73® Including Ham Radio Fun!

Amateur Radio Today

MAY 1996
ISSUE #428
USA $3.95
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International Edition

Can hams help cure AIDS?

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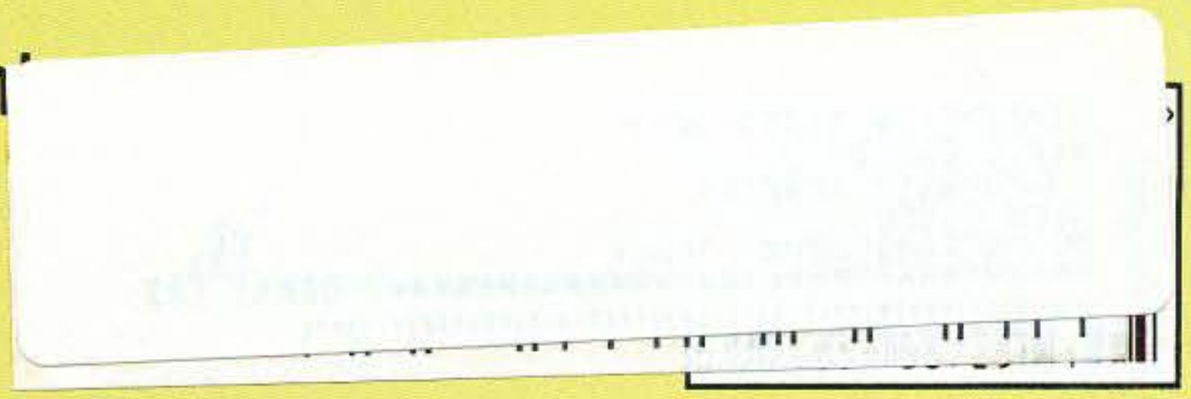
QSL Card Contest Winners

Hero Ham Helpers
Transmitter Hunting Equipment
Reviews: Hamtronics DVR-1
Ten Tec SS-11
T-Kit 2m Amp. Kit



The Dual Bander of Your DREAMS

Use the "slide-Lock" to lock/unlock keypad with the touch of a thumb!

Auto band selection! Proper band is automatically selected when a frequency is entered!

Display shows approximate battery voltage remaining each time you power on!

The IC-T7A works one band at a time! One touch of the band key toggles between 2M and 440 MHz!
Press and hold the same key to display the scan mode. It's easy!

One touch operation!
(No separate function switch)
Simply press and release a key for its 1st function, press and hold for its 2nd function!

Actual Size!
2 1/4 (W) x 4 13/16 (H) x 1 1/8 (D)

NEW!

IC-T7A Dual Bander!

• Ultra Small • Extra Easy to Use

Dual Bands at a Single Band Price!

ICOM "NEXT GENERATION" MINIATURIZATION – A single VHF/UHF PA power module and single circuits for Rx IF, PLL & Tx drivers • **MEMORY TRANSFER** – Move contents from one memory channel to another • **MEMORY ALLOCATION** – Store and scan VHF/UHF frequencies in any combination up to 70 channels • **4W VHF OUTPUT** – With optional 9.6V BP-173 (3W with 7.2V BP-180 standard) • **PC PROGRAMMABLE** – Optional DOS or Windows® software available • **"INTUITIVE" HELP FUNCTION** – Display instructs the user what to do when in the SET MODE • **ENCODE/DECODE** – 50 encode and 50 separate decode frequencies, independently programmable.

AND MORE: 70 memories · 9 DTMF autodialing memories · Adjustable DTMF transmit speed · Auto power save · Auto repeater offsets · High speed scan and scan timer · Backlit display · Auto repeater offsets · Wide band receive

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THE NEXT GENERATION

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ICOM

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

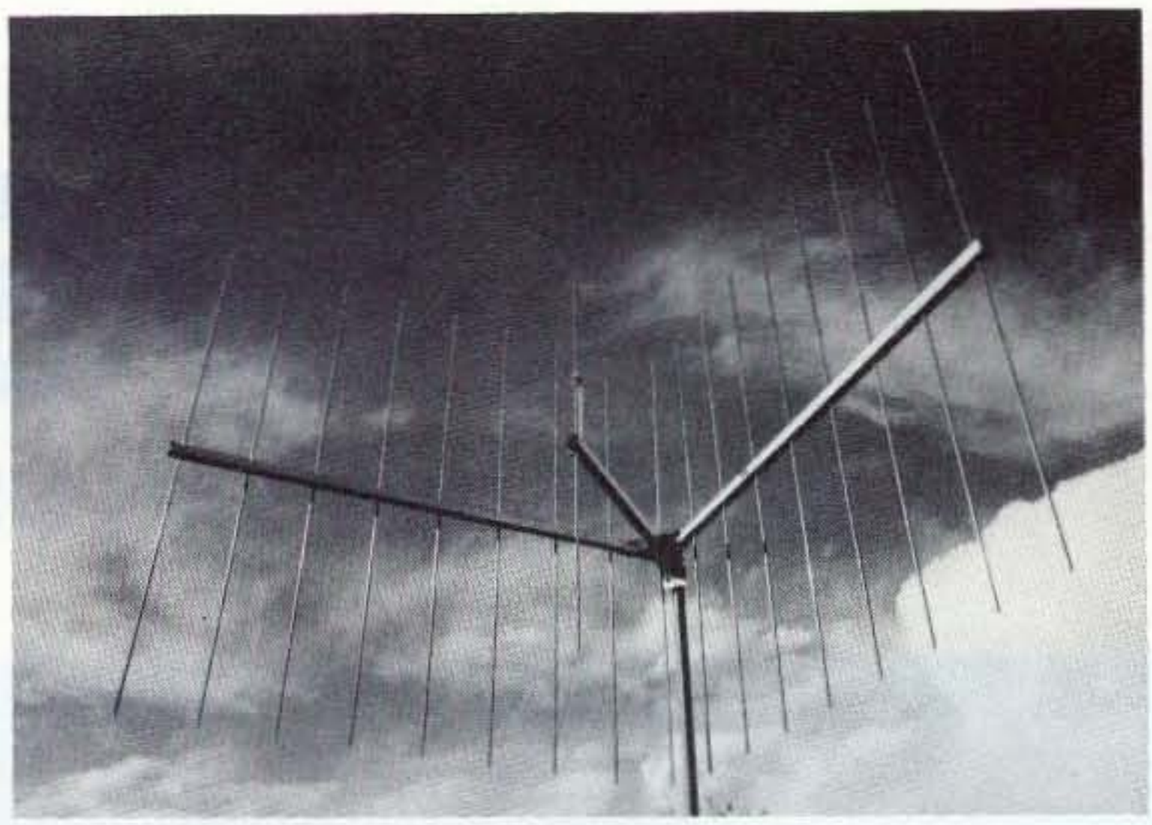
JRC *Japan Radio Co., Ltd.*

430 Park Ave., 2nd Floor New York, NY 10022 Phone: (212) 355-1180 Fax: (212) 319-5227

CIRCLE 159 ON READER SERVICE CARD

Corner Beam?

Big Forward Gain
Wide Backward Rejection
Exceptional Bandwidth
Compact Size



Your antenna makes all the difference at VHF and UHF—It determines transmitting range. It sets the limit for weak signal reception. And it decides what interference you'll hear & create.

An omnidirectional antenna radiates uniformly in all direction, and it also hears noise and interference from every direction.

A directional antenna not only sends your signal where you want, it hears the signal it's pointed at, rejecting others.

Gain really counts when you have to reach out across large distances to make contact. It also lets you operate with minimal power and cuts the interference you inflict on other stations.

Directionality is desirable in high activity locations. A clean sharp pattern without sidelobes or spikes reaches past the noise and interference to get the message through. Wide rear rejection lets you null out strong nearby signals to reduce interference.

CornerBeam vs. Yagi

When you want to contol your signal, think CornerBeam, not yagi. Take a look at what CornerBeam will do:

- •10 dB gain vs. dipole
- •40 dB Front-to-Back
- •60 degree Half-power Beamwidth
- •SWR <1.1:1 across the band
- •No dimension over 4 ft
- •Mounts directly to mast or tower
- •No need for offset or side mount for vertical polarization
- •Vertical or horizontal polarization
- •weighs only 10 pounds

Make the comparison with a yagi. A yagi with the same gain would have a boom 10 feet long. And yagi bandwidth would beless than half. Unlike a yagi, CornerBeam's pattern has no unwanted spikes or bustles to the side or behind.

Symetrical Pattern

CornerBeam's gamma match is engineered to be in-line rather than displaced from the element axis. The result is a distortion-free measured pattern that is precisely equal on each side of the antenna center line.

Bandwidth Counts

With its exceptional bandwidth, your CornerBeam can be put to work right out of the box without special tweaking. It can serve you now when you're working repeaters with an FM handheld, and later when you go after small signal DX at 144.05 or set out to work satellites.

CornerBeam can still be your beam when you join MARS at 143/148 MHz, team up with the Civil Air Patrol to locate downed aircraft at 154 MHz.

Scanning Too?

CornerBeam's directionality and gain extend your monitoring range on public service, marine, and aircraft frequencies.

CornerBeam for Repeaters

If your repeater shares a frequency with another, the deep wide null toward the rear could keep your signal out of the neighboring repeater's receiver and turn a deaf ear to its signal. A pair of CornerBeams can be combined to privide special radiation footprints. A CornerBeam aimed at an area your repeater hears poorly could improve service where incoming signals from HTs are presently too weak. CornerBeam makes it possible to increase repeater density while reducing interference.■

Corner Beam Models

Band	Max Dim	WindLd	Price
2 meters	4 ft	<2 sqft	$145
220 MHz	4 ft	<1 sqft	$145
70 cm	3 ft	<1 sqft	$115
Dual 146/435	4 ft	<3 sqft	$165

Construction: Aircraft aluminum. Booms are square. Elements are solid rod. Stainless hardware included for tower and mast mounting accepts up to 1.5" dia. mast and may be rotated for vertical or horizontal polarization. Connector is SO-239 for VHF, N female for UHF. Dual-Band antenna has separate driven elements, both with N connector.

Dimensions given in table are for reflector booms and reflector elements.

Options: Commercial Frequency $45.

Duplexer: Add $80 for VHF/UHF Duplexer and cabling for single coax feed of Dualband 146/435 Corner.

Shipping: UPS ground to continental USA ($11 S&H). Air Parcel Post to HI, AK, & Posessions ($14 P&H). Canada ($16 P&H).
Allow 2 weeks for delivery.

Can You Find theTiger'sTail?

If your eyes are sharp you can spot the **TigerTail**™ in the photo above. It puts extra growl into the signal from the Hand Transceiver it's attached to.

TigerTail™ improves SWR, lowers radiation angle, and extends range. You can use low power and save your battery pack, but still have a big signal.

Better than an amplifier, it improves reception too. **TigerTail**™ does all this by simply slipping under your flex antenna and just hanging down. It doesn't stick up or out or get in the way. It's the simplest way to boost your signal.

☐ **Yes, I want Performance in My Corner!**
___Send my CornerBeam: __2m, __220MHz, __70 cm, __Dual 146/435.
___Options: __DualBand Duplexer, __Commercial/Marine Frequency:_____
___Send my TigerTail. (1 for $7.95, 2 for $15, 3 for $21. Specify band.)

☐ **Yes, I circled the TigerTail! Knock $5 off my order.**

Name_____Amt. Enclosed_____
Call_____ Phone_____
Street_____ Unit_____
City_____ State_____Zip_____

AntennasWest
Box 50062-S Provo UT 84605

InfoPak $1

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CIRCLE 57 ON READER SERVICE CARD

73® Amateur Radio Today

MAY 1996
ISSUE #428

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73 Amateur Radio Today Magazine
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Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made upon publication. Please submit both a disk and a hard copy of your article (IBM or Mac formats), carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens must include their Social Security number with submitted manuscripts so we can submit it to you know who.

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HAM RADIO FUN SECTION

On the cover: QSL Card Contest Winners: January, KG6JY; February, W6DDB & W6JEP; March, KE5TC; April, 3A2MD & K3IVO. Thanks for all the entries which are still contenders for future months' contests. The prizes are CD's.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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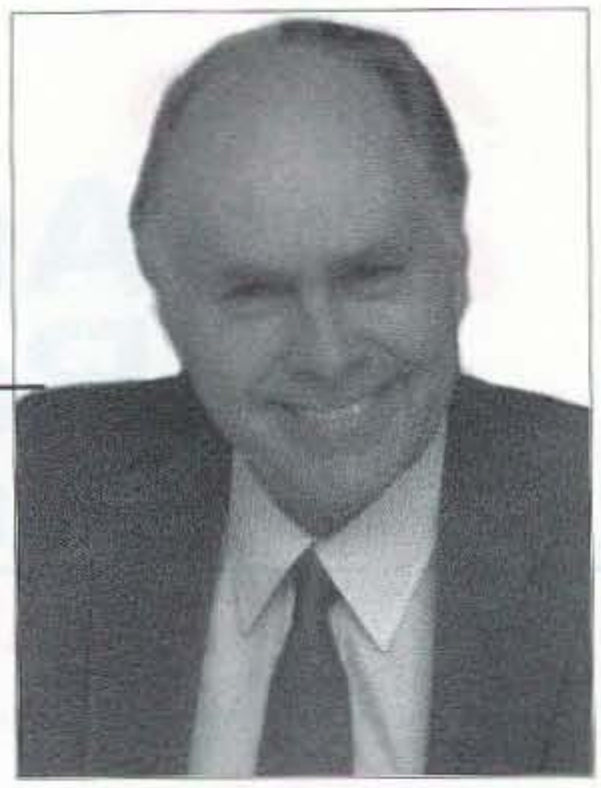
Contract: Even the most cursory glance at this text is sufficient to bind you, morally and legally, to take a kid (or kids) along on Field Day, get 'em fired up on amateur radio, and then help 'em get started toward a license. You'll feel good about yourself and our legal cousel won't have to hassle you.

Number 1 on your Feedback card

NEVER SAY DIE



Wayne Green W2NSD/1

Well, here we go with another of Wayne's editorials...starting off with a call for you to get elected to your state legislature—to help save amateur radio, if nothing else. Then I start teaching Making Money 101. I push (again) for you to give outstanding hams recognition before they die of poor nutrition and dehydration like the rest of us. I'll bring you up to date on the exciting recent cold fusion developments, plus some ideas on biological transmutation. Stuff like that.

I really should stop taking showers! That's when all of my better ideas hit. And this morning's brainstorm is a corker. It's a way we can turn our hobby into a national movement.

I've been fussing at you for years about getting youngsters back into the hobby, endlessly griping about how our beloved ARRL, then controlled by millionaire Mort Kahn W2KR, wiped out 95% of the school radio clubs 30 years ago, destroying the infrastructure which had been feeding hams into our hobby for the 17 years after World War II. Indeed, school radio clubs provided 80% of our newcomers up until 1964, and we had a steady 11% growth per year. Just thought I'd remind my Alzheimer's readers.

How would you like to help to not just keep amateur radio alive for the next generation, but to help make it grow again? How would you, at the same time, like to help a few million youngsters have a better chance at high-paying high-tech jobs? We hams, more than most people, know how important it is to understand the fundamentals of electronics and communications.

The electronic genie has been let out of the bottle and no amount of protectionism is going to stop the changes it's making in the world. Cellular phones, faxes, a new generation of personal communicators, computer networks, beepers, and so on have changed how business is run. Low cost communications and transportation has put workers almost anywhere in the world in direct competition for many of our jobs.

Our manufacturing plants are in competition with those in Korea and Pakistan, where their wages are not only a fraction of ours, but their educational systems are vastly better, and their degree of automation is enough to scare the hell out of any American manufacturer. I've written about a Korean factory I visited that turns out color TV sets by the millions. It is so totally automated that their labor per set is under 15 minutes, including packing and shipping!

More than ever before, it's either work smart or you don't work. Computers and communications are thinning the administrative ranks as well as the factory work forces. Most machines are now numerically controlled, with robots replacing workers without demanding vacations, sick pay, health insurance, unemployment insurance, coffee breaks, smoking breaks, or overtime.

I hope it is no news flash for you, but our worse-than-Third-World school system is *not* preparing our kids to cope with technology. And that's where *you* come in.

Yes, I know, the country is being run by politicians whose foresight is limited to their next reelection campaign. But that's not only a problem, it's one hell of an opportunity. And, with few exceptions (I hope), our politicians are being controlled by their major campaign donors. And that ain't us. The whole existence of amateur radio today depends on our being invisible instead of on what we're contributing to society.

Okay, here we are with around 700,000 licensed hams. That's a pretty good group to work with, but only if we can get 'em all headed in the same direction.

The plan

One of the biggest favors we amateurs could do for our states, our country, and our hobby, would be to get an eight-year course in electronics, communications, and computers into every grade school in the country. And I'll tell you exactly how we can do it, if you're game.

The key is to start locally and work upward. It doesn't cost a lot to run for the state legislature. What kind of an impact could we have if only 1% of the hams could get elected to state legislatures? That's 7,000. I don't think there are that many state legislators. Here in New Hampshire we have the largest state legislature in the country, with 400 representatives. Now that's local representation! But then New Hampshire is such a small state that I know all of my senators and representatives personally. And the governor. The president of the University of New Hampshire has been a good friend for over 35 years. And so on.

The main promise you can make to the voters is that you are going to work to improve our school system. By getting our kids a better education we'll help them make better incomes and be more able to compete with workers anywhere in the world. An eight-year course (grades 5-12) in technology isn't going to solve every educational problem, but it'll probably be better than any other single change we could make. If you can get the ball rolling in your state, we'll see this becoming a national movement. This isn't something that can be organized by Washington bureaucrats. This has to start locally.

Of course, one of the problems in teaching electronics is the speed of change. By the time a new textbook can be produced and accepted it's two or three generations of chips behind. Teaching kids 1990 technology in 1996 is stupid. The simple and logical answer to that is a monthly magazine for each of the eight grades. It would cover the material for the month, have a special encyclopedic section on one specific technology, and columns on high-tech hobbies such as ham radio, computer hacking, science fairs, and so on. The idea would be not only to teach the kids, but to get them personally involved so they would enjoy learning and go out of their way to learn as much as they could.

But, you probably argue, if you are a true-blue negative thinker, a magazine like that would cost around $25 a year per student and that might be prohibitive for many low income families. So how about allowing advertising to pay the freight? Would you really be upset if Sears, Nike, et al helped make a world-class education possible for your kids? Or grandkids?

I'll bet there would be a bunch of electronic and other science kits advertised too. Heck, with enough advertising, each issue could include a small parts kit or a CD-ROM. We might be able to wean the next generation away from Nintendo and TV.

A course like this would get a lot of kids interested in science, bringing us many more scientists and engineers. If we're going to get back our consumer electronics industries from Japan we're going to need 'em. Of course, we're only losing a few tens of billions of dollars in revenues, so who cares, right?

And I have a sneaky plan for making it possible for colleges to run tuition-free, without government or even alumni subsidization. And they'd graduate kids in three years instead of four, learning maybe double or triple what today's grads do. As a legislator you'll be in a position

Continued on page 17

ORDER NOW 1-800 4 HOBBY KITS

AIRCRAFT RECEIVER

Hear exciting air-craft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit.....**$29.95** Matching case set, CAR ...**$14.95**

FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz).....**$34.95**
CFR Matching case set **$14.95**
FT-146 Two Meter FM transmitter kit **$99.95**

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

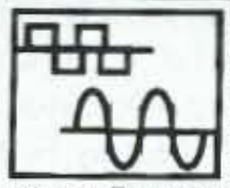
FM-5 Micro mike kit **$19.95**

FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic unit **$5.95**
FM-2, as above but with added mike pre amp **$7.95**
FM-4, long range with very sensitive audio pickup **$14.95**
PB-1, Phone bug needs no battery, hooks to phone line **$14.95**
MC-1, Micro size sensitive mike cartridge for FM-1,2,4.....**$2.95**

SYNTHESIZED AUDIO GENERATOR



DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0. 01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

SG-550 Kit ..**$199.95** SG-550WT assembled **$269.95**

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....**$29.95**
Shortwave converter kit, SC1 .....**$27.95**
Matching case set for SR1, CSR **$14.95**
Matching case set for SCI, CSC **$14.95**

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit.....**$29.95**
CAM Matching case set.....**$14.95**

SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stabilty to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit.....**$49.95**
SCN Matching case set.....**$14.95**
SCN-1WT Assembled SCN-1 and case.....**$89.95**

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experierence the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....**$59.95** CRV Matching case set.....**$14.95**
RV-1WT Assembled RV- 1 and case.....**$89.95**

TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit .....**$129.95** CURC Matching case set **$14.95**
URC-1WT Fully assembled URC-1 and case **$189.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$27.95** CSCA Matching case set.....**$14.95**
FR-1 FM receiver kit.....**$24.95** CFR Matching case for FR-1 .....**$14.95**

L-C METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit .....**$34.95** CLC case set.....**$14.95**

MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit .....**$24.95** MSC-1 DC motor kit.....**$24.95**
CSMD SMD-1 case .....**$14.95** CMSC MSC-1 case.....**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit **$34.95**
CFM Case,whip ant set.....**$14.95**

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit.....**$49.95**
CDN Matching case set.....**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case **$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$99.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit.....**$39.95** PH-15 Dual Log bargraph kit ..**$39.95**
PH-16 Dual Semi-Log bargraph kit.....**$39.95** CPH Matching case set **$14.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit **$39.95**
CSSD matching case set.....**$14.95**
SS-70WT Assembled SS-70 and case set **$79.95**

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit **$19.95**

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit.....**$99.95** CTG Matching case set.....**$14.95**
TG-1WT Fully assembled TG-1 and case.....**$149.95**

DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit.....**$59.95** CCB Matching case set **$14.95**

ORDERS CALL **1-800-4 HOBBY KITS** (446-2295) ORDERS ONLY
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TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. Add $4.95 for shipping, handling and insurance. For foreign orders add 20% for surface mail. COD (U.S. only) add $5.00. Orders under $20 add $3.00 NY residents add 7% sales tax. 90-day parts warranty on kit parts. 1-year parts & labor warranty on wired units.

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CIRCLE 34 ON READER SEVICE CARD

LETTERS

From the Ham Shack

Eleanor Schlan K6LGZ. You asked about good public speakers. I heard Jerry Freeman K9AAH, who just retired from the FCC. He gave a *fantastic* talk to our ham group.

You're right! I've known Jerry for 30 years or so, and he's got a wealth of great FCC-ham stories to draw on...Wayne.

Guy A Matzinger KB7PNQ. The hobby of amateur radio is showing some classic symptoms of hypersensitivity to suggestions that code testing speeds should be eliminated or reduced to not more than 5 wpm. The latest drumbeat from pro-code advocates who adamantly oppose the relaxation of Morse code tests is, "Standards will fall." Test speeds of 5, 13, and 20 wpm could be considered standard speeds for test purposes, but how does the day-to-day operation of anyone's station tie into these undefined standards? Even the FCC avoids defining their standards. Western Union had a minimum code speed (standard) for their telegraphy operators— so did the Armed Services. Amateur radio is not a private activity or a professional telegraphy service and those using CW should be able to operate at their own speed. Why, then, are 13 and 20 wpm code tests jammed down amateurs' throats?

Pro-code advocates expend enormous amounts of ego-driven energy with their self-centered views that those who cannot demonstrate "high speed code proficiency" should not be entitled to enjoy the hobby and, with bureaucratic pandering, they have put up legal barriers to limit participation. These rampant egos, with their lingering "standards" paranoia and their total disregard for technical advancements, make it impossible for mature amateurs to respect any organization that contends they represent amateur interests. Fearlessly soliciting meaningful feedback from the majority of amateurs, not just from those who have convinced themselves that limiting participation is a virtue, will drive improvements and, with rational collaboration, will create the future of the hobby. Political action will then achieve results that support the desires of the majority—perhaps in a manner similar to that which changed apartheid—with or without approval of hard-line opponents.

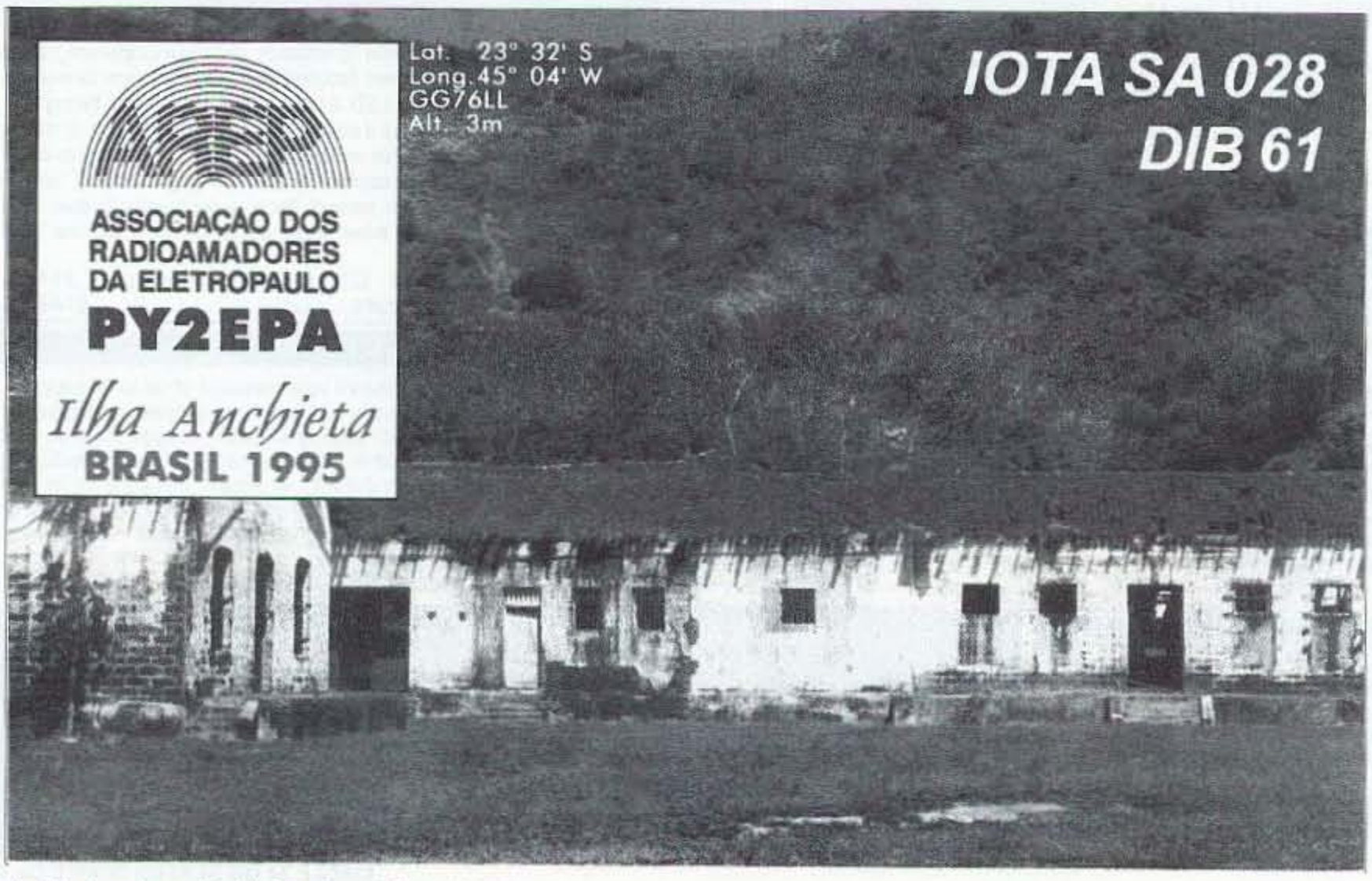
Radio spectrum is owned by the citizens of this country and both the use of that spectrum and amateur licenses are subsidized by taxpayers. Most counties charge amateurs annual licensing fees, but pro-code advocates contend that amateur operators are entitled to these "freebies" because of the "services" rendered to the community. This delusion is constantly being generated by those who want something for nothing. Occasionally some public service may be provided, but, as police from across the country have reported, cell phones are the preferred choice for emergency communications.

The constant babble that this is a technical hobby may have had some merit 60 years ago, but considering the "plug and play" technology of today's equipment, anyone who can read can assemble the necessary components to operate an amateur station. It is doubtful that 1% (7000+) of the amateur population constructs their own equipment or makes significant modifications to existing gear. The majority of amateurs are not even interested in how—technically speaking—their hardware achieves results. Continuing technological improvements can't be stopped, but improved operating could, and should, be provided to ensure an enjoyable hobby experience for the majority of amateurs.

Current testing practices no longer facilitate the society of amateur radio operators. Old ways may have been adequate years ago, but, to survive in the future, amateur radio must face the reality of today's communications technology and be responsive to the innovations and ingenuity that, even now, is evolving around the world. Recognizing the need to change is essential for any activity that wishes to avoid obsolescence—and just fading away.

Troublemaker...Wayne

Carlos Carneiro PY1CC. Here's the QSL that was sent to the stations who contacted ZW2EPA on Ilha Anchieta during a four-day DXpedition. It's a small island about five miles off the coast of São Paulo. It was once run by pirates, then by slave traders, next it was a prison, and now it's a park run by the Forrest Institute for tourists. The operators were PY2CL, PP5LL, PY2PA, PY2AH, PY2EVW, PY2FAR, and PU2NMA. The QSLs are handled by PY2YW. The best band was 15m, where almost 900 contacts were made. And almost 600 on 20m. Well, band conditions were poor. It's not a new country, but it was a new island for the Islands Of The Air (IOTA) and Brazilian Islands Awards (DIB).

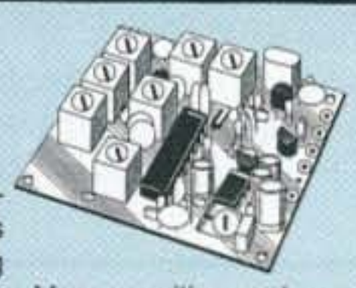


Walter Rawle VE1AWS/W5. The article Crystal "Controlled Audio Generator" by J. Frank Brumbaugh KB4ZGC, Nov. 1995, issue 422, was very well done except for a significant flaw in the schematic diagram. C11, the output coupling for the Q3 emitter follower stage, is connected to the positive supply rail. The accompanying text indicates that the Q3 stage output is connected to the Q2 mixer stage. This error motivates an interesting question: Does the mixer work better with both signals applied to the base with the transistor driven into saturation, or does the mixer work better with one signal applied to the base and the other signal applied to the emitter with the transistor operating in its linear region? It would be beneficial to have the author reply on this item.

On a second topic, I would be interested in reading your opinion on what I refer to as the "high price" of ham radio equipment. Despite the avalanching price of RF components resulting from the upward swing in the commercial wireless industry, ham radio equipment prices remain at levels consistent with those five years ago. As an RF engineer working for a company involved in the commercial spread spectrum systems market, I

Continued on page 25

WWV RECEIVER



Get time & frequency checks without buying multiband hf rcvr. Very sensitive and selective xtal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers. ..... **only $59 kit, $99 w/t.**

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FEATURES:

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- **High gain:** 13-20dB (depends on freq)
- **Wide dynamic range** - resist overload
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**Specify tuning range: 26-30, 46-56, 137-139, 139-152, 152-172, 210-230, 400-470, 800-960 MHz.*

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- **Low-cost** MOSFET preamp.
- **Small size**. Only 5/8"W x 1-5/8"L x ¾"H.
- Nf 1.2dB vhf, 1.5dB uhf.
- Solder terminals for coax & pwr connect.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

HELICAL RESONATORS

Helical resonator filters may **reduce your intermod & cross-band interference.**

MODEL HRF-(*), *$59 vhf, $99 uhf.*

**Specify tuning range: 136-140, 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

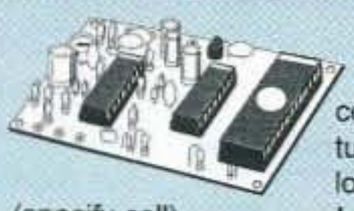
Low noise converters to receive vhf & uhf bands on a 10M receiver.

- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (atv conv. to chan 3).
- **Kit less case *$49*, kit w/case & BNC jacks *$79*, w&t in case *$99*.**

TRANSMITTING CONVERTERS

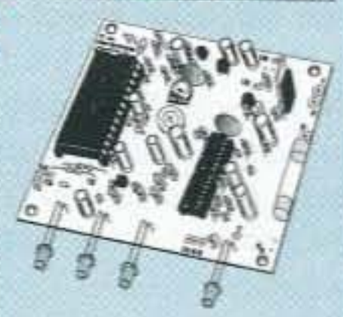
XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and atv. 1W output. **Kit only $89 (vhf), $99 (uhf).** *PA's up to 45W available.*

REPEATER CONTROLLERS



CWID-2. Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) ..... **only $54 kit, $79 w/t**

COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter.



.....**kit $99, w&t $149**

COR-3. COR, timers, court beep .... **kit $49**

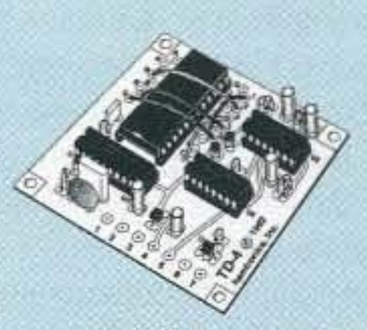
CWID. Diode programmable ..... **kit $59**

COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) .....**kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. .....**kit $59, w&t $99**

TD-4 SELECTIVE CALLING MODULE.



Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club for emergencies. Also may be used to **control autopatch or other device**, like TD-2 except only one output. .....**kit $49, w&t $79**

TD-3 CTCSS DECODER/ENCODER. Prevents access to repeater or receiver unless proper tone is present. Tone output for transmitters, too. ..... **kit $29, w/t $59**

AUTOPATCHES

AP-3 REPEATER AUTOPATCH. Reverse patch and phone line remote control. .....**kit $89, wired & tested $139**

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver. ..... **kit $39**

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DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver.....**kits $49, w&t $79**

9600 BAUD DIGITAL RF LINKS. Call for info on low-cost packet networking system: MO-96 Modem and special versions of our 144, 220, or 450 MHz fm xmtrs and rcvrs. Use directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

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REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit still only $1095
w&t still only $1295

50 & 900 MHz bands slightly higher

- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!**.....**adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID**. .....**Kit only $795, w&t $1195**

REP-200N Repeater. Want to use your own controller? No problem! We'll make you a repeater with rf modules only. ..... **Kit only $695, w&t $995**

XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

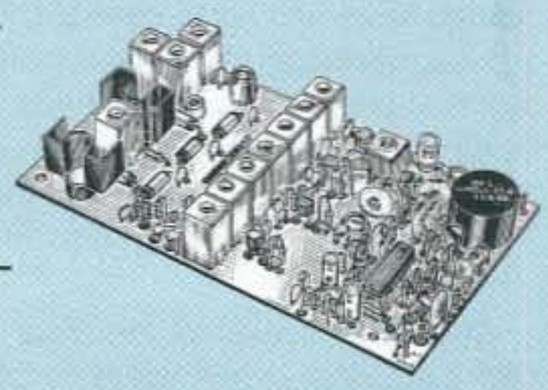
Also available in rf-tight enclosures, and with data modems.

FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.

- **TA51**: 50-54, 143-174, or 213-233MHz.
- **TA451**: 420-475 MHz . *New low price!*

Either model: .....**kit $99, w/t $169.**

- **TA901**: 902-928 MHz, (0.5W out); *New low price!* ..... **w/t $199.**



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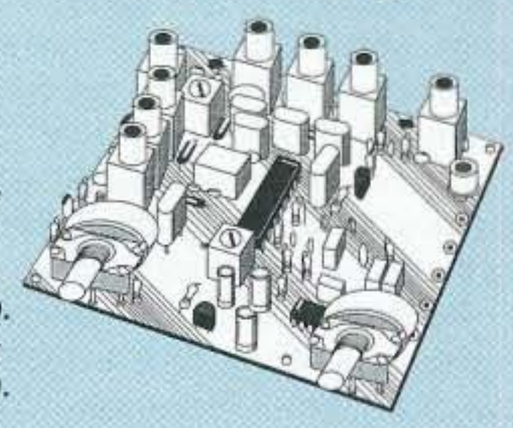
For fm, ssb, atv. Output levels from 10W to 100W. Models **starting at $99.**

FM RECEIVERS:

R100 FM RECEIVERS for 46-54, 72-76, 140-175, or 216-225 MHz. **Very sensitive** – 0.15uV, **exceptional selectivity** – both crystal & ceramic if filters for >100dB at ±12kHz (best available anywhere), **flutter-proof** squelch. .....*New low price!* **kit $129, w/t $189.**

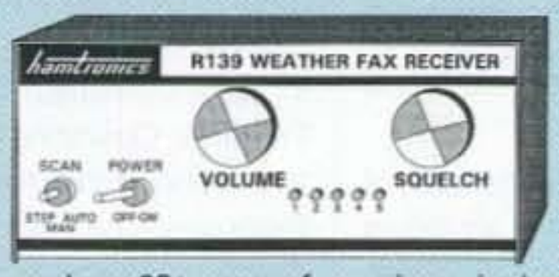


- **R451 FM RCVR,** for 420-475 MHz. Similar to above. *New low price!* **kit $129, w/t $189.**
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion. *New low price*.... **$159, w/t $219.**

R150 MONITOR RCVR for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit,** easy to assemble and align.....**kit only $99, w/t $189.**

- **R120 AIRCRAFT RCVR** for 110-136 MHz ..... **kit only $99, w/t $219.**

WEATHER SATELLITE RECEIVER



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Four Days In May — The QRP Event of 1996

QRP Amateur Radio Club, International (QRP-ARCI) proudly announces the first annual QRP Symposium to be held on Thursday, May 16 1995 - the first day of four festive days of 1996 Dayton Hamvention QRP activities. Mark your calendars and get your hotel reservations in early for this not-to-be missed QRP event of the year.

Conference presentations, meetings and workshops on everything you wanted to know about amateur radio QRP will all be part of this full day Thursday event to be held at the Days Inn Dayton South (513-847-8422). QRP-ARCI Symposium attendees will start their day with a wake-up coffee social and then plunge into a morning of multimedia QRP presentations by renowned QRPers and QRP equipment manufacturers. A short break for a catered lunch and some special QRP door prizes and then back to an afternoon of more exciting QRP technical presentations. And if that is not enough, then come join us for a Thursday evening of QRP break-out session tutorials. The 1996 QRP-ARCI Symposium will be the talk of the Dayton Hamvention.

QRP-ARCI continues the "Four Days in May" QRP extravaganza with nightly hospitality suite sessions, where QRP projects from around the world are displayed with a pride that only a QRPer could appreciate. "Four Days in May" QRP-ARCI week culminates with the annual QRP-ARCI Friday Night Banquet honoring QRP dignitaries for their service to the amateur radio community.

Registration for the QRP Symposium will be $30 if prepaid by May 1, 1996 and $35 if paid after that date or at the door. Please send your $30 (US check, money order) QRP Symposium Registration fee made out to Paulette Quick, N9OUH at the address below.

Paulette Quick, N9OUH, Registration Chairman
(plquick@facstaff.wisc.edu); P.O. Box 145,
Madison WI 53701-0145; (608) 263-9326 (work phone)

Happy Birthday 6 Meters

An important anniversary took place in March of 1996—it marked fifty years that US radio amateurs have been on 6 meters. This means that other than the WARC bands of 10, 18 and 24 MHz, 6 meters is one of the newer Amateur Radio bands. It remains as one of our most interesting ham bands and is seeing rapid growth in several areas of the world.

U.S. amateurs were first assigned the 6 meter band in March of 1946, when they were moved off the 5 meter (56MHz) band. This reallocation took place in order to accommodate a new block of VHF TV channels by the FCC. There was little commercial gear available at that time, so many hams on 6 meters homebrewed their own 6 meter gear. During the 1950s and 1960s, commercial gear that could be converted for 6 meter, AM operation was manufactured. Six meter AM was thought of as a good local communication mode for line-of-sight work. In addition, it was used as part of the Civil Defense emergency network by hams involved in public service. Six meters was particularly popular with the Technician Class hams and this led to the label "Technician's band." From L'Anse Creuse Amateur Radio Club newsletter.

Computers vs. Automobiles

Here's a quote from Robert Cringley, "InfoWorld", "If the automobile had followed the same development as the computer, a Rolls-Royce would today cost $100, get a million miles per gallon, and explode once a year killing everyone inside."

HamVention Forum News

The forums at the 1996 Dayton HamVention will continue the tradition of offering more information than you could ever absorb in three short days, but you're up to the challenge, right?

On Friday there will be a special presentation on the role amateur radio played in the aftermath of the Oklahoma City bombing, along with presentations on AMSAT, TAPR Digital Radio, Antennas, Using Ham Radio in the Classroom, County Hunters, and the Electrical Safety Demo.

On Saturday, things get really busy because several forums from Friday and Sunday have been switched to allow improvement in the facilities. Some of you may have experienced the limitations of Room 7 during the last few years. You'll be pleased to know that Room 7 has been eliminated. Arrangements have been made for three forum rooms at the Meadowdale High School, which is located just a half mile from HARA. MHS is where the alternative activities are held, along with the license exams, and is regularly served by free buses. This year, there are seven forums scheduled at MHS on Saturday only, and bus coverage has been beefed up to assure that those who want to attend the forums at MHS will have the quickest trip that we can provide, both coming and going. The forums at MHS include: Combined QRP, Media and Ham Radio, Firebirds, Operating Techniques for New Hams, International Hungarian ARC, OSSBN, and Logging Programs. The alternate activities, including a luncheon, and the license exams will also be at MHS on Saturday.

Saturday has always been the big day for forums at HamVention, and it may take some planning to get to all of the ones that interest you. Forums at HARA include: DX, Contesting, MARS, Amplitude Modulation, YLRL, Amateur Radio and the Internet, Weather Satellites, Geritol Net, SSTV, ATV, ARES, Youth in Amateur Radio, PACTOR, Direction Finding, VHF/UHF/Microwave, Digital Digest, AMSAT, Tech Talks, and the Electrical Safety Demonstration.

Then on Sunday the choices include: FCC, ARRL, Amateur Radio and the Law, Amateur Radio Repeater Operation, Mobile Radio Installation Tips, 10-10 Electrical Safety Demo.

There is so much to take in just from the forums you might be tempted to skip the vendors and the flea market! *From the RF-Carrier, DARA.*

JY1: Strong on MidEast Peace

On the international scene, Jordan's King Hussein JY1, is in the news once again. His Majesty was in Washington in March, where he joined the U.S.-led battle to prevent a wave of terrorist bombings in Israel from destroying chances for peace in the Middle East. In a meeting on Thursday, March 14th, with President Bill Clinton, the King said the bombings, which have killed 57 people, were the work of a small group acting against an overwhelming majority of people in the Middle East who are seeking a lasting peace.

According to several newspaper reports, King Hussein's powerful words helped to strengthen a United States-led drive to isolate the militants behind the bombing campaign and keep the Middle East peace process alive.

While JY1 has condemned the bombings previously, his presence at the White House alongside President Clinton gives a much higher profile to his own anti-terror stand.

Vanity, Vanity...

If you are wondering why the vanity callsign program is still on hold, look to some of your fellow hams for the answer. Several are still petitioning the FCC for last-minute changes in the program. Those petitions, coupled with a mandate from Congress to implement the Telecommunications Rewrite Act, have put vanity calls on hold at least until mid-year.

Still awaiting FCC action are Petitions for Reconsideration filed last fall by Charnelle H. Summers W4IJE; David B. Popkin W2CC; Robert Nelson, on behalf of the Hill Country Amateur Radio Club; and Christine M. Gill, on behalf of the Southern California Repeater and Remote Base Association.

As noted, it appears as if the FCC will not even begin to look at any of these petitions until early this summer. How long after that it will take to dispose of them is not known. And there is always the possibility that more Petitions for Reconsideration could arrive. By law, each must be addressed.

Even worse, some of the current crop of petitioners might take their cause further if the commission does not give them a decision favorable to a given position. This means appeals before the full Commission and maybe even taking the matter into federal court, if they have the money and the desire to do so.

Meantime, the FCC vanity callsign application Form 610V is now available, but the FCC will not accept completed forms until the appropriate filing gates are opened.

TNX Bill Pasternak WA6ITF, Amateur Radio Newsline producer & editor. 73

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- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

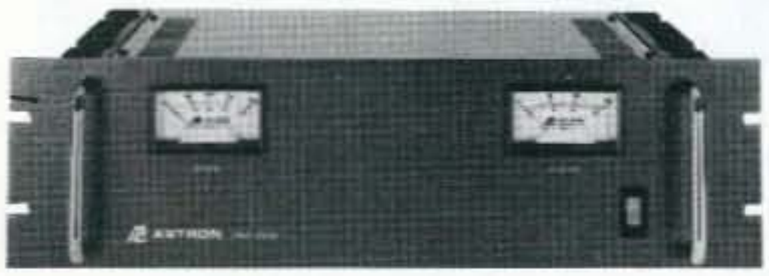
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*S—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Build the Bioelectrifier

Heal yourself and take a poke at the medical establishment at the same time!

Thomas M. Miller WA8YKN
314 South 9th Street
Richmond IN 47374

One of the first things a new amateur learns is that electricity and biology are not very compatible. A brush with the AC line can be a painful experience, and accidental contact with the high-voltage supply of a large transmitting tube can be fatal. Because of this early training, occasionally reinforced by an unpleasant accidental jolt, it might surprise some hams that tiny electrical currents can be beneficial to the human body.

For some time, doctors have known that passing a small current through a broken bone will cause it to heal faster. Damaged tendons and nerves also seem to respond to this treatment. Exactly why this works is not known, although a doctor once explained to me that it seemed to focus the body's attention on the area.

Recently, doctors at the Albert Einstein College of Medicine reported discovering that passing a current of only 50 microamps through the blood can prevent certain viruses, notably the HIV virus, from replicating. The current became even more effective when the polarity was reversed several times a second. The implications are enormous.

Unfortunately, there has been very little interest in this phenomenon by the medical community. Those of us who read Wayne Green's editorials have become aware of a simple device which introduces a small electrical current through the legs by placing electrodes on the ankles. Since the arteries in the legs are large, and the blood has less electrical resistance than the surrounding tissue, this technique results in most of the current flowing through the blood. This is an ideal approach for amateur experimentation, since it is totally external, and the required voltage and current levels are so tiny as to pose no danger. I decided to design such a device, using a simple printed circuit board, and easily obtained parts, so that it could be duplicated by other amateurs.

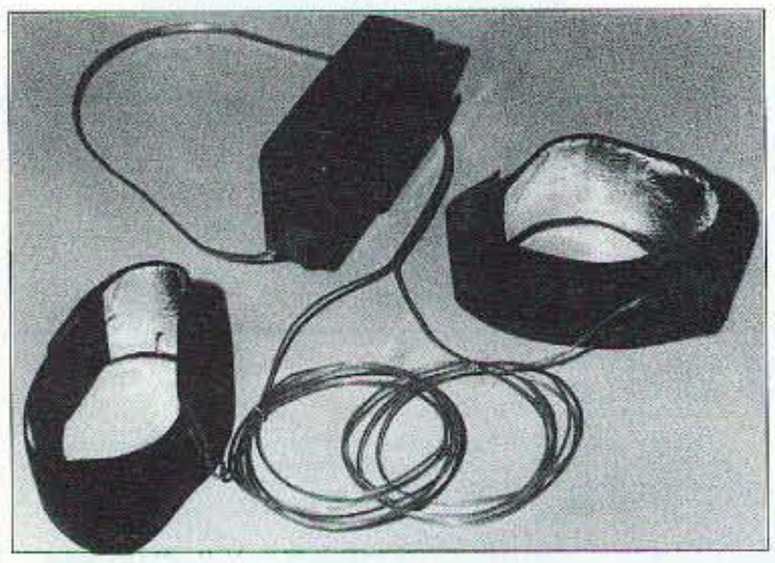


Photo A. *The Bioelectrifier with belt clip and ankle electrodes.*

At this point, let me state that I make no medical claims for this device. To paraphrase a famous Chief Medical Officer, I'm an engineer, not a doctor. Since very few doctors are electronics experts, there are many who would love to research the possibilities of this approach to eliminating vires in the blood, but are unable to build the needed experimental device. They need your help.

So I present this circuit for those wishing to help doctors experiment in an unknown field, and also as an interesting study in design and construction.

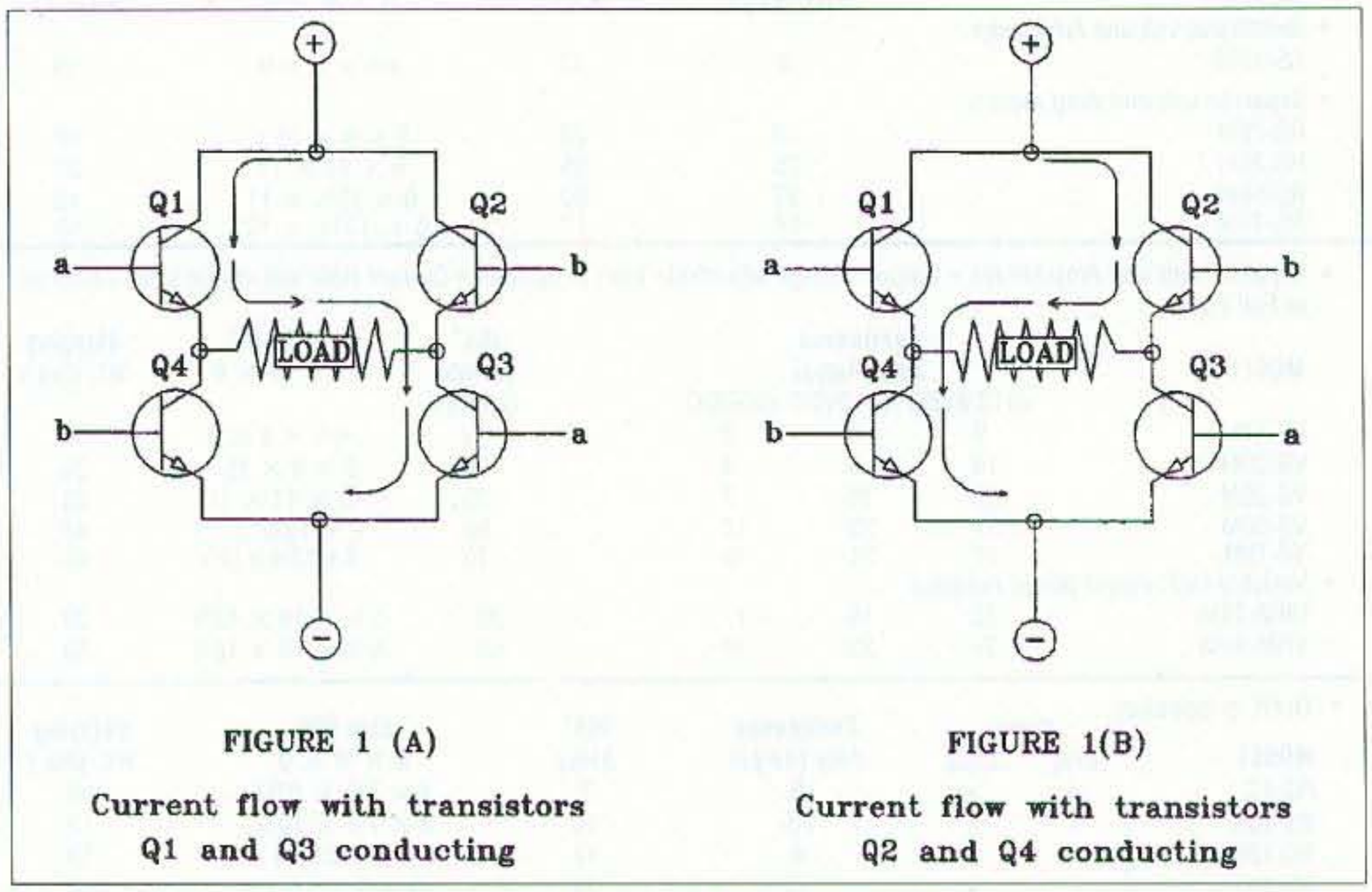


FIGURE 1 (A)
Current flow with transistors Q1 and Q3 conducting

FIGURE 1(B)
Current flow with transistors Q2 and Q4 conducting

Fig. 1. *Four transistors are used to reverse the current flow by energizing them in pairs.*

Designing a Bioelectrifier

Before attempting to design any device, it's a good idea to make a list of goals. In this case, it's a simple list:

(1) The device should produce a current flow of 50 microamps from one ankle to the other. Experimentation has shown that this requires 30 to 35 volts.

(2) It must be capable of reversing the current flow several times per second. This rate should be adjustable.

(3) It must be all solid-state—no DPDT relays clacking away, eating up the batteries.

MFJ *tunable* DSP *filter*

NEW

. . . Tunable "brick wall" bandpass, lowpass, highpass, notch, SSB, CW filters . . . programmable pre-set filters . . . automatic multiple notch filter eliminates heterodynes . . . adaptive noise reduction reduces noise and QRN . . . for Voice, CW, Data . . .

MFJ's ***tunable*** **super DSP filter automatically eliminates heterodynes, reduces noise and interference** ***simultaneously*** **on SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX, weak signal VHF, EME, satellite -- nearly any mode.**

Only MFJ gives you tunable and programmable "brick wall" DSP filters

MFJ-784B

$239.95

Patent pending

You get MFJ's tunable FIR linear phase filters that minimize ringing, prevent data errors and have "brick wall" filter response with up to 57 dB attenuation just 75 Hz away.

Only **MFJ gives you 5** ***tunable*** **DSP filters. You can** ***tune*** **each lowpass, highpass, notch, and bandpass filter including optimized SSB and CW filters. You can** ***vary*** **the bandwidth to pinpoint and eliminate interference.**

Only **MFJ gives you 5** ***factory*** **pre-set filters and 10** ***programmable*** **pre-set filters that you can customize. Instantly remove QRM with the turn of a switch!**

You get MFJ's ***automatic notch*** **filter that searches for and eliminates** ***multiple*** **heterodynes.**

You also get MFJ's advanced ***adaptive noise reduction.*** **It silences background noise and QRN so much that SSB signals sound like local FM.**

The ***automatic*** **notch and** ***adaptive*** **noise reduction can be used with** ***all*** **relevant tunable pre-set filters.**

Automatic gain control **(AGC) keeps audio level constant during signal fade.**

Tunable highpass/lowpass filters

For Voice and Data, nothing beats MFJ's exclusive *tunable* highpass/lowpass FIR linear phase "brick wall" filters.

You can tune the lower cutoff frequency 200 to 2200 Hz and the upper cutoff frequency 1400 to 3400 Hz. This lets you create *custom* filters for Voice, Data and other modes.

Signals just 75 Hz away literally disappear -- they are reduced 57 dB!

One position gives you two tunable filters you can use together. For example, tune one to mark, one to space and set the bandwidth tight for an incredibly sharp RTTY filter.

15 *pre-set* filters -- use factory set or program your own

You can select from fifteen convenient *pre-set* filters. Use them for SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX or any mode you can think of.

If you don't like our pre-set filters, you can program your own -- *an MFJ exclusive!* Save center frequency/ bandwidth, lowpass/highpass cutoffs, auto/manual notch, noise reduction -- all filter settings -- in 10 *programmable* filters.

Only MFJ gives you the best of both worlds -- *tunable* filters to eliminate nearly any QRM and fast convenient *pre-set* filters customized for any mode.

NEW MFJ-784B Features

- Tunable *Spotting Tone*™ -- an *MFJ invention* -- accurately tunes even the narrowest CW filter
- MFJ's exclusive *Adaptive Tuning*™ -- Center frequency tuning automatically becomes finer as you narrow bandwidth -- makes extremely narrow filters easy-to-use
- Improved automatic notch with *variable* aggressiveness
- New quieter audio amplifier gives you *full* 2½ Watts output
- Speaker ON/OFF button, phones always active
- Accurate easy-to-use input level indicator
- *Filter Talk*™ function sends precise filter settings in Morse code
- Filter automatically bypasses during transmit for monitoring CW sidetone, voice or data by sensing PTT line
- Improved manual notch in the CW mode
- Manual notch and automatic notch can be used simultaneously
- Noise reduction,automatic notch and tunable manual notch can be used in Memory mode
- Adjustable line level output
- More Mark-Space frequencies and baud rates for data filters
- Improved self-test for all digital circuitry, switches and controls

Plus more . . .

A push-button bypasses your filter -- lets you hear the *entire* unfiltered signal.

2½ watt amplifier, volume control, input level control, speaker jack, PTT sense line, line level output. 9½x2½x6 inches.

Plugs between your transceiver or receiver and external speaker or headphones. Use 12 VDC or 110 VAC with MFJ-1315, $14.95.

MFJ-780, $99.95, "brick wall" DSP data filter. Plugs inside MFJ-1278B or MFJ-1278 Multimode Data Controller.

Automatic notch filter

MFJ's automatic notch filter searches for and eliminates multiple heterodynes in milli-seconds. It's so fast, that even *interfering* CW and RTTY signals can also be eliminated.

With up to 50 dB attenuation, you'll copy stations otherwise masked by heterodynes.

Voice signals aren't degraded because the notch is extremely narrow.

Turn on *automatic* notch and you'll never hear unwanted heterodynes of tuner-uppers.

You can *selectively* remove unwanted tones using the two *manually tunable* notch filters --an MFJ exclusive. Knock out unwanted CW stations while you're on CW.

Adaptive Noise Reduction

Turning on noise reduction silences background noise. It reduces fatigue and makes noisy signals readable.

Noise reduction works in all filter modes and on all random noise -- white noise, static, impulse, ignition noise, power line noise, hiss.

The LMS algorithm gives you up to 20 dB of noise reduction. Noise reduction is adjustable to prevent signal distortion.

Unlike other filters, speech is not distorted by unequal time delay.

When signals are weak, you can improve copy by removing noisy high and low speech frequencies that contain little information.

On crowded HF bands, you can "slice-off" overlapping SSB signals to improve copy.

You can highpass filter out hum, pulses, rasp and other irritating low frequency noise.

Tunable bandpass filters

Narrow band signals like CW and RTTY jump out of QRM when you switch in MFJ's *exclusive* tunable FIR bandpass filters.

You can tune the center frequency from 300 to 3400 Hz, and vary the bandwidth from 30 Hz to 2100 Hz -- from super-tight CW filters to wide razor-sharp Data filters.

As you narrow the bandwidth, interfering signals drop out, because, just 60 Hz away, they're down by over 47 dB.

You can use narrower bandwidths to fight tough QRM because these linear phase filters don't distort signals with unequal time delays.

Even with the narrowest 30 Hz bandwidth, you'll never have a problem with ringing.

No Matter What ™ guarantee

You get MFJ's famous one year No Matter What™ unconditional guarantee. That means we will repair or replace (at our option) your MFJ-784B no matter what for a full year

Call your dealer for your *best* price

Automatically eliminate heterodynes, reduce noise and QRM on Voice, CW and Data. Call your favorite dealer for your best price and order your MFJ *tunable* DSP filter today!

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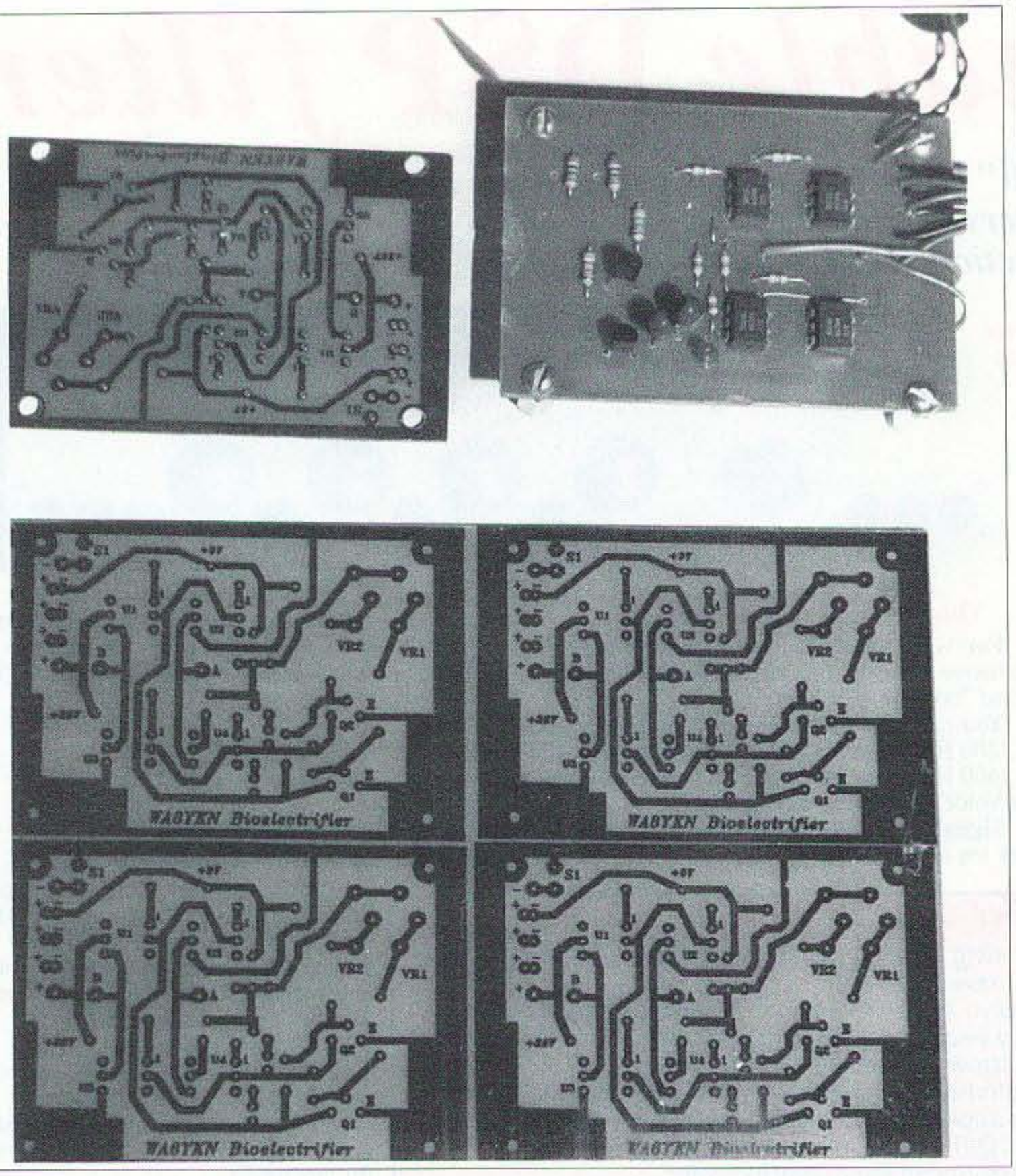

Photo B. *Four circuit boards are etched on a single piece of copperclad and are cut apart after drilling.*

(4) It must be small, light, and easy to carry. The ideal form would look like a pocket pager.

(5) It must have a low current drain for long life from small batteries.

(6) It must be as simple and inexpensive as possible, so that it may be easily reproduced.

This last goal is one of the most important in designing any device or circuit. It is, in fact, Occam's Razor, a corollary which states that when there are many ways to solve a problem, the best solution is the simplest one.

At first glance, it would be tempting to use logic chips, or perhaps a 555 timer and a flip-flop to get a variable timebase with an equal on-off ratio. However, this direction leads to a regulated power supply, high current drain, and a complex circuit. Also, logic chips will not switch 35 volts without an additional driver stage. Remember rule number six... the simplest way!

Maybe we'd be better off starting from the other end. Reversing polarity requires the solid-state equivalent of the DPDT relay. As it turns out, there is just such a circuit commonly used to drive and reverse DC motors. It uses four transistors in an "H" configuration, the load being in the center (see Fig. 1). When transistors 1 and 3 conduct, the current flows in one direction, while energizing transistors 2 and 4 reverse the flow. Most small switching transistors will stand up to our requirement of 35 volts at 50 microamps, but here we run into a new problem. For each direction, two transistors are in series, with the load in the middle. This creates a difficult bias arrangement to drive both transistor bases equally. Fortunately, there is a neat solution—the optocoupler. This invaluable device contains an LED and a phototransistor in one package. Energizing the LED produces light, which causes the phototransistor to conduct. No base voltage is required, therefore there are no bias requirements. Optocouplers are usually used to drive another device, but our requirements are so small that we can use them as output transistors.

The cheapest optoisolators cost less than a dollar and will withstand over 30 volts with current ratings in the hundreds of milliamps. For a few cents more, optocouplers are available that will withstand 80 volts or more.

With four optocouplers in the output of our device, all that remains is to alternately drive them in pairs. The simplest circuit to accomplish this is the multivibrator—nothing more than two general-purpose transistors, two resistors, and two capacitors. Voltage is not at all critical, and since we will be connecting batteries in series to get 35 volts, we can tap off at the 9 volt point to power the circuit. While we're at it, adding two more resistors and two tiny LEDs will give a visible indication of circuit operation and warn us when the battery goes dead.

Varying the frequency of a multivibrator requires that two resistors be varied

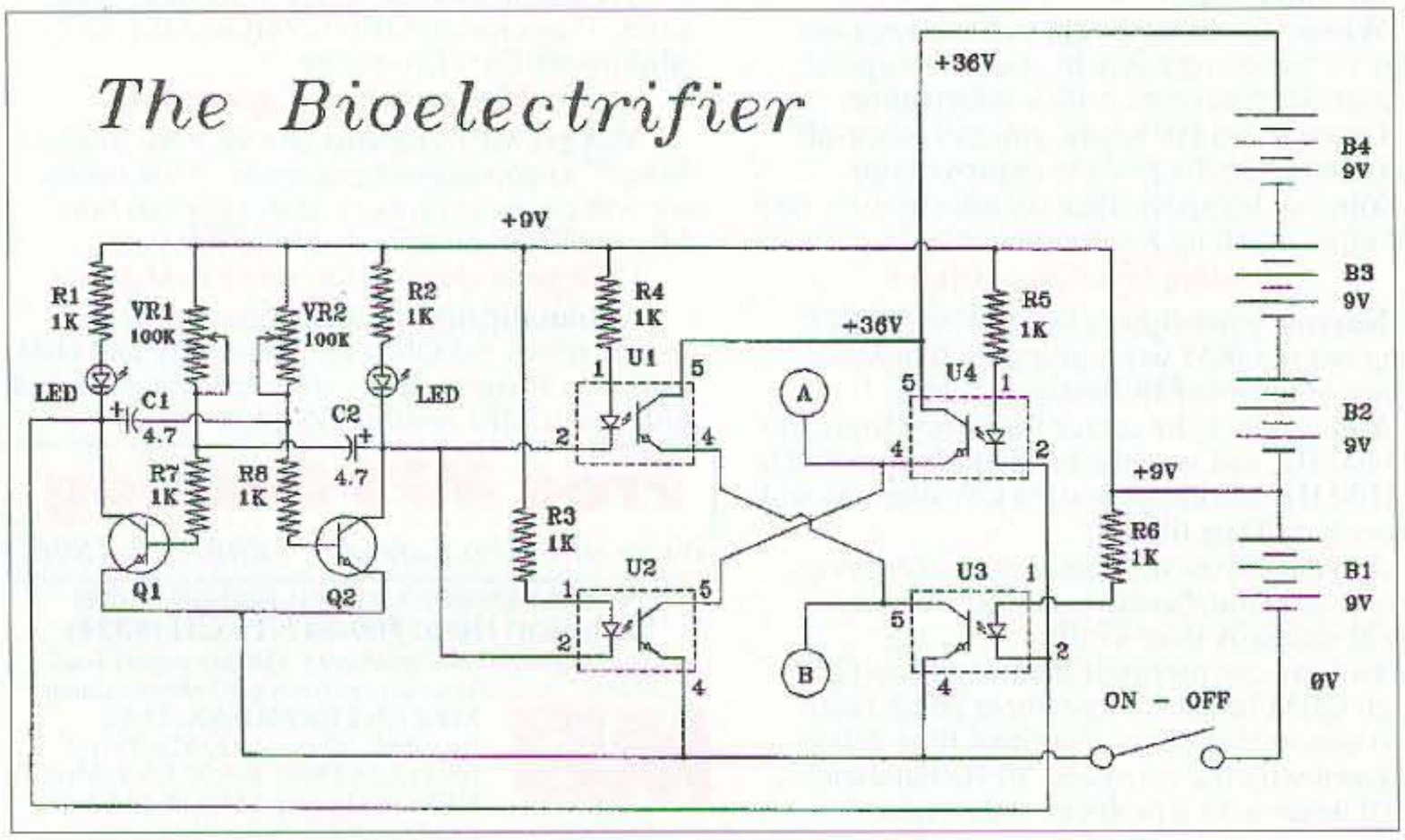

Fig. 2. *Schematic diagram of the Bioelectrifier.*

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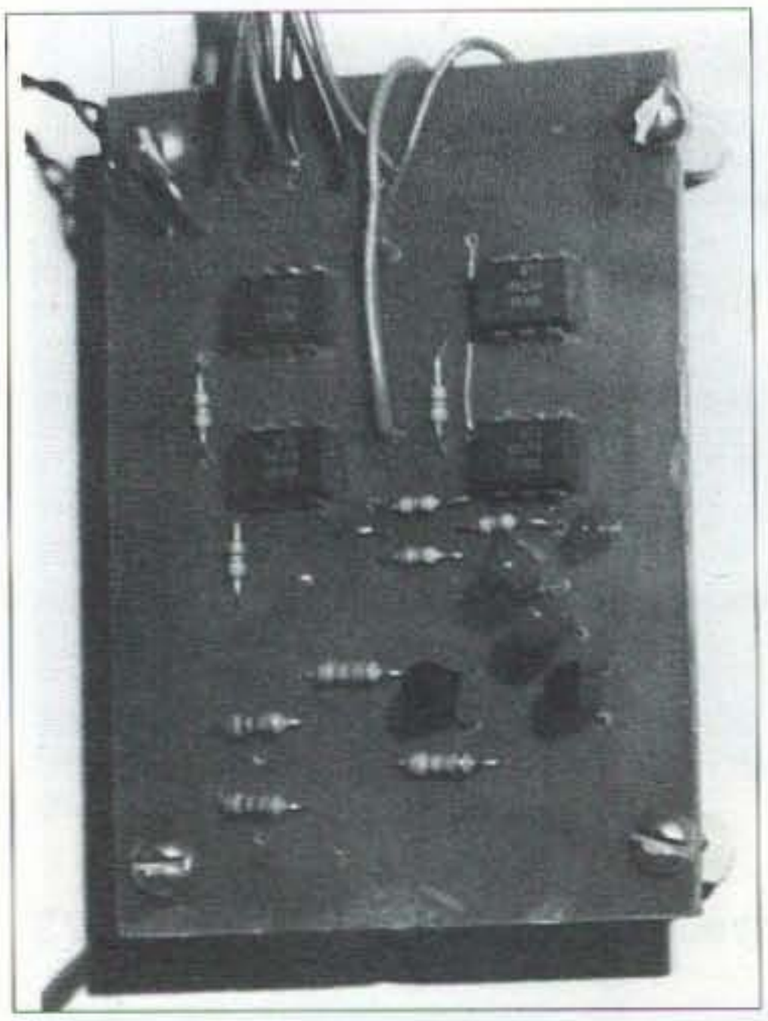


Photo C. *The Bioelectrifier – component side of the board.*

together...no big deal. Two-gang potentiometers are ideal for this. In fact, our design goals do not specify that an equal duty cycle is required, or even desired. Two trim pots will give independent adjustment of the two states if this is needed. A fixed resistor in series with each pot will establish a maximum frequency limit, preventing the circuit from dropping out of oscillation when the pot is adjusted all the way.

We now have the basis of a simple, practical design: four optocouplers, two transistors, one dual pot, two capacitors, two LEDs, and eight resistors, all of the same value! The schematic diagram is shown in **Fig. 2.** Of course, we will have to add a box, switch, and batteries, and some sort of electrodes. We also need a name. Since we are experimenting in bioelectrics, let's call it the Bioelectrifier!

The printed circuit board

When designing a printed circuit board for this type of project, a compromise must be made between size and ease of construction. The board should be single-sided with as few jumpers as possible, and there should be enough room for 1/4 watt resistors, in case the smaller 1/8 watt are not available. The final design is shown in **Fig. 3.**

In my work, I design and build a lot of prototype circuits, and I've settled on an easy technique for circuit board fabrication. I use a Computer Aided Design (CAD) program to create the actual pattern, and then use the computer to generate a mirror image. If the board is small, as in this case, I will then copy this mirrored pattern to get the maximum number of circuits from a standard positive pre-sensitized copperclad board. This mirrored array is shown in **Fig. 4.** After printing this pattern, I copy it with a standard copy machine and inspect the copy for places where the toner is less than pure black. These areas, if any, are touched up with a felt-tip marker. When I've got a pattern that will give a good, pure black copy, I run two or three copies to warm up the drum, then make a final copy on clear Mylar, sold in office supply stores for making overhead projector displays. It may be necessary to set the copy machine one step darker than normal, since machines tend to vary in how well they work with Mylar. This copy can be used as a positive for printing the circuit board.

Using a standard (4.5" by 6.5") presensitized board, place the Mylar sheet with the circuit board pattern *toner-side down* on top of the board. (The writing should be correct—not reversed!) Place a piece of glass over the Mylar to hold it in contact with the board, and expose it for three and a half to four minutes using an Ultra Violet sunlamp 12 inches above the board. Be sure to protect your eyes during the exposure!

After the board is exposed, dunk it in the developer until all the copper between the traces is shiny and clean; this usually takes around two minutes, but you really can't overdo it. Rinse the board with cold water, and it's ready to etch.

I etch my boards with ferric chloride solution in a tall, thin plastic tank that allows the board to stand up vertically. The use of an aquarium heater and air pump will cut the etching time in half. Do *not* get the etching solution on anything made of metal—it will corrode badly. It also stains everything, so wear rubber gloves and be careful!

After etching, clean the etch resist from the board, polish with steel wool, and drill the holes. The individual patterns can be cut from the board using a bandsaw, jigsaw, or even by hand with a hacksaw if that's all you have. You now have not one, but four circuit boards ready for construction.

Fig. 3. The circuit board pattern, shown actual size.

Building the Bioelectrifier

Fig. 5 shows the parts layout for the Bioelectrifier. Be sure to install the optocouplers correctly. Also, the very small LEDs often do not have a flat spot to indicate the cathode, but instead have one lead shorter than the other. Check before cutting the leads! The *long* lead connects to the dropping resistor.

There are two ways that this circuit can be built. For experimentation, the device can be mounted in a larger box, potentiometers used to vary the frequency and current, and perhaps even a microammeter to monitor the current. However, I've discovered that it's not always wise to give a device with many controls to a non-technical person, especially if changing any of the adjustments would nullify the experiment. Also, we want a pocket-sized device, or one that can be clipped to the belt. Once the operating parameters are established, the resistance of the potentiometers can be measured and the pots replaced with fixed resistors (I used 68K). This makes a much smaller package possible, with only a single on/off switch and two tiny LEDs on the outside. I built one in a 2 7/16" by 5 1/16" plastic box (Radio Shack 270-233) and mounted the switch and LEDs in the end. Four 9 volt batteries would not fit in this box, but one 9 volt and two 12 volt "N" batteries will fit with no problem, and produce 33 volts. Radio Shack sells 12 volt alkaline "N" batteries in a package of two, (23-154) and "N" battery holders (270-405).

I made a belt clip from a strip of steel banding material and glued it to the back. I also glued a two-pole terminal strip to the end of the box to connect the electrode leads, although a plug and jack would be fine. I used what I had on hand.

Electrodes for the prototype were simply strips of aluminum foil, folded to form two strips several layers thick, 2 inches wide and 12 inches long. Wrapped around each ankle, the foil was held in place by rolling the socks up over it. Later, a better electrode was made by gluing aluminum foil to strips of cloth-backed vinyl upholstery material, with hook-and-loop fastener material glued to the ends.

In either case, connect two 36-inch lengths of hookup wire to the Bioelectrifier's output terminals, and solder a paper clip to the other end of each wire. Slip one paper clip over each electrode, clip the Bioelectrifier to the patient's belt, and your doctor is ready to go.

OK, it's done. Now what?

Even if your doctor doesn't know anyone with the HIV virus, there are many experiments he can try with the Bioelectrifier. If it works on the HIV virus, what about others, such as those responsible for herpes, Epstein-Barr, colds, and flu? Will a few minutes a day actually *prevent* colds and flu? What effect will different frequencies have? The long-term benefits can only be determined by experimenting and recording the data.

It is interesting to note that all animal life on earth has evolved in the magnetic field of the planet. Blood, being mostly water and containing salts and iron, must generate a tiny voltage as it moves through this field. Is this voltage necessary for good health, and can it be disrupted by exposure to much more intense 60 Hz electromagnetic fields?

I've often wondered, as we think about manned missions to other planets, if we will one day discover that we cannot live for a great length of time without the Earth's magnetic field. So far, only a few people have ever left the planet, and only for a short time. These astronauts, however, have found that after a few days in space, the immune system starts to shut down! No one has yet found a good explanation for this. Perhaps a small application of bioelectrics is in order!

One interesting result reported by Wayne Green was that when his friend Beck used a similar device for two hours a day instead of the usual 20 minutes, just to see if there might be any harmful effects, he started losing weight! The weight loss continued until he reached his normal weight, then stopped. Since, as Wayne has repeatedly noted, many hams appear to be "eleven months pregnant," this could be the biggest thing since FM! Perhaps this device will open new fields of communication. Just adjust the frequency to match the 7 Hz resonant frequency of the Earth and tune your brainwaves to Dr. Jung's Universal Consciousness!

All kidding aside, there have been enough results from experiments to date to warrant serious study, and, as usual, mainstream science will continue to ignore it, while sucking up government funds for expensive and ineffective research. But breaking new ground is the amateur's forte. We have the technical skills and the manpower. Keep in mind that *every* new field is pioneered by

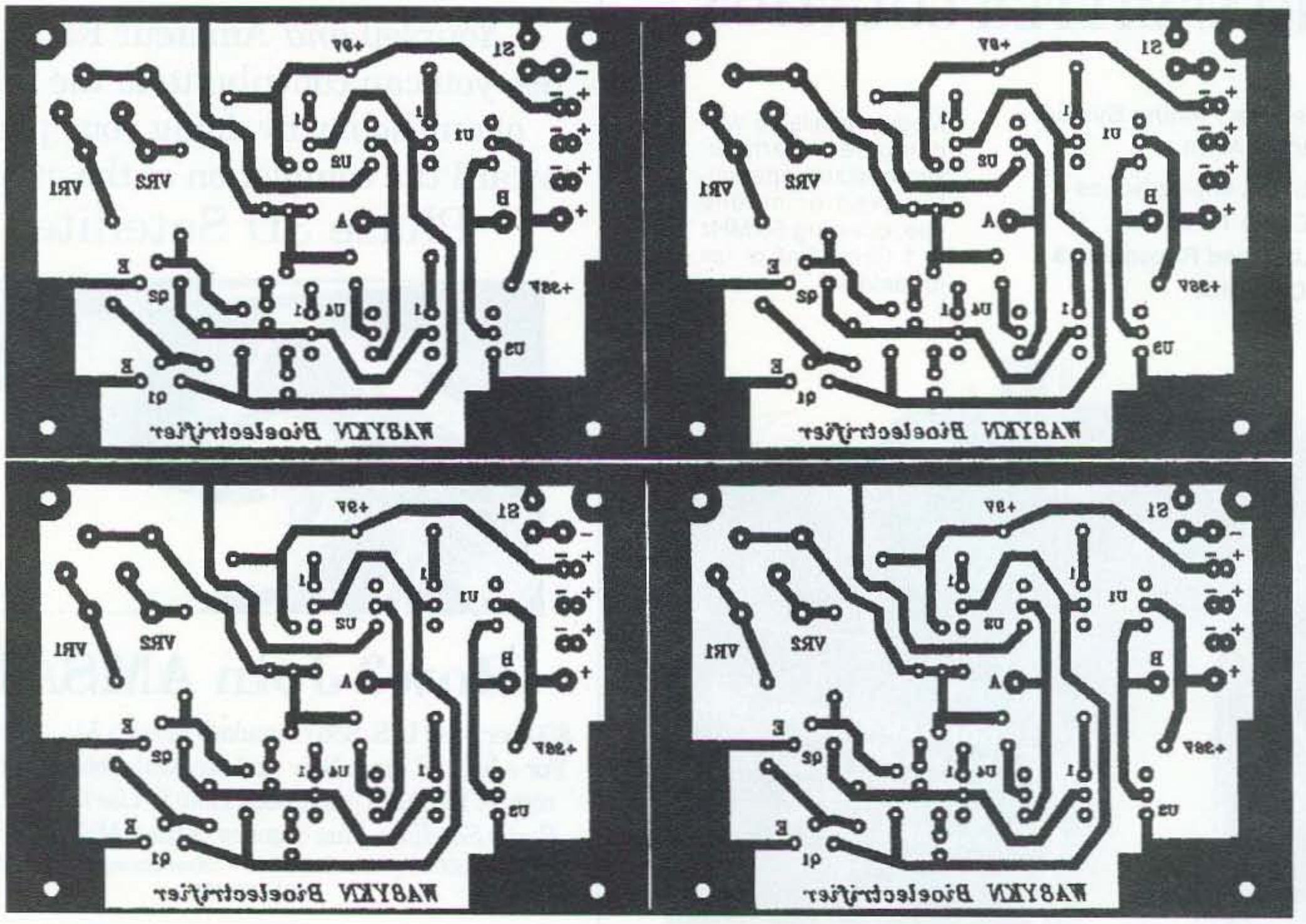


Fig. 4. Make your own "positive" by copying this mirrored pattern onto clear Mylar. Shown actual size.

NEVER SAY DIE

Continued from page 4

to help force your state university, with the professors kicking and screaming in protest, into the 21st century.

Self interest

It's about time you got involved in politics instead of griping about family values, the deficit, crime, drugs, welfare, and so on. If we can get our kids learning about electronics and other high-tech fields, we may even be able to help keep some kids from being suckered into dropping out of school and going into the crime or drug business. This will be good for everyone, including you and your family.

For my part, I can easily turn out the needed magazine. I've put out big magazines before, and I suspect this one, with a circulation of 20 million or so, would probably run several hundred pages a month, with eight editions, one for each of the eight grades. No problem, though I'd probably have to get a couple more Macintoshes for production. And I'd draw on you for the articles, encyclopedia of electronics series, and so on. The material has to be fun to read, as well as simple to understand. Right up the alley of several good ham writers.

Will we be seeing a million-ham day at Dayton? Why not? We might have to move

Continued on page 31

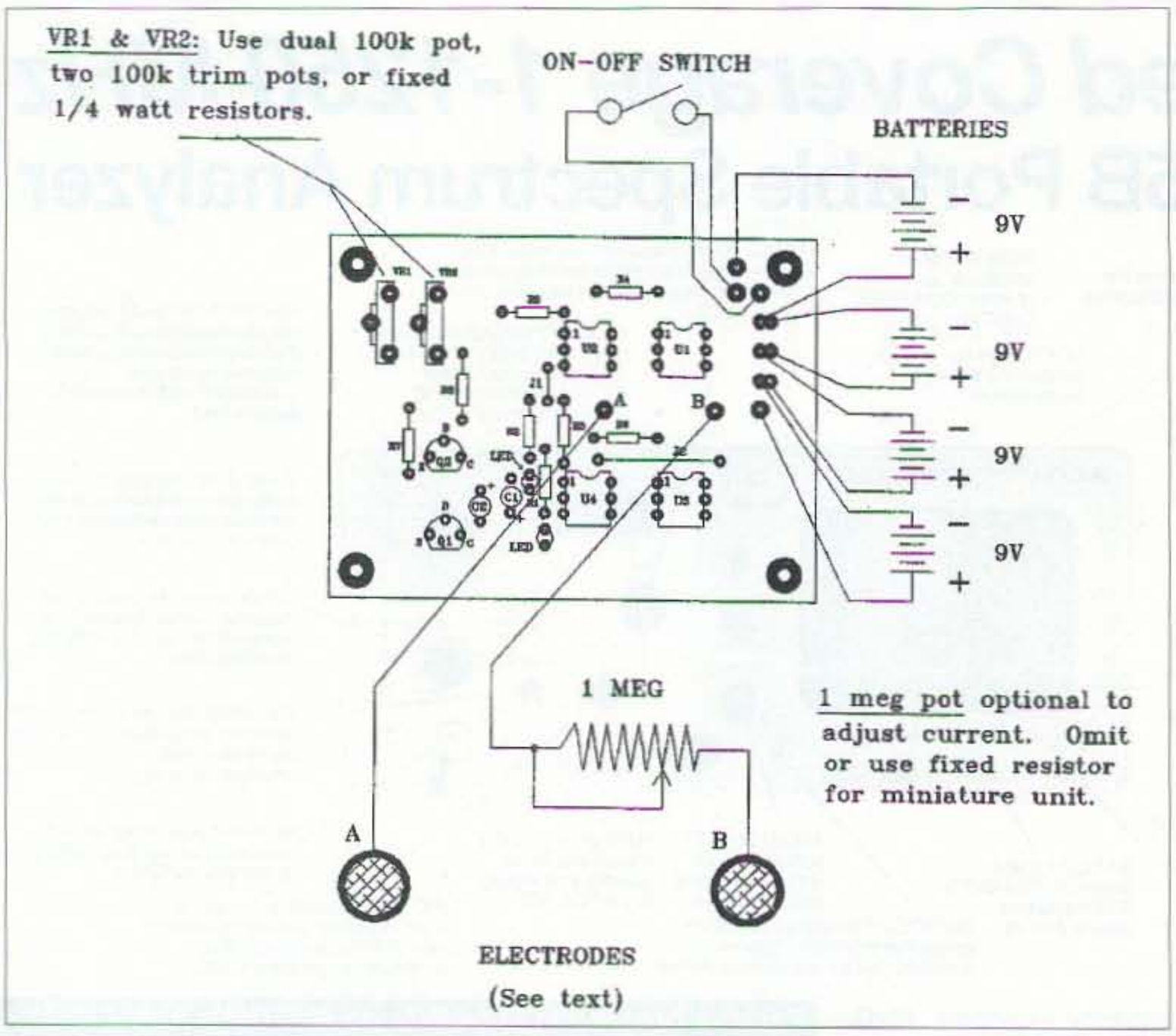


Fig. 5. Component side of the board, showing the component locations and connections.

amateurs—since the professionals do not yet exist!

One final caveat... *do not* build Bioelectrifiers and sell them as medical devices! This will surely bring unwanted attention from the wrong people. After all, these days even the U.S. Department of Health and Human Services has a S.W.A.T. team! So build it, work with a doctor to experiment, and make sure to keep careful records. Don't even give one away to someone who wants to try it but doesn't have the skills to build it, unless you have no qualms about opening yourself to almost unlimited liability. Remember, the FDA and several other government agencies have unlimited funds to persecute you, and they love nothing better than the slightest excuse to appear to be working. The last thing you need is to get the attention of the bureaucrats, who would probably protect the interests of the pharmaceutical cartels by outlawing bioelectricity, requiring us all to wear grounding straps on our behinds.

I would be interested in hearing about your results with the Bioelectrifier. Those with Internet access can send me E-mail at THOMIL@delphi.com.

A Note From El Supremo: *I highly recommend the inclusion of the 1 meg pot in series with the electrodes so that the current can be kept comfortable for the user. I adjust it so I can feel a throb, but no pain. Also, as I mentioned in my editorial, I find it easier to put the electrodes on one wrist, where there are two arteries, and keep them in place with an elastic strap. There is still a need to blast hiding critters out of the lymph glands with a coil in series with a flash gun. Then the Bioelectrifier will take care of 'em!*

I like Bob Beck's latest approach, labeling the device as a "plant growth stimulator." A commercial model, which I've been using to stimulate the degrowth of any possible viruses, bacteria, fungi, or parasites in my own aging body, is clearly marked as an experimental plant growth stimulator, not to be used on humans. I also liked Bob's sheaf of before and after lab reports of people who had had the HIV virus, which I looked over at the Global Sciences Congress in Tampa a few weeks ago (which you didn't bother to attend).

I would make a lot more noise about this except for two things. Make that three. First, I'm not an MD, so the medical industry will probably have no interest in anything I have to offer. Second, efforts to try and bring down the costs of medical treatments could easily trigger an FDA attack and prison. Ask anyone who's read about what happened to Wilhelm Reich, Raymond Rife, Gaston Naessens, and hundreds of others. Third, I'd sure like to have some people come out and say that they were dying of AIDS and a blood purifier saved their lives. Or even a few of the people to whom I've sent circuits to call or write and say they used it with success. I've never had anyone write and say they had tried it and it didn't work. I've had phone calls saying it did, but no written proof.

So, is this one of the biggest medical discoveries of the century and Bob Beck in line for a Nobel Prize? ignoring it, as the NIH and WHO have, isn't the answer. Trying to stamp it out, the FDA's approach, isn't either.

Can it really wipe out parasites and viruses in your or your pet's blood, or is it only good for stimulating your hemp growth? 73

Parts List

Qty	Part	Mouser #	Radio Shack #
2	Transistors	333-PN2222	276-2009
4	Optocouplers	512-4N38	- -
2	LED	351-3001	276-026
1	Dual Pot	31VA501	271-1732
2	4.7 µF capacitors	140XRL16V4.7	272-1024
8	1K Resistors	299-1K	271-1321
1	9V Snaps	12BC310	270-405
2	"N" Holder	12BH510	270-405

Box, switch, batteries, etc.

Materials for Circuit Boards

Materials to make your own printed circuit boards are available from Circuit Specialists, (800) 528-1417.

Part	Number
Sensitized Boards	PP114
Developer	Posdev
Etchant	ER-3

73 Magazine is looking for ham related photos suitable for 73's cover of your hamshack, hams (male and/or female), pictures from your DXpeditions, etc. Call Joyce for more details. 800-274-7373.

Belcher Islands DXpedition

Take off to the Great White North.

Winston Seeney VE3WFS
224 Cornwallis Court
Oshawa, Ontario L1H 8E8 Canada

If my wife could have seen me at that moment, she would have written me off as a madman. What teacher in his right mind would begin his summer vacation standing with a friend atop the airport garage at Sanikiluaq? The arctic wind whipped our pant legs like flags. The coax and guy ropes danced to their own senseless rhythm. From moment to moment, the precipitation switched back and forth from rain to snow to rain... seemingly unable to decide which torment we most deserved. John Harden VE3VGI shouted through chattering teeth, "What a contrast! When we put this thing up four days ago, it was 82 degrees and we were wearing shorts."

Al Griffin, our pilot, watched from the warmth of the nearby pre-fab airport. His face mirrored his concern; which one of us would be blown over the edge? Was our struggle worth it all? Al hadn't read John's sense of determination well. John is an athlete, and for years he has boxed, run marathons, and driven his body to the limits of endurance in cross-country ski races. For John, this marked the end of months of hard work. Our Belcher Islands DXpedition was in the books, another of a lengthy list of accomplishments in the story of a unique man.

"Thanks, guys. I'm a handicapped operator—you make it easy for me to travel the world."

It seemed like yesterday when John, Laird Solomon VE3LKS, and I sat in a Tim Horton's in Oshawa, on the eastern edge of Toronto, discussing a possible DXpedition. As I stirred my coffee, I quietly commented, "This is every ham's dream, but how many do it? If we say we will do it, we will."

The gauntlet was thrown. From that moment on, we agreed to a goal that had to be met. Unfortunately, the end came for Laird four months early when his wife, Connie, entered her final term of pregnancy. Laird had to withdraw from the team, but at that time, when doughnuts, coffee, and idle conversation came easily, we dared to dream.

Photo A. *Winston Seeney VE3WFS and John Harden VE3VGI*

Where would we go? Our trip had to be remote, yet affordable and attractive enough for both local and distant hams. If we were lucky, we would provide a first-time activation. At first, we thought of the High Arctic. Names like Ellesmere Island and Alert Bay rolled off our tongues, but when a local pilot suggested a fee of $10,000 to transport us and our gear to Calumet, a large community on Baffin Island, we decided to change our destination to a more affordable, southern location.

After much consideration, we decided upon Sanikiluaq, in the Belcher Islands of Hudson Bay. John discussed the problem with a friend who worked with him at General Motors. John's friend was a pilot and, although he liked the sound of the trip, he was unable to make it because his health failed. He passed us along to his brother, who was also a pilot, and who also liked the idea. We had the green light.

For our pilot, Allan Griffin, an air controller at Toronto's Lester B. Pearson International Airport, our trip to the Belchers fulfilled his long-held dream of flying to the north. His plane was a hardworking

little PL 30 Twin Comanche. It had been flown for years by Henry Shannon, traffic's voice in the sky for radio station CFRB, Toronto. Allan provided us with an affordable DX opportunity by sponsoring us with a return flight from Oshawa to Sanikiluaq for the cost of fuel.

Having overcome the transportation hurdle, we were faced with the problem of siting a station in an unfamiliar town. To save expenses, we decided to establish a base with tents and portable camping gear. We also decided to huddle as close to the airport as possible. With that in mind, we contacted Bob McLean, an airport employee at Sanikiluaq. We needed whatever support he could offer from the airport: electricity, toilet facilities, a refrigerator, and protection from bad weather. When we arrived at Sanikiluaq and learned that the airport wasn't very busy, we asked Bob if we could work from inside the building. Bob's response was a laid-back, "No problem, help yourselves, guys."

After arrival, John and I took a quick overview of the terrain around the airport. The airport and adjacent garage sat on a hill about 1,500 feet high and two miles outside of town. John, who had constructed and tested our rotating quad antenna, knew exactly how much space it required. The flat garage roof, some 30 feet off the ground, was ideal.

The skyline was magnificent. To the north, we could see the ice floes which had broken away from arctic glaciers and floated up to the island's shore. Below us, Sanikiluaq huddled around a small inland harbor. Surrounding us were hills and tundra. We set to work, snapping the telescopic sections of mast pipe in place. Then came the supporting guy wires, followed by the large triangle-shaped driver and reflector wires. After we had completed the familiar ritual of untangling wires, the structure was drawn tight.

Our next problem was feeding the coax into the room which served as our shack in the airport. We couldn't keep the outside door propped open because the temperatures dropped too low at night, and during the days the mosquitoes drifted off the tundra in raiding parties. John spotted three holes in the wall that were stuffed with packing and appeared to have been used at one time as an entrance for cable. As luck would have it, they were in a wall of the room that we had selected for our shack and, with Bob's OK, we reamed the caulking out and shoved in the coax. Within hours the radios were fired up. We made a few test contacts and our initial reports were solid. After dinner, VE8RAC was up and running.

Our station consisted of three rigs: John's Kenwood 440, my Kenwood TS 50, and our sponsor, Durham Radio Sales and Service's Alinco DX 70. It had been our plan to rotate around the rigs, with one man having time free for himself. Allan, our pilot, respectfully declined to man a station. "Sorry, guys, this is a break for me from work. I talk on a microphone for a living." John and I found ourselves caught in a situation we hadn't counted on. Allan had been good enough to fly us north for the cost of fuel. We felt that we couldn't leave him to wander alone for three days while we DXed, so we decided that we would keep one radio operating full-time and we would spell each other off. This would provide Allan with a companion. We would double-team our station whenever we had the chance. For much of the time, this was a sensible decision. It meant that we could adequately rest, and combine our trip with the opportunity to explore the area and to fish.

***Photo B.** Main Street, Sanikiluaq*

On the air

VE8RAC went on the air on the evening of June 29th. We moved onto the 20m IOTA frequency and were immediately swamped with calls. We were pumped up. To work the receiving end of a pile-up brought into play all the art and skill of a thousand hams I had heard over the five years that I been a ham. I came into the situation determined to give everyone a fair chance, although there were times that this wasn't possible. The Voice of Texas demanded to be heard by covering weaker signals. "Answer him. Get him out of the way," was our feeling. Unfortunately, he was usually replaced by another 10-gallon operation. I suspected, though, that for every one mega-station, there were a dozen average barefoot hams in the background who were waiting patiently for their opportunity. We were thankful for the many hams who expressed their appreciation for our efforts. "Thanks, guys. I'm a handicapped operator. You make it easy for me to travel the world."

Occasionally, I would stop and invite QRP stations to take a shot. When we were operating above 14,500, I would sometimes give Canadian stations a chance to take a break for it. The frustration of untangling dozens of interwoven callsigns was heightened by the carriers of stations tuning up on frequency.

It soon became apparent that our choice of islands was a good one. For three days we were a hot commodity. At times, we moved down onto the 40 and 20 meter subbands to shake off the large demand by American hams, and to make international and national contacts possible. The constraints of time defined our operating practices. One evening I called into the Sandbox Net on 7063 kcs and spoke to Stephen VE3DP in Thunder Bay. Stephen had a nice signal into the north. A few stations in southern Ontario and the Maritimes were workable. Most of the stations on the net were quite low. Although I am a Sandbox Net regular, I found myself in a dilemma — trying to decide whether I should devote two hours to having hams try to wring out a contact with me at the expense of the very real possibility of working a couple hundred hams elsewhere. DXpeditions exist for multiple contacts, so I had to move on. The log

became a monster which had to be fed, and it had a huge appetite.

Exploring the island

During our off times, we explored Sanikiluaq. It's an Inuit town of some 400 people, a cluster of small bungalows sitting nakedly on blocks above the rock-strewn ground. Most of them had multicolored beasts of indeterminate but wild lineage chained outside. Those dogs eyed us from their perches on top of snowmobiles, umiaks, and packing crates. As we walked along the streets, miniature all-terrain vehicles bombed past in clouds of dust. Smiling Inuit men and women waved.

John tuned the boom box, which sat on a desktop in our makeshift shack, to the Inuit-language local radio station. "Listen to this," he said. I expected chanting, drums, and the cry of a people thousands of years old, weaving in and out of the night like northern lights. Instead of mystery and poetry, the shriek of an alternative rock band violated the northern night.

During my off times, Allan and I fished in the harbor. My catch was humble—a cod twice the size of my hand. The locals claimed that a Spanish fleet had beaten us to the punch. Allan drew in three grotesque fish with fins like fans, and bodies covered with knobs, spines, and bumps. I told Allan that he fished ugly and he laughed. The natives call that species Offish (ugly fish).

When we weren't fishing for DX contacts or casting into the harbor, we fished for soapstone carvings. We made our best contacts at the Northern Store. I suspect that the prices we paid, while modest by southern standards, were attractive enough to encourage the local artisans to sell to us instead of the local co-op. Bartering is part of the game.

All of the villagers speak Inuit, most speak some English, and English is the first language for the kids in school, so they made great interpreters. On our second day, a procession of all–terrain vehicles worked their way up to the airport from the village. Summer holiday had begun and with it came the annual exodus of the teachers to their homes in the south. We found ourselves explaining our presence over and over again to curious villagers and to the members of the southern white community who lived in the village hotel. These, for the most part, were

VE8RAC

Belcher Islands
Hudson Bay
NWT- Canada

Operators:
VE3VGI John Harden
VE3WFS Winston Seeney
Assisted by: Allan Griffin

IOTA-NA-196

tradesmen and workers who worked in isolation during the summer months. These "Northern Junkies" came from across Canada to work in the north for isolation pay, for months at a time, before returning to their families in the south for winter. During the evening, they lounged about the colorful Amatuk Hotel, watching videos and making small talk. For some, our station was a diversion, and they enjoyed the chance to talk to someone new.

On July 1st, Canada Day, during my break from the radio, I was drawn to the bank of a small stream which ran through the village. A large group of Inuit had gathered around someone shouting through a megaphone in their language. I worked my way through the crowd and watched a game in contest. A dozen or so people were eagerly scooping water from the stream and into large containers, using small water scoops. It appeared that they were seeing who could fill their containers the fastest. The crowd then spread out and fanned past me. They were bent and focused on the ground. I stopped a high school boy and asked him what everyone was looking for. He told me that hidden among the rocks was a soapstone carving of a ptarmigan, a northern bird.

Meanwhile, on the hill outside of town, the airwaves were alive. John was passionately working the Canada Day contest. Throughout the afternoon and into the night, we worked stations back and forth across Canada from Vancouver Island to Newfoundland, but the Yukon was silent. Does it still exist? Is there really a VY1 land?

Because we had a coveted RAC multiplier callsign, we didn't have to go searching for contacts. Avid contesters dug us out of the multitude of "CQ Canada Day, CQ Canada Day," calls with a frenzy. John and I expected to work 20 meters throughout the night. We reasoned that because it was daylight in the north for 20 hours a day, our station would be operable. We were surprised to discover that, although it was still light, propagation dropped off late in the day, much as it did in the south. On the second night, the band was quiet from 1:30 a.m. to about 5:30 a.m.

Since the antenna faced Europe, we operated off the side of the quad to the west and into the Pacific. We found ourselves following the rim of darkness, as it worked west across Europe to North America and across the Pacific. Because we never changed the direction the antenna faced, we were unable to make comparisons with the success we might have experienced had we moved it around.

On the second night, I worked Australia and New Zealand at 0600 UTC. An enthusiastic ham from the vicinity of Melbourne helped me coordinate several contacts Down Under. On many occasions, signals had what seemed to be arctic flutter. On the other hand, it might have been the natural echo effect created from receiving a delayed "around the globe" signal off the back of the quad. We also used a vertical antenna for the 10 through 40 meter bands. Since it lacked the gain, we used our quad antenna in its place.

The three days were punctuated with frequent surprises. There were conversations with hams we knew from previous conversations. On one occasion, we broke a pile-up into the Franz Josef Land DXpedition, high in the Arctic Circle, to the north of Russia.

Throughout the time we were in the north, John had arranged for personal contacts and messages to be relayed by Glenn VE3AEQ, a fellow member of the North Shore Radio Club — our home club. He passed personal traffic for us. Messages were given to our wives: Yes, we were eating well and we were cleaning our teeth before we went to bed; the usual stuff. In the wee hours when it grew quiet, I found myself yawning and fighting exhaustion, so I slept briefly.

At 5:30 a.m. I was back in action. We came to life in a hurry on Sunday afternoon, when John called me to the radio to listen. Someone in Europe had thrown our presence on the 20m IOTA frequency on the Internet. The radio erupted into a blast of unforgettable sound. Thousands of callsigns melded together into an uncontrollable wave of noise. It sounded like New Year's Eve in St. Peter's Square, Rome. Eager Europeans joined the carnival atmosphere by blowing whistles and clapping their hands enthusiastically. John's professional skill was amazing. He called upon three hams with superior stations to sort callsigns out of the alphabet soup. GM3ITN of Glasgow and Dewitt Jones W4BAA of Michigan fed John lists of stations he could work, but a feeding frenzy has a mind of its own. John was repeatedly overridden by impatient hams who demanded that their appetites be fed. Again and again, John announced, "Gentlemen, please await your turn." I marveled at John's patience. When he reached the moment of no return, he handed me the mike. "Take over; that's enough."

With that I told the mob that there was no bread in the bag. It was time to go home. I changed frequency and slid down into the 20 meter subband. The hams with operating smarts won the day. They searched us out and earned their IOTA 196 QSL cards by outthinking the mob. During this time, I worked a station from near Paris, France. His 3 1/2 watts earned a respectful 5 x 8 report. Nice contact!

While the Belchers were much in demand, we learned that we were the second DXpedition to the Belchers. During the three days, we worked Tony WT2O and Martin G3ZAY, both of whom had been part of a DXpedition here the previous year. They had operated from a tent station outside the hotel during their stay.

Eventually, the time came to pack up the station. With our soapstone carvings tucked away in our baggage, we boarded the Twin Comanche. As we rolled south through the valleys of clouds, each of us privately reflected. Would we do it again? You bet! 73

Continued from page 6

routinely design transmitters and receivers with parts costs below $30. From my experience, I can only conclude that ham radio equipment companies are enjoying high profit margins on their products. These profit margins are adversely affecting the growth of our hobby by establishing financial barriers that inhibit young people who wish to purchase their own equipment.

Thirdly, I must applaud your editorial comments on maintaining a healthy lifestyle. I became involved with body building about a year ago, for stress reduction purposes, and can now attest that a lifestyle based upon good eating habits and plenty of exercise, both aerobic and strength training, is essential for success in whatever you do. As a Canadian citizen who has recently moved to the U.S., I can provide many stories concerning the demise of the Canadian health care system which has resulted from abuse and irresponsible behavior. Those who advocate socialized medicine, be wary! When the state takes on the medical expenses of the population, the population must take on the responsibility for living a healthy lifestyle. If both parties do not actively fulfill their obligations under such a contract, failure will surely occur. Thanks for a great magazine.

Fiddlesticks. I've been hearing this high priced ham gear complaint ever since I got into ham radio. It's a bunch of baloney. You want to know about high prices? Check out commercial equipment. Sure, manufacturers have to get back some of their R&D costs as part of the price, but I know of no other high tech field where margins are as cutthroat as they are in amateur radio. If there was any money in manufacturing, we'd have more manufacturers. And without the huge Japanese ham market supporting us, we wouldn't have that great stuff form Icom, Yaesu, and Kenwood! An S-19 Sky Buddy receiver of 1938 cost $20. That's about $400 in today's dollarettes for a five-tube wide-as-a-barn drifting receiver. My SX-24 cast about $90 in 1938, which is around $1,800 today. It was a nice receiver, but not that nice. It drifted a lot too. ICs are consistently bringing ham gear prices down for us...Wayne

Mike Agsten WA8TXT. Many thanks to *73 Amateur Radio Today* for publishing "The SP-10 'Senior Spider' Transceiver" in the Jan. 1996 issue. Regrettably, the all-important Parts Overlay drawing, *Fig 3,* page 17, did not condense very well into the space available. Any reader desiring a larger, more legible copy need only send me an SASE requesting SP-10 POL. 73! Mike Agsten WA8TXT, 401 W. Bogart Rd., Sandusky OH 44870.

Glenn Farr N4AK. I just want to let you know how much I agree with your editorials about getting our youth involved in electronics and science via amateur radio. I hope to soon have time to get involved actively as an "Elmer." You're right on target in advocating removing the code requirement from the license exam. I am still fairly proficient in the code and enjoy many contacts during the year on CW. The code should become just one of the many facets of this great hobby like packet, DXing, rag-chewing on SSB, etc. In other words: If you like to operate CW that's just fine, but let's not kill the future of our hobby over something that has served its purpose. Obviously some of CW's main supporters haven't yet experienced the Internet to see what our hobby is competing with!

Here in Greenville, SC, as in many other areas of the country, restrictive covenants concerning antennas (and in particular amateur radio antennas) are to be found in all subdivisions. In order to accommodate my hobby and hopefully have some fellow hams as neighbors, I decided to develop my own subdivision (Nature's Watch subdivision) with a provision for amateur radio antennas. Month after month of reading "if you don't like it, get off your duff and do something about it" in your editorials influenced me to strike out in a new direction after spending 25 years with Philips Medical Systems selling and installing X-ray, CT and Magnetic Resonance Imaging systems. The first project therefore is Nature's Watch, a subdivision that will have only 23 home sites on 65 acres—adequate space to accommodate "a few good hams." Now how's that for a retirement project? Keep challenging us!

Wow, imagine the 24-hour a day TVI with 23 ham families on 65 acres! ...Wayne

William Thim Jr. N1QVQ. Mr. Green: I have sent in some items for the new "Ham to Ham" column, one of which dealt with special event stations using packet BBS addresses for contacts. I am a no-code ham at this time, limited to 6 meter SSB, 2m FM, and packet. The letter I received from Dave got my gray cells going. So far I have contacted and QSLed some two special event stations via packet because these are the only two I have found that give packet addresses from the sysops. I would like to know how many contacts were in "real time" vs. packet BBS. There is a ham in my area who runs a VHF/HF gateway. If more hams did this throughout the country special event stations could give packet addresses and the callsign of the local gateway for contacts. Not only would this help more people contact/celebrate the special event, but it would be *great* disaster training; i.e., how long would it take to get messages from a family in Minnesota to hurricane-ravaged Florida? Would it be possible to have different VHF/HF links between relatives in New England and disaster survivors of a quake in California? Good training exercises. Well, before I ramble on too much, let me tell you to keep up the good fight and congrats on your crew who keep our gray cells active.

Thanks, Wm., but at times it seems like we're fighting insurmountable odds...Wayne

Mark Jackson NØOWE, President SPARK (Sedalia/Pettis Amateur Radio Klub). There seem to be two schools of thought. The first, that there should be no code requirement because it is an outdated form of communications. The second, that no-code Techs should never have been permitted. Most no-coders, contrary to popular belief, fully understand why so many older hams feel the way they do. They had to struggle to learn code, many had to drive long distances to take their examinations, and if they failed, they had to start the process all over again. I can sympathize with this position, but this should not be used as an excuse to hold the hobby back. It is the same whether you are a ham or work for a large business. Many old-timers, in either case, will fight tooth and nail to hang on to the old ways and resist change as long as possible.

Instead of resisting change, why not take advantage of the opportunity to experiment with today's technology? One reason many Techs haven't upgraded is because they find so few benefits to using the code compared to the more modern communications modes available. Most of them have computers, so it's easy for them to set up their stations to send and receive Morse code at practically any speed. The computer does all the work. Most old-timers stay on HF and tell each other what type of rig they bought, what antenna they bought, what the weather is, and how loud their signal is. Sounds like a code test session!

Our local club had become one of Wayne's so-called stagnant clubs. Through reorganization and a lot of hard work we are making a comeback. During the last quarter of 1995 we held a Tech licensing class to help try and boost the hobby. We successfully licensed all but one individual. We started a new class in the first quarter of 1996 and will teach Tech, Tech-plus, and General. Several of our Techs will be taking the General or Tech-plus test. Most of the Techs I know value the wisdom and experience of our old-timers. I have learned a tremendous amount about the hobby from the older hams in our club. Maybe it's time for both sides to break down the barriers and take our hobby into the next century on the cutting edge.

So send a picture of your next graduating group...Wayne

Chuck Martin AB4Y. Wayne, I just wanted to let you know that I've accepted an offer from a major telecommunications firm, and that my career success is due in no small part to you, and your decision to bring me on board at *73* magazine in the summer of 1982. The internship I served with *73* was one of the highlights of my life. Not only was it an excellent learning experience, but I enjoyed spending a beautiful

Continued on page 46

Number 26 on your Feedback card

Editor's note: If you liked the 440 MHz J-Pole last month, here's how to build a version of it for 220 MHz.

A 220 Super J-Pole Antenna

220—Use it or lose it. Here's a simple, inexpensive one-hour building project.

Marty Gammel KAØNAN
1703 Hewitt Ave. West
St. Paul MN 55104-1128

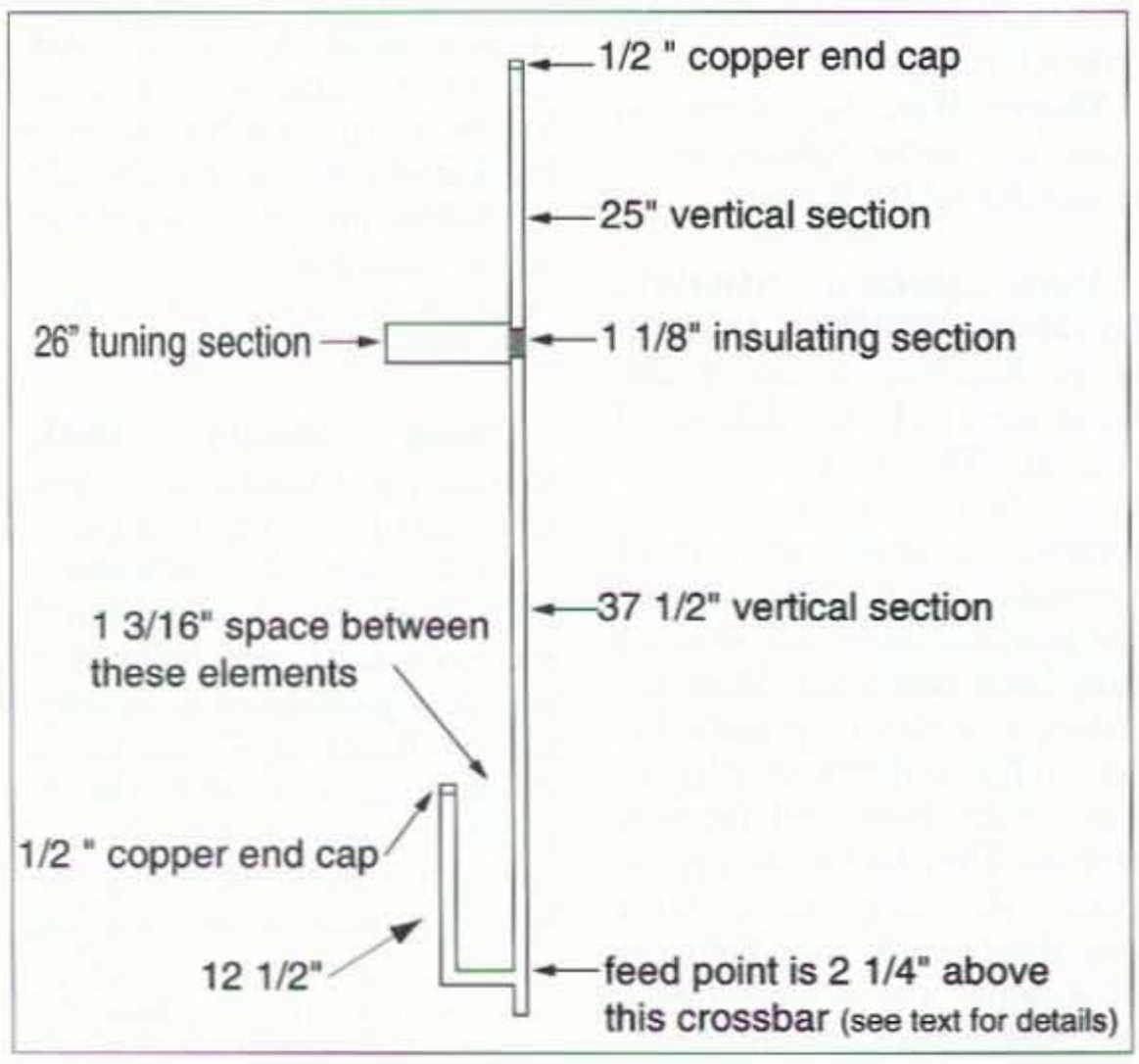
A local swap net helped me land an old Kenwood TH-31AT in good working condition. OK, now I needed an omnidirectional gain antenna. I found very few published 220 antenna projects in the ham magazines, and even fewer commercial gain antennas available. That was no problem, since I've made many J-poles over the last 14 years. The Super J-Pole has about the same gain as a well-known commercial brand antenna (about 5.5 dB), but without its poor low-angle radiation, which is more attuned to contacting aircraft than land stations. I knew my design would work with a broader bandwidth and lower SWR.

I made this antenna in less than an hour, once I had the materials on hand. Tuning it was easy; I spent less than 5 minutes finding the minimum SWR setting. My 220 Super J-pole has an SWR of less than 1.1:1 over the entire band, and with a little more fine tuning, I'm sure you can achieve an almost flat SWR.

Building it

Once you have all of the materials you can start this project. Cut all of the pieces to the lengths listed and clean the areas that will be soldered. I used solvent to clean all the copper surfaces (The secret to soldering copper tubing with a propane torch is to get the surfaces really clean). After the antenna is complete and soldered, the entire antenna should be polished clean with steel wool or a scrubbing pad.

Find the center of the 26-inch length of 3/16-inch tubing or wire, grasp both ends and loop the center around a broom handle or nearby pipe. Pull on both ends, and smooth out any kinks. It should now look like a very tall "U". The other bending of this section will be done just before tuning the antenna.



Now drill a hole about 3/16 of an inch from one end of the 37.5-inch piece of copper tubing, about halfway through the birch dowel, and 3/16 of an inch from the end of the 25-inch section of copper tubing, using the sheet metal heat shield as a spacer. Lay the parts out on your work table in the order they will fit together.

Dunk the pieces of 1/2-inch copper tubing right into the can of paste flux. Apply flux to the undrilled end of the 37.5-inch length of tubing, and slide an end of the "T" fitting onto it. Flux both ends of the base stub section and slide one end of the stub into the other end of the "T". Push the threaded 1/2-inch copper fitting onto the other end of the base stub.

Apply flux to both ends of the 1-1/8-inch crossbar piece. Insert one end into the side of the "T" and the other end into the 1/2-inch copper elbow. Finally, flux both ends of the 12.5-inch section of copper tubing, and put the other end cap on one end of the 12.5-inch section. Insert the other end of the 12.5-inch section into the open end of the copper elbow.

Measure the spacing between the 12.5-inch section and the 37.5-inch section. The 1-3/16-inch spacing must be equal at both the top and bottom of the 12.5-inch section. You may want to set a weight across these two sections to keep them in alignment when soldering.

Insert the 1/2-inch birch dowel into the top of the 37.5-inch section of copper tubing. Now is the time to bend the piece of thin sheet metal around the dowel to act as a heat shield during the soldering process.

Slide the 25-inch section of copper tubing onto the exposed end of the birch dowel, drill holes through the birch dowel, and install the 26-inch length of 3/16-inch tubing into the 37.5-inch and 25-inch vertical sections of the antenna. Finally, install a 1/2-inch copper end cap on top of the 25-inch section.

Soldering it

Check everything carefully before applying the propane torch. Then start at the bottom joint and work your way up, using the angle of the torch's flame to

CIRCLE 56 ON READER SERVICE CARD

CIRCLE 193 ON READER SERVICE CARD

CIRCLE 2 ON READER SERVICE CARD

CIRCLE 340 ON READER SERVICE CARD

CIRCLE 104 ON READER SERVICE CARD

heat the copper tubing without overheating. Discoloration will indicate overheating. The end caps are the last items to be soldered. Then wait for the rest of the joints to cool down.

After all soldering is completed, clean the antenna with solvent and paper towels. Remember, all flux must be removed from the surfaces. At this point you may want to coat the insulating section with a flexible caulking or silicone compound and then wrap the area well with electrical tape to weather-seal the dowel area.

Wiring it

Using a drill press, I used both the 5/64-inch and 3/32-inch drill bits to make the elongated mounting hole in the SO-239 fitting for the hose clamp. I like to use a small drill first and then the 3/32-inch bit, since that almost eliminates the need to file the opening. If you have a small file, you can use it to make a better-looking opening. Solder the length of copper wire to the center terminal of the SO-239. Mount the fitting to the 1/2-inch copper tubing with a stainless steel hose clamp. Attach the SO-239 feedpoint assembly with clamp to the 37.5-inch section of 1/2-inch copper tubing about 2-1/4 inches above the crossbar. Using the other clamp, mount the loose end of the wire to the 12.5-inch section of 1/2-inch copper tubing, also about 2-1/4-inch above the crossbar. After attaching the completed feedpoint, trim off the excess wire from the clamp area.

Tuning it

I clamped the base plate to my stepladder to use as a test stand. Using a support like this will make it easy to adjust the feedpoint for lowest SWR, and provide a handy shelf on which to set your tools, radio, and SWR bridge. First check the SWR at the top, middle and bottom of the band. If you started with the 2-1/4 inch above the crossbar measured at the bottom of the wire, the lowest SWR point should be very close. Move the feedpoint up or down no more than 1/16 of an inch at a time, checking the SWR reading after each adjustment, until you are satisfied.

After tuning the antenna, scratch a mark where each clamp mounts, and then remove the clamps to give the antenna a final cleaning. Remove *all* the flux and skin oils left from handling the copper with bare hands. Polish the complete antenna with a scrubber pad at this time. Reinstall the feedpoint clamps and recheck the SWR.

Spray the entire antenna with clear exterior lacquer, varnish, or sealer to keep it looking new for years. If you want to apply a little silicone sealer to the back of the SO-239 where the wire attaches, do so now.

Notes on it

It can be easier and more fun if you and a friend build your Super J-poles together, maybe even as a club project. Tune the antenna in an open area away from any wires or large solid objects that may give you false SWR readings. The 3/16-inch tubing should be bent into a half circle pattern, with about a 5-inch radius. You will want about 1-3/4 inch of space between the upper and lower halves of the 3/16-inch tubing. The distance of the end of this matching section from the vertical sections of the antenna will affect tuning to a minor degree, but it also helps balance the antenna.

Be sure to use an SWR meter that is accurate at 225 MHz. Most HF SWR bridges are not much good for VHF. Tape your coaxial connection well to seal out the weather, and tape your feedline to your mast; keeping it taped means less stress, and less possibility of future flapping.

Anyone with questions about my antenna designs may write to me direct, sending a #10 SASE. 73

Materials List continued on page 75

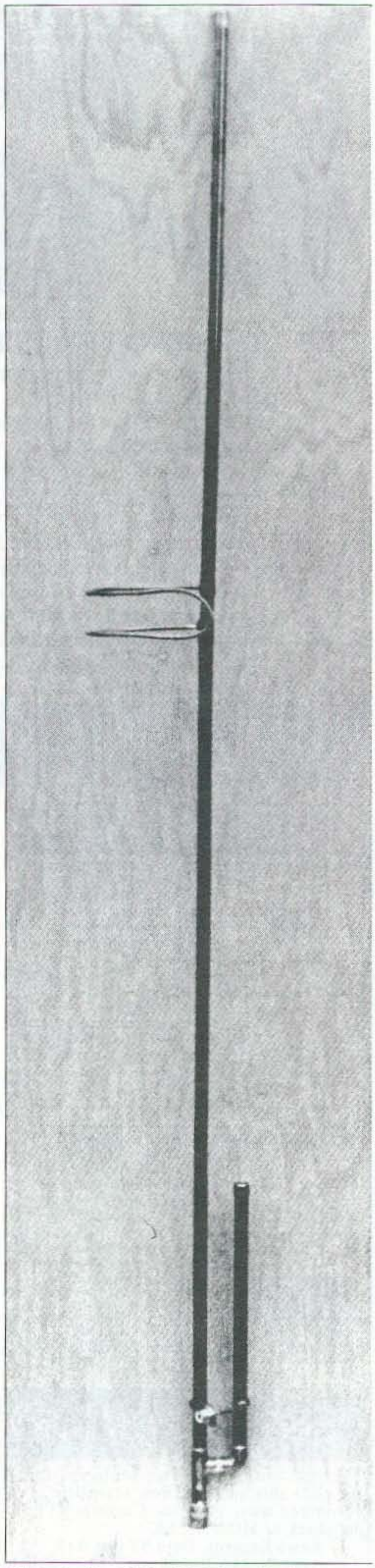


***Photo A.** The finished 220 Super J-pole antenna.*

DAYTON hamvention® '96

✣ May 17, 18, 19, 1996 ✣

General Chairman, Ken Allen, KB8KE

Asst. General Chairman, Dick Miller, N8CBU

✷ Giant 3 day Flea Market **✷ Exhibits** **✷ Activities for the Non-Ham**

When and Where •• •• NEW DATE THIS YEAR •• ••

May 17, 18 and 19, 1996; Dayton, Ohio at Hara Arena

Communications

FAXMail: (information sent to you via FAX): Set your Fax to manual send/receive, then call (513) 276-6934

BBS via America Online: Keyword "Ham", then "Conference" , then "conventions", then "Hamvention"

PHONE: (513) 276-6930. For fast response, please obtain the committee Voice Mail box numbers via FAXMail or BBS.

FAX (incoming): (513) 274-8369

MAIL: Hamvention, Box 964, Dayton, Ohio 45401-0964

E-MAIL: Hamvention@aol.com or n8emo@ix.netcom.com

WWW: http://users.aol.com/hamradclub/dayton.htm

Special Services

Lodging information and special award nomination forms were in our 1995 Program. A limited number of Handicap parking permits are available. License Exam by appointment only. For Form 610, call 1-800-418-3676
Call, FAX, Mail, or BBS for more information.

Bus service

Bus service will be provided between Hamvention, Air Force Museum, Salem Mall and Forest Park Mall parking areas. Many hotels/motels will have bus service for a nominal charge.

Returned Checks

A $25 service charge will be assessed on all returned checks.

Deadlines

In order to have time to return tickets to you, we must have advanced registration orders postmarked not later than May 3 (USA) or April 26 (Canada). Tickets will not be mailed before January 15th,1996. Ticket requests that are received **AFTER** the deadline will be processed and **HELD** for pick-up at the Hamvention Office in the Silver Arena. Tickets can be picked up beginning Thursday, May 16 at 8:00 a.m.

Flea Market

Flea Market Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. A maximum of 3 spaces per person (non-transferable). Electricity is available in a portion of the last Flea Market row for $50 additional. Rental tables and chairs are not available in the Flea Market. Vendors ***MUST*** order an admission ticket for each person when ordering Flea Market spaces. Please send a separate check for Flea Market space(s) and admission ticket(s). Spaces will be allocated by the Hamvention committee from orders mailed by February 5. Please use 1st class mail *only*.

Notification of Flea Market space assignment will be mailed on or about **March 25, 1996**. Please indicate in the box below if you would like to attend regardless of Flea Market space assignment.

HAMVENTION Is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration

Enclose check or money order for amount indicated in U.S. dollars and type or print your name and address clearly.

Make checks payable to:

Dayton HAMVENTION Mail to -
Dayton Hamvention Box 1446, Dayton, OH 45401-1446

Flea Market tickets *Please check one and enclose **two** checks.*

❑ Send admission tickets **only** if flea market space(s) assigned.

❑ Send admission tickets **regardless** of flea market space assignment.

	How Many		
Admission (valid all 3 days)	_____	@ $12.00*	$_____
Grand Banquet	_____	@ $23.00**	$_____
Alternate Activities			
Saturday Luncheon	_____	@ $9.00	$_____
Sunday Luncheon	_____	@ $9.00	$_____
		☜ **Total**	**$**_____
Flea Market ‡ (Max.3 spaces)	_____	$45/1 space	
	_____	$100/2 adjacent	
	_____	$200/3 adjacent	$_____
Electricity	add _____	$50.00	$_____
Covered tent	_____	$290.00 ea.	$_____
		☜ **Total**	**$**_____

Name _____ Call _____

Address _____

City _____ State _____ Zip+4 _____ – _____

Daytime Phone # ( ) _____ Evening Phone # ( ) _____

* $15.00 at door
**$25.00 at door, if available
‡ Admission ticket must be ordered with flea market spaces

The Difference Is Dedication

Ham radio saves four communities.

Alfred A Mikalow III K7OOZ
55371 McDonald Road
Vernonia OR 97064

The snow had been building up in the mountains. In a week, at the 1200-foot high Vernonia Peak Observatory, 15 inches had fallen. The higher mountains had received two feet or more. Then the rain started. A layer of ice half an inch thick covered the snow. On February 4, 1996, weather patterns changed and the Jet Stream moved from the Arctic to the Tropics. The precipitation changed to warm, heavy rains, and the temperature went up to the mid 60s. The ground had been saturated since before the snowfall; it couldn't handle any more water.

The problem was exacerbated by the clear–cutting of timber in the Coast Range mountains. Without the roots of trees to hold the ground in place, the earth moved. Whole mountainsides collapsed, destroying bridges and roads.

On the 5th and 6th of February, the waters started to rise. By the 7th, most area rivers were well over their banks. *All* the major rivers in the Northwest were overflowing by February 8th. Portland was sandbagging the seawall on the Willamette River. The Columbia River, as well as any other stream in the area, was above flood stage by several feet.

The 1996 flood peaked on February 9th on the Nehalem River in Vernonia, flooding about two thirds of the town. In places the water was as much as 8 feet deep, leaving a layer of mud wherever the waters touched. On February 8th the only local hams still able to operate, Cherie KA7ILQ and Norm KB7CD, put their amateur radio skills to work.

Landslides had taken out the police and fire 911 lines. The roads were washed out or covered by slides. An amateur radio station was set up at the firehouse, and for nearly a week, the hams would be the only means of communication in or out of the area. Over half of the homes in Vernonia had been flooded.

On the evening of Thursday, February 8th, the Vernonia hams were sending through requests for food and other supplies. The hams who received those requests responded by going to stores in the Beaverton and Portland areas. By Friday, Wes K7WWG and many other hams had not only located the emergency supplies, but were mobilizing the resources to transport them to Vernonia, though the roads into the devastated area were nearly impassable, even for four-wheel-drive vehicles.

By now the Net on the South Saddle Mountain 147.32 MHz repeater in NW Oregon was in full swing. The EOCs for the affected counties were online, as was the Red Cross in Portland. Hams were providing radio links to almost all of the flooded areas in Oregon and Washington.

A call went out to get a helicopter into the Nehalem River valley, to check on flooding there. The call fell on deaf ears, and concerned hams were told by officials that there was no problem. One of the Vernonia hams, Sandy K7OOZ, decided to spearhead a trip out to those areas. Sunday afternoon K7OOZ arrived via logging roads to find that almost all of the homes in Mist had been flooded. Emergency supplies were requested from Vernonia and by that evening six pickup truck loads arrived, at about the same time as the National Guard. Sandy stayed in Mist and the rest of the group went into other communities. Randy

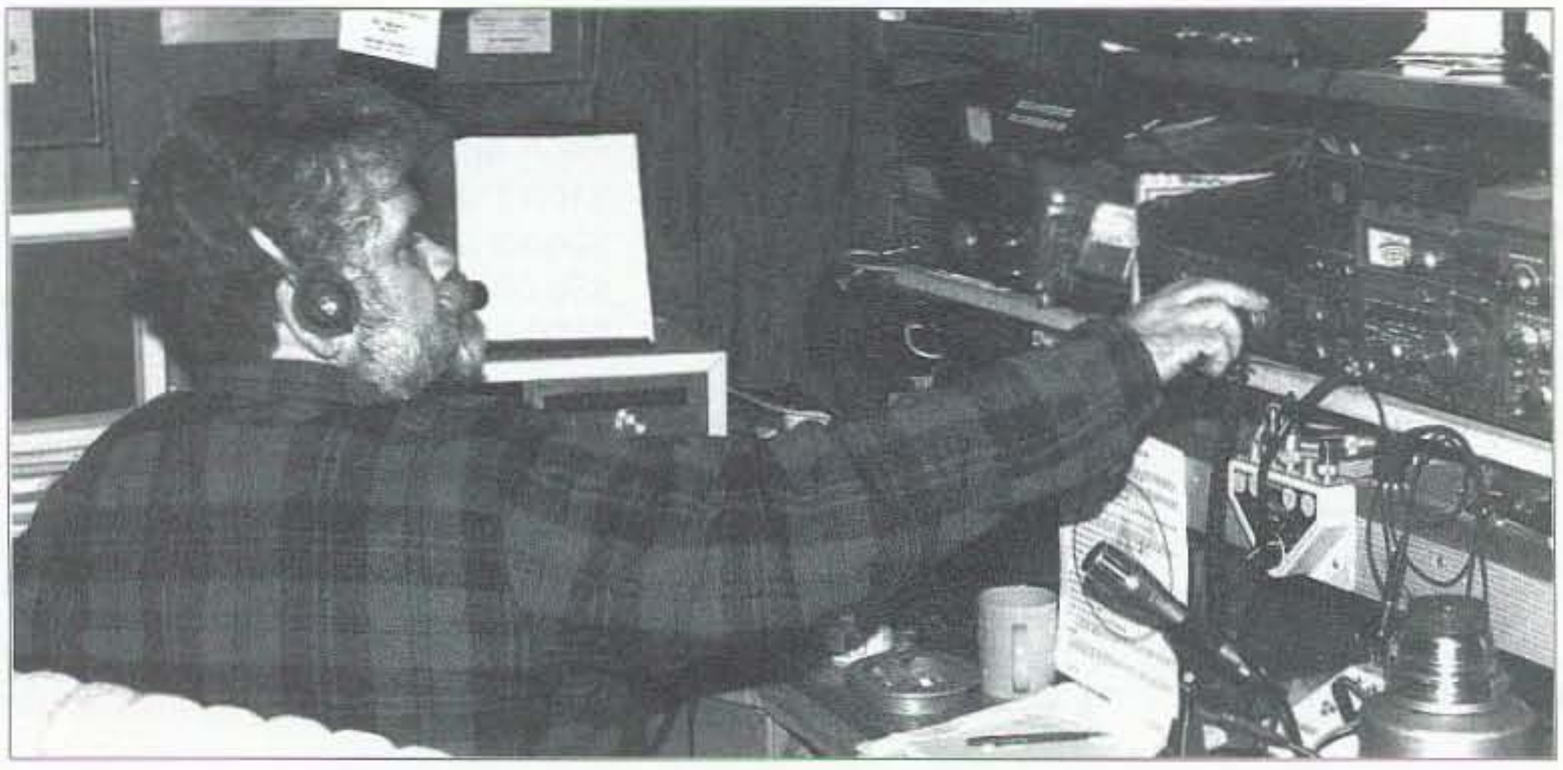


***Photo A.** One hero ham: Bill N7VZF ran the emergency net.*

KE7AF set up a ham station in Mist and worked with the National Guard and the Mist fire station. Again, official bulletins declared that there was no problem in Jewell or Birkenfeld. Four days later, it was learned that Jewell had been hit as badly as Mist.

Once again, emergency supplies were gathered and the same basic list the hams had acquired for Vernonia was sent to the school in Jewell. The hams set up a station there as well.On the evening of Tuesday, the 13th, the hams turned the food distribution operation over to the services in place by then. On the following Saturday, a portable Cell Phone transceiver was set up at the Vernonia Peak Observatory to provide communications for the Vernonia area. At 7:00 PM, Sunday, February 18, 1996, the ham network was closed down after eleven days of operation. Out of the eleven days the first four were 24-hour operations.

The devastation caused by the February flooding is hard to imagine, as was the amount of help provided by the hams. Seldom has an amateur operation run as smoothly as this one, thanks to Bill N7VZF who ran the net, and the hams who involved themselves so deeply, often digging into their own pockets to purchase what wasn't donated, and paying for fuel to transport the emergency supplies.

Until Sunday, February 11th, the hams were strictly on their own; there were no other organizations helping with the disaster in this area. At least a hundred hams were involved with supplies and communications; at least a hundred heroes who helped put nearly three thousand lives back together. The list is too lengthy to print here—the honor roll of the hams and other people who helped in the Flood of '96, but they know who they are.

Thank you from the people of Vernonia, Mist, Birkenfeld, and Jewell on a job so well done. The ham radio operators made the difference. 73

NEVER SAY DIE

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our hamfests to Las Vegas and other cities where there are facilities to deal with 100,000 attendees.

Communication

If you'll get involved with running for your state legislature I'll organize a web

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Tape-Wound Antennas

Neat, efficient, and easy to build.

Peter Laakmann WB6IOM
The Highlands
Seattle WA 98177

Using white PVC plumbing components and adhesive copper tape, you can build microwave/UHF helicals or HF/VHF verticals, dipoles and beams; efficient, good-looking antennas that lend themselves to endless fun and experiments.

Simply wind a desired pattern of adhesive copper tape onto the pipe. The tape, designed for direct soldering, can be cut to any width by suppliers from stock "logs" of up to 20 inches, making this a "printed circuit" approach to building antennas. Painting or varnishing the finished design will produce a lightweight, rugged structure, well suited to severe weather. Another option is to Fiberglas™ the finished and tuned assembly.

Because of the skin effect, tape is just as good a conductor as a solid sheet of copper. In practice, tape is a *better* conductor since the surface area can be much greater than wire. Tape is also lightweight and the instant adhesive makes winding with it a pleasure.

Common PVC pipe comes in sizes from 1/2-inch to 4-inch diameters. Sizes between 1-1/2 and 3 inches are ideal for a great variety of HF and UHF projects. You can also wind 13 and 23 cm helixes and straight sections, build capacitive "hats," and do other tricks of antenna construction.

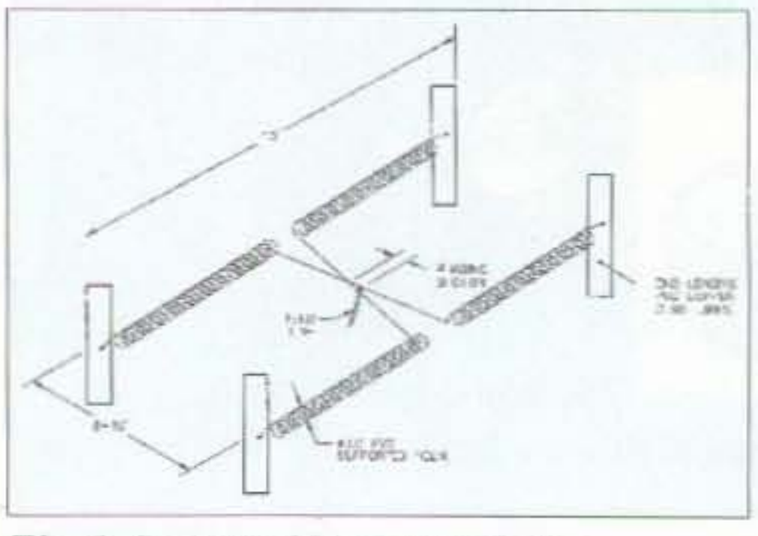

Fig. 1. Suggested beginning design.

For UHF applications, the formulas in antenna books for helicals can be followed directly. The PVC makes a convenient support for these circularly polarized broadband antennas. Three-inch PVC tubing in either Schedule 20 or 40 is rigid enough to construct 20 dB gain axial helical antennas for the 23 cm band; a rough rule of thumb is a circumference of one wavelength. Popular antenna books can provide complete details for pitch, match and ground plane dimensions. Performance should be essentially the same as any air-wound helical since the PVC dielectric loss is not likely to be significant.

As HF antennas, the tape-wound structure acts as a uniformly loaded transmission type structure that is electrically shortened relative to a free space dipole. The amount of shortening can be controlled by tape width and pitch. The advantage of the structure, aside from its simplicity, is the low loss or high electrical efficiency. A good starting point for resonance is that the physical length of the unwound tape is about one wavelength for a dipole.

This method of building small, efficient antennas compares favorably with small loop antennas. For a given maximum physical dimension both loops and dipoles have the same maximum possible bandwidth. However, a 10-foot-long dipole is lot less cumbersome than a 10-foot-diameter loop. This means in practice that a loop antenna is built to smaller dimensions and will then require remote tuning. Such remotely tuned tape-wound antennas (TWAs) have much to offer the home builder since everything needed can be found at the local hardware store, and a reasonably sized TWA can have adequate bandwidth without the complexity of remote tuning.

Performance

All small-wavelength antennas suffer conductor loss, but this is where the TWA shines. First, copper conductivity is better than aluminum, the common material used most in small antennas. Second, when compared with a wire-wound helical resonator, the tape width can be made as wide as the center-to-center turn spacing, reducing the resistance even further. The dielectric loss in the PVC is negligible as there is only a small electrical potential between adjacent turns. For these reasons one can expect the tape-wound antenna to have much greater electrical efficiency for a given length. Because of the large copper surface area, these antennas should be able to handle several times the legal

Continued on page 34

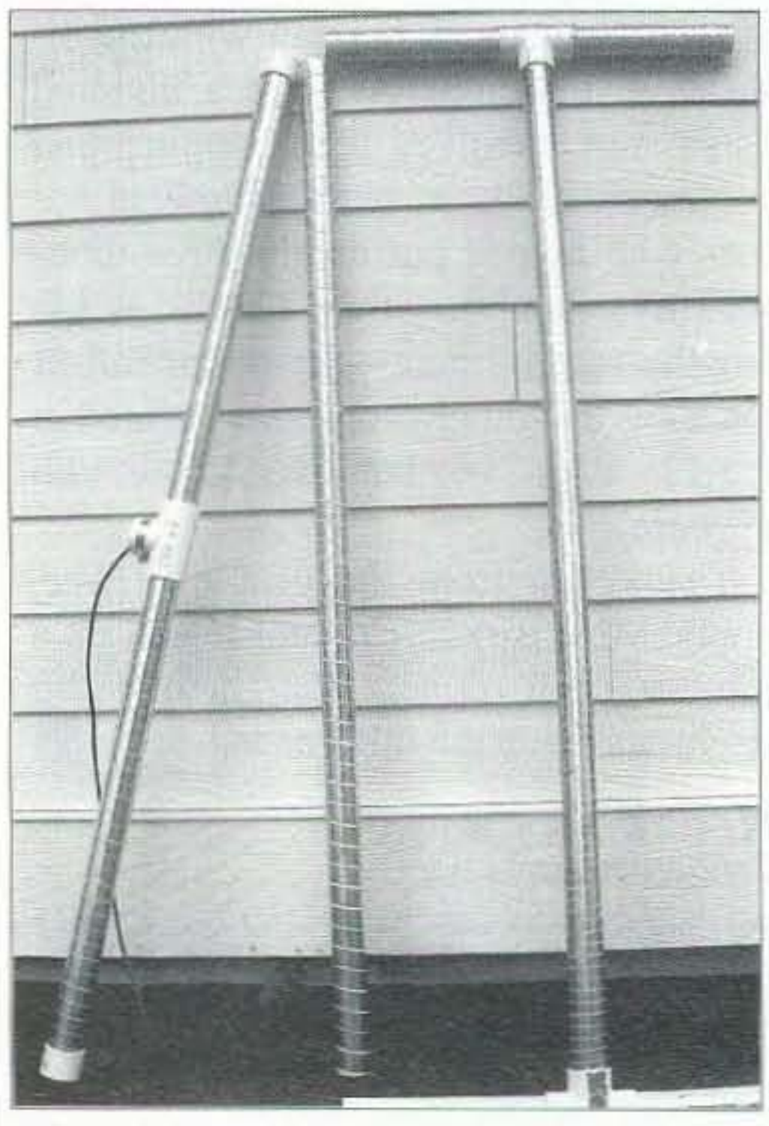

***Photo A.** Tape-wound antennas come in many shapes and sizes. Although these are all about the same size, different winding techniques make them resonate at different frequencies.*

NEVER SAY DIE

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page to help you communicate with the others so you can collectively learn from each other's successes and failures. You'll be way ahead of the other legislators, most of whom haven't any idea of what is going on in the other states.

I'm reserving some covers of *73* for the first few ham state legislators to get elected.

The first step

If you aren't in a position to run for your state legislature, how about getting your ham club members to work on finding a local ham to run? You must have a couple of members who have the time to get this ball rolling. Back them with all of the club members, their families, and as many of their co-workers as possible. With a core of 700,000 (if you bother to get the word out), and at least two more voting family members, plus three friends, we could have one heck of a lot of clout. Let's see, 700,000 divided by 50 states is an average of 12,500 hams per state. If each can generate six votes, that's 75,000 votes per state. And that's a major force.

But it means talking it up at your club meetings, writing articles for your club newsletter, and giving talks. You not only want to talk this up at club meetings, but get around to local business and social clubs. I've been giving talks to New Hampshire (and some Massachusetts) Chambers of Commerce, Rotary, Lions, Kiwanis, and so on. They all need speakers, and your message is exactly what they want to hear. And, being a ham, you're more used to talking than the average person. Hey, at the worst you'll get a lot of free lunches and dinners, plus a bunch of souvenir pens.

The people you'll be talking to are mostly small business owners so they'll be particularly receptive to your message. They know firsthand the results of our lousy educational system and are reminded of it every time they interview potential new employees.

If you're not good at speaking, you will be. All that takes is practice and a good solid knowledge of your subject. I was absolutely awful when I started talking at hamfests. It doesn't take long to get over stage fright. If there's some interest, I'll help with ideas on what to talk about. Or you can go back and swipe stuff from my past editorials. It's all there.

Once in

Step one is to get elected to your state legislature. Then you want to get on the educational committee. Next you want to talk with as many college presidents as you can. I think you'll find them highly cooperative. I know a bunch of college presidents and none have found any problem with my sneaky plan.

The next step is to start talking with local school boards, explaining the need for

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Tape-Wound Antennas

Continued from page 32

limit in power. The low loss allows you to build efficient short antennas. Simple calculations and tests bear this out:

The radiation resistance for short uniformly loaded monopoles is given by $h^2/312$ for electrical height (h) less than 45 degrees (1/8 wave). The radiation resistance of a dipole is double those values so that the radiation resistance of a short uniformly loaded dipole becomes $H^2/624$ where H is the dipole length in degrees. RF (skin) resistance of the 1.4 mil copper tape can be calculated from formulas or curves supplied in standard reference texts. However, these values are optimistic as they only apply to isolated straight conductors having a diameter much larger than the skin depth. The skin resistance is increased by the proximity effect. For a solenoid type winding using either aluminum or copper, the RF resistance is increased beyond the calculated skin resistance by as much as a factor of two.

I did some measurements of total loss on short sections with a "Q" meter, allowing me to calculate the total effective RF resistance on full-sized TWAs. Short 7- and 10-turn sections wound on 1-1/2 inch PVC tubing were used and measurements were made at 18 MHz. "Q" values of over 700 were obtained. The RF resistance inferred from Q measurements tends to be pessimistic for high values of Q because of losses due to radiation and resistance in other components of the meter circuit. The worst case estimate thus obtained showed RF resistance only about 50% greater than the calculated values that assume isolated straight conductors. These calculations assume current flow on the inside of the coil only. Therefore, calculating skin resistance from standard formulas by using tape width = wire circumference creates worst case errors of a factor of 1.5 (50%).

The radiation resistance of a 10-foot-long 3-inch-diameter helical resonator at 14 MHz calculates as 4.5 ohms. The loss resistance calculated for 1.5-inch-wide tape (56 feet) is 0.5 ohms; it is identical to the skin resistance of a 1/2-inch-diameter copper tube since both have the same surface area. This value must be divided by two because of the current distribution. Antenna efficiency is therefore about 95%. This represents about a 0.25 dB gain reduction over a full-length 33-foot dipole. The difference would be totally undetectable in on-the-air tests. For other shortening ratios, keep in mind that further shortening not only decreases the radiation resistance with the square of the length, but decreases the bandwidth even faster. The fractional bandwidth (without resistive losses) decreases with the third power of length!

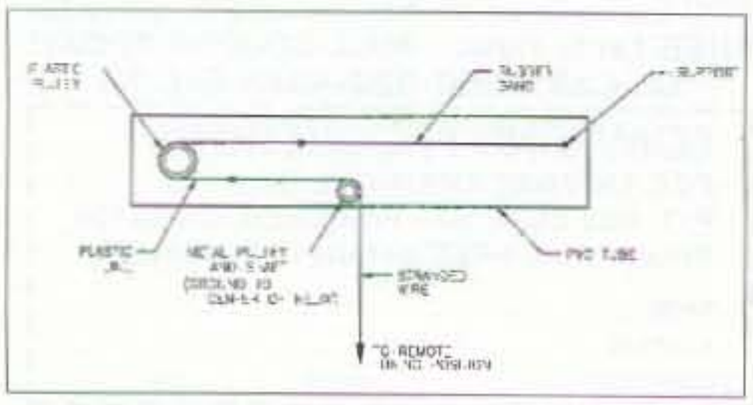


Fig. 2. Construction details.

Construction

Photo A shows a few of the structures tested using 1-1/2-inch pipe (1.9-inch o.d.). Three different tape widths were used to evaluate self-resonant frequencies. All structures are 5 feet long, using tape of 1/2-inch, 3/4-inch, and 1-inch width, closely spaced. The structure using end loading resonates at around 14.3 MHz using 1/2-inch tape. End loading stubs are 1 foot long and carry two strips of tape on opposite sides of the stub. The 3/4-inch tape structure resonates at 29 MHz. The 1-inch tape structure resonates around 45 MHz. 2:1 VSWR bandwidth of the 29 MHz TWA was measured as 250 kHz. A 14 MHz radiator of twice the dimensions would therefore yield a bandwidth of 125 kHz. Note the support tube attachment on the 29 MHz radiator. Using a saw, a "T" fitting is split, placed over the center coax connection, and clamped to the support tube with a hose clamp. The coax can then run down inside the support tube. Use good strain relief on the coax, because the tape is not strong enough to withstand pulling.

Scaling laws apply; doubling all dimensions will cut resonance frequency in half. That means doubling tape width, diameter and length of the PVC tube. Tape thickness does not affect resonance much, so it does not have to be doubled.

Close spacing, edge-to-edge, on the tape reduces ohmic losses. Losses are inversely proportional to tubing diameter for a constant tube length as tape width can be increased. However, when winding UHF helical resonators for use as axial beams, use wider tape spacing as more RF voltage exists between turns. Copper loss is not a problem in that case. I suggest using only 1/2-inch-wide tape for axial radiators.

Feeding and matching cable to HF TWAs is a snap. For a horizontal dipole, connect the coax shield to the center of the antenna (zero voltage point) and move the inner conductor to a point a few turns away until an exact match is found. No balun is required. For the test 29 MHz dipole (5 feet) with 3/4-inch tape the match was found at two turns. For the 14 MHz end-loaded dipole, the match was also found at two turns. If the frequency is off, simply unwind some turns and add a little tape or apply any form of end loading. The tape can be spliced and soldered easily.

For vertical dipoles the same principles can be used if the coax can be brought back at 90 degrees from the center. Monopoles working with a good ground plane are very simple. Just connect the end of the tape to the ground plane and the coax shield, then find the proper turn for the match as above. Make sure the ground plane resistance is less than the radiation resistance as calculated above. A half-wave monopole has a radiation resistance of only about 3 ohms! Of course, you can use two or three TWAs rather than full-length 1/4-

Continued on page 46

***Photo B.** Here's how to wind the tape onto the mast: close, but not touching.*

NEVER SAY DIE

Continued from page 33

change, and the low costs to their dictricts.

It's even possible to set up electronics labs for schools for next to nothing. Here in New Hampshire a friend of mine has been collecting no longer needed test equipment from electronics firms, refurbishing it, and giving it to local schools. He's found good school homes for hundreds of oscilloscopes and so forth. It's a nice nonprofit business that allows the donating companies to get a tax credit for their donations. Everybody wins.

I've got a lot more ideas along this line, but you don't need them now.

Who better to push for high-tech education than someone with electronics smarts like you?

Now, look around you. This is something that really needs to be done. If you don't do it, who will? It comes down to *you*.

Money

During the interview on the Art Bell W6OBB radio talk show I mentioned that if you're a ham you really should live on a 200-acre farm so you'll have plenty of room for antennas and no neighbors to bother. Well, obviously that takes money, Art pointed out. To which I replied that making money is easy, once you know the secret. Then we got off on another subject.

This resulted in several hundred people writing to ask about the secret to making money. So I sat down and wrote an instruction book, explaining the secret, and I put a $5 price tag on it. People might pay more attention if I charged $5,000, which it's well worth.

Several *73* readers have written recently asking about how to make money, so I suppose I should write about that now and then. I need an index to my editorials because I know I've written about this before. Probably many times.

Yes, it's possible to start from scratch and become a millionaire within seven years. Heck, it shouldn't take more than five years, if you're really serious about it. But that means throwing out almost everything you've been taught. Judging from the trouble I've had getting readers to change their diets so they won't be fat and sick, getting you to change your loser's approach to making money may be an even greater challenge.

The chances are that you haven't put any more thought into your future than I did when I was young. I took what came along. Everyone had to go to college to be successful, so I went to college. A war came along, so I went to war. After the war, like most everyone else, I went back to college. When I got out I started, for the first time, to think for myself. Instead of jumping into a big corporation like 99% of my school buddies, I said to hell with that and got a job as a chief engineer-announcer in a small North Carolina radio station. Small business. I handled the engineering, wrote and sold advertising, wrote programs, and had a great time announcing and doing DJ shows. I learned a lot and got very good at what I was doing.

But you're not interested in another Wayne Green bio. You are probably much more interested in how to make money. How to make a lot of money.

The basics

For starters, if you want to make money, doesn't it make sense to at least head your career in that direction? Or a second career, if you've screwed up the first.?And that means avoiding career choices which are never going to make much money. Like working for a large corporation, for instance. Another bummer is working for the government. A third route to nowhere is teaching. And what do our colleges aim you toward? Big business and teaching. Sucker.

They really love it when I lecture at universities on how to be successful. Well, actually, they don't invite me back as often as you might think because my message is that college is a total waste of time for anyone who wants to make money or accomplish anything significant. Even the professors get all upset when I discuss this because they realize for the first how badly they've been had by the system.

Remember John Taylor Gatto, the New York State Teacher of the Year, who pointed out that it only takes about 100 hours to teach a kid to read and write? Yet we have kids who manage to go through K-12 and four years or more of college without ever learning to read, much less write. If you think college grads can write you should read some of the mail and even articles I get. Pathetic!

My four years of college were pretty much a total waste for me, except as a bad example.

Yes, believe me (if you can), I know all of the arguments you're going to bring up. Sure, on the average college grads make more money than high school grads. But when you start looking into successful entrepreneurs, you're going to find the statistics show that few ever graduated from college. Many tried college and got fed up, thus putting them a few years ahead of the kids that hung in there for their diplomas.

There are very few jobs out there requiring a college diploma that are going to be very helpful to you in a career aimed at making money. Like just about none. So, if you are interested, no matter how old you are, in making money (isn't it about time?), you're not going to go back to college and piddle away another year or two. Or four.

Let's say you are in your 50s and could be downsized out of a job at any time. What then? Stacks of resumés? A few job interviews, followed by excuses. However, instead you can start from scratch and make it big time in five to seven years, depending on your dedication to success. If you're going to spend a lot of your time watching ball games and eating potato chips, you aren't serious. That's the route to oblivion, probably via a

Continued on page 47

Transmitter Hunting Equipment: A Club Project

Stimulate and strengthen your club membership.

Sam Guccione K3BY
110 Chalet Ct.
Camden DE 19934

Over the last several years a few members of the Kent County Amateur Radio Club (KCARC) in Dover, Delaware, have been active in T-Hunting. T-Hunting or transmitter hunting (also called fox hunting) is an amateur radio sport in which a transmitter, usually on 2 meters, is hidden, and hand-held radios with special electronic devices and directional antennas are typically used to find it. Joe Moell and Thomas Curlee have written an excellent book on this subject *(See "Sources" at the end of this article).*

Breck Smith K4CHE got me interested in T-hunts. The T-hunt bug bit so hard that I started harassing other club members to get involved. This reached such a level of intensity that I decided the only way to get enough hunters was to help people acquire or build the necessary equipment.

I started by using a simple device called an active attenuator. I constructed and used one described by PAØZR *(Sources)*. The design is very simple and a PC board is available from FAR Circuits. I was so pleased with it that I immediately built more. I gave away two and some parts for a third to encourage T-hunting. Well, this escalated into several club members' requesting lists of parts and where to get them, and from there it became a club project. Along with the active attenuator, some type of directional antenna is needed, plus a hand-held radio.

I designed a simple three-element beam to be used with the active attenuator, which several hunters have already copied. Let's build one!

***Photo A**. Top view of a completed attenuator. (Disregard the hole below the words "MAX dB"...nobody's perfect.)*

Constructing the active attenuator

Dave Holt N3RAE and I compiled the parts list shown for the PAØZR unit. If your club's members have well-stocked junk boxes, you may not need to order all of the parts on the list. Our club members paid half the cost of the kits and the club paid the other half. We built 27 attenuators, assembling eight of them in a couple hours during a regular club meeting. **Photo A** shows the top view of a completed attenuator. We used a regular potentiometer instead of the slide pot of the PAØZR article—it was a lot easier to drill a pot hole than to try to cut a slit for a slide pot. The switch on top marked "–25 dB" is a passive attenuator (described below).

"A bite from the T-hunt bug can start an epidemic of fun for your club, too!"

Fig. 1 shows the inside parts layout, with the PC board vertical, supported at two points to simplify construction. Bend one of the potentiometer solder tabs vertical, and solder between the outside ground trace of the PC board and this solder tab. This provides one support point. Apply a dollop of hot glue between the PC board and the end of the potentiometer to form the second support.

Since an AAA battery was used instead of the hearing aid battery used by PAØZR, a small change in the connection to the PC board is required. Wire the red (positive) wire of the battery holder to the on/off switch. Connect a wire from the on/off switch (S1) to the hole just to the right of the silkscreened area on the PC board. Then solder the black (negative) wire anywhere convenient on the ground trace, which encircles the outside edge of the board.

Hot glue the battery holder to the box. The other parts shown in **Fig. 1** are self supporting after they're soldered in place. One ground lug was used under the ANTENNA BNC connector (J1) for the ground connection of L1 and to provide a chassis ground for the PC board. Be sure you connect the PC board ground trace to the metal box, or the attenuator will not work.

The circuitry is not critical and relatively long wires may be used instead of the compact construction shown. (See **Photo B** for the construction technique used by one club member in his attenuator.)

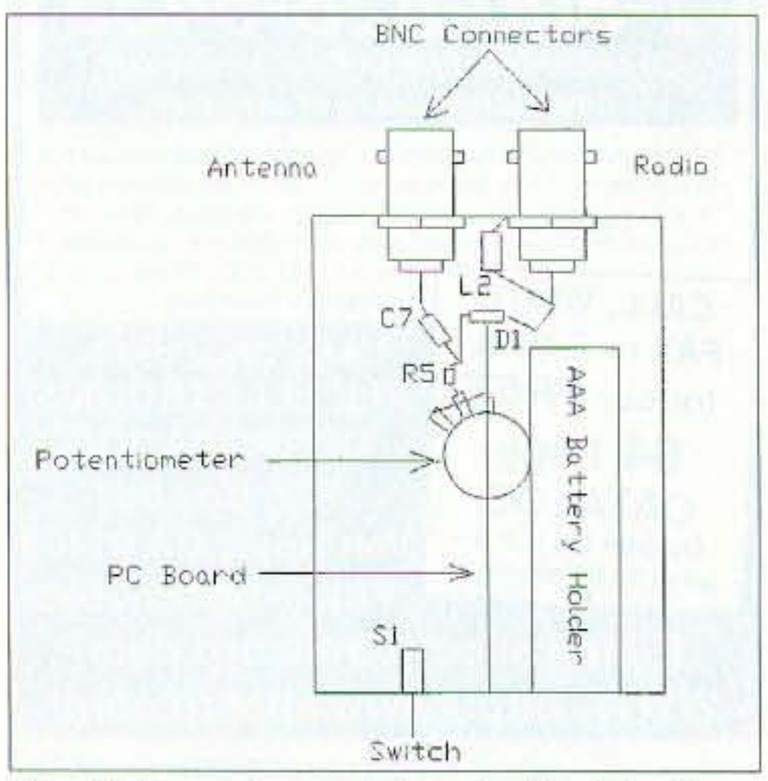


***Fig. 1** Attenuator parts layout of inside of box. The PC Board is shown in a vertical position.*

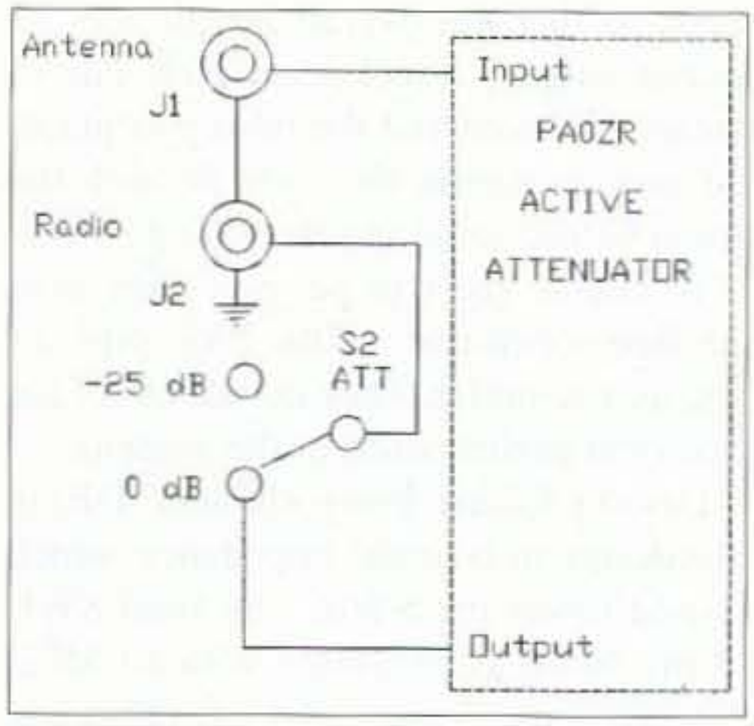


***Fig. 2** Wiring diagram of attenuator with passive attenuator included. The passive attenuator is an SPDT switch.*

Jerry Palmer N3KRX provided the idea to add a passive attenuator to be used in series with the active attenuator—it's just a SPDT switch wired as shown in **Fig. 2**. It provides 20 to 25 dB of additional loss, which (added to the active attenuator loss) gives 100 to 120 dB of attenuation for getting close to those high power hidden transmitters. If you feel that the passive attenuator will complicate your project, leave it out. Remember to wire the connector J2 directly to the active attenuator in this case.

Active attenuator operation and adjustment

The active attenuator works by mixing an incoming signal with a frequency generated by an oscillator inside the attenuator, to produce an output signal at another frequency. The oscillator frequency of this attenuator is 0.5 MHz. So if a 146.5 MHz signal is incoming, a signal of 147 MHz (146.5 + 0.5) is produced at the output of the attenuator. Since the attenuator is connected to your hand-held radio, this is the frequency that your radio should be set to. The potentiometer controls the signal level that goes to your hand-held. About 80 to 100 dB of attenuation is provided by this simple circuit. By the way, a frequency of 146 (146.5 - 0.5) could also be used since the active attenuator produces both sum and difference frequencies.

Adjusting the attenuator is simple: using the following procedure. Connect your HT, which should be set to 147 MHz, to the attenuator; put the HT rubber duckie on the attenuator input. Have a friend stand 30 to 60 feet away and transmit with his hand-held set as low as possible on 146.5 MHz. Adjust trimmer capacitor C1 for a maximum S-meter reading on your hand-held. (You may need to adjust the attenuator control R6 to keep the S-meter from pegging out.)

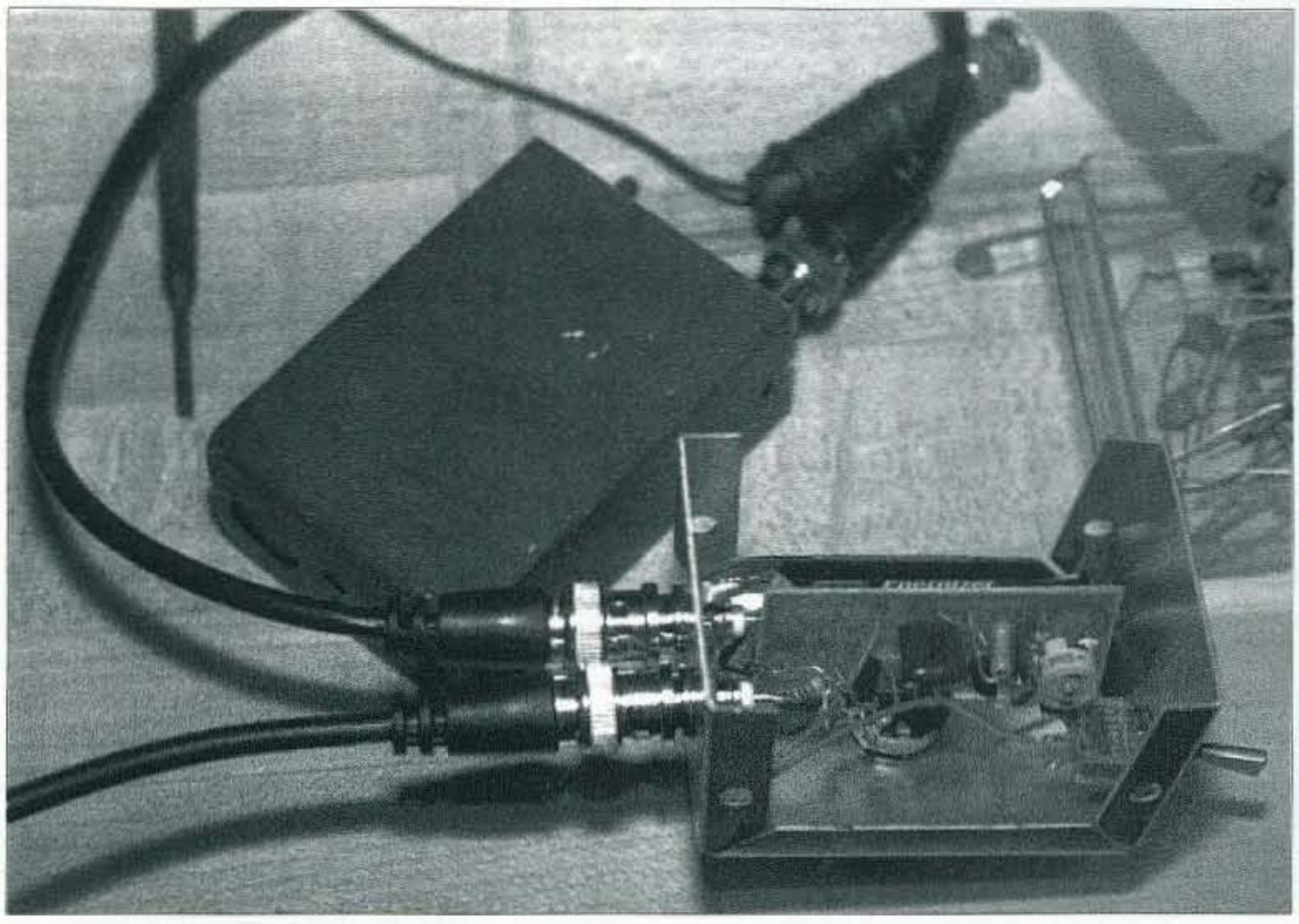


***Photo B.** Attenuator construction technique used by one club member, showing long connecting wires.*

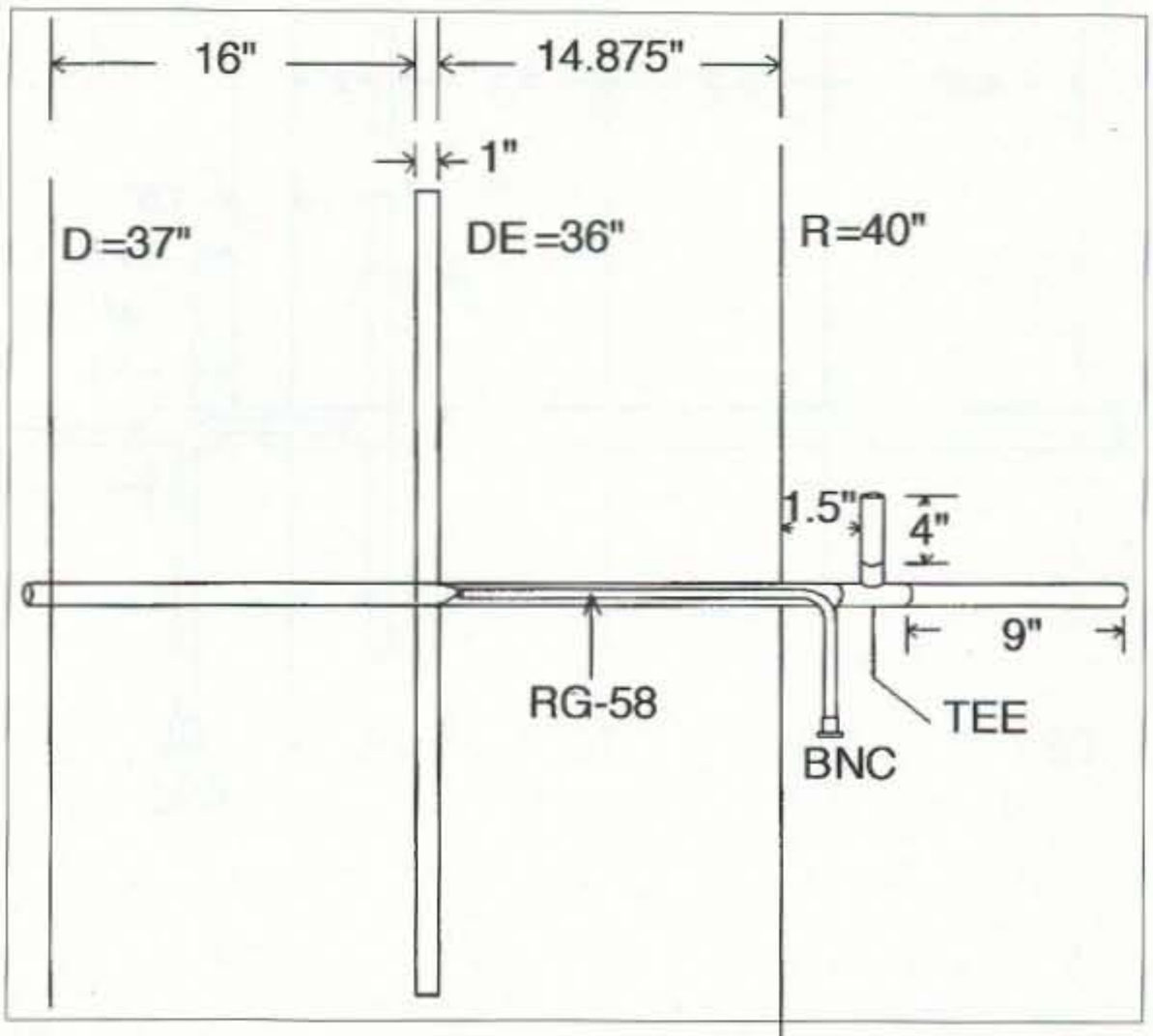


***Fig. 3** Dimensions and construction of the 2 meter T-hunt beam. The driven element dimension of 36" is correct. The length was adjusted to achieve a low SWR.*

Transmitting test

Although PAØZR didn't mention transmitting into the attenuator, I was curious. I tested mine with up to 5 watts for periods up to 3 minutes, without apparent damage. I would not recommend transmitting through the attenuator, but it is nice to know that if you accidentally key your hand-held with the attenuator attached, you won't burn it out.

Constructing the beam antenna

Many hunters have found that a yagi beam works best in most hunting situations. It is small, lightweight, easy to use in heavy brush, and simple to construct. I used the ELNEC program to design this beam. **Fig. 3** shows the dimensions and construction of the beam.

Brass brazing rods used for construction in this project were 36 inches long. Standard brazing rods are available in diameters of 1/16 inch, 3/32 inch and 1/8 inch. Be sure to use plain brass brazing rods and not the special coated ones or the center core kind.

As shown in **Fig. 3**, the boom is made from inexpensive, easy to use PVC pipe. The pipe tee forms a handle that uses your arm as a support for holding the antenna away from your body.

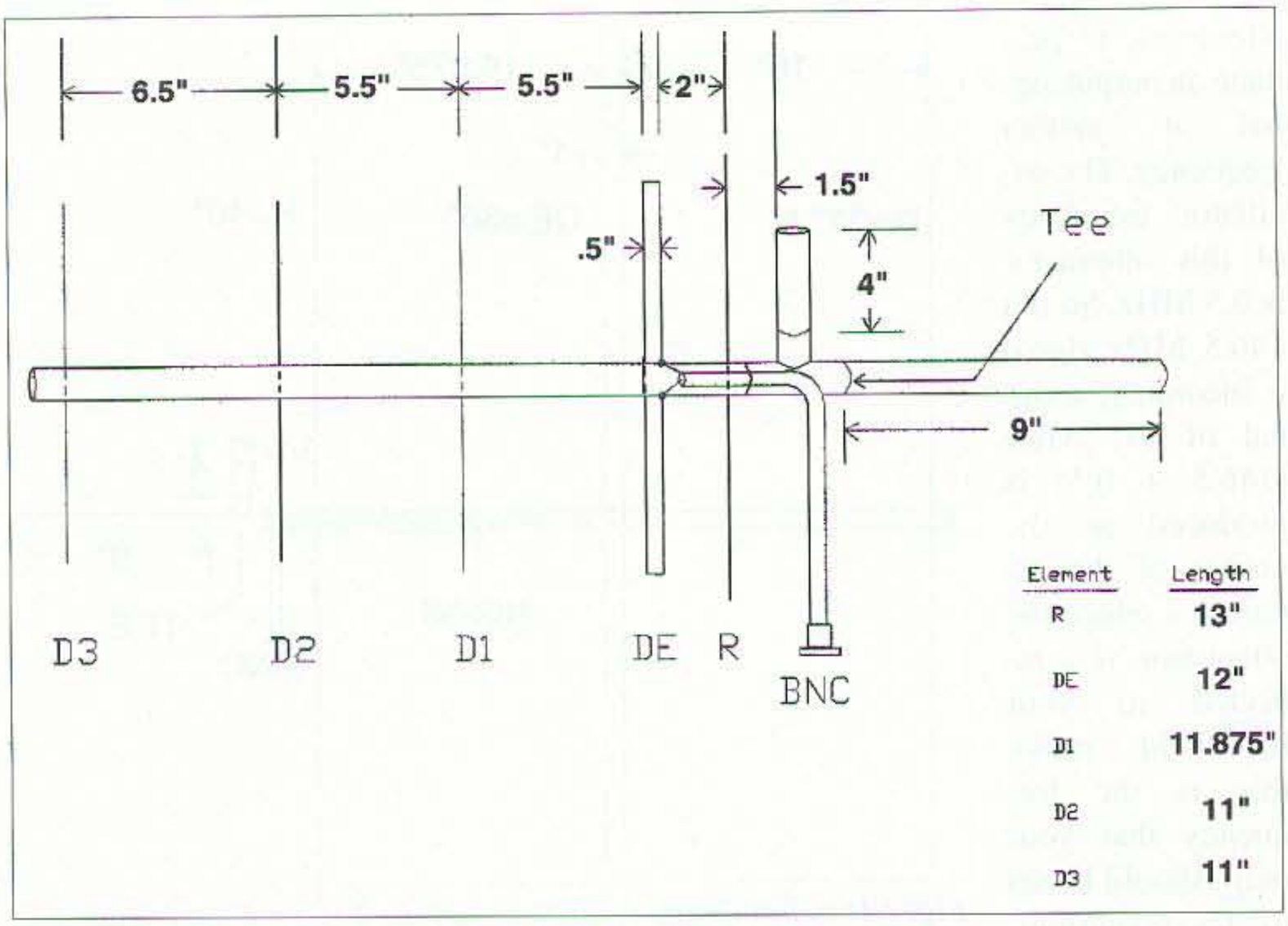


***Fig. 4** Dimensions and construction of the 70 centimeter T-hunt beam.*

The elements consist of the 36-inch brass rods with pieces of 3/32-inch (inside diameter) brass tubing used to extend the rod to the necessary length. You can probably find brass or copper tubing at your local hardware store or hobby shop.

Drilling the holes in the boom is a crucial step. I used a punch to mark the place in the PVC before drilling the 3/32-inch diameter hole for the elements. To maintain alignment of the holes during drilling, begin by drilling the hole for the director D at the distance shown in **Fig. 3**. Put a brass rod in this hole. Position the PVC so that the drill bit is over the next hole mark. Rotate the pipe until the brass rod is exactly vertical, and you can be assured that this hole will be vertical and in line with the first hole. You will probably want to clamp the PVC pipe. A drill press makes it easy to drill 40 or 50 holes if you are going to construct a large number of antennas, but we also constructed a few of the antennas with a hand drill. It took two of us to keep the drill straight so that the holes were aligned, using the brass rod for an alignment device as described above.

I made the director D by cutting two 2-inch pieces of the brass tubing. I slipped the pieces over each end of the rod, slid them so that the overall length was 37 inches with 18.5 inches on each side of center, and soldered the tubing in place. Be sure to mount the rods through the boom before soldering the tubing pieces.

To finish, you can put pipe caps over the three open ends of the PVC pipe, or not, as you prefer. They do not affect the electrical performance of the antenna.

I used a folded driven element (DE) in this design to raise the impedance, which should lower the SWR. The final SWR of my beam as measured with an MFJ-259 SWR meter was 1.1 to 1. Other antennas constructed by club members had SWRs of 1.1 to 1 up to 1.5 to 1.

The feedline is connected directly to the folded element. Antenna purists may object, citing lack of balance. However, I have built quite a few of these antennas and have not experienced significant pattern distortions; variations are not noticeable when using the antenna for T-hunting.

Hunting in the 70 cm band is catching on in various parts of the country, including Delaware. Since the active attenuator works well in this band, I have included the design and construction details of a 5 element 70 cm beam (**Fig. 4**).

If you purchase the materials for this beam at the same time you purchase materials for your 2 meter beam, you can reduce the cost of the 70 cm beam substantially.

The same construction techniques used in the 2 meter beam are used in this design. The SWR of my 70 cm beam was 1.8 to 1 as measured using an MFJ-219 UHF SWR analyzer. I have used this beam during a few 70 cm hunts held here in Delaware and found it to have a very sharp pattern.

***Photo C**. Some of the newly constructed attenuators at end of the club meeting night.*

Testing the beam antenna

Connect your active attenuator to your hand-held, and the beam to the attenuator. Note that the coax jumper cable connects from the attenuator output to your hand-held antenna jack. Hold your beam with the elements vertical, as it would be used in most T-hunts. Make sure your hand-held is set to a frequency of 147 MHz.

Have a friend standing 30 to 60 feet away transmit with low power on a simplex frequency of 146.5 MHz. Point your beam at your friend and adjust your attenuator to produce a one-half to three-quarter scale reading on your S meter.

Swing your beam slowly to the left, then to the right. You should see your S-meter fall off on either side as you point away from your friend. Rotate your beam completely around in a circle. You should see your S-meter reach a peak value when the beam is pointed at your friend. You will also get an S-meter reading when you point your beam directly away from your friend, but this reading will be much lower than when the beam is pointed at him.

Change the antenna to the horizontal orientation and repeat the above tests. You should find the maximum S-meter reading occurring in the same direction as your friend's transmission. If neither of these tests works as described, have your club's technical expert check your antenna.

After our club members completed their attenuators and antennas, practice hunts were held, starting with a walking hunt. A small T-hunt transmitter was placed about a half mile from the hunters. I have written out the procedure we used and have included it below.

To the field!

First set the attenuator for minimum attenuation (maximum signal reception). Rotate the beam quickly around in a circle to get a rough direction, then fine-tune by moving your antenna in smaller arcs to find the maximum signal. Taking a bearing with a pocket compass can help at this point.

Begin walking in the direction of the bearing. Be ready to take a new bearing any time the hidden transmitter identifies. As you get closer to the hidden transmitter, you will need to increase attenuation by turning the knob. You can get a "feel" for how close you are to the transmitter by noting how much attenuation you have at each reading you take.

Well that's it. We ended up constructing a total of 27 attenuators and 15 beams as a part of our club project. Participation in local fox hunts has boosted our enthusiasm and our membership—we picked up a number of new members.

I wish to thank the members of the Kent County Amateur Radio Club (KCARC) in Dover, Delaware for their support in making this project a success. Special thanks go to Breck Smith K4CHE, my sounding board and technical advisor, and to the KCARC club president, Richard Lomax N3JCP, for taking the photos.

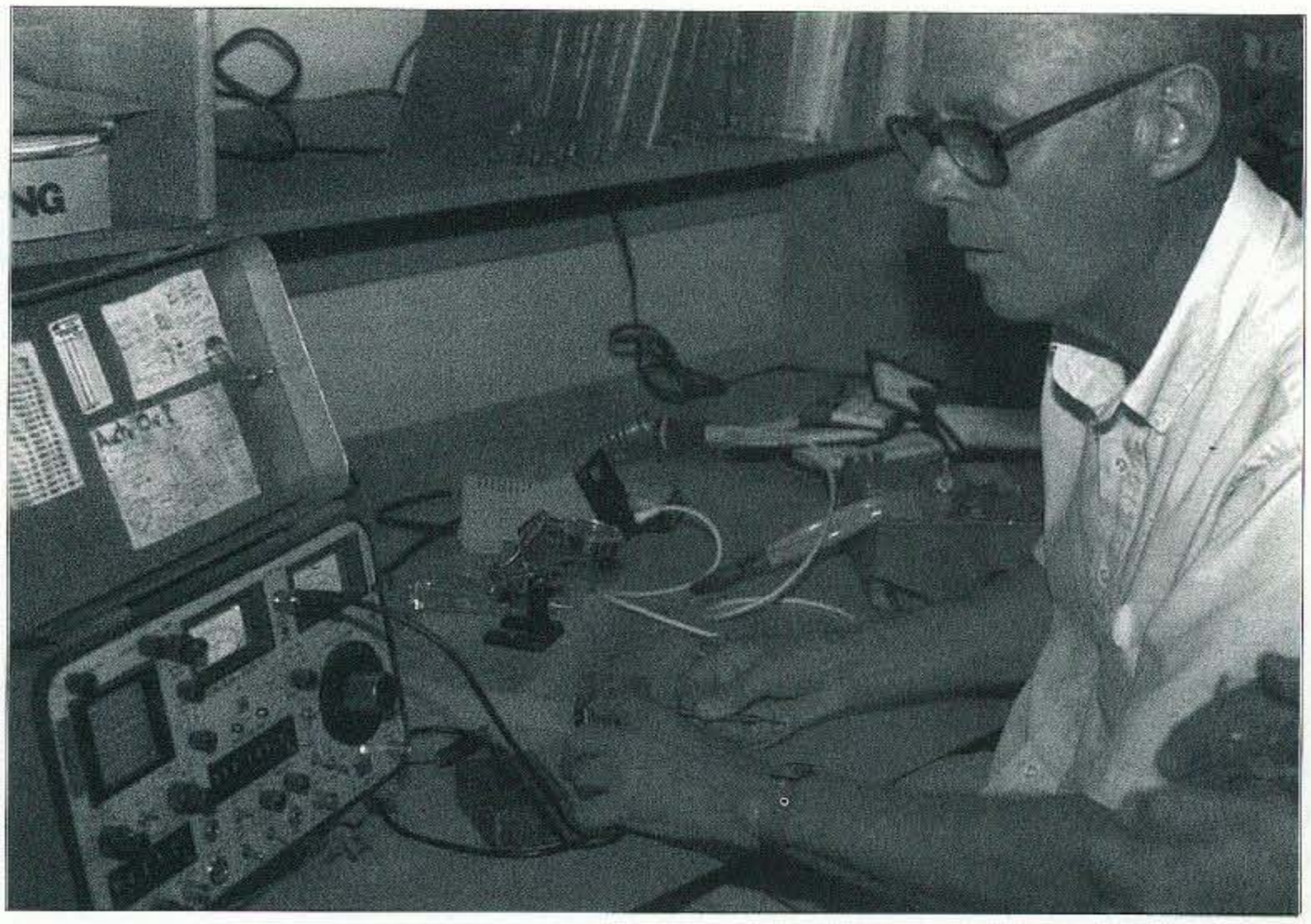


***Photo D**. Breck Smith K4CHE aligning an attenuator using his spectrum analyzer (on the left).*

I would be happy to answer questions or provide details not described to anyone deciding to take this project on. I may be reached by E-mail at sguccion@outland.dtcc.edu or by regular mail at 110 Chalet Court, Camden DE 19934. 73

70 Centimeter Beam Parts List

38"	1/2" dia. CPVC pipe
1	1/2" dia. CPVC pipe tee
3	1/2" dia. CPVC pipe caps
2	36" length 3/32" dia. brass brazing rods
3'	RG-58 coax cable with BNC connector
1 can	PVC cement

2 Meter Beam Parts List

50"	1/2" dia. CPVC pipe
1	1/2" dia. CPVC pipe tee
3	1/2" dia. CPVC pipe caps
4	36" length 3/32" brass brazing rod
18"	3/32" inside dia. brass tubing
3'	RG-58 coax cable with BNC connector
1 can	PVC cement

Sources

1. Joe Moell and Thomas Curlee, "Transmitter Hunting: Radio Direction Finding Simplified," (TAB Books, 1987)

2. Eenhoorn, Anjo, PAØZR, "An Active Attenuator for Transmitter Hunting," *QST*, November 1992, pp 28-29,95.

Attenuator Parts List continued on page 41

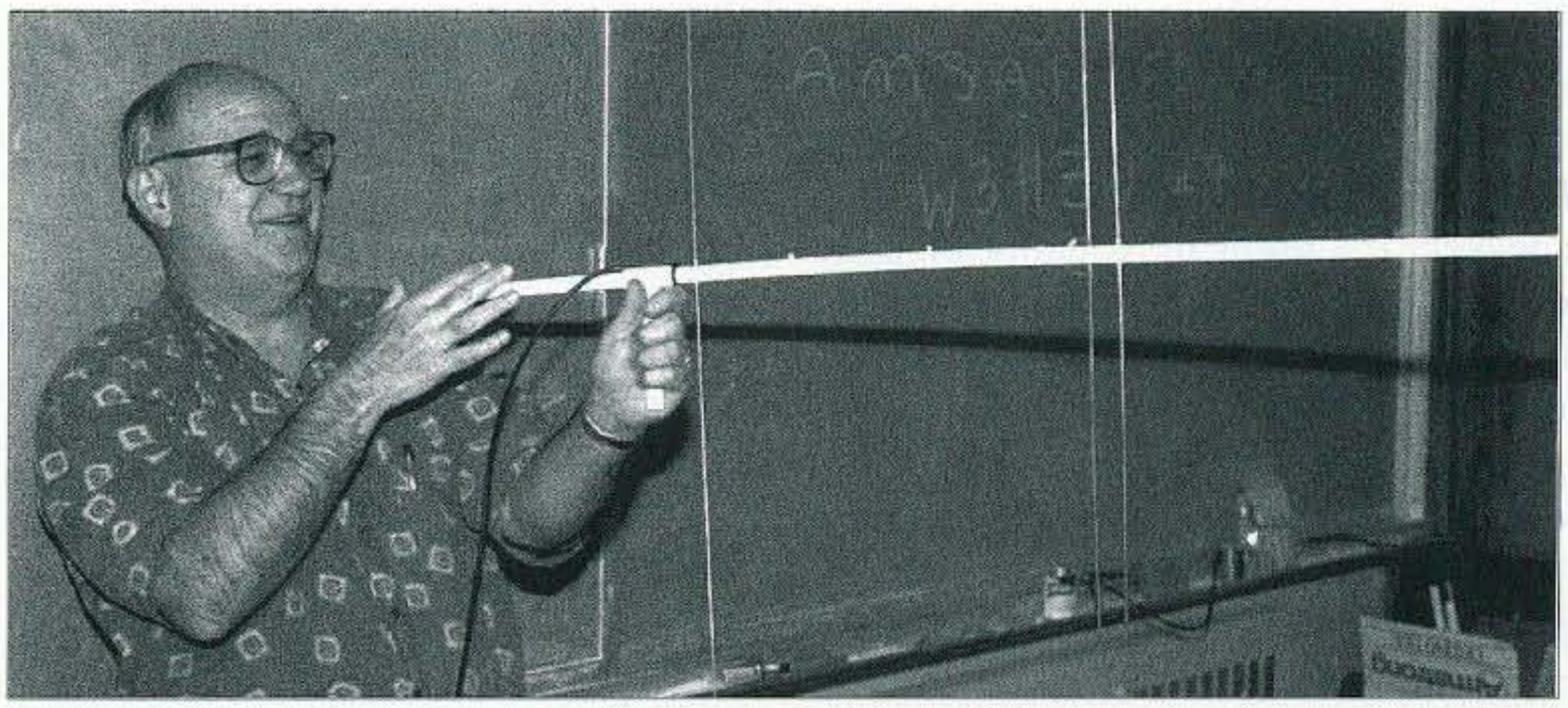


***Photo E.** The author demonstrating the use of one of the newly constructed fox-hunt beams.*

Simple Multi-use Amplified Speaker

J. Frank Brumbaugh KB4ZGC
P. O. Box 30 - c/o Defendini
Salinas PR 00751-0030

So you've built that nice kit transceiver, and you want to use it in your shack. You've got two problems right away. First, it was probably designed to run off batteries, and second, it probably doesn't have enough audio power to drive a speaker.

Many kits are designed that way to save money and to make them portable. The power supply and audio amplified circuits add weight, raise costs and create current drain that makes the units difficult to use in the field.

For everyday use, many hams add a regulated power supply and use their field units at home. The power supply doesn't solve the audio problem, however. If an audio amplifier and speaker is added to an existing receiver or transceiver it is not available for any other use. It cannot also be used on a different receiver, nor as a test speaker when checking designs of audio circuitry.

"Self–contained, lightweight—it uses almost no power, yet you get wonderful sound! At home or in the field, you'll be proud of this project."

What is needed is a compact, lightweight, self-contained amplifier and speaker with volume control, and a headphone jack that can mute the speaker. It should be capable of producing normal room volume while requiring minimum current with no or minimal distortion. It should be capable of being powered by either an internal 9-Volt battery or an external 12-Volt battery or 13.8-Volt power supply. It should use few and inexpensive parts, and be easily constructed and used by any ham. The unit described here meets all these requirements.

The Circuit

Fig. 1 is the schematic diagram of this amplified speaker. S1 is a SPDT toggle switch with a center-off position (on-none-on). In one position it connects the internal 9-Volt battery to power the amplifier. In the opposite position it connects the amplifier to J3, to which is connected an external storage battery or regulated power supply. When the unit is not in use, the switch is centered.

U1 is an LM386 audio amplifier chip in an 8-pin DIP package, wired to produce maximum gain at minimum current. In operation, low level audio is fed through J1 (audio in) through isolation capacitor C1 to the top of the volume control R1, a 10k audio-taper potentiometer. Audio taken from the wiper of R1 passes through isolation capacitor C2 and is applied to one input of amplifier U1. This input is lightly bypassed by C3 to prevent U1 from picking up stray RF, including that from any local AM broadcast station, and serves to stabilize the amplifier. Amplified audio is taken from pin 5 of U1 through coupling capacitor C7 to closed circuit jack J2 (PHONES) and then to the speaker, LS1. Mute the speaker by plugging headphones into J2.

Construction

U1 and associated components should be mounted on a small piece of perf board or one of the general purpose printed circuit boards available at Radio Shack™. C3 should be mounted with short leads between pins 2 and 3 of U1. Mount C4 at the end of U1, where pins 1 and 8 are located. Mount C6 with the shortest lead possible to pin 6 of U1. You may wish to use an 8-pin DIP socket for U1, but it is not necessary.

This unit should be constructed in the smallest case that will hold your components. The speaker should be small, yet have a large magnet and be rated for 1/2 watt or more. Recommended is a 1-Watt, 8-Ohm speaker intended for cellular phone use. It is 1.8 inches in diameter. Magnet diameter is 1.35 inches. It is available from All Electronics, P. O. Box 567, Van Nuys CA 91408-0567. The catalog number is SK-175. However, you can use any 4 or 8-Ohm speaker you have in the junk box.

A small aluminum box will make the best enclosure, but you can use a plastic box, or make one from pieces of printed circuit board material. You can drill a series of small holes in the circular area of the panel behind which the speaker will be mounted. You could also cut a circular hole for the speaker and use a piece of screen wire or perforated aluminum as a grille over the hole to protect the speaker cone.

Mount LS1, J1, J2, S1 and R1 on the panel. Mount J3 on the rear of the enclosure. Put rubber feet on the bottom to prevent scratches.

Battery BT1 can be mounted internally in a clip, or you can use self-adhesive strips of hook-and-loop.

Operation

Connect a source of audio, such as the output from the headphone jack of your receiver, to J1. Switch S1 to INT

to use the internal 9-Volt battery, or to EXT, if an external power source is connected to J3. Adjust R1 for a comfortable volume level from LS1. If there is too high a level of audio at J1, it should be reduced at its source. If you plug headphones into J2 the speaker LS1 will be muted, and you will have to reduce the volume level with R1 for a comfortable listening level. Because this unit is essentially noise-free, any noise you hear will be coming from the source plugged into J1, and will be amplified along with the desired audio.

When this unit is working, the LED Dl will be lit. When it's not being used, place S1 in the center (OFF) position; the LED will go out.

Using the internal battery, or with an external 9-Volts applied to J3, and no audio input, the amplifier draws 8 mA. With R1 fully clockwise (maximum gain) you will hear no, or almost no, white noise from the speaker or in the headphones using the internal battery for power. Any noise heard with an external power supply will originate in the power supply itself under these conditions.

With the audio level set at comfortable listening level, current drawn on CW or voice peaks can reach 50-75 mA. However, since this occurs only on peaks, the average current drain will be between one-third and one-half the peak current drawn on peaks while a signal is present. 73

Parts List

BT1	9-Volt Alkaline Battery
C1, C2	1 µF 16 V electrolytic
C3	470 pF ceramic disc
C4	10 µF 16 V electrolytic
C5	0.01 µF ceramic disc
C6, C7	470 µF 16 V electrolytic
Dl	LED, color optional
J1	Mono phone jack, builder's choice
J2	Closed circuit phone jack, builder's choice
J3	DC jack, builder's choice
LS1	4 to 8 Ohm speaker (see text)
R1	10k Ohm audio taper potentiometer
R2	2.2k Ohm 5% 1/4W
R3	22 Ohm 5% 1/4W
R4	10 Ohm 5% -1/4W
S1	SPDT center off toggle switch
U1	LM386 audio amplifier

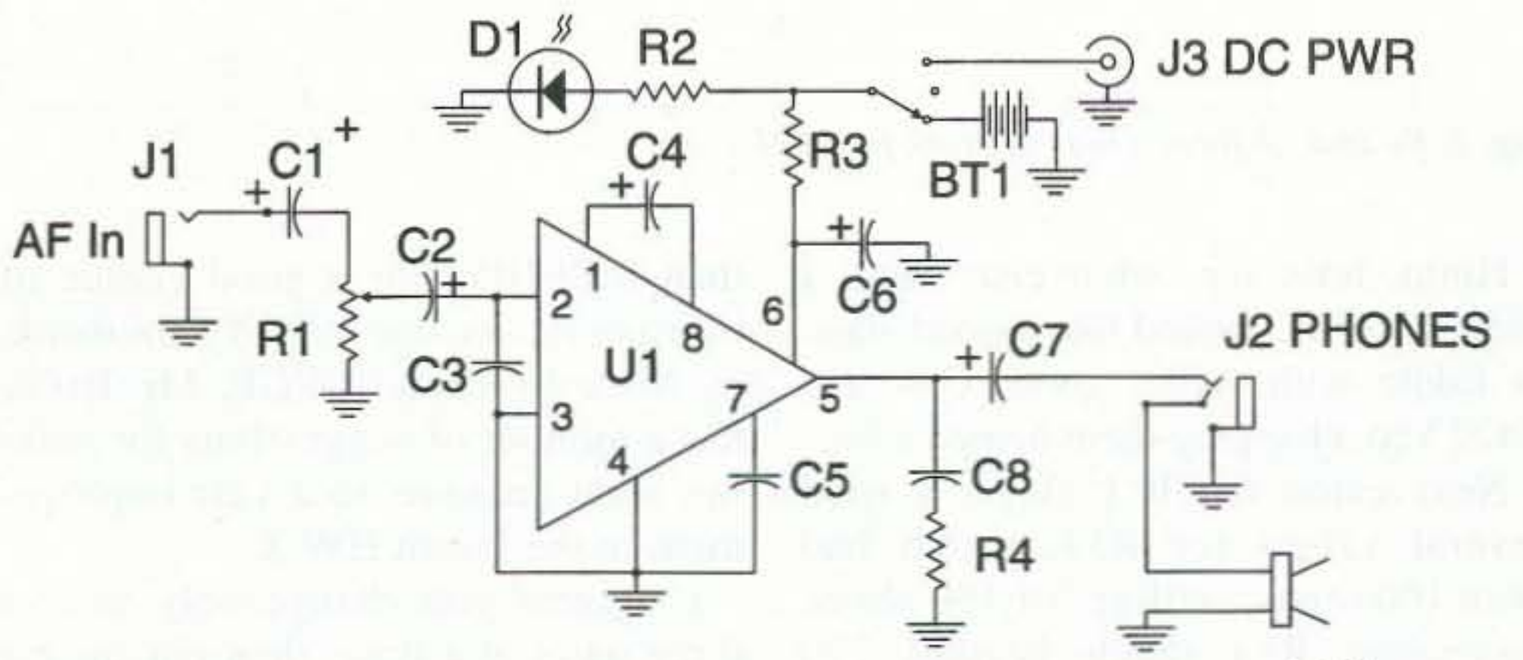


Fig. 1. The schematic diagram of this amplified speaker.

Transmitter Hunting Equipment

Continued from page 39

Active Attenuator Parts List

M = Mouser Catalog #

1	C1	112-100 pF trimmer M242-3610-100
1	C2	.0027 µF M140-PF2A272J
1	C3	.01 µF M140-PF2A103J
1	C4	330 pF M140-CA50P331K
1	C5	.1 µF M140-PF2A104J
1	C6	390 pF M140-CA50P391K
1	C7	120 pF M 140-CA50S121J
2	J1/J2	BNC chassis mount M523-31-221-RFX
1	L1	470 µH M43L0474
1	L2	3.3 µH M43L0336
1	Q1	2N2222A M333-KTN2222A
1	Q2	2N3094 M 333-2N3904
1	R1	3.3M30BJ250-3.3
1	R2	100 M30BJ250-100
1	R3	47 M30BJ250-47
2	R4/R5	1 M30BJ250-1K
1	R6	1 M31CN301
1	S1	SPST 108-MS550K
1		AAA battery holder M12BH410
1		coax jumper cable Jameco 102314
1		knob M45KN021
1		PC board FAR Circuits PAØZR board
1		project box Radio Shack 270-235

Note: 1) all resistors are 1/4 watt
2) potentiometer is 1/2 watt
3) AAA battery not included

FAR Circuits, 18N640 Field Court, Dundee IL 60118, 708 576 3540

Jameco, 1355 Shoreway Road, Belmont CA 94002-4100, 1-800-831-4242

How to Make an Old HW-8 Come Alive

New life for a vintage rig

Gerald F. Gronson K8MKB
3529 Belinda Dr.
Sterling Heights MI 48310

The next time you see an old Heathkit HW-8 at a flea mar ket, grab it. With maybe an hour's work you can put some pep into this old "hot-water" baby and have fun. Here's how I substantially improved one.

In looking at the schematic, I could see that the receiver section was pretty good, but that the resistor and capacitor values were not the best choices. I could squeeze better performance out of this puppy.

Since the audio board (**Fig. 1**) was the easiest to get at, I started there. The output transistor was only loafing, so I changed C201, C204, R202, and R205 as per the parts change list to pep it up.

Having experimented with op-amp active filters, I thought the capacitor and resistor values of the stages built around IC2A and IC2B could be improved. Using a 750 Hz center frequency, the new R and C values brought the narrow filter section into alignment. The audio and RF gain controls now had to be turned down on loud stations.

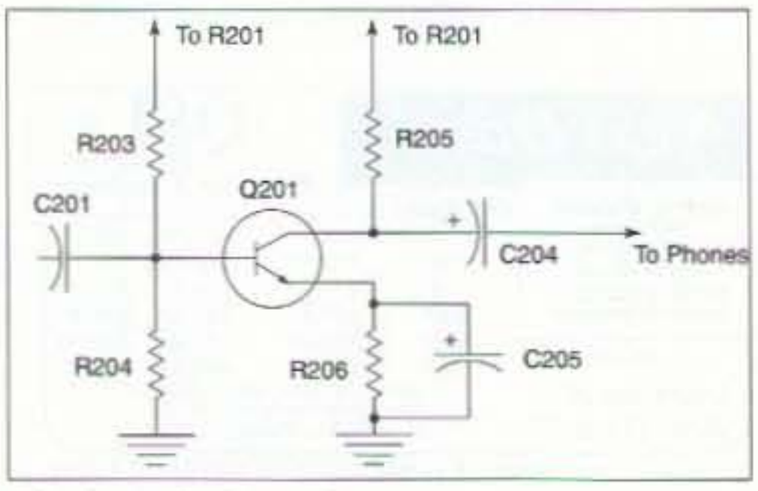


Fig 1. Audio board.

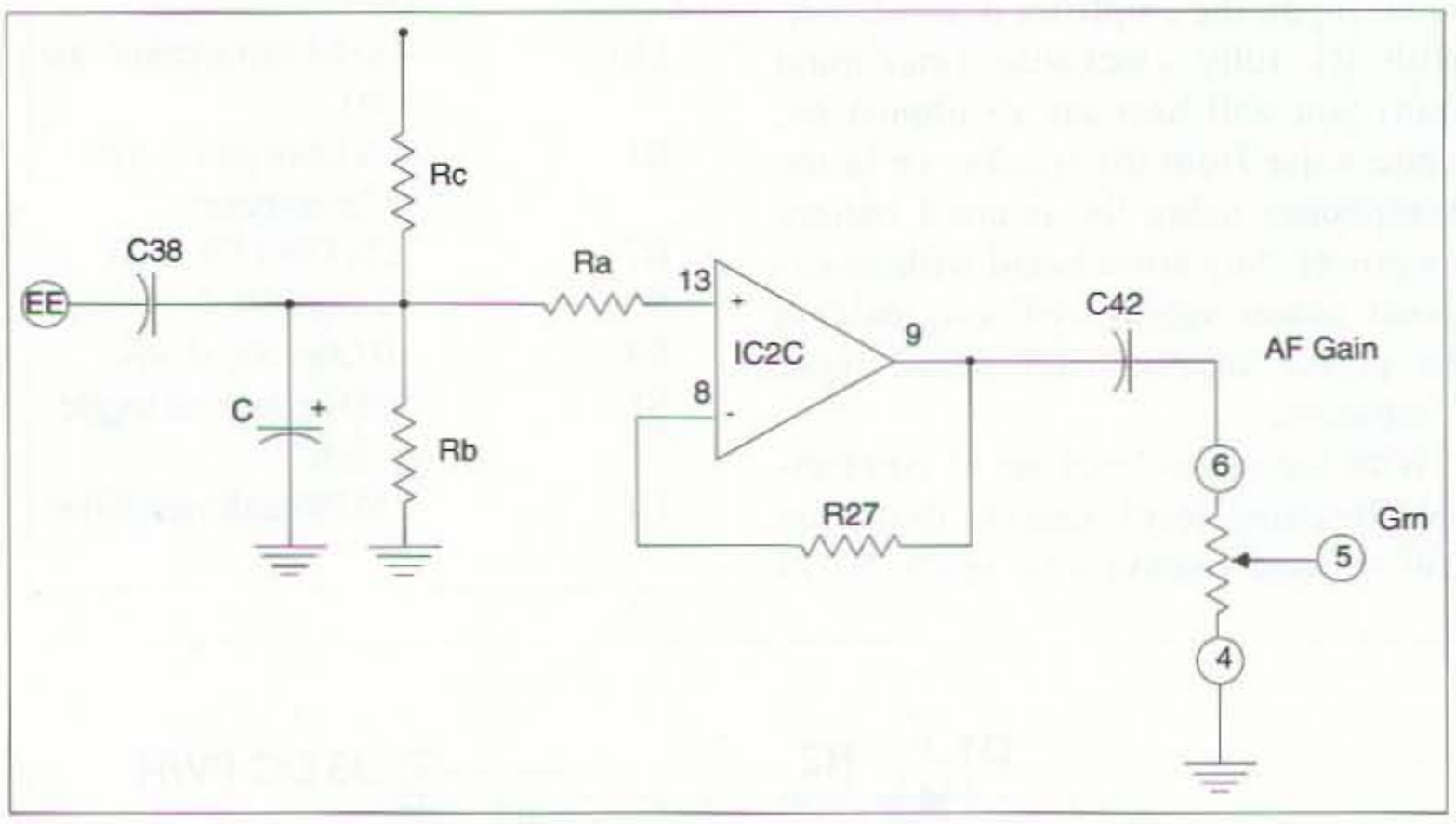


Fig. 2. Ra and Rb form a bias network for IC2C.

Hmm, let's see, what else could I change? IC2C looked like a good stage to fiddle with. What about C38 and C42? Yep, changing them helped a lot.

Next came the IC1 stage. I tried several values for R14, which had been 100 ohms, settling for 180 ohms. Increasing R14 much beyond 220 ohms causes oscillations.

One more stage to go. The RF amplifier was the kicker. Q1, #417-169, is an MPF105 — the worst possible choice they could have made for the RF amplifier. I replaced it with an MPF102, which is not the best possible FET to use. There are better transistors; however, the MPF102 *is* an RF type transistor and is a *much* better choice for Q1 than an MPF105. A coupling capacitor would be better than MPF105. For a good choice of transistors, see *The HW-8 Handbook*, by Mike Bryce WB8VGE. Mr. Bryce has a number of suggestions for making what amounts to a vast improvement in the Heath HW-8.

I suggest you change only two or three parts at a time, then put the rig back together enough so that you can turn it on and check its operation. Then proceed with the next three parts. This will ensure that if you make a mistake it will be easier to correct. Use a low-wattage soldering pencil and some Solder Wick to desolder the old components. A Radio Shack™ desoldering iron works just fine.

To reduce the internal circuit noise remove the 2.2 meg R26 and drill a little hole in the circuit board with an

X-acto knife where R26 was. Replace R26 with a tripod-like group of Ra-Rb-Rc (see **Fig. 2**). Ra should be the same value as R27. Replace R5 (**Fig. 3**) with R26.

The only other thing is to use a trimmer pot in place of R14 — a 1000 ohm value would do it. There is enough room for one and it makes it easier to adjust for optimum value.

I think you'll be happy with the receiver improvement and be able to have a lot of fun with this old rig. 73

Parts Change List

Part #	From	To
R205	1k	1.6k
C204	2 µF	35 µF (optional)
R203	47k	As necessary to adjust Q201 bias for best signal
C201	2 µF	4.7 µF
R202	4.7k	2.2k
C42	2 µF	4.7 µF
R26, R27	See **Fig. 2** for bias network	
C38	2 µF	5 µF
C31	.1 pF	.05 pF
C36	1000 pF	1800 pF styrene or Mylar ™
R25	1m	1.2m
R24	82k	47k
R14	100 ohm	180 ohm or 1k trim pot
R5	100k	2.2m
Q1	MPF 105	MPF 102 If available, 2N4416 is better

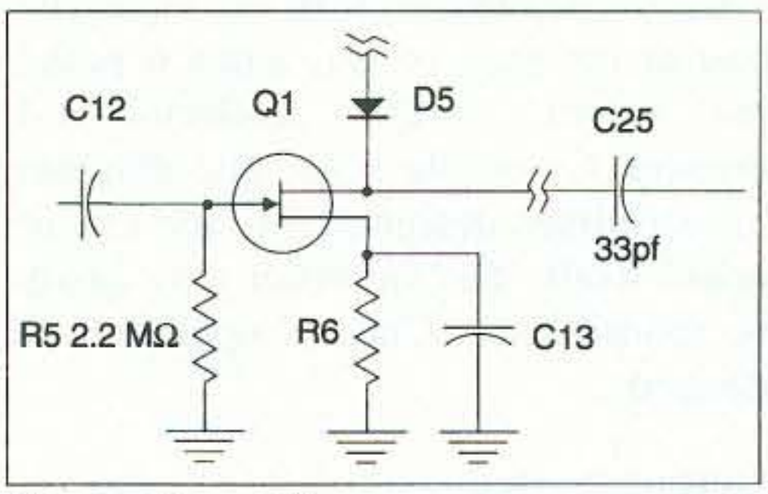


Fig. 3. RF amplifier.

Mikes and Match

Can an ICOM mike talk to a Kenwood radio?

Max Holland W4MEA
7333 Valley Lane
Hixson TN 37343

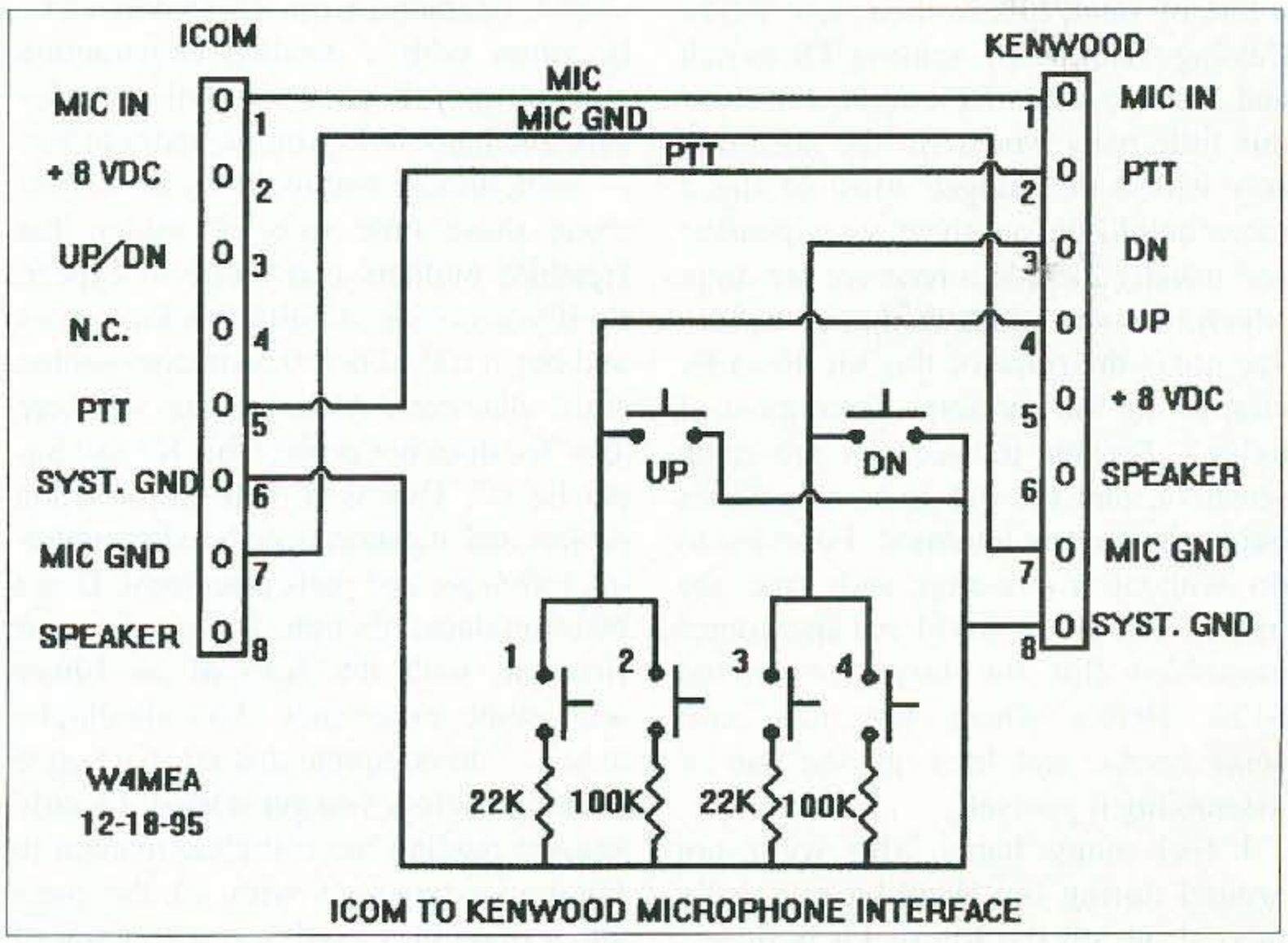
Pull up a seat and I'll explain how you, too, can interface just about any micro phone to any rig. All it takes is the brass to outwit the manufacturers. For instance, let me show you how I got an ICOM SM-8 microphone to work comfortably with a Kenwood TS-50-S transceiver. This method can be used for interfacing just about any combination of microphone and radio.

Microphones for Kenwood equipment, naturally, do not match the pin numbers of the ICOM equipment. You expected standardization? However, the voltages and operating characteristics are similar. The ICOM has two buttons on the base of the SM-8, but they do not match the UP/DOWN buttons on the Kenwood, so they are not used. The TS-50-S has an UP and DOWN button on the mike for changing frequency and four buttons for special features. So I built a simple interface box to take the place of the mike buttons and wired them so they'd be usable by the Kenwood.

This is an easy one-evening project that will cost maybe $10. Use some good quality push-button switches. The box can be plastic or metal; however, you want to keep the leads short, since the RF and AF will be close together. 73

Parts List

- 2 22k 1/2 watt resistors
- 2 100k 1/2 watt resistors
- 6 SPST Normally Open (N.O.) push-button switches
- 1 8-pin mike plug (to the Kenwood radio)
- 1 8-pin panel jack (from ICOM microphone)
- 1 Plastic or metal box



ICOM TO KENWOOD MICROPHONE INTERFACE

73 Review

Build the Neat 2m Amplifier Kit

A great pair of shoes for your HT or data radio.

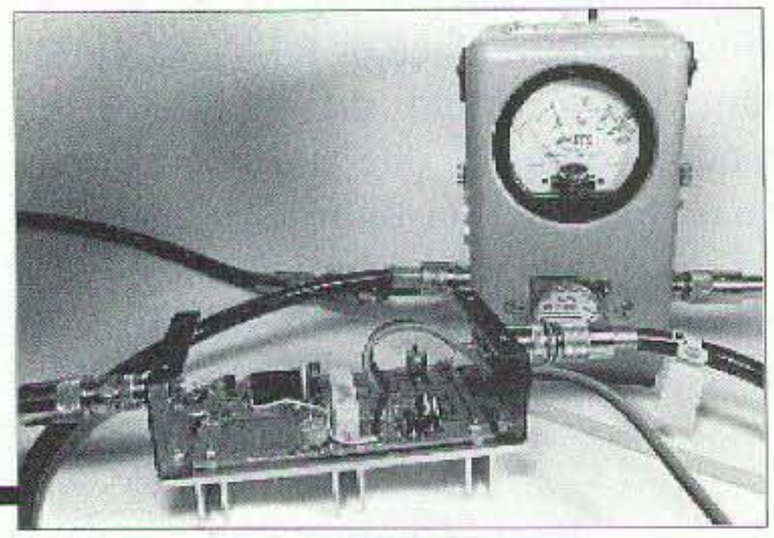


Photo A. *Tuning it up to 35 watts, just like the specs promised!*

Bill Richarz WA4VAF
10035 Little Creek Road
Charlotte NC 28227

If you are using an HT or other low power radio for packet, you may want to try your hand at building this Ten-Tec 2-Meter Amplifier Kit. Even if you're not using your HT for packet, you can take the "scratch" out of your Handi-Scratchy so everyone will hear you full quieting, and love you for it.

Recently I acquired one of those low power data radios from MFJ. It did a fine job of receiving packet, but with only 5 watts out, there were too many Retrys. There were some stations I could copy well, but they were not hearing me. I needed a boost in power to eliminate the Retrys. Enter the Ten-Tec Kit. Ten-Tec, a well-known HF manufacturer, has a line of small kits in their new T-KIT Catalog. With an RF sensing TR switch and 20 to 35 watts RF output, I decided this little baby would fill the need *and* stay within the budget. Most of the 2 meter amplifiers out there are expensive and usually include a receiver pre-amp, which of course adds to that cost. Ten-Tec holds the price of this kit down by eliminating the pre-amp. Since most of today's 2-meter transceivers are quite sensitive, and the pre-amps sometimes only enhance any intermod, I decided to do without a pre-amp and save the money. The kit costs $74 and also comes assembled (for the lazy) for around $120. Here's where you can save some bucks, and have all the fun of assembling it yourself.

I feel many hams who were not around during the Heathkit era really missed out on the fun of kit building. To take a pile of parts, solder them on a PC board or chassis, and have the whole thing come to life...well, you can't imagine the feeling until you try it for yourself. After all, experimenting and building are an important part of ham radio.

Introduction

The T-KIT No. 1200 offers you the opportunity to construct, understand, and use an RF Power Amplifier for the 2-meter. The amplifier is designed for mobile, portable, and base station operation, providing over 30 watts of RF output, operating from 12-15 Volts DC. It comes with a detailed construction manual and all parts, including enclosure and hardware. Nothing extra to buy — well, almost nothing; they do *not* include those little rolls of solder that Heathkit builders had come to expect. So if you decide to build this kit, go out and buy a roll of 60/40 resin core solder, small diameter. Also, let me say here Ten-Tec does not project this Kit as "Super-Easy." This is a VHF construction project and attention is required in soldering technique and parts placement. Don't be intimidated, though. This can be your first kit, with the help of an Elmer with some experience. You should be able to complete this kit in a single evening. Before you get started, I would suggest reading the complete manual to familiarize yourself with all the parts and terminology used in construction of this kit. Also, you will need a few tools such as a 25-watt soldering iron, diagonal cutters, needlenose pliers, and a Phillips screwdriver.

"You can take the 'scratch' out of your Handi-Scratchy."

Circuit description

Q1 is a VHF RF power transistor operating in Class AB (See **Fig 1**). Bias is controlled by Q2, adjustable by 100-ohm trimmer R2. Q3 and its related components form an RF-sensing circuit which energizes the T-R relay during transmit only. When the relay is not energized, the input is shunted to the output, bypassing the amplifier circuit. This arrangement not only makes the needed antenna connection for receiving, but also permits normal use of the transceiver when the amplifier is turned off.

C5 is adjusted to peak the input circuit at the base of Q1, and C6 peaks the output at Q1's collector. L4 through L8 on the schematic diagram are striplines designed into the circuit board itself. The amplifier may easily be modified for Class C operation, if desired.

Getting started

While the manual provides step-by-step instructions, there are no illustrations other than the circuit board layout and an exploded view of the final assembly (**Fig. 2**). You should check off each step as it is completed in the boxes provided in the manual. Also pay close attention to the orientation of the banded cathode ends on the diodes as they are installed. The PC board is silk-screened with the

component outlines, making it easy to position them correctly. All parts are mounted on the top side of the PC board and soldered to the bottom, except for one transistor which is mounted on the bottom, so there is little chance for error. The one problem you might encounter is the winding of an RF coil. It consists of 12 turns of the supplied #16 enameled wire, close-wound on a standard 1/4-inch drill bit.

The kit may be built for class AB or class C operation, making it suitable for FM, AFSK, AM, SSB, or CW operation. I would suggest building it for class AB, then modifying it for class C, which is what I did. I later cut the two jumpers, making it a class C amplifier for use with my 2-meter FM packet station.

I had no problems mounting and soldering the components to the small board. On completion, it is a good idea to inspect the PC board for bridged solder joints, correct orientation of diodes and transistors, and correct selection of resistors and capacitors. Although satisfied that all parts were assembled correctly, I was a little hesitant in applying power for the first time. Ten-Tec gives no resistance measurements to check before the initial smoke test. I measured the resistance between ground and +DC connection and found it to be about 8 ohms. At least it wasn't a dead short. I hope they will add some resistance checks in later printings of their manual, to give the kit builder a bit more confidence before applying the voltage.

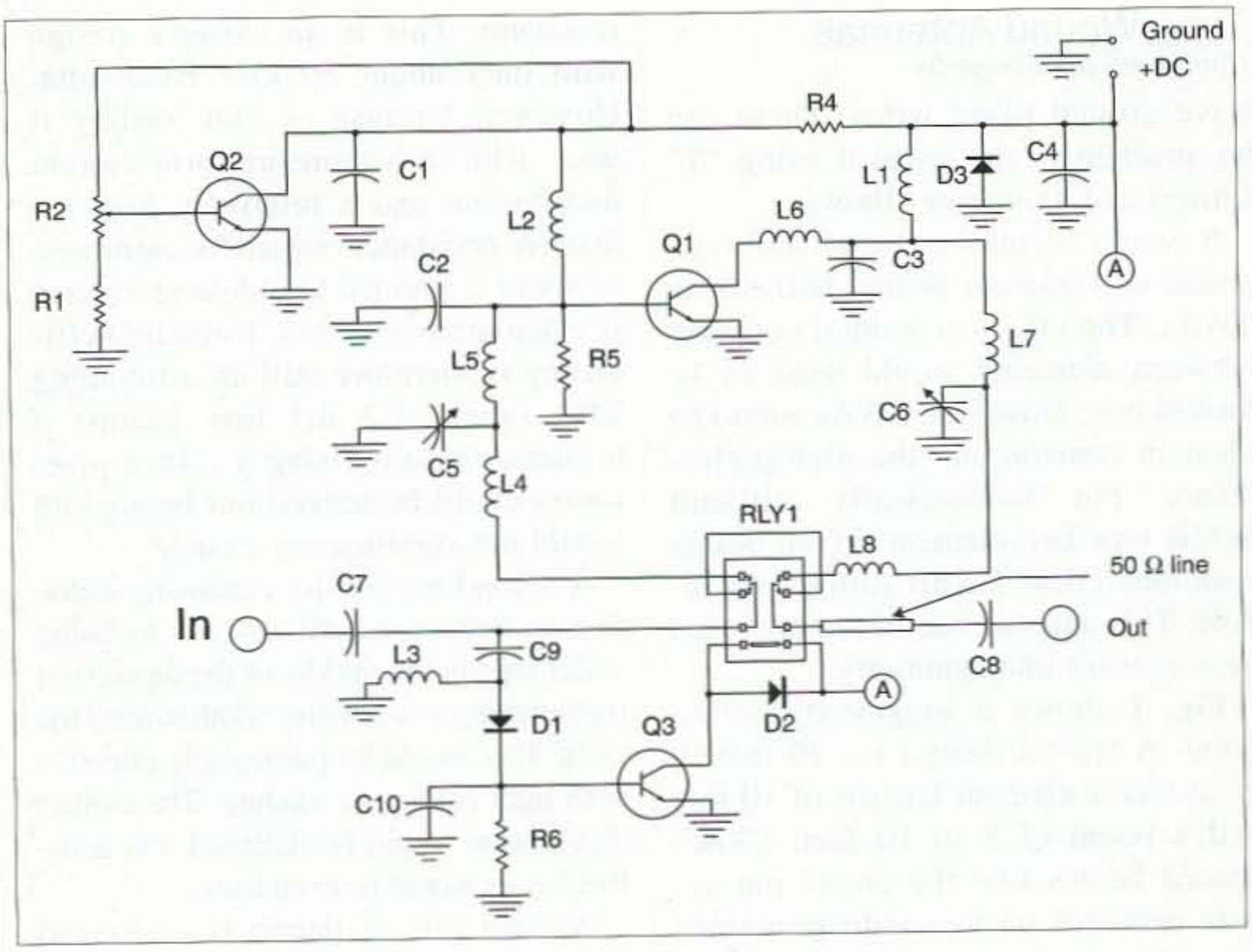


Fig. 1. Schematic diagram.

Final assembly and connection

The fully assembled PC board is mounted on the heatsink. End panels with the input and output connectors are also mounted to each end of the heatsink. Soldering the input and output capacitors C7 and C8 to the BNC and SO-239 connectors complete the electrical connections. The power cable is run through a strain relief grommet, then locked into place.

Adjustments

If you build the amp for class AB operation you must make an initial bias adjustment using your VOM. This is clearly explained in the manual. If you built it for Class C only, then you may forget this adjustment. Connect a 50-ohm dummy load or 2-meter antenna to the SO-239 output connector through an RF wattmeter or SWR/wattmeter. Connect your low-power HT or other low-powered transmitter (five watts or less) to the BNC input connector. With RF applied to the amplifier input, tune the input and output capacitors C5 and C6 for maximum output on your meter. I was able to obtain 35 watts out. That completes the tune-up. Mount the cover on the chassis and you're ready to enjoy contacts that will hear you just as well as you hear them.

Conclusion

The Ten-Tec manual contains a troubleshooting guide that you probably won't need, but it's there, just in case. Its 26 pages include a circuit description and schematic diagram. Ten-Tec also has a limited warranty and a phone number for technical assistance should you need it. The back cover of the manual shows the resistor color codes and bits of other useful information.

I found this kit quite easy to assemble and had no problems — the amplifier performed as advertised and was fun to build. It doesn't have a large number of parts so it shouldn't overwhelm the new kit-builder. It completely solved my packet problem. It should also give the HT user quite a boost for the buck; no more, "Well, you're a little scratchy!" The only modification I would suggest is the addition of an ON–OFF switch. A Radio Shack™ illuminated switch mounted on the top side of the case will let you know when it's switched in or out, and allow you to run minimum power when high power is not required. Other than that, if you want to get your feet wet building a worthwhile project, I think you will enjoy building and using this 2-meter amplifier as much as I did, and you too can say, "...Oh yeah, I built that!"

You can get a free T-KIT Catalog by calling Ten-Tec at (423) 453-7172. T-KIT is a division of Ten-Tec Inc., 1185 Dolly Parton Parkway, Sevierville TN 37862-3710. 73

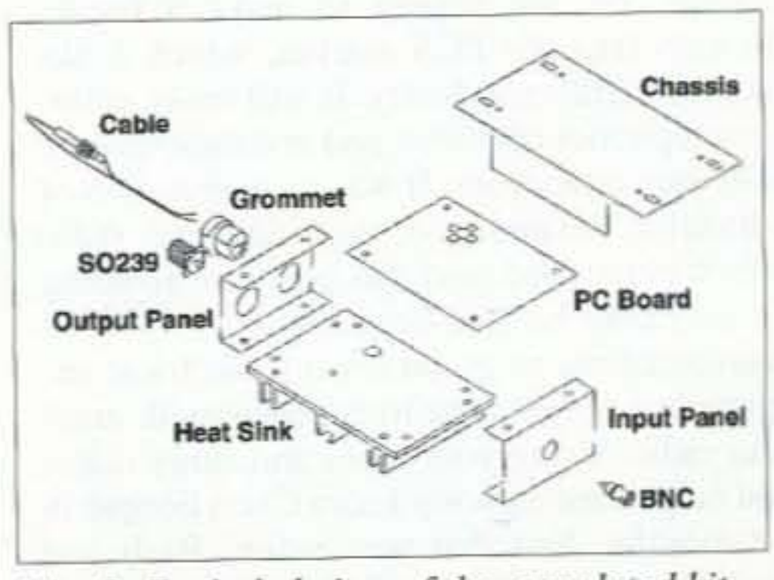


Fig. 2. Exploded view of the completed kit.

Tape-Wound Antennas

Continued from page 34

wave ground plane wires. These can be attached to the vertical using "T" fittings and 45-degree elbows.

It would be interesting to see some practical miniature beams built using TWAs. The effect of mutual coupling between elements would need to be looked into. However, TWAs would be ideal in constructing the high-performance but mechanically difficult W8JK type two-element driven beams with theoretical 5.2 dB gain over a dipole. This antenna can be set up based on resonance and symmetry.

Fig. 1 shows a suggested starting point. A typical design for 20 meters would have element lengths of 10 feet and a boom of 8 to 10 feet. Close-spaced beams like the above put severe demands on loss reduction since the radiation resistance is only a fraction of the radiation resistance of a single dipole. The TWA method is just the ticket. Rough calculations show that it should be possible to hold losses to about 1 dB with some end loading applied. This still leaves a net gain of 4 dB over a dipole, with full beam performance in all other aspects.

When capacitive end loading is applied, antenna efficiency will increase over calculated values, and would make an easy way of resonating an antenna wound a little too short. End loading can be applied by using plumbing Ts and placing copper foil on new short sections of pipe arranged at right angles to the dipole. These can then be soldered to the helical and adjusted for precise resonance, as shown in the photo for a 5-foot-long 14 MHz resonator. This is an extreme design with only about 50 kHz bandwidth. However, because of end loading it does achieve a more uniform current distribution and a relatively high radiation resistance which is estimated as about 2.5 ohms. Skin loss resistance is calculated as 1 ohm. Estimated efficiency is therefore still an astounding 71% (about 1.2 dB loss against a lossless dipole). Using a 3-inch pipe, losses could be halved but bandwidth would not significantly change.

A second method for enhancing radiation resistance and efficiency is by using wider tape in the middle of the dipole and transitioning to a smaller width toward the ends. This would be particularly effective with light capacitive loading. The current distribution would be flattened and resistive losses would be even lower.

A good rule of thumb is a physical tape length of one wavelength to achieve resonance for a uniformly loaded half-wave dipole. This rule gave very close results in all examples tried.

Multiband TWAs are also a possibility. The most straightforward approach would be to run two or more helical resonators in parallel, each wound for a particular frequency. The dipoles can be slightly turned between each other to avoid coupling, or be spaced a few inches apart. Unused dipoles simply become high Q chokes or capacitive elements. The antennas can be stacked using PVC plumbing components and cemented. It might be worthwhile to explore coaxial TWAs. Interaction between dipoles does not appear to create significant additional losses, a principle which can also be applied to the design of TWA multiband beams.

Remote tuning can be accomplished by moving an axial capacitive stub. The capacitive stub can be a flexible copper or steel wire wound and unwound on the inside center of the pipe. The wire is wound onto a metal pulley and shaft which is grounded to the center of the TWA. Little current flows so the arrangement is not very critical in terms of contact resistance. The PVC pipe provides a good seal to the environment. Either use a small motor or bring the tuning wire directly to the operating position. With a return spring, only a single mechanical control wire is needed. Teleflex type cables could be used. **Fig. 2** shows the functional arrangements. For small in-band changes, symmetry is not required. For symmetry and larger frequency changes, more elaborate tuning mechanisms can be devised.

The adhesive copper tape is readily available in major cities. I used 3M™ #1181. This tape has conductive adhesive. A non-conductive one is #1194. Both tapes have a 1.4 mil copper thickness. Skin depth at 14 MHz is 0.7 mils. Skin depth is inversely proportional to the square root of frequency so the tape could be used down to 7 MHz.

References:

1. *ARRL Antenna Handbook*, 1994.
2. *Reference Data for Engineers*, Eighth Edition, Prentice Hall 1993.
3. L.A Moxon G6XN, *HF Antennas* (Handbook), 1986 RSGB.
4. Glenn S. Smith, "Effects in Systems of Parallel Conductors" *Journal of Applied Physics*, Vol. 43, No. 5, May 1972. 73

LETTERS

Continued from page 25

summer in New England.

The telecommunications industry is growing very fast, and our company is expanding rapidly. We are hoping to make a breakthrough into the PCS market, which looks like a $5 trillion industry. It will make cellular telephones obsolete, and revolutionize all telecommunications. It was a combination of education, experience, and amateur radio which helped me land this position. Reading *73* magazine back in Germany from 1976-78 convinced me to go on for my electrical engineering degree, and to continue with amateur radio. Using your tapes and study material helped me earn my Extra Class license in 18 months. And that was before Bash and without any prior amateur radio training. This electronic knowledge and my enthusiasm for technical writing made me into a salable commodity.

It is difficult for the industry to find any competent telecommunications engineers who also have the ability to write a coherent declarative sentence. I urge you to continue to editorialize on the necessity for technical people to improve their writing skills.

Most of us have read about the excellent educational system in Japan, where they teach integral calculus to seventh graders, and have superb scientific training. What most Westerners overlook is that Japanese secondary school students spend an average of three hours a week studying liberal arts, including expository writing, calligraphy, and interpretive dance and music. This liberal education, coupled with their superior technical education, has helped make their nation a leader. We would do well to emulate their example.

Again, I wish to express my gratitude. This is the best job I ever hoped to have. Your generosity and kindness helped to make it possible.

Aw, shucks...Wayne

Michael Nie KB8VMX. Wayne: I read your "Welcome Newcomers" piece with interest. Many amateur radio publications have printed op-ed pieces or articles bemoaning the lack of activity in the higher classes of licenses. The two words at the top of the page, *"Radio Fun,"* sum it all up. Amateur radio is a hobby. It is supposed to be fun. I can only speak for myself, but I feel

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NEVER SAY DIE

Continued from page 35

heart attack or stroke.

If you have any chronic illness, that's a powerful indication that you haven't been taking proper care of yourself. Lousy food, ingesting poisons, too little exercise and sun, too much stress. The route I'm promoting is one where your work will be so much fun that you'll never really think of it as work. Why do you think I publish a ham magazine? That's nirvana for a dedicated ham. I get to visit hams all around the world. I go on DXpeditions. I get to check out the latest ham gear. It's a life of adventure and fun.

When I published a music magazine my "work" involved listening to the new CD releases of my choice, visiting recording sessions almost anywhere, and so on. Talk about fun for a music-lover!

What is the most fun job that you could have? If you could live anywhere and do anything you wanted to make money, what would it be? I'm living on a farm in New Hampshire, where the air is always fresh, the water superb, and the taxes low. Exercising is a delight. Watching a whole bunch of deer feeding around the house is exciting. Shhh, please don't scare them away.

When you run your own business, if it's at all successful, your paycheck is whatever you want it to be. I paid myself over $500,000 a year for a while, but I got tired of paying the income taxes on all that. I didn't have any big personal need for money, nor the time or interest in taking care of it through investments. But then I've never done anything because it might make money. I do the things that are fun to do, that I think need to be done, and I try to do them so they don't *lose* money.

Sure, I want to get more subscribers for *73*, but that's because I want to try and help more readers have fun and learn things. If I can get you to elmer more new hams I'll have more readers and we'll all have a little more clout with the FCC when they start wanting to sell off our most valuable microwave channels. If I get more subscribers and thus attract more ads, you'll get a fatter magazine.

But it is nice to at least be able to buy the things you want without wondering how you can pay for them. Or to zip over to Paris or Hong Kong when you feel like it.

Well, that's enough for now. I don't want to totally ruin the sales of my $5 book *Making Money, A Beginner's Guide*. You now have the first lesson, which is to realize that you don't need a college education in some field to be successful. The next step is to figure out how you can learn what you need to know for a fun career at the lowest possible expense to yourself, and how to do it in the shortest time. When I started my first entrepreneurial business I was a millionaire within two years.

A baudy bunch

With most of the new TNCs including 9600 baud, I'd like to publish more info on this. For that matter, with Internet connections being considered slow at 14.4, there must be some interest in stepping up packet speeds. Let's (a) start doing it and (b) writing about it.

How about HF packet? What progress is being made in speeding it up and what are the problems involved? What do we have to do, start using the Internet for long-haul packet trunks?

How about Macs?

A letter from Jason Spitzer KD6HYB grumbled about the almost total PC and Windows orientation of ham computer stuff these days. Since I just bought a stupid PC so I could check out some of the stupid Windows CD-ROMs, I can only attribute the world's PC fixation to ignorance. Or misplaced thrift. Sure, Apple charged ridiculously high prices for their stuff. It made for great profit margins, crummy sales volumes, and a lousy market share. Now that the Apple share of the market has shrunk from 40% to around 10%, I can understand the revolving door to the management suite.

When Apple lowered prices their sales volume zoomed

Continued on page 55

Simply Portable

An easy way to operate in the field.

Peter A. Bergman NØBLX
3517 Estate Drive SW
Brainerd MN 56401

Often when planning portable operations, whether for Field Day or an actual emergency, we need to operate on the HF frequencies. Power for modern HF rigs isn't much of a problem, but the antenna can be. Some of the solutions that we've heard suggested include:

(1) Use a mobile antenna. It isn't as efficient as we might want, but...

(2) Hang a dipole between a couple of trees. There are no trees at the site but that's okay because the guy with the bow and arrow or whatever left it at home anyway...

(3) Put up a vertical and guy it to some stakes driven into the ground. Not a bad idea, unless your site happens to be in the middle of a frozen lake or a paved parking lot. Besides, someone is bound to trip over, or worse, for the antenna, *drive* over one of the guy ropes. There is also the problem of underground utilities which may not be as *far* underground as we might think.

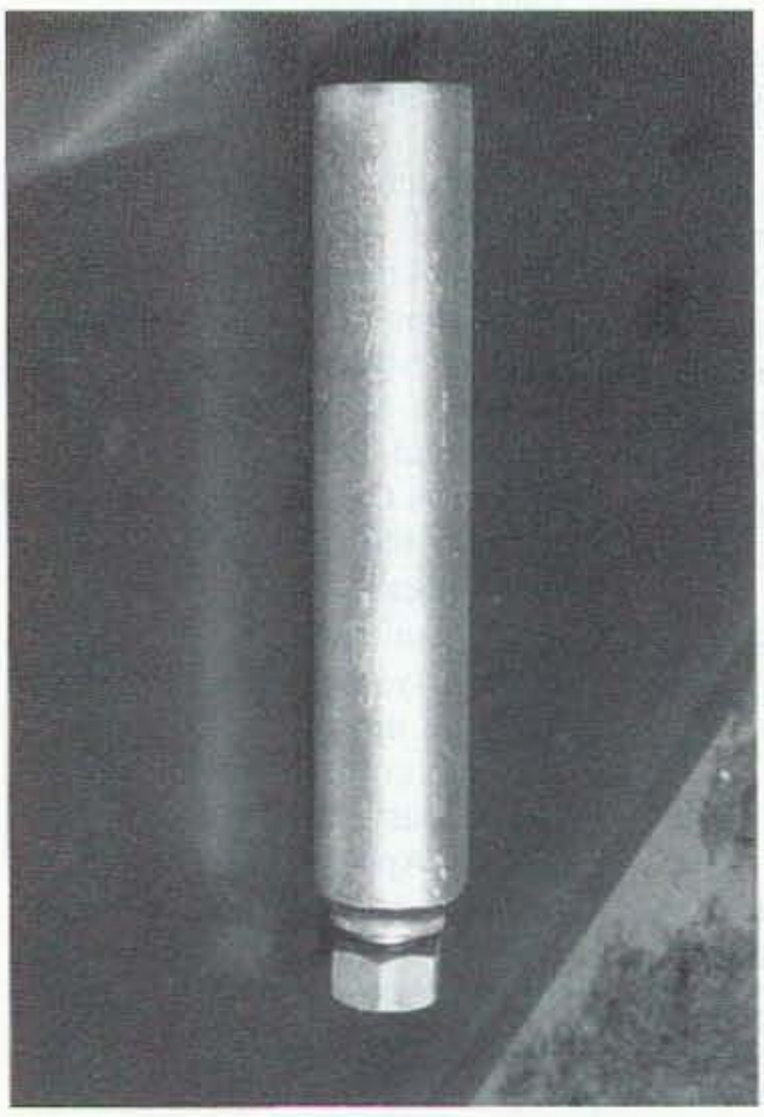

***Photo A.** Neat and discreet. The finished mobile mount.*

"Armed with this gadget and a few wrenches, one person can have a 27-foot vertical out of the car, assembled, and erected in a very few minutes."

I liked the vertical idea. I use a ground-mounted vertical without much of a ground plane at home so I decided to see if I could figure out a way to mount it in the field. I wanted something that was solid, safe and easy for one person to put up. And I did *not* want to have to drive any stakes or dig any holes.

The solidest thing I'm likely to have with me in the field is my old station wagon. Unfortunately, the solidest part of my old station wagon is the trailer hitch. After a bit of head scratching I came up with the simple solution. The junk box provided a nine-inch length of 1-5/8" o.d. pipe, the hardware store provided a 3/4" by 3-1/2" bolt and two matching nuts. Our club VP, KAØJSW, did the welding. The photos and **Fig. 1** show that this *is* the simple solution. Armed with this gadget and a few wrenches, one person can have a 27-foot vertical out of the car, assembled, and erected in a very few minutes. Even if you plan to operate from inside the car, where you might normally use a mobile antenna, the vertical should prove to be more efficient. After watching me set up at a recent hamfest, several people were sufficiently impressed to say they planned to make a similar mount for their "get-n-go" kit. "Just in case." If the junk box ever produces a 3- or 4-foot piece of pipe I may make a taller mount to get more of the antenna clear of the car body, but for now, this is simple. I may also weld some kind of crank or handle on the 3/4-inch mounting nut to avoid having to carry around a heavy, expensive wrench. 73

***Photo B.** Locked on and ready to rock 'n roll!*

HAMS WITH CLASS

Where In The World Are We?

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

The world comes alive in the classroom with amateur radio! My radio courses for 6th, 7th, and 8th graders give me the opportunity to teach geography skills on a need-to-know basis. There is nothing more natural than locating a spot on the map to discover where the voice you're hearing is coming from.

Geography skills are an intrinsic part of the bonus package that young hams get every time they make a contact out of their local area. The youngsters benefit in so many ways by becoming more geographically literate. Impromptu discussions take off after the simplest DX contact. For example, one of the best units on Central America came about after a contact with a ham in Belize.

Discussions about history, economics, government, climate, and culture went on for days in my class. I had the children designing travel brochures and creating bumper stickers. One of the cleverest slogans was, "Without geography, you're nowhere. But with geography, you're everywhere."

My suggestion to any teacher incorporating radio into class lessons is to coordinate lesson goals with a Social Studies teacher. Your school administrators will love the idea of the "team" approach to teaching, the Social Studies teacher will become enchanted with the idea of speaking directly to people from around the world, and the children, of course, will have fun while they're learning.

Every year I add at least three new resources to my Geography multi-media center. Here are some good ones that might be worth your while to pursue:

1. *Geotopia*- This booklet allows students to create their own imaginary country, including climate, crops, culture, physical features, and more. *Geotopia* is published by USA Today Educational Programs. Student copies are 35 cents each. Free teachers' supplemental materials are included. For more information call 800-USA-0001.

2. *Somewhere In the World Right Now* - Through this story book, take a look at what individuals are doing simultaneously in different time zones around the world. Written by Stacey Schuett, this 1995 release is published by Knopf for $16.00. (ISBN 0-679-8537-3)

3. *Cross-country USA* - Diatech Software has designed this elementary level software. The program, available for both PC and Mac, introduces children to U.S. geography. School editions, lab packs, and site license versions are available. For a free demo disk, contact Brian Selstedt at 800-665-0667.

4. *Kid's PACK* and *Teen PACK* - Zero Population Growth has put out two new programs for middle school and teen students. PACK stands for Population Awareness Campaign Kits. They include hands-on activities in a colorful format. These free programs can be ordered in bulk by teachers. Contact Pamela Wasserman, Director, Population Education Program, ZPG, 1400 Sixteenth St. NW., Washington DC. 20036.

5. *Material World* - Software lets you experience local customs, indigenous music, prized possessions, and the laughter and tears of people around the world by looking at the lives of thirty typical average families. Families in Kuwait, Thailand, Mali, and Sarajevo are but a few viewed. Software comes in both Mac and PC versions. For more information contact StarPress Multimedia at 303 Sacramento Street, 2nd floor, San Francisco CA 94111 or call 800-782-7944.

Remember, the most important thing you want to do is to convey a sense of genuine excitement about reaching out to other people all over the world through amateur radio. Have fun! 73

***Photo B.** Some of our best Geography projects have come about after a DX.*

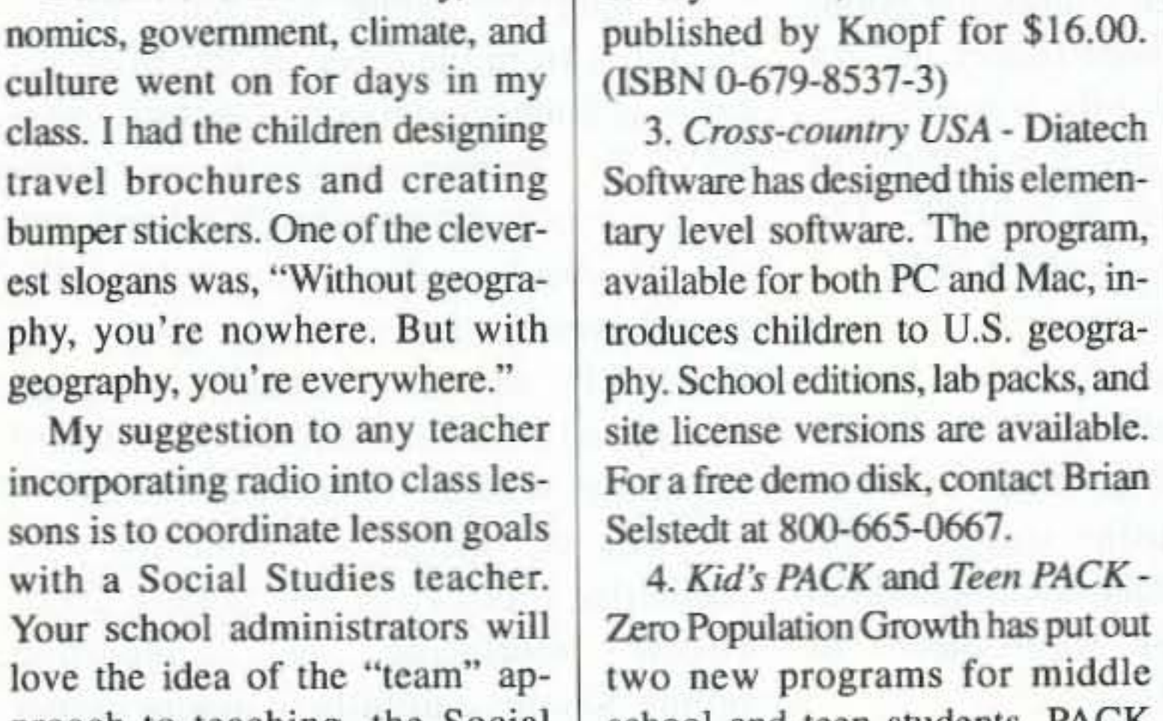

***Photo A.** Children enjoy locating the source of the radio voice.*

73 Review

The DVR-1 Digital Voice Recorder

Bill Clarke WA4BLC
764 Altamont Voorheesville Road
Altamont NY 12009

Hamtronics' easy-to-build DVR-1 Digital Voice Recorder kit was initially designed for IDer use in repeaters. The recorder does, however, have several other applications for the ham as an adjunct for SSB operation. Here's an introduction to the DVR-1, as a kit, and some generic connection information for its use with SSB transceivers.

The DVR-1 is a digital audio recorder that allows 20 seconds of recording time; you can transmit a previously recorded message at the press of a button, record incoming audio for instant playback, or retransmit previously received audio.

Why would you want to transmit a previously recorded message? Just think of how many times you might say "CQ CONTEST...CQ CONTEST...CQ CONTEST" during long hours of operation. Save your voice!

Heard a weak one and didn't quite catch the call? Press playback as many times as you need and listen, over and over, until you figure it out. That was a 59 report, wasn't it?

Ever been asked by the local microphone adjuster, "How's my signal now?" Just record the received audio and transmit the playback. Let the sender be the judge!

The DVR-1 can be bought as a kit or as an assembled-and-tested printed circuit board ready to connect with your station. I recommend the kit, as it will save you about forty dollars and will only take an hour to assemble.

The kit I assembled uses sockets for the ICs, and has ample space for all components. The circuit board is double-sided and made of high quality Fiberglas™. The layout is easy to work with; the assembly instructions are given as steps, and warnings are clearly marked for components that must be oriented in a specific manner, such as diodes.

Be sure you use a low wattage soldering iron during assembly. My personal favorite soldering tool for small projects is the Isotip rechargeable with a fine tip, available from MCM Electronics. It is lightweight, easy to handle, and is a low wattage unit that will not harm the foil on the printed circuit board. Use solder sparingly and carefully clean away any solder bridges or globs of flux.

The completed DVR-1 is meant to be installed inside a repeater; however, for use as a station adjunct for SSB, you will need a project box. Project boxes are available from Hamtronics, as seen in their catalog, or from Radio Shack™.

Use a project box large enough to hold the DVR-1 plus a few panel controls on the front and/or top and connection points on the rear. You will need rubber feet for the bottom and labels for the controls.

I chose to make my installation as simple and easy to use as possible. The project box I used was the TP43 (2.5 x 5 x 5 inches) from Hamtronics. This is a little larger than necessary, but it sits firmly on my desk (this project doesn't weigh very much). The DVR-1 circuit board was installed using standoffs and screws. It could as easily be mounted using silicone glue and short pieces of doweling for standoffs.

I installed my controls on the top of the box, so I wouldn't have to play tag with the box each time I pushed a button. The controls consist of an on/off switch, a momentary contact push-button for RECORD and the same for PLAYBACK. There are two toggle switches—one to select audio input source (internal mike or receiver audio) and the other to select audio output to the transmitter's mike line or to an external speaker and control PTT switching. Internally, I installed a small 5V DC relay to key the PTT line when I wanted audio playback to be transmitted.

On the front panel is a 12V DC pilot light and a one-inch hole to allow use of the DVR-1's built-in microphone. The mike could easily be mounted on the front. On the rear panel of the project box are four RCA jacks; for 12V DC power, audio input from the receiver, audio output to the transmitter, and the transmitter's PTT line. A pair of insulated screw terminals are used for external speaker connection. The internal connections are made to the DVR-1 circuit board per instructions in the manual.

Hamtronics provides a thorough manual with the DVR-1. It shows the method of construction and how to connect simple divider circuits for audio input and output, fully explains operational theory, and gives examples of circuit enhancements.

An interface circuit was built for audio input from the receiver, the small relay was connected to a pad that provides +5V DC during playback (normally open contacts actuate the PTT line), and the playback audio connected to the transceiver's mike input line. The RECORD and PLAYBACK switches are tapped into the DVR-1 circuit board in parallel with the existing switches.

Check the operating manual for your particular transceiver for details about circuit interfacing and connection points. Do this carefully to assure proper connections — so no damage to either device occurs. 12V DC power can be taken from your station power supply or tapped from a transceiver.

To check the DVR-1's operation, switch to the internal mike, press RECORD and speak. Using speaker output, press PLAYBACK. You should hear what you just recorded.

Receive audio is easy to interface with the DVR-1. I used a Y-plug adapter at the transceiver's external speaker jack, sending one side of the audio to the external receiver speaker and the other to the DVR-1. The constant level audio output of a transceiver could also be used, if available. Some adjustment of

the divider circuit you built inside the project box will be necessary to prevent overdriving the DVR-1. Recording is done by pushing the RECORD button and playback by pushing the PLAYBACK button. Playback will be through the speaker connected to the screw terminals on the rear of the project box.

To send a recorded message, such as a CQ, switch the audio output to the mike line (which also activates the PTT line on my unit). Record a message as you previously did. Press PLAYBACK, which will key the transmitter and play the message through the transmitter's mike circuit. Adjust output level as necessary. Recording off-the-air and instant playback are merely combinations of these two operations.

Other configuration options

Instructions are given in the operations manual for more complex setups, such as splitting the 20-second recording time into smaller time blocks. This allows the choice of more than one prerecorded message to be transmitted, by operator selection—an ideal setup for contesting.

Beacon ID can easily be accommodated using the DVR-1. The internal timing circuit can be used to activate the transmitter and play back the recorded message. The timing circuit can be changed to provide any desired timing interval.

The DVR-1 can be used anywhere instant audio recording and playback is needed, or where there is a requirement for playback of messages at prescribed time intervals. I can see applications in stores, warehouses, and in theft/intrusion alarm systems.

The Hamtronics DVR-1 is available for $59 in kit form or $99 assembled and tested. Contact: Hamtronics, 65 Moul Road, Hilton NY 14468-9535. Phone (716)392-9430 or Fax (716)392-9420. Ask for their catalog—it has lots of nice projects for radio hobbyists. 73

Number 52 on your Feedback card

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Mail call!

Well, the mail has been accumulating, so it's time to dig in and answer some questions. Before I do, though, I want to add something to the series on repairing computer monitors that we wrapped up in the April issue.

I stated that just about any horizontal output transistor could be used in most monitors. For the most part, that's true, but there is one consideration I forgot to mention: Some transistors have integral damper diodes and some don't, and never the twain should mix.

What's a damper diode? If you look at a TV schematic, you'll see that the horizontal output transistor pulls current through the low-voltage, high-current side of the flyback transformer. Even on the low-voltage side, though, there could be anywhere from 20 to 100 or more volts. The inductive spike which occurs when the transformer's field collapses can be tremendous. It can induce "ringing" in the coil, resulting in a disturbance in the horizontal scan. It can even be enough to damage the transistor. So, all TVs always have a damper diode which is reverse-connected across the transistor and damps out the ringing. In the tube days, there was a damper tube. When solid-state parts took over, a fast-recovery diode did the job. These days, the damper may still be a diode on the board, but it can also be inside the horizontal output transistor itself.

For instance, a 2SC3486 doesn't have a diode, while a 2SC3893A does. If the original transistor had a diode, you must use a replacement that has one, too. Can you replace a non-diode transistor with one that has the diode? Logic suggests that having two diodes in parallel (which is what you'd wind up with, because there'd also be one on the board somewhere) should be OK. In all fairness, though, I haven't actually tried it. To be safe, just use a compatible transistor with the same diode arrangement.

Let's dig into the ol' mail bag!

Dear Kaboom,

I've always had a dream of building an HF amplifier from transistors. I'd like to construct an amp using 24 2879s. I figure 24 120-watt transistors would give me a sturdy 1.5-kilowatt amp that would loaf along quite nicely, yet I can't find any construction articles or books for making such a beast. Where is the information? Who might I ask? Where do I look?

Signed,
Warm Up The Iron

Dear Warm,

Good question! There are a couple of commercially available, solid-state amps, but the technology has not yet become commonplace. I suspect it's mostly due to cost. Why should a solid-state amp cost so much more than a tube amp of equivalent power output? Well, you can get one heck of a lot more power from a single tube than from a single transistor. So, you have to use a lot of transistors, as you pointed out, in order to get the kind of output you could obtain from a tube or two. Really, it isn't the cost of the transistors themselves (although that's not insignificant) which makes the amp so expensive. Rather, it's all that coupling! How the heck are you going to couple the inputs and outputs of 24 active elements so that they all stay in phase and share power equally, especially at radio frequencies? It can be done, but it isn't easy, and it requires lots of windings on a big RF transformer, and plenty of heat sinks and equalizing resistors. Also, provision has to be made for enough isolation between the transistors to avoid a mutual disaster should one of them short out.

Then there's the matter of the power supply. The high-voltage, medium-current power used by tubes is fairly easy to obtain from ordinary 120- or 220-volt wall current. But where are you going to get, say, 14 or 28 volts at 100 to 150 amps? That's a lot of current, and it'll require not only a very big power supply — even with a switcher, we're talking some iron — but also extremely thick conductors to the transistors or whatever feeds them. You just can't pump that kind of current through #14 wire!

Power MOSFET transistors are easing the problem somewhat, because they can work at higher voltages (and thus lower currents), and can produce a fair amount of power per transistor, meaning you have to use fewer of them. So far, though, nobody is producing transistors with the power output of even a smallish tube like the 3-500Z.

If you really want to build a legal-limit, solid-state amp, go for it, but be aware you're facing a difficult task. I don't know where to tell you to turn for construction information, but if any of you gentle readers can advise, I'll publish the info here in the column.

You also mentioned you might like to build a tube amp. For that, the *ARRL Handbook* should be quite helpful. True, it's not a compilation of amp circuits, but there should be enough in there to get you going, and you can develop your own modifications to make the amp into what you want. I wish you the best of luck in your amplifier projects.

Dear Kaboom,

The LCD on my ICOM IC-02AT conked out. It is blackened about 90 percent, but I can't see any other physical damage. Could something be wrong with the radio's circuitry? The rig works fine otherwise. Can I replace the display? What is involved with that?

Signed,
Squinting

Dear Squint,

No, there's nothing wrong with your radio's circuitry. I've seen this happen before, generally on older radios. In fact, my car stereo's display is slowly going the same way. It's caused by loss of the seal on the edges of the display, causing the two glass plates to separate slightly. That lets the liquid-crystal material flow, leaving areas where there is none. The result is a black display, even when the radio is off. The only fix is to replace it. If you're handy at taking equipment of this scale apart, you should be able to replace the LCD fairly easily. Many LCDs are held in place only with pressure, either from a bracket attached to the PC board, or by the radio's case. Contact is made via a special conductive rubber ribbon. Other displays have regular solder contacts which will have to be desoldered from the board. I don't know which method the 02AT uses, so you'll have to open it up to find out. As for obtaining the display, you'll need to order it from ICOM; such displays are all custom-made for different radios, and you can't get one at your local surplus house. By the way, if you find any of the liquid-crystal material leaking out from the display, *don't touch it—it's poisonous*.

Dear Kaboom,

I know this is a little bit off the ham subject, but the CD-ROM drive in my ham shack computer is acting up in a strange way. It has trouble reading a disk, especially at the beginning. Sometimes it'll read it, sometimes it'll just give up. It won't read some disks at all, while others usually work. It seems to be getting worse. Any ideas?

Signed,
No Drive

Dear Drive,

If you've been using the drive in a very dusty environment, or you're a (gasp) smoker, it's possible that the lens has become dirty. There are special lens cleaning disks which can clean it for you. I suspect, though, that the real problem is that the optical pickup head in the drive is failing. I've seen many audio players with the problem you describe. Unlike LEDs, laser diodes have a finite life; they gradually get dimmer and dimmer until there's not enough light for the player to

see the disk. Because reflectivity of CDs isn't perfectly uniform, some disks work better than others when the beam is marginal. Eventually, it'll get so dim that the player will cease to function. Although it is possible to replace the head, it's rarely worth it, because the part costs more than an entire new player! Besides, alignment is tricky; you really have to know what you're doing, and an oscilloscope is mandatory. I think you need a new drive.

Well, that's it for this month. Until next time, 73 de KB1UM. 73

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave
San Diego CA 92119

Test equipment and frequency counters

Last month I described some of the methods used to form an interest group for the VHF/UHF/SHF frequency bands. I described several of the steps our group went through, in order to assist you in putting together a similar group. This month, let's get into some of the tougher issues, like what test equipment is needed to perform modifications and tune up equipment. This step is to further assist your group's technical needs. Having some basic microwave test equipment available is crucial.

"We are starting to see inexpensive frequency counters good to 2 GHz."

With any microwave group or society formed, there must be a source of test equipment available to help solve the technical problems of the group. For those of us who started our amateur operations with much simpler modes, and even with vacuum tubes, test equipment was just as viable then as it is today. In those early days test equipment was limited to Eico or Heathkit commercial kits of o-scopes, signal generators, voltmeters, and various SWR and assorted station accessories. Also available was equipment from military surplus or, more properly, World War II and later surplus material.

I remember many days of converting ARC-5 transmitters that used 1625 tubes in the final for CW operation on 80 and 40 meters (a 1625 is a military version of a tube familiar to many old-timers, the 807). However, I don't want to get hung up on converting ARC-5s as I reminisce on the meager equipment collected at that time to test and make functional early projects (I would really like to find a clean ARC-5 for Memory Lane). The test and alignment equipment needed today is more exotic and a far cry from our early frequency meters.

Frequency counters

It doesn't take much to remember a frequency counter that counted up to 1 MHz (HP-523), and a much sought after frequency counter that made it to 10 MHz directly and ultimately to 500 MHz with appropriate plug-in converters. Did I mention that the HP-523, weighing in at 60 pounds and made for rack-mount, sported several handles to allow moving it? Did I have these units in my shack in the 60s? Yes, plus a small cart to move them.

We have come a long way in test equipment development, not only in military models but in civilian models as well. We are starting to see inexpensive frequency counters good to 2 GHz, and to hear about some models on the drawing board good to better than 10 GHz. Surplus counter types that go to 50 to 300 MHz and have plug-ins to extend that range up to 18 GHz are now commonly available. There are direct-reading counters that count to 18 GHz. Needless to say, these are some of the more expensive counters available on the surplus market.

There are several different surplus choices that can be taken advantage of when you locate them. What I want to do this month is give you some guidelines on what surplus frequency counters are available today and cover some of their capabilities. Also, I want to discuss some of the newest amateur market frequency counters that are now being sold. Coverage will be limited to ease of operation, frequency coverage, frequency accuracy and, finally, cost, to give you some benchmarks to help you make up your own mind.

What are the main differences between surplus and new frequency counters? Mostly, weight and cost. Surplus counters are typically heavy and seem to cost more. Why consider a heavy and more costly counter vs. a newer, smaller, battery-operated, less costly one? To answer this question you have to ask yourself a question: What do you expect from a counter? What frequency ranges are required and to what accuracy must this measurement be relied upon?

The answer: If your frequency measurement requirements do not go over 2 GHz and the accuracy needed is average, I suggest purchasing a small battery-operated counter. There are many different models available from Startek, Ramsey, Digimax, Optoelectronics, and many others that will fill the bill very nicely. The Startek Model ATH-50 is quite nice and has a top frequency limit of 2.8 GHz (2,800 MHz) and an LED bar graph showing signal level. All those features for only $339—quite a deal.

The frequency accuracy of most of these frequency counters is in the order of 1 ppm. What that means is 1 hertz of possible error for every megahertz of frequency being measured. If we were to measure a 2 meter HT, for instance, our possible error at 2 meters would be 150 hertz of uncertainty. Most manufacturers make a high accuracy time base that is an extra add-on feature, making their frequency counters more accurate. For instance, Startek's option #HST-15 costs $125 extra, and its high accuracy "Temperature Controlled Crystal Oscillator" (TCXO) time base upgrade increases accuracy to ± .2 ppm.

Operation with a TCXO is transparent to you but allows the internal crystal reference to the counter to be controlled by a higher-accuracy time base, increasing accuracy in your measurements. Going to a .2 ppm time base TCXO oscillator would reduce errors at 2 meter (150 MHz) measurements to 30 hertz.

Photo A. *Two older HP frequency counters: the Systron Downer 1037 counter with a transfer oscillator that goes to 18 GHz (top unit); and the author's HP-5245 workbench workhorse with a 3 to 12.4 GHz plug-in.*

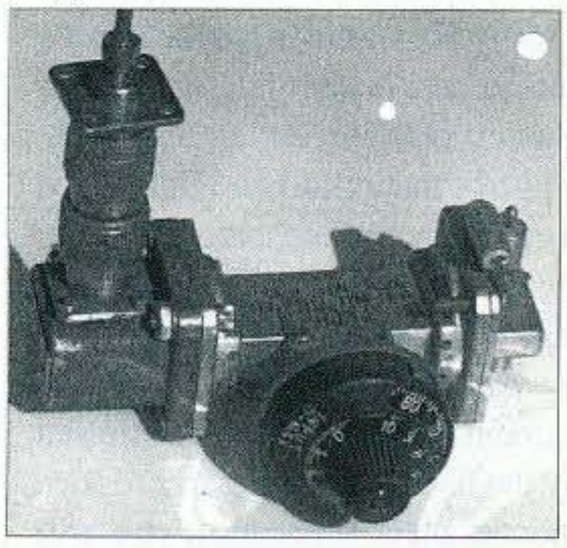

Photo B. *The author's 10 GHz Gunn oscillator (10 mW) waveguide attenuator and coax transition, forming a 10 GHz signal generator for bench tests.*

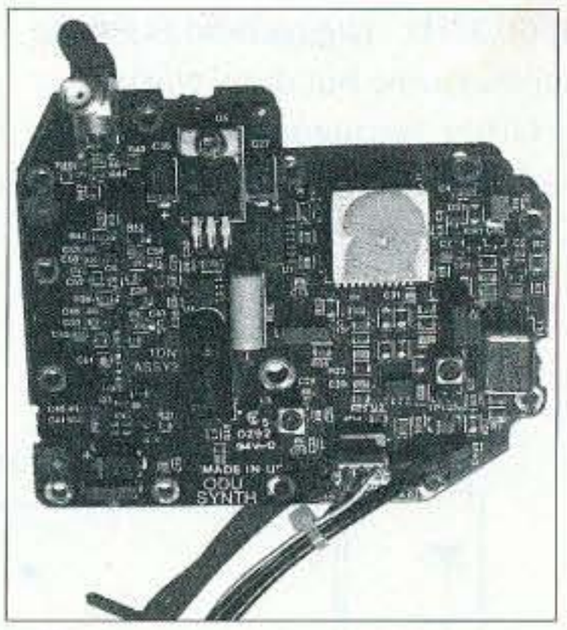

Photo C. *A Qualcomm phase-locked loop VCO-controlled synthesizer. This functions one point frequency between 2 to approximately 3 GHz, but normally resides near 2.6 GHz. It can be pin-to-pin programmed, or you can use an IBM bus.*

In practice, it's not quite that pure because the error is not a perfect 150 hertz or so. The uncertainty factor is a ratio somewhere around this number. It could be high or low depending on when the last calibration was done using WWV or some other calibrating method.

Now enter the microwave scenario. How do you measure frequencies over the range of the portable counter? Well, there are several methods, one being a surplus frequency converter (the HP-2360). This unit mixes a known harmonic whose fundamental frequency is in the 200 to 300 MHz range of the unknown microwave frequency. Make two to three measurements to find a harmonic that is nearly 60 MHz apart. After you determine what two fundamental frequencies, multiplied by the harmonic number, produce this 60 MHz separation you will know the microwave frequency exactly. The 60 MHz separation is due to one frequency going 30 MHz high and the other going 30 MHz low, resulting in a difference of 60 MHz. The method is a little cumbersome but does work.

Other frequency counters to look for in surplus are Systron Downer and Hewlett Packard units. I happen to have, for test evaluation, both the Systron Downer and Hewlett Packard counters. These all run from AC mains and are a little on the heavy side. **Photo A** shows both counters with their respective microwave frequency converters (plug-ins) in place. I like the Systron Downer as it can be set up to generate a weak signal on a frequency for marker use, while the HP does not leak a sample of the harmonic through the converter front end.

What makes these large commercial frequency counters still popular? The accuracy is quite a bit better and the frequency capabilities can go to 12.4 or even 18 GHz with readily available plug-in converters. Frequency accuracy is tighter as this type of counter uses an internal oven-controlled "high accuracy standard." How accurate? Using a counter with an accuracy of 1 ppm would give a 10 kHz possible error in your frequency at 10 GHz. Now, if you're looking for weak signals, this is a wobble in your cog and needs to be addressed.

Normally these units have an oven-controlled crystal oscillator that can be calibrated to a few parts in 10 to the 8th power—that's .01 ppm. Now, with the appropriate converter plug-in attached into the counter we will measure a 10,368 MHz frequency with a possible error of 100 hertz. With a few extra tricks it gets even better when you connect to an external frequency standard capable of higher accuracy. My external master standard (really my garage standard) is an FEI-10A capable of producing a 1 MHz oscillator which is accurate to .0001 hertz at 1 MHz. That is the same as .0001 ppm, and it's not worth figuring out the error, as that's about as good as it gets in amateur circles.

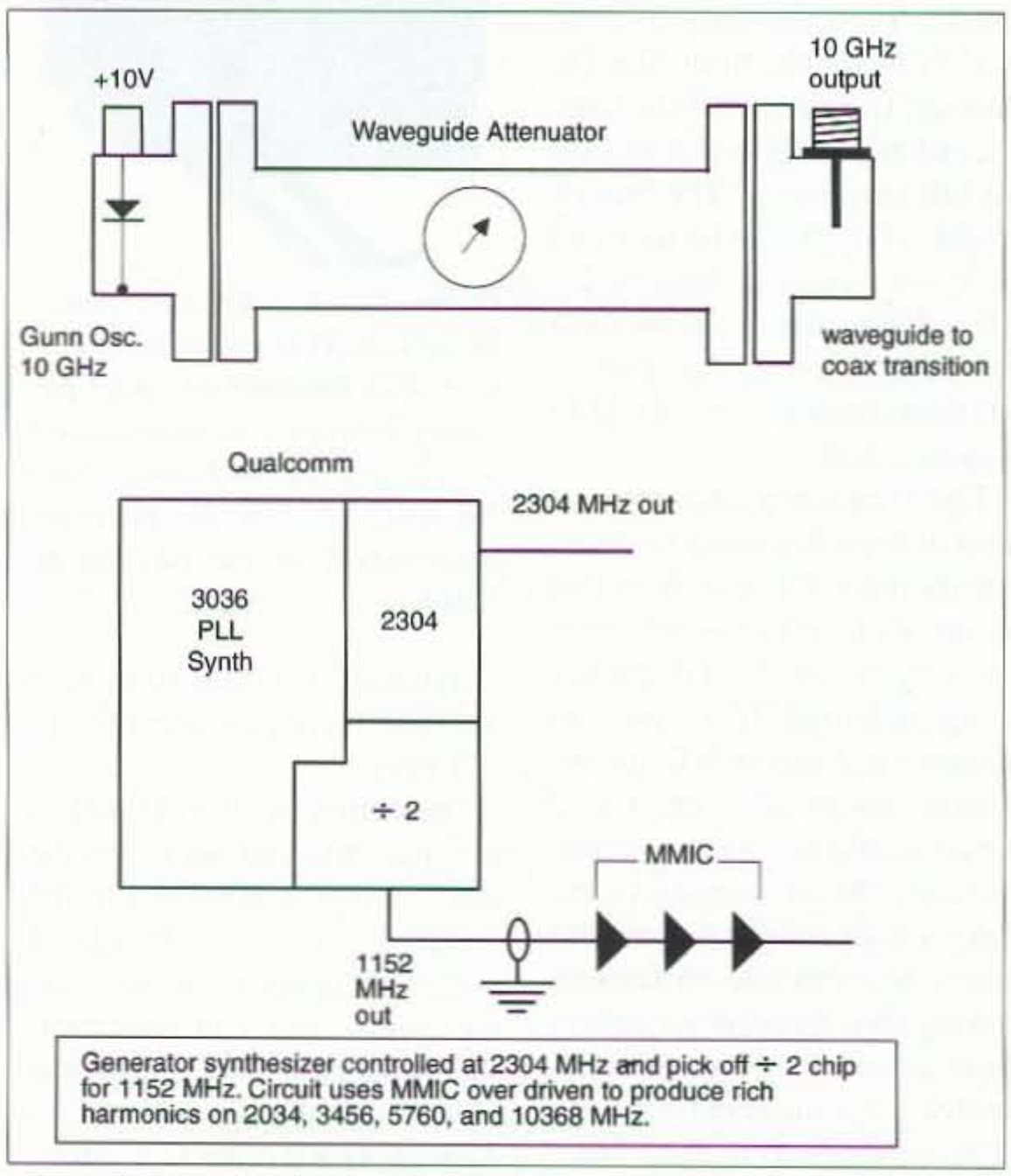

Fig. 1. Schematic of a simple microwave test generator.

"The most important piece of test equipment is the microwave power meter."

Now comes the tough question: How do you convince someone that their calibrations made with WWV at 10 MHz have little to compare with the measurements you just made with your Garage Standard? Measurements based on WWV accuracies are good to about .1 to .01 ppm at best, due to the Doppler effect. Doppler shift affects the path over which the highly accurate clock at WWV (the source) must travel before you receive it (2.5 MHz and up). Sure, at the source it's accurate to .000001 or better, but the accuracy changes at your receiver due to the transmission path Doppler effect on the low to high MHz frequency bands.

A very high accuracy reproduction of WWVB can be received at 60 kHz due to minimal Doppler problems at this low frequency. This is the same method that I, and calibration labs, use. This is the "traceable path from your standard to WWVB's national standard when so calibrated." Well, so much for counters and accuracy. Let's get on to what other test equipment is essential for microwave tinkering.

Power meters

The most important piece of test equipment that should be in any modest ham microwave workbench is the microwave power meter. This piece of test equipment is the single most used item in my shack's workbench, along with a set of attenuators to extend its range to higher power. I have written several articles on both the General Radio and Hewlett Packard power meters and don't express a preference. The most important thing is to have some means of discerning microwave power at very low levels in order to be able to perform modifications and circuit stripline tuning. Sure, a spectrum analyzer is very nice in this application as it will show you what is actually going on. For the broad picture the spectrum analyzer is paramount. But for fine adjustment response the microwave power meter will show you .1 dB increases with ease where .5 dB increases are about the best you can see on a spectrum analyzer available in the amateur's grasp. New spectrum analyzers with digital readout are available with better readout, but (gasp) the *price!*

Other test equipment

What items would I place on a shopping list to add after the power meter? I would suggest a simple test generator and attenuator setup to function at your desired test frequency so that you would be able to generate and detect the frequency of interest. The frequency generator doesn't need to be a full relay rack signal generator; it can be a simple free running or synthesized source that can be controlled. By that I mean a shielded source and one that is somewhat reliable, like the Gunn oscillator/waveguide attenuator and coaxial transition used for 10 GHz test configurations. Keep it simple; high accuracy generators are nice but not necessary. See **Fig. 1** and **Photo B** for my 10 GHz generator.

Next, to improve your calibration and test agility pick up some coaxial attenuators of various values of dB loss. These will be necessary to use in conjunction with your power meter to prevent burnout of the sensitive power meter head. These heads will usually

accept a maximum of +10 dB. Power levels above this can burn them out and they're not repairable. Remember here that 100 mW (.1 watt) is +20 dB and this level is easily reached in most circuits. Use a 10 to 20 dB protection pad on the input of your power meter for the safety of your power meter head.

A new twist on the test equipment angle is that very modern circuitry is making high-tech test equipment obsolete. Well, this is true to some extent in that recent advances in frequency control and receiver and transceiver circuitry are starting to make these products look more like computers than the products they really are. An example of this is the vertical hold control on your television receiver. Early sets had both vertical and horizontal controls accessible for your adjustment. Try to find one today; they use zero crossing detectors, instead of the earlier consumer controls, to lock up the picture. So it is with microwave circuitry in some cases.

Yes, you still need a generator to provide a test signal to tune stripline circuitry. The microwave power meter is required to give you "eyes" on power changes on tune-up or modification. Attenuators are required to limit power to acceptable levels for protecting the instrument. Frequency measurement and accuracy to your desired limits provide an additional window to give you a comfort zone in test equipment adjustment and modification ease.

With some of the newer frequency-controlled synthesizers in use today to generate a local oscillator for microwave down converting, high accuracy microwave counters are needed for reassurance of actual frequency. In most cases using these modern synthesizer components, once phase-lock is obtained you are there. Specifics: Our group uses a surplus synthesizer that uses a Qualcomm 3036 phase-locked loop chip that functions directly at 1.6 GHz (**Photo C**). All frequency generation is by VCO in the 2 to 3 GHz range. This chip (3036) can be set up to be programmed from an IBM bus or for pin-for-pin programming of frequency (**Fig.2**).

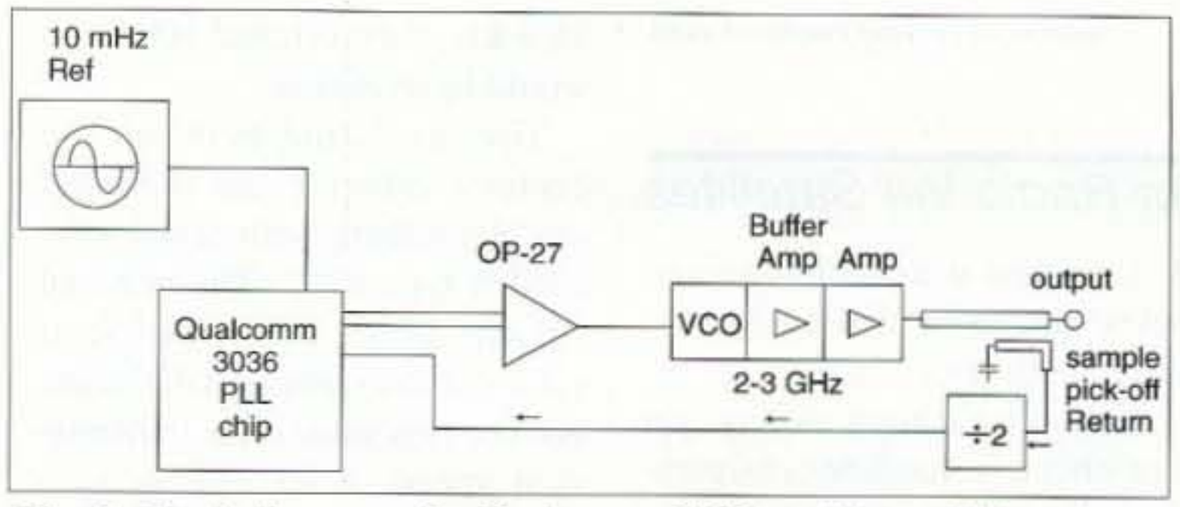

***Fig. 2.** Block diagram of a Qualcomm 3036 oscillator. This unit can be reprogrammed to 2556 MHz for 10 GHz operation, 2304 MHz for beacon work, or even 2160 MHz for .3 GHz operation. It's quite a versatile PLL controlled VCO.*

Now, with this synthesizer you could program 2556 MHz times four to provide LO injection at 10 GHz. Frequency combinations are endless. For example, 2160 at LO for 2304 with an IF frequency of 144 MHz. 2304 could be programmed for a test source or even a beacon on that frequency. If you program 2304 there is an on-board frequency divider (I said earlier that the 3036 only worked to 1.6 GHz, remember?). Dividing that by two, it could be used to pick off 1152 MHz. This one frequency and its harmonics are the mainsail of all microwave generators.

If you multiply 1152 times 2, 3, 5 and 9 you get the standard microwave frequencies of x 2 = 2304, x 3 = 3456, x 5 = 5760 and x 9 = 10368 MHz. This is nice frequency multiplication for simple generator circuits. Just overdrive an MMIC amplifier to accent the harmonics and use the signals for your version of the Gunn oscillator, not only at 10 GHz but on all the other ham bands below 10 GHz except 1296 MHz. Well, that can be handled also. If you mix in 144 MHz it will produce 1296 MHz as one of its products.

How stable is this synthesizer? If the wobble in your main frequency cog is limited to a 10 MHz TCXO oscillator, that is capable of maintaining .01 to .1 hertz at 10 MHz. In actual use this wobble works out to be less than SSB bandwidth errors at 10 GHz (a few hundred hertz maximum error).

Conclusions

What specific test equipment would I recommend? Well, I would like each of you to have a complete lab, but knowing this is not always possible I would suggest a group pool of test equipment. With several interested amateurs each contributing, you just might start a microwave interest group of your own. Check out the Startek ATH-50, or the Digimax or Optoelectronics frequency counters. They will allow you to operate to over 2 GHz with sufficient accuracy extrapolated out to 10 GHz. Remember: It's not extreme accuracy that is required if your signals can be found inside the SSB or FM bandwidth required for normal operation. Then it's just: Readjust the RIT control for clarity. Exact sometimes gets boring.

From the junk box side of things, I have picked up some surplus items you might be interested in. I have a quantity of 15 mW Class III HeNe laser heads manufactured by Melles Griot. They require a power supply and measure 7 to 8 mW output with my test arrangement. Also, I have picked up several LORAN-C complete PC board receivers. The lasers are $45 postpaid, and the LORAN-C receivers are $15 each or two for $25 postpaid. At these prices for Loran-C they're untested pulls. I have tested 10 units and had only one not function fully. I do have a batch of units for parts, great 100 kHz circuitry and coils. If you want one with your order let me know and I will throw it in for postage costs.

As always, I will be glad to answer questions pertaining to this and other amateur related topics. Please send an SASE or drop me a line on the Internet. My address on the Internet is clhough@aol.com. 73 Chuck WB6IGP. 73

NEVER SAY DIE

Continued from page 47

upwards, and all those magnificent profits which had been supporting a Parkinson's Law of ever-increasing corporate body count disappeared. They probably could get rid of half of the staff and be able to respond to the market better. They also might not get stuck with turkeys like Scully's Newton.

I'm up to here in Macs, which are the most practical computers for publishing. So, like Spitzer, I'd like to see a spotlight on Macs for packet and other ham applications. It might even be worth publishing a column. How about it? I'd like to hear from a Mac expert interested in helping out.

Ham jailed

We really need to push the ARRL to get the FCC to change our rules so it is easier to delicense the rotten apples that get through the simple screening process. A case in point is the recent jailing of Ronald Ames WB6RSD, who has been a royal pain in the ass to his fellow hams for several years. Heck, the legal actions have been going on for over two years. The judge found Ames to be "arrogant, stubborn, and closed-minded." He put Ames in the slammer for 15 days and fined him $3,000.

There should be some way for us to drain our ham sewers, like that bunch of idiots on 14,313. We should have a way to get rid of frequency coordinators who favor friends, jammers, and so on. Old-timers will remember Max W2BIB, who devoted much of his hamming time to jamming emergency traffic. He finally died. And then there was W2OY, who did little to make hamming fun.

Fame

A Silent Key announcement from Australia for Syd Molen VK2SG reminded me of a recent editorial in which I pleaded with you to make us all aware of hams who have been doing good works. Syd, it turns out, was one heck of an RTTY pioneer—and I never heard of him before! As the publisher, starting in 1951, of an RTTY magazine, I knew all of the American RTTY pioneers...John Williams W2BFD, Merrill Swan W6AEE, Bob

Continued on page 61

Number 56 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

If you can't hear them, you can't work them. This simple premise is common to all facets of two-way radio. For the amateur satellite enthusiast, weak-signal operation is the norm. Satellites have limited power budgets. With the exceptions of the high elliptical-orbit satellites like AMSAT-OSCAR-10 and AMSAT-OSCAR-13, hamsats transmit less than 10 watts to very simple antennas. On the ground, good antennas, sensitive receive gear, and quality cable to connect them are required.

On the transmit side, the same rules apply. A poor antenna with inadequate feedline will require more power from the transmitter to get a signal up to the satellite. More power means more money for an amplifier.

Most hams shop for antennas with high gain, receivers with good sensitivity and transmitter systems with adequate power for the earth-to-space link for their satellite stations. Many hams will try to save money on the feedline. If the cable is not correct for the job, the receive and transmit signals are low, enthusiasm fades, and another satellite station goes silent.

The rig-to-antenna connection

If money were not a concern, multiple runs of 7/8-inch diameter Andrew Corporation Heliax would do well for all of the current satellite bands from HF through SHF. Five 100-foot runs with new cable and connectors would cost about $750 per run for a total of $3,750. Surplus or used cable and connectors would cost a lot less, but other considerations take over. A bundle of cables that large would be hard to position and almost impossible to connect to rotatable antennas. Jumpers and additional connectors would be needed. Some interesting explanations might also be in order if the radios were in homes and holes had to be drilled for the large feedlines.

Putting together a quality, yet cost-effective, feedline configuration requires some careful study and a few trade-offs. While the Heliax would be great for a long run at 1.2 GHz, it would be serious overkill at 21 or 29 MHz.

With little previous knowledge of coaxial cables and connectors, most newcomers to the predominantly VHF and UHF realm of the amateur radio satellites find the options daunting. One look at a Belden catalog of wire and cable or an Amphenol RF and microwave connector listing can lead to quick confusion. For most antenna installations using frequencies from 450 MHz and down, a few simple guidelines can help.

Coax

For short coax runs (less than 50 feet), a premium-grade, brand name, 50-ohm RG-8/U type coax will do the job. The "RG" is a military designation for coaxial cable and the "U" means "general utility". For outdoor use, RG-213/U (Belden part number 8267) is an excellent choice. It has reasonable loss characteristics, 97 percent shield coverage and a non-contaminating PVC (polyvinyl chloride) jacket that will survive exposure to the sun and weather much longer than others.

Loss characteristics are usually given in dB (decibels) per 100 feet for various frequencies that may be used through the cable. The Belden type 8267 exhibits a loss of 1.9 dB per 100 feet at 100 MHz, 4.1 dB at 400 MHz and 8.0 dB at 1 GHz. This means that with a transmitter running 100 watts on 100 MHz at one end of the 100-foot cable, the 1.9 dB loss would attenuate 35 percent of the signal, or 35 watts. Only 65 watts would make it out the other end. The rest would be absorbed in the cable. At 400 MHz, the same 100 feet of cable would lose 61 percent of the signal, and at 1 GHz the cable would lose 84 percent of the signal. At the end of the cable, only 16 watts of the original 100 watts would be available.

The insulation between the center conductor and the outer shield is solid polyethylene for the Belden type 8267. The nominal velocity factor due to the use of solid polyethylene as a dielectric is 0.66. This value is the transmission speed of RF energy in a length of cable compared to speed in free space. It is usually expressed as a percentage.

Belden RG-8-AU (P/N 9251) has almost identical specifications, while the RG-8/U (P/N 8237) uses a slightly different inner insulation and does not have the non-contaminating jacket. Outside use will therefore limit the useful lifetime of the RG-8/U. Another favorite due to favorable loss characteristics and reasonable cost is the Belden 8214 coax. It is an RG-8/U *type* cable. It has the standard PVC jacket, but with a cellular polyethylene inner insulator that increases the velocity factor to 0.78. It is sometimes called RG-8 "foam" coax. The cable has slightly better loss characteristics than the other RG-8 cables, but it is not meant for installations with continuous exposure to moisture.

A favorite coax for longer runs, up to 100 feet, is the Belden 9913 coax cable. Although it has a standard PVC jacket and cannot make tight turns, it does have lower loss at VHF and UHF frequencies than the RG-8 types. The 9913 coax has a 100 percent shield using a braid-covered foil. The inner insulation is semi-solid polyethylene and the center conductor is solid (size 10) bare copper. The air/polyethylene dielectric provides a velocity factor of 0.84. At 100 MHz it has 1.3 dB of loss per 100 feet, 2.7 dB at 400 MHz and 4.5 dB at 1 GHz. It can usually be purchased for less than $0.45 per foot in quantity.

Some recent variations of the Belden 9913 are also available, but at higher prices. The Wireman (phone 1-800-727-9473) sells Flexi-4L which has very similar loss characteristics to 9913, but uses a stranded center conductor for a better bending radius, and can be ordered with different jacket types for inside or outside use. The cost per foot is about $0.60. SSB Electronics (phone 1-717-868-5643) sells a popular European 9913-type cable called AIRCOM PLUS. The cable is very stiff due to the solid center conductor, costs $0.77 per foot in 328-foot rolls, but is advertised with loss characteristics that are even better than 9913 by a few tenths of a dB per 100 foot at most frequencies.

For the satellite frequencies in the HF spectrum (21 and 29 MHz) coax runs are not nearly as critical. For most applications, RG-8/U will be an excellent choice. The smaller-diameter RG-8/X (Belden P/N 9258) can also be used, although it has a standard PVC jacket and cellular polyethylene inner insulation. For short runs, RG-58A/U (inside) or RG-58C/U (outside) will do well. At 29 MHz, RG-58A/U has almost 3 dB of loss for 100 feet of cable, RG-8/X has about 2 dB, and RG-8/U has about 1 dB.

For satellite frequencies above 1 GHz, the cable can become a major financial problem. The 7/8-inch Heliax has an advertised attenuation of 1.31 dB per 100 feet at 1 GHz. This is still a 25 percent power loss, but it's much better than the 64 percent loss with 9913 or the incredible 99.3 percent loss with RG-58A/U. Lengths of RG-58A/U are sometimes used as intentional attenuators at UHF and SHF frequencies.

Connectors

As with cable, the primary rule with connectors is to stick with brand names. Most satellite hams have a good collection of Amphenol "UHF" and "N" connectors for their standard cable runs. A few other manufacturers of note include Kings and Trompeter. Avoid the no-name clones. Many look fine, but act as attenuators at higher frequencies due to tolerance problems and lossy dielectric material.

The so-called "UHF" connectors (SO-239 and PL-259) should be avoided above 148 MHz. Some purists have said that these connectors are great for CB and audio, but worthless elsewhere. Amphenol states that these general-purpose RF connectors are designed to operate

"satisfactorily" up to 300 MHz. If used properly, they will do fine for the satellite bands below 420 MHz, but even then, the Teflon™ insulation type should be used.

Above 420 MHz, "N" connectors are appropriate. They have a much higher voltage rating than UHF connectors and are typically rated for use up through 11 GHz. Due to a larger center conductor on 9913 coax, special "N" connectors are required. They usually have the same outer shell as those for RG-8 type coax, but have a special center pin to take the larger diameter center wire.

Some imported "N" connector clones have exhibited incredible losses at frequencies above 1 GHz. In high-power 1.2 GHz amplifiers, they may even get hot, assuming that other mismatch problems don't arise.

When installing connectors to coax, either follow the instructions that come with the connectors or check the *ARRL Handbook*. For outdoor connections seal the connector with non-corrosive RTV sealant and tape or thick-walled heat shrink tubing. The rig-to-antenna connection is the key to success for any satellite earth-station installation. 73

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

Spring is rapidly approaching —it would be nice to see more ideas and suggestions for spring and summer projects. What have you found that might benefit the rest of us? As always, any general ham-related ideas are welcome...here are a couple of my own.

A "customized" connector

I recently needed a 7-pin male DIN connector to plug into the accessory socket on my Kenwood TS-430S in a hurry — they're not the easiest of connectors to locate! So instead I bought an 8-pin DIN plug from Radio Shack™ (their #274-026) and was able to cut down the center 8th pin far enough (using a pair of small diagonal side-cutters) so that it fit nicely into the 7-pin socket on my transceiver. The spacing of the 7 remaining pins is the same as that of a true 7-pin DIN plug.

First aid for crumbling insulating tape

Some hand-held VHF/UHF transceivers come from the manufacturer with plastic tape laid across solder connections that might touch other conductive surfaces when the small circuit boards are finally "layered" together. After time, the tape and its adhesive dry out, literally turning to dust. I've found a suitable replacement tape, one that won't leave much residue when lifted up, as near as your local drug store.

The type that I've been most happy with is made by Johnson & Johnson; it's their 1/2-inch wide waterproof First Aid tape. It's a cloth based tape, with serrated edges, and has an effective, yet non-gumming adhesive backing. Of course it's intended to be used to secure a bandage, but it also makes a good general purpose insulating tape for use with low-voltage electronics. Since it's formulated to be waterproof, it doesn't seem too hydroscopic (prone to pick up moisture from the atmosphere), making it suitable for use in radios that will spend most of their lives in a mobile or marine environment.

Don't blow money on blown fuses!

From Herb Foster AD4UA: Here's an easy way to test a piece of equipment that continually blows the AC line fuse, without having to keep feeding it expensive little fuses.

Make up a trouble lamp with well-insulated clip leads on the ends of the AC cord, instead of the normal 2-prong AC plug. Install a 60 to 100 watt standard 120 volt lamp into the socket. Leave the fuse-holder in which the fuse keeps blowing empty, and clip the trouble lamp across it. When you apply power to the piece of equipment, the lamp will shine at near full brightness if the short in the circuit is close to zero ohms, or a bit less if it's not right at zero ohms, but still fairly brightly. Once you've cleared the short by lifting components or opening circuits, the trouble lamp across the fuse holder will glow very dimly when power is again applied, depending upon the amount of "normal" current that the device is actually drawing from the AC line.

Now you can disconnect the trouble lamp and reinstall a good fuse, knowing that the fuse will more than likely "hold" this time around.

Herb's suggestion works because a "cold" 120 volt lamp has very low resistance, and will therefore allow enough current into the troublesome circuitry if the short has been cleared, but not enough to cause harm if the short still exists, since its "hot resistance" is acting to limit the maximum current. A 60 watt, 120 volt bulb will be 15 to 16 ohms cold, a 100 watt 120 volt bulb about 9 or 10 ohms cold. It's a good way to dynamically test a piece of equipment without causing further harm. Just make sure that everything is well insulated—as Herb mentioned—and that you stay clear of the 120 volt circuitry any time the device is plugged in.

Pushing the (peak) envelope

From Ken Guge K9KPM: In the "old days," an amateur could determine his or her legal transmitter power by multiplying the anode voltage of the final amplifying stage times its current (the DC power input to the final transmitter stage), and as long as that figure was kept under the maximum allowable, that was all that the FCC expected the individual to know. It's not quite that easy today.

The FCC now expects an amateur to keep PEP (Peak Envelope Power) output under a certain maximum, depending upon the power restrictions of the license class and within the band that's being used. It's 1500 watts PEP for most operators on most of the bands, but that maximum is only 200 watts for everyone in Novice 80, 40 and 15 meter sub-bands and for Novice class licensees within the 10 meter band. Novices are permitted only 25 watts PEP on the 1-1/4 meter band and 5 watts PEP at 1270 MHz. All classes of licensees are restricted to 200 watts PEP throughout the 30 meter WARC band. It's 100 watts PEP for all beacon stations and 50 watts PEP within the 70 CM band in certain geographical regions. Refer to a current copy of the FCC rules for the specifics on any of these figures.

The point is that we can't just say "I'm running well under 1500 watts PEP so I'm safe." You're expected to know that you're within the legal limit, based upon your class of license and band of operation, and here's the way to do it.

PEP, or Peak Envelope Power, is the average RF power being fed into the antenna's transmission line (down at the shack), during one RF cycle, at the peak of the modulation envelope, with an SWR of 1:1 and under normal operating conditions. The most accurate way to measure PEP is with a monitor scope, coupled to your transmission line and terminated in the line's characteristic impedance (usually 50 ohms). The presentation on the scope face will be a peak voltage, so it's averaged by multiplying its value by .707. That answer is then squared and that result is divided by the 50 ohm transmission line impedance to get actual PEP power in watts. Sounds confusing, but here are some examples that might help clarify:

22 volts times .707 = 15.554 and 15.554 times 15.554 = 242 divided by 50 = 4.84 watts PEP

70 volts times .707 = 49.49 and 49.49 times 49.49 = 2,450 divided by 50 = 49 watts PEP

To calibrate your scope for 100 volts peak, put 100 watts into dummy load, with the scope in line, by adjusting the transceiver's CW key-down output while monitoring a wattmeter of known accuracy (some transceivers and dummy loads have an output wattmeter built right into them). 100 watts average into 50 ohms comes out to 100 volts peak (an interesting coincidence of numbers). Ohm's Law tells us that voltage is equal to the square root of the wattage times the resistance. 100 average watts of power times 50 ohms equals 5000, and the square root of 5000 is 70.7 (average voltage). 70.7 times 1.414 (1.414 is the multiplication factor that's always used to convert average to peak) = 100 volts peak voltage. Take a second to look it over again, don't get average and peak confused nor power and voltage mixed up. Also remember that "normal" wattmeters read average wattage, and the FCC wants us to know our PEP power output. Scopes will read peak voltage, and once the scope is calibrated correctly, you can use the examples above to determine the PEP wattage from the peak voltage that you've read on the scope.

Also notice that the relationship between peak voltage measured on the scope and PEP power is a logarithmic, rather than a linear, one. When the voltage doubles, the power increases by a factor of 4 to 1. When the voltage goes up by a factor of 10 to 1, the power increases by a factor of 100 to 1.

There are also peak-reading wattmeters commercially available to us as hams, but using a scope is the most accurate way of determining PEP power, and it's the only way to check the accuracy of a PEP meter. It's a good idea to be aware of (and practice) the scope method, just in case the legality of your PEP power output is ever questioned by the Commission.

Stealth chimney

From Bill Thim, Jr. N1QVQ: A different approach to a stealth chimney-mounted HF long wire antenna. Here's a suggestion for hams or SWLs living in a condo or other development that prohibits the installation of visible outdoor antennas of any type. Wanting to have a long-wire antenna that was totally invisible, and having a chimney made of brick and mortar, I started out at the bottom of the chimney, where a good ground is available, and laid #22 wire into the mortar joints between the bricks. I used a zigzag pattern as large as the chimney width permitted, then applied another "cover-up" layer of mortar on top of that. Upon reaching the chimney top, I dropped the wire through an unused flue pipe into the house. The average two-story chimney can accommodate 250 to 500 feet of wire — depending upon the width of the zigzags — by using this technique, and it's completely invisible except for a few inches at the base and a few inches at the very top. I was able to end up with nearly 500 feet of wire, which, via an antenna tuner, allowed me to copy all of the HF bands from 160 to 20 meters with surprisingly good results.

Bill also mentioned, that in his case, he had to get management's approval for the "tuck-pointing" work, but in areas where single family detached homes are the norm, that probably wouldn't even be needed. Bill hasn't used his stealth antenna for transmitting, but it should be usable on at least some of the HF bands, with the proper tuner in line and at reduced power levels. As he also pointed out, it's certainly better than no antenna! I wonder what the radiation pattern would look like on 20 meters?

Paint it silver

From Richard Measures AG6K: A cure for intermittent connectors in today's radios. The subminiature push-on, crimped-on coaxial connectors, used in many ham transceivers to interconnect RF or IF signals between circuit boards, can become intermittent or exhibit higher than near-zero ohms resistance on occasion. A poor connection at the center pin of these connectors can result in numerous intermittent output problems, in the case of a transmitter section, or varying sensitivity problems if the offending connector is in the receiver's circuitry. The crimp-on pins in these connectors have a tin plating, which, when crimped against the copper inner conductor of the subminiature coax, can create a dissimilar-metal electrolytic action that eventually turns the crimp connection into a semi-insulator.

Deftly soldering the tiny ends of these connectors, without damaging the coax cable inside, can be more difficult than some may want to risk, so another solution may apply if you're in that category. GC Electronics, among others, makes a conductive paint (Silver Print® is GC's brand name) that can be successfully used in these cases. It's normally sold through electronics component dealers, locally or via mail order. The silver conductive paint can be applied to the tip of the tiny coax connector with a straightened paper clip, coating the tip junction of the protruding wire and the connector pin surface to restore good contact.

The same scheme will also work for intermittent or high–resistance crimps on the small multi-pin control-cable connectors used in most modern rigs. The suspect female pin on one of these small connectors can usually be removed by carefully removing the connector, then depressing the tiny locking tab — accessible through the rectangular hole over each pin — with a scribe or small jeweler's screwdriver, and carefully slipping the pin back out of the connector body itself toward the wire's entrance. Don't pull too hard, or you may break the wire off completely. If the locking tab is depressed enough, you should be able to extricate the pin. Again, a dab of some conductive silver paint can be applied to the crimp connection with a straightened paper clip and allowed to dry before replacing the pin back in the connector. Don't forget to bend up the little locking tab again before reinserting the pin. You should hear or feel a tiny "click" as the tab engages.

Unless a crimped connection is so tight air is unable to reach the two conductive crimped surfaces, the electrolytic action that Rich speaks of is virtually inevitable, especially in areas of high humidity situations such as might be found in a mobile installation. There are well-applied crimped connections (partly dependent upon the design of the connector itself), but not every one can be assumed to be of that type.

Rich is a well-known author of numerous tips and equipment modification suggestions, perhaps most noted for his diligent work on HF amplifier parasitic suppression problems. Rich has delved into a number of modern transceivers and ferreted out the problem areas in those radios. Watch for other contributions from AG6K in the coming months. Thanks, Rich.

Keep the engine running!

From Peter Albright AA2AD: Another of his handy tips for quickly testing transistors in-circuit. The first "quick tip" that appeared in this column dealt with testing transistors statically and out-of-circuit, but it would be handy to do some preliminary testing without removing every transistor from the board! Here are some tips for locating defective transistors while they are still mounted on the board. The tests are run with the case opened and power applied, so please BE CAREFUL. In addition to the danger to yourself, troubleshooting a piece of equipment can be complicated by one slip of the test probe; you don't want to create additional circuit problems!

Good technicians always begin the troubleshooting process with careful observation. Is a transistor too hot to touch? Remember to keep one hand in your pocket when you stick the other into the equipment's guts, and keep both hands away from high-power RF circuits! Transistors can become quite warm, even in normal operation, but generally not hot enough to raise a blister. Conversely, if a transistor looks like it is designed to dissipate heat (a big case mounted on a hefty heat sink is a good clue), but it's cold to the touch even after several minutes of operation, it may not be conducting. Watch for those clues. Is there a resistor that's discolored from excessive heat? Has any component become so hot that the board is discolored? It may be normal, or it may be another clue.

After careful visual inspection, it's probably time to break out your trusty voltmeter. By the way, a digital voltmeter is generally better for these tests because of the often small relative differences involved. You'll see what I mean.

Transistors that are conducting normally show predictable voltage patterns. Specifically, the voltage drop between the emitter and base of a silicon transistor should be between 0.6 volts and 0.7 volts (about 0.3 volts for a germanium transistor). The voltage at the base should fall somewhere in between the voltage at the emitter and the voltage at the collector. For an NPN transistor, the collector will be more positive than the emitter. For a PNP transistor, the collector will be more negative than the emitter. While the voltage difference between the emitter and the base is 0.6 to 0.7 volts, the difference between the base and the collector is generally much greater. Remember that these values are relative to each other. Here's a chart of six imaginary transistors, showing logically possible voltages for each, relative to ground, that you're likely to find on a good transistor—one that's conducting normally. Note that these patterns do not apply to a good transistor acting as a switch in the "off" mode. Also, transistors acting as higher power RF amplifiers may check somewhat differently, but the chart does give you a good idea of the viability for the bulk

of the other transistors you're likely to find on a board.

NPN
e+2.0 e-2.0 e-.05
b+2.7 b-11.3 b+.02
c+12.0 c-3.8 c+48.0

PNP
e+12.0 e-3.8 e+48.0
b+11.3 b-4.5 b+47.3
c+2.0 c-12.0 c-0.5

Remember, the chart shows typical voltages measured with respect to ground, so don't expect them to be exact in any particular circuit that you might be troubleshooting. Again, what we're looking for here are indications of parameters that are grossly wrong.

Often it's easier to simply measure the voltages across the legs of the transistor, as opposed to measuring one junction to ground. If you can identify the emitter, and put one voltmeter probe on that lead, you will measure about 0.6 volts to the base with the other voltmeter lead; the meter will measure a greater differential to the collector. The polarity of the voltage will tell you whether the transistor is NPN or PNP; you can often identify the lead configuration of a good transistor by the voltage differences on these three junctions. Again, we're looking for relative differences across the device itself.

Although some physical lead configurations are more common than others, you can never assume that the lead configuration on two transistors is the same, just because they happen to look alike. The transistor manufacturers have done that just to keep us on our toes!

Peter offers some good practical advice in his treatment. As before, it's probably worthwhile cutting this information out and keeping it handy, for the next time you're faced with an involved troubleshooting job. A small plastic card file, with tips like these on the cards, will save you additional time and frustration trying to remember when and where you saw the information you need.

Scrub 'em, don't scrap 'em

From Klaus Wolter N8NXF: A method of soldering to aluminum without the need for special solder or equipment. Here's a technique that I've used several times with success:

1.) Carefully scrape the area to be soldered so that it's good and clean, and so that fresh, raw aluminum is exposed.

2.) Aluminum carries away heat very rapidly, so you must use an iron that's hot enough to keep a ball of solder molten once it's in direct contact with the aluminum.

3.) Firmly and consistently "scrub" the area on the aluminum to be soldered, then slowly apply regular 60/40 rosin core solder, trying to "rub it into" the aluminum with either a back-and-forth or a circular motion.

4.) If all goes well, you'll begin to notice that some of the solder ball is sticking to the aluminum; keep working the area until you've created the pad size that you want.

You should now be able to attach wires or component leads to this pad of solder. It's not easy, and it does require persistence and a bit of skill, but it can be done. Practicing on the inside of an empty aluminum beverage can will hone your skills in the procedure before trying it on a finished project.

Klaus' idea does work on certain types of aluminum; I've used it myself in the past. It may not work on all varieties of chassis material, since what we call "aluminum" can take on many variations in actual formulation percentages of other metals. I've also successfully used a soldering flux containing Zinc Fluoroborate, and Mono- and Di- Ethanolamine for soldering to some aluminums and stainless steels. One such product is manufactured by Henry Mfg., P.O. Box 155, Westville IL 61883. Long ago I heard that the "big secret" to soldering to aluminum is to not give the raw aluminum surface a chance to oxidize, which it does immediately upon contact with the air, and that seems to be why Klaus' technique works when used with the persistence he mentioned. Be cautioned that a copper-to-aluminum solder joint may not have the strength of a copper-to-copper solder joint, and its conductivity may alter over time. Good long-term conductivity in any solder joint requires that there be an alloy bond between the metals involved—this may not always be the case between tin/lead solder and some aluminum formulations.

At the end of your rope?

From Robert Blacka N2WSO: A tip that bears remembering when you're shopping for new rope for that upcoming spring antenna project. I was browsing through my local Home Depot™ home improvement center when I came across a variety of rope that yelled out "amateur radio!" Needless to say, I bought a couple packs! The product is called "Camouflage Poly Rope," and it's made by The Lehigh Group of Allentown PA.

It's reasonably priced, one quarter inch in diameter, rated at 113 pounds working load and virtually invisible against a background of trees or other vegetation. Perfect for ham antenna work! Side-by-side comparisons between the camouflage rope and standard white nylon antenna support line of an even smaller diameter confirmed the night-and-day difference in visibility. Even if the background isn't vegetation, the camouflage rope is tough to see in comparison with other solid-colored rope, because the human brain easily interprets straight lines of one color, but not of broken or random colors. The military discovered this decades ago and even Mother Nature herself has equipped many animals with a similar color scheme.

I've had several sections of Lehigh's "Camouflage" 1/4-inch rope out in the weather for over a year now, with no signs of deterioration. It appears to be conservatively rated by its manufacturer. It also appears to be a seasonal item, so ask about it if you don't see it stocked. It would probably find more widespread use among hams if it were available for sale at hamfests—now there's another idea for all of you weekend entrepreneurs!

And that concludes another month of Ham To Ham. Thanks to all who sent in their suggestions, tips, ideas and shortcuts...how about you? We've all discovered "better" ways of doing the average, everyday things we face in the pursuit of our hobby. How about sitting down for a few minutes, jotting down your ideas and sending them to the address at the masthead? I'll acknowledge all contributions and give you an idea as to if and when the tip will be used in the column. If it is used, Uncle Wayne's elves will send you ten bucks for your time and postage expenses. What a deal! I'll be back next month with many more worthwhile ideas.

This month's contributors:

Herbert L. Foster AD4UA
3020 Pennsylvania Avenue
Melbourne, FL 32904-9063

Ken Guge K9KPM
1107 E. Woodrow Avenue
Lombard IL 60148-3126

William Thim, Jr. N1QVQ
50 Miller Road
Broad Brook CT 06016-9676

Richard L. Measures AG6K
6455 La Cumbre Road
Somis CA 93066

Peter Albright AA2AD
28 E. Summit Street
Lakewood NY 14750

Klaus Wolter N8NXF
910 Pinetree Drive
Ann Arbor MI 48103

Robert Blacka N2WSO
8275 Maple Avenue
Pennsauken NJ 08109

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Please send all correspondence relating to this column to *73 Amateur Radio Today's* "Ham To Ham" column, c/o Dave Miller NZ9E, 7462 Lawler Avenue, Niles IL 60714-3108, USA. All contributions used in this column will be reimbursed by a contributor's fee of $10, which includes its exclusive use by *73*. We will attempt to respond to all legitimate contributors' ideas in a timely manner, but be sure to send all specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to *73*. 73

NEVER SAY DIE

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Weitbrecht W6NRM...but no one from Australia has ever bothered to let me know about what Syd was doing.

Come *on*, if a ham mover and shaker you know won't blow his own horn, it's up to you to pick up the slack. As Gilbert put it, "If you wish in the world to advance, your merits you're bound to enhance. You must stir it and stump it, and blow your own trumpet, or trust me you haven't a chance." Okay, what musical was that from?

The VK2SG obit mentioned that Syd, who died at 76, had been having health problems for the last six years of his life. To me that says that I need to do more to get the word out that health problems, almost without exception, stem from diet. If you put a little sugar in your car's gas tank every day you can easily cut your car's life in half. I'm not selling any fad diets or vitamins (yet, anyway), just asking you to read the books I've found that make the most sense when it comes to the maintenance of your body.

It makes sense to me to provide our bodies with the same raw materials our ancestors ate, drank, and breathed over the millions of years of our development. A Danish, coffee and Tang breakfast doesn't make any kind of sense. Nor does a burger, fries and milkshake lunch. Sure tastes good though. And drugs can make you feel good. For a while.

Another new technology

Secure Technologies Inc. of Lexington, MA, has come up with a neat little radio gadget. It's a range-finding unit which will help anyone keep track of where people or animals are. It requires a base unit and a small portable device which can be used to keep track of dogs, kids (at a mall, say), Alzheimer's patients, cattle or sheep herds, and even prisoners.

It uses a 900 MHz band transmitter n the base unit which sends out a 1 ms pulse of RF, modulated at 500 kHz. The portable unit receives this and retransmits it back on a different frequency (like a miniature repeater). The base unit measures the phase shift between the two signals and translates that into distance. The base signal also contains an identifying code so many of these units can be used in the same area without interfering with each other. If the distance exceeds an adjustable programmed number, the base unit will sound an alert.

This seems like a great way to cut the cost of prisons, with the authorities able to know whenever a prisoner goes beyond a given limit. It's a different and much lower-cost type of prison cell. With the base unit easily portable, it's easy to use it to find a person or animal that has gone beyond the limit set.

This is a clever use of electronics, but is it anything that you couldn't have developed, if you'd thought of it? If it is, then you haven't been learning your fundamentals, just memorizing your way to your ham ticket. Amateur radio is not only a way to have a whole lot of fun and adventures, it's also a license to learn and build your technical skills.

And for that matter, how come *you* didn't think of it? My excuse is laziness; what's yours? I'm too busy having a good time to sit down and think creative thoughts.

STI has come up with a great new product. That means they're probably going to be looking for investors to bring it to the market. They're going to need some hot sales people, advertising and promotion experts, and so on. They'll need engineers and technicians to help design, build, test, sell and service the stuff.

Cold fusion news

Big news! The US Patent Office has, for the first time, issued a patent on a device claiming to generate excess heat (2000%). Dr. Patterson had got a couple of patents on his cold fusion cells in which his supporting figures showed excess heat being generated, but he hadn't claimed that before. Now, in patent # 5,494,559, issued Feb. 27th, they've accepted his claim. Not

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QRP

Number 62 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

I admit I go through a lot more rolls of solder than logbooks. I enjoy the challenge of building new circuits. However, troubleshooting them can be an exercise in logic as well.

So it was when a friend of mine contacted me to take a look at the QRP transceiver he'd built, the QRP-15 CW transceiver by Rick Littlefield K1BQT.

Rick describes a small CW-only rig for the 15 meter band. This version, for 15 meters, is loosely based on his article, "An NE602 Based QRP Transceiver for 20 Meters." This article was published in *Ham Radio*, January 1989. Sorry, but I don't have access to either of the references mentioned. Check your local club's library for back issues.

In a nutshell, the rig is based on several NE602 mixer ICs. An analog VFO complete with an RIT circuit controls the frequency of the rig. The VFO operates from 5.000 MHz to 5.150 MHz. The RIT has a tuning range of about ±1.4 kHz. With the operating range set at 5 MHz, the IF dictated using a 16 MHz center frequency. While this may seem to be off the wall, in real life crystals for the filters and BFO are easy to obtain. They're commonly used in computers and other digital equipment. Both Digi-Key and Mouser electronics carry these crystals. They're cheap, too; about two bucks each.

Other than the 16 MHz IF, the rest of the rig is quite basic. However, in my friend's case, his version would not work.

First things first

Troubleshooting a home-brew project you put together yourself is one thing. Working on something someone clear across the country built is entirely different. So, the first step is to check for the usual cold solder joints and solder bridges. Finding none, we move up to the components and double-check for proper placement of all polarity-sensitive components, such as diodes and electrolytic capacitors. A quick check for the correct placement of all ICs is next in order. Also, and this may seems rather simple, but do check to see if each IC is in the proper location!

The simplest thing to do is take voltage checks of a kaput rig. A novice troubleshooter always asks, "Check what voltage where?" To begin, the best place to start is at the power supply jack, then work your way backwards. A 1N4002 diode installed backwards can keep the rig from working. Next, check for the proper voltage(s) at any of the three terminal voltage regulators. This includes their input and output pins. Take a quick look at the ground pin as well. The ground pin must read zero volts, not one or two volts. Unless the ground pin is held above ground by a resistor network, look for a cold solder joint or a cold solder joint someplace along the ground bus. In my case, the three terminal regulators were providing the necessary voltages.

Even if the required voltage(s) appears at the regulator(s), check each and every VCC pin on each and every IC. One cold or missing solder connection on the VCC pin will stop the rig dead in its tracks.

Here's a helpful timesaving tip for when you're checking for proper operation from a three terminal regulator. In the case of this 15 meter transceiver, there is one 7812 regulator supplying RIT circuit and the VFO/TX mixer. If you have your supply voltage (power supply, battery or whatever) set at 12 volts, the output of the 7812 will *not* be 12 volts. The three terminal regulators require several volts above their regulated output to operate correctly. If you like to operate by battery in the woods, then I would suggest replacing the 7812 regulators in all of your rigs with one of the low dropout units from National or Linear systems. Both companies make several different voltage rating and current rating low dropout regulators. Some of these LVD regulators require only .3 volts above the regulator's output. For 12 volts at 1 amp, the LM2940T-12 is a perfect drop-in replacement for all of your TO-220 applications. For smaller current demands, the LM2950CZ-5 is available in the popular TO-92 case style. Both of these low dropout regulators are made by National Semiconductor.

The VFO—the heart of any rig

Now, I don't really care who said it, but finding the output of a VFO on a general coverage receiver is just plain nuts! You need a frequency counter. In this case, the VFO was running but at almost 8 MHz. The fix was taken in two parts.

First, the RIT coupling capacitor was removed from the VFO circuit. This eliminated any possible frequency shifting due to a messed-up RIT circuit. Fix the VFO first, then worry about the RIT.

Looking over the VFO parts, nothing seemed to be out of place. So, since the VFO was running too fast, making the output higher than needed, then one or more of the frequency-determining components was out in left field. Because the VFO *was* working, we knew the basic oscillator was running, so it was now just a matter of putting the output in its place!

Rick uses one NE602 as both the mixer and the VFO oscillator. It's a classic circuit and has been around since the NE602 first gained popularity. With plus 6 volts on the VCC pin, the output may be taken from either pin 4 or 5. With the RIT removed from the circuit, the only two parts that will determine the output frequency are coil L2 and the 50 pF variable capacitor.

To lower the frequency, we needed to add either capacitance or inductance. Had the VFO been running a tad too low, a simple and quick cheat would have been to remove one stator plate and check the output with the frequency counter. Removing stator plates is a whale of a lot easier than adding stator plates. However, we could add an external capacitor to pad down the tuning capacitor, leaving both stator and rotator plates untouched. While in theory this does work, it also reduces the amount of tuning range we could get. This is exactly what the calibration trimmer does to the circuit. It adds oh-so-slight an amount of capacitance across the tuned circuit, lowering the oscillator. In the case of our 15 meter rig, the calibration capacitor was rated at 8 pF.

The only sure-fire fix was to remove L2 and rewind it. Sure enough, there was not enough wire on the toroid; this easily increased the frequency of the VFO. To make matters even more interesting, the difference of one or two turns really shot the frequency up or down. After I had the windings in the right neighborhood, I applied some SuperGlue gel to hold the turns in place. That fixed the VFO and it operated in the frequency range it was designed for.

The output of the VFO goes to the TX mixer, another NE602. Between the VFO and the TX mixer, Rick uses an MPF102 to buffer the VFO's output. From the drain of the MPF102, RF is picked off via a 500 ohm trimmer. Although the trimmer is not critical to set, use caution so you do not apply too much RF to the mixer. All kinds of nasty things will crawl out of the NE602 if you overdrive this mixer.

The best way to set the TX mixer level is to monitor pin 1 of U6 with an oscilloscope. Adjust the mixer drive until the signal begins to flatten off. Now reduce the drive just a bit, so all you see is a clean sine wave going into the TX mixer.

Transmitter

Since this is the easiest part of the rig, let's follow the output from the TX mixer to the antenna.

By using your Tscope, you should see the input from the VFO on pin 1 of U6. IC U6 mixes the VFO signal with the signal provided by Y1. Again, as in the VFO, Rick used the NE602 as an oscillator. Check for operation of Y1 at pin 6 and 7 of U6. (I'm not able to reproduce the actual schematics.)

Output of the mixer, now at the frequency we want (in this case 21 MHz), should appear at the base of the driver transistor, a 2N5109. If not, then there's a solder bridge between pins 4 and 5, or L7 is wound incorrectly. Adjusting the TX/MX trimmer should produce a peak at the base of the driver.

Move forward to the final. RF, now rather heavy, should be on the base of the MRF475. Check for +12 volts on the collector of this transistor. If you read zero volts DC, then there is a wiring error in T1. If everything is working as it should, you'll see about 2 watts output to the antenna. *If everything is working*. And that's where we'll pick it up next month as we fix and improve the 15 meter transceiver. 73

Number 62 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153

Adjusting the epithet

We hams are famous for acronyms and abbreviations. Whether it's RTTY, AMTOR, QSL, or plain old CW, every letter has a meaning, no matter how obscure. In my warped mind, MFJ always stood for Mighty Fine Junk; after this month's batch of offerings from them, I may have to change that appellation.

Many readers will remember my tale of the bow and arrow placement of my antenna some years back. The version of the G5RV antenna I put up cost me about $50, and now, several years later, it has broken at the balun. Just the ticket to replace it is MFJ's version of this venerable antenna. This efficient 102-foot doublet runs all bands in the 80 through 10 meter range, with 160 as an option with a tuner and ground.

Fully assembled, the antenna features strain relief feed points, custom-made Fiberglas™ insulators, and heavy gauge wire that's capable of running the legal limit. All this, for a nickel under $30. **Photo A** shows you the whole picture. Wouldn't you like to have one in your backyard? I don't know about you,

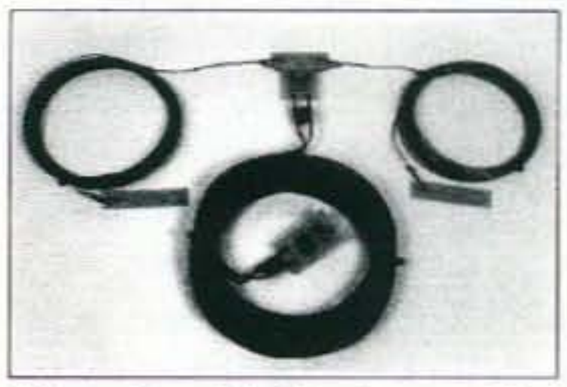


Photo A. *All this, for a nickel under $30.*

but as soon as our weather here in the East breaks — it's been winter for about three years, I think — I would love to have one of these to replace the aging skyhook out there now.

The little box in **Photo B** is the MFJ Multi-Reader, MFJ-462B, a $170 device that decodes a plethora of digital modes. Capable of decoding Morse, RTTY, and ASCII, this self-contained demodulator can either display incoming traffic on its built-in LCD display, or output them to a printer via an integral printer port. If you're into SWL or monitoring, this would be a simple way to go, to get dedicated digital reception at a reasonable price.

Photo B. *The MFJ Multi-Reader, a little box that decodes a plethora of digital modes.*

On the other hand, if full-scale digital communication is more your style, have a look at the MFJ-1278B, their DSP multimode controller that does just about everything. With the sleek case, shown in **Photo C**, and with digital modes including RTTY, CW, packet, PACTOR, AMTOR, color SSTV, and gray level FAX, about the only thing this box doesn't do is fill in the logbook. There's a built-in 32k mailbox, expandable to 512k, a built-in parallel printer port, and, unlike another unit I've seen, this one comes with its own 110 volt power supply.

The controller is available in several flavors, for several budgets, ranging from the basic MFJ-1278B for $300, without DSP, all the way up to the MFJ-1278B/DSP, featuring the "brick wall" DSP filters, for $380. MFJ's own software package, the MFJ-1289, is designed to take full advantage of the features of these controllers, and is sold separately. Again, here is another honey I'd love to replace an older unit with. Is anyone at my house reading my column?

Information on all of these products may be obtained from MFJ, at P.O. Box 494, Mississippi State, MS 39762, or call them at (601) 323-5869. Just be sure to tell them you read about it here, in RTTY Loop.

A few months ago, I mentioned the Snappy video digitizer, and invited those of you using the device to submit pictures of you or your projects. I received an E-mail from Bob KI5PG, who says he is a regular reader of the column. He purchased the Snappy video capture device, and is really having fun with it. Right now, he is using it to prepare illustrations for a short article on wiring the communications headsets sold for $5. I wonder if he will send the article to *73?* Anyway, **Photo D** is a picture of Bob, sent via the Internet.

"If you're into SWL or monitoring, this is the way to get dedicated reception at a reasonable price."

Here are some interesting WWW links this month, passed along by Dave Horsfall,

VK2KFU, in Sydney, Australia. He suggests: http://www.nsw.wicen.org.au/ the home page of the Wireless Institute Civil Emergency Network, in New South Wales. Sort of like the ARES/RACES, it contains information of interest to WICEN members and other emergency-related people, and has links to related sites.

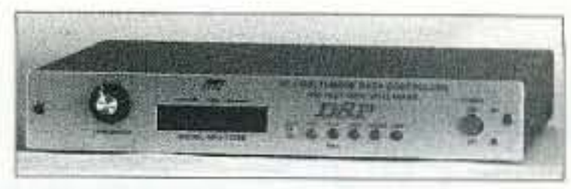


Photo C. *About all the MFJ-1278B doesn't do is fill in the logbook.*

Another of his hot hits is: http://sydney.dialix.oz.au/~wiansw/ the home page of the NSW Division of the Wireless Institute of Australia (WIA), their national amateur radio organization. You'll find information about the WIA, and links to other pages as well.

Of course, the RTTY Loop Home Page, at: http://www2.ari.net/ajr/rtty/ remains quite active, with many of you stopping by daily. Check there for recent columns, the full list of software in the various RTTY Loop collections, links, and other goodies. I look forward to hearing from you by E-mail at ajr@ari.net, or on America Online at MarcWA3AJR, or on CompuServe at 75036,2501. Non-line amateurs, feel free to drop me a letter at the address up top. Questions, comments, suggestions or critiques are always welcome, but be sure to include a self-addressed, stamped envelope if you desire a personal reply by snailmail.

Next month, even more as we conclude the nineteenth year of RTTY Loop! 73

Photo D. *Bob KI5PG, via the Internet with Snappy.*

Ham Radio Fun

Communications Simplified, Part 5

by Peter A. Stark K2OAW
PO Box 209
Mt. Kisco NY 10549

Having looked at the types of signals we may want to communicate, let's look at some methods for sending them through wires and fiber optic cables. Some of the methods we will describe depend on ideas and concepts which we will not cover until later; hence this discussion will be fairly low-level. We will fill in some more details later, as we learn more about the theory. (Continued from April 1996.)

Normal telephone circuits

Normal telephone service (often affectionately called *POTS* or *Plain Old Telephone Service*) uses 600-ohm balanced line and carries analog signals (as opposed to the newer digital lines, discussed later.) The cable carries audio in both directions at the same time, and this is called *full duplex* (as opposed to *simplex*, where a signal goes only one way, or *half duplex*, where a signal can go in both directions, but in only one direction at any given time.) Since audio goes both ways and distances tend to be long, the cable must be terminated in its characteristic impedance at both ends. Thus your telephone set is designed to have a 600-ohm impedance, and so is the circuitry in the phone company's central office.

Telephone lines come in two different types—*switched* and *dedicated* or *leased*. Your normal household telephone connects to a switched line, meaning that it connects to the phone company's switching circuits, which allow you to dial a number and be connected, through the switching circuits, to any other subscriber's telephone (*subscriber* is simply another word for customer). This dialing network (or switching network) is also sometimes called the *DDD* or *Direct Distance Dialing* network.

A leased line, on the other hand, bypasses the switching circuits and is directly and permanently connected between two subscribers. Rather than pay for such a line by the call, you pay by the month.

Since switched lines go through a lot of equipment, they generally have a limited frequency response, and substantial noise and distortion.

Moreover, each time you place a call, your connection is likely to go through a different route, so the noise and other distortions are different with each call.

Leased lines, on the other hand, always go through the same wiring, so their characteristics stay the same. They also bypass much of the circuitry that distorts signals or adds noise. Not only is signal quality better to begin with, but that also means that either the telephone company, or the user, can add additional equalizers and other circuits to improve the line even more. Such lines cost more, but can be used in places where a plain line cannot. For example, radio stations often rent such equalized lines (called *conditioned* lines) to carry high quality audio from their studios to their transmitters.

The above description holds quite well for short-distance connections (such as within a small town), but the picture changes when longer distances have to be covered and the signal gets too weak to make it without amplification. It is possible to insert a bi-directional amplifier into a full duplex line (meaning that the amplifier can amplify two signals traveling in opposite directions on the same line at the same time), but this introduces some other problems. For long-distance transmission, the telephone company therefore splits the full-duplex single line (usually two wires) into two simplex (one-directional) circuits; since this involves a total of four wires, it is called a *four-wire circuit*. This conversion is done with a device called a *hybrid* or *duplexer*. Once split into a four-wire circuit, the two simplex signals can be sent via wire, microwave radio, optical fiber, satellite, or virtually any other one-way medium.

The two-wire line which enters your home or business is generally called the *local loop*, while the four-wire line which carries the call between telephone company equipment (and other lines as well, which might be used not just for your conversation, but for others as well) is called a *trunk*.

Digital telephone lines

As of right now (1996), the telephone line—the local loop—entering your house is purely analog, meaning that the signal traveling in it is a wave shape which closely matches the wave shape of the sound of your voice. Many telephone lines, however, are purely digital.

Since even a moderately long telephone connection uses a four-wire trunk line at some point, carrying a separate set of four wires for every telephone call between large cities could obviously get very expensive. The telephone companies therefore send many different calls through a single cable at the same time, using a process called *multiplexing*.

Early multiplexing techniques were analog; the multiplexer at the sending end would change each signal into a different frequency range, and the modified

signals were then all sent through the same cable. At the receiving end, a *demultiplexer* would separate the signals, and change them back to the original frequency ranges. This concept was called *frequency division multiplexing* or FDM.

But FDM is an analog approach which is subject to noise and distortion. In an effort to reduce these effects, especially when a signal is sent through some combination of cables, microwave links, and other paths over a long distance, FDM has now been replaced by a digital approach. Right now, the actual local loop going from your home to the telephone company's central office is still an analog 600-ohm line. In the central office switching circuits, however, that signal is then converted to a digital signal by a *codec*, which is a coder–decoder circuit which converts to and from digital. The signal stays digital all through the network, until it is converted back to analog by another codec in some distant central office and sent to the person you are speaking with through his local loop.

In long distance circuits, the basic digital connection is called a *T3 digital carrier system*, which transmits digital data at a rate of 47.736M bps (47.736 million bits per second.) The T3 line can then be split into seven T2 lines, which operate at 6.312M bps; these in turn can be split into four T1 lines, which operate at 1.544M bps. Each of these can in turn be split into 24 digitized voice channels. (You will note that these numbers don't exactly multiply out to the correct values; that is because each of these T lines also carries some signaling bits.) A T1 line can therefore carry 24 voice channels at the same time, a T2 line can carry 96, and a T3 line can carry 672 voice channels.

The change to a digital network was actually driven by another problem. In order to tell the circuits at the far end of a connection how to route a call, the telephone companies needed to send additional signals through long-distance circuits. The original approach was to send these signals as audio tones (similar to the Touch-Tone tones we now use for dialing, but at different frequencies) right through the same circuits as the phone calls themselves. But some time in the 1960s or 1970s, telephone hackers called *phone phreaks* learned how to fake these tones, using a device called a *blue box*, to make free phone calls. The only way to eliminate this practice, as well as provide new services such as Caller ID, was to provide a completely different data path for the signaling signals, separate from the audio path, so there would be no way for a hacker to inject fake signals into the network. This has resulted in a complete redesign of the long distance network, making almost all the trunk lines, both those for digitized audio as well as those for signaling, completely digital.

If you have a lot of digital data to send, you can lease a T1 line, or a part of a T1 line (called *fractional T1*). Right now, this is a fairly expensive proposition which requires special wiring, so it is used only by larger businesses.

To lower the cost, a new system called ISDN or the *Integrated Services Digital Network* is being installed in larger US cities, as well as in many countries overseas. The idea is to bring a digital connection directly to your home or small business through the same twisted pair (refer to April's *Communications Simplified*) now used by the local loop connections, and put the codec directly into your telephone. This not only improves the quality of the connection — since it eliminates the last analog lines which might pick up noise — but also makes it possible to use the same lines for high speed digital non-voice applications.

The "Basic ISDN" connection, suitable for a home or very small business, is a single local loop twisted pair line which carries data at 144K bits per second. This is split into three channels, two at 64K bits per second and one at 16K bits per second. The 16K bps channel can be used for signaling or data, while each of the two 64K bps lines can carry a voice channel, FAX, or even high speed computer data.

A higher-speed ISDN connection, called "Primary ISDN," is available for larger businesses; it operates at 1.544M bps (like a T1 line), and can be split into 24 digital channels.

Although ISDN is here and now, it is only gradually being introduced. For example, even in New York City it is only available in some relatively small areas. But that will probably change in the future, especially since the local loop wiring is a big part of the telephone company's investment. Since ISDN basically doubles the number of voice channels that can be used on each local loop, there are great advantages in using it.

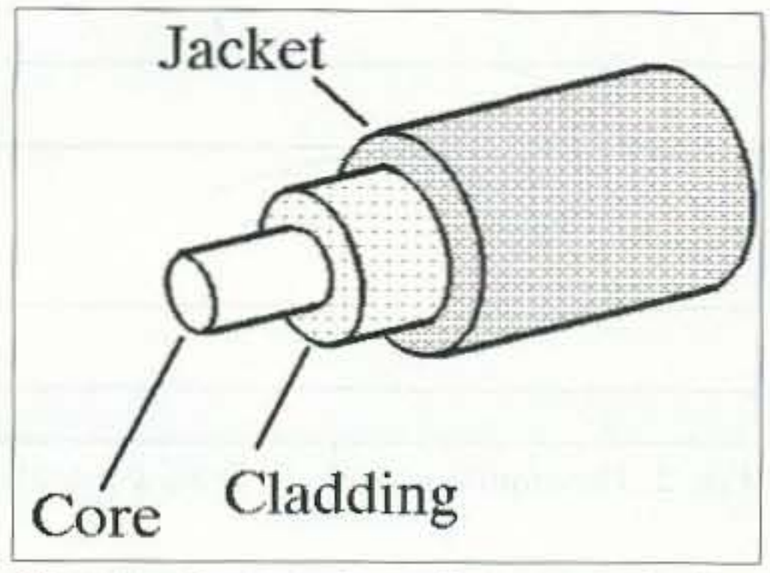


Fig. 1. *Construction of an optical fiber cable.*

Before going on, we shouldn't forget the other company that is in a position to offer you telephone service — your local cable TV company. Since so many homes are already wired with high-quality coax cable for cable TV, the cable companies are actively working on using those same cables for telephone service. One of the major hangups has been how to interconnect the cable companies' telephone subscribers with those of the traditional telephone companies, but in early 1995 there were several agreements between cable and telephone companies on how to do that. The major point of agreement was to allow subscribers to change companies without having to change their telephone numbers as well. This problem has been resolved, and so it's quite likely that "cable telephone" service will be around soon, especially since Congress has recently passed the 1996 Communications Act, which permits all sorts of new competition.

Radio-frequency signals

Just like audio signals can be sent through either shielded unbalanced cable, or through balanced cable, so can radio-frequency (RF) signals. But at the high frequencies used for radio signals, most cables wind up being quite long compared with a wavelength, and so it is important to pay attention to the impedance of cable, load, and source, to avoid reflections.

Relatively little balanced cable is used for RF. The most common one is the thin "twin-lead" cable used for TV antennas, which has a characteristic impedance of 300 ohms. Because balanced cable can have a lower loss than coax cable in some applications, balanced cable is also sometimes used in other places, but not

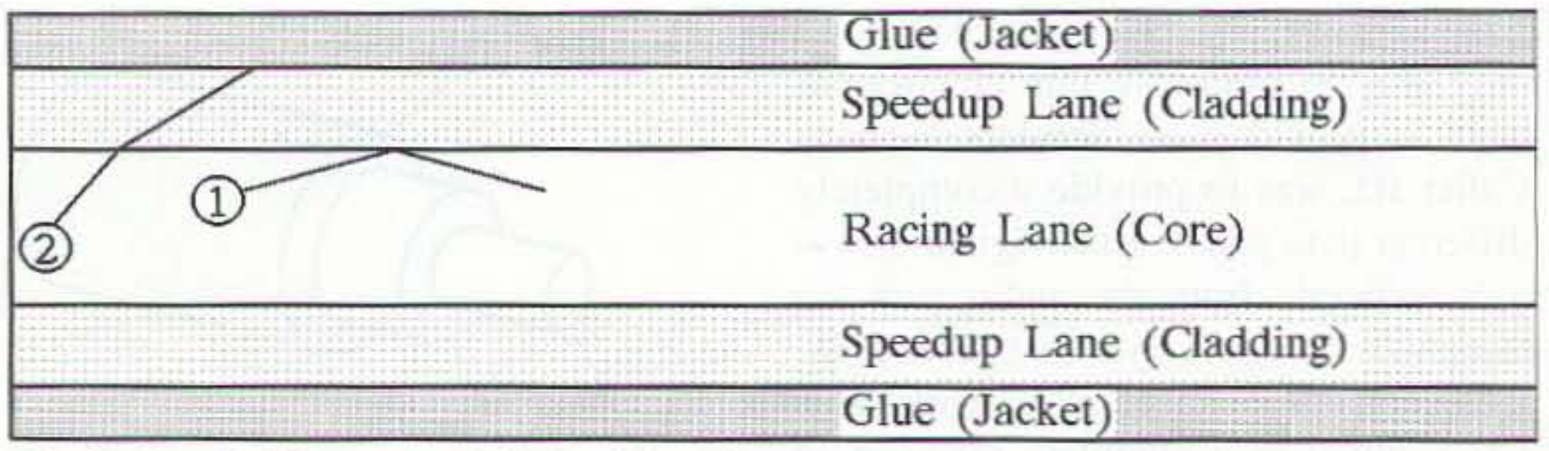


Fig. 2. *The cladding steers light back into the core.*

as often. Most coax cable is 50-ohm or 52-ohm cable (the difference is unimportant). Some 75-ohm cable is used, but mostly in TV antennas and cable TV installations. The reason TV uses 75-ohm cable rather than 50-ohm cable is that 75 ohms is exactly one quarter of 300, which makes it slightly easier to convert back and forth between the two types of TV antenna cable.

At extremely high frequencies, the insulators used for balanced or coax cables have too much loss, and so a special kind of "rigid cable" is used which has no insulator at all, other than air. It is called waveguide, and is actually more a pipe than a cable.

Keep in mind that high-speed digital signals behave somewhat like high-frequency radio signals. Hence all the cautions about watching the characteristic impedance of lines, and properly terminating them, are also important for digital applications. For example, the coax lines used for LANs (local area networks used with computers) also need to be properly terminated. Many LANs use coax lines (both 50-ohm and 93-ohm), although unshielded twisted pair (UTP) lines are also popular.

Optical fibers

As fiber optic cables fall in price, they are being used more and more for communications. In a nutshell, electrical signals are converted into a light beam (possibly visible, but more likely infrared) with an LED (light-emitting diode) or laser, the light beam is sent through a fiber made of glass or plastic, and then converted back into an electrical signal with a photodiode or phototransistor. Thus the fiber cable simply replaces the copper wire.

A major difference, however, is that optical fiber communications are almost always digital. The reason is that it is easy to switch a light beam on and off, even at high speed, to carry digital data. But to carry analog data directly would require that the brightness of the light be varied in step with the analog data; this is difficult to do with any degree of precision.

Fiber optic cables can be made of either glass or plastic. A typical cable generally looks like **Fig. 1**, and consists of three parts:

a. The *core* is at the center. Made of very pure and clear glass or plastic, the core passes the light beam from one end of the fiber to the other.

b. The *cladding* is a second layer of glass or plastic, wrapped around the core. This layer is made of a slightly different glass or plastic, one that lets light travel just a bit faster than the core.

c. The *jacket* covers the outside of the fiber and protects it.

To understand how this works, imagine that we are laying out a race course for blind runners. Since the runners can't see, how can we keep them from wandering outside their lanes? One way, of course, would be to put a picket fence at both edges of the lane, but that's not very humanitarian — every time a runner hits the fence he will get all scratched up or bloodied, and pretty soon he will give up.

So we come up with the brainstorm of **Fig. 2**. First we lay out the actual lane, labeled the racing lane in **Fig. 2**. On each side of the racing lane we put a second lane made of a slightly different material, one which gives the runners slightly better traction so they can run just a bit faster on it. This is labeled the speedup lane in the figure. Finally, at the very edge, just in case a runner gets too far off course, we'll put a layer of glue to stop him so he can't wander back into the course and get in someone else's way.

So now look at runner 1, who's running at a slight angle to the course. As soon as he enters the speedup lane, his left foot will have slightly better traction than his right foot, so his left side will wind up traveling just a bit faster. This is going to turn him slightly to the right, so he goes back into the racing lane. Runner 2, on the other hand, is so far off course that he too will turn a bit to his right, but not enough to return to the course. He will eventually get stuck in the glue, and that will keep him out of trouble.

So the whole idea is that the speedup lane keeps the runners from straying off course, without in any way hurting them or slowing them down. The optical fiber works exactly the same way. The cladding is made from a glass that lets light travel just a bit faster than the core. When a ray of light tries to leave the core and enter the cladding, it gets bent back just enough to re-enter the core. If it's like runner 1, it returns to the core and keeps going. But if it's like runner 2, then it goes right through the cladding until it hits the jacket, and gets stopped.

Although the best cables are all glass, they are also available in pure plastic, or in plastic-clad silica (PCS) cables which have a plastic cladding and a glass (silica) core. The glass cables perform much better, but also cost much more. The following table lists some of the characteristics of a few different kinds of fiber cables:

Type	Attenuation (dB/km)	Bandwidth (MHz-km)
Glass	0.5	1000+
PCS	10	20
Plastic	400	20

Table 1.

Let's look first at the attenuation of these three sample cables, and compare them with copper cables.

The attenuation of various copper cables increases with the frequency of the signal. For example, good quality RG-8 with a foam dielectric has about 1.2 dB loss per 100 feet at 50 MHz, about 2 dB loss at 150 MHz, and 3 dB loss at about 300 MHz. Let's look only at the loss at 50 MHz, since that is close to the 47.736 MHz data rate of a T3 line.

Since there are about 3300 feet in a kilometer, a 1 km length of RG-8 would have about 40 dB loss at 50 MHz. Even one of the best and most expensive coax cables (7/8-inch diameter hard-line) would have a loss of 12 dB per km at 50 MHz. Compare this with the 0.5 dB per kilometer loss of a good glass optical fiber.

The attenuation determines how long a cable can be used before the signal becomes too small to be useful. Because of their low loss, the maximum usable length of a plastic fiber is a few hundred feet — long enough to go within a building, but not much more. PCS fiber cables, and coax wires, can be used for a few km, while high quality glass fibers can go 30 km or more. In a long distance circuit, such as the telephone company might use between cities, repeaters must be placed at intervals to amplify and reconstruct the digital signal. When a glass fiber is used, these can be much farther apart than when a copper cable is used — sometimes as much as 20 to 30 miles apart.

Another aspect, of course, is the bandwidth. The bandwidth of an optical fiber is rated in "MHz-km." For example, for a plastic fiber, this number is 20 MHz, meaning that a 1 km length (about 3300 feet) has a bandwidth of 20 MHz, a 0.5 km length has a bandwidth of 40 MHz, while a 10 km length would have a bandwidth of just 1 MHz. This makes it look as though plastic cable doesn't have nearly enough bandwidth for any real digital data transmission. But because plastic cables are only used in short lengths, their bandwidth is adequate.

But look at the bandwidth of the glass fiber, shown as more than 1000 MHz-km. Even in long lengths, glass fiber has a large bandwidth. It can carry many more voice conversations, for example, than a copper cable. There are systems that can carry as many as 30,720 telephone conversations in one cable, a feat which cannot be done with copper cables.

As a result, even though glass fibers cost much more than even good quality coax cable, their higher bandwidth, and the ability to go longer distances between repeaters, outweighs their higher price and makes them attractive.

Decibels

We have used decibels (abbreviated dB or sometimes dB) in the previous section, without really explaining them. Decibels or dB are important enough that a mere detour to cover them is not enough, so here is a more complete explanation.

The decibel originated in the telephone industry. The prefix *deci* means a tenth, so a decibel is really a tenth of a Bel, a unit named in honor of Alexander Graham Bell, the inventor of the telephone. But the Bel is too big a unit for most uses, so everyone uses decibels instead.

The decibel is usually used to compare an "after" with a "before." For example, we might compare the power after an amplifier (coming out of it) with the power before it (the power going into it.) The formula is then dB = 10 $\log_{10}$ Power after/Power before (the factor of 10 converts the Bels into decibels.) The ratio of Power after/Power before is often called a *power gain ratio* or just plain gain ratio.

For example, if an amplifier takes a 1-watt signal and amplifies it to 100 watts, the gain would be dB = 10 $\log_{10}$ 100/1 dB = 10 $\log_{10}$ 100 and since the $\log_{10}$ of 100 is 2, the answer is 10 x 2, or 20 dB.

You've probably forgotten that $\log_{10}$ means the "logarithm base 10." This is the "power to which you'd have to raise 10" to equal 100. In this case, $100 = 10 \times 10 = 10^2$. so to make 100, you have to raise 10 to the second power. Hence the logarithm of 100 is 2.

If you have a modern scientific calculator, calculating logarithms is a lot easier than when I was in school. Still, we can save ourselves a lot of work if we make up a table like this:

Power Gain Ratio	db
100,000	+50
10,000	+40
1000	+30
100	+20
10	+10
2	+3
1	0
0.5	-3
0.1	-10
0.01	-20
0.001	-30
0.0001	-40
0.00001	-50

Table 2.

The important thing to notice is that when the power gain ratio is larger than 1—which means that the power after is larger than the power before—the number of decibels is positive. On the other hand, if the power gain ratio is smaller than 1—which means that the power after is smaller than before—the number of dB is negative. Therefore a positive number of dB means a gain, whereas a negative number of dB is a loss. (By the way, -3 dB represents a power gain ratio of 0.5, and so many people refer to -3 dB as "half power.")

For example, we said earlier that a 1 km length of foam RG-8 cable would have about 40 dB loss at 50 MHz. That translates to -40 dB (negative because it is a loss), so the power gain ratio is 0.0001. That means that the power after the cable is only 0.0001 times as large as the power going in. If you sent 1 watt into the cable, only 0.0001 watt would come out after just one kilometer, or about 3300 feet.

Compare that with glass fiber, which has a loss of 0.5 dB (which is really -0.5 dB) per kilometer. In six kilometers (about 4 miles), this adds up to -3 dB, and the above table tells us that is a gain ratio of 0.5. This means that the power coming out of a 4-mile length of glass fiber is half of what went in. This is an astounding number—just visualize how clear a piece of window glass would have to be if it were 4 miles thick, yet half of the light going in would still come out the other end!

Besides comparing powers, decibels can also be used to compare voltages. But in this case the equation has a 20 instead of a 10 in front of the log, and it becomes dB = 20 $\log_{10}$ Voltage after/Voltage before.

This makes all the dB values twice as large, and gives us the following table:

Voltage Gain Ratio	db
100,000	+100
10,000	+80
1,000	+60
100	+40
10	+20
2	+6
1	0
0.5	-6
0.1	-20
0.01	-40
0.001	-60
0.0001	-80
0.00001	-100

Table 3.

For example, if an amplifier takes 1 volt in and produces 10 volts out, the voltage gain ratio would be 10, and so the gain would be +20 dB. As before, positive values are a gain, while negative values mean there is a loss.

My students often ask why we use decibels at all, when we could leave gains expressed as ratios instead. The main reason is that it makes calculations a lot easier when a signal goes through a chain of circuits, one after another.

For example, suppose a signal goes through an amplifier with a power gain of 100 (+20 dB), then through a volume control which drops the voltage in half (-6 dB), and another amplifier with a power gain of 10 (+10 dB). Figuring out the gain of the entire chain is easy with decibels — we simply add +20 -6 + 10 = 24 dB. If we try to do it with gain ratios, we get all bollixed up because the amplifier gains are given as power gains, but the volume control is described in terms of voltage.

If you have the patience to see how this would work, here goes: since the formula for power is $P = V^2/R$ the power is proportional to the square of the voltage. Cutting the voltage in half (in the volume control) therefore cuts the power in a quarter. The power gain ratios would then be multiplied as 100 times 1/4 times 10, which gives 250. When we plug this into the dB formula, we get $dB = 10 \log_{10} 250/1 = 10 \log_{10} 250 = 10 \times 2.4 = 24$ dB.

How do we convert from dB back to a plain ratio? This isn't done nearly as often as converting to dB, but it still is useful to know. Let's do it for the 24 dB answer. First, assume R stands for the gain ratio, so we have: $24 = 10 \log_{10} R$.

Next, divide both sides by 10: $2.4 = \log_{10} R$.

We now remember that the log of a number is the power to which we must raise 10 to equal the number. So 2.4 is the power that we have to raise 10 to equal R. That is, $10^{2.4} = R$.

We really need at least a calculator to get this answer; the best we can do without the calculator (or at least a book of tables) is to try to approximate. Since $10^2 = 100$ while $10^3 = 1000$, at least we can estimate that $10^{2.4}$ must be somewhere between 100 and 1000, probably closer to 100 than to 1000.

Conclusion

Communications over wires is the oldest form of electric or electronic communications, but it is still in wide use all over the world. And it's not likely to ever be replaced, even though optical fibers are making great inroads.

In fact, with today's ever-increasing need for more and more communications, wires and fibers are becoming more important than ever. While it would be nice to use "wireless" methods like radio, there are severe limits to the amount of information that can be sent in this way; there is just not enough space for everyone that wants to use it.

One of the biggest users of scarce radio space is TV. Some years ago, several TV channels were taken away from TV and reassigned to other uses (such as cellular phones); with the expansion of cable TV and satellite TV, this may even happen again. 73

Number 43 on your Feedback card

73 Review

The Ten-Tec SS-11 Switching Power Supply

Neat, compact, lightweight.

Joseph M. Plesich W8DYF
173 Brockton Road
Steubenville OH 43952

What I needed was an AC supply capable of powering my Ten-Tec Argosy II. It's a great little transceiver that runs 50 watts on CW and SSB, so I needed something more practical than the 11-pound monster I had on hand.

While reading the advertisement for the Ten-Tec Scout (which I hope some day to own), I noticed that one of the supplies available for it is a little three-pound 11- amp supply. If it would power the Scout, it would certainly power my Argosy. I ordered it.

The SS-11 supply converts 120 or 240-volt 50/60 Hz AC to low noise and ripple regulated 13.8V DC. The operating voltage is selected by a switch on the rear panel. The power supply is protected against inadvertent shorts and overloads by an electronic output current limiter. This circuit reduces the output current to a very low and safe value until the overload is removed, when the output is automatically restored after the unit has been turned off for 15 seconds. It also has an over-temperature protection feature. The unit will provide 12 amps surge and 11 amps continuous duty and it measures only about 3"H x 6"W x" 5-1/2"D.

I've been using the SS-11 to power my Argosy and it doesn't even get warm. You could also use it to power a tape player, an FM or a QRP rig. It's a neat, compact, lightweight supply that's real handy around the shack. For $95, in my opinion, it's a very good buy from Ten-Tec: 1185 Dolly Parton Parkway, Sevierville TN 37862 or 1-800-833-7373. 73

HOMING IN

Homing In Radio Direction Finding

Joe Moell P.E. KØOV
PO Box 2508
Fullerton, CA 92633

More foxhunts coming up — let's build a yagi!

Hardly a week goes by without hams telling me how much fun they had at Hamcon/Foxhunt-95. This international-style radio direction finding (RDF) contest, part of the ARRL Southwestern Division convention last Labor Day weekend, was one of the first such events ever staged in the USA. Despite the fact that Southern California is the transmitter hunting capital of the USA, a formal all-on-foot hunt under International Amateur Radio Union (IARU) rules had never been tried here before.

Perhaps you read about international-rules foxhunting and Hamcon/Foxhunt-95 in "Homing In" for December 1995 and January 1996. Many readers wrote or E-mailed to declare their interest in holding similar events in their localities. If the trend continues, it may soon be possible to establish an official foxhunting committee for IARU Region 2 (North and South America). Such a committee is necessary to sanction local foxhunts as qualifying rounds for future world championships.

If reading about Hamcon/Foxhunt-95 has made you eager to try this type of radiosport for yourself, plan now to attend the 1996 West Coast VHF/UHF Conference, May 3 through 5, near Los Angeles. In addition to the usual displays and technical sessions on propagation, mountaintopping, and contesting, this year's conference features both a traditional Southern California mobile T-hunt and an IARU-style foxhunt.

Both hunts are being sponsored by the Southern California Six Meter Club, the same group that put on Hamcon/Foxhunt-95. Transmitters will be on 2 meter FM. The foxhunt will begin Sunday afternoon at a site not far from the convention center. Don't forget your RDF gear!

Gather your sporting goods

I lost count of the would-be foxhunters who stopped by the sign-up table at Hamcon-95 to say they wished they could go on the hunt, but didn't have any suitable equipment. Actually, it's easy to get set for this type of RDF contest. You could build or buy a dual-switched-antenna "homing" device, as some competitors did. A few entrants brought special foxhunting beam-receiver sets made in Japan or Russia. But the majority of runners used the tried and true amplitude-based RDF method: just a directional antenna, RF attenuator, and handie-talkie with S-meter. Some carried full-sized three-element yagis, while others held wire quads, similar to the ones they like for mobile T-hunting.

The most intriguing antenna I saw at Hamcon/Foxhunt-95 was carried by Glen Allen KE6HPZ of the Downey Amateur Radio Club (**Photo A**). Its two closely spaced aluminum elements were about the same length. It looked like a phased array, but I couldn't be sure because its feed system was concealed in PVC pipe. Glen said it was a yagi. I figured that such close spacing would not give him much sensitivity, since high gain is normally associated with long boom antennas. Thus, I was truly impressed when KE6HPZ won first place in the Masters age division. In fact, he was the only one in his division to find all six foxes within the allotted time.

Photo A. *Glen Allen KE6HPZ (second from left) had one of the smallest 2 meter RDF antennas at Hamcon/Foxhunt-95, but that didn't keep him from taking first place in his division.*

KE6HPZ 's yagi was designed by Doug Lyon N6WZI, a fellow Downey club member (**Photo B**). Doug told me that this antenna, which he calls the RDF^2, came about after he tried a number of multi-element yagis and quads and found them to be "too big and clumsy," to use his words. He set out to design his own model, one that would be light but sturdy, easy to build, compact and inexpensive. It had to have enough gain to hear distant milliwatt foxes and sufficient front-to-back (F/B) ratio to give sharp bearings.

"While reading the *ARRL Antenna Handbook*," N6WZI says, "I discovered that a parasitic element, cut as a director and placed about .05 wavelength from the driven element, provides a theoretical F/B ratio of nearly 30 dB. I was further surprised to read that at such close element spacing, theoretical gain approaches 5.4 dB. That was an unexpected plus. I kept expecting to find a snag, a problem characteristic. I had never seen this design in commercial or amateur radio use, so I assumed something must make it impractical."

Doug soon discovered that the biggest challenge would be matching a short-spaced yagi to 50-ohm coax. "The closer the director gets to the driven element, the lower the feed point impedance becomes," he says. "There is a negative reactance to be dealt with as well. I explored different feed systems including gamma, T and others. None seemed suitable. Then I read that a U-shaped loop (hairpin) will match antennas with impedances as low as 8 ohms."

Photo B. *Doug Lyon N6WZI designed the RDF^2 antenna described in this article.*

A typical hairpin match uses quarter-inch rods with 1-1/2 inch spacing. This approximates a 300-ohm transmission line. N6WZI successfully substituted TV twinlead to make a much more compact feed (**Photo C**). Physically, a hairpin is like a half-turn coil, so it is inductive. This is desirable for canceling out capacitive reactance at the feed point.

I was still unsure how Doug's close-spaced yagi with no reflector could give adequate gain and F/B ratio for foxhunting, so I modeled it with the ELNEC computer program. **Fig. 1** shows two directivity plots. The figure-8 pattern is for horizontal orientation with horizontally polarized signals. There are deep nulls at 90 and 270 degrees.

Turning the antenna to vertical orientation and tracking a vertically polarized signal source gives the outer elliptical pattern. Forward gain and F/B ratio are the same, but 3 dB beamwidth increases from ± 36 to ± 70 degrees. The side nulls disappear, but they won't be missed. Signal reflections from nearby terrain objects tend to fill pattern nulls on 2 meters, so it's best to take RDF bearings using the forward lobe instead of the nulls.

ELNEC assumes that this yagi is in free space. It takes into account the diameter of the aluminum elements and their skin-effect losses. It predicts 17.7 - 54.6 ohms complex feedpoint impedance at the design frequency (146.565 MHz). This is the value that is matched to 50-ohm coax by the hairpin. Gain is above 4.7 dBi and F/B ratio is above 8 dB over the entire 2 meter band.

N6WZI chose 1/4-inch solid aluminum rod for elements. He says, "I used grade T-6061 aluminum at a slightly higher price

because it is less apt to bend than ordinary rod. With such close spacing, construction must be sturdy so that element positions remain constant. I chose 1/2-inch PVC Schedule 40 water pipe for boom and element supports. A block of 3/16-inch thick insulating material such as hardwood or plastic centers the rods in the PVC tee and cross connectors."

The TV twinlead hairpin match is shorted at one end and connected to the two halves of the driven element at the other (**Photo D**). Length is 1-5/32 inches. It must be formed along the boom toward the driven element for lowest SWR. N6WZI measured 1.6:1 SWR at 146.565 MHz. It was under 2:1 over the entire 2 meter band. I tested the RDF² in a clear area and found its F/B ratio to be approximately 14 dB.

You should be able to build the RDF² for under $12 in materials. Overall driven element length is 37-9/16 inches. Director length is 37-3/16 inches. The model in **Photo C** is a special "cutaway" version illustrating how elements are mounted inside the PVC fittings. For a rugged water-resistant antenna, do not cut the PVC junctions. Simply assemble the antenna into the fittings.

Assembly instructions

Cut a 37-3/16 inch length of aluminum rod stock for the director and two 18-5/8 inch pieces for the driven element. Fabricate two 1 x 1/2 x 3/16 inch support blocks. You will also need 28 inches of 1/2-inch Schedule 40 PVC pipe, one each 1/2-inch tee (T), cross (X), and elbow (L) slip fittings, and PVC cement.

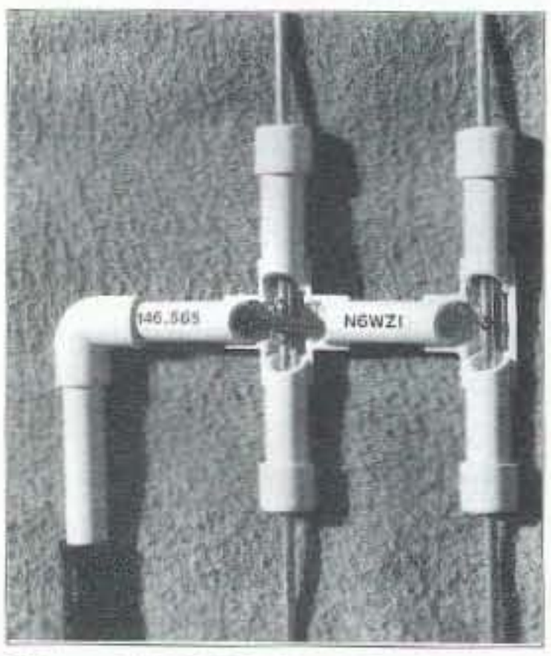


Photo C. *N6WZI made this special cutaway version of the RDF² to show how it goes together. Each of the six short PVC pipe sections is three inches long. The driven element is in two sections; the gap between them is obscured by the twinlead matching section.*

Drill the director rod at its center with a 7/64-inch bit to accept a 4-40 x 3/4-inch screw. Referring to **Photo C** for location, drill a 7/64-inch hole through the PVC T fitting. Feed the director into the T and mount it inside on its support block, similarly drilled. Secure all with a 4-40 machine nut and lock washer. Use a little hot melt glue or household glue to seal the nut in place. Cut two 3-inch pieces of PVC pipe and cement into each end of the T. Drill 1/4-inch diameter holes through the center of two PVC end caps, slide these over each end of the director and cement to the 3-inch PVC pieces. This completes the director element.

Drill each driven element rod section at 5/32 inch from one end with a 7/64-inch bit. Drill the driven element support block with a 7/64-inch bit at 9/32 inches each side of the center. These holes will be 9/16 inch apart, to provide 1/4-inch spacing between the legs of the dipole.

With 4-40 x 3/4-inch machine screws, use the drilled insulating block as a jig. Prepare two solder lugs by trimming the tabs to 1/16 inch. Place solder lugs over the screws and solder the two leads of the unshorted end of the hairpin in place, one to each lug. Now solder on a 64-inch length of RG-58 coax, center conductor to one lug and shield to the other. Trim excess wire and lift off the complete assembly.

With a 7/64 inch bit, drill two holes through one side of the PVC X, using the drilled driven element insulating block as a pattern. Now assemble all the parts (coax, hairpin, solder lug assembly and insulating block) inside the X. Put the screws part of the way through from the outside of the X, then place the insulating block inside and over the screws. Put a dipole end over each screw. Now put the solder lug/coax/hairpin assembly in the X and over the screws, feeding the coax through the X at 90 degrees to the dipole elements. Face the hairpin toward the director element inside the X. Secure all with 4-40 machine nuts and lock washers. Use glue to seal the nuts.

Cut a piece of 1/2-inch PVC pipe to three inches in length and cement it between the director T and the driven X. This provides four inches (.045 wavelength) spacing between the driven element in the X and the director element in the T. Be sure to align the elements parallel to each other. Make the handle from an elbow fitting, 3-inch and 10-inch length of PVC pipe, then cement it in place. The coax goes through the pipe and out the bottom. A bicycle handle grip held with a small sheet metal screw finishes the antenna.

A one-afternoon project

The RDF² is so easy to build that it would make a great group project for your club. Plan a short foxhunt soon after the construction party so all builders have a chance to try out their yagis and experience the thrill of finding radio foxes.

As of this writing, N6WZI is not in the antenna-building business, but he is considering making RDF² parts kits available, if there is sufficient interest. Write to him at the address in the sidebar for more information. Please enclose a self-addressed stamped return envelope with your request. (*73* columnists appreciate this courtesy, too.)

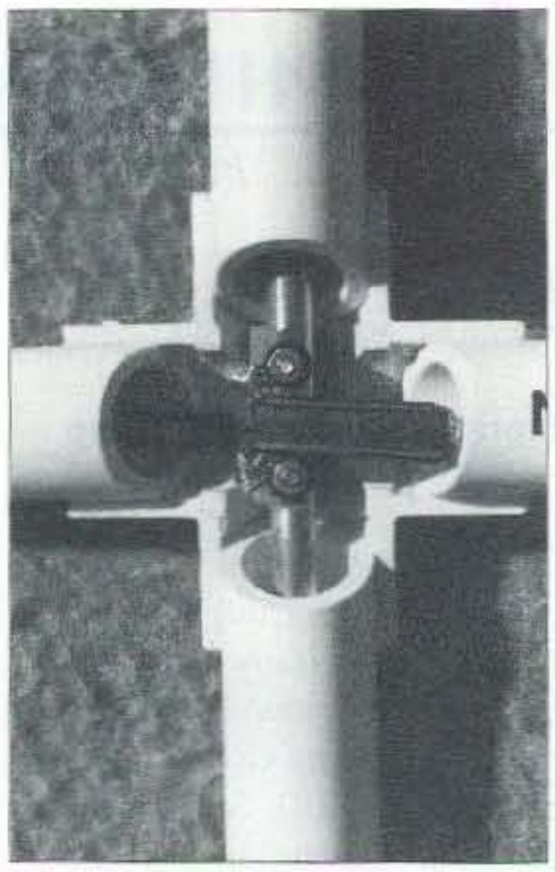


Photo D. *Close-up of the driven element feed point showing the supporting wood block, coax connection and hairpin match stub.*

A compact yagi is ideal for more than foxhunting. For example, you could use it to pinpoint sources of electrical noise around the neighborhood. N6WZI realized that it might be useful for search/rescue workers seeking aircraft Emergency

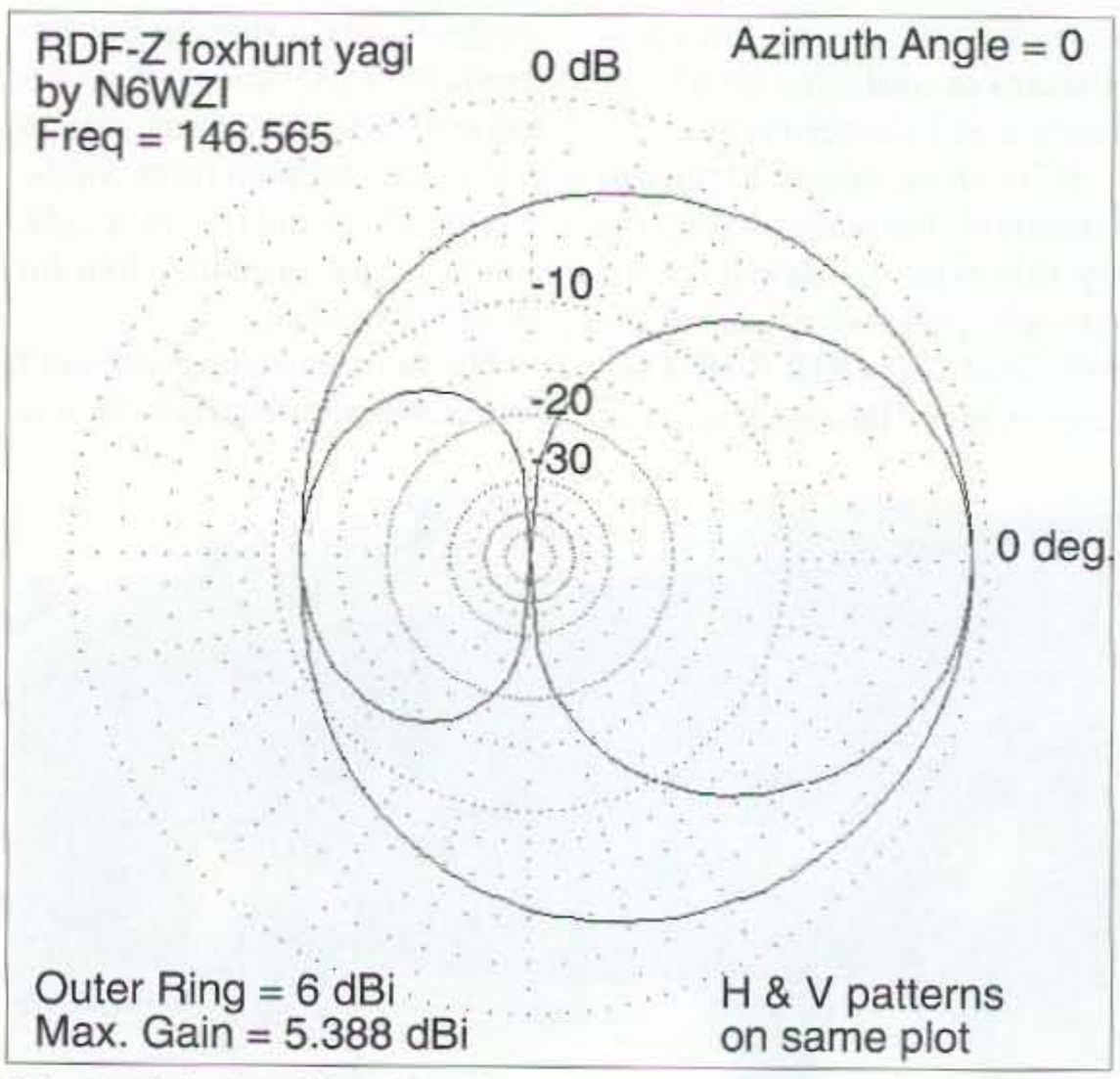


Fig. 1. *Calculated horizontal and vertical polarization patterns for the RDF². ELNEC shows that its F/B ratio is higher than the classic three-element National Bureau of Standards yagi, which has eight times greater total spacing.*

Locator Transmitters. "I made a prototype scaled to 121.5 MHz for Bob Miller N6ZHZ of the Civil Air Patrol," Doug told me. "Bob used it with such good results that I got a call from a Captain wanting to know how they could get some more. I built another six and shortly after I delivered them, I got a phone message stating that they had been instrumental in the timely location of a downed aircraft."

Caution: For ruggedness in the field, this yagi has rigid elements, firmly attached. When the antenna is oriented vertically, falling on it could cause injury. Children should be trained to hold the antenna so as to minimize this danger. If the user will be running while holding it, attach one-inch diameter solid spheres to the four element ends and wear protective goggles. Always keep safety in mind when foxhunting.

Join me for a weekend of fun at the VHF/UHF Conference. I'll be presenting a slide show Saturday morning on the joys of foxhunting. With any luck, we'll fill the woods with fox trackers Sunday afternoon. I want to hear about RDF contesting in your area, so write and send photos to the address at the beginning of this article. Send E-mail to Homingin@aol.com or 75236.2165@compuserve.com. 73

This Month's Resources

The 1996 West Coast VHF/UHF Conference will be at Gateway Plaza Holiday Inn, 14299 Firestone Boulevard, La Mirada CA. Conference registration is $15 per person. Saturday night banquet, Sunday morning breakfast, and Proceedings book are available for additional charges. To register, send check to Southern California Six Meter Club, P.O. Box 10441, Fullerton CA 92635. E-mail conference inquiries to rhasting@ix.netcom.com. Call (714) 739-8500 for hotel reservations.

Send RDF² yagi kit inquiries to Doug Lyon N6WZI, 11905 Cresson Street, Norwalk CA 90650.

ELNEC antenna analysis program for PCs is available from Roy Lewallen W7EL, P.O. Box 6658, Beaverton OR 97007. Write for prices.

NEVER SAY DIE

Continued from page 61

even Pons and Fleischmann, the discoverers of the cold fusion effect, have been able to get any patents issued making a claim of over unity energy.

What does this mean to you? Well, that depends on how alive you are. How interested in learning new things. Maybe even trying them. A Manitoba reader called a few days ago to say that when he read about this cold fusion stuff he set up a simple tabletop experiment using nickel. He got 33% excess heat and was hooked. He said he tried gold instead of nickel for the cathode and improved his output by about five times, so now he's heating his greenhouse with a small cold fusion cell.

Well, you can see why I'm excited about this.

Dennis Cravens, a young physics teacher at a small Texas community college (Vernon), is the leading American researcher in the field. His lab cost him under $5,000 over a period of five years. He's recently moved to New Mexico, set up a small lab there, and is working with Dr. Patterson to develop his patented cell. Some business giants are starting to take note.

It didn't hurt when "Nightline" devoted a half hour in early February to interviewing Dr. Patterson. Plus a short interview segment on "Good Morning America."

The Jan. 23rd piece in the *Wall Street Journal* by Jerry Bishop reported on the December Power Gen conference demo by Patterson and Cravens, but kept repeating the old critic refrain that nobody knows why excess heat is happening, and that it is preposterous to claim it is fusion. But then these same hide-bound scientists refuse to accept that fusion is constantly taking place in living cells, so they need to get off their high horses and read more.

I've had to start remembering some of my fundamental chemistry from college. If you fuse lithium and hydrogen you get beryllium plus some lost matter (energy = heat). When you fuse this beryllium with another hydrogen you get boron plus some more lost matter (energy = heat).

Scientists often tend to be so solidly imprinted with what they learned in college that almost no amount of contrary evidence can break through. Max Planck commented on this phenomenon when he proposed quantum mechanics and it was rejected by the scientific establishment. Galileo had the same problem. Nothing has changed. Indeed, I see the same pattern in the medical field. It was this rigid thinking which killed most of the computer mainframe

Continued on page 75

Number 72 on your Feedback card

New Products

Link Plus For Hams

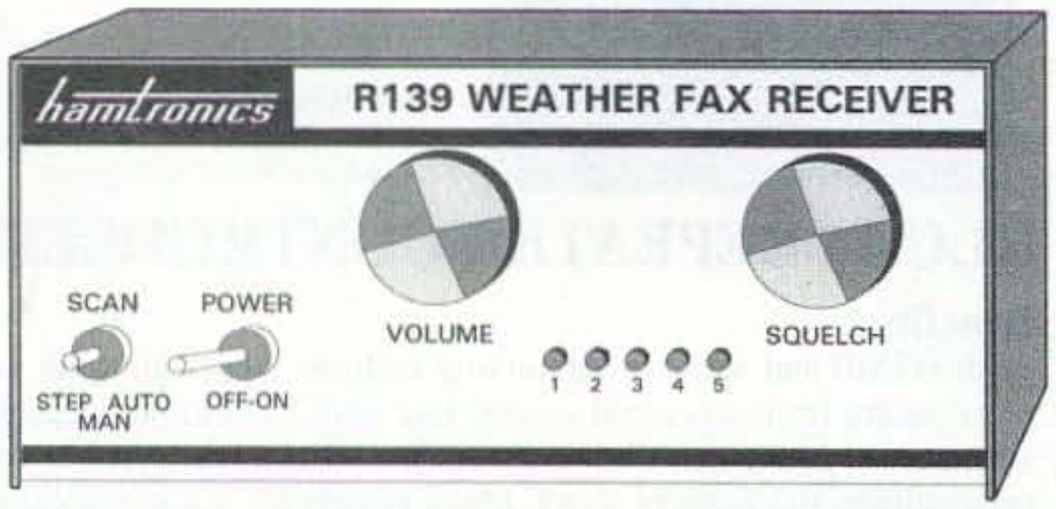
It used to be that you had to have a budget like the Pentagon's in order to afford signal processing equipment such as the LinkMate, but no more. Link Plus Corporation recently introduced the newest member of its family, specifically for the ham radio market.

The LinkMate uses Lincompex technology, in which the transmitter signal is compressed and the receiver signal is expanded, reducing noise and interference.

The marriage of the Lincompex technology and the digital signal processor technology provides a cost-effective alternative for interference reduction previously available only to military and government users.

Government tests have shown improvements ranging from 7 dB to 36 dB, with an overall average of 22 dB under "extremely noisy and unsettled atmospheric conditions."

For more information, contact Link Plus Corporation, 9052 Old Annapolis Road, Columbia, MD 21045. Phone (410) 995-1919. You can also see LinkMate at the Dayton Hamfest, booth #557.



Hamtronics Weather Satellite Receiver

Here's a cheap and easy way to receive weather fax information from the 137 MHz band—the Hamtronics R139 Weather Satellite Receiver. It's a wideband receiver specifically designed for this purpose.

Hamtronics combined the circuitry of the pervious R138/AS138 modules in one unit, with a cabinet and a power supply. Many customer suggestions were also incorporated in the new design.

The R139 is a crystal-controlled unit, with five settings that cover all the popular US and Russian weather satellite frequencies. The crystals are included. The channel can be controlled manually, or the unit can be left scanning for an active satellite.

That way, you can download and record transmissions for later output to a computer demodulator. LEDs on the front panel indicate which satellite is received.

The module form of the kit is just $159; for another $30 you get a 12V power supply and an aluminum cabinet. If you're scared of your solder iron, or don't have the signal generator needed to align the kit, you can buy one wired and tested for $239.

Contact Hamtronics Inc. at 65-D Moul Rd., Hilton, NY 14468-9535, or call (716) 392-9430. Fax: (716) 392-9420. A complete catalog of all the Hamtronics kits, which range from VHF/UHF transmitters and receivers to repeaters, preamps and accessories, is available from the same source.

New HS-1000 All-Band HF Mobile Antenna

Mobile HF operators have a new choice of antennas. High Sierra Antennas has introduced its new HS-1000 all-band HF mobile antenna.

The design incorporates features such as new low-cost mounting options, center-loading coil for high-power and high-temperature applications, a decoupler system, and improved matching system and a remote control panel with limit indicator.

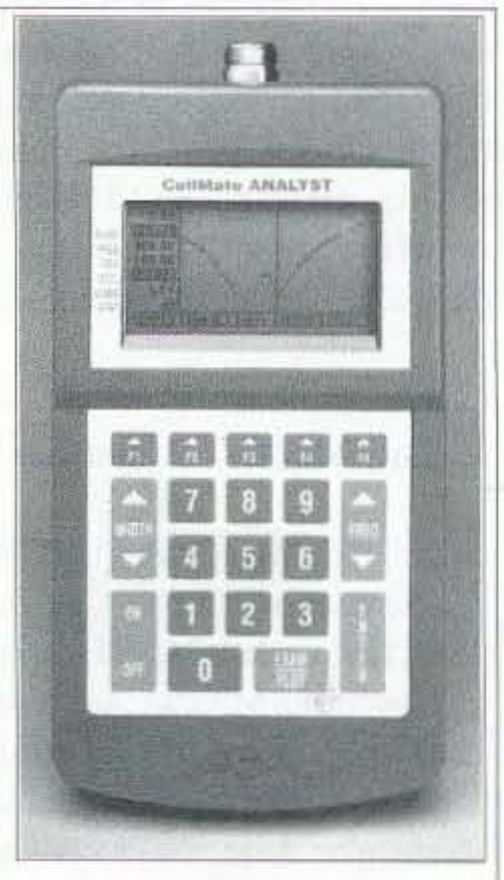
The antenna provides coverage from 3.5 MHz to 30 MHz and beyond without sacrificing performance on any frequency. The variable loading coil is remotely controlled, so the operator can tune the entire HF spectrum without leaving the driver's seat.

The HS-1000 uses two basic mounting systems. The easy-off mount allows the entire antenna to be removed in about 30 seconds for safety or security. This method uses a tapered stud at the base of the antenna together with an upper clamping mechanism.

The new single point mounting method allows the antenna to be attached to horizontal surfaces.

The antenna can be purchased as a complete package, or in its component pieces for those who already own some of the hardware from High Sierra Antennas, Box 2389, Nevada City CA 95959. FAX 916-273-7561 or telephone 916-273 3415.

Check Your Cellular Antenna Performance



Advanced Electronic Applications has released the CellMate Antenna Analyst, a hand-held diagnostic unit that provides comprehensive antenna performance information in an easy-to-read graphic format.

The CellMate covers the 806 to 960 MHz range continuously, graphically displaying antennas' VSWR vs. frequency plots on an LCD screen over a range from 1:1 to 10:1.

The unique LCD readout graphically plots the SWR curve over the entire frequency range, as well as at single frequencies.

CellMate is equipped with a serial interface for use with an IBM-compatible computer. With optional AEA software, users can store VSWR plots obtained by the Analyst in a PC for later reference, comparison or printing. You can even upload plots from the PC to the Antenna Analyst, and the Analyst's functions can all be controlled from the PC as well.

For more information, contact AEA at (206) 774-5554.

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Michael Bryce WB8VGE
2225 Mayflower NW
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Radio Magic

by Michael Bryce WB8VGE

Let's set the Wayback Machine to 1975, when a very popular construction project was the W4VVF electronic CW keyer. This keyer did all kinds of things that were unheard of then. It sported such goodies as dot–and–dash memory, iambic keying, and solid–state output keying. The keyer consisted of five TTL chips and a handful of other parts. The whole shebang went on one single–sided PC board. There were zillions of these things built by hams. Including me. I had the distinction of assembling one and never getting it to work.

After weeks of troubleshooting, I got so mad at the keyer, I took a three–pound hammer and beat the keyer, ICs and all, into the top of my workbench. While I didn't figure out what I did wrong, I sure had a case of the warm fuzzies after smashing the poogies out of it. To this day, there are still hunks of that project oozing out of the workbench. Ah hah! I hear you saying. So you had The Kit From Hell, too!

Not one to give up, I ordered another PC board and started over again. This time the keyer worked as it should have and I went on to assemble dozens more for various friends and members of the local radio club. What did I do differently the second time around? I asked for help.

As it turned out, there was a mistake in the schematic that caused the bug. Armed with this knowledge, it was a simple matter to correct the error and produce a working keyer. I would have never been able to track down the problem by myself. So, after exhausting all your options, sometimes a note to the company that packed your kit may solve your dilemma. It's always to your benefit to inform the company of a missing step or error in the assembly instructions of the kit. In fact, when you contact the company, they may have several "fixes" available to enhance the operation or assembly of the kit. Don't be afraid to ask for help!

"I got so mad, I took a three–pound hammer and beat that keyer, ICs and all, into the top of my work bench."

Go ahead...touch it

With that out of the way, let's do a little bit of signal tracing. In a receiver, the best place to start is at the input to the audio amplifier. All you need is a fingertip. Of course, don't try this trick if your receiver is being powered by 110 volts. With your fingertip, touch the center terminal of the volume control. If the audio circuits are working as they should, you will hear a load buzz coming from the speaker.

Work your way back toward the antenna. Check for the proper operation of key oscillators such as the BFO and mixers. The VFO should be running as well as the local oscillator. You may need to use a frequency counter or an oscilloscope to check these stages for proper operation. Getting your kit to work takes only a matter of time while working out a few steps in the troubleshooting process.

Projects from the pages

When building a project out of a magazine, it is usually up to the reader to supply all the parts. In some cases, the author may have specified a particular part that not only has the required electrical specifications but also physical characteristics needed to fit the PC board. Usually, the author will have at least one source for all the parts needed to duplicate the project. Be sure that "oddball" part has a source.

Don't forget to check for any software or EPROM that need coding. Without the code, many of the projects won't work. And watch out for prices when dealing with source codes. A programmed micro-processor can be expensive.

73 Amateur Radio Today is one of the few ham magazines that still print the PC board foil pattern and silk screen. Many others request that a letter be sent to obtain the artwork. I suggest you purchase the PC board, if available, and forgo trying to make your own board.

In almost every case, someplace, somewhere, there will be an error in either the silk screen or the schematic. Errors usually happen when drafting the schematic from original artwork to what ends up in the magazine. No matter how many times it is checked for screwups, bugs do get in.

I once had a ham call me and insist that both the magazine that published the article and I had put in errors just so he'd have to buy the next couple of issues. That's just not true. No one wants mistakes to show up in a construction article, especially the editors and the authors!

So, keep in mind there may be nothing wrong with your project, even though it may not work correctly. I'd drop a note to the author. Be sure to include an SASE and ask if there are any errors in the plans.

Since you are your own kit builder when dealing with a construction article, you are free to change values of some parts to match what you have on hand. Unless the author states that certain components must be a specific value, you can change most values without getting into trouble.

Resistors are perhaps the easiest to change. There's not much difference between a 10K resistor and a 12K resistor when used to couple two stages together. The same is true for pull up resistors used to keep a logic high on the output of TTL and CMOS ICs.

You don't get to play with capacitor values as much as with resistors. For one, you don't have as large of selection in capacitor values as you do in resistors. Capacitors are usually selected to provide timing signals, bypassing at specific frequencies and to couple two stages together. Of course, changing the value of a capacitor used in a timing circuit (or oscillator) means the output of that timer or oscillator will be changed.

On the other hand, a capacitor used to couple two stages together can have its value changed without much thought as to circuit performance. If the construction article specifies a 47 pF capacitor, and your junk box yields only 33 pF, that's fine.

As long as you don't stray too far from the published specifications, go ahead and adapt the circuit to suit the parts you have on hand. A good dose of common sense goes a long way when you're building a project from a magazine article. 73

A 220 Super J-Pole Antenna

Continued from page 28

Materials List

1/2" Copper Tubing (Cut one each of the following lengths): 12.5", 37.5", 25", 1 1/8" (for the cross bar), 1"-2" (for the base stub)
26" Length of 3/16" OD copper tubing or wire
2" #14 Stranded copper wire
1 1/2" Copper elbow
1 1/2" Copper "T" fitting
2 1/2" Copper end caps
2 3/4" Stainless steel hose clamps
12" Length of 1/2" birch dowel (for insulator)
1 SO-239 Panel mount coaxial fitting
1 1/2" Copper threaded fitting
1 1/2" Cast iron floor flange
Tubing cutter
Screwdriver
Electric drill and bits: 5/64", 3/32", 3/16"
Propane torch
Solder and paste flux
Electrical tape
Drill press and small hobby file (both optional)
Caulking or silicone compound
1 1/8" X 1 1/2" piece of thin sheet metal for soldering shield
Steel wool or household scrubber pad (without detergent)
Solvent
Clear exterior spray
VHF SWR Bridge capable of 225 MHz (borrow, if you don't own one)

NEVER SAY DIE

Continued from page 71

manufacturers and then wiped out most of the minicomputer companies. Where are Wang, Prime, Data General, and the others today? Even mighty DEC is fading away.

It's this pattern which has kept so many people and major companies missing the boat on new technologies. I might mischievously call this the CW mindset.

Our government does it again

One of the cutbacks of government funding has been the Navy research into cold fusion, which was going on in Washington, DC, and China Lake, California. Now, just as cold fusion has proven, even in its early research stages, to be everything promised, the Navy has stopped all further research funding. The Army and Air Force haven't been doing any research at all. Even the Electric Power Research Institute (EPRI) has cut research funding almost totally. Stanford Research Institute (SRI), funded by the Japanese, is moving ahead. Indeed, the Japanese have been increasing their cold fusion research funding every year. The Japanese have also funded Drs. Pons and Fleischmann, the pioneers in the field, and put a total blackout of news on their work.

So it sure looks like we're doing it again, setting ourselves up to lose the biggest industry yet. We lost the audio and videotape industries. We lost the compact disc industry. The TV and camcorder industries. Without any government scientific policy, big business in America is run by next quarter profits, so there's little incentive to invest in any long-range projects. And that's one of the big ways Japan has done so well.

Bio-nucleonics

Scientists have a blind spot when it comes

Continued on page 77

Number 76 on your Feedback card

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The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)--comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine,* Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the May 1996 classified ad section is March 12, 1996.

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NEVER SAY DIE

Continued from page 56

to anomalies. But I've been complaining to you for years about this, with no hint so far that I'm getting through.

It was my interest in anomalies that got me to follow up on a piece of weird science in the Tompkins-Bird book *The Secret Life of Plants*, which is on my recommended book list. They mentioned that chickens seem to be able to eat silicon and somehow turn it into calcium for their eggs. Transmutation? Shades of alchemy!

So I called Chris Bird and asked him about this. He put me onto a book by Louis Kervran, which was most fascinating. And that led me to Mishio Kushi and his book, *The Philosopher's Stone* (also on my list). All this was just my curiosity at work. I had no idea that it might lead to a possible explanation for the mysterious cold fusion reaction, which has been a matter of controversy for physicists and chemists for seven years now.

As I read these books, which confirmed the ability of living organisms (including chickens and humans) to transmute elements, it occurred to me that this might be what was responsible for all the anomalous heat the cold fusion researchers have been trying to explain.

It didn't take a lot of calculations to show that combining hydrogen and lithium to produce boron would result in a tiny bit of lost mass. We know from Einstein's $E = mc^2$ (where "c" is a huge number) that a little mass is equal to one heck of a lot of energy (heat). Somehow, in the crystal lattice structure of a few metals like palladium and nickel, this transmutation must be taking place. If more atoms were transmuted per unit of time we could have one heck of an explosion, so we're fortunate that Drs. Pons and Fleischmann discovered a very slow reaction.

I proposed this idea to the readers of my *Cold Fusion* magazine, who are some of the world's top physicists and electrochemists, expecting to get flamed for proposing something so dumb. Instead, I've been getting papers from scientists with equations showing how this is probably what is happening. We're waiting for spectrographic confirmation from two universities as to the elemental makeup of used cold fusion cells.

Louis Kervran, many years ago, did an extensive research project in Africa to check on the human transmutation of elements. He measured everything going into a group of men, and everything coming out (ugh!). His reports left no doubt that humans do somehow transmute elements. And this obviously has to result in the generation of some heat. Indeed, this might just turn out to be the major source of heat for us and all other living things. Bio-nuclear reactions. You can learn more about this by reading Kervran's book, *Biological Transmutations*, Swan House Publishing, 1972, 163p; ISBN 0-913010-03-0.

Well, somehow we mammals are turning food into heat. So where in the body is this happening? Where's the furnace? Can the transmutation of elements be the way we maintain our body heat?

In the cold fusion reaction, when we check the cathodes after use, we find microscopic pits. These could be the sites of transmutation, which would generate a lot of heat in a very tiny area as individual atoms transmute and convert the leftover matter into heat. If we find some silver, that would have had to come from palladium plus hydrogen. We'll see.

When I got interested in cold fusion a couple years ago I knew almost nothing about chemistry or nuclear physics. So I started reading everything I could find and asking endless dumb questions. And now I'm able to understand much of the stuff the theoretical physicists are writing for my magazine. I just wish I had the time to set up a small lab and do some research. I'd be surprised if I couldn't generate some high output over input devices using granulated or powdered nickel and a lithium electrolyte.

But then, I wish I had time to learn more about audio compacting algorithms so I could help develop some really narrowband real time audio. Maybe I can get you to do that? And write some articles as you pioneer? Let me put that another way: What have you read and learned in the last month? I've just ordered 30 more books by mail order. I'll let you know if any are really outstanding, and I'm pretty sure some will be.

Are you deaf?

Opportunity keeps knocking and you keep yelling for whoever it is to go the heck away and stop making all that racket. Ray WA2MMT sent me a recent newspaper clipping about a Boston doctor who managed to infect 19 of his patients with hepatitis B, despite wearing gloves while operating on them.

The first letter in the March *73* was from Ray, pointing out that most brands of latex gloves leak after about 20 minutes of use, so there is an opening for a simple gadget which could be connected to the doctor and the patient being operated on to indicate when a glove starts to leak. The medical market is a whopping one. After all, it's a trillion-dollar industry, so medical electronic gadgets command a premium price.

I remember when Wes Schum W9DYV got forced out of his Central Electronics business, a victim of the loss of our whole ham industry in 1964. He went into medical electronics and instead of just barely making a go of it, he was making money hand over fist.

He'd had to sell his small manufacturing business to a larger company a couple years before because he didn't have enough money to keep up with its growth. It all hit the fan when he announced a new rig which cost him about $400 to make. He quickly had thousands of orders on hand and not nearly enough money to buy the parts for that many rigs. The banks couldn't care less about his orders, so he had to sell his business just to keep going.

Then the 1964 "Incentive Licensing" catastrophe hit him, as it did every other ham manufacturer.

When you read Ray's letter in the March issue did you dash to your workbench to see what you could do, or did you ho-hum it and pick up *TV Guide*?

On the bright side for the 19 infected hepatitis patients, and the doctor, if they buy or make one of the Bob Beck gadgets, unless Bob faked a whole stack of lab reports, they'll be able to get rid of the wretched virus in a jiffy. Ditto anyone infected with AIDS and/or HIV.

How difficult can it be to make a gadget which will connect to the doctor and patient and indicate when there's some leakage?

Along the same line, this business of trying to promote condoms as a preventative for AIDS, as I think I've mentioned before, is not as safe as the condom manufacturers would like you to believe. The pores in condoms are much larger than the virus, so they act more as a strainer than a barrier.

Transplants

If you remember my reviewing *The Secret Life of Our Cells* by Robert Stone, you probably weren't surprised at the flurry of talk in the media about a new book claiming that transplanted organs bring along memories from the previous owners. NPR did a segment on it recently.

But this is just what I predicted in my review. My interest in this kind of weirdom started with *The Secret Life of Plants* by Bird and Tompkins, which was published in 1973. A couple of years ago I called Chris Bird to find out what new information had developed since the plants book was published. He suggested I get in touch with Cleve Backster, the chap who did most of the research reported in the book. So I called Cleve and found that his more recent work has been with human cells. The results have been incredible and are described in the Stone book. Both of these books are on my "books you're crazy if you don't read" list. Cleve and other researchers have shown

Continued on page 81

Antenna Noise Bridge Detector

Tune your antenna, then measure its radiation pattern with this pocket-sized instrument.

J. Frank Brumbaugh KB4ZGC
Box 30 – c/o Defendini
Salinas PR 00751

Using an antenna noise bridge is one of the best and simplest means of measuring antenna characteristics. It is invaluable for tuning an antenna, especially a beam, to resonance at a desired frequency. Normally the station receiver is used with the noise bridge as a detector to indicate the resonant frequency of the antenna, and the resistance and reactance (if any) at the feed point.

The feed point of most antennas, and practically all beams, is high in the air or at the top of a tower. It is extremely unhandy to carry the station receiver/transceiver up a ladder or tower, dragging a long extension cord. All this climbing increases the possibility of falling, which can be detrimental to yourself and whatever you are carrying. Of course, you could make your measurements on the ground, at the end of a multiple of half-wavelengths of transmission line, running up the tower to make an adjustment, then back down and into the shack to adjust the noise bridge and receiver. To make the job easier, I designed this simple-to-build instrument for you.

This detector, used in conjunction with your antenna noise bridge, substitutes for the station receiver. It even fits in your pocket so you can use both hands to climb to the feed point. Measurements at the feed point of your antenna are quick, easy and accurate. Even better, you probably already have the necessary parts in the junk box, so it can be constructed in an hour or two. Even if all parts must be purchased new or surplus, your total expense shouldn't exceed five dollars, not including the enclosure.

How it operates

The circuit is illustrated in **Fig. 1**. The noise output from your antenna noise bridge is applied through a coax jumper cable to J1, an SO-239. This noise, which usually will peak slightly below 1.0 volts, is broadband white noise and is fed through C1, a 100 pF capacitor, to a pair of small signal diodes connected as a rectifier/voltage doubler.

The rectified DC voltage, filtered by C3, a 0.1 µF disc capacitor, is then applied to the base of a small signal NPN transistor Q1, which serves as a meter amplifier. Meter M1 is a small surplus 200 µA meter. It monitors collector current through Q1.

The emitter of Q1 is connected to the wiper of GAIN potentiometer R2, which controls the emitter voltage between zero and about +1.5 VDC. On/Off switch S2 is mounted on the GAIN control which, in series with R3, forms a voltage divider across battery BT1, a 9-volt battery which powers this instrument. The GAIN control is wired so the wiper travels from the end of R3 to ground as the knob is rotated clockwise. This sets the emitter bias and the point at which Q1 will go into conduction as rectified noise voltage is applied to Q1 base.

The current drain from the battery is approximately 8 µA with no input, increasing to slightly over 200 µA with the meter at full scale. With such low current drain an alkaline battery should last for years, even if you forget to turn the instrument off!

Frequency coverage

This instrument covers the range from below 40 meters to above 10 meters in two bands: 40 and 30 meters; and 20-17-15-12-10 meters. Eighty and 160 meters were not included for two reasons. First, there are very few 80 and 160m beams. Second, eliminating these frequencies made band switching considerably simpler, and reduced the cost and complexity.

Bandswitch S1, an SPDT toggle or slide switch, selects the frequency range. The tuning capacitor C2 is a small 150 pF air variable, although one of the small variables with thin plastic sheets between the plates, such as used in many small portable radios, may be used instead. C2, in conjunction with inductances L1 or L2, allows peaking the

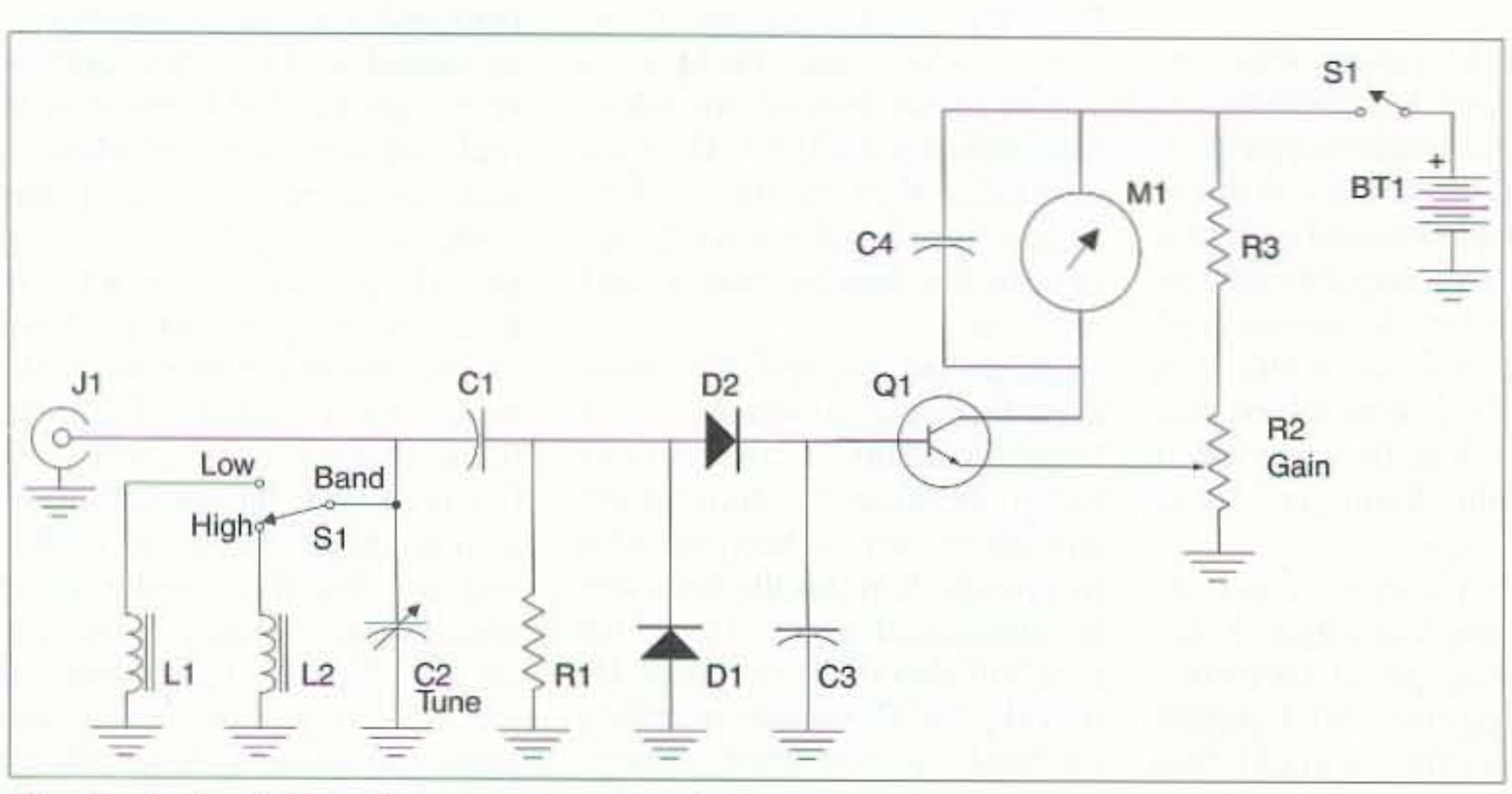

Fig. 1. Noise bridge detector schematic diagram.

frequency response of the instrument in the ham band in which your antenna is to be adjusted. Thus, it readily and handily substitutes for the station receiver, which otherwise would have to be used.

Construction

The detector should be constructed in an aluminum box, or an enclosure made of printed circuit board stock, because it must be well shielded to function accurately. Other than compact construction on a small piece of perf board, or a general-purpose printed circuit board such as are available at Radio Shack™, and short, direct leads carrying RF, parts placement is not important. Only those connections between C1, C2, L1, L2, R1, J1 and S1 carry RF. The other leads carry only DC, so their routing is unimportant.

Although any small 140-150 pF tuning capacitor can be used (take a look in your junk box), an APC type is recommended for compactness. This was a common WW II surplus item and can often be found at hamfest flea markets, or from Fair Radio Sales, Inc., Box 1104, Lima OH 45802. Small surplus meters with 100 or 200 µA movements, originally made for CB and home entertainment equipment, are also available from Fair Radio Sales and other mail order dealers as well as at hamfest flea markets. The toroid cores (T50-2) are available from Amidon Associates, Box 25867, Santa Ana CA 92799, and from Radio Shack. Other components may be found at numerous mail order parts dealers. However you probably can find just about everything you need in your junk box, from other local hams, or at the next hamfest you attend.

Calibration

There are several ways to calibrate this instrument. A source of low level RF covering the ham bands from 40 through 10 meters, with accurate frequency determination, is required. Your station receiver, or a frequency counter, can be used to check the frequency of a signal generator or a dip oscillator.

To calibrate with a dip oscillator, temporarily wind a two-turn loop around L1. Lightly couple the dip meter coil to the link, tuned to a ham band (40 or 30 meters). Be sure S1 is in the proper position. Tune C2 for a dip in the dip oscillator meter. Reduce coupling and tune C2 until the dip is just barely discernible. Mark this spot on the dial of C2. Using your station receiver to make certain the dip meter is on the right frequency will enable you to mark the edges of the wider bands on the dial.

Repeat this procedure with a link on L2 and S1 set for the high band. The 20, 15 and 10 meter bands are wide enough so you can mark both edges on the dial.

You can also use a signal generator to calibrate this instrument, using your station receiver to maintain frequency accuracy because signal generator dials are seldom very accurate. Connect the signal generator output, set for low level, to J1. With S1 set for the low band, tune C2 on this instrument for a peak on M1. Mark this point on the C2 dial. Repeat the process for each ham band.

You can also use your station equipment to calibrate this instrument by feeding your transmitter into a dummy load, or use very low power if you are feeding an antenna. Place a short piece of wire into the center terminal of J1 to act as an antenna. Key the transmitter on CW (key down) and tune C2 for a peak on M1. Mark this spot on the C2 dial.

Operation

This device can be used to replace the station receiver when adjusting an antenna. It can also be used as a linear field strength meter to measure the field around the antenna and plot its radiation pattern.

Operation as a noise bridge detector

Connect a short length of coaxial cable between J1 and the "receiver" connector on your antenna noise bridge. Connect the "unknown" connector on the bridge to the feed point of your antenna.

Tune the noise bridge detector to the ham band of interest. Then follow the directions in your antenna noise bridge manual and adjust your antenna, substituting the noise bridge detector wherever "receiver" is mentioned in the manual.

Measuring antenna radiation pattern

After you have adjusted your antenna you can use this instrument as a linear field strength meter. Connect a short antenna or a remote dipole to J1. With low power applied from your transmitter to your antenna, enough to register on the meter of this instrument, either rotate the beam to check its radiation pattern, or move the detector and its antenna around the antenna, noting the meter indications at each point. The distance between the station antenna and the detector or its remote antenna should be several wavelengths at the frequency in use for greatest accuracy.

When used to indicate field strength, the lower fifth of the meter scale will be nonlinear because of diode conduction knees. However, the upper 80% of the meter scale provides linear indications, so increases and decreases in the meter indication in this upper scale portion indicate equivalent changes in radiation intensity from your antenna.

Caution!

This instrument is extremely sensitive. It is easy to pin the meter when using it in conjunction with your antenna noise bridge, and also during the calibration procedure. Use the GAIN control as necessary to keep the meter needle from wrapping itself around the pin! 73

Parts List

BT1	9-Volt alkaline battery
C1	100 pF mica or poly capacitor
C2	140-150 pF variable capaci tor (see text)
C3	0.1 µF disc capacitor
C4	0.01 µF disc capacitor
D1,D2	Germanium diode: 1N34, 1N60, 1N90, 1N270, etc.
J1	SO-239 UHF female connector (or builder's choice)
L1	33 turns #26 enam. wire on T50-2 toroid (40-30 meters)
L2	11 turns #26 enam. wire on T50-2 toroid (20 through 10 meters)
M1	100 or 200 µA meter (see text)
Q1	NPN small signal transistor: 2N2222, 2N3904, 2N4124, etc.
R1,R3	10k 5% 1/4 Watt resistor
R2	1000 Ohm linear taper poten tiometer, with switch S2
S1	SPDT toggle or slide switch (Bandswitch)

CARR'S CORNER

Analog-to-Digital (A/D) Converters

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Amateur radio astronomy has been a long-time favorite topic in this column. I've discussed the topic of frequencies from near-DC to daylight (literally!), but there always seems to be more to say. One constant question, however, is how can one collect the (essentially) analog data that results and store it in a computer? The answer is to use an analog-to-digital converter (ADC or A/D).

How the DC signal is derived

The receiver used for radio astronomy observations, whether VLF, HF, or VHF, will produce a varying signal level according to the strength of the received signal. It is that signal level variation that you want to record. This job requires that the signal be converted into a DC voltage; or, more correctly, a unidirectional varying signal that looks a lot like unstable DC.

This is done by using a rectifier and integrator circuit. Like most things, we can do this plain or fancy, depending on how you want it and what you want to do. **Fig. 1** shows the plain solution that I learned from Bob Sickles and Jeff Lichtman. It uses a plug (P1) to the speaker or headphones jack of the receiver. Once the receiver is tuned to the frequency being observed, the plug is inserted so that this circuit comes into play. The rectifiers consist of a half-wave voltage doubler made up of C1, D1 and D2; C2 is also part of the voltage doubler, but it serves a dual role as the integrator. Capacitor C1 can be a 1 µF tantalum, or some other form. If the capacitor is a polarized variety, then the polarity as shown should be observed. The diodes are plain vanilla 1N60 germanium diodes. These diodes are also sold by some dealers under the designations ECG-109 and NTE-109 (these are intended for the radio and television repair industry).

The integrator consists of C2 and R1. The time constant of the integration can be varied by changing the values of C2. I've used values from 10 µF to 470 µF with only a small observable change in the way it operates. The output signal is a DC voltage or current that goes to a meter, an oscilloscope, strip-chart recorder, or the input of an ADC.

The fancy approach is shown in **Fig. 2**. This circuit is a *mean value amplifier*, and is made from circuits seen in most good operational amplifier books, including my newly released (March 1996) title from Butterworth-Heinemann (313 Washington Street, Newton, MA 02158-1626; 1-617-928-2500). The book was released in England, but is available in the USA through the address shown. What is a mean value amplifier? Well, it's really just a rectifier/integrator writ large to justify using the op amps.

Amplifier A1 is a precise rectifier (half-wave), while A2 is a Miller integrator. The op amps can be CA-3140s (which use 741 pinouts), or a single CA-3240 (two 3140s in a single DIP with the pinouts of the popular LM-1458 device). The values of the resistors are not critical, but the ratios (R and 2R) should be followed. 5k ohm and 10k ohm, or 10k ohm and 20k ohm are likely candidates for value. The diodes are germanium 1N60s, although I've used silicon 1N4148 with no observable problems. The integrator time constant is R times the value of the capacitor. Start with 1 µF and work up 'til you get a good response. The compensation resistor between the (+) input of A1 and ground should have a value of R, or that input can be grounded if some small DC offset can be tolerated (try it first, however, because integrators like A2 don't like offset voltages at their inputs).

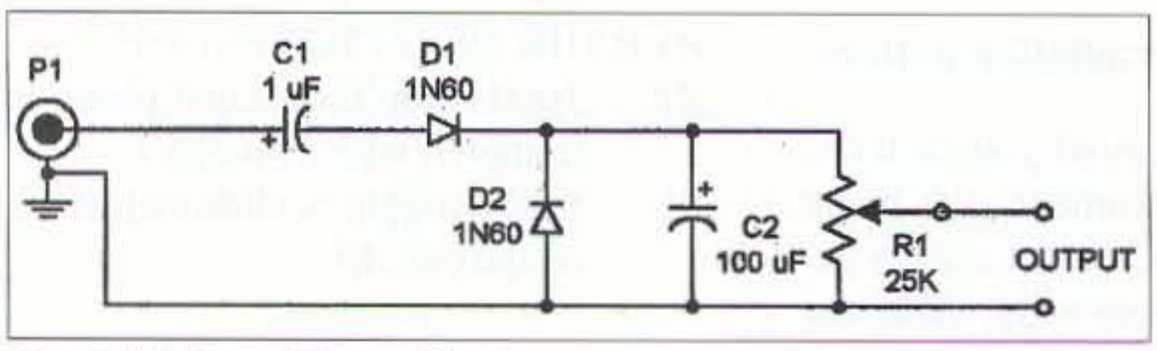

Fig. 1. Plain vanilla rectifier/integrator.

A/D converters

The job of the ADC is to take an analog input voltage and render it into a binary word that represents it. Cheapo converters that divide up the analog input voltage range into 256 states are available in 8-bit lengths A 12-bit converter costs a little more, but can divide up the analog voltage into 4,096 different values. In the 12-bit case, on an ADC that allows analog input voltages from 0 to 5 volts, 0 volts might be represented by binary 000000000000, while +5 volts would be represented by binary 111111111111. Actually, because of the 1-LSB and zero problem, the maximum input voltage would be only (4,095/4,096) x 5 volts, or 0.9998 x 5 volts = 4.999 volts.

One approach to the ADC problem is to build one yourself. The Maxim people seem to have a lot of really interesting circuits, one of which is their MAX-187 ADC. It comes in an 8-pin mini-DIP package, and offers 12-bit conversions and a serial output. The circuit of **Fig. 3** uses a MAX-187 and is connected to the computer via the parallel printer interface. The parallel printer interface is normally regarded as an output because it sends data to the printer, but there are five handshaking and signaling lines on the interface connector that either go back to the computer or are bidirectional. Wire the connector as shown, and then plug it into the printer output at the back of the computer. Make sure that the gender of the connector that you use is opposite that of the parallel printer output (otherwise, it's still a DB-25 connector).

You will have to write a short BASIC program to input the data. I have a candidate program, but it belongs to someone else. If you send me an SASE or reach me via E-mail, I'll tell you where to get the BASIC listing that runs this ADC.

The MAX-187 can be bought in single quantities from dealers such as Digi-Key (701 Brooks Avenue South, P.O. Box 677, Thief River Falls MN 56701-0677; 1-800-344-4539). By the way, if you're at all interested in electronic construction projects you need the Digi-Key

***Photo A.** Pico Technology, Ltd ADC-16 serial port ADC.*

catalog. It is chock full of neat parts; there's not a lot in the RF realm, but it offers nearly everything else (and they do have at least some RF parts). They are a source of the NE-602 chip used for a lot of direct-conversion radio receivers, for example.

Another solution is to buy a ready-made ADC from a commercial source. Several models are available that plug into either the parallel printer port or the RS-232 serial asynchronous communication port on the back of the computer. **Photo A** shows one that I bought from Pico Technology, Ltd. (Broadway House, 149-151 St. Neots Road, Hardwick, Cambridge CB3 7QJ, England). They take Visa cards, so you can order and not worry about sending a check (or as they say, "cheque") denominated in pounds sterling.

The version shown in **Photo A.** is the Pico ADC-16 model (although I understand a newer version is now out). It has eight software-selectable analog (or "analogue") inputs, resolution that is programmable between 8 and 16 bits, and a 12.5 volt input range. Pico Technology, Ltd. also offers two software programs for MS-DOS and Windows computers that allow you to run their various ADC products. PicoScope makes your computer work like a storage

***Photo B.** Radio Shack computer-interface digital multimeter.*

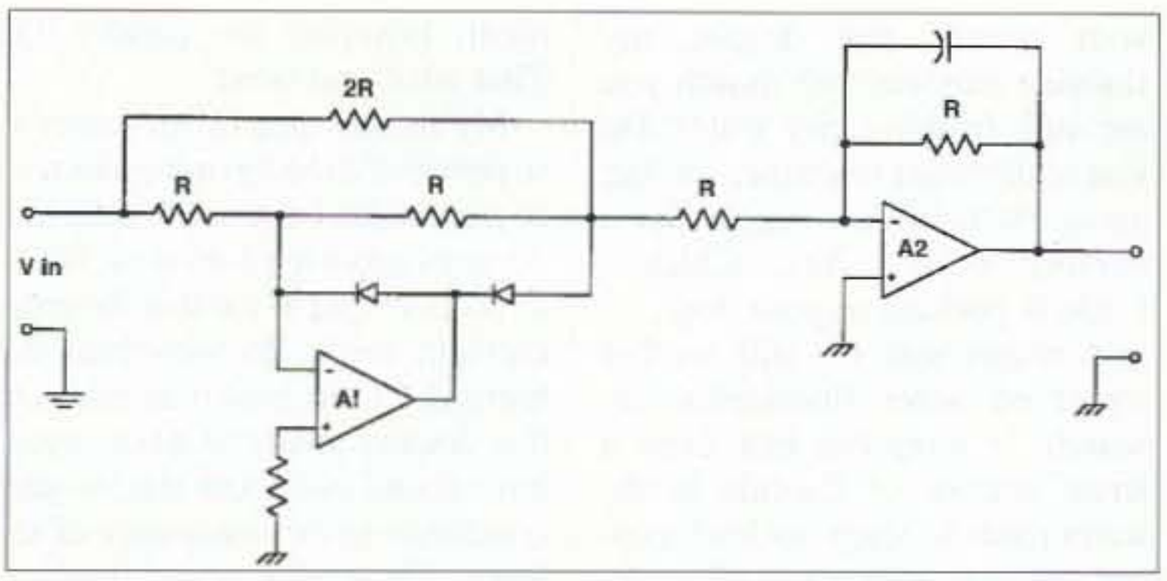

Fig. 2. Fancy rectifier/integrator (or "mean value amplifier").

oscilloscope when the ADC is connected, while PicoLog makes the computer into a nifty data logger. I use both software packages.

The final method, shown here in **Photo B.**, is the Radio Shack™ digital multimeter that interfaces to IBM-PC compatible computers through the RS-232 serial port. The advantage of this device is that it also functions as a combination frequency counter (although not to a high frequency) and digital multimeter, when not being used for ADC. Also, because of the different ranges and functions, a wider range of parameters can be input to the computer. The Radio Shack instrument also comes with its own software for MS-DOS or Windows machines.

The Radio Shack computer-interface digital multimeter comes in a couple of different models. The one I bought is not easily found anymore; however, the manager of my local Radio Shack told me that he stocks a couple of varieties that replaced it. Check with a Radio Shack store to see whether or not this is a good idea for you. I paid around $130 for mine, but don't know what the current price is.

The use of the computer allows you to make a lot more observations, as well as do some neat data analysis that would be harder by hand. Strip-chart recordings look like "real science" but are a pain in the neck to read and use properly. I prefer the computer approach, if only for that reason.

Note: If you write a BASIC or Visual-BASIC program to read data from any sort of ADC, and want to time and date stamp the data using the computer's internal clock/calendar, then make sure that you store the data in a file in comma-delimited format. This means putting a comma "CHR$(0)" character between "print#" statements for the ADC data, time and date. If you do it right, then you can display the data through an Excel, Lotus 1-2-3, or other spreadsheet program. Also, the graphing functions of those programs can be used to plot your data if the ADC software lacks its own version.

Connections

I can be reached at P.O. Box 1099, Falls Church VA 22041, or via Internet E-mail at carrjj@aol.com. I welcome your input. 73

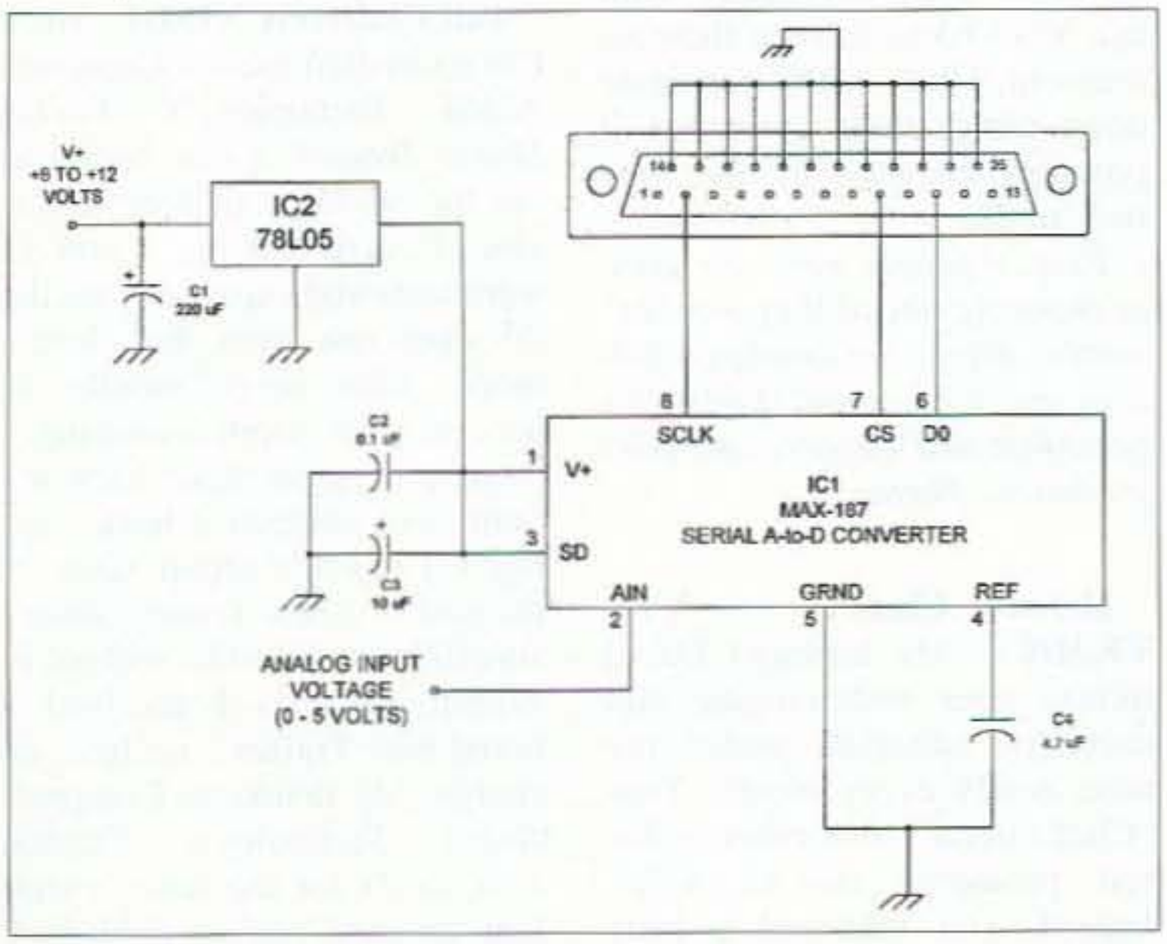

Fig. 3. MAX-187 ADC to plug into parallel port of a computer.

NEVER SAY DIE

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conclusively that all of our cells are in some way in communication with each other, no matter where they are. Which raises some interesting questions when it comes to organ transplants and blood transfusions.

It also ties in with the work of Antoine Béchamp (1812-1908), who opposed Pasteur's theory of microbes causing illness. You can read *Pasteur Exposed, the False Foundations of Modern Medicine* by Ethel Hume for the gory details of Pasteur's fakery. And the work of Royal Rife (1888-1971), as reported in *The Cancer Cure That Worked* by Barry Lynes. Rife's amazing microscope allowed him to see the most fundamental of life forms, just as Béchamp's had. And as Gaston Naessens (1924-) did with *his* super-powerful microscope. Naessens called these smallest of life forms somatids. And he found that they could survive freezing and 200°C. They were impervious to any acid, to nuclear radiation, and not even a diamond knife could cut them.

Béchamp was able to see them with his microscope by viewing cells using sunlight for illumination. This caused them to fluoresce and become visible. Rife did it by beating ultra-violet light against their UV light and viewing the mixing product of the two light frequencies.

Naessens found that when he injected the somatids from one rabbit into another he could make skin grafts to the second rabbit that would not be rejected. He tried this with humans and again there was no rejection. But the Canadian government and the medical association were so busy trying to put Naessens in prison for curing people of cancer (1989) that he couldn't get his research papers published. I reviewed the book, *The Persecution and Trial of Gaston Naessens,* by Chris Bird, some months ago. Of course it's on my recommended book list.

So much for transplanted organs staying in touch with the original owners, even after death. That brings up the question of memory, where very little research has been done. Somehow our cells seem to be able to contact our memories.

While most of us, when we are reborn, have our past lives erased from our memories, reincarnation investigators have found that many young children have memories of previous lives, but these fade away by the time they are around three. I've never had much problem helping almost anyone contact their past lives under hypnosis, often with great clarity. I found, as have many other therapists, that events in previous lives can sometimes have a considerable impact in one's current life. It would be interesting to regress someone with an organ transplant and see if there are contactable memories via the new organ. Ditto even blood transfusions.

The next step might be to develop people's ability to contact these memories. Might we eventually be able to give people transfusions of blood from hundreds of people with knowledge and skills in a wide variety of fields? How about becoming a concert pianist via a transfusion? Yes, I know, I'll probably get a bunch of letters from Techs asking where they can get some blood from a high speed CW op. Anything to keep from having to actually sit down and spend a few hours training their minds to get their hands to write letters when their ears hear the code sound patterns.

Walking out

Instead of telling me about your antenna and rig the next time we meet on the air, how about telling me about any outstandingly good movies you've seen recently? Sherry and I have walked out on two serious turkeys recently, despite one of them getting thumbs-up reviews and several OSCAR nominations.

You might also tell me what TV shows you find particularly interesting. I'd hate to be missing anything outstanding, which I doubt I am. Most of the stuff on TV is instantly forgettable and the time better spent contemplating one's navel. Or watching paint dry.

For a couple of seasons I really enjoyed "Picket Fences," but the writing took a serious nose dive this season. Something has gone terribly wrong there. Ditto "Roseanne," which used to have writing verging on genius. It's turned blah too. "Law and Order" has been

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NEVER SAY DIE

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continuing with its unpredictable plot twists, despite some cast changes. "Murphy Brown" started out pretty good, but ran out of steam a year ago. "Strange Luck" has been pretty good, but it's been canceled. Not much else I've checked out has. Oh, I enjoy Chief Inspector Morse in the "Mystery" series. And I save any magic specials that come along. Love those.

"Homicide" and "NYPD Blue" started off pretty well, but they got more and more wrapped up in developing the characters instead of the crime stories, turning them into soaps. The writing on "The Simpsons" is cleverer.

I save a lot of viewing time by taping everything first. I zip through the commercials, and ditto anything boring. I tape several of the magazine shows and zip most of them, slowing down for exposé segments. I prefer not to waste time gawking at OJ and the usual sob-sister fluff. News? If it's important it'll be covered in *Newsweek*. The rest of it is like gawking at road accidents.

I do most of my TV viewing while I'm eating meals, since I wouldn't be able to read or write then anyway. So my actual TV-only viewing time is minimal. Even so, it seems to be beating most of the movies I've gone to see. I guess my favorite for last year was "Babe." I'd rather spend more time reading, writing, and maybe even some time to get on the air.

Fluoride III

My apologies for harping on this, but I just heard from one of your friends that despite my fluoride editorial last month you are still drinking city water. Do you really want to chance ending up as Alzheimer's veggies in a nursing home? Yes, Chicken Little is pecking at your door.

A reader sent me still another report on water fluoridation research. It turns out that even a small amount of fluoride in the water tends to leach out lead, copper and iron from water pipes, increasing their toxic effects. In fact, the total toxicity of the combinations is much greater than their sum. Sodium and aluminum fluoride cause irreversible memory loss, dyslexia, behavioral and learning problems. Just what your kids need. Of course we're solving that problem by sedating 'em with Ritalin.

Fluoride exposure during pregnancy retards brain development, lowering the child's IQ. That what you want?

My mother died of Alzheimer's, so perhaps I'm being over-protective of your health. I sure wish I'd known 30 years ago what I do now, but it never occurred to me that the government might do something so harmful to our health as this. Or that doctors, many of whom must have found out about this, would contribute to the conspiracy of silence. Up until I started reading about health care as part of my homework for the New Hampshire Economic Development Commission a few years ago, I believed in doctors, just as most of you do. I sure got a rude awakening.

If you run short of something to talk about on the air you might pass the word. And please keep your eyes peeled for any clippings I may have missed. 73

LETTERS

Continued from page 46

confident in saying I have similar opinions to many "no-code Techs." Since I am in amateur radio for fun, I refuse to be bullied into jumping through hoops to upgrade. I have no interest in Morse code. To steal a phrase from a soft drink commercial, "never had it, never will." It simply makes no sense to require code proficiency in operators who will never use it. I have no problem with operators who enjoy CW. That is what they like. I enjoy repeaters, FM, public service, and packet. I wouldn't expect anyone who had no interest in packet operations to demonstrate packet proficiency.

I would like to operate HF because I could pass traffic from other areas of the world experiencing disasters. This past hurricane season highlighted the need for services like this. Who gains when an eager operator is prohibited from performing public service work due to lack of code proficiency? How about the people in affected areas? This makes losers out of the amateur community as a whole. Public service is the strongest argument for amateur radio.

Escalating difficulty levels through the theory and practices sections of the test makes sense because we all use theory and we all had better know the rules. CW subbands are good because they give operators who enjoy CW a place to have fun. Let's face it, when it comes right down to it, code is being used to keep "the riffraff" out. If there is such a need, make the written tests harder. Keep it relevant. There is also probably an element of "I had to do it, why shouldn't you?" Ridiculous! Until we get past this absurd idea that proficiency in an antiquated form of communication must be a rite of passage, the lack of activity in the upper license classes will continue. Even the military has recognized the uselessness of code and phased it out. At one time CW had its place. In an era before the high quality electronics and alternate modes of today, CW may have been the only mode that could be pulled out of the noise. This no longer applies. Hams have always been progressive when it comes to equipment. Too bad we can't say the same about licensing. People in a hobby will do what is fun and forget the rest. When the ARRL realizes this I will upgrade, and probably not before.

Hey Mike, you troublemaker, you've got the germ of a really good idea there! Since the code is considered so important by the old-timers, not only should they be retested every year to make sure their code skills haven't deteriorated, they should also be forced to demonstrate packet, RTTY, and slow-scan skills...Wayne

Pete Sedler, Georgetown OH. Even though you've got an 84-page booklet of your as yet unpublished editorials, would you please discuss in *73* how to become an entrepreneur? I don't mean learning marketing, PR, budgeting, accounting, etc.; I mean how do you change from the employee mindset to the boss mindset? When I suggest to my always-broke fellow employees that they think of starting some kind of small business, they look at me as if I'd just beamed down from the mother ship. When I tell them I've started learning about the Internet in order to start a business, they edge away. They like to complain, but where has the old American pioneer spirit gone? An article in the paper said Baby Boomers are planning on using their paychecks from age 50 to 65 to finance their retirement, but with corporate downsizing, their careers will probably be over by the time they're 58.

Pete, if people were any good at planning ahead they wouldn't smoke, drink, get amalgam fillings, eat coffee and Danish for breakfast and burgers and fries for lunch...Wayne

Helen Clancy - XYL VK3DC. My husband David thrusts your wide-ranging and excellent editorials under my nose nearly every month. Your "Chef Green" November editorial prompted me to write. Indeed, you inherited a tasty coleslaw dressing from your grandmother. We tried it! But not simply on boring old cabbage. To the finely shredded cabbage we add shallots or spring onions, capsicum, green and red pepper, celery, and grated carrot. You can also add some diced apple, corn kernels, sultanas, cooked peas, pine nuts, and diced raw mushrooms. In our climate, four or five months of the year are salad delights. As you say, raw is healthy. And delicious. Keep the creative thoughts flowing. Oh yes, I love your contract.

You're right, Helen. I too enhance my coleslaw. The dressing also makes a marvelous dip for fresh veggies. I use it every day...Wayne

Bill Chatterly N1SGI. Since I'm a satisfied user of Computer Aided Technology's *Pocket Morse Trainer*, I was happy to see the ad for it in your magazine. I've passed my 5 and 13 wpm tests and expect to pass the 20 wpm test soon, but there's more. After seven months of use, the unit stopped working. I thought it might have been my fault, so I shipped it back, saying I'd pay the repair costs or the cost of a new Trainer, since I sure didn't want to be without it. Within 10 days I received a brand new Trainer...no fuss, no charge. My thanks to Computer Aided Technology. Thanks, also, to *73* for the many excellent articles you've published. I'm glad I subscribe.

Ed Fowler KC4RIY. I enjoy your magazine and your editorials. Your projects are great and do not have the voodoo that *QST* and *CQ* have. Keep it up.

Sure, Ed, but you can help. Whenever you run into anyone on the air who's built something that sounds interesting...like maybe an antenna that's working like gangbusters...get after him to write it up for us...Wayne

Tom McLaughlin, Mango FL. We are trying some of the remedies from your Nov. editorial and they seem to be working! My dentist, who is a very smart person and a stealth health nut, hasn't said anything about mercury fillings, but he has quietly been replacing my fillings with crowns. A recent article on ozone references gas vapors released during vehicle fueling. Maybe you've seen the very tiny federal warning stickers on gas pumps. If the truth was ever let out, I'm sure we'd see that Freon™ causes less than a hundredth of the ozone reduction that gas vapors cause. There is very little of anything in the air that matches the carcinogenic power of raw gas vapor, with its benzene and toluene components. Vehicle fueling should be done with vapor-tight fittings, like those used for propane. The cancer rate would probably start to go down immediately.

Another troublemaker...Wayne

Michael Smith WD4KMP/5. Two names stand out from my early years: Gernsback and Green. Thanks for four decades of entertainment and information. Three decades ago I developed painful ulcers. Gallons of Tagamet and such provided only temporary relief. But I got lucky...I contracted something much worse. After great quantities of various drugs I was "cured" and...surprise!...the ulcer was gone. This of course proves to me your idea of ulcer causation and cure. And reaffirms my "faith" in the AMA. Microbes, little critters which we can't see, right on down to viruses and even sub-viral "living molecules" cause us various cancers, rheumatoid arthritis, and a variety of illnesses. Internal medicine, as practiced today for profit, does just that: It generates more profit than health, just as you say.

The AEC said on TV recently that 3000 people die each year from cardio-pulmonary disease caused by burning fossil fuel. Disregarding their particular pecuniary interest in such stats, that's still not as dangerous as the cheeseburger and even less deadly than the automobile. But little is said of the things which cause 95% of us to die from other than old age because these things are not emotionally arousing. Is there a cure for *this* disease?

Wayne, you cost me $5 for the wonderful Roche tape, "The Fall of the Ivory Tower."

Ulcers? Lordy, read the $15 book, "Your Body's Many Cries for Water." A few glasses of water will quickly end ulcer pains. Are the millions of Alzheimer veggies ending up in nursing homes merely the product of years of dehydration? Mike, the "health industry" is just as crooked as all the other big businesses. I would be most interested to learn of any major industry that isn't crooked. Meanwhile, if any reader knows of a way to get people interested in living longer, please let me know. I've found almost everyone angrily resistant to any efforts to help them live longer and healthier... Wayne. 73

QSL Contest

Did you buy your QSL off a rack, or did you put some thought and creativity into it? If you think you have a winner, send it in and let us have a look at it. Who knows, it might make the cover. Well, maybe page 85 or so. Or maybe Wayne's wastebasket. If it's declared a winner, you'll get a CD of your choice of any of 26 kinds of music, as listed in Wayne's November editorial. You'll also see it in 73!

Send it to:

QSLContest,
73 Magazine,
70 N202,
Peterborough NH 03458-1107

Bribery? You Bet!

New Products

Continued from page 72

Presto-Change-O: New "Jerk and Run" Bendix King Radios

When you're in your car, it's a mobile unit with an RF amplifier, and when you leave your car behind, you take out the module and it's an HT.

That's the idea behind the new line of Bendix/King Jerk & Run radios. The ECH59 0JA and ECU49 0JA models include a 50-watt broadband amplifier. In addition to increasing the output of the units, the EC series allow any Bendix/King VHF or UHF portable radio to be inserted into a metal housing that charges the battery. The Jerk and Run feature allows the user to flip a lever and eject the radio with a spring-loaded mechanism and take the unit away for portable use.

BK Radio, Inc. can be reached at 2901 Lakeview Road, Suite 100, Lawrence KS, 66049. (913) 842-0402; fax (913) 841-0287.

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Manufacturers: If you have a new product and want it considered for review in 73, please call 603-9240058.

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

APR 28

BUDD LAKE, NJ The Northwest Jersey Hamfest will be held at the Budd Lake Firehouse, Route 46, rain or shine. Open at 6 AM to sellers; 8:30 AM to buyers. Talk-in on 146.520. Call *(201) 584-6550 days; (201) 770-0242 eves.*

MAY 4

CADILLAC, MI The Wexaukee ARC will hold their annual Hamfest 8 AM–2 PM at the Cadillac Middle School. VE Exams for all classes at 1 PM. Talk-in on 146.98 Rptr. Contact *Dan KE8KU, Wexaukee ARC, P.O. Box 163, Cadillac MI 49601. Tel. (616) 775-0998.*

FRESNO, CA The Fresno ARC, Inc. will hold its annual regional HamFest at the Riverland RV Park. Gates open at 7 AM and festivities last all day. Free camping Fri. night, May 3rd. For more info, listen to the Club's Sun. night Net at 7 PM on the Club's Rptr. at 146.940(-); or call *John Pritchett WA6JWK at (209) 222-6793.*

GREENVILLE, SC The 1996 Greenville Hamfest, sponsored by the Blue Ridge ARS, will be held 8 AM–5 PM at Anderson County Fairgrounds. Talk-in on 146.01/.61 or 146.22/82. Walk-in VE Exams at 12 noon. Contact *Jeff WA4EFT* or *Kay KE4NHX Borke* at *(864) 967-3284 after 6 PM EST. E-mail: 102431.2306@compuserve.com; or mail to 403 Aster Dr., Simpsonville SC 29681.*

SIERRA VISTA, AZ The Cochise ARA Hamfest will be held at the club's site on Moson Rd., beginning at 7 AM. VE Exams on-site. Talk-in on 146.76(-). Contact John or Leatha Braden, 2200 Sonoita Dr., Sierra Vista AZ 85635. Tel. (520) 459-7960.

MAY 4–5

ABILENE, TX The Key City ARC, Inc., will host the ARRL West Texas Section Convention and the Key City ARC Hamfest. Setup for dealers and manufacturers will be Fri., May 3rd, 4 PM–9 PM. Set-up for all others, including dealers arriving late, will begin at 6 AM Sat. May 4th. Contact *Peg Richard KA4UPA, Hamfest Chairperson, Key City ARC, Inc., PO Box 2722, Abilene TX 79604. Tel. (915) 672-8889.*

MAY 5

BEMIDJI, MN The Paul Bunyan ARC will hold its annual Hamfest at the Northwest Tech. College, 8 AM–2 PM. Talk-in will be on the 146.73 Rptr. VE Exams. Flea Market. Contact Roben Beyer, *P.O. Box 524, Bemidji MN 56601. Tel. (218) 751-4801;* or *e-mail emilee@northernnet.com.* Individuals wishing to test must pre-reg. with *Gurnee Bridgeman, (218) 243-2002.*

DECATUR, IL The Richland Comm. College, Corner of Reas Bridge Rd. and Brush College Rd., will be the location for a Hamfest being sponsored by the Cenois ARC. Outdoor Flea Market open at 7 AM. New Vendor Area inside. VE Exams at 9 AM, walk-ins only. Talk-in on 146.730(-) PL 123.0; and 442.250(+) PL 123.0. Contact *Decatur Area Hamfest, P.O. Box 4595, Decatur IL 62525; or call Bert Ruble at* (217) 423-0314.

WRIGHTSTOWN, PA The 22nd Annual Hamfest of the Warminster ARC will be held at the Middletown Grange Fairgrounds, Penns Park Rd. starting at 7 AM. Setup at 6 AM. Computer hardware and software vendors are invited to participate. Talk-in on 147.69/.09 Rptr., and 146.52 simplex. VE Exams at 11 AM. Pre-reg. begins at 10:30 AM. Applicants bring original and one copy of present license and/or certificates of successful completion (if any); two forms of ID and the $6.05 exam fee (Novice class exams are free). Contact *George Brechmann N3HBT, at (215) 443-5656, 9 AM–9 PM.*

MAY 11

MANITOWOC, WI The Mancorad RC will hold their 1996 Hamfest and Computer Swapfest at Manitowoc County Expo Ctr. on County Hwy. R. Flea Market (amateur, computer, electronic). VE Exams (all classes) at Silver Lake College (Hwy. 151). Test reg. closes at 9 AM. Talk-in on 146.01/.61. Contact by sending an SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204;* or call *Red (414) 684-9097 days; or Glenn (414) 684-7096 day or eve.*

MAY 17

SOUTHWEST OH The Southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1996 Annual Banquet in conjunction with the Dayton Hamvention on Fri., May 17th, at Alex's Continental Restaurant. C.O.D. bar at 7 PM; Banquet at 7:30 PM. Reservation deadline is May 15th. QCWA membership is not a requirement. Tickets $15 ea. Make check payable to *Robert L. Dingle, Treas. Chapter 9,* and mail to *1117 Big Hill Rd., Kettering OH 45429-1201.*

MAY 17–19

DAYTON, OH The 1996 Dayton Hamvention will be held at the Dayton Hara Arena and Exhibition Center. For Exhibit info, call *(513) 276-6931;* for Flea Market details, call *(513) 276-6932.* Talk-in on the DARA Rptr. 146.94(-), alternate 146.91(-). Dayton hams also monitor 223.94(-) and 442.1(+). Sponsored by the Dayton ARA, Inc.

MAY 18

EPHRATA, PA The Ephrata Area Rptr. Soc. will hold the 11th annual Hamfest starting at 8 AM at the Ephrata Sr. H.S., 803 Oak Blvd. VE Exams will be given. For info and table reservations, write *E.A.R.S., Inc., 906 Clearview Ave., Ephrata PA 17522,* or call *Bill N3PZA after 6 PM at (717) 484-2102.*

FORESTDALE, RI The Rhode Island Amateur FM Rptr. Service, Inc., will hold their Annual Spring Auction and Flea Market at the VFW Post 6342, Main St. The Flea Market opens at about 8 AM. An Auction will be held 11 AM–3 PM. Talk-in on 146.76. Contact *Rick Fairweather K1KYI, 144 Parkview Dr., Pawtucket RI 02861;* or call *(401) 725-7595 between 7 and 8 PM.*

MAY 18–19

YAKIMA, WA The ARRL Washington State Hamfest will be hosted by the Yakima ARC (W7AQ), Sat. May 18th, 9 AM–4 PM; Sun. May 19th, 9 AM–1 PM. Commercial dealers. Flea Market. VE Exams. Talk-in on 146.06/.66 PL 123. Contact *Larry Sieger KI7JL, 13112 Douglas Rd., Yakima WA 98908. Tel. (509) 966-5117 eves.* This event will be held at Selah Middle Sch., 411 N. 1st St., Selah WA.

MAY 19

SACRAMENTO, CA The North Hills RC will hold their Annual Radio Swap and Electronics Fair from 7AM–Noon at the Carmichael Elks Lodge, 5631 Cypress Ave. Carmichael CA. Talk-in on 145.190(-) and 224.400(-). Contact *Tim Lewis KD6FWD at (916) 722-7037;* or write to *NHRC SWAP, P.O. Box 41635, Sacramento CA 95841-0635.* Internet http://www.ns.net/~NHRC.

MAY 31–JUN 1

SO. SIOUX CITY, NE The ARRL Midwest Div., and the ARRL Dakota Div. will combine for the Midwest-Dakota-Hamboree Convention. The 3900 Club will host this event. A special luncheon aboard the Sioux City River Boat "Belle" is planned for the ladies on Sat., as well as other programs for XYLs. VE Exams. QCWA Luncheon and meeting. Wouff Hong ceremony. Flea Market. A Fri. night dinner has been arranged as a special fun night. Please request a flyer from *Dick Pitner WØFZO, 2931 Pierce St., Sioux City IA 51104.* The convention will be held at the Narina Inn on the Missouri River.

NASHVILLE, TN The Nashville ARC, Inc. will sponsor "Hamfest Nashville" on June1st at the Tennessee State Fairgrounds. Open to the public at 8 AM. Open to vendors from noon–11 PM Fri. May 31st; 5 AM–7 AM Sat., Jun. 1st. For table reservations, contact *David Scott KK4WZ, (615) 736-7855 days, or (615) 356-2929 eves.*

JUN 1

BANGOR, ME The Bangor Hamfest will be sponsored by the Pine State ARC at Hermon

H.S., 0800–1300 hrs. Flea Market. Dealers. VE Exams. Campgrounds and motels within 5 mi. Contact *Roger W. Dole, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.*

LOVELAND, CO The Northern Colorado ARC will host "Superfest" 8 AM–3 PM at the Larimer County Fairgrounds, 700 S. Railroad Ave. VE Exams, commercial exhibits, computer and radio goodies, more. Reserve tables from *Jeanene Gage NØYHY, (303) 351-7327. Call Michael Robinson AAØUB at (970) 282-1167* for general info. Talk-in on 145.115(-), 100 Hz.

JUN 2

BUTLER, PA The 42nd Breezeshooters' Hamfest will be held 8 AM–4 PM on the Butlet Farm Show grounds, just north of Butler PA. Talk-in on 147.96/.36. Dealers. Hamfest. For more info, call the *Breezeshooters' Hotline at (412) 854-5593.*

PRINCETON, IL The Starved Rock RC Hamfest will be held at Bureau County Fairgrounds beginning at 6 AM. Camping and outdoor Flea Market area is free. Talk-in on 146.355/.955. Contact *Bruce Burton KU9A,* or *Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SPECIAL EVENT STATIONS

MAY 3–5

GAY HEAD, MA The Fall River ARC will conduct their 3rd Annual DX-pedition at the historic Gay Head Cliffs; Martha's Vineyard Island. All HF bands, SSB, CW. 2m FM, 220 FM, 440 FM, and 421.25–439.25 MHz ATV. W1ACT/P will operate on IOTA freq. as NA-046. There will also be a MA QSO Party around 1.810, 1.850, 3.550, 3.890, 7.050, 7.290, 14.270, 21.390, and 28.390 MHz. QSL with SASE to *Roland Daignault, Jr. N1JOY, 19 Davis Rd., Westport MA 02790.*

MAY 4

ALEXANDRIA, VA The Mt. Vernon ARC will operate NJ4F May 4th to commemorate the 133rd Anniversary of the Civil War Battle of Chancellorsville. This will be from the site of "No Man's Land" on the original battlefield. Operation will be in the General portion of the 40 and 20 meter phone bands. CW contacts by request. For certificates, send QSL and large SASE to *MVARC, P.O. Box 7234, Alexandria VA 22307.*

GLEN BURNIE, MD The Bay Area ARS will operate W3QLP 1300 UTC–2000 UTC to commemorate the 152nd Anniversary of the telegraph message "What Hath God Wrought," transmitted on an experimental line from Washington DC to Baltimore MD. CW freqs.: 7.125, 14.125, 21.125 and 28.125 MHz. A 8.5" x 11" commemorative certificate will be offered. Send your QSL card or SWL description of the QSO, along with a large 8.5 x 11 SASE to *Hal Camlin W3QLP, The Bay Area ARS, 7506 Jacqwill Ct., Glen Burnie MD 21061,* for this special award.

MAY 4–5

DANBURY, CT The Connecticut QSO Party, sponsored by the Candlewood ARA, will be held 2000Z May 4th–2000Z May 5th, with a rest period 0400Z–1200Z. Phone, RTTY, and CW. Work stations once per band and mode, mobiles as they cross county lines. No repeater QSOs. Freq.: CW–40 kHz up from lower band edges; Novices 25 kHz up from low end. Phone–1.860, 3.915, 7.280, 14.280, 21.380, 28.380. VHF–50.150, 144.200, 146.580. RTTY–normal RTTY bands (no WARC bands). For more rules and details, contact *CARA, P.O. Box 3441, Danbury CT 06813-3441.*

WALL TOWNSHIP, NJ The Ocean-Monmouth ARC will operate KB2VPQ 1600Z May 4th–1600Z May 5th, to commemorate the Marconi Memorial Tower Site. CW will be up 10 kHz from bottom of Novice subbands, and 10.145, 14.045, 18.080 MHz, the bottom of General 8015, and Novice 10 meter Phone subbands. Send 9" x 12" SASE (or $1 U.S.) to *KB2SEO at his Callbook address.* Visitors welcome.

MAY 9

WEST MIFFLIN, PA The Belle Vernon H.S. ARC will operate KB3BKW from Kennywood Park on Amusement Park Physics Day. Novice 10m, General 15m and 20 meter phone bands. For a certificate, write to *BVAHS ARC, RD 2 Crest Ave., Belle Vernon PA 15012.*

MAY 10–19

HOLLAND, MI The Holland ARC K8DAA will operate to celebrate Tulip Time. Operation will be in the lower portion of the General 20 and 15 mete subbands, 28.400 MHz; and 146.52 simplex, all bands. for a certificate, send QSL with calls worked, and a 9" x 12" SASE to *Barbara Siebelink N8NXA, 6410 Otis Rd., Saugatuck MI 49453.*

MAY 11–12

FLOYD, VA The Foundation for Amateur Internat'l Radio Service will operate KK4WW, US5WE, BY1QH, 8R1WD and S21AM in their own countries to celebrate the 5th Anniversary of FAIRS. General portion of 40, 20, and 15 meters. For a certificate, send QSL and a 9" x 12" SASE to *FAIRS, P.O. Box 341, Floyd VA 24091.*

MAY 17–19

DAYTON, OH The Dayton AR Assn. will celebrate the 1996 Dayton Hamvention by operating W8B1/8 1200 UTC–2100 UTC May 17th; 1200 UTC–2100 UTC May 18th; and 1200 UTC–1600 UTC May 19th. Freq.: 25 kHz up from lower Gen./Nov. PH/CW band edges (op's choice). For a certificate, send SASE to *W8B1/8, P.O. Box 44, Dayton OH 45401-0044.* For more details call *Charlie KA8OQF at (513) 256-3783.*

MAY 18

NEWPORT NEWS, VA The Peninsula ARC will operate W4MT 1500Z–2100Z at the parade site for the Centennial Celebration for the City of Newport News. Operation will be in the General 40, 20, 15m bands, and 145.23(-) Rptr. For a certificate and QSL, send a 9" x 11" SASE to *W4MT, 494 Pamela Dr., Newport News VA 23601.*

MAY 25

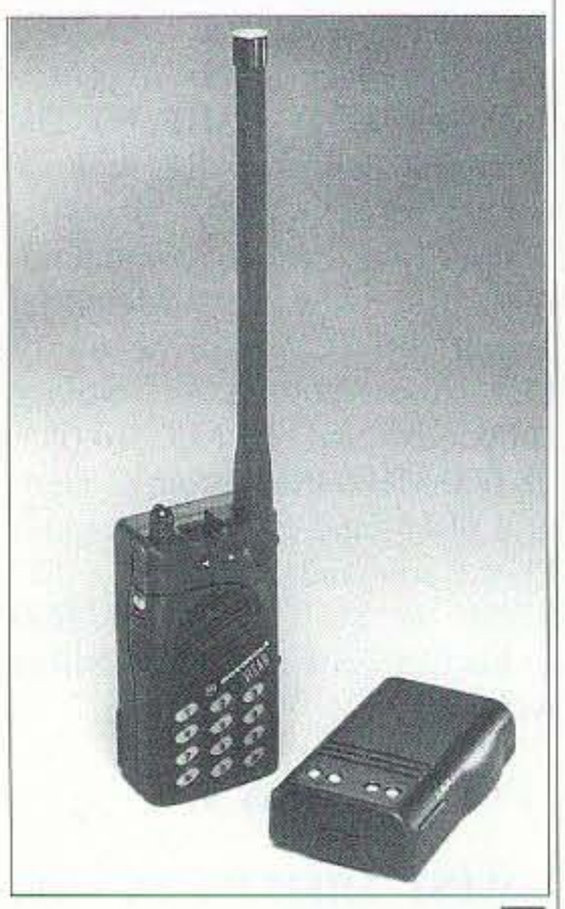
ASHTABULA, OH Members of the U.S. Power Squadron's Amateur Radio Net will operate from the Thomas Walters pilot house at The Great Lakes Marine and U.S. Coast Guard Museum from 1400 UTC–2200 UTC. Operations will be in the General portion of the 80, 40, 20 and 15 meter bands, in the Novice portions of 10 meters and on 2 meter simplex. Certificate for a confirming QSL card. Send SASE (for flat certificate send 9" x 12") to *Donald Stark N3HOW, 65 Stark Spur, Eighty Four PA 15330-9633.*

VISAR Replacement Battery and Eliminator

Battery on that HT going dead in the middle of your first QSO after a night on the charger? W & W Associates has announced the addition of the VISAR replacement battery and eliminator to the extensive line of Two-Way batteries. The batteries are available in 7.5V @ 2000mAh and 7.5V @ 1200mAh.

W & W also now stocks batteries for the Yaesu FT-10R/40R, the Icom series IC-W31, IC-21A, IC-T22A, IC-T42A and Alinco DJ190/DJ-G5.

W & W can be reached at (516)942-0011 and is located at 800 South Broadway, Hicksville NY 11801-5017.



73

The Tee Antenna

Short of room? This antenna may be just your size.

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

The low frequency bands are a bit of a problem for ham operators and shortwave listeners because longer antennas are required on those bands. For example, while a half wavelength dipole is only about 65 feet long on 40 meters and 126 feet long on 75/80 meters, you need 253 feet on 160 meters. Our SWL friends also have the same problem if they want to use a resonant antenna on the "tropical bands." Note: transmitters are more sensitive to the high VSWR that off-resonance antennas exhibit than receivers.

Real estate ain't getting any cheaper, so buying a 40-acre spread is probably not in most of our futures. *That* solution to the low frequency antenna problem is a non-starter.

One solution to the problem is the Tee-antenna shown in **Fig. 1.** This antenna uses two lengths of 300-ohm twin-lead to make a horizontal section ("A") and a vertical section ("B"). Note that this antenna looks superficially like a folded dipole, but it's: a) only about half as long as a folded dipole, and b) the conductors are continuous, rather than having the feedline drive the antenna in a balanced manner. This antenna is unbalanced.

The horizontal section length (in feet) is found from:

$$A_{feet} = 270/F_{MHz} \quad (1)$$

While the vertical section is found from:

$$B_{feet} = 270V/F_{MHz} \quad (2)$$

Where: A and B are the lengths in feet, F_{MHz} is the frequency in megahertz, and V is the velocity factor of the twin-lead transmission line (typically 0.82 for television-antenna-style twin-lead). 73

Examples of the antenna lengths:

Frequency	*A*	*B*
7200 kHz	37.5'	30.75'
3750 kHz	72'	59'
1850 kHz	146'	120'

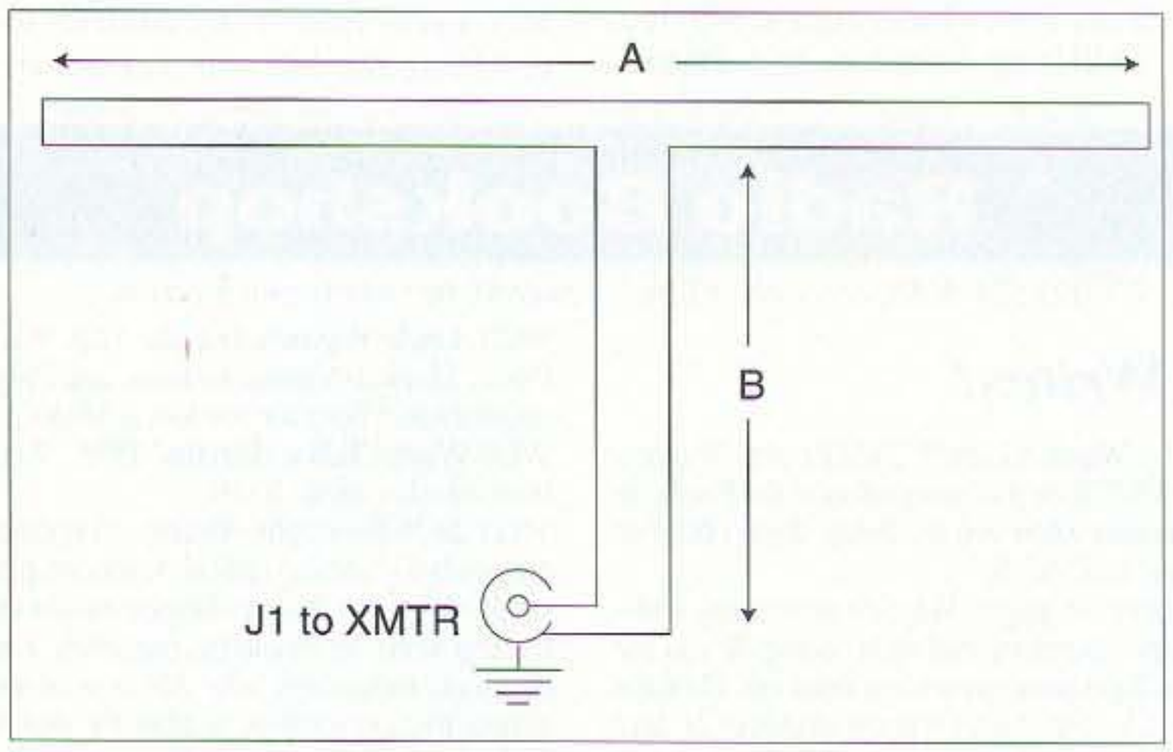


Fig. 1. *While it* looks *like a folded dipole, it's only about half as long!*

Win Fame and Fortune!

You can become world famous overnight just by getting an article published in *73*! Have you designed and build something hams would like to know about? Have you put together a kit which really deserves to be better known? Have you had an interesting ham adventure? How about a DXpedition? My answer to any of these questions you answer "no" to is why not? *W2NSD/1*

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

May is expected to be a decent DX month on good (G) days, but increasing thunderstorm activity may occasionally frustrate your weak-signal reception on the lower HF bands due to high static (QRN) levels. Expect the poorest (P or VP) conditions between the 5th and the 9th, and again between the 18th and 21st. The best days (G) are anticipated on the 1st and 2nd, 13th-15th, 23rd-25th, and 29th. The remaining days are either fair (F) or trending (F-P, P-F, F-G, and G-F as shown on the calendar).

MAY 1996

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 F	4 F-P
5 P	6 P-VP	7 VP-P	8 P-F	9 F-G	10 G-F	11 F
12 F-G	13 G	14 G	15 G	16 G-F	17 F	18 F-P
19 P	20 P	21 P-F	22 F-G	23 G	24 G	25 G
26 G-F	27 F	28 F-G	29 G	30 G-F	31 F-G	

10-12 meters

This is a daylight-only band this month, but may present openings to tropical areas as well as short-skip openings on the best days (G). During intense, sporadic E conditions (rare this month) bursts of strong signals can come and go unexpectedly. Stay alert.

15-17 meters

These bands could stay open into early evening hours with possibilities of trans-equatorial DX on good (G) days and evenings. Signals seem to peak toward the west during afternoon and evening hours. Short-skip to 1,000 miles or so should be available on many days.

20 meters

This should be your main choice for DX-chasing. Because some areas of the world are dark and others are in daylight at the same time, you can expect dawn-to-dusk, and even later, DX opportunities on good (G) days/nights. Short-skip will prevail to about 2,000 during the day, and farther at night.

30-40 meters

You may find these bands quite noisy (QRN) during the daytime, due to the onset of thunderstorms this month, but they will be quieter during the nighttime hours. DX to your east will be the best before midnight, and best to your west before dawn. Choose good (G) days for best chances of scoring a new country. Short-skip of 100-1,000 miles during the day, and 500-2,000 miles or so at night will prevail.

80 meters

You may find that 80 meters will provide DX on good (G) nights, but it will be limited by thunderstorm activity. It may also provide short-skip openings of 200 miles or so during the day and 2,000 miles or more after dark.

160 meters

There will be *no* daytime openings here, due to a high absorption of signals, but it ought to provide skip to 1,000 miles or so after dark. Only rarely will you find DX, and only on good (G) nights with low or no thunderstorm activity. Low-frequency static bursts, hundreds of miles in length, limit your spring and summer operations.

The consensus among the forecasters is that Cycle 22 has reached bottom and will now start slowly upward. It was a short cycle indeed, about 10 years, and that's good news. See you on the bands. W1XU 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

Where 10m is shown, also check 12m. Where 15m is shown, check 17m too. Where 20m is shown, be sure to look at 17 as well. Always check the bands above and below the indicated bands for possible openings to the areas shown. Remember that DX is where you find it, and not always where it is predicted to be.

Number 89 on your Feedback card

Updates

In the March issue, page 77, column 2 paragraph 2 of "Never Say Die", the telephone number for the SETI project was given as 800-AU-SETI. The correct number is 1-800-TAU-SETI.

In the April issue, page 41, "The Alpha Delta DX-A 160-80-40 Meter Twin Sloper", the author's name was spelled John Stevenson. It is actually spelled John Stephenson.

Oops! In the April issue, page 33, "Alaskan Amateurs and Their Antennas", Photo B , you may have noticed the striking resemblance between Chuck K7JUT/KL7 in Fairbanks and Sarah Anderson W7KZE from page 31, Photo B, "Ham Radio and Summer School". That's because we accidentally printed Sarah's picture twice and left Chuck's out. Apologies all around! Here's the missing picture. Can you recognize Chuck?

***Photo B.** Chuck K7JUT/KL7 in Fairbanks.*

There are a few corrections in the article, "A Decibel Primer", by Steven R. Sampson, July 1995 issue, page 42. In the 7th paragraph "they need 80 dBm of amplification..." should read, "they need 80 dB of...". In the 8th paragraph also change "the waveguide shows a 1 dBm loss..." to, "the waveguide shows a 1 dB loss..,". Lastly, Mr. Sampson wishes to amend his definition of the word "bel"; "The main definition readers should be aware of, is that 10 dB = 1 bel; therefore, 1dB is 1/10 of a bel. That is, 1 dB is 1/10 of a bel (.1), 6 dB is 6/10 of a bel (.6), and 42 dB is 42/10 of a bel (4.2), etc.."

N2YMW's keyer in "An Inexpensive Morse Code Keyer" ,of the June '95 issue, starting on page 36, had some parts values wrong or left the parts off the list. The schematic, though, is okay.

Here are two equations that should have been part of WA9PYH's "Dish Antenna for Weather Satellite Images" in July 1995's issue: 13. f = D2/16d = 3600/16x8.835 = 25.47"; and 14. Compare to 16.63" + 8.835" = 25.465".

Also in July '95 in WA9PYH's second article, "A Low Noise Amplifier for 1691 MHz" there were errors. In Fig. 5 on page 24, the small holes should be 0.03" and not 0.30" and, in Fig. 6, the "7905 regulator" and all other "7905" should be "7805".

A correction from the Sultanate of Oman pointed out that in May of 1995, the QRX item "Long Walk" on page 8, we implied that Stefan Leca YO8RCW had a Oman license; he did not.

In the July '95 issue, the review "Maldol Antennas HS-2 and HS-75" gave inappropriate designations for the yagis, potentially causing confusion when trying to order either one of them from the dealer. The correct designation for the HS-2 is HSFOX2, and that of the HS-75 is HSFOX75.

The author of the June '95 "Super CW Station", pages 10-16, offered the pre-programmed 87C52 and the PC board for $40, and the convenience pack of all the parts for $85. Some generous readers have been sending $125. What N4UAU meant was that the whole works, including the board and 87C52 are $85, as long as he has parts available. "Stop sending too much money," he cries. Editor's note: if you build this, please keep notes and let us know how much fun you have with it so we can inveigle more readers into having a ball. Share your fun and excitement with a letter to the editor. 73

Number 88 on your Feedback card

Ham Help

We are happy to provide Ham Help free on a space-available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully. A 1, for example, can be misread as the letters I, i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Due to the Silent Key of W2KF, effective immediately, I have taken over the duties of QSL manager for Pedro Katz, HC1OT - HD1OT - HD9OT. Thanks in advance for your help in this matter. Ed Eklin KG8CY, 810 Harry Paul Dr., Lake Orion MI 48362.

WANTED: LCD display (LP156AE) for my ICOM IC 02AT handy. I also need diode D2 on the CPU initialization matrix. I will gladly pay for both. Thanks. Srikanth VU2GSM, PO Box 5053, Bangalore-560 001, India. 73

***73* wants your feedback...**we've been improving *73* for the past months with more articles, easier reading type, etc. And honestly, we *need* your feedback (in detail) if you have any critique either for or against the subtle changes that we've made. We know we can't please everyone everytime, but if you tell us what you want *73* to be, we'll at least try to head in the direction for further "improvements" that might be most appealing to you. Thanks.

Patcomm introduces the PC-16000 HF Transceiver for $1395.00

Featuring Built-In Keyboard/Digital Mode Interface & Digital Signal Processor

Patcomm Corporation™ introduces the PC-16000™, a full featured HF Transceiver with a built-in keyboard interface. Plug a standard IBM-AT* compatible keyboard into a PC-16000™ and instantly enjoy keyboard CW, RTTY (BAUDOT) and ASCII data communications. Incoming morse and RTTY data is decoded and displayed on the built-in LCD display. Data is also sent to an RS-232 serial port for display on a "dumb terminal" or equivalent. The PC-16000™ offers the following features:

- Built-in AT keyboard interface (keyboard optional)
- General coverage receiver (1.5–29.9 MHz)
- Dual up conversion design
- USB/LSB/CW/FSK/AM & optional FM modes
- 160 thru 10m ham band coverage on transmit (CAP & MARS available)
- 100W output power
- DDS driven PLL synthesizer—1 Hz minimum step size
- Selectable variable speed/fixed 10Hz step VFO tuning

- **Basic display lets you know exactly where you are.**

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14.03510-T    0930
14.03510-R    M000
```

- **Standard Display shows RX/TX VFO freq's, time and current memory**

- **Send & Receive in: CW / RTTY(BAUDOT) / ASCII**

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TNX FER QSO, 73
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← **Incoming data**

← **Outgoing data appears here**

Digital Signal Processing Filtering System

- 2.4KHz, 1.8KHz, 500Hz, 250Hz & RTTY "Brick Wall" filters
- Auto notch filter removes multiple hetrodynes on SSB signals automatically
- De-noisier reduces background noise

- Manual notch for CW operation
- Built-in digital power/SWR meter
- 24 hour clock
- Built-in 5–75 WPM IAMBIC keyer
- Select 1 of 3 antennas from the front panel
- Slow/fast AGC
- IF shift

ALL THIS FOR ONLY $1,395.00

Specifications are subject to change without notice.

* IBM AT is a registered trademark of the IBM Corporation.

Patent Pending

(Keyboard Optional)

patcomm corporation

Call or Write for a Detailed Brochure
Major Credit Cards Accepted

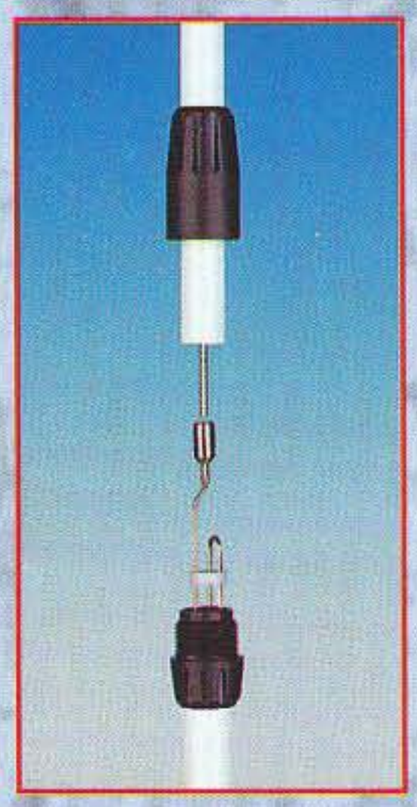
Designed and manufactured in the U.S.A.
Phone: (516) 862-6512 ■ Fax: (516) 862-6529
7 Flowerfield M100, St. James NY 11780

Connect to the world !!

Strict quality standard, technological research and years of experience are at the basis of Sirio's products. A wide range of CB-VHF-UHF antennas and accessories is available. Please, contact us for more information !!!

TECHNICAL DATA

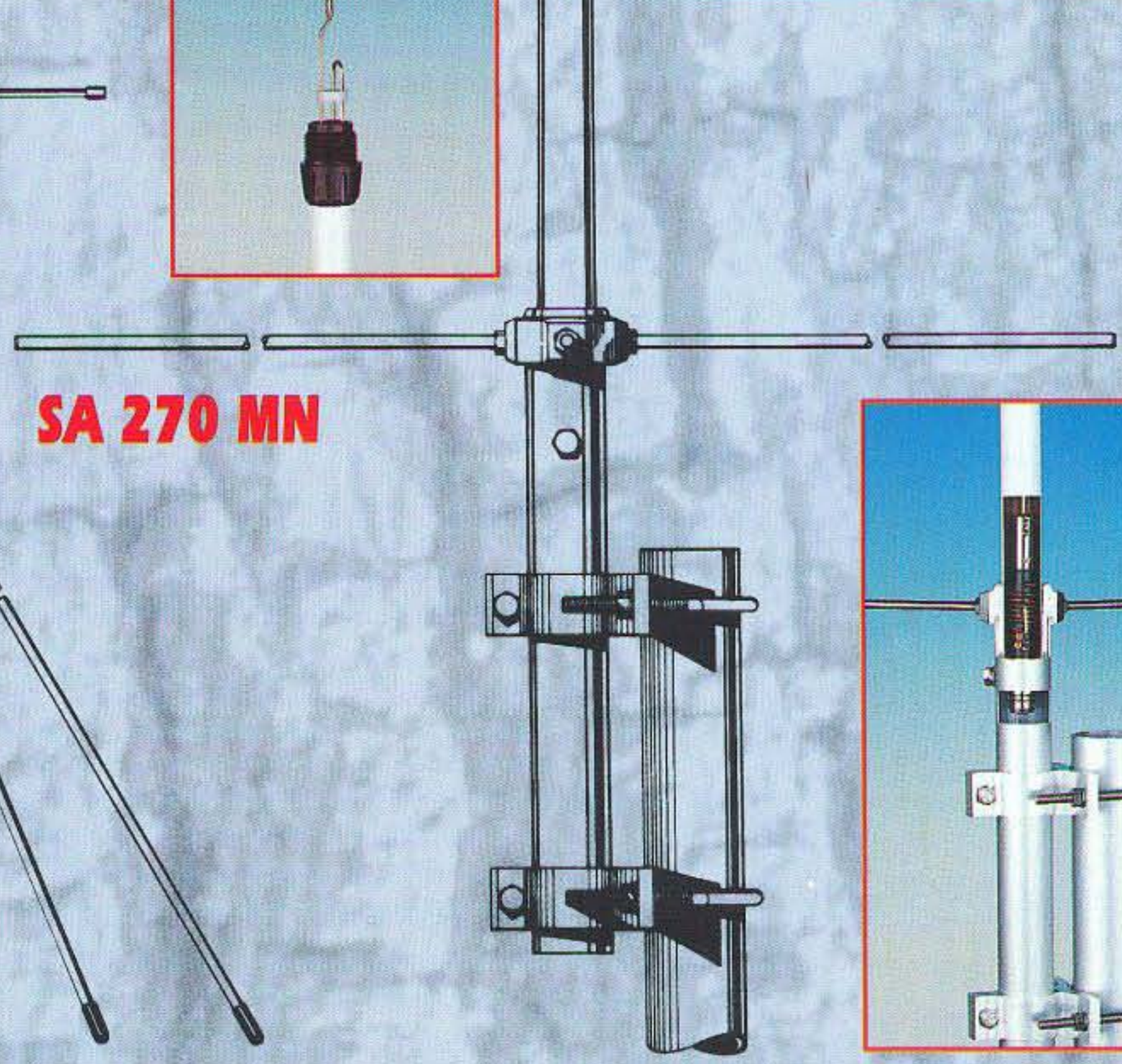
Type: ..... VHF - UHF wide-band DISCONE
Impedance: ..... 50 Ω
Frequency range: ..... Rx 25-1300 MHz
VHF Tx Band: 49-51/120-180/215-300 MHz
UHF Tx Band: .....415-465/610-650/710-1000/1130-1300 MHz
Polarization: ..... vertical
V.S.W.R.: at freq. res.: ..... ≤ 1.3:1
Gain: ..... 0 dBd - 2.15 dBi
Max Power: . VHF 300 Watts ,UHF 200 Watts
Connection:
SD 1300 U: ..... "UHF" female
SD 1300 N: ..... "N" female
Wind resistance: 40m/second
Length (approx.): ..... 1700 mm
Base diameter: ..... 850 mm
Weight (approx.): ..... 1300 gr
Mounting mast: .....ø 25-54 mm



SD 1300 U/N

TECHNICAL DATA

Type: ..... VHF 6/8 λ UHF 3 x 5/8 λ Ground Plane
Impedance: ..... 50 Ω
Frequency range: ..... VHF 142-148 MHz UHF 430-440 MHz
Polarization: ..... vertical
V.S.W.R. at freq. res.: ..... ≤ 1.2:1
Bandwidth: at VSWR 2:1: .....VHF 6 MHz, UHF 15 MHz
Gain: ..... VHF 4 dBd - 6.15 dBi UHF 6 dBd, 8.15 dBi
Max Power: ..... 200 Watts
Connection: ..... "N" Female
Wind resistance: 60m/second
Length (approx.): ..... 1800 mm
Radial length (approx): ..... 170 mm
Weight (approx.): ..... 950 gr
Mounting mast: ..... ø 35 - 54 mm



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SIRIO antenne 46049 VOLTA MANTOVANA - MN - ITALY - Tel. (39) 376/801515 - Fax (39) 376/801254
NORTH AMERICA OFFICE: TORONTO - CANADA - TEL. (519) 650 9277 - Fax (519) 650 1779