environments in very noisy vehicles, the 10-watt amplified speaker from bhi can really make a difference. Just set your radio audio output to about normal one-third volume and it will drive that 10-watt speaker plenty loud enough to be heard over any type of cab noise.

Here on the West Coast we monitor for the 2500-mile distant Hawaii beacon in the summer months. With squelch OFF, DSP ON, and the beams pointed toward Hawaii, I can hear the 2500-mile beacon through the normal 2-meter and 432-MHz band noise many hours ahead of being able to make out the CW ID without DSP processing. Therefore, cut the squelch and add DSP noise canceling to increase the capability of hearing any weak signal coming in right at your noise floor. Your "better half" will sincerely appreciate your DSP monitoring over clicking squelch or incessant white-noise hash.

In addition, for mobile, DSP can help take the pop out of your Ford's ignition system!



Software Defined Radios

FLEX-5000A™
160-6m Transceiver
+2M&70CM

- 99 db Dynamic Range RX*
- 192 KHz Receiver Display
- Optional VHF/UHF Module
- Optional 2nd Receiver
- Optional Auto Tuner
- 100 Watts Output

FLEX-3000™
160-6m Transceiver

- >93 db Dynamic Range RX*
- 96 KHz Receiver Display
- Built in Auto Tuner
- 100 Watts Output
- Only 7 Pounds!

FLEX-1500
160-6m Transceiv

- >85 db Dynamic Range R
- 48 KHz Receiver Display
- Transverter Interface
- 5W PEP Output

*Two tone third order dynamic range at 2kHz spacing -as measured by ARRL Lab

Powered by FlexRadio's world renowned PowerSDR™
The industry standard for Software Defined Amateur Radi

See us at Dayton Booth SA0315

Order Now!

Tune in Excitement.™

www.flex-radio.com
sales@flex-radio.com 512-535-5266

FlexRadio Systems®
Software Defined Radios

Converting a Commercial 10-element Channel 8 Yagi to 222 MHz

With the migration of VHF television stations to digital frequencies, old TV antennas have suddenly become surplus. Ingenuity inspired K3MD to take a TV antenna and convert it to amateur radio use.

By John W. Thompson MD (ret),* BSEE, K3MD

Just for fun I decided to convert my XYL's uncle's Channel 8 Yagi to 222 MHz. This saves around $140 versus a commercial 222-MHz short-boom Yagi. The original design uses 12-inch spacing between the distal directors, which calculates out to 0.186-wavelength spacing for the original design frequency. No attempt was made to change the relative effective length of the directors. Only a correction factor of 183/222 was used. The driven element is shortened and drilled and shorted with 1.5-inch #10 sheet metal screws, as shown in photo A. The matching system is one I have used for many homebrew Yagis, which takes the design impedance of a folded dipole of 300 ohms and reduces it to 75 ohms with a 1/2-wave 4:1 balun, made of RG-59/U. The velocity factor of this coax is 0.66. The matching system is shown in photos B and C, and figure 1. The completed Yagi is shown in photo D. The design SWR is 1.5:1 for a 50-ohm feedline, be it RG-8, LMR-400, LMR-600, RG-9913, or whatever. Type N connectors are preferable at this frequency, but many hams use PL-259s.

The original boom length of the Yagi is 8 feet 6 inches, and it is very light. It was assumed that the element diameter correction factor would be about the same for the elements, which are 1/4-inch tubing. The end of the shortened and hacksaw driven element is sprayed liberally with Krylon® spray for waterproofing,

Photo A. Close-up of connecting the elements of the matching system to the driven elements with machine screws.

Photo B. Close-up of the coax connection to the folded dipole matching system.

*e-mail: <jwt105j@yahoo.com>

	Original length	Corrected length
Reflector	32.75 in.	27 in.
DE	31.5 in.	26 in.
D 1 to 4	28 in.	23 1/6 in.
D 5 to 8	27.25 in.	22.5 in.

The element spacings (factory set) are as follows:
R: DE 10 in.
DE: D1 5.5 in
D2 to D3, D3 to D4, etc.: 12 in.

Table 1. The element corrections. The correction factor is 183/222 = 0.8243.

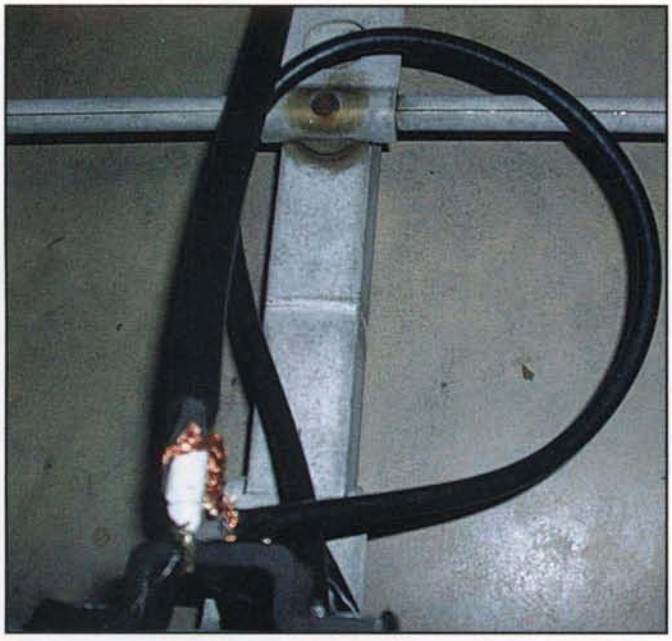


Photo C. Actual balun made from RG-59U.

Photo D. The finished product.

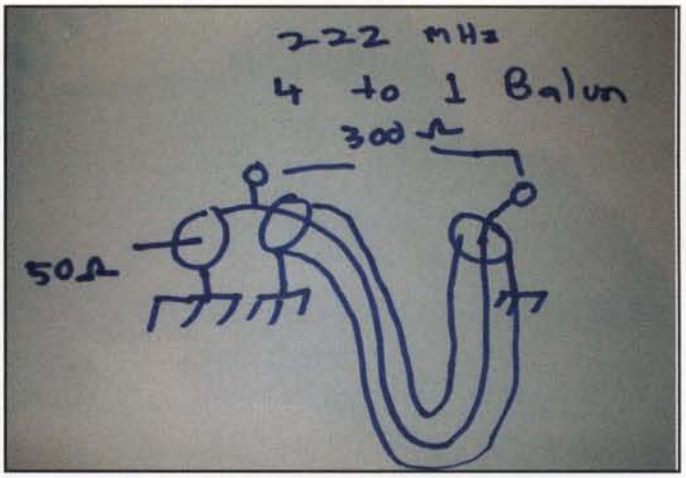


Figure 1. Schematic diagram of balun.

and all open coax ends in the balun are coated with electronics-grade silicone, available at your local electronics store. Some of the elements need to be cleaned and strengthened with tape at the fold-out element boom-to-element mounts which are popular with TV antennas.

The element corrections (done with a hacksaw, measuring tape, and Sharpie® marker) are shown in Table 1. The correction factor is 183/222 = 0.8243.

The original boom-to-mast clamp was rusted out and replaced with a 2-inch unit in my junk box, including a stainless-steel muffler clamp to strengthen it at the boom-to-mast connection.

Initial testing was done with an MFJ SWR/signal generator unit and an Oak Hills WM-2 QRP wattmeter. There is a good dip at 222/3 = 74 MHz. and, using a diode/capacitor harmonic generator there is a good dip at 111 MHz. Later testing with a Bird wattmeter and an exciter showed resonance at 223.5 MHz. I plan to take out one of the inner screws this year for lower resonant frequency.

The length of the 1/2-wavelength RG-59 4:1 balun is 16.7 inches. This is not critical, since the driven element has such a low Q, wide bandwidth, and is very forgiving.

This is not a high-performance Yagi. Spacing between the distal elements is around 0.19 wavelength on 222 MHz, which is much less than the more modern designs of up to 0.4 wavelength. Feeding with 110 feet of RG-9913, the W3CCX beacon (110 miles away) is loud and clear. Performance in two ARRL VHF contests has been fantastic, considering the total price of around $25 (given to owner of the TV antenna for permission to take it down).

This is meant as a guide to converting other used commercial TV Yagis to 2 meters, 222 MHz, and 432 MHz, which I have done before. Many log-periodic TV Yagis can be made into very good 2-meter Yagis by lessening the frequency spread of the elements, as long as the units have fairly long booms. Many UHF corner reflector arrays and collinear arrays are very easy to convert to 432 MHz.

The loudest ham I ever worked on 432 MHz when I got started on this band was running when a homebrew 16-collinear-element array—big but effective! An 8-element premade collinear array with reflector screen for TV UHF costs $30 new on the internet! This is easy to convert to 432, but stub tuning matching to a 4:1 balun may be required.

An Amplifier for 70–90 MHz

In this article N2DCH describes several options for creating a power amp for frequencies above 50 MHz from transistors that are not rated for operating above this frequency range.

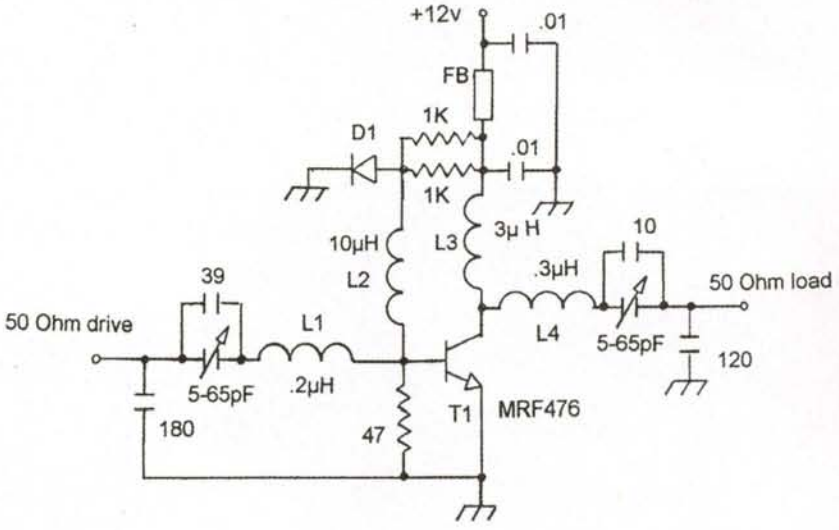
By John Pivnichny,* N2DCH

Power transistors developed for 27-MHz citizen-band radios can be operated on the amateur 50-MHz band. These transistors are generally low cost and very rugged. However, what happens if you want an amplifier at 70 MHz for the European amateur band? Furthermore, can these operate at 90 MHz to amplify a low-power FM band transmitter?

An earlier article I wrote for *Communications Quarterly* magazine[1] shows how to use the controlled-Q L Match circuit to couple power into and out of such power transistors at 50 MHz. Figure 1 shows the circuit diagram of the Black Forest Products Six Meter Amplifier Kit available from Unicorn Electronics.[2] Tuning the input and output variable capacitors for maximum power out is very smooth. The circuit also provides harmonic attenuation, because it is a low-pass structure. The power transistor, a Motorola MRF476, was designed for 27-MHz service and has a TO-220 package. It is nearly indestructible. I have yet to burn out one! The other components are listed in Table 1.

A long time ago, in 1988, Motorola published the data sheet for the MRF746 transistor which shows output up to 50 MHz with a 12-volt supply.[3] Similar Japanese power transistors are 2SC1306, 2SC1678, 2SC2075, and 2SC2078. The NTE (or ECG) 235 is also similar. All of these were tested in the Six Meter Amp kit and each will provide over 2 watts out at 50 MHz, even though their data sheets do not specify operation above 27 MHz.

Because of high-volume production made for CB service their cost is low. In addition, these transistors can often be removed from defunct CB radios for no cost at all.



L1: 0.2-µH 6 turns #22 wire on T44-10 toroid core
L2: 10-µH 14 turns #22 wire on FT37-61 toroid core
L3: 3-µH 30 turns #22 wire on T68-10 toroid core
L4: 0.3-µH 8 turns #22 wire on T44-10 toroid core
D1:Silicon diode 1N4004
FB: Ferrite bead Fair Rite #2743002122

Table 1. The other components of the Six Meter Amplifier kit.

Figure 1. Black Forest Products Six-Meter Amplifier circuit diagram.

To operate in the 70–90 MHz range, the input and output networks must be modified as follows:

Input Circuit

Reduce L1 to 4 turns #22 on the original T44-10 core.

Change the input shunt capacitor from 180 pF to 82 pF.

Remove the 39-pF fixed capacitor that is in parallel with the 5–65 pF trimmer.

Output Circuit

Reduce L4 to 6 turns #22 on the original T44-10 core.

Change the output shunt capacitor from 120 pF to 68 pF.

Remove the 10-pF fixed capacitor that is in parallel with the 5–65 pF trimmer.

However, after extensive testing, the

*3824 Pembrooke Lane, Vestal, NY 13850
e-mail: <JohnPivn@aol.com>

CB power transistor will not provide useful gain or output in this frequency range. You must use a different transistor. A good choice is the 2N3553 (also available as NTE473). This is a 28-volt device in a TO-39 can package. Although the data sheet does not specify performance at 12 volts, it works very well, producing over 2 watts out at 70–90 MHz. Power gain is over 14 dB at 70 MHz, dropping to 13 dB (a factor of 20×) at 90 MHz. For example, a 25-mW FM radio transmitter (a common level for low-power FM radio transmitters) can drive the amplifier to over 1/2 watt. One-hundred mW in produces over 2 watts out. Other possible transistors to try at lower power levels are the 2N5109, 2N4427, 2N3866, and 2SC1970. A 2SC1971 rated at 6 watts can be used for higher power output. Note that the FCC has strict limits on low-power FM radio broadcast transmissions. Make sure your signal is legal before attempting to use this or any other amplifier in the USA.

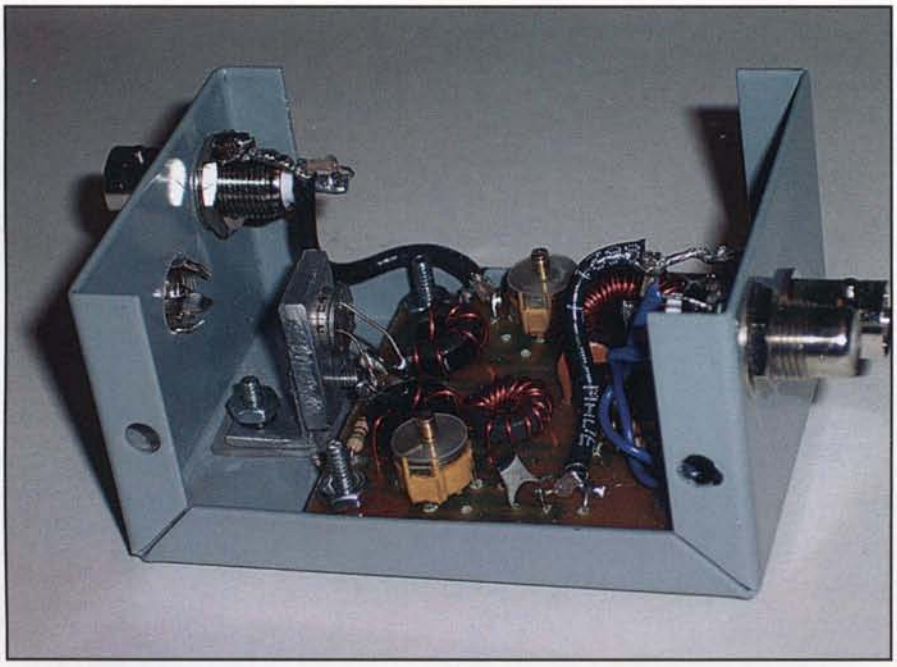


Photo A. Photograph of completed amplifier showing modified cooling.

The cooling arrangement of the Black Forest Kit has to be modified to accommodate a TO-39 transistor (see figure 2). A 1/8-inch thick aluminum slug shown in figure 3 is drilled with a 5/16-inch drill bit. A discarded heat sink of appropriate thickness can be cut down and drilled to form the slug. Other sources of aluminum material are hardware stores, home stores, and hobby stores. The hole is slowly enlarged with a tiny round file (rat-tail file) until the TO-39 can be inserted. It should be a tight fit. Note that the can as manufactured is slightly tapered outward top to bottom.

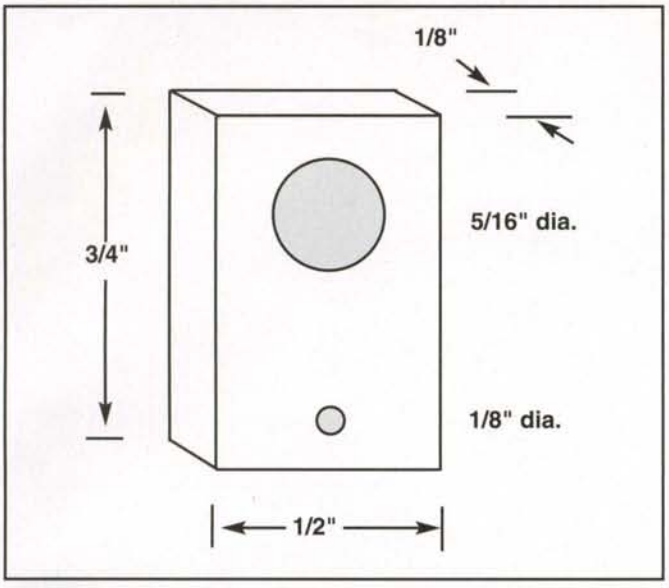


Figure 2. Aluminum cooling slug for TO-39 transistor.

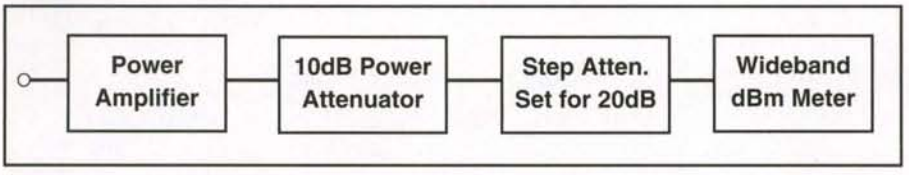


Figure 3. Measuring power output at 70–90 MHz.

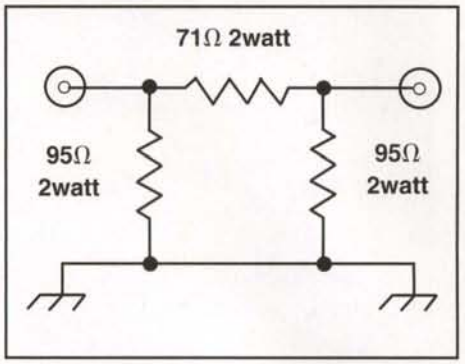


Figure 4. 10-dB power attenuator.

Otherwise the can manufacturer would not be able to get the can out of the forming die. Therefore, the deeper the can is pressed into the slug, the tighter it becomes. This slug is fastened to a $^3/_8$-inch long piece of $^1/_2$-inch × $^1/_{16}$-inch aluminum angle stock with a single 4-40 machine screw. Check the same sources mentioned above for aluminum angle stock. The angle bracket is then fastened to the case, but electrically insulated from it, using the flat insulator and shoulder washer provided with the kit for use in mounting a TO-220 package. All of this is visible in photo A.

In the photograph you can also see that the output BNC connector was moved to provide room for this cooling arrangement. The original BNC mounting hole is plugged with a $^3/_8$-inch metal hole plug, available from many hardware stores.

Output power can be measured using a dBm meter as shown in figure 3. A power attenuator, such as the one shown in figure 4, will be needed to properly terminate the amplifier at these power levels. Standard resistor values such as a 68-ohm 2-watt resistor can be used with minimal error for the series element and 91-ohm 2-watt resistors for the shunt elements. Note that a Wideband dBm Meter Kit is also available from Unicorn Electronics.

Notes

1. J. Pivnichny, N2DCH, "Transferring Power with the Controlled Q L Match and a 6 Meter Application," Communications Quarterly, Spring 1999, pp. 81–88.

2. A Six Meter Amplifier Kit #31-9930 is available for $19.95 from Unicorn Electronics, Inc., Valley Plaza Drive, Johnson City, NY 13790; phone 607-798-0260, <www.unicornelex.com>.

3.Motorola RF Device Data, vol. 1,. 1988.

Portable "Cheap Yagis"

Inspired by WA5VJB, *CQ VHF* "Antennas" columnist, author W3MEO, built this easy-to-assemble "Cheap Yagi" with the emphasis on portable use.

By Scott McCann,* W3MEO

Several years ago Kent Britain, WA5VJB, had some articles in *CQ* magazine entitled "Cheap Yagis." These antennas used wooden booms with a "J-pole" type driven element that connected directly to the coax transmission line with no matching network. I liked this idea, but needed a way to disassemble it for portable use.

This article describes modifications I made to the antenna so it will disassemble readily and the elements will pack into a 1-inch PVC-pipe case that is also the boom. The boom/case is closed on one end with a normal pipe cap and has a "T" fitting in the middle to screw onto a painter's pole that I use for a portable mast. The other end is closed with a threaded fitting to keep everything (including a small screwdriver) inside when being transported. Photo A shows the antenna in use on the mast. Photo B shows the boom/case taken down ready to transport.

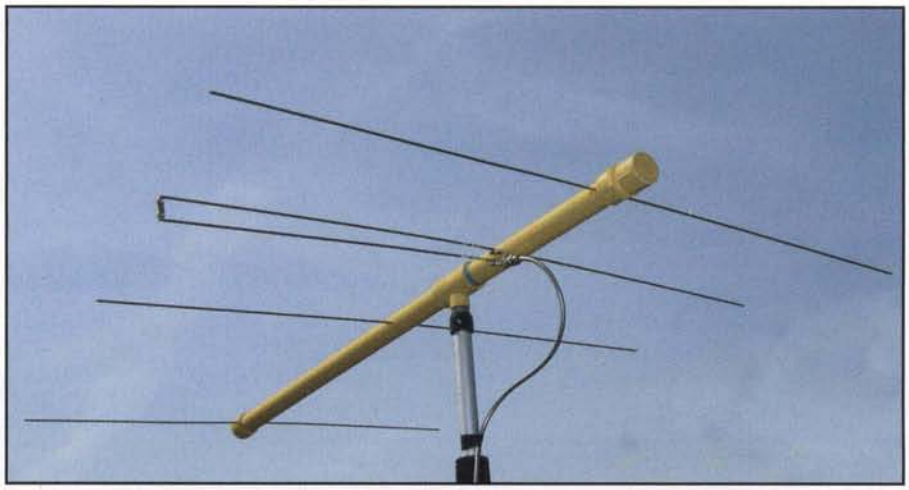


Photo A. The portable "Cheap Yagi" in use. (Photos courtesy of the author)

Photo B. Antenna packed for transport.

The elements are made from 1/8-inch brass rod. Other materials could be used, but this rod is stiff yet bendable, very easy to solder, and not too expensive. A recent check with my supplier, MSC Industrial Supply (http://www1.mscdirect.com), showed item #: 32001133—1/8" × 6' brass rod available at $3.16 each. I cut the elements (except the driven element) to length, drilled out a #6 brass nut to slide over the element, and soldered it in place as a "stop" to make sure the element is centered when inserted. Mark each element to make it easy to assemble.

The driven element is made in two pieces to facilitate disassembly. WA5VJB's loop at the end of the element is replaced by a connector of 1/4-inch brass strip (hobby shop) tapped for #6 screws. If you don't have a tap, self-tapping screws will work just as well. No. 6 brass nuts are drilled 5/32, to pass No. 6 screws, and soldered to the end of the brass rods. The No. 6 screws pass through the nuts and are tightened into the brass strip to make a take-down loop. Photo C shows the loop with one side screwed in and the other side ready to be closed. Photo D shows the two parts of the driven element with the connectors for the transmission line. Any tube with an approximately 5/32 hole for a banana plug will work. I cut the barrel of a banana jack in half and soldered the halves to the driven element parts.

Photo E shows the transmission line adapter, banana plugs connected to a BNC jack. This allows quick connection of BNC-terminated coax to the antenna, as shown in photo F. Make it small enough that it will slip into the

*160 Shields Lane, Queenstown, MD 21658
e-mail: <achess@juno.com>

boom/case. Obviously, the transmission line must be tied or taped for strain relief just as with any other antenna.

The boom is made from Schedule 40 (thick wall) 1-inch (inside diameter) PVC pipe. Some hardware stores will cut the length you need from the 10-foot "standard length," while others won't. It pays to shop. I buy what I think I will need plus a few inches extra. You will also need a plain cap for the closed end, "T" adapter (1 inch to 1/2 inch), and the adapter and threaded plug to make the open and closed end. The store clerk should be able to make sure you get the right kind of cement, too.

The center fitting is a 1-inch to 1/2- inch threaded PVC "T" adapter (photo G). This will screw onto the threads of a painter's pole with a little "technique." Heat the metal end of a painter's pole with a heat gun or similar until it "sizzles" when you touch it with a wet finger. Wearing gloves, screw the adapter onto the hot end of the painter's pole and allow everything to cool down. The PVC will deform enough to screw onto the painter's pole after you have inserted it into the boom. This step should be done before you build the boom.

Lay out the Yagi with the "T" adapter at the approximate center of weight. (I have made this antenna with vertical elements and the mast behind the reflector for VHF-FM.) Cut the pipe (a hack saw is good; a band saw is great) and assemble following the instructions on the cement can. Plan carefully, as once you make a joint with PVC cement it is permanent.

Lay out and mark the positions for the elements. Drill for the last director first, a 1/8-inch hole for the 1/8-inch rod. The 1/8-inch brass element should slide through with a tight fit. If it won't go, you can "wiggle" the drill bit just a little. If it is too

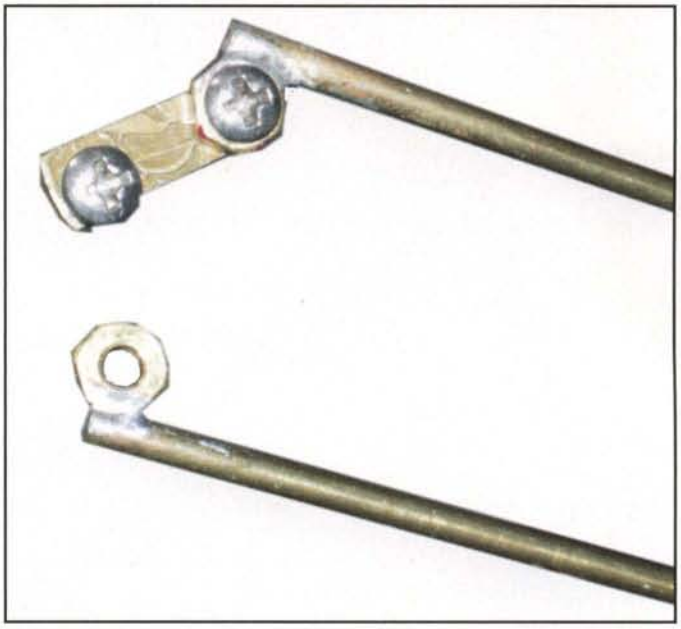


Photo C. Loop in the driven element.

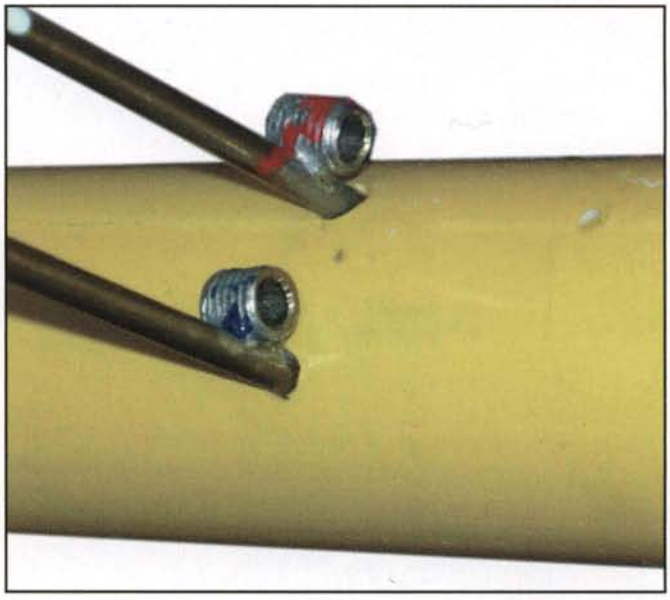


Photo D. Feedline attachment points.

Photo E. Feedline adapter.

loose, you can build up the element with solder. Push the director through the hole and use it to "sight"; align it with the bit in the drill press so the next hole will be parallel to the first. Work back from the directors to the reflector. A drill press is a great help in getting all holes and elements in the same plane.

This article has presented some ideas for converting "Cheap Yagi" antennas for portable use. For element dimensions and spacing for the 2-meter "Cheap Yagi" see Table 1, which was first printed in the "Antennas" column ("Cheap Yagis for 2 Meters") by Kent Britain, WA5VJB, *CQ*, July 2004, p. 72.

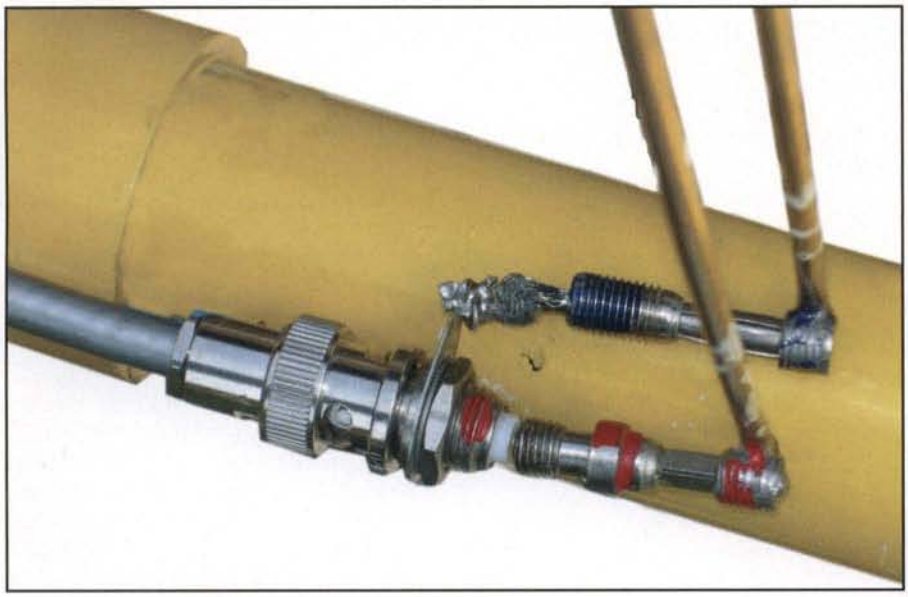


Photo F. Coax connected to antenna.

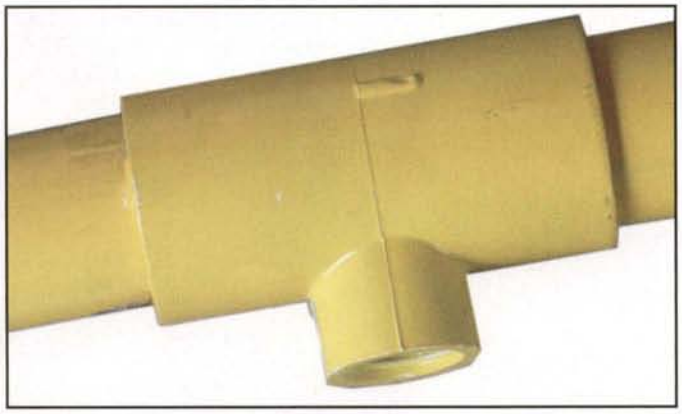


Photo G. center fitting.

Dimensions for the 2-meter "Cheap Yagi"

No. of Elements		Reflector	Driven Element	D1	D2	D3	D4
2	Length	41.5	*	—	—	—	—
	Spacing	0	—	7.5	—	—	—
3	Length	41	*	37	—	—	—
	Spacing	0	9	20.25	—	—	—
4	Length	41	*	37.5	33	—	—
	Spacing	0	9	19.5	40.5	—	—
6	Length	40.5	*	37.5	36.5	36.5	32.75
	Spacing	0	8	16.75	33.4	51.5	69.5

Table 1. Element dimensions and spacing for the 2-meter "Cheap Yagi." All dimensions are in inches. Spacings all are from zero starting at the reflector.

A Very Simple ICOM ID-1 Application

With the growing interest in D-STAR has come a growing interest in its many applications. Here NY9D describes using the ICOM ID-1 for moving large amounts of data in the digital data (DD) mode.

By Erik Westgard,* NY9D

The ICOM ID-1 in DD (digital data) mode is a powerful radio Ethernet bridge. It takes Ethernet frames and encapsulates them in FCC amateur callsigns. If you find yourself needing to move large amounts of data or access web applications over distances of yards to miles, the ID-1 is the radio of choice.

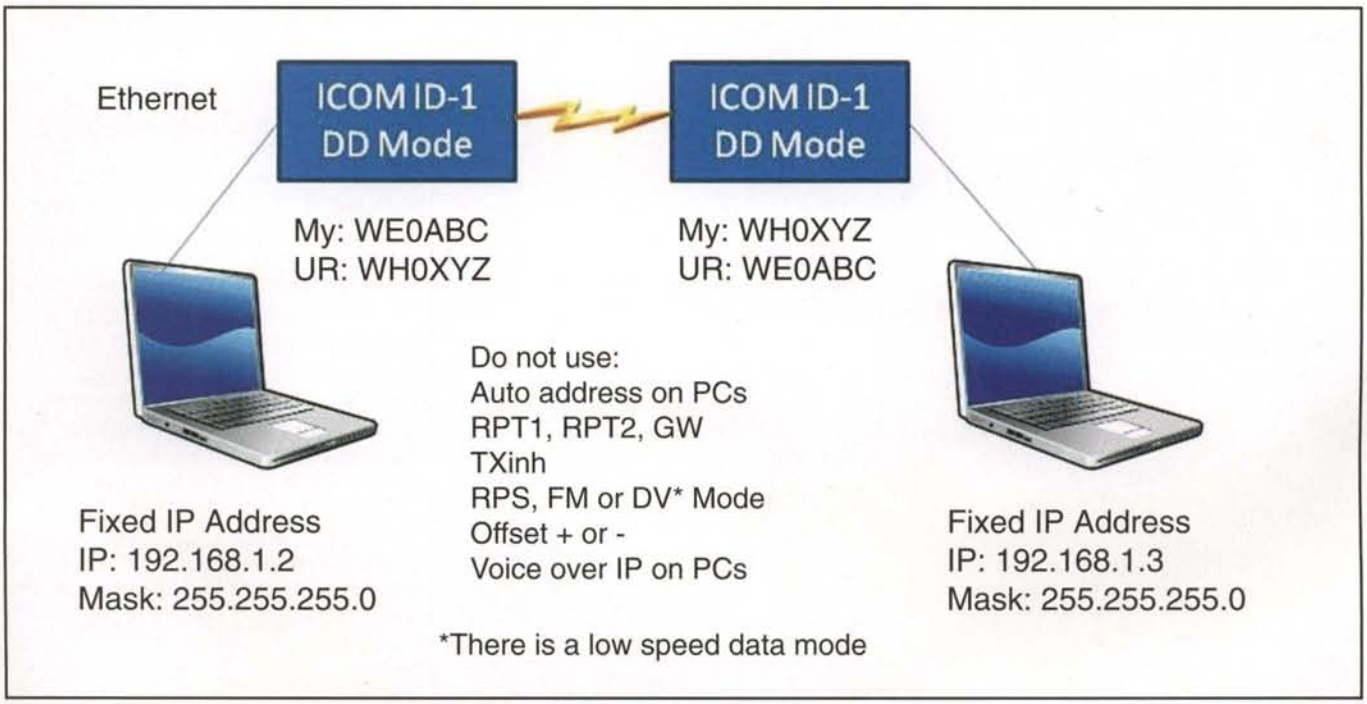
Recently, the Mining Amateur Radio Club was asked to help with scoring at a major rowing regatta located on a lake near the club station. The starting and finish lines were in the middle of the lake, and the results tent was a half mile away on shore.

*3990 Virginia Ave., Shoreview, MN 55126
e-mail: <ewestgard@att.net>

Moving pages and pages of numerical data via voice is a little tedious and there is a possibility of error. AX.25 Packet could be used as well. The Mining ARC members have a number of ID-1 radios and access to two DD-mode repeaters in the immediate area. However, a simpler solution was called for—a basic RF bridge between two laptops.

Quite a number of ID-1s are sitting on ham-shack shelves, as they are complicated to set up. While there are no external screwdriver-type adjustments, the programming is a little 1980s VCR-ish. A layered approach to solving data communications problems is always a good idea. At the lowest level you need an RF path. Some reasonable 1.2-GHz antennas are required. The radios provide around 10 watts out, so if there is a line-of-sight path, there is more than enough RF for the job.

Next, each radio requires a unique FCC callsign. In D-STAR lingo, the callsign of the owner is "Mycall." The callsign of the radio you are talking to is "Yourcall." This choice of wording was unfortunate, and endlessly confusing. Therefore, for this example we have two hams and two radios, so each radio has the owner's call as "MY" and the other radio as "UR." There are many settings and options on the ID-1. The key is to use DD mode, and not duplex and not repeater mode. All the settings for repeaters and gateways are left blank.



This is the layout of a very simple ICOM D-STAR ID-1 Ethernet bridge.

The final issue: The default mode for the radio is transmit inhibit.

The PCs in this example need to have fixed (not DHCP, dynamic host configuration protocol) IP addresses established. It is very confusing, but the ID-1 does not have an IP address, or even an Ethernet address. It is just a bridge. The average Windows® computer defaults to using a DHCP-assigned "automatic" address. While ID-1s and repeaters will pass DHCP broadcasts, let's not use them here. Go into Control Panel, and manually assign IP addresses in the same subnet and with the same mask to each PC. Do not assign the same address to both PCs. You can assign the address of the other PC as a default gateway; this seems to work without default gateways assigned as well.

If the radios and PCs are set right, the Ethernets on the PCs should come up, and the radios themselves should start chatting back and forth. The call of the other radio should pop up on your screen, and lights and up-and-down S-meters should flash. In our experience, if you are not seeing this chatting/handshake between ID-1s, you have basic RF path, radio setting, or callsign problems. You can try to ping the IP address of the other PC as a test.

We used the free application Microsoft Net Meeting on the Windows ® XP laptop computers at each end of our link. You have to shut off the microphones in Net Meeting (mute them), or the voice traffic (VoIP, Voice over Internet Protocol) back and forth will saturate the half duplex ID1-ID1 link. Most other IP-based applications should work; you have about 90 kilobits/second to work with.

If you are having trouble, check the RF path first, then the callsigns; the radios should "see" each other. The Ethernets should come up and you should be able to ping. Many problems we have seen are RF related—at this frequency PL259s, RG-58 coax, and NMO antenna mounts are not good solutions. Also start with a dedicated ID-1 Ethernet to PC Ethernet (straight-through) cable connection; all traffic visible to the ID-1 on a shared hub (or internet home router) will be sent over the air.

Erik Westgard, NY9D, lives in St Paul, MN. He is the leader of the Minnesota 145.67 Statewide Packet Network <www.14567.org>, and serves as Volunteer Chair of Medical Communications for the Medtronic Twin Cities Marathon.

By Joe Moell,* KØOV

HOMING IN

Radio Direction Finding for Fun and Public Service

Rescue in Miller Canyon and an Updated RDF Set for the 125-cm Band

Where am I and how do I get home? Imagine yourself in an unfamiliar canyon in the mountain wilderness with no map, compass, or GPS device. That was the situation for 20-year-old Jeremy Hyde, KE7ENZ, on September 18, 2010. He had just completed an overnight Boy Scout activity on Miller Peak in the Huachuca Mountains near Sierra Vista, Arizona. He started to return before the remainder of his group and inadvertently followed a wrong trail. Now he was disoriented and alone, but he had supplies and his Kenwood TH-K2AT handie-talkie with him.

It's easy to get lost in the Huachuca Mountains. According to Charles Campbell, K4AFN, "There are many trails there, including marked forest trails, old unmarked forest trails, and animal trails. There are also trails made by smugglers and undocumented aliens (called UDA trails) that follow paths intended to avoid discovery by Forest Rangers and Border Patrol agents. It may have been a UDA trail that the hiker mistook for the Huachuca Mountain Crest Trail."

Jeremy was fortunate to live in an area where ham radio operators are trained and ready to perform search-and-rescue (SAR) in situations such as this. In addition, some of them are skilled in radio direction finding (RDF). Their directional antennas, attenuators, and receivers are handy and they have practiced their skills for situations such as this.

This Mobile Command Unit played an important role in finding a lost hiker last September. It is owned by Cochise County, Arizona and operated by volunteers from Cochise County RACES/ARES under the direction of the county's Emergency Management Coordinator. (Photo courtesy Charles Campbell, K4AFN)

A Call for Help

At 1400 hours, KE7ENZ put out a call on the Cochise County Amateur Radio Association (CARA) repeater. He notified Scouting Event Frequency Coordinator Jeff Covert, KD7UOP, of his situation. He said he had followed mountain drainage that had become increasingly steep and rugged. He now was in tall trees and heavy brush with no visible trail.

Jeremy's call was monitored by Bob Hollister, N7INK, the Cochise County RACES/ARES Communications Officer, who had a brief discussion with him and immediately alerted the Sheriff's Search and Rescue (SAR) coordinator to take maximum advantage of the remaining daylight hours. RACES members activated their response network and dispatched a team to the Mobile Communications Unit (MCU). It departed for the staging area designated by the SAR coordinator (Incident Commander) as the Miller Canyon lower parking area.

In Cochise County, RACES/ARES is a suborganization under CARA. Members are proud of the MCU, which provides emergency communications on public service and amateur bands. The MCU is also a center for mapping support for the search-and-rescue teams.

*P.O. Box 2508, Fullerton, CA 92837
e-mail: <k0ov@homingin.com>

The upgraded R-300 receiver and removable FA-3 Moxon antenna from Communications Specialists. The antenna elements fold in for easy carrying and storage. (Photo by Joe Moell, KØOV)

It arrived at the staging area at 1500 and was operational in 20 minutes.

K4AFN, a co-driver of the MCU that day, continues the story: "The SAR Incident Commander fielded three ground teams. GT-1 was the first to depart and headed directly to Miller Peak. GT-2 was dispatched to Carr Canyon Recreation Area, which is the next peak to the north along the Crest Trail and an exit route from Miller Canyon. GT-3 proceeded directly up Miller Canyon from the staging area.

"We determined that the hiker was very well prepared, having just spent the night at 9400-feet elevation with his troop. He had warm clothing, water, a tent, sleeping bag, food (MREs), a couple of headlamps with fresh batteries, and fire-making equipment. He helped the SAR team determine that he was on the eastern slope of the mountain next to a fast moving stream that was very loud. The dense brush and tall trees made it very difficult to move around. He could see Sierra Vista, but he was not able to provide any landmarks that could be used to determine a bearing.

"SAR normally receives aerial support from Arizona Department of Public Safety's Ranger helicopters based out of Tucson or Phoenix. We were informed that aerial support would not be available until 2000 with an ETA of 2030 from Tucson." That made it more important for the transmitter hunters to try to pinpoint Jeremy's location with RDF.

Cooperation and Triangulation for Success

Maurice "Mitch" Mitchell, KE7WWT, is typical of the RDF team members. He wrote: "My wife and I work on SAR and that night was our date night, so we both went out together to do some direction finding. I use my ICOM IC-92AD with a handheld Arrow Yagi or a loop antenna with attenuator.[1] The Yagi is sensitive and gives reasonable accuracy, while the loop gives greater accuracy[2] of around 5 to 10 degrees, sometimes better if the signal is up long enough."

At first, the mobile RDF units were directed to locations that would provide coverage of several canyons in the southern part of the Huachuca mountains. They soon discovered that the strongest signals were coming from Miller Canyon, so they were relocated to positions where they could triangulate signals emanating from this canyon. The RDF operators sent their bearings to the MCU and to RDF Coordinator Dale Chidester, NJ7C, at his home station.

Dale and the MCU team had the same mapping software to plot Jeremy's location. "We used Terrain Navigator[3] from Maptech," he wrote. "For triangulation, I used the 'Route' function to set a waypoint anywhere and then edited the coordinates to match those of the reporting station. Then I used the mouse to set a second waypoint at the proper heading. I did that by observing the heading displayed on the bottom status line and clicking to set the second waypoint when the heading was correct. The 'Finish Route' command puts the two waypoints and connecting line on the plot. I repeated this for each location and bearing reading from the observing stations. The intersections showed a region of probable location of the RDF target."

K4AFN wrote that obtaining accurate RDF headings required considerable skill from the RDF mobile units because of the reflective canyon walls. "Pinpointing the exact location by triangulation from the valley floor was not possible. Based on the observed intersections, teams were redirected to other locations in an effort to verify the probable location. In the end, triangulation of the mobile teams' best headings located the source of Jeremy's signal within a quarter-mile of his actual location."

KE7ENZ had alkaline batteries to replace the rechargeable pack in his hand-held, but it was important to conserve them. "To activate the CARA repeater 22 miles away, he had to use medium power," Charles reported. "We had him switch to a simplex frequency, where we were able to communicate very

Front view of the R-300 receiver and optional stubby antenna with two miniature transmitters alongside. At left is the 40-mW AT-2B and at right is the 1-mW AT-1B. (Photo by KØOV)

well with his lowest power setting. We also advised him to only contact us every half-hour unless there was an emergency. We would be monitoring continuously if he had immediate concerns or needs.

"At about 1630, Jeremy was alerted to start collecting wood for a signal fire. That would produce light for the SAR ground teams to follow, as well as smoke, which in the mountains can be a very good locator. In doing that he had to move around with caution to avoid injury and to be alert for snakes that are common in the mountains.

"The helicopter and crew arrived promptly at 2030 with night-vision goggles and quickly located the signal fire. It is difficult for a moving helicopter to determine the exact location of a fixed target on the ground, but the coordinates they provided were very close. The helo was unable to land due to the steep terrain and darkness, but before departing the pilot illuminated the Jeremy's site with his searchlight. Ground Team 3, just a little way up the mountain, believed that they had a good visual fix on the location.

"Cochise County SAR has team members who are qualified for rappel and short-haul from a helicopter to aid or extract victims who are injured or in immediate peril. This night it would have been too dangerous in the tall trees. The two nearby ground teams began to reposition to Miller Canyon trail near the indicated location of the hiker. Due to darkness and the rugged terrain, this took quite some time.

"By 2300, the SAR teams were making searches into the canyon where the lost hiker was reported to be and also into an adjacent canyon to the west, using whistles and calling out. KE7ENZ reported by radio that he heard nothing from them. The nearby waterfall was probably masking their calls and whistles. When the bright moon went down around 0200, the search was paused until daylight with everyone remaining in place. The MCU crew continued to monitor all of the tactical public-service and ham frequencies throughout the night.

"Dawn came at about 0530 and the rescuers were up by 0600. Our hiker must have had a comfortable night, because we were not able to contact him until after 0700. By 0715 the teams were both on the move and working their way up the mountain. The lost hiker reported hearing whistles and shouts from the team. He responded and within 20 minutes a ground team member reported finding him."

Congratulations to everyone in Cochise County RACES/ARES for an excellent example of teamwork and ham radio support to search-and-rescue. According to Jeremy's father James, KD7ZSL, who was a member of the RDF team, "From my perspective, all personnel involved performed flawlessly. The family is grateful to each and every one of them."

In addition to the participants identified above, the MCU crew included Jim Lewis, WBØVYH, and Ken Allen, KF7IYQ. Other RDF team members were Mike Bales, KC7GTY, and Wendell Carter, AB4LE. Supporting the effort from their home base stations were Barbara Heck, KD7YOZ; Pat Thies, KD7HAB; and Ev Wittig, WB7VNF.

Thanks to K4AFN for being the first to tell me about this rescue, providing his summary report, and contacting the participants to get their permissions to be included in this column.

KD7ZSL provided some interesting details about the Scout activity, which is called "Operation On Target." Scout groups go to mountain peaks within line-of-sight of each other. Using large signaling mirrors, they relay messages in Morse Code from peak to peak. Two goals are to establish a signal link from the Mexican border to the Canadian border and to make a link from the Pacific Ocean to at least the continental divide. Scouts with ham licenses are important for coordinating the event and confirming the heliograph contacts.[4]

New RDF Receiver for 222–225 MHz

Transmitter hunting for sport isn't common on the 125-cm band. The monthly mobile hunts on 223.5 MHz simplex in southern California stopped over a decade ago. However, this frequency range is excellent for radio tracking on foot. Effective antennas can be compact and it isn't difficult to find a clear frequency. It's ideal for the recovery beacons for hams who fly model rockets. A 125-cm locator transmitter won't interfere with control links for R/C aircraft.

Three years ago, Communications Specialists of Orange, California[5] began marketing a complete tracking system for model planes and rockets. Two transmitter models are available, each sending 40-millisecond "dits" at about one-second intervals to give long battery life. A callsign can be programmed into the transmitters to be sent in CW at 10-minute intervals. The AT-1B weighs only 12 grams and puts out 1 milliwatt peak. The 28-gram AT-2B runs 40 mW peak and will stay on for almost five days with a single CR2032 lithium coin-cell battery.

Here in southern California, every 125-cm repeater pair is assigned and there is plenty of other on-air activity. No open space exists for a block of channels dedicated to low-power transmitter hunting. However, unmodulated dits fit nicely between repeaters, which are 20 kHz apart here. ComSpec has identified 128 RDF frequencies between the coordinated repeater/simplex channels. The lowest of the group is 222.07 MHz, which avoids QRM to weak-signal, EME (Earth-Moon-Earth), and propagation beacon operators.

ComSpec designed its R-300 receiver and FA-3 antenna especially for RDF with the AT-1B and AT-2B. Powered by a 9-volt battery, the R-300 covers the entire band in 10-kHz steps with a fine-tuning control. It has a MOSFET front end for high sensitivity and an eight-pole SSB-type filter at the first IF frequency. This nearly eliminates adjacent channel interference from NBFM signals. The two-element Moxon beam has thick and wide elements to widen its frequency range. It folds up for carrying and storage.

An improved version of this assembly has just been released. The receiver is smaller by about a third with a DC input jack and optional cigarette-lighter cable. A blue LED illuminates the meter for RDF at night. The antenna has a slide-off mount with a quick release so it can be separated from the receiver.

Best of all, the new receiver is even more sensitive than the original R-300. In my tests,[6] the original set would track the AT-1B out to 1.2 miles range when I added a "tiger-tail" counterpoise to the little transmitter. The AT-2B gave up to 4.5 miles of range. My tests were in metropolitan Orange County, where there is plenty of ambient QRN. Range for tracking model aircraft and rockets in the electrically-quiet desert should be greater.

Besides recovery of models, I have found that ComSpec's 125-cm tracking system is ideal for demonstrating and teaching RDF to youth. I have used it at local Scout-O-Rama and Jamboree on-the-air events with great success. The transmitters are easy to conceal in bushes and trees. The hand-grip on the receiver/antenna set makes it easy for Scouts to carry in the proper position, although it's just a bit too heavy for the youngest ones.

Foxhunting Weekend is Here

It's time again for the annual CQ World-Wide Foxhunting Weekend, a chance for clubs around the country and the world to learn hidden transmitter hunting and for experienced foxhunters to try something new. This year's Foxhunting Weekend is May 14–15. Read about it and see what kinds of hunts your fellow hams put on last year in the April and May issues of *CQ* magazine. I look forward to receiving your reports of Foxhunting Weekend 2011 activities.

73, Joe, KØOV

Notes

1. <http://www.arrowantenna.info>
2. Sharp bearings with a loop are obtained by turning for signal nulls, which will be "filled in" and not usable if there are significant signal reflections. The Arrow loop is bidirectional, so the Yagi is also important to determine which of the 180-degree-apart nulls is the correct one.
3. <http://www.maptech.com>
4. <http://www.ontargetbsa.org>
5. <http://www.com-spec.com>
6. Detailed in "Homing In" for *CQ VHF* Spring 2008

USA & IARU-R2 Championships Coming in September

Registration is now open for the 2011 USA Championships of Amateur Radio Direction Finding (ARDF). Fans of on-foot transmitter hunting under international rules will take to the forested mountains near Albuquerque, New Mexico on the weekend of September 16–18. USA's national championships will be combined with the championships of International Amateur Radio Union (IARU) Region 2 (North and South America.)

A half-day "model event" equipment testing session will take place on Friday, the first day. That will be followed by a weekend of competitions, Saturday on 2 meters and Sunday on 80 meters. Medals will be awarded after each event.

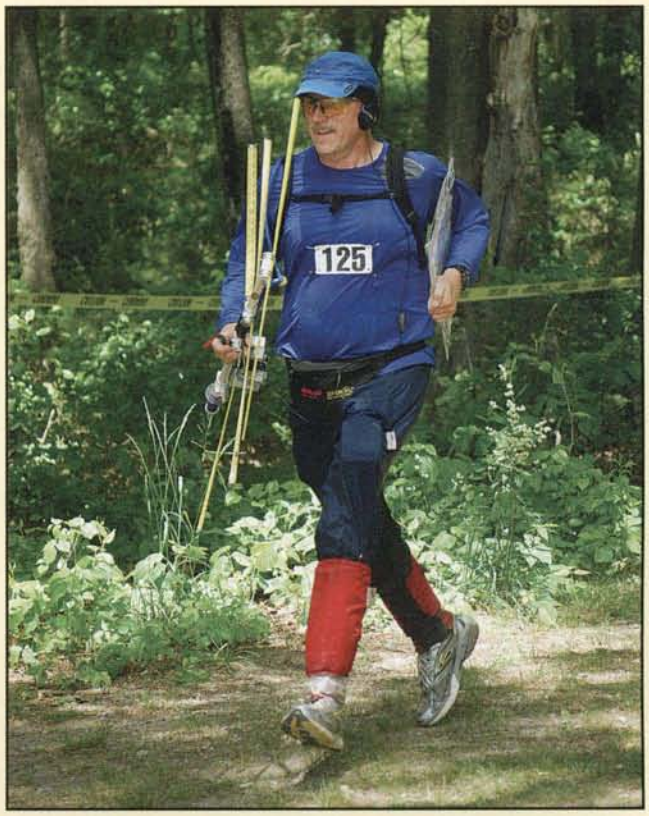
Sponsoring this year's championships are the Albuquerque Amateur Radio Club and New Mexico Orienteers. Co-chairs of the organizers are Jerry Boyd, WB8WFK, and Mike Pendley, K5ATM. Each has won medals at previous USA championships. Jerry competed in the ARDF World Championships in 2004, 2006, and 2010.

Albuquerque hosted the USA Championships in 2001 and 2005. Both events were rousing successes and there's no doubt that the 2011 championships will be equally exciting. The mountains around Albuquerque have a large number of suitable forested regions, so these transmitter hunts will be in well-mapped locations that have not been used in the past for championship radio-orienteering.

USA's ARDF Championships are open to anyone of any age who can safely navigate in the woods with hand-held radio gear for several kilometers. An Amateur Radio license is not a requirement. Participants will be divided into 11 age/gender categories as defined by IARU. Don't worry if you are inexperienced at radio-orienteering, as this is a chance to learn from experts.

International rules and techniques for radio-orienteering have been well covered in previous "Homing In" columns. Read about last year's championships in the Summer 2010 issue of *CQ VHF*. See my "Homing In" website for more about this growing sport. There is also a link to the event site for registration forms plus information on housing and the optional training camp before the championships.

Joe Moell, KØOV
ARRL ARDF Coordinator



Jerry Boyd, WB8WFK is a co-chair of the organizers for this year's USA and IARU Region 2 ARDF Championships in Albuquerque. He has competed at the ARDF World Championships three times. In this photo he is nearing the finish line and a silver medal at the 2009 USA ARDF Championships near Boston. (Photo by KØOV)

By Bob Witte,* KØNR

FM

FM/Repeaters—Inside Amateur Radio's "Utility" Mode

Land Mobile Radio Technology

Land mobile radio (LMR) equipment plays a significant role in amateur radio FM and repeater operation. In early March, I had the opportunity to attend the major trade event for the LMR industry—IWCE (International Wireless Communications Expo), photo 1—so it seems like a good time to take a look at the land mobile radio industry from a ham radio perspective.

Amateur Land Mobile

While amateur radio repeater users tend to shy away from LMR equipment, the FM repeater you use is very likely to be a commercial repeater designed for the LMR market. There are few, if any, repeaters designed specifically for the amateur market. The commercial gear from vendors such as Motorola, GE, Kenwood, ICOM, and others is solidly built and can be deployed on the ham bands without too much trouble. In particular, used commercial equipment can often find a second life in the Amateur Radio Service after being pulled from LMR service. Photo 2 shows a typical ham repeater rack using a GE MASTR II repeater.

Some radio hams also adopt LMR gear as their user radios (either portable or mobile). However, LMR equipment is set up for channelized use and usually is not easily programmed from the front panel of the radio. In the LMR world, the practice is to set up the desired frequencies and modes as channels that the non-technical user selects. Hams like to have a VFO mode that lets them tune around the band at will. Commercial LMR equipment tends to be more expensive, as well. For both of these reasons, many radio amateurs buy equipment made specifically for the amateur market. However, from time to time you will see LMR portables or mobiles being used for amateur radio.

Many of the LMR manufacturers exhibiting at IWCE are familiar to the ham community. Motorola, Kenwood, ICOM, Vertex Standard (Yaesu), and Alinco all had booths at the show. Interestingly, ICOM had a display of D-STAR equipment at this land mobile show, but it was clearly targeted at the Amateur Radio Service, with an emergency communications emphasis.

Most LMR equipment in use today still employs good old analog FM, the same modulation type that dominates VHF/UHF operation on the ham bands. There is a strong movement toward deploying digital systems, driven by two main forces: (1) the FCC mandate of narrowbanding and (2) the need for interoperability. With the goal of improving spectrum usage, the FCC is requiring all Part 90 licensees (public safety and industrial/business) above 150 MHz on 25-kHz channels to move to 12.5-kHz channels by January 1, 2013. Part 90 users can meet this requirement by adopting analog equipment operating at the narrower bandwidth, but many agencies are taking this as an opportunity to switch to digital at the same time.

Even before the narrowband requirement takes effect, many public safety organizations (police, fire, emergency management) are moving to digital systems such as APCO Project 25 (also known as "P25"),which provide for easier sharing of frequencies and interoperability between agencies. There are also

*21060 Capella Drive, Monument, CO 80132
e-mail: <bob@k0nr.com>

Photo 1. The entrance to the IWCE show floor at the Las Vegas Convention Center.

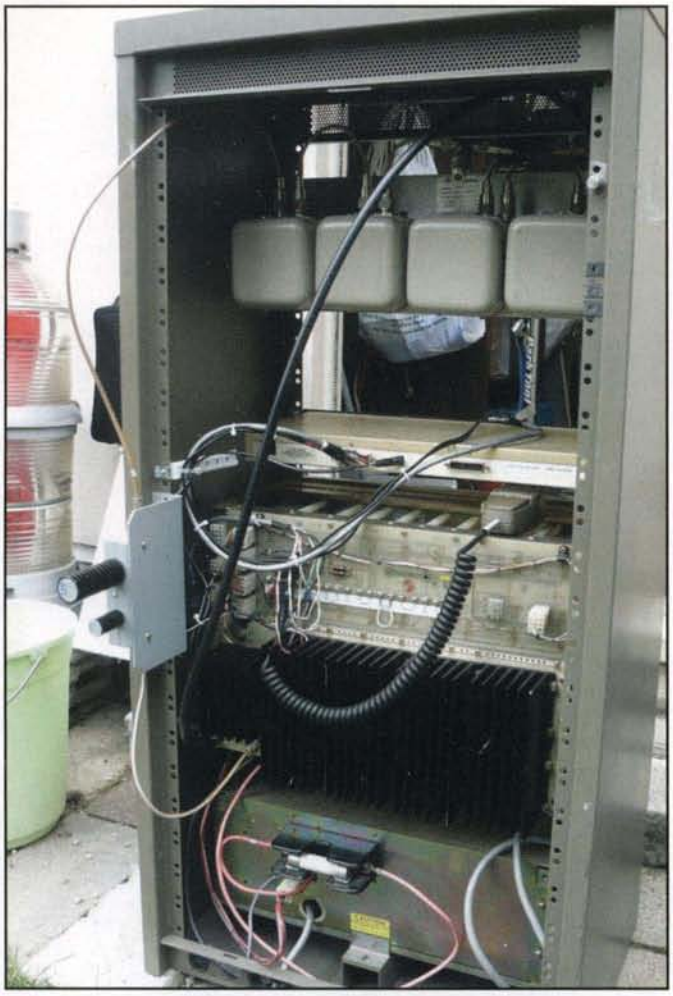


Photo 2. The Rocky Mountain Ham Radio 449.625-MHz repeater uses a GE MASTR II repeater. (Photo courtesy of rmham.org)

amateur radio repeaters using P25, another example of adopting commercial technology on the ham bands.

Another new LMR technology is the Digital Mobile Radio (DMR) standard, which is marketed by Motorola as MOTOTRBO™. This is a digital radio system targeted at the business/industrial user and is also finding its way into the Amateur Radio Service (see sidebar).

Public Safety

One of the purposes of the Amateur Radio Service is public service and emergency communications. This is normally part of pursuing the hobby and not a full-time avocation. We prepare for an event in which our radio communication skills can be used for the public good. This is in contrast to public safety communications where public service is an everyday event.

At IWCE, a major topic was the convergence of voice and data in public safety radio. As one speaker stated, "In public safety communications, voice is king." That is, the most important radio communication is when a first responder presses the push-to-talk button to get instant, reliable contact with the dispatcher or other first responders (photo 3). With lives at stake, it is clear that the public safety agencies don't compromise on basic voice communications.

MOTOTRBO™ and Ham Radio

The ARRL just filed a *Petition for Rule Making* with the FCC concerning a specific modulation format called TDMA (Time Division Multiple Access). This issue has surfaced recently and has been the subject of debate in the community of repeater owners and trustees. The land mobile industry has developed a very efficient and cost-effective digital standard called DMR (Digital Mobile Radio). Motorola markets this technology under the name MOTOTRBO™. As often happens, some radio amateurs deployed this new Part 90 radio technology on the ham bands. Along the way, someone looked carefully at the emission designator that Motorola was using for MOTOTRBO and questioned whether it was allowed under Part 97 of the FCC rules. Motorola literature indicates that the emission designator for this system is 7K60FXE (voice and data mode) and 7K60FXD (data-only mode). The "7K60" portion of the designator indicates that the bandwidth of the signal is 7.60 kHz, followed by the "F," which indicates frequency modulation. So far, no problem. The next letter, "X," indicates a category of modulation that is "cases not otherwise covered," or simply put, it means "other." Unfortunately, Part 97 of the FCC Rules does not include "X" as an allowable emission type. (The last letter D or E indicates Data or Telephony, respectively.)

The ARRL is requesting a tightly focused rule change which will remove this restriction from Part 97. The ARRL also asked for an immediate *temporary waiver* from the FCC to allow for DMR operation while the rulemaking proceeds—another good move. I expect that the waiver will be granted quickly, perhaps before this article is in print. The actual rule change will probably take a little longer.

It is unfortunate that the FCC amateur rules were written in a way that apparently disallowed the use of the latest land mobile radio technology. This is exactly what we don't want to have happen in the Amateur Radio Service, as it should be a place for easy adoption of new technology. Future FCC rule making should keep this in mind, always erring on the side of flexibility. —*KØNR*

While voice is king, access to data is becoming more important for public safety. Data capability is attractive in many ways: Imagine a firefighter having instant access to highway maps, satellite photos, and structural diagrams of buildings; or consider a law-enforcement officer accessing photos of a suspect on his two-way radio or being able to view videos of a crime in progress. Some of these applications are being over-hyped, but having a broadband data connection would open up new and useful capabilities.

Another noticeable trend at IWCE was the availability of multiband radios. This may seem odd to radio amateurs since we are used to VHF/UHF gear that covers two or more bands. Historically, the LMR industry has been a single-band game, as any one agency typically was licensed for a few channels all on the same band. Accordingly, most LMR was designed for one band. Now the manufacturers are offering multiband radios as LMR users need to span multiple systems. One example is my local fire district: Years ago it ran VHF radios on 154 MHz, but now deploys VHF radios for its own channels and 800-MHz radios for the county-wide P25 system. Currently, the fire trucks and ambulances carry both VHF radios and 800-MHz radios. Having all of this capability in one radio reduces the number of radios required and simplifies the overall system.

The Network

Another clear trend in LMR communications is the rise in importance of Internet Protocol (IP) based networks as a key part of these wireless communication systems. A typical sce-

Photo 3. The Motorola APX™ 6000 portable radio for public safety use. (Photo courtesy of Motorola)

Photo 4. Touchscreen user interfaces and smartphone features are starting to influence the direction of LMR systems. (iPhone photo courtesy of Apple)

LTE, or Long Term Evolution

The LTE standard is a fourth generation (4G) standard developed for the mobile wireless industry. The intent is to have one worldwide standard that all mobile wireless providers can adopt over time. LTE is slated to make its way into public safety radio due to the recent decision by the FCC to require LTE as the air interface for all 700-MHz public safety mobile broadband networks.

LTE provides for an uplink speed of up to 50 megabits per second (Mbps) and a downlink speed of up to 100 Mbps. This is a broadband system that can be scaled from 1.25 MHz to 20 MHz in terms of spectrum usage. The Block D spectrum assigned to public safety broadband offers 10 MHz of bandwidth in two sections: 758–763 MHz and 788–793 MHz. (Compare this to the 2-meter ham band, which is 4 MHz wide.)

LTE uses a very robust modulation format called Orthogonal Frequency Division Multiplexing (OFDM) for the downlink. In the uplink, data is mapped onto a signal constellation that can be QPSK (Quadrature Phase-Shift Keying), 16-QAM (16-level Quadrature Amplitude Modulation), or 64-QAM (64-level Quadrature Amplitude Modulation) depending on channel quality.

LTE can employ multiple antennas to improve overall channel throughput. This is referred to as a MIMO (Multiple Input Multiple Output) system where multiple transmit and receive systems *on the same channel* are combined to increase the bandwidth.

LTE is a very complex wireless communications format that delivers high data bandwidth to mobile users. It is just now being deployed in North America by Verizon Wireless. —*KØNR*

nario uses backhaul connections between radio sites that are IP-based, while the *air interface* is an LMR radio format such as analog FM, P25, or DMR. This convergence of radio frequency standards and networking standards has been in progress for some time now, but it was interesting to see that it still has plenty of challenges. One school of thought is that you can't trust the IP network for instantaneous, reliable PTT communications, while other people argue that IP performance will continue to improve and eventually LMR will run completely on IP-based systems. I suspect that the reality is somewhere in between.

An obvious comparison with amateur radio is the use of the internet to augment our Part 97 wireless communications. EchoLink, IRLP (Internet Repeater Linking Project), APRS (Automatic Packet Reporting System), and D-STAR are communication systems that blend amateur radio with the internet. These systems use the internet to expand the capabilities of the ham world, but we often hear comments about the internet not being reliable, especially during an emergency.

LTE (Long Term Evolution)

While amateur radio is influenced by land mobile radio, the LMR industry is now being influenced by technology developments in the wireless mobile industry. The FCC recently announced that the frequency range known as Block D (two sections: 758–763 MHz and 788–793 MHz), dedicated to public safety broadband use, will use the Long Term Evolution air interface standard. LTE is the dominant 4G mobile phone standard, just starting to be deployed (see sidebar). The intent is to have this frequency band available nationwide for public safety use, with all agencies using the same LTE format. The conference had several sessions that discussed the challenges of getting this system funded and actually making it work.

Since Block D will use LTE, it opens up the potential for public safety networks that also use commercial networks (e.g., Verizon Wireless) for extended coverage. These hybrid systems provide tight control over the primary network while leveraging the infrastructure investments from commercial providers—that is, a public safety agency might operate its own LTE broadband system that covers its primary service area but could take advantage of a mobile phone LTE system for extended coverage and redundancy.

Consumer Electronics

Some of the conference sessions addressed the issue of how expectations from their radio users are being driven by consumer devices such as smartphones (photo 4). A simple example is that a firefighter might wonder why he can't get department text pages on his phone instead of on that "old-school" pager? Similarly, a police chief can already use his smartphone to listen in to the dispatch channel via an online scanner, so why isn't that service provided by his radio department? Smartphones have SMS text messaging, e-mail, and GPS/location services, so why can't the agency's radios do this, too?

As more capability is loaded into a two-way radio, we'll probably need to reconsider how many buttons we can cram into the radio. The smartphone gives us a path there, too, with touchscreen user interfaces becoming well accepted. Of course, there are major differences between what a teenage consumer wants in a smartphone and what a first responder needs in a radio. Most consumer electronics won't last very long in a public safety environment, and then there's that need for "instant, reliable push-to-talk."

While we are on the topic, I have to ask, "Where are the amateur radio manufacturers with regard to this kind of innovation?" Why doesn't my handheld ham transceiver have a touch interface, network connection, text messaging, and the ability to download and run applications? This could open up a new wave of software-driven innovation in the ham radio community.

Tnx and 73

This column drifted away from the usual focus on amateur radio, but I think you'll agree that the land mobile radio industry has a lot in common with "amateur land mobile." Thanks for taking the time to read another one of my columns on the "Utility Mode." I always enjoy hearing from readers, so stop by my blog at <http://www.k0nr.com/blog>, or drop me an e-mail at the address on the first page of this column. 73, Bob KØNR

References

"FCC Part 90 Narrowband Compliance," Vertex Standard, <http://www.vertexstandard.com/lmr/resources/narrowband/Vertex_FCC_FS_0710_Final.pdf>

Digital Mobile Radio Association: <http://dmrassociation.org>

"Overview of the 3GPP Long Term Evolution Physical Layer," Jim Zyren, Freescale Semiconductor, <http://www.freescale.com/files/wireless_comm/doc/white_paper/3GPPEVOLUTIONWP.pdf>

MOTOTRBO website: <http://mototrbo.motorola.com/>

New Product: Sierra Radio Systems HamStack Microcontroller Project Platform

The power and flexibility of microcontrollers can be applied to many ham radio projects. They are used to build keyers, remotely controlled stations, repeater controllers, solar-power controllers, remote antennas switches, antenna tuners, fan controllers, and much more. The HamStack is simple enough to help radio amateurs learn to design with and program with microcontrollers and yet powerful enough to build serious projects.

The hardware platform is based on the popular Microchip 18F family of microcontrollers. Multiple boards can easily be stacked to create a complete project module. The standard CPU runs up to 40 MHz and includes 64 kb of program flash memory, 4k of RAM ,and 1k of EEPROM memory. The 30 IO pins include digital inputs and outputs, A/D inputs, PWM outputs, SPI, I2C, and RS-232 serial communications. Extra solder pads are provided to easily embed the HamStack into your own project.

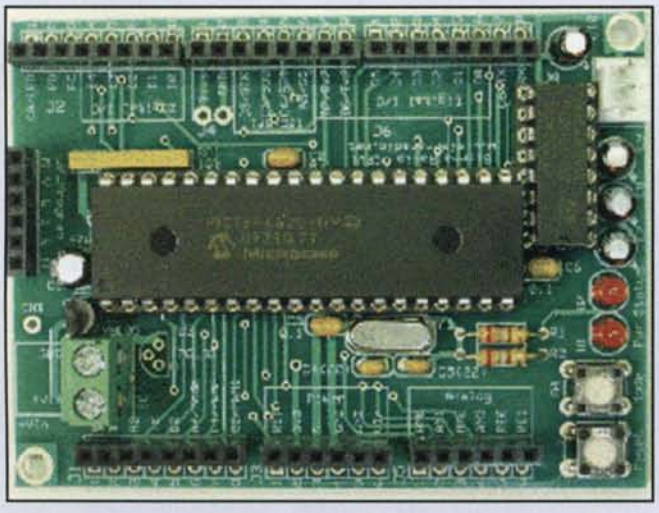
Additional boards include a dual 8A power relay board, LCD display, 2.4-GHz RF module, temperature sensor, DTMF decoder, tone generator, etc.

The HamStack comes with the powerful Swordfish Basic compiler and is also fully compatible with the Microchip C18 C language compiler MPLAB IDE and assembler.

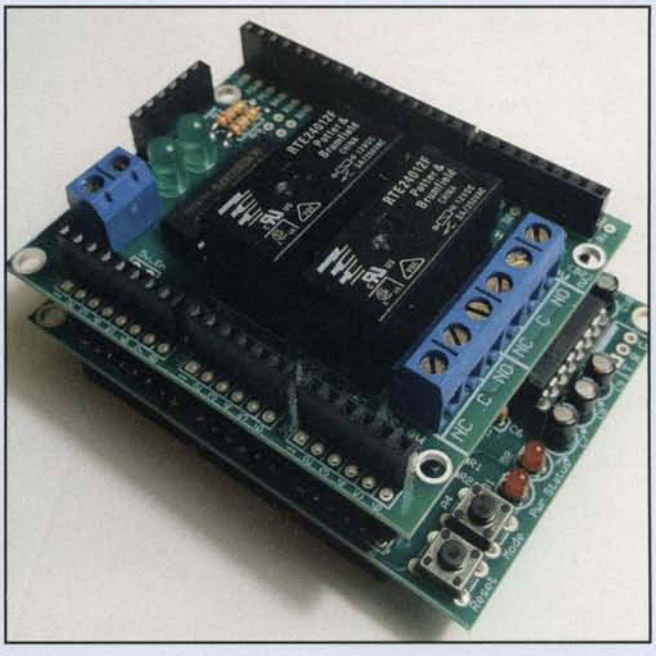
The HamStack Starter Pack includes everything you need to design your first project. The pack includes the CPU board kit, prototype board kit with solderless breadboard, in-circuit programmer, power adapter, 93-page "getting started" guide book, and software CD with the Swordfish Basic compiler and ham radio project examples.

Sierra Radio designs and manufacturers high-performance repeater control systems and microcontroller project kits. For more information, visit the website at <http://www.hamstack.com>.

Sierra Radio is a proud sponsor of the SolderSmoke pod cast and will be at the Dayton Hamvention® in booth number 406. Please stop by and say that you saw this press release in *CQ VHF* magazine.



The HamStack CPU board.



Relay board stacked on a CPU board.

By Bill Brown,* WB8ELK

UP IN THE AIR

New Heights for Amateur Radio

High-Altitude Photography

With the latest advances in lightweight, high-resolution digital still and video cameras, it's now possible to take amazing photos from a high-altitude balloon that rival photos taken by astronauts in space. When I sent my first film camera up into the stratosphere in 1987, my only option was a 35-mm pocket film camera. The fellow who developed my film at the photo shop asked me, "How'd you take these photos? Are you an astronaut?"

Here are a few cameras that have been flown successfully on NearSpace balloon missions. This list is not exclusive, as there have been a number of other brands and models that have been flown successfully. I've chosen a few of the ones that are easy to configure and have features that make them ideal for balloon missions.

GoPro Hero HD

Seemingly designed for high-altitude balloon flight, this compact, high-definition video camera is offered for the extreme sports enthusiast. A waterproof housing and a variety of mounts for helmet cams, surf boards, racing cars, and the like is available. However, for a NearSpace payload it appears to be best to just expose the camera lens to the outside and keep the rest of the camera body warm inside a Styrofoam™ payload box.

It's a very lightweight and small camera that records video in 1080p HD and provides an option to take continuous high-quality 5-megapixel photos at a variety of timed intervals. It has a built-in lithium rechargeable battery as well as a backpack battery module to add more life. I like the way the optional extra battery pack and the optional LCD display stack and snap onto the back of the camera. Since weight and battery life are a major concern, it's great not to have to fly the extra weight of the LCD display or have it drawing current when it's not needed during flight. You do have to buy an SDHC memory card for it but this does give you the option to record for several hours instead of the one- to two-hour limit imposed by other handheld camcorders on the market.

The photos and videos are wide-angle and give you a fisheye effect that enhances the effect of the curve of the Earth as seen from a stratospheric perch. More information can be found at: <http:// gopro.com>. Photo 1 shows an image captured by Bill Richardson, N5VEI's HeroHD camera during the recent KC5NXD Titans In Space flight by Olde Towne Middle School in Gluckstadt, Mississippi.

Flip Ultra

I've been using the Flip Ultra and Flip Ultra HD pocket camcorders quite successfully for a few years now (www.theflip.com). I like the fact that you can use lithium AA batteries instead of the rechargeable pack that is provided, which gives you more than enough battery life for a typical two-hour balloon flight. The main drawback is the two-hour limit on

Photo 1. Stratospheric view of a thunderstorm taken by a GoPro Hero HD camera on the Olde Towne Middle School's Titans In Space balloon. (Courtesy of Bill Richardson, N5VEI)

*12536 T 77, Findlay, OH 45840
e-mail: <wb8elk@aol.com>

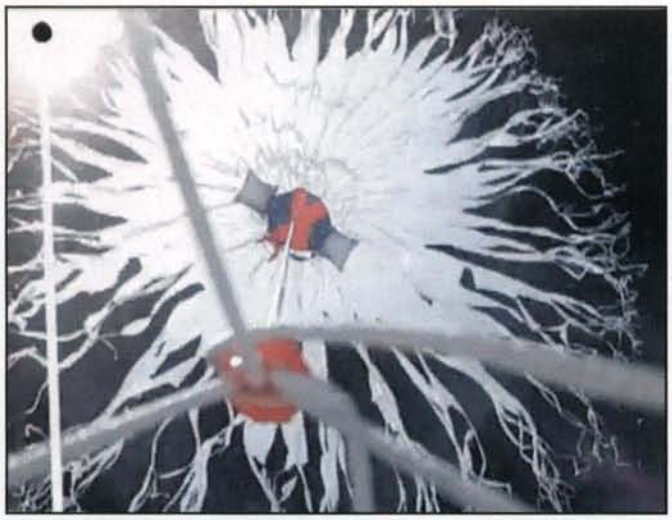


Photo 2. Still-frame of Flip Ultra footage of a balloon bursting at 95,000 feet. (Courtesy of SpacePortIndiana.com)

Photo 3. The Canon PowerShot A560 can easily be configured for high-altitude flight with the CHDK script.

recording time, which often doesn't give you enough time to record the landing phase of a balloon mission.

It is very easy to set up. All you do is turn on the camera and hit the big red button to start recording. The memory is embedded in the camera, and there is no option to expand it with a memory card. The good news is that it has a built-in USB jack that flips out (hence the name "Flip") to allow you to download the video directly to your computer.

Photo 2 shows a still frame of a balloon bursting at 95,000 feet as taken by the Flip Ultra. You can actually hear a very loud pop as the balloon burst, even though it's a near-vacuum at that altitude.

Canon PowerShot

Some of the older versions of the PowerShot series can be obtained quite reasonably on eBay. I've flown the A560 and A570 models for some time now (photo 3). They allow you to use AA lithium batteries and store the photos and videos on SD memory cards. The real power behind these cameras is that a

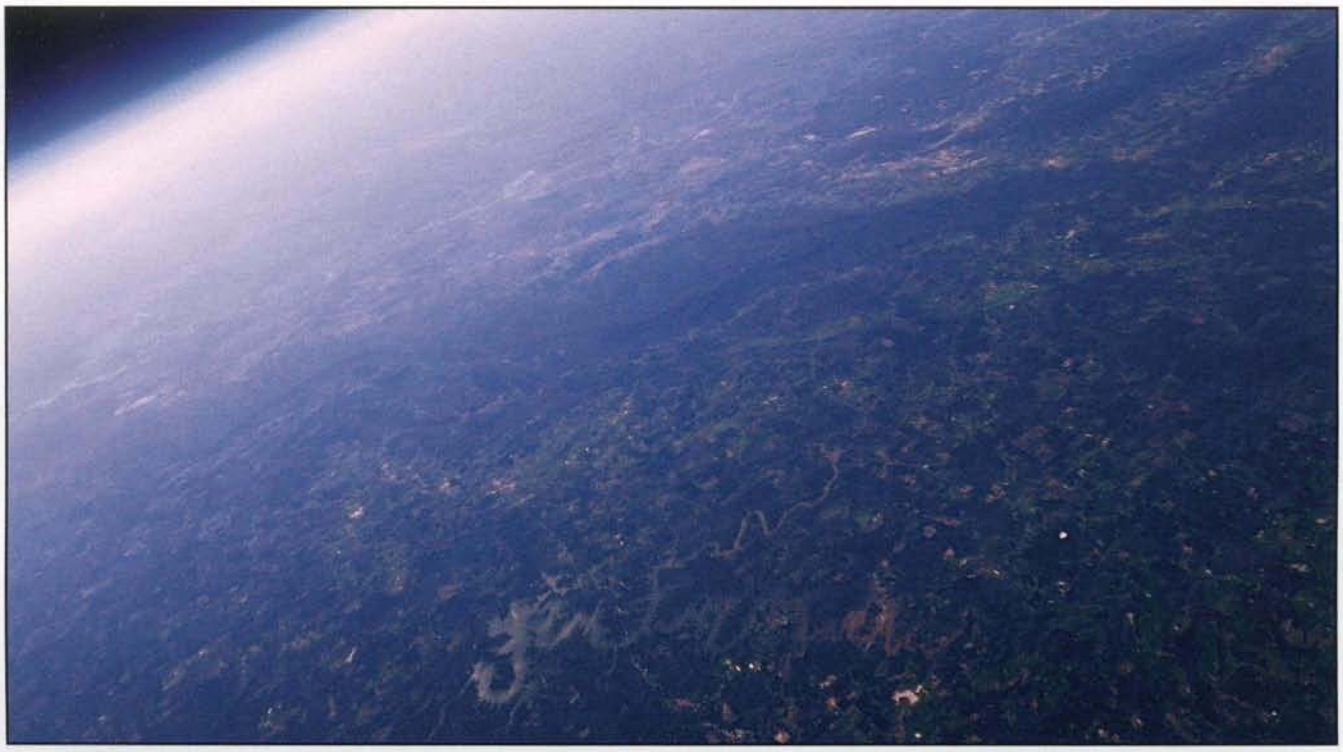


Photo 4. The thin blue line in the upper left is the Earth's atmosphere as seen from the edge of space. Taken with a Pentax W90 aboard the Pell City High School flight. (Courtesy of Ed Tyler, N4EDT)

Photo 5. The HobbyPartz mini-FPV video camera weighs less than an ounce.

small script can be stored directly onto the SD memory card to make these cameras do amazing things not originally intended by the manufacturer. You can set it up to take continuous photos (or video clips) at a variety of time invervals and even change exposure and zoom settings. The script program is called CHDK (Canon Hack Development Kit) and is available as a free download at <http://chdk.wikia.com>. Not all PowerShot cameras are supported, so be sure to check the website before buying a particular model.

Pentax W90

Ed Tyler, N4EDT, tested this 12.1-megapixel camera during the recent Pell City High School balloon launch in Pell City, Alabama (photo 4). It's a waterproof camera and has an easily configurable way of taking continuous photos in a selected time interval between photos. It has a built-in rechargeable battery pack. However, after taking 200 photos during the group's latest two-hour flight it still had most of its battery charge left.

Hobbypartz FPV cameras

I've flown Hobbypartz's mini-FPV video camera (photo 5) on several flights. It's about the same size as a USB thumb-drive and takes 640 × 480 quality video. The audio recording is quite amazing for a camera that fits in a shirt pocket. This camera uses a micro-SD memory card and has a USB connection for downloading directly to a PC. It's very low-cost and weighs less than an ounce. I've duct-taped them to the outside of my payloads as a last-minute experiment, and they've worked for over 30 minutes on the tiny rechargeable internal battery pack. With the addition of an external 5 volts supplied via the USB connection, this should work well for an entire flight. You can view this camera as well as a recently added HD version on the FPV page link at: <http://www.hobbypartz.com>.

Have fun showing your friends photos that convince them that you're an astronaut. I'm sure many new camera offerings will pop up in the near future with new features and increased resolution that are just begging for a lift to Near Space.

73, Bill, WB8ELK

Announcing:

The 2011 CQ World-Wide VHF Contest

Starts: 1800 UTC Saturday, July 16, 2011
Ends: 2100 UTC Sunday, July 17, 2011

RULES SUMMARY

Bands: 50 MHz (6 meters); 144 MHz (2 meters)

Categories: Single-Op All Band
Single-Op Single Band 6 Meters
Single-Op Single Band 2 Meters
Single-Op QRP All Band (<10 watts)
Hilltopper (SOAB QRP Portable limited to 6 continuous hours operating)
Rover (1 or 2 ops mobile/portable operating from 2 or more Grid Locators)
Multi-op

QSO Exchange: Maidenhead Grid Locator to 4 digits (e.g., FN41]

Multipliers: Total number of different Grid Locators worked *per band.*

Scoring: Work stations once per band regardless of mode. Count 1 point per QSO on 50 MHz and 2 points per QSO on 144 MHz. Total QSO points × Multiplier = Final Score.

Rovers only: Final score = Sum of QSO points from each Grid Locator visited × sum of different Grid Locators worked from each Grid Locator visited.

Note the following change in rules! **Passive** QSO alerting assistance (DX cluster, packet, etc.) is now **permitted in all categories.** Self-spotting is not permitted except by digital EME/MS stations posting callsign, frequency, and sequence **only**. Two-way **interactive** "chats" are not permitted.

Awards: Certificates are awarded to high-scoring stations in each USA state, Canadian province, and DX country in categories with outstanding effort. Rover certificates are awarded on a regional basis.

Club Competition: Credit your club for aggregate club score. See <http://www.cqww.com/clubnames.htm> for list of registered clubs. Follow directions for registering your club if not already listed.

Log Submissions: Send Cabrillo formatted logs via e-mail attachment to: **<cqvhf@cqww-vhf.com>** with subject line: Callsign [used in the contest] only. It is *strongly recommended* that paper logs be entered on-line via "Web Form for Typing in Paper Logs" link at <http://www.cqww-vhf.com> or postmarked by September 1, 2011 to: CQ VHF Contest, 25 Newbridge Rd., Hicksville, NY 11801 USA. Callsigns of electronic logs received are posted at: <http://www.cqww-vhf.com>.

Complete Rules: Complete rules are in the June issue of *CQ* magazine and at <http://www.cqww-vhf.com>.

By Kent Britain,* WA5VJB

ANTENNAS

Connecting the Radio to the Sky

Getting Ready for the CSVHFS Conference

The Central States VHF Society Conference in Irving, Texas will be this held July 29–30. I hope to see many of you there. In giving you a bit of background of one important aspect of the conference, I would like to point out our roving antenna range. Marc, WBØTEM, takes care of the 50-MHz, 144-MHz, 222-MHz, and 432-MHz antenna measuring, and photo 1 shows his antenna range at a recent CSVHFS conference.

I take care of 902 MHz though 24 GHz, and sometimes even higher. In photo 2 are some of my microwave sources. On a typical Friday morning, Marc and I measure 100–125 antennas. Even if you can't actually attend the conference, you may know someone who will. If this person has a bit of space, and you have an antenna you have wondered about, here is your chance to get it tested. This way we skip the specifications of the antenna companies and measure the antennas side-by-side at the same time under the same conditions.

*1626 Vineyard, Grand Prairie, TX 75052
e-mail: <wa5vjb@cq-vhf.com>

On the microwave range we take time to let you tweak your antenna designs as in photo 3. Quite often, moving a dish feed in or out a bit can pick up several dB and help clean up the antenna pattern, or you can even try out different feed/dish combinations.

Think you have invented a new super-duper gazillion-dB antenna? I have a HP415E and detector diode waiting for you. Some day I'll have to mention the 123-dBi gain, 1296-MHz antenna a chap submitted to me. It's a long story, and the lad had some interesting problems mixing linear and algometric math, but for a dish antenna to have 123-dBi gain at 1296 MHz, it would need to be about the size of the state of Texas. I'm afraid when we tested it he came up about 111 dB short of his prediction. However, here is your chance to find out how well that antenna really works.

Central States VHF Society Proceedings

As vice-president of the Central States VHF Society, one of my duties this year is to assemble our conference proceedings

Photo 1. 50-MHz antenna testing at the CSVHFS Conference antenna range.

Photo 2. Antenna range sources.

such as the ones shown in photo 4. Here is your chance to get that neat idea on a VHF or UHF topic published. Do you have an interesting way of mounting antennas? Perhaps an interesting antenna design? Maybe a handy modification to a VHF/UHF radio? Or some station accessory? I am very interested in any material you may have. You can e-mail me directly at <wa5vjb@amsat.org> and

Photo 3. Testing the K5VH dish at the antenna range.

we can discuss your topic. Are you going to be in Irving, Texas July 29–30? We may even talk about a technical presentation for the conference. For the latest information on the CSVHFS Conference, visit <http://www.csvhfs.org>.

A Quick Field Note

When operating portable or messing around on the antenna range, I like to use wing nuts on my U-bolts as shown in photo 5. However, for some reason I never seem to have enough of those little wing nuts. I did learn, though, that you really on need only one per U-bolt. The standard nut can be brought down to finger tight, and then really tighten it down with the wing nut. Therefore, two are handy, but with just one you can still tighten down just as hard.

Future Projects

It looks like there is a good chance that the big dish at Arecibo will be activated again on EME in a year or so. Right now I'm looking a different ways of making the wood-boom Cheap Yagis much longer, plus a combination of phasing harness with mounting points such that the antennas can be mounted for vertical, horizontal, right-hand circular, or left-hand circular polarization.

You, our readers, often come up with some of the best ideas for future columns. If you have any antenna questions or antenna projects you would like to perhaps see printed in a future column, just drop me a note. Snail mail to my QRZ.com address, or an e-mail to <wa5vjb@amsat.org> works fine. For additional antenna projects, you can visit <http://www.wa5vjb.com>, "Reference" section. The weather is is now great, so go put up some more antennas!

73, Kent, WA5VJB

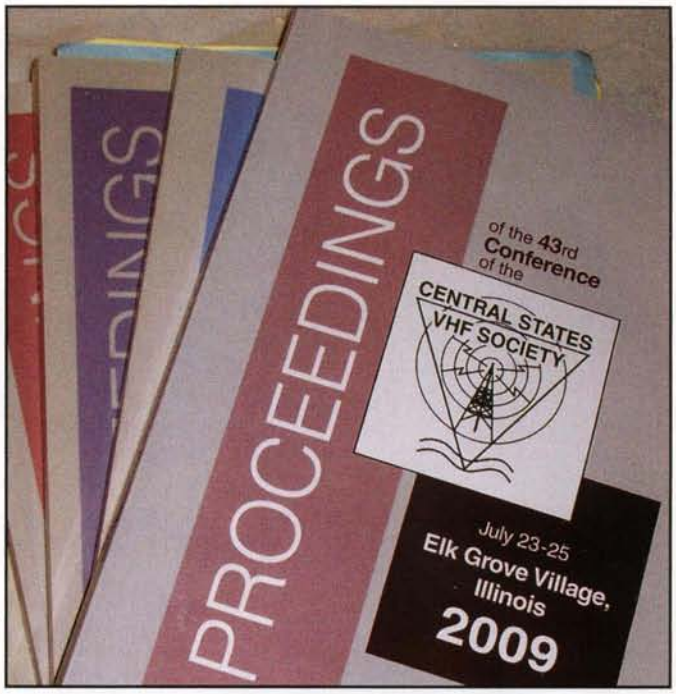
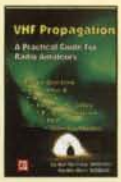


Photo 4. Past CSVHFS Conference Proceedings.

Photo 5. The VHF wingnut.

Spring into Spring at the CQ Store

FREE shipping on orders of $100 or more!



VHF Propagation

by Neubeck, WB2AMU & West WB6NOA

A comprehensive source-book on VHF propagation by two great authors. Includes: Tropo ducting, Aurora, Meteor Scatter, TEP, Sporadic-E, Combo Modes and more!

6 X 9 Paperback $15.95

The NEW Shortwave Propagation Handbook

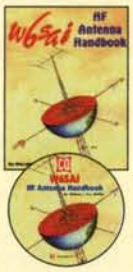
by W3ASK, N4XX & K6GKU

This authoritative book on shortwave propagation is your source for easy-to-understand information on sunspot activity, propagation predictions, unusual propagation effects and do-it-yourself forecasting tips.

8.5 X 11 Paperback $19.95
***New!* CD Version $14.95**
Buy both for only $29.95

W6SAI HF Antenna Handbook

by Bill Orr, W6SAI



W6SAI was known for his easy-to-understand writing style. In keeping with this tradition, this book is a thoroughly readable text for any antenna enthusiast, jam-packed with dozens of inexpensive, practical antenna projects that work!

8.5 X 11 Paperback $19.95
***New!* CD Version $14.95**
Buy both for only $29.95

33 Simple Weekend Projects

by Dave Ingram, K4TWJ

Do-it-yourself electronics projects from the most basic to the fairly sophisticated. Practical tips and techniques on creating your own projects.

6 X 9 Paperback $17.95

A Year of DX

by Bob Locher, W9KNI

Look over the shoulder as the author works country after country, in pursuit of the Holy Grail – winning the CQ DX Marathon.

6 X 9 Paperback $19.95

"Up Two" by G3SXW

Are you a DX'er? Have you longed to be on the other side of the pile-ups? Do you dream of taking a rig to exotic locations? If your answer to any of the above questions is yes, this book is certain to bring you the vicarious thrills of operating from exotic places.

6 X 9 Paperback $19.95

The Complete DXer

Third Edition

The joy of the chase, the agony of defeat, the thrill of victory are the stuff of The Complete DXer, a book that is almost as seductive as the DX chase it describes. It excites, it entertains, it teaches!

6 X 9 Paperback $19.95

Nifty E-Z Guide to PSK31Operation

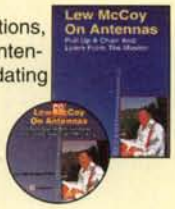
A Complete PSK31 Operating Guide!

Using DigiPan software as a basis, a detailed step-by-step approach is used for configuring your interface hardware, software and computer system for PSK31 operation. Detailed instructions and computer screen shots are provided for several Windows operating systems.

6 X 9 Paperback $12.95

Lew McCoy on Antennas

by Lew McCoy, W1ICP



Unlike many technical publications, Lew presents his invaluable antenna info in a casual, non-intimidating way for anyone!

8.5 X 11 Paperback $19.95
***New!* CD Version $14.95**
Buy both for only $29.95

Reflections III

by Walter Maxwell, W2DU

Includes all the information in Reflections I & II and much, much more! This fully revised and updated, this 424-page, third edition is truly a must have!

424-page, 8.5 X 11 Paperback $39.95
***New!* CD Version $29.95**
Buy both for only $59.95

The Quad Antenna

by Bob Haviland, W4MB

Comprehensive guide to the construction, design and performance of Quad Antennas. General Concepts, Circular-Loop & Arrays, Rectangular & Square Loops, Multi-Element Quads and more!

8.5 X 11 Paperback $19.95
***New!* CD Version $14.95**
Buy both for only $29.95

"Getting Started" DVD Paks

CQ Ham Radio Welcome Pak
1 DVD contains 3 programs:
Ham Radio Horizons
Getting Started in Ham Radio
Getting Started in VHF
Order HAMDVD ~~$24.95~~ $18.00

CQ HF Specialty Pak
1 DVD contains 2 programs:
Getting Started in DXing
Getting Started in Contesting
Order HFDVD ~~$24.95~~ $18.00

CQ VHF Specialty Pak
1 DVD contains 3 programs:
Getting Started in Satellites
Getting Started in VHF
Getting Started in Packet
Order VHFDVD ~~$24.95~~ $18.00

Any 2 Paks only $35.00 3 Paks only $52.00

Shipping & Handling: U.S. add $7 for the first item, $3.50 for the second and $2 for each add'l item. FREE shipping on orders over $100 to one U.S. address. CN/MX-$15 for 1st item, $7 for 2nd and $3 for each add'l. All Other Countries-$25 for 1st item, $10 for 2nd and $5 for each additional. Buy Both=single item!

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

***Call:* 1-800-853-9797 • *Fax:* 516-681-2926 • *website:* www.cq-amateur-radio.com**

By Rich Arland,* K7SZ

BEGINNER'S GUIDE

All you need to know but were afraid to ask . . .

A Journey to the High End of 2 Meters

Over the last few columns we mainly have focused on trying to put together a decent weak-signal station without having to take out a second mortgage or sell the family jewels. This time we are going to the "other end" of 2 meters to explore some virgin territory.

Since this is a basic column for newcomers to the ham radio hobby or to those folks who have had a license for a while and want to explore the VHF+ regions of our spectrum, we'll keep to the basics and hopefully provide some food for thought.

The old Novice Class license ushered tens of thousands of us into the amateur radio hobby. It was our first stepping stone in a vibrant, exciting, and multifaceted hobby that has its roots in the very beginning of radio at the turn of the 20th century. With the Novice license we had limited access on the 80-, 40-, and 15-meter HF bands and a small segment of 2 meters, as well. A few years ago the FCC did away with isuing the Novice license and now the entry-level license is the Technician Class, which provides a portion of 10 meters and a vast amount of spectrum above 30 MHz.

Almost without exception, the first radio that a new Technician Class licensee purchases is a 2-meter hand-held transceiver (HT) or a dual VHF/UHF HT. There are a multitude of choices out there for the newly licensed ham, to be sure. The crop of HTs currently available has some ingenious features and extremely wideband coverage for a very frugal price. A quality dual-band HT is a great purchase. The ability to cover 2 meters and 70 centimeters along with a wideband FM/AM receiver can play a very critical role in an emergency. That is the focus of this column. What can you really do with that new VHF/UHF HT? Stay tuned; you're gonna love this!

Here is my version of a nifty dipole that originally came with a Bearcat scanner. This one is centered on 146.00 and made from a 20-ft. length of RG-174, terminated in a BNC. This antenna wads up into a very compact and ultra-light package for inclusion in my emergency bag. There is a BNC-to-SMA connector that fits the top of the VX-3R HT. It can be deployed either in vertical or horizontal polarization.

More on Emergency Communications

A while back we covered emergency communications (EmComm) and why it is crucial for every amateur radio operator to become active in their local Amateur Radio Emergency Service (ARES) and Radio Amateur Civil Emergency Service (RACES) group. It's the "right thing to do." We have a unique hobby that allows us to give back to our communities. Steeped in tradition, hams helping out in times of natural and man-made disasters are well documented.

What is not so well covered is what can be done by the individual amateur radio operator with an HT if he/she is suddenly thrust into an emergency situation unrelated to a disaster. I don't know about you, but my itty-bitty Yaesu VX-3R dual-band HT is on my person all the time I am awake! Sound a bit over the top? Not really. While I have a cell phone, as does my wife, we both have been in the position of watching the failure of the cellular telephone system when it becomes severely overloaded during emergencies. A small HT gives us a more secure form of communications than cell phones, and that gives us a warm-fuzzy.

To be sure, there are other HTs out there besides the VX-3R, but we chose this particular model for its minuscule size, 1.5W power output (on 2 meters), and phenomenal wide-band frequency coverage. In short, our little Yaesu powerhouses can act as a scanner, covering most of the EMS/fire/police analog FM frequencies, civilian/military VHF/UHF aircraft frequencies, AM and FM commercial broadcast, and a whole bunch of other radio services. In short, it can keep you informed during emergencies, offer an escape while sitting in a shelter, and, of course, keep you in contact via a simplex or repeater frequency. When I say that my 3R is always with me, I mean just that—ditto with my wife Patricia. We have a prearranged frequency that we will meet on should something dire happen.

Call me crazy, but all you have to do is check out the "lessons learned" from the Christchurch, New Zealand earthquake disasters to become a firm believer in being prepared. In a nutshell, Christchurch, a modern city with professional

*770 William St. SE, Dacula, GA 30019
e-mail: <k7sz@arrl.net>

I found this EDC courier bag on Amazon.com for around $25, about one-third the price of an almost identical bag! I opted for the inexpensive version and have been well pleased. There is enough room for most of the things that I need on a daily basis for emergency radio gear, and general bopping around town. The Yaesu FT-60R dual-band HT sits in an end pocket with spare antennas and batteries. ARES credentials, bottles of water, several power bars, a knife, a Leatherman multi-tool, compass, flint/steel fire starter, #20 test monofilament fishing line, along with other "stuff," all designed to get me back home in an emergency.

fire, police, and EMS personnel, state-of-the art hospitals, and professional disaster mitigation personnel suffered back-to-back earthquakes, resulting in billions of dollars in physical destruction, loss of life, and in general turned a modern city into a third world hell-hole in a matter of minutes! My plans over the top? I hardly think so!

Summertime "FUN"(?)

It's that time again! The time when many of us soft-skinned humanoids drop what we're doing and head for the great outdoors! Yup, it's time to "hit the bush" and enjoy nature up close and personal. Unfortunately, with this annual migration from the comfort of our living rooms and large, flat-screen TVs into the wilds of the bush, often things can go wrong—in some cases, terribly wrong. That is where ham radio can come into play and offer a way to summon help.

All over the country there are conscientious radio amateurs who regularly monitor 146.52 MHz simplex just in case some hiker, camper, or outdoor explorer gets into trouble and tries to summon help via 2 meters FM. Therefore, it behooves all hams who venture into the bush to take along a quality HT, extra battery packs, and some form of external antenna that can be employed to summon help. This does not need to be anything really fancy. In my case I have my trusty Yaesu VX3R dual-band HT, spare alkaline battery pack, and a coaxial dipole antenna. Using a piece of 550 para-cord thrown over a nearby tree limb, I can hang the dipole vertically, weight the other end with a rock, and now I have a very efficient elevated antenna that will perform well and weighs almost nothing. While you might

This dual-band miniature HT is a God-send. I picked up two spare antennas—a mini-rubber-duck and a longer dual-band whip (on the HT)—and the stock antenna are shown along with the cloning cable and the spare "AA" alkaline battery pack. This makes up my emergency radio package, which stays with me all the time.

be skeptical of using an HT such as the VX3R with only 1.5 watts of RF output, that power level is only a little over one-half an S-unit below a standard 5-watt HT. Remember: It's the little things in life that make the difference. In this case Patricia and I have peace of mind when camping and hiking.

I suppose you'll be asking, "So what happens if you get into trouble and make contact using 2 meters FM?" Obviously, if you know where you are or have a hand-held GPS unit and can give the responding station your actual position, you are in good shape to be rescued in short order. However, what happens if you don't know your actual location? How can help be summoned with any hope of actually finding you and/or your party? Read on, and this is where it gets interesting.

Hunting the "Fox"

On Saturday, April 2, our local Gwinnett County ARES group engaged in a spring Simulated Emergency Test (SET) to augment the annual SET normally held each fall. The object of this spring SET was to track some jamming transmitters who were causing malicious interference to two of our ARES repeaters.

The idea behind this type of exercise is to form into several teams of two or three ARES members, and using radio direction finding (RDF) equipment, take measurements (referred to as "cuts") on the interfering transmitters, lay bearing lines on a map, and triangulate these readings to find the offending transmitter(s). Sounds simple, right? Oh, grasshopper, you have sooo much to learn!!

Suffice it to say that becoming proficient in RDF techniques is a precise application of radio savvy, technical knowledge regarding your gear and practical orienteering (finding your way using a map and compass), and, last of all, *blind luck! (For more on RDF, see Joe Moell, KØOV's "Homing In" column elsewhere in this issue.—ed.)*

RDFing (also called "fox hunting" in ham radio circles) is a specialized skill set that must be practiced regularly and often in order to maintain a high degree of readiness and operating skill. Unfortunately, we (as in the whole of amateur radio) do not do this nearly often enough to maintain a high degree of proficiency. In short, you can have all the technology in the world, but if you don't know how to use it effectively you'll end up chasing your tail all over the landscape (in our case, Gwinnett County).

What do you need to play this game? Some form of radio, naturally. It can be as simple as your HT or your mobile rig. An antenna—anything from a rubber-duck to a multi-element Yagi or quad, and loops work okay, too. Maps are a must: Topo maps are the best (Topo USA, a computer program for sale at Amazon.com for around $30 is excellent if you have a laptop or notebook computer and battery packs). You also need an attenuator to drop the signal going into your radio's receiver as you get nearer the "fox." Get a good-quality compass, and *do not skimp here!* Get a good one rated for orienteering. The cheapies just don't work well; I know from practical experience. Don't forget some way to become "mobile"—vehicle (car or truck), bicycle, or "shank's mare" . . . your choice!

The idea is to first listen for the intruding signals. Then finding an elevated location (hilltop, rise of ground, climbing onto a roof [being careful not to fall!]), and cut the frequency to get a basic bearing. Read the bearing on your compass and then plot a vector (straight line on the map from your present location along that bearing) to show the suspected line between you and the offending transmitter.

Here is where the fun begins! Then you get on the road and find another high spot and do it all over again. After three or four cuts from different locations your vector lines should intersect at some point on the map and that is where your offending transmitter "should be." Oh, grasshopper, if it were only that simple! As we will see, there are a number of factors that will affect your bearings/vectors.

One of our group's "technical heavies," Eddie Foust, WD4JEM, wrote a terrific after-action report on our Saturday antics and I have permission to publish Eddie's work here in my column. Without further ado, here's Eddie:

It was great to see everyone who came out this morning for the ARES exercise. Great job Jan, K2HJ, Dorothy, N2DLJ, Karen, KI4HPP, Kyle, W4KDA, and Emory (EMØRY??) for setting up two hidden transmitters, one on VHF and one on UHF. Two teams led by David, WA8LRL, and Dave, KA4KKF, organized and headed out from the Lawrenceville repeater site to find the hidden transmitters.

Using only simplex communications between team members (and some cell calls) the teams coordinated their efforts to find the foxes. While in the allotted amount of time neither team actually got to the foxes, but we all had a great time and a great lunch. Looking at our plotted bearings, we were on the right track; we just needed some more time. But hey, that's the way most fox hunts go anyway. If you went fishing and always caught fish it would get a little boring after a while—*not!*

In the wrap-up we discussed a few items that are important when fox hunting: A compass, mechanical or electronic (smart phone, etc.), is subject to interference from many things that will give you erroneous readings. Things such as granite rock and/or any structure (man-made or natural) with iron or steel in it and anything with electrical current flowing, including automobiles, radios, antennas, power lines, buildings, wrist watches, cell phones, pace makers, and metal writing pens can adversely affect your compass readings. One trick I like to do when taking a compass heading is to peak and null my beam heading, and then with the beam pointed toward the best peak, or some-

times the null, I lay down the beam and radio on the ground pointing in the bearing direction. I then step back a few feet and use my compass to sight the beam heading. This way the beam and radio will not be the cause of compass error.

Beam headings can be affected by reflections from nearby cars, trucks, buildings, or other objects that can reflect radio signals, all of which can cause you to go off in a wrong direction. If in doubt, it is always good to plot the bearing and then move a few hundred feet away and plot again to see if the bearings are on track with each other or each have a mind of its own. When hunting with cars, always step away from the car when taking bearingsto avoid reflections from the vehicle body.

Good direction-finding antennas have a sharp peak (direction of strongest signal) and an even sharper null (direction of little or no signal). When hunting always look for the peak *and the null*. A proper null will always be 180 degrees away from the peak. As you get closer to a signal the null is easier to determine than the peak, so sweep the antenna for the sharp null and then shoot your compass bearing 180 degrees *opposite* the null. When using just a hand-held radio, body shielding works well to determine the null. This is very important. *(The "null" is our friend! Learn how to use it effectively!)*

A good professionally built or homebrew attenuator is always very helpful when fox hunting. As the signal gets stronger, it will tend to overload your receiver, which is what we don't want. Set the attenuator to keep the received signal just barely readable to obtain the best peak bearings. Don't forget to bypass the attenuator when arriving at a new location while trying to re-acquire the signal. If you don't have a nice attenuator with you or are doing some off-the-cuff body-shield hunting with your HT, very slowly unscrew the SMA antenna connector to your radio a few turns until the signal gets weaker; SMAs can make pretty good attenuators. You can do the same with a BNC-type connector, but the precise adjustment is harder to maintain. Small portable attenuators are easy to build; usually the housing is the hardest part to assemble to make a good one with minimal RF coupling between stages. (Check the *ARRL Handbook*, or search the internet for "attenuators" to get more info on building your own.)

Not all antennas are created equal. If you plan to use a directional antenna for fox hunting, check it against a low-power RF source at a known location. Many antennas can peak and null several degrees off the boom axis,making for some interesting hunts. (Arrow Antennas and the ELK dual-band log periodic array, or LPA, are good choices. With the Arrow Antennas Yagis you can remove director elements to decrease antenna gain as you near the "fox.")

A good mechanical compass can be used both for taking position readings and plotting your results on your map. Plotting helps narrow in (triangulate) bearings from various locations to pinpoint the transmitter location.

Happy Hunting!—*Eddie Foust, WD4JEM*

My thanks to Eddie, WD4JEM, for his excellent insight into our Saturday fox hunt. While no group of hunters actually found the "foxes," we had fun, but most of all we learned that we need a lot more practice in the future to become really proficient in RDFing. One topic that Eddie did not cover was Doppler RDF units (check Ramsey Electronics for a medium-priced kit) which electronically scan several dipole antennas on the roof of a vehicle and yield a visual readout inside the cab. The next step in the evolution of Doppler RDF units will be coupling the output of the RDF unit to a laptop computer to provide on-the-move vectoring for the chase vehicle. Isn't technology wonderful?!

I hope you have enjoyed this journey to the "other" end of 2 meters. Fox hunting/RDFing is a hot topic at some ham radio clubs. Why not try it with your group and let me know your progress? After all, this column is yours not mine, so let me hear from you. As always, feedback is welcome. 73, Rich, K7SZ

By Keith Pugh,* W5IU

SATELLITES

Artificially Propagating Signals Through Space

ARISSat-1 Update, Work the Satellites on Field Day 2011, and FUNcube Dongle

ARISSat-1 is on board the International Space Station (ISS) waiting for a space walk (EVA; extravehicular activity) for deployment. Field Day 2011 is "just around the corner." Let's talk about how to take best advantage of this opportunity to work the amateur radio satellites. Also, don't forget the exciting FUNcube Dongle Receiver mentioned last time.

ARISSat-1

As this column is being written (on March 22, 2011), ARISSat-1 is on board the ISS awaiting deployment. It was launched from Baikinor on a Progress supply ship to the ISS on January 28, 2011. The deployment from the ISS during an EVA was scheduled to occur on February 16, 2011. ARISSat-1 was hooked to an external antenna shortly after arrival and successfully tested. Many stations throughout the world heard and recorded data during that brief test. The deployment on February 16 did not occur due to insufficient available time during the EVA. Roscosmos (the Russian Space Agency) now indicates that ARISSat-1 will be deployed during the next planned Russian EVA in July 2011.

Meanwhile, it will probably be turned on again for at least a day, hooked to an external antenna, as part of a celebration of the 50th anniversary of Yuri Gagarin's First Manned Space Flight. AMSAT will support this event by issuing certificates to operators who report ARISSat-1 reception during this event. Hopefully, by the time you read this, this celebration will have been successful and we will be waiting on the launch. It's even possible that an earlier launch may have taken place and we may already be enjoying the use of ARISSat-1.

Get ready to participate and to help introduce this valuable teaching asset into the "Classrooms of the World." What better way to introduce Science, Engineering, Technology, and Mathematics (STEM) into the classroom. Visit and stay tuned in!

Field Day 2011

Every year I get questions regarding how to work satellites on Field Day. Usually I answer these questions "one on one" and then report on how Field Day went after the fact. This year Field Day will be discussed "up front." For "starters," be sure to become familiar with both the ARRL and AMSAT Field Day rules.

Let me begin by saying that there are two Field Days: ARRL and AMSAT. What's the difference? We usually talk about ARRL Field Day, but AMSAT also conducts AMSAT Field Day concurrently. The principal difference is the handling of individual satellites in the scoring. In the ARRL contest, all satellites are grouped together as one band; therefore, you can only work an individual station once per mode (voice vs. CW or data). In the AMSAT contest, each individual satellite is a separate band; therefore, you can work individual stations once per mode per satellite. Obviously, you have the opportunity to make many more contacts in the AMSAT Contest. Which contest should I enter? Enter both contests with the same data, just adjust the contacts to fit the rules, and submit the scores separately.

One other difference is the matter of bonus points in the ARRL contest. One-hundred bonus points are awarded in the ARRL contest for making the first satellite contact. Many operators stop with this first contact, collect their 100 bonus points. and go no further. No attempt is made to make more contacts even though they are scored just like HF contacts from that point on. Many operators also fail to realize that the satellite station is "free"; i.e., does not have to be counted as a separate transmitter for Classes A, B, and F.

FM Satellites: AO-51, SO-50, AO-27, SO-67, and HO-68 (sometimes)

In some ways AMSAT has created a problem by calling the FM satellites the "Easy Sats," meaning satellites that are easy to work with a minimum of equipment and power. In normal times, this is usually true except on busy weekends and during contests. The FM "capture effect" is the culprit in this problem. What it says is that the biggest signal at the satellite wins. A corollary to this is that if all signals are equal at the satellite, no one gets through. What happens in practice is that a few "big guns" get through and all of the operators who thought they could get an easy 100 bonus points with their dual-band HT and a hand-held Yagi are disappointed. In past years, only the "big guns" made a few contacts and others became disillusioned. In an attempt to correct this problem, the following rule was created:

7.3.7.1 Stations are limited to one (1) completed QSO on any single channel FM satellite. This rule is now a part of both the ARRL and AMSAT contests. There are still abuses, but it is getting better. On FM satellites that have more than one active transponder, one contact per transponder is allowed. A case in point is AO-51 running both Mode V/U and V/S or L/S.

Linear Satellites: AO-07, VO-52, FO-29, and HO-68 (sometimes)

While even the linear satellites suffer some from overloading on Field Day, the situation is much better than on the FM

*3525 Winifred Drive, Fort Worth, TX 76133
e-mail: <w5iu@swbell.net>

satellites. While it is true that it takes a little more equipment and skill to work the linear satellites, the rewards are great. Once you overcome the operational hurdles (with training and practice), many more contacts are possible. Satellite Field Day then becomes a little more like HF. Don't forget that you will need equipment that is capable of SSB or CW operation for both the uplink and downlink frequencies. It's not unusual for the AO-07 pass band to sound like 20 meters during Field Day. Don't forget, too, that there are opportunities for both modes on each satellite for each station in the AMSAT contest. Also, the 2-for-1 point rule applies for CW vs. voice contacts.

Other Benefits

Working satellites on Field Day is an "attention grabber." The station looks a bit different from an HF station and many visitors and new hams have never seen one. The different technology involved "tweaks" folks' interest, particularly the young.

By their nature, there are breaks in the activity due to the passing of the satellites. During these breaks there usually is ample time to describe the operation to visitors and then show them how it works a little while later. You can even post a schedule of the passes and let visitors tour other stations and then come back to the satellite station at pass time. You can even schedule meal breaks between passes. If your station is equipped to work all of the satellites, you can stay busy as much as you want to.

ISS

The ISS only qualifies as a satellite when it is running in a repeater mode (which it rarely does). However, it is one of the biggest "attention grabbers" of all, if an astronaut decides to work Field Day. Be alert to this possibility and be ready to capitalize on it. You may be able to get some warning regarding the astronauts' intentions before Field Day, but don't count on it. The schedule changes frequently. One thing in our favor is that the weekends are usually "off time" for the astronauts and they are free to get on the radio and participate if they so desire.

FUNcube Dongle Update

In my last column I mentioned the FUNcube Dongle Receiver being developed by Howard Long, G6LVB, for the AMSAT-UK FUNcube Project. This receiver has really "caught fire," and more than 700 units have now been delivered. I got mine, #568, on my fourth attempt at purchase. Sales are handled on a "first come, first served" basis via Pay Pal over the internet. Initial batches were sold out within seconds of release, and you had to be very quick and lucky to succeed.

The FUNcube Dongle receiver is living up to my expectations for use with ARISSat-1 and FUNcube. It is also being adapted to many other uses by a large and growing group of developers. Initially, I used mine with SpectraVue as the processing and display program. I plan to check it out with WRplus this week before I take it to the Weatherford, Texas, Hamfest for demonstration. I demonstrated it at the Green County Hamfest in Claremore, Oklahoma, on March 1–12, and it created quite a bit of interest. It's not "everything for everybody," but it does do many things well. By the time you read this, it certainly will be "on its way." Look for more about it at the Dayton Hamvention® this year. In the meantime, follow its progress at: <http://www.FUNcubeDongle.com/>.

Summary

Let's welcome ARISSat-1 to the classroom and the ham shack once it's "in orbit." It represents a golden opportunity to showcase amateur radio and amateur radio satellites to kids in the classroom and promote STEM (Science, Technology, Engineering, and Mathematics education) while having "hands on" and "heads on" fun. Stay alert for its launch and be ready to participate.

Continue the amateur radio satellites in education theme with FUNcube. Support this AMSAT-UK project like our own in the U.S. It is a natural carry-on to ARISSat-1 and will be the predecessor to AMSAT-NA's project FOX and other future satellites.

Let's make Field Day 2011 a "bang-up event" for the satellites and use it to introduce our satellite fun to others. Make the Field Day satellite station the "showplace" of Field Day 2011

Also, please support AMSAT's plans for the future of amateur radio satellites. AMSAT is now updating its web page at <http://www.amsat.org> on a much more regular basis. Satellite details are updated regularly at <http://www.amsat.org/amsat-news/satellites/status.php>. Follow the projects and progress of AMSAT-UK at : <http://www.uk.amsat.org/>.

Until next time! 73, Keith, W5IU

By Mitch Gill, NA7US

EMERGENCY COMMUNICATIONS

The Role of VHF in EmComm

Disaster in Japan . . . A Lesson for Us?

After the tragedy in Japan in March, I hope we are counting our blessings and preparing for any emergency. I hope that for others it is a wake-up call. If you believe that a large-scale disaster cannot happen where you live, then you have missed the point. Since early times earthquakes can and have occurred in every state of the union and every country in the world. It is the nature of Earth that the plates underneath move and at times break. It is also obvious that disasters come in many forms, but the magnitude of what has occurred and is occurring in Japan is unimaginable for most of us. Please keep the Japanese, the thousands of Americans who live and work in Japan, plus the many others affected by this disaster in your thoughts and prayers.

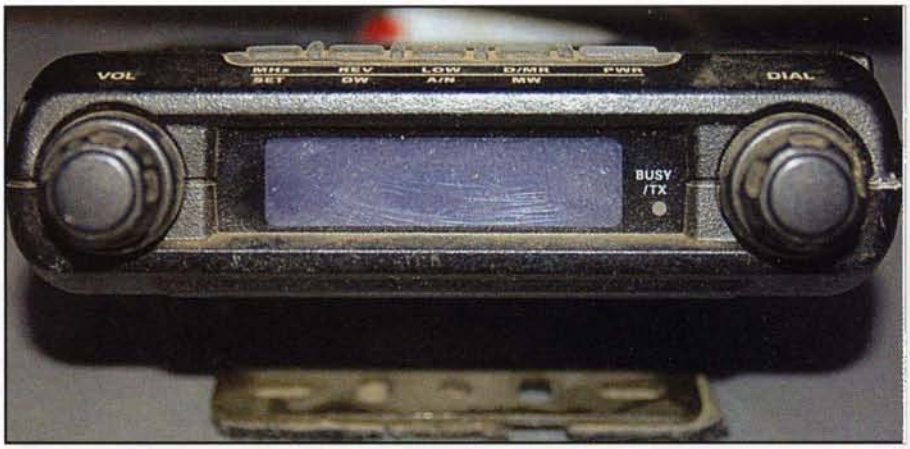
A lesson to be learned is that we need to be ready at a moment's notice to assist during a disaster, or to at least be prepared so as not to be a burden to others.

Be Prepared

My favorite motto is the Boy Scout one: "Be Prepared." My wife and I live in western Washington State. For us that means earthquakes are not only possible, but probable. We also live within the danger zone of Mount Rainer, which is a large volcano. Flooding occurs every year, and we are too high up to experience damage from it, but we could be cut off from being able to get to or from our home. We lose power several times a year due to windstorms, as we live on a plateau about 800 feet above sea level. We get winds in excess of 60 miles per hour at least twice a year.

Do I need survival kits? You bet I do. I have one in my car where I have a 2-meter radio hooked up. One kit is in my wife's car with a small 2-meter beam and a 2-meter radio in a backpack. I have one in our trailer with HF, UHF, and VHF, one in the house, and one in our boat.

Do I sound paranoid? I am not. I'm just making sure we're prepared after being scared out of my mind back in 2000. I had never experienced a good-size earthquake before, and we lost phone service, power, and water for several hours. I didn't even have a radio at that time, as I had let my ham license lapse. That won't happen ever again. I also learned later that we were lucky, and that a big earthquake, which we are due for, could leave us without any of the above for two to three



This is my FT1500M scratch-and-dent emergency radio. It has been on a quad, mounted in my car, backpacked, and even took a tour of Iraq with me. This radio now goes with my son, KD7MJO.

Two of my rigs at home. The ICOM 706 and SW30 are a quick disconnect to put them into the truck or car, whichever is necessary. I carry small, lightweight antennas for HF/VHF/UHF and test them all in the field.

*29838 SE 285th Place, Ravensdale, WA 98051
e-mail: <na7us@arrl.net>

weeks. I bought dehydrated food (such as MREs) and since then I have added more. I now have 12 months worth of food for two people. Did I waste my money? Not at all, as I am certain that some of my neighbors are not fully prepared, and if a big earthquake comes I can at least keep quite a few of them fed until relief comes.

I also knew that my radios would be invaluable to me and my neighbors if a big earthquake happened, so I purchased two deep-cell batteries that I keep charged, and I have a lead on a battery used on large tractors for a very good price. It will run up to 100 amp-hours.

An Ham is Trustworthy, Loyal, Helpful, Friendly . . .

I am a firm believer that the minute we receive our amateur radio licenses we accept the fact that we have become emergency service operators. ARES (Amateur Radio Emergency Services) is one of the groups that practices and participates in emergency exercises. It is the one which supports the infrastructure, such as fire, police, hospitals, and businesses. However, for those of us who are not members of ARES, we need to support our neighborhoods. It is you and I who will have communication with the ARES radio operator who in turn will be able to dispatch emergency services to your area.

The scenario I am describing is, of course, in the event of a catastrophic failure of all other communications on which we rely. That could mean for a matter of minutes or much longer. Right after the earthquake in 2000, the cell phones, telephones, and internet went down. Cellphone service came back within thirty minutes, but were tied up for hours with everyone trying to call family or friends. The internet, telephones, electricity, and water took longer to get working again.

It does not matter what kind of disaster could happen in your area; what matters is whether or not you are prepared. If you are not a member of ARES or MARS (the Military Auviliary Radio System, which I highly recommend you join), then you should at least see what kind of training they provide. The Red Cross is great for first-aid training, and here in Washington State it relies heavily on ARES. MARS has training nets almost daily, and there are clubs that have formed their own emergency support groups. Most important of all, train your family to at least know how to operate the radio, and make sure you have VHF or UHF in every vehicle and in your house. Whenever you use the radios, turn them back to the emergency frequency before shutting them off or leave them on for monitoring purposes.

You don't think an earthquake can happen in your area because you live on the east coast of the U.S.? Check out the New Madrid earthquake that occurred 200 years ago this December. You might just change your mind.

Make a Neighborhood Plan

Now that you have made a plan for yourself and your family, you can develop a communications plan for the neighborhood. If you are a member of a homeowners' association, a local church, or some other group, you can organize a meeting, or invite your neighbors to your own meeting. This will give you the chance to help your neighbors prepare for an emergency, and you may find that some are already prepared. In either case, you could volunteer as an alternate source of communications, and if you are not home if a disaster does occur, just remember that you have taught your family as well. (I recommend that all members of your family get an amateur radio license, but I know how difficult that can be sometimes. That will have to be a story for another time.)

Maybe you have already formed a neighborhood plan you can tell me about, or let me know what you have created when it comes to a jump kit or go kit. What else do you carry besides your radios? Why not share your stories with the readers of this column? Send me an e-mail with your plan or what is in your kit (photos are great, too) and we'll try to include it here. My e-mail address is <NA7US@yahoo.com>.

That's it for this time. The summer is right around the corner and I am looking forward to 6 meters. The sunspots are finally returning, but so is the grass. There's going to be a lot to do.

73, Mitch, NA7US

CQ's 6 Meter and Satellite WAZ Awards

(As of April 1, 2011)

By Floyd Gerald,* N5FG, CQ WAZ Award Manager

6 Meter Worked All Zones

No.	Callsign	Zones needed to have all 40 confirmed
1	N4CH	16,17,18,19,20,21,22,23,24,25,26,28,29,34,39
2	N4MM	17,18,19,21,22,23,24,26.28.29,34
3	JI1CQA	2,18,34,40
4	K5UR	2,16,17,18,19,21,22,23,24,26,27,28,29,34,39
5	EH7KW	1,2,6,18,19,23
6	K6EID	17,18,19,21,22,23,24,26,28,29,34,39
7	KØFF	16,17,18,19,20,21,22,23,24,26,27,28,29,34
8	JF1IRW	2,40
9	K2ZD	2,16,17,18,19,21,22,23,24,26, 28,29,34
10	W4VHF	16,17,18,19,21,22,23,24,25,26,28,29,34,39
11	GØLCS	1,6,7,12,18,19,22,23,28,31
12	JR2AUE	2,18,34,40
13	K2MUB	16,17,18,19,21,22,23,24,26,28,29,34
14	AE4RO	16,17,18,19,21,22,23,24,26,28,29,34,37
15	DL3DXX	18,19,23,31,32
16	W5OZI	2,16,17,18,19,20,21,22,23,24,26,28,34,39,40
17	WA6PEV	3,4,16,17,18,19,20,21,22,23,24,26,29,34,39
18	9A8A	1,2,3,6,7,10,12,18,19,23,31
19	9A3JI	1,2,3,4,6,7,10,12,18,19,23,26,29,31,32
20	SP5EWY	1,2,3,4,6,9,10,12,18,19,23,26,31,32
21	W8PAT	16,17,18,19,20,21,22,23,24,26,28,29,30,34,39
22	K4CKS	16,17,18,19,21,22,23,24,26,28,29,34,36,39
23	HB9RUZ	1,2,3,6,7,9,10,18,19,23,31,32
24	JA3IW	2,5,18,34,40
25	IK1GPG	1,2,3,6,10,12,18,19,23,32
26	W1AIM	16,17,18,19,20,21,22,23,24,26,28,29,30,34
27	K1LPS	16,17,18,19,21,22,23,24,26,27,28,29,30,34,37
28	W3NZL	17,18,19,21,22,23,24,26,27,28,29,34
29	K1AE	2,16,17,18,19,21,22,23,24,25,26,28,29,30,34,36
30	IW9CER	1,2,6,18,19,23,26,29,32
31	IT9IPQ	1,2,3,6,18,19,23,26,29,32
32	G4BWP	1,2,3,6,12,18,19,22,23,24,30,31,32
33	LZ2CC	1
34	K6MIO/KH6	16,17,18,19,23,26,34,35,37,40
35	K3KYR	17,18,19,21,22,23,24,25,26,28,29,30,34
36	YV1DIG	1,2,17,18,19,21,23,24,26,27,29,34,40
37	KØAZ	16,17,18,19,21,22,23,24,26,28,29,34,39
38	WB8XX	17,18,19,21,22,23,24,26,28,29,34,37,39
39	K1MS	2,17,18,19,21,22,23,24,25,26,28,29,30,34
40	ES2RJ	1,2,3,10,12,13,19,23,32,39
41	NW5E	17,18,19,21,22,23,24,26,27,28,29,30,34,37,39
42	ON4AOI	1,18,19,23,32
43	N3DB	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
44	K4ZOO	2,16,17,18,19,21,22,23,24,25,26,27,28,29,34
45	G3VOF	1,3,12,18,19,23,28,29,31,32
46	ES2WX	1,2,3,10,12,13,19,31,32,39
47	IW2CAM	1,2,3,6,9,10,12,18,19,22,23,27,28,29,32
48	OE4WHG	1,2,3,6,7,10,12,13,18,19,23,28,32,40
49	TI5KD	2,17,18,19,21,22,23,26,27,34,35,37,38,39
50	W9RPM	2,17,18,19,21,22,23,24,26,29,34,37
51	N8KOL	17,18,19,21,22,23,24,26,28,29,30,34,35,39
52	K2YOF	17,18,19,21,22,23,24,25,26,28,29,30,32,34
53	WA1ECF	17,18,19,21,23,24,25,26,27,28,29,30,34,36
54	W4TJ	17,18,19,21,22,23,24,25,26,27,28,29,34,39
55	JM1SZY	2,18,34,40
56	SM6FHZ	1,2,3,6,12,18,19,23,31,32
57	N6KK	15,16,17,18,19,20,21,22,23,24,34,35,37,38,40
58	NH7RO	1,2,17,18,19,21,22,23,28,34,35,37,38,39,40
59	OK1MP	1,2,3,10,13,18,19,23,28,32
60	W9JUV	2,17,18,19,21,22,23,24,26,28,29,30,34
61	K9AB	2,16,17,18,19,21,22,23,24,26,28,29,30,34
62	W2MPK	2,12,17,18,19,21,22,23,24,26,28,29,30,34,36
63	K3XA	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
64	KB4CRT	2,17,18,19,21,22,23,24,26,28,29,34,36,37,39
65	JH7IFR	2,5,9,10,18,23,34,36,38,40
66	KØSQ	16,17,18,19,20,21,22,23,24,26,28,29,34
67	W3TC	17,18,19,21,22,23,24,26,28,29,30,34
68	IKØPEA	1,2,3,6,7,10,18,19,22,23,26,28,29,31,32
69	W4UDH	16,17,18,19,21,22,23,24,26,27,28,29,30,34,39
70	VR2XMT	2,5,6,9,18,23,40
71	EH9IB	1,2,3,6,10,17,18,19,23,27,28
72	K4MQG	17,18,19,21,22,23,24,25,26,28,29,30,34,39
73	JF6EZY	2,4,5,6,9,19,34,35,36,40
74	VE1YX	17,18,19,23,24,26,28,29,30,34
75	OK1VBN	1,2,3,6,7,10,12,18,19,22,23,24,32,34
76	UT7QF	1,2,3,6,10,12,13,19,24,26,30,31
77	K5NA	16,17,18,19,21,22,23,24,26,28,29,33,37,39
78	I4EAT	1,2,6,10,18,19,23,32
79	W3BTX	17,18,19,22,23,26,34,37,38
80	JH1HHC	2,5,7,9,18,34,35,37,40.
81	PY2RO	1,2,17,184OM,19,21,22,23,26,28,29,30,38,39,40
82	W4UM	18,19,21,22,23,24,26,27,28,29,34,37,39
83	I5KG	1,2,3,6,10,18,19,23,27,29,32.
84	DF3CB	1,2,12,18,19,32
85	K4PI	17,18,19,21,22,23,24,26,28,29,30,34,37,38,39.
86	WB8TGY	16,17,18,19,21,22,23,24,26,28,29,30,34,36,39
87	MUØFAL	1,2,12,18,19,22,23,24,26,27,28,29,30,31,32
88	PY2BW	1,2,17,18,19,22,23,26,28,29,30,38,39,40.
89	K4OM	17,18,19,21,22,23,24,26,28,29,32,34,36,38,39.
90	JHØBBE	2,33,34,40
91	K6QXY	17,18,19,21,22,23,34,37,39
92	JA8ISU	2,7,8,9,19,33,34,36,37,38,39,40
93	YO9HP	1,2,6,7,11,12,13,18,19,23,28,29,30,31,40
94	SV8CS	1,2,6,7,18,19,23,26,28,29
95	SM3NRY	1,6,10,12,13,19,23,25,26,29,30,31,32,39
96	VK3OT	2,10,11,12,16,34,35,37,39,40
97	UY1HY	1,2,3,6,7,9,12,18,19,23,26.28,31,32,36
98	JA7QVI	2,40
99	K1HTV	17,18,19,21,22,23,24,26,28,29,34
100	OK1RD	2,6,7,8,9,11,12,13,18,19,21,22,28,39,40
101	S51DI	1,2,6,18,19
102	S59Z	1,2,6,7,10,12,17,18,19,22,23,24,26,31,32

Satellite Worked All Zones

No.	Callsign	Issue date	Zones Needed to have all 40 confirmed
1	KL7GRF	8 Mar. 93	None
2	VE6LQ	31 Mar. 93	None
3	KD6PY	1 June 93	None
4	OH5LK	23 June 93	None
5	AA6PJ	21 July 93	None
6	K7HDK	9 Sept. 93	None
7	W1NU	13 Oct. 93	None
8	DC8TS	29 Oct. 93	None
9	DG2SBW	12 Jan. 94	None
10	N4SU	20 Jan. 94	None
11	PAØAND	17 Feb. 94	None
12	VE3NPC	16 Mar. 94	None
13	WB4MLE	31 Mar. 94	None
14	OE3JIS	28 Feb. 95	None
15	JA1BLC	10 Apr. 97	None
16	F5ETM	30 Oct. 97	None
17	KE4SCY	15 Apr. 01	10,18,19,22,23, 24,26,27,28, 29,34,35,37,39
18	N6KK	15 Dec. 02	None
19	DL2AYK	7 May 03	2,10,19,29,34
20	N1HOQ	31 Jan. 04	10,13,18,19,23, 24,26,27,28,29, 33,34,36,37,39
21	AA6NP	12 Feb. 04	None
22	9V1XE	14 Aug. 04	2,5,7,8,9,10,12,13, 23,34,35,36,37,40
23	VR2XMT	01 May 06	2,5,8,9,10,11,12,13,23,34,40
24	XE1MEX	19 Mar. 09	2,17,18,21,22,23,26,34,37,40
25	KCØTO	17 Mar. 11	None

CQ offers the Satellite Work All Zones award for stations who confirm a minimum of 25 zones worked via amateur radio satellite. In 2001 we "lowered the bar" from the original 40 zone requirement to encourage participation in this very difficult award. A Satellite WAZ certificate will indicate the number of zones that are confirmed when the applicant first applies for the award.

Endorsement stickers are not offered for this award. However, an embossed, gold seal will be issued to you when you finally confirm that last zone.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to the WAZ Award Manager: Floyd Gerald, N5FG, P.O. Box 449, Wiggins, MS 39577-0449. The processing fee for all CQ awards is $6.00 for subscribers (please include your most recent *CQ* or *CQ VHF* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Floyd Gerald. Applicants sending QSL cards to a CQ Checkpoint or the Award Manager must include return postage. N5FG may also be reached via e-mail: <n5fg@cq-amateur-radio.com>.

**P.O. Box 449, Wiggins, MS 39577-0449; e-mail: <n5fg@cq-amateur-radio.com>*

Spring into Spring at the CQ Store

FREE shipping on orders of $100 or more!

HF Antenna Collection

RSGB 252 pages.

A collection of outstanding articles and short pieces which were published in *Radio Communication* magazine. Includes single- and multi-element, horizontal and vertical antennas, extremely small transceiving and receiving antennas, feeders, tuners and more!

Order: RSHFAC $33.00

Backyard Antennas

RSGB 208 pages

Antenna guru Peter Dodd explains how using a variety of simple techniques make it possible to achieve very high performance from a compact antenna.

Order: RSBYA $33.00

Virtual Radar Explained

By Mick Richards, G4WNC
RSGB

The reception and plotting of ADS-B transmissions for aircraft. Great for aviation enthusiasts.

Order: RSVRE $16.95

Guide to VHF/UHF Amateur Radio

By Ian Poole, G3YWX
RSGB 112 pages

Everything you will need to help you enjoy VHF/UHF to the fullest. Choosing the right transmitter, receiver, antenna, utilizing the correct part if each band and more!

Order No. RSGVUAR $16.00

HF Antennas For All Locations

by Les Moxon, G6XN

RSGB 322 pages

Details the design and construction of hundreds of amateur antennas. You'll sure to find one antenna in this collection that will work for you!

Order RSHFAAL $33.50

Understanding, Building & Using Baluns & Ununs

by Jerry Sevick, W2FMI

The successor to the popular and authoritative Baluns and Ununs. Great deal of new tutorial material, and designs not in previous book, with crystal clear explanations of how and why they work.

8.5 X 11 Paperback $19.95
***New!* CD Version $14.95**
Buy both for only $29.95

The Short Vertical Antenna and Ground Radial

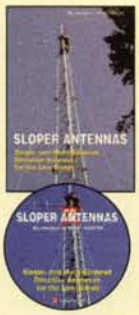
by Sevick, W2FMI

Small but solid guide walks you through the design and installation of inexpensive, yet effective short HF vertical antennas.

6 X 9 Paperback $10.00

Sloper Antennas

By Juergen A. Weigl, OE5CWL



Single- and Multi-Element Directive Antennas for the Low Bands

With calculations and practical experience, this book shows which basi concepts have to be considered for sloper antennas for the low bands.

6 X 9 Paperback $24.95
***New!* CD Version $18.95**
Buy both for only $36.95

Reflections III

by Walter Maxwell, W2DU

Includes all the information in Reflections I & II and much, much more! This fully revised and updated, this 424-page, third edition is truly a must have!

8.5 X 11 Paperback $39.95
***New!* CD Version $29.95**
Buy both for only $59.95

VHF/UHF Handbook

Edited by Andy Barter, G8ATD
RSGB 320 pages.

Guides you through the theory and practice of VHF/UHF operating and transmission lines. Includes information on getting started, antennas, constructing your own equipment, satellite ops, local nets and specialized modes.

Order: RXVUH $29.50

HF Antennas for Everyone

Edited by Giles Rad, G1MFG
RSGB

No matter the size of your available space - you'll find antenna designs that will help yo get your signals in and out!

Order: RSHFAE $27.95

HF Amateur Radio

RSGB 2007 Second Edition

This full revised and expanded second edition guides you through setting up an efficient amateur radio station, equipment to choose, installation, the best antenna for your location and MUCH more.

Order: RSHFAR $23.00

Collins Radio Repair & Tune-Up DVD Guides

From Hi-Res Communications, Inc., these well-produced, authoritative DVDs cover all the most common repair and tune-up subjects on these classic radios. It's like having an experienced professional right next to you!

Collins KWM-2
2 disc set, 236 minutes
Order No. C-KWM
$89.95

Collins 75S-3/32S-3
2disc set, 226 minutes
Order No. C-75S
$89.95

Collins 30L-1
Single Disc, 61 minutes
Order No. C-30L
$39.95

Shipping & Handling: U.S. add $7 for the first item, $3.50 for the second and $2 for each add'l item. FREE shipping on orders over $100 to one U.S. address. CN/MX-$15 for 1st item, $7 for 2nd and $3 for each add'l. All Other Countries-$25 for 1st item, $10 for 2nd and $5 for each additional. Buy Both=single item!

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

***Call:* 1-800-853-9797 • *Fax:* 516-681-2926 • *website:* www.cq-amateur-radio.com**

By Tomas Hood,* NW7US

VHF PROPAGATION

The Science of Predicting VHF-and-Above Radio Conditions

The Rise of Sunspot Cycle 24

The recent buzz around the DX clusters and 'net blogs and e-mail reflectors about the worldwide 10-meter openings is putting VHF DXers on alert. After nearly seven years of sunspot drought and the resulting lack of *F*-region propagation on any band north of 17 meters, it is nothing short of spectacular to see the constant stream of 10-meter QSOs day after day.

The conditions behind this change of activity on the higher frequencies are the result of an active sunspot season. In February 2011 we witnessed the hint that solar activity was changing. The first hint came in mid-February. Between February 2010 and February 2011, the 10.7-cm radio flux daily observed index never rose above 96. On February 12, 2010, the 10.7-cm radio flux measured 96. For exactly 12 months to the day the radio flux fluctuated from the low 70s to just shy of 96, until February 12, 2011, when the radio flux index was again 96! What are the odds? This time around, however, the solar energy continued to rise.

As of press time, the month of March has set new records for sunspot Cycle 24. By March 8, 2011, the daily 10.7-cm radio flux reading reached a new record for the Cycle 24—a very welcomed 155! This was the highest level of solar energy since July 23, 2004, when the daily radio flux reached 165. That is a very long seven years since we've witnessed this level of solar energy ionizing the *F*-region, enabling worldwide DX!

Other records were broken during the same week. On the same day, March 8, the total smoothed observed sunspot count was 137. The highest previous count was six years earlier, on July 7, 2005, when the daily number was 149. Interestingly, the

*PO Box 1980, Hamilton, Montana 59840
e-mail: <nw7us@arrl.net>

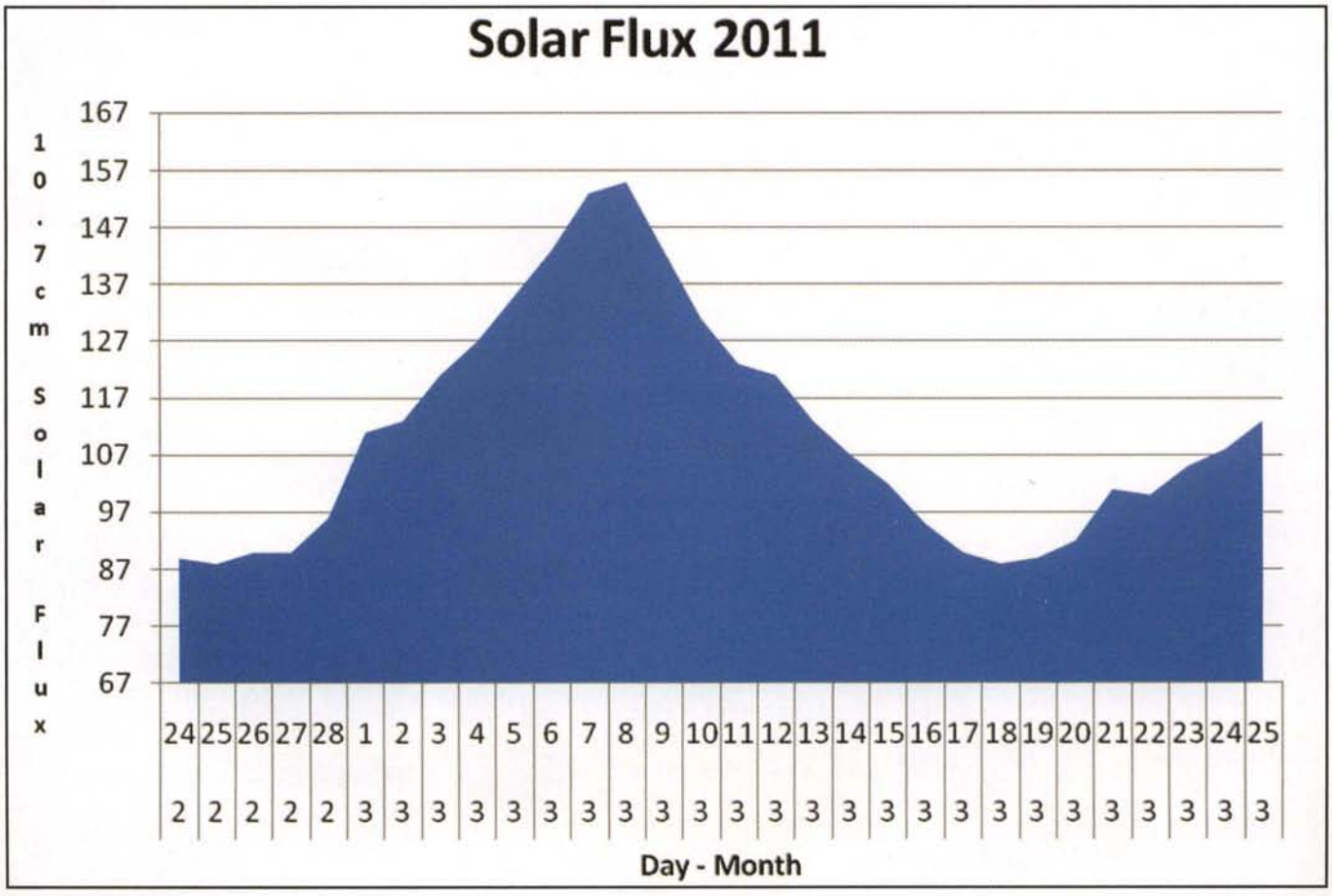


Figure 1. This is a plot of the daily 10.7-cm radio flux from the end of February through March 2011. This welcomed increase in solar energy resulted in a plethora of DX on 10 meters, signaling the soon-return of VHF 6-meter DX as early as this spring or summer. (Credit: Art Jackson, KA5DWI <http://propnet-studies.blogspot.com/>)

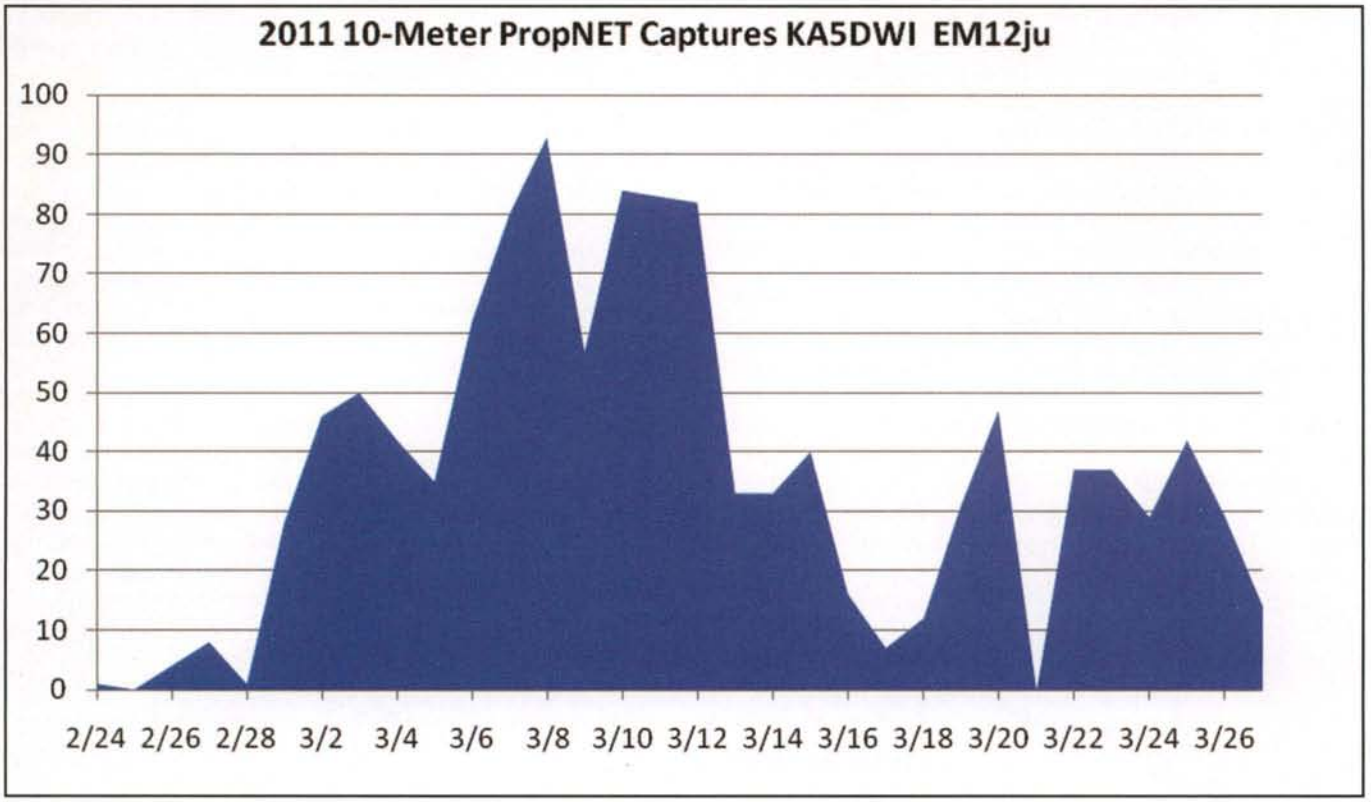


Figure 2. A plot revealing the increase in 10-meter activity at KA5DWI's PropNET (http://www.propnet.org/) station during March 2011. The level of activity directly tracts with the level of solar energy as measured by the 10.7-cm radio flux daily readings. (Credit: KA5DWI <http://propnet-studies.blogspot.com/>)

total combined sunspot area reached an incredibly huge size of 1650 "solar hemisphere" units (the units of sunspot area is millionths of the Sun's visible hemisphere). The last time the Sun was that covered by sunspots was January 18, 2005, when the combined size of that day's sunspots (109) also was 1650!

It is safe to state that sunspot Cycle 24 is finally showing a steady and more rapid rise in overall level of activity and energy. The trend numbers of this cycle do show this; the good news is that the Provisional International monthly mean Sunspot Number for March 2011 is 56.2; hat's the highest so far in the new sunspot cycle, starting with August 2009 when the monthly count was zero.

All of this sunspot activity has resulted in a plethora of DX on 10 meters. Art Jackson, KA5DWI (located in EM12ju and whom we've written about in past issues), regularly reports at his internet blog <http://propnet-studies.blogspot. com/> about his statistical analysis of propagation trends on 10 meters as revealed by the PropNET <http://www. propnet.org/> activity data which he collects. He states: "All of us who are active on 10-Meter PropNET have had the pleasure of seeing this band really take off in early March. We saw solar flux levels the highest since 2004. The results here were outstanding."

As KA5DWI illustrates in figures 1 and 2, when the 10.7-cm flux significantly rose during March, the DX "captures" at his station significantly increased on the 10-meter band. As he says, "I captured 31 DXCC entities, 98 Grid Squares, and 86 prefixes. The number of individual calls was too many to count at this time. The only continent missed was Asia. I just didn't point the antenna that way. Hello Cycle 24! Where have you been?"

Of VHF DXers, the sunspot activity of March was not yet high enough to energize the ionosphere sufficiently for refraction of 6-meter signals via the *F*-region. However, we're not that far away if the upward trend in solar activity continues. It won't be very long, indeed, before we can add single- and multihop *F*-region 6-meter DX to our logs again.

Spring VHF Propagation

The sporadic-*E* (*Es*) season should open up full throttle by the first week of May this year. Perhaps the Sun will be energetic enough to add long-distance *F*-region DX openings as well. The season will last from May to well into August.

The *Es* season is known for the quick, sometimes very strong, openings on 6 meters between short distances (hundreds of miles). This is a mostly summer-time mode of propagation where clouds of highly dense ionization develop in the *E* region of the ionosphere. These clouds might be very small, but regardless of their size, they seem to drift and move about, making the propagation off these clouds short and unpredictable. It is well-documented that *Es* occurs most often in the summer, with a secondary peak in the winter. These peaks are centered very close to the solstices. The winter peak can be characterized as being five to eight times less than the summer *Es* peak.

Ten-meter operators have known *Es* propagation as the summertime "short skip." These "clouds" appear unpredictably, but they are most common over North America during the daylight hours of late spring and summer. *Es* events may last for just a few minutes to several hours, and usually

provide an opening to a very small area of the country at any one time.

During periods of intense and widespread *Es* ionization, two-hop openings considerably beyond 1400 miles should be possible on 6 meters. Short-skip openings between about 1200 and 1400 miles may also be possible on 2 meters.

For a great introduction on mid-latitude sporadic-*E* propagation, visit the AM-FM DX Resource website: <http://www.amfmdx.net/propagation/Es.html>.

Tropospheric Ducting

Most propagation on VHF and above occurs in the troposphere. There are a number of well-documented modes of tropospheric propagation. The most common is line-of-sight propagation, which can, depending on the height of the transmitting and the receiving antennas, extend to about 25 miles. When you work simplex FM or FM repeaters in your local area, you are hearing typical line-of-sight tropospheric propagation.

Another possible mode of propagation is by tropospheric ducting. The term *tropospheric ducting* refers to the stratification of the air within the troposphere. These ducts are created by inversion layers formed from solar warming of the ground and the atmosphere immediately above it.

Under perfect conditions, the troposphere is characterized by a steady decrease in both temperature and pressure as height increases. When layers form within this region of air, the refractive index between each layer causes a refraction of VHF and UHF radio waves. If the layers form in just the right way and at the right height, a natural wave-guide is created. A tropospheric duct develops. A VHF signal can be ducted hundreds, if not thousands, of miles. It is common for California stations to work Hawaii stations during tropospheric ducting between the islands and the mainland.

It is worth watching for this mode of propagation. The spring weather season may well be violent and eventful this year, as has already been the case. Advanced visual and infrared weather maps can be a real aid in detecting the undisturbed low clouds between the West Coast and Hawaii or farther during periods of intense subsidence-inversion band openings. This condition also occurs over the Atlantic Ocean. There is a great resource on the internet that provides a look into current conditions. Bill Hepburn has created forecast maps and presents them at

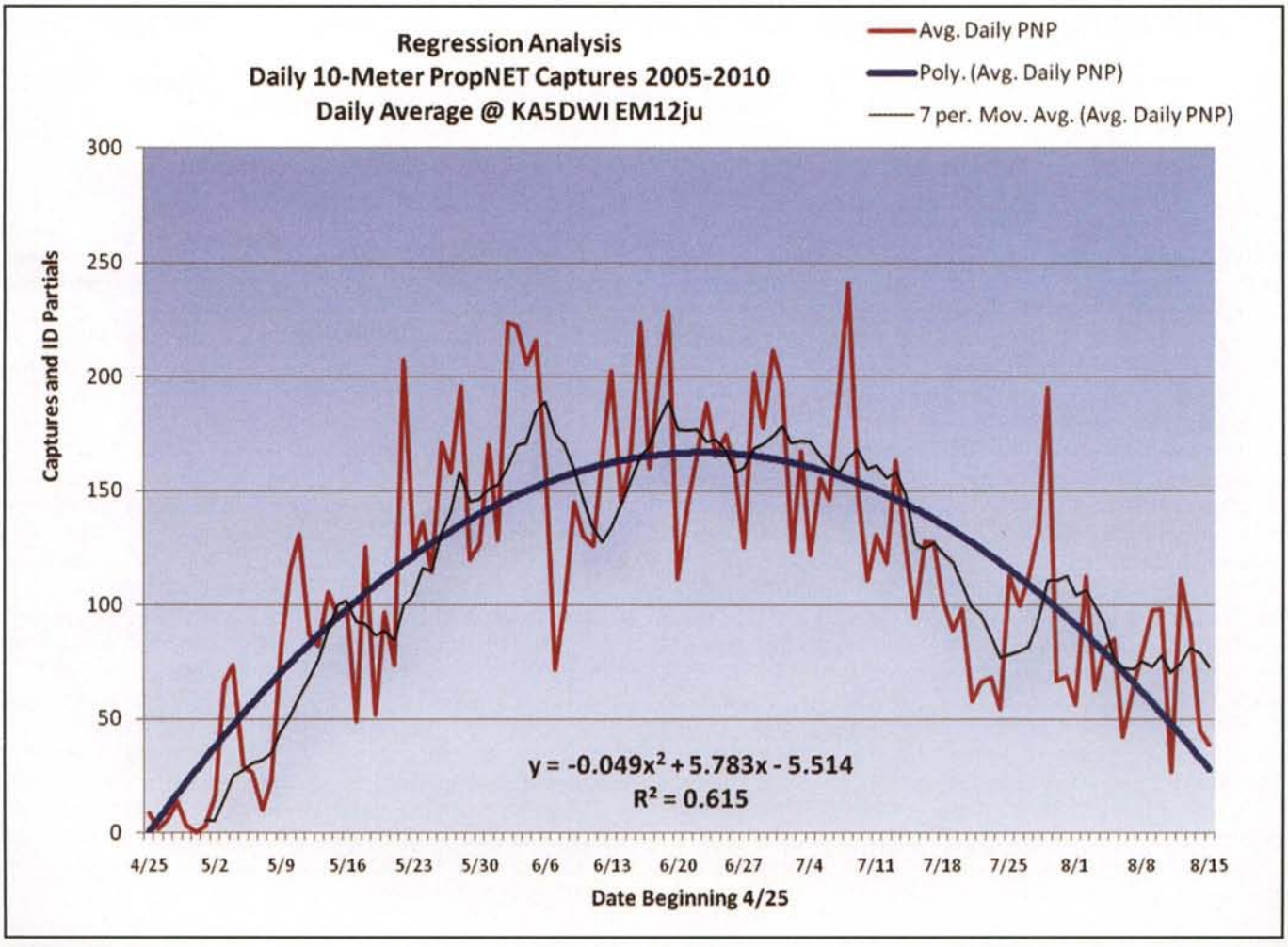


Figure 3. Now and then Es *appeared around April 21st to the 25th. The first full-scale opening appears near May 9–11. By the end of May,* Es *is in full swing and will not decline until mid-August. Activity-wise, it peaks very near the summer solstice. It rises quickly and takes its time to end. (Credit: KA5DWI <http://propnet-studies.blogspot.com/>)*

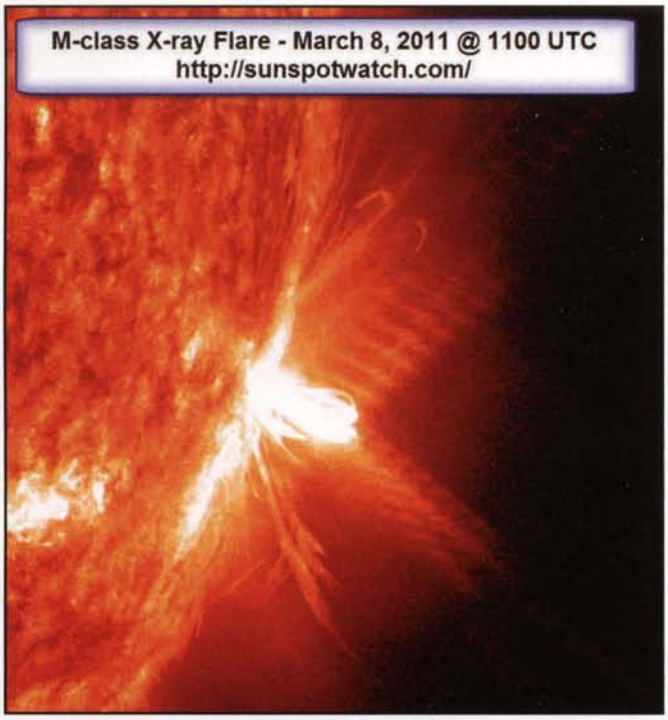


Figure 4. A stunning view of an M-class X-ray flare on March 8, 2011 as seen by the Solar Dynamics Observatory (SDO) Atmospheric Imaging Assembly (AIA) at the 304-Angstrom wavelength. Solar activity in March reached the highest yet on record for sunspot Cycle 24, and the highest since 2004. (Credit: SDO/AIA)

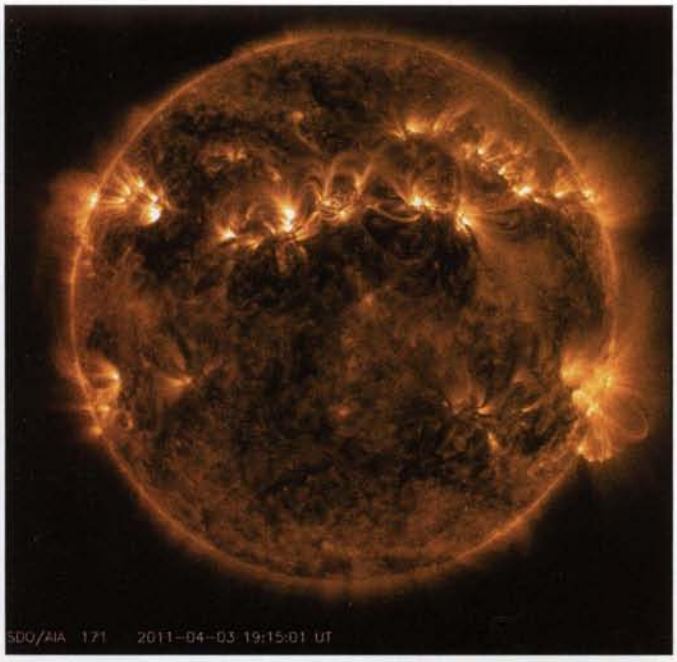


Figure 5. Magnificent, huge sunspot regions are popping with gigantic magnetic field lines capturing hot solar plasma. This is a view of our star player on April 3, 2011 as seen by SDO at the 171-Angstrom wavelength. The Sun is just getting started in the current sunspot Cycle 24. Over the next couple of years, expect an ever-increasing level of solar activity, and with it VHF DX via the F-region *of the ionosphere. (Credit: SDO/AIA)*

<http://www.dxinfocentre.com/tropo.html>, which includes maps for the Pacific, Atlantic, and other regions.

If you know that conditions are favorable for tropospheric ducting in your area, try tuning around the 162-MHz weather channels to see if you can hear stations way beyond your normal line-of-sight reception. It is possible to hear stations over 800 miles away. Amateur radio repeaters are another source of DX that you might hear from the other end of the duct.

These openings can last for several days, and signals will remain stable and strong for long periods during the opening. The duct may, however, move slowly, causing you to hear one signal well for a few hours, to then have it fade out and another station from another area altogether take its place .

The Solar Cycle Pulse

The observed sunspot numbers from January through March 2011 are 19.0, 29.4, and 56.2, with February and March now standing as the highest yet in sunspot Cycle 24. The smoothed sunspot counts for July and August 2010 (September was not yet published at press time) are 16.8 and 17.4.

The monthly 10.7-cm (preliminary) numbers for January through March 2011 are 83.7, 94.5, and115.3. The smoothed 10.7-cm radio flux numbers for July and through September 2010 are 80.1, 80.7, and 82.4.

The smoothed planetary *A*-index (*Ap*) for July through September 2010 are 6.0, 6.2, and 6.3, showing a slow increase in overall geomagnetic activity. This is consistent with the increase in solar energy. The monthly readings for January through March 2011 are 6, 6, and 7.

(Note that these are preliminary figures. Solar scientists make minor adjustments after publishing, by careful review.)

The monthly sunspot numbers forecast for May through July 2011 are 60, 64, and 68. The monthly 10.7-cm is predicted to be 107, 112, and 115 for the same period. That's really great news, as we'll likely see days with significantly higher 10.7-cm readings (as the monthly figures are averages from a month of daily readings); there may well be days when the solar energy will rise high enough to support VHF propagation. If this happens, please report to me!

Feedback, Comments, Observations Solicited!

I am looking forward to hearing from you about your observations of VHF and UHF propagation. Please send your reports to me via e-mail, or drop me a letter about your VHF/UHF experiences. I'll create summaries and share them with the readership. I look forward to hearing from you.

Up-to-date propagation information is found at my propagation center: <http://sunspotwatch.com/>. If you are using Twitter, follow @hfradiospacewx for space weather and propagation alerts, and follow @NW7US to hear from me about various space weather and amateur radio news. Facebook members should check out the *CQ VHF* Magazine Fan Page at <http://www.facebook.com/ CQVHF>, and the Space Weather and Radio Propagation Group at <http://www.facebook.com/spacewx.hfradio>. Until the next issue, happy weak-signal DXing.

73 de Tomas, NW7US

By Thomas Dean, KB1JIJ

ATV

Amateur Television – Methods and Applications

Generating On-Screen Display

In order to transmit Amateur Television, operators are required to have their callsign displayed on screen. There is, of course, no real requirement as to whom the callsign needs to be displayed, but it is most convenient and rather common to overlay text on top of the video, commonly referred to as On-Screen Display (OSD). This technique is also useful to add information such as time and date, or GPS locations. This column documents different approaches at adding OSD to analog video.

There are many easy, out-of-the-box methods for overlaying text onto video. Many VCRs include the ability to display time and date, and some also have options to add text fields which could be used to overlay a callsign. The output of such a VCR could be used as the input to an ATV transmitter. There are also a great number of prebuilt boards or kits that could be purchased for this purpose.

One vendor that provides a wide variety of OSD boards is Intuitive Circuits (http://www.icircuits.com/). Products are available as a stand-alone circuit board (figure 1) or within an enclosure (figure 2). These products are convenient to use as they provide a useful interface to input text to display. One of the most challenging parts of designing such a device is to provide OSD to create the user interface.

*e-mail: <Thomas.Dean@usma.edu>

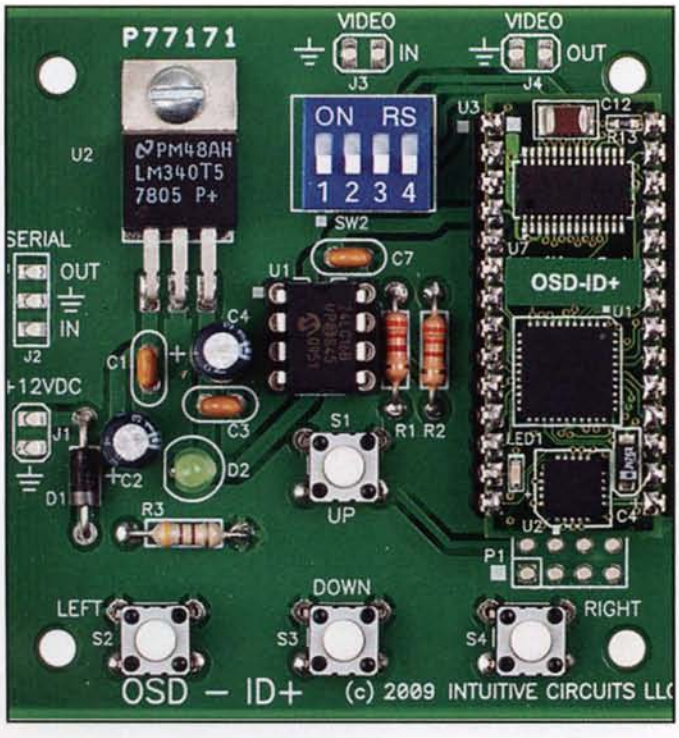


Figure 1. An OSD device from Intuitive without an enclosure.

For those interested in getting into the weeds of creating OSD, there are several integrated circuits around that can do most of the work for you. One example of such a chip is the MAX7456. The larger part of working with these sorts of chips is creating an interface to control them. This particular chip is controlled by Serial Peripheral Interface (SPI), which is a fairly common interface to control such circuits. The best way to work with such an interface is with a microcontroller.

Looking at the internal block diagram of this chip, shown in figure 3, can give great insight into how the text is displayed on screen. Understanding how the text is displayed on screen can help further understanding of the NTSC standard. Even though NTSC is an analog format, it often is broken down into pixels. The resolution is limited to 648 × 486 pixels by two factors. The vertical resolution is limited by the number of scan lines in the image and the horizontal direction is limited due to the bandwidth limitations on the video signal.

Embedded as part of the NTSC waveform are synchronization signals. These allow the television receiver to lock the image in place both vertically and horizontally. In order to properly create text to be placed on a video, the sync signals can be used to keep track of where in each frame the current picture is by pixel. The MAX7456 keeps track of the location where each pixel that is to be added must go and generates the proper color as this location passes through. This is then overlaid on the original picture (the OSD MUX in figure 3) and output. The data sheet on the MAX7456 (http://www.datasheets.maxim-ic.com/en/ds/MAX7456.pdf) gives a large amount of additional information on the operation of the chip and provides much information on the NTSC standard.

On-Screen Display is an important part of any ATV operation. It can be very simple to acquire a means to achieve OSD. Creating your own OSD system is not an overly difficult process and could provide great insight into the understanding of the NTSC standard. 73, Thomas, KB1JIJ

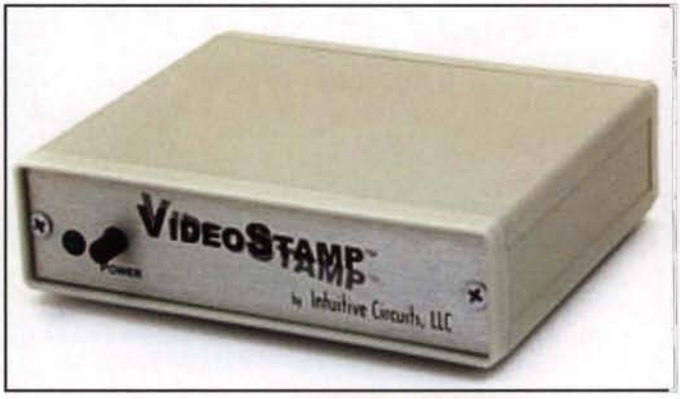


Figure 2. An example of an enclosed OSD device from Intuitive Circuits.

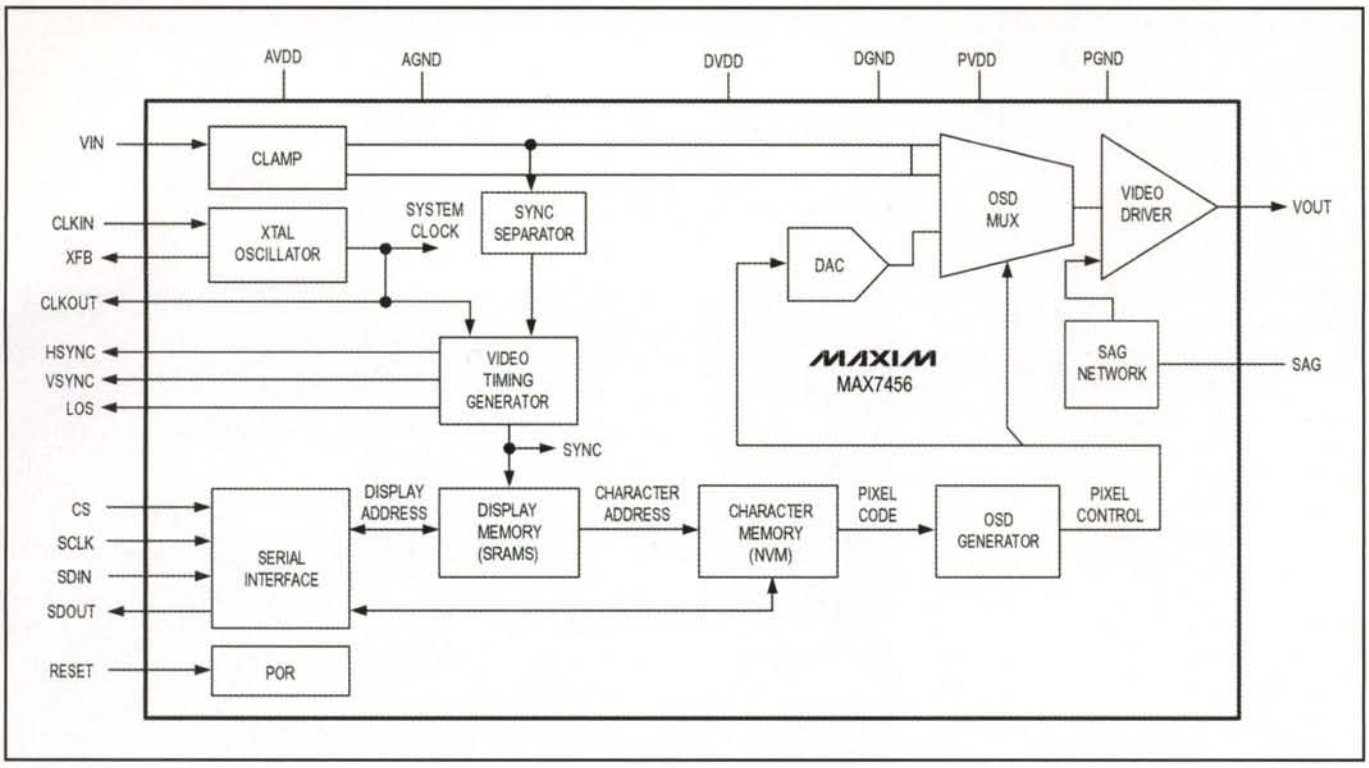


Figure 3. A functional diagram of the MAX7456 chip which generates OSD.

By Dr. H. Paul Shuch,* N6TX

DR. SETI'S STARSHIP

Searching For The Ultimate DX

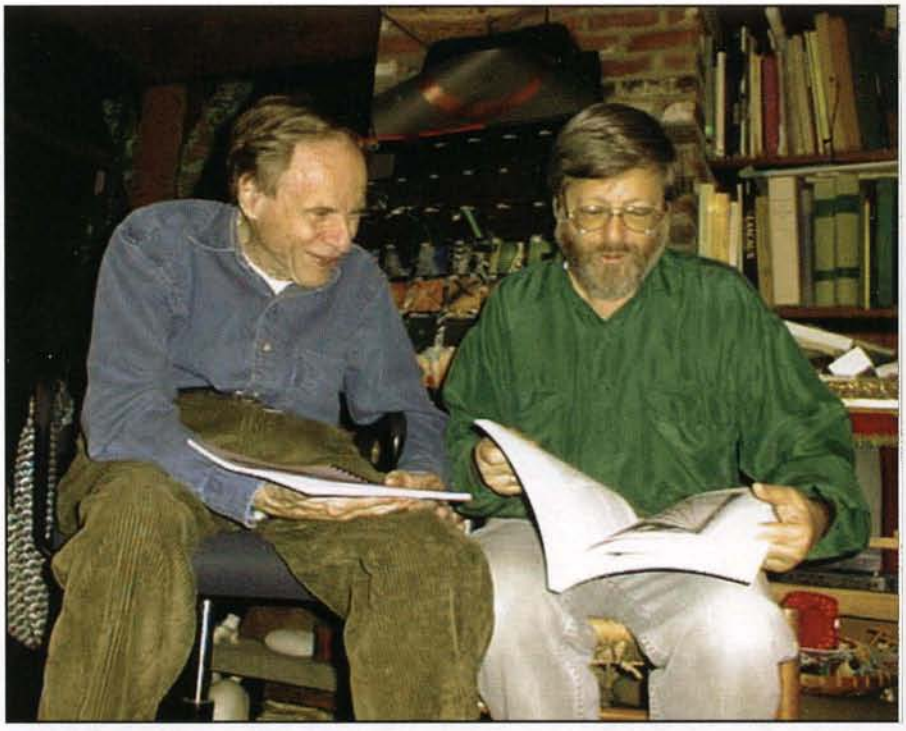
Six Degrees of SETI Separation

As this column is being written, we are about to witness the final flight of the NASA SpaceShuttle. How can one possibly associate the Space Shuttle with SETI, the electromagnetic Search for ExtraTerrestrial Intelligence? It's a long, convoluted path, so stay with me.

I'm sure every space enthusiast of appropriate age remembers exactly what he or she was doing when the *Challenger* shuttle exploded; it's one of those pivotal moments in history that's indelibly etched in our memory banks. Following that disaster, a panel of experts was convened to investigate. The person on the Rogers Commission who first figured out, and then demonstrated, the connection between low temperatures and O-ring deformation was CalTech professor Richard Feynman. That brilliant physicist and Nobel laureate (like many brilliant American physicists of his generation) had spent the years of World War II at Los Alamos, New Mexico, developing the first atomic bomb. There he worked for Enrico Fermi, best known to the SETI community for the famous Fermi Paradox . . . but I digress.

In a volume of Feynman's memoirs in the late 1980s I remember reading a passing reference to someone named Tukey, whom he had known in graduate school at Princeton University. The name rang a bell, so I went back to a book given to me by my uncle, the late Bayesian statistics authority Ward Edwards of Uuniversity of Southern California, when I was in grad school. The title was *Exploratory Data Analysis*, and the author was John Tukey, a noted statistician at Princeton, the very same Tukey of whom Feynman wrote. (That book informed and inspired some of the analytic tricks I employed in my doctoral dissertation . . . but I digress.)

*Executive Director Emeritus, The SETI League, Inc., <www.setileague.org>
e-mail: <n6tx@setileague.org>



The author exchanging ideas with SETI elder statesman Prof. Philip Morrison in 1997. (Phylis Morrison photo)

It was Tukey, I later learned, who had developed the Fast Fourier Transform (FFT), the algorithm that has been, until recently, the primary signal analysis tool of observational SETI. I first learned about the FFT in a landmark textbook on the Fourier Transform written by Ron Bracewell of Stanford. Bracewell was an Australian radio astronomer who co-authored the very first radio astronomy textbook, and later became very involved in SETI research . . . but I digress.

One of the things that motivated Bracewell's interest in SETI, it turns out, was the seminal article "Searching for Interstellar Communications," by Cocconi and Morrison. Phil Morrison, as I'm sure you know, went on to become the father of modern SETI science, and a mentor to many SETIzens, including me. He was also a veteran of the Manhattan Project at Los Alamos, and somewhere along the line had gotten to know Tukey. Interestingly, Morrison, Feynman, and quite a few other Los Alamos scientists went on to become staunch pacifists, and proponents of nuclear disarmament . . . but I digress.

I could go on (digressing), but I think you can see the pattern here. From Challenger to Feynman to Tukey to Bracewell to Morrison, it all points to SETI. It's a case of convergent influences, quite common to all intellectual pursuits, and I'm sure you've seen similar connections elsewhere. The point is, SETI is so highly interdisciplinary a field of study that you can get there from just about any conceivable starting point, and from wherever you started, you arrived at this page for a reason. SETI science needs your skills and background, whatever they may be.

73, Paul, N6TX

Advertisers' Index

It's easy to advertise in CQ VHF.
Let me know what I can do to help.
Chip Margelli at
405-ADS-CQCQ (405-237-2727), FAX 714-895-3714
e-mail:ads@cq-amateur-radio.com

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Blvd, 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between
S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jose, XE2SJB, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102, 94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Chuck, N1UC, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John, WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave, 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville,
1 mi. no. of I-285
atlanta@hamradio.com

NEW EXPANDED STORE!

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention - Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

Call or check our website for latest Spring specials from YAESU
coupons shown expired 3/31/11

YAESU

#1 Yaesu Dealer Worldwide

Competitive pricing!

FTM-350AR 2m/440 Dualband

FREE FPR-1 w/purch.

- 50W 2m/440† - 1 watt 220Mhz
- TNC built-in, Bluetooth capable
- Band scope built-in
- 500 Memories

FT-857D

FREE YSK-857

Ultra compact HF, VHF, UHF

- 100w HF/6M, 50w 2M, 20w UHF
- DSP included • 32 color display
- 200 mems • Detachable front panel (YSK-857 requ

Call for Low Price!

FT-897D VHF/UHF/HF Transceiver

- HF/6M/2M/70CM • DSP Built-in
- HF 100W (20W battery)
- Optional P.S. + Tuner • TCXO Built-in

Call Now For Our Low Pricing!

FTDX5000MP 200w HF + 6M Transceiver

- Station Monitor SM-5000 Included
- 0.05ppm OCXO included
- 300 Hz Roofing filter included
- 600 Hz Roofing filter included
- 3 kHz Roofing filter included

FT-7900R 2M/440 Mobile

$20.

FREE YSK-7800

- 50w 2m, 45w on 440mHz
- Weather Alert
- 1000+ Mems
- WIRES Capability
- Wideband Receiver (Cell Blocked)

Call Now For Your Low Price!

FT-950 HF + 6M TCVR

$50.

NEW!

- 100W HF/6M
- Auto Tuner built-in
- 3 roofing filters built-in
- DMU-2000 Compatible

Call Now For Low Pricing!

VX-7R/VX-7R Black

$20.

50/2M/220/440 HT

- Wideband RX - 900 Memories
- 5W TX (300mw 220Mhz)
- Li-Ion Battery
- Fully Submersible to 3 ft.
- Built-in CTCSS/DCS
- Internet WIRES compatible

Now available in Black!

FT-2000/FT2000D HF + 6M tcvr

$100.

- 100 W w/ auto tuner • built-in Power supply
- DSP filters / Voice memory recorder
- 200W (FT-2000D)
- 3 Band Parametric Mic EQ • 3 IF roofing filters

Call For Low Pricing!

FT-8800R 2M/440 Mobile

FREE YSK-8900

$10.

- V+U/V+V/U+U operation
- V+U full duplex • Cross Band repeater function
- 50W 2M 35W UHF
- 1000+ Memory channels
- WIRES ready

Call Now For Low Pricing!

VX-6R

$10.

2M/220/440HT

- wideband RX – 900 memories
- 5W 2/440 , 1.5W 220 MHz TX
- Li-ION Battery - EAI system
- Fully submersible to 3 ft.
- CW trainer built-in

NEW Low Price!

VX-8DR/VX-8GR

$30.

50/144/220/440 (VX-8DR)
2m/440 w/ Built-in GPS (VX-8GR)

- 5w (1w 222 Mhz VX-8DR only)
- Bluetooth optional (VX-8DR only)
- waterproof/submersible 3 ft 30 mins
- GPS/APRS operation optional
- Li-ion Hi-capacity battery
- wide band Rx

VX-8GR only

FT-450D HF + 6M TCVR

- 100W HF/6M • Auto Tuner built-in • DSP Built
- 500 Memories • DNR, IF Notch, IF Shift

Call Now For Special Pricing

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

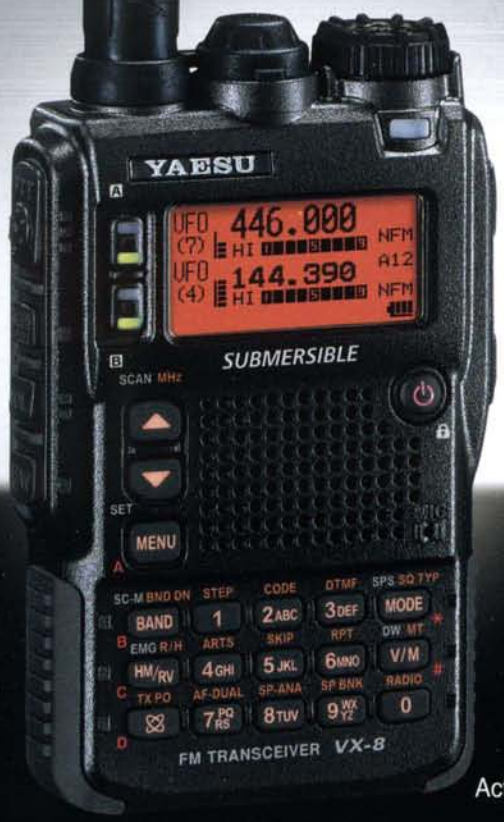
#1 in Customer Service

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!

A TECHNOLOGY BREAKTHROUGH

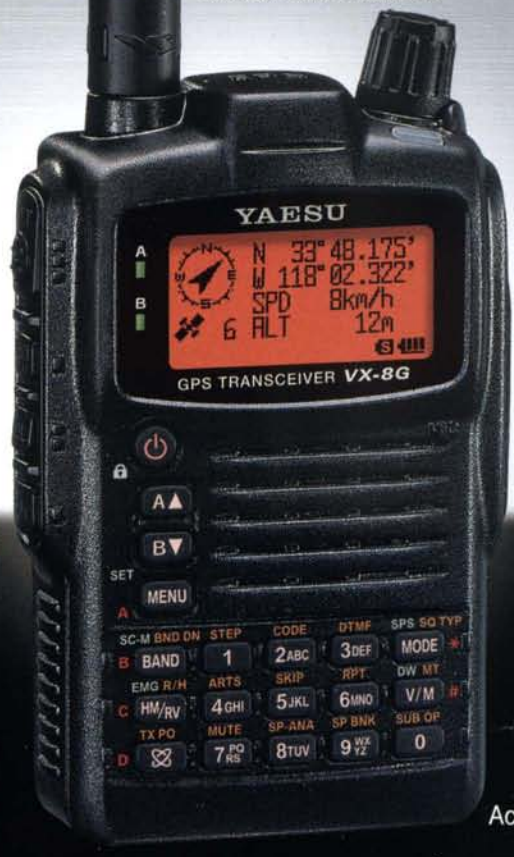
New Advanced VX-8 Series GPS/APRS® Handheld Transceivers
Choose the Yaesu that meets your APRS® operating preferences in the field

50/144/(222)*/430 MHz
FM 5 W/AM 1W (50 MHz) Triple Band Handheld
VX-8DR * 222 MHz/1.5 W (USA version)
(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)



Actual Size

144/430 MHz
FM 5 W Dual Band Handheld
VX-8GR
(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)



Actual Size

VX-8DR NEW

All-in-one Prestigious Tri-band Transceiver
Bluetooth® for hands-free Operation with optional accessories
Waterproof/Submersible IPX 7 rated - 3 ft for 30 minutes

Optional GPS and antenna unit for GPS/APRS® operation

Attached to the radio (microphone input) using the optional GPS Antenna Adapter CT-136

The optional GPS Antenna Unit FGPS-2 attached to the optional speaker Microphone MH-74A7A

Bluetooth®

VX-8GR NEW

144/430 MHz Dual Band Transceiver with GPS unit included
Built-in GPS Antenna - Waterproof
Wide Band Receive for 108-999 MHz (Cellular blocked – US Version)

Supports APRS® communication by the Built-in Worldwide Standard AX.25 Data TNC

The VX-8 series radios are compatible with the world wide standard APRS® (Automatic Packet reporting System) using the GPS system to locate and exchange position information.

- SmartBeaconing™ Function
- Memories to list 50 stations
- Memories to store 30 APRS® messages
- DIGI-PATH routing indication function
- 8 DIGI-PATH routing settings
- GPS Compass Display - "Heading Up" or "North Up"
- APRS® Symbol Icon pre-set function
- Clearly displayed APRS® Beacon Messages
- Selective Message Received indicated by Flashing LED

For the latest Yaesu news, visit us on the Internet:
http://www.yaesu.com

YAESU
Choice of the World's top DX'ers℠

Vertex Standard US Headquarters
10900 Walker Street Cypress, CA 90630 (714) 827-7600

Advanced Dual Band Mobile Radio
5.2" x 1.6" Large dot matrix (264 x 64 dots) LCD displa
GPS / APRS® / Bluetooth® Features
FTM-350AR

New Vacuum Cup-Mounting Bracket permits Angle Adjustment
New APRS® Operation Capability, and newly Expanded User Friendly Functions

144/(220)*/430 MHz 50 W FM Dual Band Transceiver

FTM-350AR NEW

220 MHz 1 W (USA version only)

New Features of The FTM-350AR

1. New Vacuum Cup-Mounting Bracket with Angle Adjustment

The new MMB-98 Mounting bracket allows easy installation of the radio control display to your Dashboard by placing the vacuum mount in the desired location and pressing a lever. You may then adjust the display to the optimum viewing angle.

2. Expanded APRS® functions

- **Uses the worldwide-accepted GPS NMEA data format**
- **Navigation to another APRS® BEACON station is possible, even if the beacon station is moving.**
- **Waypoint data (Data in/out) is available from the ACC connector on the rear of the main unit.**
- **Sub-Band APRS® operation may be active in the background, even when operating in Mono-Band Display mode.**
- **Newly added Voice Alert function**
- **Re-allocated often used keys to more convenient positions for easier operation**
- **Programmable keys on the DTMF Microphone provide direct access to APRS® functions**

*APRS® is a registered trademark of Bob Bruninga WB4APR
*SmartBeaconing™ from HamHUD Nichetronix

For the latest Yaesu news, visit us on the Internet:
http://www.vertexstandard.com

Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may differ in some countries. Check with your local Yaesu Dealer for specific details.

YAESU
Choice of the World's top DX'ers

Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714)827-760