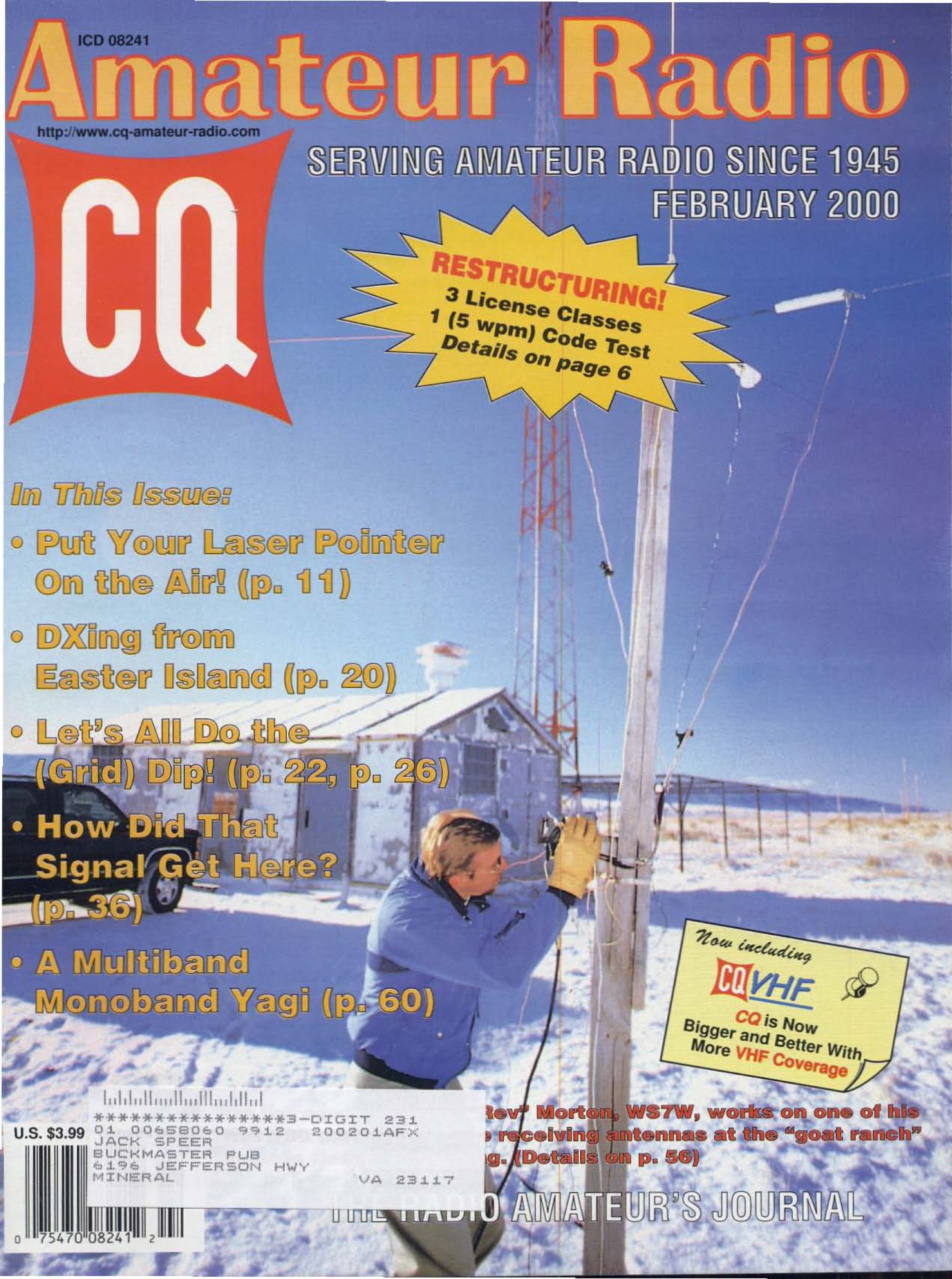
ICD 08241

CQ Amateur Radio

http://www.cq-amateur-radio.com

SERVING AMATEUR RADIO SINCE 1945

FEBRUARY 2000



RESTRUCTURING!
3 License Classes
1 (5 wpm) Code Test
Details on page 6

In This Issue:

- Put Your Laser Pointer On the Air! (p. 11)
- DXing from Easter Island (p. 20)
- Let's All Do the (Grid) Dip! (p. 22, p. 26)
- How Did That Signal Get Here? (p. 36)
- A Multiband Monoband Yagi (p. 60)

Now including CQ VHF

CQ is Now Bigger and Better With More VHF Coverage

…Rev" Morton, WS7W, works on one of his …e receiving antennas at the "goat ranch" …g. (Details on p. 56)

U.S. $3.99

0 75470 08241 2

*****************3-DIGIT 231
01 00658060 9912 200201AFX
JACK SPEER
BUCKMASTER PUB
6196 JEFFERSON HWY
MINERAL VA 23117

THE RADIO AMATEUR'S JOURNAL

CQ now including CQ VHF

FEBRUARY 2000 VOL. 56, NO. 2

FEATURES


page 20


page 22

DEPARTMENTS

Ham Radio News

From The CQ Newsroom

FCC Broadens Enforcement Efforts

After months of concentrating its enforcement efforts on deliberate interference, club callsign abuse, and questionable volunteer exam sessions, the FCC has expanded the scope of its enforcement efforts into technical standards as well.

In three "inquiry/warning letters" to hams in Mississippi, Louisiana, and New Jersey, FCC Special Counsel for Amateur Radio Riley Hollingsworth, K4ZDH, says that "Commission monitoring information" indicates they have been transmitting "an unusually wide signal or one that is over-power, or both," on 20 meters; and that the hams "may have ignored requests from other licensees operating on adjacent frequencies" to bring their signals into line with good amateur practice. The letter included relevant portions of the FCC rules and the hams were asked to answer very specific questions about their 20 meter operations. One, who apparently had been contacted previously in this regard and had not answered, was warned that failure to correct the situation could jeopardize his license.

Probe of Test Sessions Continues, Expands. The FCC is continuing investigations into two test sessions with suspicious paperwork, has added a third to its list, has ordered several retests, and cancelled the licenses of five hams who didn't appear for retests as ordered.

In a follow-up to its audit of a May 1999, Volunteer Examiner (VE) session in Yonkers, New York, one person whose name appears as an examiner was asked to confirm whether the signatures were indeed his, and whether he had even been present for the exam sesson.

The FCC is also looking into two test sessions last summer in Clemson, South Carolina, including one in which the test session coordinator was also administered an exam. Several candidates from that session were ordered to repeat their exams, and all of the people listed as assisting VEs were asked to confirm their participation and whether the signatures on the forms were actually theirs. Hollingsworth told *CQ* that results of these inquiries could result in action being taken against some or all of the VEs involved.

Hams Help in Y2K Preparedness

Ham radio has played a major role in the "Y2K" preparedness activities of emergency service agencies around the country, with amateur radio seen as the primary backup communications tool in case normal communications were disrupted by computer glitches or other problems during the changeover from 1999 to 2000. Two activities with nationwide participation included a joint National Weather Service/ARRL test of hams' ability to transmit weather information from 40 weather service forecast offices to as many other amateurs as possible, and a request from the US Coast Guard that hams serve as backups in reporting oil and chemical spills to its National Response Center via state offices of emergency management.

AO-16 Shutdown

For the first time in nearly five years, the AMSAT-OSCAR 16 satellite has stopped operating. No details were available at press time. AO-16 has been a workhorse of amateur digital satellite communication ever since its launch a decade ago, in February, 1990. The "SpaceNews" newsletter reports that the satellite was being monitored by LW1DMO in Buenos Aires, Brazil on December 12, 1999, when its signal went silent. It was still silent the next day during a pass over the New Jersey station of "SpaceNews" Editor John Magliacane, KD2BD. Magliacane reports that AO-16 had been operating for over 1800 days without a software reload or an interruption in service until this problem, whatever its cause, occurred.

FCC to Power Company: Fix the QRM

Hams aren't the only ones getting letters from the FCC telling them to clean up their acts. Pacific Gas and Electric (PG&E), a major west coast utility, has been reminded by the FCC of utilities' obligation to repair equipment problems that cause harmful radio interference. According to the ARRL, the matter involved long-standing complaints of power line noise on the ham bands by amateurs in northern California. The letter from the FCC's Consumer Center reminded PG&E that unresolved interference problems "may be a violation of FCC rules and could result in a monetary forfeiture for each occurrence," and asked that the company correct the problems "within a reasonable time."

The FCC and ARRL recommend that hams experiencing power line noise problems should first try to "work patiently with the utility" and contact the League for help before turning to the FCC. The ARRL has a webpage deovted to power line interference at <http://www.arrl.org/tis/info/rfi-elec.html>.

APRS Helps Recover Stolen Car

For the second time in four years, a ham has reported using APRS — the Automatic Position Reporting System — to lead police to his stolen car. According to a report on "Newsline," Bill Guthrie, VE6OLD, of Bentley, Alberta, had an APRS beacon transmitting from his van when it was stolen. Before calling the police, Guthrie looked at his computer screen and saw the van driving leisurely around a nearby town. Then he called the Royal Canadian Mounted Police, reported the theft, and told officers exactly where they could find his car! They did, along with the loot from a series of robberies that the car thieves apparently committed as well.

After the crooks were arrested, the obvious question was how Guthrie knew exactly where to send the officers. A description of APRS followed, along with a visit to Guthries shack by some very impressed Mounties.

"Ham Radio University 2000"

A group of radio clubs on New York's Long Island teamed up to sponsor "Ham Radio

(Continued on page 104)

A publication of

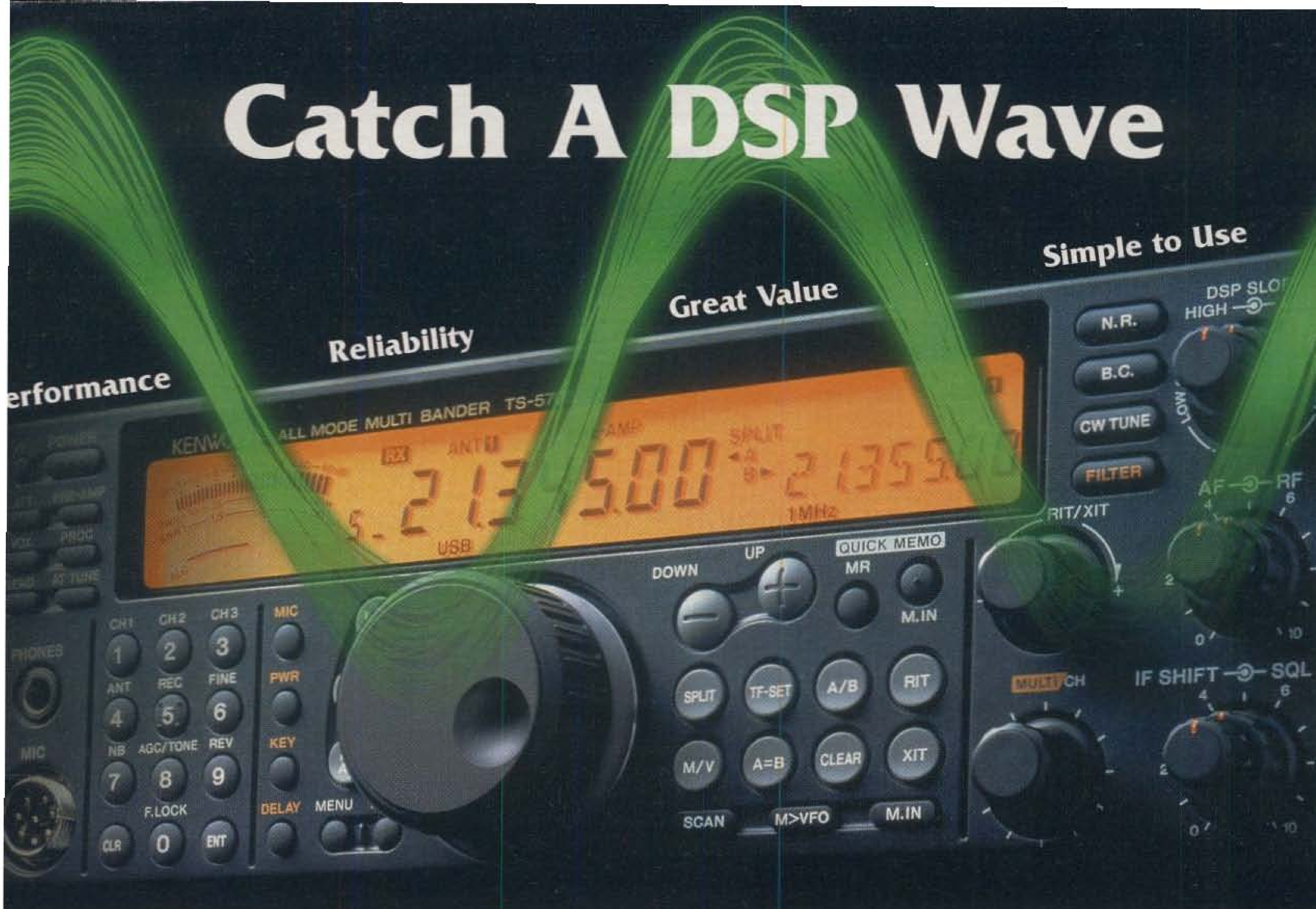
CQ Communications, Inc.
25 Newbridge Road
Hicksville, NY 11801 USA.

Offices: 25 Newbridge Road, Hicksville, New York 11801. Telephone: (516) 681-2922. FAX (516) 681-2926. E-mail cq@cq-amateur-radio.com. Website:http://www.cq-amateur-radio.com. CQ (ISSN 007-893X) is published monthly by CQ Communications Inc. Periodical postage paid at Hicksville, NY and additional offices. Subscription prices (all in U.S. dollars): Domestic—one year $27.95, two years $49.95, three years $71.95; Canada/ Mexico—one year $40.95, two years $72.95, three years $110.95; Foreign Air Post—one year $52.95, two years $99.95, three years $146.95. U.S. Government Agencies: Subscriptions to CQ are available to agencies of the United States government, including military services, only on a cash with order basis. Requests for quotations, bids, contracts, etc. will be refused and will not be returned or processed.

CQ does not assume responsibility for unsolicited manuscripts. Allow six weeks for change of address.

Printed in the United States of America.

Postmaster: Please send change of address to CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801.



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

KENWOOD COMMUNICATIONS CORPORATION
AMATEUR RADIO PRODUCTS GROUP
P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745, U.S.A.
Customer Support/Brochures (310) 639-5300 99ARD-1871-SCV/#033099

INTERNET
Kenwood News & Products
http://www.kenwood.net

BY RICH MOSESON, W2VU

An Editorial

The Wait is Over—Restructuring is Here

More than a year after it first proposed reducing the number of amateur license classes and asked hams for input on code speed requirements, the Federal Communications Commission (FCC) handed down its restructuring decision on the final business day of 1999.

Here is a summary of changes, which are effective as of April 15, 2000:

• There will be only three license classes—Technician, General, and Amateur Extra—with a single written exam element for each grade of license.

• There will be only one code exam—at 5 wpm—for licenses with HF privileges (General and Extra).

• No new Novice, Tech-Plus, or Advanced Class licenses will be issued after April 14. However, hams who now hold these licenses will retain all of their current operating privileges, and will be able to modify and/or renew their licenses indefinitely. Tech-Plus hams will be renewed as Technicians, but *will retain their HF operating privileges.*

• There will be no "refarming" of the ham bands as proposed by the ARRL. This means that current Novice and Advanced Class subbands will remain as they are, so there will be no expansion of frequency privileges for any ham without passing an upgrade exam or showing credit for all necessary exam elements (more on this later). There will also be no changes in the callsign groups.

• There will be no automatic upgrades, even for hams who qualify based on past credit. Even if no additional exams are required, a ham will have to apply for an upgrade at a VE (Volunteer Examination) session.

• There will be only three written exam elements, one for each new class of license. Decisions on structuring the new exam elements will be made by the Volunteer Examiner Coordinators' Question Pool Committee (QPC), which will be given even greater authority in designing and administering amateur exams.

• The much-abused disability waiver for 13- and 20-wpm code tests will be eliminated (since there will no longer be any 13- or 20-wpm code tests).

• The changes will take effect on April 15, 2000. This will give the QPC time to create new exams, and will give publishers time to get new license manuals into print before the new structure is put into place. In addition, it will give tens of thousands of hams with partial credit toward one of the new license classes the opportunity to pass the remaining element(s) before the new tests begin, possibly requiring re-examination on certain topics.

What Does It All Mean?

The main impact of the restructuring decision will be that upgrading to significantly greater operating privileges will now be easier, and code proficiency will play a smaller role in getting a higher class license. Psychologically speaking, it removes the cloud of uncertainty that has hung over amateur radio for more than a year, and it should make the hobby more attractive to potential hams who will no longer perceive an "onerous" code barrier of up to 20 wpm between them and full amateur privileges.

What constitutes "significantly greater operating privileges"? Well, let's say you currently have a code-free Technician license. You have all VHF/ UHF privileges and that's it. If you study real hard and pass your 5 wpm code test, you'll have code privileges—which you probably won't use—on 80, 40, 15, and 10 meters, and voice privileges on 200 kHz of the 10 meter band (which, right now, is hotter than hot). Many Techs don't find it worthwhile to invest all that energy in learning the code for a 200 kHz slice of spectrum. *However,* after April 15 that same 5 wpm code test and General Class written exam will get you voice privileges on *all* HF bands, along with the ability to try out those cool new HF digital modes, such as PSK-31 and Hellschreiber. If you're a "digital kind of guy," or want to experience HF DX at the peak of the sunspot cycle, your upgrading path has just gotten much less bumpy.

What Does it Mean to ME?

Let's take a look, license class by license class, at the effects of the FCC's restructuring decision. If you currently hold a ...

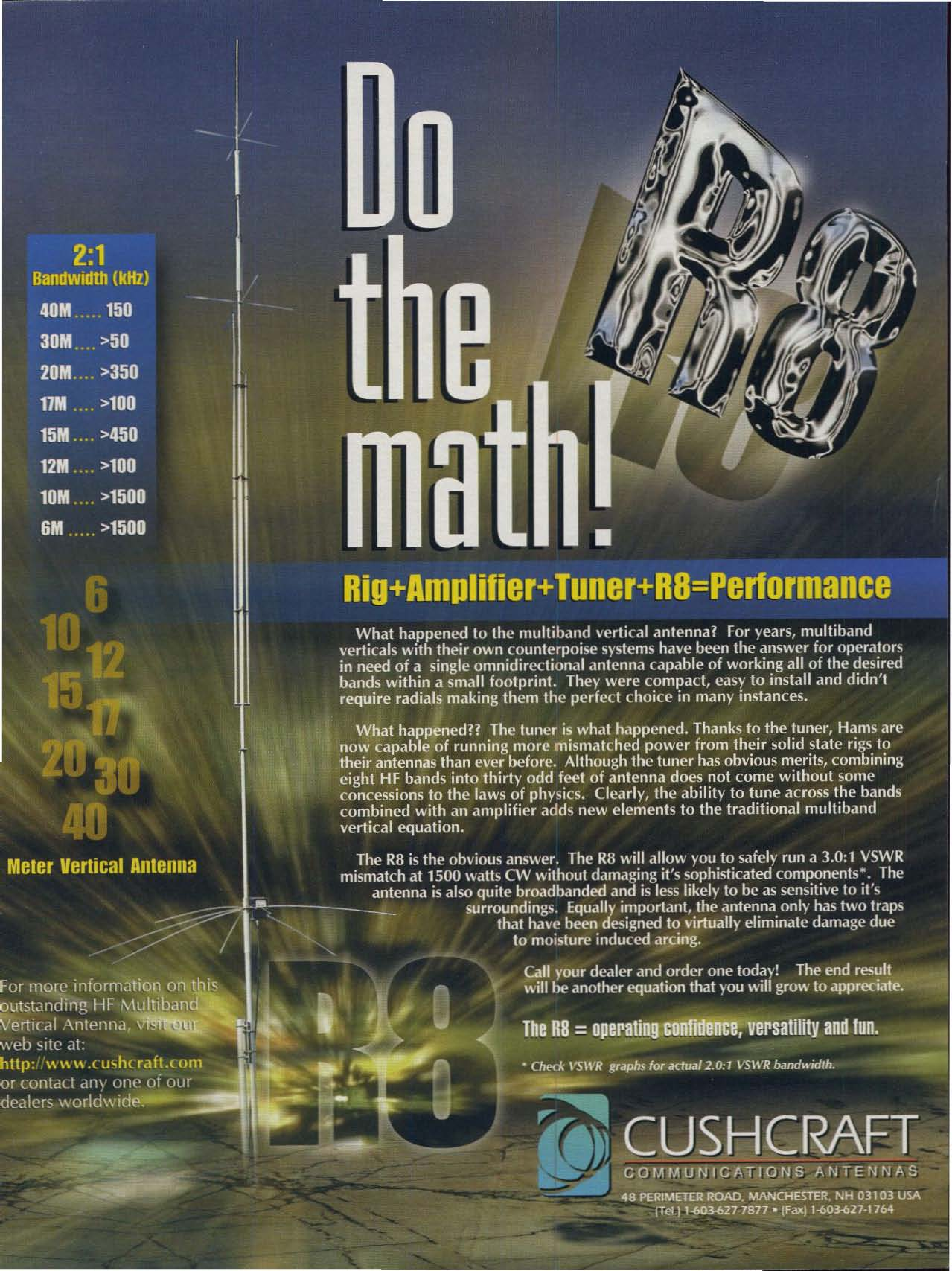
• Novice license: You've already passed the only code test you'll ever need to take. Upgrading to General after April 15 will require passing the new Element 3 written exam (or whatever it ends up being called). If you want to upgrade beforehand, take the current Element 3A for an instant upgrade to Tech-Plus, and Element 3B for credit that will allow you to apply for a General (with no additional exam) once the new system is in place. If you aren't interested in upgrading, you may renew your Novice license indefinitely.

• Technician (no-code): You have already passed half of the new General exam, but you'll lose credit for that if you wait until after April 15th to begin upgrading. If you pass Element 3B (General theory) before April 15, you then have one year in which to pass your 5 wpm code exam and qualify for a General class license. If you wait, you'll have to take the new Element 3 written exam along with the code test. In either case, you'll get broad operating privileges on all HF bands with only a written exam and 5 wpm code.

• Technician-Plus: You're two thirds of the way to your General. If you pass Element 3B before April 15, you'll be able to apply for a General class license after that date without taking any additional exams. After the 15th, you'll need to take the new Element 3 written exam. (If I were you, I'd get out that General Class study guide and get moving!)

• "Grandpappy" Tech-Plus: If you had a Tech license before March 21, 1987, you have credit for all required elements for the new General Class license. However, you must request an upgrade before operating with General Class privileges. You'll need to come to a VE session with $6.65 and your pre-1987 Tech license or other proof that you had one (on request the FCC in Gettysburg will issue a letter confirming that you were in the database, assuming that you were; and many VE teams will accept a Technician Class listing in a 1987 or earlier *Callbook* as sufficient proof) and fill out a license application form. The VEs will certify that you have credit for the necessary elements and will process your upgrade to General.

• General: No more code tests. If you pass Elements 4A and 4B before April 15, you'll get an instant upgrade to Advanced, and will be able to apply for an upgrade to Extra (with no additional exams) after Tax Day. If you wait, you'll



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
Do the math!
R8
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 it's sophisticated components*. The antenna is also quite broadbanded and is less likely to be as sensitive to it's 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
CUSHCRAFT
COMMUNICATIONS ANTENNAS
48 PERIMETER ROAD, MANCHESTER, NH 03103 USA
(Tel.) 1-603-627-7877 • (Fax) 1-603-627-1764

have to pass the new Element 4 written exam at one sitting, and immediately jump up to Extra.

• Advanced: My advice is to start studying right now for the Element 4B written exam, and pass it before April 15, then go apply for your Extra at the first VE session after the 15th. Otherwise, you'll have to take the new Element 4 exam, which most likely will include most or all of the material on which you were already tested to get your Advanced class license.

• Amateur Extra: Stop complaining. You've already got all amateur privileges, you'll never have to take another license exam, and you'll have future bragging rights that *you* passed your test back when it was a *real* man's (or woman's) exam.

Stay Tuned...

That's about it for our "instant analysis" of the FCC's restructuring decision. We're going to post the full 70-page Report and Order on our website, <http://www.cq-amateur-radio.com>, and we'll be back next month with a closer look at some of the details. Until then, get out your license manual and start studying!

73, Rich, W2VU

Chod Harris, WB2CHO/VP2ML (SK)

Once again, we have the sad duty of reporting on the loss of a *CQ* "family member." *CQ* DX Editor Charles J. "Chod" Harris, WB2CHO/VP2ML, passed away in early December from complications following a major heart attack. Chod was only 50 years old and had had heart problems for many years. He devoted much of his life to amateur radio, and was our DX Editor for just over ten years.

Chod lived a life that many hams only dream of, operating from exotic places such as Christmas Island, the Galapagos, and of course Montserrat, where he lived part-time and got his VP2ML callsign. His dedication to ham radio and DXing in particular was obvious in the location of his California home on a hilltop with a good take-off angle over the Pacific.

Filling Chod's shoes for now is *The DX Magazine* Editor/Publisher Carl Smith, N4AA. Those of you with long memories will recall that Chod started *The DX Magazine* in 1989 and was its editor and publisher, while also being *CQ*'s DX Editor, until he sold it a few years ago. Thank you, Carl, for stepping in on almost no notice and under the most difficult of circumstances.

For the finest *fully automatic, conservative maximum-legal-power* HF linear amplifier in the world...

your only choice is ALPHA 87A!

ALPHA 87A with new ***AlphaMax***™ has *both* fully automatic, real time fine tuning *and* adaptive loading. No other amateur amplifier has *either*.

ALPHA 87A lets you go–*right out of the box*– to any frequency from 160-10m, select any suitable antenna, and transmit at full output...*without any programming!* The ***87A*** *automatically* optimizes tuning & loading for any frequency and antenna in seconds, *while you transmit*. No other amateur amplifier can do that.

ALPHA 87A *automatically* readjusts loading in the event you overdrive it, thus preventing flattopping and splatter. After drive power is reduced, the ***87A*** automatically re-loads for optimal power output. No other amateur amplifier can do *that*.

All new ALPHAs will run cool and quiet for days on end at 1.5 kW RF output *with plenty in reserve*. That's just one reason why a 1999 poll of <*contesting.com*> participants revealed ***ALPHA*** as their *overwhelming* preference in amplifiers.

ALPHA 87A with new ***AlphaRemote***™ provides intuitive *Windows 95, 98 or NT*™ –based remote control and "at-a-glance" monitoring on the screen of your PC. Full time color bargraphs and status flags mean you don't scroll through menus or strain to read little monochrome LCDs.

All new ALPHAs are backed by ***ALPHA/POWER's*** 30-day *money-back* guarantee, *4-year* factory limited warranty, and *30-year reputation* for top performance, quality, and service. Our courteous and helpful factory experts are an easy phone call away, and factory service is as close as overnight UPS.

Why would you risk investing in anything but an ALPHA?

Special pricing of $5890 for a new ALPHA 87A with AlphaMax™ and AlphaRemote™ has been extended, but may be terminated without notice. An AlphaMax™ and AlphaRemote™ chipset to easily retrofit any 87A is only $99.

Call or FAX ALPHA/POWER for information

ALPHA/POWER, Inc.

14440 Mead Court • Longmont, CO 80504

(970) 535-4173 • FAX (970) 535-0281

www.alpha-power-inc.com

If you're a typical ham who can't resist inexpensive new toys, then you probably have a laser pointer. If so, you also have the basics of a light-communication system with a potential range of up to 40 miles! This project lets you build the rest of the pieces.

Tripping the Light Fantastic

BY JIM HATTON,* GM4RJX

When I first became interested in lasers, they were expensive, bulky, and required high-voltage power supplies. Recently, small, inexpensive lasers have become commercially available in many stores in the form of laser pointers. These devices use a semiconductor laser and a small power supply, usually a battery, to generate an intense beam of light.

Fig. 1– At a distance of over 40 miles a 5 mw laser is still just about the brightest object in view. This is what a laser looks like from such a distance compared to city lights.

Pointers are available with various power outputs, ranging from 2 mw to over 5 mw (*In the U.S., 5 mw is the legal maximum for a laser pointer.—ed.*). This doesn't sound like very much power, but it should be remembered that all of the available power is concentrated into the beam. This project used a standard 5 mw-laser pointer and a receiver to make a system that is capable of contacts in excess of 40 miles.

Very few special parts are used in the project; most of them came out of my junk box. The only major purchase is the pointer, but if time is taken to shop around, these can be picked up for between $15 and $20. The only other special part is the PIN diode used in the receiver. There are numerous sources of these devices and many types are available, so it shouldn't be too hard to find various types for experimentation.

Laser Safety

It may seem ridiculous to talk about safety when the power of the transmitter is only a few milliwatts. However, it's not. Lasers output all of their power into a beam that is first very narrow and second almost completely parallel. If the power of the beam at close range is equal to the output power of the laser, then all the energy is concentrated into an area of a few mm^2. In the U.K., the government's safety limit for exposure to radiation is 10 mw/cm^2. A 5 mw laser beam with a diameter of 1 mm has a power density of 159 mw/cm^2.

There are many hazards to be considered when experimenting with lasers, the most concerning of which is permanent eye damage. When light enters the eye, the lens causes it to be focussed onto the retina. A small point

*64 Abercromby Crescent, Helensburgh, dunbartonshire, G84 9DN, Great Britain

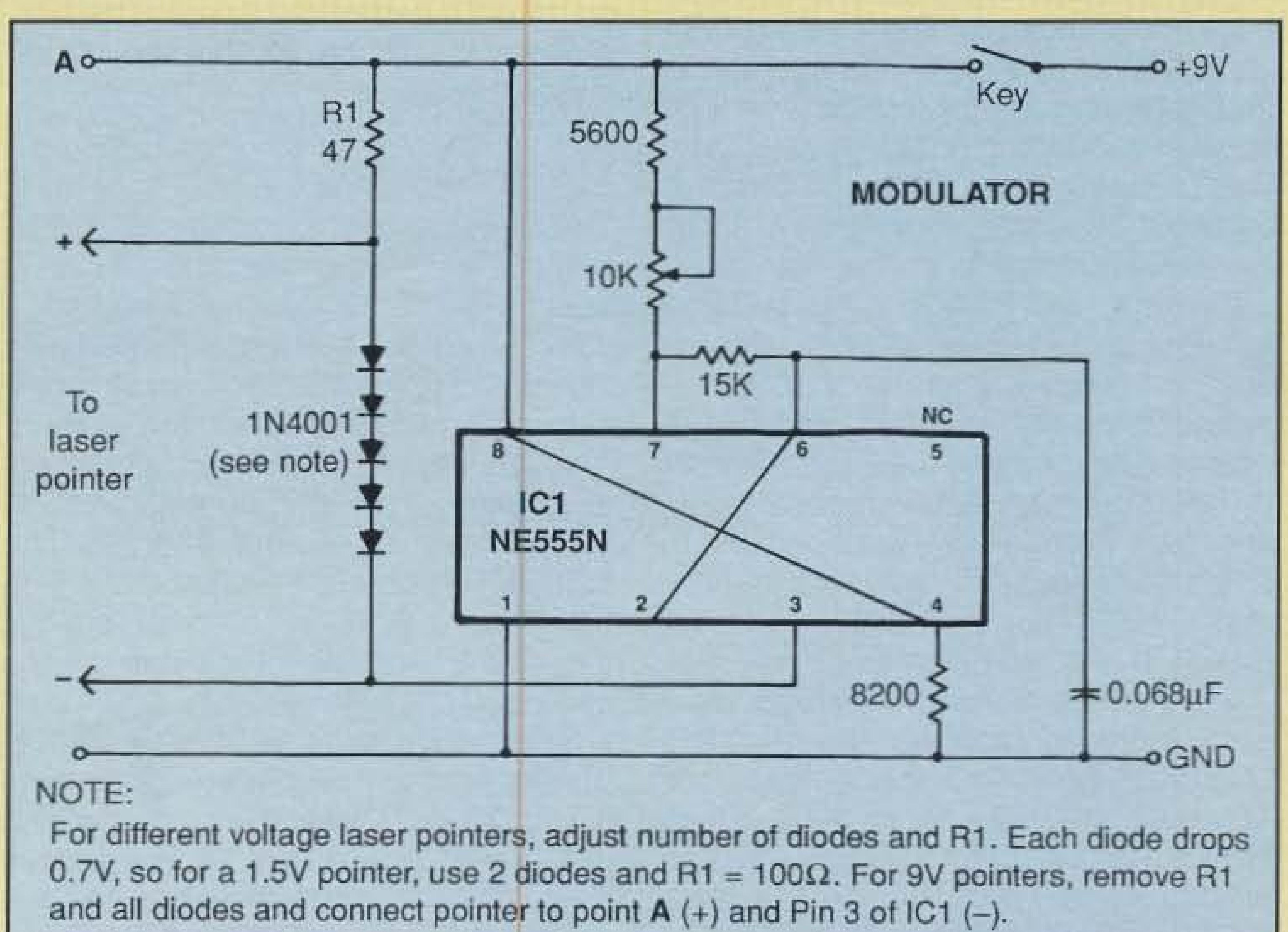


Fig. 2– The modulator circuit diagram. Component values are not critical and should not be hard to find.

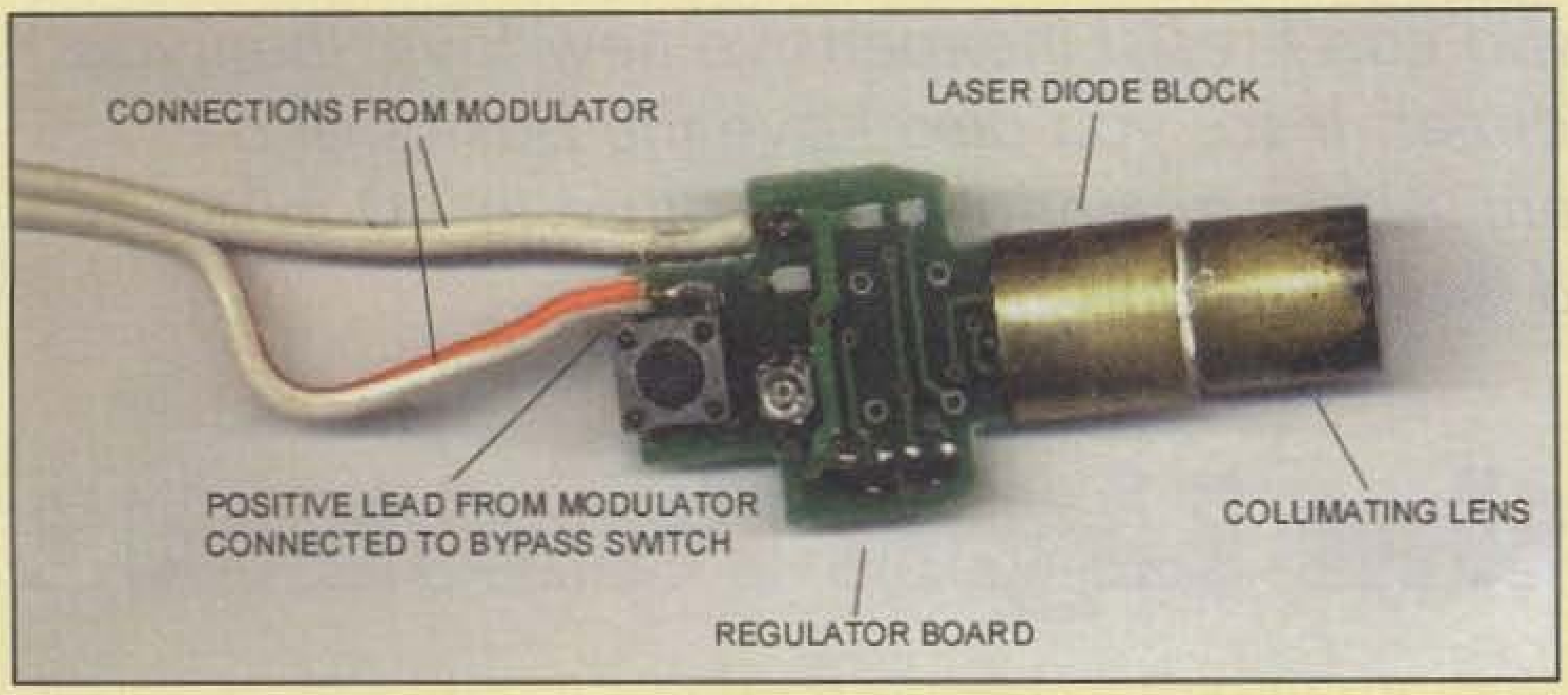


Fig. 3– The general layout of a pointer and how to connect the modulator.

source of light will be focused to a very small point on the retina. A laser beam entering the eye will be focused into a very small dot. Almost all of the original power will be concentrated onto a very small area on the retina. If the laser is powerful enough, the retina will be burned. A 5 mw laser is more than capable of inflicting such damage. (*A 5 mw laser is in the second most powerful class of lasers, Class IIIa, which includes any laser over 1 mw.—ed.*)

Working with lasers in the shack requires some careful consideration. Reflected laser light is almost as powerful as direct laser light and is just as dangerous. Care should be taken to avoid reflective surfaces. Ideally, the laser should be mounted securely on a bench, pointing at a non-reflective target.

Another precaution in the shack is to make the ambient lighting level as bright as possible. The iris of the eye opens and contracts to let more or less light through depending on the ambient light level. A small iris presents a much harder target for a stray laser beam, since there is less space for the beam to enter.

Outside the shack consideration must be given to the path of the beam and who is likely to intercept it. For example, firing the beam at head height across a freeway will almost certainly dazzle someone and cause a major accident. Pilots are very susceptible to being dazzled, so firing lasers into aircraft flight paths is definitely a no-no (see "Lasers and Pilots").

We have discussed dazzling as a safety consideration, but how dazzling is a laser? Consider the brightness of a 100 watt light bulb at, say, 18 inches from your face. It is fair to say that this would be pretty dazzling. A 5 mw laser is just as bright at a distance of well over 100 yards. As distance increases, the apparent brightness of a laser decreases only slightly, so for the laser to be only half as bright as the 100 watt light bulb, the distance may have to increase to several thousand yards. At a distance of over 40 miles a 5 mw laser is still just about the brightest object in view. Fig. 1 shows what a laser looks like from such a distance compared to city lights.

The Project

The aim of this project is to describe a simple laser transmitter and receiver capable of very long-distance Morse code communication. The transmitter uses amplitude modulation to generate a tone at the receiver. The project is low cost and uses readily available components. There are no printed circuit board (PCB) layouts for the project, as none were used for the prototypes. Both the transmitter and receiver are constructed on plain perforated board. This simplifies construction and once again reduces the costs.

The Transmitter

The major part of the transmitter system is the laser pointer. This project is based upon a pointer that works on 3 volts. An NE555N chip configured as a free-running astable multivibrator provides the modulation for the pointer. The frequency of the modulator is not at all critical, but the generally accepted standard is around 800 Hz. The NE555N produces a square-wave output on pin 3. At each half cycle, pin 3 is grounded. For the other part of the cycle, pin 3 is high.

Several attempts were made to use transistors or regulators after the NE555N, but these were clumsy and just added to the cost of the project. Since the chip's specifications say it is capable of sinking 200 ma, and a 5 mw laser pointer draws about 100–150 ma, a series of diodes was used as a clamping regulator, somewhat like a Zener, to limit the output voltage of the modulator to 3 volts.

As pin 3 is grounded, current flows from the supply rail, through resistor RX and the diodes, to ground via pin 3. The voltage dropped across the diodes is 3 volts. When pin 3 is high, no current flows, so the voltage dropped across the diodes is zero.

The use of such a diode string may seem a little odd, but it is easily justified. The main role of the modulator is to provide a supply to the pointer. A second, but perhaps more important role is to protect the pointer. The built-in regulator of the pointer will be safe over a limited voltage range. Over- or under-powering the pointer may destroy it. Regulators in pointers generally are made as cheaply as possible, and there is usually little or no protection built in. The diode string in the modulator provides a safeguard for the pointer because the normal failure mode of a diode is a short circuit. If one of the diodes fails, the output voltage will drop by only 0.7 volt. This is well within the normal operating range of the pointer regulator, which is generally designed to handle a voltage range consistent with normal battery life.

The modulator circuit diagram is shown in fig. 2. Component values are not critical and should not be hard to find. The only part to be careful about is the NE555N, which must have the correct suffix, i.e. N, to handle the current.

Building the Transmitter

Use whatever method you prefer for building the modulator. The prototype was constructed on plain perforated board, but any other technique will work just as well. There are no layout constraints, as the circuit is inherently unstable anyway. The technique I find most suitable for this type of project is to lay out the components on the plain board roughly in positions similar to those on the circuit diagram. The leads of the components are then neatly bent around under the board to connect the various components together. This method is somewhat similar to making a PCB as you go.

The advantages of this construction method are that the costs are kept to a minimum, there is no time spent making a one-off PCB, and modification is relatively simple after completion.

The board used was 0.1 inch pitch perforated board with no copper tracks. This board is readily available. Other methods of construction for the modulator are just as acceptable. Copper strip-board works fine, as does making a "proper" PCB.

Connecting and Testing The Transmitter

Before connecting the modulator to the pointer, it is worthwhile to carry out a few checks. The output to the pointer is a 3 volt square wave with a 50% duty cycle. If this is measured with a voltmeter, the voltage measured will be around 1.5 volts. This is the average voltage and may vary slightly depending on the meter used.

Once the modulator is working, the laser pointer can be prepared. Generally, pointers are based on the same principle. A power supply, usually a battery, is connected via a switch to the regulator, which controls the current to the laser diode. The modulator is designed to take the place of the power supply and to be connected after the switch. Fig. 3 shows the general layout of a pointer and how to connect the modulator.

Once the pointer is connected to the modulator, the transmitter can be tested. Aim the laser at a wall and switch on the modulator. The laser spot should be almost as bright as an unmodified pointer. Sweeping the laser rapidly from side to side should produce a dotted line on the wall. This is because the pointer is switched on and off by the modulator 800 times a second. The sweeping motion displays the on and off periods of the pointer as a series of short lines connected by equally short spaces. The 50% duty cycle of the modulator can be seen as equal lengths of line and space on the wall (see fig. 4).

The Receiver

John Yurek, K3PGP, originally developed the receiver design used in this project. After trying many different designs, I consider John's to be the best compromise between cost and performance, and after all, there is no need to redesign the wheel. I thank John for his kind permission to reproduce his design here.

The purpose of the receiver is to detect the light from the transmitter and turn it into sound. The receiver consists of two basic modules—a front end and an audio amplifier. A third filter stage can also be added between the front end and the audio amplifier to increase sensitivity and reduce interference if required. The front-end circuit diagram is shown in fig. 5(A).

The operation of the receiver is relatively simple. A PIN diode, which is sensitive to light, is connected to the gate of a Field Effect Transistor (FET). As light hits the PIN diode, a very small voltage is generated. The FET, which has an extremely high input impedance, amplifies this voltage and feeds it to a transistor buffer amplifier. The input impedance of the FET, coupled with the method of connecting the PIN diode, makes this circuit suitable for nighttime (dark) use only. Designs suitable for daytime use are on John's very interesting website: <http://www.qsl.net/k3pgp>.

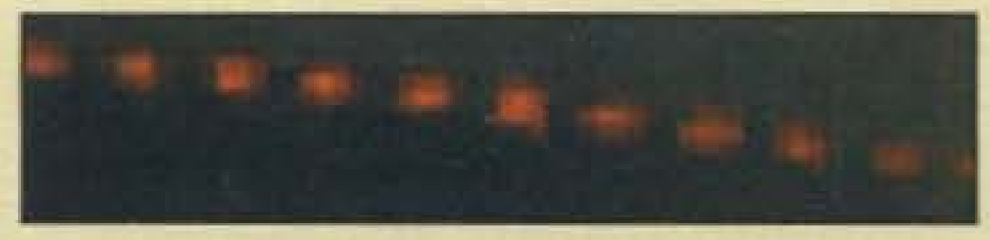


Fig. 4– The 50% duty cycle of the modulator can be seen as equal lengths of line and space on the wall.

Building the Receiver

Construction is largely a matter of personal preference, but copper strip board should be avoided. Once again, choice of components is not critical, and the only part that is likely to be hard to get is the PIN diode. When choosing the FET, a low-noise audio device is preferred over a low-noise RF device.

As with the modulator, the receiver front end was constructed on plain perforated board. Once again there is a sound reason for this. The receiver front end has very high impedance. Any leakage between components could seriously affect its sensitivity. Also, stray capacitance between strip-board tracks easily could result in instability.

The components are laid out on the perforated board much the same way they are shown on the circuit diagram. The PIN diode is mounted with the glass window facing upward. Leave the leads of the PIN diode as long as possible to allow mounting in the box. All other components should have their leads kept as short as possible.

The completed front end should be mounted in a metal box for shielding. The extremely high impedance of the front end makes it very prone to picking up noise and interference, so the power supplies and output signal are taken out of the box by 1000 pF feed-through capacitors. A small hole in the box allows light to enter and strike the PIN, which should be mounted just behind the hole. The best method of achieving this arrangement is to make the hole, about 1/4 inch diameter, in the middle of the lid of the box. Mount the board in the box with the PIN diode just below the level of the top of the box, aligned with the hole in the lid.

The Audio Amplifier

The audio amplifier stage consists of an LM386 audio amplifier chip. Once again the minimum number of components

What is a LASER?

Laser is an acronym for *Light Amplification by Stimulated Emission of Radiation.* Laser diodes use a principle similar to an LED, or light-emitting diode. Light is generated in a cavity at the junction between a P- and N-type semiconductor and amplified by oscillating backwards and forwards in a cavity (fig. 1-1). The ends of the laser diode, its *facets,* are cut or ground to very precise angles. These facets are coated with an extremely thin layer of gold, which acts as a reflector. When the light reaches sufficient energy, it passes through the gold and emerges as laser light, from *both* ends of the laser diode. The laser output is by no means parallel at this stage and requires an external *collimating lens* to focus the flattened cone to an almost parallel beam. Most laser diodes are packaged along with a PIN diode light sensor, mounted at the unused output of the device, which is used as feedback for power supply regulation.

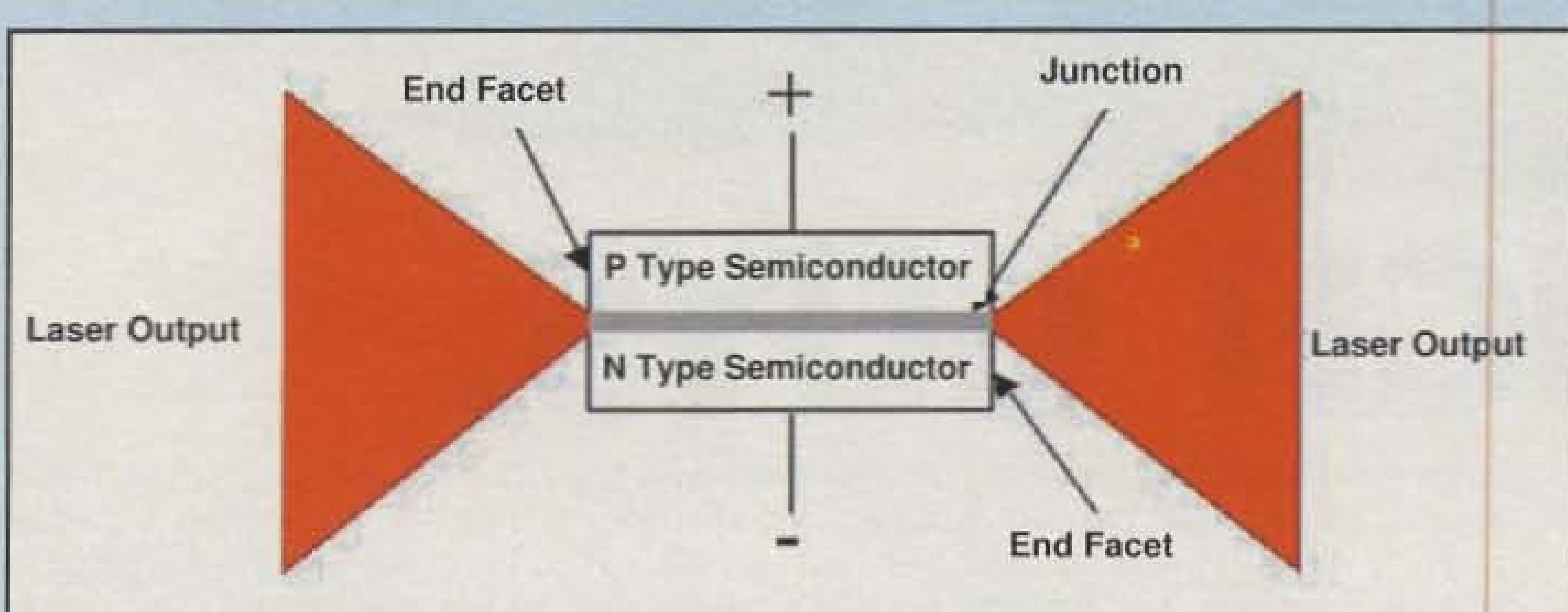


Fig. 1-1– Laser diodes use a principle similar to an LED, or light-emitting diode. Light is generated in a cavity at the junction between a P- and N-type semiconductor and amplified by oscillating backwards and forwards in a cavity.

FT-50RD
This durable, multi-featured 5 Watt Dual Bander is manufactured to rigid MIL-810 standards. Featuring wideband frequency coverage,* CTCSS/DCS operation, Dual Watch, 112 memory channels, and Digital Voice Storage.
FT-11R
This compact 2M Handheld features 150 memory channels (75 if Alphanumeric), 10-memory DTMF Autodialer, Automatic Battery Saver (TX/RX), backlit Keypad, and are available in 1.5 Watt and 5 Watt versions.
FT-23/33R
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-411E
The affordable FT-411E is compact and durable. This 5 Watt VHF FM Handheld features a die-cast case, 40 memory channels, 10 DTMF memories, built-in VOX, CTCSS, and multiple scan modes.
FT-51R
This full-featured 5 Watt Dual-Band Handheld includes dual receive, 120 memory channels (80 if Alphanumeric), Auto Tone Search, Spectra Scope, and V/V, U/U and V/U operation.
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.
VX-1R
The pocket-sized VX-1R is small in size only. Featuring Smart Search,™ DCS/CTCSS, Dual Watch, ARTS,™ wide-band coverage (76–999* MHz plus AM BC). The VX-1R provides 291 memory channels, and puts out ½ Watt (1 Watt w/optional E-DC-15 DC Adapter).
* Cellular Blocked
VR-500
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.
MR 439.700
NFM
FM TRANSCEIVER VX-5
YAESU
VX-5R
Although Yaesu's newest Tri-Band Handheld Transceiver is the world's smallest, it offers the performance of a full-size unit. The VX-5R operates on the 50 MHz, 144 MHz and 430 MHz bands with 5 Watts of power output, along with ultra-wide receive coverage of the VHF and UHF spectrum, plus AM medium- and short-wave broadcast reception. The VX-5R is military rated, so its durable, lightweight design allows you to take it anywhere. It is equally suited to walking through the concrete jungle as it is to forging the raging rivers of a real one. Along with a temperature display, the optional barometer pressure sensor unit gives a read-out of barometric pressure and altitude.
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
YAESU ...leading the way.
©1999 Yaesu USA, 17210 Edwards Road, Cerritos, CA 90703, (562) 404-2700. Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with you local Yaesu dealer for specific details.

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.)

FT-100

This ultra-compact HF/VHF/UHF 100W 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-3000M

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.

FT-290RII

Ideal for base, vacation, or expedition use, this 25 Watt 144 MHz Multimode Transceiver is outstanding for emergency, travel, or weak-signal DX work. Optional battery pack allows over-the-shoulder portable use for search-and-rescue operation.

FT-2600M

This heavy-duty VHF FM Mobile is encased in a durable aluminum die-cast chassis/heatsink assembly, and manufactured to MIL-STD 810 requirements. Features include 60 Watt power output, 179 memory channels, direct keypad frequency entry from microphone, Alphanumeric memories, and PC programming capability with optional ADMS-2E software.

FT-90R

The new FT-90R VHF/UHF Mobile Transceiver wasn't given the name Micro Mobile for nothing. Weighing only 1.42 pounds, half the size of the competing brands, it fits almost anywhere. But don't let the size fool you. The FT-90R is one powerful Dual Band FM Transceiver. The high-performance receiver front end utilizes a GaAs MES FET device for excellent sensitivity, allowing for greater simplex range and access to distant repeaters. The adaptable Micro Mobile has programmable function keys, a high-capacity memory system and a versatile scanning system for active operation.

LITTLE BIG MOUTH.

Life is an adventure. So whether you're on expedition or vacation, you will probably encounter some rough going along the way. And when you do, you'll be glad that your mobile transceiver is a Yaesu. With units small enough to install almost anywhere and rugged enough to achieve military approval for shock and vibration, Yaesu is the obvious choice for dependability. Its exceptionally clear signal and wide dynamic range tame even the most crowded bands, and provide outstanding protection from intermodulation in urban areas. Learn more about Yaesu products on the web at www.yaesu.com

YAESU ...leading the way.

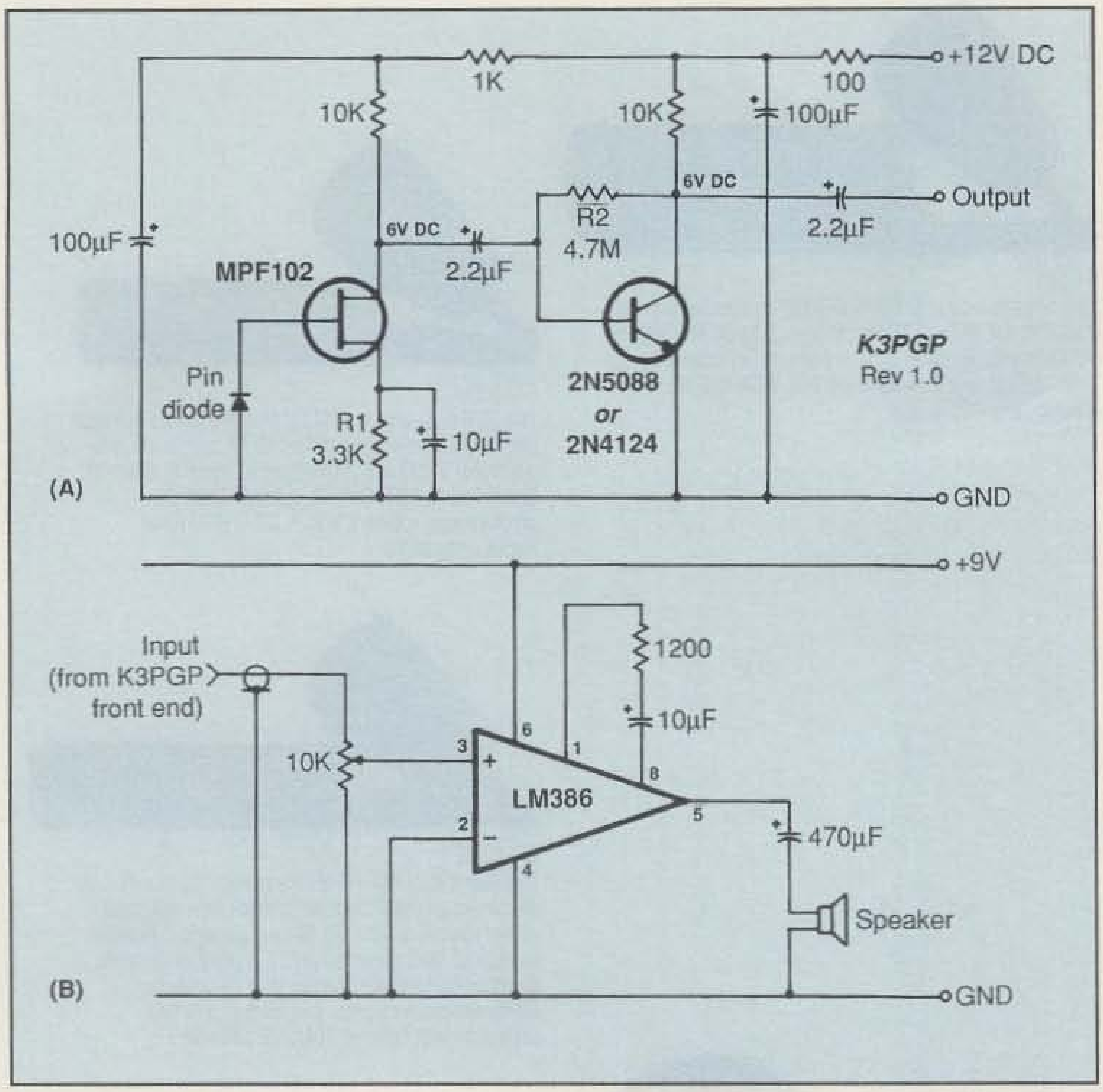


Fig. 5(A)– The receiver front-end circuit diagram (courtesy John Yurek, K3PGP). (B) The circuit diagram of the audio amplifier.

was used to keep the cost down. To maintain screening, the audio amplifier is also mounted in a metal box, perforated to allow the sound from the speaker to escape. Construction of the audio amplifier is not critical and there are no difficult-to-find components. The circuit diagram of the audio amplifier is shown in fig. 5(B).

Testing the Receiver System

Once constructed, the receiver can be tested by pointing the front end at a room light. The audio amplifier should output a buzzing noise at about 100 Hz. In a totally dark room all that should be heard from the receiver is a hiss. If hum is still audible, either there is still light getting into the room or the screening needs attention. If the transmitter is pointed at a wall in the darkened room, the receiver should pick up the 800 Hz signal even if the PIN is not pointed directly at the laser spot.

Lenses as Antennas

The front-end and amplifier combination will work reasonably well as a receiver. However, the performance can be enhanced greatly by the inclusion of a lens. The PIN diode in the front end will have a sensitive area of about 4 mm^2. This is too small to recover very much of the incoming laser light. A large lens acts as an antenna, concentrating all the light from a larger area onto the sensitive area of the PIN.

Such lenses are relatively inexpensive and easy to obtain. Many stationers sell page-size Fresnel lenses meant to be used as page magnifiers for a few dollars. These lenses are not very good quality but are more than adequate for laser work. Placing the PIN diode at the focal point of the lens will give an incredible performance increase. The lens also acts as an antenna in another way by making the receiver very directional. This is particularly useful when trying to avoid interference from street lighting and other noise sources.

To use a lens with the system, it is best to make a lightproof housing for the receiver front end. The size of the box depends on the size and focal length of the lens. A page-size Fresnel lens will have a focal length of about a foot or two. It is fairly simple to find the focal length of a lens. Hold the lens against a wall pointing towards a window. Move the lens away from the wall until the scene outside is in clear focus. The distance from the wall is the focal length of the lens.

The box needs to be just a little longer than the focal length. The ideal position for the front end is just slightly forward of the focal point (about 1/10 inch). This gives best illumination of the PIN diode. Remember, though, that the measuring point is the sensitive area of the PIN diode, not its glass window or the hole in the metal case. Obviously, the box needs to be as wide and tall as the lens. The inside of the box should be painted flat black to reduce reflections.

Using the System

Before you can run, you need to learn to walk. Laser communication is relatively straightforward but requires a new set of skills that can only be learned by practice and experience. Using the transmitter out of doors for the first time, taking into account the safety precautions mentioned earlier, is good experience in learning how to aim the laser. You will notice that after about 100 yards or so the laser dot becomes very hard to see. Over greater distances, the dot will not be visible if you are standing at the transmitter. This is because the dot you are seeing is just reflected light scattered by the surface of whatever it's hitting.

After playing around with contacts over several hundreds of yards, it will soon become evident that the transmitter needs to be mounted on something solid to be able to hit the target. A camera tripod is pretty good for starters. The laser pointer can be fixed to the tripod head; the extra stability gained will greatly increase the accurate aiming range.

Practice with the receiver is just as important. A good way to set up the aiming of the receiver is to point the transmitter at a distant wall—say, 100 yards away—and aim the receiver at the laser spot. At this range a good, clear signal should be heard. The signal being received in this case is in fact the reflection of the laser from the wall. The parallel beam hits the wall and scatters in all directions. The scattered light picked up by the receiver is only a small fraction of that produced by the laser.

At this point it is worthwhile to make some sort of sighting arrangement for the receiver. A simple 6 inch length of 1/2 inch tubing will work well enough. The tube should be fitted to the receiv-

Lasers and Pilots

The author correctly cautions against using any laser outdoors on a path where it might "dazzle" a driver or an airplane pilot. The risks, and procedures which need to be followed, were outlined in detail in the October 1999 issue of CQ VHF, *in an "Op-Ed" by Patrick Murphy, Airspace Issues Coordinator for the International Laser Display Association, and a member of a Federal Aviation Administration (FAA) advisory committee which deals with laser hazards for aircraft. The following is excerpted from that article.* — *W2VU*

First, it is critical for public safety that hams understand that lasers of all powers—not just powerful Class IV devices—can pose a hazard to aircraft pilots. The problem is not eye-safety of pilots. It is highly unlikely that a laser below Class IV could harm a pilot's vision, especially when used in the manner described in the article. The problem is one of *distracting* pilots while in a critical phase of flight: landing, takeoff, maneuvering, or emergency actions. Even a Class III laser can be bright enough to cause effects ranging from startle and distraction, to blinding glare and temporary flashblindness.

Pilots are legitimately concerned about this, and it has become an issue in the past four years or so. There are a number of concerns, including display lasers; scientific, industrial, and research lasers; and even laser pointers (usually aimed by youths towards helicopters). The last thing pilots or the laser community needs is to have yet another group using visible lasers in the nighttime sky without full approval of the CDRH (Center for Devices and Radiological Health) and FAA.

Laser-using hams need to be much more concerned with laser/aviation safety. There have already been incidents with lasers in the power ranges described in the article in which pilots have felt unable to land a plane and have turned over control to their co-pilots. (You or I might not have a problem with a brief, bright flash. However, pilots rely heavily on their vision, and they do not have the training to know how to react to a sudden flashblinding exposure. It becomes clear why even low-power exposures can cause in-flight problems.)

For demonstration lasers the CDRH requires that an FAA review be undertaken in advance for any outdoor laser display more powerful than Class II. If the FAA objects, then the CDRH will not issue a variance. In my view, laser use for free-space communications is not a "demonstration." Thus, there may be no legal basis for the CDRH to regulate this use, as CDRH regulation is limited to the equipment and to three uses: surveying, medicine, and "demonstration." Further, the FAA has no statutory authority to stop you.

Having said all of the above, it is best to act *as if* one is regulated by the CDRH and FAA, whether or not this is legally required. This is the safest method, and it would certainly provide a defense should there be any legal interference (such as police officers visiting a transmission site). To sum up to this point: *Any outdoor use of a free-space laser, where fixed-wing OR rotor craft could possibly intercept the beam, should be done only after the FAA is notified, all proper forms have been filed, and the FAA issues a written "letter of non-objection" to the laser use.*

I hope this summary of a complex topic has been clear. If you would like more information, please write to me, Patrick Murphy, c/o Pangolin Laser Systems, 771 South Kirkman Road, Suite 113, Orlando, FL 32811; e-mail to <pm@pangolin.com>; or call me at 407-299-2088. Together we can keep laser communications safe for all concerned.

Resources

To see photos showing what a laser beam looks like to a pilot, visit the website: <http://209.121.5.101/AJshoot/AJshoot.html#Thumbnails>.

The Center for Devices and Radiological Health (CDRH), a branch of the U.S. Food and Drug Administration, may be found on the web at <http://www.fda.gov/cdrh>, or you may request information by mail from Center for Devices and Radiological Health, Rockville, MD 20850.

Contact your local FAA center (see your phone book or go to <http://www.faa.gov/centers.htm> on the web) for information on securing a "letter of non-objection" to your proposed laser use.

er box so that the laser dot on the distant wall is just below the center of the field of view. (*Never look directly at the transmitted beam. See sighting procedure below.—ed.*) A similar system can be manufactured for the transmitter.

The next stage of the learning process is to find a suitable path of about a mile. Ideally, the path should be clear of all obstructions, not cross any roads or flight paths, and be dark at both ends. My first path was just over 3 miles from a hill on one side of a lake to a hill on the opposite bank and was completely dark at both ends. A long-suffering friend (Simon Lewis, GM4PLM) was parked in his car on a track about halfway up the hill. From my side of the lake I easily could see his car lights with my bare eyes. Using the sighting tube, I lined up the transmitter with the car lights. After a few adjustments, a call over the 145 MHz talkback frequency confirmed that the laser was clearly visible at the

Fig. 6(A)– GM4RJX's laser on its current mount. This has been refined from the original mount—a camera tripod.

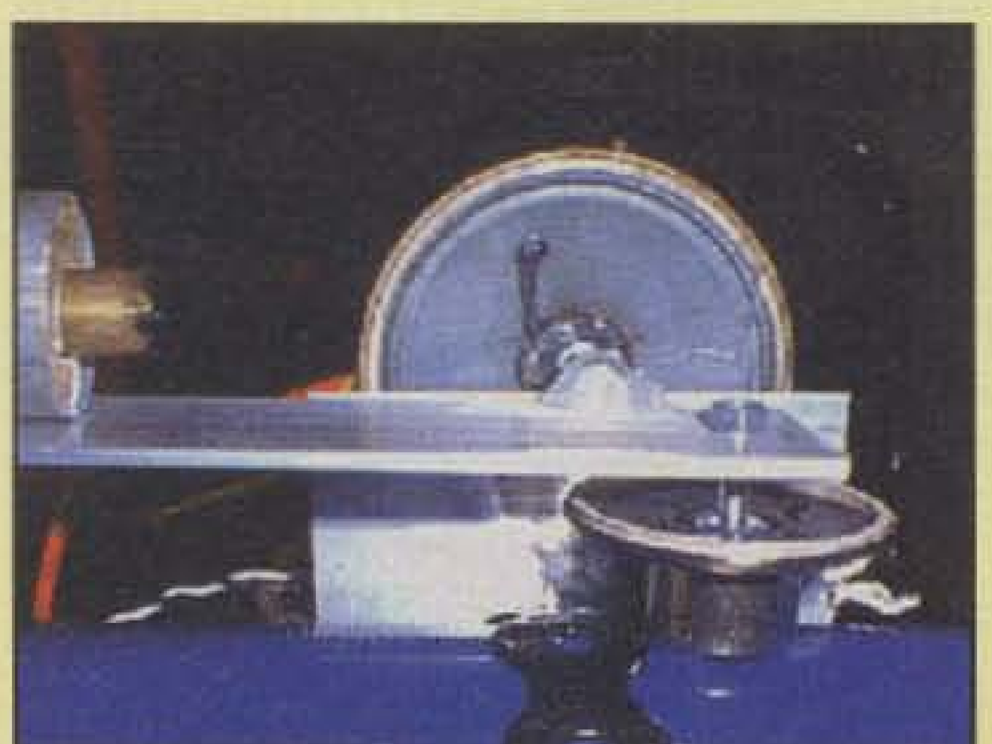


Fig. 6(B)– Close-up view of the author's current laser mount. This one uses threaded rods and small transducers to make very fine pointing adjustments.

other side of the lake. In fact, the laser was so bright that it was dazzling—an important safety lesson learned.

The receiver was lined up in a similar fashion, and a good, clear tone of 800 Hz was heard over the talkback channel. Using the modulator's on-off switch as a Morse key, I was able to send my callsign and hear it over the talkback.

Over the next few months the distance between the transmitter and receiver was increased gradually . It soon became clear that a standard camera tripod was not stable enough nor did it have sufficiently fine adjustment. Several mounts were made, and gradually the designs began to incorporate fine adjustments by threaded rods and micro adjustments with small transducers. The latest mount is shown in figs. 6(A) and 6(B).

Over a path of a mile or so it is quite easy to see the other end and work out where to point the transmitter and receiver. As the distance increases, this becomes more and more difficult, to the point where the other end of the path is invisible in the gloom. This is where good map-reading skills and a compass become essential.

The longest path I have worked with this system is just over 40 miles. Even at this range the laser was clearly visible as a bright red dot on the horizon as shown in fig. 1. The path was between two high spots overlooking the city of Glasgow. Even with all the noise and interference from the city, the laser tone was heard clearly by the receiver. On this occasion another friend (Mark, GM4ISM) had a similar setup, and a two-way Morse code contact was made easily. The major problem on this path was finding each other. Fortunately, Mark was sited at the base of a very tall TV transmitter tower that was barely visible from my site with a telescope. Once I aligned the laser on the tower, Mark was able to pinpoint my location by using my transmitter.

Finding suitable sites can be harder than making a contact. In Scotland we have a very large number of hills and mountains. Unfortunately, there are so many that it is almost impossible to find two peaks a good distance apart without another peak in the way. There is, however, an alternative to line of sight, but that is the subject of another article. The other problem with many prospective paths is crossing roads and flight paths. It is essential that for any path safety be the foremost consideration. It also must be remembered that if the receiver is at the top of a hill, the laser doesn't stop at the receiver; it will keep on going.

Final Word

The project described in this article can be used for very long-distance contacts. This is very much due to the sensitivity of John Yurek's receiver front-end design. Laser communication requires the acquisition of a number of useful skills, not all of which are related to electronics (map reading, for example). Using the simple equipment described in this article, a system can be developed for a very low cost. Above all else, be safe and consider the safety of others. ■

The CEØAA QSL featuring the famous Moais volcanic stones on Easter Island.

It was part ham radio adventure, part humanitarian mission. And it's due to happen all over again this month.

The CEØAA DXpedition to Rapa Nui (Easter Island)

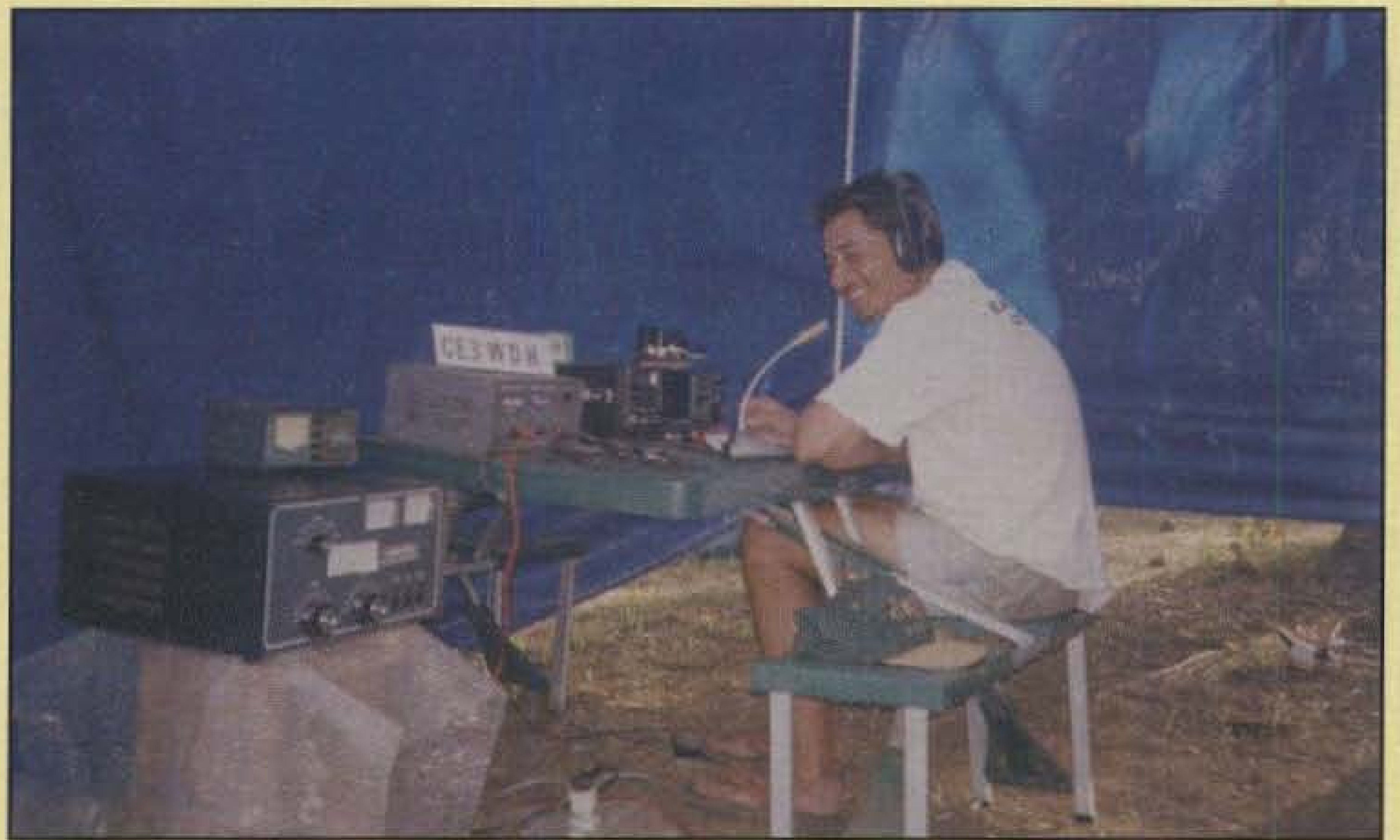
BY GIANCARLO MODA,* CE3/I7SWX

If you're hungry for exotic DX, be sure to listen this month for CEØAA from Rapa Nui, also known as Easter Island, on all bands from 160 through 6 meters. With four to six stations scheduled to be on the air at one time on SSB, CW, and RTTY for nearly three weeks, there should be plenty of "food" for hungry DXers.

This will be the second expedition to the remote island in two years. Please don't envy me, though. I was not one of the organizers nor operators of this DXpedition, and I did not even get the chance for a contact. However, I was able to see the 1999 video of the operation during the celebration of the Radio Club de Chile's 77th anniversary, and I

*Residence "Le Panoramic," 35 Av. Vincent Scotto, 83700 St. Raphael, France
e-mail: <gmoda@schange.com>

The operators of CEØAA.



One of the stations at CEØAA.

thought it would be nice to write a few words about this DXpedition.

The Radio Club de Chile (RCCH) hadn't organized a DXpedition to Easter Island (renamed Rapa Nui after a recent film) since 1981. Easter island is one of the locations most wanted by amateur radio operators all over the world, especially those chasing credits for DXCC, IOTA (Islands on the Air), and other awards. For this reason the recently founded CEDX Group (Chilean DX Group) took on this challenge, supported by the RCCH.

Planning for the 1999 DXpedition started in August 1998. Due to the great amount of effort put into the planning and execution of all the details, the resultant operation had a great impact on the world and has been a source of pride for the organizers and operators.

The DXpedition took place from March 1–20, 1999 with 16 days of "traditional" activity on all HF bands, SSB and CW. There were not less than four active operators on at a time, and for this reason the pile-ups were endless. The team made about 35,000 QSOs, with the most interest from those looking for QSOs on the 17 and 12 meter WARC bands. The group had not foreseen any activity on these bands, however, and was not set up for them.

The antennas were multiband verticals and a beam for 10, 15, and 20 meters, plus dipoles for the low frequencies, including 80 and 160 meters. The camp was positioned at the garrison of the CONAF (Corporacion Nacional Forestal [National Forest Agency]) in Anakena, 22 km (about 13 miles) from the only inhabited village on the island.

This project would not have been possible without the help and support of Carabineros de Chile (the police), CONAF, LANCHILE, LANCARGO; the following companies: House Royal (electric products), ENTEL (mobile telephone services), Labatorios Hoffman (medicines), WALMAR (antenna manufacturer, Argentina); and the many friends who prefer to remain anonymous. Not only the operators and the organizers, but also the beneficiaries of the operation should be thankful to all these contributors. *Muchas Gracias.*

Off the Radio

The motto of the expedition was *"No solo de pile-up vive el hombre"* (Not only of the pile-up is the man's life.). It was decided early on that the trip would not be limited to radio alone. During one of its many planning meetings the group decided also to make this a humanitarian effort. Together with the 1100 kg (about 2400 lbs.) of equipment and luggage also traveled 200 kg (approximately 440 lbs.) of medicine and hospital supplies donated by various laboratories. The group also transported 12 palm trees, each about 1 1/2 m (5 ft.) tall, which were given to the CONAF. These trees were planted as a remembrance of the group's visit. All of the donations were gratefully accepted by the director of the hospital and the provincial head of the CONAF of Easter Island.

The photos of this expedition speak for themselves. The group should be very proud of all their efforts, as should all of those who donated their time, effort, and resources. The support of the Radio Club de Chile was instrumental in the success of this effort.

The CEØAA QSL shows the famous *Moais* stone statues. The cards were mailed at the end of July to the fortunate hams who contacted the station.

For those of you who didn't know about or were unable to contact CEØAA, don't worry. Another DXpedition to Easter island is scheduled to take place this month. This time they expect also to operate SSTV, RTTY, the 17 and 12 meter WARC bands, and 6 meters. At press time the details were still being finalized, so watch for an announcement of the specifics. And finally, if you want to support this DXpedition, even anonymously, you may send a contribution to: CEDXG, Radio Club de Chile, Nataniel Cox 1054, Santiago de Chile, Chile.

73 and good DX, de CE3/I7SWX

The CEØAA camp on Easter Island. Some of the antennas are visible in this photo.

First brought to the attention of amateurs on the pages of CQ in the late 1940s and early '50s, GDOs continue to be very useful tools today. K8WPI takes us through the history of these devices and covers some of their applications.

The Grid Dip Oscillator

BY JAMES R. BUCHANAN*, K8WPI

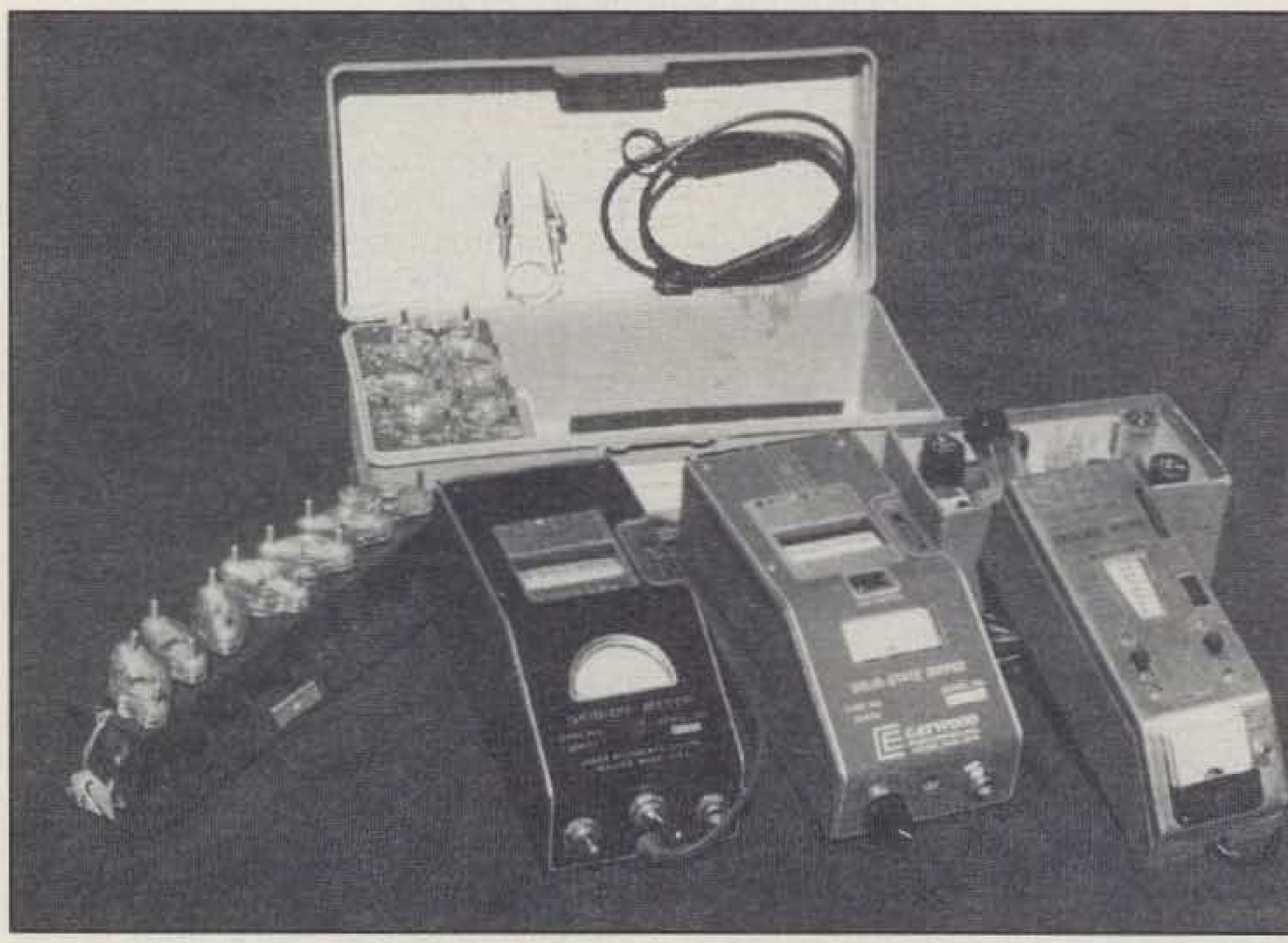
Without wishing to seem maudlin, there were some aspects of the earlier days of amateur radio which really were better than today. For some old timers, recollections of the days of yore while away the hours. Some middle-age hams, reliving the childhood they couldn't afford at the time, have a tremendous interest in vintage gear.

For the newcomer who is too busy "communicating" to spend time on the actual " radio" aspect of our hobby, well, he or she may be missing the boat. Although few of us today are obligated to build our own equipment to get on the air, the thrill is still there, albeit possibly more difficult than it was 20 to 40 years ago, as parts are more difficult to acquire.

There are many radio-based projects that can be homebrewed, and they don't need a microprocessor to drive them. I must admit, I have suspicions about receivers that lack obvious tuned circuits, and transmitters that develop 150 watts of RF output with a 12 volt DC supply cause me to wonder. Even so, playing with radio is not dead, and there may be no bigger thrill than either building anything from an antenna to a transmitter and having it work, or repairing a dead radio and putting it back on the air.

One of the most valuable tools a radio-active amateur can have in the arsenal is the venerable grid dip oscillator (GDO). Although to the uninitiated the most sophisticated GDO appears to be the equivalent of an electronic divining rod, based more on smoke and mirrors than obvious fact, that is part of the charm of the GDO. No doubt, the inexperienced may suspect a GDO as a trinket of desperation. The truly knowledgeable, however, respect the simple, honest, dependable truth and the seemingly unlimited abilities of this little wonder.

*9549 N. 17th St., Kalamazoo, MI 49004



A trio of dippers: (left) Millen 90651 with coil rack, (center) Millen/Caywood 90652 with sniffer cable and universal clip-wire, and (right) Eico 710 with coils.

The GDO is the radio-man's equivalent of the Swiss army knife! This innocuous little instrument can assist you, to great accuracy, in determining the resonant frequency of almost any tuned circuit and determining the resonant frequency of an antenna, phasing stub, or balun. The GDO can be used for checking the operation of oscillators and multiplier stages. If you have a rig up and running, you quite likely can listen to its output using a GDO, and tune transmitters and antennas for maximum output power. For servicing antennas, lines, receivers, and transmitters, even in today's world the GDO is frequently the quickest and easiest device to locate or identify a problem that is driving you nuts. The GDO is also a very useful signal generator for checking receivers, converters, mixers, and amplifier stages.

Origins of the GDO

The origins of the GDO seem to be buried deep within WW II blackouts. Radio literature prior to the war and up until 1942 fail to mention this device, while the 1948 editions of both the *ARRL Handbook* and the *Radio Handbook* from Editors and Engineers both showcase the device. Commercial devices did not show up in literature until the early 1950s. Remember, amateurs were put on hold during the war for various reasons ranging from national security to the obvious fact that everyone was involved with the war effort. There

CQ and GDOs

Grid-dip oscillators were first brought to the attention of amateur radio operators through the pages of *CQ* in the late 1940s and early 1950s, primarily due to the efforts of Bill Scherer, W2AEF, who later became *CQ*'s Technical Director.

The GDO was introduced to hams in a March 1947 article entitled ". . . About Grid-Dip Oscillators," by Clayton F. Bane, W6WB. He gave no hint as to its origin except to say that most testing laboratories were using GDOs and that they occasionally had been mentioned in the amateur radio magazines, but had never been explained.

Bane's ground-breaking description of what GDOs did and what you could do with them was followed over the next three years by a series of articles by Bill Scherer: "The Dipper" in May 1947; "Applications of the Grid-Dip Oscillator" in January 1949; "The Improved Dipper" the following month; and "Extending the Range of the Grid-Dipper" in April 1950. In March 1951 Neil Johnson, W2OLU, added "The Poor Ham's Grid Dipper," and in January 1953 Scherer and E. Miles Brown, W2PAU, jointly presented a review of GDOs and their uses, after noting that the issues containing GDO articles were the most commonly requested back issues of *CQ*.

With that history in mind, K8WPI's look at how these instruments continue to be very useful tools today continues a long and proud *CQ* tradition, thanks mostly to the vision of Bill Scherer, W2AEF. — *W2VU*

was no time for amateur radio, and even publication of traditional literature ceased or was severely cut back by the war effort. *(While the origins of the GDO may be unclear, there is no mystery as to how it became popular with hams—two letters:* CQ. *See "CQ and GDO" for details—ed.)*

The grid dip oscillator is, in reality, exactly as its name implies—a wide-range oscillator typically tuning from one to many hundreds of megaHertz by using different plug-in coils. The flea-power oscillator, which uses a meter in the grid circuit, is loosely coupled to the circuit under analysis (or should I say suspicion?) and slowly swept through the range of expected operation. When the internal oscillator frequency matches the resonant frequency of the external circuit, power is literally "sucked out" of the oscillator, causing a reduction in grid current. Hence the name "grid dip meter." Although there have been many variations over the years, they all operate the same, with features varying by make and model.

Early homebrew GDOs used a calibrated dial with markings for reference. Hence, a dial of 0–100 was indexed to a calibration chart for the various coils. Eventually there evolved multi-scale units which provide direct reading of the frequency of operation. The meter dip is based on the Q of the circuit being tested and how closely you couple the two devices. It doesn't take much practice to get a feel for coupling, and to realize the benefit of having a "sniffer" probe to allow coupling to circuits that are located in difficult places. In addition to a sniffer probe, a 6 inch length of hook-up wire with alligator clips on each end allows you to perform the electronic equivalent of walking on water.

Practical Applications

What are the practical applications of such an arcane device in today's world of 186 mph cars, Pentium-III processors, and Field Commander transceivers? For the first use, I suggest the GDO as an excellent antenna checker. For that dipole, windom, beverage, delta loop, vertical, whatever your next (or perhaps last) antenna project is, the GDO can be very useful.

After you use basic arithmetic to cut your antenna to the theoretical length for the specific frequency you want, I'll bet you missed it by a large part of the true velocity factor of the antenna wire. Hoist your antenna into the air and wind a one- or two-turn coil in that 6 inch length of wire I mentioned. Clip the alligator clips to the feed line—that would be one clip to each side of the feed line, of course. Now fire up the GDO, loosely couple it to the two-turn link, and sweep the band for which you designed the antenna. Keep the GDO meter in the upper one-third scale, without pegging the needle. As you approach RF, the meter will begin to dip. At the lowest reading, you have found resonance of your antenna. Be sure to balance meter deflection against coupling, so you are reading the true dip, and note the frequency in the dipper scale.

Bingo! You now know your antenna is resonant about 50 kHz off where you want it. Cut or add wire as necessary and try it again. Remember, the GDO will tell you resonance. However, it will not tell you impedance or reactive components.

"Big deal," you say. "I can do that with my magic antenna analyzer."

Uh, yeah, maybe you can, but remember, an antenna's resonant frequency has little to do with its impedance. Most antenna analyzers are made for 50–70 ohm impedance. If your antenna poses a 250 ohm load to your analyzer, you won't even see it, as most analyzers don't respond to SWR above 5 or 6:1, and they *are* SWR meters.

Here's a trick for you. After you cut your vertical and tune it with the GDO as mentioned above, this time connect one clip lead to the antenna and the other to ground and start cutting your radials. Yes, you can tune your radials the same way—one clip lead to the radial, one to ground, and prune the radial until it resonates at the same frequency as the antenna.

Let's say you want to make a phasing line for stacking Yagis or for that new four-square. Determine the theoretical length of the line by math; don't forget to apply the velocity factor of the cable used. Now, you could assemble the whole system and see how it works (or in my case, usually doesn't), or you could check each component before assembly. As a precaution, cut the phasing line a little long. If you are using a $^1/_4$-wave line, leave the far end open; if you are using a $^1/_2$-wave line, short the far end. Couple the GDO to the near end of the line and sweep the desired frequency range. You'll find the dip. Then adjust the length of the line accordingly to achieve dip at the desired frequency. You can even do this stuff inside where it's warm and dry in the winter! Cut and match all of the components until everything is right, and then brave the elements for installation. This kind of takes all the work out of it, eh?

While we are still on the subject of antennas, let's say you want to work on your mobile antenna to get the last bit of power radiating. Most GDOs can also function as a tunable wave meter (or field-strength meter, if you prefer). Select this mode on the meter and sit it on a wooden ladder or other non-metallic support at a convenient height as far from your car as you can read the meter. Field glasses are a handy accessory for this project. Tune the meter to the frequency of your rig. Adjust the sensitivity of the meter for mid-scale deflection when you key the transmitter. Make adjustments while keeping an eye on the GDO and tune for maximum deflection, which is maximum field strength.

One of the handiest uses of the GDO is for checking or re-tuning tank circuits. Whether you are converting a rig from one frequency to another or you brought home a source of consternation from the last hamfest, the GDO can be a life-saver. The GDO quickly can determine the frequency of resonant tanks. It is not uncommon to find a receiver or transmitter of dubious origin which just doesn't seem to perk right. My experience has been that many times amplifiers, mixers and even oscillators are tuned to the wrong frequency. A multiplier may be tuned to the wrong harmonic, offering weak output, which affects either the subsequent mixer or multiplier stage. Mixers tuned to the wrong frequency (the image) can work, but the receiver may be noisy and lack sensitivity. Rather than spend hours checking for some defective component even when voltages seem correct, many times the unit is just tuned to the wrong frequency. A quick check with the GDO, perhaps using the sniffer loop (which is just a convenient extension cord for coupling), may quickly indicate the offending stage. A tweak of a coil or capacitor, knowing which way you are headed, may bring life back into the beast.

While mentioning tank circuits, about the easiest method of finding which selection of capacitors and inductance will resonate at a specific frequency is to use the GDO. Similarly, if you have an unmarked inductance or capacitor, it is easy to determine what you really have. Place the L/C in parallel and loosely couple the GDO. Find the dip and you'll know the resonant frequency. By knowing one component, you can quickly do the math to determine the other, or just use your favorite nomograph from any decent reference publication.

What to Look for in a GDO

By now I trust you can see the value of having such a marvel of technological innocence at your disposal. If you don't already own one, perhaps you'll take a closer look around at the next hamfest. As with anything else, not all GDOs are created equal, and there are many from which to choose.

What you should look for in a GDO is, well, everything, since you will want to do almost everything with this unit after you own one. Although there are some exceptions, most GDOs offer basically the same functions—a powered oscillator function and a non-powered detector function. Some units offer headphone jacks for monitoring modulation or for listening to zero beat to determine frequencies of harmonics or parasitic oscillations. The frequency range of each manufacturer's unit varies somewhat, so whether you are a lowfer or UHF devotee, it's a good idea to check the bandwidth of the unit you are considering. The sniffer loop, which is not magic, seems to be unique to the Millen units.

Frequency accuracy and stability of GDOs seem to be directly related to their original selling price, with some units being poorly calibrated but nonetheless useful. Top-of-the-line GDOs have dial accuracy, some 50 years after manufacture, as accurately as you can read the dial, and are stable enough to stay within the bandwidth of current crystal or mechanical filters.

The most sought-after meter seems to be the original Millen, model 90651. This was the first mass-produced commercial unit and hit the market in the late 1940s. It seems to have been unchanged until the end of the line in the late 1960s. This vacuum- tube unit requires 110 VAC for operation and offers standard frequency coverage from 1.7 to 300 MHz in seven ranges using one plug-in coil for each range. If you are extremely lucky, you may find the optional coil set (four coils), which extends the low range down to 220 kHz. This classic black-wrinkle meter is not uncommon. However, without the coils it is worthless. Look for the complete set of coils, and for heaven's sake, if there isn't a manual with the unit, check with vintage manual brokers and buy one. It's worth its weight in precious metal.

Realizing the success of the Millen unit, everyone and their brother seemed to have a GDO in their line-up by the late 1950s. Probably the most prolific manufacturer was the Heath Co. The Heath GD-1 and GD-1B are abundant and quite serviceable. Kit-built units do not seem to offer the dial calibration accuracy and stability of the Millens, but they are still worthwhile investments. Eico, Allied, and many others eventually put their efforts into GDOs.

Heath, realizing the power of the transistor, introduced the Tunnel Dipper in the late 1960s. This was basically a GDO using a tunnel diode oscillator which replaced the vacuum tube. The small, attractive unit offered battery power and extended frequency range. Few seemed to perform to satisfaction, though. Do you remember, or have you ever heard of, the tunnel diode? No, I didn't think so; enough said!

The second honorable mention goes to the Millen/Caywood solid-state dipper. Although Millen introduced the unit as it was closing its doors, Caywood, who purchased the Millen assets in the early '70s, continued to marketed the solid-state version of the legendary Millen GDO. The solid-state unit closely resembles its older brother, but is gray rather than black and offers a modern rectangular meter and a thumbwheel rather than toggle switches. The large rear header still sports the trademark Millen "M" and the coils are unchanged and interchangeable with the original Millen coils. Inside, the power transformer was replaced with a 9 volt battery holder, and the 5/8 hole in the chassis which held the socket for the 9002 tube in the original has a transistor socket suspended in the center. This is truly a "plug and play" conversion which worked.

The Caywood unit was supplied in a plastic carrying case which held the meter, seven coils, and the standard sniffer probe. I purchased the Caywood unit new in the early 1970s and thought its operation flawless, until I purchased a 50-year-old Millen tube unit a few years ago. I have owned or used almost everything made over the years. The Millen tube unit lives up to its reputation, with the solid-state Millen/Caywood right on its heels.

After you purchase your unit, be sure to check it against your best receiver for dial calibration, stability, and purity of output. When you know what you have, you can establish a level of trust and bet the farm on what it tells you.

I doubt the GDO will ever return to production. Fortunately, GDOs were so popular in their heyday, there are still plenty of good used units for those of us who believe in the usefulness of this gem.

While working on this article, I found the remains of Millen on the web. It seems Millen, Caywood, and Unadilla have become brothers under the banner of <www.jamesmillen.com> on the web. I was unable to acquire additional information from them for this article, however. The web site does offer rebuilt GDOs as well as manuals. You might wish to check them out. ■

Now that K8WPI has told you what a valuable piece of equipment a "dipper" can be, here's how to build one yourself using modern components.

How To Build An LED Indicating Dipmeter

BY STUART BALL*

A dipmeter was a common piece of test equipment in days gone by (see "The Grid Dip Oscillator," by K8WPI elsewhere in this issue). Originally based on a vacuum tube (and called a grid-dip meter), the dipmeter consists of an RF oscillator with plug-in coils to cover various frequency bands. When the coil is held near a resonant circuit and the dipmeter is tuned to the same frequency, RF energy will be drawn from the dipmeter, causing a *dip* in the tube's *grid* current (hence the name "grid-dip meter").

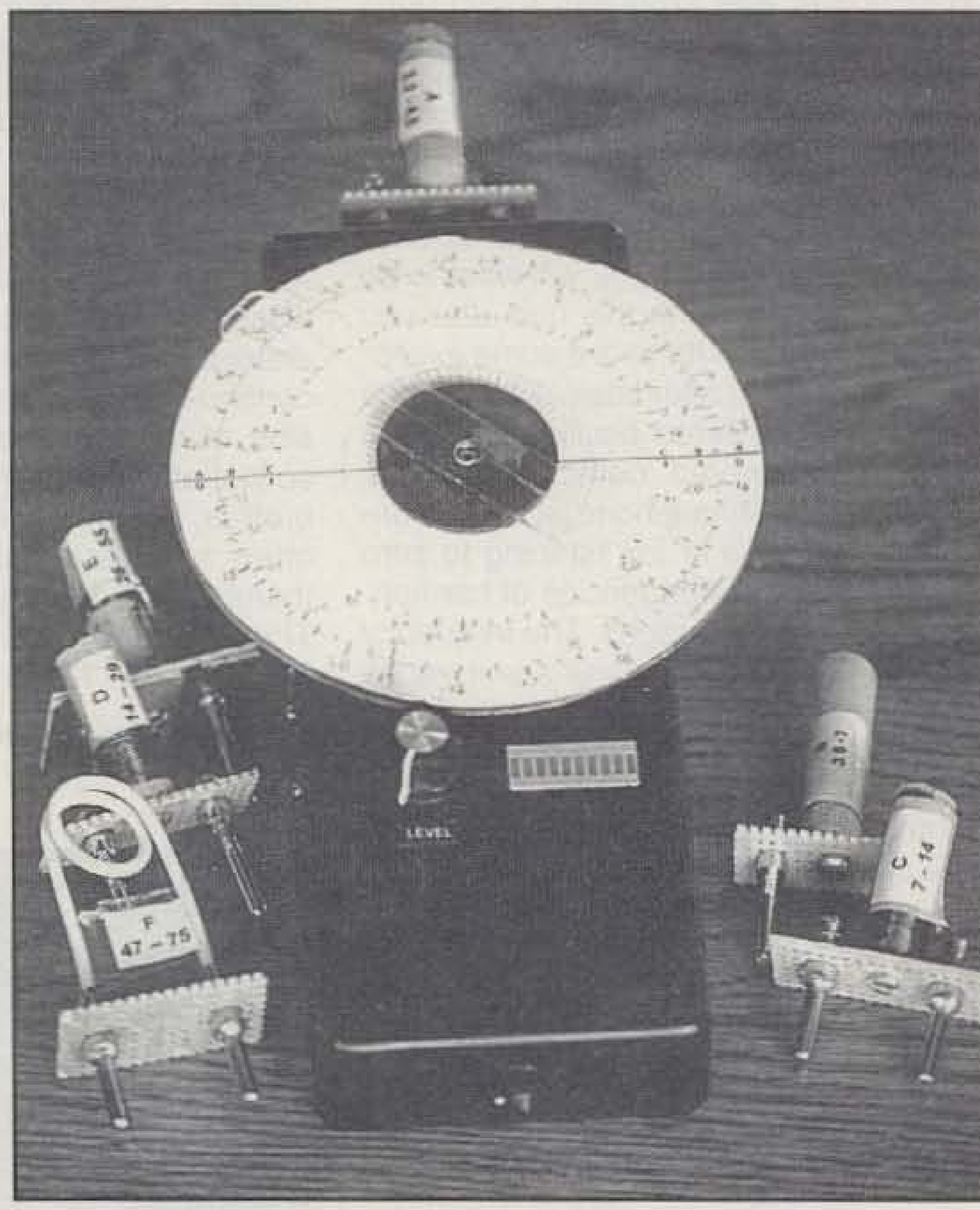
The dipmeter can be used to find the value of an unknown inductor by connecting it across a known-value capacitor and finding the resonant frequency. Similarly, a capacitor can be measured by finding the resonant frequency with a known-value inductor. An antenna can be tuned to resonance in a similar fashion. Dipmeters are also useful as RF signal sources for checking filters and receivers. Finally, a dipmeter is useful as a learning tool for working with tuned circuits.

Dipmeters do have a few drawbacks. Due to the single-turn dial, a dipmeter has limited accuracy. A dipmeter won't let you adjust a tuned circuit to 100 Hz accuracy, but you can get it in the ballpark. Accuracy is also limited because the external tuned circuit can slightly "pull" the frequency of the dipmeter.

Many of the functions of a dipmeter have been taken over by frequency counters, capacitance and inductance bridges, and high-frequency signal generators. However, the dipmeter is still a useful tool to have around the shop if you want to experiment with RF.

Modern dipmeters typically use a junction FET (field effect transistor) and measure the dip in the gate current of the FET. Fig. 1 shows a schematic diagram of an FET-based dipmeter that uses the common MPF-102 JFET. This circuit uses a Colpitts oscillator. When the circuit is oscillating, the gate of the FET swings from a little above ground to several volts below ground. This makes the average voltage a negative value. There are no negative voltage supplies; the negative voltage is generated due to energy stored in the tuned circuit.

A 50 microamp current meter is connected to the FET gate through a 100K/ 10K voltage divider. Note that the positive (+) side of the meter is grounded, due to the fact that the average gate voltage is negative. The small capacitor across the 10k potentiometer filters out the RF energy, so the meter sees only the DC average. The potentiometer, RV1, allows the meter current to be adjusted so it doesn't peg the needle.



The completed dipmeter.

A dipmeter such as that shown in fig. 1 is straightforward to build, but has a couple of drawbacks for the modern experimenter. First, the 0–50 microamp meter is fragile, expensive, and difficult to obtain. Second, a traditional dipmeter uses a dual-section air-variable capacitor for tuning. These are also expensive and difficult to find.

The circuit in fig. 2 illustrates a dipmeter that is easier and cheaper to build. The circuit is essentially the same as the previous one, but with two important differences. First, the tuning capacitor is a poly-film type, like that found in an inex-

*741 Okie Ridge, Yukon, OK 73099
e-mail: <sball85964@aol.com>

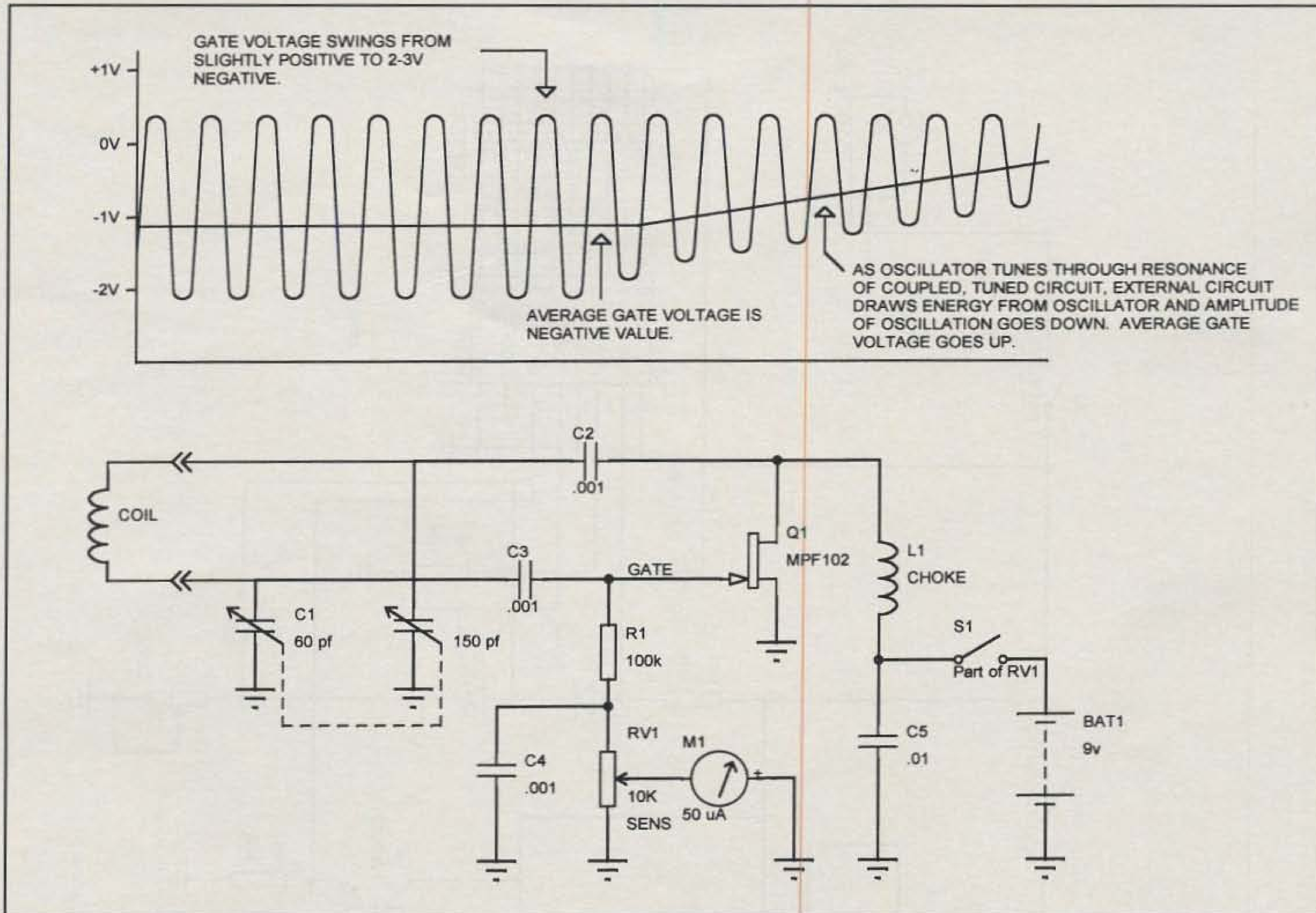


Fig. 1– Schematic of an FET-based dipmeter.

pensive AM transistor radio. Second, the analog meter is replaced with an LED bargraph display.

Tuning Capacitor

The tuning capacitor is a dual-section, 5-151 pF and 5-59 pF unit. These typically are available for under $2.00 or may be salvaged from a dead transistor radio.

Level Shifter

Since the dipmeter uses no negative supplies, the gate voltage must be shifted up to a positive value before it can be measured. This is accomplished by transistor Q2. Q2 is an emitter follower with a 47k emitter resistor. The base has a pull-up resistor to the 9 V battery voltage, and a pair of 470 ohm resistors back to the FET gate. This makes a voltage divider with the base of Q2 at the junction. If the gate voltage is 0 V, the base of Q2 will be at about 6 V. If the gate voltage is –3 V (a typical value when oscillating), the base of Q2 will be about 5 V. The large-value resistors in the base circuit of Q2 are needed to minimize loading on the FET gate. C4 filters the RF energy so Q2 responds to the DC average of the gate voltage.

Meter

The heart of the meter circuit is an LM3914 integrated circuit and a 10-segment LED bargraph display. The LM3914 contains ten comparators, each of which turns on one of ten LEDs based on the input voltage. The LM3914 can be adjusted for a full-scale range up to almost the supply voltage. If we made the LM3914 voltage range fairly large—say, 8 volts—we would not need an adjustment potentiometer. However, this would make each step (the voltage needed to move the display from one LED segment to the next) equal to .8 volts. Since the change in FET voltage when going through resonance is typically less than half a volt, we need a smaller full-scale voltage to make the dip visible on the display.

The LM3914 includes an internal 1.25 V reference that is used to set the LED current. A 1.2k resistor produces about 10 mA in the LEDs. We could use this internal reference to set the full-scale range of the meter. However, we need a scale that can be moved up and down as the FET gate voltage moves, so the dipmeter uses the forward drop across a pair of silicon diodes (about .6 V each) to set the full-scale range. This makes each LED segment represent about 120 mv.

To put this 1.2 V span where the oscillator gate voltage is, potentiometer RV1 moves both ends of the diode pair from ground up to about two thirds of the supply voltage. Switch SW2 shorts out one of the diodes (D2), making a higher sensitivity setting where each step is about 60 mv.

The LM3914 can be configured as either a moving dot (one segment on at a time) or a bar-graph display. To reduce battery drain, the dipmeter uses a moving dot display.

The circuit in the upper left corner of fig. 2 is a modulation oscillator. When turned on, it produces a square wave at about 1 kHz. It is coupled into the gate

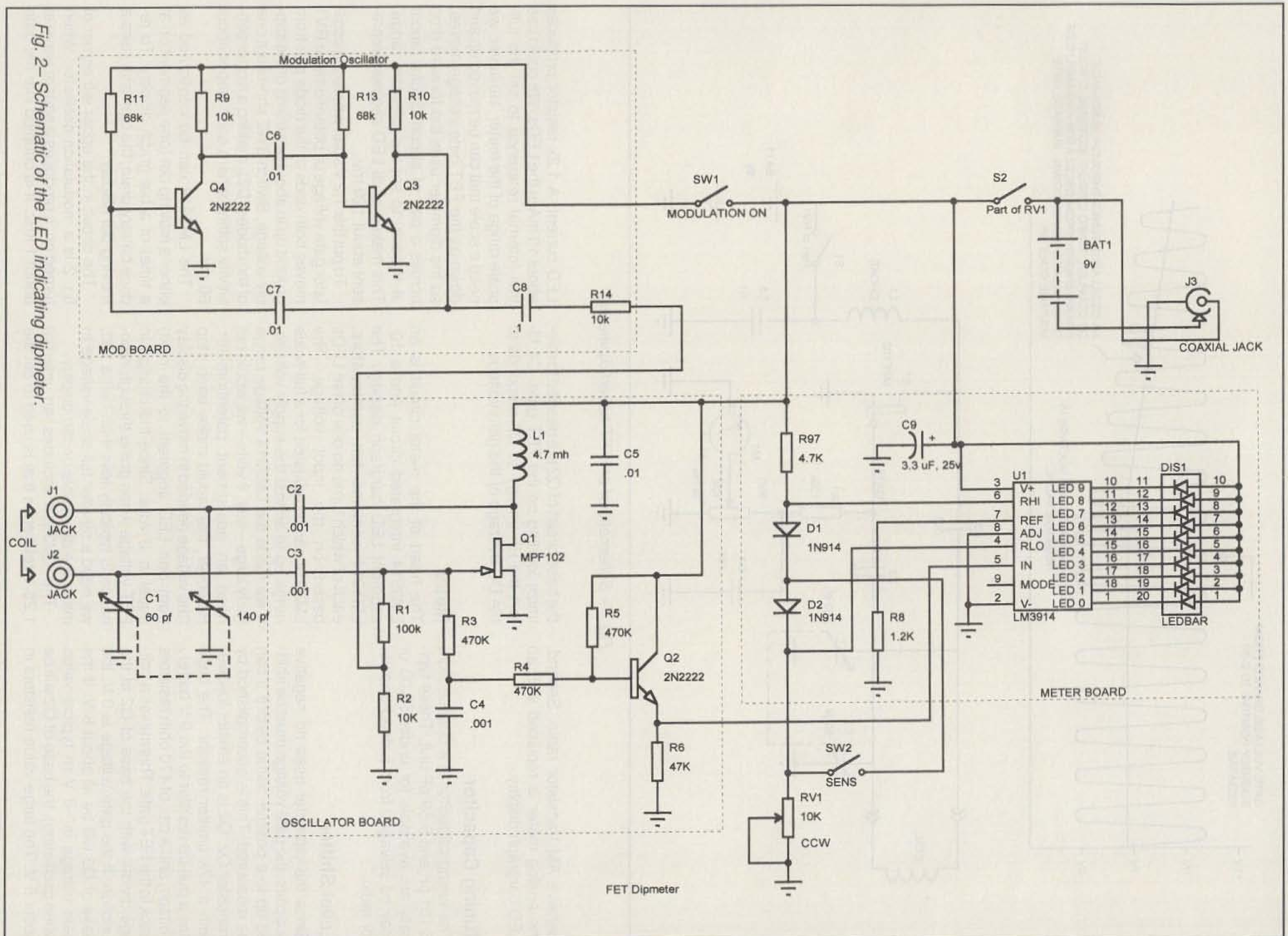


Fig. 2– Schematic of the LED indicating dipmeter.

Dipmeter Parts List

ID	Description	Source/Notes
U1	National LM3914N	Digi-Key
Q1	MPF-102	RadioShack 276-2062
Q2, Q3, Q4	2N2222 or 2N3904	RadioShack 276-1617 (pack of 15)
LED 1	10-segment LED bar display	RadioShack 276-081 (red) Digi-Key P10722 (green)
D1, D2	1N914 or 1N4148	
R1	100K, 1/4 W, 5% resistor	
R2, R9, R10, R14	10K, 1/4 W, 5% resistor	
R3, R4, R5	470K, 1/4 W, 5% resistor	
R6		47K, 1/4 W, 5% resistor
R7		4.7K, 1/4 W, 5% resistor
R8		1.2K, 1/4 W, 5% resistor
R11, R13	68K, 1/4 w, 5% resistor	
RV1	10K potentiometer with switch	RadioShack 271-215
C1	Dual section AM tuning caapacitor, 5-60 and 5-144 pF	Mouser 24TR222
C2, C3, C4, C6, C7	.001 μF ceramic capacitors	
C5	.01 μF ceramic capacitor	
C8	.1 μF ceramic capacitor	
C9	3.3 μF, 25 V electrolytic capacitor	
L1	4.7 mH choke	Digi-Key DN7445 or M9259
SW1, SW2	SPST minature toggle or slide switches	
J1, J2	Banana jacks	RadioShack 274-725
J3	2.1 mm coaxial power jack	RadioShack 274-1565

Misc: case, CD for tuning dial, 9 V battery clip

of the FET via the bias resistors and modulates the output. This allows the dipmeter to be used as a modulated signal source for checking out receivers.

The dipmeter runs from a 9 V battery, but a connector is provided so a 9 VDC "wall wart" power supply can be used as well.

Construction

The schematic (fig. 3) shows how the components for the dipmeter are divided into three perfboards and also the construction details for various parts of the project. The oscillator board contains the FET oscillator and the emitter-follower circuit. The meter board contains the LM3914 and the bargraph display. Finally, the modulation board contains the modulation oscillator.

All the parts mount in an 8" × 3" × 1" RadioShack case. The tuning dial is made from an old CD-ROM. Tuning coils can be handwound, or standard value coils can be used instead.

The RadioShack case includes slots for mounting boards, and the oscillator circuit was built on a piece of perfboard cut to slide into two of these slots. The meter board is constructed with the LM3917 on the top of the board and the LED display on the back of the board. A 1" × .3" hole in the top of the box allows the LED bar to be seen. The meter and modulation boards are mounted with plastic standoffs that are glued to the plastic case.

Coils: The coils are wound on sections of 1/2 inch wooden dowel rod using varnished magnet wire and mounted onto a pair of banana plugs (see diagram). Cut five 1.5 inch sections of the dowel, making sure the ends are square. Each coil is mounted on a 1.5" × .5" piece of perfboard. Two holes are drilled 1 inch apart in the perfboard to mount the banana plugs. A third hole is drilled in the center of the perfboard to mount the wooden coil form, using a #4 wood screw. Drill a hole down the center of the dowel so it doesn't split when you drive in the screw. The banana jacks are mounted to the perfboard from the bottom, attached with nuts on the top. Usually, the threads on the top and bottom sides of the jack are the same, so the metal shroud that is used to clamp wires on the jack can be turned around and used as a holddown nut on the top.

All but one of the coils are wound with either #26 gauge or #34 gauge wire. If you can't get those exact gauges, use something close and add about 10% more turns to each coil. You can remove turns later to tune the coils to the right frequency range.

Coil	Frequency Range (MHz)	Wire Gauge	Turns
A	2.3–4.5	#34	140
B	3.6–7	#34	70
C	7–14	#26	52
D	14–29	#26	17
E	26–55	#26	6
F	47–72	#14	1

Table I– Coil data for dipmeter using wound coils.

Coil	Frequency Range (MHz)	Standard Coil
A	1.7–3.4	150 μH
B	3.2–5.5	47 μH
C	5.5–11	15 μH
D	9.5–19	4.7 μH
E	16–33	1.5 μH
F	33–60	.33 μH

Table II– Coil data for dipmeter using standard inductors.

The highest frequency coil is wound from a single, insulated piece of 14-gauge wire. I used a single conductor from a 6 inch piece of three-conductor AC wiring, such as the type you have in the walls of your house. Just strip enough insulation from the ends to make connection to the banana plugs and wind one turn around a 3/4 inch dowel rod. This coil is stiff enough to hold its shape without a coil form.

The coils are wound by soldering one end of the wire to one of the banana jacks and then winding the coil on the form. All the coils are single-layer and wound with each turn touching the previous turn. Keep the wire tight and try to avoid gaps between adjacent turns. When you are finished, use tape to hold the wire in place and solder the other end to the other banana plug. If you can, get wire with varnish coating that melts when you touch it with a soldering iron. Otherwise you will have to scrape the insulation to make connections.

After the meter is calibrated, dip the coils into varnish (keep it off the banana plugs) to hold the coils in place. Table I shows the coil winding data.

Winding your own coils is a bit tedious, and you usually have to buy a lot more magnet wire than you need. If you prefer, you can also build the meter with off-the-shelf inductors. Table II shows the standard inductor values for the dipmeter. Be sure *not* to use shielded coils.

Tuning Capacitor: The tuning capacitor, as already mentioned, is a dual-section unit like you find in AM transistor radios. Having the exact part isn't critical. Using a different capacitor, or

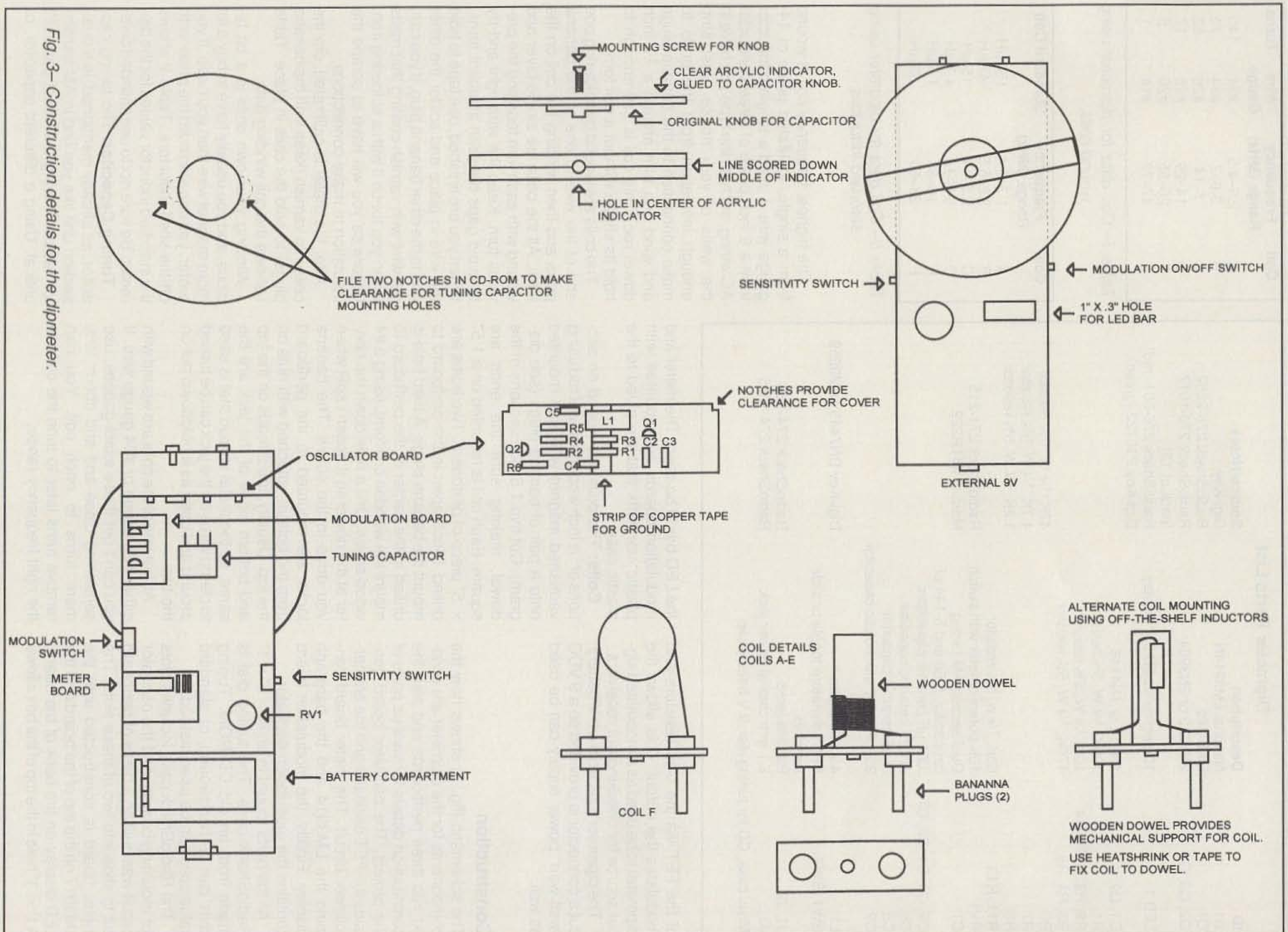


Fig. 3– Construction details for the dipmeter.

one with unknown values, simply will change the frequency ranges on which the dipmeter operates. If you're using hand-wound coils, you can adjust the number of turns to get the correct values. It isn't even important that the frequency ranges be exactly the same as the prototypes; just make sure there is enough overlap to provide continuous coverage.

Tuning Dial: The tuning dial is a paper dial made from circular graph paper and glued to an old CD that is in turn glued to the plastic case. If you have trouble finding circular graph paper, you can just make concentric circles on paper and glue it to the dial. However, calibration will be more difficult, since you won't have the marks on the graph paper as alignment references.

Before attaching the CD to the case, file two notches 180° apart in the center hole so the capacitor mounting screws can clear the edges of the CD. You'll need to sand both sides of the CD to remove its coating, or it won't stick to the case. Of course, you can also use a wider case and skip the CD, just gluing the paper dial to the case. Use plastic model cement or other acrylic glue for the CD.

The tuning knob and indicator starts with the original dial that comes with the capacitor. My first prototype of the meter used a capacitor which came with a flat plastic knob and was purchased from Dan's Small Parts. The second prototype used a capacitor from an AM radio, and the knob that came with it. Cut a rectangle about .5 inch wide and about 4.7 inches long (the diameter of the CD) out of thin, clear acrylic. Next drill a 5/16 inch hole in the center and score a straight line down the middle to use as an indicator. Glue this to the capacitor dial.

If the indicator strip is thin enough and the capacitor knob has sufficient clearance, the indicator strip can be mounted on the bottom of the knob. This places the indicator line closer to the paper dial and results in less parallax error when reading frequencies. The original prototype was constructed this way. The knob on the second prototype was too short to make this work, so the indicator was glued to the top of the knob.

Switches: The prototypes used slide switches, but toggle switches will work and are easier to mount.

Checkout and Calibration

After the meter is constructed, adjust the level potentiometer across its range.

You should see the LEDs in the display light as you turn the knob.

Next plug in a coil and and use a frequency counter or oscilloscope to verify that the meter is oscillating. Sweep the tuning knob and verify that the frequency changes. The best way to measure the output of the dipmeter is to make a loop about an inch in diameter out of a couple of turns of magnet wire, taping the ends to hold it together. Connect the ends of the pickup loop to the frequency counter or oscilloscope, and position the loop itself near the end of the dipmeter coil.

To verify that the meter will detect resonance, wrap about 50 turns of #26 magnet wire around a 1/2 inch wooden dowel. Fix the coil with tape, and attach a 27 pF capacitor across the leads. This makes a tuned L/C circuit. (As an alternative to winding a coil, you can use a 27 pF capacitor and a 12 µH inductor.) Plug coil *C* into the dipmeter, hold the test coil near the dipmeter coil, and adjust the level potentiometer so that one of the middle segments of the LED display is illuminated. With the sensitivity switch set to LOW, slowly rotate the tuning knob. You may have to adjust the level control to keep the reading on-scale. At one point you should see the meter reading jump up two or three (or more) LED segments. As you tune past the resonant frequency of the test circuit, the meter indication will come back down.

Unlike the dipmeter with an analog meter movement, this meter reading peaks instead of dipping. This is because the LED dipmeter measures the voltage at the gate of the FET, and this point is more negative with stronger oscillation. When the external tuned circuit draws energy from the dipmeter oscillator, the FET oscillation decreases, the (average) gate voltage goes up (becomes less negative), and the meter circuit indicates a jump in the voltage value.

To calibrate the meter, plug in coil *A* and record the minimum and maximum frequencies it will tune. Then plug in coil *B* and do the same. If there isn't some overlap (coil *B* minimum is a little below coil *A* maximum), rewind coil *B* with more turns to lower the frequency. If there is too much overlap, remove some turns from coil *B*. Once coil *B* is adjusted, adjust coil *C* so that it overlaps coil *B*, and then each of the other coils so that they slightly overlap the previous one. Be sure to mark the coils so you know which one is which.

Once you have the frequency ranges set for all the coils, you need to calibrate the dial using a frequency counter. Plug in the coils one at a time and tune through each band, marking frequencies on the dial. You do this by tuning to a frequency, noting where on the graph paper the indicator rests, and then moving the knob out of the way and marking that spot with a pen. Note that the frequency spacing gets more compressed toward the top of each band. If you don't have access to a frequency counter, you can calibrate the dial using a shortwave receiver, although it won't be as accurate.

Using Your Dipmeter

When finding the frequency of an unknown tuned circuit, use the loosest coupling that will give a visible indication on the meter. This minimizes the detuning effect of the circuit on the frequency of the dipmeter. You can do this by holding the dipmeter close to the tuned circuit and adjusting for a dip. Then move the meter away a half-inch or so and adjust again.

When using the dipmeter as a signal source, the meter display is not needed. To reduce battery drain adjust the level potentiometer so that none of the LEDs are on. The circuit draws about 8 ma when oscillating (10 ma with modulation on) but about 20 ma when one of the LED segments is illuminated.

To find the value of an unknown inductor, put it in parallel with a known capacitor and tune for a dip. The frequency of the tuned circuit is given by:

$$f = \frac{1}{2\pi \sqrt{LC}}$$

So the value of the inductor is:

$$L = \frac{1}{(2\pi f)^2 C}$$

Similarly, the value of an unknown capacitor (usually a variable capacitor, since fixed capacitors generally are marked) can by found the same way. Just reverse *L* and *C* in the second equation. Remember that the component values have exponents. For example, a 4.7 µH inductor doesn't plug into these equations as 4.7, but rather as 4.7×10^{-6}. A 27 pF capacitor is 27×10^{-12}.

Happy dipping!

Stuart Ball, P.E., is an electrical engineer at Organon Teknika, a manufacturer of medical electronic equipment. In the past he has worked on projects as diverse as the Global Positioning System and banking equipment. He is the author of numerous articles and two books.

Reader Survey
February 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*.

Over the next few months, we're going to ask some questions designed to help us get to know you better — about you personally and about your ham radio operating preferences. We'll start with some basic demographics. Your replies are confidential, and only aggregate responses are reported publicly.

Please indicate...	Circle Reader Service #
1. Your gender	
Male	138
Female	139
2. Your marital status	
Single	140
Married	141
3. Your age	
Under 18	142
18–24	143
25–34	144
35–44	145
45–54	146
55–64	147
65–74	148
75 or over	149
4. How much formal education you have (select only one)	
Currently in elementary, middle, or high school	150
Currently in college (undergrad) or technical school	151
Currently in graduate school	152
Out of school (did not finish high school)	153
High school graduate	154
Tech school graduate	155
2-year college degree	156
4-year college degree	157
Postgraduate degree	158
5. The job category that most closely fits your work	
Student	159
Homemaker	160
Professional/Executive	161
Educator/Writer/Creative	162
Technical	163
Service industry worker	164
Government worker	165
Factory worker	166
Disabled/not working	167
Unemployed	168
Retired	169
None of the above	170

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

What You've Told Us

The results of our first *CQ* survey won't be back until the April issue, but we have a couple of months' worth of *CQ VHF* surveys for which we haven't yet reported the results. We'll look this month at last October's survey, which asked *CQ VHF* readers about their participation in emergency and public service communications.

Nearly three-quarters (74%) of the readers who responded have been involved in emergency communications at least once, and 39% do it regularly. Just over two-thirds (67%) have participated in at least one public service event or activity, and 45% do that regularly. Emergency/disaster drills came in at 64% (at least once)/40% (regularly), followed by emergency training nets (59%/44%), severe weather nets (58%/40%), other public service activities (53%/41%), disaster communications (48%/24%), and message-handling (traffic) nets (44%/19%).

The most popular emergency communication group among our readers was the Amateur Radio Emergency Service (ARES), at 48%, followed by Skywarn (45%), public-service radio clubs (41%), RACES (32%), other public service/emergency groups (27%), search-and-rescue (7%), REACT (5%), MARS (4%), and the Civil Air Patrol (3%).

Finally, we asked each reader whether he or she personally feels prepared to provide emergency communications. A whopping 79% said yes, 13% weren't sure, and only 8% said no. Clearly, ham radio public service is alive and well.

This month's winner of a free *CQ* subscription is Thomas O'Brien of Seabrook, Texas. As always, thank you for participating.

So you just worked Ubangiland on a band that doesn't get you to that part of the world. How did your signal get there? WB2AMU looks at some possible answers.

Explanations for Unusual Propagation

BY KEN NEUBECK,* WB2AMU

Any amateur radio operator who is quite active on the different ham bands will eventually encounter some unusual band conditions. This is particularly true on the bands between 15 and 6 meters. These situations may involve anything from weird-sounding signals, rapid fading, signals from areas of the world not normally heard, to just plain crazy conditions. Why and how do these things happen? With the accumulation of experience along and the incorporation of a little bit of theory and scientific data, these questions often can be answered with what is the most reasonable explanation possible. The following are questions based on the real-life experiences of hams, along with the most probable explanation.

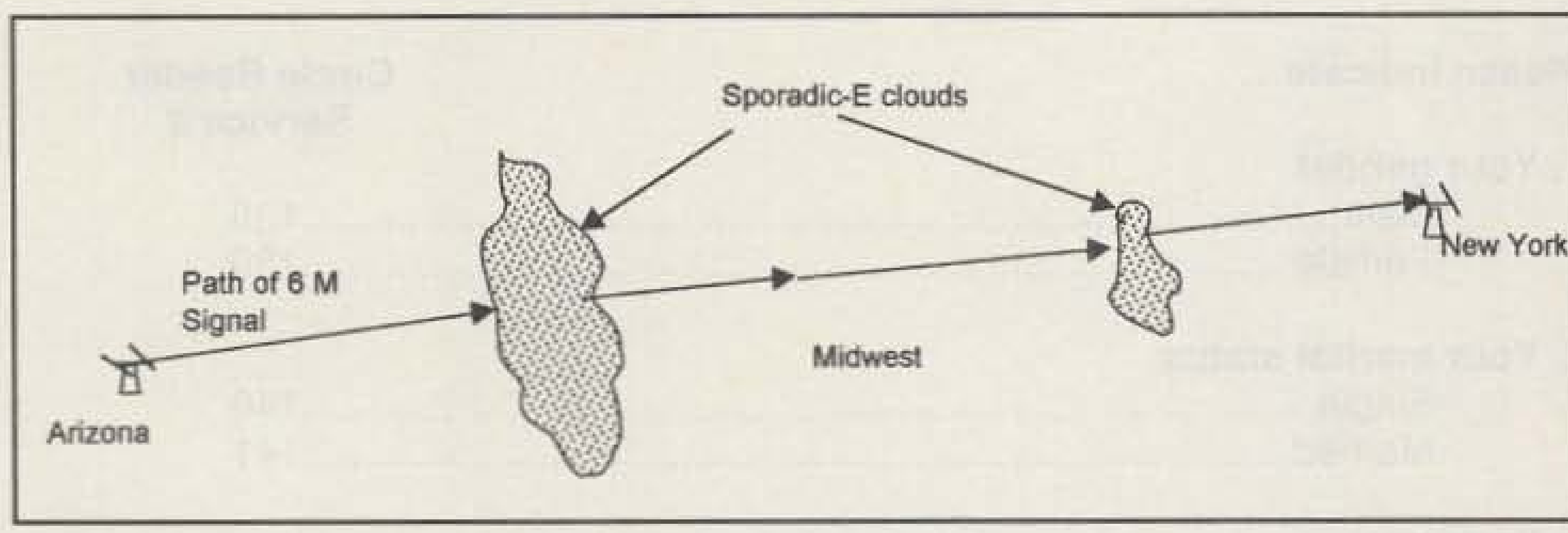


Fig. 1– The scenario that allows a station in Arizona on 6 meters to hear many stations in the Midwest, while the station in New York hears very few stations from the Midwest yet hears the station in Arizona during a double-hop sporadic-E opening. Here the smaller cloud acts like a filter that screens out some of the Midwest stations for the station in New York.

Double-Hop Sporadic-E Characteristics

Question: During certain double-hop sporadic-E openings on 6 meters why does it sometimes seem that the only stations heard are those two hops away, and no stations at the in-between hop are heard?

Answer: The answer to this question involves a little bit of logic. The double-hop sporadic-E openings on 6 meters that many of us observe during the summer months are those in which the first hop is to an area where many stations are heard with very loud signals and then eventually stations are heard that are two hops away. An example of this came during the fabulous Field Day openings in June 1998 as documented in the September 1998 issue of *CQ VHF*. During Sunday morning of Field Day from my location on New York's Long Island, I was working many, many strong signals coming in from Illinois, Indiana, and Tennessee. Then during a five-minute period I worked a string of about six stations from Colorado that came in via an additional hop. This is the kind of opening that most amateur radio operators experience during a double-hop E_S event.

There is also, however, the case of the double-hop event in which no stations are heard on the first hop, in between the two sporadic-E ion clouds. This particular case leaves a lot of 6 meter operators confused. However, after making several observations, what is happening can be determined.

A case to examine is an opening from my home QTH on Long Island (grid square FN30) into the western states of Colorado and Arizona on June 22, 1999 at 7:30 PM local time. I was hearing tremendously loud signals from KØYW in grid square DM67 and W7RV in grid square DM43, but very little from stations in between us. I heard the stations coming in and out for the next hour or two, but again, little else from in between. I heard maybe one weak signal from a station in Missouri during this entire time. Then a clue popped up. Just before I worked KØYW on CW, he stated he was looking for only East Coast stations. He then asked on frequency for the stations from the EN52 area to stop calling him so that he could try to work the East Coast. However, I on Long Island could not hear the Midwest stations at all. Fig. 1 is a rough sketch to show how this could be.

From looking at fig. 1, it is apparent that the wider cloud pattern appeared to be the cloud that was closest to the West Coast station, while the second cloud that was closest to me was probably more narrow. Thus, I could only hear a small portion of the Midwest stations coming through.

By the way, I ran into a similar condition of double-hop (possibly triple-hop) sporadic-E on 10 meters into western Germany beginning at 6:30 PM local

**1 Valley Road, Patchogue, NY 11772*
e-mail: <wb2amu@cq-amateur-radio.com>
Ken Neubeck, WB2AMU, is a CQ Contributing Editor at Large

The RF Applications VFD RF Power/VSWR Meter

VHF VERSION *now available*

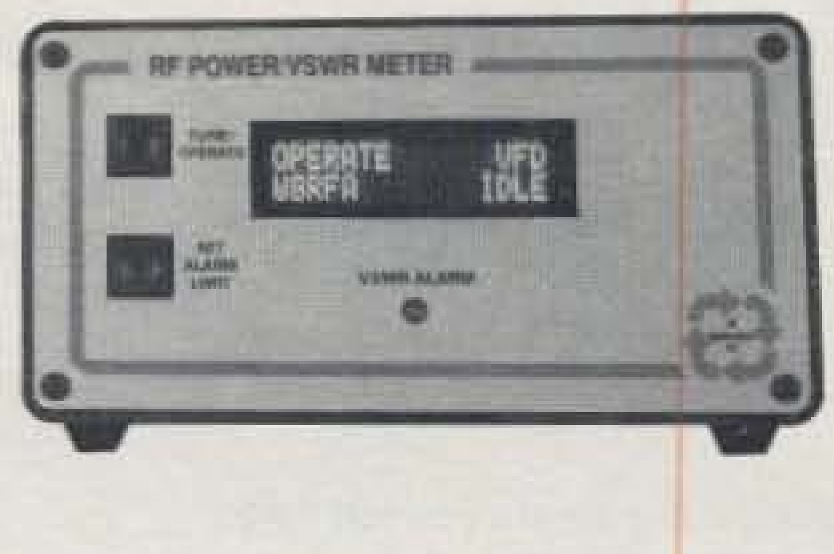
The ONLY Wattmeter for the Serious Operator

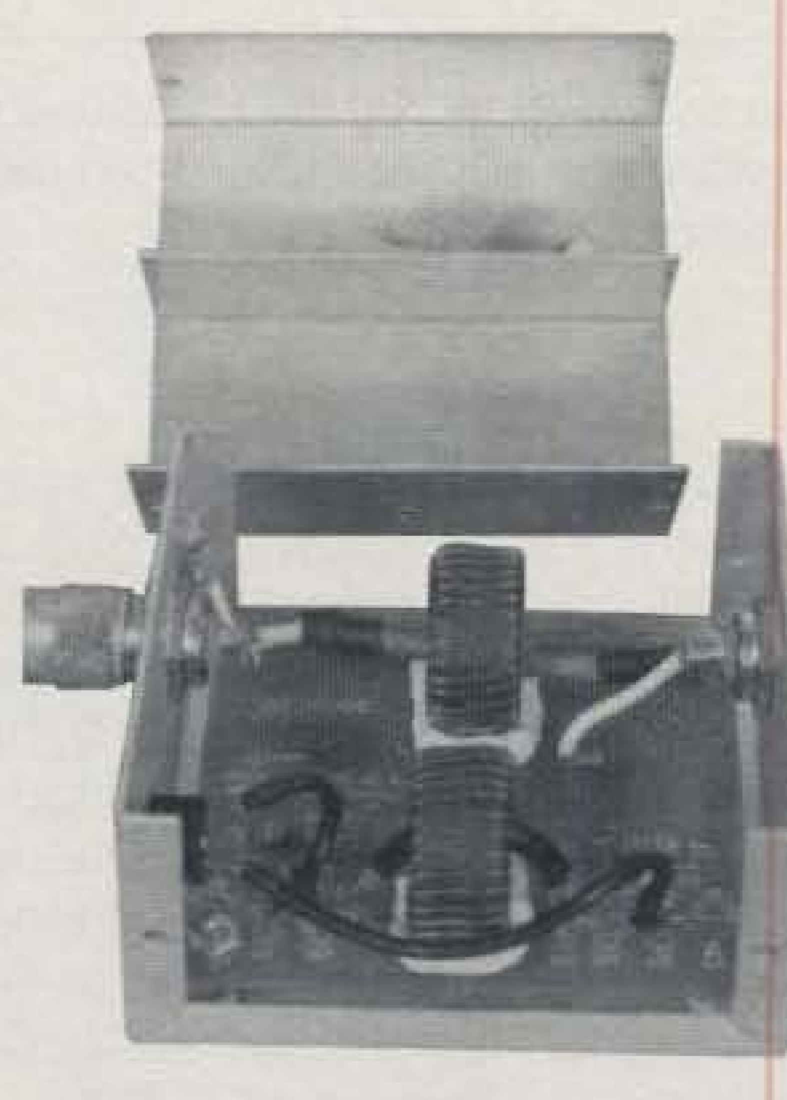
EXCITING NEW TECHNOLOGY

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.





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.

ALARM INDICATION

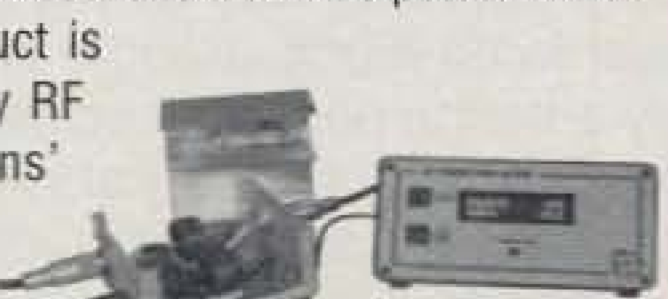
You can set the VFD to tell you if your VSWR has exceeded a preset limit. A bright red LED tells you if you have exceeded 1.5:1, 2.0:1, 2.5:1 or 3.0:1 (the default). If you have installed the optional relay, you can disable your amplifier to prevent damage to your system.

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.

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."
--WXOB

"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.

RF Applications, Inc.
7345 Production Drive
Mentor, OH 44060 USA

+1 440.974.1961 Voice
+1 440.974.9506 Fax
1.800.423.7252 Orders

http://www.rfapps.com
sales@rfapps.com

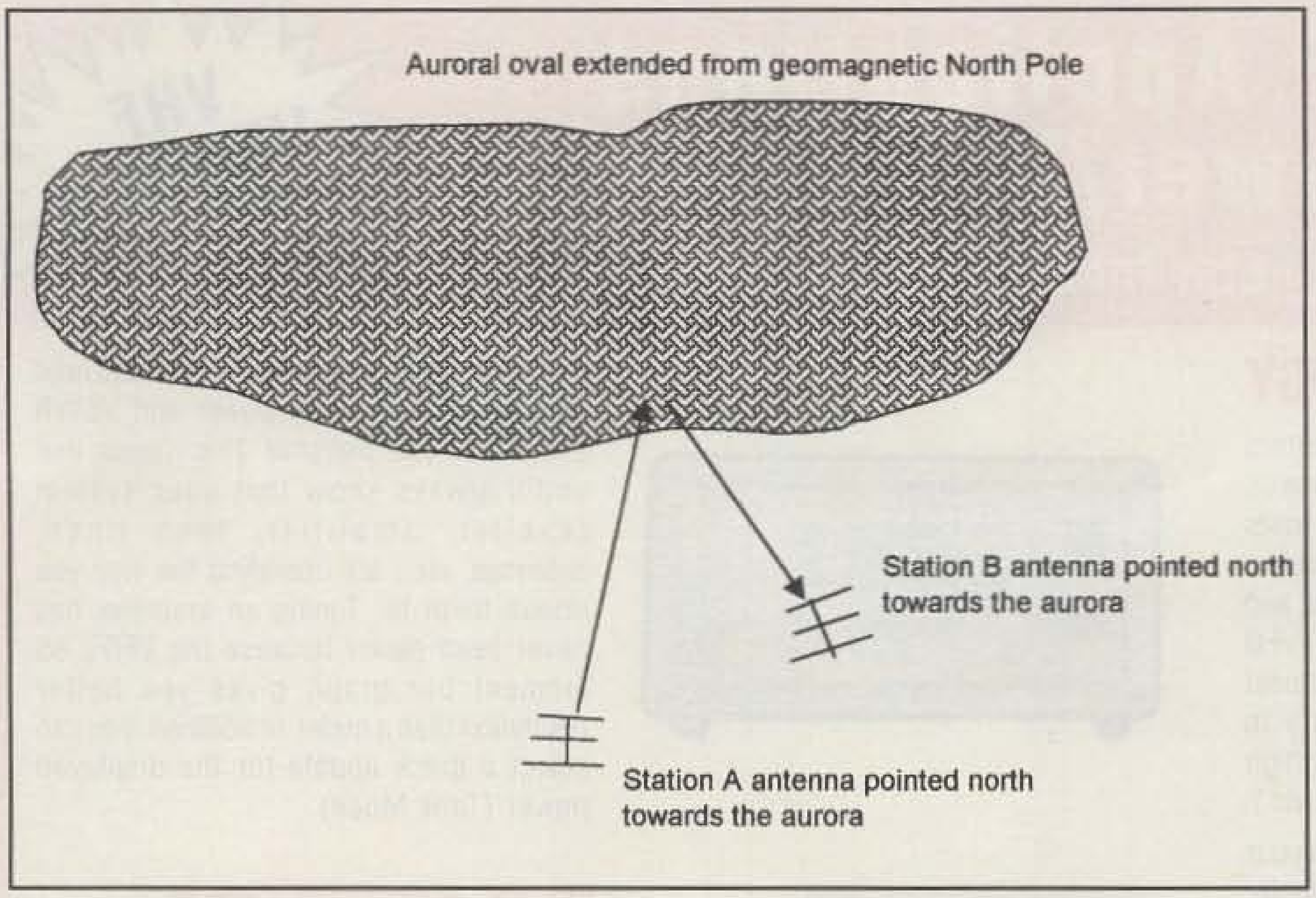


Fig. 2– Graphical representation of an aurora opening where two stations can work each other by pointing their antennas toward the aurora rather than directly toward each other.

time on May 24, 1999. I worked DL3YEH, DK8ZB, DF2JQ, and DL1IAO in succession and heard no other stations in between. Some multiple-hop sporadic-E openings, because of the size of the cloud, act like a filter for screening out some of the stations located in between the sporadic-E clouds.

The Mechanisms of Aurora Backscatter

Question: During an aurora opening in North America why do my signals appear to be much stronger when I point my antenna north as opposed to pointing my antenna directly at stations I hear that have the auroral distortion?

Answer: There are two aurora zones on the planet Earth—one surrounding the geomagnetic South Pole and the other surrounding the geomagnetic North Pole. When there are periods of high geomagnetic activity that are caused by solar precipitation, usually as the result of a major solar flare, either aurora zone can be extended into the lower latitudes. When this happens, stations that are not located directly in the aurora zone but are located close enough to the extended aurora can work many stations they normally cannot work, particularly on bands such as 6 and 2 meters.

The way they can do this is by aiming their directional antennas towards the aurora, which for those of us in the US is due north. (Dipoles or verticals will work also.) Fig. 2 shows the specific geometry. This is known as backscatter, as signals are reflected backwards.

A number of aurora-propagation studies that used observations by hams on 6 and 2 meters have verified this mechanism of backscatter. One such study was published by Lange-Hess in his paper "VHF Bistatic-Aurora Communications" in the book *Arctic Communications* (Pergamon 1964). This study used the observations of hundreds of European hams on 2 meters during aurora openings. (*Bistatic* is the scientific term for backscatter.)

What is interesting is stations that can sometimes be worked by line-of-sight communications actually may come in stronger, although more distorted, via the path of the aurora backscatter. Many hard-to-get, close-in grid squares on 6 meters (three to four squares away) can be picked up during a good aurora opening.

Neo-Sporadic Openings On 6 and 10 Meters

Question: Often when I am on 6 meters during the times of predicted meteor showers, I hear stations coming in for times up to one minute, which is longer than the two or three second burst associated with meteor-shower signals. The signals seem to behave like sporadic-E type signals, but I usually don't hear any other stations with similar symptoms at the same time. What mode of propagation am I hearing?

Answer: This situation can happen on 6 as well as 10 meters. What appears to be happening here is that there is a sporadic-E formation present in the area where meteor-scatter activity is taking place. However, the MUF (maximum usable frequency) of the sporadic-E formation is just below the frequency on which one may be listening. For example, the MUF of the formation may be hovering around 48 or 49 MHz, just below the 6 meter band. This is essentially a "near opening" on 6 meters where signals can be reflected off the sporadic-E cloud in the E-region of the ionosphere (located 70 miles above

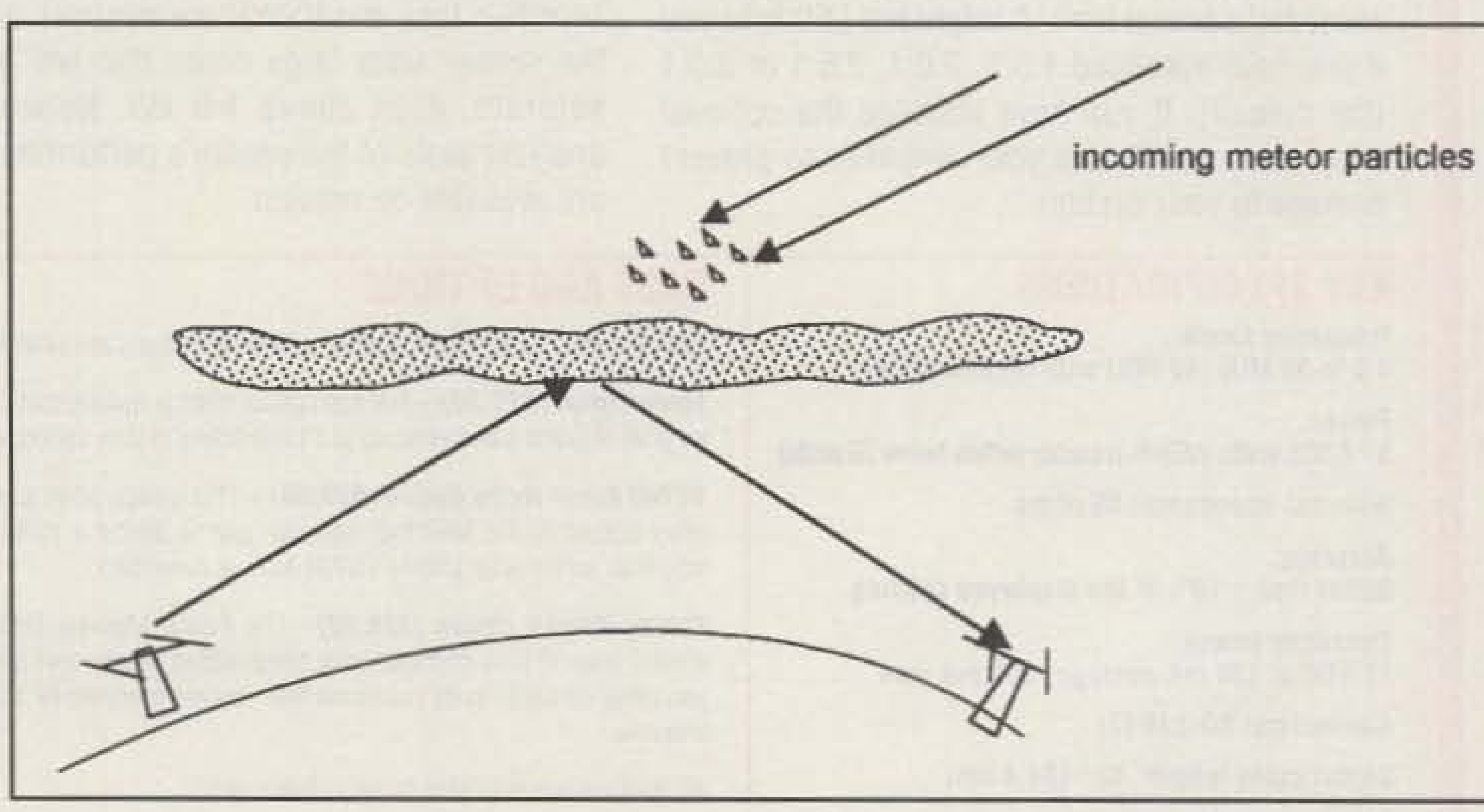


Fig. 3– Sporadic-E clouds are not uniform in shape or density. Hence, the MUF may be different throughout the cloud. Thus, meteor particles ionizing in the E-region may contribute to an increase in the MUF at a particular spot. This may briefly allow a sporadic-E contact to be made during a meteor shower. (See text for details.)

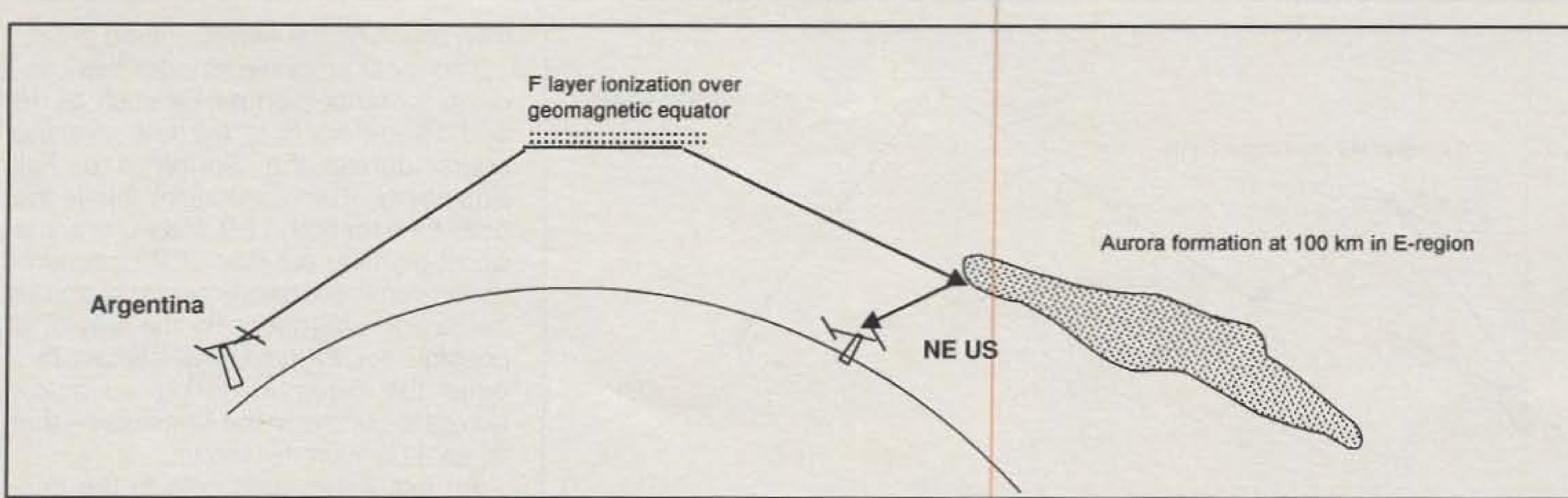


Fig. 4– Pictorial description of how 15 meter signals from Argentina pick up the auroral distortion via the combination of transequatorial and auroral backscatter propagation.

Earth). It is also important to remember that one characteristic of sporadic-E formations is that they do not have uniform density throughout, so there is no one exact MUF value. Thus, the characteristic of rapid fading and other effects on signals is associated with this lack of uniform density.

What appears to be happening is that when meteor activity is present, the ionization of meteors in this same region (80 to 110 km) may be a contributing factor in pushing higher the MUF of an existing sporadic-E formation. This higher MUF may result in being able to make a longer than normal meteor-scatter-type contact. Fig. 3 is a pictorial description of this concept.

There is a lot of energy and induced ionization from meteors that pass through the E-region, and it is not hard to believe that this affects existing ion clouds that may be present. Such energy transfer has been examined in books such as *Physics of Meteor Flight in the Atmosphere* (Opik 1958). This is speculation at this time and will be very difficult to prove. Right now, however, this seems to be the only logical explanation.

Aurora-like Signals from South America on 15 Meters

Question: During a late October evening at around 8:30 PM local time at my location in New England, I heard signals on 15 meters coming out of Argentina as I usually do at that time. However, these signals had some very

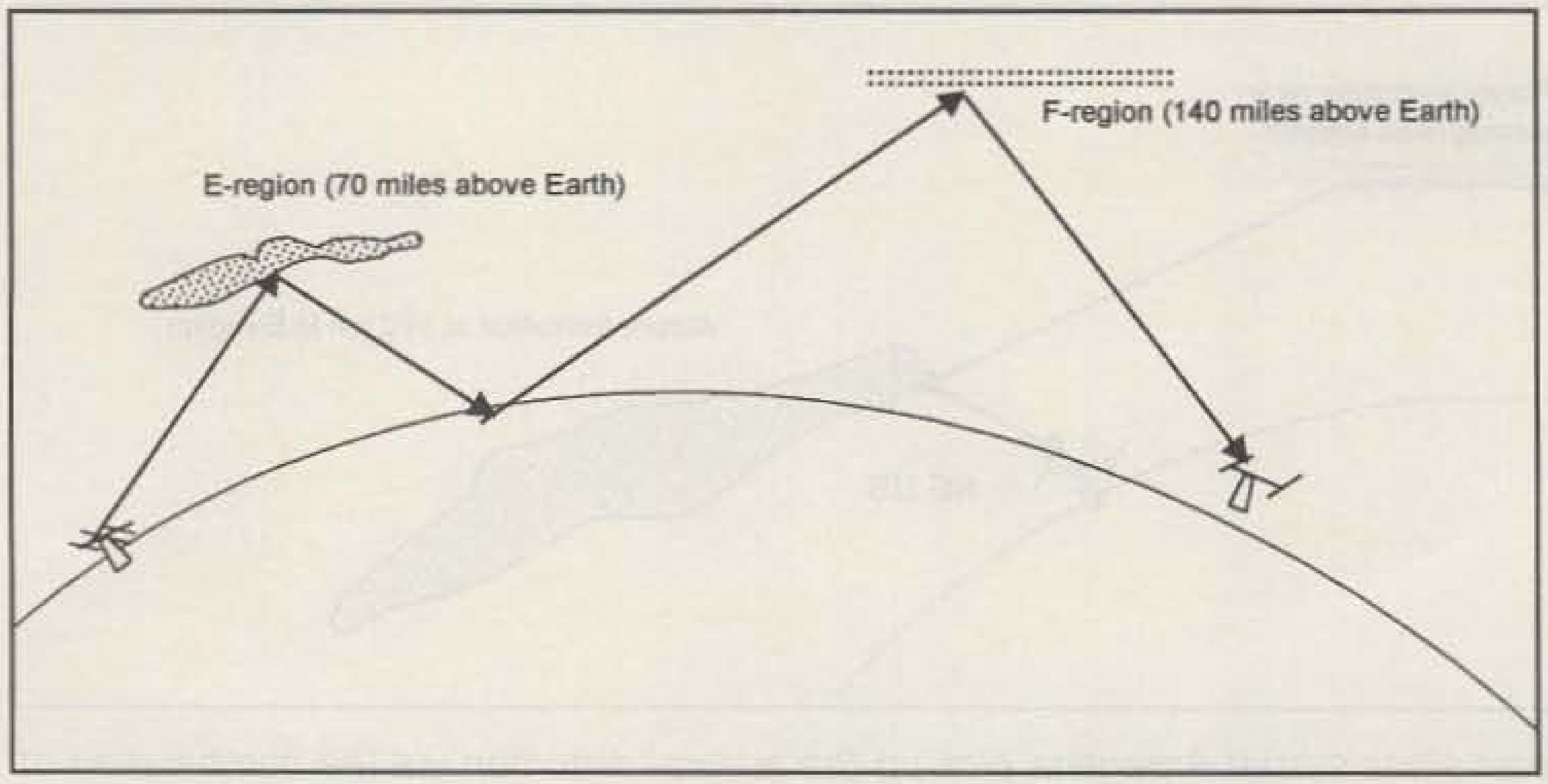


Fig. 5– Graphical representation of a sporadic-E/F2 propagation mode combination that can occur on 6 or 10 meters.

strange sound distortion, almost like the distinctive sounds of aurora signals. How is this possible? Are the signals from Argentina actually going around the aurora zone over the South Pole to reach my QTH?

Answer: The answer to this question involves a series of particularly interesting circumstances that happen occasionally on 15 meters and can be figured out through the use of geometry.

One clue to answering this question is noting, several minutes later, the appearance of aurora-type signals on the 6 meter band. As discussed in the prior question and answer about the mechanisms of aurora backscatter, aurora is primarily a backscatter mode for many stations in the lower latitudes, where antennas are pointed toward the respective poles (North American stations point north).

The only logical way for a signal from Argentina to have the distinct tone of aurora distortion on it is for the following scenario to happen. The signal from Argentina travels north and enters the heavily ionized F-layer in the 200 km height range above the geomagnetic equator and reaches into the US via Transequatorial propagation (TEP). However, in this particular case, on the way down from the Flayer the signal hits the edge of the auroral oval formation in the E-region at the 100 km height range, which has extended into the lower latitudes from Canada. At this point it becomes a backscatter signal and is reflected back into the northeast US area.Refer to fig. 4 for the graphical representation of this explanation.

This fits in well with the published literature, including the book Arctic *Communications*. What you probably are hearing, therefore, is a combination mode of TEP plus aurora. It is doubtful that the path is the South America signals going around the South Pole and then reaching the New England area.

The most probable time for this condition to happen on bands such as 10 and 15 meters is in the late evening hours during the Spring and Fall Equinoxes. This is because this is the peak time for both TEP and Aurora. It is worth pointing out that TEP communications on these bands primarily occurs in the late afternoon. By the way, it is possible for F2-type skip signals that enter the E-region during an active aurora to behave in the same way—that is, as a backscatter mode.

An interesting side note to the description of this particular opening is that it is possible that the stations in New England would not be able to hear the Argentina stations by pointing their antennas directly south. However, by pointing their antennas north, they can hear the Argentina stations through backscatter off the aurora. Imagine a case in which the TEP signal from Argentina could be heard both ways: (1) directly pointed towards the south and (2) off the aurora backscatter. This case is conceivable, and there probably would be an echo effect on the signal (because of the different distances between the two paths) as well as a distorted quality on the signal. There is no doubt that this case has occurred in the past on the higher ham radio bands.

Even though aurora moves up in frequency, it is often thought of as primarily a VHF mode, with it being observed more often by radio amateurs on 6 and 2 meters. A lot of this has to do with the fact that many of the signals within the 1000 mile range are noticed more on VHF than on HF. However, modes involving aurora can be observed on the HF bands under the right circumstances, when the density of the aurora formation is high enough to reflect the lower frequency signal and that signal reflects in backscatter fashion.

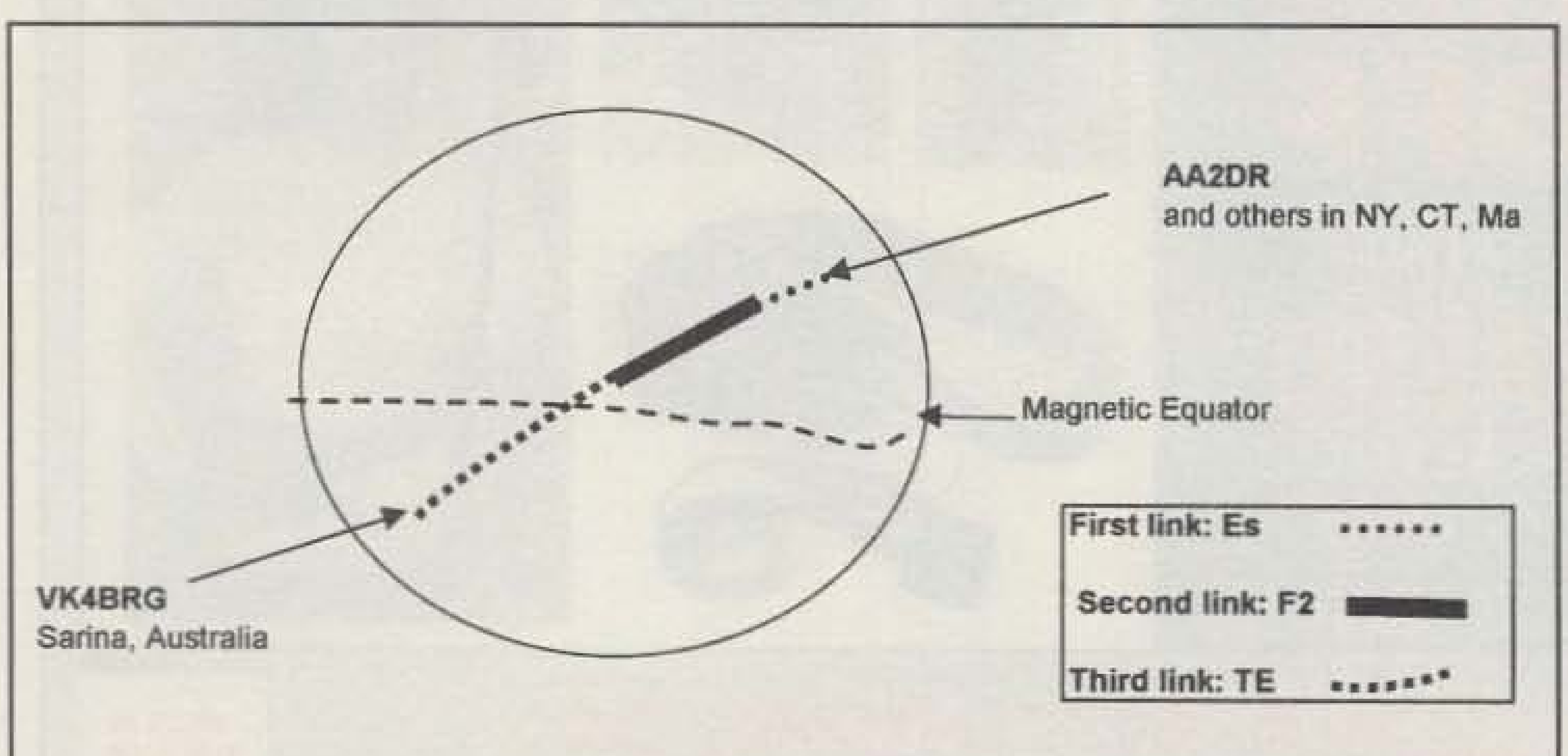


Fig. 6– Shown here are the probable propagation modes used during a 6 meter contact made by VK4BRG in Austria with AA2DR and others in the northeast US on October 29, 1991.

Spotting Sporadic-E in the Midst of F2 Activity

Question: During high sunspot count years how can I identify sporadic-E activity on 10 meters in the midst of F2 activity?

Answer: On a band such as 6 meters it is usually easier to identify the presence of sporadic-E, even when occasional F2 activity comes in. The issue becomes harder on bands such as 10 or 12 meters during high sunspot activity years.

There are ways to identify these signals, however. Sporadic-E signals often have rapid fading, more severe than F2-

type signals. Also, the sporadic-E path typically will be 1200 miles or less. If there are short-range signals that are very strong after dark, it is most likely sporadic-E, too. Please note the example of the western Germany opening described in the answer to the first question in this article.

A case in point: One morning in mid-October 1999 I was operating portable on 10 meters from my car on Long Island, and I heard signals from Europe coming in full force. In the midst of all these signals I heard C6AHN come in very loud from Bermuda on SSB just below 28.5 MHz. After about one minute his signal faded out completely. This was classic sporadic-E behavior, and the distance also was correct for this phenomenon.

This identification may not be too important for most of us, but it can alert us to potential conditions that may occur on a higher frequency such as 6 meters, particularly when the sporadic-E may be an important link for connecting to F2 activity in adjacent areas. Many interesting combinations to areas we don't normally hear can happen when sporadic-E paths hook up with F2 paths. Fig. 5 shows the mechanics of a sporadic-E/F2 combination propagation path. Refer to the next question for even more on this subject.

Paths Using Multiple Propagation Modes

Question: During high sunspot count years, why does it seem that 6 meter signals from Australia can reach the higher latitudes of the US only during certain months, such as October and April?

Answer: For a path between the upper US and Australia to exist on 6 meters, at least two different modes of propagation are needed. The main part of the trip is accomplished by TEP, since the equator is crossed and over 6000 miles can be covered by this mode alone. However, a sporadic-E link usually is needed, along with an F2 link, to make the complete trip. F2 is present only during the winter, and sporadic-E is present during both winter and summer, with the latter having the strongest. TEP is present primarily during the months surrounding the Equinoxes. Therefore, when you put all of the combinations together, late October has the highest probability for such a contact to Australia from the upper US to occur with an Es/F2/TEP combination likely. Fig. 6 gives an example of an Australia to New York path on 6 meters that took place on October 29, 1991. You can't predict exactly what day this type of path will happen, but continuous monitoring during the afternoon at this time of year may yield good results.

For a more detailed explanation as to why certain locations are heard during certain times of the year, refer to my article "Mix and Match Propagation" in the February 1999 issue of *CQ VHF*. The Australia to northeast US path is described in full detail.

With regard to this question, a further point to make is that many of us forget the Earth is not a perfectly formed sphere. The geomagnetic poles and equator are different from the geographic poles and equator, and there are other differences as well. For example, the geomagnetic equator is not a smooth circle around the Earth. Rather, there are some noticeable deviations, such as the area over South America where it dips 5 to 10 degrees lower than the circle path. As a result, stations in western Europe seem to have an easier time working TEP into the southern latitudes in South Africa and South America than do stations in the US at the same latitudes working TEP into the south. Many of the US stations need a sporadic-E link to connect with the prevailing TEP path.

Summary

The above examples show some of the interesting propagation conditions that can occur on some of the higher ham bands. The solutions offered are the most likely answers to the questions of how things can occur. However, there is never 100 percent certainty, just the best guess possible. Hams continue to have an excellent opportunity to observe on the bands such interesting scientific phenomena, some of which have not totally been explained. ■

MFJ TUNERS

MFJ-989C *Legal Limit* Antenna Tuner

MFJ uses super heavy duty components to make the world's finest legal limit tuner

MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.

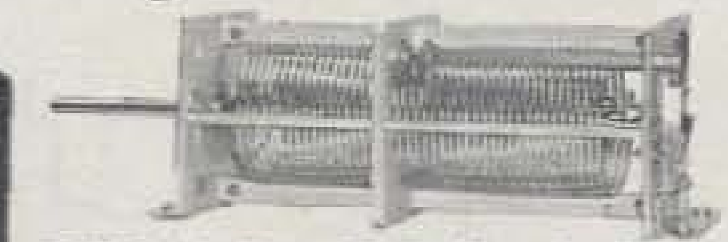
The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

MFJ's *AirCore*™ roller inductor, new *gear-driven* turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax, random wire or balanced lines.

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, *TrueCurrent*™ Balun, *scratch-proof* Lexan front panel -- all in a sleek compact cabinet ($10^3/_4$Wx$4^1/_2$Hx15D in).

MFJ-989C **$359.95**



MFJ AirCore™ Roller Inductor gives high-Q, low loss, high efficiency and high power handling.

MFJ's exclusive *Self-Resonance Killer*™ keeps damaging self-resonances away from your operating frequency.

Large, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

MFJ ***No Matter What*™ Warranty**

MFJ will repair or replace your MFJ-989C (at our option) *no matter what* for one year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$329.95**

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^3/_4$Wx$4^1/_2$Hx15 in.

MFJ-962D *compact* Tuner for Amps

MFJ-962D **$269.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^3/_4$x$4^1/_2$x$10^7/_8$ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$199.95**

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^1/_2$Hx$10^1/_2$Wx$9^1/_2$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

More hams use MFJ-949s than any other antenna tuner in the world! Handles 300 Watts. Full 1.8 to 30 MHz coverage, 48 position *Precision48*™ inductor, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/ Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^1/_2$Hx$10^5/_8$Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-949E **$149.95**

MFJ-941E *super value* Tuner

The most for your money! Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/ Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^1/_2$Wx$2^1/_2$Hx7D in.

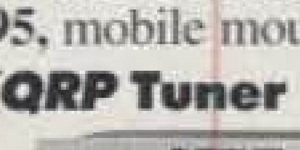
MFJ-941E **$119.95**

MFJ-945E HF+6 Meter *mobile* Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $4.95,** mobile mount.

MFJ-945E **$109.95**

MFJ-971 *portable/QRP* Tuner



Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^1/_2$x$2^1/_2$ inches.

MFJ-971 **$99.95**

MFJ-901B *smallest* Versa Tuner

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-901B **$79.95**

MFJ-16010 *random* wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

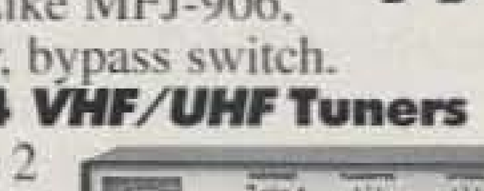
MFJ-16010 **$49.95**

MFJ-906/903 *6 Meter* Tuners

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

MFJ-906 **$79.95**

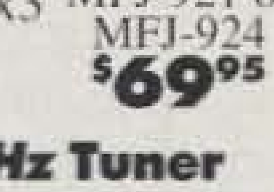
MFJ-921/924 *VHF/UHF* Tuners



MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^1/_2$x3 inches. Simple 2-knob tuning for mobile or base.

MFJ-921 or MFJ-924 **$69.95**

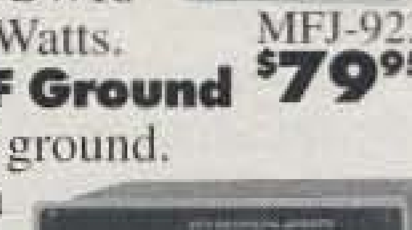
MFJ-922 *144/440 MHz* Tuner



Ultra tiny 4x$2^1/_2$x$1^1/_4$ inch tuner covers VHF 136-175 MHz and UHF 420-460 MHz. SWR/ Wattmeter reads 60/150 Watts.

MFJ-922 **$79.95**

MFJ-931 *artificial* RF Ground



Creates artificial RF ground. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire. Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 **$79.95**

Free MFJ Catalog

and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

1 Year *No Matter What*™ warranty · 30 day money back guarantee (less s/h) on orders from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (601) 323-6551; **Add s/h**
Tech Help: (601) 323-0549

CIRCLE 118 ON READER SERVICE CARD

A high-gain J-pole? Impossible? Not if you follow KA4LBE's advice and add a little here, tweak a little there, until you have a . . . well, read the article!

The EZ-J High-Gain J-Pole Antenna

BY BENSON SMITH,* KA4LBE

Last month we learned how easy it is to design and build a J-pole antenna ("The EZ-J J-pole Antenna," page 58). This time you will learn how to convert that J-pole into a higher gain antenna by converting it into a collinear. We will look at two methods of making a collinear J-pole. The methods employed may be applied to converting other types of antennas into collinear versions. You will discover that the collinear is easy to make.

A collinear antenna is so named because it has two or more radiators which are in phase with each other. In a collinear the RF signal which appears at any point on one element is in exactly the same phase at the same point(s) on the other element(s). This creates RF fields from the separate radiators which are in phase and additive, thereby strengthening the radiated field. To achieve this phasing, there are "phase lines" at the junctions of elements which act as a kind of RF delay line, which delays the RF signal between the elements so that the RF signal arriving at the next element is in phase with the RF signal arriving at the previous element. Since it requires a certain time for the RF signal to travel from its input to its output. The trick in designing a phase line is to design it so that it is the required electrical length to produce the phase delay needed.

In so-called "free space" a radio (RF) signal travels at a speed of about 984,000,000 feet (about 300,000,000 meters) per second. A full wave in free space completes one cycle in the distance, which can be calculated using equation 1.

*1324 Sunset Park Dr., Seymour, TN 37865

Lois, KA4LBD, holding the finished EZ-J high-gain antenna.

Free-space wavelength in ft. = $984/F_0$ eq. 1

where F_0 is the frequency in MHz of the RF signal.

RF signals, as we know and use them, act a bit differently. When an RF signal is traveling on a conductor, such as a wire or metal rod, the speed at which it travels down the conductor's length is slower, or appears to be slower, than its speed in free space. To explain this we simply add a "K" factor to equation 1, producing equation 2. The "K" factor is usually less than 1.

Feet = $[984/F_0] \times K$ eq. 2

Some of the properties that affect the speed of propagation include:

1. Diameter of conductor relative to wavelength.
2. Inductive coupling between conductors.
3. Dielectric of environment surrounding the conductor.
4. Capacitance between elements of antenna and/or ground.

To create a phase line it seems that we simply should need to incorporate a certain combination of these properties into a conductor and place that conductor between two identical radiator elements to create a collinear combination. This cannot be done. The reason is that a phase line has one unique, yet quite important, characteristic: *A phase line should not radiate RF!*

Loop Phasing Method

One method of creating a phase line is to use "loops" as in the "Super-J." The Super-J uses two half-wave radiator sections with loop phasing between them (fig. 1). Loops have a total length needed for proper delay or "phasing" from the first driven element to next. The loop's fields cancel, since about half of the loop lies in one direction and an equal length is in the return direction. The loop end (exaggerated in fig. 1) does radiate

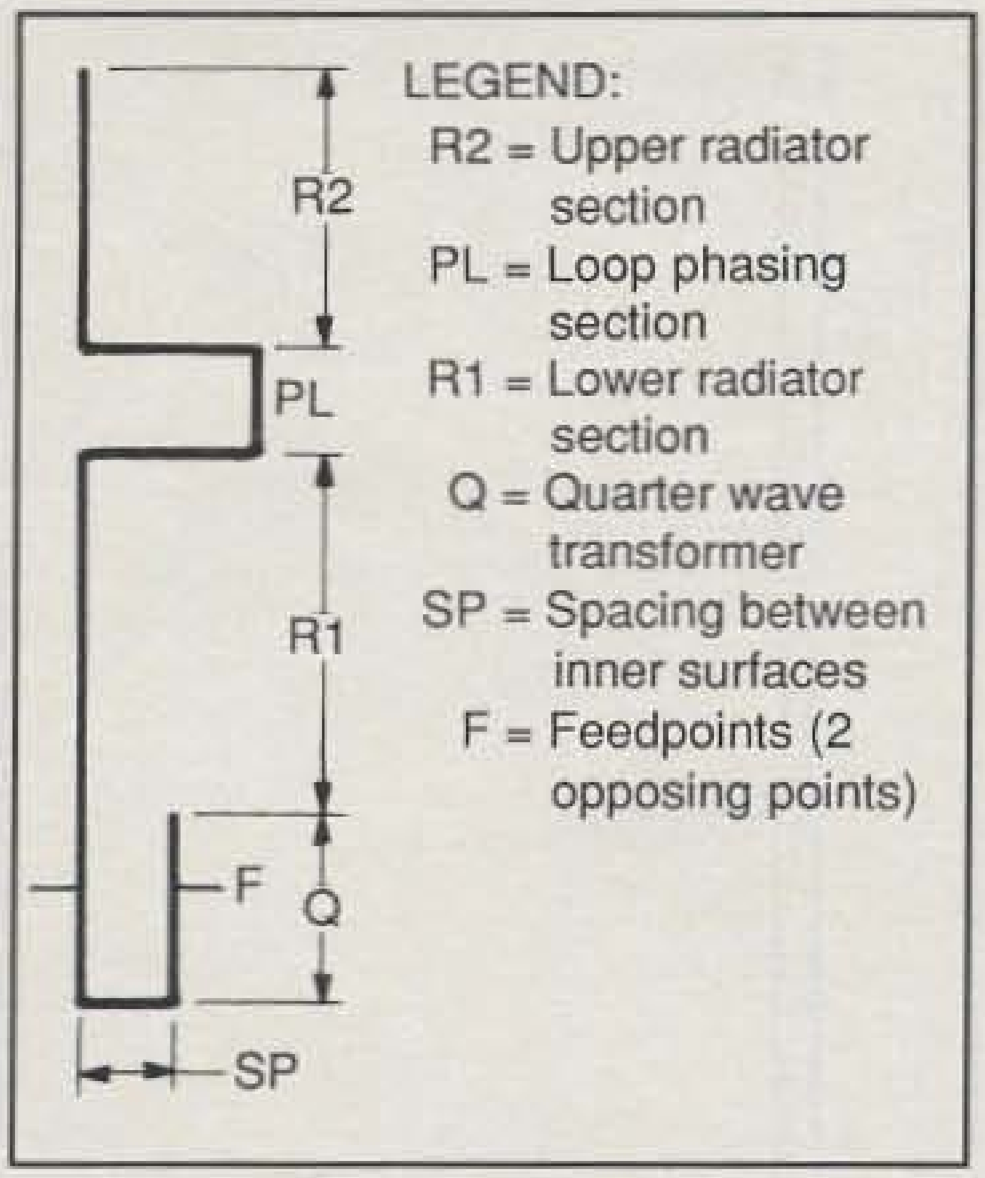


Fig. 1– The loop phasing method.

a very small amount. Loop spacing should be kept small—0.5 to 1 inch.

Coax Phasing Method

A second phasing method employs a straight- length delay line. As we have mentioned, a phase line should not radiate. If we used a simple straight piece of conductor, that line would radiate, becoming part of an undefined and unwanted antenna radiator design. What could be done to overcome the problem?

1. Shield the conductor.
2. Place the conductor in a dielectric to produce a small "K" value which will shorten the coax length, avoiding resonance length.

In other words, use lengths of coax as the phasing lines.

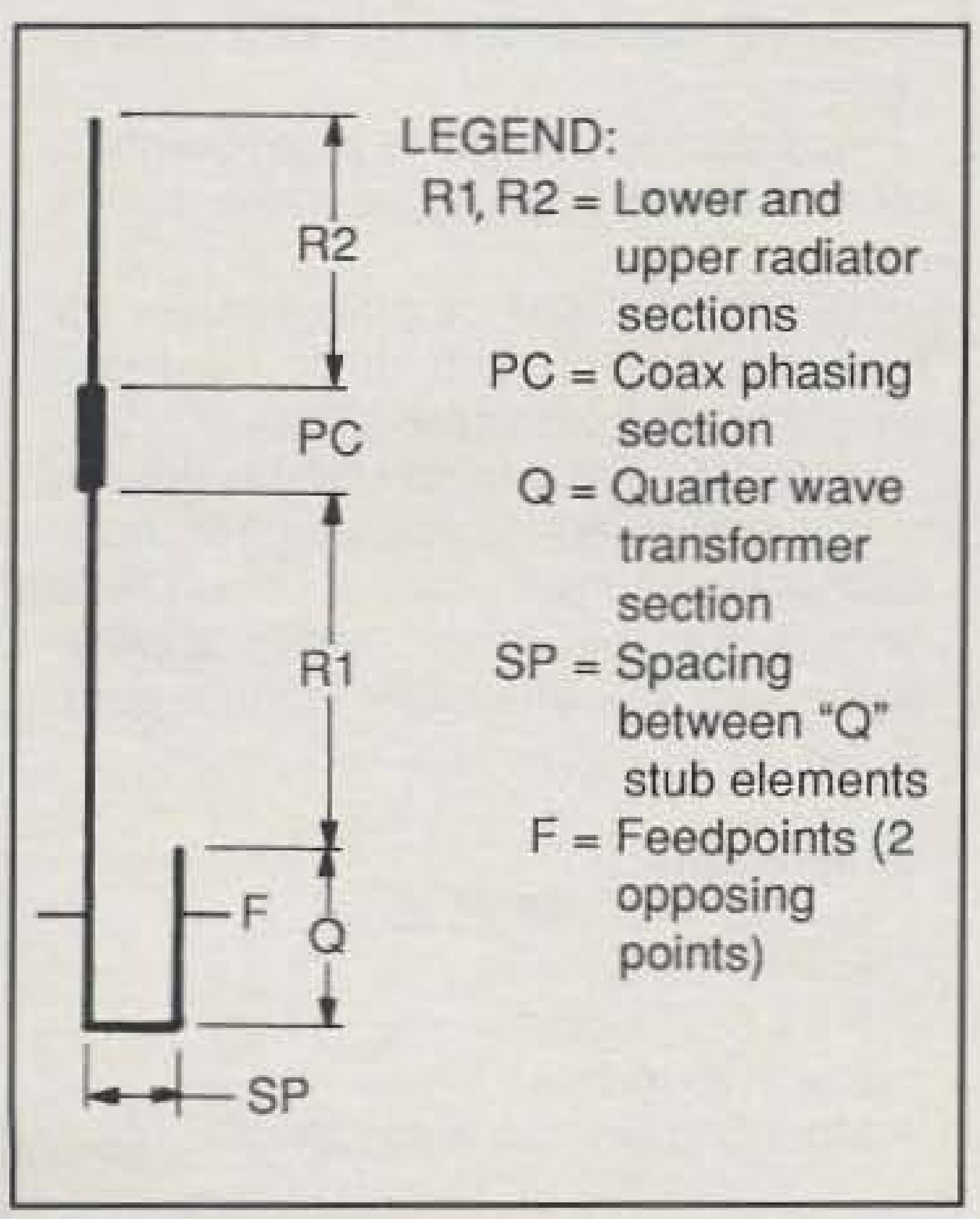


Fig. 2– A collinear J-pole phased with coax sections.

Coax has an inner conductor surrounded by a dielectric material which "slows" the velocity of travel of the RF signal. This results in a section of coax with an overall physical length shorter than a plain conductor producing the same phase delay length. Coax has an outer shield conductor such as braid or foil or both which shields (or prohibits) most radiation occurring from the center conductor.

Since the phase-line shield is not conducting RF current, it should not be terminated or grounded to any other conductor or ground. Leave both ends of the shield open. Connecting the shield to any other conductor probably would result in an RF current flow on it, which would create a totally different device and not be the collinear antenna originally desired.

Since the physical length of the section of coax is shorter than a plain piece of conductor having the same phase delay, it probably would not be resonant at or near the operating frequency. This protects against outer-shield-induced current radiation.

Fig. 2 is a sketch of a collinear J-pole phased with coax sections. The upper and lower radiators are connected by the center conductor of the coax phase section, "PC." The shield of the coax must not connect to anything. A length of "PC" is selected to achieve the correct phase delay for the radiator pair chosen. Radiator pairs other than half-wave lengths are possible, requiring a unique length of coax phase section.

The following equations may be used to determine the dimensions of the various half-wave collinear J sections.

Half-Wave Radiators (inches)

$$R1 = R2 = [(492 / F) \times K] \times 12 \qquad \text{eq. 3}$$

where "F" is in MHz

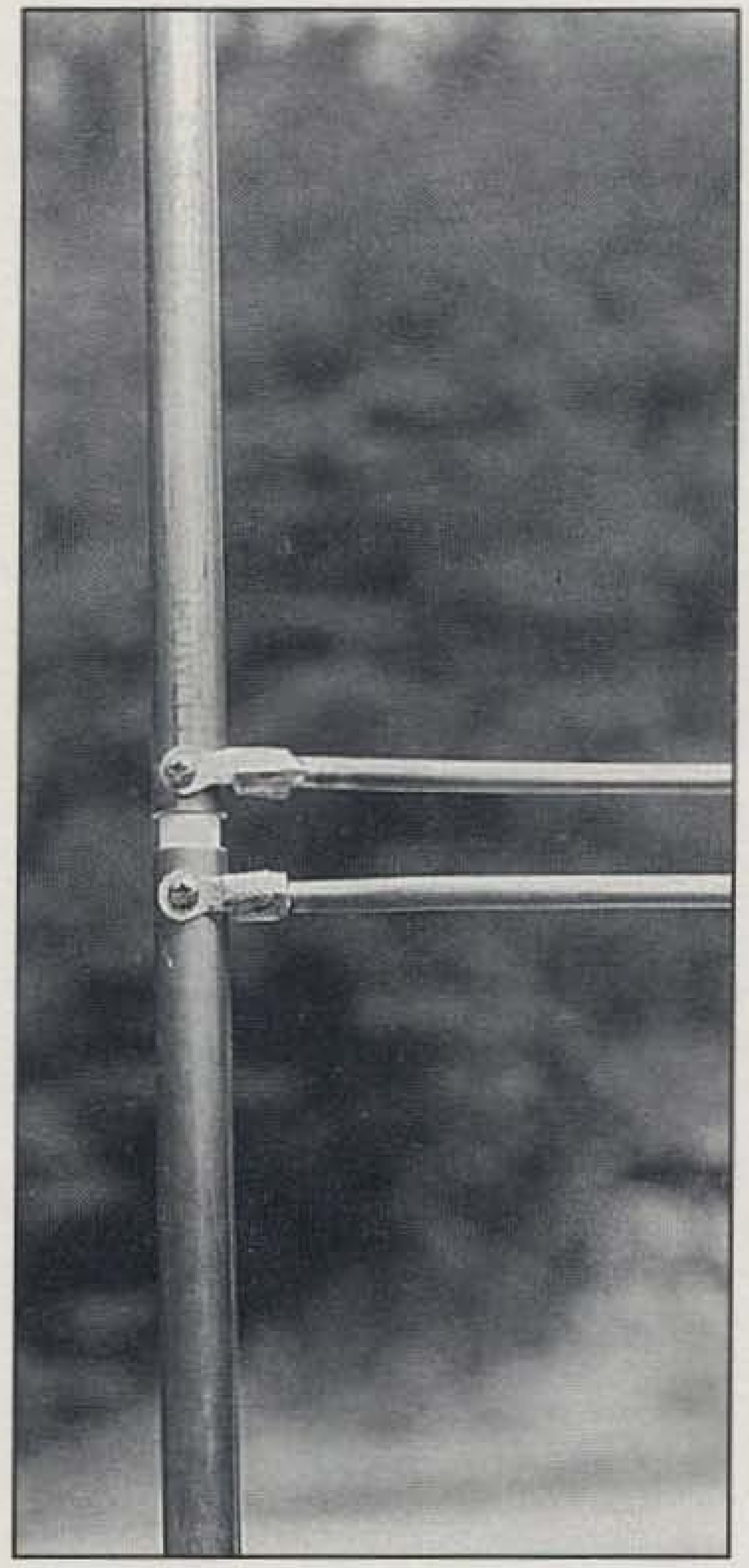
The value of "K" can be found in *The ARRL Antenna Book*. See last month's article on J-poles for information on determining "K."

Coax Phase Line (inches)

Important: To determine the length of coax phase sections you must know the true value of the velocity of propagation (Vf) of the coax to be used. Again, *The ARRL Antenna Book* has a table listing the velocity factors of most common coax cables.

The following equation allows calculation of the length of a coax phase line, "PC," for use in conjunction with half-wave radiators.

$$PC = [(492 / F) \times Vf] \times 12 \qquad \text{eq. 4}$$



Phase loop attachment. Note the insulator rod.

Loop Phase Line (inches)

The Loop Phase Line, "PL," is calculated for an overall length dimension. It is then bent into a loop having a small, uniform spacing of 0.5 to 1 inch. The length determined will be from the point of contact of the end and beginning, respectively, of the two radiators. Length includes both sides and end segment of the loop.

$$PL = [(492 / F) \times K] \times 12 \qquad \text{eq. 5}$$

where "K" is determined by the diameter of the loop conductor.

Quarter-Wave "Q" Section (inches)

$$Q = [(246 / F) \times Vf] \times 12 \qquad \text{eq. 6}$$

Our "Q" section is of open parallel conductor design so that the value of Vf we will assign is 0.98.

Converting the Sample J-pole Into a Loop-Phased "Super-J"

Let's design a collinear J-pole based on the standard half-wave "J" we discussed last month. We will use 1/2 inch thin-wall copper pipe and make a "loop phased collinear." The material for the loop will be 1/4 inch copper pipe. The dimensions of the radiator and "Q" section will be the same as in the previous sample. This means that for the same frequency of design and materials our existing J-pole will be used "as is" by only removing the top pipe cap. For those needing to start from scratch, the steps are as follows:

1. Determine design frequency. We will use 146.5 MHz.

2. Determine "K" of radiators. Refer to Chapter 2 of *The ARRL Antenna Book.* The outside diameter of 1/2 inch thin-wall copper is about 0.625 inch. The free-space wavelength at 146.5 MHz is:

$$L_{fs}\text{ (in.)} = (984 / 146.5) \times 12 \text{ (eq. 1 in in.)}$$
$$\sim 80.6 \text{ inches}$$
$$L / D = 80.6 / 0.625$$
$$\sim 130$$

From the chart, "K" is about .96.

3. Radiator sections. Insert required values into equation 3.

$$R1 = R2 = [(492 / 146.5) \times .96] \times 12$$
$$= 38.7 \text{ inches}$$

4. "Q" section. Insert required values into equation 6.

$$Q = [(246 / 146.5) \times .98] \times 12$$
$$= 19.75 \text{ inches}$$

5. Phase loop. Using the ARRL Chart again, we find the "K" value of 1/4 inch pipe at 146.5 MHz is about 0.97. Insert the appropriate values into equation 3 (this is also a half-wave element).

$$PL = [(492 / 146.5) \times .97] \times 12$$
$$\sim 39.1 \text{ inches overall length}$$

Add a bit to make connections. Remember, length is from points where the loop leaves and arrives at the radiators.

6. Miscellaneous

• We will use a "Q" element spacing of 1 to 1.5 inches.

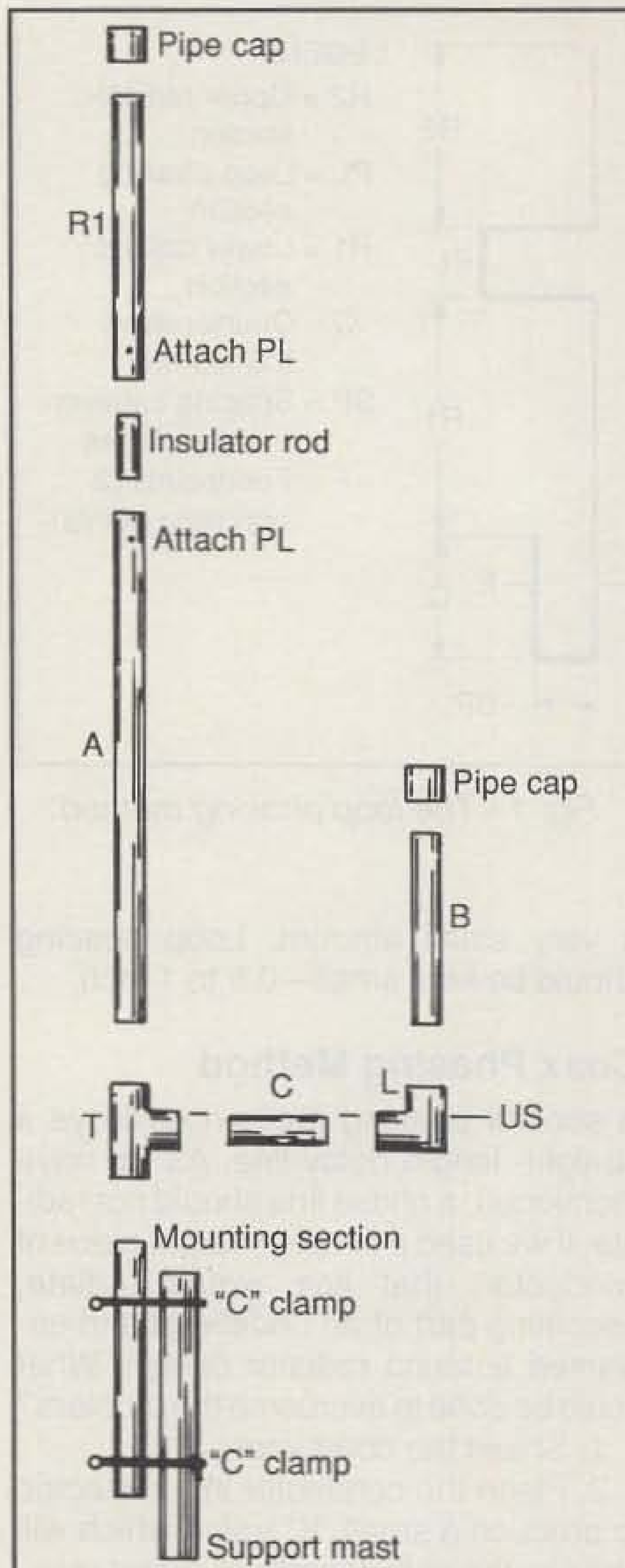
• Add an RF choke-balun at the feed point and "tune" as in last month's J-pole article.

• Be certain that the separation in the "Q" section is held firmly and uniformly. A narrow piece of clear plastic could be used at the top of "Q" to hold it. I used 1/2 inch CPVC parts to make a separator (see photo).

Assembly of the Collinear "J"

Temporarily assemble all parts (do not solder yet). Slip on caps and recheck measurements referenced to "US" (upper surface of cross-over). Disassemble and clean all ends and then flux joints. Assemble and solder carefully. Attach the phase loop, referring to fig. 4.

Attach the feed coax to a set of stainless hose clamps. Add the RF choke-



Materials:

R1, A, B, C, Pipe Caps, L, T, and mounting section are 1/2 inch copper pipe.

Insulator rod used is 3/8 inch fiberglass electric fence post, 10 or more inches long.

"C" clamps, self-tapping screws for loop attachment, and other hardware should be stainless steel.

Note: R1 = R2 in length for this design.

It is convenient to use stainless hose clamps for feed-point connections. These clamps are used in automobile applications and are available in auto-parts stores.

Dimensions:

A = R2 + Q = 58.45 inches
B = 19.75 inches
R1 = 38.7 inches
C = 1.25 inches
Mounting Section = any length

Fig. 3– Assembly of the collinear "J."

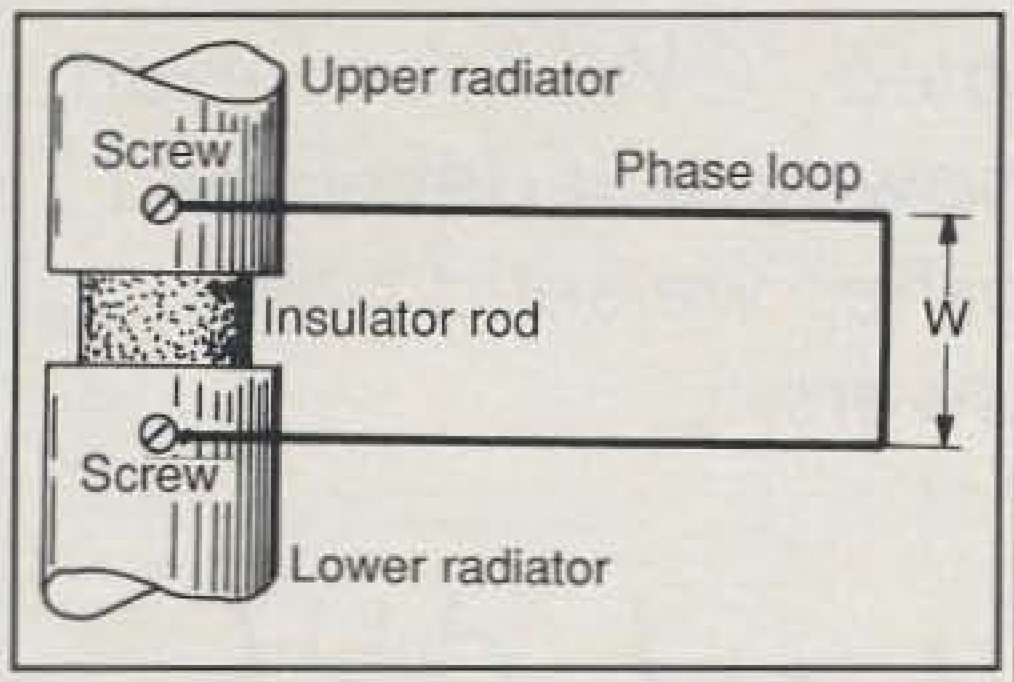


Fig. 4– The phase loop.

balun to the feed line and slide the clamps over the "Q" section areas.

Mount the J-pole away from any grounds or interference and check the VSWR. Slide the clamps up or down and repeat measurement. Continue to slide the clamps (by small increments) in the direction of reduced VSWR. When tuning is completed, thoroughly clean the entire antenna. Add a small amount of anti-oxidant at the hose- clamp connection. Finally, give the "Super-J" a thin coat of clear acrylic spray paint.

As with any antenna or mast installation, be extremely careful, especially when working around power lines. *(**Never** install an antenna where it, or you, could fall onto a power line—ed.)*

Phase Loop

Referring to fig. 4, the two radiators, upper and lower, are connected together using an insulator such as PVC or, as in this drawing, a piece of fiberglass electric fence rod.

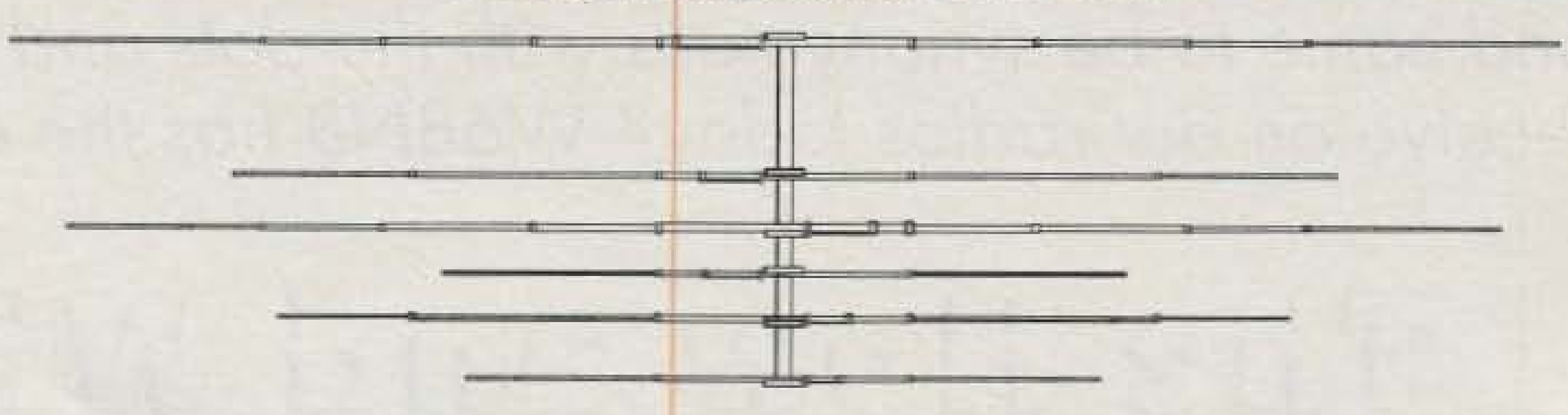
The Phase loop vertical end dimension dictates the dimension of the separation between the two radiators. The dimensions for our example are:

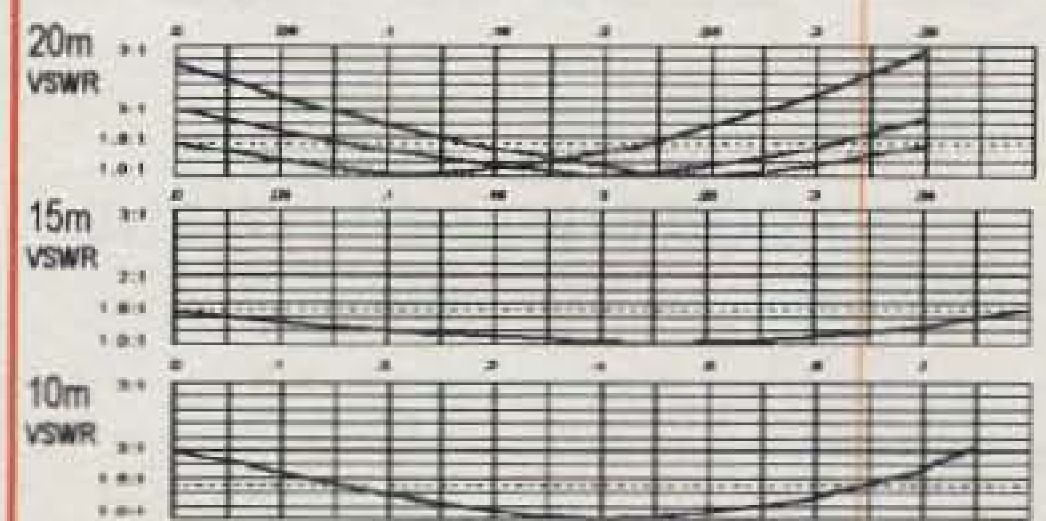
Loop width = 1 inch = W
Separation of radiators = $^1/_2$ inch
Length of sides ~ 19 inches

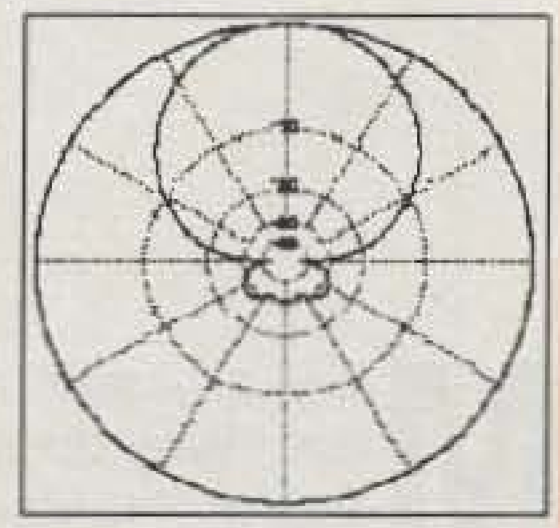
Make the loop so that the two sides are straight, parallel, and secure. The loop may be formed into a circle around the radiator axis. If this is done, the circle should not be small, less than one rotation (see photo).

Summary

Which phasing method is best—loops, sometimes called "hairpins," or coax lines? There is no simple answer. The coax method can result in a slightly tighter vertical pattern if no shield radiation occurs. The coax method can also result in a very tall antenna! The loop type tends to be a bit easier to build for me. Try them both and make your own comparisons. ■







Did you ever wonder why Morse code is abbreviated "CW"? And even if you know what CW really stands for, do you know how it developed and came to be synonymous with the dots and dashes we send and receive on our radios today? W6BNB has the answers.

The How and Why of CW

BY BOB SHRADER,* W6BNB

Many amateur radio operators ask, "Why do we have to send and receive Morse code in order to get full amateur privileges?" The answer to this is based to some extent on continuing in the historic footsteps of our early amateur radio operators, who used only Morse code to communicate with each other. In addition, it demonstrates the acceptance and winning of a challenge. Plus, it has proven to be one of our most dependable modes for message handling.

Many of those who learn to use Morse code reasonably well find it to be a most intriguing means of communicating. It may be surprising to a lot of newcomers that many amateur operators have given up on voice QSOs and only operate Morse code on the ham bands today. In outer space work, CW has the advantage of draining less of an orbiting satellite's transmitting power than do other communication modes. Probably, CW also is a better all-around exercise for a radio operator's brain than just talking into a microphone. Except for some foreign ships and point-to-point stations, amateurs are the only people today who are upholding this memorable means of communicating.

Today we may get the impression that all code operations are "CW," but the letters CW really mean "continuous wave," a special type of code emission. Let's look at some history of radio in general, see how old-time "spark"-type Morse code transmitters worked, and learn a little about our modern CW transmitters and receivers.

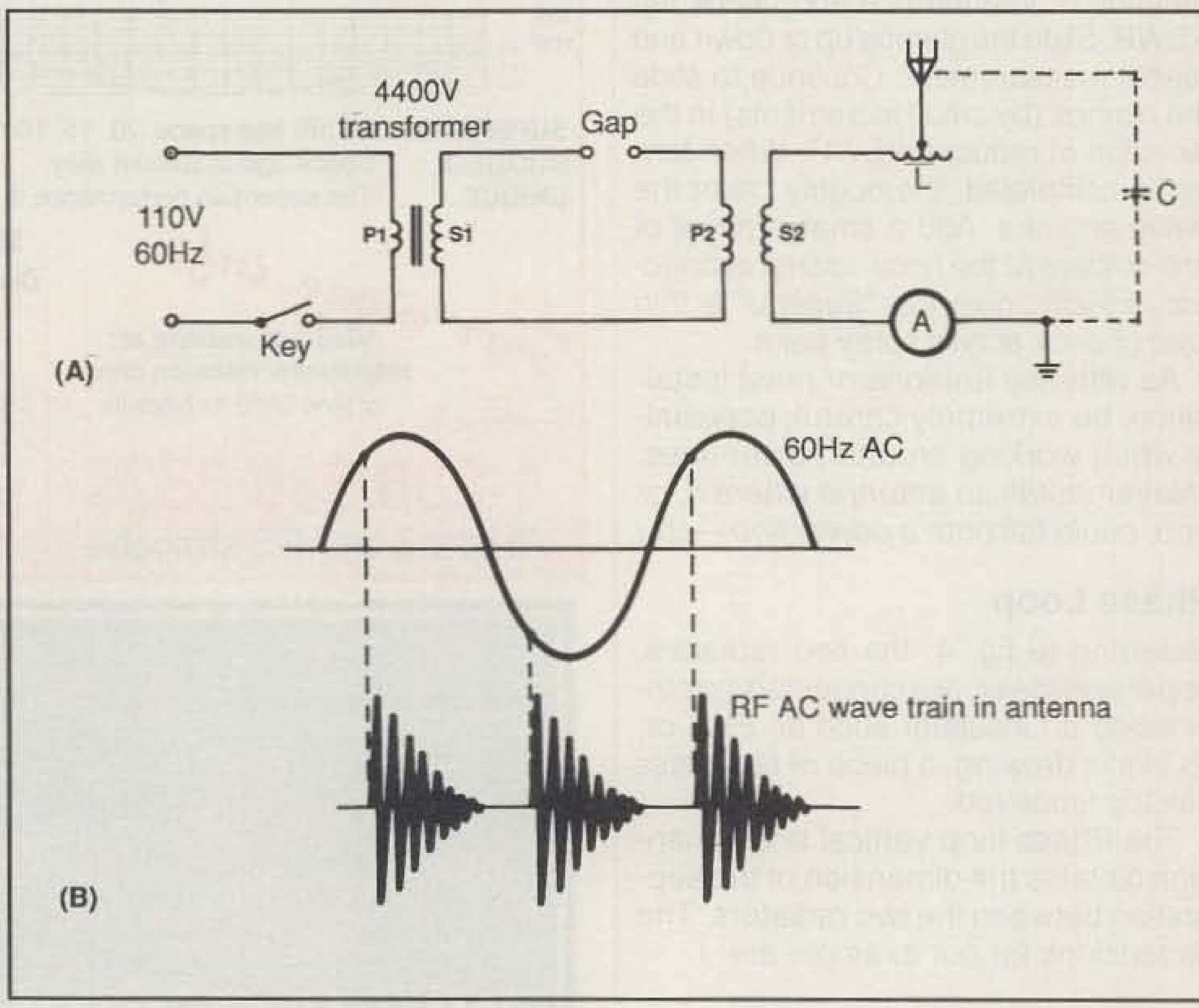


Fig. 1– (A) Basic spark transmitter circuit. (B) Power-line AC waveform and RF-AC wave trains developed in the antenna.

A Bit of History

Unknown to many people, back in 1865 a dentist, Dr. Mahlon Loomis, successfully transmitted radio signals between two mountaintops in Virginia. He used kites with the earth-ends of their wire "strings" immersed in pools of water in the ground. When a switch in one of the kite wires was opened, the wire became charged by some of the static electricity always present in the air. When the switch was closed, it discharged the antenna to ground. The resulting current pulse flowing between the kite wire and ground radiated an electromagnetic and electrostatic radio frequency (RF) wave of energy outward in all directions. Part of this wave passed across the remote kite's wire, inducing a pulse of current to ground, deflecting the needle of a sensitive meter in the kite's wire.

The two sites were 18 miles apart on top of two Blue Ridge Mountain peaks. Later Dr. Loomis sent messages between two ships a couple of miles apart. What code was used is not known. Let's tip our hats to old Doc Loomis, who 130-plus years ago must have been our first amateur radio operator! Unfortunately, he did not develop radio communicating any further.

Prior to 1900 there was very little knowledge of how to communicate by "wireless" radio. In 1893 Nicola Tesla used tuned "coil and condenser" circuits ("inductance and capacitance," or

*11911 Barnett Valley Rd., Sebastopol, CA 95472
e-mail: <w6bnb@aol.com>

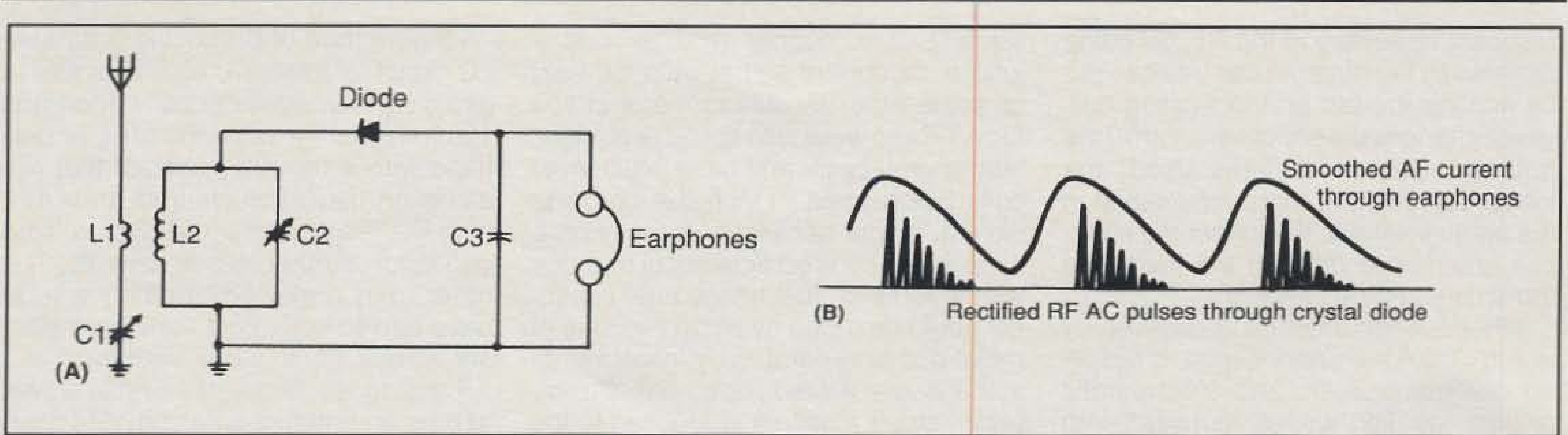


Fig. 2– (A) Basic crystal-set receiver circuit. In a crystal detector the cat-whisker touching the crystalline material makes a solid-state diode or one-way current connection, thereby rectifying any RF-AC fed to its circuit. (B) Current through the crystal and earphones.

"LC"), one for transmitting and one for receiving, at two nearby locations. He actually sent and received RF signals a short distance between these two stations. Then in 1896 Marconi, also using tuned LC circuits but with an "aerial" (antenna) wire connected to one end of them and a ground connection to the other end, was able to communicate over far greater distances. In 1901 he transmitted the famous dididit, or "S," the first radio signal to be sent and received across the Atlantic.

Around the turn of the century, when young men heard that signals were being transmitted back and forth between people through space with no wires connecting the two points, many wanted to participate in such an unbelievable activity. Because these early amateur radio operators did all of their experimenting just for the fun of it, they became known as "ham" radio operators, possibly because at the time ham was a common term for nonprofessional actors.

Wireless emissions in the early days of radio were generated by "spark"-type transmitters rather than the continuous-wave emissions we use today. With a wire antenna and a connection to a water pipe as a "ground," a spark transmitter's RF energy could be fed into an antenna and radiate RF waves out into space, which was known then as "ether." Thus, an experimenter first had to put up some kind of a wire, perhaps between a tall tree and his operating room. Such an antenna could be used not only to transmit signals, but to receive them as well. If you want to get an idea of what a received spark signal sounded like, listen to your radio when there's a thunderstorm a safe distance away. Electromagnetic waves developed by lightning bolts from far away can induce unwanted RF voltages into antennas, developing "static" noise in a receiver along with desired radio signals.

Of course, in the early days there was no readily available wireless equipment, only a few electrical parts with which experimenters might tinker. Those who tried out this newest "high-tech" idea of the time were faced with real obstacles, requiring much home-brewing of parts for transmitters, receivers, power supplies, and antennas. A spark transmitter, however, was something fairly simple that an amateur experimenter could build on his own. The required power transformers were available. If they did not produce the step-up AC voltage desired, the amateurs tore them apart (a very messy job) and rewound them until they produced the desired voltage output. The spark gap might be two properly spaced, rounded-end conductors, although a wide variety of noisy rotary and quieter "quenched" gaps were developed by amateurs and were later used by commercial stations. The transmitter' s RF coils might be made of heavy copper wire, copper tubing, or spiral-wound copper strips.

To produce "clean" (not too broad a bandwidth) RF spark signals, the degree of coupling between the spark-circuit primary and the antenna-coil secondary had to be adjusted properly, requiring considerable trial-and-error testing. The antenna RF-ammeter, "A" in fig. 1(A), gave a relative indication of the RF energy output from the antenna. Higher current readings indicated greater power output. The optimum type of antenna to use was a widely debated subject then, just as it is today.

In the simplified diagram of a spark-type transmitter shown, a 60 Hz, 110 volt AC power-line voltage is shown feeding the primary, P1, of a 1:40 step-up power transformer. Whenever the key was closed, an output voltage of 110 × 40, or 4400 VAC, appeared across the power transformer secondary, S1. At some voltage below 4400 VAC a spark jumped across the properly spaced "spark gap." The power-line voltage, alternating first in one direction and then the opposite, produced a spark (actually a short-term electric arc) on both half-cycles of the AC, which opened up as the voltage dropped to zero and then reversed (fig. I(B). Thus, two sparks were developed for each cycle of power line AC. The spark, ionizing the air across the gap, produced a very good electrical conductor for short periods of time 120 times a second (2 × 60 Hz). Since the Morse key was connected in the power line, touching its metal parts could be lethal if the operator's foot or other hand was touching a grounded object. Safe keying systems using relays were soon devised to eliminate this risk.

What happens when a spark gap ionizes is interesting. Let's simplify its theory a bit. At the time the AC voltage rises high enough to ionize the air in the gap (indicated by "I" on the AC voltage curve in fig. 1[B]), the gap breakdown starts current flowing through the RF primary coil, P2. This induces voltages and currents in the secondary or antenna coil, S2. The natural inductance of the antenna wire, plus some value of antenna-to-ground capacitance (dashed C), forms an LC resonant circuit. When driven by any strong current pulse, the antenna circuit "oscillates," meaning electrons travel up and down in it at a frequency determined basically by its L and C. If the antenna plus its loading or tuning coil, L, to ground happens to be *effectively* 117 feet long, this circuit will oscillate at 2 MHz. The length in feet for a grounded quarter-wavelength antenna is found by: Length (ft.) = 234/MHz. The resonant frequency of the RF-AC being radiated by the antenna can be changed by moving the tap on the loading coil, which changes the effective length of the antenna. The more turns used, the longer the coil; the more inductance in the antenna circuit, the longer the effective antenna length and the lower the transmitted RF-AC frequency.

Whenever an antenna was driven by energy from the spark circuit, it radiated electromagnetic and electrostatic energy as RF waves outward into space. Because of this radiation loss, every succeeding RF alternation of the spark circuit became weaker than the one before. The result was an RF-AC signal that starts at a high value at each ionization instant and decreases due to radiation of wave energy as well as the power-AC voltage dropping off. Such strings of decaying RF-AC cycles are known as "wave trains" and are the RF signals radiated by spark transmitter antennas. Also, a "negative resistance" that develops in any ionized air results in additional energy into the LC antenna circuit, helping keep the RF-AC cycles from dying out too rapidly.

Spark transmitters were outlawed for amateurs in 1927, and commercially, on ships at sea, they finally died out in the 1950s. Incidentally, while spark transmitters have been banned for many years, this wave-train-type emission is the kind of signal heard on receivers today when sparks jump across nearby power line insulators. The power lines act as an antenna which radiates the spark-type noise signals that we hear all too often! It appears that we will never get rid of spark emissions!

Receiving Systems

Before building their transmitting systems, early amateur experimenters usually put together some kind of receiving system to pick up radio signals from the air and to make them audible. The telephone was gaining in use, and its earphones were known to be able to change electrical variations into audible sound waves. Thus, amateurs had to obtain an earphone in some way (?) if they were going to hear their wireless signals.

Picking up one particular radio frequency signal could be accomplished by connecting a long antenna wire to a tunable LC circuit. If such a circuit was resonated at the frequency of a desired signal, a maximum signal at that frequency would result across a receiver's LC input circuit. Such a frequency resonant circuit in the old days was often developed by winding a size 22 or 24, usually green silk-insulated, copper wire, around a tubular cardboard salt or oatmeal box, or some other insulating material coil form. (There were also spider-web coils, honeycomb coils, and other multi-layer coils being used.) Once the coil was wound, it was necessary to develop a capacitor to connect across it or in series with it. A "fixed" (unchangeable) capacitor could be made by using two sets of metal plates separated by insulators of some kind— waxed paper, sheet mica, glass, etc. If a battery is touched to the two plates, one of the metal plates becomes positively charged (loses some electrons) and the other becomes negatively charged (gains excess electrons) and will stay that way. This ability of a capacitor to hold a charge for a period of time is also useful in holding the voltage output of a power supply more or less constant.

Making a capacitor variable took some ingenuity. The two sets of plates had to be insulated from each other and their proximity made variable. One way to vary the capacitance was to physically move the plates closer or farther apart. A better method was to have two sets of two or more metal plates interleaved, without touching, making the capacitance either greater (plates meshed in) or less (plates pulled outward). Many different homebrew forms of variable capacitors were, and still are, being developed by amateurs.

One method of producing a tunable LC circuit for those old receivers was to use a ±3 inch diameter coil of perhaps 100 turns, either with taps on it, or perhaps with a movable contact that ran along an insulation-cleared area running the length of the coil, with a fixed capacitor connected across it. The other, and preferred, method was to have a fixed coil with a variable capacitor across it or in series with it.

Passing electromagnetic radio waves across an antenna wire converts them to RF-AC which is fed to the input LC circuit in a receiver. When the LC circuit is tuned to resonate with the signal's frequency, a maximum RF-AC appears across the LC circuit. With a strong RF signal being developed across an LC circuit, all that would be necessary to hear the radio signal is to put an earphone across the resonant circuit, right?

Oh, no! Radio frequencies are far above those which the human ear can hear. Young people may be able to hear air-waves (not electromagnetic radio waves) of frequencies from about 15 to perhaps 24,000 cycles-per-second ("cps" then, "hertz" or "Hz" now). The radio frequencies used back in the early days were in the range of perhaps 50,000 to 2,000,000 Hz (50 kHz to 2 MHz). Even if an earphone diaphragm could vibrate at these radio frequencies, the air waves produced by the ear-

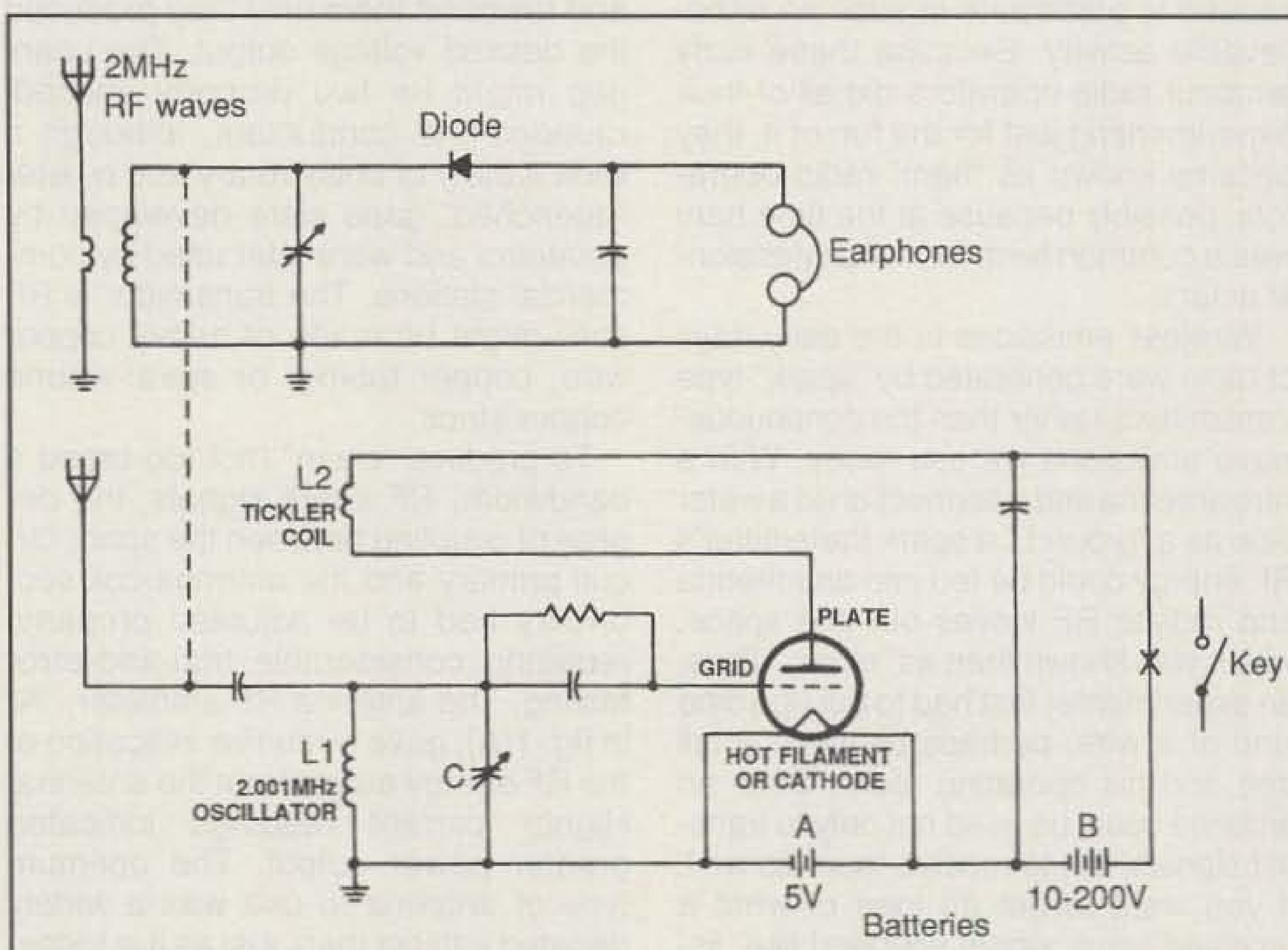


Fig. 3– (Top) Rectifying detector using a crystal, although a diode tube would work equally well. (Bottom) DeForest tickler-coil oscillator. Any disturbance at the grid is amplified by the triode and feeds back RF energy L2 to L1, keeping L1C oscillating at its resonant frequency.

phone diaphragm vibrations would be at too high a frequency for a listener to hear. So how can RF-AC signals be made audible? Good question!

Circuits used to make RF-AC signals audible are called "detector." There were a few early types—the "coherer" rectifying detector, a "magnetic detector," an "electrolytic" rectifying detector, various "regenerative" detectors, and finally the "crystal" rectifying detector, probably the most commonly used type today, and as such the only one to be discussed here.

The circuit of a crystal detector is shown in fig. 2(A). RF-AC developed in the tuned antenna circuit induced RF-AC into tuned circuit L2C2. When the antenna and the primary coil, L1, in series with variable capacitor C1, are adjusted to resonate at the signal frequency, the induced signal voltage into the parallel-looking L2C2 secondary circuit will be maximized. If this secondary circuit is also tuned to resonate at the same frequency, a still greater signal voltage will be developed across it. The early crystals consisted of one of several types of crystalline materials imbedded in a lead mounting. A thin-wire "cat-whisker" lightly touched the crystal surface. This was, in fact, what we know today as a solid-state diode!

When the RF-AC signal developed across L2C2 was applied to the crystal/cat-whisker and earphones, it found that only one half of its cycles, either the – or the +, could pass through, depending on which way the crystal was connected in the circuit. As a result, the current flowing through the earphones was decreasing-strength wave-train pulses of DC as indicated. RF-AC fed through the detector is thus "rectified" into pulsating DC. Capacitor C3 smooth the DC pulses somewhat, producing a fast-rising-slowly-decreasing DC wave for each RF-AC wave train (fig. 2[B]).

Since these somewhat smoothed pulses are at the wave-train frequency of 120 times per second if 60 Hz power-line AC is used, they produce 120 air-wave vibrations per second of the earphone diaphragm. A 120 Hz tone is audible from the earphones every time the remote transmitter's key is closed.

A 120 Hz distorted low-frequency tone is not a very pleasant sound. By using 500 Hz AC generators ("alternators") as the AC power source at the transmitter, the resulting wave-train's varying DC in the earphones was at 1000 Hz (1 kHz), producing a much more pleasing tone to the ears.

A great number of variations on the simple receiver circuit shown are possible. One simple improvement was to tap the crystal halfway down coil L2. The LC circuit then had a higher "Q" (quality), and the ability of the receiver to select one of several adjacent-frequency stations was greatly improved. This is known as increasing the receiver's "selectivity."

In 1883 Edison found that by putting two metal "plates" inside an evacuated lamp globe—one from which all the air had been pumped out, or evacuated, to create a vacuum—and heating one of them, electrons flowed from the warmer plate to the cooler one. This "Edison effect" led to Sir Ambrose Fleming's invention of the vacuum tube diode in 1904. These diodes began appearing in radios in about 1906.

Shortly after that the three-element "triode" vacuum tube was developed. It consisted of an evacuated glass bulb, a hot "cathode" electron emitter, and a plate or "anode" electron collector, with a wire-mesh "grid" added between cathode and anode. A large amount of electron plate current could be controlled by a relatively small voltage variation applied between grid and cathode. This resulted in amplified signal voltages across the plate-circuit device, or "load," when compared to the voltages applied to the grid. Triodes not only could detect radio signals, they could amplify them enough to operate loudspeakers. Later, RF signals from the antenna were amplified by tuned triode amplifier stages to feed stronger signals to detectors. This improved both the receiver's "sensitivity" to weak signals and its selectivity.

Lee DeForest, who invented the triode, then found that coupling the output signals of a triode back into its input circuit, L2 to L1 in fig. 3 (bottom), resulted in a tickler-coil "oscillator" circuit that generated a constant amplitude (strength) AC at the L1C resonant frequency. Connecting a key at point X as well as an antenna to the top of the tuned circuit (dashed antenna symbol) made a simple, very low-power Continuous-amplitude-Wave, or CW, transmitter out of the oscillator. (Practical vacuum-tube transmitters used hundreds to thousands of plate-circuit volts.) Such oscillations can produce purely sinusoidal (the "perfect," undistorted wave shape) AC, resulting in extremely narrow bandwidth emissions. On the other hand, spark transmissions, with their varying amplitude wave trains, radiated very broad signals. Ships were not allowed to use spark transmitters when in harbors because their broad, raspy signals interfered with most of the local broadcast stations!

Constant amplitude, or CW-type, RF emissions could not be detected by simple rectifying detectors because there was no "modulation," such as the variations in amplitude of the wave trains, to vibrate earphone diaphragms. However, CW emissions opened up a whole new field of narrow-bandwidth radio circuits for both CW transmitters and receivers. It also led to AM broadcasting, then FM broadcasting, and finally to SSB communications.

A detector for CW signals (fig. 3) can use a crystal detector (or diode), and by coupling a low-power variable oscillator to it, it can produce any desired CW sinusoidal tone in its earphones.

Suppose a 2,000,000 Hz unmodulated received RF signal is fed to a rectifying detector, at the top. If a weak RF-AC signal of 2,001,000 Hz is also fed to the detector through a small-value capacitor (dotted line), both RF signals, plus their sum and their difference frequencies, will appear in the earphones. However, only the difference frequency, 1000 Hz, would be audible. Varying the oscillator frequency varies the resultant "beat" frequency that is heard. This simple CW detector circuit was improved by adding amplifiers to produce our modern-day superheterodyne receivers.

In 1948 it was found that by placing two closely adjacent cat-whiskers on a crystal surface a "transistor" was formed which amplified signals much as vacuum tubes did. A wide variety of vacuum tubes and then transistors opened up whole new worlds of possible circuits for amateur radio experimenting.

Try It Yourself

Try some experimenting of your own. Enough parts should be available to build a crystal-detector AM broadcast-band receiver using the diagram shown. If a crystal and cat-whisker are not available, any semiconductor diode (germanium is better than silicon) can be substituted. For experimenting, just mount parts on a wooden board, either screwing them down or cementing them to the board. You might just twist leads together, but soldering is far better and is also good practice.

You may run into lots of little problems, but be ingenious like the old-time amateurs were. Wind the antenna and tuned circuit coils right next to each other to couple energy from one to the other. Use some kind of a coil form, maybe a small plastic bottle or plastic tubing. You might be able to scrounge the antenna and other wires by tearing apart an old transformer, or buy the wire. Almost any kind of wire will work. Try 100 turns for the LC circuit coils on a 1 .5 inch diameter round form and any reasonable-size variable capacitor. Then cut and try. Try tearing apart an old, defunct broadcast radio for parts. You should be able to hear many local stations with a diode detector if you have the correct number of turns on the coils. A 50 to 100 foot piece of wire should work well as an antenna. Play around with things and see what works best. Use a wire attached to a cold-water pipe for your ground connection.

Much of the appeal of early-day amateur radio was digging up or making the necessary parts with which to experiment when putting together transmitters, receivers, antennas, and power supplies to operate the equipment. It is still a lot of fun to build your own receivers and transmitters. Radio handbooks are full of simple circuits that can be tried. They don't have to be complex.

If you get into building transmitters, try CW rigs first because they are the simplest systems to get working. Putting together a kit may approach home-brewing in some ways, but it is not the same. Sadly, too many amateurs fit only into the "appliance operator" or "kit constructor" classifications. Can you build yourself out of those categories? ■

Announcing:

CQ Spring VHF Activity Weekends

FM: March 17–19, 2000
Weak Signal: April 28–30, 2000
Specialty Modes: May 19–21, 2000

Ever wonder what goes on in between repeater frequencies? There's a world of activity beyond repeaters on every VHF/UHF band, including FM simplex, SSB and CW (generally known as "weak signal" on VHF), packet, ham TV, and more. Here's an opportunity to discover the rest of VHF, and if you've never tried it before, to "stick your toes in the water" of ham radio contesting.

CQ's Spring VHF Activity Weekends are low-pressure, friendly operating activities designed to generate some additional activity on the VHF and UHF bands, provide non-contesters with a non-intimidating introduction to the sport, and give dedicated VHF contesters a chance to check out their gear, shake out the winter cobwebs, and hone their on-the-air skills.

CQ Spring VHF Activity Weekends

There are three Activity Weekends, each one dedicated to a specific mode or style of operating. The first, for FM simplex, is March 17–19. Next is the Weak-Signal Weekend, April 28–30, followed by the Specialty Modes Weekend (for anything that doesn't fit into one of the first two categories), May 19–21.

To encourage activity throughout each weekend, each activity has been sliced into nine 6-hour periods, starting at 6:00PM (local time) Friday, and running until midnight local time on Sunday. Period 1 runs from 6:00 PM to midnight Friday; Period 2 runs from midnight to 6:00 AM Saturday; and so on until the end of Period 9 at midnight Sunday. You may work any or all of these periods, but you will be competing only with stations operating a like number of periods during each contest. This lets you have a life and still be a contender. Best of all, you may work stations once in *each* six-hour block.

All amateur bands above 30 MHz may be used. A station may be worked once per band *during each period* for a total of up to nine times per band each weekend. Rovers may re-work stations during the same 6 hour period if they have moved to a new grid square. Scoring for each 6 hour period is the same as is used in the ARRL VHF Sweepstakes and QSO Parties. (This will make it easier for those using computer logging programs that automatically calculate your score; simply start a new log for each 6 hour period.)

Scoring is simple. Just add up the contact points *from each period* and multiply by the sum of the grids *from each period* (see scoring example) for your period total. Your final score is determined by multiplying the total number of contact points from each period by the total number of grids worked in each period (the example will clarify this). If you're short of time and want some of the fun, you can get into the activity for one or more periods and expect to find hungry folks ready to work you!

Give It a Try!

Give one or more of these weekends a try and have some fun. Don't forget to get some other operators or prospective operators involved in this wonderful aspect of our hobby. There is nothing like a grinding operating activity to test out your gear, sharpen your general operating skills, and better prepare you for emergency and public service communications operations. And . . .have some fun! Here are the specifics:

I. Contest Periods

1. The FM Activity Weekend, March 17–19

"The FM Activity Weekend" is for operators of FM equipment. This event encourages both new and experienced operators to get on the air and make contacts on any VHF+ band between 6:00 PM local time on Friday, March 17, 2000, and 12:00 midnight local time on Sunday, March 19, 2000. Repeaters and 146.52 MHz simplex may *not* be used for logged contacts, except that satellite contacts (e.g., OSCAR-27) *are* permitted. Only frequencies commonly used in a locality for FM simplex may be used during the activity. Use of frequencies adjacent to repeater inputs or outputs that causes interference to a repeater is not permitted.

2. The Weak Signal Weekend, April 28–30

"The Weak Signal Weekend" is for operators of SSB, CW, and other digital mode equipment using no more bandwidth than is used by an SSB signal. This event encourages operators to get on the air and make contacts on any VHF+ band between 6:00 PM local time on Friday, April 28, 2000 and 12:00 midnight local time on Sunday, April 30, 2000. No repeaters or translators may be used for logged contacts, except that satellite contacts *are* permitted.

3. The Specialty Modes Weekend, May 19–21

"The Specialty Modes Weekend" is for operators of video, RTTY, AMTOR, packet, and other digital equipment. This event encourages operators to get on the air and make contacts on any VHF+ band between 6:00 PM local time on Friday, May 19, 2000 and 12:00 midnight local time on Sunday, May 21, 2000. Repeaters, packet networks, or trans-

About Last Year's Event...
and How This Year is Different

The Spring Activity Weekends actually began last year under the sponsorship of *CQ VHF* magazine. Due to a variety of problems beyond our control, the scores were never reported, and we apologize for this. If we are ever able to get the scores, we will post them on the *CQ VHF* website (which is continuing to operate for the foreseeable future).

This year the Holmesburg Amateur Radio Club (HARC) of Philadelphia, Pennsylvania, has agreed to take over administration of the Spring Activity Weekends, permitting us to spread the tasks among several people if the work turns out to be too much for just one person. We hope that this will assure us scores in a timely fashion. We thank HARC not only for taking on the responsibility for this year's event, but also for its sponsorship of a plaque for the FM Activity Weekend. Other groups and individuals are encouraged to become plaque sponsors as well.

lators *may* be used for logged contacts in this event. However, all contacts must be with live operators, not with automated equipment, and all must be made in "real time" (an exchange of BBS messages does not count).

II. Entry Categories

There are five station categories:

Single Operator QRP – Fixed Station, 10W or less
Single Operator QRO – Fixed Station, above 10W
Multi-Operator QRP – Fixed Station, 10W or less
Multi-Operator QRO – Fixed Station, above 10W
Rover Stations – Travel to different operating locations

III. Exchange and Contact Logging

1. Each logged contact will consist of an exchange of callsigns and grid squares.

2. Each log entry will include the UTC date, UTC time, band, mode, callsign, and grid square. (*Note:* Even though the activity period is based on local time, the logging must be UTC.) *You must start a new log for every 6-hour period, beginning at 6:00 PM Friday.*

IV. Scoring

Each 6 hour period is scored separately. Within each period, score each contact as follows:1 point for each contact below 200 MHz; 2 points for each contact between 200 and 500 MHz; 3 points for each contact between 500 and 1300 MHz; 4 points for each contact above 1300 MHz.

Note: This mirrors the standard values used for ARRL VHF Sweepstakes and QSO Parties and is automatically logged with these scores by all popular logging programs.

In the case of cross-band contacts, such as those via satellite or ATV repeaters, base your contact points on the band on which you are transmitting (thus, an ATV contact on a repeater with a 1270 MHz input and a 421 MHz output would count for 3 points).

Next, list the number of grids worked on each band during that period and add them up. If you work 10 grids on 144 MHz and 5 grids on 432 MHz during one period, you'll have a total of 15 grids for that period. Multiply the number of contact points times the number of grids worked in each period to arrive at your total score for that period.

Sample Log Entry Summary

2000 CQ Spring VHF Weak-Signal Weekend — Period 1
Callsign: WA3PZO
Call District or DXCC Country: W3
Grid: FN20

Band	Contacts	Points	Grids
144	10	10	10
432	5	10	5
Total 1	15	20	15

Period Total (20 × 15) = 300 points

2000 CQ Spring VHF Weak-Signal Weekend — Period 4
Callsign: WA3PZO
Call District or DXCC Country: W3
Grid: FN20

Band	Contacts	Points	Grids
144	8	8	6
432	7	14	3
Total 4	15	22	9

Period Total (22 × 9) = 198 points

2000 CQ Spring VHF Weak-Signal Weekend — Overall Score
Callsign: WA3PZO
Call District or DXCC Country: Grid: FN20

Band	Contacts	Points	Grids
144	18	18	16
432	12	24	8
Total	29	42	24

Final Score (42 × 24) = 1008 points

On the Cover:

It's February, so it must be time to work on the antennas! Warren "Rev" Morton, WS7W, adjusts one of his 160 meter Beverage receiving antennas at "the goat farm," a 160 acre plot of land 10 miles north of Casper, Wyoming that he and John Hall, W7CA, lease for the sole purpose of putting a whopping signal on the air on "top band." There's no farm there, notes Warren, and no goats, either. What they do have are antelope in large numbers. In any event, the antenna farm on the goat farm consists of five 1100 foot Beverages—one each aimed northwest, northeast, due east, southeast, and southwest—all fed into a switching network (where Warren is standing) so the operators can easily select the best antenna for any given contact. Their transmit antenna is a 140 foot vertical over a ground plane of 2500 radials. It was originally a beacon tower for a B-52 training base during WW II.

There's a Ten-Tec Titan 1500 watt amplifier that "lives" in the shack there, but Warren and John bring their rigs with them each time they come to operate. Warren has a Yaesu FT-1000D; John an FT-1000MP. They also bring a portable heater in cold weather, such as the day this photo was taken, when the temperature was –10° F and photographer Larry Mulvehill's camera froze after taking just a few shots!

So how does this 160 meter superstation perform? Well, Warren says he's worked all continents on the band (with Europe being the most difficult from that location), and that John is very close to finishing his top-band DXCC. So if you operate 160 and wonder why WS7W or W7CA sounds *so* loud, now you know!

(Cover photo by Larry Mulvehill, WB2ZPI)

After the contest, add together the total number of contact points from each 6 hour period, and add up the total number of grids worked in each period. Now multiply the grand total of contact points by the grand total of grids to arrive at your overall final score. Each log submitted must include separate logs and summaries for each 6 hour period as well as an overall score summary sheet.

V. Miscellaneous Rules

Single operator and Rover stations are encouraged to stimulate activity on the bands by any reasonable means, including the use of repeaters, packet clusters, the Internet, e-mail, telephones, and smoke signals to coordinate contacts.

All stations, including single operator stations, are encouraged to stimulate interest in amateur radio by allowing non-amateurs to participate as operators and/or loggers (provided a licensed control operator is present at all times).

QRP stations may not have more than 10 watts of power going from the transmitter into the feedline.

Rovers must start their 6 hour periods using the local time of their starting location, and must operate from a minimum of two grid squares during each weekend. Scoring for Rovers is the same as for other categories, except that Rovers may rework stations during the same 6 hour period if they have moved to a new grid square.

VI. Participant Recognition

Each weekend is a separate operating activity and the results of each will be listed separately in *CQ*.

Scores for each weekend will be organized by US/Canadian call district and DXCC country; and will be listed by station category and number of periods worked. If there is significant interest, high scores for single bands and/or a single 6 hour period may also be listed.

Presentation of plaques, certificates, etc., will be at the discretion of *CQ* and will be determined on the basis of participation. Initial plans are to award a plaque to the top overall scorer in each station category for each activity weekend. The Holmesburg Amateur Radio Club is sponsoring a plaque for the top scorer in the FM weekend. Additional plaque sponsorships are solicited. Decisions of *CQ* and the contest administrators are final.

VII. Disqualification

If you lie, cheat, and/or steal, and we catch you, you will be disqualified and subject to the non-publication of your entries for the next year. Remember: This is for fun, not for profit!

VIII. Log Submissions

Logs may be submitted electronically (recommended) or on paper, along with photos and/or soapbox comments. Electronic logs may be e-mailed to **weekend@cq-amateur-radio.com**; or may be mailed on 3$^1/_2$ inch IBM-formatted diskette, along with a paper copy. Paper logs and diskettes may be mailed to *CQ* Spring VHF Activity Weekends, 25 Newbridge Road, Hicksville, NY 11801. Logs must be postmarked no later than 30 days after the final day of the activity for which they are submitted (FM: April 19; Weak-Signal: May 30; Specialty: June 21). *CQ* is not responsible for logs lost in the mail or in e-mail, or the late delivery of which makes it impossible to include them in the overall scoring. ■

MFJ Contest Voice Keyer

Brand New design . . . Microprocessor controlled

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . Can be computer-controlled by CT, NA, etc . . . Records received audio . . .

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" and more! Contest by pressing a few buttons and save your voice.

You can record and play back five natural sounding messages in a total of 75 seconds. EEPROM technology keeps messages stored for up to 100 years -- no battery backup needed.

Repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes calling CQ so easy and it's also a great voice beacon.

A receive audio jack lets you record and play back off-the-air signals -- great help if you didn't get it right the first time! No more *"Please repeat"*.

A playing message can be halted by pressing the *Stop Button*, your PTT mic button or by your

VOX PTT line. A closure to ground via remote control or computer can also halt messages.

MFJ-434
$179.95 plus s&h

Has jack for remote or computer control (using CT, NA or other program and its interface). Lets you select, play and cancel messages.

The MFJ-434 is transparent to your microphone -- your mic's audio characteristics do not change when your MFJ-434 is installed. Dual controls make it easy to tailor audio level to match your voice.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

It's easy to use -- just plug in your 8 pin microphone cable and plug the MFJ-434 shielded cable into your transceiver's mic connector. Internal jumpers let you customize it to Kenwood, Icom, Yaesu, Alinco or Radio Shack rigs. Use your station or built-in microphone for recording.

Built-in speaker-amplifier lets you monitor stored messages. 3.5 mm speaker/headphone jack. SMT technology. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312B, $14.95. 6½Wx2½Hx6½D inches.

MFJ-73, $29.95. Remote Control Head with cable for MFJ-434.

MFJ *Professional grade* Boom Mic Headphones

For marathon contesting, DXing, traffic nets, ragchewing . . . These lightweight, fully padded Boom Mic Headphones make operating superbly comfortable! Flexible gooseneck microphone boom and speech frequency tailored microphone cuts through noise and QRM!

This *professional grade* MFJ Boom-Mic Headphones set is designed for contesting, DXing and traffic nets. Features *total comfort* design with leatherette padding for operating long hours.

Superb 3/4 inch thick padding on each ear and headband lets you wear your headset all day long! So super lightweight, you won't even know they're there! Headband adjusts for a perfect fit to keep out external noise.

The headphones' frequency response is enhnanced for communications to bring out speech fidelity that you never knew existed. Signals never sounded so crystal clear.

The flexible microphone boom lets you position the mic comfortably at an optimum distance to minimize silibant sounds.

MFJ's frequency tailored microphone element lets you bust through noise and QRM!

NEW!
Total Comfort!
MFJ-396
$79.95
plus $6 s&h

Extra-long 9½ feet of cable lets you move about your ham shack!

Has standard 1/4 inch jack for headphones and 3.5 mm jack for microphone. Build your own adaptor or use MFJ's pre-wired adaptors to match your transceiver. **Order** MFJ-5396 Y/K/I (YAESU, KENWOOD, ICOM respectively). $15.95 each.

Even casual operators will appreciate the advantages of MFJ's superbly crafted Boom-Mic headphones for *hands-free* operating at an incredibly low price.

MFJ-392, $19.95. Communication Headphones only. Great for ham radio, shortwave listening -- all modes, SSB/FM/AM/ Data/CW.

Each phone has individual volume and speech enhancement control. Superb leatherette padding.

Both MFJ-392 and MFJ-396 have MFJ *No Matter What*™ one year limited warranty.

MFJ Communications Speaker

MFJ-281
$12.95
Ship Code A

SSB, FM, AM, and CW never sounded so crystal clear! Plug in this MFJ-281 *ClearTone*™ speaker and bring out communication speech fidelity that you never knew existed. Restores the smooth sinewave sound that CW naturally generates and makes copying easier. It was carefully designed to improve intelligibility of speech in the frequency range of 600 to 4000 Hz while reducing undesirable noise, static and hum. A top grade 3" Mylar cone speaker is mounted in a well designed baffle. Its fine mesh metal grille allows sound to radiate without muffling. 8 Watts, 8 Ohms. Six foot cord. 3.5 mm mono plug. 3¼x3x2¼ inches.

MFJ 12/24 Hour DXers Watch

MFJ-181
$39.95
plus $6 s&h

This *MFJ DXers Watch* lets you quickly check 12 hour local time and 24 hour time in time zones around the world. By noting day and night areas around its rotatable bezel, you can estimate which bands are open each hour to different parts of the world. You can even estimate best times of gray line propagation. It features a highly accurate *Japanese* quartz movement. Turn out the lights . . . *NiteGlo*™ hour, minute and second hands show up in the dark! Has date display. Well-known world cities encircle it's attractive world map face to indicate time zones. A durable stainless steel band adjusts to fit. Attractive giftbox has felt padding. A great gift!!!

MFJ 12/24 Hour LCD Clock

MFJ-108B
$19.95
plus $6 s&h

Dual Clock with separate 24 hour UTC and 12 hour local time displays. Large 5/8 inch LCD numerals, heavy brushed aluminum frame, sloped face, battery included. Synchronizable to WWV. 4½x1x2 in.

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

Prices and specifications subject to change. (c) 2000 MFJ Enterprises, Inc.

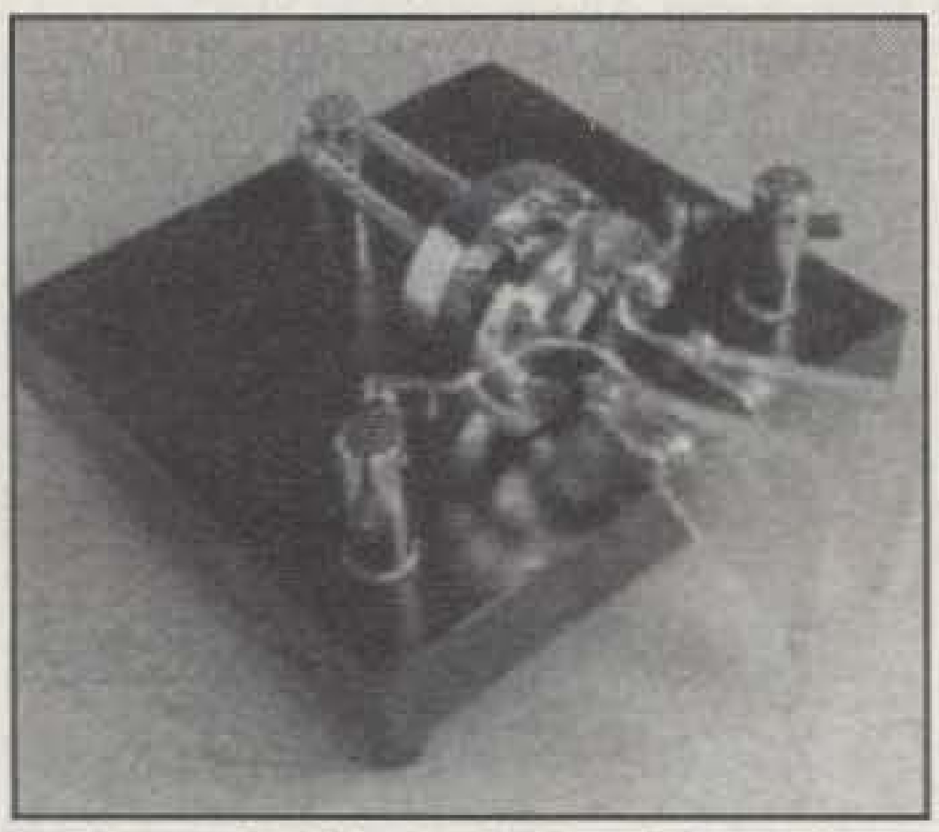
CIRCLE 80 ON READER SERVICE CARD

CQ Showcase

Quadriom TA-1 Dual Paddle Available from Morse Express

The Quadriom TA-1, made by Quadriom Company in China, is available through Morse Express. This heavy-duty dual paddle uses a cantilever design with steel needle bearings and nylon bearing seats. Contact spacing is adjusted by ordinary slotted-head screws held in place by set screws so that once proper adjustment is achieved it can be locked in tight. There are no markings on the paddle itself.

The TA-1 paddles are "Factory surplus," packed in individual Styrofoam packages, some of which have serial numbers on them. (In some cases the Styrofoam has deteriorated, but the paddles are in perfect working order.) The paddles weigh 2¼ lbs., and the machined steel base measures 3¾"× 4". Supplies are limited. The paddle is priced at $79.95.



For more information, contact Morse Express, phone 303-752-3382, check their web site at <www.MorseX.com>, or to order call 800-238-8205.

PRYME PMC-100 Desk Microphone

The PRYME PMC-100 desk microphone by Premier Communications features an electret microphone element on a flexible metal gooseneck for desktop use. Also featured are channel Up/Down controls, an on-the-air LED indicator, and both momentary and locking Push-To-Talk keys. The microphone is powered by two AA batteries (not included). An audio gain control is included on the mic for correctly matching the output of the mic to the radio. Select either FM mode for increased voice clarity or SSB mode for an extra "punch" when contesting.

The PMC-100 is sold without microphone cable. However, six different optional cables are available: for ICOM 8-pin radios, ICOM modular radios (RJ-45 style plug), Kenwood 8-pin radios (including compatible ADI and Alinco models), Kenwood modular radios (RJ-45 style plug), Yaesu 8-pin radios, and Yaesu modular radios (RJ-45 style plug).

For more information contact Premier Communications Corp.,480 Apollo St. #E, Brea, CA 92821 (phone 714-257-0300; fax 714-257-0600; web: <http:/ www.adi-radio.com; e-mail: <premier@ adi-radio.com>), or circle number 101 on the reader service card.

ATV Transceiver from P.C. Electronics

The new TC70-20 70 cm ATV Transceiver from P.C. Electronics puts out twice the power of their previous model. Typical peak envelope power RF output is 22 to 28 watts using a new power module. The power level, using 14 dBd or greater gain beams, is capable of sending snow-free, full-motion color video and audio to another ham over 100 miles away if line of sight. For the DXer, the power output is adjustable down to as low as 2 watts to enable proper drive setup to a linear amplifier. The transceiver contains a GaAsFET downconverter that tunes the whole 420 to 450 MHz band down to TV channel 2, 3, or 4 for reception. ATV is AM on the 70 cm band and uses the same standards as broadcast TV, so a regular TV set is all that is required to receive.

For transmitting the TC70-20 comes with one crystal which can be customer specified from the common frequencies of 439.25, 434.0, 427.25, or 426.25 MHz. A second channel can be ordered for $20 additional and is selected by the front-panel switch. Video and line-level audio can be plugged in from a camcorder, camera, or VCR. A separate low-impedance mic input is also provided to allow voice-over descriptions when showing home video tapes or a directional mic to cut down noise is used at large gatherings such as club meetings. There is a monitor output jack on the back which has the camera video present in receive and detected video output taken at the N connector antenna output jack.

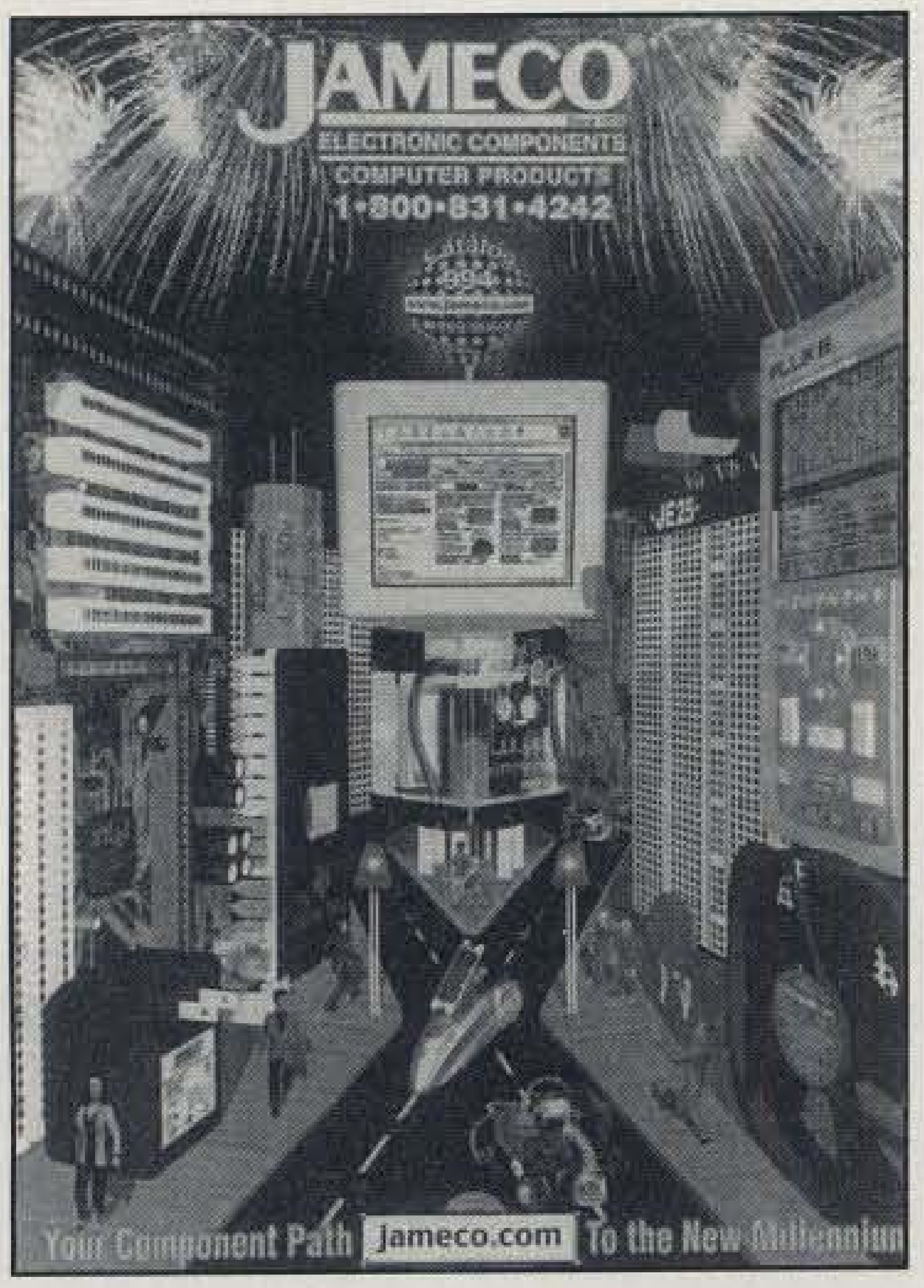
The TC70-20 is packaged in a rugged die-cast aluminum box measuring 7.5" × 7.5" × 2.7". Price is $529. For more information, contact P.C. Electronics, 2522 Paxson Lane, Arcadia, CA 91007 (626-447-4565; web: <http://www.hamtv.com>; e-mail: <tom@hamtv.com>), or circle number 102 on the reader service card.

MFJ-281 *ClearTone™* Communications Speaker

The new *ClearTone™* speaker was designed to improve the intelligibility of speech in the frequency range of 600 to 4000 Hz while reducing undesirable noise, static, and hum. The speaker also restores the smooth sound of sine waves that CW naturally generates and makes it easier to copy. A top-grade 3 inch Mylar cone speaker is mounted in a speaker baffle. A fine-mesh grille allows sound to radiate without being muffled. A swivel mounting bracket lets you direct the sound where you want it.

The speaker will handle 8 watts, 8 ohms, and it comes with a 6 ft. cord and 3.5 mm mono plug. It measures 3¾" × 3" × 2¼".

The MFJ-281 *ClearTone™* speaker is covered by MFJ's "No Matter What" one-year unconditional warranty; MFJ will repair or replace (at their option) the unit for one complete year. For more information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762 (phone 601-323-6551; fax 601-323-6551), or circle number 103 on the reader service card.



Jameco Electronics Components Catalog

Jameco Electronics has announced their new catalog, "Your Component Path to the New Millennium." The 150-page catalog features thousands of ICs, components, tools, test equipment, and computer products for OEMs, engineers, educators, and service/repair technicians. More than 190 new products have been added, including a new line of power supplies and converters by Volgen and Atmel ICs. Thee company also has extended their lines of data acquisition products by ComputerBoards, motors, USB products, Parallax basic controllers, SX chips, and more.

You can log onto <www.jameco.com> to check out the on-line catalog and Virtual Spec Room. For a free copy of the new catalog, call 1-800-831-4242, fax 1-800-237-6948, or e-mail: <info@jameco.com>, or circle number 105 on the reader service card.

If you want the benefits of multiple monoband Yagis, but don't have the real estate for multiple towers, try ON4ANT's innovative approach.

A Multiband Monoband Yagi

Design and Construction

BY JOHAN VAN DE VELDE,* ON4ANT

Many experienced DXers believe that the monoband Yagi is by far the best antenna choice. However, most hams do not have the room to put up several towers for all the different monobanders. The average ham chooses a trapped multi-band Yagi. This antenna type allows him to be active on a number of bands, but it has some drawbacks as well, which include loss of SWR bandwidth, antenna gain, and F/B (front-to-back)ratio.

Over the past years a number of commercial interlaced designs have been available. These designs often put two bands on a single boom. The interlaced Yagis often produce good results and can be an excellent replacement for trapped Yagis. (The W4RNL web site has an interesting article about these interlaced Yagis.[1])

Struggling to get a number of bands with good SWR bandwidth and gain on a single boom made me decide to develop the antenna described here. The basic principle is to put a number of monoband Yagis on the same boom, one in front of the other, with several elements doing "double duty" on multiple bands. The antenna covers the 20–10 meter bands.

The first conclusion is that the boom length increases rapidly, especially if you want to cover 20 to 10 meters. The boom length was limited to 15 meters with an option to shorten the boom to 12.8 meters. This should allow most of you to reproduce the design. Those who have plenty of room can go for the long design 18.3 meter (60 ft.) boom.

The electrical design can be found in Part 1 below. Full details of element lengths and spacing are given. The feedpoint impedance, free-space gain, and SWR bandwidths are also given. Two modified designs are described as well. The design was done with the help of several antenna design programs, specifically AO, YO, EZNEC/4, STRESS, and YAGI DESIGN.[2]

Part 2 gives mechanical details, including the tapering detail, wind survival, and total wind load.

Part 1

The basic calculation has been done for an antenna in free space and the reference antenna is an isotropic radiator (a theoretical antenna that radiates equally in all directions). All values are in dBi (decibels over isotropic); 0 dBd (decibels over a dipole) = 2.15 dBi. We don't take into account the influence of the earth ground gain. If you take into account the ground gain (as most manufacturers do), the gain figures will be 4–5 dB higher. However, this in influenced by the antenna height. The setup above real ground will change the radiation pattern.

*Rezedastr 5, B-1770 Liedekerke, Belgium
e-mail: <on4ant@hotmail.com>

The following table gives the element length for a constant diameter (20 mm) and the element spacing indicated.

Element length (m)	Description				Position (m)
5.45	Reflector	20			0.00
5.2	Driver	20			2.00
4.9	Director	20			3.60
4.15	Reflector	17	and director	20	5.25
4.02	Driver	17			6.20
3.8	Reflector	15	and director	17	7.20
3.395	Driver	15			8.40
3.02	Director	15	and reflector	12	9.50
2.91	Driver	12			10.30
2.78	Reflector	10	and director	12	11.60
2.55	Driver	10			12.45
2.355	Director	10			13.40
2.265	Director	10			15.00

What can you expect from this antenna? Gain is comparable to a 3–4-element monobander, with excellent SWR bandwidth and F/B. The specifics are shown below.

Antenna Specifications

Freq.	Gain (dBi)	Impedance	F/B	SWR
14.000	8.1	33.0–j4.1	26.8	1.26
14.175	8.2	30.9+j3.0	29.1	1.00
14.350	8.3	26.0+j12.2	25.9	1.44
18.068	8.1	20.9–j3.6	21.5	1.10
18.118	8.6	22.3–j2.3	22.3	1.00
18.168	8.6	23.5–j1.2	23.2	1.07
21.000	8.4	32.4–j7.8	21.1	1.27
21.200	8.5	34.2+j0.5	21.0	1.00
21.400	8.6	35.7+j8.1	20.9	1.25
24.880	8.5	10.7–j3.6	30.6	1.19
24.940	8.5	10.8–j1.7	30.6	1.00
24.990	8.5	10.8+j0.1	28.0	1.19
28.000	7.9	26.0–j7.2	29.7	1.47
28.350	8.1	26.9+j3.1	25.7	1.00
28.700	8.2	27.6+j13.9	22.6	1.48

This design has an almost constant gain over the five bands. The SWR bandwidth is excellent over the entire range with the exception of 10 meters; here it is limited to 28.8 MHz. Of course, this SWR is in reference to the matching frequency. I'm sure that things still can be improved, but this may have a negative influence on SWR bandwidth and/or F/B. Another disadvantage of getting the last .5 dB out of the design is that you will make the design more critical and less tolerant of small dimension errors (such as element lengths and spacing).

If you really want more gain, go for the longer design on the 18 meter boom. You will get the same bandwidth and F/B (or even better) with higher gain.

Variation 1

Is a 15 meter boom too big for you? Perhaps this 12.8 m antenna is the solution. There will be one less element on 20 meters. The gain will drop to about 7 dBi, which is still good.

Element length (m)	Description				Position (m)
5.45	Reflector	20			0.00
5.2	Driver	20			2.00
4.15	Reflector	17	and director	20	3.05
4.02	Driver	17			4.00
3.8	Reflector	15	and director	17	5.00
3.395	Driver	15			6.20
3.02	Director	15	and reflector	12	7.30
2.91	Driver	12			8.10
2.78	Reflector	10	and director	12	9.40
2.55	Driver	10			10.25
2.355	Director	10			11.20
2.265	Director	10			12.80

Only 20 meters changes; the other gain figures remain.

Antenna Specifications

Frequency	Gain (dBi)	Impedance	F/B	SWR
14.000	7.2	33.5-j11.6	16.0	1.40
14.175	7.1	39.8-j0.9	29.1	1.00
14.350	7.0	45.3+j9.0	14.3	1.30

Variation 2

Do you have plenty of room? This 18.3 meter monster is the solution. It gives you higher gain on the top three bands with an excellent bandwidth.

Element length (m)	Description				Position (m)
5.45	Reflector	20			0.00
5.2	Driver	20			2.00
4.9	Director	20			3.60
4.15	Reflector	17	and director	20	5.25
4.02	Driver	17			6.40
3.8	Reflector	15	and director	17	7.20
3.395	Driver	15			8.40
3.02	Director	15	and reflector	12	9.50
2.91	Driver	12			10.80
2.68	Reflector	10	and director	12	12.00
2.55	Driver	10			13.014
2.47	Director	10			13.816
2.44	Director	10			15.775
2.31	Director	10			18.25

Antenna Specifications

Frequency	Gain (dBi)	F/B
14.175	8.3	34
18.118	8.3	21
21.200	8.7	23
24.940	9.6	38
28.350	10.0	29

This design is at my home QTH. The calculated specifications seem to be corresponding very well with the on-the-air performance. Initial testing shows an advantage as compared to a very large commercial multiband Yagi.

Part 2

Feeding the antenna. The driven elements are all resonated in band. The actual impedance of the antenna is high enough to allow different kinds of feeding. Personally, I use a gamma match; the elements don't need to be spliced in this case.

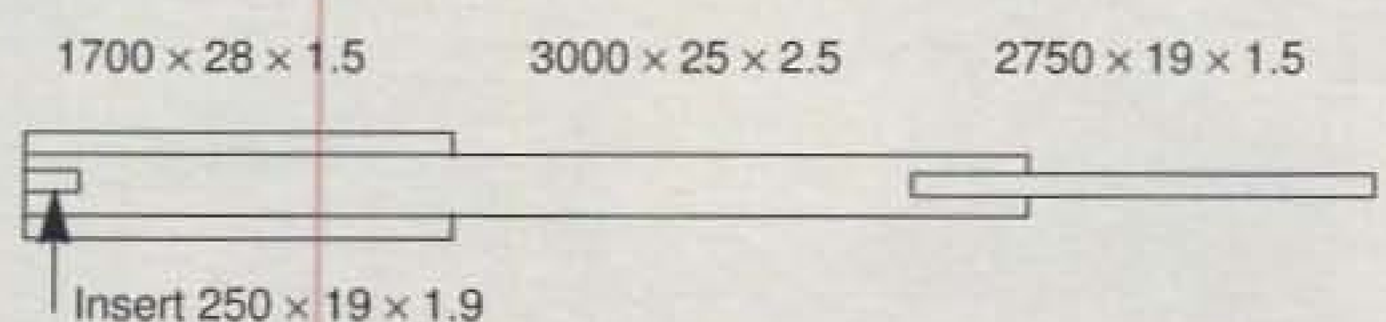
Element mounting. You can choose isolated or non-isolated element mounting. The boom influence on the element length is minimal. The use of isolated elements can be a disadvantage if you want to use your tower as a top-loaded vertical on 160 meters. The boom-element plate measures 200 × 100 mm. If you wish to mount the elements non-isolated, you can calculate the influence of the boom on the element lengths with YAGI DESIGN. The calculated influence is only a few millimeters for the 20 meter element. As this design is not critical, one can use the isolated element lengths.

Element tapering. Each element has to be as strong as possible for minimal windload and weight, so we use tapering. Most of the available antenna-design software programs allow you to calculate the taper. Only a few allow you to calculate the element strength. Initially, I used STRESS, the software used by the former Telex/Hy-Gain company. Afterwards I used a Belgian product, YAGI-DESIGN, by ON4UN. This package allows you to calculate in all circumstances the taper of an element that complies with a wind survival rating. This for the lowest possible weight and windload. The element sag can also be calculated. The calculated minimal wind survival is 160 km/h (100 mph). The antenna here is mounted on an 80 ft. tower on top of a 300 ft. hill.

Parameters: EIA-222-C pressure 30 lb./sq. ft. at 86 mph
Shape factor .666
No ice-load
Aluminum 6061-T6 (yield strength 35000)

The following information gives element diameter, wall thickness, length, and half-element weight and length. The elements will be adjusted with the tip end. Some of these elements are telescopic on the inside. All of the 20 meter elements consist of three diameters.

Element 1-2-3

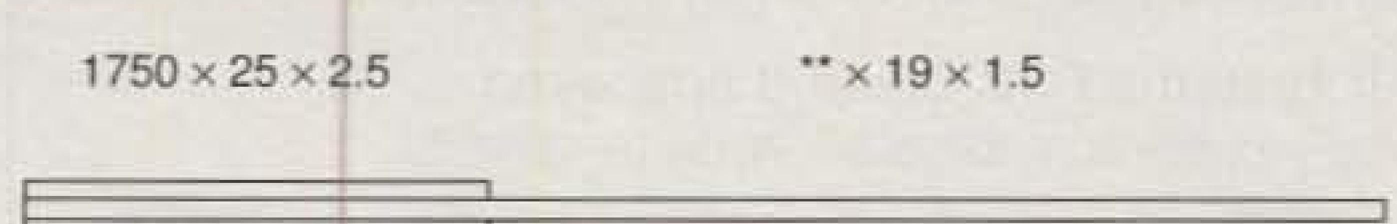


The wind load of this half element is 0.13 m^2.
The weight of this half element is 2.6 kg.
Element sag is 20.5 cm.
The tip will be adjusted.

Tip length (100 mm overlap)

	Isolated	Non-isolated
Element 1:	2567 mm	2570 mm
Element 2:	2309 mm	2312 mm
Element 3:	1998 mm	2000 mm

Element 4-5-6



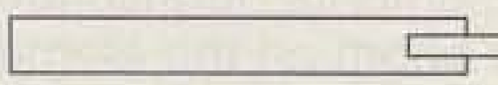
The wind load of this half element is 0.084 m^2.
The weight of this half element is 1.85 kg.
Element sag is 8.4 cm.
The tip will be adjusted.

Total element length

	Isolated	Non-isolated
Element 4:	4222 mm	4224 mm
Element 5:	4053 mm	4056 mm
Element 6:	3852 mm	3854 mm

Element 7-8-9

1500 × 25 × 2.5 **** × 19 × 1.5



The wind load of this half element is 0.074 m^2.
The weight of this half element is 1.2 kg.
Element sag is 6 cm.
The tip will be adjusted.

Total element length (100 mm overlap)

Element 7:	3450 mm
Element 8:	3082 mm
Element 9:	2957 mm

Element 10-11-12-13

750 × 25 × 2.5 ** × 19 × 1.5

The wind load of this half element is 0.059 m^2.
The weight of this half element is 1.1 kg.
Element sag is 3.5 cm.
The tip will be adjusted.

Total element length (100 mm overlap)

Element 10:	2845 mm
Element 11:	2583 mm
Element 12:	2364 mm
Element 13:	2264 mm

Wind load and weight of elements. 44.55 kg and a 2.20 m^2 windload. If you choose variation 1, you will have 0.26 m^2 less wind load and will gain about 5.2 kg. The actual weight of the antenna is a function of the chosen boom diameter, the mounting plates and all related hardware. My antenna uses a 4 inch boom and the weight is around 60 kg.

Part 3

Is it all worth the trouble? Looking at the actual cost, *yes*. The price should be below $800 (U.S.) for the 60 ft. design. The design is non-critical and can easily be reproduced. The gain is excellent, and you will have a big signal on the bands. However, an antenna this size requires a strong tower and big rotator. If you have the tower and rotator for it, it is an excellent choice.

Conclusion

This design is a valuable alternative to a 4-element monoband Yagi, taking into account the gain and SWR bandwidth. It is obvious that some improvements can be made, depending on your specific needs. Perhaps you need less bandwidth. I tried to have a broadband Yagi with gain figures close to or better than the common 4-element commercial monoband Yagis.

The real gain, with associated radiation angle, is given below.

14.150	13.55 dBi @12°
18.118	13.64 dBi @10°
21.200	13.74 dBi @ 8°
24.940	14.20 dBi @ 7°
28.400	13.77 dBi @ 6°

If you wish more information on this design, or want to share some of your antenna experiences, you can e-mail me <on4ant@hotmail.com>.

References

1. A comparison of this design made by W4RNL with EZNEC4 shows very similar results to those obtained with AO. The W4RNL site <http://web.utk.edu/~cebik/radio.html> contains a great deal of valuable antenna information and is worthwhile visiting. My sincere thanks to L. B. Cebik, W4RNL, for the verification of this design and the information available on his website.

2. AO and YO were written by K6STI. YAGI DESIGN was written by ON4UN and covers all mechanical issues of antennas. It's a DOS-based program, and is extremely easy to use. I wish to thank John for his help as well. Those wishing to obtain this program can contact John, ON4UN. STRESS software was originally used by Telex/Hy-Gain. ■

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 ot just an antenna tuner . . . it's a eautifully crafted work of art, using e finest components available and e highest quality construction.

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

The attractive two-color Lexan front panel is ratch-proof. Take a quarter. Scratch the HFT-i00 front panel as much as you want. You won't ave a mark!

Arc-Free Operation

Two heavy duty 4.5 kV transmitting variable pacitors and a massive high current roller ductor gives you arc-free operation up to 2 kW EP 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

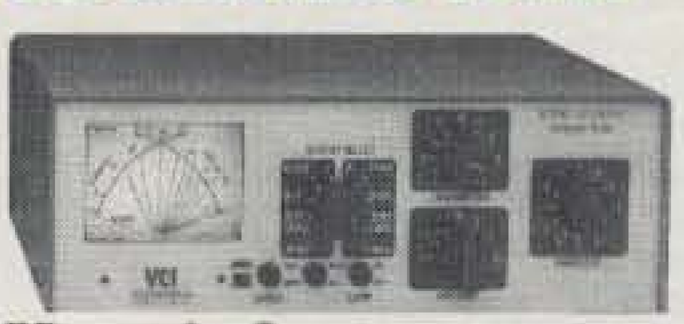
A 4:1 Ruthroff voltage balun feeds dual high voltage Delrin terminal posts for balanced lines. HFT-1500 is 5.5x12.5x12 inches. Has *VECTRONICS'* splendid one year limited warranty.

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 ailable to build the highest quality 300 Watt tenna tuner ever made.

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

8 position antenna switch, built-in 50 Ohm mmy load, peak reading backlit cross-needle WR Power meter, 4:1 balun for balanced line tenna. Scratch-proof Lexan front panel.).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.

VECTRONICS®

. . . the finest amateur radio products made!

VECTRONICS 300 Industrial Pk, Starkville, MS 39759 USA **VOICE:** (662) 323-5800 **FAX:** (662) 323-6551 **WEB:** *http://wwwvectronics.com*

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

Ready for a break from chasing DX on the amateur bands? Here's a look at shortwave listening—DXing the world on the HF bands—from the radio amateur's standpoint.

Shortwave DXing for Hams–Part I

BY KARL T. THURBER, Jr.,* W8FX

Do you need a break from the rigors of chasing DX and participating in the latest ARRL or CQ-sponsored contest or operating event? If so, you may want to simply "sit back and smell the roses," to borrow an old cliché, and passively tune the shortwave (SW) broadcast (BC) bands. You may find a world of low-stress enjoyment in shortwave radio listening (SWLing) while you recharge your psychic batteries.

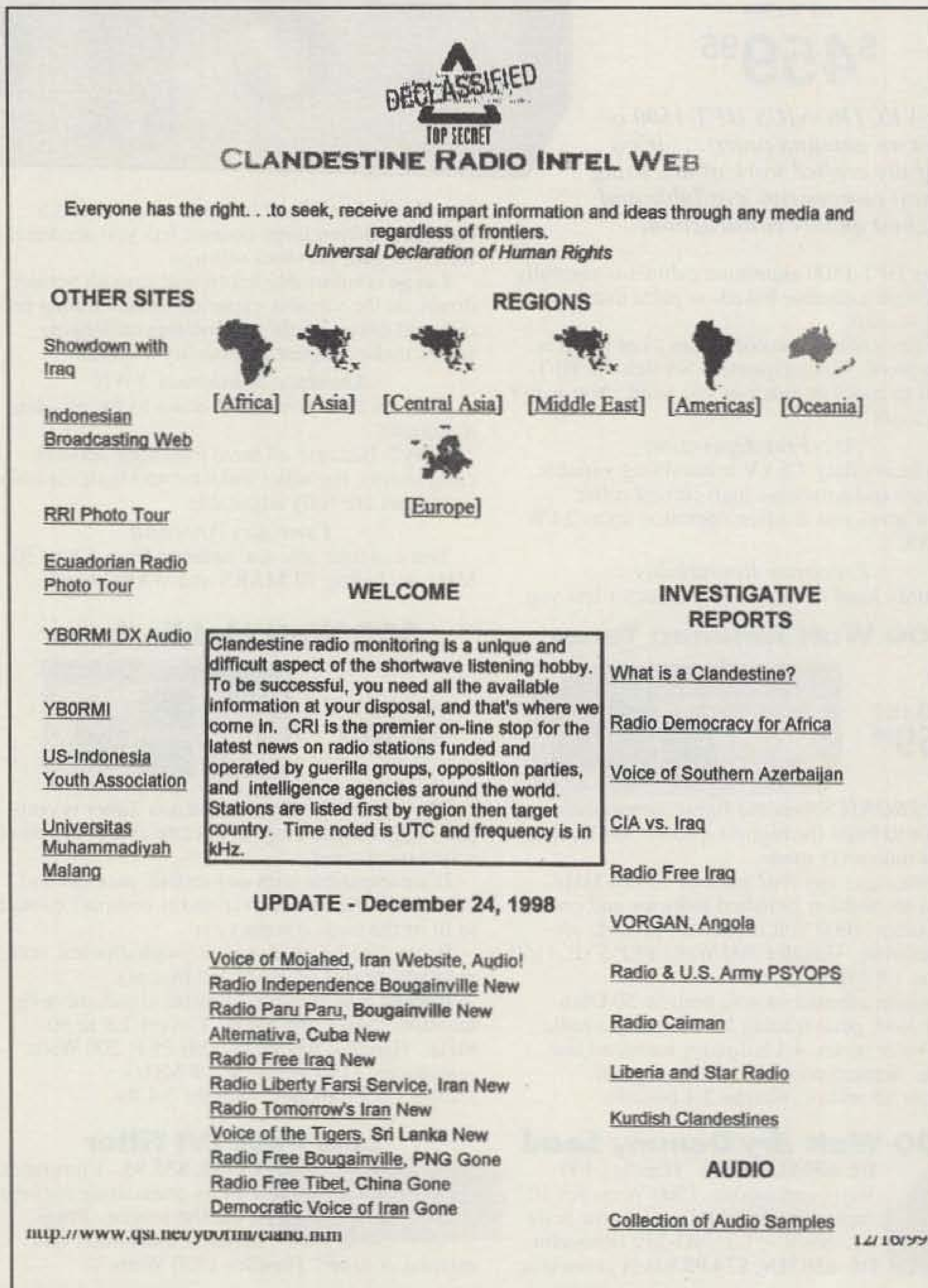
This two-part article presents some of the myriad attractions of the radio listening hobby for radio amateurs. Part I tells you why you might want to listen to shortwave radio in this high-tech era, and what SW broadcasting is all about. In Part II we'll examine receivers and antennas for long-distance (DX) reception, HF radio propagation fundamentals and prediction, and identifying and reporting what you hear. Various Internet-based resources are also included, such as showing how to use the Net to improve your SW DXing enjoyment. Before we examine all this, let's first ground ourselves in what the electromagnetic (EM) spectrum is all about.

The EM Spectrum

As radio amateurs, most of us are well aware of the EM spectrum. But to refresh our memories, and to place the SW bands into perspective, let's begin by defining terms.

The EM spectrum is the total array of radiant energies, classified by wavelength or frequency, from the longest radio waves to the very shortest gamma and cosmic rays. The total usable radio and microwave spectrum extends from a few Hertz (Hz) to 300+ gigahertz (GHz).

In radio's basement, you'll find the *ultra low frequencies* (ULF), from essentially 0 Hz to 3 Hz. Above ULF lie the


DECLASSIFIED
TOP SECRET
CLANDESTINE RADIO INTEL WEB

Everyone has the right. . .to seek, receive and impart information and ideas through any media and regardless of frontiers.
Universal Declaration of Human Rights

OTHER SITES

Showdown with Iraq
Indonesian Broadcasting Web
RRI Photo Tour
Ecuadorian Radio Photo Tour
YB0RMI DX Audio
YB0RMI
US-Indonesia Youth Association
Universitas Muhammadiyah Malang

REGIONS

[Africa] [Asia] [Central Asia] [Middle East] [Americas] [Oceania]
[Europe]

WELCOME

Clandestine radio monitoring is a unique and difficult aspect of the shortwave listening hobby. To be successful, you need all the available information at your disposal, and that's where we come in. CRI is the premier on-line stop for the latest news on radio stations funded and operated by guerilla groups, opposition parties, and intelligence agencies around the world. Stations are listed first by region then target country. Time noted is UTC and frequency is in kHz.

UPDATE - December 24, 1998

Voice of Mojahed, Iran Website, Audio!
Radio Independence Bougainville New
Radio Paru Paru, Bougainville New
Alternativa, Cuba New
Radio Free Iraq New
Radio Liberty Farsi Service, Iran New
Radio Tomorrow's Iran New
Voice of the Tigers, Sri Lanka New
Radio Free Bougainville, PNG Gone
Radio Free Tibet, China Gone
Democratic Voice of Iran Gone

INVESTIGATIVE REPORTS

What is a Clandestine?
Radio Democracy for Africa
Voice of Southern Azerbaijan
CIA vs. Iraq
Radio Free Iraq
VORGAN, Angola
Radio & U.S. Army PSYOPS
Radio Caiman
Liberia and Star Radio
Kurdish Clandestines

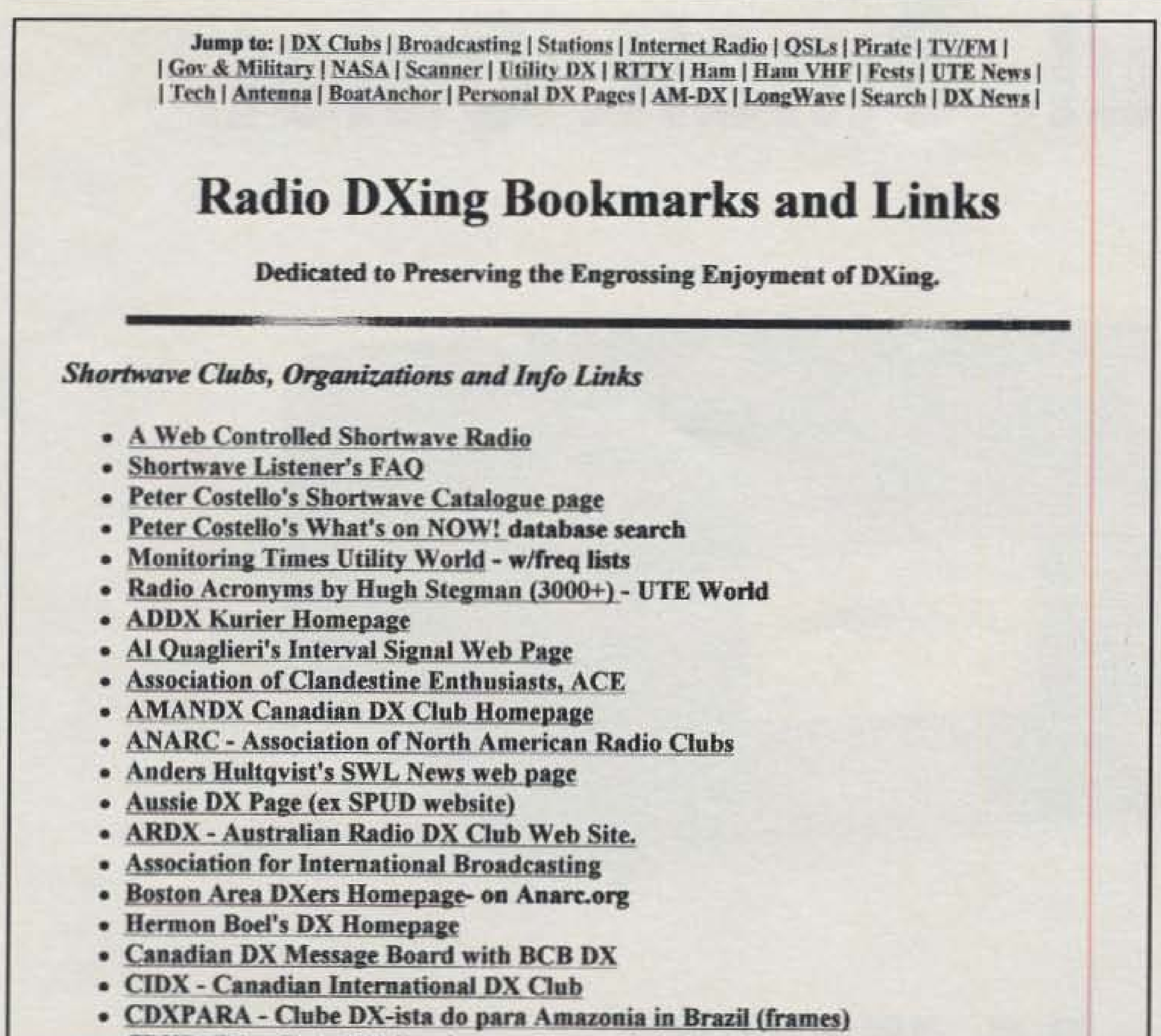
AUDIO

Collection of Audio Samples

http://www.qsl.net/yb0rmi/cland.htm
12/16/99

Fig. 1– Clandestines usually are ideologically- or politically-motivated broadcasters, often supported by a covert government operation. Here's a portion of the Clandestine Radio Intel (CRI) Website, at <http://www.qsl.net/yb0rmi/cland.htm>. The site is devoted to clandestine radio monitoring aspects of the SWL hobby.

*289 Poplar Dr., Millbrook, AL 36054-1674
e-mail: <w8fx@cq-amateur-radio.com>



Jump to: | DX Clubs | Broadcasting | Stations | Internet Radio | QSLs | Pirate | TV/FM | | Gov & Military | NASA | Scanner | Utility DX | RTTY | Ham | Ham VHF | Fests | UTE News | | Tech | Antenna | BoatAnchor | Personal DX Pages | AM-DX | LongWave | Search | DX News |

Radio DXing Bookmarks and Links

Dedicated to Preserving the Engrossing Enjoyment of DXing.

Shortwave Clubs, Organizations and Info Links

- A Web Controlled Shortwave Radio
- Shortwave Listener's FAQ
- Peter Costello's Shortwave Catalogue page
- Peter Costello's What's on NOW! database search
- Monitoring Times Utility World - w/freq lists
- Radio Acronyms by Hugh Stegman (3000+) - UTE World
- ADDX Kurier Homepage
- Al Quaglieri's Interval Signal Web Page
- Association of Clandestine Enthusiasts, ACE
- AMANDX Canadian DX Club Homepage
- ANARC - Association of North American Radio Clubs
- Anders Hultqvist's SWL News web page
- Aussie DX Page (ex SPUD website)
- ARDX - Australian Radio DX Club Web Site.
- Association for International Broadcasting
- Boston Area DXers Homepage- on Anarc.org
- Hermon Boel's DX Homepage
- Canadian DX Message Board with BCB DX
- CIDX - Canadian International DX Club
- CDXPARA - Clube DX-ista do para Amazonia in Brazil (frames)

Fig. 2– Bob Colyard's Radio DXing Bookmarks & Link popular Web page is dedicated to DXing and is promoted by the Society to Preserve the Engrossing Enjoyment of DXing (SPEEDX). The Website boasts hundreds of bookmarks and links to Web pages of SWL interest; links to SW organizations, clubs, and individuals, are included. Check it out at <http://www.cybercomm.net/~slapshot/swlmarks.html>.

extremely low frequencies (ELF); they cover 3 Hz to 3 kHz. Above them, from 3 to 30 kHz, are the *very low frequencies* (VLF). Next come the *low frequencies* (LF), from 30 to 300 kHz. The *medium frequencies* (MF) run from 300 to 3000 kHz (3 MHz). From 3 MHz to 30 MHz are the *high frequencies* (HF). Above HF are the *very high frequencies* (VHF), from 30 to 300 MHz. The *ultra high frequencies* (UHF) extend from 300 to 3000 MHz, or 3 GHz. From 3 GHz to 30 GHz are the *super high frequencies* (SHF), and from 30 GHz to 300 GHz, are the *extremely high frequencies* (EHF).

Here we will be concerned with but a small portion of the total EM spectrum. This is the popular "SW region" from about 3 to 26 MHz, where you'll find most international SW broadcasters.

You won't find the major SW bands exactly at the familiar 80, 40, 20, 15, and 10 meter band markers. However, they're not far away, and there is some overlap (as any 40 meter operator knows all too well). You'll find the major SW band segments at about 120 meters (2300–2500 kHz); 90 meters (3200–3400 kHz); 75 meters (3900–4080 kHz); 60 meters (4700–5100 kHz); 49 meters (5730–6250 kHz); 41 meters (6890–6995 and 7100–7600 kHz); 31 meters (9020–9080 and 9250–10000 kHz); 25 meters (11500–12160 kHz); 22 meters (13570–13870 kHz); 19 meters (15000–15800 kHz); 16 meters (17480–17900 kHz); 15 meters (18900–19020 kHz); 13 meters (21450–21850 kHz), and 11 meters (25670–26100 kHz). Note that 11 meters is rarely used.

Why Listen to Shortwave Radio?

There are several reasons I can see for tuning in shortwave broadcast stations, including:

A Practical Alternative to the Internet. In these days of instant, no-static, worldwide Internet communications, why should you put up with the hassle of SW radio reception? After all, you can hear many SW broadcasters "Webcasting" over the Internet. You also can beam up CNN on TV almost anywhere. There is a certain nostalgia, though, in dialing up SW broadcasting stations around the globe—stations which, unlike the Net, can and do fade in and out, and which may take serious technical skill and patience to log.

Global Influences on Broadcasting. Recent major geopolitical changes around the world—in Russia, the Middle East, the Balkans, and elsewhere—have had a major influence on SW broadcasting. Equally important, "international broadcasting" and "SW broadcasting" are no longer exactly synonymous. Why? New signal-delivery technologies—including FM, satellite, and digital Internet Webcasting (online broadcasting)—are providing other ways to reach audiences, shaking up things on SW and somewhat diminishing its relevance. There still is a great deal on the SW BC bands to which you can listen, however.

What Shortwave Broadcasting is All About

What is shortwave radio? SW radio is the medium used by many international SW broadcasters to transmit programming to the world. Many stations broadcast in several languages, beaming each language's programming to where that language is spoken most. Thus, English is broadcast mostly to North America, Europe, Oceania, and Africa. Stations also use target countries' native language(s) when broadcasting to certain countries.

Most countries have a government SW station, and many have true international services. European stations are likely to have more extensive broadcasts than those in Africa or Asia, which simply may be providing a domestic radio service on which you eavesdrop. As we all know, due to the way HF signals travel, you frequently may hear a station on the other side of the world, but are unable to hear a nearby station well.

You'll find most SW broadcasters in the 3 MHz to 26 MHz range, generally clustered in the meter-band ranges we mentioned previously. As we amateurs might expect, SW radio audio isn't of digital quality, but the very nature of so-called "World Band" programming tends to make up for any audio shortcomings. While SW audio quality can be as good as your local standard medium wave (AM) broadcaster, interference from other stations and varying signal strength can often cause listening difficulties.

The domestic AM and FM radio bands in most countries are quite orderly, but not so SW. For example, certain

To Learn More...

If this article has gotten you interested in pursuing the hobby of shortwave listening, there are several books and magazines devoted to the topic. Here's a sampling:

Books for SWLs

Buying a Used Shortwave Receiver. In Fred J. Osterman's booklet, the author discusses the merits of buying a used solid-state set. Included are a performance checklist, prices, and overall ratings for many radios. It's $5.95 plus $2 s/h from Universal Radio.

Communications Receivers. For information on vacuum-tube era receivers, obtain Ray Moore, ex-K1DBR's Communications Receivers, Third Edition. About 400 receivers are profiled. The 125-page book is $19.95 plus $2.50 s/h from RSM Communications.

The Complete Shortwave Listener's Handbook. This 408-page handbook, by Andrew Yoder, now in its fifth edition, has up-to-date information on equipment, worldwide stations and broadcasts, SW clubs, satellites, SW Websites, and computers. The Yoder book is $29.95 and is published by Tab/McGraw-Hill Companies.

The Easy Wire Antenna Handbook. By Dave Ingram, K4TWJ, the book (112 pages, $9.95) is aimed at constructing many types of inexpensive skywires. The book also covers a variety of commercial wire antennas and accessories. It's available from Universal Radio for $9.95 plus $2 s/h.

Passport to World Band Radio. This complete annual SW guide by Lawrence Magne is published by International Broadcast Services (IBS), Ltd. at $19.95. It includes reports on the best and worst SW radios, station and Internet addresses, receiver reports, and broadcasting schedules from among 165 countries.

Shortwave Receivers Past and Present. This 1998 book, also by Fred J. Osterman, includes information on sets suitable for SW monitoring. The 473-pager, in its third edition, covers tube and solid-state sets from 1945 to 1996. Over 500 receivers are featured. It's $24.95 plus $2 s/h from Universal Radio.

World Radio TV Handbook (WRTH). The WRTH is arguably the most authoritative, up-to-date publication on the world's LW, MW, SW, and TV stations. The WRTH contains receiver reviews, names and addresses of key broadcasting personnel, maps showing current political boundaries and transmitter sites, and more. The $24.95 Billboard Publications book is issued each January.

Magazines for SWLs

Monitoring Times. Grove Enterprises publishes *MonitoringTimes,* dedicated to the communications monitoring hobby. Issued monthly, it includes broadcasting schedules, frequency listings, station profiles, propagation charts, monitoring tips, special interest columns, and much more. A one year sub is $24.95.

Popular Communications. This magazine covers a variety of listener interests. Covered are BCB/MW DXing, broadcasting news, pirate and clandestine radio information, alternative radio, computers, antennas, CB radio, scanning, and the like. Subs are $25.95 per year from CQ Communications, Inc.

bands are open to a station's target area only during certain hours of the day, so they must make periodic frequency changes, causing frequency clashes and interference. Many international SW broadcasters use several frequencies at once to help ensure acceptably good signal coverage even under trying interference. Some stations don't adhere to the bands and ranges we noted.

Major SW broadcasters, such as the British Broadcasting Corporation (BBC) and the Voice of America (VOA), broadcast on hundreds of different frequencies every day to just about everywhere, in dozens of languages. Such stations often have relay stations worldwide.

Many SW stations use very high power. Radio amateurs think of "high power" as 1 KW RF, and your local AM standard broadcast station may use, say, 1 to 50 KW. A SW broadcaster may use 1 megawatt (1,000,000 watts) or even more—and many do.

Programming

You'll find world band SW programming to be quite varied. For starters, there still is a lot of information, perspectives on international events, news, music, cultural information, and DX programming on SW you can't easily get on the Internet or on domestic stations. Real, "direct from the horse's mouth" global news is the favorite of many. For demanding folks, SW news broadcasts are good alternatives to the prepackaged, entertainment-oriented, and sometimes "dumbed-down" news programming, lifestyle reports, and newsmagazine shows favored by many U.S. media outlets.

In the developed world the news broadcast typically is a mix of international news and news from the country that's doing the broadcasting. In many poorer countries there may be a lack of information, so the content of news broadcasts may lean toward the information available. You also can listen to music, religious broadcasts, DX features, sports, and other programming.

Pirates, Clandestines, and Jammers

So far we've talked mostly about permanently operated and licensed stations. However, there also are many less-permanent signals you can hear. The most prominent of these are pirates, clandestines, and jammers.

Pirates, or so-called "free radio broadcasters," operate openly but unofficially. They range from home-based pirates to major operations broadcasting from ships at sea. Occasionally you'll find pirates adjacent to the AM or FM broadcast bands (BCBs), but most have migrated to around 6950 or 7400 kHz, in the popular 41 meter SW band, adjacent to the 40 meter amateur band. There it's easy to radiate a strong signal using modified AM amateur transmitters (old Johnson rigs are in favor).

Clandestines usually are ideologically- or politically-motivated broadcasters, often supported by a covert government operation. Stations may pretend to be something they're not, to reflect regional political changes. Today, you'll find most clandestine stations in the Middle East.

Jammers are malicious, deliberately interfering with reception. They usually involve transmissions of noise to blank out another signal. The amount and severity of jamming reflects the degree of political unrest in the region. The heavy jamming in Eastern Europe and the former USSR now largely is history, but jammers still abound in the Middle East and in the Koreas. You'll usually find jammers where there are serious issues between countries and/or factions within the countries.

Using the Net to Enhance Your SW Radio Enjoyment

Okay, so maybe computers and the Internet are slowly killing SWLing, perhaps the SW broadcasters themselves, and possibly even amateur radio. But sometimes it's better to join the competition than to fight it. If you do so, going online, you may find that there is plenty of Internet support for your SWL pursuits.

Many Internet Websites and several Internet newsgroups and mailing lists can help you enjoy your hobby more, supplementing and updating the basic information, tutorials, and listings found in the publications noted in the box "To Learn More." And you often can contact key station personnel by e-mail using the Internet.

There are many Websites with global SW schedules, DX programs, frequency lists, station contact information, and links to other sites you can use to explore SW radio. Here are several Websites you may find informative and helpful:

• Association of North American Radio Clubs: <http://www.anarc.org/homepages.html>

• Clandestine Radio Intel (CRI) Website: <http://www.qsl.net/yb0rmi/cland.htm>

• Bob Colyard's Radio DXing Bookmarks & Links: <http://www.cyber-comm.net/~slapshot/swlmarks.com>

• DXing.com Web Resource for Radio Hobbyists: <http://www.dxing.com>

• EHam.net: <http://www.eham.net>

- The Radio Netherlands Information Center: <http://www.rnw.nl>

• Shortwave/Radio Catalog Web Page: <http://itre.ncsu.edu/radio/RadioCatalogSW.html>

• TRS Consultants Web Site for SWLs and Amateur Radio: <http:// trsc.com/Radio/radio.html>

• The World Wide Web Shortwave Listening Guide: <http://www.anarc.org/naswa/swlguide>

There also are many SW and amateur radio resources in Usenet newsgroups, Internet discussion groups that focus on specific subjects. You'll probably the most useful newsgroup to SWLs is rec.radio.shortwave. Here are some others:

• rec.radio.broadcasting (broadcast radio)

• rec.radio.swap (radio flea market)

• rec.antiques.radio+phono (antique radios)

• alt.radio.pirate (pirate radio discussion)

For convenience in working with Newsgroups, check out Deja.com, a slick Web interface to newsgroups that gives you a Web-based way to browse, search, find, and read newsgroups of interest to you. You'll find Deja.com at <http://www.deja.com>.

Shortwave-Oriented Mail Servers and Lists. The Internet boasts thousands of mailing lists, or e-mail discussion groups or reflectors, broadcasting to all who place themselves on the lists for specific topics. Special software programs maintain these mailing lists, acting as "list servers." They automatically distribute e-mail messages to all members of the mailing list. For SW-oriented mailing lists and reflectors in the area of general SWLing, DX, QSLing, contesting, and equipment, go to the AC6V Amateur Radio and DX Reference Guide page at <http://www.ac6v.com/pageae.html>. Are mailing lists too complicated to mess with? There's a Website that simplifies finding and subscribing. Dial up ONElist, a full-featured mailing list system that lets you subscribe to a variety of existing lists, or even create and manage lists. There are references to several SW-oriented mailing lists on ONElist, which you'll find at <http://www.onelist.com>.

Coming Up Next

When we return with Part II, we'll get into the nitty-gritty of setting up an SWL station, tips on tuning in and logging stations, and how to get confirmations of your reception reports—in other words, QSL cards. ■

Resources

The following companies and organizations offer products or information of interest to shortwave listeners (equipment sources will be listed with Part 2):

American Radio Relay League (ARRL), 225 Main Street, Newington, CT 06111-1494; (1-888-277-5289; e-mail: <pubsales@arrl.org>. Web: <http://www.arrl.org>).

Association of North American Radio Clubs (ANARC), Mark W. Meece, Chairman, 529 Sandy Lane, Franklin, OH 45005-2065 (e-mail: <mmece@siscom.net>; Web: <http://www.anarc.org>).

Billboard Publications, Inc., 1515 Broadway, New York, NY 10036 (212-764-7300). Publications are distributed by Billboard Books, PO Box 2013, Lakewood, NJ 08701.

Electric Radio Magazine, Barry Wiseman, N6CSW/0, 14643 County Road G, Cortez, CO 81321-9575 (970-564-9185; e-mail: <er@frontier.net>).

Grove Enterprises, 7540 South Highway 64 West, PO Box 98, Brasstown, NC 28902-0098 (1-800-438-8155; e-mail: <order@grove-ent.com>. Web: <http://grove-ent.com/hmpgabout.html>).

International Broadcasting Services (IBS), Ltd./Passband.com, Box 300, Penn's Park, PA 18943 (215-794-8252; e-mail: <mktg@passband.com>; Web: <http:// passband.com>).

McGraw Hill Companies (Tab Books), Order Services, PO Box 545, Blacklick, OH 43004-0545 (1-800-338-3987; e-mail: <customer.service@mcgraw-hill.com>; Web: <http://www.books.mcgraw-hill.com/ tab-electronics/tab-electronics-home. html>).

North American Shortwave Association (NASWA), 45 Wildflower Rd., Levittown, PA 19057 (e-mail: <bolivar@blackboard.com>; Web: <http://www.anarc.org/naswa>).

Popular Communications, 25 Newbridge Rd., Hicksville, NY 11801 (1-800-853-9797; e-mail: <editor@popular-communications.com>; Web: <http://www.popular-communications.com>).

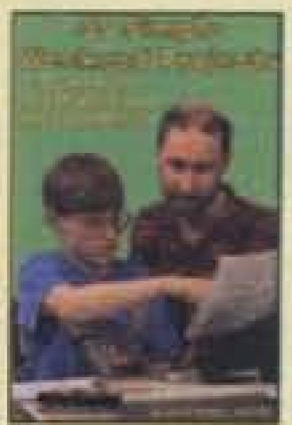
Society to Preserve the Engrossing Enjoyment of DXing (SPEEDX), Bob Thunberg, Business Manager, PO Box 196, DuBois, PA 15801 (Web: <http://www.cybercomm.net/~slapshot/speedx.html>).

Universal Radio, Inc., 6830 Americana Parkway, Reynoldsburg, OH 43068-4113; 1-800-431-3939 (e-mail: <dx@universal-radio.com>. Web: <http://www.universal-radio.com>).

Books, Videos, Calendars, Cards!

Visit Our Web Site www.cq-amateur-radio.com

33 Simple Weekend Projects
by Dave Ingram, K4TWJ

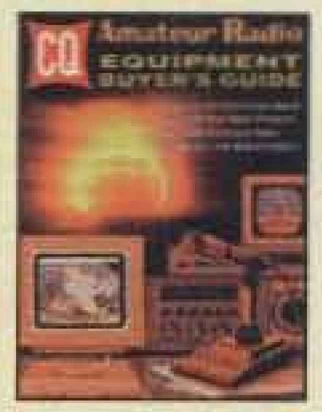


Do-it-yourself electronics projects from the most basic to the fairly sophisticated. You'll find: station accessories for VHF FMing, working OSCAR satellites, fun on HF, trying CW, building simple antennas, even a complete working HF station you can build for$100. Also includes practical tips and techniques on how to create your own electronic projects.

Order No. 33PROJ.... $15.95

Amateur Radio Equipment Buyer's Guide

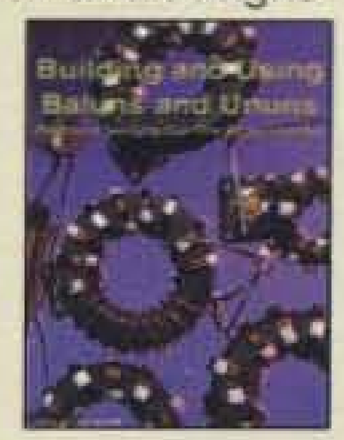
This 144-page book is your single source for detailed information on practically every piece of Amateur Radio equipment and accessory item currently offered for sale in the USA complete with specs and prices. Also includes the most comprehensive directory of Ham product manufacturers and dealers in the USA.



Order No. EBG...... $15.95

Building and Using Baluns and Ununs
by Jerry Sevick, W2FMI

This volume is the source for the latest information and designs on transmission line transformer theory. Discover new applications for dipoles, yagis, log periodics, beverages, antenna tuners, and countless other examples.



Order No. BALUN . . . $19.95

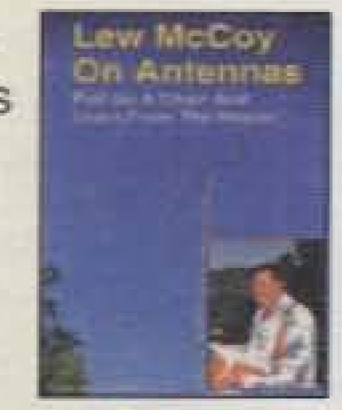
The Vertical Antenna Handbook
by Paul Lee, N6PL

Learn basic theory and practice of the vertical antenna. Discover easy-to-build construction projects.

Order No. VAH....... $9.95

McCoy on Antennas
by Lew McCoy, W1ICP

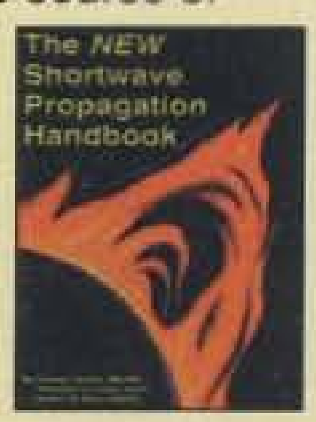
Unlike many technical publications, Lew prsents his invaluable antenna information in a casual, non-intimidating way for anyone!



Order No. MCCOY...................... $15.95

The NEW Shortwave Propagation Handbook
by W3ASK, N4XX & K6GKU

A comprehensive source of HF propagation principles, sunspots, ionospheric predictions, with photography, charts and tables galore!

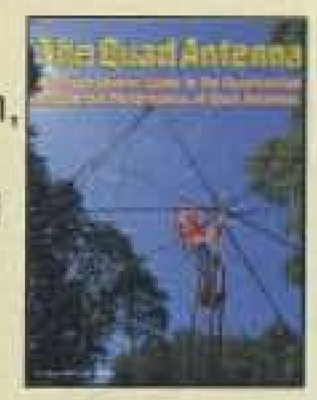


Order No. SWP $19.95

The Quad Antenna
by Bob Haviland, W4MB

Second Printing

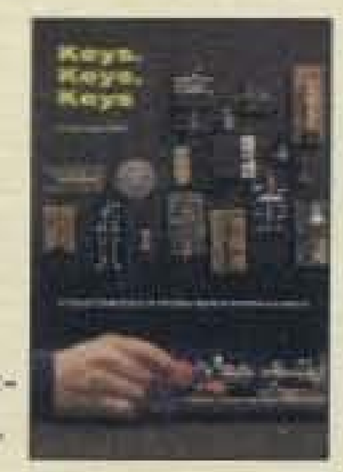
An authoritative book on the design, construction, characteristics and applications of quad antennas.



Order No. QUAD $15.95

Keys, Keys, Keys
by Dave Ingram, K4TWJ

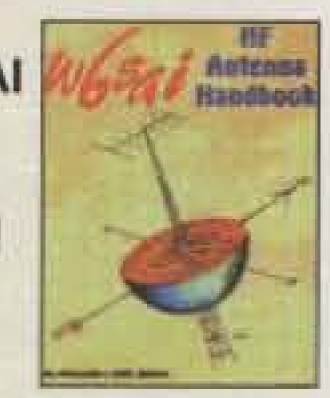
You'll enjoy nostalgia with this visual celebration of amateur radio's favorite accessory. This book is full of pictures and historical insight.



Order No. KEYS $9.95

W6SAI HF Antenna Handbook
by Bill Orr, W6SAI

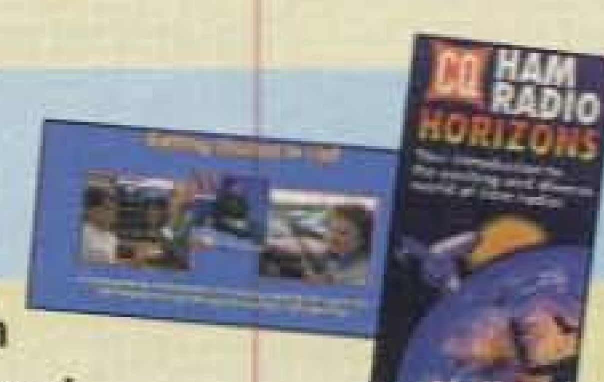
Inexpensive, practical antenna projects that work! Guides you through the building of wire, loop, Yagi and vertical antennas.



Order No. HFANT...... $19.95

Getting Started Videos - "How-To," Tips, Techniques & More!

Ham Radio Horizons: The Video . . *Order No. VHOR*
Getting Started in VHF . . *Order No. VVHF*
Getting Started in Ham Radio . . *Order No. VHR*
Getting Started in DXing . . *Order No. VDX*
Getting Started in Packet Radio . . *Order No. VPAC*
Getting Started in Amateur Satellites . . *Order No. VSAT*
Getting Started in Contesting . . *Order No. VCON*



Only $19.95 each
Buy more and save!
Buy 2 or 3 for $17.95; Buy 4 to 6 for $15.95
Buy all 7 for your Club for only $99.95

Fax us at 516-681-2926
Call us toll free at 1-800-853-9797

1999/2000 Calendars

$9.95

Fifteen month calendars January 2000 through March 2001

Please specify Amateur Radio or Classic Radio Calendar

CQ Award Pins

If you've earned any of CQ's Awards, you can also display the corresponding CQ Award pin. Available for WAZ, 5 Band WAZ, 160 Meter WAZ, CQ DX, CQ DX Honor Roll, WPX, WPX Honor Roll, and USA-CA awards. **ONLY $5.00 EACH.**

Playing Cards

Top quality, plastic coated playing cards.

ONLY $9.95 per deck

FREE SHIPPING on orders over $50*

Name ______________________ Callsign ______________________

Strreet Address ____

City ______________________ State ______________________ Zip ______________

Qty	Item #	Description	Price	Total Price
U.S. and possessions - add $4 shipping/handling. *FREE S/H on orders $50 and over. Foreign - shipping/handling charges are calculated by order weight & destination. *A $4 credit will be applied for Foreign orders over $50.			Shipping/Handling	
			Total	

Method of payment ☐ Check ☐ Money Order ☐ Visa ☐ MasterCard ☐ Discover ☐ American Express

Credit Card No.______________________ Expiration date______________

CQ Communications, Inc., 25 Newbridge Rd., Hicksville, NY 11801/516-681-2922; Fax 516-681-2926

Quick and Easy RF Amplifiers

Most experimenters are usually quite familiar with the various logic families and the applications of gates, inverters, and the like. However, did you know that these inexpensive and readily available devices can be used for analog applications as well? It is a fact that simple TTL and ECL devices can be used for low-level RF amplification at almost no cost, particularly when you have an extra gate or two "left over" from a design. Furthermore, the frequency range that can be accommodated can be fairly high and the packing density (a hex inverter can provide six amplifiers, for example) is ideal for building compact devices.

Fig. 1 is a circuit of an extremely simply TTL gate, one sixth of a 7404 hex inverter, along with its approximate transfer function. You will note that the output stays at a TTL high as long as the input is at a TTL low. As the input voltage rises above a certain "transition" point, however, the output switches low, hence the inversion. Digital designers strive to be certain that signals never fall within the transition region, as uncertain logic states can result. It is exactly in this region, though, that the device can function as a linear amplifier.

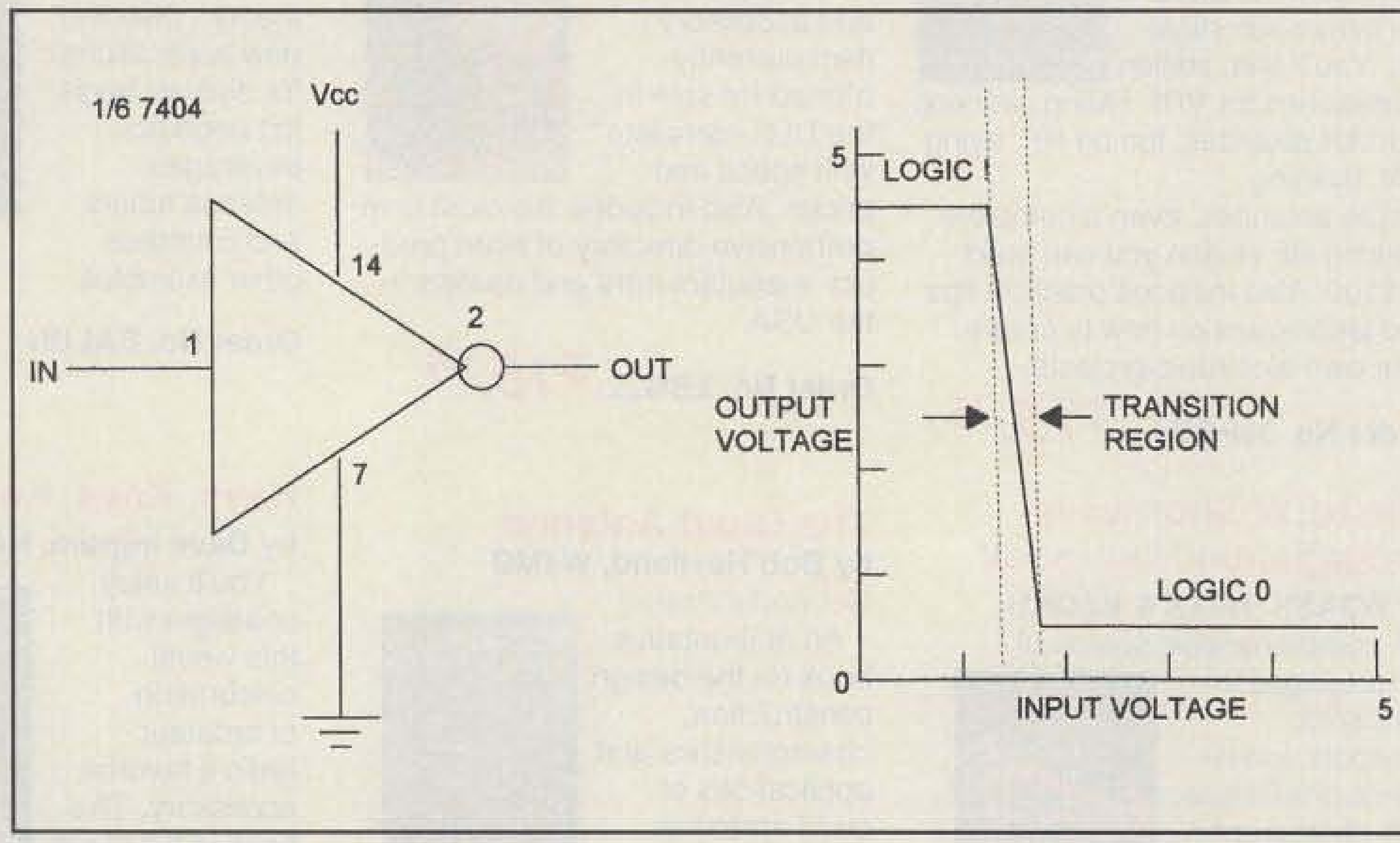


Fig. 1– Shown here is a typical TTL (transistor-transistor logic) inverter and its associated transfer function.

Fig. 2 shows a method of operating the same inverter in its linear region. The resistor from output to input forces the inverter to "settle" at a point where the output is roughly halfway between logic one and logic 0. If you now capacitively couple signals into and out of the device, you have an amplifier.

Fig. 3 shows how to implement a two-stage amplifier. Here DC coupling is used, but it is important to note that the use of more than a stage or two almost always requires AC coupling, since the exact quiescent DC level of the output will vary from gate to gate. In both examples the actual value of the feedback resistors will have to be chosen experimentally. Start with 10 K and work your way up or down as per the gate you have and the overall results you are trying to obtain.

The actual realizable gain of such an amplifier will be a function of the logic family chosen as will the overall frequency response. Standard TTL will function well from a few Hz up to 10 MHz or so, while high-speed TTL can operate beyond and even extend as high as 100 MHz. Voltage gains on the order of 5 to 20 dB are not unreasonable, however. While the frequency response of such an amplifier will very much be a function of the logic family employed, it will also be a function of the components used. Lower value feedback (biasing) resistors will increase the operating frequency but will also decrease gain, while the values of the coupling capacitors will determine the low-frequency cutoff point. In any event, experimentation is the word when configuring such an amplifier, but the results are often well worth it.

If still higher frequency operation is desired, ECL gates must be employed. This type of gate is capable of operation to and beyond 1 GHz but requires

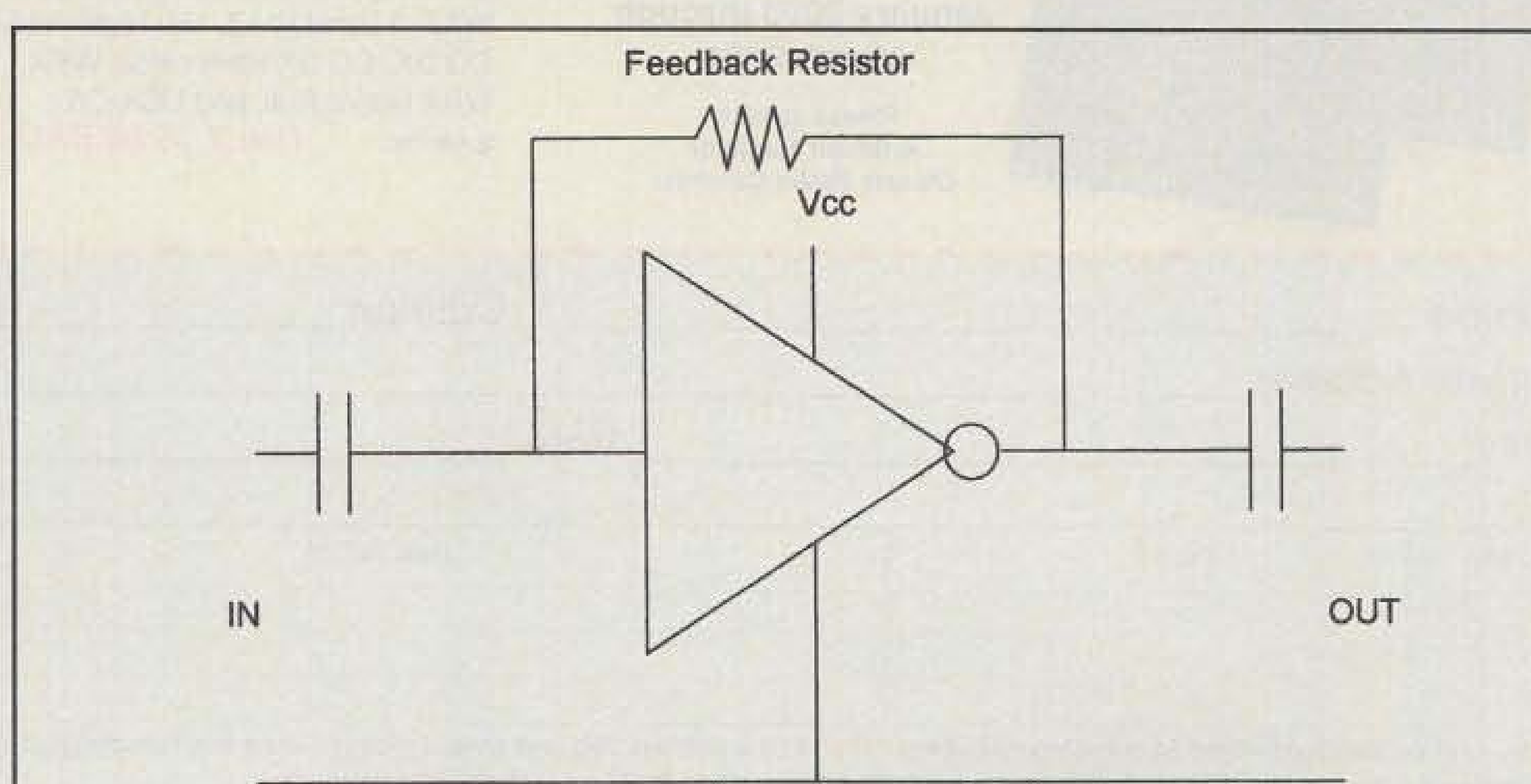


Fig. 2– Method of linearizing a TTL inverter.

c/o CQ magazine

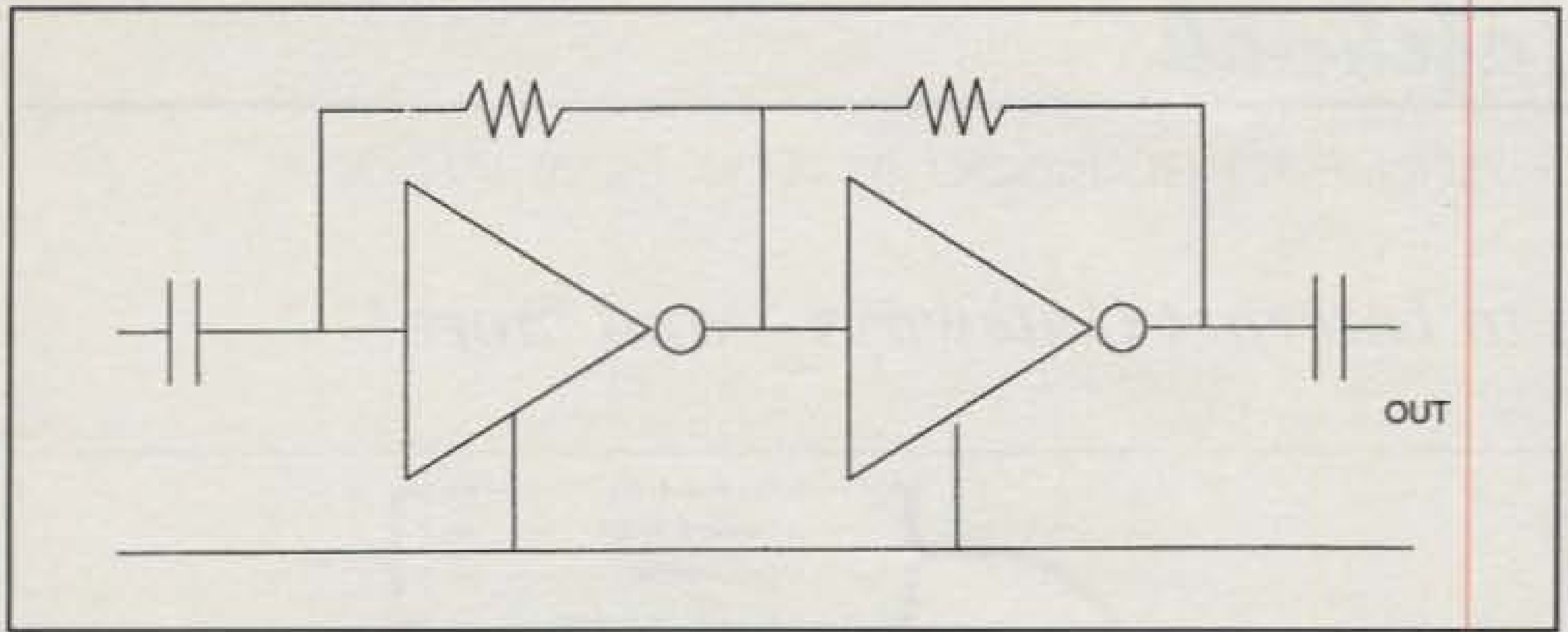
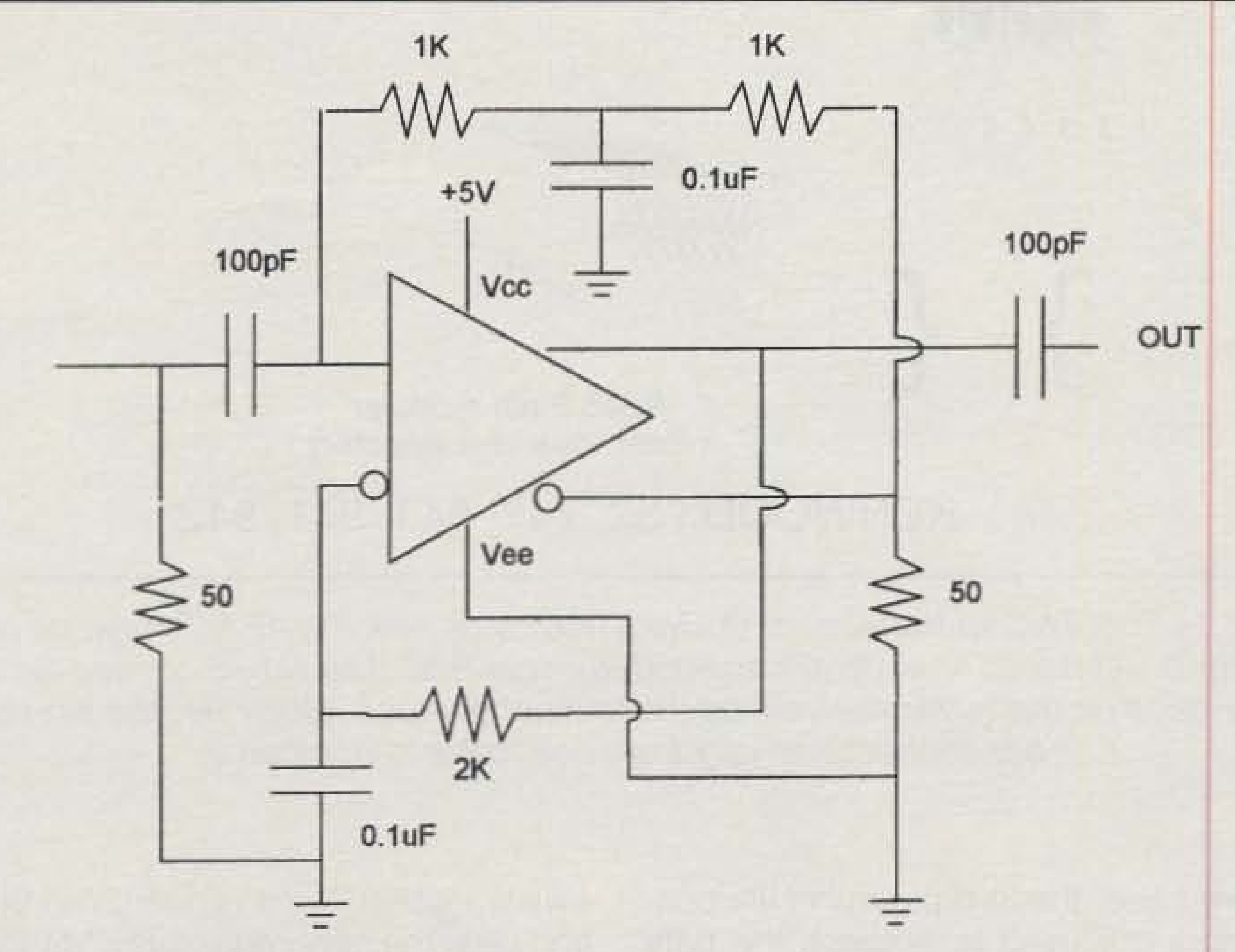


Fig. 3– A two-stage TTL linear amplifier.



Note that the 0.1uF capacitors must be shunted with 100pF capacitors for good high frequency bypassing.

Fig. 4– Biasing a typical ECL (emitter-coupled logic) gate for linear operation.

a somewhat different biasing approach, since it operates in a differential mode. One suggested biasing scheme *(RF Design Magazine,* February 1999) is shown in fig. 4. Since the input to the ECL gate is differential, the feedback resistors have to be connected so as to not upset this mode as well as to overcome the input differential "threshold" so that the circuit will respond to low signal levels. ECL gates can also operate from either positive or negative power supplies. For our purposes we have shown the positive connection, since this makes the circuit easier to interface with other portions of the circuitry.

Some typical ECL gates with which you might wish to experiment are the Motorola MECL series and the Motorola ECLinPS series. Information on these can be obtained from Motorola's web site at <http://www.motorola.com>.

The above examples have only been given to stimulate your appetite. Experimentation is absolutely the game here, and the results can be well worth it. In a commercial product we manufacture, ECL gates are used to amplify 30 MHz IF signals from 100 mv or so up to 2 volts with good, consistent results over production runs of hundreds of amplifiers. Therefore, once you determine the exact values for your project, the results will be a stable, trouble-free (and inexpensive) building block.

73, Irwin, WA2NDM

Packet User's Notebook

BY BUCK ROGERS, K4ABT

Connecting You And Packet Radio In The Real World

Packet Radio to Internet Gateways—and more!

Okay, so you survived the roll-over to Y2K. Now all you have to do is wait for the roll-over to the new millennium come December 31, 2000—so they say. Oh, well. If we don't have one thing to think about, or keep our minds occupied, it's another. In any case, we've made it this far, so let's make the best of a good life!

Gee, but it's great to be alive and see all the wonderful advancements we've made in the last five or six decades. Since I'll bet many of you just received some new ham gear for Christmas, there are a number of you who may be wondering what you can do with the new transceiver or digital controller (TNC). Well; let me help you with the most frequently asked question (FAQ).

Decisions, Decisions

How do I interface this device to that radio, or how do I make my multi-mode controller work with my new transceiver? Most of the time there will be a manual with all the documentation to cover the "how-to" install, interface, and operate. It has been my experience that most of the material covered in the documentation assumes that all new equipment is manufactured with full compliance with the ISO 9000 or ISO 9002 standards. I wish!

When it comes to standardization, "all" the transceiver manufacturers didn't get together and agree on which connector would be used as an interface device, or to interface even their microphone. To some degree the transceiver manufacturers are moving towards some form of standardization with their microphones, but they stopped short of which pin would be used for mic audio, receive audio, push-to-talk, and system/shield ground. Case in point—the RJ-45. I'll address the use of the RJ-45 connector, referencing to some of the late-model transceivers in the drawings at figs. 1 and 2.

Figs. 3, 4, and 5 show some cooperation and agreement on the pin use and signal connections to the 6-pin mini-DIN now being employed on many VHF and UHF amateur transceivers. In almost every case, these 6-pin mini-DIN connectors are used to address the data input and output port on the respective transceiver. The 6-pin mini-DIN is used exclusively for the data I/O purpose.

If you would like more TNC-to-transceiver interface drawings, go to <www.PacketRadio.com/tnc2rad.htm> or to <www.PacketRadio.org/tnc2rad.htm> and view the hundreds of TNC-to-radio interface drawings I have created for the packet radio user. I've included more links to the TNC-to-radio drawings page at <www.AmateuRadio.org>. Either of the two main pages will provide you with all the information you can handle for

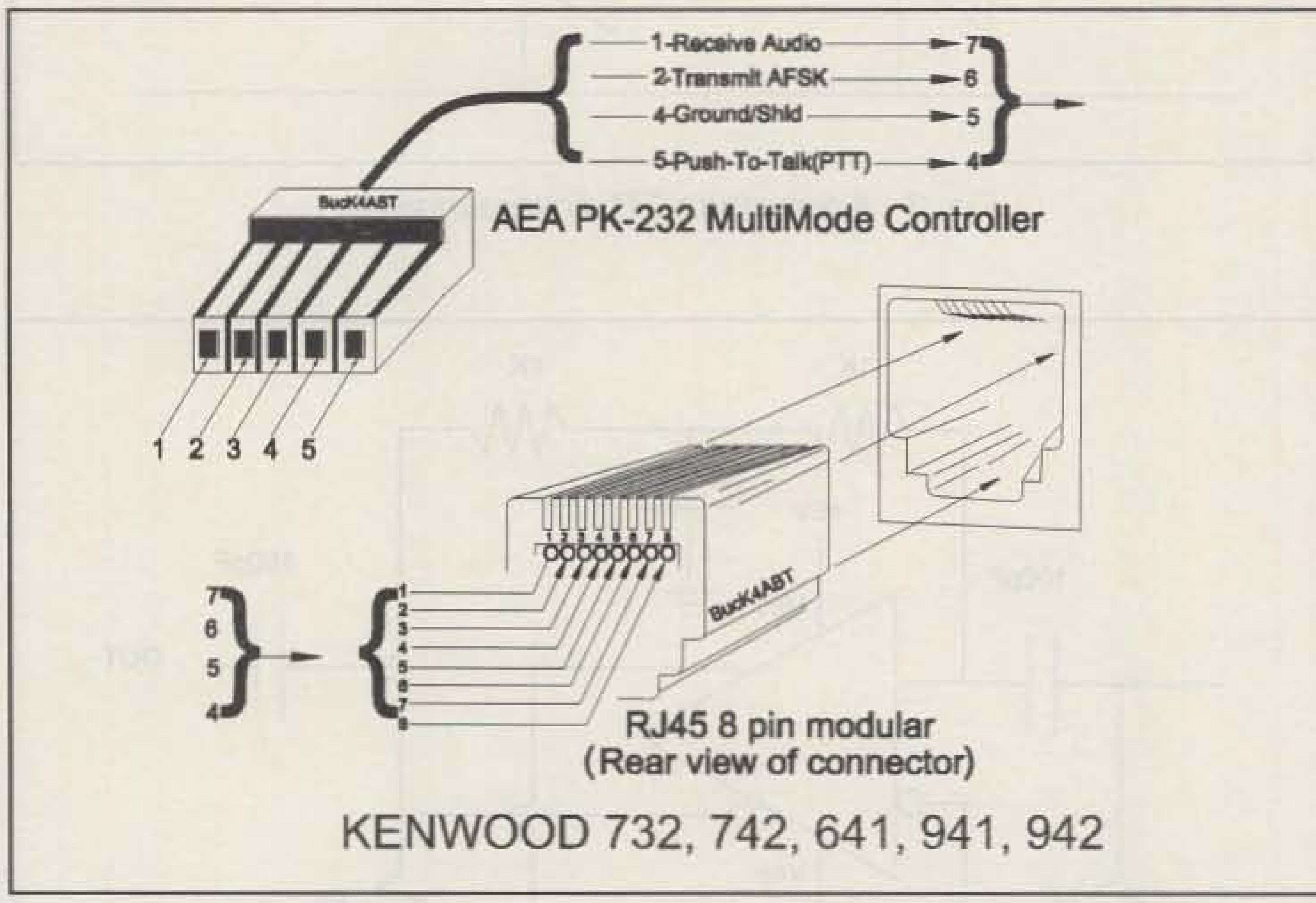


Fig. 1– This TNC-to-transceiver drawing illustrates how the AEA/Timewave controller is interfaced to several Kenwood transceivers. The RJ-45 connectors are now used on many transceivers as the microphone port. However, the pin-number connections vary from one make to another.

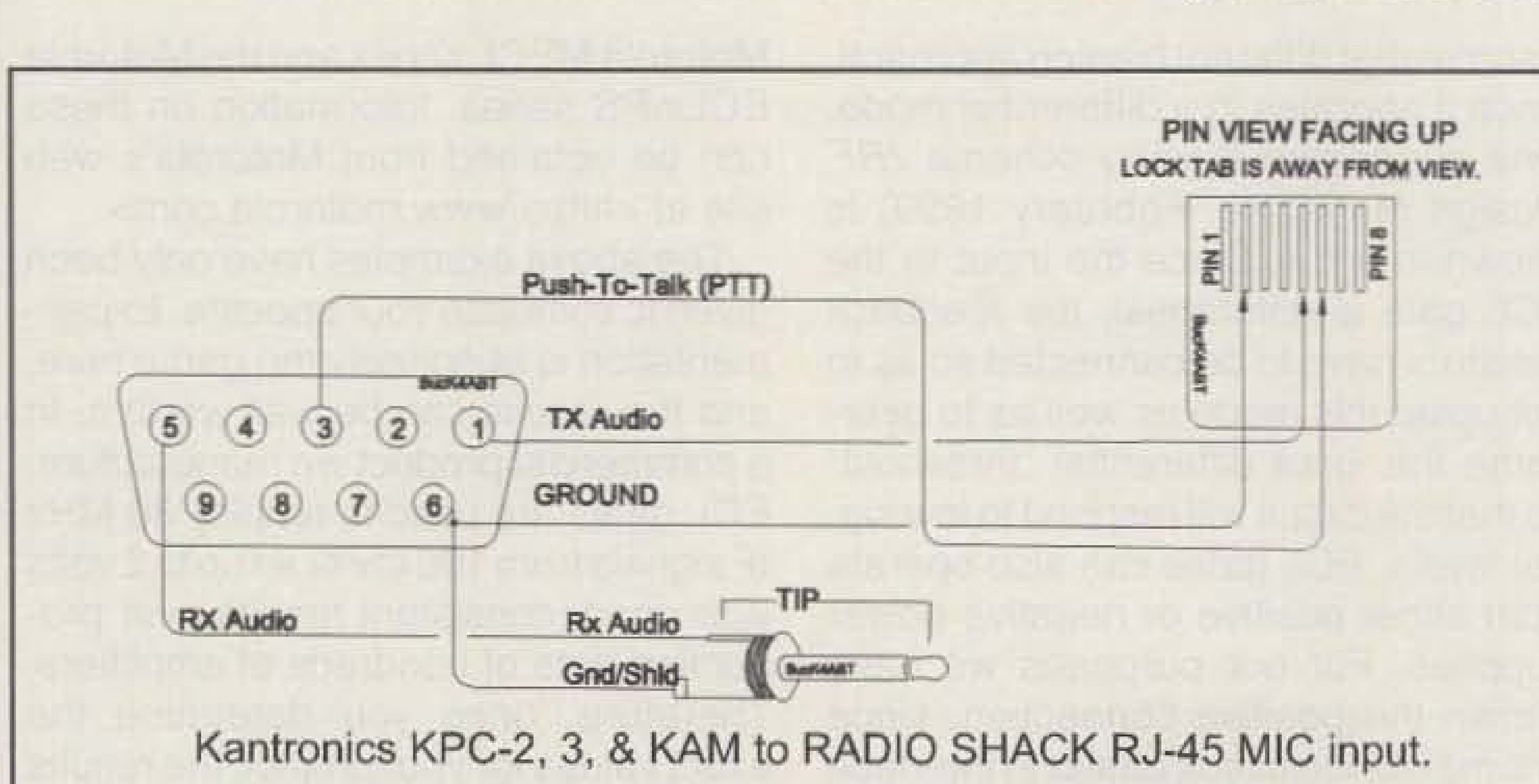


Fig. 2– Not as yet an industry-wide standard, this is the RJ-45 employed as the "mic" connector on the RadioShack transceivers. This illustration depicts the interface of the Kantronics VHF port to some RadioShack amateur transceivers.

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

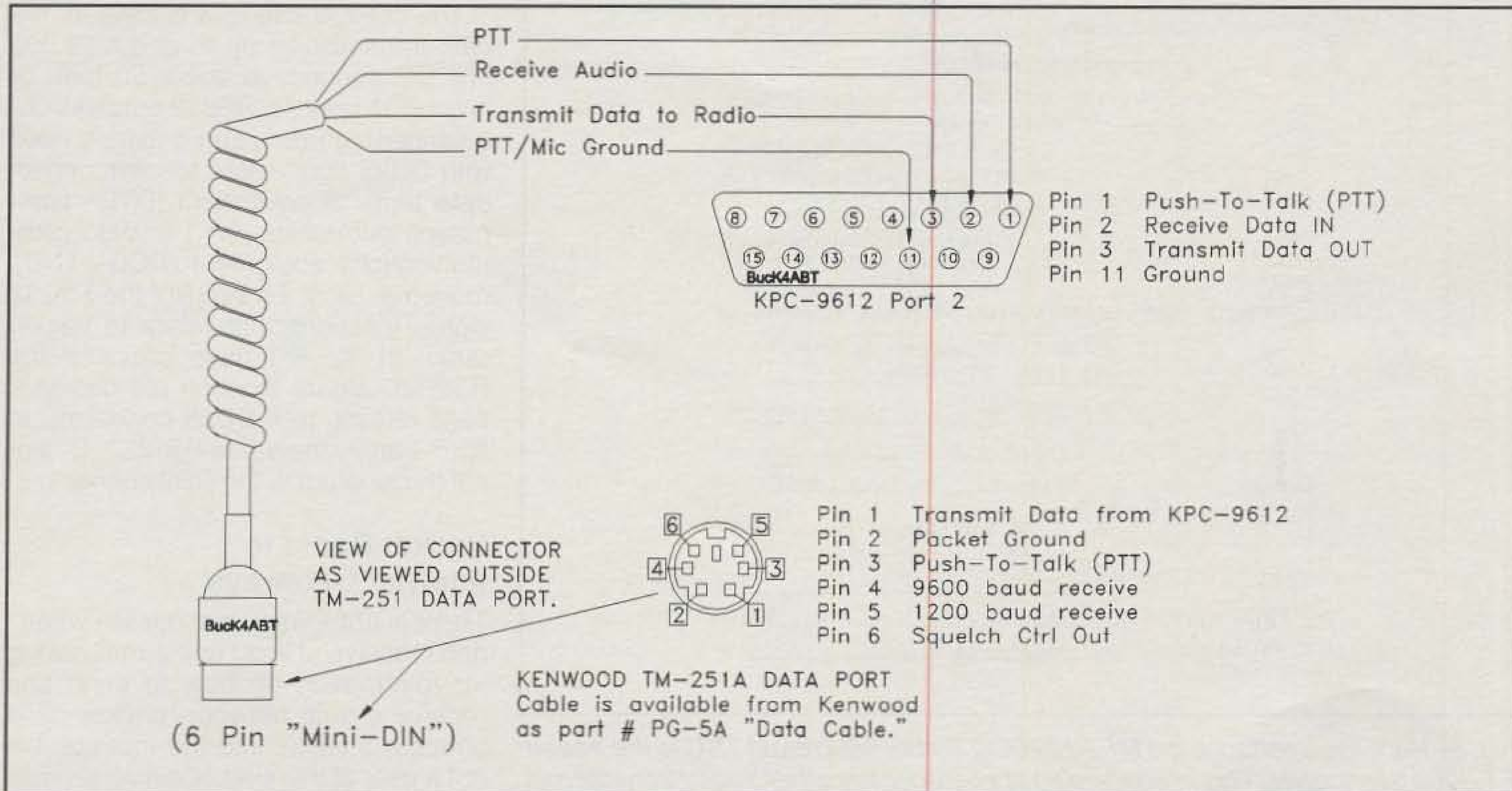


Fig. 3– The growing popularity of the 6-pin mini-DIN as a data input and output (I/O) data port has made interfacing for 1200 and 9600 baud TNCs much easier for the new packet radio user. This drawing illustrates the interfacing of the Kenwood TM-251A to the 9600 baud port (port 2) of the Kantronics KPC-9612.

the next 72 hours of paging through these packet radio and amateur radio pages. If you discover that your particular transceiver mic connector I/O is not shown in any of the drawings, then use the handy e-mail "click ON" at the bottom of that page to send me e-mail for additional help.

Serial Data Transmission

Now that you've received that new TNC or KPC for Christmas, you will want to put this new toy into service. One of the first items with which you'll be confronted is the computer-to-TNC interface hookup. This will involve one of two types of connectors. On the Kantronics, MFJ, and Timewave TNCs you will note

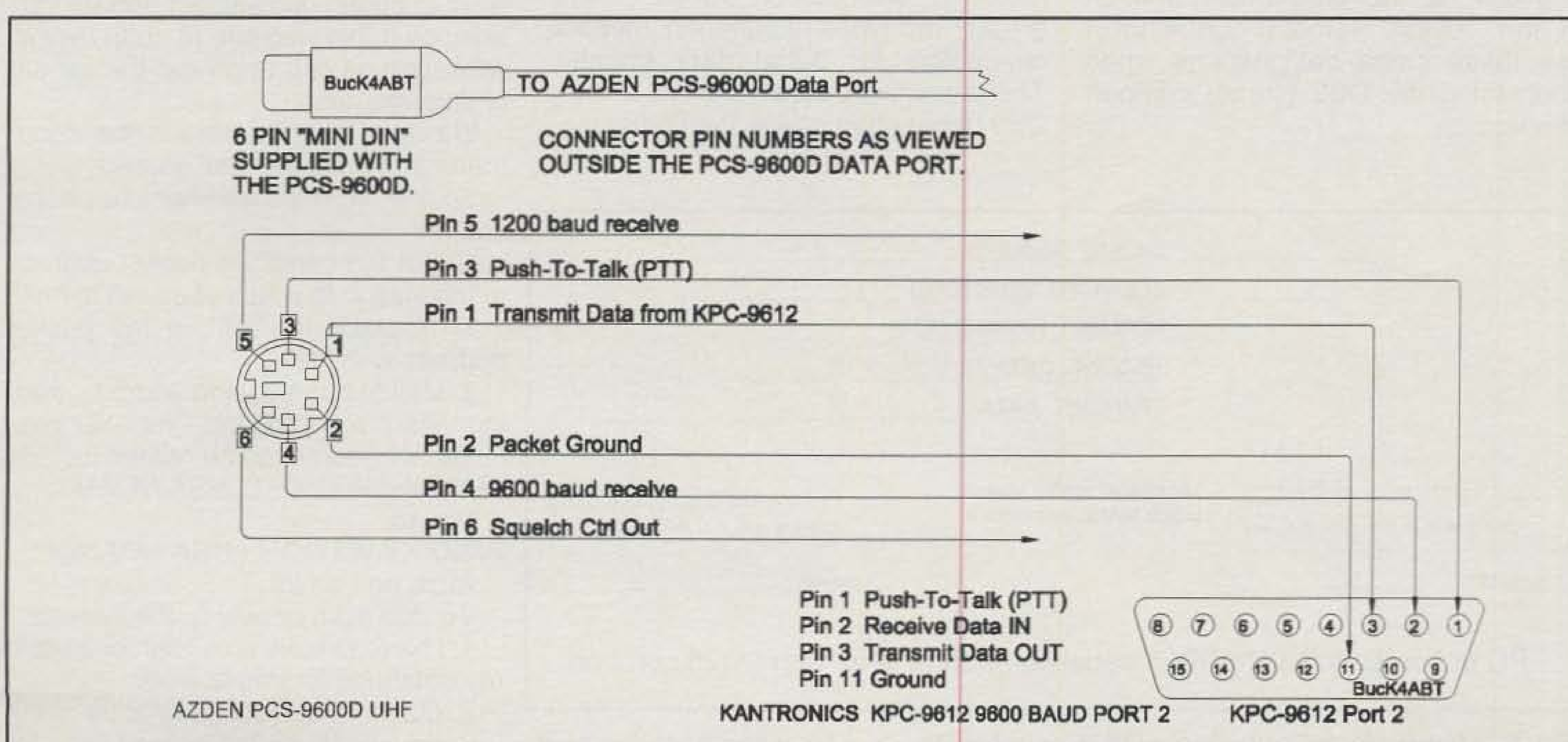


Fig. 4– One of the first transceivers to adopt the use of the 6-pin mini-DIN dataport was the Azden PCS-9000.

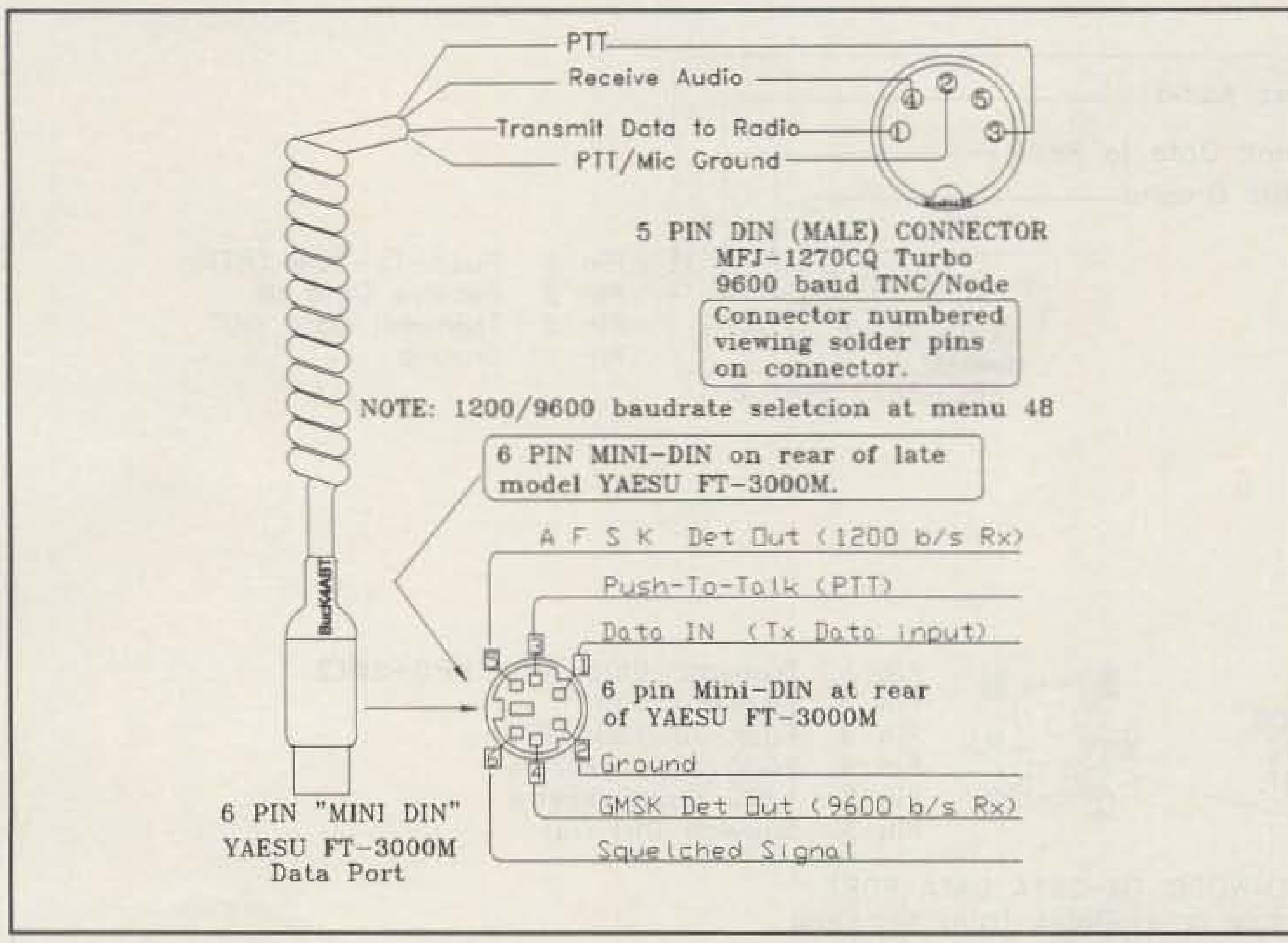


Fig. 5– Here I've interfaced the MFJ-1270CQ Turbo, 9600 baud TNC to the Yaesu FT-3000 transceiver. This interface also applies to many other Yaesu transceivers which are 1200 and 9600 baud data-ready.

that the TNC comport is more than likely a DB25S connector. This is a 25-pin connector used for the RS232C signal I/O. On other TNCs such as the PacComm, you may find the DE9/DB9P comport connector. This is a 9-pin connector used for the input and output (I/O) RS232C signals.

In much of my documentation I refer to the DB25"P" or DB25"S." Where I use the "P" or "S" suffix, I simply am referring to "P" as the "plug" (male) and "S" as the "socket" (female) connector. I use these same designations when addressing the DB9 (serial) comport connectors.

In most cases you can purchase a ready-made cable at a nearby RadioShack, or office-supply store.

The following is of use if your computer has a DB25P (25 pin) comport and your TNC has a DB25S comport. Serial data transmission is the most common method of sending data from one DTE to another. During transmission, the data must pass through a serial interface to exit a computer as serial data. Packet radio terminal node controllers (TNCs) employ two types of common interface connectors for serial data transfer. These connectors are the DB25 and the DE9 (more often called the DB9).

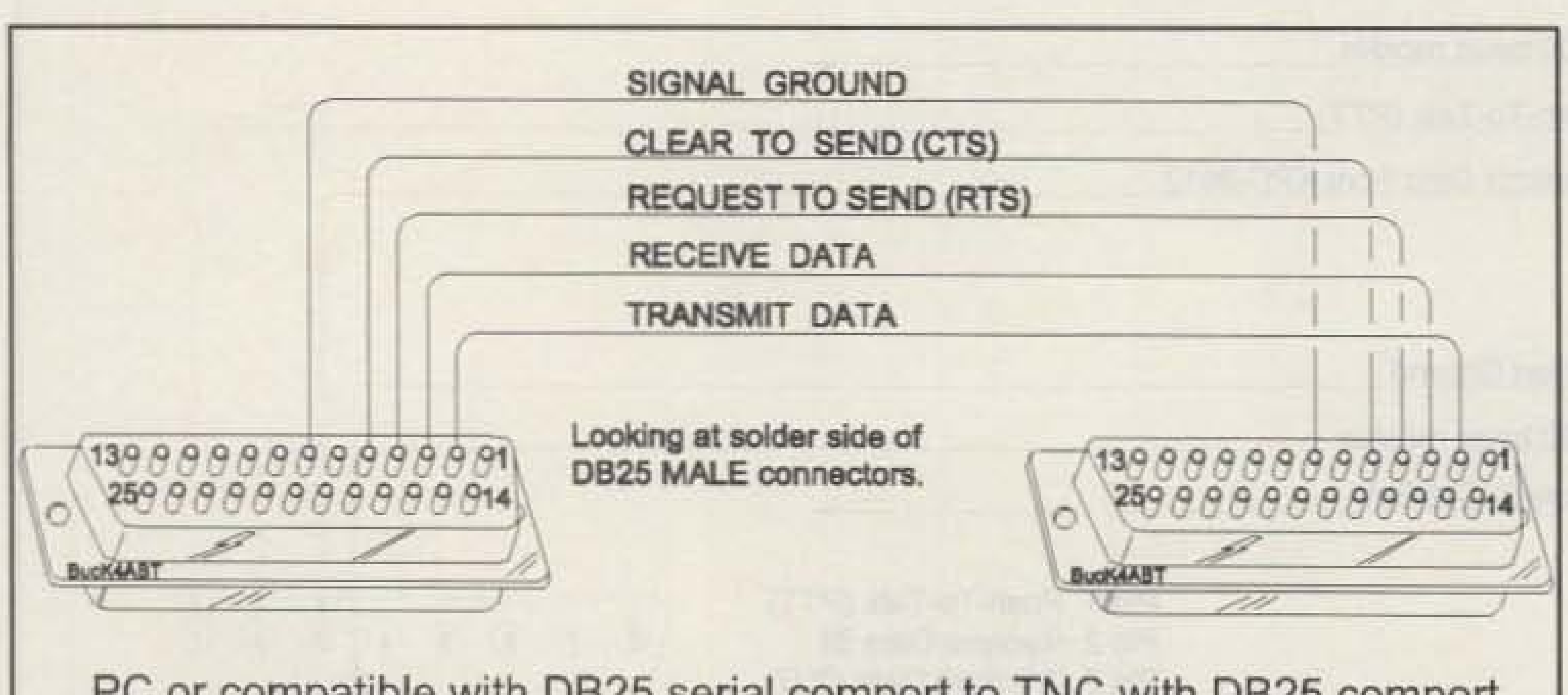


Fig. 6– Many older PCs utilize the DB25 serial comports. This diagram shows how the RS232C signals are applied to the DB25P connectors of the PC and TNC comports.

The RS-232 interface is ideal for the data-transmission up to about 20,000 bits per second, to about 50 feet, or around 15 meters. RS232 employs unbalanced signalling and is usually used with DB25 connectors to interconnect data terminal equipment (DTE—computers, controllers, etc.) to data communications equipment (DCE—TNCs modems, etc.). To simplify the RS232 signal functions that relate to packet radio, in fig. 6 I have provided the RS232C signal function pin designations relating to a DB25 connector. In fig. 7 I apply the same RS-232 "C" signal designators to the DB9 connectors.

Packet Radio to Internet Gateways

There is not a week that passes when I don't receive at least one e-mail asking for information on how to send and receive e-mail between packet radio amateur stations and the Internet. I'm not a user of this kind of e-mail service, and I'm sure many maritime and remote operators who do not have Internet access are users of the cross-link between the Internet and packet radio.

To try to provide an answer for those who need this kind of help, I went shopping for documentation that would support cross-link communications between packet radio and the Internet. To date, the best documentation that I have found is written by Jim, W2XO, and we will present it here. The text is taken directly from his web site: <http://www.w2xo.pgh.pa.us/gateway.docs>. If you wish to obtain Jim's latest update version, go to his web site at <http://www.w2xo.pgh.pa.us> and read the full set of documentation.

Via Jim, W2XO: Here is the documentation for the e-mail gateway!

To mail from the Internet to a packet station:

1. Get the complete packet address of the station to which you wish to mail.
2. Replace the "@" in the packet address with "%".
3. Mail to the resulting address, adding "@w2xo.pgh.pa.us"—for example:

Packet address to be mailed to:
W2XXX@W2YYY.LI.USA.NOAM
Mail to:
W2XXX%W2YYY.LI.USA.NOAM@w2xo.pgh.pa.us

To mail from packet to the Internet:

1. I have to have a callsign or alias in my database for this to work.
2. Mail to that callsign or alias at the Internet host "w2xo.pgh.pa.us"—for example: If W3AAA is in my database as "bromley@fudd.com"

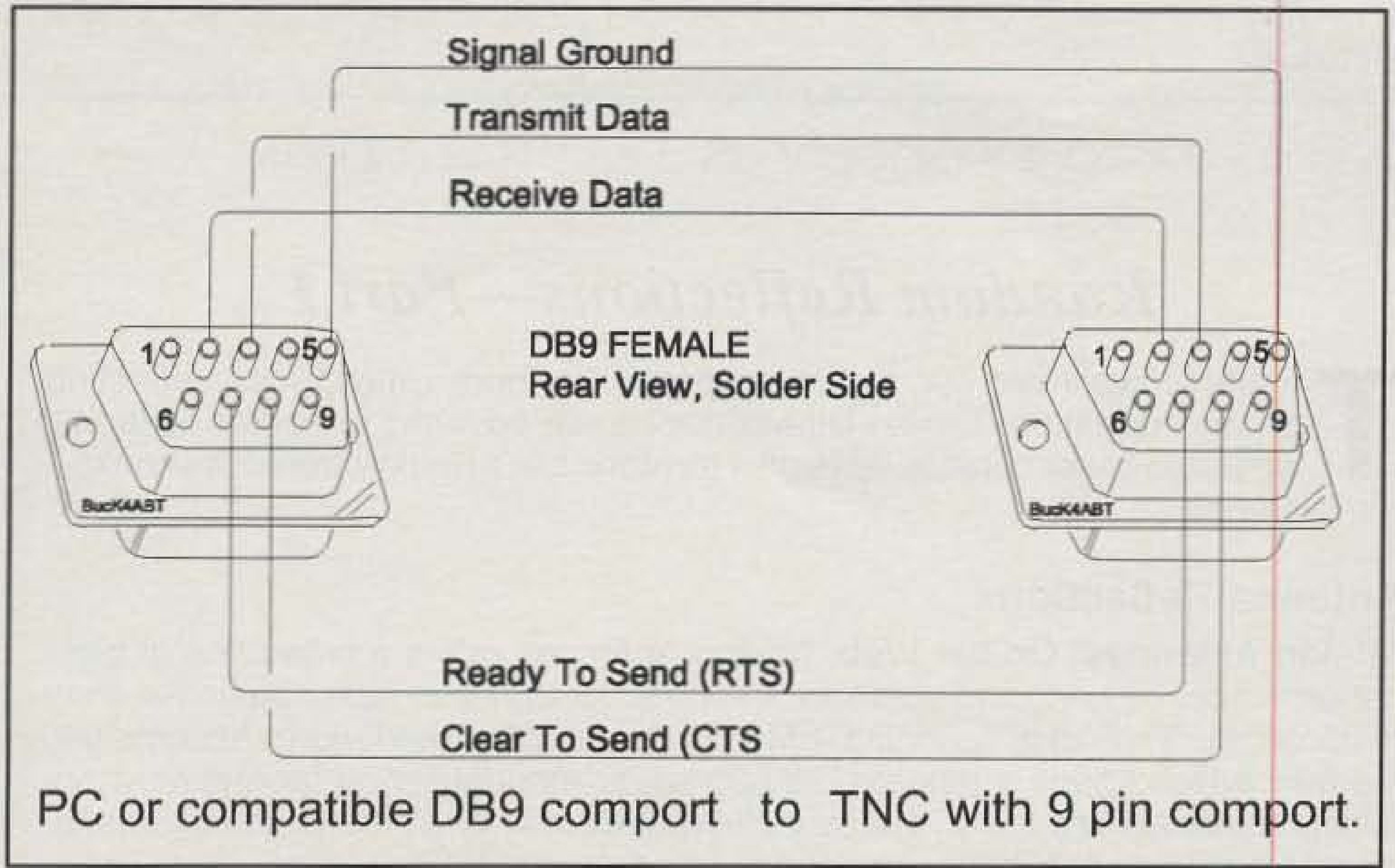


Fig. 7– In this drawing I've shown how the DB9P has the RS232C signals applied. The interface drawing shown here will interface the DB9P serial comport computer to a PacComm Tiny II or similar TNC.

Mail to:
W3AAA@W2XO.#SWPA.PA.USA.
NOAM (the mail will be forwarded to "bromley@fudd.com").

(Non-hams get "Third-Party Aliases" such as "3PTY01," which will fit in the six-character space of a ham packet header. (These are used just like calls. If you are a non-ham, please ask for a third-party alias and I'll give you one.)

Note (very important!): E-mail from non-hams to hams, or e-mail from ham to ham through the gateway, where the message enters the packet radio network at W2XO from a country that does not have a *third-party traffic agreement* with the U.S., is illegal and could put my amateur radio license in jeopardy. A list of countries with third-party agreements with the U.S. follows. Please don't ask to use the gateway if you are not either in the U.S. or on this list. I regret this policy, but it is U.S. radio law (see Table I).

Don't forget to visit the packet radio pages at <www.PacketRadio.com> and <www.PacketRadio.org>, and the amateur radio pages at: <www. AmateuRadio.org>.

Until next month, Happy Packeting!
73, de BucK4ABT
e-mail: <k4abt@PacketRadio.com>
<k4abt@AmateuRadio.org>

V2 Antigua/Barbuda	V6 Federated States of Micronesia	
HP Panama	LU Argentina	ZP Paraguay
VK Australia	C5 Gambia	OA Peru
V3 Belize	9G Ghana	DU Philippines
CP Bolivia	J3 Grenada	V4 St. Christopher/Nevis
PY Brazil	TG Guatemala	J6 St. Lucia
VE Canada	8R Guyana	J8 St. Vincent
CE Chile	HH Haiti	9L Sierra Leone
HK Colombia	HR Honduras	3DA Swaziland
D6 Comoros	4X Israel	9Y Trinidad/Tobago
TI Costa Rica	6Y Jamaica	GB United Kingdom*
CO Cuba	JY Jordan	CX Uruguay
HI Dominican Republic	EL Liberia	YV Venezuela
J7 Dominica	V7 Marshall Islands**	4U1ITU - ITU,Geneva
HC Ecuador	XE Mexico	4U1VIC - VIC,Vienna
YS El Salvador	YN Nicaragua	

**Limited to special-event stations with callsign prefix GB (GB3 excluded) and informally to stations number (sic) on Pitcairn Island (VR6).*
***The Marshall Islands are independent, but the FCC currently honors the previous agreement until a formal agreement can be made. The gateway can't be used to or from a country not on the above list.*

Table I– Countries that have third-party traffic agreements with the U.S. (see text). (Table courtesy Jim, W2XO)

The Digital Dipole

BY KARL T. THURBER, JR., W8FX

From Software Through Antennas For The Shack

Random Reflections—Part I

This time we'll set our sights on some "random reflections," reflecting on and updating "Digital Dipole" topics we covered in earlier columns; we'll also cover considerable new territory. Let's begin where we should—with antennas.

Antenna Reflections

Nil-Jon Antennas: On the Web. Nil-Jon Antennas offers a broad line of high-performance, rugged, and compact antennas for amateur radio, business communications, VHF/UHF scanning, FM and TV reception, and more. According to the firm, which sports a modern, 25,000 sq. ft. manufacturing facility, only top-quality materials are used. These include seamless aircraft HD aluminum elements, stainless-steel hardware, and polycarbonate plates.

Not long ago the company went online with an attractive website which profiles each antenna offered in the categories we noted. The site also provides dealer listings, online ordering, antenna photos, radiation plots, and "helpful hints."

In the area of antennas for the amateur radio community, Nil-Jon offers wide-bandwidth, off-center-fed, half-wave vertical dipoles for 10, 6, and 2 meters; high-gain, compact "Super Omni-Verticals" for 2 meters and 70 cm; 2 meter and 70 cm Yagis; and dual-band mobile antennas that cover 2 meters and 70 cm.

For more information, contact Nil-Jon Antennas, 29462 Lorain Road, North Olmstead, OH 44070 (1-877-964-5566; e-mail: <niljonant@ameritech.net>; web: <http://www.nil-jonant.com>).

706 Tune Control. A handy plug-in device to enable the TUNE/CALL button on the ICOM IC-706 transceiver is offered by Gerry Smith, W6TER, and Jim Van Putten, W8QT, both of The BetterRF Co. Boasting easy installation, it's contained in a small PC board that plugs into the IC-706 rear Molex connector.

With the device plugged in, you can use the signal to tune your antenna or an antenna tuner, or to check standing-wave ratio (SWR). By pushing once on the button, the transceiver emits 10 watts steady carrier with a sidetone through the speaker. If you press twice more, the transceiver reverts to its previous mode and power. The device requires no radio modification, and it works over 160 through 10 meters. Price is $32.95 plus $3 s/h.

For details, contact The BetterRF Co., 44 Crestview Lane, Edgewood, NM 87015 (1-800-653-9910; e-mail: <BetterRF@qth.com>; web: <http:// www.qth.com/BetterRF>).

New from RF Applications. We highlighted the firm of Bruce R. Knox, W8GN, RF Applications, and its RF accessory products most recently in May 1998. These products include the P-100A, P-1500, P-2000, P-3000, and P-5000 Series Digital Wattmeters; the Match Alert™; the PM-2100 Series RF Power Monitoring

The RF Applications VFD Series Wattmeters, which use a remote sensor, represent a breakthrough in microprocessor, display, and software technology. The units feature a two-line by 16-character vacuum fluorescent display, tuning and operate modes, and a settable VSWR alarm limit. (Photo courtesy RF Applications, Inc.)

289 Poplar Drive, Millbrook, AL 36054-1674

System; the P-1 Serial Digital Wattmeter; and more.

Bruce has expanded his product line to include the VFD Series Wattmeters. The compact units, which use a remote sensor, are a breakthrough in microprocessor, display, and software technology. They feature a two-line by 16-character vacuum fluorescent display, tuning and operate modes, and a settable VSWR alarm limit. The VFD display holds your peak RMS power for about two seconds after you stop transmitting; the bargraph updates instantaneously, making tune-up very easy.

With the VFD External Relay Option you can interrupt your transmit control circuitry to protect from high VSWR, and you can have your wattmeter personalized with your callsign. While the basic VFD meters cover HF from 1.8 to 30 MHz at 3 KW, other frequency coverage and power versions are available.

For pricing and other information, contact RF Applications, Inc., 7345 Production Drive, Mentor, OH 44060 (1-800-423-7252; e-mail: <sales@rfapps.com>; web: <http://www.rfapps.com>).

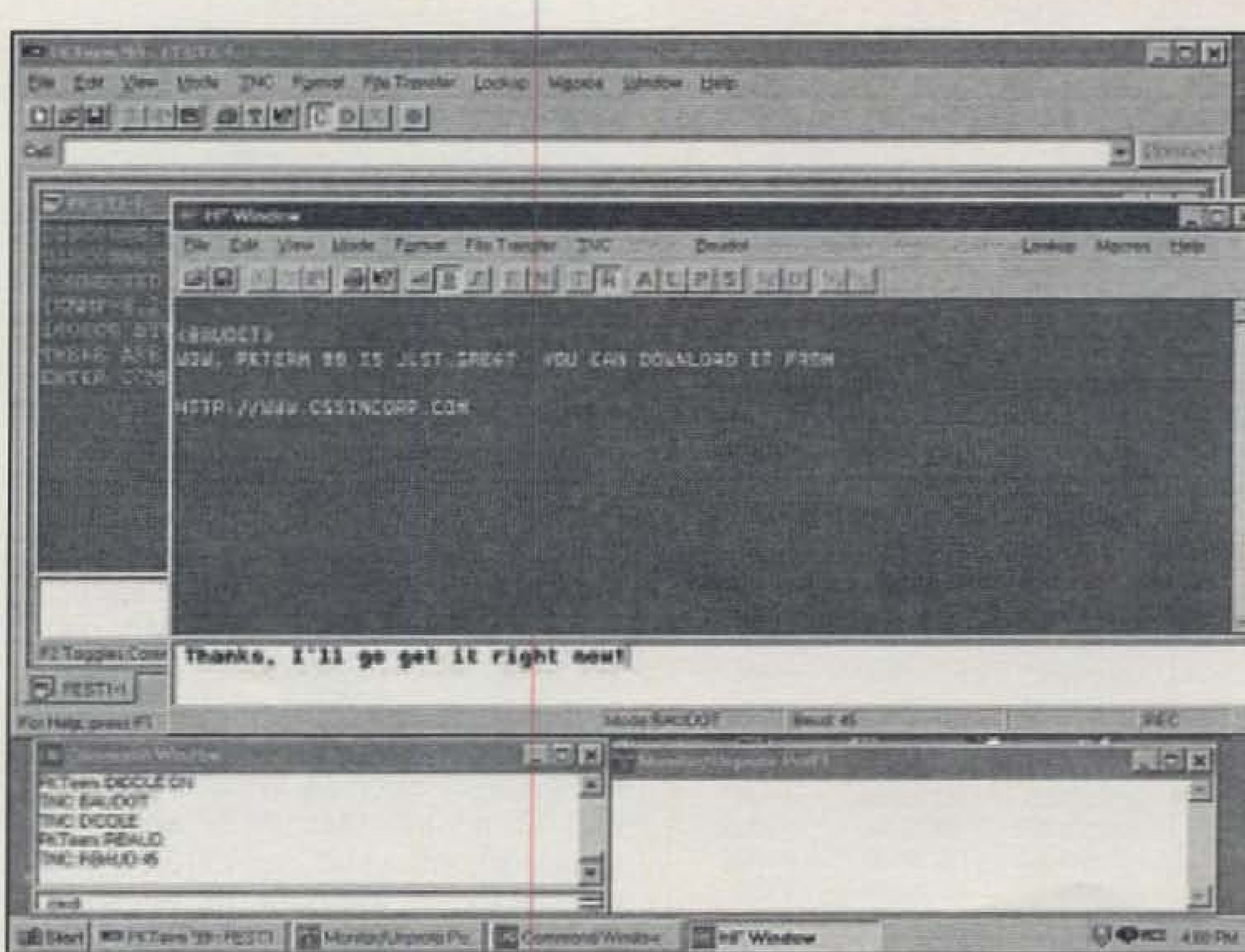
At the time of this writing, RF Applications was to introduce the Windows™)-based WinWatt™ Dual Channel Wattmeter. Details are on their website at: <http://www.rfapps.com/winwatt.htm>.

KB6KQ Antennas: On the Net. Loop antennas long have been popular on VHF and UHF, especially for local, mobile, and weak-signal work. As we noted in November 1998, Norm Pedersen, KB6KQ, offers several single-band loop antennas covering 6 meters through 70 cm. The antennas meet most any need, from directive VHF/UHF SSB and CW work to omnidirectional net-control uses.

Norm's horizontally polarized, pretuned loops, which are stackable and adaptable for base operation, are based on half-wavelength aluminum elements. They recently have been enhanced to provide greater strength and more bandwidth, eliminate weather detuning, and handle over 750 watts. The antennas are priced from $45 to $85, depending on band. Phasing harnesses are $35.

Norm now has his "KB6KQ Loop Antenna Home Page" up and running. The site describes the antennas and their specs, shows photos at users' ham shacks, offers product testimonials, points to published articles, and lets you print out a flyer and order.

For more information, contact Norm Pedersen at KB6KQ Antennas, 70 Arrowhead Drive, Carson City, NV 89706 (775-885-7885; e-mail: <kb6kq@pyramid.net>; on the web: <http://www.kb6kq.com>)).



Creative Services Software (CSS) offers a comprehensive line of "wireless communication software" that lets you enjoy a host of operating modes. One of the best-known CSS programs is PKTerm '99 for the Timewave/AEATM, shown here. The CSS packages are fully featured, user friendly, and Y2K compliant. Each is priced at $79.95. (Photo courtesy Creative Services Software)

Soft Stuff

Creative Services Software Offerings. Rick Ruhl, president of Creative Services Software (CSS), contacted us with information on his comprehensive line of "wireless communication software." Rich offers TNC and other control software for a host of operating modes: CW, RTTY, ASCII, AMTOR, PACTOR, FEC, NAVTEXT, VHF and UHF packet, WeFax, even HF e-mail.

Perhaps the best-known programs are the TNC software products, such as PacTerm '98 for the Kantronics™ TNC, PKTerm '99 for the Timewave/AEA™ TNC, and MultiComm Host for MFJ™ and TAPR TNC2, among others. The packages are fully-featured, user friendly, and Y2K compliant. Each is priced at $79.95 and runs under Windows® 95, 98, or NT.

If you're into weather fax reception over HF radio, Rick offers WeFax '99, a facsimile program designed for Kantronics TNCs. WeFax lets you save images in bitmap format, allowing integration into other Windows-based programs. WeFax is $49.95.

Rick also offers an intriguing radio-based e-mail software package, HFEmail '99. The 32-bit software operates much like an Internet e-mail program. The $59.95 program lets you send and receive Internet e-mail via commercial shore station providers.

Contact Creative Services Software, Inc., 503 West State Street, Suite 4, Muscle Shoals, AL 35661 (256-381-6100; e-mail: <sales@cssincorp.com>; web: <http://www.cssincorp.com>).

Note: Check out the CSS website, since several of the programs may be into new versions as you read this.

New eHAM.net Website. Bill Fisher, W4AN, wrote to ask that I check out a new "amateur radio community website," eHAM.net. Bill indicated that the new site is more than just another amateur radio website. Rather, it's best described "as a community of ham radio operators from all over the world."

The eHAM.net website has a great deal of content distributed over a number of community areas. These include callsign lookup, chat groups, classified ads, an online search tool, DX packet spots and QSL managers, mailing-list search and archives, web links, news, practice exams, product reviews, a personal "Ham Spotlight," and propagation. There's even room to enter additional personal information and a photo in the callsign lookup area. An op-ed "Speak Out" section lets you toss in your two cents on controversial amateur radio issues.

Help is needed in building and managing the interactive website. For more information, check out the site at <http://www.eham.net>. You can contact Bill Fisher, W4AN, at <w4an@contesting.com> or the website team at <team@eham.net>.

Virtual PC™ for the Mac. Apple Macintosh users take a lot of ribbing, but few would trade their Mac for an IBM PC. Nevertheless, radio amateurs always have suffered from a somewhat limited range of available Mac application software. Now, however, Mac owners might want to check out a software program that lets them run PC software and the full range of Windows® operating systems such as Windows 95, 98, and NT, on their Mac. While we haven't personally checked out Virtual PC by Connectix, it appears to be a key "bridge" to running the latest Windows-based PC software on your Mac.

The Connectix program has received generally good reviews, although it is very processor-intensive software. This means that your Mac needs considerable processing horsepower and memory, such as a PowerPC G3 processor-based system with at least 48 MB RAM. The faster the processor, the better the performance.

For more information, contact Connectix Corp., 2955 Campus Drive, San Mateo, CA 94403 (1-800-950-5880; e-mail: <info@connectix.com>; web: <http://www.connectix.com>).

Note: We'd like to hear from Mac users who successfully have used Connectix or other IBM PC emulation programs with a variety of amateur radio or electronics application software.

From the Bookshelf

Maxim: A Genius in the Family. Most readers are familiar with Hiram Percy Maxim (1869–1936), who founded the American Radio Relay League (ARRL) in 1914 and who is, by some, credited with almost singlehandedly creating amateur radio as a hobby. As the "father of amateur radio," Maxim was the ARRL's president for 22 years until his death in 1936. His callsign, W1AW, was awarded to the ARRL for its headquarters station in memory of this ramrod-straight standards-setter who was revered by amateurs.

What is not so well known is that Hiram Percy Maxim was an MIT engineering graduate who created several inventions, including an automobile and the famous Maxim silencer for explosive weapons. He was a member of a family of inventors, being the son of Sir Hiram Stevens Maxim (1840–1916), who later moved to England, where he invented the Maxim machine gun and was knighted by Queen Victoria in 1901. Hiram Stevens Maxim had a brother, Hudson Maxim (1853–1927), a chemist and inventor.

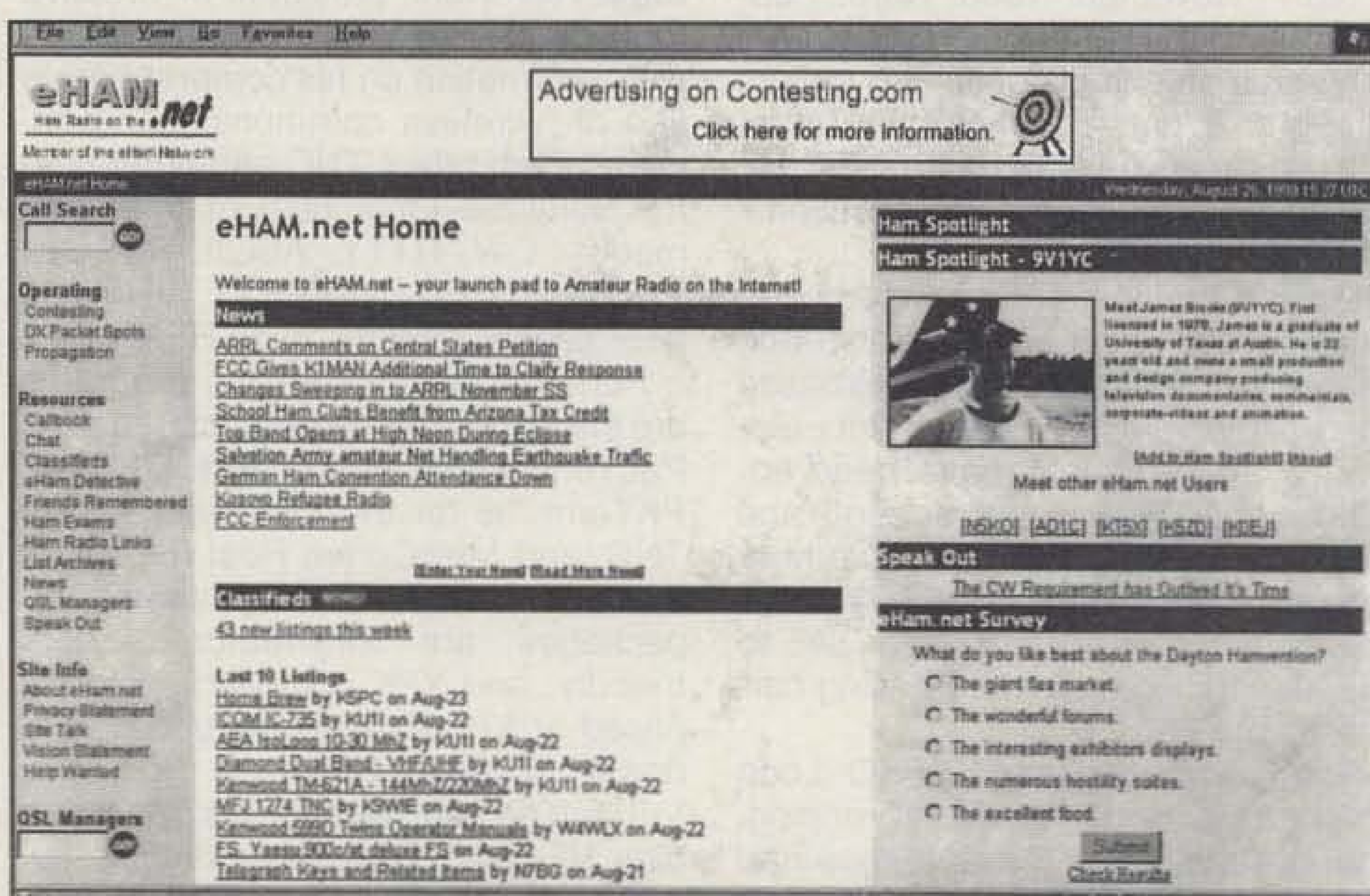


Fig. 1– Here's the attractive "amateur radio community website," eHAM.net. The site is more than just another amateur radio website. Rather, it's best described "as a community of ham radio operators from all over the world." The eHAM.net website has a great deal of content distributed over a number of community areas. The site's at <www.eham.net>.

Hiram Percy Maxim ended up writing a book about his very interesting experiences growing up in a family of inventors. His book was *A Genius in the Family,* subtitled "Sir Hiram Stevens Maxim Through a Small Son's Eyes," originally published by Harper Brothers just after Hiram Percy Maxim's death in 1936. The 216-page book is a delightful memoir of an eccentric childhood as the son of a wonderful man who nevertheless "never quite learned to be a father." It's full of interesting tales and observations, none of which are directly connected to amateur radio. The book now is available under the "A Common Reader" imprint of The Akadine Press, Inc. for $17.95 postpaid.

For more information, contact The Akadine Press, Inc., 141 Tompkins Avenue, Pleasantville, NY 10570 (phone 1-800-832-7323; e-mail: <Service@CommonReader.com>; web: <http://www.commonreader.com>).

Radioware & Radio Bookstore: On the Web. It took a while to get the website up and running, but Craig Clark, W1JCC, can take pride in his attractive "Radioware & Radio Bookstore Radio Hobbyist Catalog" website. It effectively combines the previous Radioware and Radio Bookstore functions into one website that promotes "great products and books for the radio hobbyist."

The site, at <http://www.radio-ware.com>, is organized into general products, books, and specials/closeouts categories. There also is an excellent set of links to a variety of useful amateur-radio-related websites, as well as a list of hamfests and shows to which the staff travels.

Books offered include a good selection of antenna, reference, scanner, SWL, and CB titles; calendars; handbooks; study and radio modification guides; and collectible books and manuals. Also offered are several amateur radio software packages. Other products featured include CB, amateur, phone, and scanner antennas; mounts; wire; cable; rope; grounding parts; RFI and lightning protectors; and other antenna parts.

Contact Radioware and Radio Bookstore, div. of Unglar, Inc., P.O. Box 209, Rindge, NH 03461-0209 (1-800-457-7373; e-mail: <radware@radio-ware.com>; web: <http://www.radio-ware.com>).

Protecting Yourself Online. We're all familiar with the "dummy," "idiot's guide," and similar-sounding computer books of recent years. These are designed to guide you to computer success even if you know nothing about PCs or software. Such books are useful for learning, but some assume substandard intelligence and technical illiteracy, and so are demeaning to many.

Not so with an impressive recent book in this genre by noted computer expert Preston Gralla. It's *The Complete Idiot's Guide to Protecting Yourself Online.* The 348-page, $16.99 Que® book offers quick and easy ways to ensure your online safety while using the Internet, helping you avoid common pitfalls and security mistakes we're *all* likely to commit.

Some areas covered include selecting hacker-proof passwords; protecting against spam and scams; keeping your e-mail private; dealing with "web cookies" and online registration forms; participating in chat areas and newsgroups; protecting your children and family online; buying online safely; protecting yourself from Trojan horses, viruses, rogue Java applets, and other nasty creatures; and keeping your PC safe from prying eyes.

For a catalog contact Macmillan Publishing USA, 201 West 103rd St., Indianapolis, IN 46290-1097 (1-800-858-7674; e-mail: <info@mcp.com>; web: <http://www.mcp.com>).

New C. Crane Company Catalog. The C. Crane Company, in business for nearly a quarter century, publishes an annual catalog that tops out at nearly 90 pages. Their "Communication Excitement" catalog is subtitled "radio, light, and science." As such, it's directed mainly at SWLs, scanner buffs, and other radio and science hobbyists, but it also includes many interesting products of interest to radio amateurs. The searchable catalog is online at the C. Crane website.

The company's product line has been expanded since we last perused the catalog. Included are antennas and radios for AM, FM, and shortwave listening; scanners; mobile electronics products; telephones and accessories; CB radios and antennas; chargers and batteries; power packs; flashlights and lanterns; books; and other accessories and "odds and ends."

The catalog also includes entries in the science and technology category. These include weather radios and weather stations; optical devices, including specialized microscopes and telescopes; GPS receivers; a Geiger counter; a metal detector; clocks; and science and other kits.

For a free catalog, contact C. Crane Company, 558 10th Street, Fortuna, CA 95540-2350 (1-800-522-8863; e-mail: <ccraneco@aol.com>; web: <http://ccrane.com>).

Note: Check out the website. It has a number of links to other websites of radio interest, including the website of Art Bell, W6OBB, <http://www.artbell.com>, where C. Crane Company is a regular advertiser on Art's speculative, all-night radio show.

We Get Letters

Once again we're just about out of space. Before wrapping up things this month, we'd like to acknowledge some of the folks who wrote, faxed, e-mailed, phoned, or otherwise corresponded with us. A tip of the hat to Rick Meyer, KF4CGP; Brian Cooke, W8BPC; Johan Van de Velde, ON4ANT; Zeke Lutz, N9JL; Ben Zieg, W3BZ; Mike Lamb, N7ML; and Benjamin Tan. Many thanks, folks—and keep those cards and letters coming!

Short Bursts

Ham Radio's Future? Today communications satellites and the Internet have made the world a much smaller place. Finding out what's up across the world doesn't require you to be a skilled radio amateur or shortwave listener. To many, amateur radio, along with allied hobbies such as SWLing, is becoming a relic of sorts.

So what about amateur radio's future? Many believe that the only way to slow the decline in interest in amateur radio is to rekindle *youth* interest in the hobby; reportedly, amateur radio is a predominantly male hobby with a median age over 50 years!

Some advocates hold that education-based exposure to fun and employment opportunities in the communications, broadcasting, and related industries might cause some of the old magic to return to the hobby. Only time will judge whether amateur radio and its sister hobbies survive in the online era.

For more, although somewhat contrasting, thoughts along these lines, check out the Op-Ed page in last September's *QST*. On page 91, Randy Pirtle, N6GN, offered a perceptive essay, "A Farewell to HF?" In it he optimistically noted that when a new technology or way of doing things improves on or overtakes the old, it doesn't necessarily mean the old must disappear. In fact, working with the older technology can result in beneficial challenges and fun for participants.

Will encouragement of our youth or "allowable technological diversity" save our hobby—or will something more radical be needed? Food for thought.

Wrap-Up

That's all for this time, gang. Next time more "Digital Dipole" topics of current interest. See you then.

Overheard: In amateur radio as in everything else, if you can't solve a problem, at least try to put some humor into it.

73, Karl, W8FX

BY FREDERICK O. MAIA, W5YI

Regulatory News In The World Of Amateur Radio

FCC Dismisses Seven Amateur Radio Related Petitions

The FCC has turned down seven Petitions for Rulemaking, including four filed by the American Radio Relay League. Some were nearly three years old. The dismissals were all acted on by the FCC during the latter half of November 1999.

"In the interest of administrative efficiency, we have consolidated these petitions in this Order because in all cases we find that they do not warrant the issuance of a Notice of Proposed Rule Making and the commencement of a separate proceeding. Because the petitioners in these cases have not presented sufficient evidence to justify altering the current operator privileges or request changes that are inconsistent with the international Radio Regulations, we are dismissing these petitions," said the FCC.

FCC Refuses To Strengthen PRB-1

The FCC has denied RM-8763, a 1996 ARRL petition asking the Commission to further compel state and local governments to reasonably accommodate amateur radio and apply the least restrictive means to regulate amateur antennas and activity. The requested rules changes would have expanded and clarified PRB-1, the Federal preemption of state and local regulation spelled out by the FCC in 1985 and since incorporated into the laws of several states.

The ARRL asked the FCC to amend the Part 97 rules to say that any state or local antenna restrictions limiting amateur radio antennas to heights below 70 feet would be "presumed unreasonable" unless the state or local authority could show its restrictions were necessary for health, safety, or aesthetic reasons.

The ARRL also wanted the FCC to acknowledge that it "has no less interest in the effective performance of an Amateur Radio Station" in an area regulated by deed restrictions, covenants, or condominium regulations than in an area regulated by zoning ordinances. It also asked the FCC to preempt overly burdensome conditions and excessive costs localities might require in connection with hams' antenna installations.

The FCC said it would not be "prudent" or "appropriate" to set a height standard for amateur antennas and supporting structures "because of varying circumstances that may occur" for differing antenna configurations. "We believe that the policy enunciated in PRB-1 is sound."

"We continue to believe that the standards the Commission set, that is 'reasonable accommodation' and 'minimum practicable regulation,' have worked relatively well," the FCC said.

The FCC also said its policy with respect to restrictive covenants already is clearly stated in PRB-1, which excludes restrictive covenants in private contracts as being "outside the reach of our limited preemption."

Use of 7.1–7.3 MHz in American Samoa

The ARRL requested on March 12, 1997 (assigned Rulemaking File No. 9106) that the Amateur Radio Service rules and the Table of Frequency Allocations be amended to permit stations in the Territory of American Samoa to transmit on the frequency band 7.1–7.3 MHz as a domestic exception to the International Table of Frequency Allocations. The League argued that the Territory of American Samoa is an unincorporated, unorganized Territory of the United States located, for purposes of the international Radio Regulations, in ITU Region 3.

The international Radio Regulations allocate only the frequency band 7.0–7.1 MHz to the amateur service in ITU Region 3. In support of its petition, the League said that nearby Australia, New Zealand, and Western Samoa—all located in ITU Region 3—had authorized these frequencies to be used by their amateurs on a non-interference basis. ARRL said that amateur radio operators in those countries had established emergency and other communications networks on the frequency band 7.1–7.3 MHz for communications with amateur stations in Hawaii and the United States mainland.

The FCC denied the request based on propagation characteristics of the 40 meter band. The Commission said that Australia, New Zealand., Hawaii, and the U.S. mainland were beyond the predictable 500 mile range of 7 MHz.

The FCC also noted that the 40 meter ham band is shared with the International Broadcast Service in Regions 1 and 2. "...communications between amateur service stations at night is hampered by interference from broadcast stations, especially on the 7.1–7.3 MHz frequency band," the FCC said.

Ham Band Use by Emergency Professionals

On March 10, 1997, Mr. James Cardillo-Lee, KE6VGV, of Petaluma, California, filed a petition for rule making, RM-9114, requesting that Section 97.113 of the Commission's Rules be amended to permit amateur radio operators who also are emergency personnel engaged in disaster relief to use the amateur service bands when such operators are in a paid-duty status.

Mr. Cardillo-Lee states that the amateur service rules prohibit an amateur station from transmitting communications where there is a pecuniary interest, including transmissions made on behalf of an employer. He wanted an exception in the rules similar to that granted school teachers who are allowed to conduct educational activities on the amateur bands in connection with their employment.

In 1993 the Commission amended the amateur-service-prohibited transmission rule, Section 97.113, to permit greater flexibility for amateur stations providing communications for public service projects, such as races and parades, and to support educational activities. Amateurs also were permitted to use amateur radio for personal communications such as making appointments and ordering food, to collect data for the National Weather Service, and to provide assistance voluntarily even where there are other authorized radio services available.

The FCC declined to develop a list of permitted or prohibited communications because the list would be very lengthy. Instead, the FCC adopted five

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

general standards that an amateur radio operator should use when deciding whether his or her station should transmit a message.

1. This rule allows amateur radio stations to transmit any amateur-station-to-amateur-station communication unless it is specifically prohibited;

2. transmitted for compensation;

3. done for the pecuniary benefit of the station control operator;

4. done for the pecuniary benefit of the station control operator's employer;

5. or communications, on a regular basis, which could reasonably be furnished through other radio services.

It also decided to rely on the amateur service's tradition of self-regulation and cooperation between licensees, the cornerstones of the amateur service, to determine whether specific communications should be transmitted on amateur service frequencies.

The Commission believes that amateur radio operators who also are emergency personnel engaged in disaster relief are not receiving compensation for transmitting communications. Rather, the FCC believes, these individuals are receiving compensation for services related to their disaster-relief duties and in their capacities as emergency personnel, and the fact they also are amateur radio operators is incidental to these functions.

The FCC said further clarification was not necessary since two-way communications on amateur frequencies by paid emergency personnel engaged in disaster relief are permitted under existing rules.

Communication Between RACES and ARES

In RM-9115 filed March 12, 1997, the ARRL asked that the rules be amended to permit intercommunication between RACES participants and other amateur stations, especially ARES stations, actively providing communications related to emergency or disaster situations, including drills and tests. The League also asked that the one hour per week training limitation be modified to a maximum of five hours per week. RACES is the Radio Amateur Civil Emergency Service, while ARES is the ARRL-sponsored Amateur Radio Emergency Service.

The FCC said the ARRL has failed to demonstrate that a separate rulemaking proceeding is warranted, particularly given the ARRL submitted a similar request that was considered and denied in 1976 when the Commission updated the RACES rules.

The Commission said, "The importance of allowing amateur stations to participate in providing essential communications when there is an emergency situation or a natural disaster cannot be overstated. Because such communications may be instrumental in saving human lives and protecting property, we believe that an amateur station should be able to communicate with other amateur stations in furtherance of those objectives.

"...our decision not to pursue further the ARRL rulemaking requests will not adversely affect the ability of amateur service stations to provide emergency communications. Under the current Rules, a primary, club, or military recreation station has more ability and flexibility than a RACES station to provide emergency communications because a primary, club, or military recreation station can provide emergency communications with any other amateur service station at any time and on any frequency authorized the control operator of the station."

Observing Band Plans is "Good Amateur Practice"

In RM-9259 filed on April 3, 1998, the ARRL requested that the FCC issue a Declaratory Ruling acknowledging that the phrase "good amateur practice" as used in the rules requires that amateur radio stations comply with voluntary band plans adopted by the amateur community. The League believes that as more users attempt to operate in increasingly crowded spectrum, it becomes more important to define minimal standards of "good amateur practice" in order to prevent interference by "rogue operators."

The ARRL asks that the FCC confirm that "...non-compliance with accepted band plans which causes interference to one or more amateur service stations that are operating in accordance with these accepted band plans should not be considered good amateur practice under any circumstances." The League agreed, however, that rigid enforcement of band plans is neither warranted nor feasible. The Commission received over 70 comments on the ARRL proposal.

The FCC said a basic amateur principle is that all frequencies are shared and no frequency will be assigned for the exclusive use of any station.

"Voluntary band planning is a method that amateurs have long used to meet the requirement that licensees make the most effective use of the amateur frequencies. It allows the amateur community to accommodate the varied operating interests of licensees and the specific operating activities that a station or a group of stations wishes to engage in without explicit regulation.

"Voluntary band planning also allows amateurs the flexibility to reallocate its spectrum among operating interests as new operating interests and technologies emerge or operating interests and technologies fall into disfavor. The Commission's role in amateur service band planning, especially on the HF and Medium Frequency amateur service bands, generally has been limited to establishing the emission types that can be transmitted in different frequency segments," FCC said.

"We believe that it is not necessary to define the term 'good amateur practice' as used in the Rules as requiring that amateur stations comply with voluntary band plans or declare that any amateur station control operator who selects a transmitting frequency not in harmony with those voluntary band plans is not operating in accord with good amateur practice. We believe that such definition would have the effect of transforming voluntary band plans into *de facto* required mandates.

"...we note that numerous commenters object to the request, and to any attempt to establish mandatory band plans."

Protecting Weak-Signal Operation

On May 3, 1999 the Central States VHF Society (CSVHFS) asked in RM-9673 that the rules be amended to prohibit amateur stations from transmitting wideband emissions on certain VHF (6, 2, and 1.25 meter) and UHF (70 cm) frequency segments. It contended that long-distance weak-signal work above 50 MHz is important and that wideband emissions such as FM voice and packet radio interfere with these communications. CSVHFS said voluntary band plans had not been successful in limiting the activity.

CSVHFS said it wants to protect weak-signal communications by prohibiting amateur stations from transmitting wideband emissions in the 50.1–50.3 MHz, 144.0–144.3 MHz, 222–222.15 MHz, and 431.8–432.5 MHz frequency segments. It defined wideband emissions as those wider than Morse code and SSB. The FCC received 68 comments on the petition.

The FCC stated that weak-signal enthusiasts had already been provided segments at 144.0–144.5 and 100 kHz telegraphy segments in the 6 and 2 meter band. "We believe, therefore, that spectrum that is free of FM emission types is available for licensees interested in weak-signal communications.

"A hallmark of the Amateur Radio Service has been that all frequencies are shared. The expectation of any station that it can operate in a totally interference-free environment, therefore, is unreasonable. We also believe that subdividing amateur service frequency bands would undercut the voluntary band planning that the amateur service community does and would result in a loss of flexibility to reallocate spectrum as licensee's operating interests change, new technologies are incorporated, and frequency bands in the radio spectrum are reallocated."

The FCC also is "...concerned that subdividing amateur service bands on the basis of operating interests would result in a loss of flexibility to accommodate changes in operating trends and emergence of new technologies."

The FCC noted that "...some commenters express the view that weak-signal operations is a minority operating interest within the VHF amateur service community [and] ...dispute the need for protecting weak-signal operations."

Broadcasting on the Amateur Bands

The FCC also denied and dismissed the March 2, 1999 Petition for Rulemaking filed by Michael R. Reynolds, WØKIE, of Tulsa, Oklahoma. He had requested that the amateur service Rules be changed to permit amateur stations to make one-way transmissions intended for reception by the general public, either direct or relayed, on amateur service frequencies above 420 MHz.

Reynolds also requested that the rule prohibiting amateur stations from engaging in any form of broadcasting [Section 97.113(b) – Prohibited transmissions] be amended to exclude broadcasting only on amateur frequencies below 420 MHz.

In support of his request, Reynolds said that his proposal, if adopted, would provide new opportunities for non-commercial community-oriented radio and additional diversity in radio voices and program services. He also said that he believed the amateur service frequencies above 420 MHz "...are seriously underutilized"

The FCC said, "...the Commission considered the scope of communications that can be transmitted by amateur stations when it amended its amateur service rules regarding prohibited transmissions in 1993." (PR Docket No. 92-136.)

"In that proceeding, the Commission amended the amateur service rules to allow amateur operators more flexibility to provide communications for public-service projects as well as to enhance the value of the amateur service in satisfying personal communications needs.

"The prohibition against news gathering and broadcasting by an amateur service station, however, was retained because we do not believe the amateur service frequencies should be used generally for news gathering or as an alternative to Broadcast Service frequencies. For this reason, an amateur station is prohibited from engaging in any activity related to program production or news gathering and any form of broadcasting," the FCC said.

"We also note that broadcasting is not one of the purposes for which frequencies are allocated to the amateur service and that this would be inconsistent with the definition of the service in both the Commission's Rules and the *[International] Radio Regulations.*

"Additionally, we believe that authorizing amateur service stations to broadcast in the 420–450 MHz band would cause harmful interference to other stations that share the band with the amateur service, such as Government radiolocation (radar) stations and space stations.

"...with respect to your argument that amateur service frequencies above 420 MHz are seriously underutilized, we note that 420 MHz is the lowest amateur service frequency that can be used for spread-spectrum emission types and fast-scan television emissions."

Based on listings in the *ARRL Repeater Directory,* the FCC said that "...[there appears] to be numerous amateur service repeater stations in the United States and Canada that transmit on this band, even on a secondary basis.

"For this reason, we believe that amateur service frequencies above 420 MHz are well utilized and that usage of these frequencies is increasing. Additionally, we feel that the assignment of a rulemaking number to your petition and the commencement of a separate proceeding is not warranted because the Petition requests rule changes that are repetitive of those considered in PR Docket No. 92-136.

"Finally, we note that the Commission is exploring ways to provide new opportunities for non-commercial community-oriented radio stations in an on-going rulemaking proceeding entitled *Creation of a Low Power Radio Service,* MM Docket 99-25, Notice of Proposed Rulemaking."

Summary

The FCC denied and dismissed all seven Petitions for Rulemaking on the basis that "...they had been previous considered, are unnecessary in light of existing rules, and do not warrant further consideration at this time."

73, Fred, W5YI

Looking Ahead in CQ

Here are some of the articles we're working on for upcoming issues of *CQ:*

- "SWLing for Hams" (Part 2), by W8FX
- "*CQ* Review: Transtronics SW Receiver Kit," by N2OZ
- "*CQ* Review: The 5-Band HEX Beam," by W1ICP
- "A Weathernode Paging System," by KC5RTH

Plus...

- "Exploring Aurora Communication," by WB2AMU
- "A Skeleton Sleeve-Fed Monopole," by K6MHE
- "Global Optimization of Yagis," by K6STI
- "The 2000 *CQ* National Foxhunting Weekend," by KØOV

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, Hicksviulle, NY 11801. We plan to have an on-line version available soon on our website: <http://www.cq-amateur-radio.com>.

BY JOE VERAS, N4QB

Vintage Gear and Its History

The "Golden Age"—In The Beginning

Amateur radio was at its high-water mark on the day I received my license. Every change to this pristine state since has come dangerously close to destroying the hobby. For the record, that's not a personal statement of fact, only the paraphrase of an opinion apparently held by many. I've heard it from hams licensed in the days of spark as well as from those with callsigns too new to appear in the CD-ROM callbook.

When exactly was the "Golden Age"? For some it's a mythical time that never really existed; others, driven by sentiment or historical interest, can pinpoint a specific era. Still others believe the best days are yet to come. You'll have to answer the question for yourself, but I believe there is an unbroken connection between the early days and the present. It runs like a lossless feedline from the first amateurs, through those populating the years in between, to the hams of today. The essence of what we do, the core of the hobby, remains the same. The change occurs in the devices we use to communicate.

Occasionally a piece of equipment will be significant enough to act as an instrument of change on the hobby itself, or some aspect of it. The easiest way to see this is to take the long view, to examine amateur radio and its commercial gear over a number of decades. This column, on a quarterly basis, will touch on both the benchmark achievements and peripheral minutiae of the ham radio equipment world. Driven by my whims as well as those of readers, it will not necessarily follow the industry's evolution in chronological succession. Even though our journey will frequently diverge from the straight timeline's main path, the suitable place to start is still at the beginning.

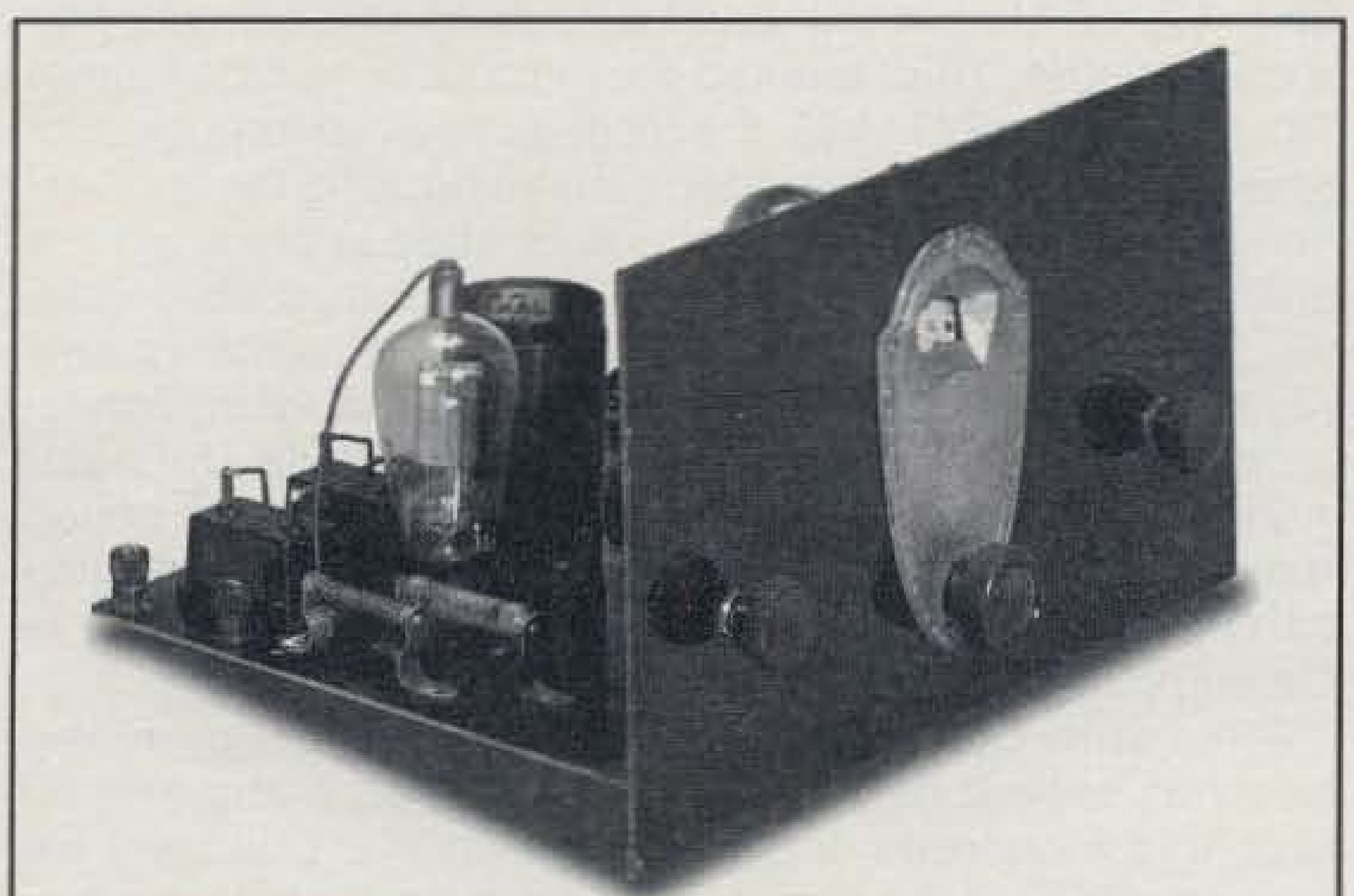
P.O. Box 1041, Birmingham, AL 35201
e-mail: <n4qb@cq-amateur-radio.com>

Prior to 1930, most ham gear was home built. *QST*, *Radio News*, and other contemporary publications were long on projects and ads for parts but short on commercial gear. The publishers' advertising salesmen were not to blame, as virtually no ham equipment industry existed to buy ad space. Two names still familiar today, National and Vibroplex, pitched their wares to the fledgling market. Hammarlund and E.F. Johnson were both in the parts business. Others, including Collins, Hallicrafters, and RME, were waiting in the wings. Considering this industry debuted on the stage of the Great Depression, it is a wonder that these companies, and those to follow, succeeded at all.

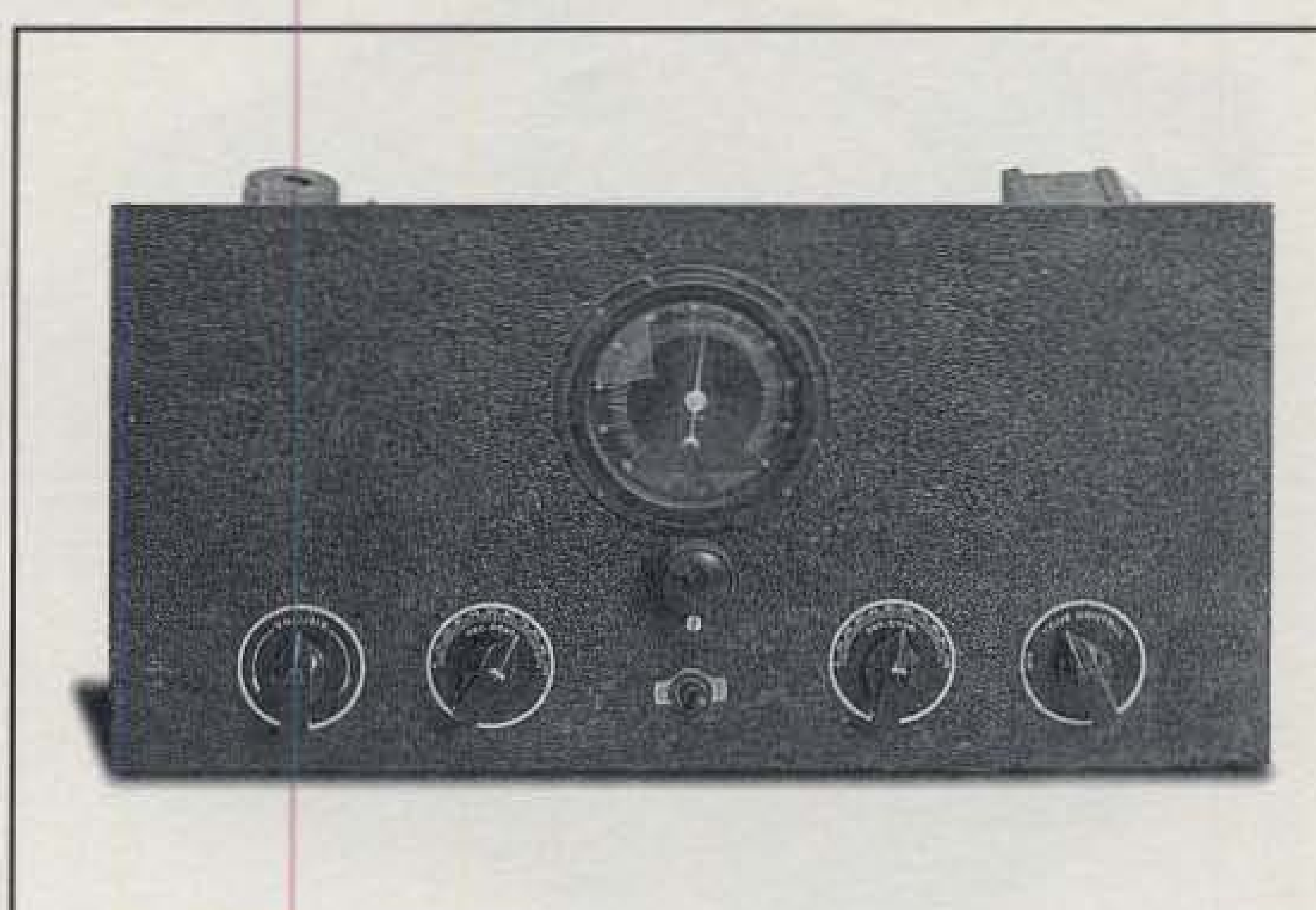
Even companies not directly involved in marketing their own ham equipment found a way to get into the act. Cornell-Dubilier, Ohmite, Thordarson, and others sponsored a couple of receiver construction articles in *Radio News* and similar magazines in the mid-1930s. The five- and six-tube superhets were known, respectively, as the All-Star Jr. and Sr. Schematics and assembly instructions were available free of charge from the magazines; radio-parts jobbers carried drilled and punched panel/ chassis units to give the finished project a commercial look. The parts-manufacturing sponsors were hopeful their components would be used in constructing the receivers.

The National Company entered the decade of the 1930s on the strength of momentum developed during the late '20s with their "thrill-box" receivers. The SW-2 through SW-5 series evolved under the guidance of James Millen, hired by National as Chief Engineer/General Manager in 1928. The SW receivers were regenerative sets, the numeric part of their name indicative of the number, or in some cases the type, of tubes employed.

The basic panel-and-chassis SW-2 of 1928 later acquired a third tube but kept its original nomenclature. A four-tube successor, the SW-4, appeared in 1929. The additional tube



James Millen's association with National had a simple beginning—the SW-2 regenerative receiver. (All photos in this column are by Joe Veras, N4QB.)

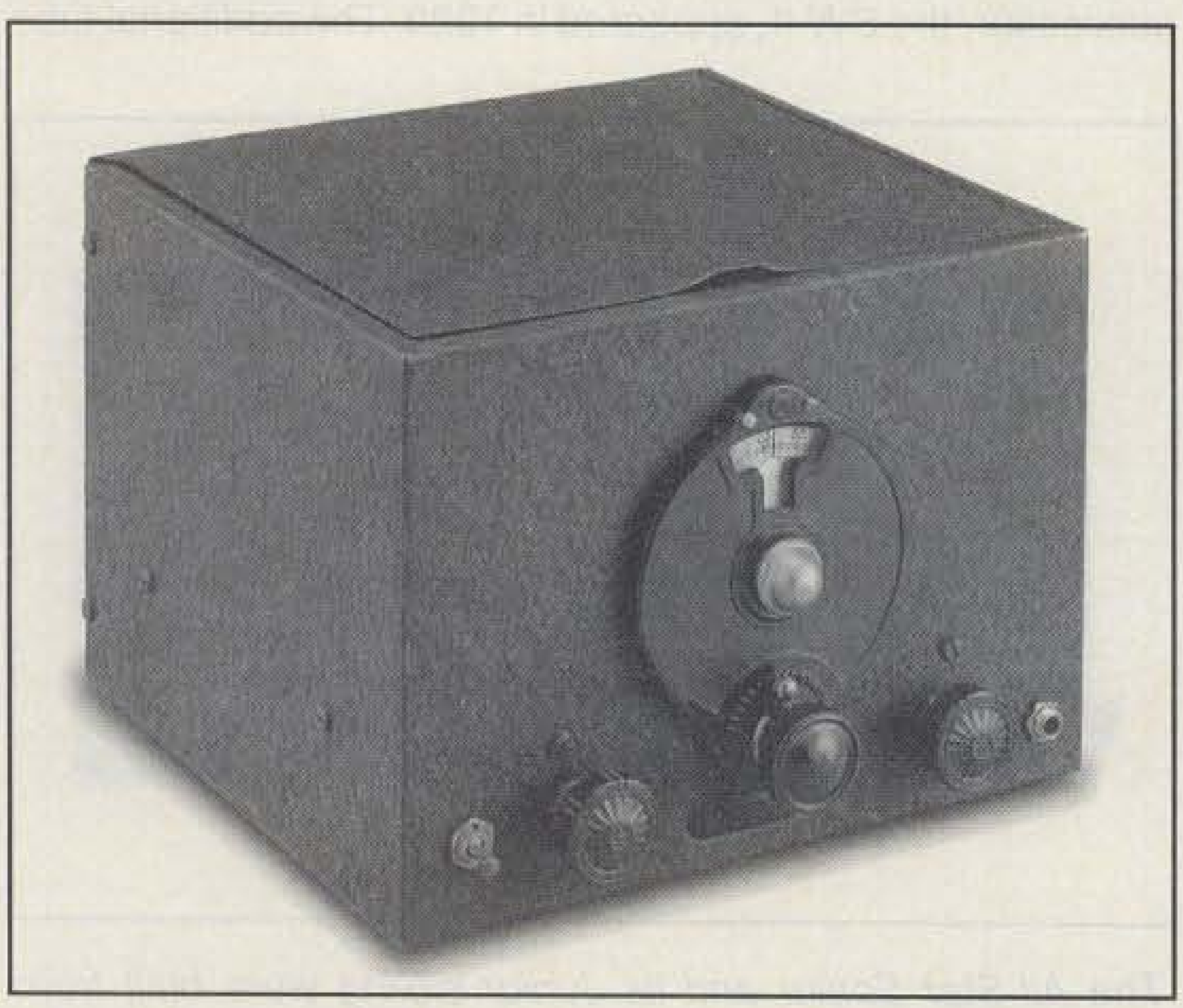


The All-Star Senior and its Junior sibling were built from plans published by several popular radio magazines in 1934–35.

The SW-5 (pictured) and the SW-45 and 58 were variations on the same theme.

supplied increased audio output, and the receiver was fabricated with custom tooling, unlike the hand-drilled SW-2. Push-pull audio and a five-tube lineup arrived with the SW-5's introduction in 1930. An SW-5 variant, aimed at the broadcast market, was dubbed the SW-45, its name reflecting the substitution of type 45 tubes for the 27's in the audio output stage. Another version, taking advantage of improving tube technology, the SW-58 employed type 58 tubes for better RF-stage performance. The SW-4 and 5 iterations of the thrill-box were housed in metal cabinets attractive enough to make them acceptable in all but the most fashion-conscious living rooms. Consistent with their contemporary competition, and many future Millen designs, the SW series used plug-in coils.

Hammarlund, like National, initially was involved in manufacturing and entered the radio business by marketing broadcast receiver kits. National's Malden, Massachusetts factory sold the Browning-Drake kits, while the Manhattan-based Hammarlund's hyphenated subsidiary was Hammarlund-Roberts.



National aimed the SW-3 at the amateur market and hit pay dirt with a product that survived 15 years.

The Hammarlund Comet Pro grandfathered the line of Super-Pro receivers which stretched four decades into the future.

Hammarlund manufactured a variety of consumer and industrial goods before making its first radio-related product, a variable capacitor, in 1916. The Hammarlund-Roberts BC receiver kits were introduced in 1925, and a two-tube regenerative shortwave set, similar to National's SW-2, hit the hobby market in 1930. Space in this maiden-voyage column does not permit an in-depth exploration of the firm. For the present, however, I just will say that Swedish immigrant Oscar Hammarlund lent his name to the company he founded in 1910 and save most of the history lesson for another time.

The first receiver bearing a family resemblance to subsequent offspring in the Hammarlund line was the Comet, later the Comet Pro. The familiar "two-eyed" symmetry of its front panel is a recognizable trait that runs through all of the Super-Pro and HQ series that followed. When introduced in late 1931, the Comet made its mark as the first commercially-produced shortwave superhet. There are plausible claims to this same distinction by others; for the moment, we will toe the Hammarlund company line and entertain arguments to the contrary later.

The original Comet and Comet Pro were eight-tube sets; the former covered the BC band through 21 MHz and the latter 1.5–20 MHz in four bands. Each band required a pair of plug-in coils. 1932 marked the introduction of the Comet Pro. From then until 1935, the receiver evolved through successive versions. The wooden cabinet housing the first version gave way to an all-metal one finished in black wrinkle which matched the front panel. Shielding and oscillator coupling were improved. The addition of a crystal filter greatly increased selectivity that had depended solely on lightly-coupled IF transformers. A ninth tube was added for automatic volume control. Examining magazines of this period leads one to conclude that it was difficult for those writing ad copy to keep pace with the engineers' changes to the equipment.

At the same time the incessant march of technology moved receivers toward bigger and better, the economy exerted force in the opposite direction. The National Company felt that in the face of the Depression, a simple, no-frills receiver would be welcomed by amateurs. Out of this reasoning, the SW-3 was born in 1931.

Essentially an SW-5 stripped of its push-pull audio stage and repackaged in a simpler cabinet, the SW-3 came complete with a set of band-spread coils for 80, 40, and 20 meters. With appropriate general-coverage coils it could pull in signals from .35–33 MHz. Versions powered either by batteries or an external AC supply were available. Tube substitution and minor wiring changes enabled the owner of a battery set to use it with AC power, as well. As a measure of the SW-3's success, it remained in production until 1948.

Thanks to those who provided equipment for the pictures in this month's column. The Comet Pro, SW-2, and SW-5 are owned by Bob Enemark, W1EC. The SW-3 is the property of Dave Cisco, W4AXL, and the All-Star belongs to Chuck Dachis, a name most often associated with Hallicrafters.

I'll see you back here again in a couple of months. Right now I'm headed into the shack to warm up the filaments, flip on the B+, and check out 40 meters.

73, Joe, N4QB

Joe Veras, N4QB

A few words of personal introduction are in order in this first "Radio Classics" column. Who am I and why am I writing about these things? A second-generation ham, I was licensed as KN9OCO 43 years ago. My dad, Norm (now K9NA), had prepared my mom, Jennye, for the rat's nest of wires and basement full of old radio parts that would follow my entry into the hobby.

The "happily ever after" ending to that story would have me pursuing a career in electronics, but I defied convention and became an advertising photographer instead. There is still a "happily" part to it, however, as a life spent photographing toasters, shoes, and automobiles also prepares one to photograph old radios.

Six years ago, *CQ* publisher Dick Ross, K2MGA, gave me the opportunity to do just that. Each year since, we have produced the *Radio Classics* calendar, and work has progressed concurrently on a book project. In that period of time, more than 1500 pieces of vintage radio gear have found their way in front of my camera. In the process, I developed a fascination with the equipment and the companies that produced it; they are part of our hobby, woven into the fabric of its history. This column will provide a means of sharing that story with you. It will revisit the ham gear of days gone by, sometimes in contrast or counterpoint to current technology, sometimes just to celebrate gear from the "Golden Age" in its own right.

My travels for the calendar and book projects have taken me through 47 states, accumulating a "radio museum on film" in the process. The joys of such a journey are not limited to the radio equipment I have seen, though; I have met some wonderful people along the way. Friendships have developed, the bond cemented by a mutual love of radio gear from days gone by. Those who collect, restore, or use this gear are a special breed. They have been generous with their time and knowledge, and I am grateful for both.

Acquiring an education on vintage radio gear has also taught me the value of dialogue. Your comments and responses will make this column more beneficial to us all. E-mail me here at *CQ*, <n4qb@cq-amateur-radio.com>, or write to: Joe Veras, N4QB, P.O. Box 1041, Birmingham, AL 35201, if you prefer that method of correspondence.

Our Readers Say

More Reaction to the *CQ VHF - CQ* Merger

Editor, *CQ:*

I recently received my December 1999 *CQ VHF* and eagerly read through it. Since this is the only American amateur radio magazine devoted entirely to VHF and higher frequencies, and this is my main interest in amateur radio, I anxiously await each new issue before it arrives. However, I was shocked to see the front cover of the Dececember '99 issue emblazoned with a red sign stating, "Final Issue."

After reading the editorial, I was relieved to hear that the January 2000 issue of *CQ* magazine will carry VHF material. But how are you going to "cram" 84 pages of *CQ VHF* into 32 pages of *CQ*? It won't fit! Some things will have to be left out.

As far as the "line between VHF and HF" being blurred, I strongly disagree. The differences are very clear and distinct. Aurora might block HF while it could propagate VHF. Ever try moonbounce on 15 or 20 meters? How many repeaters have you heard on 40 meters lately? Ever try to foxhunt with a portable 3-element 80 meter beam ... vertically polarized? I rest my case.

Am I mad? Yes! Do I want my money back? No. I want my January 2000 *CQ VHF* magazine, and my February 2000 *CQ VHF*, and so on. But I guess it's not going to happen, so I will anxiously await my January 2000 *CQ* magazine and will eagerly read it when it comes in. 73 from disappointed...

David Benton, WB4JGG
Cleveland, Tenn.

David: The secret to squeezing 84 pages into 32 is this: We're not. We're squeezing 84 into 132. The vast majority of articles of VHF interest are also of general interest. The January issue, for example, had four VHF-related features, three HF-related features, and four general-interest features that would have worked well in either magazine.

I think you misunderstood what I meant about blurring the line between HF and VHF. Certainly no one will dispute that there are things you can do on VHF that you can't do on HF (and vice versa), but more and more hams are finding that they enjoy doing a variety of things on a variety of bands, both HF and VHF. Radios capable of operating in both areas help even more. The line to which I referred is one of operating habits, not band characteristics. I hope you enjoyed last month's issue, and that you're enjoying this one, too.

Editor, *CQ:*

I read with great distress today that *CQ VHF* will end publication at the end of 1999 and be merged with *CQ* magazine. Even though I don't currently subscribe, I have been buying single issues at the local bookstore and was just this week thinking of sending in my subscription for next year.

CQ VHF has become a very fine magazine with its emphasis on many of the modes that most amateurs are missing in their operations—i.e., weak-signal VHF/UHF/microwaves, ATV, satellites, meteor scatter, high-speed packet, etc.

CQ VHF needs to continue as a separate publication. Please continue *CQ VHF* separately.

Respectfully submitted,
Dan Carlisle, WK8L

Dan: It is our goal to bring to CQ *everything you liked about* CQ VHF, *so that* all *hams may be exposed to activities such as ATV, satellites, meteor scatter, high-speed packet, etc., along with DXing, contesting, etc. We hope you'll give us the chance to make it work.*

World Of Ideas

BY DAVE INGRAM, K4TWJ

A Look At The World Around Us

QRP is Hot and Cooking!

There is no question about it, gang, QRP 2K is red hot and cooking! QRP contests and QSO parties are also increasing in number, with approximately 40 weekends a year presently supporting some irresistible on-the-air QRP activities.

Why is QRP so appealing? Maybe it's the challenge (and gratification!) of working long distances with low power, the attraction of using ultra-small and low-cost gear for QSOs, or possibly it's a natural spin-off of Y2K preparedness. In light of those facts, *CQ* is increasing coverage of QRP from two or three times a year in my "World of Ideas" column to six times a year in a new and dedicated QRP column. It will alternate with my "How It Works" column that is being moved over from CQ VHF. This extra coverage addresses your continuing requests for more news, views, and in-depth details of both equipment and activities on the QRP scene today. Everyone is invited to join the celebration by sharing views of your QRP setup, special project, or through quick sketches of your favorite circuits or antennas. Shoot some good pictures, add one or two descriptive notes, send them to me, and let's get some well-deserved recognition directed your way! Just remember to include an SASE if you want a personal/out-of-column reply to a question, and/or be patient for e-mail replies (I read mail and write in various and impromptu places).

4941 Scenic View Drive, Birmingham, AL 35210

Good News Notes

I have said it before, friends, but it still warrants repeating: QRP romps!

During a recent DX contest, I noticed P40B coming through on 10 meters at 10 dB over S9. I switched on the 20 dB RF attenuator in my IC-761, and his signal dropped to S7. I was not sure of his exact power level, but that was academic. If he was running 2000 watts, the 20 dB drop reduced him to a strength of 20 watts. If he was running 500 watts, the drop moved him into the 5 watt category (read that again!). Immediately, the IC-761's AGC compensated for the drop and I could not hear any difference in signal strength. Honest! I had to look at the rig's meter to realize a difference. Yes, and the AGC on all modern transceivers are equally effective or "QRP beneficial." Don't just take my word for it here, friends; try that same experiment with your own rig in your own shack and see for yourself. Then hit the bands with full confidence and enjoy QRP'n to the max!

Neat Treats

Now shifting into the "what's new in gear and goodies" category, our spotlight

Photo 1– Front view of the new Elecraft K2 kit transceiver. The unit was designed by Wayne Burdick, N6KR, of NorCal QRP fame and measures 3"H × 8"W × 8"D. The transceiver operates CW with 10 watts output, and you can add options such as SSB, 160 meters, noise blanker, extra filters, auto antenna tuner, etc., to produce a custom unit. (Photo courtesy Elecraft Co.)

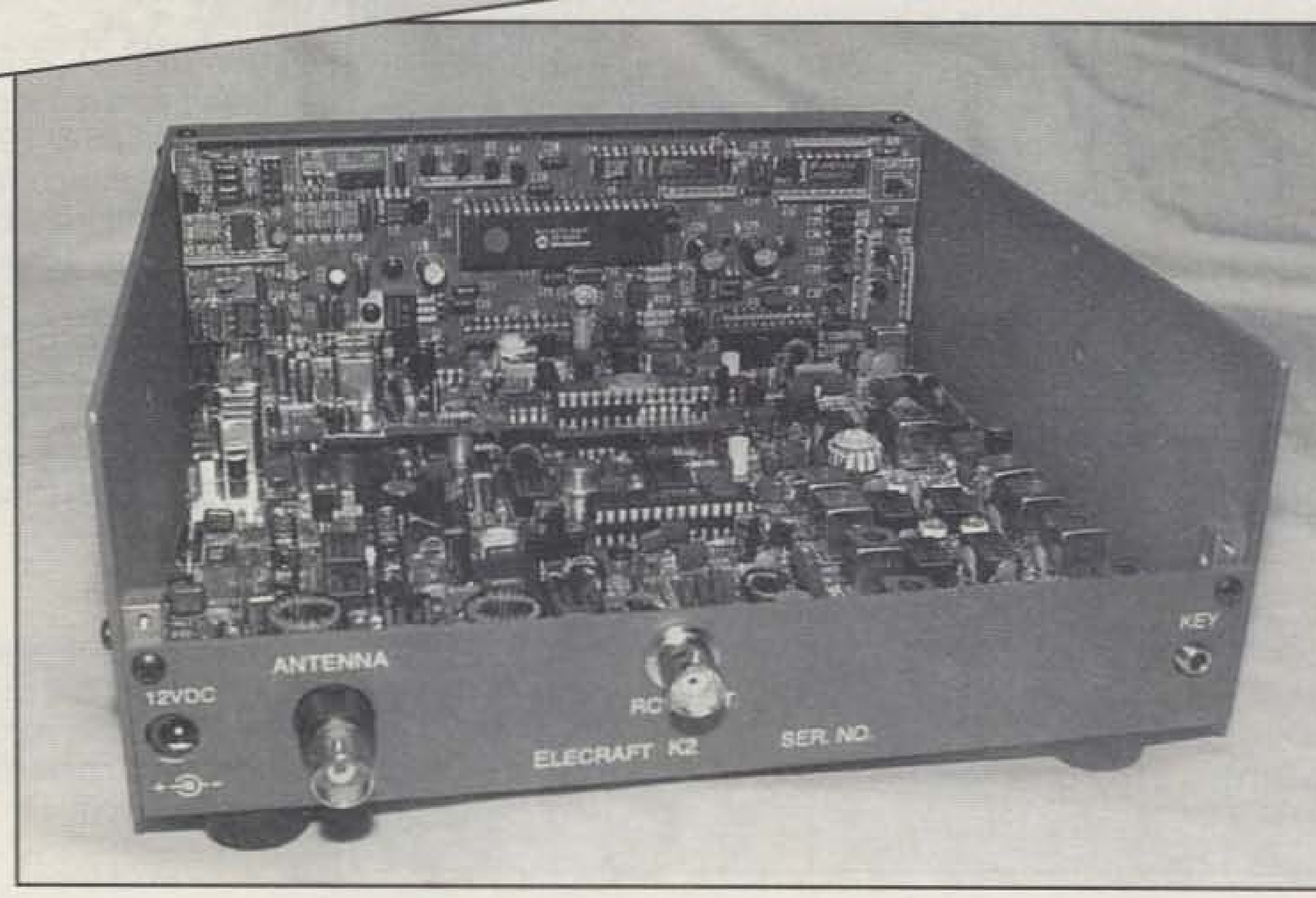


Photo 2– Interior view of the K2. Notice there is not any off-board wiring, and there is also room for an optional 3 amp rechargeable battery pack or 100 watt RF power module. (Photo courtesy Elecraft Co.)

falls on Elecraft's recently-introduced K2 kit transceiver shown in photo 1 and 2. This little tyke covers all 8 HF bands between 80 and 10 meters with a few microwatts to 10 watts output and a full compliment of "big rig" features and options. It includes, for example, dual digital VFOs, 10 memories, selectable receive bandwidths, RIT, XIT, semi or full CW break-in options, memory keyer, optional automatic antenna tuner and more. It is surprisingly compact for traveling or outdoor QRP'n, and it can also be tailored with add-on options to fit your particular needs or preference. How so?

The "stock" K2 is a CW-only unit with all the previously mentioned features. If you wish to include SSB operation, 160 meters, SWR monitor, noise blanker, extra filters, etc., you must assemble and add optional modules. There is also room inside the K2's cabinet to install an optional 3 amp rechargeable battery pack or a 100 watt output RF module. With the battery pack included, you just add a key and antenna for on-the-spot QRP'n. For SSB, incidentally, the K2's microphone socket is a familiar 8-pin item that can be configured with internal jumpers to accept a Kenwood, Yaesu, or ICOM mic (a new Heil Goldline mic like the one featured in our December 1999 column should really make it sparkle!).

Although the K2 is sold as a kit, it is different from your usual "wires everywhere and technical expertise required for assembly" type transceiver. That's because the rig is built on three full-size PC boards with all parts—including controls, switches, sockets, the backlit LCD readout, and the main tuning dial—directly mounted in marked positions. No jumpers or stray wires that may cause problems or confusion are used. All you focus on is double-checking each part "as you go" to ensure that it is the proper value and is installed in the right place—a concept that really streamlines assembly. Also, the only piece of test equipment required for basic checkout and setup after assembly is a digital volt-ohmmeter. I have not tuned a K2 as of yet, but I have scrutinized its printed info plus discussed it with "beta testers," and it seems like an easy-to-understand and operate unit. I say that because often-used parameters are set directly by front-panel knobs and switches rather than through difficult-to-remember software menus. Although still a newcomer, the K2 holds promise as a hot item in QRP. You can learn more about it (or order one) by contacting Elecraft at P.O. Box 69, Aptos, CA 95001-0069 (831-662-8345; web page: <http://www.elecraft.com>).

As we all know, one of the neatest aspects of QRP is its "go anywhere" nature. Indeed, small transceivers and wall-wart power supplies are ideal for traveling and/or casual in-den operations. The only hitch is finding or devising a convenient way to tilt and secure such lightweight gear for comfortable viewing of dials and meters. In light of that fact, Thomas Hart, AD1B, shares views of his clever solution (which you can adapt or scale to fit your own needs) in photos 3 and 4.

Tom cut out his stand from a piece of white pine approximately 1 by 2 inches and two small sheets of fiber board. The pine board's width is $5^1/_2$ inches between notches for the fiber board. That width allows it to sit under and prop up the MFJ transceiver and tuner (which are bolted together via short side straps). The front support/pine board's width and the tilt angle cut in the side fiber boards obviously can be tailored to fit your own gear. Since the three pieces just snap together, they can also be separated for storage or traveling.

Listen for me week nights on 30 meters. I 'll be the weak one running QRP!

73, Dave, K4TWJ

Photo 3– This smart-looking, functional QRP rig stand made by Thomas Hart, AD1B, tilts gear for easy viewing of dials and meters and snaps apart for traveling. Rather than including a bottom platform, gear is supported by fiber-board side rails. (Photo courtesy AD1B)

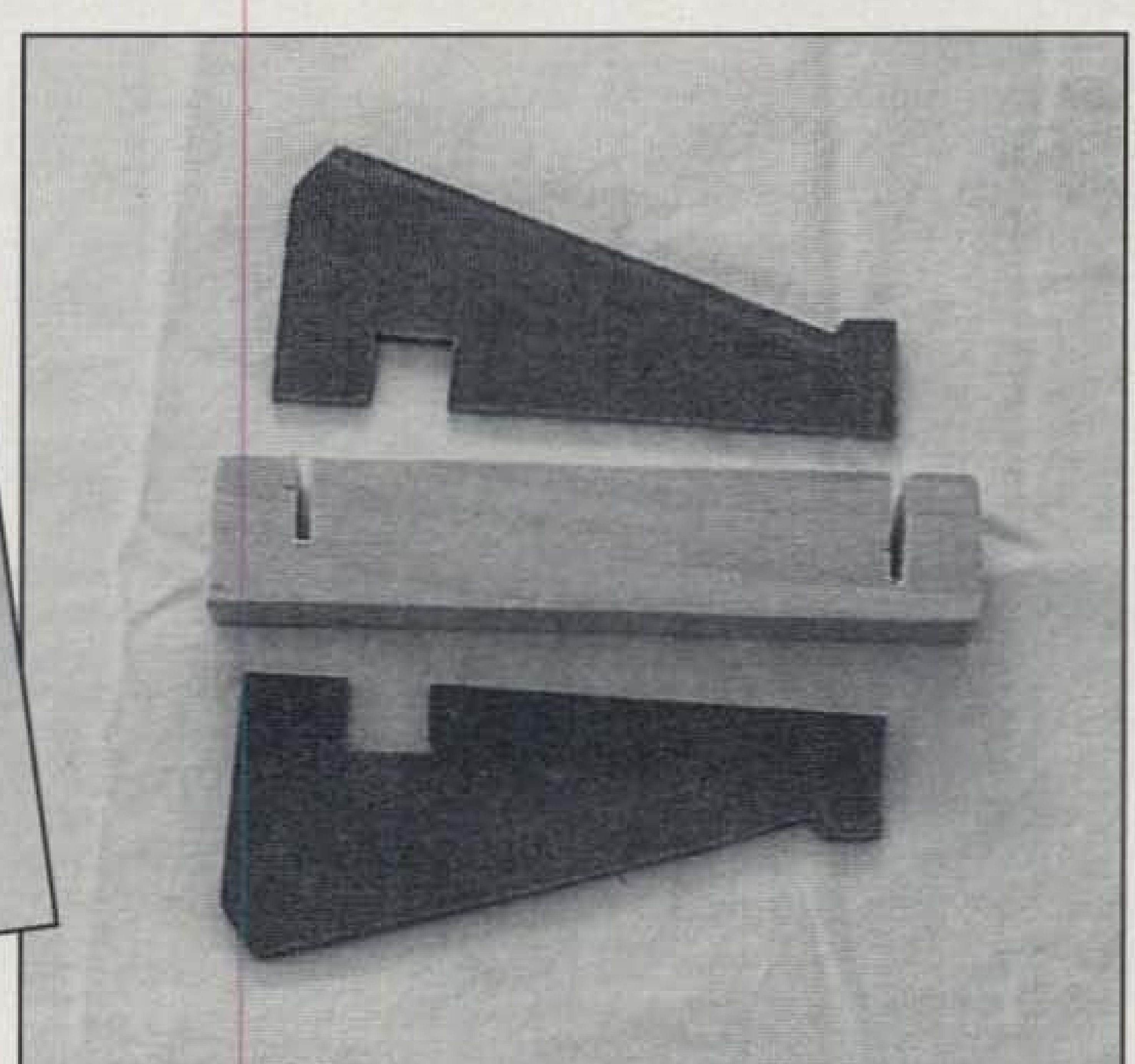


Photo 4– Here are the raw materials (pine-board front and fiber-board sides) that AD1B used to make his rig stand. Pieces were cut out with a jigsaw and left as natural wood rather than painted. (Photo courtesy AD1B)

Turning Swords into Plowshares

As we go to press, some important events are occurring with amateur radio satellites. A handful of new ham satellites was scheduled for launch (possibly in January) on the first flight of the Air Force's Minotaur launch vehicle. The Minotaur consists of two refurbished Minuteman lower stages attached to the upper stages of Orbital Science's Pegasus rocket. It's an excellent way to change a Cold War strategic weapon in to a useful national asset—a modern version of turning swords into plowshares. Arms-control agreements and a desire not to compete with commercial rockets will limit the Minotaur to government payloads.

The amateur payloads are *ASUSat* from Arizona State University, *JAWSAT* (Joint Air Force-Weber State University Satellite), and *OPAL* (Orbiting Picosat Automatic Launcher) from Stanford University. In addition, the Air Force Academy's *Falconsat* and *Optical Calibration Sphere* (OCS) experiment from the Air Force Research Laboratory are flying.

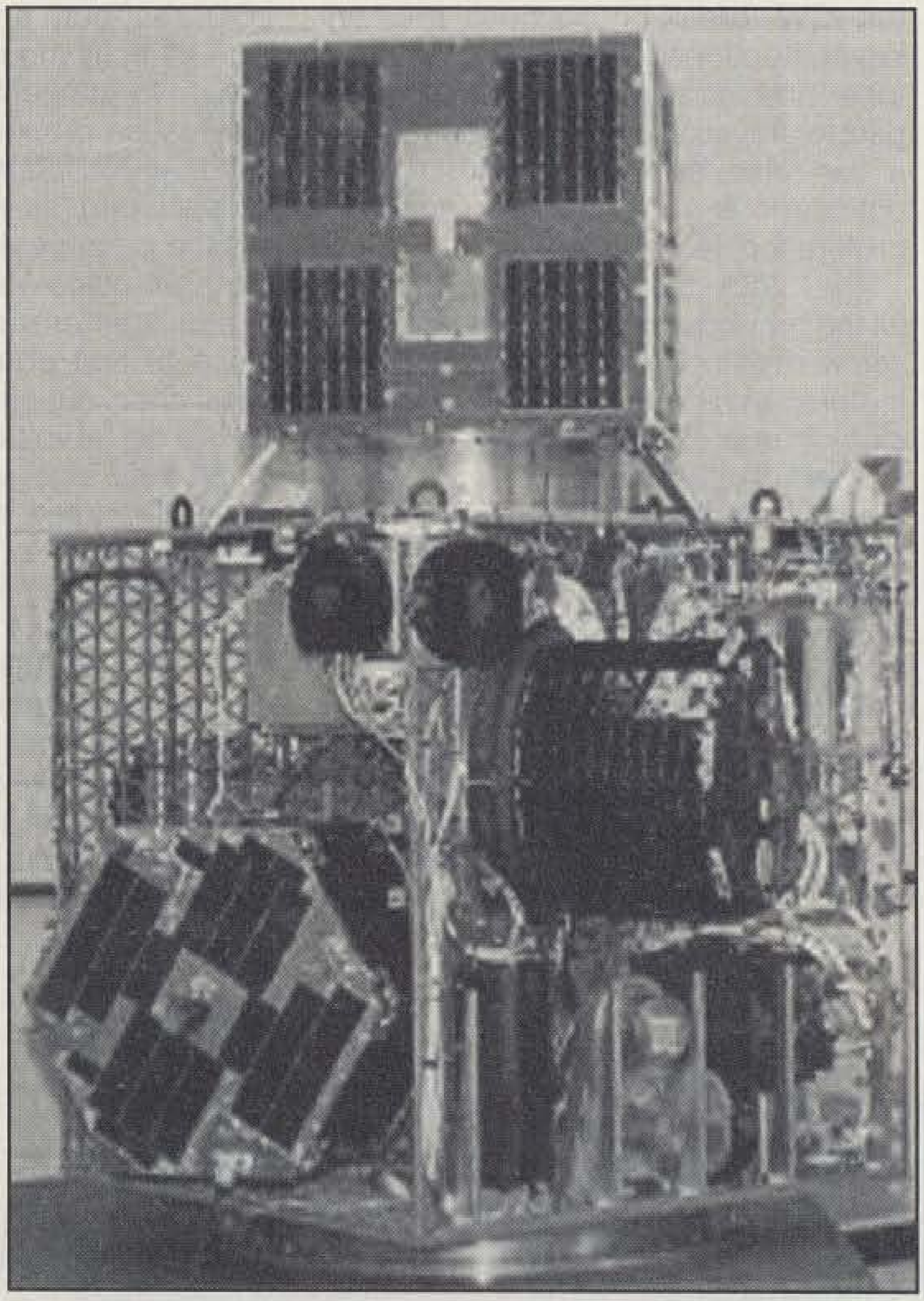
OPAL is unusual in that it's a mothership which will eject several miniature satellites, each the size of a deck of playing cards. The *picosats* for this test flight are *StenSat*, *Artemis 1* and *2*, and a *DARPA* orbital sciences *Picosat (actually two picosats tethered together)*. While StenSat has a Mode-J FM ham transceiver—2 meter uplink/70 cm downlink—there's only so much you can do with such a small payload. Therefore, don't expect too much, or for very long.

ASUSat and JAWSAT also have Mode J FM transceivers and may become as popular as AO-27 among amateurs who do not have the capability or interest to use more sophisticated, complicated, and expensive single-sideband OSCARs.

JAWSAT will carry several scientific payloads, including the *Plasma Experiment Satellite Test* (PEST). PEST is based on experiments which have flown on four shuttle flights: STS-3, STS 51-F, STS-46, and STS-75. Its data will be transmitted in the 70 cm and 13 cm amateur bands, a very gray use of amateur radio frequencies in my view. FCC regulations specify that amateur radio frequencies can only be used for information for amateur radio operators. The language talks about information which is so trivial in nature that it isn't suitable for transmission on other frequency bands. Whether or not the ham community considers scientific data on the Earth's ionosphere part of ham radio communications is questionable. (*Considering the reliance of many hams on the ionosphere for long-distance communication, there could be valid arguments on either side of the question.—ed.*)

NASA is encouraging hams with satellite setups to receive the data and has promised to make the data format available. The data rate will be 38.4 kb/s and is compatible with G3RUH or GMSK modems. The data will be broadcast on 437.175 MHz or 2403.2 MHz. Hopefully JAWSAT will spend most of its time as an amateur radio satellite instead of just a satellite which happens to use amateur radio frequencies.There is a NASA story about its involvement with

779 Merritt Island Causeway #808, Merritt Island, FL 32952
e-mail: <kc4yer@cq-amateur-radio.com>



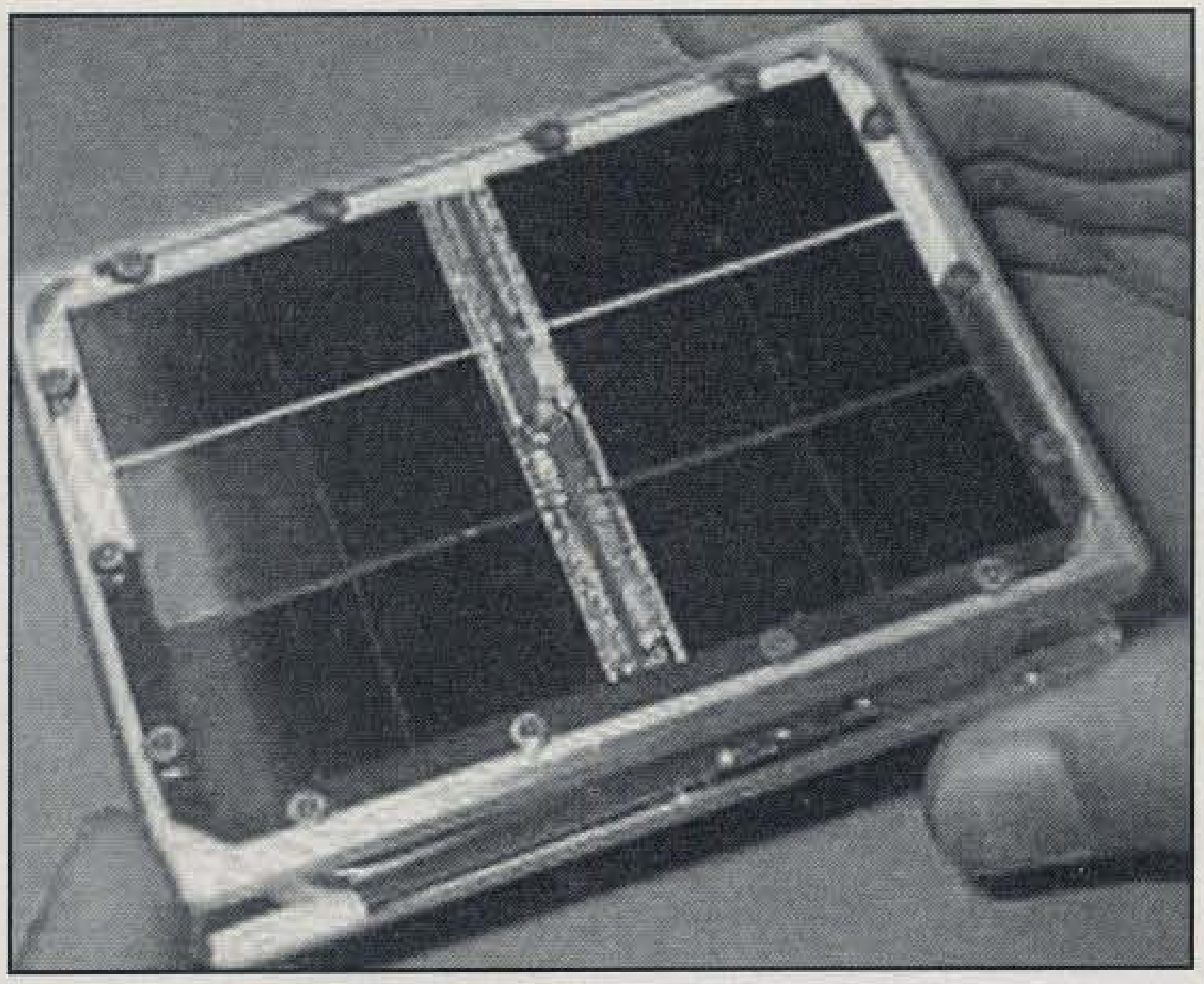
JAWSAT, the Joint Air Force Weber State University Satellite, is one of several new ham-band satellites scheduled for simultaneous launch in early 2000. (Photo courtesy Weber State University Center for Aerospace Technology)

JAWSAT at the following web site: <http://science.nasa.gov/newhome/headlines/ast04nov99_1.htm>.

Old Launch Pads

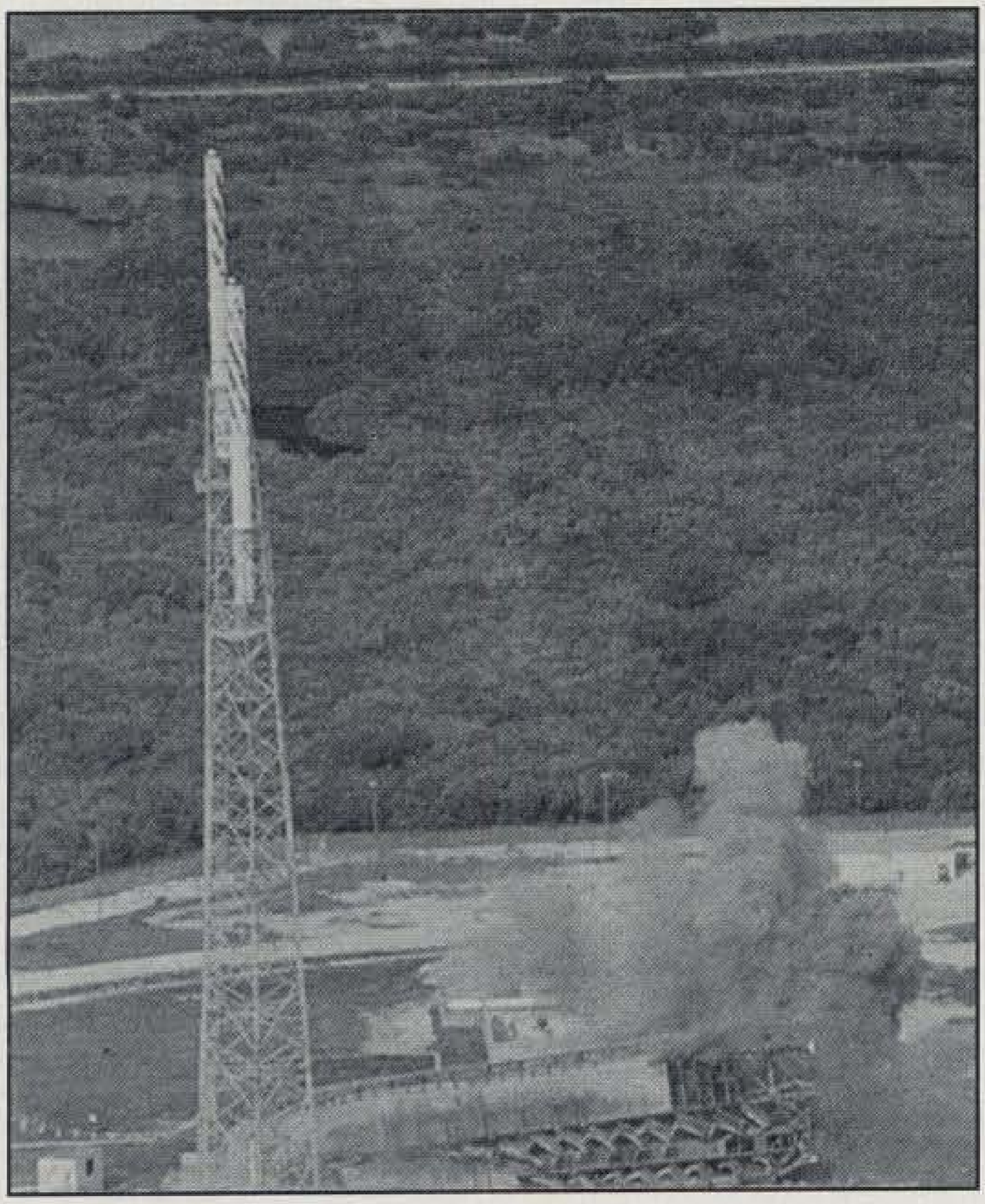
Last October you may have seen news coverage of a unique event—demolishing a historic launch complex by explosives. Launch Complex 41 at the Kennedy Space Center in Florida was used to launch Viking to Mars, Voyager to the outer solar system, and dozens of military satellites.

Lockheed-Martin is refurbishing the pad for its Atlas V launch vehicle and needed to disassemble the 2 million pound Umbilical Tower and 5 million pound Mobile Service Structure. When a similar pad was disassembled several years ago, it took welders months to disassemble the gantries piece by piece. Contractor Hensel Phelps recommended that it would be less expensive, safer, and quicker to use care-



One of the smallest satellites ever built. STENSAT will be launched from another satellite, Stanford University's OPAL. STENSAT carries a mode-J FM ham radio transponder.

fully placed explosives to take down the LC-41 towers. The challenge was to make sure that the towers fell in the correct direction, leaving the four lightning masts intact. The technique is similar to how trees are felled, making precise cuts ahead of time to ensure that the object falls in the correct direction. The explosives cut out the lower legs and then



The 2 million pound Umbilical Tower (left) and 5 million pound Mobile Service Tower (right) at Launch Complex 41 are toppled by explosives to make way for the new Atlas V launch vehicle. Among other satellites, LC-41 was used to launch Voyager, Viking, and OSCAR 4—the first high-altitude amateur radio satellite. (NASA photo)

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

A photo of the handheld transceivers, headset, and packet module which will be the initial amateur radio equipment on the International Space Station.

gravity took over. Within 30 seconds, 7 million pounds of steel was lying on the ground.

What you may not have known is the very first payload launched from Launch Complex 41 was OSCAR 4, the first attempt by amateur radio operators to put a satellite into a geostationary orbit (that is, an orbit in which the satellite appears to remain stationary overhead at all times). OSCAR 4 was built by hams at aerospace contractor TRW. The other payloads on the maiden flight of the Titan IIIC were three experimental military satellites, OV2-3, LES 3, and LES 4.

The Titan IIIC was launched on December 21, 1965. The lower stages of the rocket successfully put the satellites into their parking orbit. The upper stage (Transtage) was supposed to make two separate burns to raise the satellites to geostationary altitude (22,300 miles), but failed after the first burn. The satellites therefore were stuck in an egg-shaped transfer orbit which traveled through the Earth's radiation belts twice each day, exposing the satellites to far more radiation than planned.

While OSCAR 4 never made it to its planned orbit, there were some successful contacts through it, pioneering high-altitude amateur satellite communications. One of the contacts was the first amateur satellite contact between hams in the United States and the Soviet Union.

The first Atlas V is scheduled for launch in 2001. Wouldn't it be nice if its first launch included an amateur satellite as one of its payloads?

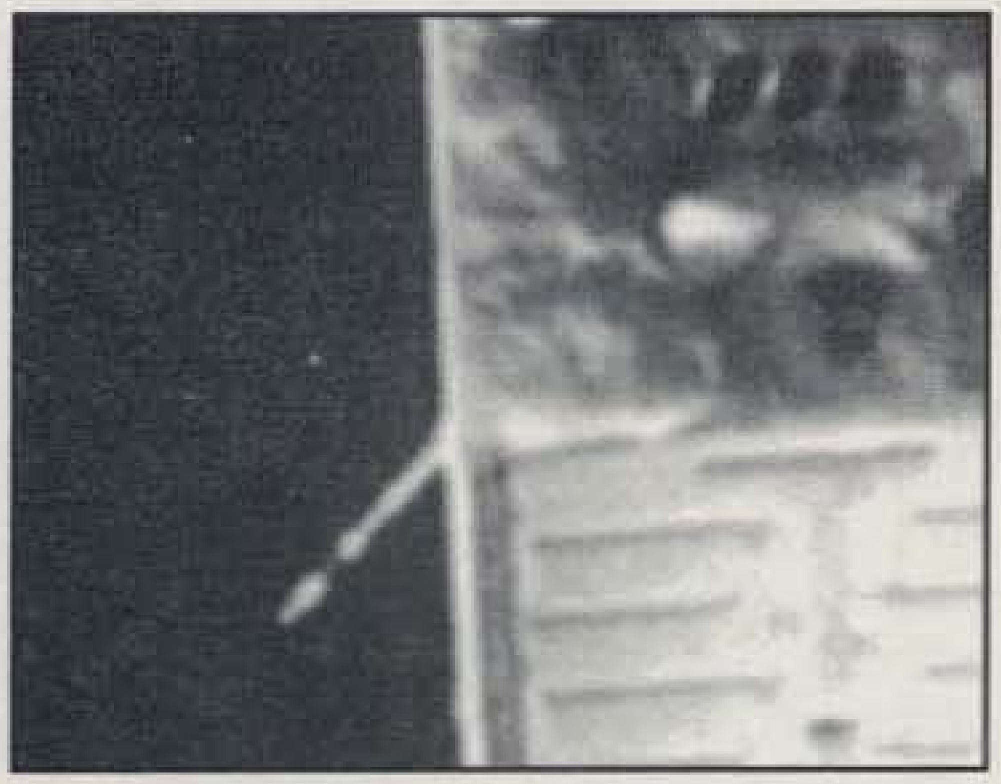
Space Station Ham Station

The first amateur radio equipment is about to be launched to the International Space Station. The STS-101 logistics flight, currently scheduled for March 2000, will carry the handheld transceivers, packet rig, and headset. The flight will occur after the Russian service module has been launched and docks with the two components (Zarya, the initial command module, and Unity, a connecting point for all the other modules) already in orbit. Once the service module is up and running, it will take over from Zarya as the command post. As we go to press, the Russian Proton launch vehicle has been grounded due to problems with its second-stage engines. If the problems are not solved in time, the service module's launch will

Resources

Web pages for Minotaur satellites:
<http://cast.weber.edu/jawsat/jawsat.html>
<http://www.eas.asu.edu/%7Enasasg/asusat/asusat.html>
<http://aa.stanford.edu/%7Essdl/projects/squirt2/intro.html>
<http://users.erols.com/hheidt/http://screem.engr.scu.edu/artemis/>
<http://www.usafa.af.mil/dfas/falcon.html>

Web page for Launch Complex 41:
<http://www.ast.lmco.com/frameset.shtml?top=Media_Gallery,content=gallery_atlas5>



A close-up photo of the Sirius antenna on the Russian FGB module, which may be used as the temporary amateur radio antenna on the International Space Station.

be delayed along with all future space-station missions.

Initial plans called for the STS-101 shuttle crew to mount external ham antennas on the service module during one of their scheduled spacewalks, but that may not be possible. The ARISS (Amateur Radio on the International Space Station) team currently is negotiating an unusual solution. The Zarya module has 22 antennas. Some of these transmit telemetry, while others are used by the automated docking systems or to transmit video to Russian ground stations. The Sirius monopole antennas were used during launch to transmit telemetry. They no longer have any use, and it is hoped that permission can be obtained to use those antennas for early amateur radio operations until the permanent antennas can be mounted on the service module.

The first space-station crew of Commander Bill Shepherd, KD5GSL; Soyuz Pilot Yuri Gidzenko, RØMIR; and Flight Engineer Sergei Krikalev, U5MIR, will be launched to the space station on their Soyuz spacecraft shortly after the STS-101 mission. That will mark the planned beginning of continuous human presence in space. A new crew will be launched to the space station as the crew already in space prepares to return to Earth.

The former Soviet Union and Russia set an enviable record of ten years of continuous occupation aboard the space station Mir. That record ended in August 1999, when Mir had to be put in to hibernation due to lack of funds. Had the International Space Station remained on its initial schedule, the Russian endurance record would still continue, as would the American presence in space, which would have started with Shannon Lucid's launch to Mir in 1996.

All About The World Above HF

The Future—Band By Band *(continued)*

Last month I covered the VHF-plus bands of 50 MHz through 902 MHz. This month I will cover the rest of the VHF-plus ham bands, beginning with 1240 MHz.

1240 MHz

This band has lots of upward potential. However, with upward potential it also has problems. As more equipment becomes available, this band could develop into a third alternative for FM repeater work. It also has the spectrum available for high-definition television (HDTV) experimentation. Further, with the launch of the Phase 3D satellite, this band could become quite active in satellite operation. Finally, weak-signal EME contacts will continue to increase in popularity. The challenge of this latter type of operation seems to be increasing power and higher gain antennas that are less cumbersome.

Because of the amount of activity on the 1240 MHz band, I predict that a weak-signal WAS (Worked All States) will be achieved in the next two to five years. Further, I predict that a Phase 3D satellite WAS will also be achieved within the same timeframe.

2300 MHz

This band has some built-in problems. Because of the cross-band allocations of various countries, it is a challenge to work very many stations from different countries via EME. Even so, there is a small group of dedicated hams who are keeping the challenge alive, both terrestrially and via EME. For the satellite user, this band will become increasingly useful after the Phase 3D launch. An amateur radio equivalent to a PCS telephone system could make use of this band, particularly for local or regional coverage. High-definition television could also make use of the available spectrum.

3300 MHz

This band has much to offer for a cross-section of experimenters. While small in number, there is a contingent of weak-signal operators on this band who continue to operate both terrestrially and via EME.

Perhaps the biggest promise this band holds, however, can be found in a proposal made at last year's TAPR Digital Communications Conference. Matthew Ettus, N2MJI, proposed a Spread Spectrum Transponder payload for the International Space Station. According to Ettus, this payload ". . . would provide high-bandwidth, wide-area data communications capabilities for radio amateurs." He suggests that varying tiers of service can be provided depending on the end-user equipment investment, from low-cost paging, through digital voice, video, and high-speed data communications.

Using a downlink on this band and an uplink on the 5700 MHz band, the SST would occupy 50 MHz of bandwidth. It would be able to accommodate over 500 digital voice conversations, dozens of high bit-rate video conferencing sessions, and a T1-class data link all at once. Earth stations within a 400 mile radius of the space station would be able to access the transponder with minimum antenna and power requirements. Ettus concluded his paper by stating that his proposed project would ". . . open up a whole new world of digital communications to the amateur radio community. By taking advantage of underutilized spectrum, and advanced communications techniques, we will finally be able to interconnect the ham world with a high bit-rate, integrated network." Certainly, this represents a most ingenious use of the spectrum of both bands plus the very creative use of the International Space Station as a satellite repeater.

VHF Plus Calendar

Feb. 1	Moon apogee.
Feb. 2	Lowest Moon declination.
Feb. 5	New Moon.
Feb. 5–13	Third 23 CM EME SSB Contest. *(See text for details.)*
Feb. 6	Poor EME conditions.
Feb. 12	First quarter Moon.
Feb. 13	Moderate EME conditions.
Feb. 16	Highest Moon declination.
Feb. 17	Moon perigee.
Feb. 19	Full Moon.
Feb. 20	Very good EME conditions.
Feb. 26	Last quarter Moon.
Feb. 27	Very poor EME conditions.

— EME conditions courtesy W5LUU

5650 MHz

This band also has a core group of weak-signal operators who are active on this band, both terrestrially and via EME. As outlined above for 3300 MHz, this band would be used as the uplink for the proposed SST project for the International Space Station. Without such creative use of the spectrum as proposed by Ettus above, this band would continue to be a vast wasteland just ripe for the picking by other interests.

10 GHz

A small but increasing number of weak-signal operators are experimenting with EME operations on this band. Furthermore, a larger and still increasing number of weak-signal operators are experimenting on this band terrestrially. I predict that this band will prove to be a workhorse band for more and more weak-signal stations. I also predict that successors to Paul Lieb, KH6HME, and Chip Angle, N6CA, will set a record with a QSO via Hawaii and the mainland within the next ten years.

24 GHz

Before his death, long-time VHF weak-signal microwave operator, Paul Wilson, W4HHK, had begun to experiment with equipment on this band. He represented a growing number of weak-signal operators who are experimenting on 24 GHz. I predict that the first EME contact will be made on this band within the next five years.

This band will also be a major beneficiary of the Phase 3D satellite because of the beacon that will operate on it. Many weak-signal and satellite operators will focus on trying to hear the beacon not only for the reception report, but also for mapping satellite and terrestrial propagation possibilities.

47 GHz

Operating near this frequency by troops during the Gulf War proved extremely beneficial for secured commu-

P.O. Box 73, Oklahoma City, OK 73101
(phone 918-627-6625; fax 918-835-9785)
e-mail: <n6cl@cq-amateur-radio.com>

nications because of the extreme attenuation of the atmosphere, specifically oxygen. Signals would not travel much farther than from vehicle to vehicle. Hence, there was no way to intercept the signals. It remains to be seen what terrestrial applications this band may present, however.

Even so, in-space communications is another issue. Without the attenuation of the Earth's atmosphere, point-to-point communications within the International Space Station or from the space station to a base on the Moon could be a probable use of this band. Perhaps a beacon on the International Space Station or a future satellite would expose the amateur community to new realms of possible communications via this band.

75.5, 119.980, 142, and 241 GHz

Again, these bands suffer from disuse because of lack of understanding of how to use them. Even so, I predict that future space communications will open doors for increased operations on these bands.

300 GHz and Above

This portion of the frequency spectrum includes light, specifically *laser* light. I predict that future exploration of this band will include increased use of the technology and bandwidth available via laser communications. It has been a few years since any record-setting QSOs have been attempted, mainly because of the challenge of the setup process.

I believe that laser communications have wide-ranging possibilities. Perhaps as space communications expand, use of light for carrying communications will increase. Furthermore, a possible laser repeater station could be established on the Moon.

In General

Advancements in computer programming and technology will make it possible for amateur operators automatically to select the best possible path for communications between their respective stations. Using the Internet as a link, computer-controlled stations will talk to each other via the net to understand what equipment is available at each station. From such net-based communications a route would be established for possible over-the-air communications. Input for the computer program would be taken from a wide variety of sources, such as solar propagation reports and weather reports. With data supplied, each station would automatically be instructed which equipment to activate and which antenna to select, along with the positioning of that antenna.

Such automatic communications could make it much easier to establish DX records, such as via Hawaii and the mainland on bands such as 10 GHz. As it is now, reliance upon manned operations limits the possibilities. However, with computer-controlled operations that are continually linked via the Internet, such record-setting operations would enjoy infinitely more possibilities.

There you have it—my predictions for our use of the VHF-plus ham bands from a weak-signal perspective. Since these bands represent so much spectrum territory yet unexplored, infinite possibilities exist for their use.

As I opened last month's column by saying that I will be both a prophet and a chaplain, I end these predictions the same way by saying that I have prophesied a great future for these bands. However, as a chaplain, I also advise that if we do not use them wisely, they will be taken by others for their use. As amateur radio operators who wish to hang on to our spectrum, we have to be the pioneers and figure out creative ways of using it. Without our input they will be lost to the commercial interests.

Paul Wilson, W4HHK, SK

The following is from the *ARRL Letter:* "VHF-UHF pioneer Paul Wilson, W4HHK, of Collierville, Tennessee, died November 29. He was 75.

"A stalwart in the 144 MHz and Microwave Standings, Wilson remained active right up until his health deteriorated earlier this year. In early July he completed his VUCC on 10 GHz. He celebrated his 75th birthday in September by making his first contact on 24 GHz.

"'Paul's life should inspire every amateur to strive to always try something new in Amateur Radio, regardless of age or health,' said ARRL Vice President Joel Harrison, W5ZN, one of Wilson's friends. 'He has definitely been an example for me.'

"Wilson got his ham ticket in 1941 at the age of 16. While still in high school, he began experimenting on the old $2^1/_2$ meter band (112 MHz). After World War II, he rekindled his interest in VHF and UHF, becoming a major figure on the then-new 2 meter band.

"During the 1950s, he got involved in meteor-scatter propagation. In 1954, W4HHK and Tommy Thomas, W2UK, in New Jersey, sent and received reports via 2 meter meteor scatter over a 950 mile (1520 km) path—a first! W4HHK and W2UK won the ARRL Technical Merit Award for 1955.

"Wilson took on the challenge of Earth-Moon-Earth propagation as well, and in 1961 he began work on an 18 foot dish. He was among those making their first 70 cm EME contacts in July 1965. From that frontier, he moved on to attempt 2304 MHz moonbounce, and he won the ARRL Technical Merit Award for 1969 for his work on that band. In 1970, W4HHK and W3GKP claimed a new record—the first 2304 MHz EME contact.

"In 1972, Wilson used his 18 foot dish to monitor the Apollo X command module on 2.2 GHz as the astronauts orbited the moon. He received a NASA confirmation of his reports in the form of a photograph signed by all the astronauts on the mission.

"Noted VHF-UHFer Al Ward, W5LUA, called Wilson 'a true VHF pioneer' and said he would be missed. 'Paul's signal on 2304 EME was like a beacon station, and his presence will be missed by all who have worked him in the last 29 years off the moon,' Ward said.

"Wilson retired in 1980 after 30 years as an engineer for TV station WMC in Memphis. His wife 'DB,' to whom he was married for 54 years, is W4UDQ. His son, Steven, is N4HHK.

"A staunch League supporter and ARRL Technical Advisor, Wilson was frequently in the pages of *QST* over the years, both as an author and as a subject. In his December 1999 *QST* 'It Seems to Us . . .' editorial, ARRL Executive Vice President Dave Sumner, K1ZZ, singled out Wilson as an amateur radio hero for his pioneering accomplishments.

"The Central States VHF Society awarded Wilson its Chambers Award in 1986 for 'his continuing technical contributions to UHF, especially EME on 13 cm.'"

Al Katz, K2UYH, added in his "432 MHz and Above Newsletter" this tidbit: "Paul had celebrated his 75th birthday in September with his first 24 GHz QSO with his son Steve, N4HHK. We have lost a great one."

Your editor met Paul and DB on several occasions. Perhaps the last time I saw them was at their home in Collierville, Tennessee, the year the Central States VHF Conference was held in Memphis. After the conference Paul and DB hosted a reception in their home. Several of the conference participants were able to attend. Climbing up the platform that held the 18 foot dish and taking each other's pictures was the highlight of the afternoon for many. I think that my highlight was looking through Paul's QSL card collection. Actually seeing and touching the QSL card that he received from Tommy Thomas, W2UK, for their first-ever 2 meter meteor-scatter contact held particular significance for me. At one point I had located Tommy and put him and Paul back in touch with each other some 40 years after their QSO.

Paul was a wonderful gentleman and a true hero to our particular niche of the hobby. He truly will be missed by so many of us. His example of a pioneering spirit will continue to spur us on as we reach for new goals to achieve. 73, OM de N6CL.

Leonids a Bust in NA

While the peak of the *Leonids* meteor shower occurred with excellent results over Europe, here in the U.S. the shower proved to be much less than predicted. On one of the rare opportunities that I had to get on the air, I spent the entire night of the predicted peak listening to 2 meters. I also set up a sleeping bag on the back porch to watch for any display. I saw one meteor and it was going the wrong way. I heard one burst of activity on 2 meters during the night. Local (here in Tulsa, Oklahoma), Tommy Henderson, WD5AGO, made a few contacts on his way to work in the morning, and Charlie Calhoun, K5TTT, made a couple of contacts during the night. In general, however, there was no storm, no shower, nothing during the predicted time.

Even so, those who stayed with it were treated with essentially a daytime shower during the morning hours. The following is part of a faxed report I received from Gordon West, WB6NOA:

"Here in southern California, the peak of *Leonids* activity occurred at approximately 1700 UTC Thursday morning. Six meters was alive with activity from sun-up to around 11:00 AM local time. The best catch was hearing WA1ECF from Massachusetts pounding into the West Coast on 6 meters for over five minutes. Thanks to AA6DD who made the announcement on 50.125 MHz for everyone to QSY up 10 kHz for this double-hop catch.

"Every now and then, a double hop came in, and the veteran meteor shower op quickly ran the exchange in less than 10 seconds and let others get in on the action. But even some seasoned operators took up to 45 seconds for a leisurely exchange of signal reports, handles, type of antenna, how much power they were running, local wind conditions, and just about anything else to tie up that station from making further contacts. During a meteor burn, I would recommend we all make that contact in as short an amount of time as possible. You will find you have a lot more friends afterward!

"While 6 meters was relatively active, 2 meters to southern California didn't produce too much to the northeast. But when I rotated due north, I improved my contacts by working several stations in Oregon and Washington. On 2 meters, typical "burns" were less than five seconds, and only now and then did *Leonids* produce any 8 to 12 second bursts. It just wasn't there."

Geminids Not Much Better

While visual observers of the *Geminids* meteor shower were treated to a fairly decent light show, ham operators did not make many successful contacts. Typical of reports was one issued by Pete Heins, N6ZE, which stated that the burns were too short to enable him to complete a scheduled contact with a station in Utah.

Current Contests

Third 23 CM EME SSB Contest: The following is from the "432 MHz and Above EME Newsletter": "This year the SSB contest is scheduled for the second Moon pass of the 12/13 February SW, on 1296 only. The contest starts at local moonrise on Saturday 5 February, (This is the second moonrise of the SW referenced to Europe; the first starts on Friday afternoon local time in most places.), and ends on the following moonset on Sunday 13 February. Scoring will be contact points times number of Grid Sectors (IO, JM, FN...). SSB to SSB contacts will count as 2 points. SSB to CW (or CW to SSB) 1 point. The exchange is your Grid Sector. Operation may be by single or multiple operators. No distinction for scoring will be made. CW only stations are encouraged to participate."

And Finally . . .

By the time you are reading this column, it is hoped that *I* will be able to read it better. You may say, "What a weird way to end the column." I do so with good reason. As I write this column, I have been diagnosed as having cataracts. In a couple of weeks I will have surgery on one eye, followed by surgery on the other eye. I am preparing an article outlining my experience which hopefully will be published in the coming months as a separate feature.

Please continue to keep your good news coming. Much of the column space these past two issues has been devoted to speculation as to the future of our hobby. Now that we are into the new year, I would like to know just how on- or off-target my predictions have been. I need your input, so please keep me informed.

As always, I thank you for helping me create this, your "VHF Plus" column. Until next month...

73, Joe, N6CL

Announcements

• FAR Scholarships – The Foundation for Amateur Radio, Inc. plans to administer 73 scholarships for the academic year 2000–2001 to assist radio amateurs. Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college, or technical school. The awards range from $500 to $2500, with preference given in some cases to residents of specific geographical areas or the pursuit of certain study areas. Additional information and an application may be requested by letter or QSL postmarked by April 30, 2000 from FAR Scholarships, P.O. Box 831, Riverdale, MD 20738.

• Korean War Project – This June will mark the 50th anniversary of the beginning of the Korean War. The Korean War Project, founded by WDØHTG, is a nonprofit organization established by veterans. They would like to hear from amateur radio operators who participated in that war, and they will publish stories relating to their experiences. See <http://www.koreanwar.org/>, or write to Korean War Project, P.O. Box 180190, Dallas, TX 75218-0190.

• North Carolina QSO Party – Sponsored by the Alamance ARC, from 1200–2359Z Feb. 26 and 1200–2359Z Feb. 27. For details check the Alamance web site: <http://www.netpath.net/~n4mio/qsoparty. htm>; or write to NC QSO Party, c/o K4EG, Box 3064, Burlington, NC 27215.

• The following Special Event stations will be on the air in February:

WA5DTK, from Alamo Siege Days, commemoration of the siege of the Alamo in 1836; Feb. 23 – March 6 on SSB 14.250, 21.300, 7.240; CW 14.050, 21.050, 7.050. For special historical QSL, send QSL to WA5DTK, 603 Broken Bow Drive, Round Rock, TX 78681-7401.

K7MAR, from Leap Year Day, Salem, Oregon; 2000Z Feb. 29 to 400Z March 1 on 3.960, 7.260, 14.260, 28.450. "Leapy Hams" receive certificate. QSL to Raenell Dawn, K7FEB, 4405 Panther Ct. NE, Keizer, OR 97303.

K8LOD, from U.P. 200 Sled Dog Championship, Marquette, Michigan; Hiawatha ARA; 2000Z Feb. 18 to 2000Z Feb. 20. Suggested frequencies the General class portions of 80–10 meters. For certificate send 9 × 12 SASE to Rich Schwenke, N8GBA, 21 Smith Ln, Marquette, MI 49855. Note your contact number on your QSL card.

W8GQN, from Straits Area ARC celebration of 50 years of service to northern Michigan; Petoskey, Michigan; 1300–2200Z Feb. 5 on 3.970, 7.270, 14.270, 21.370, 28.370, 146.68. For certificate send SASE to SAARC, Rick Jersey, 2768 Berger, Petosky, MI 49770.

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

Feb. 5, **Hiawatha ARA 21st Annual Swap and Shop**, Negaunee Township Hall 42 M-35, **Negaunee, Michigan**. Contact Bruce Bureau, WB8NJP, 906-486-6400, or Bill Beitel, N8NRG, 906-226-2779.

Feb. 5, **Charleston Hamfest & Computer Show**, Stall High School, **north Charleston, South Carolina**. Contact Jenny Myers, WA4NGV, 2630 Dellwood Ave., Charleston, SC 29405-6814 (843-747-2324; e-mail: <brycemyers@aol. com>). (Exams at 12 noon; for more information, call Ed, KE2D, 843-871-4368; e-mail: <efrank@charleston. net>.) Talk-in on 146.790 and 145.250, plus 147.180+, 146.940–, 147.270+, 147.345+, 146.760–, 147.150+, and 443.800+.

Feb. 5–6, **40th Tropical Hamboree & ARRL Southeastern Div. Convention**, Fair Expo Center, **Miami, Florida**. For more info: home page <http://www.hamboree.org>; phone 305-226-5346; fax 305-642-1648; e-mail <w4wyr@arrl.net> or <wd4sfg@bellsouth.net>. (Exams)

Feb. 6, **NOARS Winterfest 2000**, Gargus Hall, **Lorain, Ohio**. Contact John Schaaf, KC8AOX, 216-696-5709; e-mail: <noars@qsl.net>. Talk-in 146.700– and 444.800+.

Feb. 7, **West Valley ARC Radio Equipment Auction**, St. Clement of Rome Catholic Church Social Hall, Sun City, Arizona. Contact WVARC, P.O. Box 1573, Sun City, AZ 85372 (623-214-7054; e-mail: <kc5ac@arrl.net>). Talk-in 147.30+.

Feb. 11–13, **53rd Orlando Hamcation℠ Show and ARRL State Convention**, Central Florida Fairgrounds, **Orlando, Florida**. Contact Ken Christenson, 5548 C Cinderlane Pkwy., Orlando, FL 32808 (407-291-2465; e-mail: <kd4jqr@ arrl.net>). (Exams, must preregister; call Gil Lineberry, 407-843-4112.) Talk-in 146.760– offset.

Feb. 12, **2000 District One ARES/ RACES Hamfest**, Cole Community Center, Canyon, Texas. Contact Ben Pollard, WS5R, P.O. Box 5378, Amarillo, TX 79117 (e-mail: <ws5r@arrl.net>). (Exams)

Feb. 12, **Cherryland ARC Swap-n-Shop**, Immaculate Conception Middle School, **Traverse City, Michigan**. Contact Joe, W8TVT, 231-947-8555, or Chuck, W8SGR, 231-946-5312. (Exams) Talk-in 146.86.

Feb. 13, **Mansfield Mid*Winter Hamfest & Computer Show**, Richland County Fairgrounds, **Mansfield, Ohio**. Talk-in call W8WE on 146.34/94.

Feb. 19, **2000 Salem Hamfair**, Polk County Fairgrounds, **Rickreall, Oregon**. Contact Evan Burroughs, N7IFJ (503-585-5924; e-mail: <n7ifj@teleport.com>) or check: <http://members.xoom.com/kb7cw/sra/index.html>. (No exams)

Feb. 19, **RadioFest 2000**, General Stilwell Community Center Pom Annex, **Seaside, California**. <http:/www.k6ly.org/radiofest/>, NPSARC web page: <http:/www.sp.nps.navy.mil/npsarc/k6ly.html>. Talk-in 146.970.

Feb. 19, **Algonquin ARC Fleamarket**, Marlborough Middle School, **Marlborough, Massachusetts**. Call Ann Weldon, KA1PON, 508-481-4988 before 9 PM, or AARC, Box 258, Marlborough, MA 01752-0258.

Feb. 19, **2000 Winter Hamfest**, Citizens Fire Company of Oberlin, **Oberlin, Pennsylvania**. Contact Dick, N3NJB, 717-939-4825; e-mail: <n3njb@aol.com>; web: <http://hrac.tripod.com>. (Exams nearby 9 AM)

Feb. 19, **Dallas ARC Auction**, Calvary Family Church, **Mesquite, Texas**. Contact Bob Peters, K1JNN, 877-753-9577; e-mail: <soundimp@pobox.com>.

Feb. 19, **ARA of the Southern Tier 19th Annual Winterfest**, Elmira College Murray Athletic Center Domes, 5 miles north of **Horseheads, New York**. Contact Gary, N2OKU, 607-739-0134. (Exams) Talik-in on 146.700–.

Feb. 20, **Greater Boston Antique Radio Collectors Fleamarket**, Westford Regency Inn, **Westford, Massachusetts**. Contact Antique Radio Classified, Tammy DeGray, P.O. Box 2, Carlisle, MA 01741 (phone 978-371-0512; e-mail: <arc@antiqueradio.com>).

Feb. 20, **Livonia ARC Swap 'n Shop**, William M. Costick Activities Center, **Farmington Hills, Michigan**. Contact Neil Coffin, WA8GWL, Livonia ARC, P.O. Box 51532, Livonia, MI 48151 (734-261-5486; e-mail <swap@larc.mi.org>; web: <www.larc.mi.org>).

Feb. 20, **South Hills Hamfest**, Castle Shannon Volunteer Fire Dept., **Castle Shannon, Pennsylvania**. Contact Steve Lane, W3SRL, 412-341-1043; e-mail: <slane@adelphia.net>; web: <http://www.hky.com/~sanfordb/index.htm>.

Feb. 20, **Aurora Repeater Assn. Swapfest 2000**, Adams County Fairgrounds, **Brighton, Colorado**. Contact Wayne, NØPOH, 303-699-6335; e-mail: <NØARA@qsl.net>.

Feb. 26, **LPARC Cabin Fever Hamfest**, La Porte Civic Auditorium, **La Porte, Indiana**. Contact Neil Straub, P.O. Box 30, La Porter, IN 46352 (219-324-7525; e-mail: <nstraub@niia.net>). Talk-in 146.520, 146.610 (131.8) PL–.

Feb. 26, **Woodbridge Radio Club Auction**, Iselin First Aid Squad building, **Woodbridge, New Jersey**. Contact Jerry, KK2J, 732-721-1046.

Feb. 26, **Northern Vermont Winter Hamfest & ARRL Vermont State Convention**, Milton High School, **Milton, Vermont**. Contact W1SJ, 802-879-6589; e-mail: <w1sj@arrl.net>; web: <http://www.ranv.together.com>. (Exams 9 and 1 PM) Talk-in 145.15.

Feb. 27, **Annandale Winterfest**, Annandale Campus of Northern Virginia Community College, **Annandale, Virginia**. Contact Jim, WA4LTO, 703-392-0150; e-mail: <k3mt@erols.com>; web: <http://users.erols.com/k3mt/vws>. Talk-in 146.31/91.

Feb. 27, **2000 LIMARC Winter Hamfest**, Levittown Hall, **Hicksville, New York**. Call the LIMARC 24-hour info line 516-520-9311; e-mail: <hamfest@limarc.org>; web: <www.limarc.org>. Talk-in 146.850 (PL 136.5).

Feb. 27, **Cuyahoga Falls ARC Hamfest**, Electronic, & Computer Show, Emidio's Party Center, **Cuyahoga Falls, Ohio**. Contact Carl Hervol, 330-497-7047; e-mail: <carlh@pop.raex.com>.

BY PETER O'DELL, WB2D

For the Newcomer to Ham Radio

Verticals

Last month we took a look at simple half-wave wire antennas, because they are among the easiest and least expensive antennas to build and erect. This time we will continue with vertical antennas.

Up until about ten years ago, "vertical" was synonymous with a "quarter-wave vertical." At that time we started seeing half-wave verticals appearing on the market. We'll come back to the half-wave later, but for now we'll look at the old standard, the quarter-wave vertical. This is the bargain antenna you are going to find at a hamfest, or you may decide you want to make one yourself. They are simple enough such that you can make one with a minimum of tools and experience.

One of my first antennas was a vertical mounted on the roof of the small New York City building in which I lived. I made hundreds of Novice contacts with that antenna. Later, I bought a house in Michigan and put up the same antenna in my backyard. I rarely made a contact with it. Dipoles ran circles around it. It took me a long time to figure out what the real difference was. For a while I thought it had suffered some unexplained damage that interfered with its functioning. Later on I began to see why the "vertical" is loved by some hams and hated by others.

At the heart of any quarter-wave vertical is the primary radiator, which is exactly what it sounds like—a vertical element electrically one-quarter-wavelength long. The approximate length is determined by using one of ham radio's magic formulas—234 divided by the frequency in MHz. Thus, for instance, a quarter-wave vertical radiator cut for 7.20 MHz is going to be approximately 32.5 feet. Again, all sorts of factors will influence the precise length of the radiator, but this formula certainly will put you in the ballpark. (See last month's column for a discussion of how to fine tune these formulas.)

Most hams feed a vertical with 50 ohm coax; the center conductor attaches to the vertical element, while the braid attaches to the ground. It is this second connection that makes or breaks the vertical! The ground. Is it really ground (electrically speaking), or is it merely a collection of dirt and rocks held in place by gravity? With the former, you have an efficient, inexpensive, unobtrusive antenna that will yield you plenty of DX contacts. With the latter, you have an outdoor dummy load.

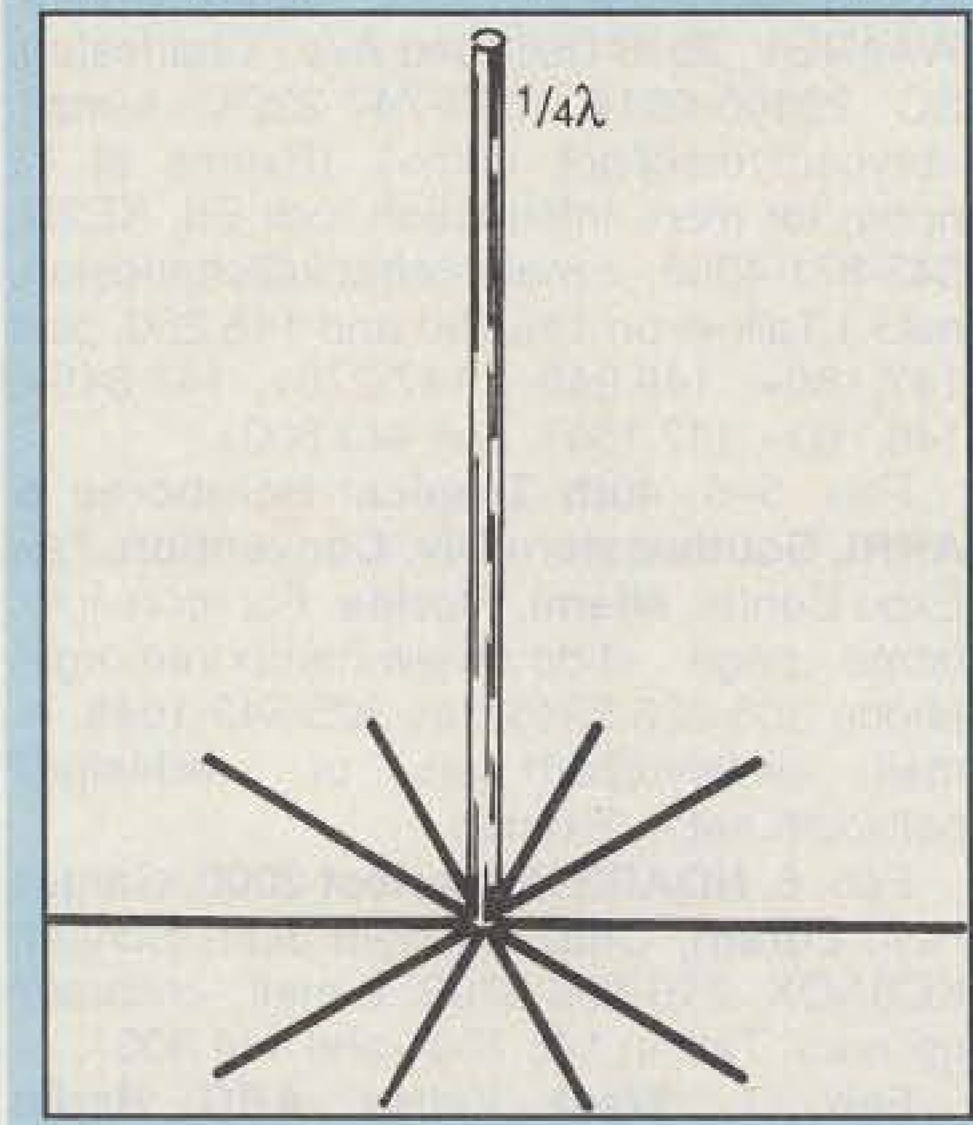


Fig. 1– The basic quarter-wavelength antenna.

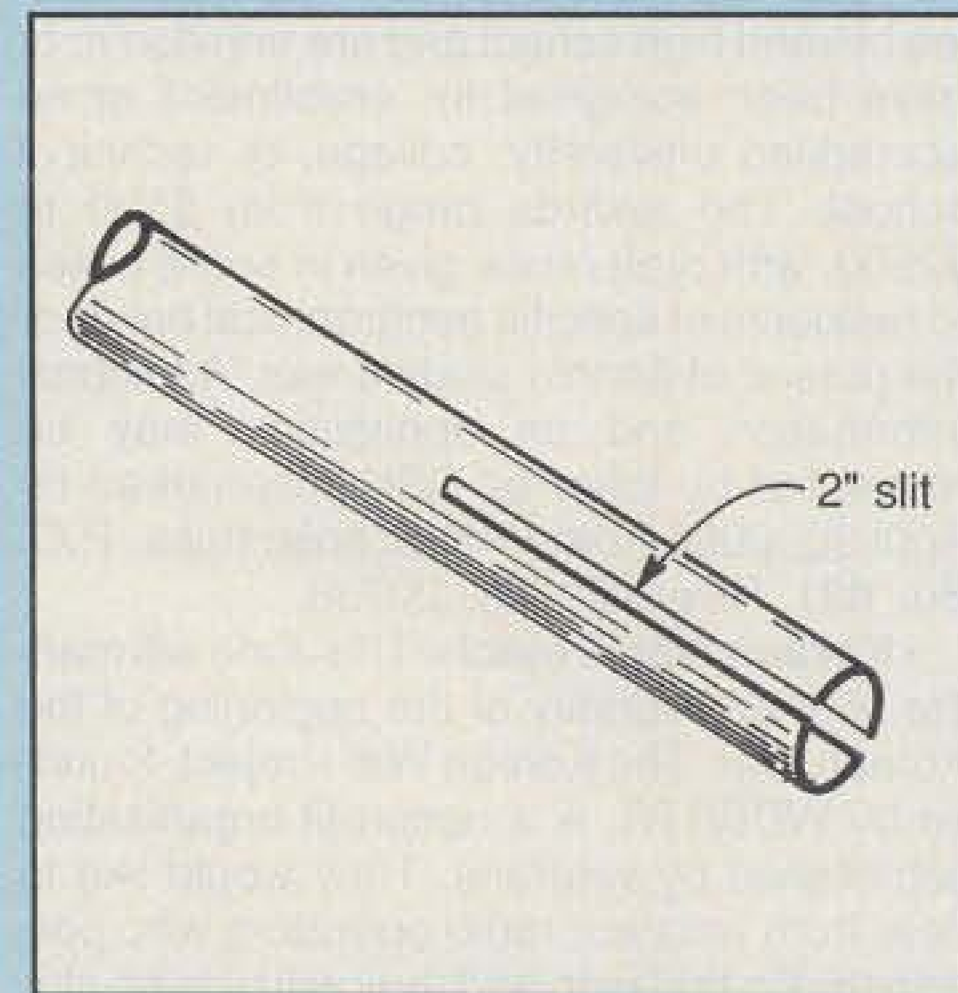


Fig. 2– The outer piece of aluminum tubing from a vertical assembly. A hacksaw has been used to saw a 2 inch slit in the tubing.

For the vertical to be an efficient radiator, it needs what amounts to an electrical mirror beneath it. You get that by having little or no resistance in the surface surrounding the vertical (radius approximately equal to the length of the vertical radiator). Suppose you wanted to mount a vertical in your backyard. The best thing you could do to improve its performance would be to cover your backyard with sheets of copper or aluminum. If you could do that, you would have assured yourself of having an excellent performer. However, some amateurs receive objections from family members when they contemplate such a project—obviously, misplaced values on the family's part. Just think of how it would cut down on lawn maintenance! It would probably pay for itself in no time.

Radials

If your family falls into the killjoy category, there are still some relatively simple things that you can do to turn your ground-mounted vertical into a good performer. Adding radials to the system greatly enhances the performance. How long should the radials be? There is no cut-and-dry answer to that. Ideally, you want them to be at least 1/4-wavelength long, and there is benefit in making them longer, up to just over 1/2-wavelength. After that, there is no significant improvement by having them longer. The question then becomes: How many? Four helps, and eight is better. You get significant increases in performance by increasing the number of radials until you get up to 96. Above this number, increase in performance is far harder to achieve.

Do radials make a difference? You had better believe it. Years ago when I worked at the ARRL, a new ham from the midwest called in to complain that he couldn't seem to make any contacts. He was using a ground-mounted vertical with no radials. I talked to him about radials and suggested that most of his RF was being turned into heat in the ground around the base of the antenna. He had never heard of such a thing, but he had a great attitude. Had I ever measured such an increase? Well, no, but . . . Being an engineer, he decided to check it out for himself.

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

A few days later this new ham called back to tell me that he had set temperature probes in the ground around his antenna and measured the temperature before and after transmitting. Sure enough, there was a significant increase in soil temperature around the base of the antenna just after transmitting. His calculations indicated that over 90% of the transmitter's output was being converted into heat. Now do you understand why I called it a dummy load earlier? Then he put in thirty-two 1/4-wave-length radials and checked the change in temperature—now barely detectable, indicating that almost all of the energy was being radiated as RF.

Radials have another benefit besides making the antenna more efficient: They lower the angle of radiation. This means that more of your signal goes toward the horizon, which is better for DX! The same constraints for size and numbers hold true here: More is better up to about 96, and you get improved performance up to about 1/2-wave-length long.

Suppose you go to the maximum and decide to put down 96 radials in your backyard. Well, your family may welcome that idea about as warmly as covering the backyard with sheets of copper. Between kids and spouses tripping on them, pets getting tangled in them, and lawnmowers "eating" them, your radials could have a short life span. A friend of mine who wanted to put in radials rented an electric "trencher" from the local hardware store and used it to bury his radials a few inches beneath the surface. Since he was putting in 96 of them, it took him all weekend, but it made for a neat, safe installation.

Most commercial antennas come with three or four small screws for attaching radials—hardly adequate if you are going to go with 96 of them. One product that has been around for years is the Lance Johnson GP-1 radial buss. It is a cast alumaloy buss designed to improve the installation of radials on an HF vertical or ground-plane antenna. It is a little less than 1 foot in diameter and has 24 screws evenly spaced around the edge. It accepts masts up to 2 inches in diameter. (More information on the GP-1 can be obtained by calling 303-646-4630 or visiting the website: <www.qth.com/lance>.)

So far my comments have been based on the assumption that you need radials. There are a few hams who do not need to use them. If you live on a swamp or marsh you may not really need radials. If you have a multimeter, you can quickly check this out. Set the meter to read ohms. Go out in your backyard and stick the probes in the ground as far apart as you can comfortably. If the resistance is more than a few ohms, you probably can benefit with radials. Jim Cain, K1TN, once lived in a house located next to a swampy area. He measured the resistance of the ground over a range of about 120 feet and found it to be only a few ohms. That was (and still is) an excellent radio location, where radials aren't needed. Those spots are rare in the US.

The Ground Plane

There is another way of mounting a quarter-wave vertical that changes all the rules—mount it above ground. In this configuration it is often referred to as a *ground-plane* antenna. You still need radials, but you can get by on a lot fewer; three or four is often sufficient for decent performance.

At the beginning of this column, I talked about having a vertical that performed very well in New York, where it was mounted on the roof. It was a multiband trap design, and I had two radials for each band. When I moved to Michigan, I installed it ground-mount fashion with no radials—hence the big disappointment in performance.

A few years back I acquired a vertical that covered 80 and 40 meters. Living on a city lot, there was no way I could install enough radials of sufficient length if I ground mounted it. Therefore, I installed it about 7 feet above ground and attached only two radials per band. Neither of the 80 meter radials went in a perfectly straight line, and both were bent at right angles at the edge of my property. Soil conductivity was average at best. This antenna, however, was one of the best DX antennas I have ever had for 80 meters.

Multiband Antennas

Most of the commercial vertical antennas are multiband devices. The traditional way this is achieved is by using parallel traps along the length of the radiator so that it resonates on different bands. Just to keep things simple, let's suppose you have an antenna designed to cover 10, 20, and 40 meters. The base will be insulated from the mounting bracket and have some sort of means for attaching the feedline—often an SO-239 connector. You will have about 8 feet of aluminum tubing (approximately 1/4 wavelength) and then a parallel trap (the 10 meter trap). This will be followed by a couple more feet of aluminum and a trap for 20 meters. Above the 20 meter trap you will have enough aluminum to make the unit resonate on 40 meters.

The traps are parallel circuits (coil and capacitor) tuned to band. Feed a 10 meter signal into the antenna, and it sees the 10 meter trap as a high impedance. In other words, this is where the antenna stops for this signal. All the aluminum above the trap might as well not be there. Feed a 20 meter signal into the antenna, and it sees the 10 meter trap as a loading coil, which has the effect of shortening the physical length needed for resonance. However, it sees the 20 meter trap as a high impedance, and therefore the "end" of the antenna. A 40 meter signal is going to see both traps as loading coils. Traps mean that you are going to lose some bandwidth and some efficiency for each trap in the unit. It is a compromise for sure, but often it is well worth it in terms of cost and the amount of space occupied.

If you flip through the ads in magazines, you will find multiband antennas that use stubs and devices other than traps to provide multiband service. If it is a quarter-wave antenna, it will perform better with radials or some sort of ground plane.

Single-Band Antennas

If you want to make a single-band antenna, you can fashion it out of aluminum tubing and hose clamps. You'll want to choose tubing sizes carefully so that the pieces "telescope" together. At each junction cut a 2 inch slit into the "outer" piece of tubing and use a hose clamp to secure the two pieces together—pretty simple stuff, really. Another approach, if you have a suitable tree available, is to suspend a wire element from a high branch.

Half- and Quarter-Wave Verticals

Now let's go back to the other kind of vertical, the new kid on the block, the half-wavelength variety. Virtually nothing that I have mentioned here applies to these devices. They do not need radials, and I am not aware of any information suggesting that their performance can be enhanced by adding them. You can ground-mount them or mount them elevated. Electrically they are very similar to a dipole that has been mounted vertically. These antennas tend to be more expensive than their quarter-wave cousins.

A quarter-wavelength vertical can be a fun antenna—and inexpensive, too. Just keep in mind that quarter-wavelength designs require a good ground system to function properly.

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.

Ham Radio News (from page 4)

University 2000" on January 23. It will be a day of forums dedicated to a variety of ham topics, from antenna theory and QRP (low power) to license restructuring, according to the "Hudson Loop" newsletter. Over 20 ham radio groups were scheduled to be represented there, along with QSL card checking for awards and a tune-up clinic. For more information,see the Ham Radio University 2000 website at <http://www.arrlhudson.org/nli/hru2000.htm>.

Kenwood Seeks FCC Okay For 2 Meter Remote Control

Kenwood Communications Corporation has asked the FCC to give its blessings to using the 2 meter ham band for remotely controlling an HF radio via its Sky Command System. The FCC in turn issued a public notice asking for comments from hams on the request. The problem is that FCC rules limit "telecommand" (remote control) transmissions to frequencies above 222.15 MHz, and the Sky Command System is designed for use with dual-band mobile rigs, most of which use a combination of 70 centimeters, where telecommand is legal, and 2 meters, where it is not. Kenwood contends that since the control signals are sent on 70 centimeters, and that the 2 meter band is used only to retransmit audio from the HF station, the system is legal and that the 2 meter portion of it is third-party communication, not telecommand.

In its petition Kenwood asked for either a declaratory ruling that such transmissions are legal or a blanket waiver of any rules with which the system does not comply. The FCC is seeking comments from the amateur community before making a decision. Comments are due by January 31, with a reply comment deadline of February 14. For more information, including filing procedures, look for Public Notice DA 99-2805 on the FCC's web-site, or contact William T. Cross of the FCC's Wireless Telecommunications Bureau at 202-418-0680.

6 Meter DX Best in Decades

DX activity on 6 meters has heated up to near-record levels, as the approaching peak of sunspot Cycle 23 has opened up winter-time F_2 propagation on the band. There were several reports on the internet in mid-December of openings from Alaska and Hawaii to the eastern US, as well as New Zealand to New England contacts and a large number of less-impressive but still exciting openings over long distances within the United States. Some longtime "magic band" operators are comparing conditions in late 1999 to the record-setting openings of the 1959 solar peak. If your rig covers 6 meters, you may want to keep an ear on 50.125 (the domestic SSB calling frequency), 50.110 (the DX SSB calling frequency), or 52.525 (the primary FM simplex frequency) MHz.

BY BOB JOSUWEIT, WA3PZO

Public Service Around the World

Amateur radio public service is not limited to North American hams. This month we take a look at hams around the world providing communications in the public interest. They provide the same valuable services to their communities in times of need as do amateurs in the United States and Canada, but sometimes with a few differences. We'll start our world tour…

In India

In the aftermath of one of the worst cyclones to hit India in modern history, amateurs provided critical communications. Nearly 10,000 people were killed by a "super cyclone" that hit the Orissa state in late October last year. An official at an emergency ham radio center in Jagatsinhpur, just one of several stricken districts, said authorities had confirmed 2464 deaths in that district alone. Scores of people in eastern India suffered serious skin burns from acid at a damaged fertilizer plant. The acid was getting into ponds where the villagers bathe. The Associated Press reported that the number of victims was expected to rise, since thousands of people were washed out to sea and their bodies were unclaimed and often cremated in mass pyres.

"At one place, people were fishing in the dirty pond and washing their hands and feet and our doctors shouted at them to stop," said Ram Narayan, a volunteer operating a ham radio station in New Delhi that was in touch with medical teams in inaccessible areas. According to the AP, Narayan said the villagers shouted back, "Then which water do we use?"

"Each district headquarters will have a satellite phone," said Chief Minister Giridhar Gamang, who relied on ham radio operators when the cyclone knocked out regular communications in one of the poorest regions in India. "Cyclone-resistant houses will be built along the coast. Nature has taught us a lesson." Calcutta VHF Amateur Radio Society Secretary Indranil Majumdar, VU2KFR, reported, "The entire communication in the state is being maintained by hams—except for some satellite phones that are operating now and then and facing battery problems."

RARES (Russian Amateur Radio Emergency Service) logo. (Courtesy Andy Fyodoroff, RW3AH, RARES Leader)

Majumdar reported to the ARRL that teams of amateurs from all over India responded to the disaster. The Calcutta club set up an Amateur Radio Control Room at the shack he shares with his brother, Horey, VU2HFR. At one point a dozen Calcutta hams were staffing the facility around the clock. The teams handled message traffic relating to emergency food, clothing, and medical needs; road conditions; and health and welfare. Similar fixed facilities were set up in other Indian cities, including New Delhi and Hyderabad, and linked via HF. VU2KFR said VHF links were being used to route regional traffic within and between states. There were no repeaters. The hams used what he called "human relay."

According to the *ARRL Letter*, "This is the first time the whole of India has to come to know and appreciate ham radio," VU2KFR said. He said ham radio provided the initial communication link between the stricken state and the rest of the country." One Jajpur official praised the amateur radio efforts. In a letter to Calcutta VHF ARS President Dipak Mitra, VU2DPM, District Magistrate R. Balakrishnan said the radio links were helpful in monitoring the spread of disease and in damage assessment efforts. "I am of the view that the concept of ham radio should be popularized and more and more such groups need to be encouraged," he wrote.

RW3AH monitors RARES calling frequency. (Photo via RW3AH)

Russian Hams Respond To Turkey and Kosovo

Besides supplying communications within the former Soviet Union, the Russian Amateur Radio Emergency Service responds to communications needs around the world. Most recently, RARES members were deployed to Kosovo to help with refugee relief efforts, and to aid relief efforts after the earthquakes in Turkey.

Moscow resident Andy Fyodoroff, RW3AH (also WL7AP and 9XØA), who is the head of RARES, explained that the group is an non-government, non-profit volunteer national amateur radio organization with over 300 active members from the former USSR. RARES works closely with "CENTROSPAS," the Federal Rescue Service of Ministry of Emergency Situations and Civil Defense of Russia. The national rescue team, EMERCOM, was dispatched to Turkey following the earthquakes. RARES activated an HF net with the rescue team on its 24-hour alert duty frequency, 14347 kHz. The net is active daily at 0700 UTC on USB/CW. They usually have 50–70 stations participating.

The RARES headquarters club station, R3ARES, is located on the rescue service base of EMERCOM in Moscow. Andy says their shack includes Yaesu FT-900, FT-890, and FT-1000MP trans-

c/o CQ magazine
e-mail: <wa3pzo@cq-amateur-radio.com>

HAMNET's mobile van ready to be put into service in South Africa. (Photo via Sean Inggs, ZR5BBL)

The logo of HAMNET, South Africa's amateur radio emergency network. (Courtesy Sean Inggs, ZR5BBL)

ceivers, an Alpha-88b amplifier, Cushcraft monoband Yagis (4 elements) for 10, 15, and 20 meters, and a homemade ground plane for 14 MHz. On VHF they have an FT-2500 and an FT51rh.

In 1990 Fyodoroff discussed the concept of an International Rescue Amateur Radio Service or team with the ARRL and the ITU. According to Fyodoroff, RARES received no reply to their ideas. "The year by year situation in the world is getting worse (wars, regional conflicts, terrorism) also earthquakes, tornadoes, etc....," said Fyodoroff. "We should do something and *all together*! RARES is *ready* at any time!"

RARES does not use 2 meter nets primarily because they do not have many hams who are able to operate on VHF/UHF frequencies. Fyodoroff said Moscow hams have a big problem with unofficial (pirate) radio stations using the 2 meter band in their area, and many have given up trying to use it. Only two VHF repeaters are active now, and very often these repeaters are closed down because they have lots of interference from pirate stations.

RARES cooperates on VHF with the EMERCOM Rescue Service in Moscow on their 145.350 FM simplex active-duty frequency. Help is available in case of any emergency situations, too.

South Africa's HAMNET

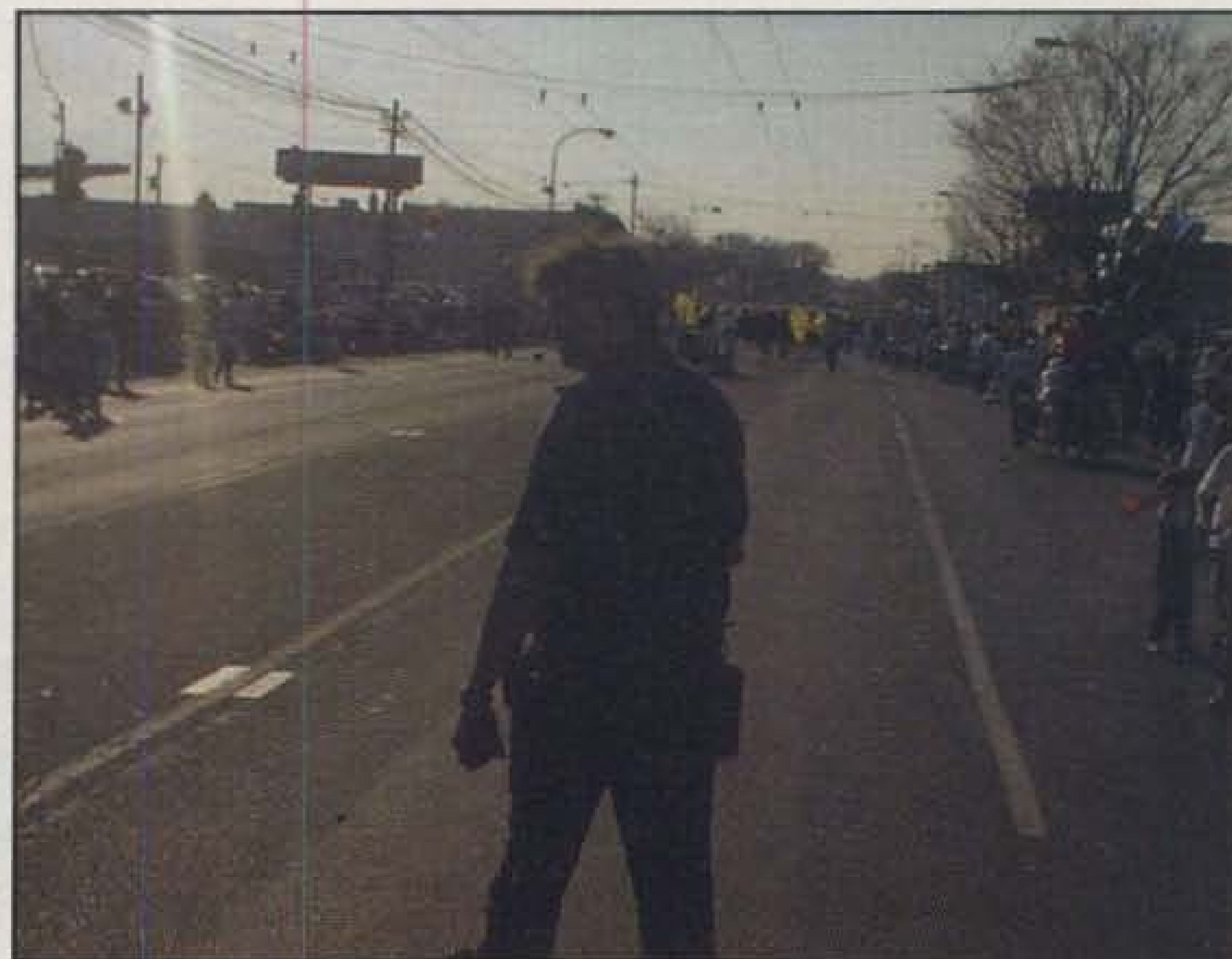
HAMNET is a division of the South African Radio League (SARL) and is organized at the national, provincial, and local levels. HAMNET promotes service to the community and provides a service to the government of South Africa by helping to provide a radio communications network in times of disaster or whenever the life, property, or safety of the community is endangered. HAMNET works closely with the National Disaster Management organization (formerly known as Civil Defense) in liaison with the SA National Defense Force, SA Police Services, provincial and local governments, and other bodies which all play a supportive role when an emergency arises within the country.

All HAMNET members regularly take part in simulations ranging from train accidents and sinking ships to airplane crashes. All day long, members keep watch on a network of local repeaters around the country ready to provide assistance if needed.

In the Natal Province there is a caravan marked HAMNET in reflective colors; it is often used by the traffic department during the holiday season to offer assistance to road users. It has local government maps and radios equipped

Radio-equipped patrol jetboat used in the Waimak Gorge for the coast to coast speedboat race in New Zealand (Photo via NZ AREC)

New Zealand hams stand by ready to help. (Photo via NZ AREC)



Holmesburg Amateur Radio Club Vice President Dave Hogan, KB3AKK, keeps an eye on parade movement while tuning out crowd noise by using headphones. (WA3PZO photo)

for HF, VHF, and UHF. If needed, their radios are also on standby to be used for disaster management contact. Members also have reflective clothing which can be used in times need, including caps and vests imprinted with the words "HAMNET emergency comms."

The members of HAMNET include all types of people willing to serve their community, including fire chiefs, police officers, students, protection service people, and those who own their own businesses. All members have HAMNET ID cards. Some have the money to buy the most current, expensive radios, GPS handheld units, and laptop computers for use in the field. Regular meetings are held, and there are on-the-air bulletins, etc., to keep members up to date on situations.

HAMNET provides communications for a variety of public-service events, including car and bike racing, the world-famous Comarades Marathon in Natal, and the national government elections. Members also help the highway patrol by reporting any suspicious behavior,

Volunteers Needed

Amateur radio volunteer communicators are needed for the American Lung Association's Big Ride Across America, a 3500 mile bicycle ride from Seattle, Washington to Washington, D.C. The 6 1/2 week ride will last from June 19 to August 5, 2000. You can volunteer for the entire ride or choose one or more parts of the country. Detailed information about the ride can be found on the web at <http://www.bigride.com>. To volunteer or obtain more information about volunteer responsibilities, contact Dick Anderson, KE7A, via e-mail at <ke7a@arrl.net> or phone toll-free 1-877-752-3868.

American Lung Association map of the "Big Ride Across America" this summer. Ham volunteers are needed. (Courtesy American Lung Association)

fire, robberies, or car thefts. According to Sean Inggs, ZR5BBL, "One of the communications systems we will be glad once it is up is the UHF network in Natal that should give us capabilities in linking up the whole of the country's UHF repeaters by a simple code given from your handheld keypad, or open a link going from Durban to Johannesburg by typing in the area code for the province/state."

Looking Down Under...

In New Zealand the Amateur Radio Emergency Corps participates in a variety of emergency and public-service events. AREC regularly assists with search-and-rescue operations. According to Section Coordinator Steve Davis, ZL2UCX, AREC operators were activated recently for a major search that lasted for six days. They also participate in search-and-rescue competitions and training sessions.

One event that is not mentioned a lot in the United States is speed-boat racing. Davis says, "A small but dedicated team heads out into the cold and wet conditions during the winter months." These hams are active for four monthly races on local rivers. Other events include the Hurunui Endurance Race, the Canterbury (Road) Rally, and the New Zealand Motor Cycle Grand Prix.

The Four "P"s: Pumpkins, Parades, Preparedness, and Planning

Back in the US, over the 1999 Halloween weekend members of the Dutchess County, New York Mt. Beacon Amateur Radio Club (MBARC) participated in "Pumpkin Patrol 1999." Pumpkin Patrol is a statewide program of the New York State Police which began in 1976 as an important element of the State Police crime prevention effort.

Thirty-eight members of MBARC assisted NY State Police Troop "T" in staffing bridges over Interstate 84 to ensure that no debris was thrown onto the highway. Club members were linked to NY State Thruway Headquarters through their mobile amateur radio equipment and cell phones.

A little bit farther south, members of the Philadelphia-based Holmesburg Amateur Radio Club were making plans to provide logistical and safety communications for one of the largest community-based parades in Pennsylvania. The Mayfair-Holmesburg Thanksgiving Parade draws a crowd of over 125,000 spectators to watch a 2 1/2 hour march of bands, floats, sports-team mascots, community groups, and Santa Claus. Club members are responsible for updating the order of march to the reviewing stands at the end of the parade, as well as watching out for possible medical emergencies. Medical emergencies are almost expected during the parade. In past years band members became overheated or dehydrated, and an older band member suffered a heart attack. Quick and accurate reporting of the information to the right officials was of paramount importance. On the lighter side, club members report that it is a successful parade if Santa is delivered to the end of the parade route.

9-1-1 Dials H-A-M-S

Preplanning and preparedness paid off for residents of Lehigh County, Pennsylvania in late November when the county's 911-phone and radio systems failed for four hours. Christopher Post, N3SIG, reported that amateur radio operators were activated on a Tuesday morning to assist the Lehigh County Emergency Management Agency in Allentown:

"At 0945 hours the Lehigh County EMA office notified the RACES net control station of the situation and requested an emergency communications network be established to support county functions. Net Control Bruce Hull, KA3ONZ, established a directed net on the 146.940 repeater in Allentown. He opened the net and took check-ins of operators who could be deployed into the field. Within 10 minutes, all incoming 911 calls were routed to the Allentown City 911 Communications Center and backup communications were being put in place to support the County Fire, Emergency Medical Services, and Police radio and phone answering services.

"Chris Kelly, N3RPV, reported to the County Emergency Operations Center and stood ready to relay traffic from amateur operators in the field to the remote dispatch center at the county transmitter site. Within minutes, key individuals of the RACES team were alerted and activated and assigned to locations in the county. Post, an Emergency Management Specialist for Lehigh County, relocated to the transmitter site which geographically covers the whole county. He relayed traffic via the county's public-safety frequencies and coordinated with the RACES operators in the field. Joining N3SIG at the transmitter site were Jeff Kelly, N3MFT, and a dispatcher from the county 911 center. N3MFT and N3SIG used the local control microphones to operate the high-power public-safety transmitters atop South Mountain in Allentown."

Planning in Full Gear...

Plans are well underway for the annual Baker to Vegas 120 mile relay foot race, which takes place in the desert. It is a competition between teams of 20 runners representing law-enforcement agencies. This group uses APRS (Automatic Position Reporting System) tracking and sets up temporary voice repeaters on hilltops to provide logistical communication support to the runners. According to group member Cas Caswell, a wide variety of radios, antennas, TNCs (terminal node controllers), and GPS (Global Positioning System) units will be interconnected with modular cables and installed in vans right before the race.

Looking Ahead...

First, we would like to thank all of the hams who supplied information this month. Amateur radio public service knows no boundaries. Next month we hope to tell the Y2K story. Was it the last headache of 1999 or the first disaster of 2000? We look forward to hearing about how your group provides public-service communications in your part of the world. Send information to <wa3pzo@cq-amateur-radio.com>.

73, Bob, WA3PZO

Here and There

As I'm sure all of you know, Chod Harris, VP2ML, CQ's DX Editor for ten years, passed away in December of last year. Chod lived a life that many hams only dream of, operating from exotic places such as Christmas Island, the Galapagos, and of course Montserrat, where he lived part-time and got his VP2ML callsign. His dedication to ham radio and DXing in particular was obvious in the location of his California home on a hilltop with a good take-off angle over the Pacific.

Chod had been involved in the DX reporting business for many, many years, publishing the "DX Bulletin" and *DX* magazine until a few years ago. He had resources all over the world. In filling in with the column, I hope that my efforts will "come close" to Chod's excellent reporting.

CQWW CW '99

The contest season has gotten off to a great start thanks to much improved propagation. As I write this, the CQWW DX CW weekend has just concluded and quite a weekend it was. Rumor has it that a W4 station has the high-claimed score for the U.S., beating out the New England gang. That's quite an achievement for one so far from all of those European QSOs.

This column is for DX, however, not contesting. Having just taken on the responsibility of this column at the last minute, I am scrambling for material, though, so here goes.

Pitcairn Island, VP6BR

Jukka, OH6BR, was planning an extensive DXpedition to Pitcairn Island as VP6BR in January. His stated goal was to give the DX community a maximum number of VP6 contacts on all ten amateur bands from 6 to 160 meters on CW, SSB, and RTTY. Pitcairn stands at position 52 on the 425 DX News 1998 Most Wanted list, and it ranked number 21 in Europe on the 1998 Most Wanted list from *The DX Magazine* survey. Jukka should have been running the popular FT-1000MP with a factory prototype of the new remote-controlled automatic ACOM 1 KW linear, with Yagis for 20–10 meters and verticals for the low bands. After his operation, Jukka planned to leave the antennas for others to use. Not one to take the chance of losing power, he planned on having two 2 KW generators and plenty of gasoline.

c/o CQ magazine
e-mail: <n4aa@cq-amateur-radio.com>

Tony DePrato, WA4JQS, is a member of CQ's prestigious DX Hall of Fame.

Jukka was being hosted by Tom and Betty Christian, VP6TC and VP6YL, operating from the island's club station location on the flat top of a hill with 360-degree visibility. He was looking forward to the possibilities on 6 meters from such a location. Jukka planned on a web page and log-searching capability while on the island. QSL requests should go directly to OH2BR.

Myanmar, XZØA

The Central Arizona DX Association should have been off to Myanmar again in January. This time they planned operating from Thatay Khun Island off the southernmost tip of Myanmar in the Andaman Sea.

Peter, ON6TT, is well known for his DXpedition leadership skills.

The operation was scheduled from January 13 to February 6, allowing plenty of time for anyone to work them. A total of 24 operators were going to operate 8 stations. The antenna systems for the low bands were very impressive indeed: a 180 foot tower/vertical for 160 with enough beverages to do the job, 4-Square antenna arrays for 80 and 40 meters, and plenty of aluminum for the higher bands should have made them workable anywhere.

One neat feature of their web page is a section with zone-by-zone propagation information, prepared by Carl Luetzelschwab, K9LA. You just click over your QTH on the world map to see a chart of hour-by-hour band openings for your location. This perhaps could be a feature for future DXpeditions to include in their plans. Check that web site at: <http://getnet.com/~k7wx/myanmar.htm>. As in the Central Arizona DX Association's past operations, QSLing will be handled by Bob Myers, W1XT. If you use the bureau, you should clearly mark your card "XZØA via W1XT."

Clipperton Island DXpedition

Another much needed country is Clipperton. It ranked 53 in the 1998 *DX*

The WPX Program

SSB

2727	NØPFY	2729	IZ5BAM
2728	KF3AA	2730	N3LRP

CW

3023	IK3UVD	3025	PA7XG
3024	IZ5BAM		

CW: 350 IZ5BAM, PA7XG. 400 IZ5BAM, PA7XG. 450 IZ5BAM, PA7XG. 500 PA7XG. 550 PA7XG. 600 PA7XG. 1150 I2EOW. 1950 I7PXV. 2000 I7PXV. 2100 G4SSH. 3050 K9QVB. 3100 K9QVB. 3200 K9QVB. 3250 K9QVB. 4000 N6JV.

SSB: 350 IZ5BAM. 400 VK2FHN. 450 VK2FHN. 500 UA1KZF. 550 UA1KZF. 600 UA1KZF. 900 AG4W. 1000 WBØUBD. 1050 WB4UBD. 1100 WB4UBD. 1150 WB4UBD. 1200 K9GWH, WB4UBD. 1250 K9GWH, WB4UBD. 1300 WB4UBD. 1350 WB4UBD. 2650 I2EOW. 2700 I2EOW. 2750 I2EOW. 2800 I2EOW. 2850 I2EOW.

MIXED: 450 JH8MWW. 500 JH8MWW. 550 JH8MWW. 600 JH8MWW. 650 JH8MWW. 700 JH8MWW. 750 JH8MWW. 800 JH8MWW, KK6ZO. 850 JH8MWW, KK6ZO. 900 JH8MWW, KK6ZO. 1000 KK6ZO. 1200 K9GWH. 1250 K9GWH. 3000 I2EOW. 3050 I2EOW.

10 meters: NØPFY
40 meters: UA1KZF
80 meters: WB4UBD

Asia: JH8MWW
Africa: W2FKF
No. America: JH8MWW, OK1DWC
So. America: KK6ZO
Europe: JH8MWW
Oceania: JH8MWW, W2FKF

Award of Excellence Holders: K6JG, N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, I8JX, 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, DEØDAQ, 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.

CQ DX Awards Program

SSB

2293 .... IK6WQU

CW

997	YZ1NR	999	YU1YO
998	YT1TN		

SSB Endorsements

320	ZL3NS/331	320	VE7WJ/329
320	W7BOK/331	320	WB3DNA/329
320	PY4OY/331	320	K2JF/329
320	N7RO/331	320	VE4ACY/328
320	W4UNP/331	320	VE2GHZ/327
320	YV1CLM/330	320	I8LEL/324
320	K8CSG/330	310	CT1YH/311

CW Endorsements

320	K6LEB/331	320	K2JF/326
320	K2OWE/331	320	9A2AJ/323
320	N7RO/330	310	YU1TR/316
320	WØHZ/330	310	CT1YH/313
320	W8XD/329	300	W6YQ/304
320	KA7T/326	200	YU1UO/201

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.

Magazine survey. The DXpedition is planned for March 1–9 with at least 12 operators. This group also has a web site for further information on their plans at: <www.qsl.net/clipperton2000>. I don't know how many of you were around in 1954, but there is a photo on the web site of the 1954 DXpedition of FO8AJ. How they got all that heavy tube-type gear on the island would be a story in itself!

9N1MM Memorial Station

A very worthwhile project undertaken by Charlie Harpole, K4VUD, and Satish, 9N1AA, is the establishment of a memorial to the late Father Moran, 9N1MM. For many, many years Father Moran was the only way to contact Nepal, from his school in Kathmandu. Charlie and Satish have received promises from the government to assign 9N1MM to the memorial station. This station would allow many of the young licensees in Nepal an opportunity to operate there and provide training for them—and lots of contacts for us DXers, too. Charlie collected a sizeable amount of equipment donations and was to take them to Nepal last December.

It is amazing to think that hams in Nepal have almost nothing to work with—

The WAZ Program

Single Band WAZ

12 Meter SSB

17........................G4BWP

12 Meter CW

15........................VE3XN

12 Meter Mixed

20........................G4BWP

15 Meter SSB

528 ....JH1EVF

15 Meter CW

274 ....K4JLD(7/26/98)

20 Meter SSB

1052 ....KB9MDL

20 Meter CW

489 ....JA4FMS (6/15/98)
490.........UA6MF (7/27/98)

30 Meter CW

32........................VE3XN

80 Meter CW

52.........G4BWP (6/20/99)

All CW

145........................GØCGV

160 Meter WAZ

143 ....OK1DWC, 30 zones

All Band WAZ

SSB

4517 ....K8GWU 4518....................F5UTE

CW/Phone

7895......................W8FAX 7897..................OK1DWC
7896 ....JA8EC

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 November 30, 1999, 500 stations have attained the 200 Zone level.

New recipients of 5 Band WAZ Award with all 200 Zones confirmed:

None

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)	W3NO, 199 (26)
W4LI, 199 (26)	K4UTE, 199 (18)
K7UR, 199 (34)	K5RT, 199 (23)
WØPGI, 199 (26)	K4PI, 199 (23)
W2YY, 199 (26)	HB9DDZ, 199 (31)
VE7AHA, 199 (34)	N3UN, 199 (18)
IK8BQE, 199 (31)	UA3AGW, 198 (1, 12)
JA2IVK,199 (34 on 40)	EA5BCK, 198 (27, 39)
K1ST, 199 (26)	G3KDB, 198 (1, 12)
ABØP, 199 (23)	KG9N, 198 (18, 22)
KL7Y, 199 (34)	DKØEE, 198 (19,31)
NN7X, 199 (34)	KØSR, 198 (22, 23)
OE6MKG, 199 (31)	K3NW, 198 (23, 26)
HA8IB, 199 (2 on 15)	UA4PO, 198 (1, 2)
IK1AOD, 199 (1)	JA1DM, 198 (2, 40)
DF3CB, 199 (1)	9A5I, 198 (1, 16)
F6CPO, 199 (1)	K4ZW, 198 (18, 23)
W6SR, 199 (37)	OH2VZ, 198 (1, 31)
W3UR, 199 (23)	RAØFA, 198 (2 on10,15)
KC7V, 199 (34)	LA7FD, 198 (3, 4)
GM3YOR, 199 (31)	K5PC, 198 (18, 23)
VO1FB, 199 (19)	NT5C, 198 (18, 23 on 40)
KZ4V, 199 (26)	VE3XO, 198(23, 23on40)
N4CH, 199 (18 on 10)	K4CN, 198 (23, 26)
OE1ZL, 199 (1)	KF2O, 198 (24, 26)
W6DN, 199 (17)	

The following have qualified for the basic 5 Band WAZ Award:

W1XV, 200 zones CT1ESO, 183 zones
OK1DWC, 179 zones

1100 stations have attained the 150 Zone level as of October 30, 1999.

Endorsements:
LU2FFD, 200 zones UT5UGR, 200 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>.

no coax, no antenna wire, no PL-259's, no DIN plugs, to say nothing of equipment. Nepal runs on 220 VAC, so a lot of equipment won't work over there. We wish Charlie and Satish good luck in the final stages of setting up this memorial. I know I treasure my QSL from Father Moran, and to hear that callsign on the air again would be music to my ears.

Macquarie Island, VKØLD

Jim Smith, VK9NS, has just released a rather lengthy report on the activities of Alan, VKØLD. I will give you just the bare facts here.

Alan is ex-GM4EEL, VP8PJ, A4XFY, VS6AC, V85AC, and P29AC. He is currently licensed as VK6CQ and VK8AC. With all that background, he is an experienced operator. He is active now from Macquarie and will be there until late next year. Alan is employed as a Senior Communications Engineer for the current Australian Antarctic Research Expedition (ANARE) 2000. Operating time will depend on the extended workloads.

A CW man, Alan will devote much of his on-the-air time to working that mode. He can operate split and is capable of sustained high QSO rates. He will concentrate mainly on 20 or perhaps 15 meters to maximize the number of contacts. He seems *not* to be interested in chasing around for multi-band QSOs. His rig is an ICOM 706 MK II.

Do not attempt to send any correspondence either by post, e-mail, or telephone via ANARE proper. ANARE is an official Australian government enti-

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	2276...WA1JMP	2159...W4UW	1580...I1-21171	1319...WT3W	1100...OK1DWC
4305...W2FXA	3566...VE3XN	3085...WA8YTM	2727...IK2ILH	2273...YU7JDE	2018...N3XX	1572...AA1KS	1298...VE6BMX	1014...EA2BNU
3984...W1CU	3507...9A2NA	3059...PAØSNG	2711...KØDEQ	2272...9A4RU	1871...DJ1YH	1544...Z32KV	1280...W2EZ	1010...F5RRS
3946...F2YT	3482...N4MM	2968...I2MQP	2689...HAØIT	2270...KS4S	1855...PY2DBU	1499...YU1ZD	1271...VE6FR	813...K6UXO
3891...EA2IA	3456...I2PJA	2934...WB2YQH	2669...S53EO	2259...W9IL	1796...JN3SAC	1451...AI6Z	1268...KW5USA	743...KU6J
3827...K6JG	3444...YU1AB	2926...KF2O	2355...K2XF	2242...K5UR	1759...I2EAY	1397...NH6T	1264...VE6BF	611...JH2IEE
3797...UA3FT	3424...SM3EVR	2842...I2EOW	2346...S58MU	2237...W6OUL	1707...KC6X	1395...VE6BF	1195...W2CF	
3708...N4NO	3369...N5JR	2832...HA5NK	2281...N6JM	2224...W8UMR	1591...W7CB	1339...N1KC	1162...JR3TOE	

SSB

4180...IØZV	2844...N4NO	2446...KF2O	2074...IN3QCI	1685...KS4S	1544...DK5WQ	1380...SV3AQR	1028...DL8AAV	790...N3DRO
3779...ZL3NS	2804...N5JR	2401...PY4OY	1975...W4UW	1650...HA5NK	1535...I3ZSX	1318...KC6X	1011...I2EAY	786...JN3SAC
3557...K6JG	2780...I2MQP	2397...WA8YTM	1975...HAØIT	1613...K3IXD	1525...W2ME	1271...W2FKF	1010...EA7CD	736...VE6BMX
3476...F6DZU	2712...9A2NA	2396...I8KCI	1921...K5UR	1570...W6OUL	1443...N3XX	1160...K4CN	1002...N1KC	729...F5RRS
3450...I2PJA	2657...PAØSNG	2329...KF7RU	1814...N6FX	1567...CT1BWW	1438...DF7HX	1090...LU3HBO	972...AI6Z	660...F5LIW
3154...CT4NH	2642...I2EOW	2213...EA1JG	1785...K2XF	1560...K8MDU	1421...T30JH	1073...NH6T	946...LU4DA	643...BD4DW
3049...N4MM	2618...CT1AHU	2211...CX6BZ	1770...YU7SF	1550...LU5DV	1397...I3UBL	1061...KI7AO	896...JR3TOE	641...F5UTE
2978...EA2IA	2491...LU8ESU	2162...K5RPC	1737...I8LEL	1546...IKØEIM	1396...W9IL	1061...WT3W	892...AG4W	608...KE4SCY
2918...I4CSP	2487...UA3FT							

CW

3984...WA2HZR	2826...YU7LS	2384...WA8YTM	1982...N6FX	1694...N3XX	1546...9A2HF	1271...LU3DSI	1094...LU7EAR	888...VE6BMX
3687...N6JV	2786...YU7SF	2362...YU7BCD	1964...G4SSH	1652...KS4S	1537...JN3SAC	1270...W9IL	1078...9A3UF	815...WT3W
3305...VE7CNE	2613...VE7DP	2179...HA5NK	1865...I7PXV	1651...IK3GER	1514...EA5YU	1262...I2MQP	1055...W4UW	792...K6UXO
3272...N4NO	2541...LZ1XL	2165...EA7AZA	1823...K2XF	1626...DJ1YH	1513...IK5TSS	1217...AC5K	1002...YU1TR	791...K6UXO
3251...UA3FT	2511...N5JR	2127...HAØIT	1806...LU2YA	1599...EA6BD	1509...9A3SM	1178...KC6X	998...K2LUQ	659...N1KC
3084...K6JG	2479...G4UOL	2120...KA7T	1804...K5UR	1590...JA1GTF	1506...I2EAY	1167...AI6Z	984...EA2BNU	621...WA2VQV
3021...K9QVB	2451...N4MM	2079...KF2O	1711...W6OUL	1565...EA7AAW	1335...VE6BF	1167...I2EOW	967...NH6T	619...F5RRS
2940...EA2IA	2432...9A2NA	2043...S58MU						

ty and is not a route for private correspondence in any form it might take.

Alan reports that he has already experienced the pile-up situation, and by all accounts he is not impressed. He points out that he is not interested in list operations of any sort. It is important to remember that VKØLD is not a DXpedition and that due consideration should be give to Alan under all circumstances.

Visit Alan's website at: <http://www.geocities.com/vk0ld/1.html> for further information. *(Editor's note: I checked this address this morning [back in December] and it is correct as printed. Alan displayed his "Next Operating Schedule," date, time, and frequency and presumably will keep it updated.)*

As far as QSLing goes, it seems that it will be done at the end of the tour on Macquarie Island.

Jim Smith adds: "It seems likely that Alan might be the last amateur radio operator on Macquarie for many years to come. However, the DXer always lives in hope, and rarely cold facts."

(The above information comes from Jim Smith, VK9NS. I am merely reporting the information as it was provided to me. Any questions about this information should be directed to Jim Smith and not to this reporter.—N4AA)

East Timor

As much as we would like to have another "new one" to work, at this writing it appears that it won't happen anytime soon. The "country" has a lot of work to do before they could even think about ham radio. There was some talk of an operation under the UN, similar to others in Africa, etc. This apparently was considered and nothing more is expected to come of that idea.

QSLing

This is always a good topic to get into. I constantly get asked how to get a card from some DX station, or how many green stamps and/or IRCs it takes for a particular country. Steve Wheatley, KU9C, and I had kicked this around for several months. I finally talked Steve into writing an article relative to this subject for publication in *The DX Magazine*. Steve has been a QSL Manager for a long time and is very knowledgeable on the subject. In preparing the material, he sought the advice and input from a number of other long-time QSL Managers. The final result is a great listing of do's and don'ts in preparing your own card and addressing *both* of the envelopes. He also defines terms such as SASE, Direct, QSL Service, and QSL Bureau. You old-timers might not find anything new, but for the newer DXers there is a lot to be learned.

73, Carl, N4AA

QSL INFORMATION

3A/WØYR to OM2SA
3D2HA to F6FNU
3D2IO to DL7VRO
3D2IO/R to DL7VRO
3D2ND to W4DN
3W6DK to NØODK
3W6KM to ES1AKM
3W7TK to OK1HWB
3XY2D to VE2DPS
4K3OWA to RA1OA
4K5RRC to UAØFAA
4L8Ø – pirate
4L8A to OZ1HPS
4M7X to WA4WTG
4S7OF to KØJN
5H3OC to IN3DEI
5H3RD to SM4GSD
5H3US to WA8JOC
5NØW to OK1KN
5R8FK to NY3N
5R8FL to F5TBA
5R8FU to SMØDJZ
5T5XX to DL8YR
5X1T to ON5NT
6V6U to K3IPK
7B8BO - pirate
7P8FC to DF3EC
7P8FJ to ZS1FJ
7Q7BO to ZS5BBO
7S2E to SM2DMU
8P1A to W2NY
8P6ET to WA4JTK
8P6SH to KU9C
8P9CW to N8DCJ
8Q7IT to DH3MIT
8Q7RX to I4ALU
8S7IPA to OZ5AAH
9H3RS to DL3LAR
9H3VJ to DL8YR
9J2AM to JAØJHA
9M6CT to HSØ/G3JMB
9M6DU to N2OO
9M6MU to N2OO
9M6NA to JE1JKL
9M6OO to N2OO
9U5D to SMØBFJ
A35SO to DJ4SO
A41KL to N7RO
A61AJ to W3UR
AA1NY/KHØ to JA4CZM
AH2R to JI3ERV
AH6MO to DF3EC
AP2N to KU9C
B4R to BY4RSA
BD4ED to BY4BHP
BV/JAØID to JA1JKG
BWØR to JA1JKG
BXØQSL to JA1JKG
C21JH to VK2GJH
C6AGY to ND6S
C6AKP to N4RP
C91MSF to F5MAW
C9EC to DF3EC
CM8DC to IKØZKK
CN8SH to IKØZKK
CN8WW to DL6FBL
COØDX to CO7DS
COØRIA to CO2WL
CO8DC to IKØZKK
CO8HF to WØDM
CO8ZZ to AD4Z
CO9BCC to VE2EH
CP6/LU9AY to NU4N
CX5X to W3HNK
CX9AU to KA5TUF
DAØCW to DL7RAG
DL1VJ to DL8YR
DL1VJ/T5 to DL8YR
DL1VEW/VY1 to DL8YR
DS2EWU to HL2KV
E3ØHA to F6FNU
E41/OK1DTP to OK1TD
EA6WX to N7RO
EA8AH to OH1RY
EL2RF to K1SE
EP3HR to I2MQP
ERØITU to ER1DA
EY8XX to GW3CDP
EZ8CQ to I2JSB
FOØAOI to F6AOI
FOØPAP to K8OU
FOØSOU to F6AUS
FOØTHA to DF2IY
FO5DP to N7RO
FO5PI to F5OTB
FR/DL1VJ to DL8YR
FT5WH to F6KDF
FT5ZH to F6KDF
GM7V to ZS5BBO
H44MX to KQ1F
H44MY to JAØIXW
H44YL to KQ1F
HBØ/HA5RT/P to HAØHW
HB9ICH to WA1ECA
HC1MD to K8LJG
HC8A to WV7Y
HC8GR to N2AU
HI9/DK8YY to DL4AU
HKØ/DF5JT to DF3CB
HK7UL to N7RO
HL9CW to N7RO
HL9DC to N7RO
HSØAC to HSØ/G3NOM
HSØZBS to HB9AMZ
HS72A to HS1CKC
HZ1HZ to N7RO
IO8O to IK8HCG
IQØA to IKØXBX
IQ4A to IK4QJH
IY4W to I4AUL
J37K to W8KKF
J42T to SV2BFN
J68J to N5VL
J69R to N3NT
J79SH to DJ4IJ
JD1BIC/JD1 to JARL
JI3DST/3 to JARL
JW/DJ3KR to DJ3KR
JW5E to LA5NM
JY4ØVJ to DL8YR
JY8VJ to DL8YR
JY9NE to N3FNE
JY9NX to JH7FQK
KH2/K4ANA to W2PS
KH2/N2NL to W2YC
KH8/N5OLS to N5JA
KL1SLE to NU4N
KP4WW to W4DN
L99D to LU7DW
LA8W to LA4DCA
LRØH to LU9HS
LR6D to JK3GAD
LT5V to LU8VCC
LU/OHØWW to OH1EB
LX/DL1VJ to DL8YR
LX2LX to LX1NO
LX4B to LX1TI
LX7A to DF3CB
LZØA to LZ1KDP
M2ØØØA to G4DFI
M6T to G4PIQ
MU/OH9MM to OH3LQK
MUØC to GØOFE
OD5/OK1MU to OKDXF
OD5NH to W4AO
OE5T to OE5XVL
OHØJWH to DJ2PJ
OHØR to OH2TA
OHØZ to OH1EH
OH2U to OH2IW
OIØJWH to DJ2PJ
OK1KCI to OK1CDJ
OM2SA to OM2SA
P29BI to VK4EJ
P3A to W3HNK
P4ØR to NK4U
P4ØW to N2MM
P49MR to VE3MR
PYØZFO to W9VA
PZ5CM to K3BYV
R1ANB/A to RU1ZC
R1ANC to RU1ZC
R1ANK to RU1ZC
RA3AA to W3UA
RM3C to RA3CW
RM4W to RW4AR
S21YJ to SM4AIO
S5ØE to S59AB
S52ZW to S5ØS
S79AU to IK4AUY
S79EC to DF3EC
S79JDC to G3TBK
SO/DL1VJ to DL8YR
SO5VJ to DL8YR
SV2BFN to SV2BFN
T3ØCW to DL7DF
T32BE to WC5P
T32BO to N5RG
T32BW to HA8RJ
T32KV to NØKV
T32PO to N5PO
T88NH to JA4OWG
T88WF to JN1WTK
TA1KA/2 to DL8YR
TA2BK to TA2BK
TA2WCY to TA2BK
TI5EBU to JM6EBU
TJ1BB to N4JR
TJ1GD to SP9CLQ
TL8NG to WA1ECA
TM2Y to F6BEE
TOØDX to LA9VDA
TY/F6FCM to F6FNU
TY1IJ to DK8ZD
TY1PH to F6FNU
TZ6DX to K4DX
TZ6YV to WA1ECA
UNØN to IK2QPR
UN1F to DF5PBD
US7IIA to TU2WK
V26YR to W2YR
V47DX to K1CN
V47KP to K2SB
V63LJ to JH8DEH
V73CW to AC4G
V85TG to JH3GAH
V8A to JH7FQK
VE8JR to KL7JR
VK2IA to DL8YR
VK2IMC to DF3EC
VK6VJ to DL8YR
VK8CI to VK9NS
VK8ML to VK9NS
VK8VJ to DL8YR
VK8VJ/2 to DL8YR
VK9CC to ZK1JD
VP2MBT to EA3BT
VQ9DX to AA5DX
VQ9JA to N1ZZZ
VR2CT to HSØ/G4JMB
XF4MX to XE1MX
XQ6OS to CE6OS
XT2PT to N5DRV
XU7AAV to G4ZVJ
XU7AKM to ES1AKM
XV7SW to SM3CXS
XX9TDX to SMØGNU
XX9TRJ to JH2MRA
XX9TRR to N6XJ
XZØA to W1XT
YBØJWA to W3HNK
YBØRP to W2FXA
YC6HDF to IKØZKK
YC8FI to IKØZKK
YI2CL – pirate
YJØDX to VK4JSR
YN6WFM to JA6VU
YN6WW to JA6VU
YV7/K2KW to WA4WTG
YV7/W4SO to WA4WTG
YW5FC to W4SO
Z31VP to DJØLZ
ZA1DX to F6FNU
ZA1HA to F6FNU
ZA5B to WA1ECA
ZD8A to N6CW
ZD8Z to VE3HO
ZD9CR to KA1DE
ZF2CF to N6VHF
ZF2KV to NØKV
ZK1AAN to F6FNU
ZK1CRR to F6FNU
ZLØADV to DL8YR
ZM4IR/4 to W8WC
ZM7ZB to DJ4ZB
ZS1XR to N7RO
ZS8D to ZS6EZ
ZX9A to JA1VOK
ZZ7Z to PR7AR

(The table of QSL Managers 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>.)

Is There Any Limit to Escalating Contest Scores?

February's Contest Tip

Ever wonder what to do with all those memories in your new, fancy transceiver? Take a few minutes before the next contest to load a few of the WWV frequencies into your radio's memories. Keeping abreast of the propagation data that is transmitted regularly at 18 minutes past the hour is a great way to focus your operating strategy. And, with WWV now at your "memorable" fingertips, it couldn't be easier to keeping an eye on the propagation landscape.

Once upon a time, it was a very big deal to break the one-million point barrier in the CQ WW DX Contest. If you find that hard to believe, ask Frank Donovan, W3LPL. Many years ago he won the CW event for the U.S. with a score slightly over 1 million points! In contrast, U.S. operators were getting that done by late Friday night in the 1999 event.

Last fall's CQ WW contest season was truly something at which to marvel. By nearly any measure it was an affirming metric that contest participation is far from dead. In fact, I can't remember two contests that sported so much activity from around the world. If you doubt the claim, consider some of these facts (using what's available at press time):

N5TJ, operating at EA8BH, made over 10,000 QSOs as a single operator on SSB, achieving a score that's well north of 20 million points. That works out to an average of over 200 QSOs /hour for the entire contest!

Leading U.S. multi-multi stations submitted scores above 25 million points, with KC1XX working over 10,000 stations on SSB from stateside, coming within 8 zones of working 5B WAZ in a single weekend.

CN8WW broke the 70 million point barrier as a world-leading multi-multi station on both modes.

The Yankee Clipper Contest Club claimed a score is in excess of 700 million points.

W4AN broke 2500 QSOs in the CW contest as a U.S. single operator in just the first 24 hours. Bill's score approached 5 million points in the same time period.

2 Mitchell Pond Road, Windham, NH 03087
e-mail: <K1AR@contesting.com>

Calendar of Events

Jan. 28-30	**CQ WW 160 M CW Contest**
Jan. 29-30	REF CW Contest
Jan. 29-30	UBA SSB DX Contest
Feb. 5-6	New Hampshire QSO Party
Feb. 5-6	Vermont QSO Party
Feb. 5-6	The Classic Exchange Contest
Feb. 5-7	Delaware QSO Party
Feb. 6	North American SSB Sprint
Feb. 12-13	World-Wide RTTY WPX Contest
Feb. 12-13	Dutch PACC Contest
Feb. 13	North American CW Sprint
Feb. 11-13	YLRL YL-OM SSB Contest
Feb. 18-20	YLRL YL-OM CW Contest
Feb. 19-20	ARRL Intern'l CW DX Contest
Feb. 25-27	**CQ WW 160 M SSB Contest**
Mar. 4-5	ARRL Intern'l SSB DX Contest
Mar. 25-26	**CQ WW WPX SSB Contest**

It is estimated that over 225 countries were active in the SSB contest.

Nearly 3000 electronic SSB logs were received by the CQ WW Contest Committee. The forecast is for approximately 8000 logs to be submitted for the 1999 WW contest.

And If That's Not Enough . . .

I don't know about you, but I find the summary above to be mind-boggling. But if you still need more to be impressed, consider the activity levels in last year's contests. With solar absorption relatively low, a propagation formula was in place to offer the perfect mix between good low-band conditions and a very hot 10 meter band. Quite simply, there were many operating band choices, making strategic operating decisions the toughest operators have encountered in years.

Perhaps most impressive, however, was an operating frenzy on 10 meters that has never been witnessed in active contesting. On SSB, for example, activity ranged for a full megahertz from 28.200 up to 29.200. CW enthusiasts enjoyed activity above 28.200 (witnessed again in the recently conducted ARRL 10 Meter contest). It was a common occurrence to find rare multipliers operating very high in the band just to avoid the throng of activity in the lower end of the band. If you didn't have problems with carpal tunnel syndrome before this past fall, you did after the CQ WW just from tuning your VFO dial so much!

What Are We to Learn?

I suppose there's good news and bad news to gather from the experiences of last fall. I already can hear the keyboards clicking as some of you express your disdain for this egregious abuse of our precious ham bands. When being open-minded about it, there is a very real case for this position. On the other hand, more than ever ham radio needs an injection of operating adrenaline, and nothing works better than the CQ WW near the peak of the sunspot cycle.

My vote on this one is probably predictable. Ham radio is a great hobby. It's also a hobby which has been losing both its popularity and activity level by nearly any measure. While your weekly schedule with Uncle George may be disrupted by the frenzy of an event such as the CQ WW or the ARRL 10 Meter contest, we have to acknowledge one simple fact: Tens of thousands of hams choose these weekends to make the point that contesting, and more importantly HF operating, is alive and well.

Is there an end to the escalation of contest scores? I hope not. The activity that is generated by these events is worth its price in gold. Hams can demonstrate to those who challenge our valuable spectrum that we are not going to roll over and play dead. We are an active group that still enjoys the sport of turning on our radios and talking to people around the world. How can you view that as anything but good for the hobby we love?

Final Comments

As some of you may know, it's soon that time of the year to run another *CQ* Contest Survey. Keep an eye out for the Year 2000 edition over the next month or two. There will be special emphasis on making the Internet a primary means of composing your responses.

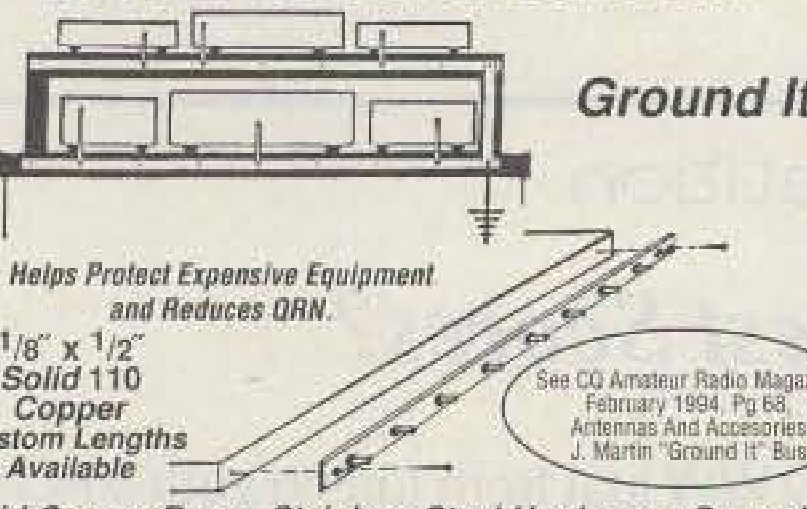
As always, please remember that the deadline for the May issue is March 1st.

73, John, K1AR

The Classic Exchange Contest

2000Z Sat. to 0500Z Sun., Feb. 5–6

The Classic Radio Exchange ("CX")



is a contest celebrating the older commercial and homebrew equipment that was the pride of our ham shacks and our bands just a few short decades ago. The object is to encourage restoration, operation, and enjoyment of this older equipment. A "Classic Radio" is at least ten years old (age figured from first year of manufacture), but is *not* required to participate in the Classic Exchange. You may use anything in the contest, although new gear is a distinct scoring liability.

Exchange: Your name, RST, QTH (state/province for US/Canada; country for DX), receiver and transmitter type (homebrew entries send final amp tube or transistor), and other interesting conversation. The same station may be worked with different equipment combinations on each band and on each mode. Non-participants may be worked for credit.

Frequencies: CW 60 kHz up from lower band edge; Novice/Tech Plus 20 kHz up from lower band edge; phone 3880, 7290, 14.280, 21.380, 28.320 kHz. Note that 7060 and 3560 kHz tend to be the most popular CX frequencies.

Scoring: Multiply total QSOs (all bands) by the total number of different receivers plus transmitters (transceivers count as both transmitter and receiver) plus states/provinces/countries worked on each band and mode. Multiply that total by your CX multiplier—the total years old of all receivers and transmitters used, three QSOs minimum per unit. For transceivers, multiply the age by two. If your equipment is homebrew, count it as a minimum of 25 years old unless the actual construction date or date of its construction article (in the case of a "reproduction") is older.

Final Score: Total QSOs on all bands times receivers + transmitters + states/provinces/countries (total each band and mode separately; add totals together) times CX multiplier.

Awards: Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses, and other unusual achievements.

Send logs, comments, anecdotes, and pictures to Jim Hanlon, P.O. Box 581, Sandia Park, NM 87047. Include a two-unit-postage SASE for the next "CX Newsletter" and announcement.

Vermont QSO Party

0000Z Sat. to 2400Z Sun., Feb. 5–6

This is the 42nd annual Vermont QSO Party sponsored by the Central Vermont Amateur Radio Club. This is a great opportunity to work one of the rarest states on several bands. Participation is open to all licensed radio amateurs worldwide on 160–2 meters.

Classes: Single or multi-operator all bands, club, QRP, mobile.

Exchange: Vermont stations send RS(T) and county (14 total). Others send RS(T) and state/province or DXCC country.

Frequencies: Phone first 25 kHz up from the beginning of the General band and the entire Novice 10 meter band. CW 40 kHz up from the bottom edge of the bands and 20 kHz up from the bottom of the Novice subbands. VHF 50.20, 144.20, and 146.69 MHz. Other modes can be used. Repeater contacts do not count.

Scoring: Credit 1 point per phone QSO and 2 points for CW or digital-mode QSOs. Non-Vermont stations multiply total QSO points by the number of VT counties and special-event QSOs with W1BD. Vermont stations follow a similar format with the addition of states/provinces/DXCC country multipliers. Stations may be worked up to four times per band (i.e., SSB, CW, RTTY, etc.).

Awards: Special certificates will be awarded to the three highest scoring Vermont stations. Certificates also will be awarded for the highest scoring station in each state, province, and DXCC country. In addition, there will be a QRP category with the high-scoring station winning a certificate.

Send your postmarked entries no later than March 6, 2000 to: Central Vermont Amateur Radio Club, Vermont QSO Party, Barry Driscoll, KE1BV, P.O. Box 674, Montpelier, VT 05602. Be sure to include an SASE for the final results.

New Hampshire QSO Party

0000Z Sat. to 2400Z Sun., Feb. 5–6

This year's party is again sponsored by the New Hampshire Amateur Radio Association. It's New Hampshire stations working all other stations. As with most QSO parties, the same station may be worked once on each band mode. Total operating time is limited to 24 hours. Off-times must be a minimum of 15 minutes and be clearly indicated in the log.

Classes: Single or multi-operator all bands low power (<150 W) or high power (>150 W), club (large 50+, small <50), QRP, and mobile (allowed to operate the entire contest period).

Exchange: RS(T) and QTH. County and state for NH stations; state, province, or country for others.

Scoring: All stations credit 1 point/ SSB QSO and 2 points for digital QSOs. (RTTY, CW, packet). NH stations multiply QSO points by number of NH counties, states, provinces, and DXCC countries. Others simply use counties. Count 5 points for phone and 10 points for CW when working the bonus stations: W1FGM, K1BKE, W1FZ, W1WQM, N1FD, K1NCR. Stations may be worked once per band and mode.

Final Score: Final score is calculated by multiplying QSO points times total multiplier and adding bonus points.

Frequencies: CW 1830, 3530, 7030, 14030, 21030, 28030. SSB the first 25 kHz up from the bottom of the General band plus 50.20, 144.20, and 146.55 MHz. Repeater QSOs do not count.

Awards: Awards are available, although no details were provided in the contest announcement.

Logs must be received no later than March 31, 2000. Be sure to include an SASE for final results. Send logs and comments to: NHARA, P.O. Box 119, Goffstown, NH 03045.

Delaware QSO Party

1700–0500Z Sat., Feb. 5
1300–0100Z Sun.– Mon., Feb. 6–7

This is a banner weekend for QSO Parties with the addition of Delaware. This year's edition is sponsored by the First State Amateur Radio Club and is open to everyone. Stations may be worked once per band and mode.

Exchange: RS(T) and QTH (county for DE stations; state/province/DXCC country for others).

Frequencies: CW 50 kHz up from lower band edge; SSB 1860, 3940, 7260, 14260, 21360, 28560. Novices use 25 kHz above the lower subband edge.

Certificates will be awarded to category winners (categories not provided in rules). Logs must be submitted no later than March 9, 2000 and should be sent to: Contest Chairman FSARC, Inc., P.O. Box 1050, Newark, DE 19715 or via e-mail to <QSOparty@fsarc.org>.

Dutch "PACC" Contest

1200Z Sat. to 1200Z Sun., Feb. 12–13

Sponsored by the Vereniging voor Experimenteel Radio Onderzoek in Nederland (VERON), it's the world working The Netherlands on all six bands, 1.8 through 29.7 MHz, in the 43rd PACC Contest. The same station may be worked on each band, but on one mode only, phone or CW, for QSO and multiplier credit. Note that SSB QSOs are not allowed on 160 meters.

Categories: Single operator, multi-operator, and SWL.

Exchange: RS(T) plus a QSO number starting with 001. Dutch stations will add two letters to identify their province. There are 12 provinces: DR, FR, GD, GR, LB, NB, NH, OV, UT, FL, ZH, ZL.

Scoring: Each QSO with a PA/PB/PI station counts one point. DX stations determine their multiplier by the number of provinces worked on each band (maximum of 72).

Final Score: Total number of QSOs times the number of provinces worked on each band.

Awards: Certificates will be awarded to the top-scoring station in each category in each country.

SWLs must log the call of the Dutch station as well as the station being worked and both serial numbers. Scoring is the same as above. Indicate the multiplier in a separate column in your log only the first time it is worked on each band. Include a summary sheet showing the scoring, your name and address in block letters, and the usual signed declaration.

Mailing deadline is March 31, 2000 to: PACC Contest, Hans P. Blondeel Timmerman, PA7BT, Nieuweweg 21, 4031 MN Ingen, The Netherlands. Foreign stations may e-mail their logs to <pa7bt @amsat.org>.

World Wide RTTY WPX Contest

0000Z Sat. to 2400Z Sun., Feb. 12–13

This is the sixth annual running of this digital-mode contest sponsored by Hal Communications Corp. This event is open to amateurs worldwide using any digital mode including Baudot, AMTOR, PACTOR, G-TOR, and CLOVER. Although inspired by the CQ WW WPX Contest, this contest is not affiliated with *CQ* magazine in any way.

Classes: Single operator (all band high and low power, single band), multi-single, multi two transmitters (new), multi-multi, and SWL. All categories are limited to 30 hours of operating except for multi-multi entries. Packet spotting is allowed in all categories.

Exchange: RST and serial number. Multi-multi stations may use separate numbers on each operating band.

Scoring: QSOs between stations on different continents are worth 3 points on 20–10 meters and 6 points on 40–80 meters. QSOs with stations on the same continent but different countries are worth 2 points on 20–10 meters and 4 points on 40–80. QSOs with stations on the same continent and in the same country are worth 1 point on 20–10 meters and 2 points on 40–80 meters. Each valid prefix is counted as a multiplier. Multipliers are only counted once (not per band). The *CQ* WPX rules are used to determine valid prefixes. Final score is calculated by multiplying total QSO points times total multiplier.

Awards: A wide range of certificates and plaques is available for category winners. Contact K5DJ for more information.

Entries must be postmarked no later than 30 days after the end of the contest. Hard-copy logs and/or disks may be sent to: Eddie Schneider, W6/GØAZT, 1826 Van Ness, San Pablo, CA 94806. Electronic logs may be sent via Internet to: <edlyn@global.california.com> (MIME encoded).

YLRL YL-OM Contest

SSB: 1400Z Fri. to 0200Z Sun., Feb. 11–13
CW: 1400Z Fri. to 0200Z Sun., Feb. 18–20

Sponsored by the Young Ladies Radio League, this annual event is open to all licensed men and women operators around the world.

Exchange: Callsign, QSO number, RS(T), ARRL section/VE province/country.

Scoring: Phone and CW are considered separate contests. Score 1 point for each station worked. YLs only work OMs, and OMs only work YLs. Credit a special multiplier of 1.5 if you are using 100 watts or less on CW and 200 watts PEP on SSB. Final score is the total QSO points times the sum of ARRL sections, provinces, and countries worked per band.

Frequencies: CW 3540–3570, 7040–70, 14040–070, 21120–150, 28180–210 kHz. SSB 3940–70, 7240–70, 14250–280, 21380–410, 28280–410 kHz.

Awards: Special cups will be awarded to the winning phone and CW YL and OM. Certificates will be sent to the high scorers in each US call area, VE province, and DX country, provided there are at least 10 valid QSOs in the log.

All logs are to be postmarked no later than 30 days after the contest and sent to: Nancy Hall, KC4IYD, P.O. Box 775, N. Olmsted, OH 44070-0775.

ARRL International DX Contest

CW: Feb. 19–20 Phone: March 4–5
0000Z Saturday to 2400Z Sunday

This is a great DX contest you should not miss. I strongly recommend that you study the rules on the ARRL's web site for details. Send a large SASE (2 IRCs for DX) for sample log and entry forms.

All bands may be used, 1.8 through 28 MHz, but not 10, 18, or 24 MHz. Aeronautical and maritime mobile stations cannot be worked for contest credit.

Categories: Single operator, both single and all band, and single operator assisted. Multi-operator, one transmitter and two transmitters. Also multi-operator, multi-transmitte, and QRP all band only (5 watts or less output). Multi-transmitter stations must remain on a band at least 10 minutes once a contact is made.

Exchange: RS(T) and state or province for W/VE; RS(T) and power input for DX stations (three-digit number).

QSO points: W/VE stations earn three points for each W/VE contact.

Multiplier: Each DXCC country worked on each band for W/VEs. DX stations use US states (48), District of Columbia (DC), and VE provinces (13) for their multiplier. (Maximum multiplier of 62 per band.)

Final Score: Total QSO points times the sum of the multipliers from each band. Entries with 500 or more QSOs must include a QSO check sheet.

Awards: Certificates will be given in each category, in each country, and in each ARRL section, plus a wide selection of plaques. Certificates will be awarded to DX stations making over 500 QSOs.

Disqualification regulations will be strictly enforced and are listed in the official rules. Mailing deadline for all entries is April 8, 2000 and they go to: ARRL DX Contest, 225 Main Street, Newington, CT 06111 or via the Internet to <contest@arrl.org>. Send your summary sheet file (make sure it includes all the pertinent information outlined in the official ARRL summary sheet) and your log file following the ARRL Suggested Standard File Format.

CQ WW 160 Meter SSB Contest

2200Z Fri. to 1600Z Sun., Feb. 25–27

Just a reminder that the SSB section of the CQ WW 160 Meter Contest will be coming up the last full weekend of this month. Extensive coverage has been given to this event, with complete rules in the November issue of *CQ*.

Mailing deadline for your entry in last month's 160 CW contest is February 28, 2000; March 31 is the deadline for this month's SSB section.

Logs should be sent directly to CQ 160 Meter Contest, 25 Newbridge Rd., Hicksville, NY 11801. Please be sure to mark CW or SSB on the envelope.

Awards

BY TED MELINOSKY, K1BV

News Of Certificate And Award Collecting

To start out this month's column, and to start out a new year, it seems like a good time to go over the requirements for applying for the USA-CA Award, as we haven't done that in a while. You may apply for the USA-CA award at any level. For a large percentage of USA/VE applicants, the first application is their only application. Most DX stations (note the Easter Island CEØ applicant this month) enter the program at the 500 or 1000 level. I personally think that getting the certificate at the first possible opportunity is the way to do it. However you do it, here are a few tips to keep in mind.

- The award fee is $10 for nonsubscribers and $4 for CQ subscribers. Include a recent mailing label if you are a subscriber.
- The check or money order should be made out to "USA-CA Custodian."
- If this will be your *big* application for the highest level, before sending in your application please communicate to me either via e-mail or my mailing address shown in this column. I will ask you to provide several QSLs or MRCs of my choice that should be sent along with your application. Enclose an SASE for their return.
- Cost of the plaque for the highest level is $41. It will be drop-shipped to you by the engraving company. (This is the best price I could find for the quality involved.)
- If you are applying for an endorsement, the fee is $1.25, no matter how many endorsement seals are involved.

US Awards Available

The first two awards this month are available from the "good guys" who are patrolling the freeways of the Golden State. (No, earning either or even both of these awards won't save you from a speeding ticket. Just slow down!)

The California Highway Patrol (CHP) Awards. The fee for each of these awards is $US3 (overseas $US5). SWL okay. Apply to: Robert Faulkner, W6RF, 15733 Rancho Ramon Drive, Tracy, CA 95376.

CHP Award. Work one California Highway Patrol licensed amateur and get his badge number. There are over 50 sworn officers who are amateurs.

65 Glebe Road, Spofford, NH 03462-4411
e-mail: <k1bv@cq-amateur-radio.com>

USA-CA Special Honor Roll

Robert W. Roehm, KM6GF
USA-CA All Counties #985
October 26, 1999

Udo A. Heinze, NIØG
USA-CA All Counties #986
November 1, 1999

James F. Wild, WB9UKS
USA-CA All Counties #987
November 22, 1999

Ross Harrell, NØZA
USA-CA All Counties #988
November 22, 1999

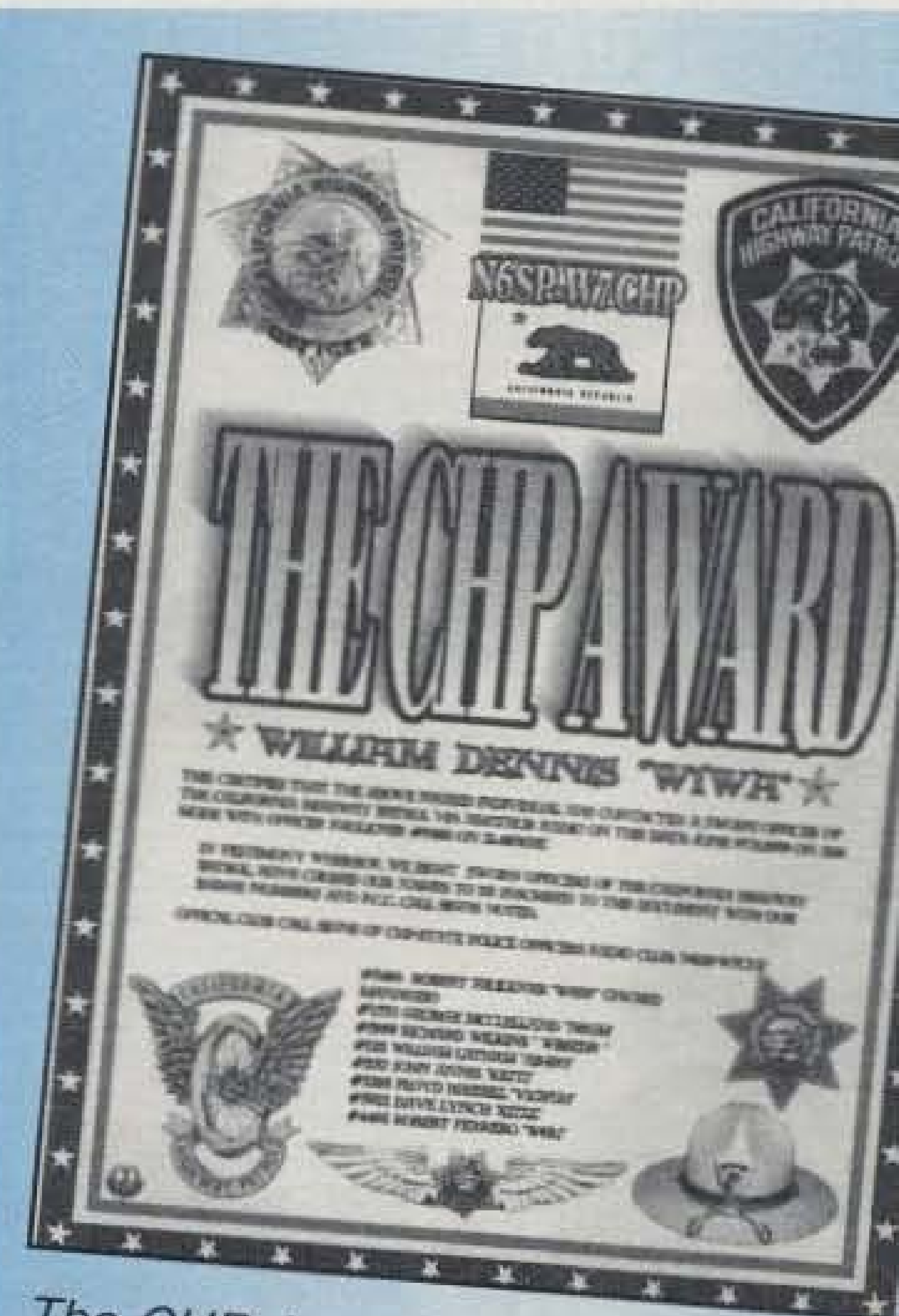
You can also try the IPARC net on Wednesdays and Sundays at 1700Z on 21410 kHz.

70th Anniversary CHP Award. The group is commemorating the 70th anniversary of the California Highway Patrol during the period 1 July 1999 to 1 July 2000. Club stations N6SP (northern California) and W7CHP (southern California) will be making contacts during this period for the award.

Worked All Wisconsin Counties Award. The Wisconsin Counties Award is new enough so that there's only one winner at press time. The award is sponsored by the West Allis Radio Club, which also sponsors the very popular Wisconsin QSO Party. This fall contest offers the chance to work many rare and semi-rare Wisconsin counties as mobiles criss-cross the state. The club has a well designed website at: <http://www.warac.org/wawc/rules.htm>.

Confirm contacts with each of Wisconsin's 72 counties on or after 12 March 1995. A special application form must be used and is available from the sponsor for an SASE or at their www site in the form of a PDF printable document. Endorsements for single band or mode are available upon request. Send GCR list (no fee mentioned) to: West Allis Radio Club, P.O. Box 1072, Milwaukee, WI 53201.

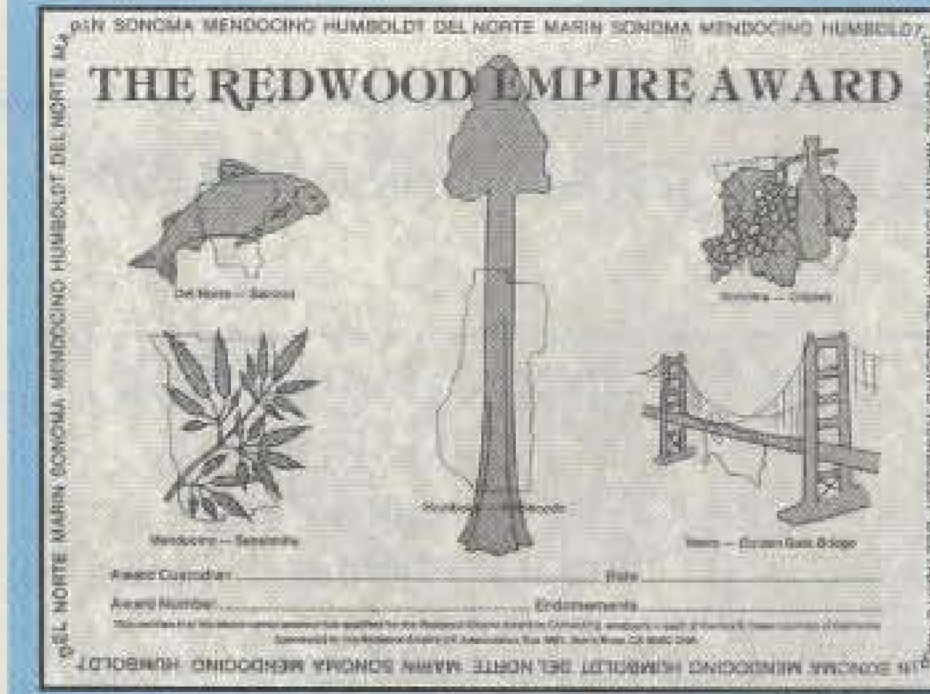
The Redwood Empire Award. The sights and products of northern California are featured on this award sponsored by the Redwood Empire DX Association. Some of the counties needed are fairly hard to come by, so your best chance to work them might be during the California QSO Party.



The CHP Award is sponsored by the hams of the California Highway Patrol.

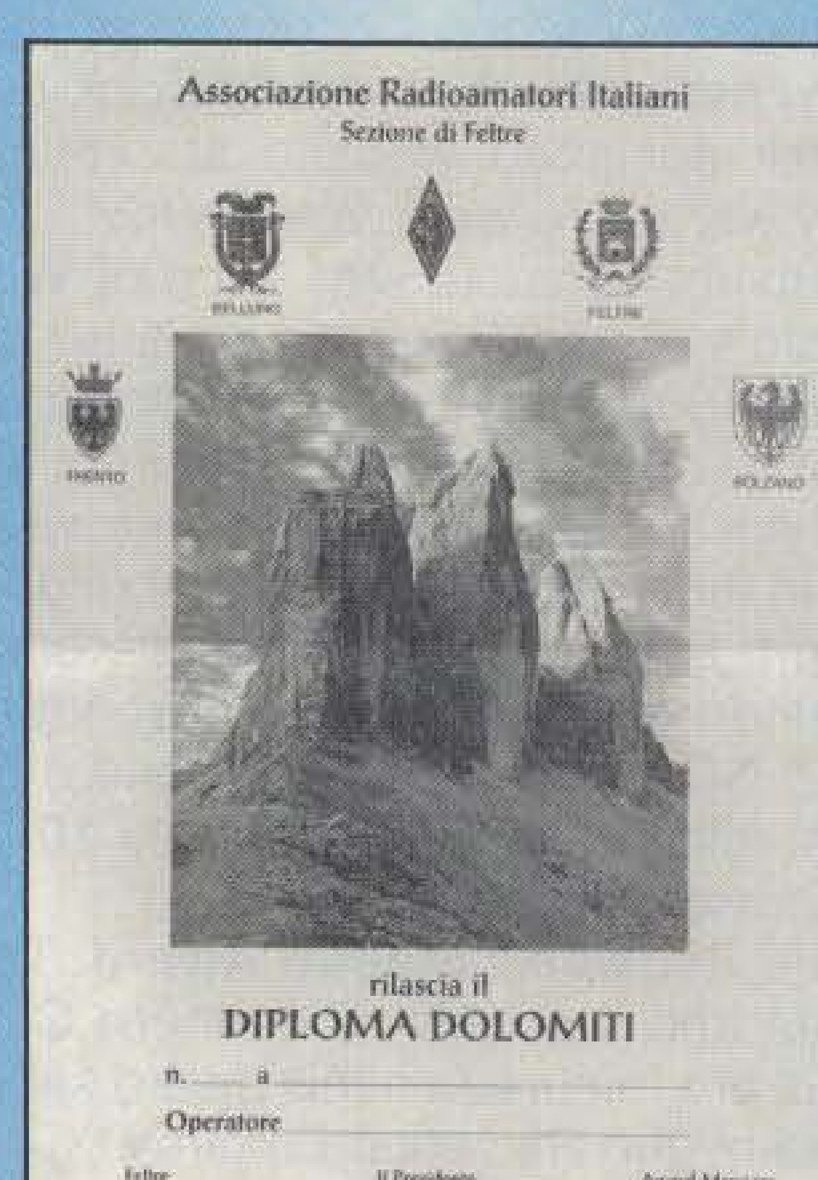
The 70th Anniversary CHP award.

The Worked All Wisconsin Counties Award is sponsored by the West Allis Radio Club.



The Redwood Empire Award requires that the applicant work at least one amateur radio operator in each of the five California north coast counties.

The basic requirement for the European Community Award is to work 225 different stations from the member countries.



Make contacts with stations in the Dolomite Mountains region of Italy to earn this award.

USA-CA Honor Roll

500		2000	
NIØG	3098	KM6GF	1174
CEØYFL	3099	NIØG	1175
KJ8WW	3100	WB9UKS	1176
WB9UKS	3101		
UX1MM	3102		
1000		**2500**	
KM6GF	1529	KM6GF	1099
NIØG	1530	NIØG	1100
CEØYFL	1531	WB9UKS	1101
KJ8WW	1532	NØZA	1102
WB9UKS	1533		
UX1MM	1534	**3000**	
1500		KM6GF	1003
KM6GF	1274	NIØG	1004
NIØG	1275	WB9UKS	1005
WB9UKS	1276	NØZA	1006

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.

Work at least one amateur in each of the five California north coast counties of: Marin, Sonoma, Mendocino, Humboldt, and Del Norte. SWL okay. Any band or mode. Contacts after 1 January 1981 count. Endorsements for band or mode upon request. Send GCR list and $2US or 7 IRCs to: Redwood Empire DX Association, Box 4881, Santa Rosa, CA. 95402.

Belgium's European Community Award

This award requires working large numbers of European stations. The recently improved band conditions and publication of this article during the contest season might be taken as my hint that this is a great time to work for the ECA.

Issued by the European Community to publicize the objectives of its member countries, the basic requirement consists of working 225 different stations from the member countries. The countries and associated prefixes are as follows: Austria OE, Belgium ON, Denmark OZ, Finland OH/OJØ, France F/TK, Germany DL, Greece SV/SV5/SV9/SY, Ireland EI, Italy I/IS/IT, Luxembourg LX, Netherlands PA, Portugal CT/CU (starting 1-1-95), Spain EA/EA6, U.K. G (etc.), Sweden SM.

There are two ways to log 15 × 15 different stations, either in CW, SSB, or

The Salento Islands Award is sponsored by the Sezione ARI Lecce and the Salento DX Team.

Mixed. There are no mode restrictions or endorsements.

Outside UBA contests: Work or log 225 different stations from the EC member countries, with at least six different stations from each of the 15 member countries. No more than 30 stations from a single country can be used to reach the 225 contacts.

During the UBA contests: Work or log 225 different stations from EC member countries. At least two different stations from each of the15 EC countries are required. No more than 35 stations from a single EC country may be used.

All contacts should be logged during the UBA contests from up to four consecutive years, starting not earlier than 1994. Only QSOs from UBA contests for which a log was submitted to the contest manager within the stated contest time limit may be considered. A missing LX or SV QSO during the contests may be replaced by three other stations from the same country *outside* the contest.

Joker: A contact with OR5EEC, club station of the EC in Brussels, may be used to replace a maximum of three missing contacts.

Send GCR list and copies of all referenced contest logs if using this method. The fee for non-contest-mode applications is 7 IRCs, $US4, or equivalent. Contest-mode applications are *free of charge.* Apply to: UBA HF Awards Department, Egbert Hertsen, ON4CAS, Postbus 85, Mechelen 2, B-2800 Mechelen, Belgium.

Awards from Italy

Dolomiti Award. Looking like a sight out of Arizona or New Mexico, the centerpiece photo on this award is the most beautiful I've seen in quite some time. This certificate is definitely worth framing and would be a handsome addition near your operating position. Italian stations are usually very good about including their province designation on their cards. Look for I3/IK3 /IV3 stations with identifiers of BL (Belluno), BZ (Bolzano), and Trento (TN).

Make contacts with stations in the Dolomite Mountains region of Italy after 15 September 1967. These are: Trento, Belluno, and Bolzano. Italians need 15 contacts with at least four in each province, Europeans need 10 (at least three per province), and all others need five (at least one per province). Send GCR list and fee of L10,000 or Euro5,16, DEM10, or 10 IRCs to: Sezione ARI di Feltre, P.O. Box 6, I-32032 Feltre, BL, Italy.

Salento Islands Award. Another island-oriented award joins the many available. Issued by the Sezione ARI Lecce and the Salento DX Team, these sponsors have provided a list of stations that have conducted operations on these islands.

SWL okay. All active (not deleted) Italian islands in the Brindisi, Lecce, and Taranto provinces are valid. Contacts must be after 1 January 1980.

Italians need 20 islands, EU need 15, and all others need 10. You can get the island list from the sponsor for an SASE/IRC. CW, Phone, RTTY, and Mixed modes are available. All bands may be used. There is a special plaque for 50 confirmed islands.

Send GCR list and fee of $US10 or 20 IRCs plus SASE if cards are sent. Apply to: ARI Sezione, SIA Award Manager IK7VJX, P.O. Box 161, I-73100 Lecce, Italy.

Stations who have operated IJ7 or /IL7: I7LMR, PXV; IK7DXP, EZP, FPX, IMO, JWX, QHS, TAJ, TAL, UYB, VEH, VJK, VJX, VXA, VXB, XIB, XNF; IK8TWP; IØKYN; IK1NAO; IK2SGC; IK6CAC.

Internet Site of the Month

Back in November I took the big step and registered <http://www.dxawards.com> with INTERNIC. At this writing, almost 7000 visitors from 62 DXCC countries have visited my old site. The new site will allow a dramatic expansion (up to 200 Mb is available), and I hope this is the case by the time this gets to print. Come on over and visit. Let me know what you'd like to see there.

73, Ted, K1BV

BY GEORGE JACOBS, W3ASK

The Science Of Predicting Radio Conditions

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for February 2000

	Expected Signal Quality			
Propagation Index...............	(4)	(3)	(2)	(1)
Above Normal: 16-17, 19, 21-22	A	A	B	C
High Normal: 4-5, 7, 10-12, 18, 20	A	B	C	C-D
Low Normal: 2, 6, 8-9, 13, 23, 26-27, 29	B	C-B	C-D	D-E
Below Normal: 1, 3, 14-15, 25, 28	C	C-D	D-E	E
Disturbed: 24	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 fair-to-poor (C-D) on Feb. 1st, fair-to-good (C-B) on the 2nd, fair-to-poor on the 3rd, good (B) on the 4th and 5th, fair-to-good on the 6th, etc.

Great CW DX Contest Weekend!

Wow! That seems to be the best way to describe propagation conditions during the CQ WW DX CW Contest weekend of November 27–28 last year. Mother Nature cooperated fully, and much better than even the expected good propagation conditions took place during the contest.

The solar flux climbed to 169 on the 27th and inched up to 175 on the 28th. The sunspot count was 124 on the 27th and 105 on the 28th. The geomagnetic field was exceptionally quiet, the ionosphere was stable, and daytime maximum usable frequencies climbed to as high as 60 MHz in parts of the world. A solar flare did occur at 1815 UT on November 28th, which degraded conditions in the daylight portion of the world for about a half hour. Other than that, *wow!*

Overall conditions ranged from Low Normal in polar and auroral regions; High Normal at mid-latitudes; and between High and Aove Normal in low and equatorial latitudes. Favorable solar/propagation/geomagnetic conditions on all bands experienced during the 1999 WW DX CW Contest weekend were noticeably better than the good conditions that were reported during the October SSB weekend, with more longer and more widespread 10 and 15 meter openings. They also appear to have exceeded the "fantastic" conditions reported during the 1998 CW Contest period. This should result in exceptionally high scores, and very likely new records. Thank you, Mother Nature!

Table I summarizes worldwide HF propagation conditions based upon reports jointly made by the USAF and NOAA through the Space environmental Services Center, Boulder, Colorado. Table II shows the level of geomagnetic activity taken every three hours during the contest weekend as measured by the kp worldwide, or planetary, index.

Sunspot Cycle Progress

The Royal Observatory of Belgium, based upon data received from its worldwide network of three dozen observatories, reports a mean sunspot number of 116 for October 1999. A high count of 157 was recorded on October 13th, with a low of 50 reported on the 1st. October's mean value results in a 12-month running smoothed sunspot number of 85 centered on April 1999. This is a one-point increase the level in March.

A smoothed sunspot number of approximately 111 is forecast for February 2000, as Cycle 23 nears its peak intensity. Canada's Dominion Radio Astrophysical Observatory in Penticton, British Columbia reports a 10.7 cm solar flux level of 164 for October 1999. This results in a smoothed value of 148 centered on April 1999. A smoothed 10.7

Geographical Area	November 27	November 28
Polar	Low Normal	Low Normal
Auroral	Low Normal	Low Normal
Middle Latitude	High Normal	High Normal
Low Latitude	High/Above Normal	High/Above Normal
Equatorial	Above/High Normal	Above/High Normal
10.7 cm Radio Flux	169	175
Sunspot Count	124	105
WW Geomagnetic Ap Index	3	7
WW Geomagnetic Kp Index	0.9	2.1

Table I– Summary of HF propagation conditions reported jointly by USAF and NOAA during the CQ WW DX Contest CW weekend of November 27–28, and from initial reports received from contest participants. A solar flare degraded conditions for about a half hour in the daylight portion of the world on November 28th.

Planetary Kp index	UT 00–03	03–06	06–09	09–12	12–15	15–18	18–21	21–24
November 27	0	0	1	1	1	2	1	1
November 28	2	2	3	2	1	3	2	2

Table II– Worldwide geomagnetic indices (planetary Kp) reported every three hours during the CQ WW DX CW Contest weekend of November 27–28. All values indicate exceptionally quiet, stable, non-storm geomagnetic conditions; (0/1) Above Normal, (2) High Normal, and (3) Low Normal. (Data provided by NOAA and SEC)

11307 Clara Street, Silver Spring, MD 20902
e-mail: <george@gjainc.com>

cm solar flux level of approximately 149 is predicted for February 2000.

Sunspot Cycle Comparison

There is now three years of smoothed sunspot data available for Cycle 23, which began during May 1996. Table III compares the progress of Cycle 23 with seven other cycles at the 36-month mark. From data appearing in Table III it appears very unlikely that Cycle 23 will be a very high cycle as typified by Cycles 22 and 21. On the other hand, from progress to date, neither does it seem likely that Cycle 23 will be a low high cycle as typified by Cycles 13 and 10. Of the 22 previously recorded solar cycles, the progress of Cycle 23 at the 36-month mark very closely tracts the progress of Cycles 20 and 17, which were medium high cycles. If this comparison continues, Cycle 23 is most likely to peak at a smoothed sunspot count between 111 and 119.

Using an established statistical method, the Sunspot Data Index Center at the Royal Observatory of Belgium is predicting a smoothed sunspot peak of 116 for Cycle 23 to occur in either December 1999 or January 2000. Since a smoothed sunspot number lags by six months, we will not know the accuracy of this prediction until June or July 2000. The Solar-Terrestrial Physics Division of the National Geophysical Data Center in Boulder, Colorado, utilizing another established statistical method, is predicting a peak of 114, which is most likely to occur between June and September 2000.

February Conditions

Sunspot Cycle 23 is nearing its peak intensity This means that the ionosphere will be stronger this year than at any other time during the past ten years.

During the daylight hours of February expect good or better DX propagation simultaneously on six bands. Fifteen meters is likely to be the best band frorn shortly after sunrise until just after sunset, with 10, 12, 17, and 20 meters not far behind. The 6 meter band should be an extra DX bonus this month during the hours of daylight. Be sure to check this band for unusual DX openings, particularly when conditions are expected to be High Normal or better. Look for openings towards Europe and the east before noon, towards the South Pacific and the west during the late afternoon, and towards Central and South America throughout most of the daylight hours. The best times to listen for 6 meter DX openings are shown in the DX Propagation Charts by a **.

During the period from sundown to midnight as many as seven bands may be availablc tor DX. Fifteen and 17 meters should hold up well past sundown for DX openings towards Central and South America, the Pacific area, and the Far East and Asia. Twenty meters should remain open to most areas of the world during this period, but with signals strongest from southerly and westerly directions. Good DX towards the east and the south should also be possible on 30, 40, and 80 meters, with some openings in the same directions also possible on 160 meters.

Between midnight and the sunrise period it should be a toss-up among 20, 30, and 40 meters for worldwide DX honors. Good DX openings to most areas of the world should also be possible on 80 meters. Be sure to also check 160 meters for some unusual DX openings during this period.

Beginning late in February and continuing through March and early April, expect considerable improvement in DX conditions between the northern and southern hemispheres. This will result from the effects of the spring equiinox period, as the sun crosses the equator in its apparent travels toward northern skies. These improved interhemispheric conditions should be noticeable on all bands 6 through 160 rneters, and on circuits mainly between the United States and South America, southern and central Africa, Australasia, Antarctica, and parts of Asia. Equinoctial propagation conditions tend to maximize during the sunrise and sunset periods, and over both short- and long-path openings.

This month's propagation charts contain band-opening predictions for major DX paths for the period February 15 through April 15, 2000. A short-skip propagation forecast for February appeared in last month's column.

VHF Ionospheric Openings

As mentioned earlier in this column, expect unusually good DX conditions on the 6 meter band during the hours of daylight, with *F*-layer openings to many areas of the world from the United States. Another form af 6 meter propagation, trans-equatorial scatter (TE), usually peaks during the equinoctial period. Some TE openings should be possible during February between the southern tier states and South America. The best time to check for such openings is between the 7 and 10 PM local time. Some TE openings may also be possible on 2 meters at the same time.

Cycle	36 Month Mark (Smoothed)	Peak Intensity
23	90	?
22	157	158
21	153	165
20	95	111
17	90	119
13	81	88
10	75	98

Table III– A comparison of current sunspot Cycle 23 at its 36th month with progress of two previous high cycles (22 and 21); two medium-high cycles (20 and 17) ,and two low high cycles (13 and 10).

No significant meteor showers are expected during February. Radio storminess expected during the month should produce some widespread auroral activity, with increased chances for short-skip openings on both 6 and 2 meters for distances up to approximately 1300 miles. Check the Last-Minute Forecast at the beginning of this column for those days during February that are expected to be Disturbed or Below Normal. These are the days on which unusual ionospheric short-skip opening on the VHF bands are most likely to occur. 73, George, W3ASK

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 80 meter openings. An ** indicates best time to check for 10 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 *standard* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 13 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 04 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.

February 15 - April 15, 2000
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	10 meters	15 meters	20 meters	40/80 meters
Western & Central Europe & N. Africa	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (4) 13-14 (2) 14-15 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-11 (3) 11-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	00-03 (1) 03-06 (2) 06-09 (3) 09-11 (2) 11-13 (3) 13-18 (4) 18-22 (3) 22-00 (2)	17-18 (1) 18-19 (2) 19-22 (3) 22-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-00 (2)* 00-02 (1)
Northern Europe & European CIS	08-09 (1) 09-10 (2) 10-11 (3) 11-12 (2) 12-13 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	00-02 (3) 02-03 (2) 03-05 (1) 05-07 (2) 07-09 (3) 09-14 (2) 14-18 (3) 18-21 (2) 21-00 (1)	17-19 (1) 19-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 20-01 (1)*
Eastern Mediter-ranean & Middle East	08-09 (1) 09-11 (2) 11-12 (3) 12-13 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-13 (4) 13-14 (2) 14-15 (1)	04-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-20 (3) 20-22 (2) 22-02 (3) 02-04 (2)	18-20 (1) 20-23 (2) 23-00 (1) 20-23 (1)*
Western Africa	07-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-18 (2) 18-19 (1) 08-12 (1)**	06-09 (1) 09-11 (2) 11-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	02-06 (2) 06-13 (1) 13-15 (2) 15-17 (3) 17-00 (4) 00-02 (3)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 22-02 (1)*
Southern Africa	07-08 (1) 08-10 (2) 10-11 (3) 11-13 (4) 13-14 (2) 14-15 (1) 11-13 (1)**	06-10 (1) 10-12 (2) 12-14 (3) 14-17 (4) 17-18 (2) 18-19 (1)	05-07 (2) 07-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-21 (2) 21-23 (1) 23-02 (2) 02-03 (2) 03-05 (1)	18-20 (1) 20-23 (2) 23-00 (1) 21-23 (1)*
Eastern & Central Africa	09-11 (1) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1) 09-11 (1)**	07-09 (1) 09-11 (2) 11-13 (3) 13-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-23 (4) 23-02 (3) 02-03 (2) 03-05 (1)	19-23 (1) 23-01 (2) 01-02 (1) 23-01 (1)*
Central & South Asia	08-11 (1) 19-21 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-13 (1) 19-20 (1) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-21 (3) 21-22 (2) 22-00 (1)	19-22 (1) 04-06 (1)
Southeast Asia	10-13 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-18 (1) 18-21 (2) 21-22 (1)	05-07 (1) 07-09 (2) 09-11 (1) 14-17 (1) 19-20 (1) 20-23 (2) 23-01 (1)	05-07 (1)
Far East	09-11 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-16 (1) 16-17 (2) 17-19 (3) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (3) 09-11 (2) 11-13 (1) 17-19 (1) 19-22 (2) 22-00 (3) 00-02 (2) 02-03 (1)	05-08 (1)
South Pacific & New Zealand	08-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 16-18 (1)**	07-08 (1) 08-10 (2) 10-13 (1) 13-16 (2) 16-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	11-19 (1) 19-21 (2) 21-23 (3) 23-03 (4) 03-05 (3) 05-07 (2) 07-09 (3) 09-11 (2)	00-01 (1) 01-02 (2) 02-05 (3) 05-07 (2) 07-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Austral-asia	09-11 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 17-19 (1)**	08-09 (1) 09-12 (3) 12-15 (1) 15-16 (2) 16-19 (3) 19-21 (2) 21-22 (3) 22-23 (2) 23-00 (1)	06-08 (2) 08-10 (4) 10-12 (2) 12-15 (1) 15-17 (2) 17-21 (1) 21-23 (2) 23-02 (3) 02-03 (2) 03-06 (1)	02-04 (1) 04-05 (2) 05-06 (3) 06-07 (2) 02-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (2) 09-16 (4) 16-18 (3) 18-19 (2) 19-20 (1) 09-11 (1)**	05-06 (1) 06-07 (2) 07-11 (4) 11-13 (3) 13-19 (4) 19-21 (3) 21-22 (2) 22-00 (1)	03-05 (2) 05-06 (3) 06-09 (4) 09-10 (3) 10-14 (2) 14-16 (3) 16-00 (4) 00-03 (8)	18-19 (1) 19-20 (2) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-03 (2)* 03-05 (1)**
Peru, Paraguay, Brazil, Argentina, Uruguay, Bolivia, & Chile	07-08 (1) 08-10 (3) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1) 01-12 (1)** 15-17 (1)**	06-07 (1) 07-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	15-16 (1) 16-17 (2) 17-18 (3) 18-02 (4) 02-03 (3) 03-04 (2) 04-05 (1) 05-07 (2) 07-09 (1)	19-21 (1) 21-00 (2) 00-03 (3) 03-04 (2) 04-06 (1) 21-05 (1)**
McMurdo Sound, Antarctica	16-17 (1) 17-19 (2) 19-20 (1)	12-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-05 (2) 05-06 (1) 06-08 (2) 08-09 (1)	23-01 (1) 01-05 (2) 05-06 (1)

Time Zones: CST & MST (24-Hour Time)
CENTRAL USA TO:

	10 meters	15 meters	20 meters	40/80 meters
Western & Central Europe & N. Africa	08-10 (1) 10-12 (2) 12-13 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	00-06 (1) 06-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-20 (3) 20-00 (2)	17-19 (1) 19-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 20-22 (1)* 22-00 (2)* 00-01 (1)*
Northern Europe & European CIS	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	07-10 (2) 10-13 (1) 13-15 (2) 15-18 (3) 18-20 (2) 20-22 (1) 22-02 (2) 02-07 (1)	19-22 (1) 22-00 (2) 00-02 (1) 22-01 (1)*
Eastern Mediter-ranean & Middle East	09-10 (1) 10-11 (2) 11-12 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-18 (3) 18-20 (2) 20-23 (3) 23-01 (2) 01-02 (1)	19-22 (1) 20-22 (1)*
Western Africa	08-09 (1) 09-11 (2) 11-12 (3) 12-14 (4) 14-16 (3) 16-17 (2) 17-18 (1) 08-10 (1)**	06-08 (1) 08-10 (2) 10-13 (3) 13-16 (4) 16-17 (3) 17-19 (2) 19-20 (1)	04-06 (2) 06-12 (1) 12-15 (2) 15-17 (3) 17-23 (4) 23-01 (3) 01-02 (2) 02-04 (1)	18-20 (1) 20-23 (2) 23-01 (1) 21-00 (1)*
Southern Africa	07-08 (1) 08-10 (2) 10-11 (3) 11-12 (4) 12-13 (2) 13-14 (1) 11-13 (1)**	07-09 (1) 09-11 (2) 11-12 (3) 12-16 (4) 16-17 (2) 17-18 (1)	05-07 (2) 07-13 (1) 13-15 (2) 15-16 (3) 16-19 (4) 19-20 (3) 20-22 (2) 22-00 (3) 00-02 (2) 02-05 (1)	19-20 (1) 20-21 (2) 21-22 (1) 20-21 (1)*
Eastern & Central Africa	09-11 (1) 11-13 (2) 13-16 (4) 16-17 (2) 17-18 (1) 13-15 (1)**	08-09 (1) 09-12 (2) 12-16 (3) 16-18 (4) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Central & S.Asia	07-09 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-02 (1)	05-07 (1) 18-20 (1)
Southeast Asia	09-10 (1) 10-12 (2) 12-14 (1) 16-17 (1) 17-19 (3) 19-20 (2) 20-21 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-17 (1) 17-21 (2) 21-22 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-18 (1) 18-21 (2) 21-23 (1)	04-07 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	09-11 (1) 14-16 (1) 16-17 (2) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (2)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-16 (1) 16-20 (2) 20-22 (1) 22-00 (3) 00-02 (2) 02-03 (1)	02-04 (1) 04-06 (2) 06-08 (1) 05-07 (1)*
South Pacific & New Zealand	10-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-20 (2) 20-21 (1) 11-14 (1)** 17-19 (1)**	08-12 (1) 12-14 (2) 14-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-23 (3) 23-01 (2) 01-02 (1)	17-19 (1) 19-21 (2) 21-23 (3) 23-04 (4) 04-05 (3) 05-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (1)	22-00 (1) 00-01 (2) 01-06 (3) 06-07 (2) 07-08 (1) 00-02 (1)* 02-05 (2)* 05-07 (1)*
Austral-asia	09-11 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 16-18 (1)**	07-08 (1) 08-11 (3) 11-14 (1) 14-16 (2) 16-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-00 (1)	05-07 (2) 07-08 (3) 08-10 (4) 10-12 (2) 12-14 (1) 14-16 (2) 16-21 (1) 21-23 (2) 23-01 (3) 01-04 (4) 04-05 (3)	02-04 (1) 04-06 (3) 06-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (2) 09-10 (3) 10-16 (4) 16-18 (3) 18-19 (2) 19-20 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-10 (4) 10-13 (3) 13-19 (4) 19-20 (3) 20-21 (2) 21-23 (1)	06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-23 (4) 23-02 (3) 02-05 (2) 05-06 (3)	18-19 (1) 19-20 (2) 20-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)*

Peru, Paraguay, Brazil, Argentina, Uruguay, Bolivia, Chile	07-08 (1) 08-10 (3) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 09-11 (1)** 14-16 (1)**	06-07 (1) 07-10 (2) 10-13 (1) 13-14 (2) 14-16 (3) 16-20 (4) 20-22 (3) 22-00 (2) 00-01 (1)	13-15 (1) 15-16 (2) 16-18 (3) 18-01 (4) 01-03 (3) 03-05 (2) 05-07 (3) 07-08 (2) 08-09 (1)	19-20 (1) 20-00 (2) 00-02 (3) 02-03 (2) 03-04 (1) 21-03 (1)*
McMurdo Sound Antarctica	14-16 (1) 16-19 (2) 19-20 (1)	13-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	16-19 (1) 19-20 (2) 20-04 (3) 04-05 (2) 05-07 (1) 07-08 (2) 08-10 (1)	22-02 (1) 02-04 (2) 04-06 (1)

Time Zones: PST (24-Hour Time) WESTERN USA TO:

	10 meters	15 meters	20 meters	40/80 meters
Western Europe & N. Africa	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-14 (1) 19-21 (1)	00-06 (1) 06-09 (2) 09-11 (3) 11-14 (2) 14-16 (3) 16-19 (2) 19-22 (1) 22-00 (2)	19-20 (1) 20-22 (2) 22-00 (1) 20-22 (1)*
Central & Northern Europe & European CIS	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (1) 19-21 (1)	05-06 (1) 06-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Eastern Mediter-ranean & Middle East	o8-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (1) 20-22 (1)	05-06 (1) 06-09 (2) 09-12 (1) 12-16 (2) 16-18 (1) 18-22 (2) 22-02 (1)	18-21 (1)
Western & Central Africa	08-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	07-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	01-06 (1) 06-08 (2) 08-12 (1) 12-15 (2) 15-17 (3) 17-21 (4) 21-00 (3) 00-01 (2)	18-22 (1)
Eastern Africa	09-12 (1) 12-14 (2) 14-15 (1)	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	06-08 (1) 12-14 (1) 14-16 (2) 16-20 (3) 20-22 (2) 22-23 (1)	18-20 (1)
Southern Africa Southern Africa	07-08 (1) 08-11 (1) 11-12 (2) 12-13 (1)	06-09 (1) 09-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	04-06 (1) 06-08 (2) 08-13 (1) 13-15 (2) 15-18 (3) 18-19 (2) 19-21 (1) 21-23 (3) 23-00 (2) 00-02 (1)	18-21 (1)
Central & S. Asia	07-09 (1) 17-18 (1) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-11 (1) 16-17 (1) 17-19 (2) 19-20 (3) 20-21 (2) 21-22 (1)	16-18 (1) 18-21 (2) 21-23 (1) 02-03 (1) 03-05 (2) 05-07 (1) 07-09 (3) 09-10 (2) 10-12 (1)	05-07 (1) 18-20 (1)
Southeast Asia	08-09 (1) 09-11 (2) 11-12 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (2) 19-20 (1) 16-18 (1)**	07-08 (1) 08-10 (4) 10-12 (3) 12-17 (1) 17-20 (3) 20-21 (2) 21-22 (1)	23-01 (1) 01-03 (2) 03-06 (3) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	00-02 (1) 02-05 (2) 05-07 (1)
Far East	14-15 (1) 15-16 (2) 16-18 (4) 18-19 (2) 19-20 (1)	08-10 (2) 13-14 (1) 14-15 (2) 15-17 (3) 17-20 (4)	04-06 (2) 06-07 (1) 07-08 (3) 08-09 (4) 09-10 (3)	00-02 (1) 02-05 (2) 05-06 (3) 06-07 (2) 07-08 (1)

	15-17 (1)**	20-21 (3) 21-22 (1)	10-11 (2) 11-19 (1) 19-21 (2) 21-23 (4) 23-00 (3) 00-03 (2) 03-04 (3)	02-04 (1)* 04-06 (2)* 06-07 (1)*
South Pacific & New Zealand	09-10 (1) 10-12 (3) 12-16 (2) 16-20 (4) 20-21 (3) 21-22 (1) 10-12 (1)** 18-20 (1)**	07-08 (1) 08-09 (2) 09-11 (3) 11-17 (2) 17-18 (3) 18-22 (4) 22-23 (3) 23-01 (2) 01-02 (1)	06-07 (3) 07-09 (4) 09-10 (3) 10-11 (2) 11-17 (1) 17-19 (2) 19-20 (3) 20-01 (4) 01-04 (3) 04-06 (2)	19-21 (1) 21-22 (2) 22-23 (3) 23-05 (4) 05-06 (3) 06-07 (2) 07-08 (1) 22-01 (1)* 01-05 (2)* 05-06 (1)*
Austral-asia	11-13 (1) 13-14 (2) 14-16 (3) 16-19 (4) 19-20 (3) 20-21 (1) 16-18 (1)**	06-07 (1) 07-09 (3) 09-11 (2) 11-13 (1) 13-15 (2) 15-17 (1) 17-18 (2) 18-21 (4) 21-22 (2) 22-23 (1)	12-20 (1) 20-22 (2) 22-00 (3) 00-04 (4) 04-06 (3) 06-08 (4) 08-10 (3) 10-12 (2)	00-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South	07-08 (1) 08-09 (2) 09-10 (3) 10-16 (4) 16-17 (3) 17-18 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-14 (3) 14-17 (4) 17-18 (3)	05-07 (4) 07-09 (3) 09-14 (2) 14016 (3) 16-22 (4) 22-00 (3)	18-20 (1) 20-01 (3) 01-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)*

America	09-11 (1)**	18-20 (2) 20-21 (1)	00-03 (2) 03-05 (3)	03-04 (1)*
Peru, Bolivia Paraguay, Brazil, Argentina, Uruguay, Chile	07-08 (1) 08-09 (3) 09-11 (2) 11-14 (3) 14-17 (4) 17-18 (2) 18-19 (1) 09-11 (1)**	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-20 (4) 20-23 (3) 23-00 (2) 00-01 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-01 (4) 01-02 (3) 02-06 (2) 06-08 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 22-02 (1)*
McMurdo Sound, Antarctica	13-14 (1) 14-18 (2) 18-19 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	16-18 (1) 18-19 (2) 19-21 (3) 21-02 (4) 02-04 (3) 04-05 (2) 05-07 (1) 07-08 (2) 08-09 (1)	22-02 (1) 02-04 (2) 04-06 (1)

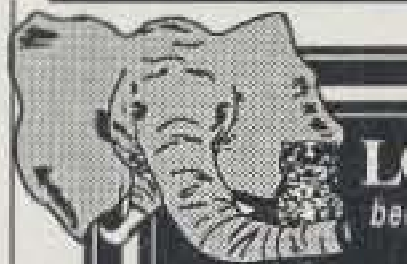
*Indicates best times to listen for 80 meter openings. Openings on 16o meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.

**Indicates best times to listen for F-2 layer openings on 6 meters.

For 12 meter openings interpolate between 10 and 15 meter openings.

For 17 meter openings interpolate between 15 and 20 meter openings.

For 30 meter openings interpolate between 40 and 20 meter openings.



Q&A

Questions and Answers About Ham Radio

The following were excerpted from the "Q & A" page of the CQ website.

Q: Please don't laugh at my possibly silly question. I am ready for my test and will be licensed soon. I have put a down-payment on a used dual-band (144/440) mobile rig and will also be acquiring an HT. My question is this: What are my likely chances of making a DX QSO with this dual-band radio which is an FM rig at 50 watts on 144 and 35 watts on 440? Please tell me and don't laugh at me. Remember I am new at all of this!

Wayne Horne

A: *Ryan Szekeres, KB9TQN, replies:* Your chances are pretty good. I live in Chicago. There was an opening a little while back and we heard a ham here working a ham on an HT up in Wisconsin on the 2 meter calling frequency (146.52 MHz). You just have to keep an eye out for openings and get on the air when you find them.

Norris Klesman, N9XGZ, adds: Another thing to watch for is the activation of the ham station on the International Space Station. I've spoken with both the Russian Space Station, MIR, and a shuttle flight, using a handheld. Timing is the main thing, since you can only talk with them line of sight. Good luck.

W2VU here: DX is in the mind of the beholder, Wayne. Don't expect to talk to Europe or Africa on a VHF FM rig. But there will be band openings that let you talk several hundred miles. In addition, there's a growing number of amateur satellites that are using FM on the 144/440 MHz bands. If your dual-bander will tune the 435–438 MHz satellite segment on 70 centimeters, you might be able to work one of these satellites. Keep an eye on our satellite column (starting in this issue) for regular updates on both these satellites and the International Space Station's ham station.

Q: I am a new ham and want to upgrade to Tech Plus. I want to download an easy-to-install and easy-to-use Morse code tutor program for Windows 95 use from the Internet. Anybody know of one or several? Please share the sites to download it or them from. Thanks.

André Landrum, KC5ZJG

A: *Dave Wright, KB9MNM, replies:* I, myself, am in your spot. Being a No-Code Tech is fun, but more is needed. My brother-in-law, Bill, N9KQE, got me Ham University. Now it's been awhile since I've looked at it, but as I recall, it is a very nice program. Also try Morse Academy. That one isn't as pretty, and it is a DOS program, but it'll get the job done. Go to the QRZ.com website, and you can download one or the other, or even find a different one. Good luck!

Editor's note: This is not an endorsement by CQ of any particular code instruction program. There are many on the market, each with different features to meet different needs. Shop around, and choose the one that looks as if it will best meet your *needs.*

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.

Ham Shop

Advertising Rates: Non-commercial ads are 20 cents per word including abbreviations and addresses. Commercial and organization ads are $1.00 per word. Boldface words are $1.50 each (specify which words). Minimum charge $2.00. No ad will be printed unless accompanied by full remittance. All ads must be typewritten double-spaced.

Closing Date: The 10th day in the third month preceding date of publication (example: Jan. 10th for the March issue). Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of *CQ* cannot vouch for the merchandise listed therein. The publisher reserves the right to reject any advertisement. Direct all correspondence and ad copy to: CQ Ham Shop, 25 Newbridge Road, Hicksville, NY 11801.

CB-TO-10M CONVERSIONS: Frequency modifications, FM, books, plans, kits, high-performance CB accessories. Catalog $3. CBCI, Box 1898A, Monterey, CA 93942. <www.cbcintl.com>

FOREIGN AIRMAIL POSTAGE for successful QSLing! Many countries, monthly bargains, plus **EUROPEAN NESTING AIRMAIL ENVELOPES!** We offer **QSLs, EYEBALL CARDS, QSL ALBUMS, WALLHANGERS.** Bill Plum, 12 Glenn Road, Flemington, NJ 08822-3322 (weekdays: 908-788-1020; fax: 908-782-2612).

QSLs FOR DX STATIONS: Our new "International Division" was established to handle QSL needs of DX hams. We understand the problems of packaging, shipping, and dealing with the customs problems. You can trust us to deliver a quality QSL, usually much cheaper than you can find locally. Write, call, or FAX for free samples and ordering information. "The QSL Man—W4MPY," 682 Mount Pleasant Road, Monetta, SC 29105 USA. Phone or FAX 803-685-7117.

"QRZ DX"—since 1979: Available as an **Adobe PDF file** each Wednesday or by regular mail. Your best source for weekly DX information. Send #10 SASE for sample/rates. **"The DX Magazine"—since 1989:** Bi-monthly – Full of DXpedition reports, QSL Information, Awards, DX news, technical articles, and more. Send $2.00 for sample/rates. DX Publishing, Inc., P.O. Box DX, Leicester, NC 28748-0249. Phone/Fax: 704-683-0709; e-mail: <DX@dxpub.com>; WEB PAGE: <http: //www.dxpub.com>.

CALLBOOK 2000 CD-ROM: $38.95 POSTPAID. All ARRL items discounted. **<AA6EE@amsat.org>**, 760-789-3674. D. Heise, 16832 Whirlwind/C2, Ramona, CA 92065. **<http://www.radiodan.com/ aa6ee/>**

LEARN CODE BY HYPNOSIS: http://www.qth.com/cweasy/ or 1-800-425-2552.

CERTIFICATE for proven contacts with all ten American districts. SASE to W6DDB, 45527 Third Street East, Lancaster, CA 93535-1802.

TOWER HARDWARE, SAFETY EQUIPMENT, weatherproofing, T-shirts, and **MORE**. Champion Radio Products, telephone 888-883-3104, or <www.championradio.com>.

ALUMINUM CHASSIS-CABINET KITS, UHF and VHF Antenna Parts. K3IWK, 5120 Harmony Grove Rd, Dover, PA 17315-3016; <www.flash.net/~k3iwk>.

AMERICAN HAM GEAR manufactured between 1930 & 1980 needed to illustrate *CQ* book and calendar projects. Photography can be done at your location. Contact Joe Veras, N4QB, P.O. Box 1041, Birmingham, AL 35201. Tel: 205-967-2384 days, 205-967-0639 evenings and weekends, or e-mail: <N4QB@cq-amateur-radio.com>.

B&B WITH A HAM! Enjoy hamming from Hawaii. Join those who have chased DX from beautiful upcountry Maui! (Non-smokers only, thanks.) "SEA Q MAUI," call 808-572-7914; <kh6sq@seaqmaui.com> <http://www.seaqmaui.com>.

HALLICRAFTERS Service Manuals. Amateur and SWL Write for prices. Specify Model Numbers desired. Ardco Electronics, P.O. Box 95, Dept. C, Berwyn, IL 60402.

FREE GUIDE "THE TEN MOST COMMON TOWER BUILDING MISTAKES": Written by well-known tower expert Steve Morris, K7LXC, this guide will help you avoid dangerous mistakes. TOWER TECH, Box 572, Woodinville, WA 98072; e-mail <UpTheTower@aol.com> or call 800-TOWERS8 or on the web: <www.championradio.com>.

FREE IBM DISK CATALOG! Ham Radio, Shareware, and CD-ROMs. MOM 'N POP'S SOFTWARE, P.O. Box 15003-HE, Springhill, FL 34609-0111 (phone 1-352-688-9108; e-mail: <momnpop@webcombo.net>; website: <www.momnpopsware.com>).

TRYLON SELF-SUPPORTING TOWERS: Steel towers available up to 96 ft. Terrific value and reliability. The popular T-500 72-footer will take 45 square feet of antennas at 70 mph and is only $1825.00. <www.championradio.com> or 888-833-3104 for more info.

NEW CD-ROM release for 1999, for the PC with the PicturePacket (LITE) program ready to install on your Windows 95, 98, or NT based PC. The CD also contains many of K4ABT's articles, PacketRadio Handbooks, and hundreds of TNC to transceiver drawings, transceiver modifications (both 9600 baud and some commercial radio conversions), TNC to node conversions, and text file radio modifications. Some documents are in MSWord format. Here is a library of files and drawings from 15 years of the "Packet User's Notebook." Most drawings are in GIF and JPG formats. All orders are shipped PRIORITY, FIRST-CLASS MAIL within 24 hours of received order. Send check or MO ($20.00 US) payable to Buck Rogers, K4ABT, 115 Luenburg Drive, Evington, VA 24550.

KNOW FIRST! Ham radio fanatics—you need THE W5YI REPORT, a twice-monthly award-winning Hot Insider Newsletter Acclaimed best! Confidential facts, ideas, insights, nationwide news, technology, predictions, alerts. Quoted coast-to-coast! We print what you don't get elsewhere! $19.50 annually to new subscribers! Money-back guarantee! FREE sample for SASE (two stamps). W5YI, P.O. Box 565101, Dallas, Texas 75356.

W7FG Vintage Manuals and Ladder Line: Most manuals in stock. SASE for catalog. 600 ohm Ladder Line. Visa/MasterCard accepted. **402731 W. 2155 Dr.**, Bartlesville, OK 74006 (918-333-3754 or 800-807-6146) **<http://www.w7fg.com>**

FREE Ham Gospel Tracts, SASE. KW3A, 265 West Ave., Springfield, PA 19064.

Orlando, Florida: The Orlando Amateur Radio Club is sponsoring the 53rd ORLANDO HAMCATION^{SM} SHOW and the ARRL State Convention on Friday, Feb. 11th 5–9 PM; Saturday, Feb. 12th 9 AM – 5 PM, and Sunday, FEb. 13th 9 AM – 3 PM at the Central Florida Fairgrounds ocated on Rt. 50 Colonioal Drive, 3 miles west of I-4. Over 150 commercial booths, over 400 swap tables, largest tailgate in the southeast, and RV camping with electricity and water $16 per night in advance, or $20 at the gate. Admission $7 in advance or $9 at the gate. Commercial booths $225; swap tables $35 in advance or $45 at the gate; tailgate $25 in advance or $35 at the gate. Price is for three days. Setup Friday, Feb. 11th 9 AM – 4 PM. TI 146.760 - offset. VE exams, must register in advance: Gil Lineberry, 407-843-4112. Foxhunt, must register by 4 PM at info booth. Seminars, lectures, demonstrations, and special guest speakers. Check our website for up-to-date info: <www.oarc.org/hamcat.html>. Contact Ken Christenson, 5548 C Cinderlane Pky., Orlando, FL 32808 (phone 407-291-2465; <KD4JQR @arrl.net>).

HAM RADIO REPAIR, quality workmanship. All Brands, Fast Service. Affordable Electronics, 7110 E. Thomas Rd., Scottsdale, AZ 85251 (480-970-0963). <hamservice@aol.com>

ANTENNA HARDWARE – S.S. "U" bolts, Aluminum Saddles, Element and Boom Plates, S.S. Hose Clamps. Write for list to HARBACH ELECTRONICS – WA4DRU, 2318 S. Country Club Road, Melbourne, FL 32901-5809 (http://www.harbach.com).

INTERESTED IN VIEWING the Earth from space? Subscribe to Weather Satellite Report. Since 1992 the international quarterly of Earth and atmospheric imagery. Woodhouse Communication, telephone 616-226-8873; fax 616-226-9073; e-mail <www. view2earth.com>.

WORK RARE CW DX? CW CONTESTS? Contest Code is the answer. Powerful hypnosis audio tapes teach you to copy High Speed (30/40 WPM) or Ultra High Speed (50/60 WPM). Subliminals speed you along! 20 min/day for 30 days yields results. Each tape $15.95 ppd US. $3.00 shipping/handling. Specify 30/40 or 50/60 tape. Amex/VISA/ MC Order now! Call 1-800-425-2552, Alternative Arts.

WANTED: Older model bugs, unusual bugs, and miniature hand keys. State price, condition. Dave Ingram, K4TWJ, 4941 Scenic View Drive, Birmingham, AL 35210.

FOR SALE: CQ/Ham Radio/QST/73 magazines and binders. SASE brings data sheet. W6DDB, 45527 Third Street East, Lancaster, CA 93535-1802.

FREE HAM RADIO GOSPEL TRACTS: Christian youth leaders needed for out-reach areas. Membership is free. Send #10 SASE with call letters for details. Ray Bohmer, W1REZ, P.O. Box 8, Harmony, ME 04942.

P49V's ARUBA COTTAGE FOR RENT with 2 bedrooms, rig, and antennas. For info write Carl Cook, 2191 Empire Ave., Brentwood, CA 94513.

HamMall.Com : Largest Web site dedicated to the sale of all types of amateur radio equipment. Check out the QSL Manager's Listing, add your call to the Call Wall, or get technical assistance. Find us at: <www.hammall.com>.

IMRA-International Mission Radio Assn. helps missioners—equipment loaned; weekday net, 14.280 MHz, 1:00–3:00 PM Eastern. Sr. Noreen Perelli, KE2LT, 2755 Woodhull Ave., Bronx, NY 10469.

RADIOAMADORES BRASILEIROS, compre ICOM, Kenwood no Brasil. Tel/Fax: +19-875-6174 ou <www. bestway.com.br/radiohaus>.

WANTED: HAM EQUIPMENT AND RELATED ITEMS. Donate your excess gear—new, old, in any condition—to the Radio Club of Junior High School 22, the Nation's only full time non-profit organization working to get Ham Radio into schools around the country as a teaching tool using our EDUCOM—Education Thru Communication—program. Send your radio to school. Your donated material will be picked up ANYWHERE or shipping arranged, and this means a tax deduction to the full extent of the law for you as we are an IRS 501(c)(3) charity in our 18th year of service. It is always easier to donate and usually more financially rewarding, BUT MOST IMPORTANT your gift will mean a whole new world of educational opportunity for children nationwide. Radios you can write off; kids you can't. Make 2000 the year to help a child and yourself. Write, phone, or FAX the WB2JKJ "22 Crew" today: The RC of JHS 22, P.O. Box 1052, New York, NY 10002. Twenty-four hours call 516-674-4072; fax 516-674-9600; or e-mail <wb2jkj@juno. com>. Join us on the WB2JKJ Classroom Net, 7.238 MHz, 1200–1330 UTC daily and 21.395 MHz from 1400 to 2000 UTC.

FOR SALE: **Transmission Line Transformers** (Baluns and Ununs). Due to QTH downsizing, I have to dispose of the many transformers used in my study of these broadband and highly efficient matching transformers. A suggested price is $20, covering labor, packaging, and shipping. Oldest transformers will be shipped first. They will include a short personal note on the particular experiment. Please, no special requests.Most transformers are uncased. Jerry Sevick, W2FMI, 32 Granville Way, Basking Ridge, NJ 07920 (908-766-6122). **Note:** These are one of a kind, for experimental use only.

ASTRON Power Supply, brand new w/warranty, RS20M $99, RS35M $145, RS50M $209, RS70M $249. Call for other models, AVT 626-286-0118 <www.aventrade.com>.

CASH FOR COLLINS: Buy any Collins Equipment. Leo, KJ6HI, phone/fax 310-670-6969; <radioleo@ earthlink.net>

Advertiser's Index

now including websites

HEATH, DRAKE, more. Equipment, manuals, parts. SWL. List $1.00 and SASE. Joseph Bedlovies, P.O. Box 139, Stratford, CT 06615.

ATTENTION SB-200 & SB-220 OWNERS: Restore and up-grade your tired old amplifier with our parts and kits. Power supply boards, soft keys, soft starts, new fans & motors, many more items. Write for details—**Please specify the model**. Harbach Electronics—WA4DRU, 2318 S. Country Club Rd., Melbourne, FL 32901-5809 (http://www.harbach.com).

TRIBANDER COMPARISON REPORT: Find out the real lowdown on HF antenna performance. K7LXC and NØAX test the KT34XA, TH7, TH11, C-3, Skyhawk, and more. Over 60 pages. $15 plus $3.00 s/h. <www.championradio.com> or 888-833-3104.

QSL CARDS Many styles. Top quality. Order Risk Free. Plastic cardholders, T-shirts, Personalized caps, mugs, shirts. Other ham shack extras. Information and samples: **Rusprint 1-800-962-5783; 913-491-6689; or fax 913-491-3732.**

LOW BAND DXers K1FZ Beverage antenna transformers. Single wire and two wire switchable two direction types. <www.qsl.net/k1fz/> e-mail: <k1fz@agate.net> Clark Electronics, 207-338-0474.

VP5 – Be DX: Newly constructed 2BR/2BA villa with rig and antennas overlooking north coast of beautiful Middle Caicos. Telephone 904-282-0158, or e-mail <islands@southeast.net>.

OVER 2500 DIFFERENT DX AWARDS from 122 DXCC countries listed. K1BV DX Awards Directory. Put your QSLs to work for you! $21 postpaid. Ted Melinosky, 65 Glebe Road, Spofford, NH 03462-4411. <http://top.monad.net/~k1bv>.

AMERICAN HAM GEAR manufactured between 1930 & 1980 needed to illustrate *CQ* book and calendar projects. Photography can be done at your location. Contact Joe Veras, N4QB, P.O. Box 1041, Birmingham, AL 35201. Tel: 205-967-2384 days, 205-967-0639 evenings and weekends, or e-mail: <N4QB@cq-amateur-radio.com>.

HEARD ISLAND commemorative T-shirts, same shirt as team is wearing on QSL card. Proceeds benefit VKØIR DXpedition. Personal checks on U.S. banks okay. Please no credit cards. Sizes remaining: large, extra-large. 100% cotton, U.S. made. $20 Priority Mail stateside, $25 DX Air Mail, postage included. Tom Anderson, WW5L, 3505 Cliffwood Drive, Bedford, Texas 76021-2043 (phone 817-498-2820; e-mail <WW5L@gte.net>).

KENWOOD TS-520 $350; Drake TR-4C $350. K1BW, 413-538-7861.

SX88 Hallicrafters receiver wanted. Jim, W6OU, 714-528-5652.

RAINBOW AMATEUR RADIO Association, the gay/lesbian club. Active weekly HF nets, monthly newsletter, e-mail reflector, web page: <www.rara.org>. Privacy respected. E-mail: <rara@qsl.net>, or P.O. Box 191, Dept. A, Chesterland, OH 44026-0191.

RF TRANSISTORS & TUBES: SD1446, 2SC1969, MRF454, MRF455, MRF422, 2SC2290, 2SB754, 2SC2312, 2SC2166, SAV17, MRF448, MRF151G, 3-500ZG, 3CX3000A7, 3CX400A7/8874, 4CX250B, 572B. WESTGATE 800-213-4563.

KK7TV COMMUNICATIONS: *See our display ad.*

GREAT CIRCLE MAPS computer generated for your exact QTH, $20 ppd worldwide. Printouts $12 ppd. SASE for info. Bill Johnston, K5ZI, Box 640, Organ, NM 88052 (505-382-7804).

Wanted **COLLINS S-LINE** Pristine (RE) 32S3-A, 75S3-C, 516F2, 312B4, 30L1 or 30S1 and SM-3. Willing to pay top dollar for the station I have wanted since age 13. Call 1-512-925-3907 (cell), 1-888-917-9077 (home), toll free residential. <willbryant@aol.com>. WA5JUL, Bill Bryant. *This station is for personal use, not for resale!*

FOR SALE: Ham station with Yaesu-Musen radios. Belonged to W2VBM. Prices negotiable. Call 516-538-3825, Uniondale, NY.

Join the LAMBDA AMATEUR RADIO CLUB (LARC) since 1975, the only open and visible public-service oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, internet listserv and IRC, hamfest meetings, chapters, DXpeditions. Write LARC, P.O. Box 56069, Philadelphia, PA 19130-6069 or e-mail <lambda-arc@geocities.com>; <http://www.geocities.com/WestHollywood/1686>.

19" RACKMOUNT PC CHASSIS <www.cti-texas.com>.

CALLSIGN BRASS BUCKLES and Custom Ham Products. <www.TheMaineStore.com>

The famous copper **J-POLE** antenna for 2 meters. KF6TSS 5/8 wave version. $29.95. <http://home.earthlink.net/~drduggee/jpole.htm> or toll-free 1-888-881-5670.

PHASED ARRAY NETWORKS by COMTEK SYSTEMS deliver gain and front to back. Call 704-542-4808; fax 704-542-9652. COMTEK SYSTEMS, P.O. Box 470565, Charlotte, NC 28247.

PACKET RADIO AND MORE! Join TAPR, connect with the largest amateur radio digital group in the U.S. Creators of the TNC-2 standard, working on Spread Spectrum technology. Benefits: newsletter, software, discounts on kits and publications. For membership prices contact TAPR, 8987-309 E. Tanque Verde Road, #337, Tucson, AZ 85749-9399 (phone 940-383-0000; fax 940-566-2544; internet <tapr@tapr.org>; web: <http://www.tapr.org>).

WORK RARE CW DX? CW CONTESTS? Contest Code is the answer. Powerful hypnosis audio tapes teach you to copy High Speed (30/40 WPM) or Ultra High Speed (50/60 WPM). Subliminals speed you along! 20 min/day for 30 days yields results. Each tape $15.95 ppd US. $3.00 shipping/handling. Specify 30/40 or 50/60 tape. Amex/VISA/MC Order now! Call 1-800-425-2552, Alternative Arts

Advertiser's Index

now including websites

It's easy to advertise in CQ.
Let me know what I can do to help.
Arnie Sposato, N2IQO
(516) 681-2922 or FAX (516) 681-2926
e-mail:arniecq@aol.com

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-l00 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-l00 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-l00 (active tuning antenna system) ushers in a new age of mobile and field day operation (from HF to UHF frequencies). Add the optional ATBK-l00 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

YAESU

Choice of the World's top DX'ers

For the latest news, hottest products:
Visit us on the Internet! http://www.yaesu.com

Specifications subject to change without notice. Specifications guaranteed only within Amateur bands.Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

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

YAESU **Choice of the world's top DX'ers.**