ICD 08241

Amateur Radio

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SERVING AMATEUR RADIO SINCE 1945

APRIL 2000

CQ

Now including CQ VHF

In This Issue:

Al Schulman, WØDRT, and his granddaughter, KØGAL, search for DX from her station in uri. (Details on p. 116.)

RADIO AMATEUR'S JOURNAL

GET OUT. HAVE FUN.

ICOM MOBILES

Plenty of Power, PC Programmable, and Ready for FUN!

QST says:
"Those shopping for a wide variety of advanced features in an economically priced 2-meter mobile will find the ICOM IC-2100H worthy of serious consideration."
– QST, 1/99

IC-2100H ▶ 2 meters has never been easier or more fun! 55 watts of power; PC programmable*; 113 memory channels; die cast aluminum chassis; full control mic; CTCSS; highly intermod resistant; and a cool DUAL color display.

Only 4.3" Wide
The IC-207H's super compact remote head boasts a large display with soft key menu controls.*

Green or Amber
Select which color you want the display to show. The large alphanumerics and soft key controls are easy to see

◀ IC-207H The ultra-compact remote control* head of this 2 meter/440 MHz dual bander fits on just about any kind of dashboard. Also enjoy: CTCSS encode/decode; up to 9600 bps packet*; built-in duplexer; 182 memory channels; full control mic; auto repeater; and more.

IC-2800H ▶ Audio excellence, video excitement. 2M/440MHz dual bander with: remote control head; independent tuning & control knobs; cross band repeat; TFT color LCD display; NTSC video input; 118 - 174, 440 - 450 MHz wide band receive**; band scope; 9600 bps data port; CTCSS encode/decode; 232 memory channels; PC programmable*; die-cast aluminum chassis; full control mic; and MUCH more.

Easy to Install
Comes with two mounting brackets– one for the main unit, one for the control head

Gordon West says:
"We are happy to report programming is a snap, and seeing the TFT color display on your dash is no problem during the day, and graphically, tantalizing at night!"
– Amateur Radio Trader, 9/99

PC Ready!
*Optional equipment required. Check with your dealer today.

ISO 9001 SGS

Get out and have MORE fun. Whatever your 2 meter or 440 MHz needs, ICOM has the rig for you. Visit your ICOM dealer today, or call 425-450-6080 for a brochure.

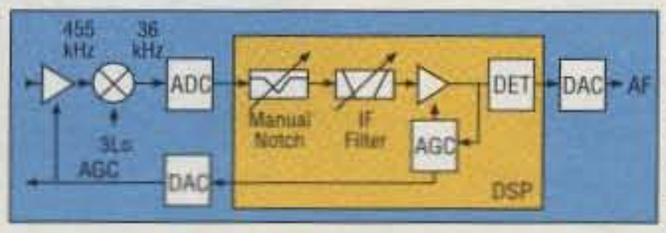
ICOM®
www.icomamerica.com

ICOM IC-756PRO

This is not your father's HF rig. This is all new, 32-bit DSP digital processing.

THE GREATEST THING TO HIT HF SINCE...

The new IC-756PRO sets a new standard in ham radio design and construction. At the heart of the 'PRO is a new, 32-bit floating point DSP. Older 16-bit fixed point DSP units limited the performance of earlier rigs. Not on the 'PRO.



DSP IN THE IF, BEFORE THE AGC. *Dual loop digital AGC eliminates strong signal pumping.*

THE DX ADVANTAGE YOU'VE ALWAYS WANTED

The 144 dB dynamic range of 32-bit floating point technology blows away the limitations of older 16-bit technology. If your ear had that range, you could still hear a whisper while standing next to a jet engine. With the 'PRO, you may not get the full theoretical performance, but you will get amazingly clear, crisp reception and almost no background noise.

YOU'LL NEVER BUY ANOTHER FILTER

The IC-756PRO features 41 built-in, front panel selectable levels of DSP filtering. No additional filters or high stability crystal oscillators are available or needed. Our filters are the sharpest–more selective than any crystal or mechanical filters. The selectivity lets you pull out weak signals like never before.

CD VS VINYL

The 'PRO's audio quality is revolutionary. You've got to hear it to believe it.

Customize the screen's look by changing colors, fonts, brightness, contrast, and more.

Keep tabs on memory channels with an alpha-numeric readout of mode, frequency, filters & more.

A digital voice recorder has 4 slots for RX and 4 for TX, each 15 seconds long–a contesting bonus!

Copy RTTY DX without firing up your computer. A dual auto peak filter makes it easy.

Visual indicators of filter selection let you tweak the band pass. Choose from 31 steps of 100Hz between 3600–600Hz and 10 steps of 50Hz between 500–50Hz.

If the AGC is too fast or too slow, make it "just right" with a quick settings change. Use different settings for different modes.

EASY TO USE, EASY ON THE EYES. *The IC-756PRO's front panel is well laid out and easy to control. The TFT LCD display is easy to see from wide angles, day or night. This handsome rig will great in any home or shack.*

SPECS & FEATURES

Subject to change without notice or obligation

Transmit: ..... All Amateur HF, 6 Meters
Receive: ..... 0.03 – 60 MHz
Mode: ..... USB, LSB, CW, RTTY, AM, FM
Power: ..... 5–100W (5–40W AM)
Power Supply Requirement: 13.8VDC, 23A
Memory Channels: ..... 101 Total
Size & Weight : .... 13.4(W) x 4.4(H) x 11.2(D) in.
340(W) x 111(H) x 285(D) mm., 21 lb / 9.6 kg

- **5" TFT Color LCD**
  - Wide viewing angle, more information
  - Adjustable colors and settings
- **32 Bit Floating Point DSP Processor**
  - Digital AGC loop operation
  - Digital IF filter, 41 selectable bandwidths
  - Built-in RTTY demodulator / dual peak APF
  - Built-in microphone equalizer
  - Manual notch function
- **8 Channel Digital Voice Memory**
- **Digital Twin Pass Band Tuning**
- **Built-In Auto Antenna Tuner**
- **Dual Watch • VOX**
- **Triple Band Stacking Register**
- **Built-In Memory / Electronic Keyer**
- **Independent RIT / ΔXT Control**
- **2 TX/RX, 1 RX Only Antenna Connectors**
- **100% Duty Cycle**

Whether it's voice, CW or data, the new IC-756PRO offers the details and performance capable of topping the contest charts. Contact your ICOM dealer today, or call for a free brochure. **425-450-6088**

Are you a PRO?

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CQ now including CQ VHF

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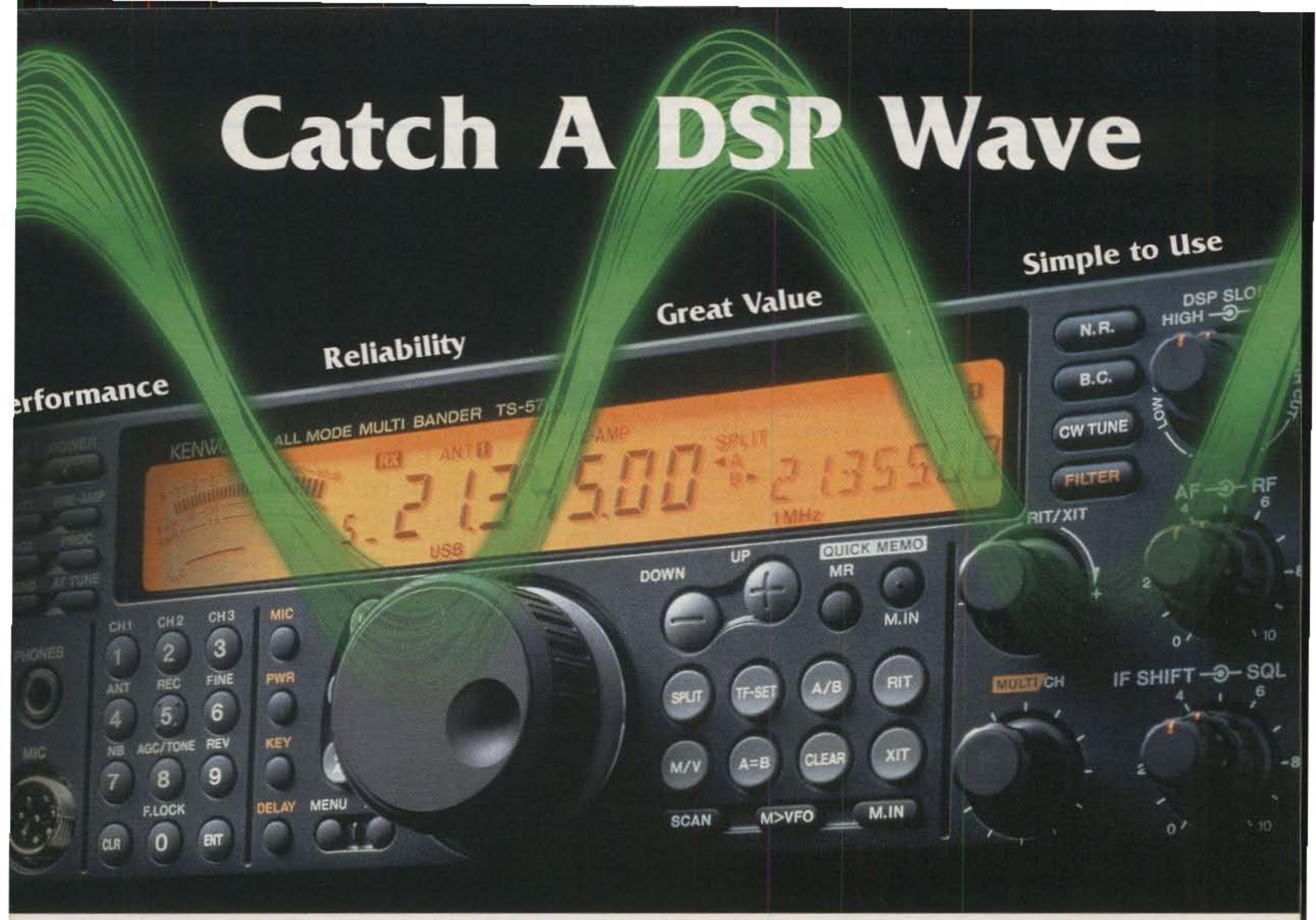
DEPARTMENTS

Catch A DSP Wave



TS-570D(G) HF TRANSCEIVER/TS-570S(G) HF + 6M TRANSCEIVER

Kenwood has not been standing still since the introduction of the TS-570D/S HF Transceiver last year. Now you can command even more of Kenwood's advanced DSP technology with the G model.

The **DSP** filters and extracts signals with digital technology that is unmatchable with standard analog circuits. It provides **CD-class transmit and receive audio quality** that can be shaped to your needs, and two powerful noise reduction systems: **Line Enhancer Method** for SSB/AM modes, and **Speech Processing by Auto Correlation** (SPAC) for CW mode. DSP also enables the **CW-Auto Tune** feature that automatically zero-beats CW signals.

The **Extensive Memory Functions** provide a bank of 100 memory positions split into 90 standard channels for general operation and 10 for programmable VFO, programmable scan and long-term memory. Memory contents can be scrolled, copied or locked out. In addition there are **5 quick memories** for storing frequencies and modes on the fly, perfect for the busy DX contester.

The powerful **Menu System** incorporates **46 menu features** and an **on-line guide** for instant reference. The **large amber backlit LCD display** provides 4 light levels for clear readability under any lighting conditions.

The TS-570D/S has no shortcomings in the construction and performance area. The **continuous-duty 100 watt transmitter** incorporates a large heavy-duty heat sink with integrated cooling fan for non-stop operation even under extreme environmental conditions. The **wide-band receiver** is rock-stable from 500 kHz through 30 MHz with **dual pre-amps** and **dual bandpass filters** for exceptional selectivity and sensitivity.

With the features and performance of a high-end radio integrated into an affordable mobile-size package, the TS-570D/S is the perfect choice for the field or to build a full station around at home.

- ***FREE* operating manual via FTP site**
  ftp://ftp.kenwood.net
- Beat cancel
- 2 position antenna switch
- CW auto tune adjust (a world's first)
- Channel scan, program band scan, memory scan with channel lock-out and group channel scan, all with TO (time operated) or CO (carrier operated) resume modes
- Compact 10-5/8 inch by 3-3/4 inch front panel size for any travel or installation requirement
- Preset auto antenna tuner with 18 sub-bands
- Variable electronic keyer (0 and 100 wpm)
- Packet and FSK features
- RCP-2 software for PC-based display and memory configurations available via the Internet
- Full functionality on 6M (TS-570S) including DSP, 100 watts output and preset Auto Antenna Tuner

TS-570D/S (G) new features

■ TX sound quality monitor with 9-step monitor volume for absolute control over voice quality ■ NR1 (SSB) is operator controllable in 9-step increments, or automatically tracks input signal strength ■ New CW DSP Filters (80 Hz, 150 Hz and 500 Hz) give you a total of 11 user-selectable filters ■ NR1 and NR2 settings can now re-configure automatically when changing mode groups (SSB/AM/FM to CW/FSK) ■ Manual weight feature (with built-in electronic keyer) for adjusting the relative length of dots and dashes in 16 steps between 1:2.5 and 1:4.0 ■ Equalize receive signals, and use different settings for both TX and RX ■ "One-touch" DSP filter wide mode allows 'resurfacing' to check the band conditions when operating in narrow mode ■ Dual selectable Beat Cancel (BC) works against intermittent beat interference (except in CW mode) ■ CW auto tune mode links only with the RIT frequency without changing the transmit frequency.

Advance Technology Upgrade is available in new production models and for pre-existing TS-570D/S; contact you dealer for details.

ISO 9001
JQA-1205
Communications Equipment Division
Kenwood Corporation
ISO9001 certification

KENWOOD
Amateur Radio Products Group

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AMATEUR RADIO PRODUCTS GROUP
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Zero Bias

BY RICH MOSESON, W2VU

An Editorial

Dairy Farms, Antenna Farms, and the 14th Amendment

Back in 1985, the FCC issued a limited federal preemption of local antenna regulations as applied to amateur radio operators. The document, called PRB-1, said that there is "a strong federal interest in promoting amateur communications" and that "(s)tate and local regulations that operate to preclude amateur communications ... are in direct conflict with federal objectives and must be preempted." The FCC ruled that local regulations "must be crafted to accommodate reasonably amateur communications, and to represent the minimum practicable regulation to accomplish the local authority's legitimate purpose," such as safety or aesthetics. However, in a footnote to that sentence, the Commission reiterated an earlier statement that the ruling "does not reach restrictive covenants in private contractual agreements," explaining that "(s)uch agreements are voluntarily entered into by the buyer or tenant when the agreement is executed and do not usually concern this Commission."

Restrictive covenants, also known as deed restrictions or "CC&Rs," are attachments to the deed or rental contract for your house, condo, or apartment that place certain restrictions on your use of the property—even if it is *your* property—and are passed on from one owner to the next. For example, my wife and I are prohibited by a deed restriction from operating a dairy farm on our postage-stamp size, semi-urban property. Now, we can live quite well without a dairy farm on our one tenth or so of an acre. But what if the deed restrictions said I couldn't put up an *antenna* farm, or more specifically, any outdoor antenna at all? This would pose a major problem. My choice would have been to try to negotiate the removal of the restriction (easier said than done in most places) or to buy a different house.

In theory, all terms of a private contract are negotiable, and the federal government historically has been extremely hesitant to stick its fingers into private contracts. Generally speaking, most of us would agree that we are capable of making informed personal and business decisions without government "help." The FCC, mindful of this history, said 15 years ago that it had no authority to extend the terms of PRB-1 to private contracts.

The landscape of buying a home in this country has changed dramatically since 1985, however. The traditional American residential real-estate transaction of one person or family purchasing a home from another, with usage subject only to local laws and zoning regulations, is becoming a rarity. Over the past 15 years, there has been an explosion in the growth of "planned communities," in which an entire neighborhood—or even a town-size development—is built by a single developer and each property is sold subject to a host of restrictive covenants regarding what you may and may not do with and to your home. These restrictions range from permitted paint colors to types of trees and shrubs you may plant, to barring any outdoor antennas and prohibiting radio transmissions of any sort. Not only are these restrictions written into the deeds, they are enforced after the developer leaves by homeowners' associations with *de facto* governmental powers (more on this later).

Fifteen years ago, you might indeed have had the choice to buy a different house in a nearby neighborhood if you didn't like the restrictions that came along with a proposed purchase. Today, however, in many parts of the country it is virtually impossible to buy or lease a home in any given geographic area without being part of a "planned community" with restrictions on outdoor antennas. Today, if you want to live in a particular area, you may have very little choice. In addition, many homeowners' associations enact restrictions *after the fact*, and may force you to move if you don't comply. What can hams do?

The ARRL's Petition

In 1996, with over a decade of experience in real-world application of PRB-1 in cases around the country, the ARRL filed a petition with the FCC, asking it to extend the reach of its preemption policy to include restrictive covenants and similar private regulations, and to clarify that the "prohibitive and excessive fees" and other costs imposed by some municipalities as part of the permit process do not meet the FCC's requirements for "reasonable accommodation" and "minimum practicable regulation" set forth in PRB-1. The FCC sat on the petition for three years and then, last November, denied it, again saying that restrictive covenants in private contracts are "outside the reach of our limited preemption." The ARRL promptly filed a petition for reconsideration, citing the many changes of the past 15 years. We believe the ARRL position is correct and strongly urge the FCC to reexamine the matter from a year-2000 perspective.

The Public Policy Question

Federal preemption of private contracts is extremely rare, but it is certainly not unprecedented. Even the FCC, since 1985, has seen fit to do so, and this is why it is appropriate for it to consider doing so now.

In the past, the federal government has placed limits on deed restrictions in real-estate transactions only when those restrictions were deemed to be contrary to law or "public policy." The best example deals with discrimination. Up through the 1960s, it was not at all uncommon for a deed restriction to limit future sale of the property to members of particular racial or religious groups. After passage of civil rights and fair housing laws in the '60s and '70s, these provisions of private contracts were declared illegal because they violated the public policy that racial and religious discrimination in housing sales is wrong.

Along comes the 1990s and the explosive growth of "planned communities" that prohibit outdoor antennas as part of their deed restrictions. Well, these limits weren't a problem just for hams. By barring all outdoor antennas, these developments essentially required residents to subscribe to cable TV (with no choice of cable company) in order to have TV signals with anything more than "rabbit ears" quality. The FCC began to be bombarded with complaints from residents who were unhappy with their designated cable provider, and from broadcasters and satellite TV companies who complained that these restrictions illegally stifled competition, limited consumer choice in access to news and entertainment, and restricted interstate commerce. It has long been the public policy of the United States that competition and free choice in the marketplace are good things (and conversely, that monopolies and restrictions on consumer choice are bad); and the Constitution clearly states that only the federal government may regulate interstate commerce.

In response, the FCC correctly preempted those restrictive covenants that barred citizens from putting up antennas to receive broadcast television and/or direct satellite TV transmissions. Now, the ARRL correctly asks the FCC, "What about us?" After all, the FCC has already said it has a "strong federal interest" in

Do the math!

2:1 Bandwidth (kHz)

40M	150
30M	>50
20M	>350
17M	>100
15M	>450
12M	>100
10M	>1500
6M	>1500

6 10 12 15 17 20 30 40

Meter Vertical Antenna

Rig+Amplifier+Tuner+R8=Performance

What happened to the multiband vertical antenna? For years, multiband verticals with their own counterpoise systems have been the answer for operators in need of a single omnidirectional antenna capable of working all of the desired bands within a small footprint. They were compact, easy to install and didn't require radials making them the perfect choice in many instances.

What happened?? The tuner is what happened. Thanks to the tuner, Hams are now capable of running more mismatched power from their solid state rigs to their antennas than ever before. Although the tuner has obvious merits, combining eight HF bands into thirty odd feet of antenna does not come without some concessions to the laws of physics. Clearly, the ability to tune across the bands combined with an amplifier adds new elements to the traditional multiband vertical equation.

The R8 is the obvious answer. The R8 will allow you to safely run a 3.0:1 VSWR mismatch at 1500 watts CW without damaging its sophisticated components*. The antenna is also quite broadbanded and is less likely to be as sensitive to its surroundings. Equally important, the antenna only has two traps that have been designed to virtually eliminate damage due to moisture induced arcing.

Call your dealer and order one today! The end result will be another equation that you will grow to appreciate.

The R8 = operating confidence, versatility and fun.

** Check VSWR graphs for actual 2.0:1 VSWR bandwidth.*

For more information on this outstanding HF Multiband Vertical Antenna, visit our web site at:
http://www.cushcraft.com
or contact any one of our dealers worldwide.

R8

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(Tel.) 1-603-627-7877 • (Fax) 1-603-627-1764

promoting amateur radio, and that local regulations that effectively bar amateur operation "are in direct conflict with federal objectives." In other words, they violate public policy. This, coupled with the Commission's previous decisions to preempt private restrictions on outdoor *receiving* antennas, make it very clear that the FCC has the authority, and the just cause, to extend that preemption to amateur transmitting antennas as well. After all, from a visual perspective (and this is the concern of most of these restrictions —controlling the visual aesthetics of a development), there is no difference between a receiving antenna and a transmitting antenna, or between an amateur band antenna and a TV antenna. "We hold these truths to be self-evident, that all antennas are created equal." From a regulatory perspective, indeed they are. And the 14th Amendment guarantees all Americans "equal protection of the laws." Thus, a law that requires private contracts to permit one sort of antenna must also require that they permit other, similar, antennas. Federal regulations carry the force of law, so that applies here as well.

A Clear and Present Danger

Another provision of the 14th Amendment is the requirement for "due process of law." One of the biggest problems with these massive "private" developments is that their governing bodies—generally homeowners' associations or condo boards—have in fact become *de facto* local governments, but without the requirements of due process.

In many of these developments, "the board" has taken on most of the responsibilities and powers of local government, often contracting privately for police and fire protection, road maintenance, and trash removal, levying taxes (in the form of common charges and special assessments), setting rules of acceptable conduct, regulating land use, and imposing penalties for violations. Yet these boards are not accountable to anyone (yes, there are elections, but they are not subject to laws that apply to elections for public office), and since their actions generally fall under the umbrella of "private contract," their decisions often are not subject to judicial review and are essentially above the law. Often, there is no appeal, and the penalty for opposing "the board" is to be forced to move—providing the board approves of your potential buyer. The "developments" that they govern are often huge, and could many times qualify to become municipalities in their own right, but then they would be subject to things such as due process and honest elections.

For some reason, millions of Americans have opted to trade a vast amount of personal freedom for a "nice-looking" neighborhood and the perception of greater security than in surrounding areas. In all too many places today, your only choice is which one of these mini-dictatorships you're going to live in.

In our view, it is these "private developments"—not the Internet, not restructuring—that pose the greatest danger today to the future of amateur radio, because they are beyond the reach of government regulation and are, in many cases, above the law. In fact, the danger they pose to our liberties goes far beyond amateur radio.

The ARRL is right. The FCC needs to take a hard look at these *de facto* local governments, at its own previous actions regarding amateur antennas and other types of antennas, and at its responsibility as an agency of the federal government to assure due process and the equal protection of the laws to all citizens. In short, the FCC needs to reconsider. And it needs to change its mind and provide the same protections to amateurs living in "planned communities" as it does to those living outside them. ■

THE VECTRONICS HFT-1500 . . .
THE FINEST HIGH POWER ANTENNA TUNER MADE!

- *High current Roller Inductor*
- *SSB*Analyzer Bargraph™*
- **Cross-Needle Meter**
- *6 position Antenna Switch*
- *Built-in 4:1 Balun*
- *Gear driven Turns Counter*

HFT-1500

$459.95

The VECTRONICS HFT-1500 is not just an antenna tuner . . . it's a beautifully crafted work of art, using the finest components available and the highest quality construction.

Every HFT-1500 aluminum cabinet is carefully crafted with a durable baked-on paint that won't scratch or chip.

The attractive two-color Lexan front panel is scratch-proof. Take a quarter. Scratch the HFT-1500 front panel as much as you want. You won't leave a mark!

Arc-Free Operation

Two heavy duty 4.5 kV transmitting variable capacitors and a massive high current roller inductor gives you arc-free operation up to 2 kW PEP SSB.

Precision Resetability

A sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately return to your previous settings.

Large comfortable knobs and smooth vernier drives on the variable capacitors make tuning precise and easy. Bright red pointers on logging scales make accurate resetability a breeze.

Absolute Minimum SWR

You can tune your SWR down to the absolute minimum!

Why? Because all three matching network components, the roller inductor and both variable capacitors are fully adjustable.

Tune any Antenna

You can tune any *real* antenna from 1.8 to 30 MHz, including all MARS and WARC bands.

You can tune verticals, dipoles, inverted vees, yagis, quads, long-wires, whips, G5RVs, etc . . .

*SSB*Analyzer Bargraph™*

VECTRONICS' exclusive 21 segment bargraph display lets you visually follow your instantaneous voice peaks. Has level and delay controls.

Accurate SWR/Power Meter

A shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

6 Position Ceramic Antenna Switch

Select two coax fed antennas (tuned or bypassed), balanced line/wire or bypass.

Built-in Balun

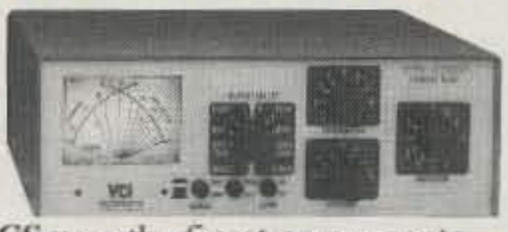
A 4:1 Ruthroff voltage balun feeds dual high voltage Delrin terminal posts for balanced lines. HFT-1500 is 5.5x12.5x12 inches. Has *VECTRONICS'* splendid one year limited warranty.

Try any product for 30 days

Call toll-free 800-363-2922 and order any product from VECTRONICS. Try it for 30 days. If you're not completely satisfied return it for a full refund, less shipping and handling -- no hassles. All VECTRONICS products come with a one year warranty.

300 Watt Antenna Tuner

VC-300DLP
$159.95



VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and continuous rotation 1000 Volt capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

8 position antenna switch, built-in 50 Ohm dummy load, peak reading backlit cross-needle SWR Power meter, 4:1 balun for balanced line antenna. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. Weighs 3.4 pounds.

300 Watt Mobile Tuner

VC-300M
$109.95

The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna and any mobile HF transceiver and is compact enough to fit in the most compact car.

It can also be used at home with dipoles, vees, verticals, beams or quads fed by coax.

Backlit dual movement meter simultaneously monitors Power and SWR. Covers 1.8 to 30 MHz. Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. Weighs 3.4 lbs.

SWR/Power Meters

PM-30
$79.95
PM-30UV
$89.95

PM-30, $79.95, for 1.8 to 60 MHz. Displays forward and reflected power and SWR simultaneously on dual movement Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction includes scratch-proof case/front panel. 5.3x5.75x3.5 inches. SO-239 connectors.

For 144/220/440 MHz, 30/300 Watt ranges:
PM-30UV, $89.95, has SO-239 connectors.
PM-30UVN, $89.95, has N connectors.
PM-30UVB, $89.95, has BNC connectors.

1500 Watt *dry* Dummy Load

DL-650M, $69.95. Handles 100 Watts continuous, 1500 Watts for 10 seconds to 650 MHz. Ceramic resistor. SWR < 1.3. SO-239 connector. **DL-650MN, $74.95** has N connector.

Low Pass TVI Filter

LP-30, $55.95. Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. Handles 1500 Watts.

High Pass TVI Filter

HPF-2, $29.95. Installs between VCR/TV and cable TV or antenna lead-in cable. Eliminates or reduces interference caused by nearby HF transmitters.

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Free catalog, nearest dealer or to order call 800-363-2922

CIRCLE 81 ON READER SERVICE CARD

Announcements

• **OMARC Swap & Shop Net –** The Ocean-Monmouth ARC of central New Jersey has announced the return of the OMARC Swap & Shop Net on the club 2 meter repeater (N2MO) at 145.11 (PL 1271.3 Hz) on Monday nights at 8 PM. All amateurs are welcome to participate in the directed net to be held weekly all year, including holidays. For further information, visit the club website at <http://www.QSL.net/n2mo> or e-mail the net control at <n2ckh@cybercomm.net>.

***The following Special Event stations will be on in April:**

W1FGM, honoring the birthday of Marconi, from U.S. National Marconi Museum and Guglielmo Marconi Foundation; 7 PM Apr. 28 to 8 PM Apr. 29; on 14.275, 3.920, and 29.30 MHz. Contacts confirmed with QSL. If any club or group wishes to participate as a key Marconi station, contact Ray Minichiello, W1BC, <raymin@marconiusa.org>.

N2MO/IMD, from Belmar Marconi receiving station, Camp Evans, Wall, New Jersey; Ocean/Monmouth ARC; 24 hours beginning at 0000Z April 29; CW and SSB on most HF bands in the General class portion. For QSL (SASE) or certificate and QSL (IRC) QSL via OMARC, P.O. Box 267, Oakhurst, NJ 07755.

WA2GM, from International Marconi Day, Fort Monmouth, New Jersey; QCWA Marconi Chapter 138; 0000–2359Z April 29; CW 3.525, 7.025, 14.025, 21.025, 28.025; SSB 3.850, 7.250, 14.250, 21.350, 28.350. QSL (business-size SASE) or certificate (9 x12 SASE) via Bob Buus, W2OD, 8 Donner Street, Holmdel, NJ 07733.

N7GV, from commemoration of closing of Titan missile sites, Green Valley, Arizona; Green Valley ARC; 1800Z April 8 to 2100Z April 9; on 7.272, 14.272, 21.372, 28.372. For certificate send SASE to GVARC, 601 N. La Canada, Green Valley, AZ 85614.

W8A, from March of Dimes Walk America, Utica Shelby Emergency Communications Assn., Sterling Heights, Michigan; 1100–1700Z April 30; General portion of 20 and 40 meters and Novice/Tech portion of 10 meters. USECA will acknowledge contacts with either a QSL or an $8\frac{1}{2} \times 11$ certificate to all verified stations that send an SASE to USECA, P.O. Box 1222, Sterling Heights, MI 48311-1222. Details: <www.useca.org>.

W9DK, from WW II memorial submarine *USS Cobia AGSS-245* celebrating submarine memorial radio reactivation weekend 2000 and 100th birthday of the submarine; 1400–2100Z April 29–30; on 7.243, 14.243, 21.343, 28.343. For QSL or certificate send appropriate SASE to Fred Neuenfeldt, W6BSF, 4932 S. 10th St., Manitowoc, WI 54220-9121.

WØYI, from Iowa State University's VEISHEA 2000 Celebration; Cyclone ARC; 1300–2300Z April 15; on 7.240, 14.240, 21.325, 147.375. QSL to Cyclone ARC, Iowa State University, Friley Hall Box 7275, Ames, IA 50012.

•The following hamfests, etc., are slated for April:

Apr. 1, **Longmont ARC Hamfest 2000**, Boulder County Fairgrounds, **Longmont, Colorado**. Contact Fred, 303-678-5830, or e-mail: <larc@qsl.net>; <http://www.qsl.net/larc/>.

Apr. 1, **IRAC/K2GQ Hamfest**, West Orange High School, **West Orange, New Jersey**. Contact Jim Howe, N2TDI, 973-402-6066. Talk-in 146.415 +1.0; 146.520 simplex. (Exams)

Apr. 1, **RAS of Norwich Ham Radio Auction**, 10 AM, Waterford Senior Center, **Waterford, Connecticut**. Bring gear to sell. Contact Tony, AA1JN, 860-859-0162; web: <www.rason.org>. Talk-in 146.730 (–).

Apr. 1, **T-SARG Hamfest 2000 & Eyeball QSO**, Mooreland Fairbarns, **Mooreland, Oklahoma**. Contact Jim, <nw5ok@pldi.net>; <http://www.digitalcupboard.com/w5okt/>. (Exams 12:30; see home page and click on VEC Team for info)

Apr. 8, **Oak Ridge Hamfest 2000**, Old National Guard Armory, **Clinton, Tennessee**. Contact Doug, N1CWR, 423-483-8042; or David, K4PZT, <d.bower@ieee.org>. Talk-in W4SKH 146.880–, 146.970–.

Apr. 8, **Lawton/Ft. Sill ARC Hamfest & Computer Fair**, Comanche County Fairgrounds, **Lawton, Oklahoma**. Contact Bob, KA5YED, 580-355-6120. Talk-in 146.910–.

Apr. 8, **North Country ARC & LARK Amateur Radio & Computer Fleamarket**, Twin Mountain Town Hall, **Twin Mountain, New Hampshire**. Contact Richard, WB1ASL, 603-788-4428, <bhabooks@together.net>. Talk-in 147.345. (Exams)

Apr. 8, **Eastern Washington Hamfest & Computer & Electronics Fair**, Spokane Community College, **Spokane, Washington**. Contact Warren, KJ7BB, 509-534-8443. Talk-in 146.52 simplex, 147.38 repeater. (Exams)

Apr. 9, **Raleigh ARS Hamfest, NCS ARRL Convention & Computer Fair**, Jim Graham Bldg., NCS Fairgrounds, **Raleigh, North Carolina**. Contact Greg, W4IK, 919-528-6510. (Exams, W4VFJ, 919-556-8551)

Apr. 9, **Hamcomp 2000**, Tall Cedars of Lebanon picnic grove, **Trenton, New Jersey** area. Call 609-882-2240, or <www.slac.com/w2zq>. Talk-in 146.67–.

Apr. 9, **Madison, Wisconsin Swapfest**, Mandt Community Center, **Stoughton, Wisconsin**. Call 608-245-8890, or <www.qsl.net/mara/>. Talk-in 147.15 repeater.

Apr. 14–15, **Southeastern VHF Society Conference**, Atlanta Marriott, **Marietta, Georgia**. Contact Bob, K4SZ, 706-864-6229, e-mail: <k4sz@arrl.net>, web: <http://www.svhfs.org/svhfs/>.

Apr. 16, **Smartsfest 2000**, Canterbury Park, **Shakopee, Minnesota**. Contact SMARTS, P.O. Box 144, Chaska, MN 55318. Talk-in 147.165+. (Exams 10 AM)

Apr. 29, **Bankhead ARC Hamfest**, Moulton Recreation Center, **Moulton, Alabama**. Web: <www.n4idx.org>. (Exams 9:15 AM)

Apr. 29, **Upstate South Carolina Hamfest**, Spartanburg County Fairgrounds, **Spartanburg, South Carolina**. Contact <w4rgw@backroads.net>.

Apr. 29, **Ham Expo Springfest**, Bell County Expo Center, **Belton, Texas**. Contact Mike, WA5EQQ, 254-773-3590; e-mail: <hamexpo@tarc.org>; <http://www.tarc.org>.

Apr. 29, **W6AJF ARRL Hamfest**, Sonoma Valley Veteran's Memorial Building, **Sonoma, California**. Contact Darrel, WD6BOR, 707-996-4494. Talk-in 145.35, –600 with PL 88.5. (Exams, registration 9 AM, begin 10 AM)

Apr. 30, **SW Pennsylvania Hamfest & Fleamarket**, Washington County Fairgrounds, **Washington, Pennsylvania**. Contact Dave, N3IDH, 724-228-8178. (Exams)

Apr. 30, **Moultrie AR Klub Hamfest**, Moultrie/Douglas County Fairgrounds, **Arthur, Illinois**. Call days 217-543-2178; evenings 217-873-5287. Talk-in 146.055/146.655, and 449.275/444.275.

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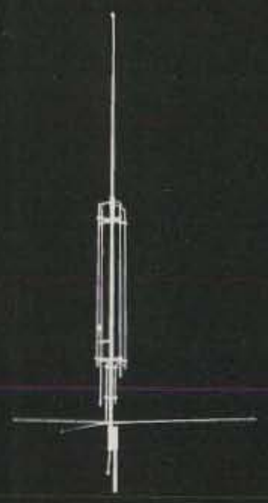
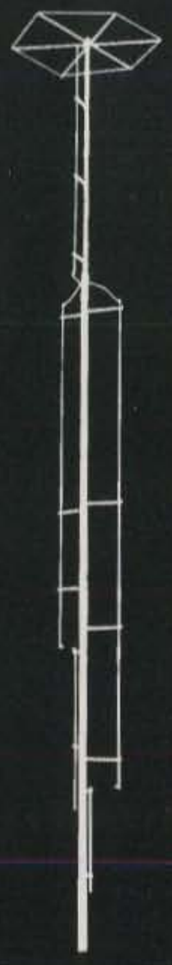
We at GAP realize there isn't a perfect antenna. No singular antenna will scream DX on 80 and be the best for local nets on 10. If anyone tells you there is, beware! The perfect antenna does not exist, but the right one for you may. If you want something to bust the pile on the low bands, then consider the Voyager. Just starting out in ham radio and need a great general coverage antenna, the Challenger is easy to assemble and for little effort will yield superior performance, especially on DX. Maybe you knowingly or unknowingly moved into one of those "restricted areas" where the Eagle's limited visibility, but unlimited ability is desired.



Eagle DX

Challenger DX



Voyager DX

This chart helps you select the right GAP antenna. When comparing GAPs, bandwidth is not a concern. With few exceptions, a GAP yields continuous coverage under 2:1 for the **ENTIRE BAND**.

All antennas utilize a GAP elevated asymmetric feed. A major benefit is the virtual elimination of the earth loss, so more RF radiates into the air instead of the ground. This feed is why a GAP requires **NO RADIALS**. Just as elevating a GAP offers no significant improvement to its performance, adding radials won't either, making set up a breeze.

A GAP antenna has no traps, coils or transformers. This is important. The greatest sources of failure in multiband antennas are these devices. Perhaps you heard someone discuss a trap that had melted, arced or became full of water. Improvements to these inherent problems are the focus of the antenna manufacturer, while the basic design of the antenna remains unchanged. **GAP improved the trap by eliminating it!** Removing these devices means they don't have to be tuned and, more importantly, won't be detuned by the first ice or rain. The absence of these devices improves antenna reliability, stability and increases bandwidth.

Another major advantage to a GAP antenna is its NO tune feature. Screws are simply inserted into predrilled holes with a supplied nutdriver.

The secret is out and people in the know say:

CQ–"The GAP consistently outperformed base-fed antennas...and was quieter."

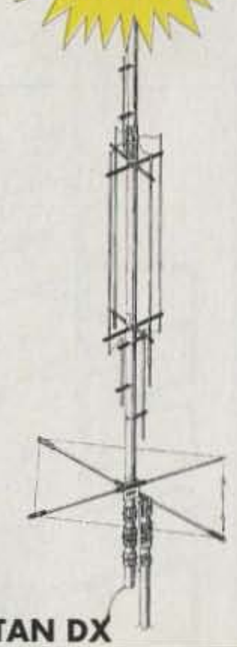
73–"This is a real DX antenna, much quieter than other verticals."

RF–"To say this antenna is effective would be a real understatement. Switching back and forth on 40m between another multiband HF vertical and the GAP, there was no comparison. Signals were always stronger on the GAP, sometimes by S units, not just DB's."

Worldradio – "These guys have solved the problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. A half-wave vertical does need radials if it is end fed (at the bottom). But the same half-wave vertical does not (as much, hardly at all) if is fed in the center."

IEEE–"Near field and power density analyses show another advantage of this antenna (asymmetric vertical dipole): it decreases the power density close to the ground, and so avoids power dissipation in the soil below it. The input impedance is very stable and almost independent of ground conductivity. This antenna can operate with high radiation efficiency in the MF AM standard broadcast band, without the classical buried ground plane, so as to yield easier installation and maintenance."

Celebrating 10 Years 1989-1999



TITAN DX

This all purpose antenna is designed to operate 10m-80m, WARC bands included. It sits on a 1-1/4" pipe and can be mounted close to the ground or up on a roof. Its bandwidth and no tune feature make it an ideal antenna for the limited space environment as well as a terrific addition to the antenna farm.

MODEL	BANDS OF OPERATION											HT	WT	MOUNT	COUNTER-POISE	COST
	2m	6m	10m	12m	15m	17m	20m	30m	40m	80m	160m					
Challenger DX	■	■	■	■	■		■		■	■		31.5'	21 lbs	Drop In Ground Mount	3 Wires @ 25'	$279
Eagle DX			■	■	■	■	■		■			21.5'	19 lbs	1-1/4" pipe	80" Rigid	$289
Titan DX			■	■	■	■	■	■	■	■		25'	25 lbs	1-1/4" pipe	80" Rigid	$319
Voyager DX							■		■	■	■	45'	39 lbs	Hinged Base	3 Wires @ 57'	$399

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"What rig should I buy?" Every ham has asked that question at least once. And with the great number of choices available today, CQ decided to help you out by publishing periodic market surveys. We'll start this month with a look at the marketplace for HF transceivers.

CQ Market Survey:

High-Frequency Transceivers

BY GORDON WEST,* WB6NOA

With the FCC rules changing April 15th for General Class testing at 5 wpm, there will be thousands of Technician and Technician-Plus hams hitting the books and code classes to get onto the worldwide high-frequency (HF) airwaves.

The lure of worldwide operation with a modest home or mobile station is indeed appealing to those operators who may have worked Field Day or gone to another ham's "shack" and seen the line-up of high-frequency equipment. But with more than 30 new and recent models to choose from, as well as over 50 older models available at swapmeets, it's no wonder the ham stores are always being asked the big question, "So what radio should I buy?"

"When Ham Radio Outlet employees are asked that question, we always try to see how our customers are planning to use the high-frequency equipment," explains Janet Margelli, KL7MF, Ham Radio Outlet's Anaheim store manager. "And everyone's requirements are different: RVers may want a high-frequency transceiver where the head detaches, yet boat owners may want a small but powerful one-piece rig that they may easily pull out from below decks for use the next week in their cars."

"Squeak" Porray, AD7K, Amateur Electronic Supply (AES) store manager in Las Vegas, Nevada, adds, "Some of our high-tech (hams) want their computer to control their ham rig, and here is yet another twist on that very common question on what is the best rig for me."

Ask any seasoned DXer what is the best equipment, however, and he will usually go by brand name, rather than specific big, small, or computer-ready model.

Luckily, nearly all manufacturers offer a wide assortment of HF transceivers—some small, some large, a few with detachable heads, and even a couple with radio remote-control capabilities. It would be tough to say one specific brand is better than another without actually getting down to models, features, and added bonuses that usually mean added dollars to the price tag. So let's begin our search for that "right" HF radio by starting at the bottom of the pay scale and working up. The price ranges we're quoting here are approximate and generally reflect "street prices" (what you'd actually pay) rather than the normally higher "list price." They are based on a survey of five major dealers, but be aware that prices may vary from dealer to dealer, and you also need to consider other factors such as proximity, repair service, etc.

New Versus Used

There are some excellent used HF transceivers available at swapmeets, on the internet, at almost all ham stores, and through ads in ham radio publications. If the used equipment is less than five years old, expect to pay about half of what it sold for new. This is how quickly technology is changing. But don't forget to add in additional expenses for original-owner installed filters, a base microphone, power supply, and other options that may have increased the original purchase price. Many hams selling their bought-new equipment will show you their original sales slip.

It's a good idea to stay away from equipment sold as "needing repair" or sold by a non-ham who claims he doesn't know if it's working. These may be basketcases just waiting to ruin your day. But if the ham who owned the rig is selling it, and if he or she tells you it's working perfectly, you can almost bank on the reputation of that person's call-sign that it *is*.

Equipment popular in the 1980s wasn't all that expensive back then, so the half-off rule still applies. The equipment is usually hybrid with tubes in the finals and transistors in the receiver, and a good $600 pre-owned HF set should go for around $250. One caution about output tubes, though: They more than likely will need to be replaced, and this could add up to another hundred bucks. In addition, reasonably priced, high-quality tubes are getting to be hard to find.

Again, my advice on buying used equipment is to purchase it from the ham who originally owned it and cared for it, and be assured that the ham is going to give you the straight scoop on how it was performing before it went off-line. No one likes to hear someone on the air claiming that ham operator KZØZZZ just sold him a rig that even Marconi himself couldn't re-align! If they say it works, it usually does.

Some of the bigger old transceivers also contain a built-in 110 VAC power supply, or came with a matching power supply for AC use. This is good; you won't need to dredge up an old battery to get it on the air from your home ham shack. Those old, big rigs won't really play at all in a mobile, so keep this in mind if you plan to go mobile with used equipment and ask whether or not it can be powered directly off of 12 volts DC.

There is good news with name-brand used gear: The equipment manufacturers and their service facilities generally carry parts back to around 10 to 15

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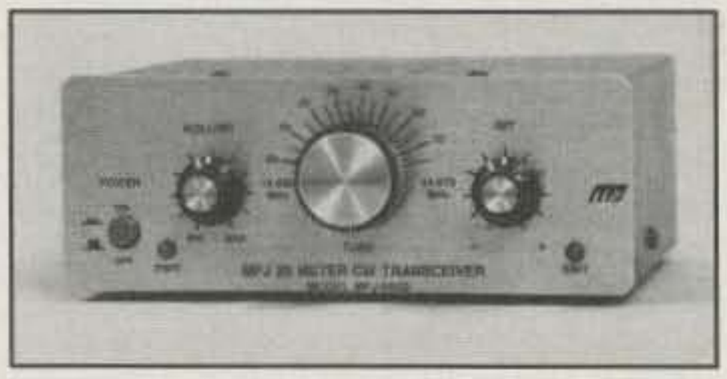
years ago, and older gear with its classic type of interchangeable components usually can be repaired without the proverbial "your equipment is beyond repair" note from the fix-it factory.

On the other hand, newer gear with surface-mount technology components and wave-soldered integrated circuits sometimes requires a complete board change-out when something goes snafu on the inside. This is a relatively expensive fix after the one-year warranty runs out.

Therefore, if it's used and runs 100 watts out, covers 10 through 160 meters, and plugs into AC power, or if it's a smaller used set that runs 100 watts out, covers 10 through 160 meters, and runs on 12 volts, don't expect to pay more than about $500 unless it has something really extraordinary in high-end deluxe features. Also go for a second opinion from a seasoned fellow ham.

New Gear Under $500

New equipment below $500 is specialized for single-band or QRP (low power) portable operation on the worldwide ham bands. An example would be MFJ's 12 watt, 20 meter SSB single-bander for under $250, including the mic. The company also has new CW-only single-banders for even half this price, and a fun $259 20 watt single-bander for 10 meters. RadioShack and Ranger also offer single-band 10 meter rigs in the same price range. Then there's Ten-Tec's 50 watt Scout, which comes with your choice of one band module for $549, with additional band modules only $29 each.



The MFJ-9420 20 meter SSB transceiver and MFJ-9020 20 meter CW transceiver are both priced at well under $500. (Photos courtesy MFJ Enterprises)

The Elecraft K2 kit is a 10 watt, QRP, CW, 10–160 meter transceiver with single-sideband upgrade capabilities. (Photo courtesy Elecraft Co.)

You can stay in the $500 range and be proud that you built your own equipment as a kit, such as the Elecraft K2, a 10 watt, QRP, CW, 10 meter through 160 meter transceiver with upgrade capabilities later for single sideband. And if you're *really* on a budget, Ten-Tec offers single-band, 3 watt, CW-only "T-Kits" for just $95 each! There are also excellent kits available from Ramsey Electronics and from some of the major QRP clubs, such as NorCal and the New Jersey QRP Club.

The new under-$500 HF transceivers might make fun projects for new Generals who want to start out on QRP, for hams who would like the satisfaction of going on the air with equipment they have built as a kit, or for the ham on a super-tight budget. See the tables in this article for listings of additional models not specifically mentioned here.

The $700 to $900 Price Range

All of the major amateur radio manufacturers offer entry-level-priced, all-band HF transceivers with full capabilities. These rigs all have 100 watts output on a whistle, work all of the amateur radio HF bands (including the so-called "WARC" bands—30, 17, and 12 meters), are fully transistorized, feature modern phase-locked-loop tuning, and receive great and sound super over the HF airwaves on General, Advanced (yes, that license sub-band will still be there after Restructuring takes effect), and Extra class frequencies! Let's look at a few examples. Again, the tables have additional listings.

The Alinco DX-70 sells for around $800. Its control head can detach from the body with an interconnecting cable about the size of your thumb. It is a terrific performer and even includes the 6 meter band in addition to 160–10 meters. It's an amazing HF radio, and you must listen to the receiver's audio output to appreciate the razor-sharp filtering on the inside. Alinco also offers (in the middle $700) the DX-77T, which is slightly larger in size and would make a dandy base station when hooked into an AC-to-DC power supply capable of supporting a minimum of 20 amps of current draw. Expect to pay about $125 more for a transformer-type or switching-type home power supply to run all of these HF transceivers that take 12 volt DC input power.

The DX-77 is one of two Alinco entries in the HF ham radio marketplace. (Photo courtesy Alinco Electronics)

ICOM America's IC-707 is a very uncomplicated, full-featured HF transceiver that was last seen selling *below* $695! This is quite a radio, with wide-spaced buttons and knobs, 100 watts of power output, plenty of memory channels to store your favorite DX spots, and the proven ICOM reliability to stay cool on prolonged transmit times.

A first look at ICOM's new IC-718, an entry-level-priced HF rig with 100 watts out, 101 memories, and a general-coverage receiver. Expect to see the first ones at the Dayton Hamvention in mid-May, and look for a "street price" in the $700–$800 range. (Photo courtesy ICOM America)

A brand new entry (not yet available as we went to press) from ICOM in this price class is the IC-718. It will offer all-mode operation on all HF ham bands, a general-coverage (30 kHz to 30 MHz) receiver, and a 100% duty cycle for transmit-intensive modes such as RTTY. It will put out 100 watts and have 101 memory channels and a variety of other features, including a speaker that sends audio to the front of the radio. Anticipated street price is in the $700–$800 range.

Table 1– Under $800

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (*tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
Alinco DX-70	DC	.15-30 MHz + 50 MHz	All HF + 6m	110*	Dual Conv.	100	Yes	No	No	No	$750
Alinco DX-77T	DC	.15-30 MHz	All HF	120*	Dual	100	No	No	No	No	$699
Elecraft K2 Kit	DC or built-in battery	1.8-30 MHz	All HF	10*	Dual	10	No	No	Yes	Option	$600
ICOM IC-707	DC	.5-30 MHz	All HF	105*	Dual	32	No	No	No	No	$650
ICOM IC-718	DC	30 kHz-30 MHz	All HF	100	n/a	101	No	Option	No	No	$799
Kenwood TS-50	DC	.15-30 MHz	All HF	110*	Dual	100	No	No	No	No	$750
MFJ 9xxx series	DC	Ham band	Single banders for 10, 20, 40, 80m	14*	Dual	VFO	No	No	No	No	$250 each
Patcomm PC-9000	DC	Ham band	All HF + 6m	40 (HF), 20 (6m)	Single	1 per band	No	No	Yes	No	$799
RadioShack HTX-10	DC	28-29.7 MHz	10m.	31*	Dual	5	No	No	No	No	$150
Ramsey QRP-RX	DC	Single banders for 20, 30, 40, 80m	(Rcvr only)	n/a	n/a	—	No	No	No	No	$30/kit/band; $15 case+knobs
Ramsey QRP-TX	DC	(Xmtr only)	Single banders for 20, 30, 40, 80m.	1 CW only	n/a	—	No	No	No	No	$30/kit/band, $15/case+knobs, $10 power supply
Ramsey SX-20	DC	20m.	20m.	10	n/a	n/a	No	No	No	No	$300 kit, $370 wired/tested
Ranger RCI-2950DX	DC	24.8-24.9, 28-30 MHz	12 & 10 m.	25*	Dual	10	No	No	No	No	$400
Ranger RCI-2970	DC	28-30 MHz	10m.	100*	Dual	10*	No	No	No	No	$550
RF Limited 357DX	DC	28-29.7 MHz	10m.	150*	Dual	5	Yes	No	No	No	$400
SGC 2020	DC or battery pack	1.8-30 MHz	All HF	21*	Triple	20	No	No	No	No	$675
Sierra Kit	DC	1.8-30 MHz	All HF	3*	Dual	—	No	No	No	No	$369
Ten-Tec Scout	DC	Ham modules	Ham modules	49*	Dual	—	No	No	No	No	$549
Yaesu FT-600	DC	.5-30 MHz	All HF	140*	Triple	100 w/ alphanumerics	No	No	No	No	$900
Yaesu FT-840	DC	.1-30 MHz	All HF	125*	Dual	100	No	No	No	No	$749

Table 2– $1000–$1500 Range

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (*tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
ICOM IC-706 MkII	DC	.2-179 MHz	All HF + 6/2m.	120*	Triple conv.	100	Yes	Yes	Yes	No	$1075
ICOM IC-706 MkII-G	DC	.2-470 MHz	All HF + 6/2m + 70cm.	125*	Triple	100	Yes	Yes	Yes	No	$1400
Kenwood TS-570D(G)	DC	.1-30 MHz	All HF	120*	Dual	100	No	Yes	Yes	Yes	$1050
Kenwood TS-570S(G)	DC	.1-54 MHz	All HF + 6m	120*	Dual	100	No	Yes	Yes	Yes	$1349
Patcomm PC-16000	DC	.1-30 MHz + data readout	All HF	110*	Dual	100	No	No	Yes+reader	No	$1000
Ten-Tec Pegasus	AC+DC	.5-30 MHz	All HF	104*	Dual	Comp. control	Yes/Comp.	Yes	Yes	No	$900
Yaesu FT-100	DC	.1-1000 MHz (cellular blocked)	All HF + 6/2m +70cm	128*	Dual	200	Yes	Yes	Yes	No	$1300
Yaesu FT-920	DC	.1-30 / 48-56 MHz	All HF + 6m	145*	Dual	110	No	Yes	Yes+memory	Yes	$1400

Table 3– $1500–$2585 Range

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (*tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
ICOM IC-746	DC	.3-60 / 108-174 MHz	All HF + 6/2m.	121*	Quad conv.	100	No	Yes	Yes	Yes	$1600
ICOM IC-756	DC	.3-60 MHz	All HF + 6m.	130*	Quad	100	No	Yes	Yes	Yes	$2000
JRC JST-245	DC	1.8-30 / 50-54 MHz	All HF+6m	180*	Triple	200	No	No	Yes	Yes	$2500
Kachina 505 DSP	AC+Comp. DC	1.1-30 MHz	All HF	110*	Dual	Comp. memories	Yes/Comp.	Yes	Yes	No	$2000
Kenwood TS-870	DC	.1-30 MHz	All HF	135*	Quad	100	No	Yes	Yes	Yes	$2300
SGC-2000 w/ADSP	DC	1.8-30 MHz	All HF + marine	170*	Dual	100	Yes	Yes	No	No	$1850
Yaesu FT-847	DC	.1-30/ 50-54/ 144-148/ 430-450 MHz	All HF + 6/2m + 70cm	119*	Dual	100	No	Yes	Yes	No	$1600

Table 4– Top of the Line ($2500+)

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (*tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
ICOM IC-756 Pro	DC	.1-60 MHz	All HF+6m	170*	Triple conv.	100	No	Yes	Yes	Yes	$3500
ICOM IC-775	AC	.1-30 MHz	All HF	175*	Quad	100	No	Yes	Yes	Yes	$3500
ICOM IC-781	AC	.1-30 MHz	All HF	195*	Quad	100	No	No	Yes	Yes	$7000
Kenwood TS-950SDX	AC	.5-30 MHz	All HF	110*	Quad	100	No	Yes	Yes	Yes	$4000
Ten-Tec Omni VI	DC	Ham bands	All HF	105*	Triple	100	No	Yes	Yes	No	$2500
Yaesu FT-1000	AC	.1-30 MHz	All HF	200*	Double	100	No	Yes	Yes	Yes	$3400
Yaesu FT-1000D	AC	.1-30 MHz	All HF	200*	Quad	100	No	Yes	Yes	Yes	$4100
Yaesu FT-1000MP	DC	.1-30 MHz	All HF	200*	Double	100	No	Yes	Yes	Yes	$2600

Kenwood offers the TS-50, which looks slightly larger than a big CB set. It is capable of 100 watts output and has 100 memory channels and a proven track record over the last six years, during which time Kenwood has just kept pumping out these little babies to the delight of mobile and mobile-marine operators needing an ultra-small, compact transceiver for 10 through 160 meter HFing.

The Yaesu FT-840 is typical of the under $900 entry-level HF rigs on the market today. (WB6NOA photo)

Over at Yaesu the FT-840 has been seen selling new for around $700. It offers 100 watts out, 100 memory channels, a big analog meter to show power output as you yak on the General class bands, and direct digital synthesis (DDS) for an ultra-smooth-sounding receiver. For $100 more, you can step into the military-style Mil Spec Yaesu FT-600, which offers all-band capabilities from 10 through 160 meters, 100 memory channels, and—best of all—a minimum of knobs, buttons, and switches that could get you into trouble while mobile and could (but won't with this rig) cause you to accidentally hit the wrong button. You have to see the LCD display to appreciate how it looks under the dashboard at night.

The entry-level-priced SGC 2020 twenty watt transceiver is designed for mobile and portable use. (Photo courtesy SGC)

A unique around-$800 HF transceiver comes from marine single-sideband manufacturer SGC, Inc., a company well known for high-end military radios designed for commercial installation applications. I have worked with the SGC 2020 twenty watt transceiver, and it truly is designed for both mobile as well as portable use with a built-in, snap-on battery system to turn you into a real field operator during Field Day. It's a unique transceiver, so find someone who has one and listen to the great audio from its very sensitive and ultra-selective receiver. The SGC equipment is made in the USA.

Also made in the USA is Ten-Tec's new 100 watt Pegasus transceiver. It is completely computer-controlled (under Windows ™ 3.1, 95, and 98) and in fact looks more like a mini-tower computer than a radio. The "front panel" is on your computer screen and everything is controlled with either mouse or keyboard, although there is an outboard tuning control available as an option for those who prefer a tuning *dial*. Both receive and transmit are DSP (digital signal processing) based, and performance is reported to match that of other rigs in this price class. The Pegasus sells for $895, with an additional $139 for the remote tuning dial.

$1000 Category

Spending a few hundred dollars more won't necessarily buy you more power output or more receiver sensitivity. The mid-priced high-frequency receivers may offer more receiver selectivity, more individual memory channel capabilities, perhaps the 6 meter band, and loads more buttons and knobs to help you fine-tune your reception as well as tailor your transmit audio output characteristics.

ICOM America still has a few IC-706 MKII transceivers which originally set the benchmark for what an HF radio can add, including 6 and 2 meters! That's right: The IC-706 was one of the very first in the country to include the 2 meter band with full high-frequency capabilities, along with the detachable head. It puts out a good, solid 100 watts, has over 100 memory channels, and can even store alpha-numerical channel names. Although originally priced several hundred dollars more, ICOM's latest IC-706 MKII-*G* now includes the 70 cm band too, but this will cost you around $1400 to end up with HF, VHF, and UHF in one nice, compact rig.

The ICOM IC-706 MKII-G now also includes the 70 cm band. This will cost you about $1400 to end up with HF, VHF, and UHF in a nice, compact rig. (Photo courtesy ICOM America)

Yaesu also has one of these HF plus 6 meters, plus 2 meters, plus 440 MHz transceivers, the FT-100, and it too sells for around $1350. Yes, the head detaches just like the ICOM, and both ICOM and Yaesu right now are locked in fierce competition over which of these transceivers will be the winner. Actually, they *both* are. Yaesu and ICOM should be congratulated for all that they can stuff into an ultra-small chassis yet still offer complete HF/VHF/UHF multi-mode, multi-band capabilities without leaving out any bells or whistles. Play with both of them before you make up your mind which is "best" for *you*!

Kenwood's TS-570D(G) provides a step up from entry level with more features, including digital signal processing (DSP). (WB6NOA photo)

The Kenwood TS-570D (G) also has been selling for a little above $1000. It is a wonderful 160 through 10 meter transceiver capable of full *wireless* remote control with the Kenwood Sky Command system using Kenwood Sky Command D7 handhelds or the new D700 mobile. (*Editor's note: The legality of the Sky Command system under current FCC rules is ambiguous. Kenwood has asked the FCC to clarify the situation.*) The 570 also has a nice alpha-numeric sub-display to provide newcomers with a scrolling screen of help when they are in the menu options trying to figure out what's what for the first time on a worldwide radio. The 570 has plenty of power output (to 100 watts) and 100 memory channels. Like the Yaesu and ICOM mid-priced equipment, it also has DSP in the receiver to pull out extremely weak signals from the background mush. You won't find DSP in the entry-level-priced radios (except the Ten-Tec Pegasus), but you will find it in virtually all of the mid-priced transceivers. In addition, for $300 more Kenwood offers the 570S (G), which also includes the 6 meter band.

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MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

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A very interesting $1000-class transceiver comes from Patcomm. The PC-16000 is a base-station rig that is made in the USA and features a built-in digital converter to decode Morse code and frequency shift keying (FSK) signals. Standard software supports RTTY, ASCII, and CW modes, with planned software upgrades for AMTOR and PACTOR. If you're thinking of going digital, you should investigate this rig, as well as Patcomm's less expensive ($800 range) PC-9000, because both are designed around playing data off of a keyboard attached directly to your transceiver.

The ICOM IC-746, in the around $2000 price range, includes HF, 6 meters, and 100 watts output multi-mode on 2 meters. (Photo courtesy ICOM America)

Around $2000

Most of the manufacturers are eager to show off their physically larger transceivers in this price category, such as the ICOM IC-746, which includes HF, 6 meters, and a whopping 100 watts output multi-mode on 2 meters. For just under $2000 you also get an automatic antenna tuner, and a big, bright LCD screen with a band scope for electronically looking up and down the band for action, while staying on one specific frequency listening to a radio call. The big display also shows memory names, key assignments, twin pass-band tuning settings, plenty of digital signal processing, and a built-in 4-channel memory keyer with 50 characters. This can be a great help in contesting.

Kenwood is in this price category with its "big league" TS-870S, a 100 watt transceiver with DSP capabilities, computer-control operation, built-in automatic antenna tuner, and all sorts of receiver refinements to really let you work weak-signal DX when tied into a good beam antenna at least 70 feet above your house.

It's rumored that Kenwood may soon be introducing a new HF transceiver with many of these same features, but also including 6 meters, 2 meters, and 70 cm. This will put Kenwood right in the middle of DC-to-daylight competition with ICOM and Yaesu. The new rig, which Kenwood hopes to show off at the Dayton Hamvention in mid-May, might also include Sky Command capabilities for VHF/UHF remote operation (with companion Kenwood VHF/UHF rigs), a built-in TNC for APRS (Automatic Position Reporting System), and advanced satellite functions.

Yaesu's FT-920, seen selling for under $1500, covers 160–6 meters and also includes a built-in, high-speed antenna tuner. (Photo courtesy Yaesu)

Yaesu offers the two-big-knob FT-920 (seen selling for under $1500) which covers 160 through 6 meters and also includes a built-in, high-speed, automatic antenna tuner to help trim out any bumps in your antenna system. You get a built-in digital voice recorder which allows storage and playback of incoming signals and which stores up to four repetitive messages of up to 16 seconds each in case you think your voice might give out when making long-winded CQ calls. You also get plenty of digital-signal-processing filters, automatic notch filters, and some pretty snazzy noise reduction that can take the whistle out of annoying heterodynes on 40 meters.

For just under $2000 the Yaesu FT-847 is the ultimate base or mobile transceiver. It covers HF, plus 6 meters, 2 meters, and you guessed it, 440 MHz, too. This rig is also ideal for VHF/UHF satellite work because of its normal and reverse tracking and dedicated satellite memories. It's a swell rig to hook into packet radio, including all those DSP filters, notch filters, noise-reduction filters, and band-pass filters. Like the FT-920, this is a 12 volt DC radio for which you supply the battery or external power supply. This really isn't all that bad; if you decide to go mobile, you won't be carrying the extra weight of a bigger rig with a bigger built-in AC power supply.

The ICOM IC-756 is the big brother to the IC-746, and lately it has been an extra good deal on the market because ICOM is bringing out a new IC-756 *Pro* which turns that big, blue LCD display into a color display. The regular IC-756 covers 160 through 6 meters and has 101 memory channels, 100 watts output, and a big 5 inch multi-function LCD display for operating frequency mode

The ICOM IC-756 is the big brother to the IC-746 and lately has been an extra good deal on the market. (Photo courtesy ICOM America)

and filter selection. Best of all, the spectrum scope undulates up and down the bands, giving you a bird's-eye view as to who is on the air above and below you. It also has a dual-watch function to allow you to simultaneously monitor two frequencies. You can't mistake the look of the IC-756 transceiver; the big monochrome or color display has to be seen to be believed.

The Kachina 505-DSP, in the $2000 category, looks like a computer, but it's really a radio. (Photo courtesy Kachina Communications)

One more interesting transceiver in the $2000 category is the HF computer radio from Kachina, the Model 505-DSP. It looks like a computer, but it's really a radio! Kachina is a well-respected name in commercial and military radio, and many operators who spend a great deal of time on the computer like to spend a lot of time in front of their Kachina system. For those hams who really have to have the "big knob," they can give you that too for a little bit more. The Kachina sounds terrific over the air and does a spectacular job of pulling in noisy signals that end up sounding as smooth as a whistle. The screen of the Kachina is the screen of your computer, and you can customize exactly what you want to look at as you dial up and down the bands. I worked with the Kachina during Field Day, and I can tell you first hand that if you're into computers, you'll love the way this equipment plays!

Top of the Line—$2500+

Here we get into big-budget radios for

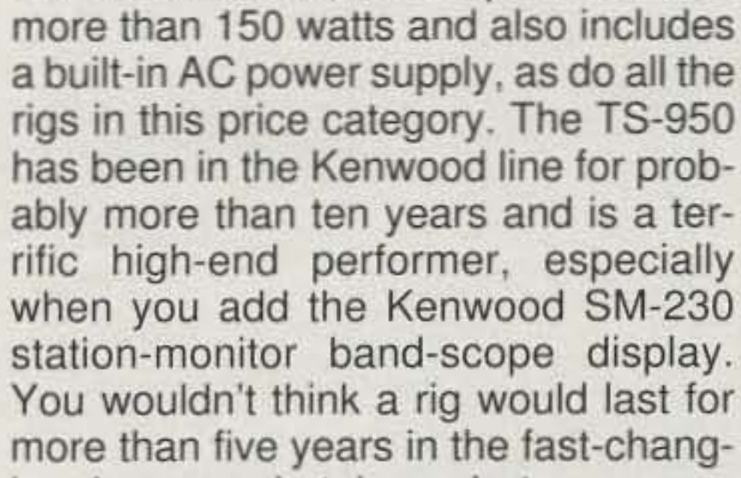
very serious operators. For ICOM America it very well could be the IC-775, a $3400 transceiver that has receiver capabilities you must really listen to in order to appreciate where the extra bucks are going. Digital noise reduction, digital signal processing, digital automatic notch filters, digital low-pass and high-pass, ultra-narrow CW filters, digital audio peaking filter—you get the idea. Here's a transceiver that absolutely can pull out of the ether signals that some of the other radios would barely know were there.

If you really want to spend top bucks, consider the IC-781, seen selling for around $7000. This actually is a slightly older rig, but it is still full of big-league features, including a cathode-ray-tube display and band scope. Both the ICOM 775 and 781 are AC-only transceivers, and both easily will put out from 150 to 200 watts.

It will be interesting to see where ICOM prices the IC-756-Pro HF transceiver, which was just granted FCC type-acceptanc, and sports that thin-film transistor, 5 inch color LCD display. It probably will be in the three K range, but you must see it and hear it to believe it. Check out the IC-756-Pro if you're looking for one of ICOM's top HF rigs.

The folks at Kenwood have the classic TS-950 SDX, which puts out well more than 150 watts and also includes a built-in AC power supply, as do all the rigs in this price category. The TS-950 has been in the Kenwood line for probably more than ten years and is a terrific high-end performer, especially when you add the Kenwood SM-230 station-monitor band-scope display. You wouldn't think a rig would last for more than five years in the fast-changing ham marketplace, but everyone keeps demanding the Kenwood TS-950 for big base-station use. After you use it, you will see why it truly has earned its place in the big DXer's ham shack.

Over at Yaesu, the FT-1000D and FT-1000MP are indeed the radios of choice for the world-class contest operators and those hams who absolutely demand the finest rig on their bench. There are several models in the Yaesu 1000 series. The FT-1000MP, priced at about $2800, runs on 13.8 volts DC; if you really want the ultimate mobile, this might be the way to go. Direct digital synthesis provides extremely-fine-tuning steps, and a full-featured contest memory keyer allows the radio to do all



The top-of-the-line Yaesu FT-1000MP, the contesters' favorite. (Photo courtesy Yaesu)

Manufacturers' Contact Info

Alinco, 438 Amapola Ave., Suite 130, Torrance, CA 90501 (telephone 310-618-8616; fax 310-618-8758; web: <www.alinco.com>).

Elecraft, P.O. Box 69, Aptos, CA 95001-0069 (telephone 831-662-8345; web: <www.elecraft.com>).

ICOM America, Inc., 2380 116th Ave. NE, Bellevue, WA 98009-9029 (telephone 206-454-8155; fax 206-454-1509; web: <www.icomamerica.com>).

Kachina Communications, Inc., P.O. Box 1949, Cottonwood, AZ 86326 (telephone 520-634-7828; e-mail: <kachina@sedona.net>; orders on-line at: <www.kachina-az.com/factory.htm>).

Kenwood Communications Corp., 2201 E. Dominguez St., Long Beach, CA 90801-5745 (telephone 310-639-5300; web: <www.kenwood.net>).

MFJ Enterprises, Inc., Box 494, Mississippi State, MS 39762 (telephone 662-323-5869; fax 662-323-6551; web: <www.mfjenterprises.com>).

Patcomm, 7 Flowerfield M100, St. James, NY 11780 (telephone 516-862-6511; fax 516-862-6529; e-mail: <patcomm1@aol.com; web: <www.qth.com/patcommradio>).

Ramsey Electronics, Inc., 793 Canning Pkwy., Victor, NY 14564 (telephone 716-924-4560; web: <www.ramseyelectronics.com>).

SGC, P.O. Box 3526, Bellevue, WA 98009 (telephone 425-746-6310; fax 425-746-6384; e-mail: <sgc@sgcworld.com>; web: <www.sgcworld.com>).

Ten-Tec, 1185 Dolly Parton Pkwy., Sevierville, TN 37862 (telephone 865-453-7172; fax 865-428-4483; e-mail: <sales@tentec.com>; web: <www.tentec.com>).

Yaesu USA, 17210 Edwards Road, Cerritos, CA 90703 (telephone 562-404-2700; web: <www.yaesu.com>).

the contesting while you take another sip of diet cola. The MP has those impressive twin knobs, and this way you can keep track of two different conversations at the same time!

The FT-1000D sells for around $4000 and offers simultaneous dual-frequency reception and a powerful transmitter that can pump out more than 200 watts. It is computer controllable, and the AC power supply is built-in. There is also the $3400 FT-1000, and this has the features of the FT-1000D except for some band-pass filtering and temperature-compensated oscillator circuits. All three of the Yaesu FT-1000 series could be considered the ultimate contester's transceiver.

Ten-Tec's entry in this category is the powerful Omni VI Plus, an all-band HF transceiver with DSP noise reduction and a triple-conversion receiver with special crystal mixing that the company says eliminates phase noise from received signals. The transmitter puts out 100+ watts and the radio includes a built-in keyer, as do most of the other rigs in this class. This made-in-the-USA rig sells factory-direct for $2585.

So How Much Am I Spending?

To get all of the high-frequency bands, plus a power supply that will take house power and convert it down to 12 volts DC, plus coax and a 5- or 7-band vertical antenna system, buy one of the entry-level $700–$800 transceivers, spend another $100+ for the power supply and another $300 for a great all-band antenna system, and you will be on the air "big time" from your home station.

If you're going to go with a nice little 3- or 4-element HF beam antenna, you may wish to consider one of those step-up $1000 transceivers. With the beam

Ten-Tec's entry in the top-of-the-line category is the Omni VI Plus. (Photo courtesy Ten-Tec)

and roof tower and additional power supply, your entire investment is coming in a little under $2000. The beam is really going to make a big difference on incoming and outgoing signal levels, and you'll need the capabilities of a slightly more expensive receiver in order to begin separating all of the strong signals your new beam antenna will be pulling in.

If you're going to go HF big time and you have the real estate to put up a 70 foot tower, then you might as well go for the *big* rigs and get all of the receiver capabilities you can, plus all of the added punch that they can afford in processing your outgoing modulation. Anyone with a big tower would be somewhat embarrassed if a fellow ham came over and saw a little $699 ham set sitting on the desk. If you're going to put up a big outside installation, it's best to go with a big radio on the inside to make full use of all of the aluminum in the air!

Will hooking a big, several-thousand-dollar HF transceiver to your little roof-mounted, 5- or 7-band vertical really improve your signal that much? Probably not. The difference between 100 watts output and 200 watts output can barely be measured over the air. And all the neat, more expensive receiver capabilities of the very expensive rigs would not be necessary on the modest signal levels that a good multi-band vertical will pull in. The vertical will do a fabulous job for working the USA and strong DX stations, but you really won't need much more in the receiver than what the $700 rigs have to get you started working long-range DX.

Before you make your decision, stop at a radio dealer or at the home of a fellow ham who has the equipment you are considering, and spend some time in front of the dial seeing how it tunes, how it sounds, and how it plays on the air. Nothing beats this hands-on inspection of a new HF rig, and since your new radio should give you thousands of hours of pleasure on the airwaves, you want to make sure you get the rig that best suits your operating needs. ■

AMERITRON *True Legal Limit™* Tuner

Easily handles 1500 Watts continuous carrier even on 160 Meters . . . High-current edge-wound silver plated Roller Inductor . . . Two 500 pf high capacitance tuning capacitors with 6:1 vernier reduction drives . . . 3 core choke balun . . . Six position antenna switch . . . True peak reading Cross-Needle SWR/Wattmeter . . .

Call your dealer for your best price!

AMERITRON ATR-30

$599

Suggested Retail

- *Handles 1500 Watts carrier*
- *Super High Current edge-wound silver plated Roller Inductor*
- *500 pf tuning capacitors with 6:1 vernier reduction drives*
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- *6 position antenna switch*
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AMERITRON's ATR-30 *True Legal Limit*™ roller inductor antenna tuner is ham radio's toughest! It'll handle 1500 Watts *continuous carrier output* on *all* modes and *all* HF bands into most antennas -- even on 160 Meters where most antenna tuners fail.

It's perfect for Ameritron's most powerful amplifiers where the ATR-30 just loafs.

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You'll see Ameritron's new *super high current* air core roller inductor. It's *edge wound* from a thick solid copper strip and silver plated. This produces a large surface area and a massive conductor. It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn ordinary roller inductors.

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Two 500 pf -- *the highest of any antenna tuner* -- variable transmitting capacitors give you no-arc wide range impedance matching for true high power performance.

6:1 vernier reduction drives makes capacitor tuning smooth and easy.

Super Balun, 6 position Antenna Switch

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A 6 position antenna switch lets you select your desired operating antenna.

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Ameritron's active electronic *true* peak reading meter accurately reads forward and reflected power and SWR *simultaneously* on a lighted Cross-Needle meter.

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Ameritron has the best selection of *TrueLegalLimit*™ HF Amplifiers

AMERITRON's legal limit amplifiers use Peter Dahl super heavy duty Hypersil power transformer capable of 2500 Watts!

Ameritron's *most powerful* Amp

with Eimac® 8877 ceramic tube

AL-1500

$2845

Suggested Retail

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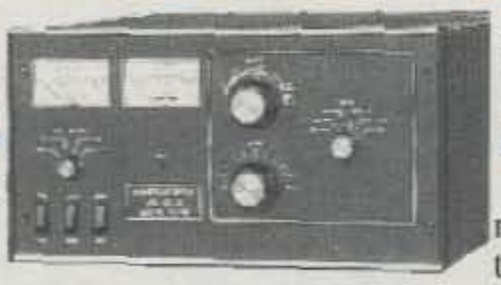
Ameritron's *toughest* Amp

with Eimac® 3CX1200A7 tube



AL-1200

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

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with 2 Eimac® 3CX800A7 tubes

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CIRCLE 14 ON READER SERVICE CARD

View of late fall aurora photographed by Howard Sine, WB4WXE, during his stay in North Pole, Alaska. The end of his 4-over-4 six meter array is visible at the far right.

Most people associate aurora with glowing lights in the northern sky. But for hams who know what to listen for, it's also a means of communication. Hams have been key players in helping scientists understand this unusual phenomenon.

Amateur Radio and Aurora Research

By Ken Neubeck,* WB2AMU
Photos by Howard Sine, WB4WXE**

One of the strangest natural phenomena that occur on our planet is the *Aurora Borealis*, also known as the Northern Lights, in which large displays of green and red formations appear in the sky at higher latitudes. (There also exists its southern-hemisphere sibling, known as the *Aurora Australis*). Aurora, however, is more than just a visible phenomenon; it creates an interesting form of radio propagation that occurs in the *E*-region of the ionosphere and that allows many hams to make contacts at greater-than-normal distances. Contacts via the aurora can occur on the HF bands, but its major impact is felt on the VHF frequencies of 6 and 2 meters, where it can result in long-range contacts and much excitement on the air.

Most hams probably have never experienced aurora propagation first hand on any amateur band. When hams hear a weird, distorted, ghostlike-sounding signal, very few know that it actually is coming to them via the aurora. Those who have experienced this

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mode observed it primarily in VHF work and only from certain locations on the planet. However, it also occasionally can be seen experienced on HF bands as well as from locations one might not normally expect. This will be discussed later on.

Just like the discovery of the sporadic-*E* phenomenon, hams were the first group to discover the existence of radio aurora. They have contributed significantly to research aimed at a better understanding of the phenomenon. With many of the newer HF radios including 6 and 2 meters, more and more hams are discovering radio aurora for the first time when they use the weak-signal modes of CW and SSB in the lower part of the VHF bands. Let's take an overall look at this amazing, complex phenomenon and how it affects hams and long-distance communications.

Hams and The Initial Discovery of Radio Aurora

During the 1930s hams discovered the sporadic-*E* phenomenon on the old 5 meter band. (During a sporadic-*E* opening, patches of ionization in the *E*-layer of the ionosphere reach a level at which they can refract signals of a certain frequency. At this point, a band that had been quiet may suddenly spring to life with long-distance contacts. The phenomenon is most common on the 6 and 10 meter amateur bands.)

During the same decade hams discovered radio aurora as an important propagation mode, also on the 5 meter band. One of the earliest reports of auroral propagation was made by W2AMJ in the May 1939 issue of *QST* magazine. He reported:

"The Northern Lights were going to town on the night of February 24th. I got on 56 Mc. at about 8:20 PM. I sent a CQ on i.c.w and was rewarded with a call from W8VO in Akron, Ohio, also on i.c.w. His carrier was S9 but had the most peculiar sound to it, with or without modulation. He told me that the band had been open out there for about an hour. I swung over to phone, and he advised me that phone was unintelligible. Then he shifted to phone, and boy, if you ever heard inverted speech you should have heard his. It sounded nothing like voice modulation. We continued the contact on i.c.w, S9 both ways. At no time was there any appreciable fading. The signal was just like it was around the corner, except for the peculiar combination of howl and roar that accompanied his carrier."

W2AMJ also noted that another ham, W8AGU from Penfield, New York, heard both W8VO and W2AMJ in QSO and heard the same strange distortion that he coined as exceptional QSB (fading). Hams would continue to be instrumental in collecting data and making observations that better defined the understanding of this phenomenon, with a number of articles appearing in *QST* over the years by hams such as R. Moore, W2SNY; Rolf Dyce, W2TTU; Don Lund, WAØIQN; Richard Miller, VE3CIE; and Emil Pocock, W3EP. These articles can be found in Emil's book, *Beyond Line of Sight* (ARRL).

Hams often have been instrumental in providing direct input to scientific studies. In one study European hams provided key observation of radio aurora on 2 meters that was collected during a study conducted from 1957 to 1963. The results of this study were reported in the paper "VHF-Bistatic-Aurora Communications as a Function of Geomagnetic Activity and Magnetic Latitude," by G. Lange-Hesse in the book *Arctic Communications* (Pergamon, 1964). At the end of his paper Lange-Hesse thanks the many European radio amateurs who participated in the study, as well as the Deutscher Amateur Radio Club, for collecting the comprehensive observation data. He states, "Here is a good example of amateur radio supplying research information difficult and expensive to obtain in any other way."

In past studies scientists often have referred to the aurora phenomenon as sporadic-*E*. However, the more correct terminology, which currently is being used, is *radio aurora* or *bistatic aurora*. As hams know, the sporadic-*E* phenomenon is much different from aurora, although the two have some simi-

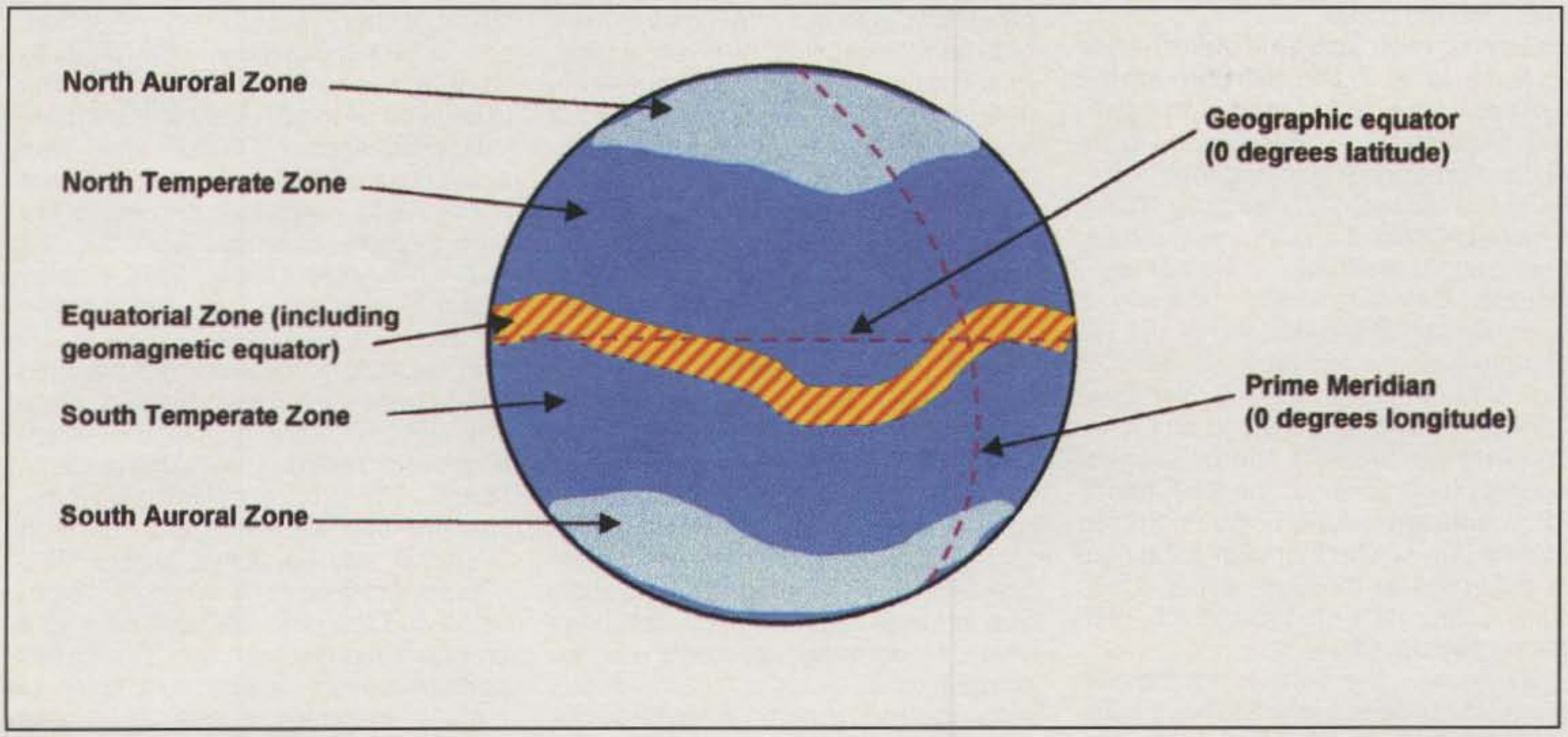


Fig. 1– The approximate locations of the Earth's various zones relative to auroras. You can see that the geomagnetic equator differs from the geographic equator and that the two auroral zones center around the geomagnetic poles and not the geographic poles.

larities: They occur in the *E-r*egion of the ionosphere and account for many of the openings observed on VHF.

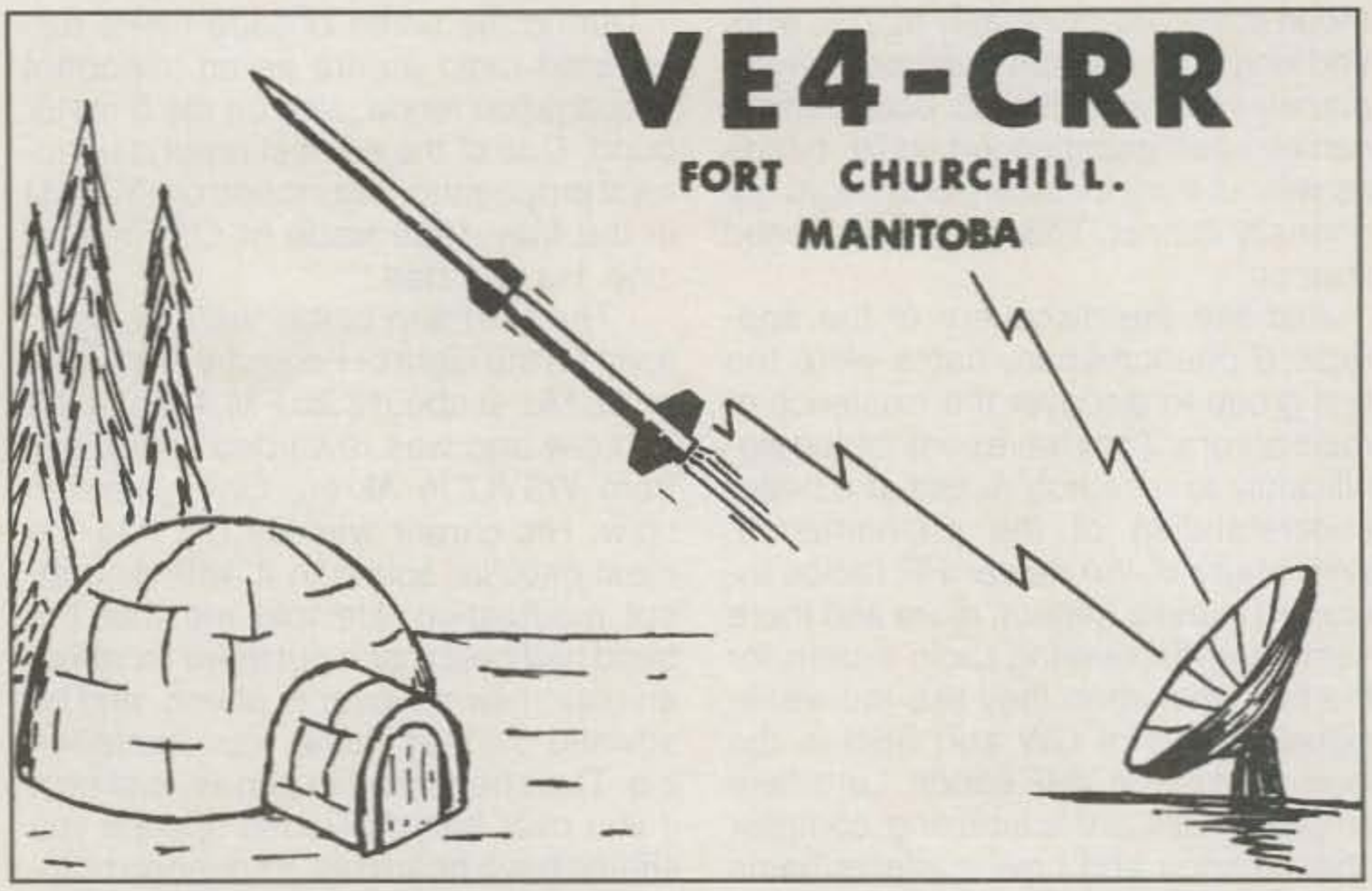
Origins and Characteristics Of Aurora

The aurora is a visible and—for hams—audible sign of the interactions between the Sun and the Earth, as it is triggered by an increased flow of solar particles into the Earth's ionosphere. The Earth has two auroral zones which are centered around the north and south geomagnetic poles (fig. 1). The best times for aurora propagation to happen for those in the auroral zone and in the higher latitudes of the temperate zones is generally during the time of the spring and fall equinoxes. This is because at these times of the year the Earth is in a favorable position relative to the active zones of the Sun, as the active zones are where most solar eruptions generally occur. These solar eruptions result in a stream of particles ejected from the Sun towards Earth via the solar wind.

The particles take a little over two days to reach the magnetosphere of the Earth, where the electron precipitation interacts with the geomagnetic field lines and ambient particles in the *E*-region at approximately 70 miles above Earth. This interaction is a complex process in which many things result, including high amounts of electric current flowing in the ionosphere. The Earth's magnetic field is such that any particles from the Sun enter the ionosphere via the poles.

Geomagnetic activity is measured at a specific location and rated through the *Kp index*, which can range from 0 to 9, with the higher number representing the highest amount of geomagnetic activity. In the US measurements by NOAA (National Oceanic and Atmospheric Administration) are taken at the agency's Boulder, Colorado facility. Typically, a geomagnetic storm that wipes out HF communications can be on the order of Kp values from 6 through 8. Yet while conventional *F*-skip HF communications will be impaired, the potential of aurora propagation on the VHF bands is *increased* during geomagnetic storms. Thus, when a major solar flare is observed at the Sun, experienced VHF hams start monitoring the VHF bands two days later.

By the way, the Earth is not the only planet in the solar system to have auroral zones that are affected by solar precipitation. Voyager space probes to Saturn have revealed a similar type zone at both of that planet's poles. It is not impossible that the characteristics of the auroral zones of both planets may have many similarities and that studies of these two planets may provide additional information regarding the many questions about aurora.



The 1960s QSL card of VE4CRR, the club station at Fort Churchill, Manitoba, shows a sketch of a research rocket typically launched into the ionosphere from that location. (QSL courtesy Wendy Heinze)

As aurora is a visual phenomenon, this aspect of it is referred to as the *optical aurora*. In addition to the radio aspects of the phenomenon, visual accounts of the aurora given by people located in the auroral zone are very interesting. A former supervisor of mine told me of a number of visual experiences, as he spent a couple of years stationed at Fort Churchill, Manitoba when he was in the service in the 1960s. He was part of the team that shot rockets into the active aurora to collect various scientific data such as electron density and ion composition. He also met his future wife while he was stationed there, and they both told me that when the aurora occurs in a remote area such as where they were stationed, one can hear the high-pitched whistle of the aurora. They also told me that many of the scientists stationed there who had arrived as agnostics became quite spiritual after witnessing this phenomenon over time. There was an amateur radio club station, VE4CRR, on the base which made many contacts via the aurora mode.

Auroras tend to come in two basic colors—green (Type C) and red (Type D). The other variations are green aurora with red outlining the top (Type A) or green aurora with red outlining the bottom (Type B). The color of the aurora is due to the composition of specific elements along with the excitation levels of various molecules. For example, the green aurora looks green to the visible eye because of the excitation of the oxygen atoms to a certain level, whereas the red aurora is the result of oxygen atoms being excited to a different state where more red light at 6300 angstroms is visible. The book *The Aurora Watcher's Handbook*, by Neil Davis (University of Alaska Press), is recommended, as it provides exceptional details as to what causes certain colors and patterns to be seen on the different aurora types.

Howard Sines, WB4WXE, a ham who was stationed in Alaska, told me that during his four-year stay the color of the aurora tended to be greenish, but was red when researchers from nearby Poker Flats released gas inside active auroras.

In addition to oxygen and nitrogen gases residing inside the aurora, there is evidence of active metallic ions which account for radio aurora taking place. In March 1965 a rocket containing a mass spectrometer was launched from Fort Churchill into an active aurora. The mass spectrometer records ion composition and the data are sent back to a ground station by telemetry. During this particular flight a stratified layer of metallic magnesium ions (Mg+) was detected at 100 km. This would seem to suggest that these metal ions, which are resident in the *E*-region, were excited by the electron precipitation brought

about by solar events, resulting in a radio aurora. It would appear that either the metal ions, the excited oxygen ions, or both contribute to the effects of the radio aurora.

Indeed, perhaps the most vivid view of the aurora came from space rather than from the ground. This took place when astronaut Owen Garriott, W5LFL, observed a major aurora formation over the South Pole while he was orbiting Earth in the Skylab space station in September 1973. On September 7th the Skylab astronauts observed a spectacular solar flare, and an unmanned spacecraft observed a tremendous burst of x-ray flux emanating from the violent solar eruption. About 2 1/2 days later particles ejected from the Sun during the flare began arriving at the Earth's upper atmosphere. At the time, Skylab was in an orbit inclined only 51 degrees to the equator; the aurora was observed from the equatorial side with Dr. Garriott taking several pictures using a hand-held camera. The Kp index reached a high value of 8 on September 9th. This is essentially storm level!

For those of us located in the northern hemisphere, the auroral zone is typically located in the northern latitudes of Canada. However, during such storms it can extend down to the southern part of Canada and even into the northern part of the US! When there is intense aurora activity caused by major geomagnetic storms, the auroral zone can extend even farther down, creating one of those rare opportunities for hams in the southern states to get in on the fun.

The effects of geomagnetic storms can extend beyond radio propagation and visual displays to the point of causing major damage to power lines and telephone lines. This is because during these storms there are high levels of electrical currents flowing in the atmosphere that can be felt as low as ground level and can cause electrical shorts. In recent years there have been several cases of magnetic storms that fall into this category.

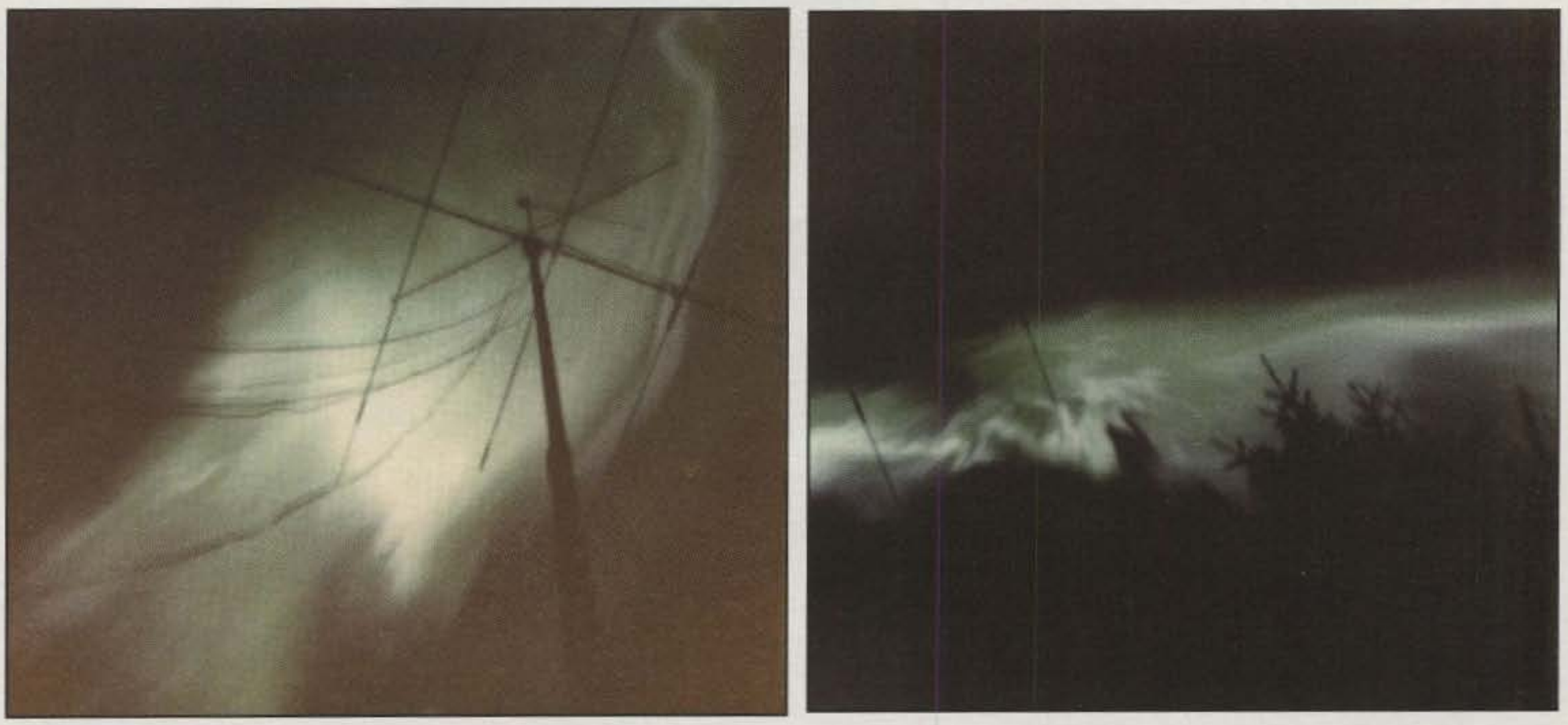
One of the most intense geomagnetic storms of recent times happened during the first week of August 1972. Three gigantic solar flares ejected matter that accelerated to speeds of almost 2.7 million miles per hour. The Pioneer 9 spacecraft was the first to feel the shock. Beginning during the night of August 3rd, a series of brilliant aurora radiated over much of North America and Europe. Power lines surged with voltage fluctuations, and a 230,000 volt transformer was blown in British Columbia. A similar magnetic storm took place some years later, causing electrical disturbances throughout the month of October 1989, when power was disrupted for millions of Canadians. During times of high storm activity when the Kp index is greater than 7, normal HF communication is wiped out and the auroral arc is extended such that aurora contacts on 6 and 2 meters are possible. *(Therefore, when the HF bands are dead due to a solar flare, use those upper bands on your HF/VHF transceiver, point your beam roughly north, and start listening!—ed.)*

A number of scientists have predicted major geomagnetic storms corresponding with the projected peak of the current sunspot cycle in the spring of 2000 (in other words, now). These storms may be on the order of the ones observed in 1972 and 1989. Look for this possibly to occur any time between March and October 2000. Even low-power stations will be able to do well on 6 and 2 meters during such openings.

Ham Radio Observations

I was one of those hams who had never really experienced an aurora opening until I got active on 6 meters. Perhaps I might have heard an unusual-sounding signal on HF occasionally over the years, but there were many other "normal"-sounding signals around to work.

All of this changed when I experienced my first real aurora opening on 6 meters in May 1992 after 20 years of being a ham. It was an all-day affair during which I heard and worked stations



These pictures of a wintertime Type D aurora (all green) were taken by Howard Sine during his stay in North Pole, Alaska from 1979 to 1982. The photo on the left shows the silhouette of his triband HF antenna against the aurora, while the photo on the right shows the outline of trees against the vivid aurora display. These photos were taken from the roof of his house using 3 to 4 second exposures.

FT-8100R
The versatile FT-8100R Dual Band Mobile offers rugged RF design, 50 Watt (VHF)/35 Watt (UHF) power output, 310 memory channels, Dual Receive (VV/UU/VU), Enhanced Smart Search,™ CTCSS Encode, and a TX Time-Out Timer. (ADMS-2E programming software available.)

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This 70W high-powered 2M FM Mobile provides extended UHF receiver coverage, AM Aircraft RX, and is MIL-STD approved. The FT-3000M features 81 memory channels, Smart Search,™ CTCSS/DCS, optional ADMS-2E programming software, and is 1200/9600 Baud Packet compatible.

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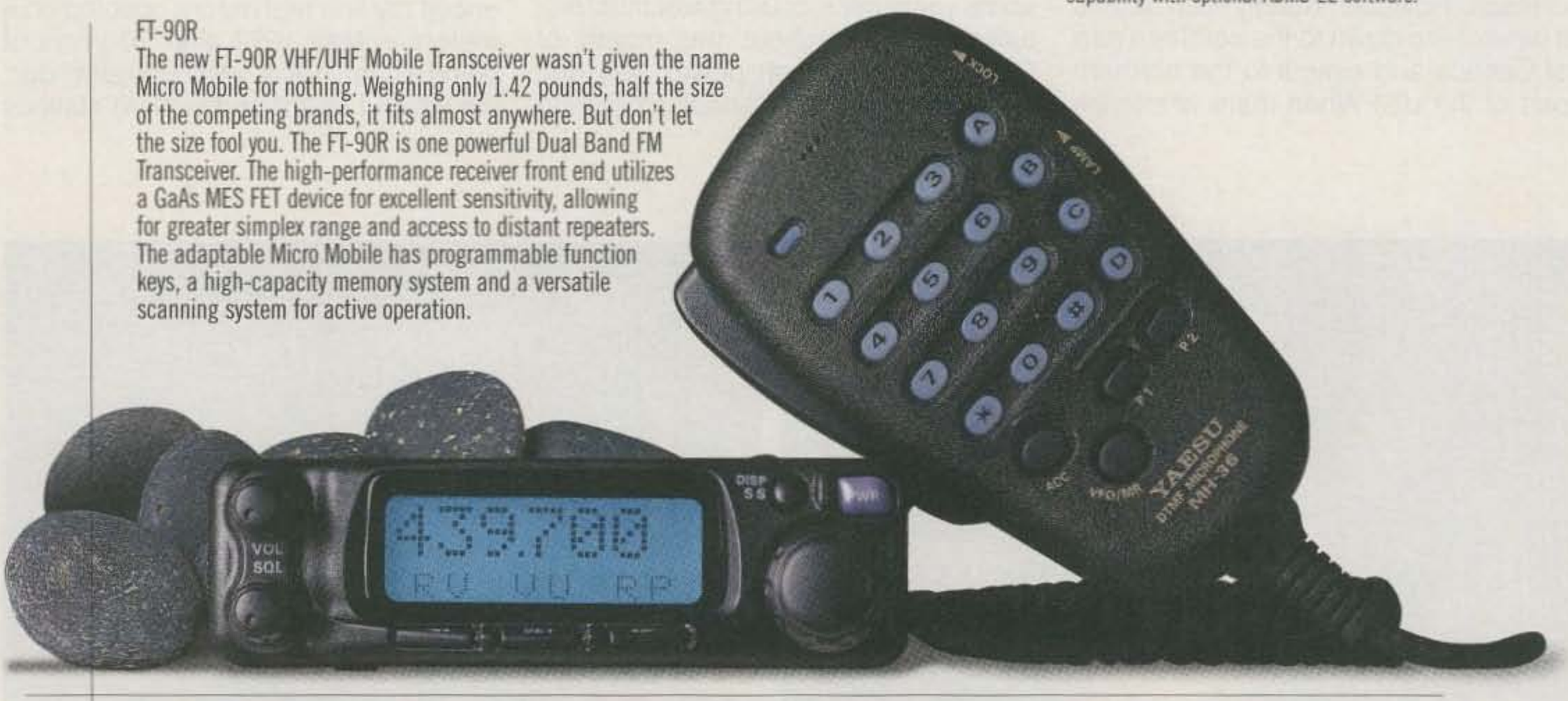

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* Cellular Blocked

FT-11R
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These ultra-compact, 5 Watt VHF FM Handhelds feature rugged die-cast aluminum cases, 10 memory channels, optional CTCSS, and multiple scan modes. The FT-23R (2M) and the FT-33R (222 MHz) are easy to operate, and give outstanding performance.

FT-10/40R
These single-band handhelds are manufactured to MIL STD 810 specifications, featuring either 30 or 99 memories, CTCSS/DCS operation, Dual Watch, and are available in 2.5 Watt or 5 Watt versions, with four keypad options.

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This miniature Handheld Receiver provides FM, AM, SSB and CW reception on 100 kHz–1300 MHz, with 1091 memory channels, Smart Search,™ versatile Dot Matrix display, Band Scope, and Dual Watch.

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TOUGH GUYS.

When you're small, you get picked on. Isn't that how it goes? Well not in Yaesu territory, because not only do we design compact handhelds for efficiency, but we give these clever little guys plenty of muscle. Yaesu handheld transceivers have earned the bragging rights for being the smallest handhelds with the most durable water resistant casings ever created. And packed inside the brawn are engineering accomplishments in performance that are unmatched in the industry. Our high-tech handheld transceivers provide clean power output on the VHF and UHF bands and offer revolutionary features that allows these tough guys to continually outperform the competition. Learn more about Yaesu products on the web at www.yaesu.com

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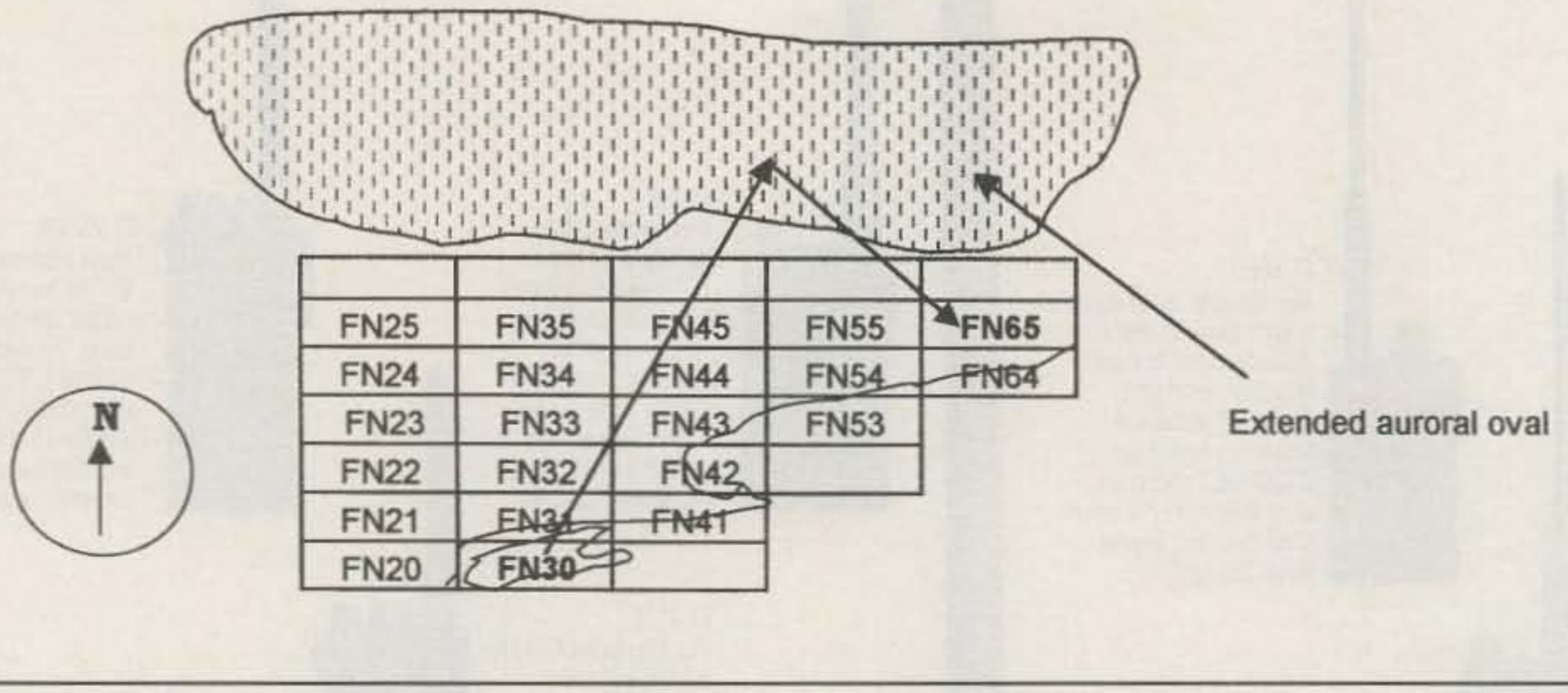

Fig. 2– In this figure WB2AMU from Long Island (grid FN30) is able to work KB1DSG in Maine (FN65) during an aurora opening on September 22, 1999 on 6 meters by means of backscatter. Both stations point their antennas north and can hear each other. WB2AMU was using only 10 watts and a dipole and would not have been able to work KB1DSG via direct path, even though the direct path (400 miles) was shorter than the backscatter combination (over 500 miles).

from Maine to Ohio. All of the signals on the band, both SSB and CW, had this noticeable buzz and distortion.

As noted in that first report of aurora communications in 1939, CW is generally the best mode to use during an aurora opening on 6or 2 meters, as voice modes tend to be severely distorted and difficult to understand. This happens because of Doppler shift and is one of several valid arguments why hams should know Morse code. This is particularly true if you have ever been in the position of trying to decipher the callsign of a horribly distorted SSB signal during an aurora opening!

What causes the Doppler shift and the aurora buzz sound? It is a very complex process, but simply put, the mass movement of aurora *E*-layer electrons in the same direction relative to the Earth creates powerful ionospheric currents. These currents propel the electrons at velocities up to 3000 meters per second, parallel to the Earth's geomagnetic latitudes. The velocities are sufficient enough to cause major frequency shifts in VHF signals.

The aurora buzz is a more complex process and has been the subject of many scientific studies. There apparently are many scattering regions inside an aurora, as the aurora is not a homogenous plane throughout. Random motion of electrons is believed to be responsible, applying a different sort of relative motion to the scattered radio signal entering the formation. Thus, the frequency shift for Doppler effect and the auroral buzz may be caused by two separate sources of motion inside the aurora. Quite simply, there is a lot going on inside an aurora. For a more detailed description, refer to the paper "Practical Radio Aurora," by Emil Pocock, W3EP, in his book, *Beyond Line of Sight*.

By the way, when giving an RST signal report to other stations on aurora contacts, it is not of much use to give a tone report, because the tone quality is never going to be pure. As a result, the convention is to use the letter "A" in lieu of the number 9 in the "T" position of the report. A standard report therefore could be 57A. The same report format is used for grading the signal strength of both CW and SSB signals.

Is it possible to work stations via aurora if you can't *see* the aurora? Absolutely. For many of us who are located in the temperate zones of the US, working stations via aurora propagation is by means of the *backscatter mode,* as we generally do not have visual sighting of the aurora. The scientific nomenclature for this backscatter mode is *bistactic,* indicating the two paths for this to happen. An example of how this works is shown in fig. 2. Note that the great circle path (or direct path) is not used to make contacts, as stations generally would not be able to hear each other via direct means. Remember, the aurora formation is in the *E*-region at about 70 miles above Earth, and it acts like a reflector, behaving much like sporadic-*E* formations on different ham bands.

One of the neat things about aurora backscatter contacts on 6 meters is that they allow you to work many of the close-in grid squares that are beyond the line-of-sight communications or common tropospheric enhancement paths. For example, I live on Long Island, New York, in grid FN30, and I have worked into grids such as FN34 in upstate New York via aurora. That is too far for me to work via line of sight and too short for sporadic-*E* skip. Distances of 1000 to 2000 miles can be worked, almost as well as a single-hop sporadic-*E* opening.

For stations located just below the auroral zone, such as Lefty, K1TOL, in Maine, some very good experiences can occur via direct auroral propagation. In January 1992 Lefty worked all but two states in the contiguous US during a major auroral opening. He also worked into Europe via *F2*/aurora combinations during November 1990. Lefty has observed aurora openings into much of Canada as well, hearing stations as far north as the VE8BY beacon in the Northwest Territories not only during the equinoxes, but occasionally during strong geomagnetic storms that occur during the summer.

What about hams who are located *in* the aurora zone? Where do they point their antennas? From the experiences of Howard, WB4WXE, when he was stationed at the North Pole, Alaska during the late 1970s, it appears that you should point your antenna toward the direction of the signals you hear. Essentially, these stations are inside the skip zone. Howard indicated that there were very few stations to work north of him, and he just pointed his antennas in the

direction he heard signals. In his case, this was often east or southeast in the areas of Minnesota, North Dakota, Alberta, Saskatchewan, British Columbia, and even NWT (VE8BY).

Aurora can be heard on HF bands such as 10 and 15 meters. However, it often is not observed by hams on the HF bands at the same level it is on the VHF bands. Sometimes aurora can combine with other propagation modes such as transequatorial propagation (TEP) on 10 or 15, resulting in unusual-sounding signals from the lower parts of South America coming into the northern US. (This is explained further in my article "Unusual Propagation Modes," which appeared in the February 2000 issue of *CQ*.) Thus, stations in areas near either auroral zone have the possibility of working this mode as part of a combination, such as TEP plus aurora and on rare occasions *F2* skip plus aurora.

For hams located in the northern hemisphere, aurora activity generally occurs only during the equinox period and may only occur two or three times a year during the low end of the sunspot cycle. As the sunspot count increases, more events are observed and appear in other months besides the equinox months of March and September. Already, during 1999, a relatively high sunspot count year, I observed six openings on 6 meters from my Long Island location, including a strong opening that occurred in July.

High power (on the order of 100 watts) generally is required for most openings because of the distortion and fading of signals. However, some aurora openings can be so strong that power levels of only 10 watts can be used. This was the case during an opening on September 22nd that lasted three hours, during which time I was able to work stations in Maine, Ohio, and Ontario from my location using only 10 watts and a dipole. I heard from other stations during this opening that they worked other stations using 10 watts and simple antennas such a vertical. I received feedback from Gordon West, WB6NOA, who was in Anchorage, Alaska on the same day, and he reported hearing distorted signals not only on 6, but also on 10 and 20 meters.

By the way, at the end of this particular opening at around 9 PM, many stations in the northeastern US caught a combination sporadic-*E*/TEP opening into Argentina on 6 meters. Speculation is the same events that caused the major aurora opening also caused strong ionization in the *F* layer over the geomagnetic equator. Indeed, some major aurora events can result in a special phenomenon known as *auroral-E* in which the distortion is minimal and the signals have very high fidelity. Thus, it pays to monitor the 6 meter band after a major aurora event occurs.

One other operating tip to keep in mind is the fact that the same side of the Sun faces the Earth every solar rotation period, which equates to approximately 28 days or so. The active zones of the Sun that currently have many solar flares are very likely to continue to have more flares for a period of time. Therefore, after a strong opening has occurred on 6 meters, it pays to check the band again about four weeks later for another aurora event to occur. This did happen for us in the northeast with regard to the September 22nd event, when another aurora opening occurred on the 21st of October. This one, however, was not as strong.

In Summary

Hams will continue to play a very important part in studies of radio propagation modes, and not only aurora, but also sporadic-*E* and transequatorial propagation. They have first-hand, widespread observations that are extremely useful to scientists studying these phenomena.

Hams are on notice to get ready for that "big one," the geomagnetic storm that is expected to take place sometime in the next several months. When a large solar flare takes out most HF communications and there are power outages in the higher latitudes, it is time to get the VHF radio working and start listening on 6 and 2 meters! Hams are encouraged to keep good records and logs and report what they have been able to work, both on the Internet and to the VHF editors of the various amateur radio publications.

I would like to thank Howard Sine, WB4WXE, for his excellent photos, which were taken during his stay in North Pole, Alaska and for his observations. In addition, I want to thank Dr. Owen Garriott, W5LFL, for detailed information during his observations of a major aurora event from Skylab.

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Looking for the benefits of a beam antenna for HF, but don't have room for a monster on your roof? Consider Traffie Technology's HX-5B five-band HEX beam.

CQ Reviews:

The Five-Band "HEX Beam"

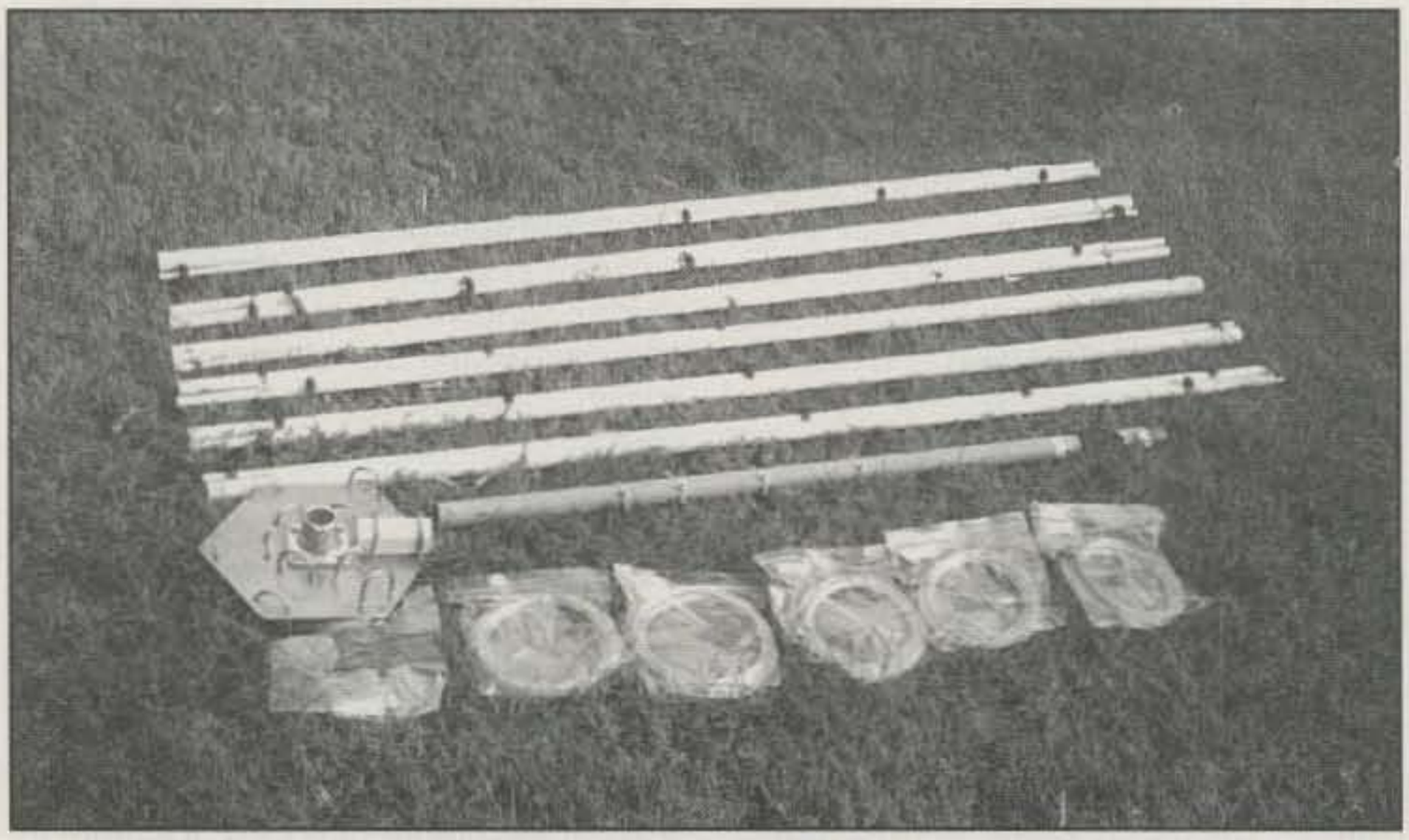
BY LEW McCOY,* W1ICP

A few months back I got on 17 meters one morning and I ran into Mike Traffie, N1HXA, who just happens to manufacture the HEX beam. I had not been aware of this beam, nor did I have any information on it. Mike was kind enough to run a few checks with me, and I was somewhat astounded to see four very solid S units on my receiver's meter when we checked his antenna for front to back. This was on 18,154 kHz. Unlike many hams who talk about S units and decibels, I have calibrated my receiver in microvolts and then translated to decibels. It so happens that I really have 6 dB per S unit on 18 MHz. This meant that Mike's HEX beam was showing me a 24 dB front-to-back ratio—rather astounding for a 2-element beam.

Being an antenna nut, I asked Mike for more information about the HEX beam. He referred me to his web page (see the manufacturer's information at the end of this article), and all the details showed up there. I called Mike and asked if he would like a review in *CQ* and he said he would.

We put up a five-band job, 20 through 10, at KI7ZZ's house. I am not allowed beams in the restricted park where I live. (However, Mike has since sent me a 10 and 15 meter HEX beam which I did manage to install here; I plan to review this super small beam in a future issue of *CQ*).

The assembly of the HEX beam at Don's house took a little over an hour and then it took another hour or so to get it up on the tower at about 40 feet. My first step was to check the SWR and



Here are the parts of the five-band HEX beam. The poly rods are of space- age technology material and are very strong. The hub, which supports the antenna, is at the bottom left.

bandwidth, and I was pleasantly surprised. I could provide curves in this review, but quite simply, the SWR did not go above 1.7:1 on any of the bands except the very high end of 10 meters, where it was 2:1 (which makes this an excellent contest antenna). The transceiver we were using had a built-in tuner, but in no instance was it necessary to use the tuner.

Briefly, the five-band antenna consists of five dipoles with reflectors, no traps or any other devices. Before going further, I should describe the size of this antenna. A regular 2-element Yagi for these frequencies would have elements on the order of 33 to 36 feet, usually on a 10 foot or longer boom. This means a turning radius of at least 18 feet or a diameter of more than 30 feet. The configuration of the HEX beam is just about half the size of the Yagi, with a turning radius of only 9.4 feet. Thus, by any standard its small size is a real plus—less windloading, light weight, and many other features, as we will see.

A word about windloading: An antenna with this configuration is always going to be in a minimal configuration in heavy winds. This is because it is a completely symmetrical antenna, so windloading is not even a factor to consider (see photos). Another important point I should touch on here: With trap beams there is always a sacrifice in gain because of element spacing. Optimum gain in Yagis is always obtained with optimum spacing. In this five-band HEX beam this does not appear to be a problem. That may seem like a very unusu-

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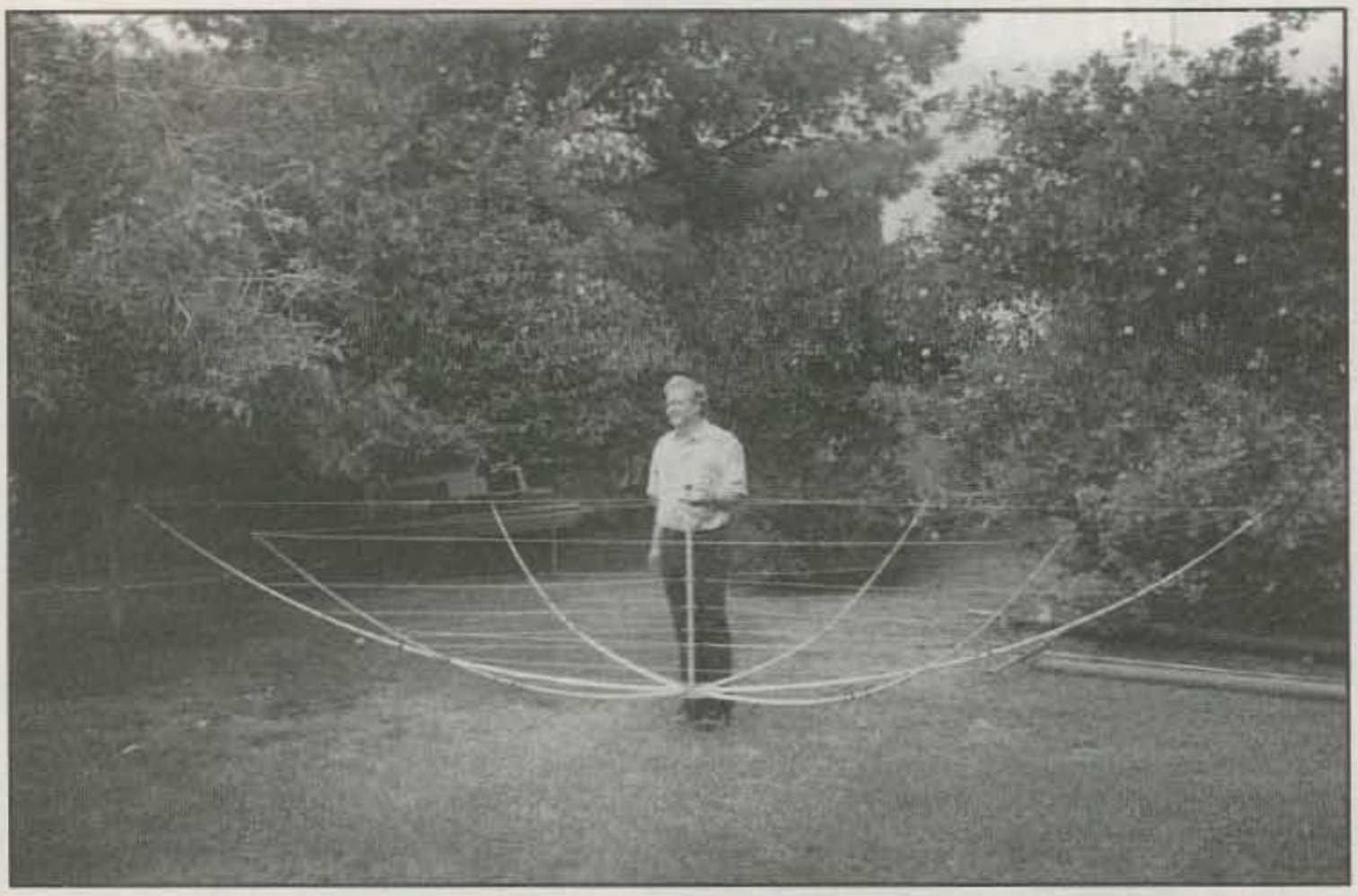


KI7ZZ is shown here with the completed five-band HEX beam. Note the symmetrical aspect of the antenna, which vastly reduces any wind-loading problems. The total weight of this five- bander is about 20 pounds.

al statement, but in actual use, the configuration of this HEX beam does *not* depend on spacing for gain.

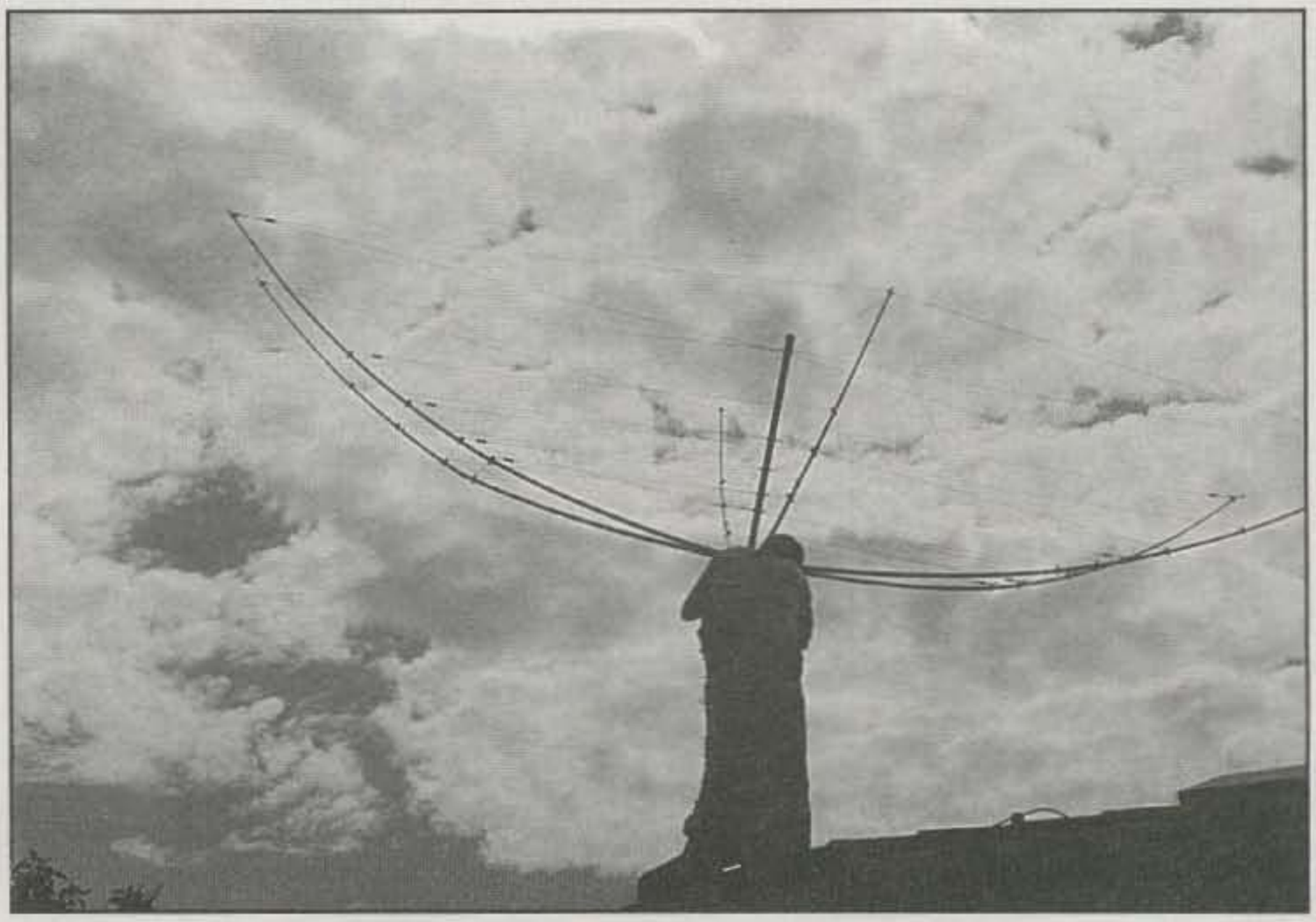
The proof of the pudding, of course, is in performance, so let me give you some of the results of that first hour or two. We first got on 10 meters and checked with some of the DX stations. VK7VU, in Australia, gave us 18 to 24 dB front to back, and this figure was repeated on both stateside and DX stations. There was a huge pile-up on a station in Saipan, so I thought I would try to break it with our 100 watts. The pile-up was huge by any standard, but it only took two calls to nail the DX station. It was the just about the same story on all the other bands—at least 12 dB front to back on some bands and as much as 24 dB on others. All these tests were made on sky wave.

Next I used the antenna, again with 100 watts, in the CQ World-Wide DX Contest. We gave it a real workout on 20 and 15 meters. In no case, in no pile-up, did it take more than four calls to make contact—and this was at 100 watts. The CQ WW is an excellent place to test a new antenna (and I must add, this contest is also lots of fun!). The pile-ups are frequent, and it's easy to make assumptions about an antenna's performance. I am not in the least afraid to state that the HEX beam's performance was, and is, outstanding. From my very first time on the air I have always been a DXer. It's a real pleasure to use an antenna that makes pile-ups easy to beat—and only running 100 watts input.

A single antenna, one band, is similar to two letter "W"s, one of the Ws being the driven element and the other the reflector. To visualize the antenna, the feed point is at the center of the top junction of the letter W of the driven element. Immediately behind this feed point is the reflector, which is a parasitic element. The antenna is a very close-spaced array, with the feed point of the driven element only an inch or so from the center of the reflector. The antenna is supported by specially made fiberglass rods. These are not ordinary poly rods, but what I would call space-age technology; they are very, very strong.

In the multiband configuration we tested, the driven elements all are connected to the center column, and a 50 ohm coaxial line is connected at the top of the column. The fiberglass poles are mounted on a circular plate, and these are used to support the various dipoles. These fiberglass rods are drawn up by the antenna wires so that the antenna looks like an upside down umbrella (see photos). A pipe or mast is used to support the antenna structure on a rotator, and because of the antenna's light weight, an ordinary TV rotator can be used to turn the antenna. The five-band version we tested comes in at 20 pounds. Again, construction time took less than an hour and the antenna was up and rotating within two hours of opening the package. The instructions are very clear and easy to follow.

Trying to understand the reason this antenna works so well is rather difficult. Such close spacing of two elements can justify the classification "super gain," but in this case there has to be more than simple gain involved. If you go way back in beam history and look in the old ARRL antenna manuals, you will find that maximum gain occurs at very close spacing—as I recall, 0.05 wavelength spacing. What gives me a problem, though, is not just the gain, but the apparent shaping of the radiated signal. Keep in mind that gain is obtained by shaping the radiated signal. Just from observation on my part, it would appear



On the roof, getting ready to mount the antenna on the mast.

there is some form of compression of the RF in desired skywave angles. Some antenna people might question that statement, but it is difficult to argue with results. It's like that old statement "been there, done that," but in this case results speak for themselves.

You might ask, what about computer programs such as NEC? From my viewpoint, and heaven knows I have done enough computer programming and modeling, the configuration of this antenna makes it difficult to obtain reliable results. Again, the bottom line here, when all is said and done, is that the antenna is a very good performer.

I cannot help but relate an experience I had with antennas back in the late 1940s. Clarence Moore, the inventor (or discoverer) of the quad beam, came back from Ecuador. He had worked for a missionary in the Quito area, and they had a high-power radio station at about 10,000 feet above sea level. Moore had put up a Yagi, but when they applied power, the aluminum elements actually caught fire and burned. This happened because of the extremely high voltage and the corona effect prevalent in high altitudes—in this case 10 KW at 10,000 feet, and that's high altitude. In searching for a way to avoid the RF voltages, Moore came up with a full-wave loop antenna, or if you will, a single-element quad. The antenna performed marvelously, so he added a director.

In those days, 10 meters was hotter than a Saturday night special, and when Moore came back to his home in Indiana, he put up a two-element quad and showed up on 28,500 kHz. There were several of us who laid claim to 28.5 simply because the DX portion of the band was 28.0 to 28.5. The DX would call CQ and start listening for the U.S. at 28.500. Suddenly Moore showed up and started "stealing" DX from us. I might add that we didn't get mad or get even, but were open-minded enough to go down and visit him and see what he was using. Well, several of us converted to quads and were more than happy.

Shortly after that I went to work at the ARRL. I asked then-Technical Director George Grammer how come they didn't show much on the quad in the *Handbook* or other literature. His answer was that they had tested a single quad loop and it only showed 1.8 dB gain over a dipole. They had never tested a quad beam! I got a supply of bamboo and built several quads, and I must say they outperformed many of those early Yagis.

What does all of this have to do with a review of the HEX beam? Quite simply, from my experience so far I firmly

Up in the air ready to work the world. And it does!

believe that the HEX beam is a new approach to a very good skywave antenna. I don't have an antenna range, but after checking the performance of this antenna versus Yagis of known gain, from skywave performance I would stick my neck out and state that the antenna has at least six decibels of gain over a dipole, and possibly more on some attack angles.

Some readers may question ice or wind loading. In the case of ice, these antennas have withstood heavy icing conditions such as those which have dragged down Yagis.

The HEX antennas are very lightweight, simple to erect and as I said, can be rotated with an ordinary TV rotor. Going even further, in many cases hams have a problem putting up a beam because the beam extends over a neighbor's property. This antenna, with its small diameter, may be an answer to this dilemma. Also, you do not need a heavy-duty tower nor rotator.

When doing a review I do not usually quote from the manufacturer's literature. However, in this case the following description from the manufacturer's web page best describes this antenna:

The Hexagonal Array

With the HEX Beam, two intense flattened fields are phased and coupled to provide a high level of performance in a compact package. Thus the completed array is half normal size; the HEX Beam's elements are full size. To repeat, no loading devices are used. The HEX Beam's small size and enhanced performance at low heights make a substantial saving possible in tower and rotor cost. The array is direct feed with 50-ohm line. The HEX Beam is built to handle 1500 watts. Its unobtrusive appearance is an asset in sensitive locations.

I was very impressed by the HEX beam. If I had to rate beams on a 1 to 10 scale, I would give this antenna a solid 10. Many models are available, including single banders and multiple-band units such as the one I used, which sells for $599.

The HX5-B is made by Traffie Technology, 421 Jones Hill Road, Ashby, MA 01431 (toll-free 1-888-599-BEAM). Brochures are available on request. For more details, see the Traffie Technology website at <http://www.hexbeam.com>. ■

At Issue

BY RICH MOSESON, W2VU

An In-Depth Look at a Story Making News

ARRL vs. Kenwood Sky Command

Hams traditionally are a vocal, opinionated group of people. However, the organizations that represent us and the companies that build and sell our radios tend to be more subdued. Thus, it's more than a bit unusual to see the ARRL and a major ham manufacturer going toe-to-toe before the FCC over a new product. That's exactly what's happening in the case of Kenwood's Sky Command System.

How it Works

Essentially, Sky Command is a remote base system that lets you use a dual-band handheld to control and operate a properly-equipped HF radio. Actually, you need *three* properly-equipped radios to make it work. On the HF end, Kenwood's TS-570 family and the TS-870 are equipped to "talk" to the system. On VHF/UHF, you could use specially-equipped TH-79 handhelds, TH-D7A handhelds, or the new TM-D700A mobile rig. One dual-bander, which Kenwood calls the "transporter," is connected by wire to the HF rig. The second dual-bander, the "commander," operates independently and becomes your control point for both of the other radios. You transmit both voice and control signals from the "commander" on 440 MHz, where they're received by the "transporter" and relayed by wire to the HF rig. HF audio is fed to the "transporter" and is retransmitted to you on 2 meters (see figure for typical setup).

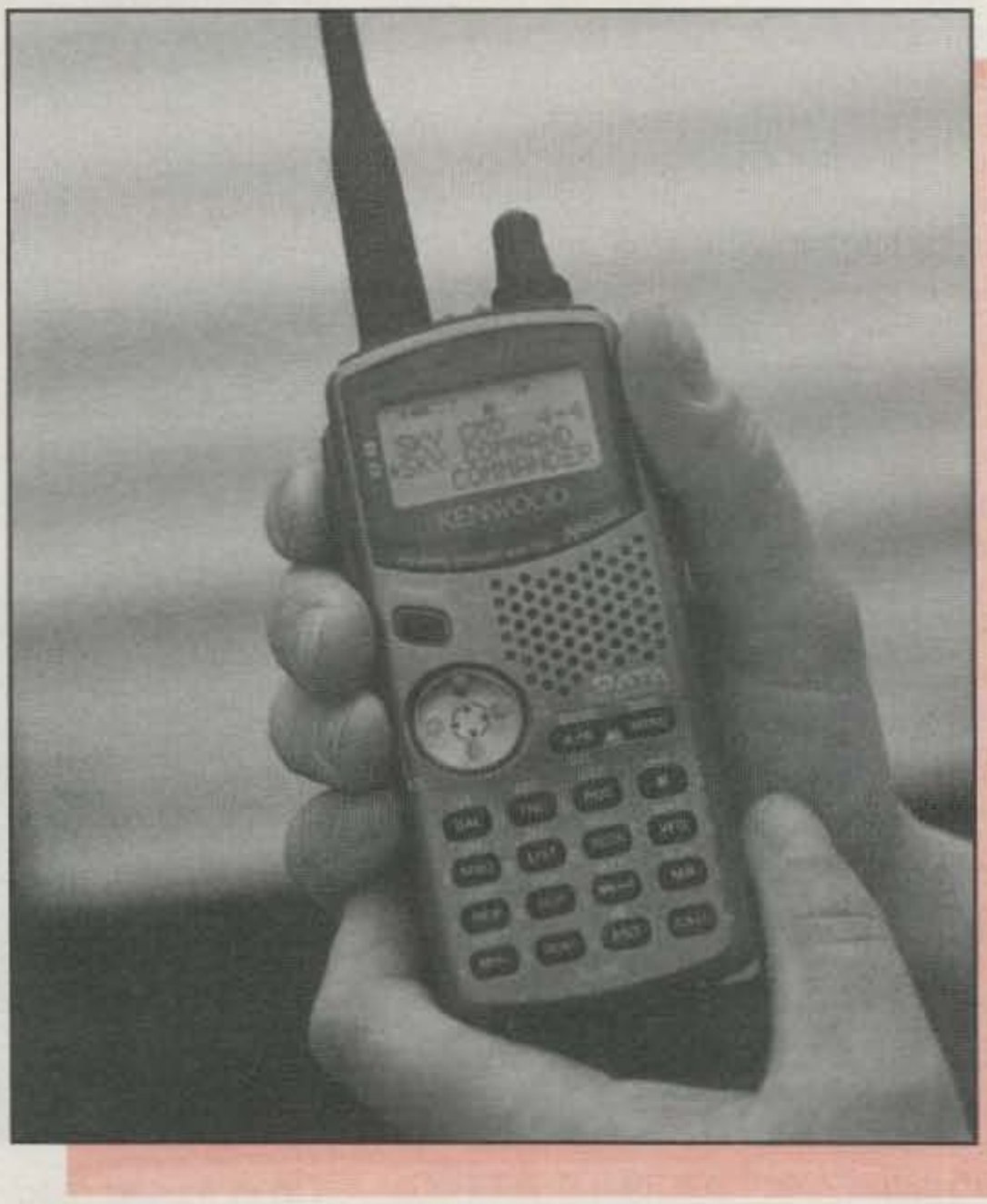
This last step in the chain—the retransmission of HF audio on 2 meters—is what the dispute is all about. However, if the FCC decides the issue broadly, it could have a wider impact on remote base operations and possibly even on the use of cross-band repeat features in dual-band radios. Even more broadly, the issue focuses on whether regulations drafted for one purpose may inadvertently put roadblocks in the path of technological developments that weren't envisioned when the rule was written.

Is It or Isn't It?

The ARRL says both legs of the Sky Command link are "auxiliary" transmissions and that auxiliary stations are permitted only above 222.15 MHz; therefore, says the League, Sky Command is illegal. "No question," says ARRL Executive Vice President Dave Sumner, K1ZZ. "It's been clear since 1972."

Kenwood insists that only the 440 MHz signals, which carry control codes, are auxiliary transmissions, and that the 2 meter side of the link, which carries only audio, is actually third-party traffic; thus, says Kenwood, the system is legal. In fact, Kenwood says, it's gone out of its way to assure compliance with all FCC rules. There's a CW ID that's transmitted every 10 minutes on the 2 meter side, and a time-out timer that shuts down the system if no signals are received on 440 for three minutes or longer (features that many rigs offering cross-band repeating lack).

ARRL officials have had problems with Sky Command since it was introduced in 1998. "I remember the first time we showed Sky Command at Dayton," recalls Joel Berger, WD6BQD, of Kenwood's Research and Development department. "Dave Sumner walked through our booth with



Kenwood's Sky Command system lets you use a dual-band HT to operate your HF rig. Cool ... but is it legal?

(ARRL Publications Manager) Mark Wilson. He looked at it and said, 'This is no good; this isn't legal.'"

Sumner concurs. "When they first introduced Sky Command, I told them it was illegal," he says. "They chose to ignore that advice and to go ahead with marketing it."

Kenwood says it wasn't a matter of ignoring the ARRL's advice, but rather accepting an informal FCC opinion that it was okay. "We would never have done this if we hadn't consulted ... the FCC," says Berger, adding that they got a verbal go-ahead from now retired Private Radio official John Johnston, W3BE. "We asked Johnston to put it in writing," notes Kenwood National Sales Manager Paul Middleton, KD6NUH, "but he retired before he had the chance to do that."

Johnston, however, says he never okayed anything, even informally. "Whenever anyone asked us for something like this," he told *CQ*, "we always told them the same thing: 'This is what the rules say...' "

The dispute came to a head when the League told Kenwood it would not accept an ad in *QST* magazine for the TH-D79 that promoted Sky Command, as it considered the system illegal. After informal discussions between the two were unable to resolve the disagreement, Kenwood consulted with Johnston's successor at the FCC, Bill Cross, W3TN. "Cross said he agreed with Sumner that it was illegal," says Berger.

After that meeting last October, Kenwood filed a formal petition with the FCC asking for a "declaratory ruling" that the

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arrangement is permissible, or if the Commission determined that it was *not* allowed under current rules, a waiver of those rules to permit continued operation. The FCC decided to seek input from the ham community and put out a Public Notice in December asking for comments. About a half dozen comments were received by the January 31 deadline, with the only opposition coming from the ARRL.

Kenwood's Arguments

Kenwood told the FCC in its petition that Sky Command "permits amateurs to operate their high frequency (HF) equipment, which often requires considerable space for the HF antennas, from areas that are space confined." It cited restrictive covenants that prohibit outdoor antennas and offered an example of a ham with a weekend home in a rural area with plenty of antenna space who might use the system to operate HF during the week from his downtown high-rise apartment.

Kenwood also pointed out the public service and emergency uses of the system, and the benefits of being able to access HF circuits from remote locations. "The ability to use combinations of frequencies to form complex communications systems will make amateurs even more effective in handling disaster (and) emergency ... communications," said the petition.

The manufacturer went on to state its basic contention that only the 440 MHz portion of the system—where control codes are transmitted—is in auxiliary operation, while the 2 meter link, carrying only HF audio, is nothing more than third-party communication, with the third party in this case being the HF operator whose signals are being retransmitted. "The VHF link is not involved in the control of the HF station in any way," Kenwood concluded. "In addition, the VHF link is at all times under the supervision of the control operator ... and is not functioning as an auxiliary station."

Kenwood asked the FCC to back up the interpretation it presented, with a fallback request (in case the Commission disagreed) for a waiver of the frequency restrictions on auxiliary operations "by amateur operators who utilize the Sky Command System."

The ARRL's Response

The ARRL opposed both of Kenwood's requests, arguing first that "(t)he type of operation described in Kenwood's petition is clearly auxiliary operation, and as such is not permitted in the 144–148 MHz band," and second that "(a) grant of the requested waiver would be inappropriate favoritism for a single manufacturer's product."

The League backs up its first argument with the statement that "(t)he principal flaw in Kenwood's reasoning is that it overlooks Section 97.113(f) of the Commission's Rules..." This rule limits automatic retransmission of other amateur signals to auxiliary, repeater, or space stations. "(A)utomatic retransmission of the radio signals of other amateur stations—namely, the stations being received by the HF station—is precisely what is occurring when Sky Command is in operation." The League goes on to say that by a process of elimination, since Sky Command is neither a space station nor a repeater, it must be an auxiliary station and is therefore illegal on 2 meters.

In addition, the League argues that a waiver would give an unfair advantage to Kenwood and its customers. "It just wouldn't be appropriate to grant a waiver to users of one manufacturer's equipment," says Sumner, noting individuals have been designing similar systems for several years, but using bands above 222 MHz that don't raise legal questions. "A waiver would disadvan-

tage those who build their own systems and follow the rules," he says, "versus the customers of one company to whom those rules would no longer apply."

Kenwood's Middleton says the ARRL's favoritism charge "really baffled us." He says the protocol "is completely open. Anyone who wants to create a similar system is welcome to." And while Kenwood's initial written petition specifically requests the waiver for "amateur operators who utilize the Sky Command System," its reply comments broaden the request to include "similar remote systems" as well as its own.

This question is really secondary, however, as it's most likely that a person with the skills to design and build his/her own system will do so with existing equipment rather than investing in three new radios in order to use Kenwood's system. As Kenwood's Joel Berger points out, "this is a plug-and-play concept ... (for) the average guy" who doesn't know how to build his own system. Besides, the FCC recently tightened up its rules for granting waivers, so getting one is more difficult than ever.

So what *are* the real issues here? And why should they be of interest to anyone other than a ham who has purchased the system and now isn't sure it's legal to use it?

The Primary (Auxiliary) Issues

The most important part of the dispute centers on how one interprets the terms *auxiliary station* and *automatic retransmission*. An auxiliary station, according to Part 97 (the FCC's Amateur Service rules), is "An amateur station, other than in a message forwarding system, that is transmitting communications point-to-point within a system of cooperating amateur stations." An auxiliary station must be used for radio remote-control links, according to the rules, and may not transmit below 222.150 MHz. These rules date back to 1972, when repeaters were first becoming popular, and the FCC felt a structure was needed in order to promote orderly growth with minimal interference. The basic purpose of this rule was to say that radio remote control of a 2 meter repeater should be done on a different band. When you get away from a classic repeater situation, it starts to get muddy.

Fig. 1– Layout of a typical Sky Command remote-control setup. (Courtesy Kenwood Communications)

Kenwood agrees in its petition that the control transmissions on 440 MHz are auxiliary signals, but insists that the return link on 2 meters, with audio only, is not. Therefore, says Kenwood, the frequency limitations on auxiliary transmissions do not apply to that part of the link. The ARRL disagrees, saying the HF audio is being automatically retransmitted on 2 meters, and automatic retransmission of other amateur signals is permitted only by space stations, repeaters, and auxiliary stations—above 222.15 MHz.

Automatic retransmission is an interesting term in that the FCC uses it in Part 97 but does not define it. Dave Sumner of the League says "retransmission" is self-explanatory, and "automatic retransmission" is that which is done "without active operator intervention." Because there's no operator holding a microphone to the speaker of the HF rig and manually keying the 2 meter transmitter, Sumner insists that Sky Command's 2 meter side is an example of automatic retransmission. Kenwood and others familiar with the system and the rules argue that because a Sky Command station is under *remote* control (not automatic control), and the control operator is physically at the remote-control point, there is no automatic retransmission and therefore the frequency limitations on auxiliary stations do not apply.

What Is the Frequency?

In fact, the question of frequency is central to the debate. "There certainly is a place in ham radio for this sort of operation," says Sumner, "but not on 2 meters under the current rules." In addition to the rules restrictions, he notes, the

nature of Sky Command operation, essentially transmitting full-time, makes it inappropriate for the relatively small and densely-populated 2 meter band. "There is no possibility of time-sharing on the selected frequency when the system is active," he explains.

On the other hand, says Sumner, moving the audio return path to a higher frequency band would make the problem go away. He points out that Kenwood has a dual-band HT it sells in Japan only (the TH-89) that operates on 440 and 1260 MHz. "The TH-89 would solve the problem," he says. "We have no problem with that, or with 440 and 222. Of course there's no domestic market in Japan for 220," which is not an amateur allocation there.

Bingo, says Berger, and there's no market in the US for 1260 MHz dual-banders. "The TH-89, which the ARRL suggests would be fine for this because it operates on 1260 instead of 2 meters, isn't sold in the US because there's not a big enough demand here for that band." Kenwood feels that people investing in a pair of dual-band radios are looking for more than just Sky Command and want the radios to operate on bands popular for other uses as well.

Kenwood also challenges the assertion that 2 meters is too crowded for this type of operation, with Middleton noting that it "doesn't make sense if you're out there using the band."

"The 2 meter simplex overcrowding issue is a fallacy," he says. "If there's no overcrowding in southern California, there can't be anywhere else."

On the other hand, if you have even 25 to 30 people in any given area using Sky Command as Kenwood envisions it in its FCC filing—with relatively high power to cover relative long distances—a currently quiet band could very quickly overflow with HF retransmissions. Besides, one could argue that putting a potentially popular system, such as Sky Command, on a band that is lightly used at the moment could help promote additional activity on that band. How many people owned 2 meter rigs before FM repeaters gave them a reason to operate there?

You also still have the nagging question of what really constitutes auxiliary operation. While Kenwood says in its FCC filing that the 440 MHz portion of the system "clearly qualifies as an auxiliary station," Joel Berger wondered in an interview whether even the 440 link actually fits the definition. "The auxiliary rule talks about 'a group of cooperating stations,'" he said. "This is not a group of stations, but your own station ..." A handheld or mobile station is not transmitting "point to point." So do the auxiliary station rules really apply? It's not at all clear.

Kenwood expanded on this point in its reply comments and also opened the door for possibly revising the current rules to fit the technology. If the FCC feels a rulemaking request is the appropriate procedure, says Kenwood, please consider our request as a petition for rulemaking.

No Room for Compromise

It is clear from both the FCC filings and extensive interviews that both sides in this dispute see the matter as more than a simple disagreement over how to interpret a rule. Each side approaches the situation from a different perspective.

Kenwood, of course, is in business to sell radios. It has invested a significant amount of money and effort in developing, manufacturing, and marketing the radios that offer this system as a feature. The ARRL, which has always seen itself as a sort of consumer advocate for hams, feels Kenwood is trying to get an unfair competitive advantage by asking for an exemption from a rule that would still apply to everyone else. The result is that instead of trying to find common ground on what both sides agree is an excellent concept, they are going to the mat to protect their own interests. ■

Hams will fly the freeways and beat the bushes this spring, looking for hidden transmitters. Plan to join the fun!

Announcing:

The 2000 *CQ* National Foxhunting Weekend

April 15-16, 2000

BY JOE MOELL,* KØOV

The National Foxhunting Weekend was run in 1998 and 1999 under the sponsorship of CQ VHF *magazine. With the merger of* CQ VHF *into* CQ *at the beginning of this year, the sponsorship of this event passes to* CQ. *—ed.*

You may think you've tried everything ham radio has to offer, but if you haven't been on a hidden transmitter hunt, you've missed a thrill. You'll probably experience a technical challenge, intrigue, deception, suspense, and perhaps some physical exercise thrown in for good measure. The *CQ* National Foxhunting Weekend (NFW) is the ideal time to try it.

Competitive transmitter hunts take many forms, but there are two main types. In one the participants are in their vehicles, equipped with radio direction-finding (RDF) gear. They try to drive all the way to the signal source, or at least close to it. The winner does it first, or does it with the lowest odometer mileage, depending on the rules. That's called *T-hunting* in some western states, and *mobile foxhunting* elsewhere. You never know where you'll end up and you never know what you'll find when you get there (photo 1).

Photo 1– Hams in Montgomery, Alabama searched for the fox in more ways than one during last year's NFW. Dennis Rumbley, KS4UO, put the hidden transmitter next to this van. In this picture, Lew, K1AZE, and Karen, KA1BYP, Nyman are happy to be the winners. (Photo by Peter Carroll, KF4QOE)

Contesting With a Twist

If you like on-the-air contesting, you might enjoy T-hunting even more. It's ham-versus-ham at its finest. The hider tries to keep you and all the other hunters at bay for as long as possible. You'll encounter them (the other hunters) before and after the hunt—maybe during, too—for friendly harassment and prevarication. Before you go home, you'll probably know if you won or lost. If you win, that usually means it will be your privilege to hide the transmitter the next time.

The other kind of foxhunting takes place in parks and wilderness areas. Everyone is on foot. There are multiple transmitters to find. Europeans and Asians have a set of standard rules for this kind of *radiosport*, which they call *foxtailing*, *fox-teering*, and *ARDF* (Amateur Radio Direction Finding). The fox transmitters are brick-to-shoebox size, and are stationary and unattended. All are on the same frequency, transmitting in sequential order.

Foxtailers use a map and compass to plot the most effective route to find all fox transmitters and get back to the finish before their opponents do. That's why the term *radio-orienteering* is sometimes used to describe it in the USA. A complete set of ARDF rules, promulgated by the International Amateur Radio Union (IARU), standardizes these hunts so that multi-nation championship competitions are possible. For a local hunt your club can follow as many or as few of these rules as it wishes.

An ARDF variation, called *ROCA*, is gaining popularity in some places, especially on the West Coast. It has more transmitters (7 to 20) on several frequencies. They can be concealed anywhere, stationary or moving, within the

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web: <http://www.homingin.com>*

Photo 2– Fred Miller, WO2P, and Judy Stonehill, N2KXS, went transmitter hunting in style during last year's NFW with a quad and rotor on the back of their van. Jon Dickason, N2JAC, reported from the Xerox Amateur Radio Club in Fairport, New York.

hunt area. The goal is to find as many as possible (and more than anyone else) within a fixed time period, typically 90 minutes. ROCA stands for *Radio-Orienteering in a Compact Area.*

What's Your Specialty?

No matter what your special interest in ham radio, you can use it to enhance foxhunting fun. For instance, basement builders have unlimited opportunities to construct unique fox transmitters. For hunting, they can develop and perfect their own time-difference-of-arrival and Doppler RDF sets.

Antenna experimenters can test their latest creations on foxhunts. Some whom I know seem to have a new RDF antenna every time they hunt (photo 2). The hider can use even more antenna creativity. Over the years I have tracked down foxes that had almost every kind of radiator, from rubber duckies to circularly polarized helices (photo 3), and even a 2 meter rhombic!

Do you like QRP? Maybe you can make the world's smallest hidden transmitter. Packet and APRS (Automatic Position Reporting System) fans can use their favorite mode for linking mobile and fixed RDF stations. Some versions of APRS constantly display updated bearings, enabling all stations in the network to triangulate them on the fly.

What about amateur television fans? Believe it or not, some hams have held hunts for hidden ATV stations. For the ultimate no-holds-barred T-hunt, courtesy of Mother Nature, launch the ATV transmitter under a high-altitude weather balloon and see where it ends up (photo 4).

DXers should consider going on a southern California style All-Day Hunt, where the transmitter can be anywhere in the country that can send a 2 meter terrestrial signal to the starting-point hilltop. The record so far is 344 miles, achieved by the 600 watt transmitter of AF6O and N6YKE in 1993 from the Jarvis Peak area in Utah to Rancho Palos Verdes, California.

The Right Foxhunt for You

Your NFW event can be as simple or fancy as you wish. The Fullerton (California) Radio Club makes its hunt part of an annual barbecue and potluck in the park. Santa Barbara hams like to cook their famous tri-tip roast after a NFW radio-orienteering session. Mobile T-hunters usually prefer to find a restau-

Resources

You can read about the clever capers of last year's NFW hiders and hunters in the December 1999 issue of *CQ VHF* magazine, beginning on page 14. "Results of the 1999 *CQ VHF* National Foxhunting Weekend" includes details of both mobile and on-foot hunts. International-style foxtailing was featured in the March 1999 *CQ VHF*, where you can read about American foxhunters' travels to Hungary. "The USA Takes on the World Foxhunting Championships" begins on page 12.

Elementary radio direction-finding techniques are discussed in the "Basics" section of the January 1998 *CQ VHF*, page 81. The most comprehensive book for hams on this subject is *Transmitter Hunting—Radio Direction Finding Simplified*, by KØOV and WB6UZZ (TAB/McGraw-Hill #2701). It has 323 pages and 235 illustrations of RDF techniques, projects, and equipment reviews. Technical information about VHF RDF methods is also in the "Repeaters, Satellites, EME and Direction Finding" chapter of *The ARRL Handbook.*

The first foxhunting stop for Internet surfers should be the author's web site: <http://www.homingin.com>. Here you will find 30 articles on hidden transmitter hunting, a bibliography of 138 more articles, and information on 22 RDF equipment suppliers, plus 160 RDF-related web links and local foxhunting e-mail contacts.

Photo 3– Gary Holoubek, WB6GCT (pictured), and Tony Levand (now AA9CC) assembled this 16-foot-long circularly polarized beam with 6× 6 foot screen reflector in a wilderness area for a Fullerton Radio Club T-hunt a few years ago. Just as they hoped, it put lots of RF at the far end of the canyon into which it was aimed, but there was very little signal at the road just behind it. (Photo by Joe Moell, KØOV)

Photo 4– Members of the Butler County ARC near Wichita, Kansas show off their high-altitude balloon experiment. The payload in a foam minnow bucket rose to 115,000 feet elevation and then parachuted into Hickory County, Missouri, where the transmitter hunters located it in a large oak tree. (Photo by Bill Briles, WØOQC)

rant near the finish area, where they can calculate scores and swap stories.

If your club already has regular transmitter hunts, the NFW is an ideal time to try something new and different. If mobile T-hunts are the norm, try an on-foot foxhunt in the park, or vice versa. Invite a local youth or Scout group to participate. Remember, *a ham ticket isn't necessary, except for the transmitter operator.*

If you are public-service minded, contact your local Civil Air Patrol or search-and-rescue agency to plan a cooperative exercise simulating the search for the Emergency Locator Transmitter (ELT) of a downed aircraft. That's what hams in Berkley Township, New Jersey did last year. Following their example, your hunt could be on the ELT practice frequency (121.6 MHz), provided that such use is arranged beforehand by the CAP or other authorized agency.

Alternately, your search-and-rescue simulation could be on ham radio frequencies, as the South Shore Foxhunters of eastern Massachusetts did last fall. Either way, it's good to be capable of rapidly performing RDF on both bands. Just ask KE3HT, N1ISB, and N1FGY of the Berkshire Mountain Search and Rescue Association in western Massachusetts, who used their skills to help state police find the fast-fading ELT of a downed Beechcraft King Air 200 that crashed into Mount Berlin last October.

Reporting Your Hunt

We want to include your hunt in the pages of *CQ* magazine later this year, so be sure to appoint someone to prepare a brief report. There are very few specific rules, in order to provide the greatest flexibility. However, your report should include the following facts:

Name of club, if any
Date of hunt
Starting city and state or province
Number of hidden transmitters
Frequency(ies) of transmitter(s)
Type of hunt (e.g., mobile, mobile/sniff, IARU, ROCA)
Scoring method (time, mileage, combination, other)
Callsign(s) of hider(s)
Callsign(s) of winner(s)
Comments, quotes, etc.
Your name and callsign

The above list is posted at my web site <http://www.homingin.com>, so you can download it to your word processor and insert the information if that's convenient. Or if the report that is printed in your club's newsletter includes all the information, just send me a copy, electronic or printed. (You *will* have a big write-up in the newsletter, won't you?)

If your group has more than one NFW event, send a separate report for each one. Add other facts if they are important, such as the distance of each fox from the start, whether the transmitters were continuous or intermittent, attended or unattended, and other technical features. It's often interesting to include first-person reports from both the hiders' and the hunters' perspectives.

Let's make this the biggest National Foxhunting Weekend ever. Spread the word and encourage other clubs in your area to try it. I'll be waiting for the reports, which should come directly to me. Send e-mail to <homingin@aol.com> or postal mail to Joe Moell, KØOV, P.O. Box 2508, Fullerton, CA 92837. ■

More Foxhunting Opportunities

The NFW makes an ideal start to the year 2000 foxhunting season. After that your club will probably want regular RDF activities, continuing for as long as the warm weather does. Plan to make transmitter hunting part of your local hamfests and conventions. Be sure to get the organizing committee to provide some prizes as incentives to participate.

Hams in the Dayton, Ohio, area will be foxhunting once again at the HamVention in mid-May. Last year it was a 16-fox ROCA. What will it be this time? The organizers (WA6EZV, WB4SUV, and KC8FQY) won't say in advance, but you can bet that it will be fun.

Before long you'll be ready to take on the world, and you'll have your chance this coming October. Team USA is now forming to compete at the next World ARDF Championships in Nanjing, China. We're looking for men, women, boys, and girls to fill as many as 24 positions in eight age/gender divisions. To find out how you can be part of Team USA and fly to Shanghai for this week-long event, visit the author's website or contact him directly.

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IC-R10 .5MHz-1.3GHz HT Rec. .**$299.95**
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It appears that nothing is more abhorrent to a non-smoking ham than purchasing a piece of equipment that has been used by a smoker! Now, at the behest of a well-known equipment manufacturer, the Lauton Institute has developed a sure way by which the owner of a piece of equipment can prove that neither he nor anyone else smoked around his equipment.

Electronic Sniffers For Amateur Radio Equipment

PROFESSOR EMIL HEISSELUFT*
Lauton Institute
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e-mail: <heisseluft.emil@mashuga.orf.ar>

We've all seen them . . . the ads that specify this or that piece of amateur radio equipment for sale with a tagline noting that the current owner is a non-smoker. Clearly, some non-smokers demand that equipment be free of the odors and nicotine stains, however insignificant, before they will even consider a purchase. Up until now you only had the seller's word that he or she didn't smoke around their gear. With the new device developed by the Lauton Institute, sellers of equipment will now be able to demonstrate unequivocally that they absolutely, positively never lit up in the shack. —ed.

I must say, dear readers, that in all the years I have been working as a research scientist at the Lauton Institute, never have I received as strange a challenge as that presented to me late in 1998 by a representative from a very well-known Japanese manufacturer of amateur radio equipment. It seems that some owners of his company's equipment, who were non-smokers, had complained that the resale value of their transceivers and other electronic devices was depressed because they could not *prove* that they did not smoke in the shack. They suffered this unjust consequence despite the fact that they even noted in the ads for their equipment that they did not smoke. At first, I found this hard to believe. However, the gentleman from Tokyo showed me two typical ads that I share with you (see fig. 1). I have blocked out the name of the manufacturer whose equipment is cited in order to protect the reputation of the company.

I must say it all seemed very strange, but the manufacturer's representative assured me that many non-smoking hams would not touch a piece of equipment that had been used by a person who smoked. What he wanted me to do was develop an electronic sniffer that could be incorporated in his company's equipment. This sniffer would provide a visual indication if someone smoked a cigarette, cigar, or pipe anywhere within three meters of the equipment. Further, the electronic sniffer had to have the capability of self-destructing in the event that anyone tried to tamper with it. At first I was hesitant to even consider taking on the challenge. When he handed me a check for US$150,000, though, I immediately reconsidered, accepted his challenge, and sped to my laboratory.

XXXXXXX, Model XXX, no scratches, manual, and original box for shipping, with antenna tuner, only two years old, must sell, $950. Non-smoker, call 1-XXX-XXX-XXXX.

XXXXXXX, Model XXX, recent serial number transceiver with built-in computer interface, mint, few hours, original box and manual, $1100 OBO. Also have 1 KW antenna tuner with manual and original box, $250 firm. Non-smoker, call 1-XXX-XXX-XXXX.

Fig. 1– Examples of ads in which the seller stated that he was a non-smoker but could not prove it.

Electronic Sniffers

For some time I had been dabbling with the development of electronic sniffers under contracts from various agencies of the U.S. and other governments. The desire was for the Institute to develop devices that could be used by customs officials to detect the presence of illegal drugs contained in international shipments arriving in their countries. This work was very hush-hush, and was concealed under the code name "Jimmy."

My first effort, begun (would you believe this?) in the mid-1980s, was a study of how human beings perceive odors. Humans sniff, which causes air that contains odorants to move past bony structures in the nose that we call "turbinates." These turbinates produce a turbulent airflow, which causes the air to flow over a thin mucus layer coating the olfactory epithelium. The cells that detect odorants are part of the epithelium. The brain then converts the signals it receives from the epithelium and "tells" us what we smell. So far so good (as you Americans say). To replicate this process, I developed a three-stage electronic nose: (1) an air intake and sample handling device; (2) multiple gas sensors, each "tuned" for a different gas; and (3) a digital signal processor for evaluating the output of the gas sensors.

Sensor arrays are the most difficult components to develop. I evaluated

**Correspondence may be directed to the professor c/o* CQ.

many different types, including conductivity sensors, piezoelectric sensors, optical sensors, and MOSFETs, among others. I finally settled on using the latter, because they are relatively inexpensive to manufacturer and are quite small (easy to conceal within a piece of electronic equipment). They do operate at high temperatures, however, which some of my colleagues thought was a drawback. However, having the electronic nose operate at elevated temperatures made it somewhat easier to destroy should anyone attempt to tamper with it, because the device, to some extent, was already thermally stressed.

It took me several months to decide on the type of catalyst I would use to cover the MOSFET gate, but I finally settled on iridium. Once that decision was made, I had to vary the thickness of the catalyst until the device produced the signal levels desired. I did experience some so-called "baseline drift" with my electronic nose, but was able to compensate for this using a feedback mechanism. Once completed, the device responded well to VOCs (volatile organic compounds) from cigarette, cigar, and pipe smoke. My device worked so well, in fact, that I could tell the difference between a cigar imported from Cuba as opposed to one produced using tobacco leaves from Guatemala. Is that not perfection?!

The Electronic Nose's Brain

The key to my electronic nose is its brain. No simple electronic circuit, this! I borrowed from some earlier experiments in neural networks to process and classify the various sensor responses produced by the 50 different MOSFET chips that comprise my "nose." (Don't forget, it had to sense a multitude of molecules!) Each chip produced a characteristic response, which when grouped with the others in what I called a "feature" space would yield well-defined patterns (really clusters in a multi-dimensional space) characteristic of different types of tobacco smoke. I must say, training the device caused a lot of problems because I first had to develop an electronic smoker that would burn any tobacco product at the same rate as would a human smoker. I had thought about using human beings to smoke cigarettes, for example, and then to blow the smoke up my electronic nose. However, the lawyers for the Lauton Institute, who were educated in the United States, cautioned me against this, saying that some of my smokers might later claim that they suffered from cancer induced by my experiments.

Electronic Nose Installation

The Lauton Institute's electronic nose for amateur radio and other electronic equipment currently is packaged in an epoxy-filled cube about one inch on a side. It has two circular openings (intake and outflow) on opposing faces, with the air driven through the cube by means of a micro-miniature fan. The nose requires only a 12 VDC source (easily obtained from the equipment in which it is installed) and draws less than 9 ma in normal operation (including the current required to heat the unit to its proper operating temperature). On transceivers the nose's output will be displayed using either the phrase "No Smoke" or "Farshtinkener" (literal translation: "It is rotten") in five different languages (English, French, German, Spanish, and Japanese) just above the frequency readout. On equipment with no LCD or other display, a green (no smoke) or red (smoke) low-current LED can be used to indicate the state of the equipment.

If an attempt is made to tamper with the device, a sensor automatically causes the current to increase to 100 ma, thereby elevating the nose's temperature and effectively destroying the sensors and the neural network. This in turn extinguishes the display of the equipment's status. The first versions of the new nose will appear in high-end transceivers some time this summer.

Finally, users of equipment containing the Lauton Institute's Electronic Nose are cautioned not to smoke *anywhere* near their rigs, nor should they allow spouses or friends who smoke to enter the shack, because even the odorants on their clothes and in their hair will trigger the nose. Be especially wary of using your equipment on Field Day or during other contests, when you have no control whatsoever over smokers who may be in the vicinity of your equipment. If you can manage to do this, then you truly will be able to advertise—and demonstrate—your equipment as coming from a non-smoking environment.

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Want to introduce newcomers to radio? Try N2OZ's approach—starting them out with a combination of kit-building and shortwave listening. He says Transtronics has a receiver kit that can be just the ticket.

CQ Reviews:

The Transtronics SK205 Shortwave Receiver Kit

BY LEW OZIMEK,* N2OZ

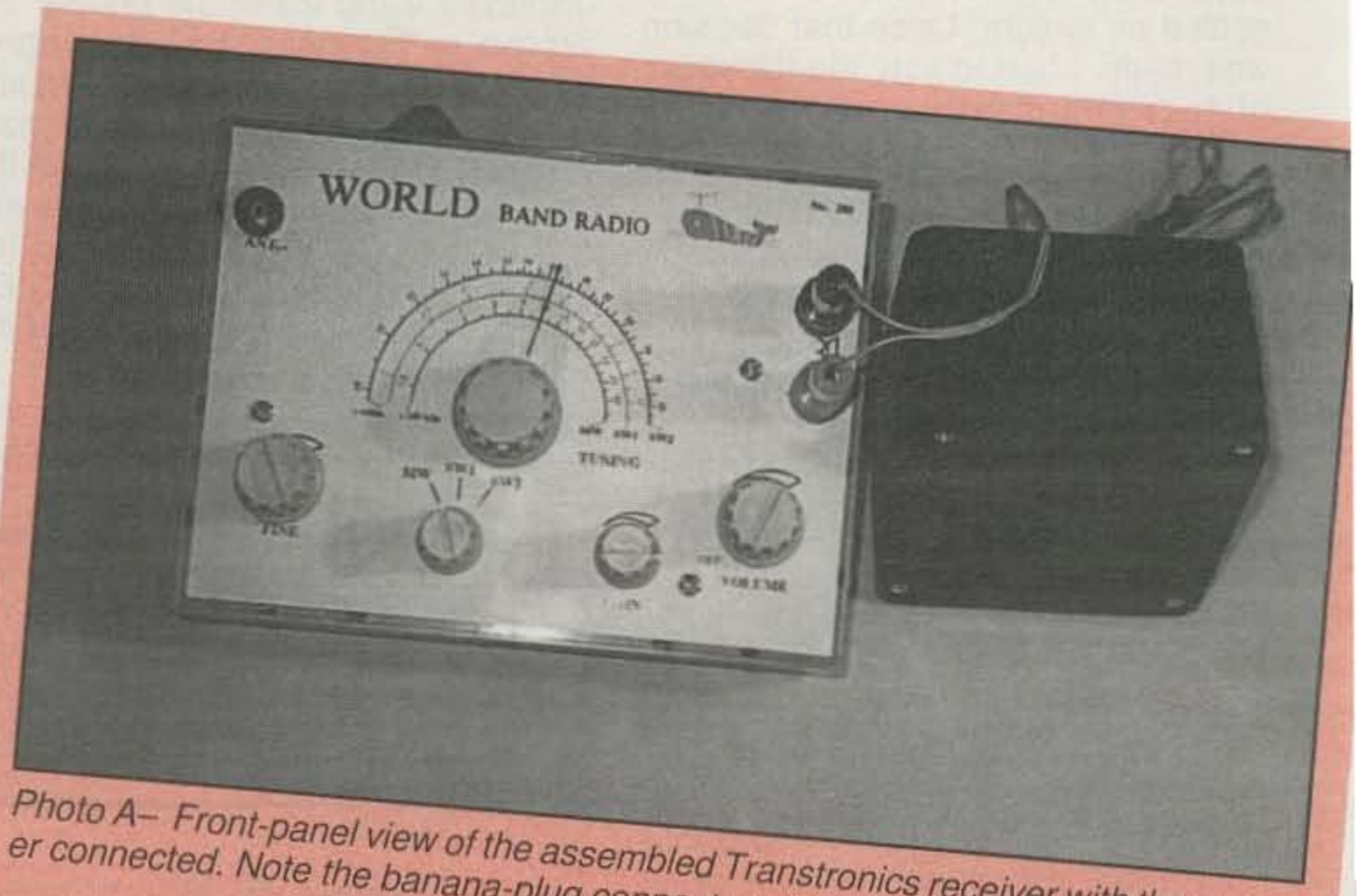

Photo A– Front-panel view of the assembled Transtronics receiver with the speaker connected. Note the banana-plug connectors used in lieu of spring connectors.

I have often wondered how, and even if, I could ever get any of the younger members of my family to develop an interest in radio as a hobby. Is it possible to develop an interest today comparable to what I experienced many years ago? Back then radio was new; it was different. Very few homes had a receiver, and those which did were popular places to visit. Standard broadcast reception (medium wave, or MW) was a unique new form of entertainment with a generous dose of news and educational features.

As exciting as MW was, shortwave (SW) surpassed it. Just the concept of receiving messages which had traveled over long distances was fascinating and in some respects bordered on the mysterious. If receiving was great, how about transmitting? My cousin Fred and several of my school friends were hams, and a visit to their stations to witness their ability to transmit really filled me with awe. Electronics was, and still is, a magical world.

Building: The Key

I remember the first crystal set I built and the thrill I felt hearing signals which traveled over seemingly impossible distances. I also remember the first superhet receiver I built from scratch, using plans published in one of the radio magazines of the time. I should remember it: The receiver never worked, and my father lovingly teased me about having built something that would never disturb anyone! Even though the receiver never produced a sound, I enjoyed the challenge of searching for parts, scratching for money to buy them, and then the actual assembly. My building capability not only improved over the years, it increased in complexity after I received my ham ticket.

Are things so different now? If a youngster is properly introduced to radio, would he or she develop a significant level of enthusiasm? What is the most effective way to make such an introduction? Somehow, I developed an interest, began to explore, and then started to build. *Construction projects seemed to be the cement which held it all together.* Does the same apply today, or has the proliferation of computers and video games overwhelmed the younger generation and left no room for exploration? Since I can only believe that a young mind is always interested in learning and absorbing new ideas, I decided to see if any of my grandchildren could and would develop an interest in radio after being properly introduced to it.

The best way to do this was not clear, but instinctively I felt that if they built a "radio" and got it to "play," it would provide an appropriate impetus. I know it worked for me. Before I could try, however, I had to find a product which could be used for this purpose. Companies such as Heath had deserted the electronic kit field and now there was no obvious path to follow.

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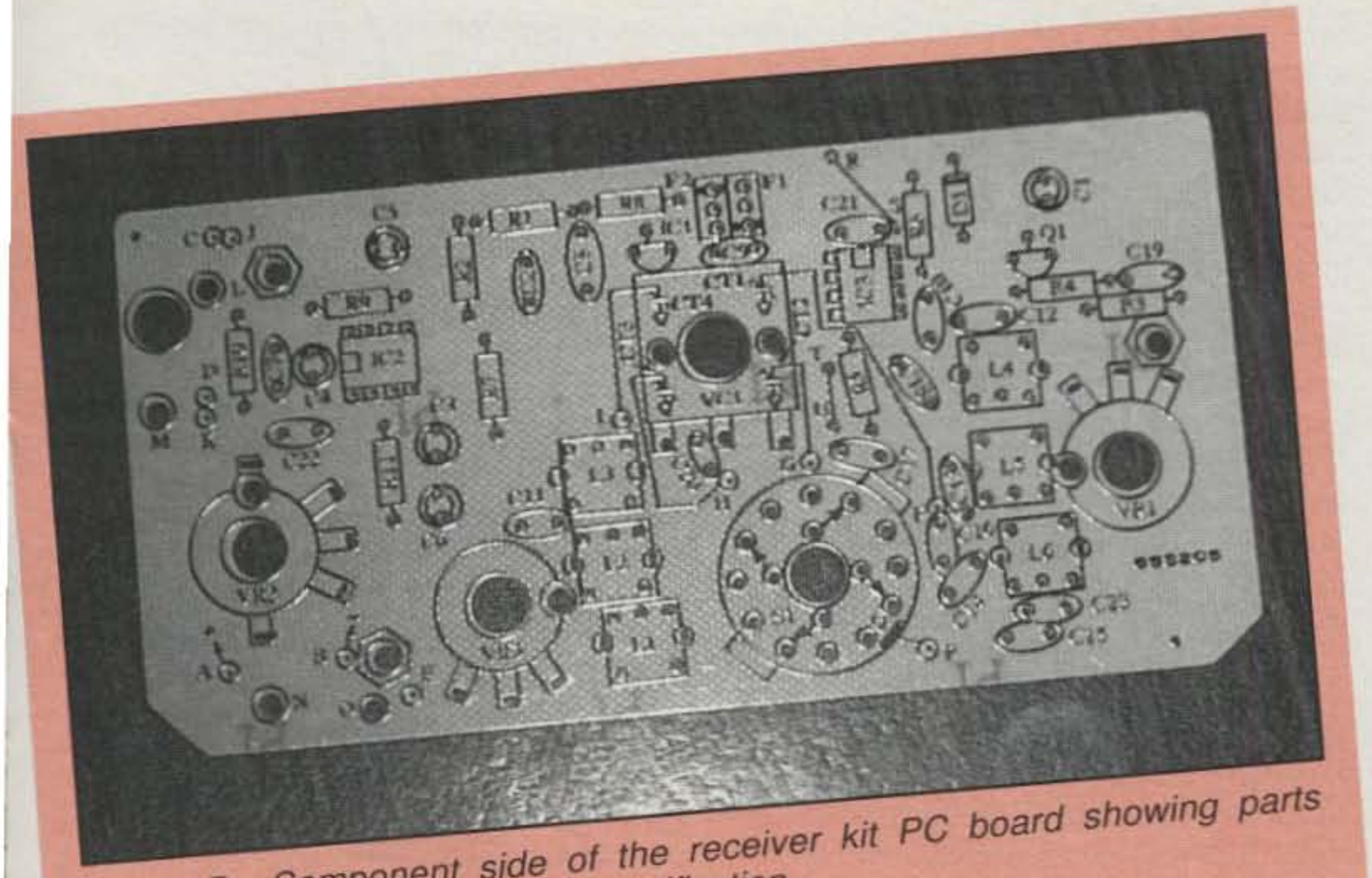

Photo B– Component side of the receiver kit PC board showing parts identification.

I experimented by taking an existing design, laying out and etching PC boards, accumulating components, and finally assembling a receiver. The results for the most part were disastrous. I had to find a better way. I ultimately decided that if a computer was my major opponent in capturing the minds of these young people, then I would use a computer to help me find the proper electronic kit which could be built by newcomers. I guess it was a case of "If you can't beat em, join em."

A short surfing expedition on the Internet unearthed a number of likely candidates. In fact, I was quite surprised at the quantity and variety available. One company which caught my eye was Transtronics Inc. (see Resources). It offered many products, including power supplies, test equipment, RF signal generators, wireless microphones, amplifiers, metal detectors, receivers, etc. The item that seemed to be tailored for my purpose was a shortwave receiver kit, Model SK205 (see photo A). It was described as an easy-to-build medium-wave and shortwave radio receiver with a "state-of-the art" front end, IF stages to simplify alignment procedures, and electronic band-spread for smooth tuning. The kit included parts, an enclosure, hardware, and knobs, but not a speaker nor a 9 volt battery. The description convinced me to place an order with the company.

The Transtronics SK205

The kit arrived, well packaged, with groups of like or similar components in individual see-through bags. The single printed circuit board was well made and had excellent silk-screen markings on the component side to simplify assembly (see photos B and C). A seven-page set of instructions included a circuit description, schematics, and assembly/test directions.

The design is relatively sophisticated. It uses an NE602AN integrated circuit as a balanced mixer, RF oscillator, and voltage regulator. An MK484 IC provides several stages of RF amplification and an AM detector in a single 3-pin TO-92 package. Band coverage (in three bands—535–1650 kHz, 3.5–11 MHz, and 11–30 MHz, AM only—switch-selected at the front panel) is controlled by trimmer capacitors imbedded in the single variable capacitor. Band-spread tuning is achieved by using the collector and base junctions of an NPN transistor, type 9014, as a voltage variable capacitor. A pair of 455 kHz ceramic filters provide IF selectivity, and detected audio signals are amplified by an LM386 audio amplifier, producing 1 watt of power (enough to drive up to a 6 inch speaker). A zener diode is used to control voltage levels for frequency stability.

Schematic diagrams and component-location drawings are excellent. The circuit diagram and the printed circuit board layout are included in the instruction guide. Directions for building and soldering are adequate, even for a beginning kit builder. Although the language used is somewhat stilted (probably stemming from a translation of foreign text), I eliminated it as a problem by reading the directions slowly and carefully.

A complete parts list is included with an identification of every component required, but a color coding guide for resistor value identification is omitted. I penciled in the appropriate colors for all resistors listed in the parts list before any assembly work started. All other parts in the kit are well-marked and easily identifiable. (One caveat: Capacitors

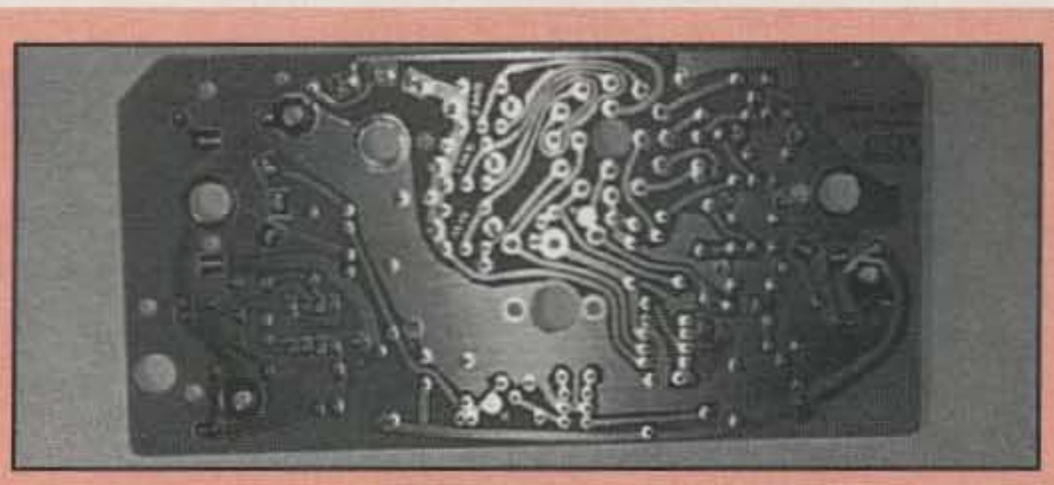

Photo C– SK205 PC board lead side showing solder resist coating.

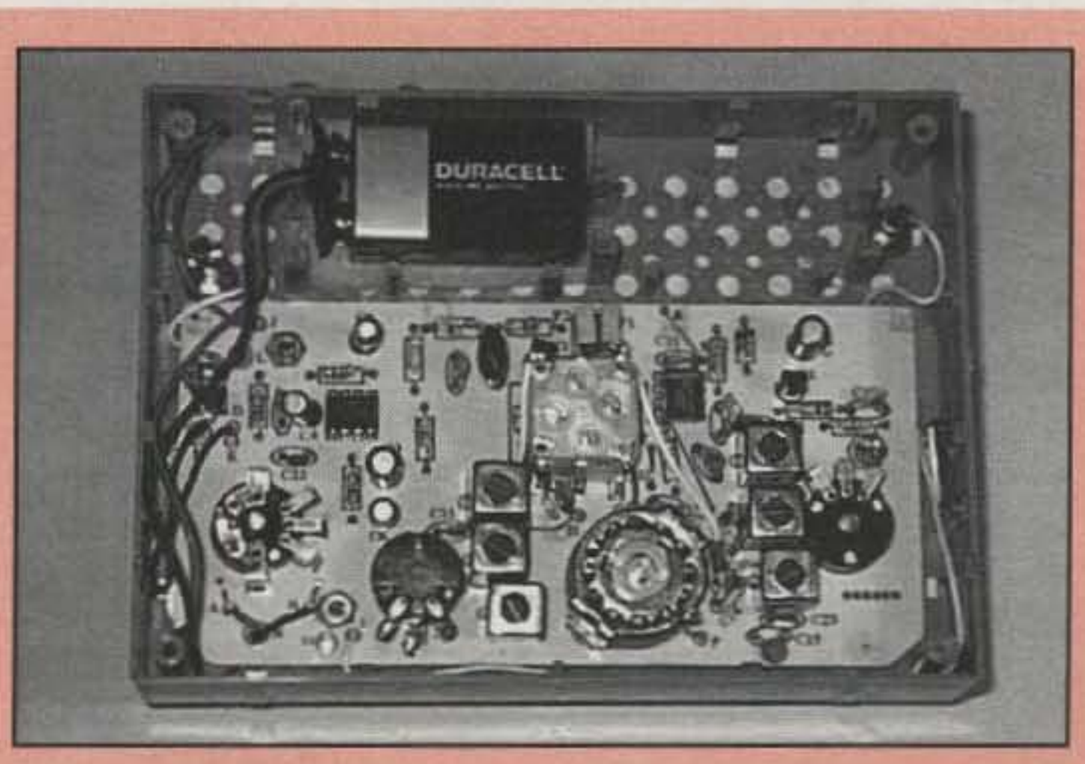

Photo D– Inside view of receiver showing assembled PC board. →

might be confusing, because markings on the parts are in microfarads or in picofarads, whereas the values in the parts list might be reversed. If you have any doubt, a little help from an experienced individual will help in the correlation.) There is no question in my mind that the purchase of all of these components separately would cost more than the complete kit did, and the quality of the finished "package" would not equal that of the kit.

Building the Kit

The first opportunity I had to try building was when my daughter visited with her three children, ages 14, 11, and 8. They all were immediately interested in the concept of building a radio. I described the general identification of parts and briefly explained the function(s) of each type of component—nothing too difficult, just some fundamentals. We set up an assembly line after I gave detailed safety instructions applicable to the use of the soldering iron and a demonstration of proper soldering technique. They rotated the job of selecting a part, matching it to the parts list, finding the location on the PC board, inserting it in the board, and soldering it. It was almost like a game to them. The rotation kept up their interest, and they all eagerly awaited their next chance to insert and solder. I checked every part for proper value before a solder connection was made. They, of course, trimmed leads.

I was amazed to hear statements such as: "You mean that metal (solder) melts when the iron is applied?" "Those little things (components) make it work?" "You mean that televisions and computers have parts like these?" "That rocks." The level of interest was maintained throughout, even though the assembly time took most of an afternoon. My three "students" were quick studies.

One problem we encountered was the fact that the colors on some of the resistors were difficult to identify. However, a VOM easily cleared up any resistance value ambiguities. Another was that the parts list called for a 3300 pF and a 2200 pF "Poly" capacitor, and there were no such "Poly" caps in the kit. After installing all other capacitors, the only caps left were ceramics at 3000 pF and 2000 pF. I used these ceramics in the spots calling for "Poly" and found that they worked well, so there really was no problem.

Assembly turned out to be simple, because all components—including pots, switch, and variable capacitors—are inserted into the single PC board and the completed board is mounted to the front panel with the shafts of all controllable components projecting through the panel. Plugging in a battery and connecting a speaker and 6 foot antenna wire (recommended in the instructions) completed our effort.

The on-off switch is mounted on the volume control so only a twist of the knob was needed to turn the receiver on. With my fingers crossed, we turned the knob and *voila!* It worked! Not a single error in the assembly process and no solder shorts nor bridges! There were stations galore on all three bands.

A step-by-step alignment procedure is included in the instructions. Alignment is made by adjusting slug-tuned IF transformers and trimmer capacitors to set the receiver dial frequencies to agree with the station frequency and to maximize signal volume. Setting the frequencies on the MW band (standard AM broadcasts) was easy because there were plenty of known local stations to use for comparison. The SW bands were more difficult, because I could not always identify the station being received and therefore its frequency. By matching stations received on my ham station receiver with those received on this receiver, I was able to at least approximate the proper settings for the shortwave bands.

Performance

This little receiver amazed me. With just the 6 foot antenna wire we were able to pick up most of the local MW stations and a multitude of SW stations from around the world. We heard the BBC from London, Deutsche Welle in Germany, several Asian stations (location not positively identified, but I believe they were Japanese and/or Chinese), Cuba, South America, Canada, and a number of European stations. This was all done in a relatively short period of time in one evening. Note, though, that this is not a communication-grade receiver and will not be suitable in a ham station. It is, however, perfect as an introduction to radio and a fun vehicle for interested newcomers.

Reactions and Follow-Up

I can truly say that the reaction of my grandchildren to the entire process was very positive. They all enjoyed the various tasks and were thrilled when it worked (I was relieved). The youngest of my three grandchildren was the one who showed the greatest interest. He searched the bands for different stations for several hours the first evening, and kind of appropriated the receiver as his own when they left the following day. I have since learned that his interest somewhat continued after their arrival at home.

I subsequently obtained a second kit and followed the same procedure with two other grandchildren, one 10 and one 15. Again, the receiver worked perfectly on the first try, and the performance equaled that achieved by the first kit. The strongest interest was also developed in the younger member of this family. She kept playing with the receiver, searching for different stations. On the trip home from New York to Massachusetts she operated the radio in the car and started a log of foreign languages she heard. The experience seems to suggest that the earlier we can introduce our youngsters to "radio," the more likely it is that they will develop a positive interest. How long such interest will be sustained is still to be determined.

Recommendations and Comments

By now you know that this experiment was positive and enjoyable. The following may be helpful to those who want to try to duplicate this exercise:

- The poor color marking of resistors

required a VOM, so be prepared. Component identification also may differ slightly from kit to kit or from the parts list. Just use common sense.

• The alignment was hampered somewhat by difficulty in identifying the location of the correct trimmer capacitor to be used. Trust the markings on the circuit-board assembly diagram and it will work.

• The design included springs protruding through the front panel for use in connecting the antenna and speaker. I did not like the springs and substituted standard banana plugs and posts (purchased at RadioShack).

• I had trouble deciding how to handle the speaker. In one of the two kits I mounted a 2 1/2 inch speaker in the case (this was my own idea and not discussed in the assembly instructions). It was a little tricky, but I succeeded in making the mount secure. However, the case cover never seemed to fit perfectly after the speaker installation. In the second receiver I used the Transtronics Model SK603 speaker (a small speaker mounted in a plastic case). Of the two, I preferred the separate speaker.

• A small compartment, with access door, is included in the case to house the 9 volt battery. No provision is made to strap the battery in place. The best I could do was add some foam cushioning to enclose the battery (photo D). Only time will tell if this stands up.

• Finding stations on the receiver was tricky. Care had to be exercised to detect the hiss or sound of a possible station. Once approximately on frequency, however, the fine-tuning brought it in easily. I suggest consideration be given to using a multi-turn control knob in place of the standard knob provided. It might simplify tuning.

• A ground plane is used to shield the PC board. It was necessary to attach a shield, in the form of adhesive-backed aluminum foil, to a sheet of plastic (the plastic prevented any shorts to the PC board leads). Be careful. Once the foil is stuck to the plastic, it cannot be removed. Plan the clearance holes and be sure the foil is on the proper side of the plastic. It is necessary to make a good ground connection to the foil; directions are not great, so be ingenious. I found that a small solder lug fastened to the foil with a small bolt, nut, and washer provided a good connection point.

Conclusion

This was a very satisfying exercise. It will take a long time to see if it triggers any long-lasting interest in the participants. Even if it turns out that the interest is temporary, there is no doubt that all of my "students" came away at least with an introduction to and respect for the complexity of electronic equipment. I am sure they will appreciate, to a greater degree, all electronic products they use in the future.

I recommend that a similar effort be undertaken by our readers. Introduce your children, grandchildren, nephews, nieces, or children of friends to radio in a manner similar to the one described here. Remember that the younger your audience, the more positive the response. If you try it, I hope you get as much satisfaction as I did.

Resources

For more information, or to order a kit, contact Transtronics, Inc., 3209 West 9th Street, Lawrence KS, 06049-3127 (phone 785-841-3089; fax 785-841-0434; e-mail: <kitcat@xtronics.com>; web: <http://xtronics.com>).

List prices: Model SK205 Receiver $25.95; Model SK603 Speaker $5.28.

What You've Told Us . . .

The results of our January survey are in, and they're beginning to paint a fascinating picture of who reads *CQ*. Since January was our first combined issue of *CQ* and *CQ VHF*, we started out by asking which magazine you'd been reading previously. Among those who responded, 57% said they'd only read *CQ* in the past, and 15% had been *CQ VHF* readers. On the other hand, 26% of you previously had been reading *both* magazines. (The other 3% were first-time readers.)

We next asked about your activity on HF vs. VHF. Five percent of you are either not licensed or not active. Among the rest, 41% operate mostly HF and a little VHF; 19% operate about half-and-half; and 12% operate mostly VHF and a little HF, for a total of 72% who operate some combination of HF and VHF. Only 10% operate HF exclusively, and 13% operate only VHF.

If you're reading this, there's a better than even chance that you have an Advanced or Extra Class license and you've been a ham for a long time. Among the readers who responded, 40% hold Extras and 23% have Advanced licenses, while Generals account for 12% of our readers, Tech Pluses and Techs 11% each, Novices 1%, and not licensed 2%. As for time licensed, fully 60% of you have been hams 20 years or longer, followed by 16% between 5 and 10 years, and 11% between 1 and 5 years. There's a big hole in the 10–20 year range, which accounts for only 8% of our readers (5% 10–15 years, 3% 15–20 years). Finally, 2% have been hams one year or less, and another 2% are not licensed.

This month's winner of a free *CQ* subscription is Page Pyne of Hagerstown, Maryland. As always, thank you for participating.

Reader Survey
April 2000

We'd like to know more about you about who you are, where you live, what kind(s) of work you do, and of course, what kinds of amateur radio activities you enjoy. Why? To help us serve you better.

Each time we run one of these surveys, we'll ask a few different questions and ask you to indicate your answers by circling numbers on the Reader Service Card and returning it to us (we've already paid the postage). And, as a bit of an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to *CQ*.

This month, we'll get back to building a demographic profile of *CQ* readers, with some questions about your ham radio activities.

Please indicate... **Circle Reader Service #**

1. ...whether you have recently upgraded your ham license
- Extra class 2 years or longer 138
- Yes, within the past 6 months 139
- Yes, within the past 2 years 140
- Not within the past 2 years 141
- Not currently licensed 142

2. ... whether you plan to upgrade your license (or become licensed) soon
- Extra class, can't upgrade 143
- Yes, before April 15, 2000 144
- Yes, in the next 6 months 145
- Yes, in the next 2 years 146
- No plans at this time 147

3. ... the MF/HF bands on which you are currently active
- 160 meters 148
- 80 meters 149
- 40 meters 150
- 30 meters 151
- 20 meters 152
- 17 meters 153
- 15 meters 154
- 12 meters 155
- 10 meters 156
- not active on HF 157

4. ... the VHF/UHF bands on which you are currently active
- 6 meters 158
- 2 meters 159
- 1.35 cm (222 MHz) 160
- 70 cm (420–450 MHz) 161
- 33 cm (902 MHz) or above 162
- not active on VHF/UHF 163

5. ... which modes you currently use (circle all that apply)
- AM 164
- ATV (Fast-scan) 165
- ATV (Slow-scan) 166
- CW 167
- Digital (HF) 168
- Digital (VHF) 169
- FM 170
- SSB 171
- Other 172
- Not active at this time 173

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

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Measure inductance and capacitance. Troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

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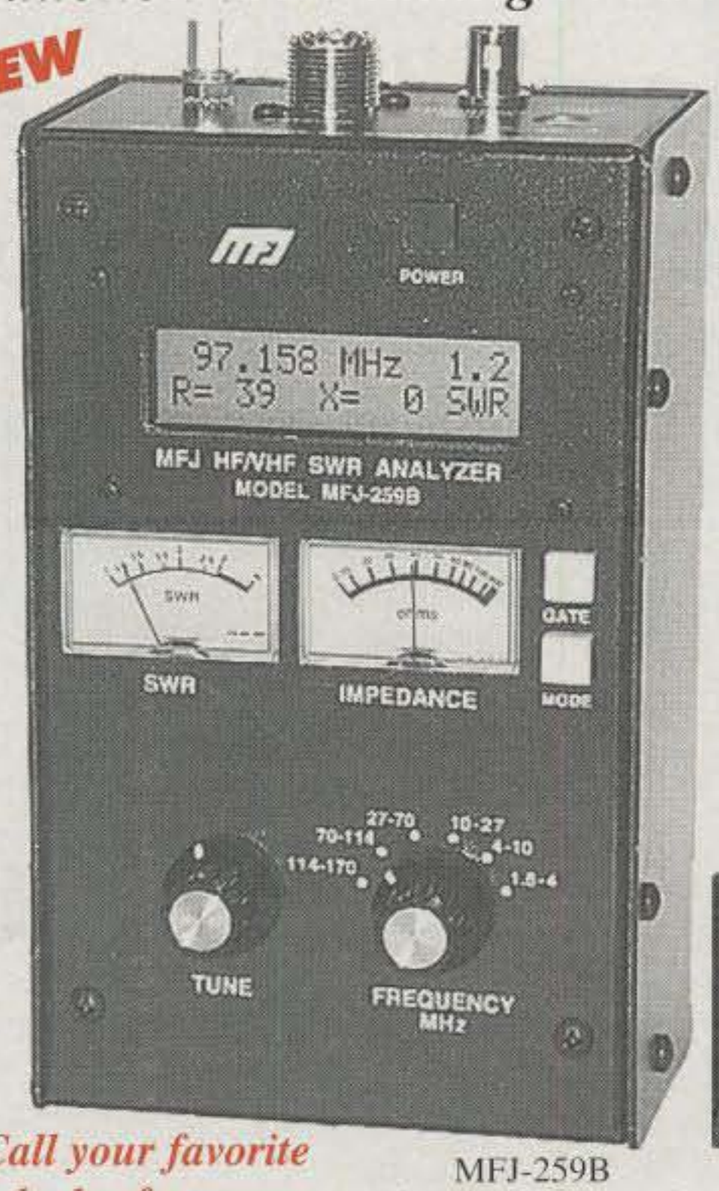

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CIRCLE 94 ON READER SERVICE CARD

After April 15th, an Extra Class license will prove very little about your code proficiency. Here's the story of how one group of "Real Hams" solved this dilemma and developed the innovative Extra-to-Advanced downgrade exam.

"Real Hams" Don't Upgrade They *DOWN*grade!

BY HORACE SESREAR,* WB2OOU

Elsewhere in this issue, you'll see an ad for a license downgrading *course. It caught our attention, too, and we tracked it back to its origins, which are reported here by one of the participants, Horace Sesrear, WB2OOU. Callsigns have been omitted to protect the guilty. Our reporting on this matter does not suggest that we support or condone it.*
—W2VU

It was just about midnight, and the Real Hams Net on 75 meters was starting to wind down for the night. Of course, the talk all evening had been about the FCC's restructuring decision, the dumbing down of America in general and of ham radio in particular, and the fundamental unfairness of it all.

"It's just a crying shame," said Don in Illinois. "All my hard work over 25 years right down the tubes. And the worst part is, the FCC says nobody's losing anything. Well, that's a lie. I'm losing a lot."

"What exactly are you losing?" asked Dick in New York, a newcomer to the net. "You've already got your Extra. You're not really affected by this at all."

"Not affected!" roared Don. "Of course, I'm affected. I busted my behind for 10 long years to get my code speed up to 20 words a minute for that danged test, and after April 15th the license on my wall might as well say 'Novice,' for all it'll prove about my CW proficiency. There won't be any way to tell the difference between a 20 wpm Extra like me and a dumbed-down 5 wpm Extra, like all those CBers who are gonna be crawling all over *my* subbands before I know it.

Dick thought about reminding Don that *he* was planning to take advantage of the rules change to upgrade from General to Extra, but then he thought better of it, since he didn't want Don to decide he really *was* a CBer after all, and that letting him join the net had been a mistake. Meanwhile, while Dick was doing all that thinking, Harold broke in from New Jersey.

"Well, I'll tell you what I've decided, Don. I'm gonna upgrade my General to Advanced before April 15th and stay put. I could pass that Extra theory in a flash; it's soooo easy. But nope, I just want my Advanced." Harold continued, explaining, "That way, everyone will know I can copy at least 13 words per minute. Nobody will have to wonder if I'm a 20 word-a-minute Extra or a 5 word-a-minute weenie!"

"Wow!" Don responded. "What a great idea! Too bad I can't downgrade my Extra to Advanced."

There was a brief moment of silence on the frequency as everyone took in what Don had just said. Then it seemed as if everyone reached for their mic buttons at the same moment, but Bill down in Maryland got there first.

"Don, you've done it! You've saved ham radio for all of us Real Hams," Bill practically shouted. "We'll all downgrade our licenses to Advanced so we can still be at the top of the heap! I know I'd be willing to trade those little 25 kilohertz tidbits for FCC proof that I'm no 5-word weenie!"

"I don't want to spoil anyone's fun," broke in Dick, "but does anyone know *how,* or even *if,* you can *downgrade* your license?"

"Well, I have a friend at the FCC," said Bill. "I can call him tomorrow see what I can find out."

Then Freddy broke in from Texas. "A friend of mine is on the Question Pool Committee. I'll see if he can tell us anything."

"All right, troops," bellowed Don, an ex-Marine drill sergeant. "You have your orders—I mean assignments. Report back here tomorrow night at 0300 Zulu. Best 73s and goodnight."

With that the Real Hams Net went QRT for another day. The following night all the pieces began to come together.

Piecing It Together

Don opened the net promptly at 0300 the next night, and called for reports from Bill and Freddy.

"Well, I talked to my friend at the FCC," said Bill, "and there *is* a way to do it, but it's kind of complicated."

"Tell us, son," said Don. "We're all Real Hams. We can 'do' complicated."

"Okay," Bill continued, "here goes. First you send in your current license to the FCC and ask them to cancel it. Then you watch the online databases every day, and as soon as you disappear, run down to your nearest VE test session, take your 13 word-a-minute code test and all the written elements to bring you up to Advanced. Let's see, that'd be Elements 2, 3-A, 3-B, and 4-A. I'd bring lunch if I were you."

"There's more," Bill continued. "Once the FCC issues your new license—and

*c/o CQ *magazine*
e-mail: <wb2oou@arrl.net>

remember, you won't be able to operate until you get it..." He paused for a breath and Don broke in.

"Now wait a minute, son. If I do that, I'll lose this callsign which I've had since before you were born, and the FCC will give me one of those weird, new-fangled calls. I don't want anything to do with that."

"Not to worry, OM," Bill continued. "It'll just cost you a few extra bucks. Once you've got your new license and your new callsign from the FCC, just apply to get back your old call as a vanity call. Since you'll be a former holder, you'll be first in line."

"How long will all this take?" asked Don.

Bill answered, "Well you never can be sure when you're dealing with the government, but I'd guess about six to eight weeks from start to finish, assuming, of course, you can pass that Advanced exam. You know it's changed a lot since 1951!"

"Yeah, it's been dumbed down," said Don. "But there's gotta be an easier way. Freddie, what did you find out?"

"Well, there wasn't an easier way when I first talked to my friend on the QPC," answered Freddie, "but after we discussed it, he made some phone calls and then got back to me. He said he'd talked to the VECs and the FCC, and they'd all come up with a plan for a special one-shot downgrade exam. It'll be a 50-question written test, and you'll have to show how much you've forgotten since you upgraded to Extra. But in order to qualify, you'll need to re-take your 20 word-a-minute code test first, to be sure you're still qualified to be an Extra to begin with. If you flunk the 20 word-a-minute test, you have to go through the cancel and retest route that Bill told you about."

Freddie, knowing better than to pause for a breath, continued, "Once you re-pass the code test, you'll be able to take the written downgrade exam. The 50 questions will cover changes in technology and ham radio rules over the past 40 years. If you get at least 25 questions *wrong,* that'll be considered proof enough that you no longer qualify to be an Extra, and your license will be downgraded to Advanced. But be careful not to get *too many* wrong, because if you get 30 wrong, you'll be busted to General; 35 wrong will make you a Tech Plus; 40 wrong gives you a one-year, non-renewable Novice license; and if you get more than 40 wrong, you'll get a coupon for $25 off a new CB rig at RadioShack!"

"All right," said Don. "Now that sounds like my kind of test! Is there a time limit?"

"Absolutely," said Freddie. "Downgrade exams will be offered only between April 1st and April 15th this year."

"But I'm ready to downgrade right now," said Don.

"Sorry," Freddie answered. "It's already March and the VECs need time to create the test; and you won't be able to get a new Advanced Class license at all after April 15th. Besides, the FCC says anyone who's fool enough to want to take this test can only take it in April, so they'll be certified April Fools!"

That, my friends, is the story of how one small group of Real Hams developed the idea for the revolutionary license downgrade system. And I'm proud to say I'm one of them! ■

Washington Readout

BY FREDERICK O. MAIA, W5YI

Regulatory News In The World Of Amateur Radio

Question Pool Committee Releases New Amateur Exams!

As you all know by now, the FCC as approved a massive realignment of the Amateur Radio Service which takes effect on April 15, 2000. This month let's talk about the transition from the current six amateur radio license classes to only three new classes and what to expect in the way of new examinations. First let's summarize what the FCC has done.

The New Lineup

Effective April 15, 2000 applicants for amateur licenses may be examined for only three license levels: Technician (entry-level VHF/UHF), General (entry-level HF), and Extra Class (the top-of-the-line, technically oriented license). Until then applicants may continue to qualify for the six existing amateur license classes: Novice, Technician, Tech Plus, General, Advanced, and Amateur Extra Class.

Effective April 15th only four license examinations will be administered in the Amateur Service: one code and three written examinations. They are Element 1 (5 words-per-minute Morse code, the only code test that will be required for any class of license), Element 2 (Technician Class theory), Element 3 (General Class theory), and Element 4 (Extra Class theory). Elements 2 and 3 each have 35 questions, and you need to get 26 correct to pass; Element 4 has 50 questions with a passing grade of 76% (37 questions correct). New question pools from which these examinations are to be constructed were issued on February 1, 2000.

The format and character spacing of the 5 wpm code test is determined by the VE team. The answer format may be multiple choice, fill in the blank, or one minute solid copy. Since the 13 and 20 wpm code exams are being discontinued, the controversial waivers of the higher speed telegraphy examinations for the "handicapped" will no longer be needed.

Although examinees may only qualify for new Technician, General, and Extra Class, the Novice, Tech Plus, and Advanced Class licenses will be continued indefinitely in the FCC database. However, no *new* Novice, Tech Plus, or Advanced Class licenses will be issued after April 15, 2000.

Novice and Advanced Class licenses are being permanently "grandfathered." That is, the licenses may be renewed and modified (i.e., name, address, and callsign may be changed). If these licensees do not upgrade, they will remain "forever" in the FCC database as Novice or Advanced, and they will retain their present Novice and Advanced Class privileges without change.

Tech Plus licensees will also remain in the database, at least for now. When these licenses come up for renewal, however, they will be renewed as Technicians with permanent credit for Element 1 (5 wpm code). New Technician Class amateurs—including those who pass the code exam after April 15, 2000—will also receive a Technician Class license. Thus, some Technicians in the FCC database will have 5 wpm credit and will be able to operate on the four HF Novice-Tech Plus segments at 80, 40, and 15 CW and 10 meter CW/SSB. The downside is there will be no easy way for others to tell which Technician amateurs have 5 wpm credit and which do not. Their authority to operate HF will be conveyed by the Certificate of Successful Completion of Examination (CSCE) received from the VE team when they passed the 5 wpm code exam. Other Technicians will be "Codeless" Technicians and will not have HF privileges.

The FCC is relying on the amateur community's long history of self-policing to ensure that "No Code" Technicians do not operate on 10 meter sideband without passing 5 wpm. Where there is a question, the VE team or VEC will be able to confirm from their records that a Technician has indeed passed 5 wpm—that is, up to a point.

Since VEs and VECs are only required to keep their records for 15 months, the American Radio Relay League will be seeking a Partial Reconsideration of the Restructuring Rules asking that Tech Plus amateurs be so indicated in the FCC database. This is to ensure everyone will be able to determine if a Technician Class licensee is permitted to operate on HF.

Technician Class Exam Credit

There is some confusion among many radio amateurs as to just what authority a Certificate of Successful Completion of Examination (CSCE) confers. A CSCE actually conveys two different things—examination credit and operating permission. A CSCE issued when an applicant passes 5 wpm confers *permanent operating authority* on the Novice-Technician Class HF bands (i.e., CW: 80m—3.675–3.725 MHz, 40m—7.10–7.15 MHz, 15m—21.10–21.20 MHz, and 10m—28.10–28.50 MHz. SSB: 10m—28.3–28.5 MHz). Thus, Technicians who have passed a code exam may operate on 10 meter phone, for example, for as long as they have their Technician license.

A CSCE confers *examination credit* for only 365 days. Therefore, a Technician who has passed 5 wpm *more than one year prior* to passing the General Class written exam must *retake* the 5 wpm examination in order to upgrade.

Now here is where it gets confusing. Current Technician Class amateurs examined prior to March 21, 1987 receive exam credit for new Elements 1, 2, and 3 and are eligible for upgrade to the General Class on or after April 15, 2000 without further examination. All these "Old Techs" have to do is appear at a VE test session and present proof that they were examined for the Technician Class prior to March 21, 1987, and they will be awarded a General Class license and privileges. Another "wrinkle" is that a license of an "Old Tech" may be dated up to 4 months after March 21, 1987 due to the lag between examination and licensing.

What if your "old Tech" license has expired? The new rules will still give you credit for Elements 1 and 3, but not for Element 2! Therefore, if you walk into a test session without a current license, but with a pre-1987 Tech that's been expired for more than two years, you will need to take and pass Element 2, the current Technician exam; the combination of that exam plus the old element credits will qualify you for a General. If

National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101 (telephone 817-461-6443)
e-mail: <w5yi@cq-amateur-radio.com>

you don't currently have a license, you will have to wait until a new one is issued before you may go on the air.

Current Technician Class amateurs examined prior to February 14, 1991 receive examination credit for Element 1 (5 wpm code) and Element 2 (the new Technician theory test). The Technician license may be dated up to March 12, 1991—the date that the first No Code license was issued by the Commission. If you are no longer an amateur and your license expired more than two years ago, you may still claim credit for Element 1, the code test, but you will have to retake Element 2 to get your Tech license again. Once you pass that, you will have full Technician privileges plus Novice HF privileges. Again, you will have to wait until the FCC issues you a new license before you may transmit.

The FCC is holding the VECs responsible for determining and examining the evidence used to determine that a Technician qualifies for Elements 1, 2, and 3 ("Old Tech") or Element 1 and 2 (Technician prior to No-Code license) examination credit. Most VECs will also accept a page from an old (pre-1987) *Callbook* in addition to a CSCE or an old license copy.

Technicians examined after February 14, 1991 receive credit only for Element 2. Tech Plus (or Technicians with a 5 wpm code CSCE) receive exam credit for new Elements 1 and 2.

Exam Credit for Other Classes

Curiously, the element credit extended to people with expired Technician Class licenses also applies to expired Novice licenses (permanent credit for the Element 1 code exam), but *not* to expired General, Advanced, or Extra Class licenses. Thus, if you came into the hobby with a higher class license, then let it lapse beyond the two-year grace period for renewal, you're out of luck as far as claiming element credit.

As for expired Novice licenses, they give you credit only for Element 1. Therefore, if you come into a test session with no current license and an expired Novice license, you'll still have to take Element 2 to get a Technician license with Novice HF privileges, or both Elements 2 and 3 to get a General Class license. This applies to upgrading a current Novice license as well. You will have no credit for written exam elements, so any upgrade will require taking a written exam. You may, however, continue to renew indefinitely as a Novice without taking any additional tests.

Examination credit for applicants of all other classes (i.e., General and Advanced) requires that the applicant hold an unexpired license (or be within the two-year grace period for renewal). In other words, you must be continuously licensed. General and Advanced Class operators receive exam credit for Elements 1, 2, and 3.

Prior to April 15, 2000 current amateurs may take the existing written examinations needed for the General and Extra Class licenses. These examinees will not upgrade at that time, but may use their CSCEs as credit toward the new General and Extra Class license *after* April 15.

A Tech Plus operator taking the current Element 3B (General written) will qualify for the new General Class without further examination when presenting his/her CSCE for Element 3B to a VE team at an exam session on or after April 15th.

Likewise, an Advanced Class operator taking the current Element 4B (Extra Class written) will qualify for the new Extra Class without further examination when by presenting a CSCE for Element 4B to a VE team at an exam session on or after April 15th.

A General Class operator would have to pass both the current Element 4A (Advanced) and 4B (Extra) to qualify for the new Extra Class on or after April 15th. Most General Class operators will probably elect to wait until April 15th to take the new Element 4, since only one 50-question examination will be required, as opposed to the current 90.

A No Code Technician may take the current Element 3B (General written) examination without first taking the 5 wpm code exam. The CSCE for 3B may be used as Element 3 credit for one year, during which time the applicant would have to pass Element 1 (5 wpm code).

All amateur frequency band allocations for the various license classes remain the same. The FCC did not accept the ARRL's "refarming" of the Novice frequency band proposal, which would have yielded additional frequencies to General and higher class licensees.

Converting from Eight Exams To Four Exams

The number of questions in the five current combined (Novice, Technician, General, Advanced, and Extra Class) exam question pools is being reduced and folded into three new pools. The new Element 2 (Technician) pool will primarily consist of questions from the current Element 2 (Novice) and Element 3A (Technician) pools. The new Element 3 (General) pool will primarily come from the current Element 3B (General) pool. The new Element 4 (Extra Class) pool will primarily consist of questions from the current Element 4A (Advanced) and 4B (Extra Class) pools. A few questions have been revised or added to the pools to reflect the new rules. The same graphic diagrams, figures, and tables that were used in the previous pools are being carried over to the new pools.

The strategy was to end up with fewer than 400 questions each in the new Technician and General Class Pools and less than 700 in the Element 4 pool. The FCC requires that each pool contain at least ten times as many questions as will appear in any one examination. All three question pools were released to the public on February 1st by the Question Pool Committee. The QPC, an internal committee of the

	Topics	Element 2 Pool	Element 2 Exam	Element 3 Pool	Element 3 Exam	Element 4 Pool	Element 4 Exam
1	FCC Rules for Amateur Service	112	9	66	6	99	7
2	Station Operating Procedures	55	5	66	6	46	4
3	Radio Wave Propagation	33	3	33	3	45	3
4	Amateur Radio Practices	44	4	55	5	68	5
5	Electrical Principles	33	3	22	2	111	9
6	Amateur Station Circuit Components	22	2	11	1	72	5
7	Practical Circuits in Station Equipment	22	2	11	1	95	7
8	Signals and Emissions	20	2	22	2	69	5
9	Amateur Antennas and Feedlines	22	2	44	4	71	5
0	Radiofrequency Safety Practices	31	3	55	5	0	0
	Total Questions in Pool and Exam	**394**	**35**	**385**	**35**	**676**	**50**

Table I– Total number of questions in each question pool and exam by sub-element.

National Conference of VECs, is charged with developing the question pools (see Table I).

There are now a total of 1455 examination questions in the various question pools. The previous pools contained a total of 2278 questions. The Element 2 (Technician) and 3 (General) written examinations consist of 35 questions each. The Element 4 (Extra Class) exam consists of 50 questions. Approximately 90 percent of all examination questions are exact word-for-word carryovers from the five previous questions pools.

The New Question Pools

The new FCC Amateur Service Rules turn the amateur radio written exam program over to the VE/VEC examining community. This does not mean that each VEC organization will have its own questions, nor will VE teams be able to make up their own questions. No VE teams will have easier tests than others. Each VEC organization and its VE teams will be using the exact same question pools, multiple choices, and answers and will be administering the same number of questions from each of these pools. Part 97 Rules still require:

"**§ 97.523 Question Pools.** All VECs must cooperate in maintaining one question pool for each written examination element. Each question pool must contain at least 10 times the number of questions required for a single examination. Each question pool must be published and made available to the public prior to its use for making a question set."

Although this "10 times" rule applies only to the entire question pool, the QPC applied it to each subelement and even to each syllabus topic. To make it easier for software writers who develop examination software, each question was limited to 210 characters, including spaces, and the answers and distractors were limited to 140 characters. The four-digit numbering system as has been used in the question pools for the last several years continues to be used.

Thus, there is basically no change in the way the written examinations will be handled. There will still be a standard, publicly available, question pool for each of the three remaining license classes. What *will* change is that the VECs' Question Pool Committee (QPC) will now be authorized to change the topics on which the various classes will be examined and the number of questions asked on each of these subjects. This is so the QPC can better adjust the questions to changes in technology, operating habits, and transmitting equipment advances.

Thirty years ago, for example, when repeaters and VHF/UHF communications were reasonably new, there was more construction and experimenting. Today virtually all VHF/UHF transceivers are purchased in the commercial marketplace. Therefore, less emphasis needs to be placed on electronics in Element 2. Effective April 15th the ten topics that were previously shown in Part 97.503(c) are no longer mandated by the FCC.

For this first revision of the question pools the QPC elected not to change the "topics." They will still start with FCC Rules and end with RF Safety. One of the reasons why the topics were not changed is to prevent existing license preparation material in the publishing marketplace from being instantly obsolete. Another reason is that this is the first time the QPC has revised all of the pools simultaneously, and there was very little time to do it. Like everyone else, the QPC (of which your columnist is a member) found out about the new restructuring parameters at the end of December 1999. The new examinations had to be ready by April 15, 2000. That gave us about four months to get the pools developed and turned over to the publishers so they could print study manuals and have them available prior to their use in examinations. It seemed to be an impossibly tight schedule.

After the QPC deliberated via conference telephone calls and e-mail, the plan of action we adopted was to develop the syllabuses (outlines) for each pool. Then existing questions would be redistributed into each of the new pools. One week was allocated to each of the new pools. The job was completed at the end of January, and the new question pools were released to the publishers and public on February 1st.

The existing (Element 2 and 3A) Technician study manual with its 924 questions may still be used to study for the new (Element 2) Technician exam, since for the most part the 394 questions in the new Technician pool were taken verbatim from the previous material. You can see that the study material needed for the new Technician was reduced by nearly 60 percent.

The same mechanism was employed for the new General Class. Those questions came primarily from the old Element 3B. The new Extra Class pool was constructed from questions in the old Element 4A (Advanced) and 4B (Extra Class) question pools.

Each VEC organization must conform to the new "rearrangement" developed by the QPC. The new written examinations will place more emphasis on rules, practices, and operating procedures at the Technician and General Class levels. The Extra Class will be a more difficult, technically oriented examination—that is, a greater percentage of the questions will be on math formulas and electronics.

There were previously 1022 questions in the combined Element 4A (Advanced) and Element 4(B) pools. The new Element 4 (Extra Class) pool has 676 questions—about one-third less, but no reduction in difficulty. The new General Class pool actually has about 15 percent more questions than before. Examinees will perceive very little, or no, change in the way the written examinations are handled.

When releasing the new question pools on February 1st, QPC Chairman Ray Adams, W4CPA, said he hoped that "...publishers will have the study guides available on the bookshelves no later than March 15, 2000." While that may be a little optimistic, you can be assured that new study manuals will be available in time for the big hamfest of the year, the Dayton HamVention, which takes place the weekend of May 19–21, 2000. Again, you may continue to use the "old" study materials until the new ones are available.

Looking Ahead

The QPC also adopted a schedule for more thoroughly revising these first pools. The QPC last revised the General Class pools. It was decided that we should pick up where we left off and next do a thorough revision of the Extra Class. The following schedule was adopted by the QPC:

The Extra Class questions will be valid from April 15, 2000 to June 30, 2002. They will be more thoroughly revised next year and released to the public at the end of 2001. This will give publishers an approximate two-year selling period for their study manuals. The Technician Class pool will be revised the following year, followed by the General Class in 2003. From then on, one pool will be revised each year in turn. The Technician question pool that was recently released and takes effect on April 15, 2000 will be valid until June 30, 2003. The April 15, 2000 General Class pool will remain in effect until June 30, 2004.

73, Fred, W5YI

Q&A . . . About Ham Radio

Q: I read with interest the article "End-Fed Antennas," by Lew McCoy, W1ICP (January 2000 *CQ*). In particular, I found his statement on page 20 "A balun isn't necessary to feed this type of antenna"...apparently because the antenna is unbalanced being connected to one side of the feed line. I realize that is probably a gross simplification.

Now here's my question: On page 59, Benson Smith writes ("The E-Z J-Pole Antenna"): "...the J-Pole is a balanced-feed antenna." Earlier he admits that "the J-Pole probably developed from the end-fed Zepp." I would go further and say the J-Pole is an end-fed Zepp which is vertically polarized. If so, who's right? Balanced or unbalanced feed? I have built several J-Poles and always fed them directly with coax cable as shown in Smith's article, but without any balun or de-coupling choke with no noticeable bad effects. I will be curious to see what the authors say.

Ed Cole, AL7EB (ex-K8MWA)
Nikiski, Alaska

A: *CQ*'s Lew McCoy, W1ICP, replies: Ed, I suppose the J-Pole could be likened to an end-fed antenna, except it is really a dipole with one half extended. What you have with a J-Pole is two quarter waves fed at one end. Visualize a half-wave dipole, two quarter waves fed at the center. Now bring the two sides together, almost parallel. In other words, it looks like two feeders—extending from one of these sides is a half wave—the real J-Pole. Because the system is fed with 50 ohm coax, the coax is tapped slightly up the two halves of the dipole to get to the 50 ohm matching point. I suppose one could call it an end-fed antenna but not a Zepp. What I tried to do in my article is correct the many hams who call any end-fed wire a "Zepp." As to baluns, I have a reputation for not liking baluns. They have their uses, but in most dipole cases they are not necessary. *—73, Lew, W1ICP*

Q: Just recently heard that amateur radio has been radically revised. Being a Tech Plus, I am anxious to move up to General Class and went and bought a manual yesterday. However, how much of this manual is obsolete now that the rules are changing? When will you come out with another manual to study for the new General Class and Advanced Class? I want to get my upgrade soon, but don't know if I need to wait until April 2000, or should I go ahead and take the written test for General Class now and if I do will it count? So many questions. I need some answers, please.

Steven Faucette, KD4KXK
via e-mail

A: You do not need to wait until April 15th to take your upgrade exam. However, if you take the exam before the new licensing structure goes into effect, you will need to return to a VE test session *after* April 15 to submit an upgrade application (more on that in a minute). Your element credit for passing Element 3B (which virtually is going to become the new Element 3) will be good for one year; your code credit as a Tech Plus is permanent. If you wait until after April 15th to take your test, you will need only one trip to the test session, one application form, and one check to the VEC.

If you pass Element 3B before April 15th, all you'll need to do to get a General is go back to a VE session with your Tech Plus license and the CSCE (Certificate of Successful Completion) for Element 3B, plus a check for $6.65. You'll need to fill out a new Form 605, applying for upgrade to General, and hand in your $6.65. You will have credit for all required elements, so your application will then be sent on its way to Gettysburg.

The material in the current (old) General Class manual will not be obsolete, except that a few specific questions may change and there will be fewer in the overall pool. See this month's "Washington Readout" column for complete details. New study guides will be available as soon as the publishers can get them in print and onto bookstore shelves, but the old ones should still teach you what you need to know. One final note: There will not be a new Advanced Class guide as that license is being phased out.

Do *you* have a question about any aspect of ham radio? We'll do our best to give you a clear, concise answer, or if it's not a question that has just one easy answer, we'll invite readers to offer their solutions. Send your questions via e-mail to <q&a@cq-amateur-radio. com>, or by mail to Q&A, *CQ* Magazine, 25 Newbridge Road, Hicksville, NY 11801.

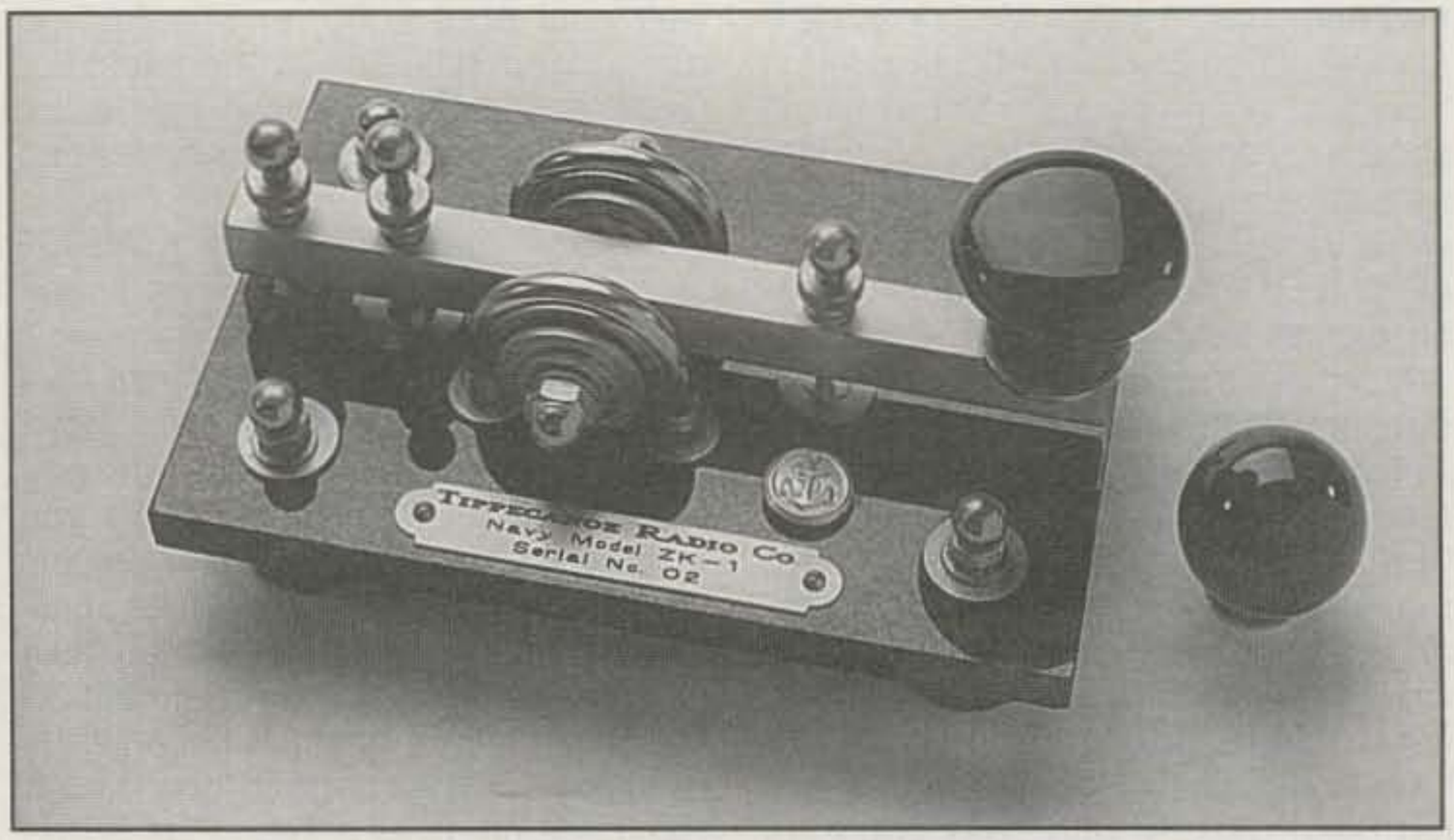
What's New

BY KARL T. THURBER, JR., W8FX

A New Column for A New Century

Now it's official, and the "under construction" wraps are off. Your "Digital Dipole" column has a new name, as we dramatically expand the column's scope. We'll no longer focus strictly on antennas, antenna accessories, software, computers, and books. Instead, we will tackle an increasing array of products as we examine "what's new" in amateur radio in the new century.

This month, we will focus our gaze on new radio gear you can use, accessories for the radio shack, portable and mobile goodies, software and computers, new things on the internet, and books you'll like. Sounds like fun, so let's get started.



The Navy Model ZK-1 Key is reminiscent of the type of hand key found on British Navy vessels. It has two knobs— a traditional-style, flat-top knob, and a round knob that is said to reflect the key's British heritage. (Photo courtesy Tippecanoe Radio Company)

Radio Gear You Can Use

Alinco DM-330MV Switching Power Supply. Sure, it's next to impossible to design an "ideal anything," but this is what Alinco says it has tried to do with their new DM-330MV "Next Generation" Switching Power Supply. To this end, they've certainly come close, having designed a high-current (30 amp continuous) unit that has just about every desirable feature amateurs want.

The DM-330MV is an extremely compact and lightweight communications-grade switching power supply. The unit features preset memorized voltages, voltage and current metering, and several different output terminals. It also includes several built-in safety protections and a patented "Noise-Offset" circuit for eliminating the pulse noise of the switching circuitry.

Could there be more? There is, so request a product flyer from Alinco U.S.A., 438 Amapola Ave., Suite 130, Torrance, CA 90501 (310-618-8616; web: <http://www.alinco.com>). *Note:* Instruction manuals for most Alinco gear are available online.

Accessory for the Shack

Tippecanoe Key. Just about all I used to know about "Tippecanoe" was a vague recall of the popular presidential campaign slogan of William Henry Harrison and John Tyler: "Tippecanoe and Tyler Too." Now I also know that Tipp City, Ohio is the home of Tippecanoe Radio Company

The Navy Model ZK-1 key is a robust, functional key that is reminiscent of the type of hand key found on British Navy vessels. It has two knobs, a traditionally-style flat-topped knob, and a round knob that is said to reflect the key's British heritage. The key is $125. A brochure is available from Tippecanoe Radio Company, P.O. Box 321, Tipp City, OH 45371 (937-667-9399).

Portable and Mobile Goodies

Spider Multi-Band Antennas. Fred Shmitka, K6AQI, is an old hand at HF mobile work, going back to his days as W9OWX in 1933. Since 1980 Fred has offered the patented Spider™ series of HF multi-band mobile, maritime, and residential antennas.

Fred saw a real need for no-tune mobile antennas to complement the no-tune solid-state transceivers that became popular in the late 1970s. Mobile antennas then in vogue were of the efficient but inconvenient single-resonator, center-loaded, whip type. These required you to stop the vehicle, change the resonator or coil, and retune the antenna to change bands.

Instead of a single resonator and whip combination, the convenience-oriented Spiders use four resonators (up to seven can be used), one for each frequency band, with adjustable tuning sleeves. The patented antennas are fully and automatically bandswitching, and they reportedly have good overall performance on multiple bands.

The "no-hassle, no trap, no whip" Spiders are particularly suitable for installation on vans, campers, motor homes, and even freshwater boats; a special "salt-water" version is offered for seagoing vessels. While the antennas were designed originally for mobile work, they also have proved suitable for use in mobile-home parks, apartments, and condominiums.

The basic four-band Spider costs about $140; special dipole and maritime versions cost more. Various resonators, adapters, masts, mounts, and other installation accessories are available.

For a thick packet of Spider information, contact Multi-Band Antennas, 7131 Owensboro Ave., Ste. 263C, Canoga Park, CA 91303 (818-341-5460; e-mail: <spiderrs@pacbell.net>. web: <http://www.spiderantenna.com>.

Software and Computers

Jotter Internet Toolbar. Most of us are familiar with the popular QRZ.com "Ham Radio SuperSite," which many of us visit when we need to look up callsigns. Now the QRZ website offers even more functionality. The site lets us download Jotter, which signifies that the

**289 Poplar Drive, Millbrook, AL 35054-1674*
e-mail: <w8fx@cq-amateur-radio.com>

popular internet-based "microportal" agent concept has come to the amateur radio community.

Jotter is a small but highly customizable toolbar that includes a direct lookup connection to the online QRZ Ham Radio Callsign Database, as well as to a real-time amateur radio ticker that contains the latest DX hotspots, callsign updates, and more. However, the Jotter toolbar does a lot more than just amateur radio. For example, it remembers your online user name and password and other information to help you automatically fill out online forms and questionnaires when accessing a variety of websites.

To download Jotter go to the QRZ.com website for a link to the download page. Contact QRZ.com, 8711 East Pinnacle Peak Road #159, Scottsdale, AZ 82555 (fax 480-515-9908; e-mail: <sales@qrz.com>; web: <http://qrz.com>).

ELEKTA Professional Knowledge-Based System. ELEKTA is a unique new product that the publisher says really is "HELP files for your career." It's a knowledge-based system for analog electronics, one which includes an encyclopedia of electronic principles, tutorial electronics instruction with interactive examples, and an extensive set of design and analysis utilities.

ELEKTA is organized like conventional computer-based HELP files. Instead of helping you with the operation of a software program, however, it helps you with your job. With a few clicks you can get tutorial background information, interactive design tools, modeling and simulation support, and more. A "tools" icon takes you to over 35 design utilities, from inductor winding data to two-port network transformations and transmission-line calculations. As such, the multifaceted program offers good value for hobbyists as well as professional engineers.

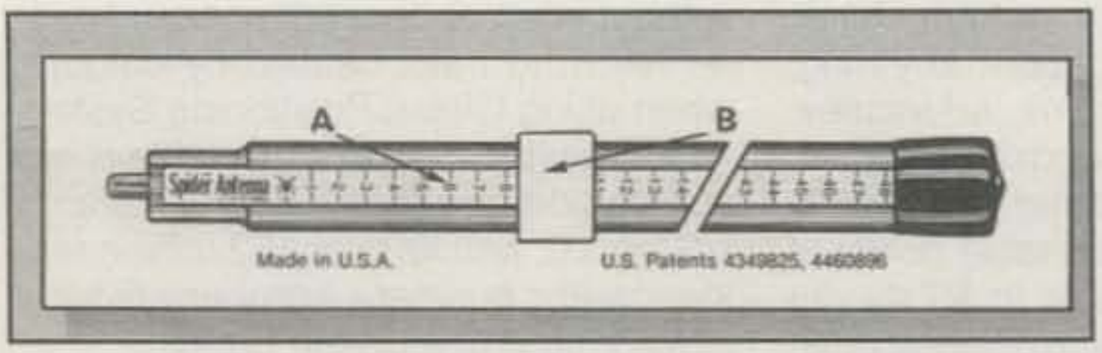
For more information, contact Noble Publishing Corporation, 4772 Stone Dr., Tucker, GA 30084 (770-908-2320;. e-mail: <editor@noblepub.com>; web: <http://www.noblepub.com>).

DeLorme Street Atlas USA 7.0. DeLorme's Windows flagship software product, Street Atlas USA, has undergone much development and improvement over the years. With good reason the publisher boasts it has been the "gold standard" in street mapping and routing software. We covered V6.0 in April 1999.

DeLorme has introduced a host of new and improved features in Street Atlas USA 7.0. An indispensable resource for home, office, or ham shack, it helps you find just about anything, including cities and towns, addresses, highway intersections and exit services, lakes, streams, and other geographic features. With the searchable points of interest (POIs) available in V7.0, you can locate nearly 3 million different businesses, services, cultural locations, and government offices.

The latest version features easier street address searching, without the need for a ZIPcode; precise routing without internet dependence; and easier return to track caused by detours, when using Global Positioning System (GPS) navigation. Also available is the companion program, Phone Search USA® 5.0, with its over 102 million residential and business telephone listings across the entire United States.

Pricing? Street Atlas USA is $44.95, or $24.95 to DeLorme users; Phone Search USA is $29.95, or $24.95 to DeLorme users. Contact DeLorme, Two DeLorme Drive, P.O. Box 298,



The heart of the Spider ™ Multi-Band Mobile Antenna is the resonator, shown here. Tuning the Spider is accomplished (using an SWR bridge or antenna noise bridge) by means of a tuning sleeve that slides over the length of each resonator. The resonator has an easy-to-read, weatherproof logging scale. The devices are patented by Fred Schmitka, K6AQI.

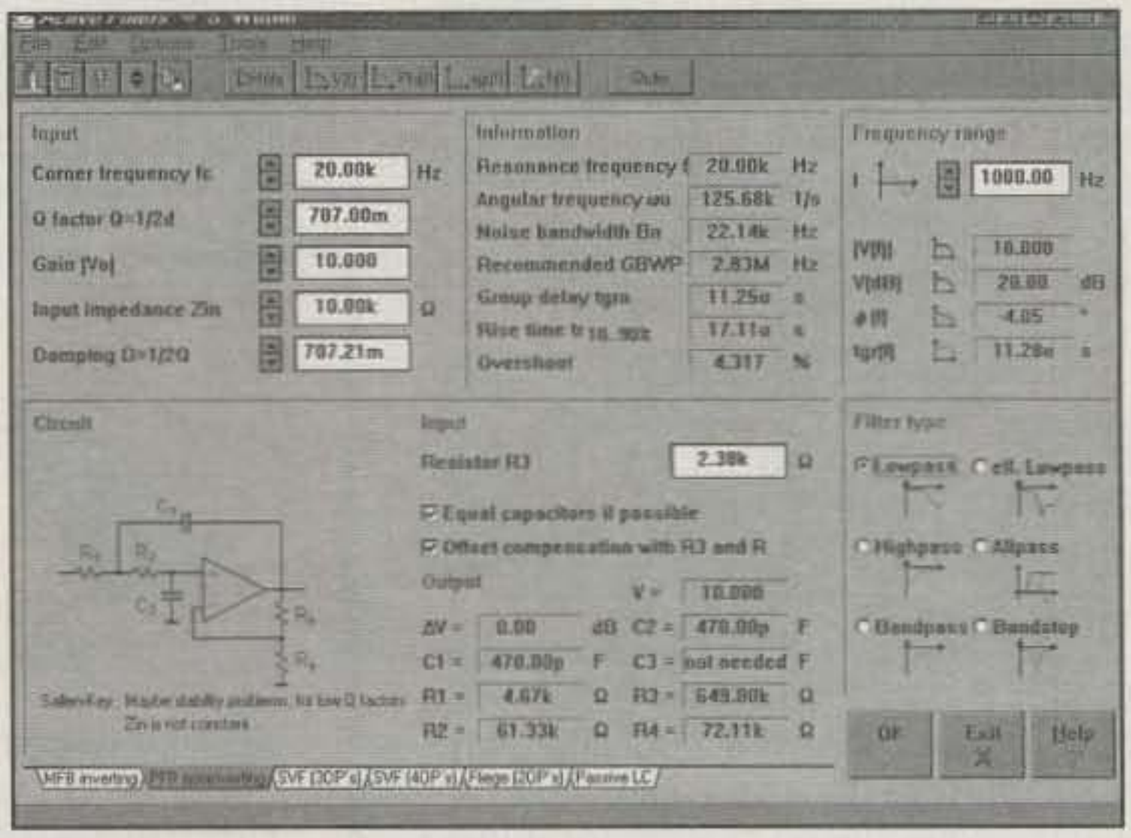
Yarmouth, ME 04096 (1-800-452-5931; e-mail: <info@delorme.com>; web: <http://www.delorme.com>).

New on the Net

Surplus Sales of Nebraska: Searchable Database on the Web. With his catchy marketing motto of "where the hard to find parts are found and on hand," Bob Grinnell, WDØFDE, of Surplus Sales of Nebraska, has one of the largest selections of new and surplus electronics parts in the country.

The Surplus Sales of Nebraska website, which you'll find at <http://www. surplussales.com>, is full of goodies of interest to radio amateurs, experimenters, and homebrewers. Thousands of new parts have been added recently, including antenna tuners, blowers and fans, chokes, computer items, knobs, microwave equipment, scientific radio parts, vacuum capacitors, and more.

This large selection now is available online. The really good news is that you can browse and search the online catalog effectively, with its over 100,000 individual files and more than 3500 photos. You can use the powerful search engine the website employs to locate the parts you want by name, number, manufacturer, or description. A paper catalog also is available.



Thinking of doing any serious active filter design? Here's the ELEKTA Professional software's Active Filter Tool Screen, showing just one of the software's many capabilities. This tool helps you design both active and passive LC filters.

Contact Surplus Sales of Nebraska, 1502 Jones St., Omaha, NE 68102 (1-800-244-4567; e-mail: <grinnell@surplussales.com>; web: <http://www.surplussales.com>).

From the Bookshelf

ARRL Antenna Compendiums, Vols. 5 and 6. The philosophy of the editors of the *ARRL Antenna Compendium* series results in a sort of "antenna feast" for readers who are diehard antenna buffs. The six volumes provide good vehicles for publishing deserving antenna articles that overflow the ARRL's journal, *QST*.

We began covering the *Compendiums* with the 1985 Vol. 1, and later covered Vols. 2, 3, and 4, but didn't get around to Vol. 5. This month we'll belatedly cover Vol. 5 as well as the latest book, Vol. 6.

Vol. 5, at 200 pages, was published in 1996. With its 41 previously unpublished articles, the volume offers good coverage of 80 and 160 meter antennas; VHF/UHF antennas; antenna modeling; multiband antennas; propagation; measurements and computations; and antenna tuners, baluns, and transmission lines. There's even a section euphemistically devoted to "special" antennas, which includes an HF beam made of PVC materials and a "no-see-um" underground HF antenna. The $20 (plus $4 s/h) volume comes with a disk of DOS-based supporting software.

The 237-page Vol. 6 covers a wide range of topics among its 43 articles. Included are articles on 10 meter antennas; 40, 80, and 160 meter skyhooks; antenna modeling; measurements and computations; multiband and "special" (unusual) antennas; propagation and ground effects; quads; towers; antenna tuners; transmission lines; vertical radiators; and VHF/UHF antennas. A companion CD-ROM is included. The combo is $20 plus $4 s/h.

Contact the American Radio Relay League (ARRL), 225 Main St., Newington, CT 06111-1494 (1-888-277-5289;. e-mail: <pubsales@arrl.org>; web: <http://www.arrl.org>). Also check out the ARRL publications catalog at <http://www.arrl.org/catalog>.

New Computer Books from Macmillan. Sometimes I think Macmillan, with its many book imprints (Que, Sams Publishing, New Riders, etc.), is becoming the Microsoft of the computer publishing industry. It seems that as the amount of printed software documentation provided by software publishers decreases, and users need more help to use their purchases, publishers such as Macmillan go into high gear with their help books.

I have a bookshelf full for you this time, but there is little room for them except simply t list some of the new titles that have crossed my desk. These include the inside-scoop oriented Que® book *The Unauthorized Guide to the Internet,* by Shannon R. Turlington, priced at $17.99; the massive (1179 page-plus-a-CD) *Que's Official Internet Yellow Pages,* Millennium Edition, by Marcia Layton Turner and Audrey Seybold, at $29.99; and (yes, Virginia, DOS is still out there!) the massive and highly authoritative Que tome *Special Edition Using MS-DOS 6.22,* Second Edition, by Allen L. Wyatt, Sr., at $34.99 including CD.

Contact Macmillan Publishing USA, 201 West 103rd Street, Indianapolis, IN 46290-1097 (1-800-858-767, for a catalog; e-mail: <info@mcp.com>; web: <http://www.mcp.com>).

We Get Letters

Once again we're just about out of space. Before wrapping things up this month, we'd like to acknowledge some of the folks who corresponded with us. We would especially like to thank the many readers who enjoyed our two-part feature article on old-time amateur radio gear, "Classic Jurassics," which appeared in last November and December's issues. To our surprise, we received more mail on the antique radio duo than on any article or column we had ever written for *CQ*!

A tip of the W8FX hat goes to our many respondents. A partial list includes Brian Howard, KA9SLX; Jeff Wolf, MD, K6JW; Dennis Vernacchia, N6KI; Herbert J. Ulrich, Jr., PhD, K2JVM; John Turner, KA7GLA; Anthony Musero, K3UKW; Jerry Kincade, W5KP; Bob Moody, W4WSZ; Ron Trepka, W8RON; and Jeff Adams. Many thanks, folks—and keep those cards and letters coming!

Wrap-Up

That's all for this time, gang. Next time, more "What's New." See you then.

Overheard: We tend to have a lot of power outages in our area. Thus, long ago I learned flashlights are really just convenient appliances for holding long-dead batteries.

73, Karl, W8FX

Math's Notes

What's New And How To Use It

BY IRWIN MATH, WA2NDM

A 1 KW Optical Transmitter

As April comes around I always think of ways to try to fool (or at least confuse) our loyal readers in keeping with the spirit of the day. In the last year or so, however, these hypothetical offerings have turned out to be more practical than imaginary, so I for one am beginning to wonder if today's fiction indeed will become tomorrow's fact. And I really mean tomorrow, not in the next 10 years!

This month we have another one, and it is up to you, the reader, to decide whether this one is fiction or indeed fact. Think very carefully before you decide, however. You may be in for a surprise.

At the beginning of the year you may remember that we mentioned the possibility of optical communications at levels that could begin to rival conventional RF transmissions. Well, that time has come! This month we would like to present our thoughts and ideas pertaining to the design of a simple, easy-to-duplicate 1000 watt optical transmitter. Such a device could be used for point-to-point communications or for bouncing off clouds, tall buildings, mountains, or other high structures for over-the-horizon DXing. Construction is fairly simple, and the only drawback, if it can even be considered one, is the use of "old-fashioned" AM. In this case, however, the modulation method is called *intensity modulation,* or IM (note the similarity to my initials).

Fig. 1 is a diagram of the transmitter. The "local oscillator/power amplifier" is a 1000 watt projection lamp, while the modulator is a homemade magneto-restrictive device. The "antenna" is the optical system from a small telescope. In operation, the projection lamp produces a beam of light that is processed and collimated by means of a typical heat-absorbing filter and condenser lens of the type found in most 35 mm slide projectors. In fact, the entire optical system from a junk-box projector can be used if available. The collimated beam of light is passed through a slit composed of a fixed side, made from a common single-end razor blade, and a second fixed side made from another razor blade soldered or otherwise attached to a nickel rod. Around the free end of the nickel rod is a coil of wire connected to a high-power modulator.

Nickel is an interesting material. It is magneto-restrictive, which means that when current flows through the coil of wire surrounding the rod, the rod actually shrinks (or constricts) in step with the current. This causes the opening in the slit formed by the two razor blades to also vary in step with the current. Now when the coil current is varied or modulated with information, the slit opening varies accordingly, and the light passing through the slit is modulated. Since nickel is capable of constricting at very rapid rates, the modulation signal can be audio, video, or even digital data (including CW). Fig. 2 shows several rnethods to match the coil of wire around the rod with the various signals. The degree of movement and the linearity of modulation is a function of just how well the slit

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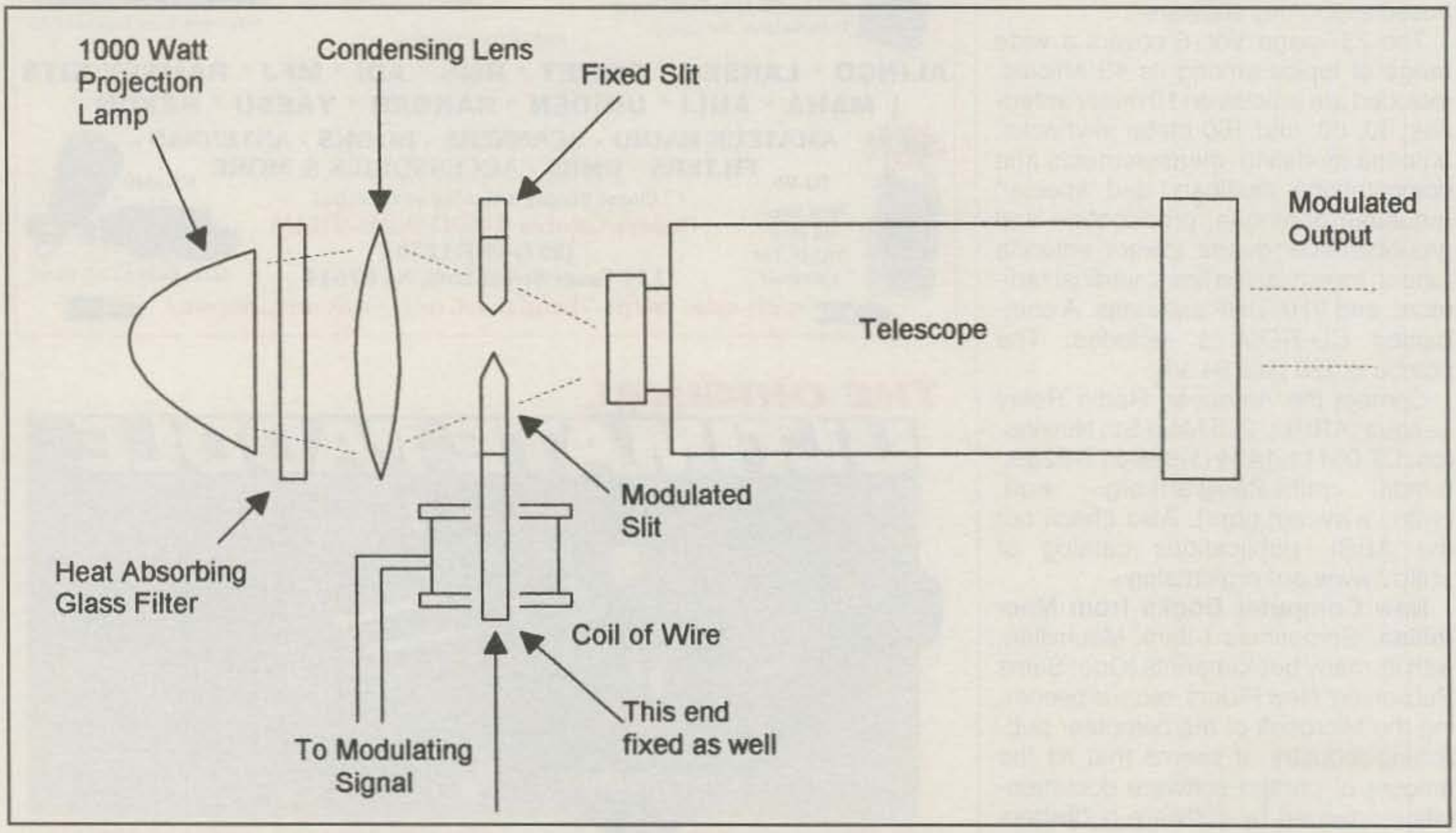


Fig. 1– Operating diagram of a 1 KW optical transmitter.

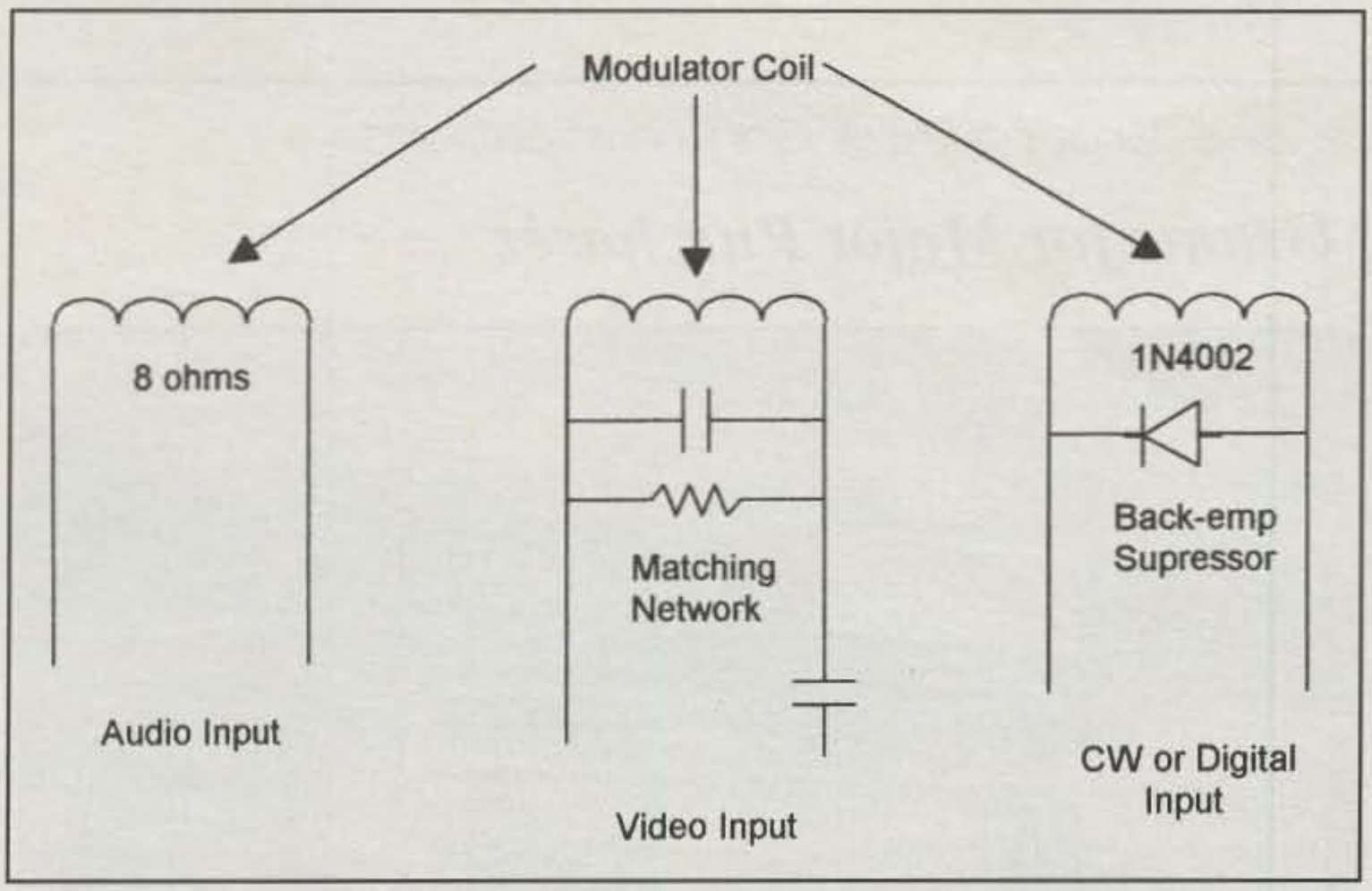


Fig. 2– Methods for matching the modulator coil.

is constructed and how the signal matching to the coil is accomplished.

With video, linearity would be critical for non-distorted pictures, but with audio or digital, more non-linearity can be tolerated. The actual level of the modulating current will depend on the degree of constriction of the nickel rod desired, which will be directly proportional to the depth of modulation. For audio our experiments indicate that an amplifier of at least 100 watts is required, and that if one is clever, the coil can be wound so that it exhibits an impedance of 8 ohms, thereby presenting a perfect load for such an amplifier. In fact, if audio is to be used, one might even consider the use of an iron rod or even a large nail as the modulator rod instead of the nickel. The side connected to the iron rod would not be fixed in this case, but would move like the rod in a solenoid. This would probably achieve a much greater degree of movement and depth of modulation.

For those who wish to use CW, the circuit on the right of fig. 2 is all that is necessary. The diode across the coil, by the way, limits the back EMF when the telegraph key opens and protects its contacts. Operating the key causes pulses of current to flow through the coil and modulate the light accordingly. Since such a slit allows some light to pass in its "logic 0," or quiescent mode, the resulting "optical carrier" could be used at the receiving site to align the receiving optical antenna for maximum signal reception.

A receiver for such a system would again use a telescope as the antenna. This would be coupled to a photodiode and electronic processing circuitry much like the fiber-optic systems we spoke about last year, except that the photodiode would be coupled directly to the telescope. The bandwidth of the electronics would be designed to match the signal being received.

As is the case with UHF radio systems, operation is essentially line-of-sight, although bouncing as already mentioned is a real possibility. For multiple signal operation perhaps color filters could be employed at both the transmitter and receiver. When one considers the possibilities, even portable stations could be made with high-power battery-operated lanterns or searchlights. The options are many, and although probably rudimentary by future standards, such a system is a very easy way to operate in the terrahertz (THz) region.

Comments accepted!

73, Irwin, WA2NDM

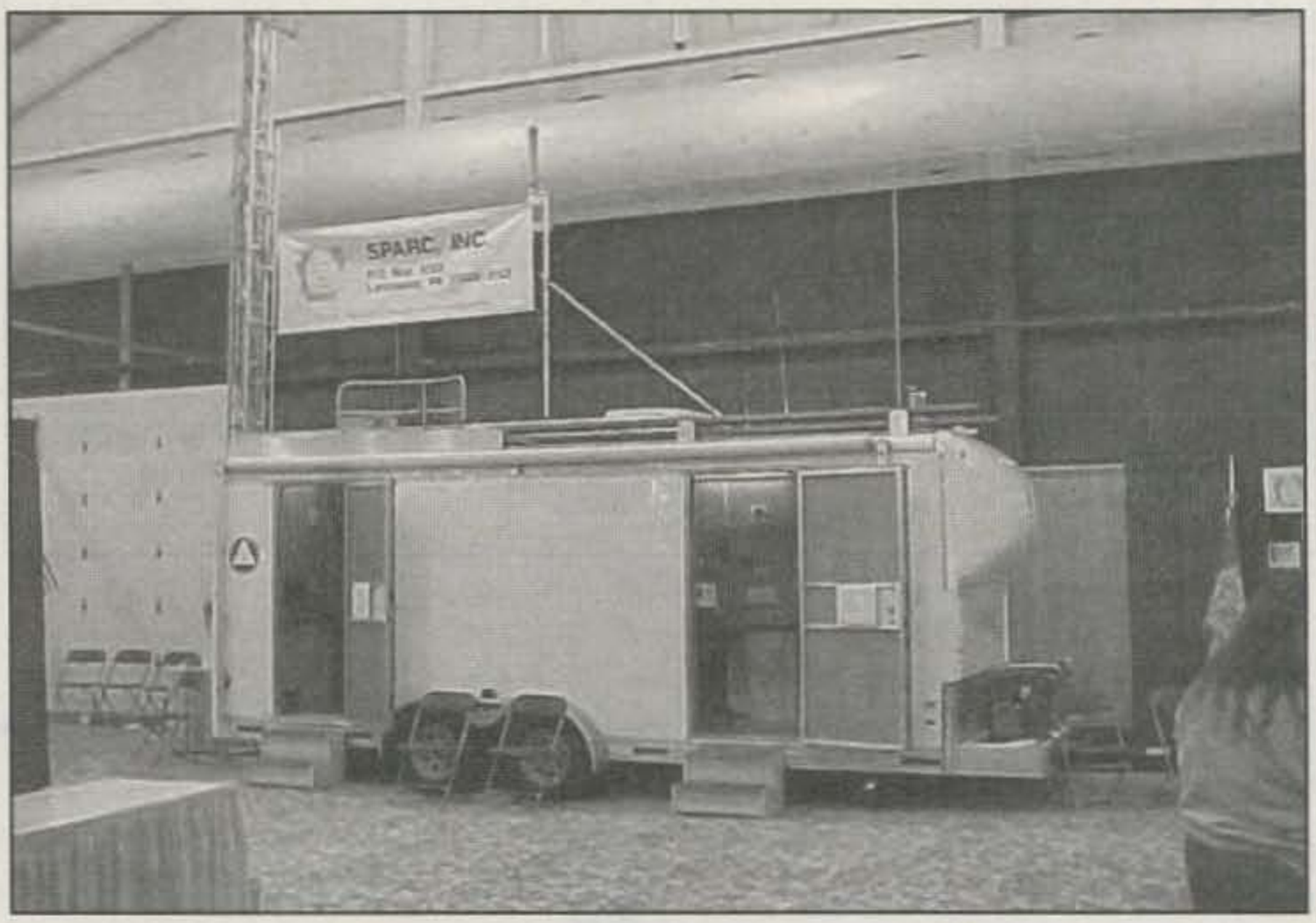
Public Service

BY BOB JOSUWEIT, WA3PZO

Public Service and Emergency Communications

Getting Grants for Major Purchases

Many ham public-service-minded groups routinely bring their radio equipment into the field and set up a temporary command post to run a big event. Here's the story of one dedicated public-service group that used real-world job-related project management skills to obtain a highly polished Field Service Vehicle.



SPARC's Field Service Van was completed in just over two years. It has an attached tower and two generators for power. (Photo courtesy KA3UQA)

Getting Involved!

For the past eight years the Southern Pennsylvania Amateur Radio Club (SPARC), Inc. has been providing personnel and communication support to approximately 30 local not-for-profit and business organizations for community events. Some of these events include the March of Dimes Walkathon, MS Walkathon, Nissley Vineyards 5 and 10K runs, Columbia Jaycees Halloween Parade, Rockford (President Buchanan's home) Plantation Revolutionary Reenactments, Rockford Candlelite Tours over the Christmas holidays, Franklin and Mary College Presidents' receptions, and APCO (Association of Public Safety Communicators) convention support.

"By continuing to do these events each year in the local communities," says SPARC President J. "Yogi" Bear, WB3FQY, "the organization's name and its reputation became well known in the business sector and with community support agencies and organizations." Each event showed the need for a communications support vehicle.

Before You Get Started

Bear points out, "If your organization is not getting involved in helping in the community, you should forget about the project now. Don't waste your time or the time of others!" He explains that the success of this project was linked with the community services the club provides year after year. "You simply cannot sit on your duff and expect community support," Bear says. "It just won't happen."

The club also revitalized the ARES/RACES programs in the county and began working closely with local and county government entities and police departments. Lancaster County is involved with emergency response planning for two nuclear power plants, including Three Mile Island, site of the nation's worst nuclear accident.

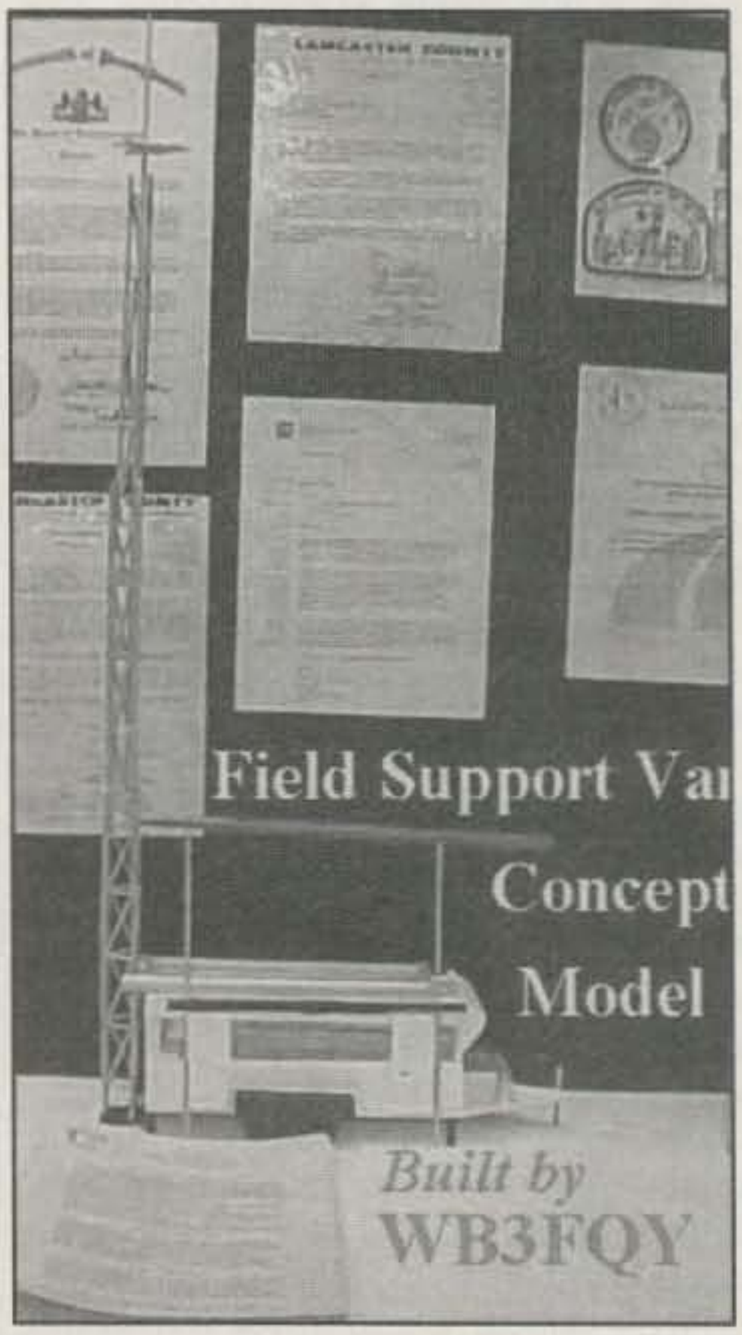
Incident Leads to Idea

As SPARC's communications capability was increased, it became evident that the communications capability of *all* volunteer emergency providers had to be improved. Bear explains that three years ago there was a train derailment along the county's low-grade railroad tracks. These tracks run along the Susquehanna River and are visible only from the adjoining county across the river. County emergency management personnel were unable to get any "real time" information on the crisis.

After the incident was over, it became evident to all involved that something needed to be done for this type of emergency. The best solution proposed—a transportable communications system. How to do it was another challenge. The project began on December 8, 1997.

Starting with the Membership

The first step was to go to the SPARC membership and fill them in on the idea



The Field Service van started with an idea and a scale model. (Photo courtesy KA3UQA)

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e-mail: <wa3pzo@cq-amateur-radio.com>

and the need for a communications vehicle. Bear says the idea was very rough when presented. Questions were answered as best they could be, and the membership approved the project with one stipulation: the project would not put the organization into any debt.

The membership put the entire project—planning, acquisitions, and integration—in the hands of the board of directors. The board would update the membership as progress was made. In order to get the project going and to sweeten the pot, one of the members issued a challenge, stating that if the group acquired the vehicle to build this project, he would purchase and donate a 65 ft. collapsible tower for it.

Reviewing Membership Assets

A key point when looking over your club's membership assets is that those assets include more than radios, antennas, and CW or voice operators. Every person has additional skill sets. The easy ones to identify are what each member does at work every day. Bear says SPARC has both retired and employed electrical engineers from major corporations; retired military communications personnel; nuclear engineers and operators; computer systems analysts, installers, and programmers; machinists; electricians; and business managers. One might think that SPARC is a large organization, but Bear says it has 51 members, with about eight to ten doing most of the work.

Some volunteers were assigned several areas of responsibility because of their expertise. The Program Manager and the Systems Coordinator were assigned the task of coming up with their "vision" of the project and presenting it to the other team members at a special meeting prior to presentation to the general membership. At this "vision" meeting it was decided that the best way to sell the project was to have something to sell.

Program Manager WB3FQY built a scale model of the proposed vehicle, including the interior operating positions, and presented the project to the membership for approval. With the easy part accomplished, the real work began. How do you pay for a project of this magnitude? Bear answers, "Bottom line is you work for it."

Publicity, the Next Step

Publicity Chairman E. Kenneth Manning, N3ABC, began his part of the challenge by arranging for meetings with the local print media and utilizing the scale model. Several of the team members met with the local editor and explained the project and why it was needed. They explained how everyone in the county would benefit. Manning emphasized the fact that Lancaster County is one of only five counties in the United States that has two nuclear power stations within five miles of each other and in the same emergency zone area. He also emphasized that all personnel involved in this project were volunteers serving the local communities. They all focused on the project and the financial needs.

Bear reports the meetings worked and the publicity continues today. During recent emergency exercises for the Three Mile Island and Peach Bottom nuclear facilities SPARC members took a reporter with them and gained additional coverage.

Developing Relationships

Appointments were made with the County Commissioners to advise them of the project and solicit their support. The Emergency Management Coor-

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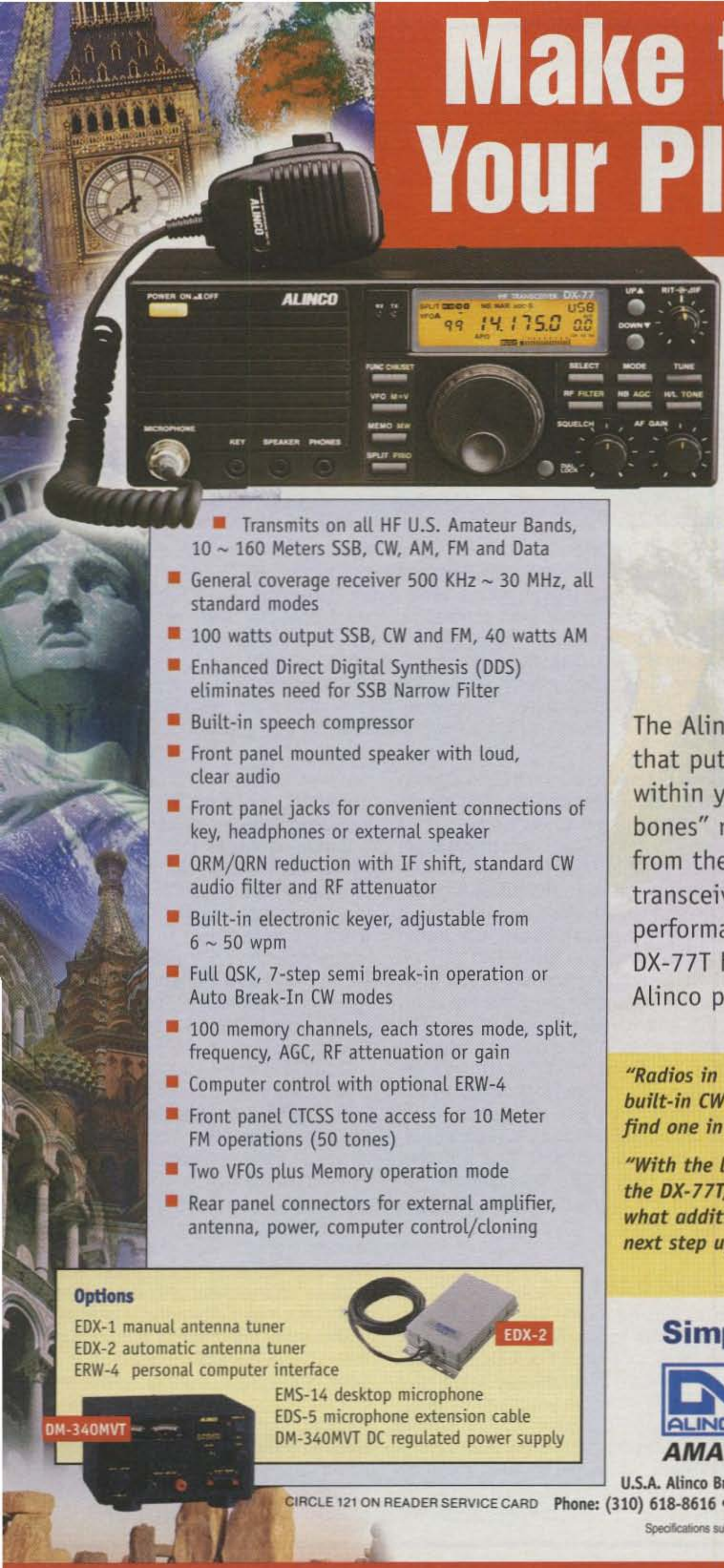

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- Front panel CTCSS tone access for 10 Meter FM operations (50 tones)
- Two VFOs plus Memory operation mode
- Rear panel connectors for external amplifier, antenna, power, computer control/cloning

Options

EDX-1 manual antenna tuner
EDX-2 automatic antenna tuner
ERW-4 personal computer interface

EMS-14 desktop microphone
EDS-5 microphone extension cable
DM-340MVT DC regulated power supply

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"Radios in this price class typically don't include built-in CW keyers, so it was a pleasant surprise to find one in the DX-77T. Nice going, Alinco!"

"With the long list of features already included in the DX-77T, first-time buyers may be curious as to what additional capabilities they would find in the next step up."

—QST Product Review, June 1998

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Communications Van Project Team

Program Manager: J. "Yogi" Bear, WB3FQY
Systems Coordinator: E. Max Peters KI6NJ
System Integrator: David Payne Sr., N3LOM
Finance: Mike Warner, N3XPD
Test and Evaluation: Hal Hartman, AD3X
Publicity: E. Kenneth Manning, N3ABC
Fast Scan ATV Systems: James Ibaugh, AA3C
Computer Systems: Tim Headings, KA3UQA
Slow Scan ATV Systems: Hal Hartman, AD3X
Packet Radio Systems: Scott Felton, WF3R
APRS/GPS Maps and Locator Systems: Mike Warner, N3XPD
Direction and Control Systems: Dave Payne, Sr., N3LOM
Engineering Reviews: Pat Campbell, WA3UOE, and Dave Sarraf, N3NDJ

SPARC's Field Service Van will handle a variety of frequencies and modes of operation. Communications are possible on packet, RTTY, AMTOR, PACTOR, and several other digital modes. Slow Scan Television (SSTV) on either VHF or UHF radio can be done on simplex or through repeater systems. Another computer is the central command and control network system, being used here to track the RS-12/13 satellite. The fourth computer controls the real-time Automatic Position Reporting System (APRS). Another computer system will be used to control the Fast Scan Amateur Television. All computers are tied together via a network, which transfers data. (Photo by KI6NJ)

dinator joined the SPARC representatives at the meetings. The 20-minute presentation turned into a one-hour meeting. SPARC members showed the scale model and explained the concept and the benefits to the county and its residents.

A "Partnership Agreement" was entered into between SPARC and the county. This is not an ordinary Memorandum of Understanding, Bear explains. "This is a specific agreement of partnership between the Southern Pennsylvania Amateur Radio Club, Inc. (SPARC, Inc.) and the Commissioners. This agreement was made specifically for the acquisition of the van by the Commissioners. However, SPARC, Inc., is totally responsible for equipping the van with its required communications equipment. In turn, however, the County Commissioners agreed to fund the EOC Operations Room."

Getting the Funding

Most organizations don't have spare change in their treasuries to fund a complete communications vehicle. Where do you go to get funding for a project of this magnitude? Start with the public library and locate the not-for-profit section. This area should give you all the knowledge you need to get started.

Bear explains that using the direct-mail route to acquire potential donations is not the best way to proceed, even for a small geographic area. "The average return on investment for these mailings varies from two to five percent maximum. Considering the cost factors of preparing and mailing a significant number of request pieces, this may not be as beneficial as you think.

"The better way to acquire funding is through foundations, trusts, and the members' employers that have matching fund programs," Bear continues. "You may be sidelined in this process in the beginning after you read the majority of requirements to be funded."

The most significant item these foundations want to see is the documentation that you are a recognized not-for-profit organization. You have to include a copy of the IRS Determination Letter confirming that you are a 501 (c) (3) not-for- profit organization. If you don't have this document, you need to apply to the Internal Revenue Service. Request a copy of the booklet "How to Apply for Exemption," and it will be mailed to you. Bear reminds everyone that this is not a free exemption. It will cost between $400 and $450, plus attorney's fees, to submit it. On the other hand, he says, most organizations can prepare the forms themselves without using a lawyer.

Research 101

Go back to the library. The first book you should look for is *The Taft Directory.* This three inch thick book lists foundations that give away money. It will give you all of the details you need to determine which foundations you should contact. "You need to do your homework here," says Bear, "and if you do not, you're wasting your time and effort. Be realistic in your proposals, as the review boards of most foundations are not dumb people. They know what they're looking for in your proposal."

Other books to look for are those which have specific information on all foundations and trusts in your state that may give you funding. In Pennsylvania there are three books that were helpful in the search. They are the *Pennsylvania Non-Profit Handbook*, the *Pennsylvania Nonprofit Report*, and *Nonprofit issues/Pennsylvania Non-Profit Handbook*.

Don't stop at the local and state level. Check out federal grants programs as well. There are numerous publications in this area which you should review. "This is not an overnight project," says Bear. "This is part of the pre-planning process leading up to preparing requests." He suggests that you may also benefit by visiting your local Congressional Representative's office. You should explain your project and inquire which programs may be beneficial to you.

One other approach to acquiring information and possible funding is to visit your local and county government offices. "Every level of government has funding available," continues Bear. "You need to know this and you need to know how to apply for it. When you approach these areas you need to be humble and present a great first impression."

The club's first endeavor in the funding area took 18 months after applications were submitted. By the time the first funds were received, requests for funding were in place for the next funding year.

Take the time to meet with local foundations. Make an appointment to discuss your project with them. "You only get one chance to make a good first impression," Bear says, "and you may only get 10 minutes to do it." If you get asked to stay longer, Bear suggests that you relax and make the most of it.

Vehicle and Equipment

While funds were being sought, Systems Coordinator E. Max Peters, KI6NJ, was busy preparing layouts, space requirements, wiring, grounding, power units, and redundancy planning. The vehicle needed to be lightweight when procure, and have a solid welded framework, heat and air conditioning, protected wiring, etc. Bear says the only manufacturer that met their needs was Wells-Cargo Company.

A closer look at the Slow Scan TV unit with miniature SSTV camera-modem/transceiver. (Photo by KI6NJ)

Each operating position was designed for ease of operation, and the computer systems were designed for a hub operating system. Each position had a preplanning table of equipment and accessories, including every PL-259, N, or UHF connector, assembly screw, washer, bolt, nut, electrical connector, block, switch, and fuse. From these preplanning sheets a detailed presentation was assembled to submit to potential donors. The package was put together the way

A closer look at the HF radio transceiver. (Photo by KI6NJ)

a business prepares a proposal to a potential client. The details made it very effective in obtaining funding.

Finally, the van would need to be transported. The Development Group visited local car and truck dealers. After several months they acquired a one-ton 4×4 GMC truck, a $15,000 value, for a total cost of $1000 with the balance donated to the project.

Regular Meetings

The Project Development Team held (and still holds) monthly meetings to review where everyone was on the project. In December 1999 the group was advised that they would be receiving a substantial sum of money which would complete the initial part of the project and the base-station equipment. Those funds came from two sources. The club had invested about one third of the total dollars spent to date. The other substantial sums were provided by grants from the Lancaster County Foundation of Lancaster (whose funding is limited strictly to not-for-profit organizations located in Lancaster County) and the Pennsylvania Office of Economic Development. Just two years and 12 days after the initial kickoff, Bear announced, "It's all paid for."

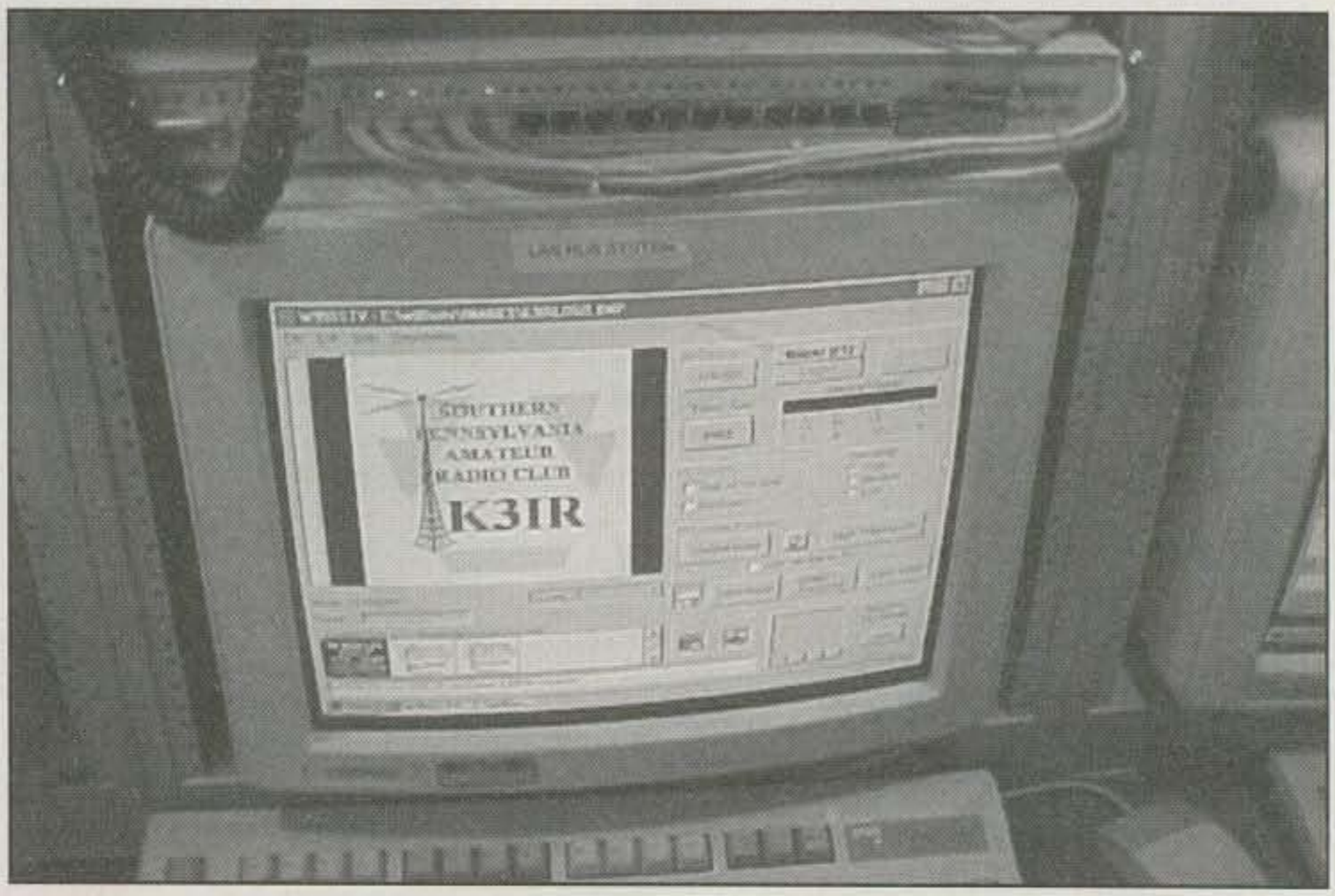
Of course the job will never be totally done, and the Project Team has been preparing for upgrades, which will cost an additional $20,000 to $30,000. These upgrades include computers with more memory, along with completion and upgrade of the laptop field units. In addition, procurement of additional radios for VHF slow-scan operations, on-board repeaters, and redundant power systems was also planned.

Bear was asked if the group is up for the challenge after the original project was completed. He replied, "We've already begun the process!"

A Note of Thanks

This month we want to thank Jim "Yogi" Bear, WB3FQY, for providing information on SPARC's Field Service Van. SPARC supports repeater, packet, and ATV systems, and members teach entry-level ham radio classes. As part of their fund-raising efforts, they conduct a recycling project. For further information on SPARC check out their web page at <http://www.geocities.com/CapeCanaveral/8872> or contact Yogi at <WB3FQY@juno.com>.

73, Bob, WA3PZO



The Synoptics Hub System enables all units in the FSV to share any and all information with each specific operating area. (Photo courtesy WB3FQY)

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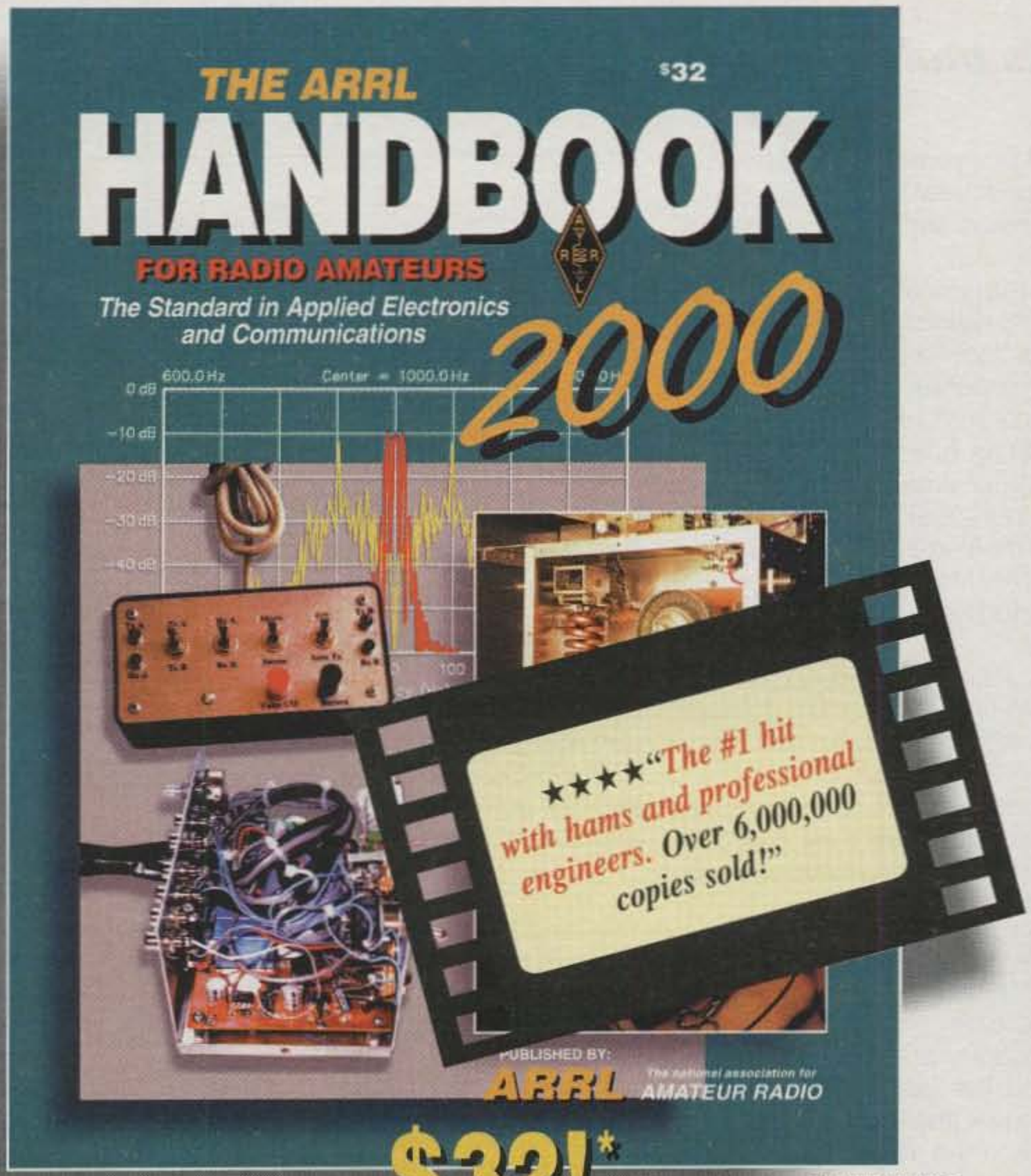

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CIRCLE 112 ON READER SERVICE CARD

Contents

World Of Ideas

BY DAVE INGRAM, K4TWJ

A Look At The World Around Us

Keys and CW: Timeless Treats—Part II

We are back with Part II of this year's "Keys Special," friends, and it is a by-request treat highlighting some delightful gems of increasing popularity: miniature keys and paddles.

What makes these little Morse manipulators so attractive, you ask? Everything! They are light weight, pocket size, and easy to carry (ideal for portable or mobile use). Most miniatures are also exceptionally quiet in operation (perfect for low-profile hamming), and they are economically priced (always a factor!). Do they handle as well as full-size keys or paddles? That depends on your fist, your preference, and what you are accustomed to using. I personally find miniatures exceptionally good performers for their size and cost, but they are not "beyond-comparison" N2DAN Mercurys (featured last month in Part I). Think of them as fun keys or QRP keys and you will be right on track.

Did Dave say QRP keys? Relax. I have personally checked every miniature or QRP key I could find with my "big rig" and can factually state they also work with high power. Yes, they are an all-around gas!

Now let's hop to an opening telegraphic tale and then jump to the keys. Folks are always asking where they can find miniatures, so all of our featured items are new keys you can order directly from the stated addresses. Enjoy!

Western Union Today: An Update

As most of you know, two of the most well-known names associated with Morse and telegraphy are Western Union and Vibroplex. We have discussed The Vibroplex Company in past columns, so let's now briefly talk about Western Union.

This legendary company began in the 1800s as the New York and Mississippi Valley Printing and Telegraph Company and boasted an impressive 500 miles worth of wire coverage. Wires between various telegraph companies were not interconnected, so eleven other "biggies" were bought out and merged with NYMVPTC to form Western Union. The company's use of telegraphy continued on into the 1950s, when it switched to teletype.

During recent decades cell phones, e-mail, the Internet and multiple cut-rate telephone companies have noticeably changed wired communications mediums. Western Union has also changed with the times. Today it has over 50,000 facilities located in everything from strip malls to grocery stores throughout the U.S. and over 100 foreign countries. The company's main business is direct money transfers, just like handing cash between point A and point B, plus Western Union also still sends, receives, and hand-delivers telegrams.

What is the significance? Western Union delivers telegrams to places where telephone services and the Internet are not accessible. Official hand-delivered Western Union telegrams also still stand as the most prestigious way of conveying messages from one place to another. Just like Vibroplex and Wells Fargo, Western Union is a true survivor.

4941 Scenic View Drive, Birmingham, AL 35210

Photo 1– Thinking about a real glitz and glamour paddle to use with your favorite HF rig? Check out this 2 inch square "3 in 1" iambic paddle from G4ZPY. It has an excellent feel you can adjust from rather light to slightly heavy as desired, and it can even be engraved with your call letters atop its main yoke.

Yes, and it is now past time to focus on awaiting key views, so hang on and let's roll!

Widdle Wabblers

Leading our parade of pint-size CW stars is the classy "3 in 1" iambic paddle custom-made by G4ZPY and shown in photo 1. The paddle is an elaborate little critter with twin levers, a highly polished brass mechanism, chrome screws, and a glazed black base. Each lever has separate gap and tension adjustments, plus rubber pads are included behind set screws to ensure they stay locked in place. Looking from the back, the paddle's shiny screws and twin tension adjusting tubes gives the illusion of a miniature gatling gun from the old west. It is a real attention grabber ideal for home, mobile, or portable operation, and it works great. This is one

Photo 2– This good-looking brass and red-plastic paddle is made by Gil Kost, W3MKE, and is popular among QRPers nationwide. It measures 2" × 1.5" and has a medium to slightly heavy feel and a hearty "use anywhere" personality.

of the most expensive type miniatures, but it is a work of art.

The paddle is available from Gordon Crowhurst, G4ZPY, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs, L407TG, England, or through his U.S. sales outlet, The Morse Express listed later on in this column.

Remember the Little Red Key made by Gil Kost, W3MKE, of the American Radio QRP Key Mfg. Co. and featured in this column a couple of years ago? It now has a twin lever/ iambic paddle mate informally called the Little Red Paddle (photo 2), and it works very well. The paddle's assembly is brass and red plastic, with recessed adjustments on each side for gaps and an adjustable spring between the "butterfly"-shaped fingerpieces for tensioning. The base is also plastic, and the one shown in photo 2 sports a mirror top plate for extra "flash." It is neat, rugged, and handles like a champ—just the right thing for Field Day and other outdoor pursuits.

Gil makes and "tweaks" these paddles to fit each operator's fist, so he mainly sells them at hamfests. You can describe what you like in a paddle by mail or telephone, however, and direct order one. Contact Gil at 3710 Buckingham Rd., Baltimore, MD 21207 (410-484-7951).

Next up is the unique "bulldog" iambic paddle made by Louis Petkus, K9LU, and shown in photo 3. The heart of this triangular-based marvel is a small bulldog paper clip like the kind used in an office to hold papers together. Here it is fitted with brass buttons for fingerpieces and clamped to a wood block mounted upright on a solid-oak base. Small retaining wires added on each side of the clip establish gap and tension, and three tiny suction cups on the key's base hold it securely in place during use. The thing may look like a novelty, but its feel during operation rivals a full-size paddle.

The Bulldog is available as a complete paddle with 30 inch cable and prewired 1/8 inch stereo plug or as paddle head only for mounting to a base of your choice. Order it direct from Louis Petkus, K9LU, 1020 Cedar Avenue, Suite 2M, St. Charles, IL 60174 (toll free 1-877-227-9139).

Bob Hammond, KI7VY, continues expanding his popular line of miniature Paddlettes, and the latest item is a combination paddle plus Tick keyer called the KP-3 (photo 4). This tiny treat measures only 1"H × 2"W × 1.5"D and may easily qualify as the world's smallest deluxe-feature and fully self-contained paddle/keyer combo. The Paddlette sports spring brass arms in a cantilever design with adjustments for travel or gap on each side. Its overall feel is light, agile, and really quite pleasant.

The base-enclosed Tick keyer has a beacon or auto CQ mode, memory with paddle interrupt, sidetone with top-mounted monitor, and more. Speed, key down for tune-up, and other functions are set by a single top-mounted push-button. The convenience of having everything right in your hand or right on your paddle, incidentally, is simply terrific and must be experienced to be fully appreciated. It's terrific.

This KC-3 combo plus other miniature and subminiature version Paddlettes, knee mounts, and more are available direct from Bob Hammond, KI7VY/ Paddlette Company, P.O. Box 6036, Edmonds, WA 98026 (425-743-1429).

Vibroplex has also joined the miniature, or QRP key field with their production of the trim, low-slung K8FF iambic paddle shown in photo 5 and catching well-deserved attention. The paddle sports a polished-brass mechanism with clear fingerpieces mounted on a classic black base measuring 2.5" × 3". The brass has a special coating to retard darkening. Rather than using springs, a magnet is mounted horizontally through the paddle's center block for tensioning. The amount of magnetic "pull" is set by screws with locknuts on each lever, while two more screws with locknuts on rear posts

Photo 3– If you thought a hand key made from a stapler was unusual, check out this Bulldog paddle made from a compression-type paper clip by K9LU. It measures 1.5"H×2.0"W × 2.75"D and has brass button fingerpieces. This inexpensive item has a surprisingly good "medium pressure" feel.

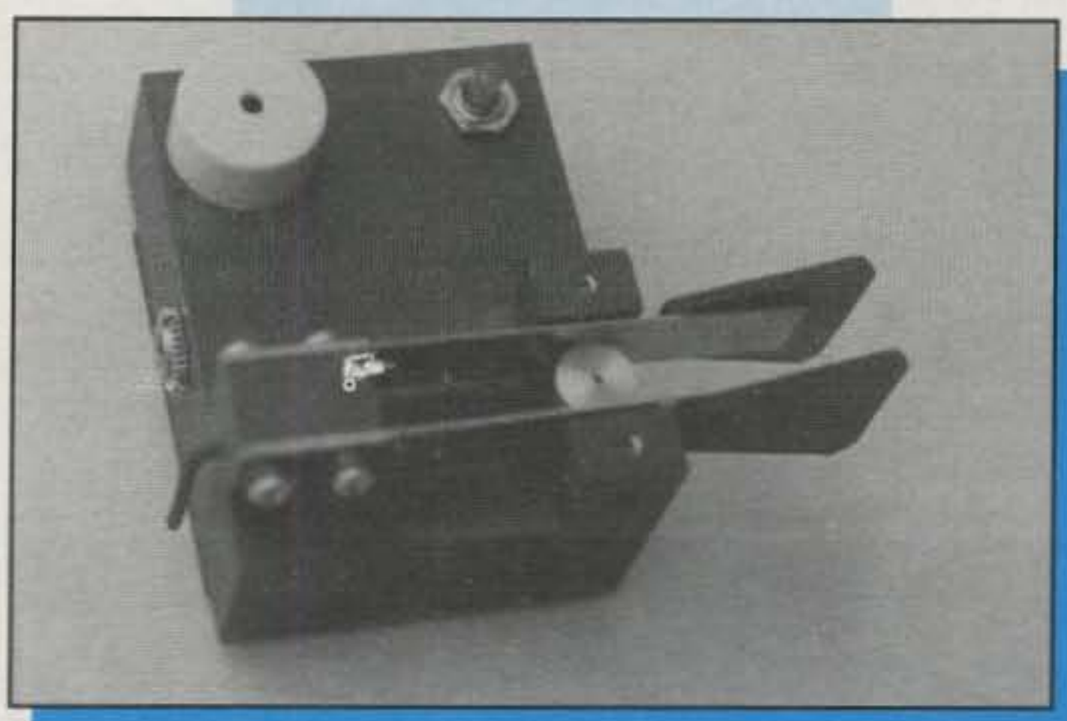

Photo 4– This all-in-one CW unit combines a miniature twin-lever Paddlette with a deluxe Tick keyer and one to three 3 year lithium battery in a 2.0" × 1.5" package. It also has a magnetic base pad that mates with an adhesive-backed pad (two are supplied) for "stay put" use. Paddlettes are available from KI7VY.

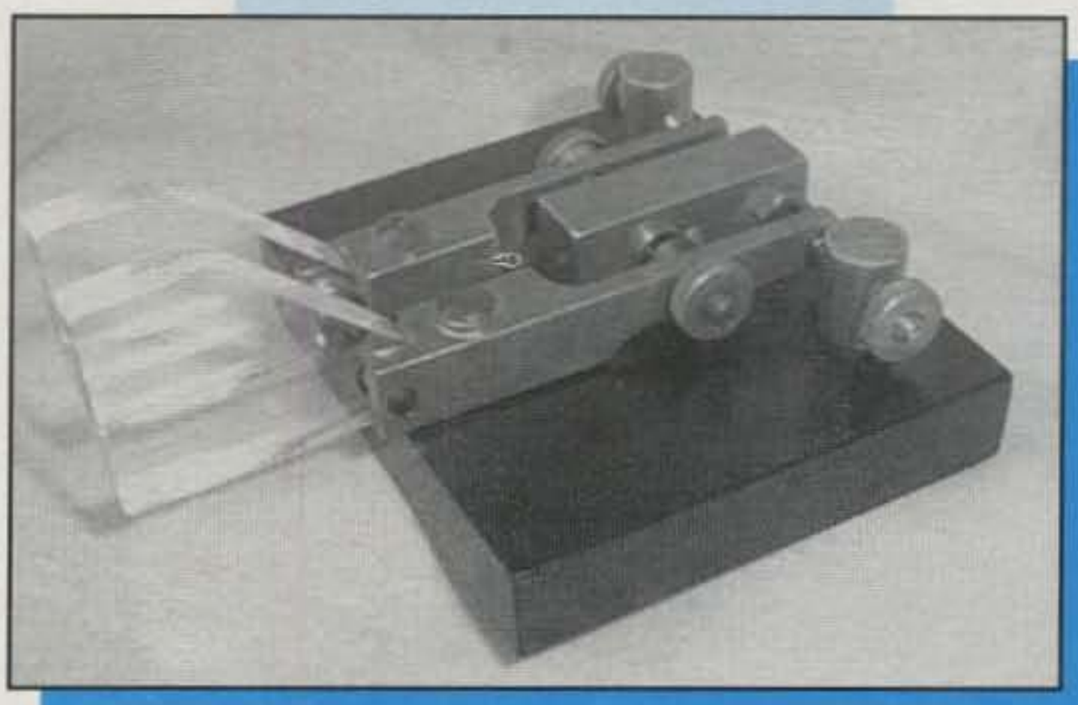

Photo 5– No springs and miniature to boot! This recently announced Vibroplex mini paddle is called the "Code Warrior Junior," and it is a commercial version of the NorCal-introduced K8FF QRP paddle. It responds to a fairly light touch and handles very well.

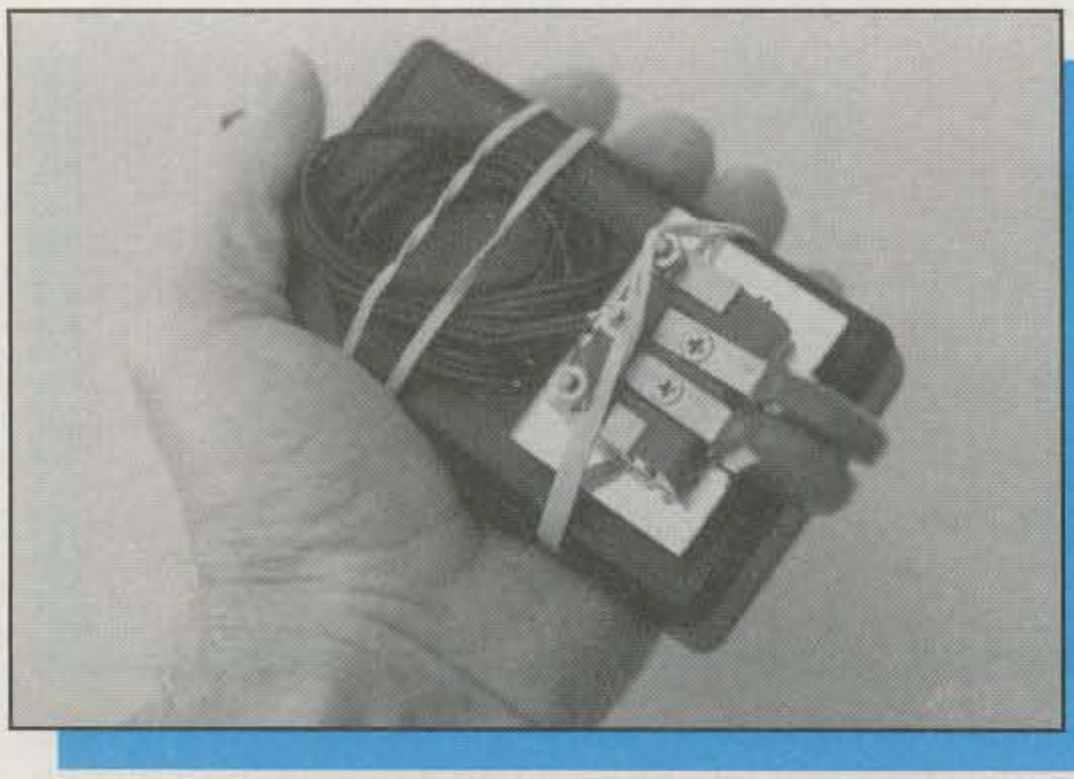

Photo 6– This new palm-size enclosure and Tick EMB keyer kit from Embedded Research add new zest and zing to both indoor and outdoor CW operations. The enclosure also makes a good mounting platform for a miniature paddle.

Photo 7– Interior view of new Tick EMB keyer and enclosure. Unit was assembled in only a few minutes (see text).

set gaps. I have an original K8FF prototype of this little "Code Warrior Junior" and find it has a slightly light yet positive feel that I would describe as "effortless sending."

This paddle is available from the Vibroplex Company, Inc., 11 Midtown Park E., Mobile, AL 36606 (1-800-840-8873).

Klassy Keyer

Say you need a miniature, full-function keyer to go with your favorite miniature paddle? No problem. Remember that super-feature "EMB" electronic keyer kit available from Embedded Research and featured last year in my "World of Ideas" column? It was the one with an RF proof layout and all parts (including paddle in/keyer output sockets, mode-controlling pushbutton, etc.) directly mounted on its 2" × 2.5" PC board. Like all of ER's Ticks, its various functions (speed, tune/keydown, sidetone on/off, left/right hand paddle select, memory record/play, beacon mode, etc.) are set by a single pushbutton and a connected paddle's levers. ,

Gary, N2JGU, and Brad, WB8YGG, now offer a mating enclosure for the little keyer and it really produces a handy "use anywhere" treat (photos 6 and 7). The enclosure has all holes drilled and a prelabeled panel, and installing an EMB keyer in it takes less than 20 minutes. You must attach the front panel with the input/output sockets nuts, slip the panel into the enclosure's grooves, secure the board with two screws, attach the top cover with two more screws, and go. Fit one of today's popular miniature paddles on top of the enclosure, and you have a completely self-contained CW marvel right in your hand. Now that's cookin' in style!

The EMB kit, incidentally, is now supplied with ER's Tick 4 chip which includes two 50-character memories, beacon mode, and all the other previously mentioned functions, and they are all accessed by one pushbutton. Easy to use? You bet. Just listen to the sidetone-sent menu selections, then

Photo 8– Romance recaptured for sure! This dynamite delight is a miniature reproduction of the famous Chubbock camelback key from the 1860s, and it is totally awesome in appearance and operation. It is 1.5" × 2.75", has ball bearings at fulcrum, and is available on special order from DK1WE

Photo 9– This miniature "CT1" key hails from UT7CT in Russia, and although made of brass, it looks like gold jewelry. The key measures 1.5"H × 1.25"W × 2.75"D and has fine adjustments for gap and tension. It is available in the U.S. from N1FN of The Morse Express.

Photo 10– Schurr keys and paddles are well known for their hearty design and agile feel, and this new "mini" version supports that description in fine style. It measures 1.75" × .75"W × 2.75"D and is built for robust hamming from any location. This gem is also available from The Morse Express.

tap a fingerpiece to make your choice. These little critters are truly "operator friendly." Want to order a Tick or study more info on them? Contact Embedded Research, P.O. Box 92492, Rochester, NY 14692.

Tiny Tappers

Now moving into the hand key or "pumper" category, our spotlight falls on the blow-away treat in photo 8. This item is a miniature replica of what many folks consider the most famous of all camelbacks—the 1860s Chubbock key. Yes, it's a real heartthrob that works great and captures attention anywhere it goes. Just look at the soft, flowing lines of that arm—that offset pivot point, those sculptured, silver-tipped contacts. Check out the meticulously crafted cherrywood knob—the smooth black base. What a key! It almost fogs your magnifier just studying it!

Compared to the original design, this replica has ball-bearings rather than sleeve bearings at the fulcrum and a modified tension spring for smoother operation. Brass parts are finished with a coating to prevent dulling, and the overall impression is a key pulled right out of an old-time telegraph office. This miniature Chubbock is available on special order from Englemar Wenk, DK1WE, Hubenring 4, 88048 Friedrichshafen, Germany (telephone 07544-2635).

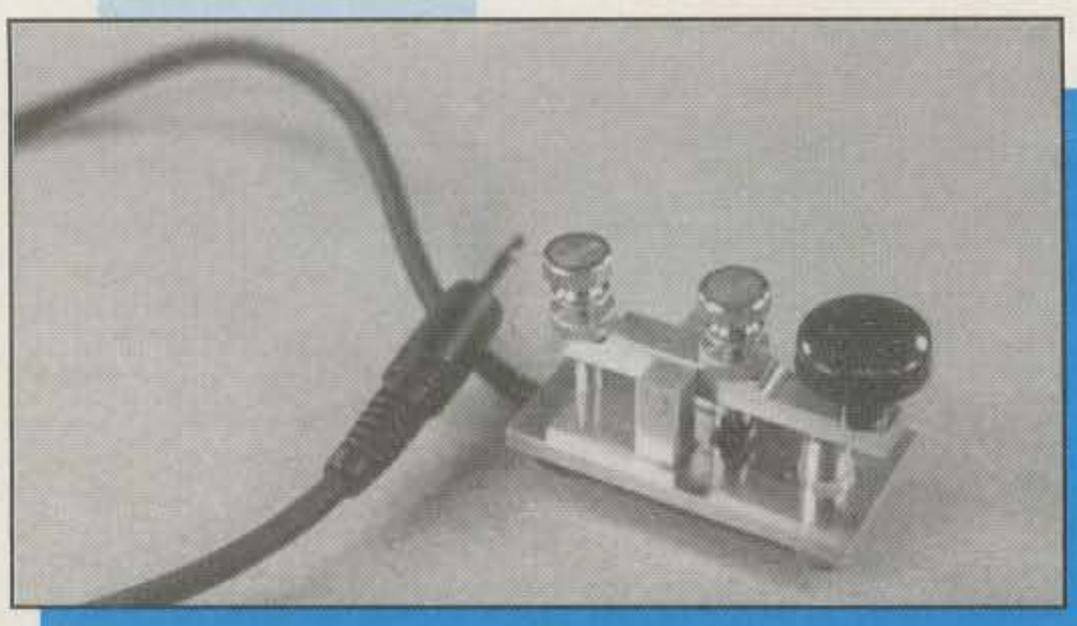

Photo 11– Tiny, temptuous, and terrific best describes this miniature "Sox Key" made by W3ZVT and sold by The Morse Express. It measures 1.25"H × 1"W × 2"D and is magnetically tensioned (unique for a miniature hand key). It is supplied with cable and 1/8 inch plug and can even be used handheld.

Our next three key views are courtesy of Marshall Emm, N1FN, of Morse Express/Oak Bay Research, and they are also available through his fine establishment. First is the miniature pumper debuting in photo 9. This key is produced by Anton Koval, UT7CT, in the Ukraine and is called the CT1. It is solid brass, polished to perfection, and topped with a glossy wooden knob. Notice the superb craftsmanship in the fulcrum's side post, the gap and tension adjusting screws and their locknuts. It is both impressive and a noticeable variation from usual "plain Jane," enclosed mechanism-type Soviet keys of eras past. Although I have not used this tyke, I would say it is closer to rear than center positioned fulcrum point should give it an elegant feel. The key's spring also looks hefty enough for setting anywhere from a light to a heavy touch.

Moving to photo 10, we have a new German mini-key made by well-known machinist Gerhard Schurr. This new, smallest addition to his famous line is diamond-ground brass with beveled edges and "zaponierung" coating to deter dulling or corrosion. It sports a center pivot point (as opposed to more traditional German designs with rear pivot points) and has sealed bearings for smooth operation. Fine pitch-adjustment screws are included for precisely setting gap and tension, and the key is topped with a polished cherrywood knob.

The tiny wonder in photo 11 is made by Tim Soxman, W3ZVT, and called the "Sox Key." It is exquisitely machined of brass, fully adjustable, and has a center fulcrum for a well-balanced feel. The little key uses a magnet rather than a spring for tensioning, and its knob-over-base design even makes it attractive for handheld operation. It is supplied with a prewired cable and 1/8 inch mono plug. A most commendable item indeed. Each of the last three keys, incidentally, is available through The Morse Express, 2460 South Moline Way, Aurora, CO 80014 (1-800-238-8205).

Later, Gator

That overflows our available space for this time, gang. I trust you enjoyed our "fashion show" format of presentation. More key views are already standing by for next time. Stay tuned! If you have a special key that warrants recognition, incidentally, send me some good photos plus an in-use description for inclusion in a future column (plus an SASE on inquiries), and let's get some well-deserved recognition going your way. May the force of good signals always be with you!

73, Dave, K4TWJ

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SS-18	15	18	1⅞ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅝	4.2
SS-30	25	30	3¼ x 7 x 9⅝	5.0

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MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅞ x 7 x 9⅝	4.2
SS-30M*	25	30	3¼ x 7 x 9⅝	5.0

MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅝	6.5
SRM-30	25	30	3½ x 19 x 9⅝	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅝	6.5
SRM-30M	25	30	3½ x 19 x 9⅝	7.0

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30-2	25	30	3½ x 19 x 9⅝	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅝	11.0

MODEL SS-12SM/GTX

MODEL SS-10EFJ-98

CUSTOM POWER SUPPLIES FOR RADIOS BELOW

EF JOHNSON AVENGER GX-MC41
EF JOHNSON AVENGER GX-MC42
EF JOHNSON GT-ML81
EF JOHNSON GT-ML83
EF JOHNSON 9800 SERIES
GE MARC SERIES
GE MONOGRAM SERIES & MAXON SM-4000 SERIES
ICOM IC-F11020 & IC-F2020
KENWOOD TK760, 762, 840, 860, 940, 941
KENWOOD TK760H, 762H
MOTOROLA LOW POWER SM50, SM120, & GTX
MOTOROLA HIGH POWER SM50, SM120, & GTX
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
UNIDEN SMH1525, SMU4525
VERTEX — FTL-1011, FT-1011, FT-2011, FT-7011

CIRCLE 134 ON READER SERVICE CARD

NEW SWITCHING MODELS

SS-10GX, SS-12GX
SS-18GX
SS-12EFJ
SS-18EFJ
SS-10-EFJ-98, SS-12-EFJ-98, SS-18-EFJ-98
SS-12MC
SS-10MG, SS-12MG
SS-101F, SS-121F
SS-10TK
SS-12TK OR SS-18TK
SS-10SM/GTX
SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
SS-10RA
SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V

*ICS – Intermittent Communication Service

Packet User's Notebook

Connecting You And Packet Radio In The Real World

BY BUCK ROGERS, K4ABT

RANGR™ Enhancements

Last month we presented a modification to the low-band (6 meter) RANGR™. Well, as promised, this month we're going to make some enhancements to that beast. We're going to put some teeth in it as we add packet (1200 and 9600 baud) capability to our low-band (Hi split, 6 meter) GE RANGR. We'll continue to reference it as the RANGR model 138-B.

Note: If you attempt to modify the 162B or 163B for 6 meter operation, the VCO in this model may not lock above 52 MHz. The 162 and 162(B) can be made to work above 52 MHz with the addition of several chip caps in the VCO/Exciter section. In the 162-B and 163-B, J603 is labeled as J606 and J601 is labeled as J607.

If you happen to have the RANGR model 138-A (Low split, 60 watt) and 139-A (Low split, 100 watt), don't go away disappointed. You can implement some of the same mods from last month's column, and it becomes a great 10 meter FM transceiver.

115 Luenburg Drive, Evington, VA 24550
e-mail: <K4ABT@PacketRadio.com>

To save a lot of reading and make your enhancements to this unit easier, we'll use the same approach as we did last month. I'll use photos and drawings in lieu of confusing you with a wordy document. I've learned from your many letters and e-mails in the past that you like the "photo shoot" approach.

Again, it will help if you have the GE Communications LBI-31619-D or similar revision as we perform this addition to our 6 meter voice radio.

Let's Pack It with Packet

The upgrade to the 6 meter FM voice RANGR will come in the form of adding one SPDT switch and a 5-pin DIN radio-to-TNC cable. Note the location of the SPDT switch in photo K. We'll discuss this switch later in the text. We're also adding additional components to the mini-control head which will make our RANGR into a 32-frequency, 6 meter transceiver. With these added components, our RANGR will now have the capability to operate 6 meter FM voice, 1200 baud AFSK, and 9600 baud DFSK packet, on 32 frequencies, rather than the earlier 16 frequencies.

Oh, yes! You read correctly: Our RANGR will indeed pass 9600 baud like a dose of salts through a—er, uh... well, you know what I mean.

For the record, I've modified many different brands, makes, models, and types of both commercial and amateur transceivers for 9600 baud packet radio use, but the RANGR to date appears to be one of the best 9600 baud radios yet. One reason the GE RANGR is so good at passing 9600 baud is that it is part of the same family, but a more recent design, of the GE DELTAs (S, SX, S/SX, etc.) that had the capability to transmit 9600 baud "Voice Guard™."

Having knowledge of this information, I made my point of interest the *voice guard* circuitry of the RANGR to test it for use at 9600 baud DFSK packet. *Eureka!*

It Worked—and Did It Ever!

As we discussed last month, connect the RANGR to the control head and cable it to the dummy load and power source. The tests and mods will require that you have either a 20 amp, 13 volt DC supply for the model 138-B, or a 30

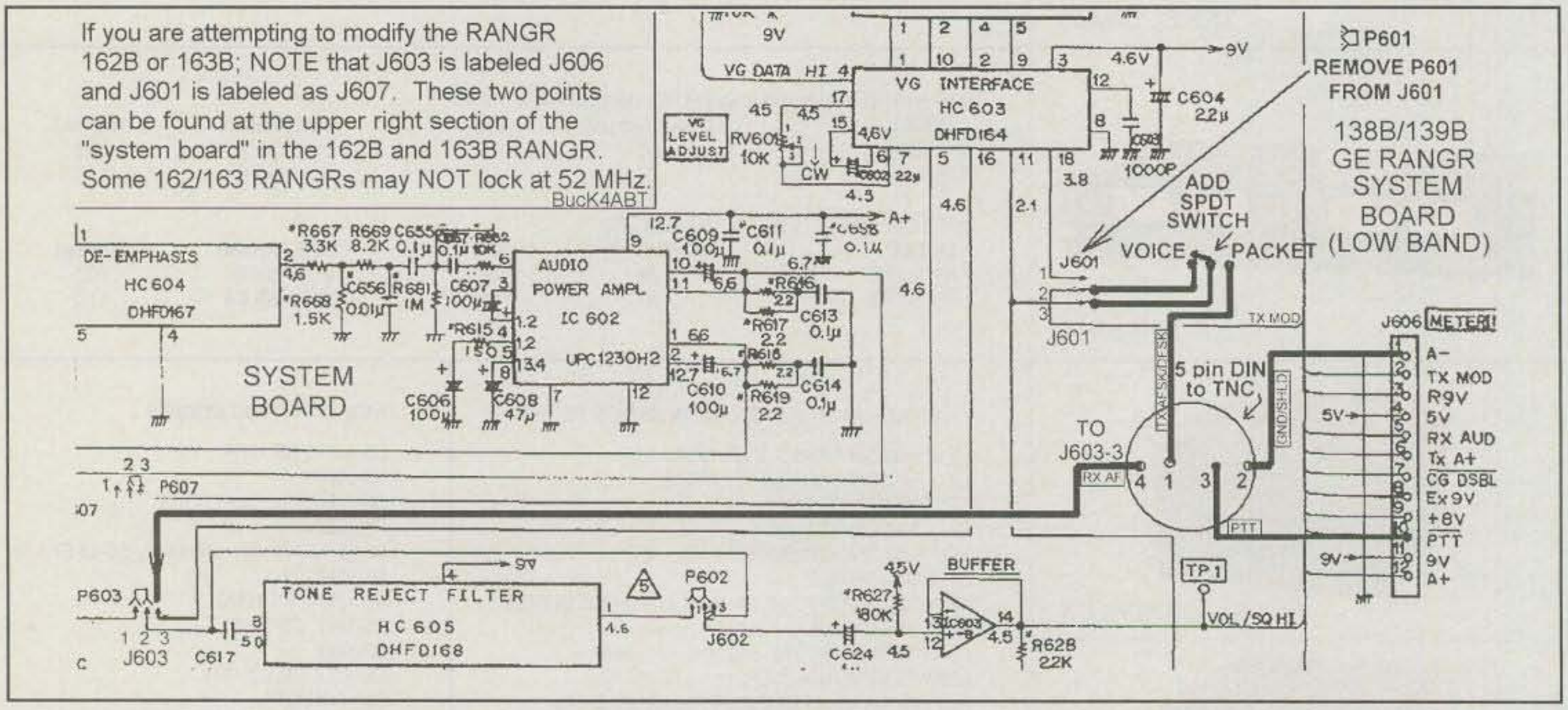


Fig. 1– This drawing is a capture of a small portion of the "system board" drawing. The darker lines are the only points of importance. J601 pins 2 and 3 are routed to the newly installed SPDT switch (see photo L). Pin 3 is attached to the switch center post/wiper, and pin 2 goes to one side of the switch. The remaining switch contact is from the TNC 5-pin DIN (AFSK/DFSK) pin-1 line.

The RF Applications VFD RF Power/VSWR Meter

VHF VERSION now available

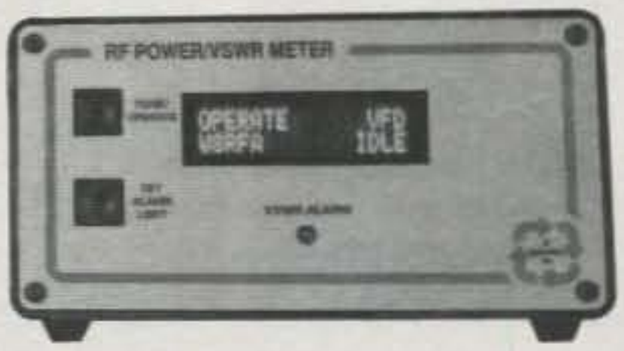
The ONLY Wattmeter for the Serious Operator

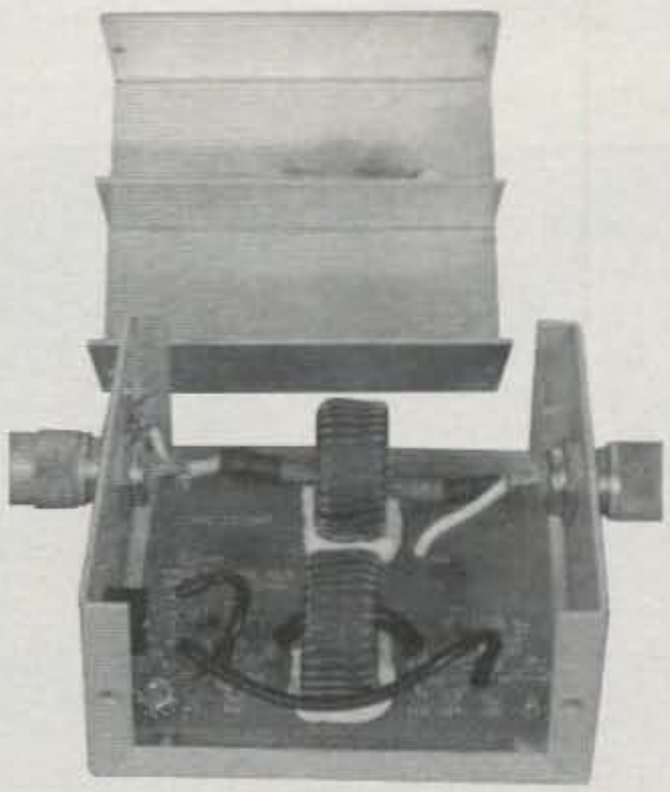
EXCITING NEW TECHNOLOGY

RF Applications, Inc. VFD Series Wattmeters represent breakthroughs in microprocessor, display and software technology. These units feature a 2 line by 16 character vacuum fluorescent display, tuning and operate modes, and a settable VSWR alarm limit. With our VFD External Relay Option, you can use this instrument to interrupt your transmit control circuitry to protect your valuable station equipment in high VSWR conditions (wrong antenna, bad cable, ice, etc.).

We can even *personalize* your wattmeter with your callsign (11 characters maximum). The Vanity Option is supplied as a separate chip (you keep the original), so your VFD can still be used by someone else!

Housed in a compact (5.75" by 3.0" by 2.0") enclosure, the VFD Series Wattmeters offer many features you cannot find anywhere else. The VFD Wattmeters use our "battle proven" remote sensor design being used around the world today. All this at a price you can afford.





ALARM INDICATION

You can set the VFD to tell you if your VSWR has exceeded a preset limit. A bright red LED tells you if you have exceeded 1.5:1, 2.0:1, 2.5:1 or 3.0:1 (the default). If you have installed the optional relay, you can disable your amplifier to prevent damage to your system.

THE BEST SENSOR

The VFD uses our P-3000-D sensor. Insertion loss and VSWR are minimal, and the sensor uses large cores that will not saturate, even above 1.5 kW. Network analyzer plots of the sensor's performance are available on request.

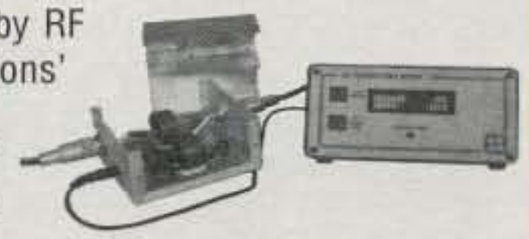
The VFD gives you a real time peak and hold display of your actual power and VSWR *every time you transmit*. This means that you'll always know that your system (exciter, amplifier, feed lines, antennas, etc.) are operating the way you intend them to. Tuning an amplifier has never been easier because the VFD's 65 element bar graph gives you better resolution than a meter. In addition, you can select a quick update for the displayed power (Tune Mode).

IS IT ACCURATE?

The VFD uses sophisticated technology that achieves remarkable accuracy in a low cost package. Compare it with your Bird™ or other accurate meter. You'll be amazed at this unit's performance.

WHAT YOU GET

The VFD is shipped with a display unit, the P-3000-D sensor and a 12 VDC power cable. This product is covered by RF Applications' standard two year warranty.



KEY SPECIFICATIONS

Frequency range:
1.8 to 30 MHz (60 MHz with recalibration)

Power:
5 - 2,955 watts (VSWR accuracy suffers below 20 watts)

Nominal impedance: 50 ohms

Accuracy:
Better than ±10% of the displayed reading

Operating power:
12 VDC at 130 mA average, 200 mA max

Connectors: SO-239 (2)

Signal cable length: 62" (24.4 cm)

Shipping weight: 3 pounds

COST AND OPTIONS

The VFD sells for $249.00, and the following options are available:

Vanity Option ($20.00)—You can special order a replacement chip for your VFD that can contain up to 11 characters of your choosing.

VSWR Alarm Relay Option ($20.00)—This option adds a reed relay output to the VFD that you can use to inhibit a radio or amplifier when your preset VSWR limit is exceeded.

Power Monitor Option ($35.00)—The Power Monitor Option allows your VFD to monitor your transmitted power and gives you relay contacts to let you know that you are applying RF to an antenna.

All options are available factory direct only.

OUR CUSTOMERS SAY

"This one is a keeper. Easy on the amp, and easy on the QRM."

--WX0B

"Best station accessory value since computer logging."

--W3LPL

"Best wattmeter I own."

--W4AN

Founded in 1992, RF Applications has products installed and operating around the world.

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CIRCLE 74 ON READER SERVICE CARD

Photo A– A couple of holes up front for the microphone and TNC I/O cables. Your application may vary if you plan to use a MIC jack instead of hardwiring the mic to the RANGR.

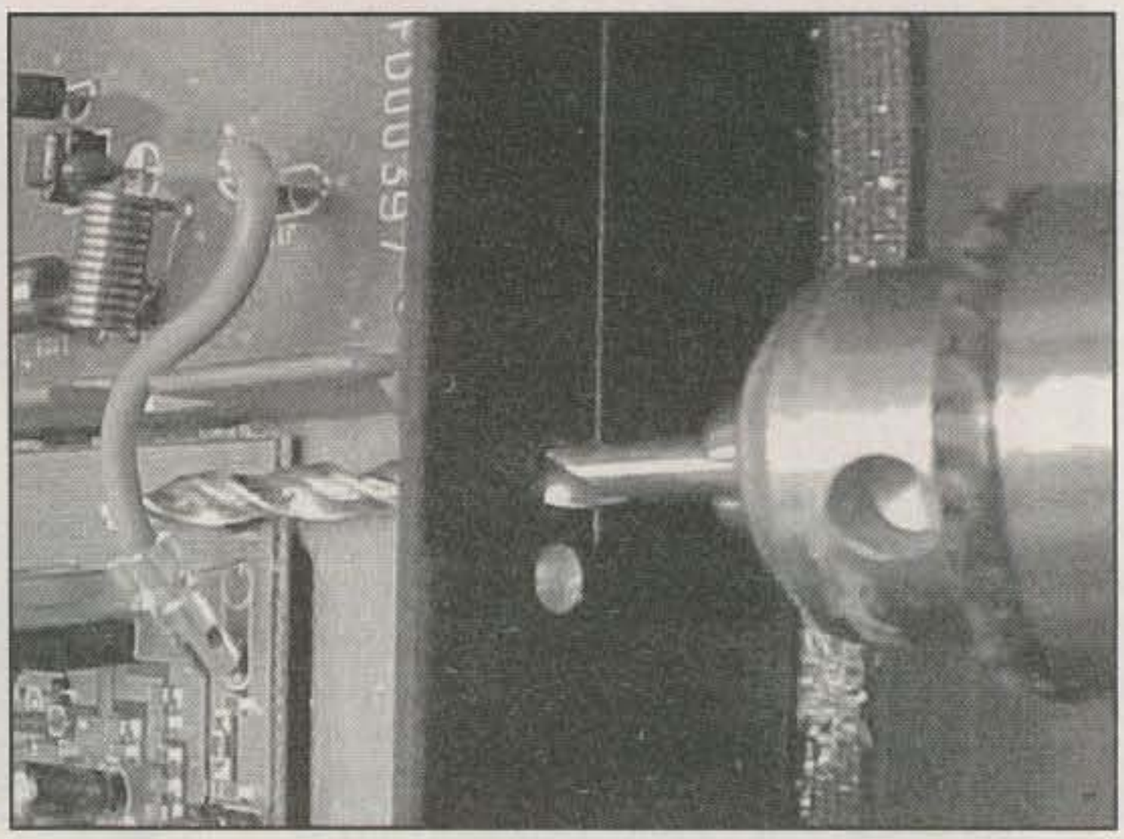

Photo B– For the DC power input to the RANGR we drill two holes at the back apron of the RANGR.

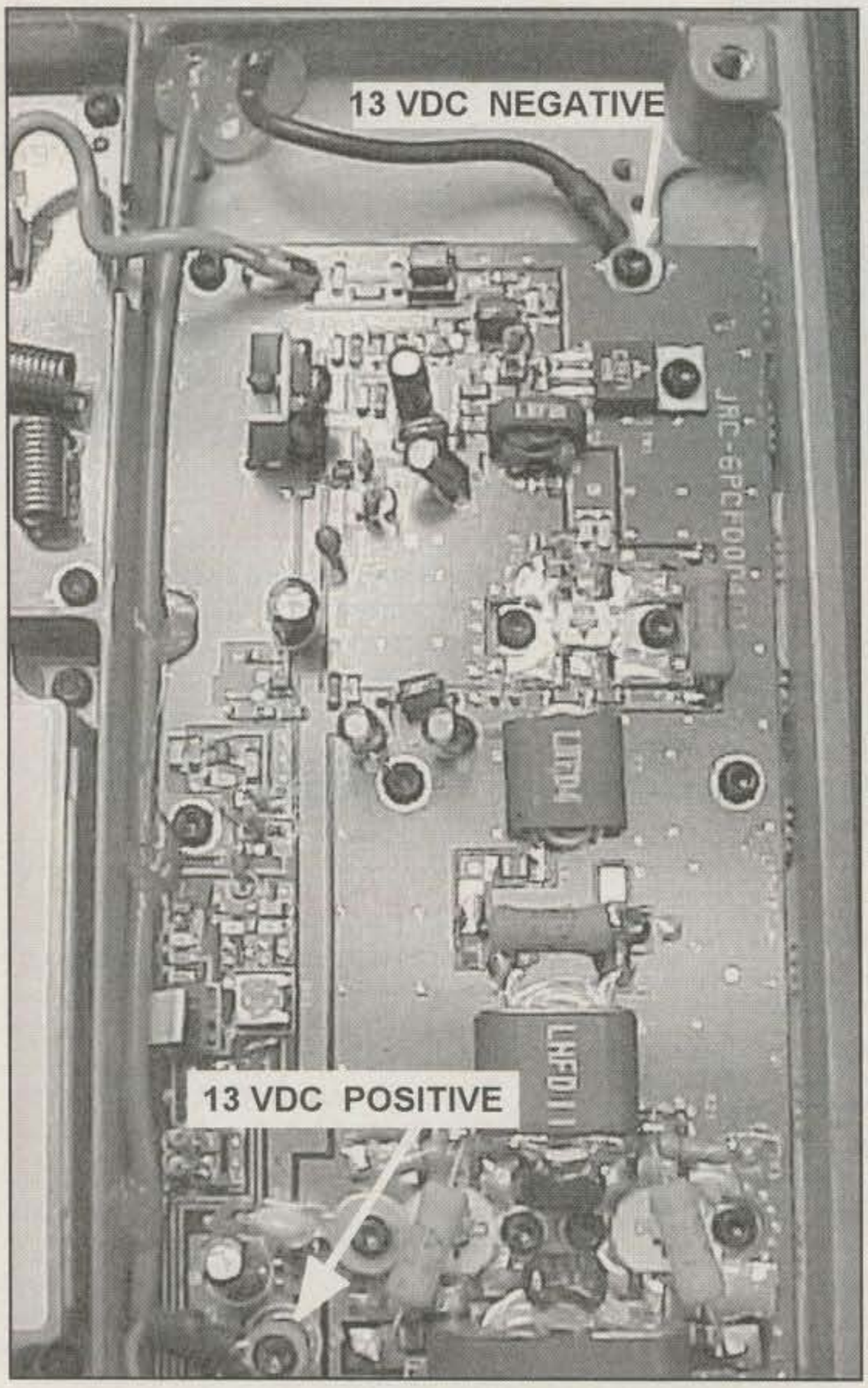

Photo C– This photo should give you an idea of how the DC power leads are routed and the point where the DC negative leads are connected to the casting.

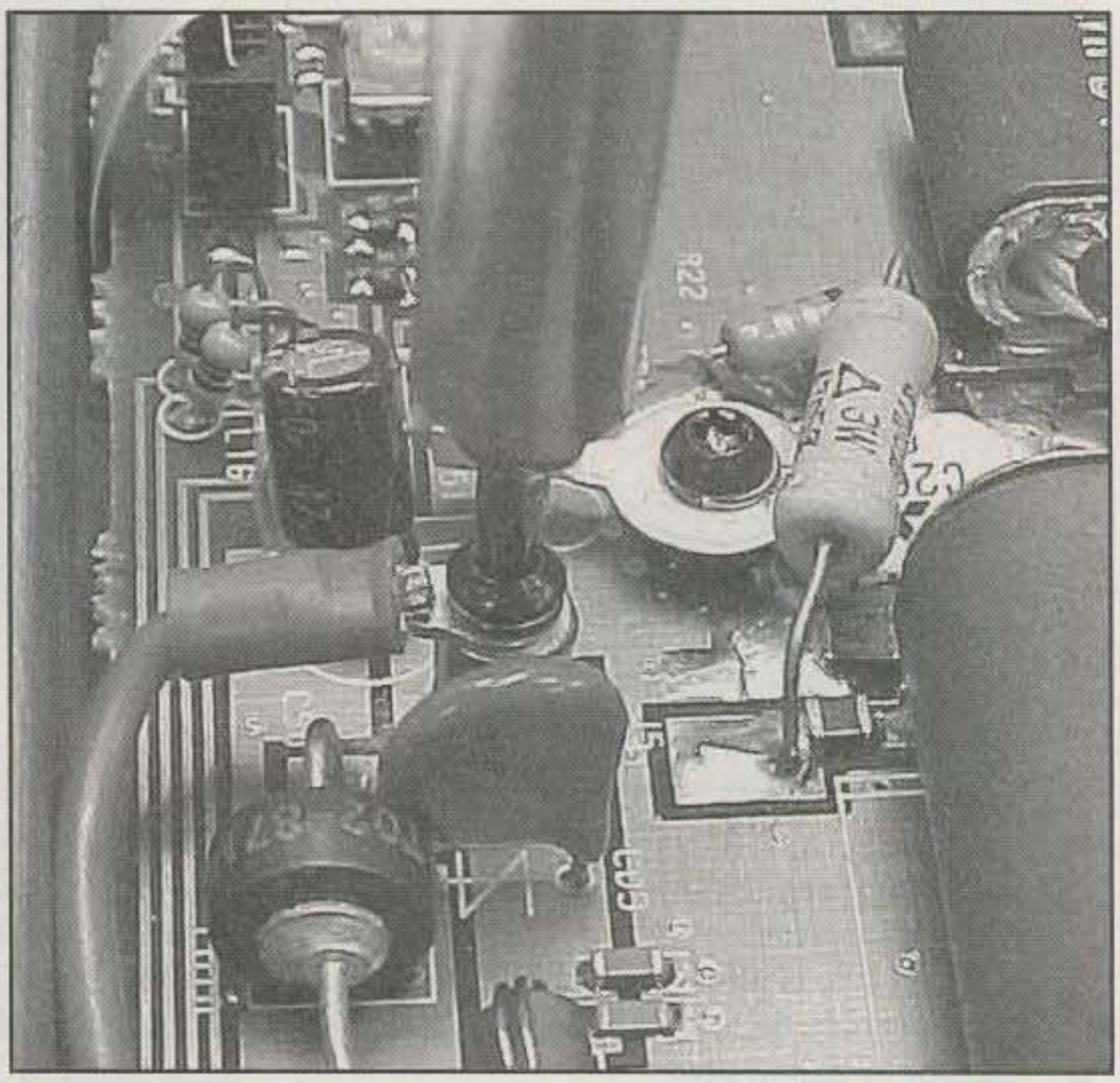

Photo D– This photo provides a better view of how, and where, the positive DC lead is connected.

amp, 13 volt DC supply available for the model 139-B.

Let's have a look at the points where we install the "goes-innance" and the "comes-outtance." Some preparation to the radio must be made before we have microphone, TNC (photo A), and power (photo B) inputs to the RANGR. After the two holes are drilled at the back apron of the RANGR, see photo C for the routing of the DC power wires into the RANGR. Photo D provides a better view of how, and where, the positive DC lead is connected.

The SPDT switch we talked about earlier will enable the switching between voice and packet operation. The SPDT switch will toggle the transmit audio stream between the voice and data audio path at J601 pins 2 and 3.

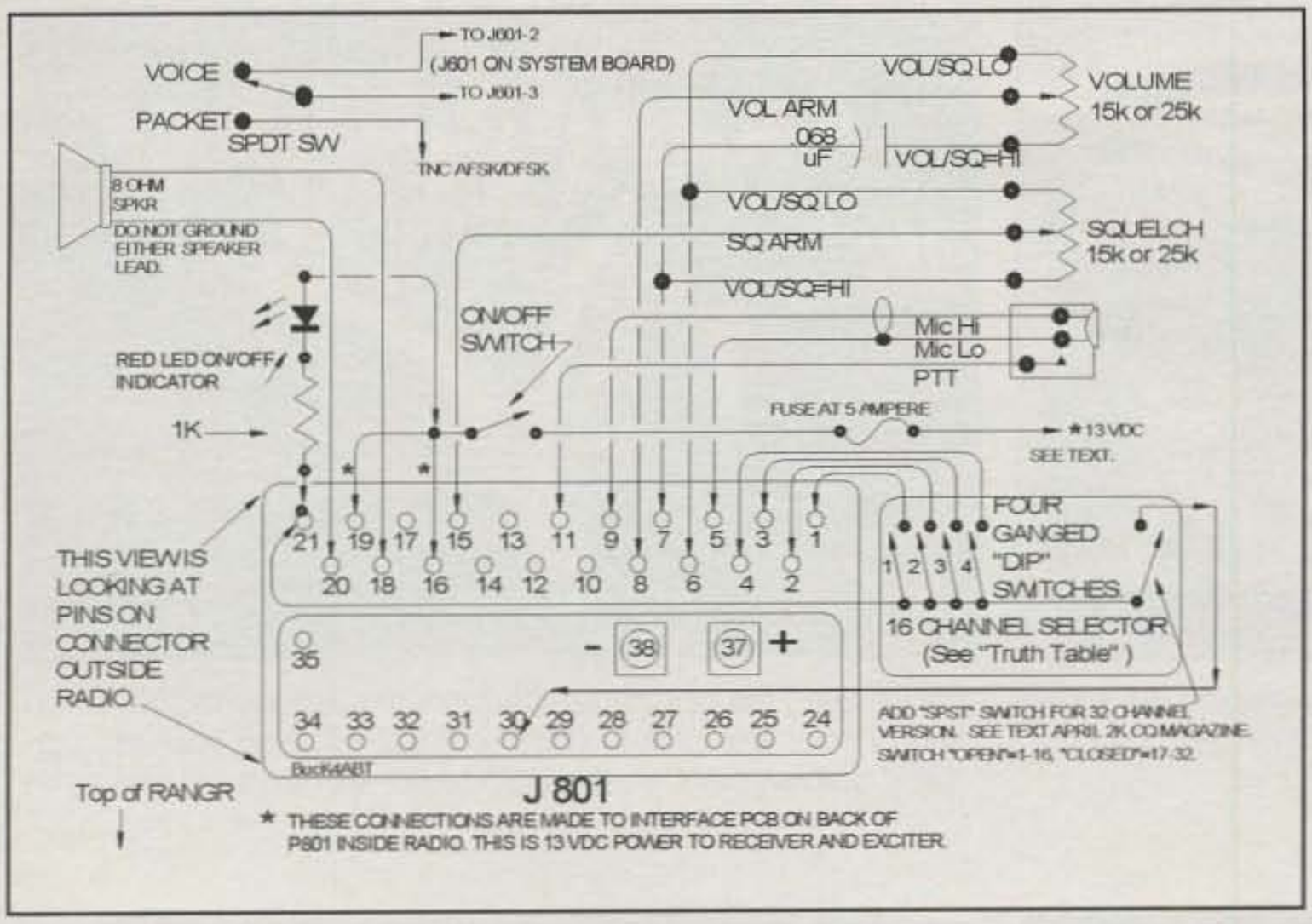

*Fig. 2– Study this drawing carefully, as it will make your task much easier. To get a better feel for the layout and wiring, see photos E and F. This illustrates the connections made to the main connector, J601. This J601 is **not** the same as the "J601" staking pins of strapping options on the "system board," referenced earlier.*

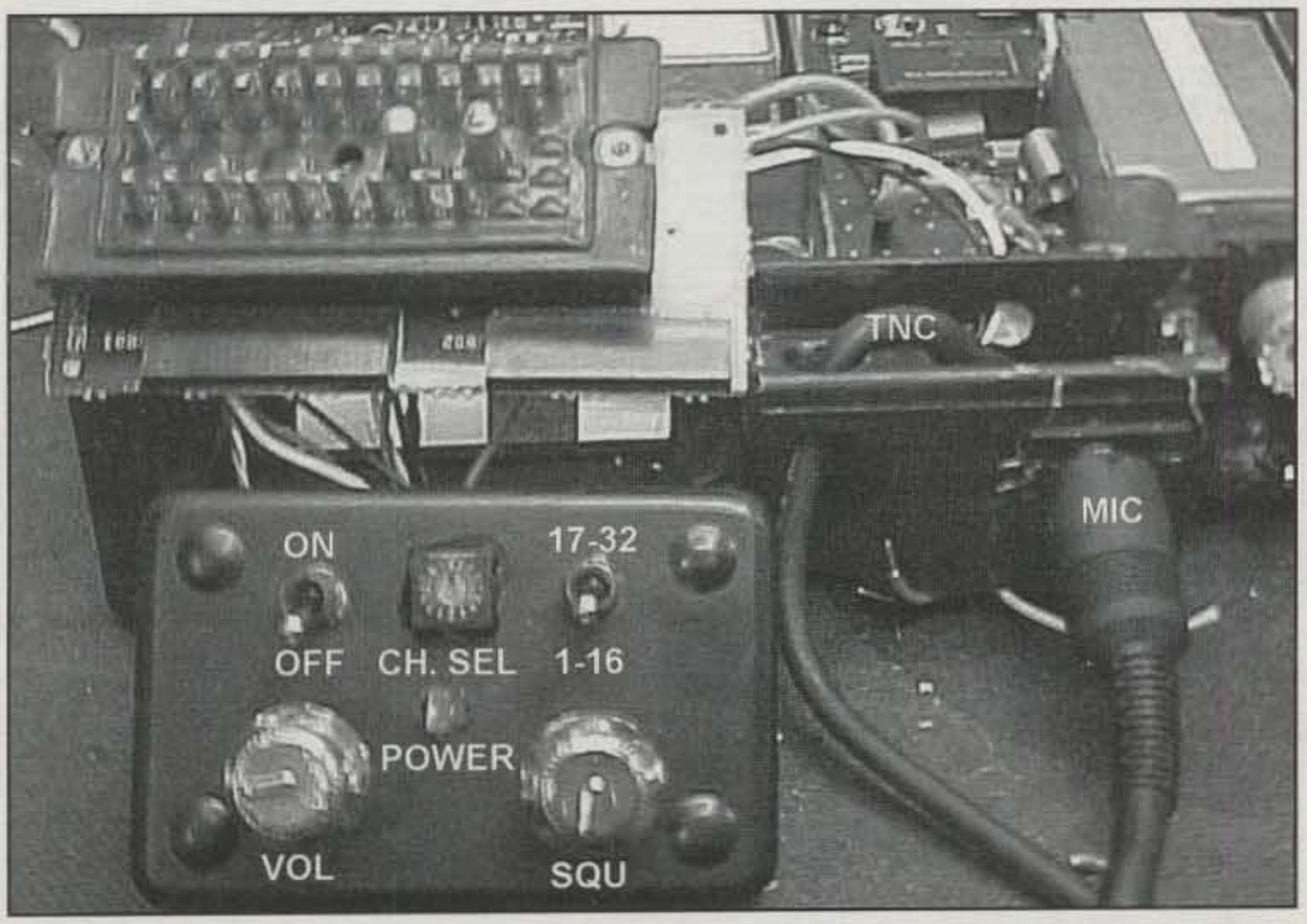

Photo E– This is a view of the condensed *(mini) control head built according to the drawing at fig. 2. The mini-control head is housed in a plastic RadioShack project enclosure, P/N 270-1801.*

Fig. 1 is a capture of a small portion of the "system board" drawing. The darker lines delineate the only points of importance. J601 pins 2 and 3 are routed to the newly installed SPDT switch at photo K. Pin 3 is attached to the switch center post/wiper, and pin 2 goes to one side of the switch. The remaining switch contact is from the TNC 5-pin DIN (AFSK/DFSK) pin-1 line (photo L and fig. 1). If you attempt to modify the 162-B or 163-B for 6 meter operation, the VCO in this model may not lock above 52 MHz. The 162 and 162(B) can be made to work above 52 MHz with addition of several chip caps in the

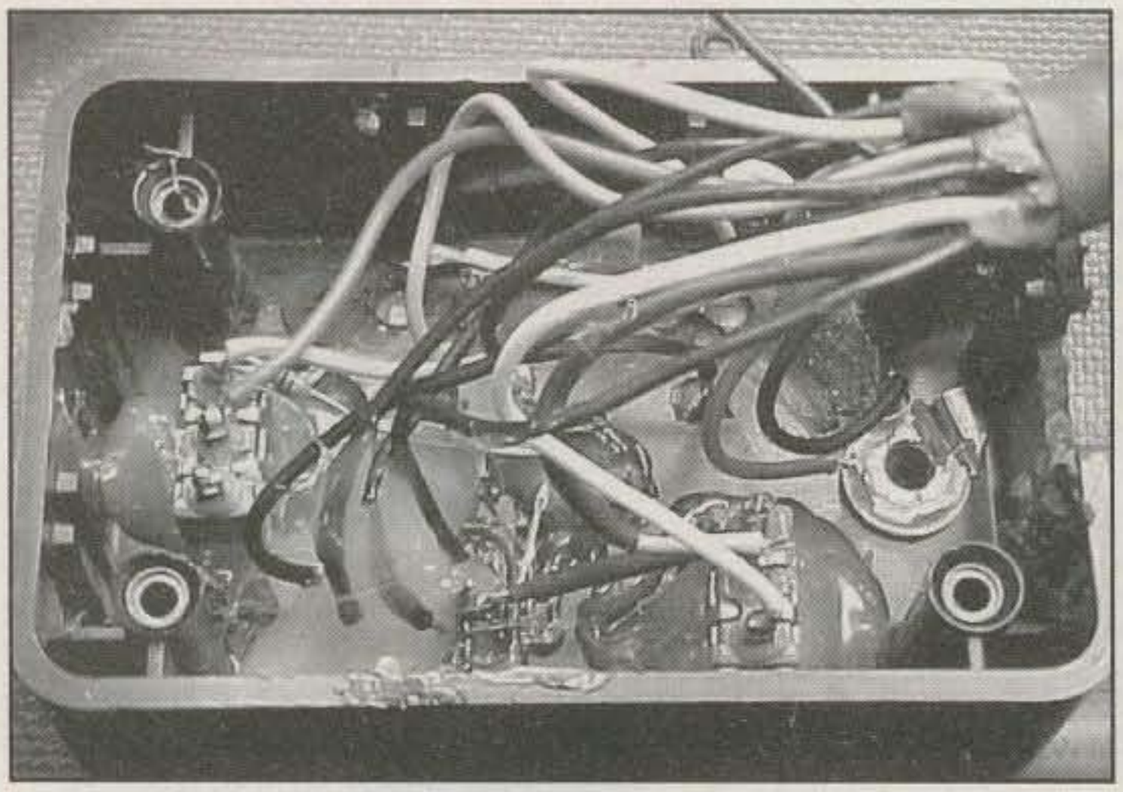

Photo F– This gives a better view of the layout and wiring of the mini-control head for the RANGR.

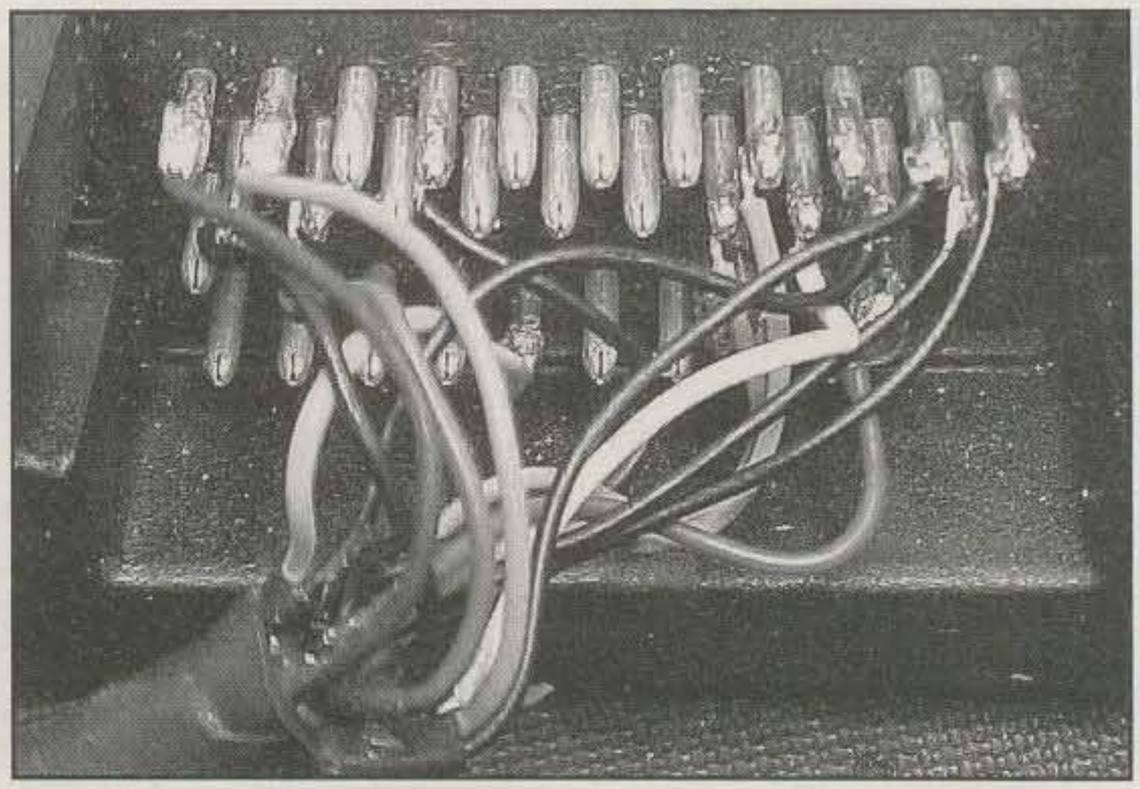

Photo G– This photo details the connections made to the main connector, J601. Careful soldering and you can use "tack" solder joints. A small 35 to 60 watt iron will make the job easy.

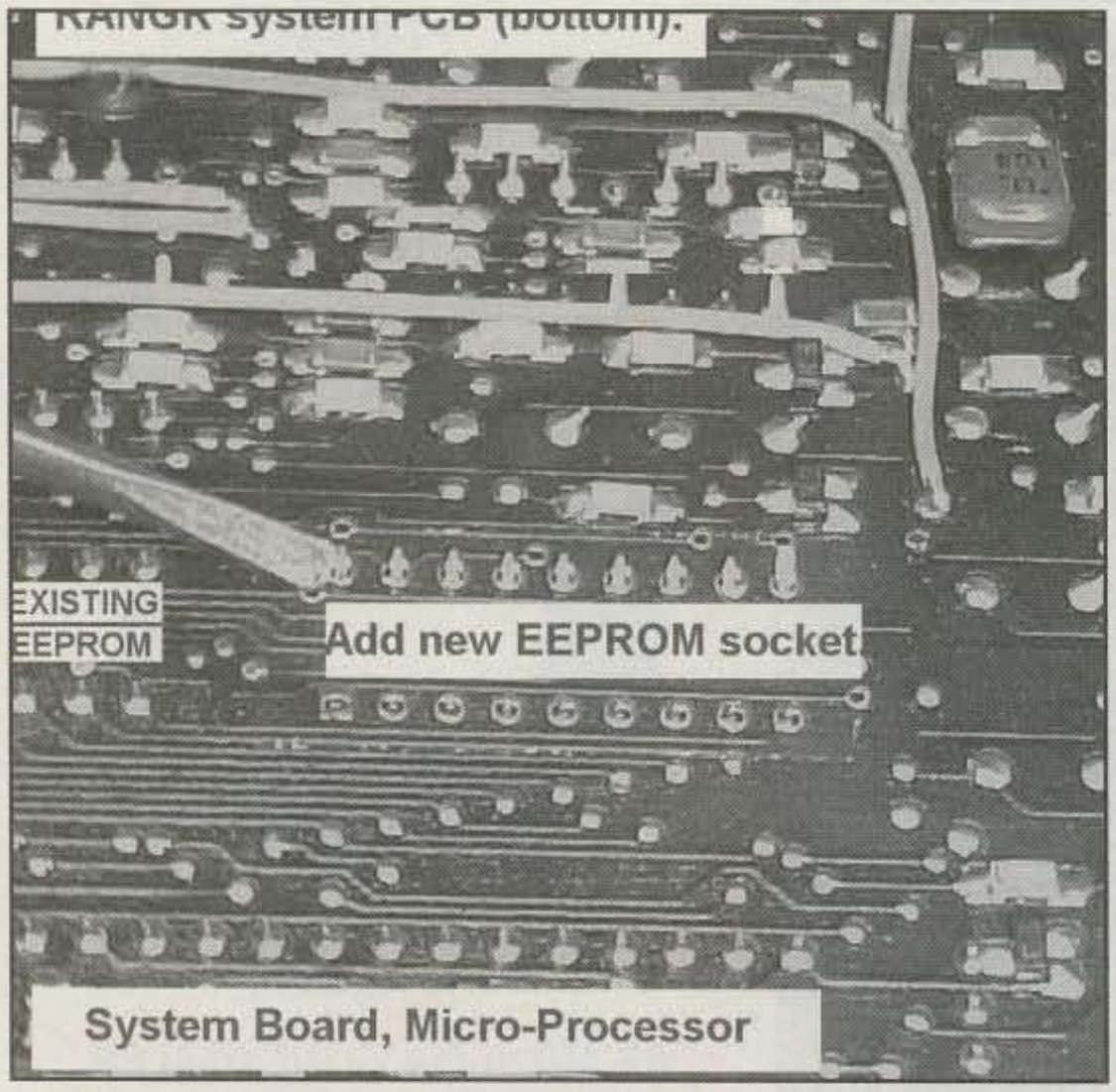

Photo H– Almost all GE/ComNet-Ericsson RANGR radios will have a spare EEPROM socket as shown above.

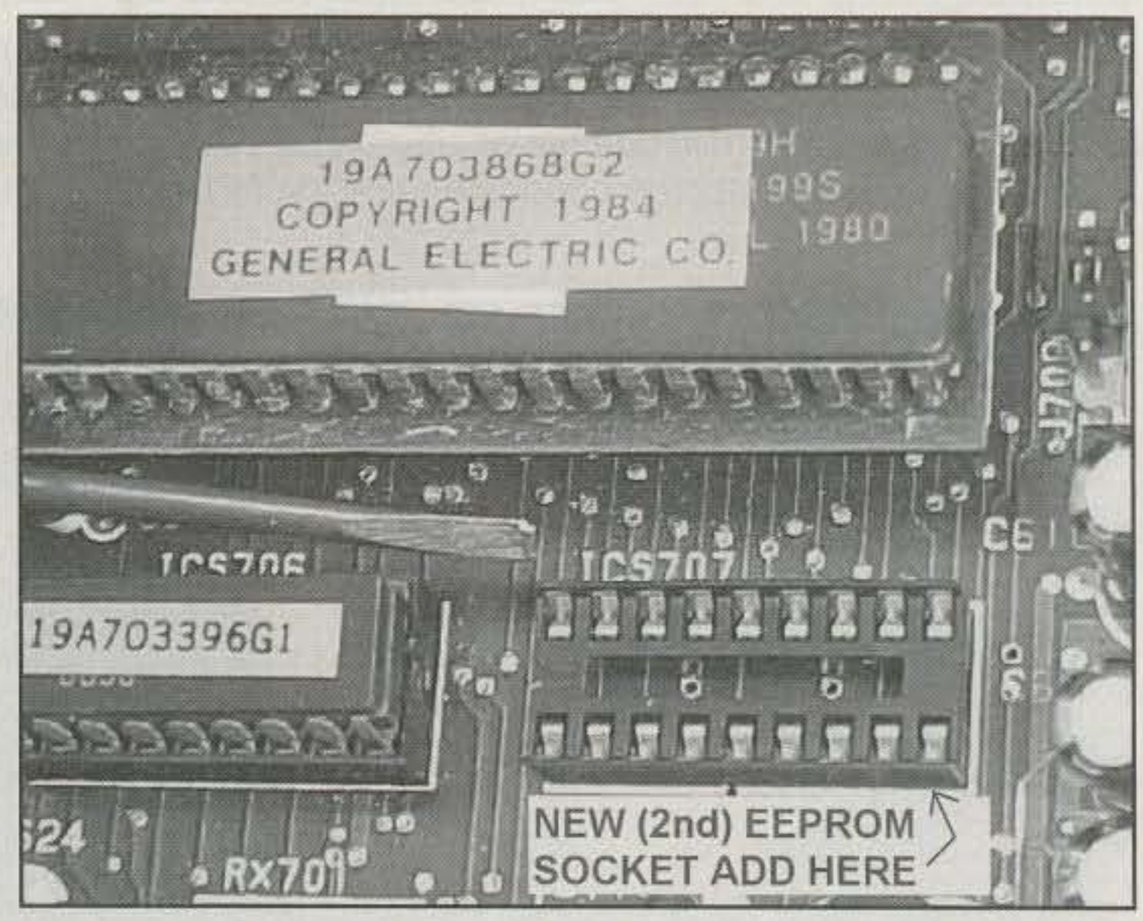

Photo I– By adding another 2212 IC socket (Radio Shack P/N 276-1992) in the "spare" location and popping in another 2212 EEPROM programmed with 16 frequencies (and tones), you'll now have a 32-channel RANGR.

VCO/Exciter section. In the 162-B and 163-B, J603 is labeled as J606 and J601 is labeled as J607.

The only other item to consider for the packet interface is the ground/shield and PTT point. The 12-point test socket at the rear of the "system board" compartment lends itself open for a multitude of uses and applications. I used test point 1 to access the ground (A–) point, and test point 10 for the push-to-talk (PTT) access point.

I know there will be e-mail and snail mail telling me about other points where 9600 baud packet transmit and receive data can be input and output in the RANGR. I am aware of these other related data I/O points. However, I opted to use points that are easy to locate and accessible without destroying the tiny traces on the circuit PC board.

I acknowledge that you may have to run more *AFSK* drive to the RANGR transmit data input than you'll need at 9600 baud *DFSK*. Be that as it may, most TNCs already provide separate 1200 and 9600 baud adjustments. Thus, you should be able to set the AFSK and DFSK inputs to the RANGR separately.

An FYI is due here. The PTT for the TNC (see fig. 1) is separate from the PTT for the microphone (see fig. 2 and photo J). This is not for any techinical reason, but because the mic PTT and connections are on the other side of the RANGR casting (see photo J). I opted to use a PTT point that was nearby for the TNC rather than have a long lead going to the same point were the mic PTT is located.

Study fig. 2 for a few minutes. Although this diagram might appear similar to fig. 1 in last month's column, this drawing is different. It has some added components that will enable more features in your 6 meter RANGR. In this month's draw-

ing alone there is a wealth of information. Study it carefully; it will make your task much easier.

To get a better feel for the layout and wiring, see photos E and F. For a view of the opposite end of the cable from that shown in photo F, see photo G. This photo details the connections I made to the main connector, J601. This J601 is *not* the same as the "J601" staking pins of strapping options on the "system board," referenced earlier.

An Echo from Last Month

If you don't have the control head and cable harness for the RANGR, then take the RANGR to your friendly GE Service Shop and ask them to give it a quick test using their RANGR test set.

Before we get too deep into this project, and while you are testing the RANGR to make sure it is in good working condition, go to the RF PA section and use RV1 to reduce the power level to around 20 to 30 watts. This will make more sense later when you are testing the transmit and setting the transmit VCO.

After you have ensured that your low-band, high-split (138-B) RANGR is working okay, then build the mini-control head as described in fig. 2 (see photo F). Photo E is a view of the *condensed* control head built according to fig. 2. The mini-control head is housed in a plastic RadioShack project enclosure, P/N 270-1801.

The wire size and length is not etched in stone. However, it is good to have an idea of what wire size and type to use for the control-head construction. I used stranded, insulated, and tinned wire similar to #20 or #22 AWG. Okay, so I may have used a few cuts of #24. The length of each wire from J601 to the control head is approximately 6 inches.

TRUTH TABLE

Bits	CH#	Tx MHz	Rx (MHz)	Bits	CH#	Tx MHz	Rx (MHz)
0001	1	52.525	52.525	10001	17		
0010	2			10010	18		
0011	3			10011	19		
0100	4			10100	20		
0101	5			10101	21		
0110	6			10110	22		
0111	7			10111	23		
1000	8			11000	24		
1001	9			11001	25		
1010	10			11010	26		
1011	11			11011	27		
1100	12			11100	28		
1101	13			11101	29		
1110	14			11110	30		
1111	15			11111	31		
0000	16			10000	32		

Table I– The truth table. Note: The bit structure for channels 17 through 32 in the truth table is for reference only. To activate channels 17 through 32, an 18-pin socket is required at the location in photo H and as I designated as "spare." A switched lead (SPST) from pin 30 of J-801 to ground activates channels 17 through 32, thus enabling the channel selector to select additional 16 channels.

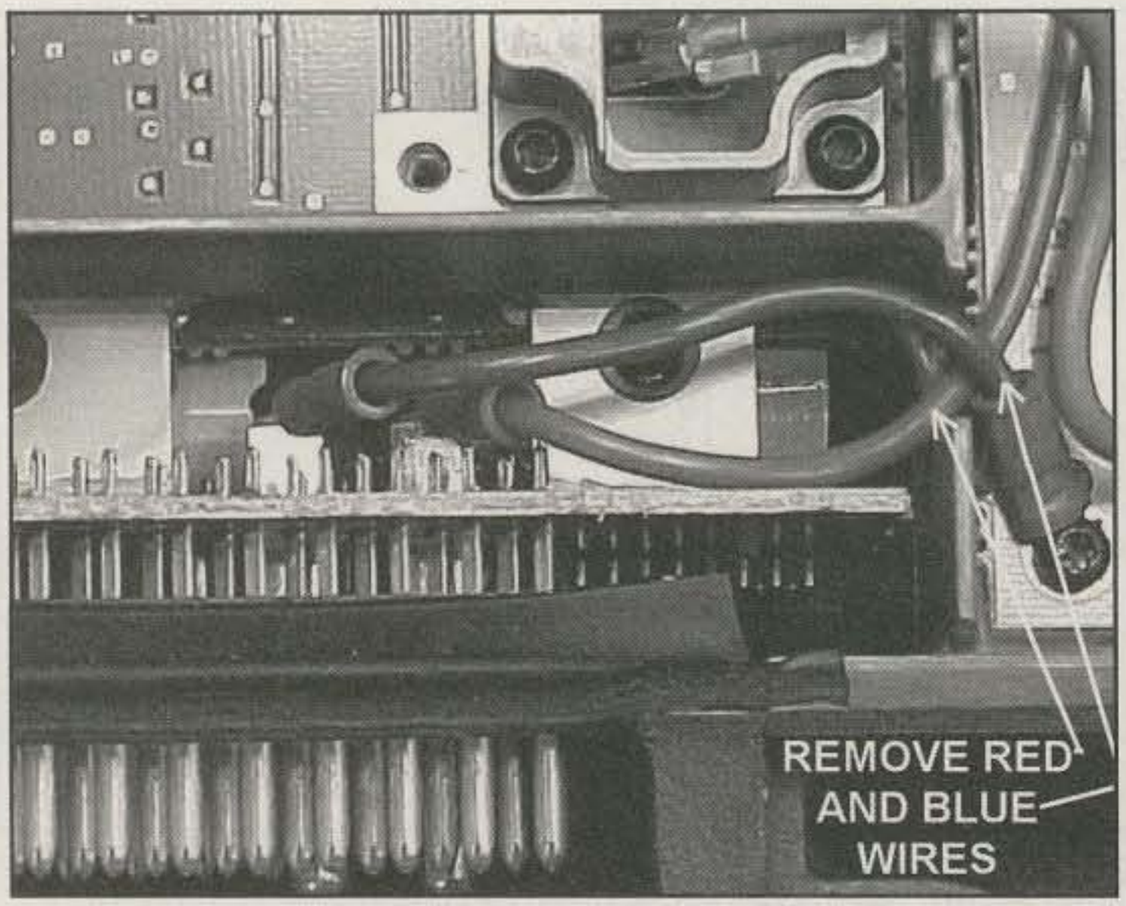

Photo J– The mic and TNC PTT connections are made at two different points (see text). This photo shows where the microphone PTT, Mic Hi, and ground/shield connections are made on the solder side of the J601 main interface PCB.

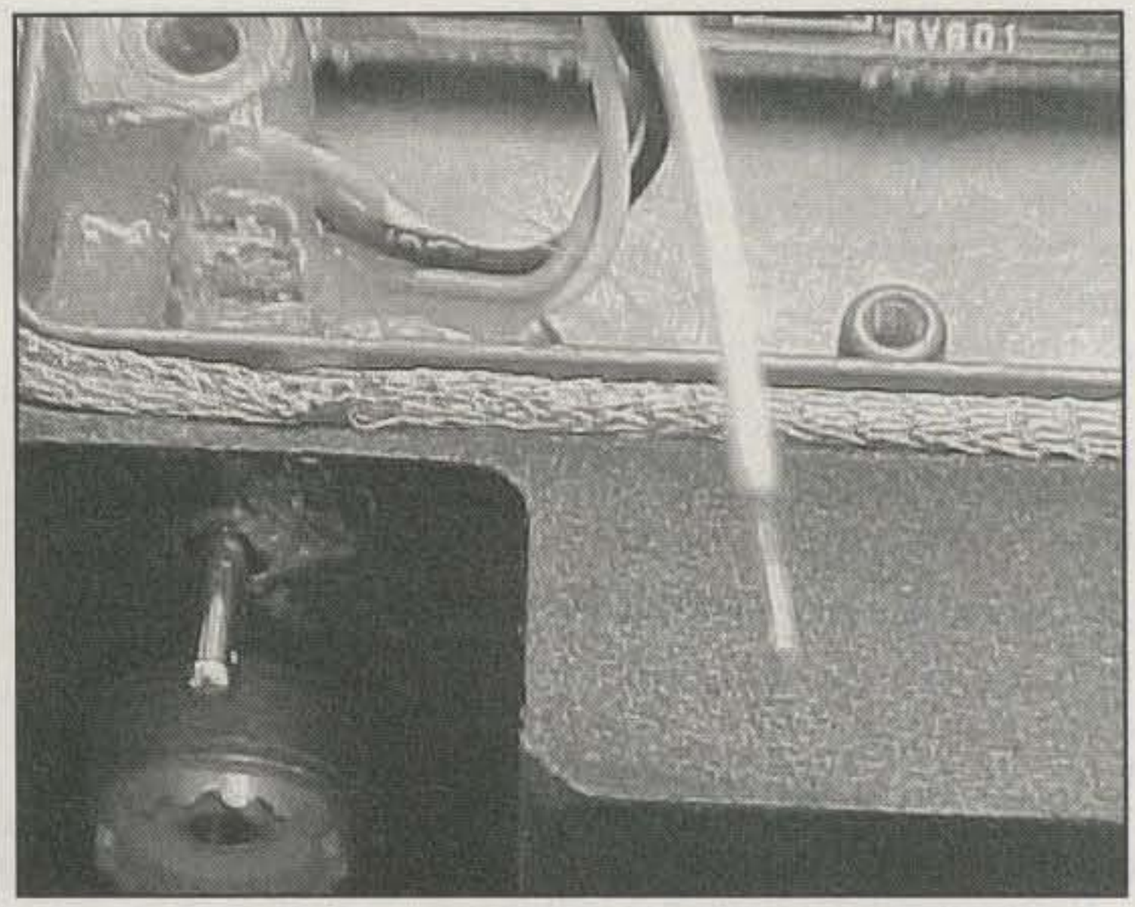

Photo K– This photo provides a good look at how and where the "voice/packet" switch is installed. If the casting is too thick for the SPDT switch, use hot-glue to hole the switch in place after all connections are made.

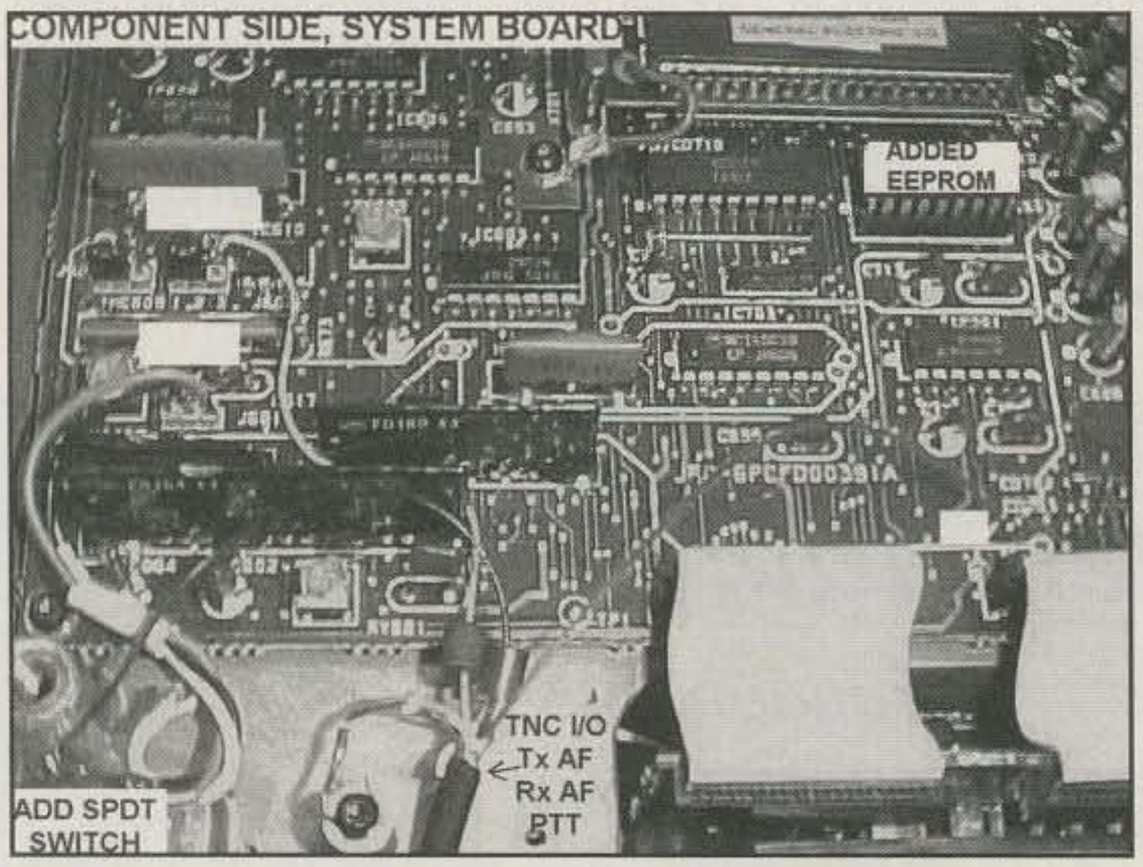

Photo L– J601 pins 2 and 3 are routed to the newly installed SPDT shown here. Pin 3 is attached to the switch center post/wiper, and pin 2 goes to one side of the switch.

Four inches will make for a tight fit and some difficulties when soldering to J601 (photo G).

To make all the mini-control-head connections easy, I *pre-solder-tinned* all the pins of J-801 that were to be used, and I pre-tinned all the wire leads. In every case I only cleared about 1/16 to 1/8 inch insulation from each wire. Make all the connections to the mini-control head first. Double check all connections and ensure that each connection follows the drawing when the interface is complete.

Bit-Bucket Construction

Configuration of the 2212 EEPROMs is next. The only difference in this month's EEPROM and last month's "Bit-Bucket" setup is the addition of a second 18-pin DIP socket at IC**S**-707 (see photos H and I), the "S" meaning "System Board."

Please note: This next section applies only after you have programmed the RANGR, or had the 2212 EEPROM programmed by someone. Many of us use the GE suitcase programmer, and others use the GE TQ-3330 programmer. Many ComNET-Ericsson (GE) two-way service shops will have the latter and will program the 16 channels into the 2212 EEPROM for a small fee.

Important note: It is well known that when configuring the frequency list into the RANGR and DELTA EEPROM (2212), the <ENTER> key will cause the programmer to display "OUT OF RANGE." When using the suitcase programmer, use the "INSERT" key.

When using the TQ-3330 RANGR and DELTA PC programmer, then use a "Ctrl-E" instead of the <ENTER> key. This technique will force the programmer to allow the entry of amateur band frequencies.

Pop the Lock

For those who didn't read last month's "Packet User's Notebook," go back and look at the section/paragraph that reads "Enter the Can Opener." As soon as you get the Torx screws out of the top and bottom covers of the RANGR, remove the lock as described in that column.

Repeat Performance, Or Rehearsal

If you are referring to some of the information from last month's column, or LBI-31619-D, or the synthesizer maintenance manual, you'll find this phrase somewhere in the text: "The synthesizer is factory aligned and should not require further adjustment."

The next phrase applies more appropriately to our modification or when we attempt to move the low-band, high-split outside the frequency(s) for which it was intended. Read on: "Should it become necessary to adjust the synthesizer please refer to the Maintenance Manual LBI-31714 and the

Photo M– The finished product is now a 32-channel/frequency, 6 meter transceiver capable of operating FM voice, 1200 baud AFSK, and 9600 baud DFSK packet. If you wish to acquire some of the hard-to-find parts and components for these mods, on the internet check <www.PacketRadio.com/parts.html>.

'Frequency Synthesizer' section." This will familiarize you with the operation of the VCOs and make the alignment procedure more understandable.

To Tell the Truth

I'm including the same truth table in this month's column as we had last month. This month Table I is more applicable, simply because this month we are adding the additional 2212 EEPROM and socket for 32-channel operation.

Note also that I am using a 16-position HEX switch in this month's mod instead of the 4-position DIP switch set. Any 4- or 6-position DIP switch, or hexadecimal rotary switch, will suffice. The switching arrangement must be "REAL," not "complementary." The 16- position HEX switch I use is alphanumeric labeled 0 through 9, and A through F, for a total of 16 detent positions. The switch has a small arrow slot that accommodates a small screwdriver for channel selection.

If you have internet capabilities and would like a macro view of the switch I use, go to <www.PacketRadio.com/parts.html> and view the first item at the top of the page.

A Brief Recap

Most GE/ComNet-Ericsson RANGR radios will have a spare EEPROM socket as shown in photo H. By adding another 2212 IC socket (RadioShack P/N 276-1992) in the "spare" location and popping in another 2212 EEPROM programmed with 16 frequencies (and tones), you'll now have a 32-channel RANGR. The second bank of 16 is achieved by switching pin 30 of J801 to ground (see fig. 2). Use a SPDT switch mounted on the mini-control head (see photo E).

Photo M is the finished product. The speaker shown is similar to MFJ model MFJ-281 and comes with a 3.5 mm plug already installed. The speaker jack that is mounted in the mini-control head is a two-conductor, 1/8 inch (3.5 mm), miniphone jack (open-circuit type), Radio Shack, P/N 274-251C.

Parts Source for the Mods

If you're interested in acquiring the parts and components for these mods without having to chase all over the country to find them, on the internet go to <www.PacketRadio.com/parts.html>.

Credits

ComNet-Ericsson, *Field Services*
Ben Jones, KB4MPX, ComNet-Ericsson (TAC)
Pete Lascell, W4WWQ, ComNet-Ericsson (TAC)
Bill Glahn, AD4YY, New London Technologies
Robert Woods, K4OFQ, New London Technologies

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Beginner's Corner

BY PETER O'DELL, WB2D

For the Newcomer to Ham Radio

Making Single Sideband (SSB) Contacts

Are you new to HF? Coming from VHF/UHF FM? Well, "This ain't your Grandma's radio." Those of you who are new to HF may be in for a few surprises as you move over to HF SSB (single sideband) operation. With an FM communications circuit, the other operator often sounds like he is present in the room with you. Operation is channelized: Everyone in a QSO is on the same frequency unless someone has a transmitter problem. Weak signals drop out quickly when you reach the fringe area. Then there is the capture effect: When two or more stations transmit at the same time, the strongest station completely captures the receiver. Unless two signals appear that are within a few percentage points of being equal in strength, the weaker signal simply "disappears."

With SSB it is a different story, however. There are no channels, and in crowded conditions operators frequently squeeze in between existing conversations. Tuning in a particular frequency is an analog operation; well, it used to be. Now virtually all the radios on the market employ digital VFOs, but the steps are so small that they have the "feel" and appearance of analog VFOs, and there can be slight discrepancies between the exact transmit and receive frequencies on a given transceiver. Weak signals fade out slowly in fringe areas. Plus, there is no capture effect.

Suppose you are trying to listen to station X on a particular frequency, and suppose that station Y is on the same frequency. When station Y has only one percent (1%) of the received signal strength of station X, it will still cause noticeable interference to station X. Because you are dealing with propagation over vast distances, it is common for a band to be open to more than one distant area at a time. Thus, station Y may not even know station X is transmitting. All this adds up to a very different experience than FM operation.

Rules of the Road

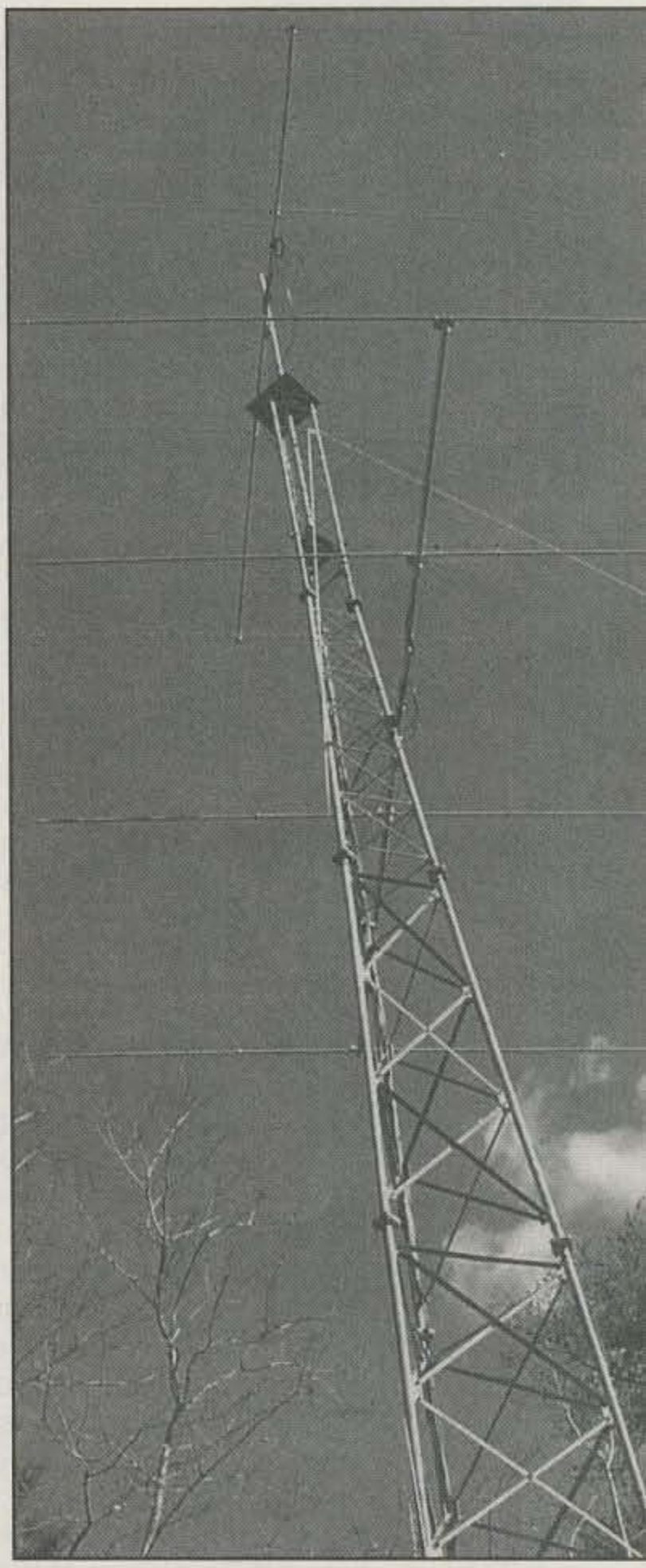
So what does all this mean? It means that the rules of the road are very different—not the FCC rules, but commonly accepted definitions of what is and isn't courteous operation. It takes a different set of "ears," too. Understand ahead of time that you are not going to have an FM "clear channel" kind of operation unless the band is dead and you are just chit-chatting with your buddy on the other side of town. When things are crowded, other stations are going to "squeeze" in; they have just as much right to be there as you do. Therefore, you are going to experience some degree of interference almost every time you get on the air. Just learn to accept it and live with it.

Before you go off the deep end and figure that I have just given you license to waltz across the bands without concern for interfering with other stations, think again. These are all the more reasons to be courteous and considerate of the other operator. They also are very strong reasons to act in a mature fashion when you are on the receiving end of a bit of unintentional interference. Unfortunately, the FCC/VECs have not come up with a pool of questions that test maturity, common decency, and such. Sure, we have Riley riding range, but most of his efforts are aimed at the bad apples, not wet-behind-the-ears "lids" (poor operators).

Your First Contact

First of all, you need to know which band segments are available to you, depending on your license class. So far this is not something that the FCC has seen fit to change in its continuing de-emphasis of CW. While it may change in the future, for now the frequencies in Table I are the segments where phone operation is permitted. Also, note that on 7 MHz and lower frequencies, LSB (lower sideband) is normally used. On 14 MHz and up, USB (upper sideband) is commonly used. It is not illegal to use the other sideband, but you certainly won't make friends or contacts if you decide to make a stand for rugged individualism on this particular issue.

Several years ago I was using a friend's station that was outfitted with the Collins twins (separate transmitter and receiver). I had used a *transceiver* in my own station for some time. Tuning around 15, I came across a Jordanian station that I wanted to work. I quickly tuned up the rig and amplifier, and swung the four-element quad around in his direction. I called and called, but he always went back to some other station. Maybe I couldn't get through on the first call, but I darned well should have worked him in less than the 45 minutes or so that I kept calling. Finally, he complained about a loud interfering signal, and another station popped in with the



Get on HF and you might work Quintin, ZS6IY. He shares this station with his father, Gary, ZS6YI.

*123 NW 13th Street, Suite 313, Boca Raton, FL 33432
e-mail: <wb2d@cq-amateur-radio.com>

comment, "Oh, that's some moron on the wrong sideband." A quick glance at the transmitter control panel told me that although I was listening to USB through the receiver, I was transmitting LSB. I was too embarrassed to admit that I was the idiot, so I shut the rig off and went upstairs and watched the football game with my friend. Well, that sort of thing "can't" happen with a transceiver (at least, none that I've used). However, the point is to use the conventional sideband or be regarded as an idiot. Not a good thing.

Band	General Class Voice Freqs. (commonly-used sideband)
160 m	1800–2000 kHz (LSB)
80/75 m	3850–4000 kHz (LSB)
40 m	7225–7300 kHz (LSB)
30 m	None (CW and data only)
20 m	14,225–14,350 kHz (USB)
17 m	18,110–18,168 kHz (USB)
15 m	21,300–21,450 kHz (USB)
12 m	24,930–24,990 kHz (USB)
10 m	28,300–29,700 kHz (USB)

Table I– General Class voice frequencies on MF/HF amateur bands.

Keeping Legal

To stay legal you have to keep *all* of your signal inside your permitted band segment. You can figure that an SSB signal is about 3 kHz wide. Suppose you are on 20 meters, and you want to operate close to the top of the band. What is the upper limit of the digital readout on your rig where you can be sure that you are perfectly legal? Since the band edge is 14,350 kHz (14.350 MHz), the absolute closest you would want to be is 14,347 kHz—*if* you are *absolutely* sure that your digital readout is 100% accurate, and *if* you are sure that your signal is less than 3 kHz wide. Why push it? Give your station a little slack and back off another kHz or two.

Modern rigs with antenna tuners and such make it easy to jump from one band to another—maybe too easy. Recently, I was attempting to keep a schedule with a friend on the West Coast (a General). We had agreed to meet in the upper portion of 15 meters. I could just barely make out his signal, so I suggested we try 20. I flipped the bandswitch to 20 and started to call him. No response. I called again. My friend didn't come back, but there was a female voice (an angel, perhaps?) that simply said, "You are out of band." A quick glance at the digital readout confirmed that when I switched bands, I had come up on 14.385. Guess Riley was at the coffee machine just then, since I did not hear from the Friendly Candy Company about my indiscretion. It is a good thing to pause for a second and go over your settings and frequency before you start transmitting. Also, if you have RIT engaged, your transmit frequency is going to be different than your receive frequency. Turn RIT off before you start transmitting.

What is RIT? *Receiver Incremental Tuning.* With an SSB receiver, shifting the frequency slightly changes the pitch of the received signal. Sometimes someone's voice just sounds better when you adjust the pitch slightly. Before RIT was common, you would frequently find a QSO in progress where both operators adjusted their frequency slightly each time the other started talking. Sometimes they would "walk" several kHz in the course of a 10-minute

WORLD RADIO TEAM CHAMPIONSHIP WRTC-2000
Call for Contributions

The WRTC-2000 will be held in the city of Bled, Slovenia from July 5 to July 11, 2000. Amateurs worldwide are invited to come to Slovenia to experience an adventure of a lifetime. Previous WRTC events (1990 and 1996) brought together hundreds of amateurs and their families. It is expected that WRTC-2000 will attract close to a 1000 contesters from all over the world.

Whether you can attend WRTC-2000 or not, your financial contribution will help assist the funding of this great contesting event. Carl Cook, AI6V (P49V), has been asked by the Slovenian Contest Club to solicit contributions and act as WRTC-2000 Treasurer/Non-Europe. A donation in excess of $250 may be submitted via a direct contribution to the: Northern California DX Foundation, a non-profit organization, and addressed to: Bruce Butler, W6OSP, 4220 Chardonnay Ct., Napa, CA 94513 USA. Contributions under $250 should be sent to: Carl Cook, AI6V/P49V, 2191 Empire Ave., Brentwood, CA 94513 USA. A contribution of any magnitude will be greatly appreciated.

If you would like to contact the fund-raising drive, please send an e-mail to: <ai6v@aol.com>. For more information on WRTC-2000, point your browser at <http://wrtc2000.bit.si>. Thank you for your support.

73, Carl Cook, AI6V/P49V

ITU Recommended Phonetics

A	Alfa (**AL** FAH)
B	Bravo (**BRAH** VOH)
C	Charlie (**CHAR** LEE or **SHAR** LEE)
D	Delta (**DELL** TAH
E	Echo (**ECK** OH)
F	Foxtrot (**FOKS** TROT)
G	Golf (**GOLF**)
H	Hotel (HOH **TELL**)
I	India (**IN** DEE AH)
J	Juliett (**JEW** LEE ETT)
K	Kilo (**KEY** LOH)
L	Lima (**LEE** MAH)
M	Mike (**MIKE**)
N	November (NO **VEM** BER)
0	Oscar (**OSS** CAR)
P	Papa (PAH **PAH**)
Q	Quebec (KEH **BECK**)
R	Romeo (**ROW** ME OH)
S	Sierra (SEE **AIR** RAH)
T	Tango (**TANG** GO)
U	Uniform (**YOU** NEEFORM or **OO** NEE FORM)
V	Victor (**VIK** TAR)
W	Whiskey (**WISS** KEY)
X	X-Ray (**ECKS** RAY)
Y	Yankee (**YANG** KEY)
Z	Zulu (**ZOO** LOO)

Note: The bold syllables are emphasized.

Table II– Standard phonetic alphabet recommended by the International Telecommunications Union (ITU). While it's okay to use other standards (e.g., Able, Baker, Charlie, Dog...), it's best to avoid using "cutesy" phonetics on SSB. Remember, the goal is to make yourself clearly understood.

QSO. With RIT, once you establish contact, leave your main dial alone. Turn on RIT, and use it to fine-tune the pitch of the other signal.

Make Yourself Perfectly Clear

One of the points of making a contact is to exchange information accurately. Under weak-signal and crowded conditions that can be difficult. Also, if you work any DX at all, you are sure to work someone who speaks little or no English. Unless you happen to speak his language, rest assured that you are not going to ragchew. However, that does not preclude you from making a legitimate contact (and getting a QSL to prove it, too). One habit that enhances your ability to complete these contacts (and to communicate clearly under difficult band conditions) is to use standard phonetics. See the chart (Table II) of ITU recommended phonetics. Copy this chart and keep it handy until all 26 become automatic.

Some hams get a kick out of "cutesy" phonetics for their callsigns. Save the "Fuzzy Wuzzy Wabbit" for club meetings and such. I actually heard a guy using that phonetic one time. I couldn't figure out if it was "W" for wabbit or "R" for rabbit. When I went back and asked him which it was, he became angry and shouted "Wabbit, Wabbit, Wabbit" into the mic. I still don't know if the guy had a speech impediment or was just weird. Another time I was working a contest and had been up for 48 hours or so. I was attempting to work a Swedish station, but I kept missing his callsign because he was using "Europe" which my fuzzy brain instantly translated to "U"; it is a different experience to hear this rather than look at it on paper. Finally, I wrote out the word "Europe" on my scratch pad. Obviously, the misunderstood element of the callsign was an "E." However, I had wasted a couple of minutes of a really good opening because some lunatic wanted to be patriotic to his continent or whatever. Use the standard phonetics. It is a good thing.

There is a tendency to get nervous when doing something new. Sometimes, too, even if you are not nervous your mind just goes blank—at least mine does. Early on I found an easy way out of this potential embarrassment on the air. I made up "cheat sheets" with all the essential information and appropriate phonetics written out and kept them at my operating position. Hey, this is radio, so no one sees the notes you have in front of you. I had a set of large index cards with things like "Peter—Papa Echo Tango Echo Romeo." Okay, so I will probably never be invited to join Mensa. It still works, and it does not cost you a penny. That is a good thing.

Next time we will continue our tour through the world of SSB with a look at some of the common operating practices as well as some of the typical features of an SSB transceiver.

73, Pete, WB2D

Call for Photos and Stories

We'd like to hear from you about your experiences as a newcomer. If you have questions, we'll try to incorporate them into future columns. If you have photos (color prints or slides okay) of your station or antennas, please send them along and we'll publish the best ones. If you have a solution to a common problem that new hams experience, we'd like to hear about it so we can pass it along. You can contact me at <wb2d@cq-amateur-radio.com> or Peter O'Dell, WB2D, Beginner's Corner, 123 NW 13th St., Suite 313, Boca Raton, FL 33432.

Amateur Television

BY ED MANUEL, N5EM

All About Ham TV

You Light Up My . . . Screen

This month we welcome Ron Sparks, KC5ODM, as a guest columnist to educate us on a vital aspect of ATV (and other elements of life)—proper lighting.*
—N5EM

Light is pretty simple. It's either bright or dim, right? Well, that may be good enough for you to keep from tripping over the piano bench on the way to answer the phone in the middle of the night, but it just does not make it as a measurement method. In ATV we often need to pay close attention to lighting in order to make a scene clearly visible. This carries through to many other imaging issues hams also deal with—for example, exposures for digital and 35 mm cameras, camera sensitivity, matching cameras to the purpose, projection of video images in demonstrations, lighting your shack and bench to prevent eyestrain, and so forth.

The first thing most people find when they try to quantify light is a totally confusing set of measurement units which have been made even more confusing by photographic and video equipment advertising departments. Their ad copy has been much like the power-output advertisements for audio equipment in the 1970s—purposely confusing in order to win the specifications war.

The American National Standards Institute (ANSI) has stepped in and things are getting a little better, but the units are still a confusing mess. You will find among the measurement unit terms the candela, foot-candle, candlepower, lux, lumen, steradian, phot, lambert, and a few more (see the sidebar "Lighting Units and Conversions"). When you try to find conversions from one to the other, you will realize that sometimes "You can't get there from here."

We do not have the space to go into the details of each of the above and how and why they are applied. Whole texts have been written on the subject. Therefore, we will deal with just the basic information you need to begin further study. Fortunately, only a few of the units are really needed for our purposes.

A word of warning is in order here: *If you are an illumination scientist, engineer, or specialist reading this article without an "ordinary" person to hose you down and/or comfort you, it may be hazardous. The author will unabashedly take liberties with the absolutely correct terms and equations in order to make them approachable by "mere mortals"!*

There. Now we can proceed without anybody (especially me) getting hurt.

**P.O. Box 945, Katy, TX 77492*
e-mail: <rls@sparkles.com>

Measuring Light

The first point of confusion comes from the many ways in which light can be measured. It can be either incident or reflected. It can be a spot measurement or an average. It can be a measure of the radiant energy or the energy available or the energy perceived. Each of these conditions, singly or in combination, results in different measurement units. The most common units you will have to deal with are the lumen, the lux, the foot-candle, and the candlepower. You will also come across f-stops, effective speed, and foot-lamberts.

These can be best described as one of three types of measurement: total flux, illuminance, and luminance. For the purpose of explanation we will call total flux a measure of intensity. Also, since illuminance and luminance are so similar as to be confusing, we will say luminance is the same as visibility. Now we have intensity, illuminance, and visibility. Now let's explore each of these in amateur radio terms as well as in their own right.

In order to do this, picture an amateur radio communications system. You have a transmitter which drives a beam antenna which sends electromagnetic (EM) waves to a receive antenna and then into the receiver. Now also picture a lighting system in which a source of light shines out of a fixture (luminare) and across a path to an object, where it is then reflected to the viewer's eye. Hopefully you can see the similarities. We can start with the transmitter, or source, and explore it.

Intensity

The intensity of the light source therefore is analogous to the transmitter power. There is power that goes in and power that gets converted to the type of EM wave in which we are interested. The only difference is the frequency. Where the transmitter may operate at, say, 146.52 MHz, the light could be at 600,000,000 MHz. Well, if they are the same, then they both should be measured in watts, right? Sort of. Light intensity certainly can be measured in watts. For example, laser output is usually rated in milliwatts or watts. However, more commonly you will find lumens and candlepower as measures of light-source intensity. These intensity measurements quantify the amount of light being generated, just as your transmitter power measurement quantifies the amount of RF being generated.

This brings us to our first conversion. How do we get from watts to lumens or candlepower? Easy. One lumen is 1.47 milliwatts or 680 lumens/watt. Be careful, though! When you think about transmitters you think about *output* power. When you think about a 60 watt bulb, you are thinking about *input* power. For example, that 60 watt bulb is probably only about 2% efficient, so only 1.2 watts of the total power consumed is going into useful light. That would mean it would have a rating of about:

1.2 watts × 680 lumens/watt = 816 lumens

This agrees pretty well with the 870 lumen rating on the box of my 60 watt bulb. However, if you listened in science class, you might remember your teacher saying that the efficiency of a regular bulb is about 10%. Where did that other 8% go? Well, it turns out that there are a number of conversions from lumens to watts. Another source I had quoted the value at 179 lumens/watt. If you use the 870 lumen figure, that would mean the bulb was putting out about 4.8 watts of light, or 8.1% efficient. The other 2% is probably losses from the glass, bulb coating, filament supports, and so on.

It turns out that the conversion factor is highly dependent on the spectrum over which you integrate. In radio terms, if your power meter ignores the harmonics and sidebands of a signal, it will read a lower power than if it takes in all of the signals. My recommendation is to use the 680 lumens/watt number for

Lighting Units and Conversions

Total Flux (intensity)

1	Watt	±	680.3	Lumen (monochromatic 550 nM)
1	Watt	±	179	Lumen (white)
1	Watt	±	100	Lumen (real candle)
1	Lumen	=	0.079577472	Candle
1	Candle	=	1	Candela
1	Candle	=	1	Candlepower
1	Candle	=	1	Candlepower (spherical)
1	Candle	=	12.56637061	Lumen
1	Candle	=	0.96	Candle (English)
1	Candle	=	0.95	Candle (German)
1	Candle	=	0.1	10-cp Pentanes
1	Candle	=	0.104	Carcel
1	Candle	=	1.11	Hefner

Illuminance

1	Lux	=	0.09290304	Foot-Candle
1	Foot-Candle	=	10.76391042	Lux
1	Foot-Candle	=	0.001286	btu
1	Foot-Candle	=	1.3566	watt-seconds
1	Lux	=	1	Lumen/m^2
1	Lux	=	0.1	milliPhot
1	Lux	=	0.0001	Phot
1	Lumen/ft^2	=	1	Foot-Candle
1	Lumen/ft^2	=	1	Light Flux Density Unit
1	Lumen/m^2	=	1	Lux

Luminance (visibility)

1	Lambert	=	1	Brightness Unit
1	Lambert	=	0.318309886	Candle/cm^2
1	Lambert	=	2.053608062	Candle/in^2
1	Lambert	=	3183.098862	Candle/m^2
1	Lambert	=	929.0304	Foot-Lambert
1	Ft^2 of perfectly diffuse surface lit by 1 foot-candle	=	1	Foot-Lambert
1	Lumen/ft^2	=	1.076391042	milliLambert
1	Lumen/cm^2	=	1	Lambert
1	Lumen/cm^2	=	1	Phot
1	Candle/cm^2	=	1	Stlib
1	Candle/m^2	=	1	Nit
1	Lumen/cm^2/Steradian	=	1	Candle/cm^2
1	Lumen/cm^2/Steradian	=	6.283185307	Candle/in^2
1	Lumen/cm^2/Steradian	=	3.141592654	Lambert
1	Lumen/cm^2/Steradian	=	3141.592654	milliLambert

Other Useful Measures

1	hemisphere	=	2	Steradians
1	sphere	=	4	Steradians
	Light Adapted Human Eye	±	1	milliLambert
	Dark Adapted Human Eye	±	0.00001	milliLambert
	Human Peak Blue Response	±	445	nM
	Human Peak Green Response	±	555	nM
	Human Peak Red Response	±	600	nM
	HeNe Laser Frequency (most common)	=	632.8	nM
1	milliRadian	=	0.05729578	degrees

sources of a single color, such as a laser or LED, and go with the 179 lumens/watt number for white-light sources. Just be consistent. I would not lose a lot of sleep over it. Remember that the more light "packed" into a single frequency (color), the more efficient the source will be. That is just like your radio. Later we will look at these numbers in relation to the human eye's response.

What you should really care about is how the light sources compare to similar types. For those, just take the rated lumen output and divide it by the watts consumed. The higher the number, the more efficient the light source. Therefore, for a given amount of needed light, the higher efficiency sources will cost less to operate. However, they probably will cost more initially. When you divide the extra initial cost by the operating cost savings per month, you will get the number of months of operation it will take to pay out the extra invest-

ment. We will cover that later in "Putting It To Use" (examples of how to solve real-world problems).

As we discussed earlier, you can use the sidebar information to convert from lumens to candlepower. This conversion is as simple as multiplying the lumens by 0.07958 to get candlepower, or another way, one candlepower is 12.56 lumens.

Illuminance

The second type of light measurements are those of illuminance. This is *very* close to the *word* luminance, but it has a very different meaning. Luminance is the energy picked up directly by your eye or camera. Illuminance is only the amount of energy striking the surface that will be lit. Think of illuminance as the amount of energy that is striking your receiver antenna, while luminance is the amount of energy that actually gets converted into audio in your receiver. For illuminance we are talking about only the amount of energy striking the antenna.

The distance to the transmitter, the type of path (path loss), and the size (gain) of your antenna all affect this. Using this similar concept, you can imagine that the distance to the source, the path, and the size of the surface being illuminated would affect the illuminance from the source.

It turns out that this is exactly true. We measure illuminance in foot-candles, or lux. Since one foot-candle is equal to 10.7639 lux, the conversion is simple. In fact, many lighting designs just use 10 lux to the foot-candle to simplify conversions. As you might have guessed, the candela (candle or candlepower) and the foot-candle are the older Imperial measurements. Their metric equivalents, the lumen and the lux, are generally replacing them. Even so, the foot-candle is so widely used it bears a little further discussion.

As we already discussed, the illuminance measure has two parts: the distance from the source and the area illuminated. The two are tightly linked, and that can make things confusing. Remember that our sources are specified as ideal points of light. In other words, they are isotropic radiators giving out light uniformly in all directions. That is just like the dBi measurement we use on transmitting antennas. If you put a 1 candlepower source inside a sphere, then a portion of the light will fall on each piece of the inside of the sphere. From high school geometry we (might) remember that the surface area of a sphere is $4 \cdot \pi \cdot r^2$, so if our sphere were 1 foot in radius, we would have an area of 12.56 square feet.

That number should sound familiar. It is the conversion from candlepower to lumens. This example is exactly how the lumen originally was derived. It is the amount of light that falls on one square foot of the one foot-candle sphere. My guess is that this is because the candle preceded the lumen as a standard, and the lumen was "back engineered" to the existing standard. This is where I, and many others, begin to get confused. Much of what has been written about illuminance, intensity, and their measurements fails to separate this theory and derivation from the practical use of these measurements. Some simplification is in order.

If you imagine that the light from the candle is striking a sphere one foot in radius, then the light on the sphere is said to be one foot-candle. Because the surface of the sphere gets bigger by the square of the radius, but the quantity of photons emitted by the candle is the

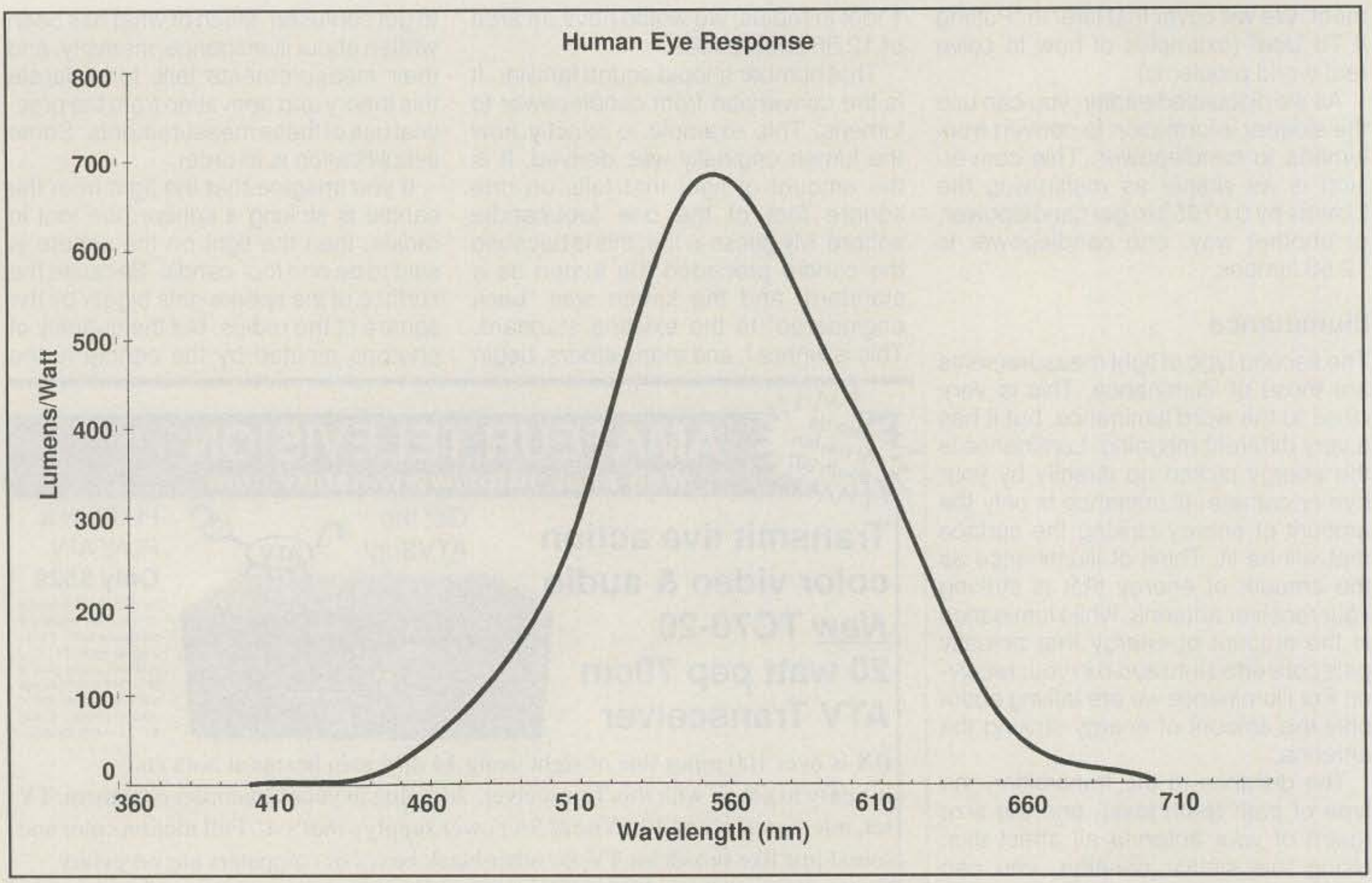


Fig. 1– What the human eye sees.

same, the brightness of the surface goes down. You often will hear this called the "inverse square law." It turns out that if the source length *and* width are less than four times the distance to the surface being lit, you simply can use the square of the distance to figure the change in illuminance. Thus, a light that produces 100 foot-candles at a distance of 1 foot will only produce about 1.5 foot-candles on the floor 8 feet below:

$$(1 \div 8)^2 \times 100 = 1.5 \text{ foot-candles [or 15 lux]}$$

We will get into that more in the "Putting It to Use" section. Thus, if you know the intensity of the source and the amount of area it lights, you can calculate the illuminance. One lumen shining evenly on one square foot is equal to one foot-candle; or in metric terms, one lumen shining evenly on one square meter is equal to one lux. That is all there is to it.

There are a number of recommended standards for illumination for various work tasks. These are published in various places, but all are rooted in the work done by the Illumination Engineering Society (IES). Some of these can be found on their web site: <http://www.iesna.org>. You will find that a good "ball park" for lighting to maneuver around in, such as a parking lot, needs to be about 2–5 foot-candles. For general work you will probably need 25–50 foot-candles. For close, detailed work you will want 125–150 foot-candles. From this you can estimate the foot-candles, or lux, required.

One word of caution, though: Many new cameras are rated (confusingly) in lux. What they are talking about is the amount of light required by the camera to show a usable picture. This means that the surface being viewed must give the camera this minimum amount of lux in the darkest area of interest. This is not the same as the amount of light in the scene as measured by illuminance. The third measure of light will explain why these are not the same thing.

Visibility

As mentioned above, the terms *luminance* and *illuminance* are just too similar to avoid confusion. Therefore, we will use the term *visibility* to mean luminance. The explanation for visibility is pretty simple. It is the amount of light received from a source or object. However, the actual measurement and calculation of visibility is not so straightforward. This is where our simple radio-system analogy begins to break down in all but one way—complexity.

A receive system has to consider antenna polarization, antenna position, multipath, feedline losses, receiver sensitivity, IF bandwidth and selectivity, gain, noise, and a host of other items. Calculating the visibility of an object has just as many factors. For example, there is the angle of the object, its reflectance, its surface shape, reflected light from the source, its distance from the observer, the color of the light, the color of the object, and the sensitivity curve of the observer (human, mechanical camera, electronic camera, etc.).

The common measurement of visibility is the Lambert. This was in honor of Lambert's law, which says the luminance of a perfectly diffuse object will be the cosine of the its angle to the observer. Interestingly, there is no physics involved in this law; actually, it is used most often in the reverse—to define a perfectly diffuse surface.

A particularly handy item, especially if you have a photographic light meter, is a Kodak® 50% gray card. This can be purchased very reasonably from any good photo-supply house. Theoretic-

ally, it gives you a perfectly diffuse surface with 50% reflectance. This is what all photographic meters are calibrated to. If you put the gray card in the subject and measure it with your meter, the exposure you read will be as close to accurate as possible. It is also an excellent item to use for setting up your video cameras.

One last bit of theory and we will be ready to put all this information to some practical use. You will find a number of references to the color response of the human eye. The correct name for this is the *tristimulus curves*. They reflect the relative response of each of the three color receptors to wavelength. Often it is summed together into a single, more useful curve. This is shown in fig. 1. Similar curves can be found for CMOS cameras and other devices.

Putting It to Use

If you have made it to this point, you have enough theory and understanding to do some calculations on "real world" examples. Let's first work through a few examples of light-source calculations. We can then give some attention to various cameras (including the human eye).

Lasers

A laser is a unique light source because it is coherent. In radio terms this means that all the phase fronts are aligned and the frequency is like a pure carrier. Because of this and the way laser light is generated, a typical laser beam has a very "tight" beam (small divergence). The most common laser specifications will indicate the power, the frequency, and the beam divergence. One common question is "How does my laser compare to other light sources?"

Let's try out some of our new conversions and see if we can find the answer. First, calculate the equivalent brightness of our laser. My homebrew HeNe laser is fairly typical of many low-cost lasers. It is rated at 1.5 mW. That is the only specification found on it. If we look up the "normal" wavelength of HeNe, we find that 633 nM is the most common. From fig. 1 we can read a value of about 200 lumens/watt. Thus, our laser would have a brightness of only 0.3 lumens! The calculation is:

0.0015 watt × 200 lumens/watt
= 0.3 lumens = 0.02 candlepower

However, the real secret to the laser is its narrow beam. That 0.3 lumens is all concentrated in a spot about 1 mm in size.

When I measured the beam on my laser at 60 ft., it had a diameter of about 1.89 inches (48 mm). Let's see what that would work out to be based on the distance. The area of the spot is $\pi \cdot r^2$, so that works out to:

$$3.1416 \times (1.89 \div 2 \div 12)^2 = 0.0195 \text{ ft.}^2$$

Then dividing our 0.3 lumens by this, we find the illumination to be a respectable 15.4 foot-candles.

Hmmm. What brightness bulb would we need to give that illumination if the bulb were shining in all directions like a regular light bulb? Well, let's calculate it from our illumination equations. If we had a sphere 60 ft. in radius it would have an area of:

$$(4 \times \pi \times (60 \text{ ft.})^2) = 45{,}238 \text{ ft.}^2$$

Thus, if we had 45238 lumens on this 45238 ft.^{2} it would be 1 lumen/ft.^{2}, which we know is 1 foot-candle. That means to get the same 15.4 foot-candles as the laser we would need:

$$15.4 \text{ foot-candles} \times 45{,}238 \text{ ft.}^2 = 696{,}680 \text{ lumens}$$

Wow! That is about 800 times brighter than my 60 watt bulb! Putting all that light in a tight little beam really makes a difference.

Let's look at one more laser specification. Remember that on my laser, the beam started at about 1 mm. This means that it grew by a factor of 48 over 60 feet. The formula for calculating the length of the opposite side of a triangle is to multiply the *sin* of the angle by the length of the adjacent side. Therefore, in my case the 60 ft. becomes 720 inches, and since the spot was 1.89 inches we can write:

$$1.89 \div 720 = \textit{sin} \text{ (beam divergence)}$$

so beam divergence = 0.150°

On some laser specifications you will be lucky enough to find a beam divergence number. 1.2 mr is fairly common on commercial lasers. This means that the beam spreads in an angle of 1.2 milliradians. Since there are $2 \cdot \pi$ radians in a 360° circle, we can calculate that a milliradian is 1000th of 57.296°, or 0.0573°. Multiplying that means my laser had a divergence of 2.6 mr. That is probably pretty reasonable for an inexpensive laser.

LEDs

The candlepower has gone the way of the megacycle and is being replaced by its new name, the *candela*. About the only place you commonly will encounter the candela or candlepower is in light-output specifications for LEDs, a few small bulbs (particularly automotive), and headlights/searchlights. The candela is a very old unit that was derived from the amount of light actually produced by a standard candle. Our modern equivalent must be the LED, since the LED measurements in catalogs will show the LED outputs in millicandela (mcd). Technically, these are usually "spherical candlepower" instead of candelas, but for our purposes you can treat them as the same measurement.

As you might expect, the mcd is one one-thousandth of a candela. Going back to our original concept of bright and dim, you can say that one of the ultra-bright 10,000 mcd LEDs is about as bright as a two-cell pen light. A 10,000 microcandela (µcd) blue LED is pretty dim, since it is only about 1/1000th as bright. Watch the units closely, especially on blue LEDs, because they commonly are specified in the smaller µcd. It is easy to misread this and end up with a brightness mismatch on the front panel of your new homebrew widget.

As we saw in the laser calculations, the beam width is critical when comparing LEDs or doing calculations of illumination. For example, let's look at the Digikey CMD204UWC bright-white LED. To make it into a mini-flashlight, we will want to see how bright it might be when held 2 feet away from a page in our log book. The specifications show it to be 1000 mcd with a beam angle of 20°. At a distance of one foot the beam would be about:

$$2 \text{ ft.} \times 12 \text{ in./ft.} \times \sin(20°) = 8.2 \text{ inches in diameter}$$

That would work out to be about 0.368 ft.^{2} for our 1000 mcd to cover. Let's convert the mcd to lumens and find the lumens/ft.^{2}, giving us foot-candles:

$$(1000 \text{ mcd} \times 0.001 \text{ cd/mcd} \times 12.57 \text{ lumen/cd}) \div 0.368 \text{ ft.}^2 = 34 \text{ foot-candles}$$

As it works out, that is about the same as an ordinary 100 watt bulb would put out, but only in the 8 inch spot, and for about 1/800th the power and twice the price.

"Regular" Lighting

Now that we have explored candlepower, lumens, and beam divergence, let's try some of the same techniques on conventional tungsten lighting. You probably are beginning to see the importance of beam width and illuminated area in our determination of how bright something really is. This can be useful in checking out efficiencies. Remember that we converted candles to lumens by multiplying by 12.57. That means the super-mega-whopper 1.5 million candlepower handheld searchlight I use to peer into the woods behind my house would be rated at 18 million lumens. If the manufacturers thought, for even a second, that people would understand lumens, they would jump on that for their ad copy.

This may confuse you. If the thing puts out 18 million lumens of white light, then using the 179 lumens/watt conversion we would say that the light source would be consuming 105 kw at even 100% efficiency! That would go up to nearly 1 mw for a 10% efficiency, which seems pretty impossible for even a big handheld light. Think back to our analog of the transmitter. What do we use besides output power to measure the effective power of our transmitted signal? Right. We use EIRP, Effective Isotropic Radiated Power, the power that an isotropic source would have to be to create the same field strength

(intensity). An isotropic source is one which radiates uniformly in all directions, like a spherical pattern.

The way to increase the EIRP is by antenna gain. Now it begins to make sense. The spotlight has a gain "antenna" built in. It is the parabolic dish of the reflector. The equations are all the same as your microwave-dish equations. It is just that in this case the wavelength is 400–600 nm. Since the dish is about 5 inches (12.7 cm) across, that means it is about 254,000 wavelengths in diameter! No doubt that it has some real gain.

Let's use an old engineer's trick to figure out an approximation of the gain. If the bulb is a 50 watt halogen, we can guess that it is about 10% efficient. That means it puts out about 5 watts of white light, which converts (using 179 lumens/watt) to about 900 lumens. Since we just converted the manufacturer's specification to 18 million lumens, we can "back into" the gain. By dividing 18 million by 900, we get a gain of 20,000. If you remember the equation for converting to dB of gain, you can calculate this to be a gain of 43 dB. That number seems pretty reasonable given the 250,000 wavelength diameter.

Let's tackle another example. Suppose we go to the store to buy the right brightness bulbs for our shack to properly light the video area. All the lights are rated in lumens. If we know the area to be lighted and the lumens, we can calculate the number of lux, or foot-candles. Basically, you calculate the area illuminated by the bulb and the distance to the bulb from the surface. This will allow you to calculate the equivalent sphere being illuminated, as we have done in the previous examples. When that spherical space is divided into the lumens, you get the lux (metric) or foot-candles (english) on the surface.

Since we will be doing close surface-mount work on dark PC boards, the target should be about 125 foot-candles. If our bench area is 3 ft. by 2 ft., that is 6 ft^2. This means that the total lumens divided by 6 $ft.^2$ will be equal to our desired value of 125 foot-candles. Thus, the total lumens at the surface must be 750. If the work lights are mounted 5 ft. above the bench, then light at the source would be 5 squared, or 25, times the 750. That is equal to 18,750 lumens at the source if they only had the proper beam width. We do not have the space to go through the area of a sphere calculation again to find out what size bare bulbs would be needed, but that is really not important, because you will probably use some type of focusing fixture or light anyway. It turns out that a 150 watt PAR spotlight has about the right beam width for these dimensions and puts out a rated 1740 lumens. However, you would need ten of them for the desired illumination. That certainly would bake your cookies, wouldn't it?

Let's try again. If we reduce the distance to 3 ft., then the lumen requirement drops to a more reasonable 6,750. One more problem, besides the heat from halogen or tungsten lamps, is shadowing. We will look at that in a minute. What I did was try the 3 ft. configuration with four 75 watt halogen floods rated at about 900 lumens. That would calculate to give me 66 foot-candles. As a matter of fact, with proper focusing, I measured almost exactly 70 foot-candles at the bench top. There was a problem, though: Using only four narrow beam lights caused bad shadows and resulted in poor visibility. I found that by adding a 30 watt fluorescent lamp (about 2125 lumens) mounted about 3 ft. above the bench, I got a more uniform light, better shadowing, and upped the illumination to about 90 foot-candles. Then when I added my 22 watt circline magnifier fluorescent (about 1100 lumens) at 1–1.5 ft., the measured value at the work surface was right at my target. It measured 118–121 foot-candles. Now I can see those tiny parts well.

Moving Further

Now that you understand lighting and how to calculate intensity and illumination from common sources, we can build on this knowledge and tackle visibility examples. This would allow us to calculate how much light would be needed to light a scene for proper response from your video camera or photographic camera. We could also see how color affects the camera and your eye. This would include filters and different types of lights such as high-pressure sodium and fluorescent. Reflectance and density are also important to look at. Finally, we could look at room lighting calculations and methods.

Sadly, though, I am out of space. This means you will have to pursue these things on your own, but now you have the foundation necessary to do it successfully. I would like to thank both Ed Manuel and *CQ* for allowing me to write this guest column. There are enough items for another article if you would like. Be sure to let *CQ* know if you found this helpful, as they might invite me back some time in the future. ■

QRP

BY DAVE INGRAM, K4TWJ

The Art of Low-Power Hamming

A Hands-On Guide to QRP Success

Are you ready for QRP views, tips, and words of encouragement, friends? Well the fun starts right here, right now, with this new bi-monthly QRP column. Our collection of good news is growing by leaps and bounds, so let's cut short the opening formalities of this first QRP column and let the good times roll!

First, I sense many of you are presently thinking about license restructuring and looking at QRP with renewed interest. You want to know if you really can "work out" with low power, if running QRP on SSB also holds merit, if there are many all-QRP activities on the air, and if I have some more "tried and proven" notes for QRP success, right? Well, the answer to all of these is yes, so start thinking about big thrills on a small budget and read on!

Under favorable band conditions—no, just make that under "reasonable" band conditions—QRP consistently proves it can reach out almost as well as the usual 100 watt setups. Further, the convenience of operating small, "use anywhere" QRP gear for impromptu hamming when "firing up the big rig" is inconvenient may actually prove advantageous. That may seem like reverse logic, but it's true: The more inopportune the time to get on the air, the better that time is for hamming.

The bulk of QRP activity is on CW, true, but that is only because it consistently proves more productive and reliable under various band conditions. A surprising amount of QRP activity, however, is also via SSB—and FM and AM (listen in the 29.0 to 29.7 MHz range of 10 meters) and via FM repeater satellites such as AO-27 and SO-35. Recently, for example, I heard a chap running only 2 watts on 20 meter SSB engrossed in a solid-copy QSO for over 15 minutes. Flipping over to 10 meters SSB, I heard a DX station sign off with K5NU/bicycle mobile QRP right as I tuned on frequency. Isolated incidents? No. This happens every day in the low-power world of SSB QRP!

What are popular choices in SSB QRP transceivers, you ask? MFJ's "94 series" rigs for 10, 20, 40, 75, and 6 meters are rugged little tykes with great performance records to their credit. SGC's new SG-2020 all-band transceiver (see "*CQ* Reviews," June 1999 *CQ*) and Elecraft's new K2 kit transceiver (see "World of Ideas," February 2000 *CQ*) are also neat treats, and they are reasonably priced. Are we piquing your interest and enthusiasm, friends? Read on!

Photo A– Did you say more QRP?

4941 Scenic View Drive, Birmingham, AL 35210

Tips for Success

QRP success depends on three main factors: your antenna system, equipment, and operating expertise. Shortcomings in any one of those three areas might be offset by an advantage in the other two, but you really need all three assets on your side for optimum results.

With respect to antennas, my advice is always think big and high efficiency. Larger types such as full-wave loops and extended double Zepps exhibit a creditable edge over basic dipoles and inverted-Vees, and they are really no more difficult to erect. Random wires and/or multiband doublets are okay for 100 watt setups that can afford signal losses, but they are a noticeable setback for QRP. Verticals are okay only if they are mounted in the clear and complemented with a good ground or base radial system. Regardless of your selected antenna, performance is always best when the antenna's mating coax cable is new and unspliced, all connections are well soldered and waterproofed, and all lengths are pruned for lowest possible SWR.

Regarding equipment, you need a transceiver that emits a clean signal to catch attention and a smooth VFO plus RIT control so you can call stations on exactly the frequency they are receiving. Fewer and fewer operators tune even slightly for calls, and many use sharp filters continuously. Shifting your transmit frequency only 100 or 200 Hz when a first call fails often yields an immediate reply. Naturally, your transceiver and operating savvy must be fast and sharp enough to copy that reply through long-winded callers/QRM and other band noises. If you use earbud-type 'phones as many QRPers do, try different types. Some emphasize bass tones, some emphasize high tones, and some drop off mid-range tones and actually attenuate desired signals.

Finally, strive for perfection in your ability to accurately send and receive

QRP Contests and Activities

Event	Sponsor	Time of Year
QRP Afield	ARCI	Fall/September
ARCI QSO Party	ARCI	Winter, Spring, Summer, Fall
Summer Daze SSB Contest	ARCI	Summer
QRP CW Contest	ARCI	Winter, Spring, Summer, Fall
Homebrew Spring	ARCI	Summer/July
Holidays Spring	ARCI	Winter
Bubba Contest	ARCI	Fall/September
Run for the Border	NorCal	Spring/April
QRP to the Field	Radio Adventure Society	Summer/May
Flight of the Bumblebees	Radio Adventure Society	Spring
The Power of One	Radio Adventure Society	Fall/September
Colorado QRP Party	Colorado QRP Club	Winter, Spring, Summer, Fall
FYBO Field Contest	AZ ScQRPions	Winter/February
Michigan QRP Contest	Michigan QRP Club	January

Fig. 1– Popular QRP contests and on-the-air activities.

CW at any speed (or copy speech of any dialect). Try to put yourself in the other operator's place. Make your signal the easiest one on frequency to copy. Use full break-in and listen between your transmitted dots and dashes so you can spot when the frequency is clear and your call should be heard. Some operators have (or develop) the ability to copy a weak signal amidst a sea of QRM (adjusting your RIT so a desired station is the lowest pitch often helps). Other operators need the assistance of narrow filters and/or DSP units. Determine what works best for you and go for it! Now implement some of my suggestions, then think positively and hit the bands with QRP. The good times are waiting!

On-the-Air Activities

If you are new to QRP or if you spend more time building QRP rigs than using them, you may not be aware of all the exciting QRP contests, sprints, and QSO parties gracing the airwaves each month. Indeed, the list of events is so long (and still growing!) that even superactive QRPers have difficulty keeping up with all of them. A condensed sampling of the more well-known contests is shown in fig. 1. As you will notice, many of the contests focus on using battery power and hamming in the great outdoors (even in cold winter weather, no less). Personally, I like the "Run for the Border" contest with near Taco Bell sites good for extra points.

Listen around the popular QRP "hot spots" listed in fig. 2 almost any weekend, and you will hear these contests in full swing. Don't even think about running QRP as a handicap or a weak signal. Just be sure you are only pumping out 5 watts or less, jump in the action, and start making contacts. You will find

QRP Frequencies

Band	CW	SSB
160 meters	1.810 MHz	1.910 MHz
80 meters	3.560 MHz	3.985 MHz
40 meters	7.040 MHz	7.285 MHz
30 meters	10.106 MHz	—
20 meters	14.060 MHz	14.285 MHz
15 meters	21.060 MHz	21.385 MHz
12 meters	24.906 MHz	24.950 MHz
10 meters	28.060 MHz	28.385 MHz

Fig. 2– Popular QRP "hot spots" and operating frequencies.

QRPers are sharp operators with a special knack for pulling weak signals out of the noise.

Do you like award chasing and/or quick gratification? Make just one contact that spans a distance tallying 1000 miles per watt, and you qualify for the famous 1K M.P.W. Award available from the QRP Amateur Radio Club International (QRP ARCI).

Details of various contests and awards, incidentally, are usually included in newsletters of their sponsoring clubs. If your stack of newsletters is low or you are not familiar with the format of a particular contest or QSO party you hear in progress, briefly monitoring information exchanges will give you "how to" guidance. Usual exchanges consist of a signal report, QTH, QSO number, and a member number from the club sponsoring the event. Nonmembers usually transmit their power level in lieu of a club number. It's that easy, and it really opens your eyes to the capabilities of low power.

Clubs and Newsletters

Like contests and QSO parties, the number of big-time QRP clubs is also increasing at a very healthy rate. Joining several of the clubs at one time also makes sense, even if they are not in your local area. In addition to receiving a member number and getting a head start with club kits and projects, many larger clubs also produce outstanding newsletters. These are more than fliers; they are 40- to 60-page mini-magazines filled with details on operating events, kit-building reports, and homebrew projects galore. Reading through a few issues plus building one or two of their irresistible projects really gets the QRP enthusiasm rolling. Then almost as soon as you finish reading and building from one group of newsletters, another batch arrives and the fun starts all over again. It is like a continuous QRP celebration! As a quick guide to joining this action, a list of "most popular" clubs follows.

The QRP Amateur Radio Club International is one of the most popular clubs in QRP, and its membership is

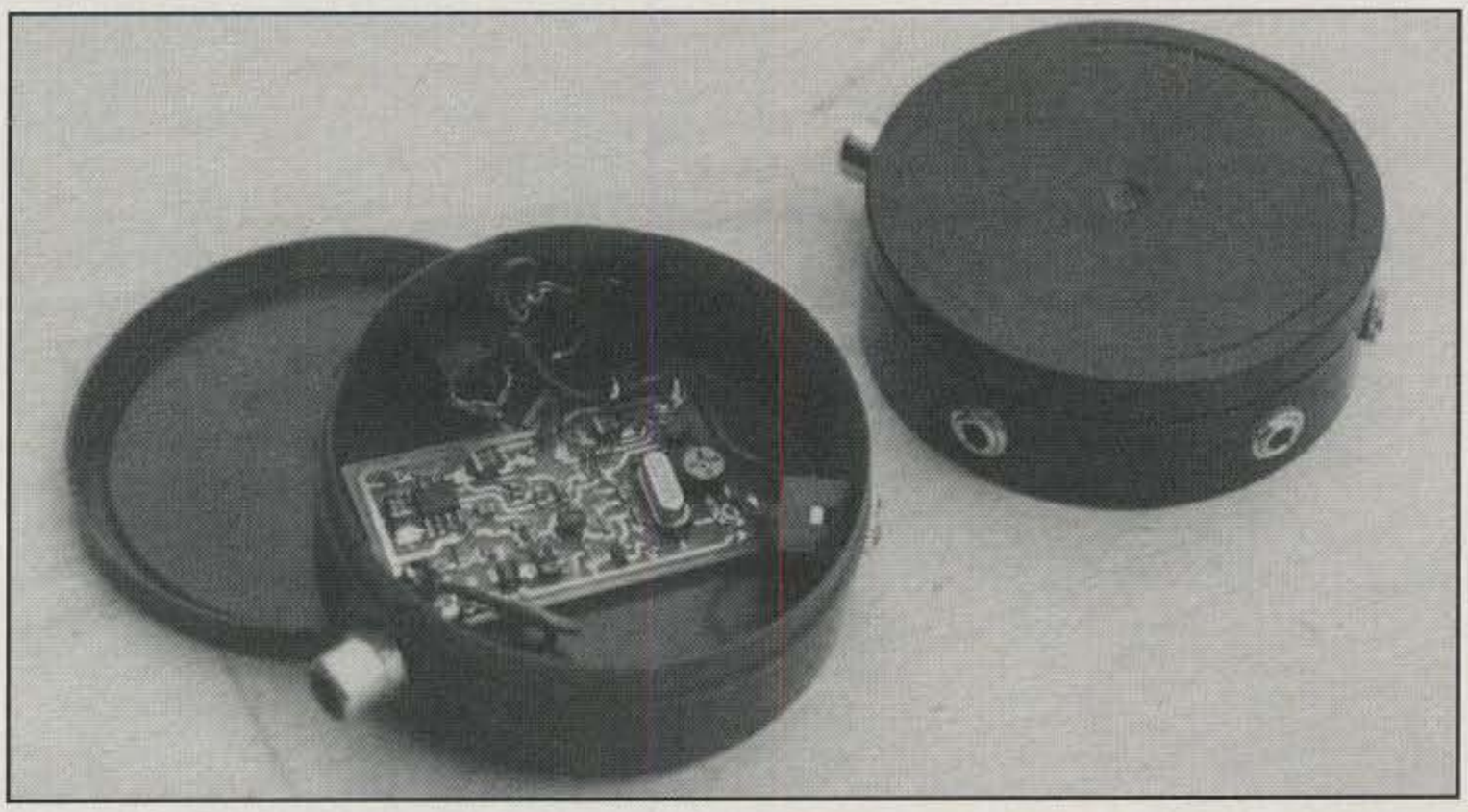


Photo B– This pair of pocket-size rigs are surface-mount KnightSmite transceivers for 80 meters. They were built by WB4JWD and make dandy toss 'n go QRP rigs.

around the 10,000 mark. The club sponsors a full awards program, and its newsletter, "QRP Quarterly," admirably covers the full field of QRP. Membership is $15 U.S., $20 DX and goes to QRP ARCI, 848 Valbrook Ct., Lilburn, GA 30047.

Northern California QRP Club (NorCal) is another hot and thriving club with over 2000 members around the world. The club is into homebrewing in a big way, and every issue of its newsletter "QRPp" is full of terrific projects to build. Membership is free, subscriptions to QRPp are $15 U.S., $20 DX and go to Jim Cates, 3241 Eastwood Rd., Sacramento, CA 95821.

The New Jersey QRP Club is a new, up-and-coming club with a very enthusiastic membership. Their first newsletters were posted on the Internet, but they recently began printing their own (rather large!) newsletter, and it is filled with great articles covering everything from antennas to projects. If it does not get your QRP adrenalin pumping, check your pulse! Membership in NJQRP is free; subscriptions to their newsletter "QRP Homebrewer" are also $15 annually U.S., $20 DX and go to George Heron, N2APB, 2419 Feather Mae Ct., Forest Hill, MD 21050.

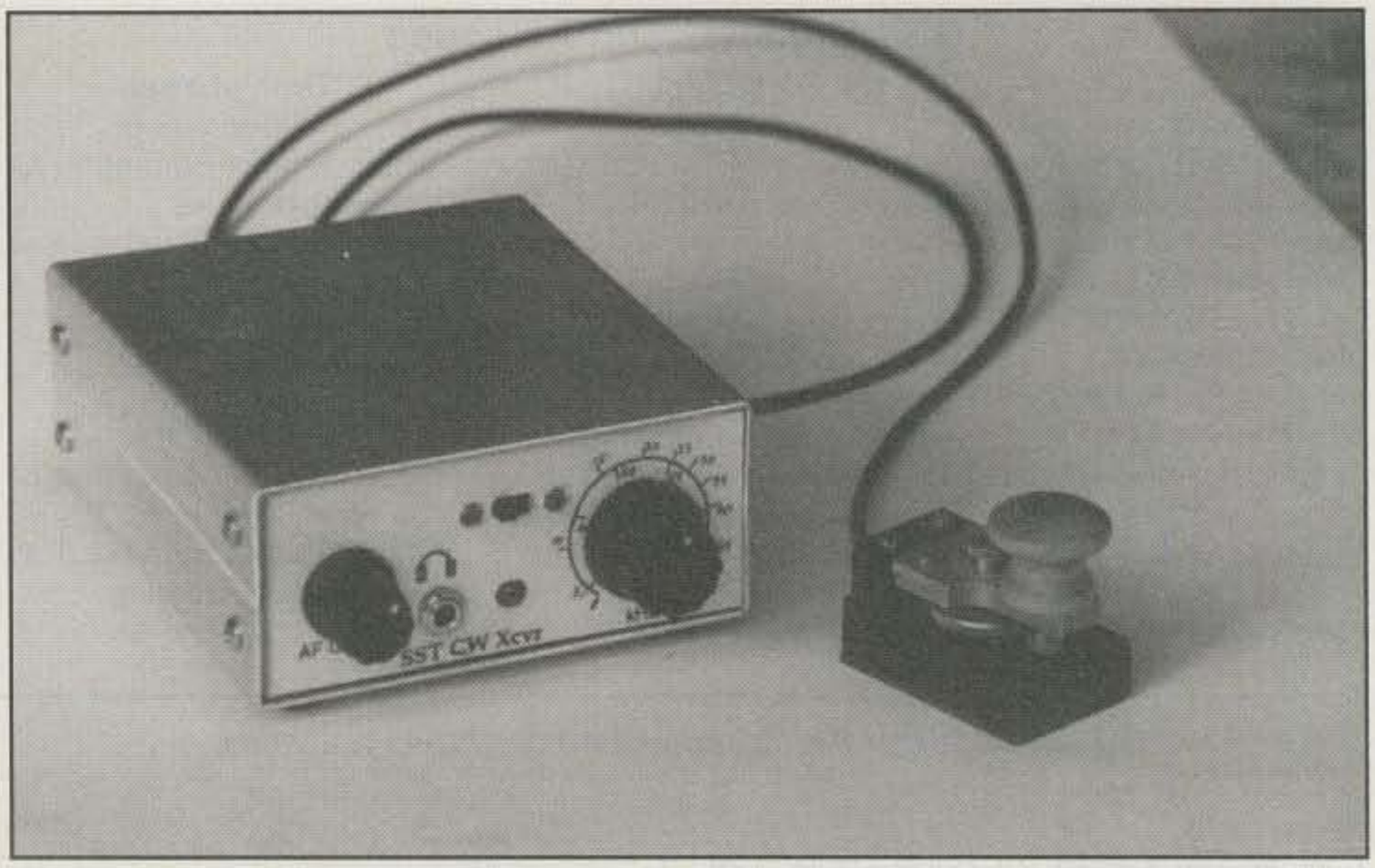


Photo C– This spiffy, hot-performing QRP setup belongs to Englemar Wenk, DK1WE. It consists of a popular 2 watt SST transceiver from Wilderness Radio (modified for dual-range coverage with one VXO) and a snazzy one inch-square key. Englemar makes and sells the little keys, and they are gems.

The G-QRP Club is another world-famous QRP club with a large membership (near 7000) and a killer newsletter called "Sprat." The newsletter is always loaded with cool ideas and neat circuits—an absolute gold mine of projects for homebrewing. Sprat serves as a focal point for QRP companies throughout Great Britain. U.S. memberships with Sprat subscriptions are $12 and go to Luke Dodds, W5HKA, 2852 Oak Forest, Grapevine, TX 76051.

The Colorado QRP Club is also well-known for its on-the-air activities, contests, and awards, which are quite efficiently covered in its newsletter "Low Down." It's a good "all around" newsletter with a slant toward on-the-air QRP'n. Membership and annual subscriptions are $12 U.S., $15 DX and go to CQC, P.O. Box 371883, Denver, CO 80237.

There are many more QRP clubs and newsletters, but this list should "getcha goin" for now. If your club's newsletter was not listed, incidentally, pass along the details to me and I will strive to include it next time. I aim to please!

Show and Tell

That winds down the good words and friendly tips for this time gang, but a couple of recently submitted photos and tales must be shared before signing off.

First is a pair of trim KnightSmite surface-mount QRP transceivers that H. D. Martin, WB4JWD, built into repainted tobacco tins (see photo B). The KnightSmite kits were produced by the KnightLites QRP Club and offered by Bob Kellogg, AE4IC, of 4708 Charlottesville Rd., Greensboro, NC 27410 a couple of years ago. They are based on the popular Pixie 2 direct-conversion circuit that uses only a pair of 2N2222s and an LM386 and produces 250 to 500 milliwatts of power. Martin says this was only his second kit to build (the first was K8EDN's "MRX" receiver), and it worked "right off the bat." Martin also asked if other surface-mount kits are in the works. Yes, indeed: MFJ will soon announce its new QRP "Cub," and one of the first Cubs out of the den will be highlighted right here!

Next is the little 20 meter SST transceiver and miniature hand-key setup Englemar Wenk, DK1WE, put together and used during his recent visit to the U.S. (photo C). As you may recall from past columns, the SST is a professionally produced kit from Wilderness Radio (P.O. Box 734, Los Altos, CA 94023; telephone 415-494-3806). It sports a quite sensitive and selective superhet receiver, 2 watt transmitter, VXO control, and full QSK. Englemar makes and sells that tiny key (called Micky) you see beside the SST. It is a one inch-square rear-pivoting beauty that looks simply irresistible. His address is DK1WE, Hubenring 4, 88048, Friedrichshafen, Germany (telephone 07544 2635).

If you have a special QRP rig, kit, or project worthy of recognition, incidentally, pass the pertinent details plus some good photos to me and I will do everything possible to help. Remember to include an SASE with letters, be patient for a reply, and always—keep on QRPing! Here's listening for you on 30 meters, kid! 73, Dave, K4TWJ

Looking Ahead in CQ

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

- *"CQ* Reviews: Kenwood TM-D700A," by WB6NOA
- *"CQ* Reviews: Ten-Tec Pegasus," by N7NB
- "Amateur Radio Astronomy," by KC4YER
- "Global Optimization of Yagis," by K6STI

Plus...

- "A Skeleton Sleeve-Fed Monopole," by K6MHE
- "Turn the Tower, Hold the Antenna," by W8CM
- "Identify That Feedline," by KA4LBE
- "A 20-Meter Bootlegger 'Fesses Up'," by K4IJS

Writers wanted: If you have a ham radio story to tell, we'd like to hear about it and consider sharing it with our readers. If you'd like to write for *CQ,* please send a request for writers' guidelines, along with a self-addressed, stamped envelope (SASE) to: CQ Writers' Guidelines, 25 Newbridge Road, Hicksville, NY 11801. We plan to have an on-line version available soon on our website: <http://www.cq-amateur-radio.com>.

VHF Plus

BY JOE LYNCH, N6CL

All About The World Above HF

222 MHz Sporadic-E in February

It is rare to have any sporadic-*E* openings on 222 MHz. Only twice before have openings been reported on 222, and both of these openings occurred in the summer, when sporadic-*E* seems to go higher in MUF. Furthermore, these openings were several years apart. It is thus a first for a reported sporadic-*E* opening on 222 MHz to have occurred in the winter sporadic-*E* season.

John Butrovich, W5UWB (EL17), reports the following contacts during a sporadic-*E* opening on 14 February: "On 2 meters: K7JA, KE6HPZ, K6TSK, K6DV, N6HKF, K6IBY, W6QIW, WB6NOA, K6TEE, and N6KZB. On 1.25 meters: N6HKF (DM13) and W6QIW (DM04). All contacts occurred between 0130 and 0150 UTC." John comments, "What a night! Two meters sounded like 20 meters...very strange for February. And what a thrill to work the two gents on 222 MHz!"

Other DX Reports

The month of February has been replete with reports of *F2* (on 6 meters) and other propagation. Widespread openings have occurred between North America and Australia and New Zealand. Furthermore, openings between North America and South America also have been reported.

Among the reports was this one from Chip Margelli, K7JA: "Worked ZL3TY and ZL2AGI on 6 meters around 2150 UTC February 13, and W5UWB, W5GVE, KM5RG, KC5NOA, KI5GF, KC5YKX, K5DGU, and WA5IYX on 2 meters around 0130 February 14. Guess the 2 meter opening went to 222 MHz right at the start, but I'm not equipped for that band.

"Heard many XEs, VKs, and other ZLs as well. The band was really hopping around, although southern California seemed to be a little too close to some of the DX Saturday and Sunday. Only 100 watts here, 7 elements on 6 meters and 19 elements on 2 meters. I think I was among the first to catch the 2 meter opening here in southern California."

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e-mail: <n6cl@cq-amateur-radio.com>

VHF Plus Calendar

Apr. 2	Moderate EME conditions
Apr. 4	New moon
Apr. 8	Moon perigee
Apr. 9	Poor EME conditions
Apr. 10	Highest moon declination; 144 MHz Spring Sprint contest (see text)
Apr. 11	First quarter moon
Apr. 14-15	Southeast VHF Society Annual Conference (see text for details)
Apr. 16	Good EME conditions
Apr. 18	Full moon; 222 MHz Spring Sprint contest (see text for details)
Apr. 22	*Lyrids* meteor shower predicted peak
Apr. 23	Very poor EME conditions; *pi-Puppids* meteor shower predicted peak
Apr. 24	Moon apogee and lowest declination
Apr. 26	Last quarter moon; 432 MHz Spring Sprint contest (see text for details)
Apr. 29–May 7	West Coast Weak Signal High Speed Meteor Scatter Contest (see text)
Apr. 30	Moderate EME conditions

• *EME conditions courtesy W5LUU*

Incidentally, Chip's wife Janet, KL7MF, is the manager of the HRO Anaheim store that was caught in a strip-center fire. It totaled the store and its contents. The fire occurred early Sunday morning, so fortunately no one was hurt. Janet reported that the only item in the store that survived was a plastic owl used to keep birds away from towers. It has since become the new store's mascot.

Sam Whitley, K5SW, reports the following: "Between 1800–1926 UTC on 7 February I heard HC2FG/B and HC8GR/B. I worked on backscatter N5JHV (DM62), W5UWB (EL17), and K7ICW (DN26). Also heard but did not work K6GMV (DM14), W6JKV/5 (EM00), AE4RO (EL97), WA7KYZ (DM51), AA6DD (DM13), and KC2TX/T (DM42). The last signal heard at 1926 was NØLL/B."

On the other end, M. A. Foubister, ZL3TIC, reports: "On 13 February I worked or heard XE1KK/B, N6XQ, WA7KYZ, W7RV, K6SYW, WSØF, KC8CC, K7JE, KF7NP, N7CW, KC6NBI, W6CPL, K6GMV, WA6PEV, and WA6JRA."

Ed Rodriguez, WP4O, reported: "The bands were open every night for three nights. On Saturday (12 February) we had *F2* conditions into LU land around 2000 UTC for about a hour." Ed also reported several 2 meter TE openings during January and February.

Oscar, CO2OJ, reports the following: "At last we have some action on 2 meters on this side of the world. Worked this morning (Saturday 12/2/2000) around 1200–1300 UTC W4WHN (EL94), W1GUD (EL87), KF4YOX (EL96), and KE4FEX (EL88). I also worked my best DX during these openings—WD4MGB (EL99) and WB4BFG/M, in the area of Tampa. The band was still opened on Sunday between Cuba and south Florida. Worked some stations. I'm running 8 watts and got good reports from KF4AER and KG4CWP in EL96, so the band is open. By the way, Dave, KG4CWP, is a newcomer to 2 meters SSB. He started just yesterday, so welcome to the family, Dave."

HSMS the Wave of My Future For Meteor Scatter

Now that I am settled into my new QTH in Tulsa, I have decided to try something new—new to me, that is. After examining my options, I have decided to try high-speed meteor scatter (HSMS). With the contest this month (see the announcement below), I hope to get into this aspect of weak-signal communications with both feet. I should have my station set up with a 15-element beam and the FT-736 and TE Systems 300 watt brick ready to go by the deadline. My wife Carol, W6CL, tells me that I have to clean out the garage first, though.

For my mast, I had the good fortune of inheriting an old homebrew television mast from one of my parishioners for the price of hauling it away. The wife told me that she wanted her old TV

antenna taken down because she was "hearing voices and music" on it without it being hooked up to anything. My parishioners were quite bemused when I told them how glad I was to be allowed to haul away the old mast (and fix the problem of audio rectification). Even so, they were glad to get rid of the nuisance and I was glad to be the proud owner of a mast for my antenna.

Here in Tulsa, radio station KVOO seems to get into practically everything. Apparently, they have some major problems, because I can copy their ninth harmonic at my QTH about ten miles away from their transmitter site. While hooking up our HF station, I noticed that their station was coming in on the old Heathkit HD-899 keyboard speaker. Carol thought that she was hearing things for a while, until I figured out what was happening and grounded the keyboard. As a result, I knew what this woman had experienced with her old TV antenna.

The feature that most attracted me to this mast was that it consists of a galvanized pipe that was secured to a base with a large bolt in such a manner that the mast can be tilted for installing or working on the antenna. When I first saw how the mast was attached to the base, I was concerned that the base was in concrete. My concerns were alleviated when I discovered that I could turn the base pipe with a pry bar. Using my car jack and the pry bar, I was able to jack the three foot pipe right out of the ground!

I have chosen HSMS because of the ease with which one can get on the air, plus I like meteor scatter. Furthermore, according to Jim McMasters, KM5PO, a significantly higher number of HSMS skeds are completed as compared to SSB skeds.

Regarding SSB meteor scatter, there are a few similarities between it and HSMS, but mostly there are major differences. For example, the sequencing is much different (one minute verses 15 seconds). In addition, the signal report exchanged is different. It consists of a two-digit number that describes the burst duration and the signal strength. Furthermore, the exchange, while similar, also is different. For more information, Shelby Ennis, W8WN, maintains a home page with numerous articles concerning just about every aspect of HSMS that you might want to know and then some. You can access this information via <http://www.qsl.net/w8wn/hscw/hscw.html>. A list of numerous other home pages can be found within the contest announcement below.

To keep up with the latest on HSCW, you should join the HSCW reflector or the meteor scatter reflector. To join the HSCW reflector, send a message to <majordomo@qth.net> with the text *subscribe hsms*. To join the meteor scatter reflector, send a message to <majordomo@qth.net> with the text *subscribe meteor-scatter*.

HSMS Software

In my run-up to getting on HSMS I have been checking out what I need. One of the key elements of my station is software. The most popular software (and the most complete) is the WinMSDSP 2000, developed by Tihomir Heidelberg, 9A4GL. Look at <http://ham2.irb.hr/9a4gl> for all details (click on MSDSP project).

Tihomir's software is now in regular use all over the world. You may obtain a version that runs for only 15 minutes. This is not long enough for practical use, but it will allow you to test it. You then can register it with Tihomir by sending him $20 in US currency. When you do so, you will be given a key, which will then convert your test version into a fully functioning version. Registration instructions can be found in its Help file.

Tihomir cannot accept personal checks due to international banking problems. He can accept cash, and he can also accept Bank Checks and Bank Money Orders (made out to him). It takes about two weeks for mail from North America to arrive in Croatia, and the mail seems to be very reliable.

I am quite impressed with the software. It allows for transmitting and receiving up to 20000 lpm. The decoding feature makes it possible for someone who does not know CW to read what was sent. Even so, just by glancing at a good signal you can interpret Morse code by looking at the characters and spacing. For those of us who like to copy the real thing (Morse code), you can slow down the playback slowdown to 200X. This will slow down the code speed to nothing.

There are four test files supplied with the software so that you can get used to using the program. One is at 2000 lpm and the other three are at 4000 lpm. It is easy to load the test software and run it. In so doing, you get a feel for how it will be on the air.

About all you have to do to use the software is hook the audio output and input from your computer to your rig's mic jack and audio out and you are ready to go. The software practically runs itself. You can set your computer's

clock to WWV via the home page: <http://www.time.gov>. When you do, you are ready to rely on the software's built-in clock for transmitting and receiving sequencing.

Current Meteor Showers

The *Lyrids* meteor shower is active between 19–25 April. It is predicted to peak around 0130 UTC on 22 April. This is a north-south shower, producing at its peak around 10–15 meteors per hour, with the possibility of upwards of 90 per hour. A minor shower and its predicted peaks this month is *pi-Puppids* (peak around 0900 UTC on 23 April). The above information is courtesy the International Meteor Organization and their home page at <http://www.imo.net/calendar/cal00.html#April>.

Current Contests

The following contests are scheduled for April.

2000 Spring VHF/UHF Sprints

The following was supplied by Bert Rollen, K4AR, Trustee, East Tennessee DX Association, NJ4I: The East Tennessee DX Association (ETDXA) has recently began a effort to promote weak-signal activities, and therefore would like to offer ongoing sponsorship of the Spring Sprints. The format will remain similar to the 1999 Sprints, and the ETDXA will offer certificates for the top three scores on each sprint. In addition, they will offer a plaque for the station who submits the highest cumulative score total from all yearly sprints.

Object: To work as many amateur stations in as many 2 degree by 1 degree grid squares as possible using authorized amateur frequencies on the 50, 144, 222, 432, 902, and above bands.

Contest Periods:

The *144 MHz Sprint* , 7–11 PM local time, Monday, April 10.

The *222 MHz Sprint* , 7–11 PM local time, Tuesday, April 18.

The *432 MHz Sprint,* 7–11 PM local time, Wednesday, April 26.

The *902 MHz and above Sprint,* 6 AM to 1 PM local time, Saturday, May 6.

The *50 MHz Sprint* , 2300Z Saturday to 0300Z Sunday, May 13–14.

Exchange: Grid-square locator; signal report is optional.

Scoring:

QSO Points: Count one point for each complete QSO.

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

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

Reporting: Logs must be submitted no later than four weeks after the closing of the event. Only submitted logs are eligible for awards.

Certificates for top three finishers in each sprint. Mail or e-mail complete logs to ETDXA. Paper mail may be sent to 1620 Hidden Hills Dr., Clinton, TN 37716. E-mail information was not available as of the writing of this article. However, you probably can obtain this information by e-mailing Bert at <k4ar@pop3.ispchannel.com>.

HSMS Contest

The Year 2000, Third Annual North American High Speed Meteor Scatter (HSMS) Contest is sponsored by The Western States Weak Signal Society.

Purpose: To promote the development of skilled HSCW operators in North America.

Objective: Work as many North Am-

erican stations as possible via meteor scatter during the contest period using HSCW on the amateur radio bands above 50 MHz. HSCW for the purpose of this contest is any speed no less than 495 lpm (99 wpm).

Contest Period: 0000Z, 29 April through 2359Z, 7 May (Friday night through Sunday night of following weekend). You may operate up to 48 hours during this time period. An operating period begins with your first *transmission* and includes time spent listening between transmissions. Operating time must be taken in 30 minute blocks. Time spent listening outside of your operating periods does not count toward your operating time. Multi-ham households: Each licensed ham is eligible to operate 48 hours under his/her own callsign.

Contest Operation: Random and scheduled QSOs count for contest credit. The use of the letter system for CQing is *required*—i.e., CQF, CQX. Report is your four-digit grid square. Real-time skeds, spotting assistance, DX-alerting nets, etc, are permitted for the purpose of arranging contact attempts. Refer to the Region II HSCW standard operating procedures <http://www.nitehawk.com/rasmit/hscw-sop22.html> for suggested HSCW techniques and meteor scatter calling frequencies. The use of HSCW on VHF SSB calling frequencies is poor operating technique. A station may only be worked once per band during the contest period unless one of the stations has changed grid squares. A separate log is required for each grid activated. Each grid activated will be scored separately.

QSO Requirements: To log a completed contact you must copy both calls, report, rogers. Any form of liaison communication between the parties involved in a contact in progress is prohibited. Any interruption of a contact in progress requires both stations restart the QSO attempt from the beginning. All information required for a complete contact must be exchanged using meteor scatter and no other propagation mode.

Classes: Single Operator Limited—2 meters only; Single Operator Limited—Multi-band; Single Operator Unlimited—2 meters only; and Single Operator Unimited—Multi-band.

Limited: Station ERP is restricted to less than or equal to 5 kw.

Unlimited: Station ERP is greater than 5 kw. Multi-band stations must enter in the class corresponding to the highest ERP used. A station may only enter in *one* class.

Multipliers: The sum of each unique four-digit grid square worked on each band.

Scoring (QSO points): The following is the scoring order, band, assisted, and random: 6 meters, 1, 1; 2 meters, 3, 6; 1.25 meters, 9, 18; and 70 cm, 9, 18. The final score is the sum of all QSO points from each band times the multiplier.

Awards: Certificates will be awarded to the top three overall, and to the highest scoring station in each USA/VE call district and each North American DXCC country for each category. In addition, a certificate will be awarded to the highest scoring portable station activating two or more grids (based on the sum of their scores from each grid activated). A minimum of two QSOs is required to qualify for any award. Additional certificates may be awarded where activity warrants. Participants may only enter in one class for contest credit.

Reporting: The following information must be contained on the summary sheet, which must accompany the log: callsign used, grid square(s) activated, maximum ERP used, name, address, and e-mail address (if available). Log information must contain the following data: callsign of station worked, starting and ending times/dates of contact (and operating periods), frequency, reports, and sked or random.

Miscellaneous: Station equipment can only be used under one callsign, with the exception of multi-ham households. Single-band entrants: Time spent working stations on bands other than 2 meters does not count against your 48-hour operating time. Single-band entrants are requested to send in check logs for all contacts made on other bands. The decisions of the awards committee are final. All logs must be postmarked or e-mail dated no later than May 30th. E-mail logs must be sent in ASCII format to: <hscw@contesting.com>. Postal mail logs must be mailed to: WSWSS HSCW Contest, c/o Steve Harrison, KØXP, 37 Plainfield Ave., Shrewsbury, MA 01545.

Sample blank log-page/summary sheets are available from <http://www.qsl.net/n7stu/hscw.html> or a reasonable facsimile may be used. A printed copy of the rules and sample log/summary sheetmay also be obtained by sending an SASE to the WSWSS. Enclose an SASE if you would like to receive a printed copy of the results via postal mail.

Note: The radiant of the *Eta Aquarids* shower is projected to provide the best conditions during the contest (in North America) from approximately one hour before sunrise local time for approximately eight hours daily. This is the suggested best operating time each day. Remember, though, HSCW contacts can be completed at any time of the day.

The following internet web sites contain a wealth of information about high-speed meteor scatter. Note that there are several minor operating practice differences between North America and European; for example, in North America, the northern- or eastern-most station normally transmits during the odd minutes (those minutes beginning with odd numbers—1231Z, 1415Z, etc.). Also, North American sked speeds (and sometimes CQ speeds) tend to be somewhat higher than in Europe because most North American HSMSers use computers to record and playback recorded reflections. Suggested HSMS operating practices are described in HSCW Procedures (v. 7), available at <http://www.nitehawk.com/rasmit/hscw-sop22.html>. Information regarding calculating station ERP can be obtained from W5UN's website <http://web.wt.net/~w5un/>. Other information, including hardware modification tips, software, and HSMS articles, may be found at these URLs:
<http://www.nitehawk.com/rasmit/ws1_15.html>
<http://www.ilk.de/sites/gap>
<http://www.mint.net/~n1bug/>
<http://www.qsl.net/k0sm/>
<http://www.sci.fi/~oh5iy/>
<http://www.cannon.net/~mattmc/kb0vuk/hsms/hsms.html>
<http://www.qsl.net/kd5bur/>
<http://www.qsl.net/n7stu/hscw.html>.

Many more links covering other HSMS topics may be found on most of the above web sites.

Current Conferences

The Southeastern VHF Society Annual Conference will be held in Marietta, Georgia on April 14–15, 2000. The conference location will again be the Marriott Hotel at Windy Hill in Marietta. The hotel and conference center is conveniently located northwest of Atlanta, Georgia at exit 110 of Interstate 75. The room rates for attendees will again be $69 per night, but does not include breakfast this year. For reservations, call the Marriott at 1-800-228-9290. For commercial air transport, Atlanta-Hartsfield Airport is about 45 minutes away by Atlanta Airport Northside Shuttle. The hotel is also equidistant from three local airports for private aircraft. They are Peachtree-DeKalb, Brown-Fulton County, and McCollum-Cobb County airports. For more information, visit their web site <http://www.svhfs.org/svhfs/svhfs2000.htm>.

The Ultra Highs Weak Signal Society

What started out essentially as a paper club to obtain the callsign W5VHF has evolved into an active group of hams who reside within the "golden circle" of northeast Oklahoma, southeast Kansas, southwest Missouri, and northwest Arkansas. On February 5 about a dozen of us gathered at the QTH of San Hutson, K5YY, in Springdale, Arkansas for a two hour get-together. Among those present were WD5AGO, N6CL, W6CL, KØETC, AB5GG, KBØHH, K5PJR, WØRT, K5SW, K5TTT, KØUO, K4YA, and K5YY. The next gathering will be at 2 PM one weekend in April. The final date had not been decided by press time; check home page <http://www.geocities.com/CapeCanaveral/Cockpit/6264/> for the latest information. The society meets on 144.190 on Saturday mornings at 8 AM Central time for an informal roundtable.

And Finally . . .

The FCC Lightens Up: I never did like the term "no-code Technician." Additionally, I abhor the phrase "tech-light." I know where the latter came from. Those who drink beer know that the "lights" have fewer calories. They think that something has been left out. This logic was derisively transferred to the then-new code-free Technician class licensee just because he or she may not have learned Morse code. Unfortunately, this distinguishing of these licensees was negative!

Now, however, with the new FCC class of license regulations set to take effect this month, the nomenclature of Technician Plus will disappear. In its place will be the simple nomenclature Technician. Unfortunately, there are those who wish to maintain the old nomenclature. In a Petition for Partial Reconsideration filed on January 17, Alan J. Wormser, N5LF, Frederick V. Adsit, NY2V, and Michael J. Dinelli, N9BOR, argued, "Since the only difference between Technician and Technician Plus classes is the telegraphy examination, if the Commission and its auxiliary observers are hampered in distinguishing between the two, then the Commission risks violating Rule S25.5 of the International Radio Regulations treaty. They recommend that the FCC "...should consider keeping the 'Technician Plus' designation within the callsign database in order to aid in continued enforcement of the international treaty."

I disagree. I feel that it is possible to maintain a database that indicates the passage of the Morse code requirement without maintaining the discriminatory label of Technician Plus.

When the FCC created the code-free license, it was not its intention to create a license class that is entirely free of a Morse code requirement. In the inception of the code-free license the FCC stated that those new Technician class licensees would have all amateur privileges above 30 MHz. This meant that their privileges started at 50.0 MHz, a CW portion of 6 meters. The code-free Technicians, as well as all other class of licensees authorized this portion of the band, must operate CW on it or be in violation of FCC rules. The FCC allows this mode for these licensees partially as a way of learning and practicing the code for those who are inclined to do so.

This editorializing is not to say that I do not want our new brethren to learn the code. I do, because three forms of propagation almost require knowing the code. Aurora contacts are best completed at very-high-speed CW. High- speed meteor or scatter operations (described above briefly), the now fastest growing mode of weak-signal VHF operation, uses high-speed CW. Furthermore, EME contacts are almost always completed using CW. Even so, so much of the spectrum and so many different modes of propagation are open to all of us who operate on the VHF+ frequencies.

Nevertheless, we have a long way to go. Traditionally, the code-free Technician class licensee has been the least assimilated into our ranks. Surveys conducted by CQ Communications and the ARRL have come to this conclusion. Is it possible that they are just not joiners? I don't think that's the problem. Rather, I think that it is a recruitment problem on our part.

It is up to us older and hopefully wiser members of the fraternity to welcome these new Technicians, whether or not they have passed the code. How can we do this? We can incorporate the welcome mat within our contest teams and our clubs. Indeed, for years now the Pack Rats, the W2SZ contest group, and the Rochester VHF Group all have made it a point to include newly licensed Technicians, regardless of their knowledge of the code, on contest outings. Additionally, the RVHFG has made a serious effort to attract newly licensed amateurs to its organization because its leadership realizes that the future of the hobby is to be found amidst these new amateurs.

These endeavors have been steps in the right direction. However, we must continue to make every effort to make our new hams, regardless of their class of license, welcome within our fraternity.

Thanks to the FCC's new regulations, therefore, the Technician Plus designator will become a thing of the past. Let's also make it a part of our past terminology. When it comes to the Technician class licensee, let's get him or her into our club, onto our Rover team, working at our contest station. If we don't, we might just find his or her callsign listed with a competitor's results in the next contest summary!

Until next month...73, Joe, N6CL

DX

BY CARL SMITH, N4AA

News Of Communication Around The World

Activity Around the World

The past few months have seen a burst of activity from around the world. Juan Fernandez Island (CEØZ) attracted a lot of attention with three operations in as many months, one group from Chile in January, a second group from Germany in February, and a third from Finland in March.

Mayotte (FH) saw some much needed CW activity with Roger, G3SXW, and Nigel, G3TXF, making a total of 21,740 QSOs from Mayotte and another 4460 from Seychelles between January 21 and February 3. WARC-band contacts were by FH/G3TXF and S79TXF, and all non-WARC band contacts were by FH/G3SXW and S79SXW. They used two TS570D's, two R7000 verticals, and an HF2V vertical. An interesting aspect of this operation is that you can request a bureau reply by sending e-mail (including your callsign and QSO details) to one of the following: FH/G3TXF and S79TXF at <g3txf@compuserve.com> or FH/G3SXW and S79SXW at <g3sxw @compuserve.com>.

Clipperton Island (FO) was to be activated around March 1st for one week, headed by John Kennon, N7CQQ. It has been some time since the last operation from Clipperton, so this one is expected to generate a lot of activity.

Macquarie Island (VKØMM) continues to be active on several of the bands. Alan posts the operating schedule on his web page <http://www.geocities.com/vkØld/1.htm> each week. Although his operating style has been criticized by some, he is providing a lot of contacts with Macquarie, if you follow his rules. QSLs for his one-day operation as AXØLD, on January 26, celebrating the millenium, are being handled by the Brazilian CWSP, with any extra money from the QSLing process being donated to a children's cancer hospital. QSLs for his regular VKØ operations will not be handled until after he leaves the island later this year.

Jukka, OH2BR, began a four month long operation from semi-rare Pitcairn Island in late January as VP6BR. He will be active from the island until May.

Chesterfield Island (TXØDX) is another of the "new ones" found by meticulous checking of charts for distances,

P.O. Box DX, Leicester, NC 28748-0249
e-mail: <n4aa@cq-amateur-radio.com>

Christian, 6W1QV, and Jean Claude, TR8XX, during their operations as 3C2JJ in May 1999.

(Left to right) N4PN; N6MZ; Paul, BV4FH; N4XP; and Jimmy, BV4AS. The US DXers stopped in Taiwan enroute to Spratly and visited with Paul and Jimmy, who are part of the teams that activate Pratas. They will be there again in April of this year.

The WPX Program

SSB

2732 .....JH4DGN
2733 .....EA5AIH
2734 .....EA3FAJ
2735 .....RU3DG
2736 .....NH6C
2737 .....N8WEL

CW

3028 .....NH6C
3029 .....CE8GLQ
3030 .....JQ2FFS

Mixed

1848 .....UA3AP
1849 .....BA4TB
1850 .....KQ6NS
1851 .....N6HC
1852 .....JA1ODB

CW: 450 CT4NH. 1000 F5YJ. 1300 W9IL. 1350 W9IL. 1650 JN3SAC. 1700 JN3SAC. 2250 PAØSNG.
SSB: 350 N8WEL. 400 N8WEL, IK8OZP, K8NIA. 450 N8WEL, IK8OZP, K8NIA. 500 K8NIA. 600 K8NIA. 650 N1SHM. 1200 IV3VCG. 1500 W9IAL.
MIXED: 450 UA3AP, VE9FX. 500 UA3AP, VE9FX. 550 UA3AP, VE9FX. 600 UA3AP, VE9FX. 650 VE9FX. 700 VE9FX. 750 VE9FX. 800 VE9FX. 850 VE9FX 900 VE9FX. 1000 VE9FX, WZ4P. 1050 JA3BKP. 1100 JA3BKP. 2350 W9IL. 2400 W9IL. 2600 N4UH. 4350 F2YT.

10 meters: K8NIA

Africa: KK6ZO
So. America: W2FKF

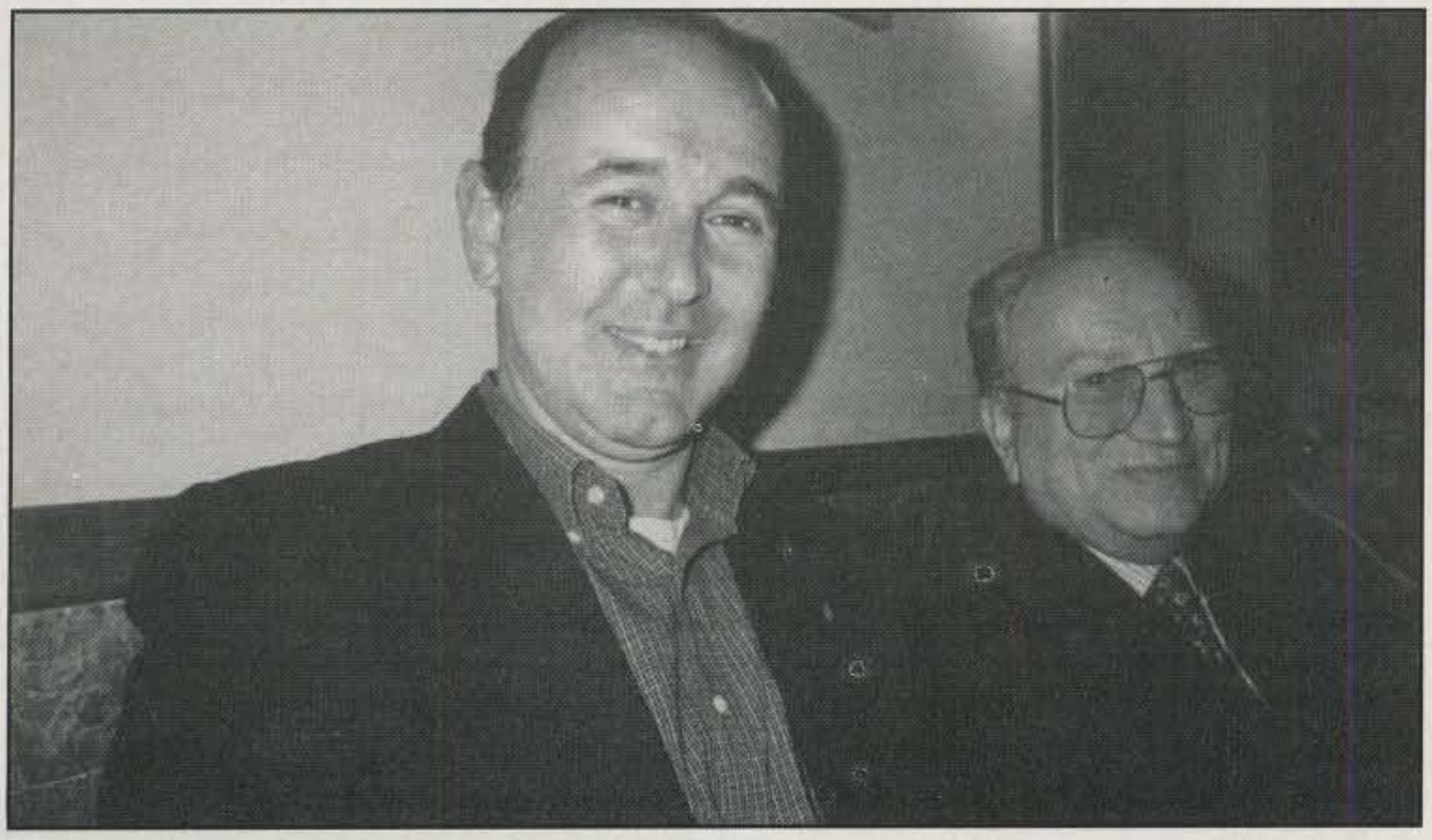
Award of Excellence Holders: K6JG, N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP KØJN, W4VQ, KF2O, W8CNL, W1JR, F9RM, W5UR, CT1FL, W8RSW, WA4QMQ, W8ILC, VE7DP, K9BG, W1CU, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, I8YRK, SMØAJU, N5TV, W6OUL, WB8ZRL, WA8YM, SM6DHU, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, DK4SY, UR2QD, ABØP, FM5WD, I2DMK, SM6CST, VE1NG, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, HA8XX, K7LJ, SM3EVR, K2SHZ, UP1BZZ, EA7OH,, K2POF, DJ4XA, IT9TQH, K2POA, N6JV, W2HG, ONL-4003, W5AWT, KB0G, NB9CSA, F6BVB, YU7SF, DF1SD, K7CU, I1PO, K9LNJ, YBØTK, K9QFR, 9A2NA, W4UW, NXØI, WB4RUA, I6DQE, I1EEW, I8RFD, I3CRW, VE3MC, NE4F, KC8PG, F1HWB, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, KC7EM, YU1AB, IK2ILH, DEØ-DAQ, I1WXY, LU1DOW, N1IR, IV4GME, VE9RJ, WX3N, HB9AUT, KC6X, N6IBP, W5ODD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, WØULU, K9XR, JAØSU, I5ZJK, I2EOW, IK2MRZ, KS4S, KA1CLV, KZ1R, CT4UW, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, OE1EMN, W9IL, S53EO, DF7GK, I7PXV, S57J, EA8BM, DL1EY, KØDEQ, KUØA, DJ1YH, OE6CLD, VR2UW, 9A9R, UAØFZ, DJ3JSW, HB9BIN, N1KC, SM5DAC, RW9SG, WA3GNW, S51U, W4MS, I2EAY, RAØFU, CT4NH.

Award of Excellence with 160 meter Endorsement: K6JG, N4MM, W4CR2, N5UR, VE3XN, DL3RK, OK1MP, N4NO, W4BQY, W4VQ, KF2O, W8CNL, W1JR, W5UR, W8RSW, W8ILC, G4BUE, LU3YL/W4, NN4Q, VE7WJ, VE7IG, W9NUF N4NX, SMØDJZ, DK3AD, W3ARK, LA7JO, SMØAJU, N5TV, W6OUL, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, UR1QD, AB9O, FM5WD, SM6CST, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, K7LJ, SM3EVR, UP1BZZ, K2POF, IT9TQH, N8JV, ONL-4003, W5AWT, KBØG, F6BVB, YU7SF, DF1SD, K7CU, I1POR, YBØTK, K9QFR, W4UW, NXØI, WB4RUA, I1EEW, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, YU1AB, IK4GME, WX3N, WBØDD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, K9XR, JAØSU, I5ZJK, I2EOW, KS4S, KA5CLV, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, S53EO, S57J, DL1EY, KØDE1, DJ1YH, OE6CLE, HB9BIN, N1KC, SM5DAC, S51U, RAØFU, UAØFZ, CT4NH, W1CU.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if airmail desired) to "CQ WPX Awards," P.O. Box 593, Clovis, NM 88101 USA.

under the revised DXCC rules. A multinational group is scheduled to operate from this group of islands (part of New Caledonia) from mid-March to early April. They were expected to run five stations from two sites on all bands/modes. A web site was created for updated information on Chesterfield at <http://www.n4gn.com/tx0dx/>. Log checking is available.

Rivilla Gigedo (XF4) was scheduled to be active in early March by three XE ops as XF4LWY. Little information was made available on this operation, so I hope you kept up news sources for this one.



Giuseppe LaParola, IT9BLB (left), president of the Palermo (Sicily) Amateur radio Club, with Aldo Lupo, IT9LUP, one of the club's long-time members. Photo by Silvano, KB5GL, on a recent visit to Sicily and Italy.

The WAZ Program

Single Band WAZ

12 Meter Mixed

21.....4N7ZZ

15 Meter SSB

529.....JI8DXO

17 Meter CW

27.....DK2GZ

20 Meter SSB

1055.....W7GAX 1056.....9A7K

20 Meter RTTY

47.....VK3EBP

30 Meter CW

34.....DK2GZ

40 Meter SSB

92.....NT5C

All CW

151.....EA5ERY 152.....DJ3MJ

All Band WAZ

SSB

4527	F5UJK	4530	VE2BCS
4528	G3EKJ	4531	JF2GIZ
4529	EA1ATQ	4532	K6CIL

CW/Phone

7905	OK1IVU	7910	GI4SNC
7906	JA3LA (All Phone)	7911	GØKRL
7907	HLØC	7912	KU6J
7908	DL5LBY	7913	JT1CO
7909	CT4NQ (All CW)	7914	KØEVE

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: WAZ Award, CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the CQ WAZ Award. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. The WAZ Award Manager is Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75088; e-mail: <k5rt@cq-amateur-radio.com>.

5 Band WAZ

As of 12 January 2000 509 stations have attained the 200 Zone level.

New recipients of 5 Band WAZ with all 200 Zones confirmed:
None

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)	W3NO, 199 (26)
W4LI (AA4KY), 199 (26)	K4UTE, 199 (18)
K7UR, 199 (34)	K4PI, 199 (23)
WØPGI, 199 (26)	HB9DDZ, 199 (31)
W2YY, 199 (26)	N3UN, 199 (18)
VE7AHA, 199 (34)	NØTN, 199 (6 on 40)
IK8BQE, 199 (31)	F6CUK, 199 (19 on 10)
JA2IVK, 199 (34 on 40m)	UA3AGW, 198 (1,12)
K1ST, 199 (26)	EA5BCK, 198 (27,39)
ABØP, 199 (23)	G3KDB, 198 (1,12)
KL7Y, 199 (34)	KG9N, 198 (18,22)
NN7X, 199 (34)	DKØEE, 198 (19,31)
OE6MKG, 199 (31)	KØSR, 198 (22,23)
HA8IB, 199 (2 on 15)	K3NW, 198 (23,26)
IK1AOD, 199 (1)	UA4PO, 198 (1,2)
DF3CB, 199 (1)	JA1DM, 198 (2,40)
F6CPO, 199 (1)	9A5I, 198 (1,16)
W6SR, 199 (37)	K4ZW, 198 (18,23)
W3UR, 199 (23)	OH2VZ, 198 (1,31)
KC7V, 199 (34)	RAØFA, 198 (2 on 10,15)
GM3YOR, 199 (31)	LA7FD, 198 (3,4)
VO1FB, 199 (19)	K5PC, 198 (18,23)
KZ4V, 199 (26)	NT5C, 198 (18,23 on 40)
N4CH, 199 (18 on 10)	VE3XO, 198 (23,23 on40)
OE1ZL, 199 (1)	K4CN, 198 (23,26)
W6DN, 199 (17)	KF2O, 198 (24,26)

1122 stations have attained the 150 zone level as of December 30, 1999.

The following have qualified for the basic 5 Band WAZ Award:

Endorsements:

F6HMJ, 194 zones	NT5C, 199 zones
RW9SG, 181 zones	

****Please note: Cost of the 5 Band WAZ Plaque is $80 ($100 if airmail shipping is requested).**

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: WAZ Award, CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the CQ WAZ Award. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. The WAZ Award Manager is Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75088; e-mail: <k5rt@cq-amateur-radio.com>.

The big operation from Myanmar by XZØA went on for three weeks and ended with something over 75,000 contacts in the logs. This group spent an extraordinary amount of time, and money, erecting antennas for the low bands, including a 180 foot tower/vertical for 160 meters. From the reports I saw, they made a lot of the Top Band ops happy.

Several "new ones" have come out of the Pacific in the last year, due to that distance rule change. You'll remember Austral and Marquesas as well as Temotu. There could be others out there, and I'm sure there will be further "scanning" of the charts for other possible islands meeting the distance requirement.

FR/T—Tromelin

Good news for DXers is the announcement by the Lyon DX Gang (France) that they are putting together a major DXpedition to this island. Tromelin has been very high on all of the Most Wanted lists for a long time. The exact dates were not available, but it is expected to be in August. The plan calls for renting an airplane for the trip from Reunion to Tromelin, taking four operators and the equipment for a two-week stay on the island. Tromelin and the other islands in the area (Glorioso, Juan de Nova/Europa, etc.) are quite remote and are considered to be scientific preserved areas. None of these islands have seen any significant operation in a long, long time. Getting permission to even go to these islands is very difficult, let alone permission to stay there for two weeks. I congratulate the Lyon DX Gang for

finally gaining permission to provide this rare one for the DXing community.

9U—Burundi

In the May 1999 DX column, Chod, VP2ML (SK), talked about the deletion of contacts with Burundi due to license irregularities. With the recent activity by Gus, 9U5D, I thought it would be wise to again mention that there has not been any "legal" activity there since January 1, 1994. The only exception is a short operation by 4U9U around October of 1994, which is acceptable for DXCC. Any contact with stations signing 9U/xxxx since January 1, 1994 is invalid. Also, any contact with 9U5W, 9U5DX, 9U5T, or 9U5CW is not acceptable. Gus has been quite active, both SSB and CW. He likes to make a "full" contact, complete with QTH, name, etc. He was expected to be in the country until March. Hopefully, his activity has "broken the ice," and we will be able to see future legal activity from Burundi.

Islands On The Air (IOTA)

Although this RSGB program has been around for quite awhile, it continues to attract the attention of DXers. After a DXer has *worked 'em all,* he searches for other challenges, and the IOTA program offers just that—a challenge. Roger Balister, G3KMA, is the RSGB IOTA Manager, and you can get more information on the program from Roger via his e-mail address <g3kma@dial.pipex.com> or from the website <http://www.eo19.dial.pipex.com/index.htm>.

In addition to the above, there is a relatively new organization called the Island Radio Expedition Foundation, Inc. (IREF). This foundation was established to assist DXpeditioners with the financial aspects of putting islands on the air. The IREF has its own website at <http://www.sat.net/~iref> where you can obtain details on their purpose and procedures.

DX Gatherings

Visalia. This convention, alternately sponsored by the Northern and Southern California DX Clubs has been running for over 50 years. The Southern California DX Club has the honor of sponsoring the Year 2000 Convention in Visalia. The dates are April 14, 15, and 16. They are expecting over 800 DXers from all over the world to be in attendance. The convention offers a hosted cocktail party; HF-, low-band-, and DX-oriented forums and technical sessions; the Traditional Conventions Patch; Saturday night banquet and DX program featuring a well-known speaker; and Sunday morning breakfast buffet with guest speakers. There is a golf tournament on Friday, a tour to the Squaw Valley Herb Gardens on Saturday, and the US Towers lunch on Saturday. Although this announcement is a bit late, you may contact Don Bostrom at 818-784-2590, or by e-mail at <dbostrom@pacbell.net> for any late information you might want.

Dayton - 2000 SWODXA DX Dinner. As we mentioned last month, the Southwest Ohio DX Association is hosting the 15th Annual DX Dinner to be held on Friday, May 19, 2000, at the Crowne Plaza Hotel, Dayton, Ohio. There will be a cash bar at 6:30 PM and dinner at 7:15 PM. Tickets are $31 and must be purchased in advance. Groups wishing to sit together must order as a group. A table seats eight. Please make your check or money order payable to SWODXA and send an SASE for ticket return. Seats will be assigned in the order that requests are received. Seats will be assigned on 12 March 2000. Seating is limited. Order tickets from Steve Bolia, N8BJQ, 7354 Thackery Rd,, Springfield OH 45502. For information on the dinner, check <http://members.aol.com/SteveB4622/> or

THE WPX HONOR ROLL

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix list. Scores are based on the current prefix total, regardless of an operator's all-time count. Honor Roll must be updated annually by addition to, or confirmation of, present total. If no up-date, files will be made inactive. Lifetime Honor Roll fee is $4.00 (U.S.) for each mode, with no fee for additions.

MIXED

5017 .....9A2AA	3701.....N6JV	3099.....YU7SF	2787.....W9HA	2339.....W9IL	2224....W8UMR	1707.....KC6X	1397.....NH6T	1195.....W2CF
4339.....W2FXA	3657.....VE3XN	3099..WA8YTM	2760.....KØDEQ	2313.....9A4W	2159.....W4UW	1591.....W7CB	1395.....VE6BF	1162....JR3TOE
3986.....EA2IA	3507.....9A2NA	3055.....IT9QDS	2727.....IK2ILH	2292.....W6OUL	2018.....N3XX	1580...I1-21171	1351.....W2EZ	1100..OK1DWC
3984.....W1CU	3482.....N4MM	2983..WB2YQH	2689.....HA0IT	2281.....N6JM	1948.....DJ1YH	1572,.....AA1KS	1339.....N1KC	1014...EA2BNU
3865.....K6JG	3456.....I2PJA	2968.....I2MQP	2669.....S53EO	2276...WA1JMP	1915...OZ1ACB	1544.....Z32KV	1298...VE6BMX	1010.....F5RRS
3797.....UA3FT	3444.....YU1AB	2926.....KF2O	2494..YU7GMN	2273....YU7JDE	1855...PY2DBU	1499.....YU1ZD	1271.....VE6FR	813.....K6UXO
3863.....F2YT	3424...SM3EVR	2842.....I2EOW	2433.....S58MU	2270.....KS4S	1796....JN3SAC	1451.....AI6Z	1268..KW5USA	743.....KU6J
3797.....UA3FT	3369.....N5JR	2832.....HA5NK	2355.....K2XF	2242.....K5UR	1759.....I2EAY	1432.....WT3W	1264.....VE6BF	611.....JH2IEE
3708.....N4NO	3133...PAØSNG							

SSB

4260.....IØZV	2918.....I4CSP	2487.....UA3FT	2074.....IN3QCI	1685.....KS4S	1546.....IKØEIM	1380...SV3AQR	1028....DL8AAV	892.....AG4W
3833.....ZL3NS	2844.....N4NO	2446.....KF2O	1975.....W4UW	1650.....HA5NK	1535.....I3ZSX	1358.....W2FKF	1028....EA5DCL	790.....N3DRO
3598.....K6JG	2804.....N5JR	2414..WA8YTM	1975.....HAØIT	1617.....W6OUL	1525.....W2ME	1318.....KC6X	1011.....I2EAY	786.....JN3SAC
3476.....F6DZU	2780.....I2MQP	2401.....PY4OY	1921.....K5UR	1617....DK5WQ	1444.....W9IL	1181...LU3HBO	1010.....EA7CD	736.....VE6BMX
3450.....I2PJA	2724...PA0SNG	2396.....I8KCI	1814.....N6FX	1613.....K3IXD	1443.....N3XX	1160.....K4CN	1002.....N1KC	729.....F5RRS
3148.....CT4NH	2712.....9A2NA	2329....KF7RFU	1785.....N2XF	1571..CT1BWW	1438.....DF7HX	1124.....WT3W	972.....AI6Z	687....OK1DWC
3057.....EA2IA	2642.....I2EOW	2292.....EA1JG	1770.....YU7SF	1560.....K8MDU	1421.....T30JH	1073.....NH6T	946.....LU4DA	643.....BD4DW
3049.....N4MM	2618...CT1AHU	2211.....CX6BZ	1737.....I8LEL	1550.....LU5DV	1397.....I3UBL	1061.....KI7AO	896.....JR3TOE	608.....JE4SCT
3040.....OZ5EV	2491....LU8ESU	2162.....K5RPC						

CW

3895..WA2HZR	2875.....YU7LS	2410.....9A2NA	2083.....S58MU	1804.....K5UR	1625....JN3SAC	1506.....I2EAY	1167.....AI6Z	984.....EA2BNU
3614.....N6JV	2734.....YU7SF	2376..WA8YTM	2079.....KF2O	1758.....W6OUL	1599.....EA6BD	1356.....LU3DSI	1167.....I2EOW	967.....NH6T
3300...VE7CNE	2593.....VE7DP	2357...YU7BCD	1982.....N6FX	1694.....N3XX	1590....JA1GTF	1335.....VE6BF	1094....LU7EAR	888.....VE6BMX
3249.....N4NO	2527.....LZ1XL	2147.....HA5NK	1964.....G4SSH	1679.....DJ1YH	1565...EA7AAW	1318.....W9IL	1078.....9A3UF	838.....WT3W
3100.....K6JG	2490.....N5JR	2113.....KA7T	1865.....I7PXV	1671.....9A2HF	1514.....EA5YU	1262.....I2MQP	1055.....W4UW	791.....K6UXO
2998.....K9QVB	2445.....G4UOL	2102....EA7AZA	1823.....K2XF	1652.....KS4S	1513.....IK5TSS	1240.....AC5K	1002.....YU1TR	659.....N1KC
2961.....EA2IA	2425.....N4MM	2094.....HAØIT	1806.....LU2YA	1651....IK3GER	1509.....9A3SM	1178.....KC6X	998.....K2LUQ	621....WA2VQV

QSL INFORMATION

3B8FG to 3B8FG
3B9FR to 3B9FR
3Z1V to SP1MHV
4S7EA to 4S7EA
5R8FA to JE8BKW
5WØEE to DL1DX
5X1P to G3MRC
7N2KUH to 7N2KUH
7Q7DC to GØIAS
7X2CR to ISØLYN
7X4AN to 7X4AN
8J1RL to JA9BOH
8Q7WP to PA5ET
9G1AA to PA3ERA
9G5ZW to OM3LZ
9K2UB to 9K2UB
9Q5HX to IK2MRZ
9U5D to SMØBFJ
9V1PC to 9V1PC
A41LZ to A41LZ
A71BY to F5PYI
A71EH to A71EH
C31LJ to VE3GEJ
CEØZX to DK7YY
CEØZY to DK7YY
CE4NV to CE4NV
CO8LY to EA7ADH
D2BF to EA8EE
DAØRC to DAØRC
DK7YY to DK7YY
DL1DX to DL1DX
DL2JRM to DL2JRM
DU1/DL4OCM to DL4OCM
DU3NXE to W3HNK
EA7BO to EA7BO
EK6AD to EK6AD
EM1KGG to UT7UA
EP2AC to RV6AB
ER39MMZ to ER3DW
ET3VSC to DAØRC
EX8MLE to IK2QPR
EZ8AQ to EZ8AQ
FH/G3SXW to G3SXW
FH/G3TXF to G3TXF
FK8VHU to FK8VHU
FK8VHY to F8CMT
G3SXW to G3SXW
G3TXF to G3TXF
GIØKVQ to GIØKVQ
GJ4GG to GU4GG
GM3VLB to GM3VLB
GU4GG to GU4GG
HB9TU to HB9TU
HLØEXN to HLØEXN
J37XC to W2BJI
J73VW to J73VW
JG1OUT to JG1OUT
JT1DA to JT1DA
JW9VDA to LA9VDA
KG4AS to N4SIA
KHØ/AE4SU to JA3KWZ
KH2/K4SXT to K4SXT
KH2K/AHØ to JA1RJU
LU/KYØC to G4VGO
LY2OX to ISØLYN
M2ØØØA to G4DFI
M2I to WW2R
N6DE/KP2 to N6DE
NP2/K7BV to KU9C
OG2R to OH2BH
OH1NX to OH1NX
OH2BOZ to OH2BOZ
OH2MXS/CEØZ to OH2BOZ
OH2NSM/CEØZ to OH2BOZ
OH3JF/CEØZ to OH2BOZ
P29KPH to K5YG
R1ANA to RU1ZC
R1ANJ to RU1ZC
R1ANZ to RU1ZC
R1FJV to UA3AGS
RA9LI/9 to DL6ZFG
S21AR to JA1UT
S51DQ to S51DQ
S52OOO to S51DQ
S79LE to DL8LE
S79SXW to G3SXW
S79TXF to G3TXF
SM5RQ to SM5RQ
SV/OK1YM to OK1TN
SV9SK to SV9SK
T32DA to W4ZYV
T88HK to JE6DND
T99RM to DL2JRM
TE8CH to TI5KD
TI2WGO/4 to N5BUS
TI5BX to TI5BX
TY/FK8VHU to FK8VHU
TYD11 to FK8VHU
UAØFF to UAØFF
V29TU to HB9TU
V51AS to V51AS
VP5/K4ISV to N2AU
VP8NJS to GM3VLB
VQ9NL to W4NML
VQ9PO to W3PO
W6XK/KP2 to W6XK
W7MH/KP2 to W7MH
WH7C/DU3 to JG1OUT
XQ3IDY to CE4NV
XX9TUH to 7N2KUH
YB8NA to YB8NA
YO3GRE to YO3GRE
YS1ECB to EA7BO
ZA5G to ZA5G
ZF2MU to K4BI
ZF2ZZ to SM7DZZ
ZK1GNW to I2YSB
ZV4D to PY4AUN

(The table of QSL information is courtesy of John Shelton, K1XN, editor of "The Go List," P.O. Box 3071, Paris, TN 38242; phone 901-641-0109; e-mail: <golist@wk.net>.)

contact Steve at 937-788-2803 or e-mail to <n8bjq@erinet.com>.

Trip to Russia: Ham Exchange

Guy Shields, W4GBU, says, "I am in the process of coordinating a "ham" exchange with Russia for the Winter 2000/ Spring 2001 time frame. I am working with the Friendship Force in Atlanta on the details of the exchange. So far I have about ten Atlanta hams interested in this trip to Moscow. We will visit the Russian Central Radio Club/Box 88, as well as numerous Russian ham stations while documenting the trip with photos. We would like to have about 50 or so hams with us on this 'ham adventure.'

"You can get complete details at <http://w4gbu.home.mindspring.com>. Click on the 'Trip to Russia' link."

DXCC Field Checking Changes

The ARRL DXCC Desk announced a new, enhanced DXCC Card Checking program, which was approved by the ARRL Board of Directors at their January 2000 board meeting in Memphis. This new program will allow DXCC members to have their cards checked by local card checkers without the necessity of mailing cards to ARRL Headquarters.

Under the new program, DXCC Card

CQ DX Awards Program

SSB

2298 .....W4OGG
2299 .....UA6LDD
2300 .....EA3FAJ

CW

1000 .....N7WO
1001 .....SM5HV/HK7
1002 .....KD8IW

SSB Endorsements

320 .....N4MM/331
320 .....VE7WJ/330
320 .....DL9OH/331
320 .....KD8IW/326
320 .....W2FKF/323
310 .....K3LC/310
300 .....VK3IR/303
300 .....SV3AQR/302

CW Endorsements

320 .....N4MM/331
310 .....SM5HV/HK7/317
310 .....NØFW/317
300 .....W6YQ/305
300 .....YU7FW/300
275 .....N7WO/285
275 .....KD8IW/275
200 .....UA9SG/220

The basic award fee for subscribers to *CQ* is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business-size, No. 10, self-addressed, stamped envelope to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. Currently we recognize 331 active countries. Please make all checks payable to the award manager.

Checkers will be able to check all awards except 160 meter DXCC and all QSLs from any current DXCC Entity. This will apply to both new awards and endorsements. QSOs made up to ten years prior to the current year will be eligible for checking in the field, while older cards and Deleted Entities may still be sent to ARRL HQ.

The current DXCC Field Checking program will end on March 31, 2000, with the new program to begin on April 1, 2000. Reappointment of DXCC Card Checkers under new criteria will be necessary. Nominations may be made by Section Managers and ARRL-affiliated DX Specialty Clubs of 25 members or more.

DXCC 2000 Millennium Award

Just one of the new awards established under the DXCC 2000 program, the DXCC 2000 Millenium award should be fun for everyone. Remember when you first started chasing DX and everything you worked was a "new one"? Well, here's a chance to get that feeling all over again with little or no pressure. There are no QSL cards to collect or any of that other "hard stuff." Whether you are a "Top of the Honor Roll DXer" or just getting started, you can have some fun with this award.

73, Carl, N4AA

Our Readers Say

Vintage Equipment

Editor, *CQ*:

Many thanks for the articles on vintage equipment in the November and December issues of *CQ*. Keep them coming. Especially nice would be articles on some of the individual companies, especially the earlier ones in the 1920s and 1930s which are so little known today—e.g., Guthman, Howard, and the like.

73, David Edsall, W1TDD

David: Karl Thurber's "Classic Jurassic" articles paved the way for our new "Radio Classics" column by Joe Veras, N4QB, which began in the February issue and will be appearing on a quarterly basis. I'm sure Joe will take your suggestion under advisement.

January Zero Bias

Editor, *CQ*:

I just read your editorial in the January 2000 issue. Your treatment of the "perception is reality," "positive vs. negative," and "half full vs. half empty" ways of looking at ham radio was terrific! What a powerful way to begin the new year and the new millennium. I immediately thought about other areas of our existence to which one could apply the very same approach.

Bill Gerth, WØMDX
Nashville, Tennessee

A Better Battery Pack

Editor, *CQ*:

I enjoyed the article in the January 2000 issue of *CQ* entitled "Battery Replacement for the Radio Shack HTX-202/404." Recelling old NiCd packs is a great way to keep old equipment running.

Please note the following correction. The replacement battery pack does not appear to be still available from RadioShack. I bought my HTX-202 new in April 1995 with the 5-year extended service policy. In November 1999, when my battery pack failed to hold a charge, I took it into the nearest store. They took the old pack, and they mailed me a replacement, but instead of an RS pack, it was a W&W Associates WC-024J2-IC8. This is rated 8.4v @ 1800mAh, much better than the original. The RS charger fits it, and it also has an extra jack to charge it from 13.8 volts. It works really well and I have not had the opportunity to run it all the way down yet. The only disadvantages are that it is larger and heavier than the original pack, and it is dark green and does not match the dark gray radio.

Ralph Katz, KB8ZOY
Ann Arbor, MI

Amateur Satellites

BY PHILIP CHIEN, KC4YER

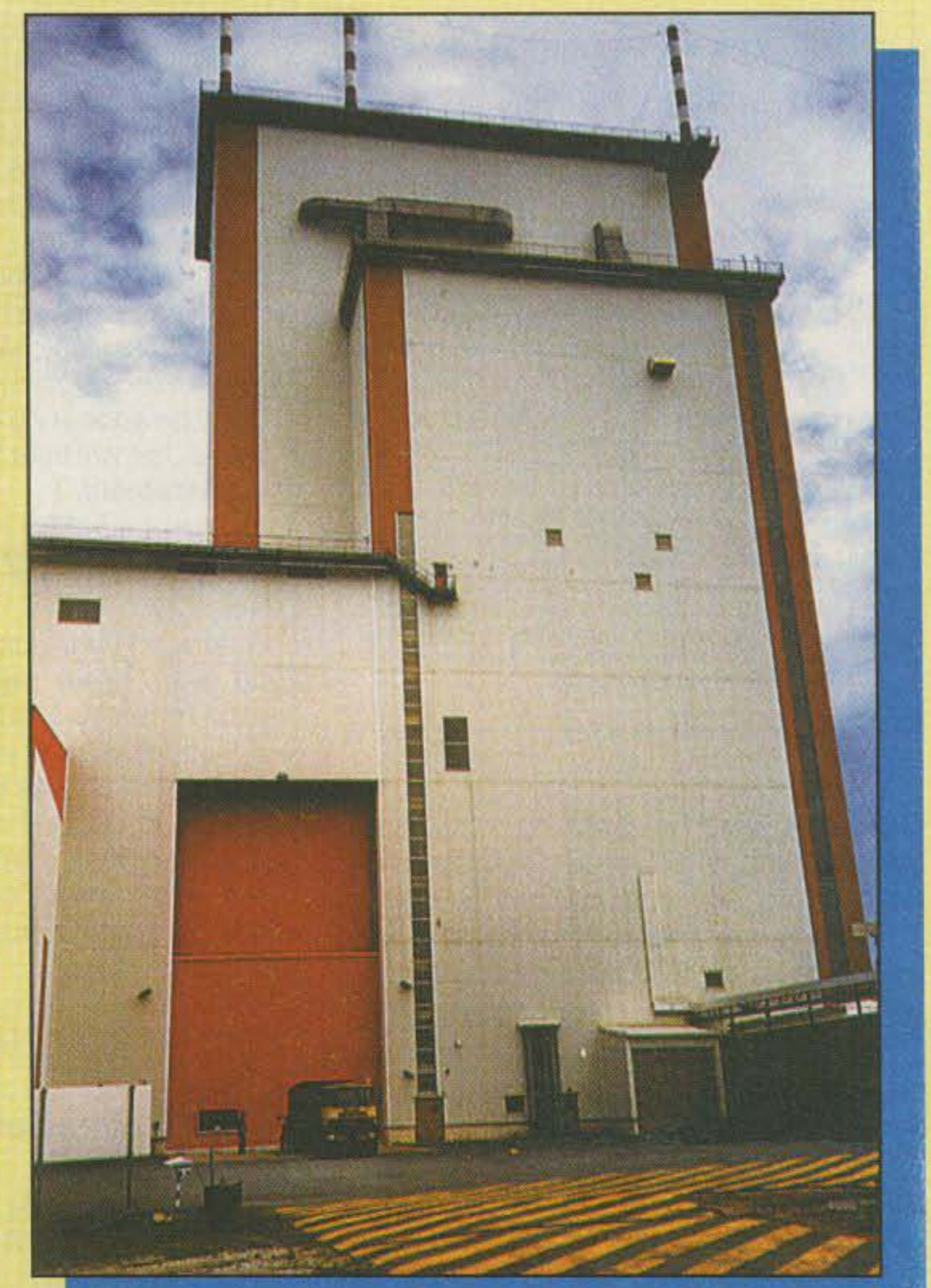
Ham Radio in Space

Phase 3-D Shipped to French Guiana

It was a day many were wondering would ever happen. After over two years of delays the AMSAT Phase 3-D satellite was finally shipped to the European Space Agency's South American launch site in Kourou, French Guiana. On January 16th at 1 PM Phase 3-D left the AMSAT Lab in Orlando, Florida on the back of a flatbed truck headed for Atlanta, Georgia. The next day it was loaded on an Air France 747F cargo aircraft for a transatlantic trip to Paris, France. After a couple of days in Paris the spacecraft was loaded on a 767 and flown back across the Atlantic, arriving in French Guiana on January 23rd.

The two transatlantic hops were made necessary by money and logistics. The only commercial wide-body aircraft large enough to fit the Phase 3-D shipping container through its cargo doors and which flies to French Guiana flies only from France. A hundred-million dollar commercial comsat can afford to charter a dedicated cargo aircraft to ship its satellites directly to the launch site, but amateur satellites typically have to fly on scheduled commercial flights. Even then the cost of the shipping came to over $20,000.

Phase 3-D currently is sitting in the BAF (Final Assembly Building) in Arianespace's facilities until the launch schedule is fully defined. The $64,000 question is when will Phase 3-D actually launch? Arianespace has agreed to launch Phase 3-D as a secondary payload on an Ariane 5 flight. A typical Ariane 5 mission consists of two large commercial communications satellites. When one becomes available with enough excess capacity, Phase 3-D will fly. This is a fairly tricky situation; satellite schedules change and launch vehicle manifests adapt as required. In many cases excess launch vehicle capacity can translate into a more optimized geosynchronous transfer orbit, which results in less propellant requirements for the satellite and therefore a longer operational lifetime. Thus, Arianespace often sells enhanced performance missions to its commercial customers. However, when a mission's requirements have been established, there is often some excess capacity. The question then becomes when will enough capacity become available to carry Phase 3-D. Based on Arianespace's track record and the current backlog of commercial satellites, there should be enough space for Phase 3-D within the next three to six vehicles.



Phase 3-D's new, and hopefully temporary, home at the European Space Agency's launch facility in French Guiana. If you look very carefully at the bottom, you may be able to see the truck delivering the P3D satellite. (Photo by Peter Gülzow, DB2OS, courtesy AMSAT-DL)

Y2K and Amateur Satellites

Well, the infamous Y2K bug came and went with a whimper, not a bang. In most cases computer programmers were prepared in advance and ready to deal with whatever issues came up. It turns out the most significant Y2K issue was with a top-secret spy satellite's ground station. It wasn't able to receive data for a couple of hours until a work-around could be implemented. The satellite had had similar length outages for non-Y2K issues in the past, but there was much more attention focused on the problem due to the awareness of potential Y2K problems.

There were even fewer concerns in the case of amateur radio satellites. In some cases control operators uplinked Y2K compatible code. In most cases, though, the satellites weren't subject to Y2K issues because they don't count time in terms of two-digit years. Most satellite clocks count the number of days from an arbitrary start date.

While all of the working amateur satellites survived the transition from 1999 to 2000 without any noticeable problems, the same can't be said about satellite tracking programs. Many satellite tracking programs will not accept new element sets, while others will generate incorrect information.

Many publishers are using Y2K as the logical reason to stop supporting older versions of programs. As an example, WISP16 is not Y2K compatible and no updates are planned

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to make it so. However, there is a new version of WISP32 which is fully Y2K compatible.

Satellite tracking is especially prone to Y2K bugs because of the many places where things can go wrong. The most obvious issue is rollover, common to many other programs which keep track of time. If your tracking program thinks that Mir's launch date of Feb-19-86 is actually Feb-19-2086, then it will believe that Mir won't be launched for another 86 years!

A trickier issue is how the two line elements keep track of time. There are two separate values where the century is assumed. The International ID includes the last two digits of the year, the serial number for when the launch took place, and whether it's the primary object from the launch, a secondary satellite, a piece of the rocket, or a piece of debris. Mir's international ID is 86 017A, which indicates the primary (A) object from the 17th launch in the calendar year 1986. The 19 is implied. The second number that assumes the century is the epoch date. It includes the two-digit year, the day of the year, and the fraction of the date where the element set was generated. A typical epoch date would read 99364.50000, in this case the year 1999, December 30 (the 364th day of the year) at 12 noon GMT (.5 days).

USSPACECOM's position is that no launch took place before 1957. Thus, if the two digits of the year range from 57 to 99, it took place in the 1900s. If the year ranges from 00 to 56, it's in the 2000s. One would assume that by the year 2057 a new system will be implemented. *(Of course, similar assumptions about computers and the year 2000 are what caused all these problems to begin with!—ed.)* It's the responsibility of the tracking program, or any other utility which manipulates element sets, to calculate the proper year.

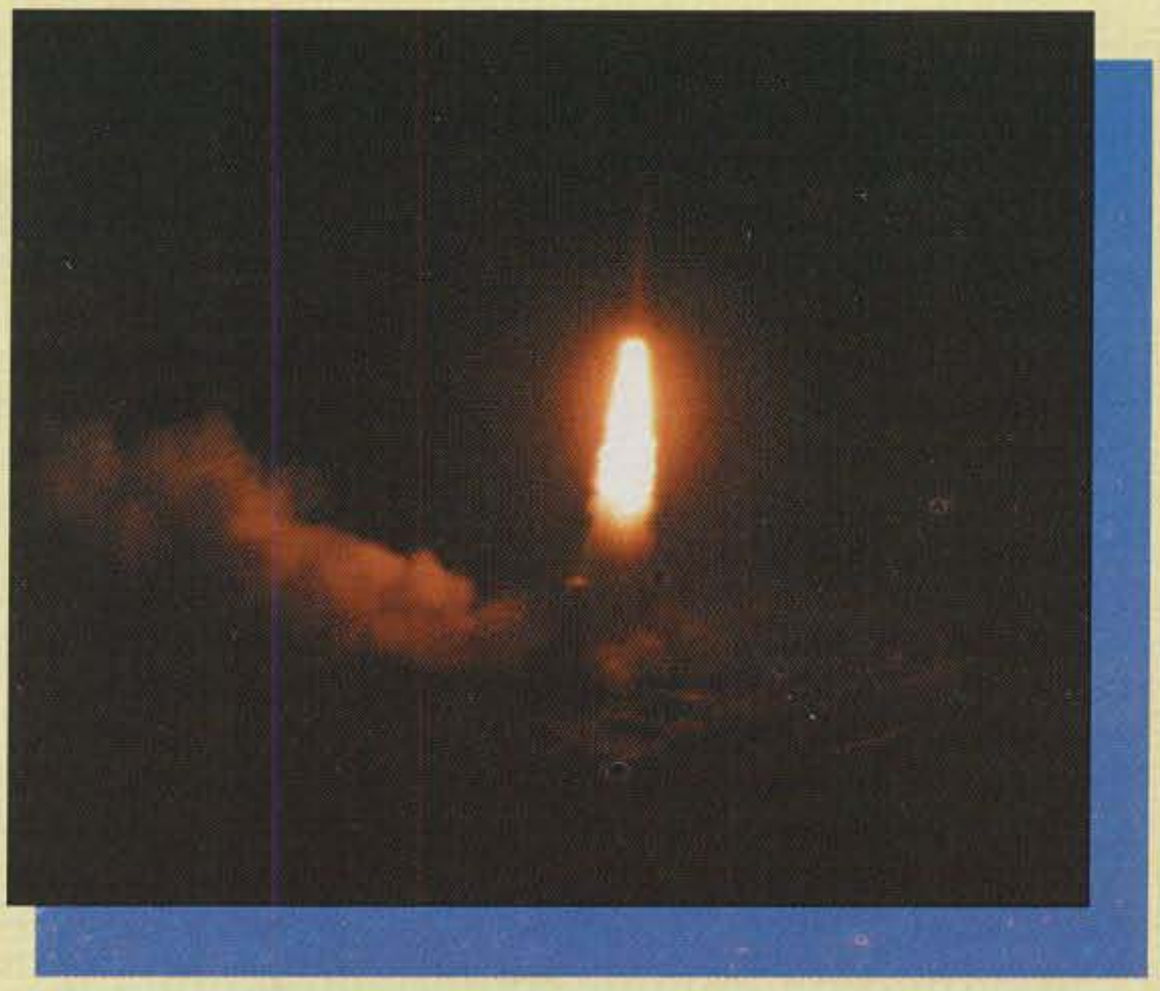
In some cases programs will generate predictions for where a satellite theoretically was located in 1900 instead of 2000. In other cases programs will generate correct predictions for the year 2000, but won't accept new Keplerian elements because it thinks they're older than the existing keps in its database.

One of AMSAT's most popular tracking programs, Instantrack, is not Y2K compatible. It's an extremely old DOS program using EGA quality graphics and is extremely unsophisticated by today's standards. It does have its enthusiasts, though, like owners of old cars who are unwilling to part with an old friend. What's frustrating is that it's still sold as a brand-new product even though its age really shows and it doesn't have as many functions as newer, more state-of-the-art tracking programs.

The upgrade from Instantrack 1.0 to a Y2K compatible version initially was promised for "October 1999," then "any day now," and as of this writing it still hasn't been released. Its status is now "should be soon." There is a work-around, a separate program which updates the elements file. It's available on the Internet from <http://www.ccr.jussieu.fr/physio/amsat-france/epatch-it.htm>.

Minotaur Launch

The February column described the Minotaur launch vehicle and its handful of amateur radio satellites. The first launch attempt was on January 14th. The countdown proceeded toward zero, but the ground launch sequencer didn't activate when it was supposed to. The launch team went through its turnaround procedures, and the second attempt proceeded toward launch until engineers noticed that a flight battery had too low a voltage reading. It turns out that there would have been enough power for the vehicle's mission, but not as much margin as the engineers desired.



Well, it was a nighttime launch, so you can't really see much, but this is a shot of the Minotaur rocket as it lifted off from Vandenberg Air Force Base in California on January 26th. It carried several amateur-band pico- and nano-satellites, but only one, Stensat, shows any signs of life. (Air Force photo)

As we explained in February, Minotaurs are retrofitted ICBMs. A ballistic missile has to sit in a silo for many years—literally decades. Then it has to be ready to go on a moment's notice; its batteries only have to work for about an hour, but they have to be extremely reliable. These requirements result in the use of thermal batteries. The battery's active chemicals are in separate isolated compartments. A small squib is exploded to mix the chemicals, which quickly generates a fairly large amount of power. Once activated, however, the battery only provides power for a short period of time and then is useless. These are excellent characteristics for a missile, but not so desirable for a launch vehicle which may have to go through multiple launch attempts due to technical problems or weather delays.

It took over a week to find a suitable approved flight battery in storage for the next launch attempt. There was a lot of pressure to launch by the end of January before other items in the rocket expired, resulting in another lengthy delay.

The second launch countdown on January 26th was uneventful, and the launch took place at 7:03 PM PST.

The launch vehicle was supposed to radio back telemetry directly to the Vandenberg launch site for the first three stages and record the telemetry from the fourth stage after it passed under the horizon. The telemetry, including details on the separation of the satellites from the launch vehicle, was supposed to be transmitted to a ground station in Antarctica. Telemetry was lost during the third stage burn, about a minute earlier than anticipated. Observers at Vandenberg Air Force Base were able to visually observe the fourth stage burn. Only one burst of telemetry was recorded in Antarctica, so what actually happened during the fourth stage of flight is a mystery.

The planned orbit was 750 by 750 km, but the actual orbit achieved was 750 × 810 km, with an apogee (high point) 60 km higher than planned. It shouldn't affect the performance of the satellites, but it's a mystery as to why it happened.

Still, even if the launch vehicle was silent, it appears to have done an adequate job. JAWSAT was mated to the vehicle and the other satellites were attached to JAWSAT. JAWSAT eject-

ed the other payloads—ASUsat, OPAL, Falconsat, and the Optical Calibration Sphere—on schedule. Within hours hams around the world reported receiving beacons from the satellites with transmitters on amateur frequencies, and amateur satellite observers saw the inflated OCS.

Falconsat appears to be the main success story from the Minotaur launch. While it uses many of the same techniques as amateur satellites and even some of the same people, it is not an amateur satellite. It transmits on military frequencies only when it's over the Air Force Academy in Colorado Springs, Colorado. However, many hams have successfully decoded its signals with out-of-band radios.

JAWSAT successfully accomplished its primary mission of deploying the remaining payloads, and it was commanded to shut off the transmitter and unnecessary equipment so its batteries could get recharged. Ground controllers later sent commands to reactivate the transmitter, but as we go to press they have not received any confirmed signals.

Regrettably, ASUSat failed due to power problems. It appears the solar arrays never recharged the batteries.

OPAL had several problems receiving commands which the Stanford ground station believed was in their equipment. One major issue was access to Stanford's large radio astronomy dish. Besides supporting OPAL, the Stanford dish was used to try to send commands to the Mars Polar Lander spacecraft in case it's still alive. Therefore, the OPAL people had only limited times when they could use the dish as an ultra-high-gain antenna.

The first attempt to send a command to eject the DARPA Picosats was unsuccessful; nothing happened. Fortunately the second attempt on February 7th succeeded, and Aerospace Corporation was able to receive signals from its pair of satellites.

About 10 PM PST on February 10th the OPAL ground station in Stanford, California sent the commands to eject Stensat and JAK, one of the Artemis trio. JAK presumably didn't send any data before its batteries failed. Early monitoring of Stensat seems to indicate that it's alive, although possibly in an incorrect configuration.

Stensat is the only OPAL picosat with solar arrays and rechargeable batteries. The others used primary batteries with extremely limited lifetimes.

The remaining two picosats, Thelma and Louise (aka Thunder and Lightning), were launched on February 12th.

What few people realize is the four-minisat and six-picosat launch sets a record for the largest number of satellites lifted into space on a single launcher. The previous record is eight, which was set on several military Titan launches which deployed early constellations of experimental comsats. There was an attempt to launch 12 Globalstar satellites on a Ukrainian Zenit-2 launcher, but that launch vehicle failed.

NASA TV on DBS

One of the most asked for television channels is NASA TV. It's also one of the least profitable channels, since cable companies and other retransmission services realize they can't charge very much for it. In comparison, another infomercial channel is much more profitable. Consequently, the only direct broadcast service to carry NASA TV was Dish Network, and even then only on its third satellite, which requires an additional satellite dish.

It had always been anticipated that the FCC would require direct broadcast satellites to carry some public-service channels. The key question was what percent. The FCC finally ruled that direct broadcast companies had to carry a minimum of 4 percent of public-service channels on the company's primary satellites. Therefore, Dish Network moved NASA TV to its primary satellite, Echostar 1 at 119 degrees West, and added it to the standard "Top 40" package. Unfortunately, this decision has increased the cost for some consumers. Many space fans purchased Dish Network systems just to get NASA TV and paid a nominal $5 per month for that service. But now that NASA TV is part of the "Top 40" package, it cannot be ordered separately.

In the case of competitor DirecTV, it complied by adding NASA TV to the Tempo satellite, coincidentally also located at 119 West. But that's DirecTV's secondary satellite, carrying primarily Spanish programming, local channels, and—in the future—high-speed Internet access. DirecTV's primary programming is transmitted from its three primary satellites co-located at 101 West. Only two of the public-service channels are on the primary satellites; the remaining four are located at the secondary location. To get NASA TV with a DirecTV setup, you need an enhanced package with the specially shaped dish to receive programming from the 101 and 119 locations.

Compounding the problem, many consumers have complained about problems getting DirecTV to activate NASA TV. It's supposed to be available as a free channel, but many of DirecTV's technical personnel have no idea how to activate it or even that it's available.

If DirecTV's problems activating NASA TV for its customers are solved, it will create a major increase in the number of individuals who can watch NASA TV directly instead of relying on commercial news media to find out what's happening with the space program ■

Contesting

BY JOHN DORR, K1AR

News/Views Of On-The-Air Competition

Sweating the Details as a Multi-Op

April's Contest Tip

Planning on operating as a multi-single (or multi-2) in the next contest? Most traditional multi-op setups (unless you're one of the fringe players) have a run station and a multiplier station. Serious competitors will tell you that the addition of a third operating position can make a big difference in your total score by giving your station another set of ears, especially when conditions are as good as they are now. Also, if you have a number of operators, it gives the team members more to do when they're not actively operating. Next time you do a multi-op contest effort, consider adding a third station. I guarantee your score won't go down!

Calendar of Events

Mar. 25-26	**CQ WW WPX SSB Contest**
Apr. 1-2	SP DX Contest
Apr. 1-2	EA RTTY Contest
Apr. 7-9	Japan Intl. DX Contest (20-10 m)
Apr. 8-9	MARAC County Hunters SSB
Apr. 8-9	King of Spain Contest
Apr. 9	UBA Spring SSB Contest
Apr. 15-16	Michigan QSO Party
Apr. 15-16	Holyland DX Contest
Apr. 15-17	YLRL DX to NA YL CW
Apr. 22-23	Helvetia DX Contest
Apr. 22-23	SP DX RTTY Contest
Apr. 22-24	YLRL DX to NA YL SSB
Apr. 29-30	Florida QSO Party
Apr. 29-30	Ontario QSO Party
Apr. 29-30	Nebraska QSO Party
May 6-7	ARI Int'l DX Contest
May 13-14	CQ-M DX Contest
May 27-28	**CQ WW WPX CW Contest**

If I take a look at my own decades of contest operating, I'd be willing to bet that there's a fairly even split between single operating and participation at multi-op stations. Over the years I've had the good fortune to participate among some of the best, including W2PV, W1ZM, W3AU, W3LPL, K1EA, K1GQ, K1OX, and even a few at my own station. In fact, getting involved with multi-op contests/stations is really where I learned the basics of contesting, putting in my time, if you will, by operating with some of the best contesters of the day such as K2TR, K1ZM, W3LPL, and many others.

In addition to benefitting from the ability to learn contest operating at its finest, I also discovered that multi-op contesting adds new meaning to the concept of preparation.

More Than Just Showing Up?

Let's face it. As a single operator, contesting is much easier from a logistics standpoint. It's akin to being single vs. married with a boatload of kids. Both have their benefits, but most of us know the extra effort required to manage a multi-op household. Contesting is no different in that regard. Those who are not committed to the ongoing preparation required for success as a team will most certainly underachieve. With that in mind, let's focus on some of the details that separate a winning effort from mediocrity.

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e-mail: <K1AR@contesting.com>

Preparation

No matter in what category you operate, being prepared is always a key differentiator. However, this is even more the case when it comes to managing a multi-op situation. Consider the following factors:

- Operators
- Radio equipment
- Antennas/switching
- Computers/software/networking/packet
- Accessories
- Operating game plan
- Human comforts (sleeping arrangements, food, transportation for some)
- Inter-station interference

With the list at hand, let's take a look at each one and do a little planning on the spot.

Operators. There are really only two primary issues to consider in the area of operators—finding them and keeping them happy! Over the years of multi-op contesting I've tended to operate with "lean and mean" teams. The result is a group of guys who are good candidates for a sleep deprivation study, but at least they are happy. We have tended to be a group that likes to operate a lot during any given contest, and an under-staffed team certainly will allow that to happen. The point is you need to establish a philosophy about team size right up front, before you start recruiting members.

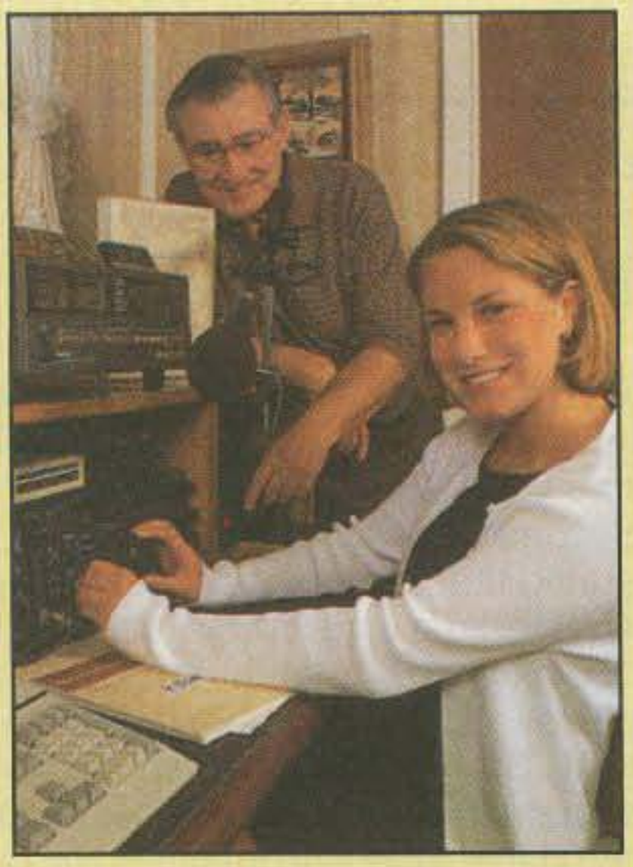
Second, there's always the issue of ensuring that everyone gets in enough operating time and on the bands that they enjoy. Put another way, setting expectations for your team members is critical. The last thing you want is for a new member to join your multi-op team thinking that he will be the main run guy on 15 meters when you have the 20 meter night shift in mind for him as the station owner.

There's no better way to plan your operation than to have a team meeting and discuss the details with everyone. In fact, if you're new at it or have a number of new members, meeting a few weeks before the contest is an even better idea.

Radio Equipment. Obviously, the task of organizing radio equipment is entirely up to the station owner, right? Wrong! Unless they've been blessed with time and money, few multi-op stations have all their equipment ready to go, resulting in the most tedious task being simply to turn it all on. Sweating the details by preparing an inventory of what is needed is key, and knowing who's bringing what piece of gear is critical. Moreover, over the years I've learned that setting up the station on Friday afternoon is a formula for disaster. No matter how many times you've done it, there are always issues that will emerge which could better be managed with a little preparation. If you have the luxury of time, try setting up your station a week or two in advance.

Antennas/Switching. Unlike inside equipment, I'll have to defer to the station owner on this one. I've yet to see a multi-op where one of the operators strapped an 80 meter 4-square to his car roof and brought it over Friday morning (although there are many who have put one up a few hours before the contest!). This is an area where the station owner needs to take charge and plan months in advance.

It's important to remember that there is more to the game than just ensuring you have the right antennas. In a multi-op situation you also have to focus on flexibility in antenna switching. For example, do you have the ability to put any antenna on any station? Does your



On the Cover:

To say that Al Schulman, WØDRT, of Ballwin, Missouri, is a bit of a proud grandfather is just a bit of an understatement. His admiration for his granddaughter, 17-year-old Sarah Pickle, KØGAL, also of Ballwin, seems to know no bounds. However, it also seems that his admiration is well-deserved. Sarah is a junior at Marquette High School, wants to be a surgeon, and is not only taking college courses already, but last summer she tutored college students in chemistry! Sarah has been a ham since she was 12 and holds an Advanced Class license.

Grandpa Al has been a ham for 49 years, holds an Extra Class license, and says he's worked just about everything there is to work. But it's still a thrill, he adds, to get a call from Australia or Micronesia, as he did recently while conducting a test on 15 meters. His primary interest is DXing, and he operates mostly phone, with a little bit of RTTY and CW as well. Al says he is "90% retired" from his financial planning business.

Hamming is a family activity for Al and Sarah. He says they often operate together—each from his/her own station—working DX. "I'll call her up and say, 'so-and-so's on 15 meters; let's go work him,' and she'll get on and we'll go after the DX together." Both of Sarah's parents are teachers, and neither is a ham.

Al notes that many of Sarah's non-ham friends have spent a lot of time in their ham shacks, and many of them seem especially fascinated with RTTY. "A lot of them feel uncomfortable talking on a mic, but they have no problem on a keyboard," he notes, adding, "Every kid in America today has half a ham station— they have a computer." (Cover photo by Larry Mulvehill, WB2ZPI)

40 meter antenna rotate along with your 10 meter beam, causing contention in the late afternoon? Does your 80 meter operator have to go to another room to switch the 4-square from Europe to the west to work a KH6? Common sense prevails here for sure.

Computers/Software/Networking/Packet. At times, despite all the advantages of computer logging there are situations when we yearn for the old days of pen and paper. I'm sure many of you can recall times at your stations when you spent 5 percent of your energy worrying about the ham stuff and the remaining 95 percent messing around with computers.

Of course, we also have this scenario: A large operating team is coming over; let's try out some new software this weekend! This is clearly a plan for failure. While it may not be practical to set up your computers weeks in advance, knowing the game plan is critical. Testing the version of software you plan to use in advance is a prerequisite. Preparing a "bill of materials" that includes cables, connectors, plug-in cards, and other minutia is equally important.

Finally, don't forget about your friend the packet station. Friday afternoon is not the time to learn that you have a bad cable on your 2 meter antenna running up the tower, nor is it the time to discover that 20 meters destroys the packet station above 14200 kHz.

Accessories. Don't you hate it when you're all set up and you realize you're one keyer paddle short or someone forgot an extra set of headphones? I'm convinced that a meaningful percentage of RadioShack's revenue come from contesters hitting their stores on selected Friday afternoons several times a year. Just as with computers and radio equipment, a well thought out list of accessories and owners is a major component of sweating the details for success in multi-operating. It doesn't have to be the job of the station owner, either. Many successful multi-ops parse their assignments out to the team members. Some manage operators, others deal with equipment logistics, while still others manage transportation for out-of-town guests.

Operating Game Plan. This area of preparation is probably the most controllable aspect of multi-op contesting. Just as with sports, having a game plan is a key component of success. Do you have goals for your operation? Does everyone subscribe to the same objectives? Have you assembled the team you need to meet your plan? There's nothing worse than having a station owner mentally prepared to try to win a category and then to have him be forced to live with an operating team that is there only to have a little fun and drink beer for the entire weekend. Put another way, be connected with your team members ahead of the weekend. Make sure everyone knows his role and set expectations for that up front to eliminate problems during the contest.

A second and equally important aspect of this topic is to ensure that you understand propagation and the underlying strengths and weaknesses of your station. Preparing a mental (or even written) plan around these elements is a critical success factor. Again, just as with sports, know your competition and the playing field you're about to take on. With a little forethought, you can maximize your operation and final score.

Inter-station Interference. While it may not be practical to set up the entire station weeks in advance, it is reasonable to anticipate inter-station interference challenges, especially if you're new to the game of multi-operating. Some items to prepare for in advance include filters, coaxial stubs, spare cables, etc. The more you can anticipate in this area the less diagnostic time you will spend on Friday afternoon.

Human Comforts. This can be a touchy subject for many households as a hoard of hams converge on a station, taking over the house and turning it upside down for the non-hams in the brood. Make sure, as the station owner, you've prepared your family for what's to transpire over the weekend. In a similar way, make sure your operating team knows the rules of the house as well. For example, should they bring their own food or expect to be fed? Is the entire house fair game, or are the hams banished to the basement for the weekend? Do your operators need to bring their own bed gear, or can they expect an environment that mirrors the New York Hilton? Remember, you may be loud on 20 meters, but an unhappy spouse can really slow down the team's run rate overall!

And finally . . . I hope I've given you some food for thought this month. The task of multi-operating is an art in itself. The reason so many contesters do it, though, is simple: It's fun! A little preparation and sweating through the details can make it an even more rewarding experience for everyone involved. Go get 'em, team!

Some Final Thoughts

That's it for now. The 2000 Contest Survey, promised for this month, will be pre-

sented soon, as there were still a few questions to ponder ourselves before we ask for your input.

As always, please remember to provide any submissions for the July issue to me by May 1. More and more of you are catching on, but as you can imagine, you can really help with the accuracy of contest calendar information by submitting your contest announcements to me via electronic mail.

73, John, K1AR

EA RTTY Contest

1600Z Sat., to 1600Z Sun., Apr. 1–2

This is the 2000 edition of the Spanish RTTY Contest sponsored by U.R.E. It is open to participants worldwide on 80–10 meters.

Classes: Single operator, all bands and single band, multi-single, and SWL.

Exchange: Signal report and Spanish province (for EA stations). All others substitute CQ Zone for province.

Scoring: For non-EA stations: On 10–20 meters credit 1 point for contacts in your continent, 2 points for QSOs outside your continent. On 40 and 80 meters triple your QSO points (i.e., 3 within your continent/6 outside your own continent). QSOs between stations in the same country are only valid for multiplier credit and have no QSO point value.

Multipliers: Credit EA provinces (maximum 52) and DXCC countries worked per band. The first QSO with an EA, EA6, EA8, and EA9 station, on each band, counts for 2 multipliers (DXCC + province).

Final Score: Multiply total QSO points times multiplier.

Awards: Various certificates and plaques are available to the winners of each operating category.

Send your entries by June 30th to: EA RTTY Contest, c/o EA1MV, Antonio Alcolado, P.O. Box 240, 09400 Aranda de Duero (Burgos), Spain. E-mail logs (in ASCII format only) go to: <alcolado@redestb.es>.

Polish "SP" DX Contest

1500Z Sat., Apr. 1 to 1500Z Sun., Apr. 2

Sponsored by the Polski Zwiagek Krotkofalowcow (PZK), this one is on CW and SSB and is held the first weekend of April, generating high operating activity by the SPs. Contest operation is on all bands 160–10 (no WARC bands).

Classes: Single operator, single and all band (CW, SSB, or mixed mode); multi-operator, single transmitter (all band, both modes only); and SWL.

Exchange: Signal report plus a three-digit serial number. SP stations will substitute their one-letter province abbreviation for the number.

Multiplier: Count the total number of Polish provinces worked (maximum of 16 per band).

Scoring: Three points per QSO times the number of Polish provinces worked.

Awards: Certificates will be awarded to the high scorers in each class per country.

All logs must be received no later than April 30th. Send entries to: Polski Zwiazek Krotkofalowcow, Contest Committee, P.O. Box 320, 00-950, Warszawa, Poland, or e-mail to: <spdxc-logs@writeme.com>.

Japan Int'l DX CW Contest (High Band)

2300Z Fri. to 2300Z Sun., Apr. 7–9

The object of this one is for amateurs around the world to work as many JA stations in as many JA prefectures as possible. It is sponsored by *Five-Nine* magazine. The maximum operating period is 30 hours (except for JAs, who can use the full 48 hour period) with off periods longer than 60 minutes. This is the high-band edition (others to follow in subsequent months), and operation is limited to 20–10 meters.

Classes: Single operator high power/low power/all band/single band; multi-operator; marine mobile. All stations may use packet DX spotting.

Exchange: JA—RST and prefecture number (1–50). Others—RST and CQ Zone.

Scoring: 20 and 15 meters—1 point per QSO; 10 meters—2 points. Multipliers are total prefectures worked per band (DXCC countries for JA). Final score is total QSO points times multiplier.

Awards: Plaques and awards will be sent to the winners in each class around the world. A special contest award will be offered to anyone working all Japanese prefectures during the contest period. E-mail entries are accepted, too. To obtain electronic log instructions, send an e-mail to: <jidx-info@dumpty.nal.go.jp> (this address is only for information request) with the command **#getjidxelog.eng** in the body of the message. Commands must start with the "#" character.

All logs must be postmarked no later than May 31st and should be sent to: JIDX HFCW Contest, c/o *Five-Nine* magazine, P.O. Box 59, Kamata, Tokyo, 144 Japan. Contest results will be sent to anyone including one IRC and an SAE.

MARAC County Hunters SSB Contest

0000Z Sat,. Apr. 8 to 2400Z Sun., Apr. 9

The Mobile Amateur Radio Awards Club is sponsoring the 29th running of this event. Mobile and fixed operation from every county in the United States is welcome. Mobiles and portables may be worked each time they change counties or bands.

Exchange: RS(T), U.S. county and state (province/country for others).

Scoring: One point for fixed stations; 15 points for mobiles; US/VE contacts with DX countries are worth 5 points. Final score is computed by the total QSO points times the total number of U.S. counties worked.

Frequencies: 3880, 7240, 14270, 21340, 28340 kHz. Fixed stations should operate above the suggested frequencies to allow

more freedom for mobiles to operate on clear frequencies.

Awards: Certificates will be awarded to winning fixed stations in each state/province/country; mobiles in each state operating in three or more counties with a minimum of ten QSOs per county. MARAC plaques to the highest scoring first- and second-place mobile stations in the U.S., North American fixed station, and DX station.

Completed logs, summary sheets, and check sheets must be received by May 9th and go to: Norm Beavers, W3DYA, 3320 McMillan Drive, Tyler, TX 75701-8239. Enclose a #10 SASE and two units of postage with your entry for a copy of the final results.

YLRL DX to North America YL Contest

CW: Apr. 15–17 SSB: Apr. 22–24
1400Z Wednesday to 0200Z Friday

This is another popular YLRL-sponsored contest open only to licensed women operators around the world. Participants may work only 24 total hours in each contest. Operating breaks must be shown in the log.

Classes: Single operator only.

Exchange: QSO number, RS(T), and ARRL section/country. Entries in log must also show time, band, date, and transmitter power.

Frequencies: CW—3540–3570, 7040–7070, 14040–14070, 21120–21150, 28180–28210 kHz. SSB—3940–3970, 7240–7290, 14250–14280, 21380–21410, 28280–28410 kHz.

Scoring: Phone and CW are entirely separate contests. DX YLs, including Alaska and Hawaii, may contact the North American continent. A station may be counted as one point and worked once per band for credit. Multiply the number of QSOs by your total multiplier (sections/countries) for final score. You may apply a bonus multiplier of 1.5 if less than 150 watts is used at all times during the contest.

Awards: Various cups and plaques will be awarded to the category winners. In addition, certificates will be provided to all second- and third-place winners.

Logs are due 30 days after the conclusion of each contest. Mail your logs to: Phyllis Shanks, W2GLB/7, 1345 W. Escarpa, Mesa, AZ 85201-3853.

Swiss Helvetia Contest

1300Z Sat., Apr. 22 to 1300Z Sun., Apr. 23

This is a good chance to build up your Canton total for the Swiss Helvetia Award, which requires confirmation from all 26 Cantons.

Classes: Single op (high power or QRP), multi-single, and SWL. All entries are mixed-mode only.

Frequencies: Use 1.8–28 MHz (no WARC bands) on both phone and CW.

Exchange: RS(T) plus a three-digit serial number. Swiss stations will also include a two-letter abbreviation for their Canton.

Scoring: Only contacts with Swiss stations count. Each contact with an HB station is worth 3 points. You may only work a station once per band regardless of the mode.

Multiplier: The sum of the Cantons worked on each band (26 per band).

Final Score: Calculate your final score by multiplying your total QSO points by the sum of Cantons worked.

Awards: Certificates will be awarded to the top scorers in each country and each USA and VE call area.

Logging: Indicate a Canton in a separate column for each band the first time it is worked. Check your log for duplicates and include a summary sheet showing the scoring and your name and mailing address in block letters. Also include the usual signed declaration.

The mailing deadline for contest logs is May 31st. All logs are to be sent to: Nick Zinsstag, HB9DDZ, Salmendorfli 8, CH-5084, Rheinsulz, Switzerland.

Nebraska QSO Party

1700Z Sat., Apr. 29 to 1659Z Sun., Apr. 30

Help complete your 5BWAS by operating in this popular QSO party sponsored by the Heartland DX Association. This contest is for single operators only with operation allowed on all non-WARC HF bands, 160–10 meters. All operating modes are permitted.

Classes: Single operator, multi-single, mobile, and Novice/Tech.

Exchange: NE stations—RS(T) plus county (93 maximum). Non-NE stations—RS(T) plus US state, VE province, or DXCC country.

Scoring: Credit one point per QSO for SSB contacts; two points for CW. NE mobiles add 50 QSO points for each county operation. NE portables add 100 QSO points for operating from other than your resident county. NE mobiles may be worked again when they change counties for new points/mults. NE mobiles operating on county lines may be counted as only one QSO. Final score is calculated by multiplying total QSO points times multiplier.

Frequencies: CW—1805 kHz and 60 kHz up from lower band edge. SSB—1815, 3860, 7260, 14260, 21360, 28360, 146460 kHz. Novices operate 10 kHz up from lower band edge and 28380 kHz.

Awards: Five plaques are available for category winners in Nebraska, the US, and overseas as well as Novice/Tech/Tech-Plus stations. Certificates will also be awarded as appropriate.

Logs and a signed summary sheet must be postmarked no later than May 31st. Send all entries to: Nebraska QSO Party, P.O. Box 375, Elkhorn, NE 68022-0375. Enclose a #10 SASE for final results. For more information visit <www.qsl.net/hdxa/neqso/neqso.htm>.

1999 Florida QSO Party (FQP)

1600Z–0159Z Sat., Apr. 29
1200Z– 2159Z Sun., Apr. 30

This one is back and sponsored by the Florida Contest Group. Here's the chance for amateurs outside of the state of Florida to make contact with as many Florida stations as possible. Florida stations work everyone. Stations may operate the full 20 hours.

Classes: (A) Single operator—One person performs all operating and logging functions. Use of spotting nets is not permitted. Only one transmitted signal permitted on the air at any time.

(B) Multi-operator—Those obtaining any form of assistance, such as relief operators, loggers, or use of spotting nets. *Note:* Multi-operator stations do not have to remain on a band for 10 minutes before changing bands. (1) Multi-single—only one transmitted signal on the air at any time. (2) Multi-multi—more than one transmitted signal on the air at any time. No simultaneous SSB/CW signals on one band at the same time.

(C) Mobile—mobile is a station that is self-contained (radio, antenna, power source) and capable of motion. Motion is optional. Mobile entrants may be either single operator or multi-operator.

(D) Novice/Technician—Novice or Technician licensees perform all operating and logging functions. There are three power output categories for all categories: (a) QRP—5 watts output or less, (b) Low Power—150W output or less, (c) High Power—more than 150 watts output. Logs not showing power output category will be listed as high power.

Modes:(A) Single operator, mobile, and Novice/Technician categories may operate: (1) mixed mode (phone and CW), (2) phone only, (3) CW only. (B) Multi-operators work mixed mode only.

Exchange: Florida stations send signal report and county. All other W/VE stations (including KH6/KL7) send signal report and state or province. DX stations (including KH2/KP4, etc.) send signal report and DXCC country.

Scoring: (A) QSO points: Each complete non-duplicate phone contact is worth 1 point. Each complete non-duplicate CW contact is worth 2 points. No partial contact credit. Duplicate contacts must be clearly identified and are worth 0 points. Stations may be worked once per mode, per band (i.e., WC4E may be worked on both 20 CW and 20 SSB for credit).

Multipliers: For Florida stations, 50 states (including Florida); Canada MAR (VE1, VE2, VE9, VY2), NF (VO1, VO2), PQ (VE2), ON (VE3), MB (VE4), SK (VE5), AB (VE6), BC (VE7), NW (VE8), YT (VY1); DXCC countries (except the US, Canada, KH6, and KL7). A multiplier can be counted once per mode. Working NP4Z on CW and then on SSB is two Puerto Rican multipliers.(2) All others work Florida counties (a maximum of 67). Florida mobile stations that change counties are considered to be a new station and may be contacted again for point and multiplier credit. Florida stations on a county line may be claimed as a multiplier for any or all of the counties they give in their exchange. A Florida county multiplier can be counted once per mode. Working W1YL in

Hillsborough County on CW and then on SSB is two county multipliers.

Final Scoring: Multiply QSO points by total multipliers by the power multiplier (see below). Florida mobile operations must submit separate logs for each county activated; a mobile entrant's score will be the total points for all counties activated by that effort.

Power Multiplier: If all QSOs were made using 5W or less, multiply your score by 3; if all QSOs were made using less than 150W, multiply your score by 2; if any or all QSOs were made using more than 150W, multiply your score by 1.

Frequencies: CW—3.535, 7.035, 14.035, 21.035, 28.035, and 10 kHz up for Novices/Technicians. Phone—3.860, 7.260, 14.260, 21.335, and 28.485. Look for SSB activity on the hour and CW on the half hour. Fixed stations are urged to call CQ above/below these frequencies to keep them clear for low power mobile operations. No 160 meters, WARC, or VHF bands.

Awards: Certificates will be awarded to top scorers in each category from each Florida county, state, Canadian province, and DXCC country. Special awards may be awarded at the discretion of the Florida QSO Party Contest Committee.

Entries must be postmarked no later than 30 days after the end of the contest (May 30, 2000). No late entries will be accepted. Any entrants (other than check logs) with over 100 QSOs in their log are encouraged to submit their logs in computer-readable format. Any entrants who submit paper logs with more than 100 contacts must also include cross-check (dupe) sheets. You may submit your contest logs via e-mail to <FLQSOParty@aol.com>. Send your summary sheet file and your log file following the ARRL Suggested Standard File Format. You may submit your logs on diskettes instead of paper logs. The floppy diskette must be IBM compatible, MS-DOS formatted, 3.5 inch. Log information must be in an ASCII file. Contest logs (paper or diskette) may be submitted to: Florida Contest Group, c/o Ron Wetjen, WD4AHZ, 5362 Castleman Dr., Sarasota, FL 34232. To receive entry forms (rules, summary sheet, log sheet, and county abbreviations) by mail send a business-size SASE to WD4AHZ (address above) or obtain information at the FQP web site: <http://www.qsl.net/fqp>.

Ontario QSO Party

1800Z Sat., Apr. 29 to 1800Z Sun., Apr. 30

Here's a fun contest sponsored by the Ontario DX Association.

Classes: Multi-operator, single operator low power (up to 150 watts on HF, up to 50 watts on VHF/UHF), single operator high power (over 150 watts on HF, and over 50 watts on VHF/UHF), single operator single band, mobile, HF QRP (5 watts and under), VHF/UHF FM QRP, CW, SSB or mixed mode, and SWL.

Exchange: Ontario stations send signal report and Ontario county, district, regional municipality, or city in the case of the amalgamated City of Toronto. Other stations send signal report and Canadian province/territory, U.S. state or DXCC country.

Frequencies: Phone/CW—all HF bands 160–10 meters with the exception of the ,WARC bands (12, 17 and 30 meters), which by IARU agreement are contest-free. All VHF/UHF bands, too. Suggested frequencies for QRP/mobile stations: SSB—1.870, 3.735, 3.860, 7.070, 7.260, 14.130, 14.265, 21.260, 28.360; CW—1.820, 3.520, 3.720, 7.020, 7.120, 14.020, 21.020, 21.120, 28.020; FM—52.540, 146.550, and 446.100. Operators may not use repeaters for the purpose of the contest or for soliciting contacts. Operators should keep the 2 meter FM simplex calling frequency of 146.520 MHz. clear.

Scoring: Ontario stations work everyone. Stations outside Ontario work only Ontario stations. Score 1 point for every station worked per band. Score 10 points for working VE3ODX and VA3RAC per band. Shortwave listeners log only Ontario stations. Work each station once per band whether CW or SSB. Ontario stations earn 1 multiplier point for each Ontario county, district, regional municipality and the amalgamated City of Toronto worked on each band (see multiplier list), each Canadian province/territory, each U.S. state and DXCC country. Stations outside Ontario earn 1 multiplier point for each Ontario county, district, regional municipality and for the amalgamated City of Toronto worked on each band. Shortwave listeners use the same formula for multiplier points as stations outside of Ontario. Mobile and/or portable stations may be worked once per band from each Ontario county, district, or regional municipality from which they operate.

Awards: Certificates will be awarded to the top scorers in each category and to top scorers in each Ontario county, district, regional municipality, amalgamated City of Toronto, Canadian province/territory, US state, and DXCC country. Each station making over 50 QSOs will qualify for an "Ontario QSO Party" button bearing your callsign. Operators at multi-operator stations making over 50 QSOs will also qualify. Other certificates may be awarded based on activity.

Entries should be postmarked no later than May 31, 2000. Send your logs to: Ontario QSO Party, Ontario DX Association, P.O. Box 161, Stn. A, Willowdale, Ontario M2N 5S8. Entries can be sent on disk or via the Internet in standard text file format. (Do not send logs in a word-processing format and include your snail-mail address). Send e-mail logs to: <ve3sre@rac.ca>.

If you qualify for an "Ontario QSO Party" callsign button, please send $2.00 to help cover costs. Entry forms may be downloaded from the ODXA web site at <http://www.odxa.on.ca/oqphome.html> or send an e-mail note to: <ve3sre@rac.ca> or send an SASE to the ODXA.

Awards

BY TED MELINOSKY, K1BV

News Of Certificate And Award Collecting

This month we present a profile of Zareh Amadounv, VE2NW, USA-CA All Counties #993, January 10, 2000.

"It all started back in the late 1940s when my uncle (OD5AT) became interested in amateur radio through his uncle Salim. The legacy passed on to my brother (DJØTO), who in turn, to avoid writing letters (no e-mail existed at that time) or making long-distance calls, convinced our eldest brother (VA2AZ) to get his radio license in order to chat across the Atlantic. At the time I was only 24 and was busy chasing young ladies. However, they harped on me and bribed me with an old Galaxy transceiver, so I found time to get my license and join my brothers.

"Not long thereafter I became hooked on chasing DX. When that dried up, I turned my attention to the IOTA program and began to activate special Canadian prefixes whenever I was permitted to do so. The latter alone allowed me to accumulate about 750 counties. As I moved up the IOTA ladder, the pickings got slim and the days just got longer while waiting for a new DXCC entity or IOTA activity.

"One day while chatting with my friend VE2CY on packet, I noticed a spot that read 'G4KHG/W4 rare Grand county, Utah on 14.336 MHz.' Like any good DXer, not wanting to miss a rare one I jumped in the pileup and worked him, only to be slapped on the fingers later on by the net controller for making a 'faux pas' and using phonetics while making the contact. (I have to admit that since then the net controllers are more diplomatic regarding using phonetics when a newcomer joins the group on 14.336 MHz.)

"Needless to say, I got hooked on 14.336 and managed to work the rest of the counties in about 14 months thanks to a bunch of fantastic folks who often went out of their way to give me a new one. My thanks to all of you for helping me. I will not mention any callsigns or names in order not to miss anybody, but you know who you are, as we talked often enough on the air. As I became more familiar with the fellows and the net procedures, I did not hesitate to run the show once in a while, and I would encourage all to chip in and do the same. You know, mobile operators go out of their way to help us, and we as fixed stations should pay back in any way we can.

"I would like to take this opportunity to thank two fellow amateur radio operators for helping me hang in there: Randy, N8ELQ, for taking the time to answer my e-mail as well as for calling me long distance to explain all the trimmings associated with county hunting on 14.336 MHz, and to Ed, N4UJK, mobile operator *par excellence*. Ed's humor and hilarious comments had me kneeled over several times laughing. leaving my kids wondering why their father had tears coming down his cheeks, such a happy face, and a headset on. Ed, you're the best. Keep it up; it's worthwhile to listen to you handle the pileup and the traffic (navigating) while operating mobile.

"What's next on the agenda? Well, I have my sights set on the 5Band Worked All Zones (WAZ) award. It's going to be tough on 80 meters, but I'll get there."

65 Glebe Road, Spofford, NH 03462-4411
e-mail: <k1bv@cq-amateur-radio.com>

Special Honor Roll

Gene Olig, KD9ZP
USA-CA All Counties #991
January 3, 2000

William D. Hall, KQ4FA
USA-CA All Counties #992
January 5, 2000

Zareh Amadouny, VE2NW
USA-CA All Counties #993
January 10, 2000

Honor Roll

500

KQ4FA	3107
VE2NW	3108
G3LAS	3109

1000

KQ4FA	1539
VE2NW	1540

1500

KQ4FA	1280
VE2NW	1281

2000

KQ4FA	1179
VE2NW	1180

2500

KQ4FA	1106
VE2NW	1107

3000

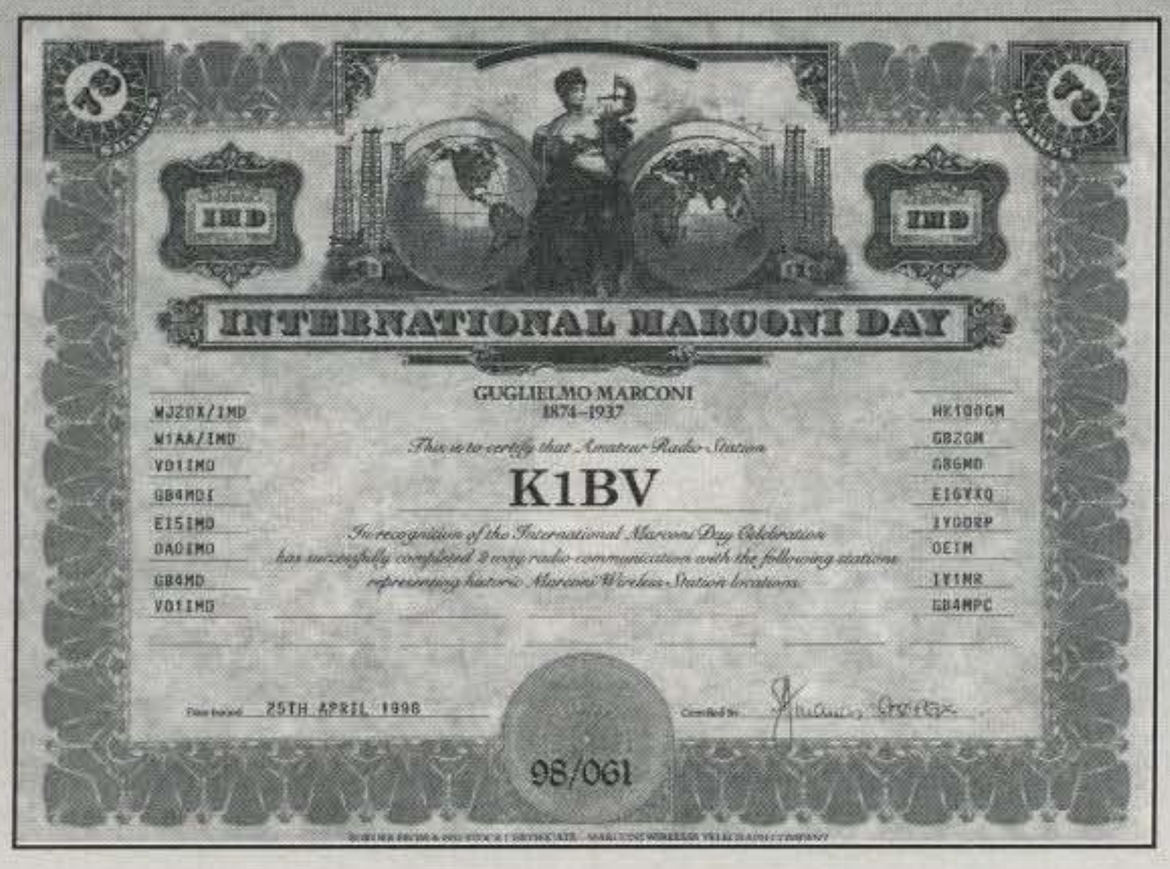
KQ4FA	1009
VE2NW	1010
KB6HW	1011

The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $4.00. For nonsubscribers it is $10.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated March 1, 1997. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 65 Glebe Road, Spofford, NH 03462-4411 USA. DX stations must include extra postage for airmail reply.

Broomfield County, Colorado

Effective November 15, 2001 the city of Broomfield, Colorado won permission from voters to secede from the four counties that presently divide it (Adams,

Zareh Amadouny, VE2NV, USA-CA All Counties #993.



A Marconi Day certificate patterned after a 1912 Marconi Wireless Telegraph Company stock certificate.

The Czech Radio Club's S6S Worked Six Continents award.

Boulder, Jefferson, and Weld) and create its own county. It will become Colorado's 64th county and immediately jumps into rank as the 15th largest in the state. This information was supplied by Al Kaiser, N1API. If this is confirmed, the USA-CA program will certainly recognize that entity. The top level of USA-CA will require a confirmation from the new county.

International Marconi Day

Every year on April 25th, the anniversary of Guglielmo Marconi's birth, numerous special event stations operate at the many locations where Marconi conducted his early communication experiments or where some of the first wireless stations were established. A handsome certificate, patterned after a 1912 Marconi Wireless Telegraph Company stock certificate, is offered for making contact with at least ten commemorative stations. A copy of my certificate from 1998 is shown. I've had the best luck working the stations on 20 meters CW and SSB. The majority of activity not suprisingly comes from Europe. There have been stations active from the east coast of the USA and from South America. Look for an announcement with current fees and sponsor address.

Czech Radio Club Awards

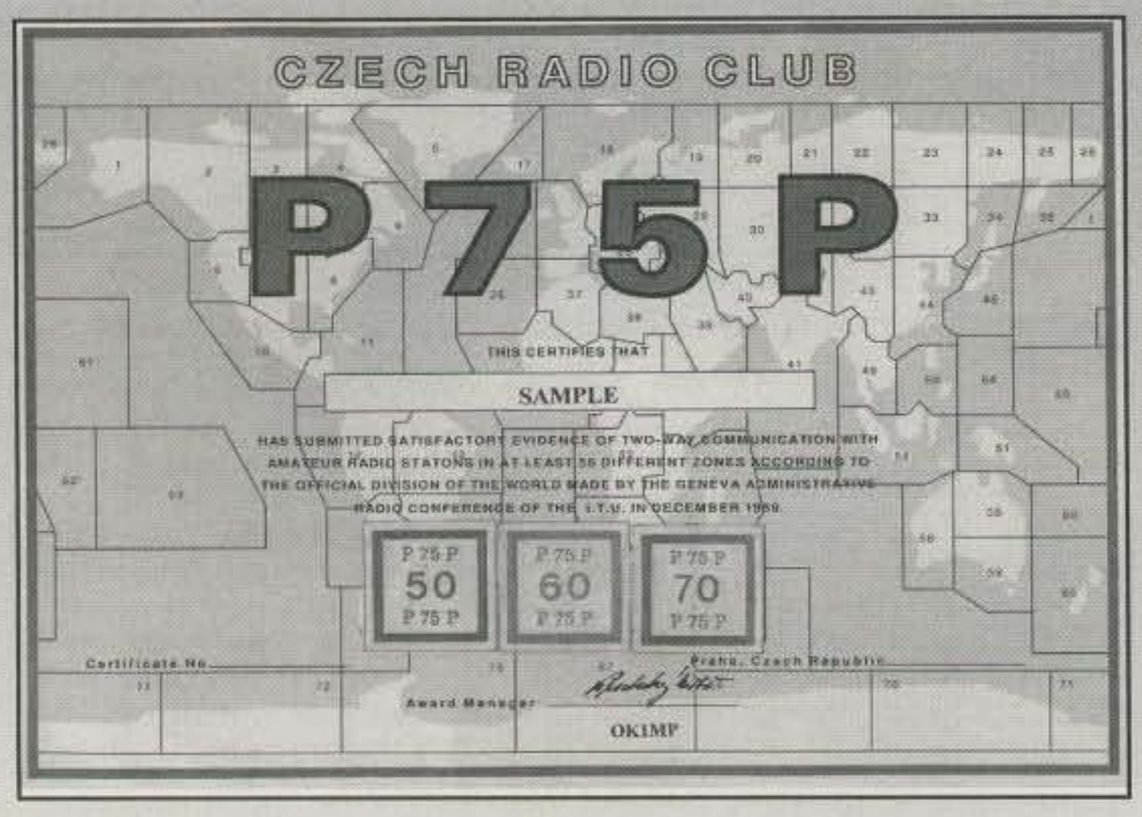
The Czech series listed below is a continuation of a long-established award series, with minor changes made to reflect the split from the Slovak Republic in 1993. Let's see: My QSL collection includes about 815 OK cards, and while lots of them date back to the 1960s, I'm sure there are a couple of hundred on or after 1 January 1993. If not, just wait until the next DX contest, when OK stations are very well represented.

Czech Radio Club Series General Requirements: Fee for all awards is 10 IRCs, or $5US. Endorsement fee is 2 IRCs, or $1US. If applying for an endorsement, you should indicate original serial number and issue date of basic award. Send cards unless GCR from national- level society has confirmed possession. List for the P75P must contain locations of listed stations. Apply to: Czech Radio Club, Awards Manager, P.O. Box 69, 113 27 Praha 1, Czech Republic.

S6S – Worked Six Continents. Work and confirm contacts with at least one station located in each of the six continents since 1 January 1950. All CW, all phone, all RTTY, all SSTV. Endorsement stickers for basic certificate are available for 80, 40, 20, 15, and 10 meters.

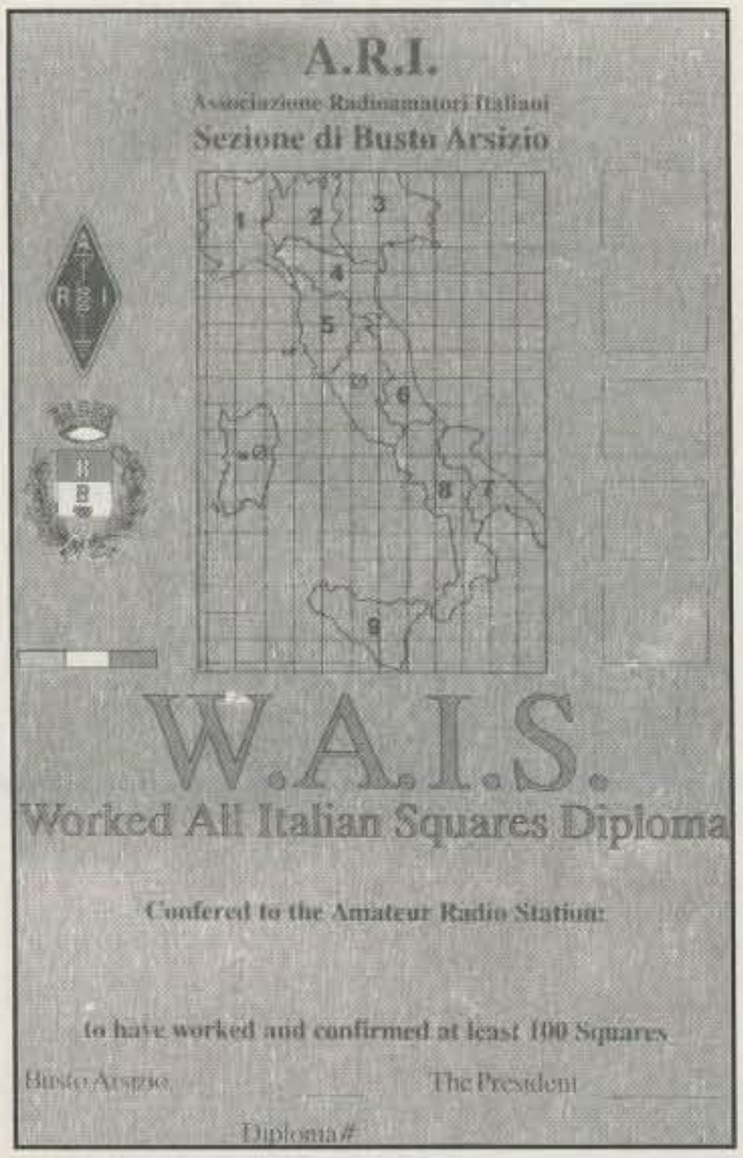
P75P – Worked 75 Zones. Work and confirm contacts with at least one station located in 50 different ITU zones since 1 January 1960. Endorsements for 60 and 70 zones. SWL okay.

100-S – Worked 100 Czech Stations. Work and confirm contacts with at least 100 different OK/OL stations



The P75P award is for working at least one station in 50 different ITU zones.

The 100-CS award from the Czech Radio Club.



The Worked All Italian Squares award.

since 1 January 1993. Issued for mixed mode, all CW, all phone, all 160 meters, all VHF, or SWL. Endorsements available for each addtional 100 up to 500.

OKDX Award. Contact at least 40 different Czech counties during the annual OK/OM DX contest which is held every year during the second weekend of November.

OMDX Award. Contact at least 15 different Slovak counties during contact as above.

(Logs for the two above awards go to contest sponsor: Karel Karmasin, OK2FD, Gen Svobody 636, 674 01 Trebic, Czech Republic.)

Grid Squares

Grid squares are usually associated with VHF activities, but several European countries offer awards for contacting grid squares in their country on both HF and VHF. The sponsor for the following even offers a tracking program for your computer. Just send a formatted 3½ inch 1.44 MB floppy and an SASE bubble-pack envelope with $2US for surface or $3US for airmail return to you. Address your request to: Pier Luigi Anzini, IK2UVR, Via Maestri del Lavoro 5, P.O. Box 140, I-21052 Busto Arsizio (VA), Italy. The award is a small, metal, gold-colored sheet with multicolor printing and room on the right-hand side for endorsements.

Worked All Italian Squares

The ARI of Busto Arsizio sponsors this award for working Italian grid squares. Italy is divided into geographical squares. The size of each square is 10' or a degree on the parallel and 10' of a degree on the meridian. In each square are eight WWL little squares, two on the parallel and four on the meridian. The geographical coordinates of start and finish on this grid are: from latitude 47°10'N to latitude 35°20'N; and from longitude 6°30'E to longitude 18°40'E, for a total of 5143 squares. This grid encompasses all the Italian territories, islands included.

To identify the squares, an alpha-numerical code has been used: On the direction of the parallels there is a number from 00 to 72, on the way of the meridians there is a pair of letters combining the letters A, B, C, D, E, F, G, and H with the letters J, K, L, M, N, P, Q, R, and S, obtaining AJ, AK, AL, AM, AN, AP, AQ, AR, AS, BJ, BK, BL, and so on until HR. Thus, the codes of the squares are from AJ00 to HR72. Many squares are occupied by the sea; some others do not have Italian territory and cannot be used. There are 1487 valid squares.

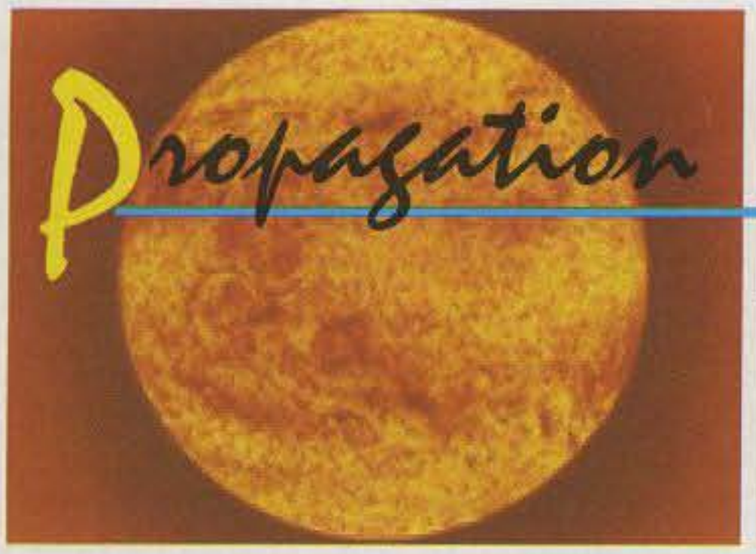
The basic award requires working 100 such squares on or after 1 January 1994. Endorsements for 200, 300, 500, 1000, and over 1400. You may work fixed or mobiles in the squares. The HF diploma requires using only HF. The over 30 MHz diploma requires use of VHF/UHF, etc. Also endorsements for monoband, WARC, CW, RTTY, phone, etc. Send GCR list and fee of $12US, DM20, or 7 pounds to: ARI di Busto Arsizio, P.O. Box 140, I-21052 Arsizio (VA), Italy.

Internet Site of the Month

HL1KIS has assembled a web page consisting of directories or search engines from 37 countries. His site also includes the popular search engines for DXpeditions from IK4ZLH and OZ7C. As you are pursuing cards for your award collection, give this a try: <http://www.qsl.net/hl1kis/callbook.htm>. One of the nearby HL1KIS pages showcases a nice selection of Korean awards.

I'm always looking for sample awards offered by your club or organization. Check <http://www.dxawards.com/> for the latest in short-term awards.

73, Ted, K1BV



Propagation

BY GEORGE JACOBS, W3ASK

The Science Of Predicting Radio Conditions

Sunspot Cycle 23 Progress

Based on daily observations of the sun made by a worldwide network of three dozen telescopic observatories, the Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean sunspot number of 86.4 for December 1999. This results in a 12-month running smoothed sunspot number of 93 centered on June 1999 and is an increase of three in the level of sunspot count since the previous month. The daily high count for the month was 116 on December 18, and a low count of 48 was recorded on December 30.

A smoothed sunspot number of approximately 111 is forecast for April 2000. Sunspot Cycle 23 continues to rise slowly but steadily towards its peak. The National Geophysical Data Center (NGDC) in Boulder, Colorado has fine-tuned its forecast and is now predicting the peak of Cycle 23 to occur during August 2000 with a count of 113.

The Dominion Radio Astrophysical Observatory of Canada, located at Penticton, BC, reports a corresponding increase in the adjusted mean level of 10.7 cm solar flux to 164 for December 1999. This results in a smoothed value of 154 centered on June 1999. A smoothed level of 158 is forecast for April 2000.

Table I is a listing of smoothed sunspot numbers observed for Cycle 23 from its beginning through June 1999, as well as predictions made by the NGDC through 2001.

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for April 2000

Propagation Index.....	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 8-10, 27	A	A	B	C
High Normal: 1, 5-7, 16, 23 26, 28	A	B	C	C-D
Low Normal: 3-4, 11-12, 15, 17, 20-22, 24-25, 30	B	C-B	C-D	D-E
Below Normal: 2, 13, 18, 29	C	C-D	D-E	E
Disturbed: 14, 19	C-D	D	E	E

Where expected signal quality is:

A—Excellent opening, exceptionally strong, steady signals greater than S9.

B—Good opening, moderately strong signals varying between S6 and S9+, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S6, with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find the *propagation index* associated with the particular path opening from the Propagation Charts appearing on the following pages.

2. With the *propagation index,* use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be good (B) on April 1st, fair-to-poor (C-D) on the 2nd, fair-to-good (C-B) on the 3rd and 4th, good (B) on the 5th through the 7th, etc.

QSL

Bernie McClenny, W3UR, asks: *Can you tell me a URL website where I can find the smoothed sunspot numbers? Also, how often does the number change? Daily? Weekly? Monthly?*

Presently, a worldwide network of more than three dozen telescopic observatories view the sun's surface daily, and count the sunspots. The data is collated by the Royal Observatory of Belgium. The numbers can vary over a very wide range from day to day. As reported at the beginning of this column, for example, during December 1999 the daily counts varied between 48 and 116. A monthly mean value is derived by averaging the daily values. Monthly mean values averaged over a period of 12 months result in a 12-month running smoothed sunspot number centered on the middle month. The sunspot cycle is measured by the smoothed sunspot numbers. The latest smoothed count is 93, centered on June 1999. This is derived from the monthly mean values reported between January and December 1999. Records are also kept of yearly sunspot numbers, which represent the average of the 12 monthly mean values.

The best internet source for the official daily, monthly mean, 12-month running smoothed sunspot numbers, and yearly mean values is the website of the Royal Observatory of Belgium. The URL is:<http://www.oma.be/KSBORB/SIDC/index.html>. The data is current and is also archived back to the 18th century.

Michele Gordon of Potomac and several other readers have asked: *What is the highest value of daily sunspot count and the highest monthly smoothed sunspot number ever recorded?*

The highest daily sunspot count on record occurred during Cycle 19 on December 24 and 25, 1957. On both of these days the count rose to 355. The highest daily count recorded through January 2000 for Cycle 23 is 206 on November 10, 1999.

The highest monthly smoothed sunspot number also occurred during the record-breaking Cycle 19, with an un-

Smoothed Sunspot Numbers for Cycle 23

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct	Nov.	Dec.
1996	10	10	10	9	8*	9	8	8	8	9**	10	10
1997	11	11	14	17	18	20	23	25	29	32	35	39
1998	44	49	53	57	59	62	65	68	70	71	73	78
1999	83	85	84	85	90	93	*96*	*99*	*101*	*103*	*106*	*108*
2000	*109*	*110*	*111*	*111*	*112*	*112*	*112*	*113*	*112*	*112*	*111*	*111*
2001	*111*	*111*	*110*	*110*	*109*	*109*	*108*	*107*	*106*	*105*	*104*	*103*

Predicted values appear in italics.
**May 1996 marks Cycle 23's mathematical beginning.*
***October 1996 marks the beginning of Cycle 23 according to a consensus of scientists. NGDC is now using this date.*

Table I– Smoothed sunspot numbers observed for Cycle 23 through June 1999, as well as predictions made by the National Geophysical Data Center, Boulder, Colorado through 2001. Note that the NGDC expects Cycle 23 to peak at a level of 113 during August 2000.

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precedented peak of 201 recorded for November 1957 and again for February and March 1958.

Brian Smithson, N8WRL, e-mails: *Thanks, George, for such a great column. I was wondering if it would be possible to have the propagation charts posted on the CQ website, perhaps in a downloadable format. I was very interested in the contest planning scenarios in your October and November columns. That seems like something I'd like to do pretty often, but I'd hate to have to type in each month's numbers.*

This is a very interesting suggestion, Brian. I have discussed it with Rich, W2VU, Editor of *CQ*. He is willing to give this serious thought if a reasonable number of readers would find it useful. The way that I produce the charts does not easily permit a computer spreadsheet format. At first thought, however, it seems technically convenient to scan the charts and place them onto the *CQ* website. This could be helpful in manipulating the data into other formats based on individual operating habits. I would appreciate reader opinions on your suggestion. Of course, we would still continue to have the hard copies of the charts in this column as usual.

Incidentally, a current worldwide map of ionospheric conditions, which can be very useful in visually determining an optimum band for HF communications on a worldwide basis, appears at the following: <http://dx.qsl.net/propagation>.

April Propagation

The 10 and 12 meter bands should remain very much alive during April and the spring months for DX openings to most areas of the world. Expect considerable DX from an hour or two after sunrise to just after sunset. While normal seasonal changes will result in fewer east-west openings, conditions towards southern and tropical areas should hold up very well. Expect peak signals to most areas of the world during the late afternoon hours.

Expect 15 and 17 meters to be the optimum DX bands during most of the daylight hours of April and the spring months. The bands should be loaded with DX openings from just after sunrise to well beyond sunset. Signals should be strongest to most areas of the world during the afternoon hours, but expect good, solid openings towards southern and tropical areas to as late as midnight and sometimes beyond.

Twenty meters should be a 24 hour DX band during April and the spring months. Besides the usually good openings to most areas of the world during the daylight hours, this band should be optimum for DX openings during most of the darkness period. Strongest signals, with DX openings to almost all areas of the world, should take place during a 2 hour window after local sunrise and again during the late afternoon and through the evening hours to about midnight. Many of the nighttime DX openings are expected to be associated with exceptionally strong signal levels.

Fewer hours of darkness and increasing static levels in the northern hemisphere will result in somewhat poorer DX conditions on the 40, 80, and 160 meter bands during April and the spring months. Nevertheless, expect strong, stable conditions to most areas of the world on 40 and 30 meters during the hours of darkness. Signals should peak from an easterly direction about an hour or two before midnight, and from most other directions about an hour or so before local sunrise at the US end of the path . Fairly good DX openings should be possible to many areas of the world on 80 meters during the hours of darkness. Propagation patterns should be similar to those on 40 meters, but 80 meter openings will be noisier and weaker. There is also a chance for some DX openings on 160 meters during the hours of darkness, but expect to encounter seasonally high static levels.

The favorable equinoctial propagation conditions discussed in last month's column should continue through April for openings between the northern and southern hemispheres. Check both long and short path on intercontinental openings during the sunset and sunrise periods, on all bands between 80 and 10 meters.

For short-skip openings between distances of approximately 50 and 250 miles, use 80 meters during the day, 80 or 160 meters from sunset to midnight, and 160 meters from midnight to sunrise. For distances between 250 and

750 miles, 40 and 30 meters should be best during the day, 40 and 80 meters from sundown to midnight, and 80 meters from midnight to sunrise. For openings between distances of 750 and 1300 miles, 20 and 17 meters should be optimum most of the day, with 30, 40, and 80 meters best during the hours of darkness. Between 1300 and 2300 miles, check 12, 15, and 20 meters during the day; 20, 30, and 40 meters from sundown to midnight; and 40 meters from midnight to sunrise. Short-skip openings beyond 1300 miles also should be possible on 10 meters during most of the afternoon hours.

The DX Propagation Charts in this month's column contain DX propagation predictions for each amateur band between 6 and 160 meters for the period April 15 to June 15 Beginning this month and continuing through the summer and early fall, the times shown in the charts will be local *daylight* time (EDT, CDT, MDT, and PDT). For detailed predictions of short-skip openings between distances of 250 and 2300 miles, see the Short-Skip Propagation Charts, which appeared last month.

VHF Ionospheric Openings

The combination of near-peak sunspot activity and equinoctial propagation conditions makes April a good month for *F2*-layer DX openings on 6 meters. Openings from North America will favor southern and tropical areas such as Africa, the South Pacific, New Zealand and Australia, and Central and South America. Openings are more likely to occur during local afternoon hours, when propagation conditions are High Normal or better.

F2-layer DX 6 meter openings should decrease considerably by early May. However, May also marks the beginning of the summer sporadic-*E* propagation season, with its associated short-skip on 6 meters and to a lesser extent on 2 meters ranging between approximately 750 and 1300 miles. During periods of intense sporadic-*E* ionization, two-hop propagation beyond this range occasionally may be possible on 6 meters.

While, as its name implies, sporadic-*E* ionization can occur at just about any time, there is a tendency for it to peak between 8 AM and noon and again between 5 and 9 PM, local time.

Trans-equatorial (TE) propagation between the US and South America should reach a seasonal peak during April. These openings are most likely to occur on 6 meters, with some also possible on 2 meters, between 8 and 11 PM local time. TE openings favor the southern tier states, but some openings may also be possible to more northerly locations. Unlike *F2*-layer openings, which can produce strong signals on 6 meters, TE openings are usually very weak, often with severe flutter fading.

The *Lyrids*, a major meteor shower, should peak between 22 UT April 21 and 05 UT April 22. During the shower's peak, at least 15 large meteors should enter the Earth's atmosphere hourly, permitting fairly good meteor-scatter communications on the VHF bands.

Widespread auroral activity can occur during April, producing unusual ionospheric short-skip openings on the VHF bands. The best times to check for such auroral-type openings would be during periods of radio storminess. See the Last-Minute Forecast at the beginning of this column for those days during April that are expected to be Below Normal or Disturbed.

For a more comprehensive review of VHF ionospheric propagation, see the excellent article by Ken Neubeck, WB2AMU, "Explanations for Unusual Propagation," which appeared in the February 2000 issue of *CQ* (page 36).

73, George W3ASK

April 15 to June 15, 2000
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	10-13 (1) 13-16 (2) 16-18 (1)	07-09 (1) 09-11 (2) 11-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	09-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-01 (3) 01-04 (2) 04-07 (3) 07-09 (2)	19-20 (1) 20-21 (2) 21-00 (3) 00-02 (2) 02-03 (1) 20-21 (1)* 21-22 (2)* 22-00 (3)* 00-01 (2)* 01-02 (1)*
Northern Europe & CIS**	11-16 (1)	08-10 (1) 10-13 (2) 13-16 (3) 16-18 (2) 18-19 (1) 22-00 (1)	06-09 (2) 09-13 (1) 13-16 (2) 16-20 (3) 20-22 (4) 22-02 (3) 02-03 (2) 03-06 (1)*	19-20 (1) 20-23 (2) 23-01 (1) 20-23 (1)*
Eastern Mediterranean & Middle East	14-17 (1)	10-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	12-16 (1) 16-18 (2) 18-21 (3) 21-00 (4) 00-02 (3) 02-03 (2) 03-06 (1) 06-08 (2) 08-09 (1)	20-22 (1) 22-00 (2) 00-01 (1) 21-23 (1)*
Western Africa	10-11 (1) 11-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-21 (1)	07-08 (2) 08-10 (3) 10-13 (2) 13-16 (3) 16-20 (4) 20-23 (3) 23-04 (2) 04-07 (1)	07-14 (1) 14-16 (2) 16-18 (3) 18-02 (4) 02-05 (3) 05-07 (2)	20-22 (1) 22-02 (2) 02-03 (1) 22-02 (1)*
Eastern & Central Africa	16-17 (1) 17-19 (2) 19-21 (1)	08-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	14-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-01 (3) 01-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	21-01 (1) 22-00 (1)*

HOW TO USE THE DX PROPAGATION CHARTS

1. Use chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4, and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9, and 0 areas; the Western USA Chart in the 6 and 7 areas; and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 meters) for a particular DX region, as shown in the left-hand column of the charts. An * indicates the best time to listen for 160 meter openings.

3. The propagation index is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of days during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *daylight* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts CW, or 1 kw, PEP on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

6. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado 80302.

Southern Africa	10-11 (1) 11-13 (2) 13-14 (1)	08-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1) 01-03 (1)	12-14 (1) 14-16 (2) 16-17 (3) 17-18 (2) 18-19 (1) 00-01 (1) 01-02 (2) 02-04 (3) 04-05 (2) 05-06 (1) 06-08 (2) 08-09 (1)	21-22 (1) 22-00 (2) 00-02 (1) 22-01 (1)*
Central & South Asia	19-21 (1)	09-12 (1) 15-18 (1) 18-20 (2) 20-22 (1)	16-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-00 (1) 05-06 (1) 06-08 (2) 08-09 (1)	05-07 (1) 19-21 (1)
South-east Asia	18-21 (1)	08-11 (1) 18-20 (1) 20-22 (2) 22-23 (1)	06-07 (1) 07-09 (2) 09-10 (1) 16-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	05-07 (1)
Far East	18-20 (1)	08-10 (1) 15-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-10 (1) 16-17 (1) 17-18 (2) 18-20 (3) 20-21(2) 21-22 (1)	06-08 (1)
South Pacific & New Zealand	15-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	09-11 (1) 13-15 (1) 15-17 (2) 17-18 (3) 18-21 (4) 21-23 (3) 23-00 (2) 00-01 (1)	19-21 (1) 21-22 (2) 22-23 (3) 23-04 (4) 04-08 (3) 08-09 (2) 09-10 (1)	00-02 (1) 02-05 (2) 05-06 (3) 06-07 (2) 07-08 (1) 02-07 (1)*
Austral-asia	17-19 (1) 19-21 (2) 21-22 (1)	09-10 (1) 10-11 (2) 11-12 (1) 17-19 (1)	23-00 (1) 00-03 (2) 03-05 (3) 05-08 (4)	03-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)*
		19-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	08-09 (3) 09-10 (2) 10-11 (1) 17-19 (1)	
Carib-bean, Central America & Northern Countries of South America	11-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-09 (2) 09-14 (3) 14-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	02-06 (2) 06-07 (3) 07-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-23 (4) 23-02 (3)	19-20 (1) 20-21 (2) 21-05 (3) 05-07 (2) 07-08 (1) 21-02 (1)* 02-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-10 (1) 10-14 (2) 14-17 (3) 17-19 (4) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-15 (2) 15-16 (3) 16-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	05-06 (1) 06-09 (2) 09-15 (1) 15-17 (2) 17-19 (3) 19-00 (4) 00-02 (3) 02-05 (2)	20-21 (1) 21-04 (2) 04-06 (1) 23-03 (1)* 03-04 (2)* 04-06 (1)*
McMurdo Sound, Antarctica	17-19(1)	16-18 (1) 18-20 (2) 20-21 (1) 02-07 (2) 07-08 (1)	16-18 (1) 18-20 (2) 20-02 (3)	20-01 (1) 01-05 (2) 05-06 (1)

Time Zones: CDT & MDT (24-Hour Time) CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	11-17 (1)	07-12 (1) 12-14 (2) 14-18 (3) 18-19 (2) 19-20 (1)	05-09 (2) 09-14 (1) 14-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-01 (2) 01-05 (1)	19-21 (1) 21-23 (2) 23-01 (1) 00-01 (1)*
Northern Europe & CIS**	NIL	10-12 (1) 12-16 (2) 16-18 (1) 21-23 (1)	01-07 (1) 07-09 (2) 09-14 (1) 14-19 (2) 19-23 (3) 23-01 (2)	19-21 (1) 21-23 (2) 23-01 (1)
Eastern Mediter-ranean & Middle East	15-18 (1)	10-13 (1) 13-17 (2) 17-18 (1) 20-22 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-22 (4) 22-00 (3) 00-01 (2) 01-03 (1)	20-00 (1)
Western Africa	10-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	09-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	12-15 (1) 15-17 (2) 17-19 (3) 19-23 (4) 23-00 (3) 00-01 (2) 01-03 (1)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Eastern & Central Africa	17-19 (1)	12-14 (1) 14-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-01 (2) 01-03 (1) 07-09 (1)	20-23 (1)
Southern Africa	10-12 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-15 (2) 15-16 (1) 00-02 (1)	14-16 (1) 16-19 (2) 19-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-05 (1) 05-07 (2) 07-08 (1)	20-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Central & South Asia	18-21(1)	16-18 (1) 18-21 (2) 21-22 (1)	05-07 (1) 07-09 (2) 09-11 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-00 (1)	06-08 (1) 19-21 (1)
South-east Asia	18-20 (1)	09-11 (1) 11-13 (1) 13-15 (1) 17-19 (1)	23-03 (1) 03-07 (2) 07-09 (3) 09-11 (2)	05-07 (1)

		19-21 (2) 21-23 (1)	11-12 (1)	
Far East	18-21 (1)	08-11 (1) 15-16 (1) 16-17 (2) 17-21 (3) 21-23 (2) 23-00 (1)	23-02 (1) 02-04 (2) 04-06 (3) 06-08 (4) 08-09 (3) 09-11 (2) 11-13 (1)	03-05 (1) 05-06 (2) 06-07 (1) 05-06 (1)*
South Pacific & New Zealand	11-14 (1) 14-16 (2) 16-20 (3) 20-21 (2) 21-22 (1)	08-09 (1) 09-11 (2) 11-14 (1) 14-17 (2) 17-18 (3) 18-21 (4) 21-23 (3) 23-01 (2) 01-03 (1)	16-19 (1) 19-20 (2) 20-21 (3) 21-03 (4) 03-07 (3) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (1)	00-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-05 (2)* 05-06 (1)*
Austral-asia	15-17 (1) 17-19 (2) 19-21 (3) 21-22 (1)	08-09 (1) 09-10 (2) 10-11 (1) 16-18 (1) 18-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	05-07 (3) 07-08 (2) 08-10 (3) 10-12 (2) 12-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-01 (3) 01-05 (4)	02-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Carib-bean, Central America & Northern Countries of South America	09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	07-09 (1) 09-11 (2) 11-14 (3) 14-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	03-06 (2) 06-08 (3) 08-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-23 (4) 23-03 (3)	19-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 21-23 (1)* 23-04 (2)* 04-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-10 (1) 10-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-15 (2) 15-16 (3) 16-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	05-06 (1) 06-09 (2) 10-15 (1) 15-17 (2) 17-19 (3) 19-00 (4) 00-02 (3) 02-05 (2)	21-22 (1) 22-00 (2) 00-02 (1) 02-05 (2) 05-07 (1) 01-05 (1)*
McMurdo Sound, Antarctica	18-20 (1)	15-17 (1) 17-19 (2) 19-21 (3) 21-23 2) 23-00 (1)	16-18 (1) 18-19 (2) 19-02 (3) 02-04 (2) 04-06 (1)	20-22 (1) 22-00 (2) 00-02 (1) 02-04 (2) 04-06 (1)

April 15 to June 15, 2000
WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	09-12 (1) 16-17 (1)	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	01-07 (1) 07-10 (2) 10-13 (1) 13-17 (2) 17-19 (3) 19-21 (2) 21-23 (3) 23-01 (2)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Central & Northern Europe & CIS**	14-16 (1)	11-14 (1) 14-16 (2) 16-17 (1) 22-00 (1)	02-07 (1) 07-09 (2) 09-13 (1) 13-16 (2) 16-18 (3) 18-22 (2) 22-00 (3) 00-02 (2)	19-23 (1) 21-22 (1)*
Eastern Mediter-ranean & Middle East	Nil	09-11 (1) 11-15 (2) 15-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-20 (2) 20-22 (3) 22-23 (2) 23-03 (1)	20-23 (1)
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Southern Africa	09-11 (1)	07-09 (1) 09-11 (2) 11-12 (1) 12-14 (2) 14-15 (1)	07-09 (1) 13-15 (1) 15-18 (2) 18-22 (1) 22-23 (2) 02-03 (3) 01-02 (2) 02-03 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
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FT-1000MP
The radio of choice for world-class contest operators, the FT-1000MP provides 100 Watts of power, Enhanced DSP,™ Dual In-band Receive, Cascaded IF filters, General Coverage RX, and 160-10 M TX. (DC-only version also available.)

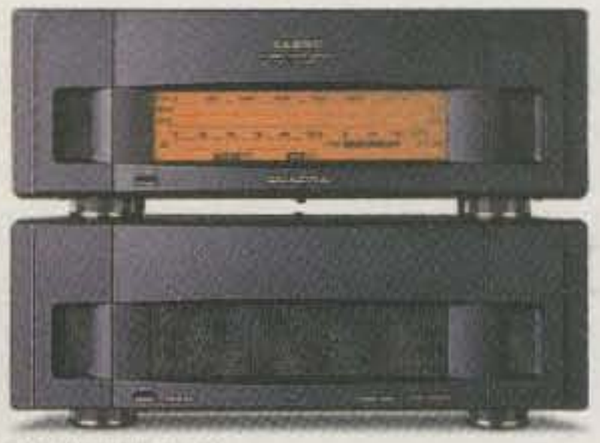
FT-920
The FT-920 HF/6M Transceiver is designed for today's active Ham. It features high-speed DSP in all modes, 127 memory channels, AFSK or FSK Digital operation, new-technology MOSFET PA finals, high-speed Automatic Antenna Tuner, and high-resolution LCD display.

FT-1000D
Truly an elite-class HF masterpiece, the 200 Watt FT-1000D provides Dual Receive (in-band or cross-band), Cascaded IF Filters, extraordinary Dynamic Range, DDS, high-speed Automatic Antenna Tuner, and 100 memory channels.

FT-100
This ultra-compact HF/VHF/UHF 100 Watt Transceiver provides SSB, CW, AM, FM and AFSK coverage of the HF, 6M, 2M and 70 CM bands. Features include 300 memory channels, built-in Electronic Memory Keyer, DSP, IF Shift, IF Noise Blanker, and CTCSS/DCS.

FT-840
Affordable yet feature filled, the FT-840 is an ideal traveling companion. It offers 160-10M TX with general coverage RX, 100 memory channels, DDS, CTCSS, Twin Band Stacking VFOs, and excellent receiver dynamic range.

FT-600
This compact 100 Watt HF Transceiver offers the utmost in operating simplicity. The MIL-STD rated FT-600 covers the 160-10M Amateur bands with General Coverage Receive, 100 memory channels, Direct Keypad Frequency Entry, and a front-mounted speaker.



VL-1000/VP-1000
The VL-1000 Quadra System is a Solid-State Linear Amplifier featuring four twin-MOSFET PA modules to produce 1000 Watts of clean power output on 160-15 Meters (500 Watts on 6M, modifiable for 12/10 meters). Included are an Automatic Antenna tuner, 2 Input and 4 Output Antenna Jacks, and extensive status displays on the multi-function LCD.

FT-847
The introduction of the FT-847 completely redefines base station operation by offering three radios in one—HF, VHF/UHF and Satellite. A full power multi-mode transceiver, the appropriately named Earth Station covers the HF, 50 MHz, 144 MHz and 430 MHz bands, and it includes crossband Full Duplex operating capability for satellite work. Its exceptional receiver performance is ready for all aspects of DX work thanks to the DSP filtering. And for local FM work both CTCSS and DCS encode/decode are built in. The FT-847 is an engineering breakthrough offering you the earth, the sky, and the moon in one compact package.

THE TASK MASTERS.

They're out there. Those elusive DX signals that can't poke through the QRM regardless of the late-night hours you put in trying to find them. But when a Yaesu HF enters the picture, weak signals suddenly jump into your headphones. Yaesu's High Frequency transceiver technology uniquely combines years of RF and AF design know-how with cutting edge advancements in IF filtering, noise reduction, and dynamic range. Whether you're on high bands or low, at home or away, the high frequency technology of Yaesu's task masters quickly fills up your log with contacts. Learn more about Yaesu products on the web at www.yaesu.com

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HF ENTHUSIASM

Yaesu, Choice of the World's top DX'ers

MICRO MOBILE FT-100

Over 40 years of experience in HF transceiver design has firmly established Yaesu as the choice of the world's top DX'ers. The knowledge that produced unequaled RF technology and design that is found in the State of the Art FT-1000MP can also be found in the miniature FT-100. The FT-100 while small in size 6.3" × 2.1" × 8.1"(160 W × 54 H × 205 D mm :w/o knob) is large in features and performance. This is accomplished by using the most advanced manufacturing techniques and component mounting technology. High Dynamic range RF front-end technology and Advanced Digital technology such as DSP sets a new standard of receiver performance for miniature HF transceivers. The single piece die cast frame, dual cooling fan system and revolutionary RF high power design technique keeps the FT-100 running cool and smooth in the most adverse operating environments. (TX Power output=100W HF, 50W VHF/20W UHF) The TX Equalizer offers crisp, clear and clean TX audio reproduction that until now was only found in top of the line HF base stations. The optional ATAS-100 (active tuning antenna system) ushers in a new age of mobile and field day operation (from HF to UHF frequencies). Add the optional ATBK-100 base kit (Good for limited space, simple setup.) and you've got a base station that ranks among the best in the world.

Features

- Frequency coverage:
  RX : 100 kHz-961 MHz (cellular blocked)
  TX : 160-6 m/144-148 MHz/430-450 MHz
- Power output : 100 W (160-6 m), 50 W (144 MHz), 20 W (430 MHz)
- DSP Bandpass Filter, Notch Filter, Noise Reduction, and Equalizer
- IF Noise Blanker
- SSB, CW, AM, FM, AFSK, Packet (1200/9600 bps) operation
- Detachable Front Panel
- Two Antenna Jacks (HF/50 and 144/430)
- IF Shift
- VOX
- Dual VFOs
- Available IF bandwidths of 6 kHz, 2.4 kHz, 500 Hz, and 300 Hz (6 kHz, 500 Hz, 300 Hz filters optional)
- Built-in Electronic Memory Keyer
- Speech Processor
- Built-in CTCSS and DCS for FM operation
- Automatic Repeater Shift and Auto-Range Transponder System
- Smart Search™ Automatic Memory Channel Loading System
- 300 memory Channels
- Quick Memory Bank (QMB)
- Bright LCD with multi-function display
- Optional FC-20 External Antenna Tuner
- Compatible with ATAS-100 Active-Tuning Antenna System. Add the optional ATBK-100 base kit

MICRO MOBILE SERIES

FT-100

Ultra-Compact HF/VHF/UHF Transceiver

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- *Simple operation*
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  - *Direct frequency input via 10 button key pad*
  - *Auto tuning steps (TS). Senses the rate the knob is turned*
- *Microphone compressor*
- *IF Shift*
- *100w of power (40w on AM)*
- *Meter functions (Output Power, ALC, VSWR)*
- *Easy to use front panel controls*
- *Built-in keyer*
- *VOX*
- *Large front firing speaker*
- *Optional DSP*

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