ICD 08241

Amateur Radio

SERVING AMATEUR RADIO SINCE 1945
APRIL 1996

CQ

In This Issue

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- **A Really Cheap 20 Meter Rotary Dipole**
- **Talking 9600 Baud On Packet**
- **Test Equipment Bargains**
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the cover: Bill Hider, N3RR, Rockville, MD

U.S. $:

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THE RADIO AMATEUR'S JOURNAL

MINI-MOBILITY SUPER SIMPLICITY

Powerful Portability

Kenwood's popular TS-50S is an extra-compact HF transceiver that's perfectly sized for mounting in a vehicle or taking on a DXpedition. Yet it's powerful too, offering spectacular TX/RX performance that's on a par with the big rigs. Maximum RF output is 100 watts (25W on AM), and all modes — LSB, USB, CW, AM and FM — are supported. The new ultra-light PS-40 compact switching power supply (option) is great for travel.

Intuitive Menu System

When time's at a premium, the user-friendly menu system allows you to rapidly adjust just about any setting with a minimum of fuss. The menus are also accessible via the supplied microphone.

Operating ease is further enhanced by 100 memory channels and extensive scan functions.

DDS with Fuzzy Logic Control

The fuzzy logic control circuitry allows for slow or fast tuning of the band.

AIP (Advanced Intercept Point)

Kenwood's renowned AIP system raises dynamic range to 105dB, giving the TS-50S first-class receiver performance.

Other Features

- RF output power control (100W, 50W, 10W)
- Large LCD panel with digital bar meter
- Auto-mode capability
- Dual VFOs (A and B)
- TF-SET
- Carrier-operated scan stop mode
- Switchable AGC circuit (SLOW/FAST)
- All-mode squelch
- CW reverse mode
- 20dB attenuator
- IF shift ▮ Noise blanker
- Multi-function microphone supplied
- Optional YK-107C 500Hz CW filter
- Optional AT-50 external antenna tuner
- Optional PS-40 switching power supply
- Optional TC-50 travel case

TS-50S
HF TRANSCEIVER

TS-60S
50 MHz ALL-MODE TRANSCEIVER

6-Meter All-Mode Performance

Confidently holding its own against much larger rigs is the TS-60S 50MHz all-mode transceiver. Thanks to a pair of MRF492 final transistors, it delivers an impressive 90 watts in SSB, CW and FM modes (23W in AM).

First-Rate Interference Reduction

In addition to Kenwood's AIP circuitry, the TS-60S is equipped with IF shift (SSB & CW), a 20dB attenuator, CW reverse mode, and a pulse noise blanker. A 500Hz CW filter is optional.

100 Memory Channels

The TS-60S may be small in size but it's big on memory: 100 channels store transmit and receive parameters such as frequency, mode, and filter settings. Memory shift transfers data directly to the VFOs.

Multi-Function Microphone

The supplied MC-47 remote-control microphone has 4 programmable function keys that provide rapid access to chosen menu functions — perfect for mobile operation.

Other Features

- DDS (Direct Digital Synthesizer) with fuzzy logic control
- Large LCD panel with digital bar meter
- Auto-mode capability ▮ Dual VFOs (A&B)
- Dual-menu system ▮ All-mode squelch
- Switchable AGC circuit (SLOW/FAST)
- Full break-in and semi break-in
- TF-SET ▮ TO and CO scan stop modes
- Relay & ext. ALC terminals
- 3-position RF output power control
- Dimmer control ▮ Auto power-off
- Optional PS-40 switching power supply
- Optional TC-50 travel case

ISO 9002
Meets ISO Manufacturing Quality System

KENWOOD

KENWOOD COMMUNICATIONS CORPORATION
AMATEUR RADIO PRODUCTS GROUP
P.O. Box 22745, 2201 E. Dominguez St., Long Beach, California 90801-5745
Customer support/Brochures (310) 639-5300
Repair Locations/Parts (800) KENWOOD Bulletin Board Service (BBS) (310) 761-8284
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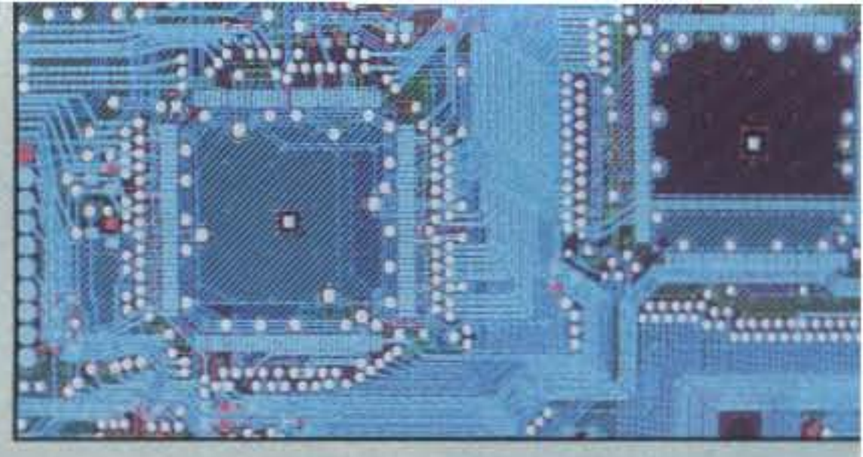
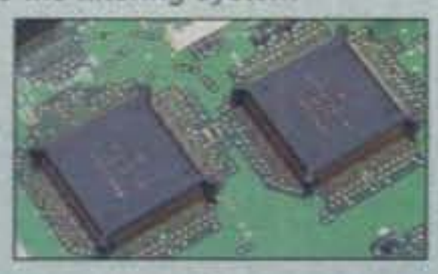
HF TREASURE

Intelligent Digital Enhanced Communications System



State-Of-The-Art IF-Stage DSP

Once again Kenwood defines the standard with next generation DSP. Utilizing dual digital signal processing chips, the TS-870S captures wave forms at the IF stage (including AGC circuit) in realtime to provide unmatched clarity, noise reduction and control over inbound or outbound signals. The DSP chips deliver a dynamic range of 144dB, enabling you to detect previously unheard signals and customize the filtering system through the menu interface. No other transceiver on the market gives you this much power and flexibility.



Digital Filters

Applying complex algorithms at the IF stage allows you to attain filtering that is unattainable with conventional analog circuits. For instance, you can shape the filter sharp enough to obtain over 100dB out of pass band attenuation with virtually no signal loss. Through the menu-driven interface on the front panel, you can apply standard filters or customize and store them for rapid and convenient access. And because it's all digital, there is no additional cost of optional filters!

Two Noise Reduction Methods

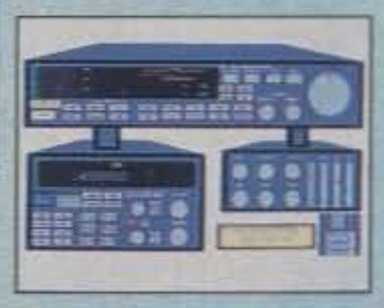
Choose from 2 methods of noise reduction: Line Enhancer Method (LEM) or Speech Processing/ Auto Correlation (SPAC). LEM allows you to custom-shape a filter curve around a target signal, essentially 'carving' it out of the background noise — a powerful tool in SSB operation. For tough CW conditions use the SPAC function, which employs a statistical correlation algorithm to pull weak signals out of the background.

IF Digital Auto-Notch

Another benefit of IF-stage DSP is the ability to detect and eliminate broadcast carrier and continuous beat signals far more effectively than analog systems. It automatically tracks beat signal changes so you can 'set it and forget it'.

57.6 Kbps Computer Control

High speed computer control is available through a built-in RS-232C port and supplied Windows®-compatable software called RCP (Radio Control Program). This enables access to most functions of the TS-870S including on/off, frequencies, bands, modes and more. It's also possible to "create" a customized screen radio, based on an original design or the included templates.



Built-In K1 LogiKey Keyer

Sophisticated CW operation is possible with the built-in K1 LogiKey electronic keyer with full or semi break-in, DSP-adjustable rise/fall times, and side tone monitor. A second keyer may also be connected to the TS-870S.

Easy-Access Menu System

Control all of the rig's functions through the menu-driven user interface on the front panel. It also incorporates a Quick Menu feature for rapid access to your most commonly used functions.

Dual Antenna and RX Out

Switch between 2 separate antenna systems from the front panel, plus attach an external receiver to the TS-870S for maximum antenna utilization.

Other Features

■ Beat cancel ■ Variable AGC ■ Selectable voice equalizer (SSB & AM) ■ Speech processor ■ Selectable transmit equalizer ■ 100 watts output on SSB, CW, FSK; 25 watts on AM ■ 100 kHz - 30 MHz general coverage receiver ■ Built-in automatic antenna tuner (TX & RX) ■ Dual VFO with 100 channel memories plus 5 channel quick memory ■ Full band scan, programmable band scan, group scan, memory scan with memory channel lock-out ■ Built-in tone encoder ■ High-quality 60-second digital recording unit option (DRU-3) ■ Voice Synthesizer unit option (VS-2) ■ Modifiable for MARS/CAP*

*Permits required for MARS and CAP use. Specifications guaranteed for Amateur bands only.
Kenwood follows a policy of continuous advancement in development.
For this reason, specifications may be changed without notice.

TS-870S

HF TRANSCEIVER

ISO 9002 Meets ISO Manufacturing Quality Standards

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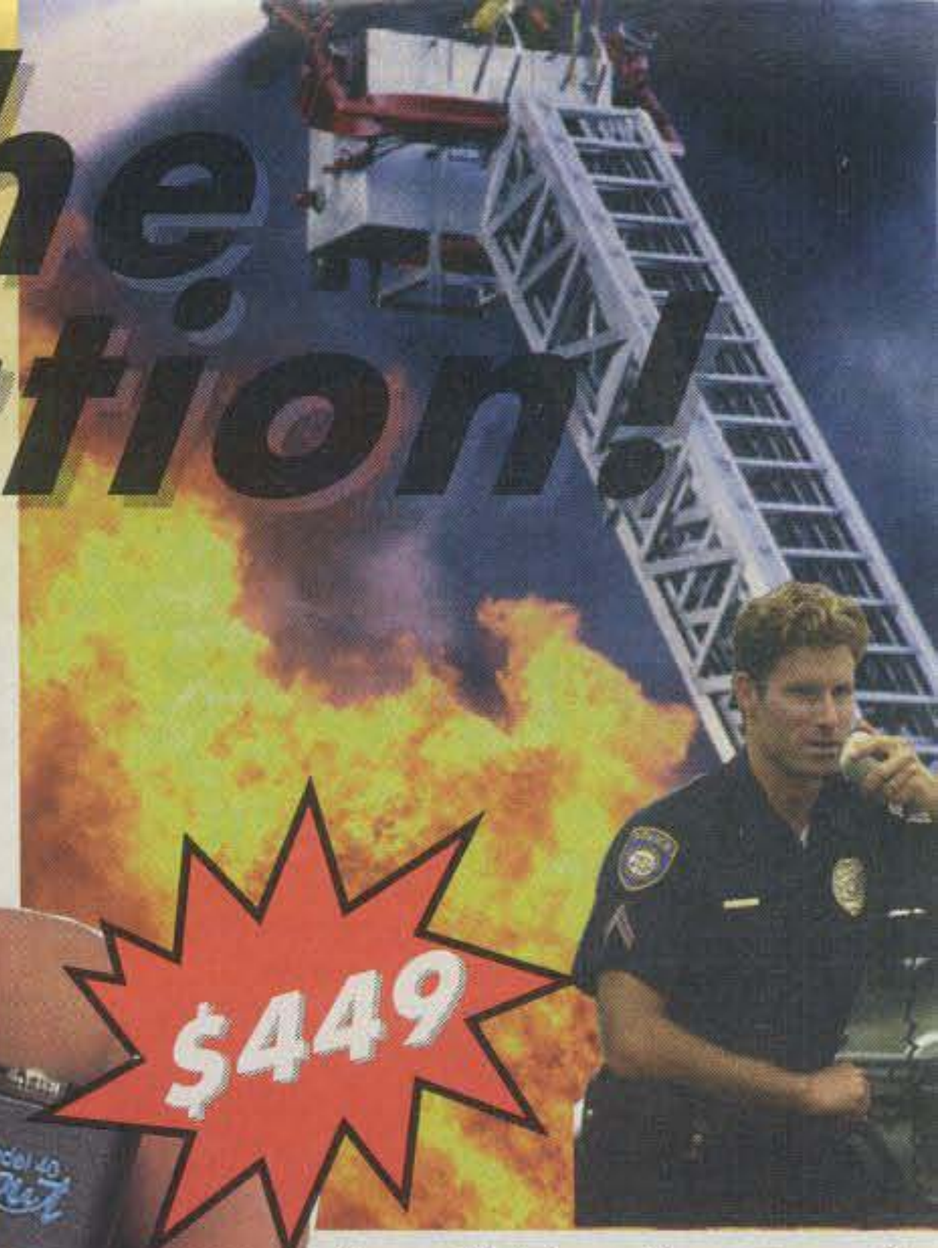
Capture the action!



Don't Miss Out!!
Purchase a Scout for only $449.00
& Receive Free:
- DB32 Mini Antenna
- CC30 Carry Case
- Spectrum FCC CD

Total package value $526.00
For only $449.00
LIMITED TIME ONLY!!

$449

SAC8000 $35

•Using the optional SAC8000 is a snap-Just plug and play. SAC8000 includes cable, back panel with slot, and velcro attachments.

Scout® Reaction Tune® brings you all the action. Whether it is police, fire, commercial or just everyday communications monitoring, the Scout will bring you closer to the action. The Scout will not only capture the frequency, but it automatically tunes the receiver to that frequency at the same time; (*see receivers appl. below*). Let the Scout Reaction Tune your way into the world of communications.

FEATURES

- Records up to 400 unique frequencies in memory.
- Records up to 255 hits on each frequency in memory.
- 10MHz - 1.4GHz single frequency range.
- Records frequencies automatically with Patented Digital Auto Filter & Digital Auto Capture.
- Reaction Tune the AOR AR8000, AR2700, ICOM R7000, R7100, R9000, Radio Shack Pro 2005/2006 with OS456 installed, and the Radio Shack Pro 2035/2042 with OS535 installed.
- All frequencies are automatically saved until deleted.
- Interface to a PC with the optional ***OPTOLINX*** or ***CX12AR*** for data download.
- Custom 10 digit LCD display with automatic EL backlighting.
- 16 segment RF signal strength bargraph.
- Pager style vibrator for discreet recording. Distinctive beeper indicates frequency detection.
- Rapid charge NiCads with AC charger supplied; 2 hour recharge and 8-10 hour battery discharge.

SPECS

Frequency Range: 10MHz - 1.4GHz
Input Amplifier: 50 Ohm vswr <2:1
Sensitivity: 1mV 30MHz - 900MHz
Maximum Input: +15dBM, 50 milliwatts
Display: 10 digit LCD with backlight
Operating Time: 8 - 10 hours
Power: 2VDC 1 Amp wall plug adapter for rapid charging. 6VDC 130mA minimum operating power required. AC90 adapter supplied.

Factory Direct Order Line: 1-800-327-5912

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CQ Amateur Radio

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Features

Departments

ON THE COVER: The highlight of Bill Hider, N3RR's antenna farm is his impressive 134 ft. tower in the background. This structure is the support for an EF180A 80 meter rotary dipole at 149 ft., 5-el 10 meter Yagi at 141 ft., and 402CD at 134 ft., all turned with a ring rotor. The smaller 55 ft. tower in the foreground holds an A4 tribander.

Bill's primary interests in amateur radio are contesting and DXing. When he's not sitting in the shack, he serves as Vice-President of Telecommunications for Gannett Communications, Inc., publishers of *USA Today*. Bill was *USA Today*'s 12th employee, with initial responsibility for establishing their worldwide corporate satellite network.

Bill shares his life with his wife, two children, and four cats in their Rockville, Maryland home. (Photo by Larry Mulvehill, WB2ZPI)

ZERO BIAS

AN EDITORIAL

I know it's April, but how come I'm not going to Dayton? For over 30 years, through thick and thin, I've celebrated the official end of winter by contemplating the trip to amateur radio nirvana, the Dayton Hamvention. This year, which has been one of the most miserable winters on record, produced a vengeful hedgehog from Pennsylvania who practically assured us of six additional weeks of winter. Here on the east coast we like to look at it as penultimate antenna weather, where only the strong survive. The only thing we advise our gallant friends is not to wear white when climbing the tower. If something were to happen, it could be June before anyone would see you hanging there.

In case you haven't heard the news, the "Big One" in Dayton is being held next month this year, which should help to explain why it was so easy to get a hotel room in Dayton in April this year. The primary reason for the switch purportedly is hope for warmer (and drier) weather, although for some of us it also represents a primitive rite, a celebration of an amateur radio solstice, a gathering of the clan to usher in the new planting season of our hobby. By all predictions and accounts, May will be the absolute bottom and turning point of the current sunspot cycle. The sun will shine once again, and the bands will show the greening of life and renewed activity.

Soon the DX buds will slowly begin to form, and once again we'll hear the resplendent calls of nature—"Split, Split" . . . "Up 5, Up 5" . . . "What's (your, his, their) call? What's (your, his, their)?"—filling the once desolate bands. It's the young, fledgling new amateurs spreading their wings, much to the consternation of the older veterans of one or more cycles who are now higher up on the food chain and most deserving. It is the amateur radio hint of spring, the tingle of new beginnings in the air. What better place is there to celebrate and to rejoice but Dayton?

If you are a veteran of at least one cycle, then you also are aware (or should be) of what and who beat you out of all the good stuff you should have worked but didn't. You should be able to recall the thrill of the chase, the hunt, and the elusive quarry. You probably still remember what it felt like to make your first DX contact and hear your own call come back at you from halfway around the globe, or even from the next state. If all of this jars some memories, then you have the best reasons there are to be in Dayton this May. You're not going into another cycle bemoaning the "if onlys." You know, the kind of things you went through this past cycle: "if only I had a better transceiver," or "if only I had a better antenna," or "if only I could run more power" to whatever you thought might give you an edge. What you need in the way of equipment, hardware, and parts will be at Dayton in ample supply. What you need to know to maximize their use will be covered by pros and world-class experts in seminars that weekend. There is no need to get caught short this time around.

If you're a new amateur going into your first complete cycle, let me tell you that you're heading into a very exciting period—the stuff dreams are made of. It's all there, it's all brand new, and it's all yours. All the possibilities and things that sparked your interest in getting a license in the first place are just ahead. For you, too, Dayton is a wonderful way to experience what the hobby is all about and to explore all the extraordinary things to do. It's a quick way to learn about and immerse yourself in the world's greatest hobby.

Obviously, you can pick up a lot of this at your local hamfests, but there is nothing of the magnitude of Dayton anywhere else in the world. No, this isn't my hype trying to separate you from either your hard-earned money or your beloved Globe King. I'm just trying to put you in a physical position to actually see the latest in everything devoted to amateur radio, including your fellow amateurs. It's one thing for a salesman or an editor to tell you about something, and it's quite another when you see your fellow amateur react to it.

The next time you're at Dayton or any other hamfest, look around at your fellow amateurs. You virtually can see the enthusiasm and interest, you can hear it in what they say and ask, and you can feel their immense sense of satisfaction in what they do. Granted, a few might be just a bit too intense, but in general what you are experiencing is their sense of joy in what they do. This holds true for whatever special interest they might have within the hobby. I sometimes feel that even the tiny group who derives a sort of self-imposed misery finds that misery enjoyable, if not satisfying. Judging from the people you meet at any hamfest, it's quite evident that the vast majority of amateurs are having a good time doing what they do.

Reality dictates that most of us simply can't chuck everything and build a brand-new station complete with a multi-acre antenna farm. Most of us, though, can make significant improvements to what we have simply by rethinking some of the accessories we thought we could do without and some of the ad-on units that are available. The parts that involve listening, skills, and perseverance are still free, but do involve the investment of time, patience, and practice. There are good times ahead, and there's plenty of time for us to prepare ourselves for it.

If you're newly licensed or someone who is thinking about working towards a license, rest assured that you won't be spending eons singing your rendition of "The Sounds of Silence." The world is coming back, and you're in the right place to take advantage of it. It left a little at a time, and it will come back a little at a time. If you're into DX, now is the time to familiarize yourself with prefixes (and their variations) to quickly recognize what country you are hearing. Learning propagation techniques gives you an idea of when things are possible and lets you make efficient use of your free time. Trying your hand at a few contests now will definitely improve your phone or CW operating skills in a less-crowded atmosphere. Certainly during these times your contact will be more than greatly appreciated. It's also a good time to practice using the other fifty controls and knobs on your transceiver to find out just what they really do. You can also spend some time with your multiband, micro-button HT to find out what it's really capable of doing. While the world might not have gone away up there, you may be stuck in one tiny corner of it.

If you've done all the above and then some, and you still come up short, it may be time to move on up to the big time. This, of course, brings us back to Dayton and the opportunity to see and find out about a lot of things that some folks already seem to know. It's learning, it's catch-up, and it's a lot of fun. If you want to find out if it's worth the time, effort, and money to get involved in a new mode, then Dayton is also the place for you. You can see, touch, and experience just about everything available for that mode, as well as meet probably a couple of hundred devotees who can fill you in on what you've already missed and all the wonderful things you can do now.

Finally, for those of you whose license is about to expire and who haven't been active for a long time, come on out to Dayton or any other hamfest and take a look around. You'll see a lot of old friends, although you might not recognize some. Some of us may have put on a few pounds, lost some hair, and now wear glasses, but we all have a great time together and we'd like to see you there again, too. The mystery of wireless that brought us together is still there, and the dream or fantasy (actualized or not) is still there waiting for you and the rest of us.

We're all moving ahead into a new cycle. The operant word will be *more*. There certainly will be *more* activity, *more* DXpeditions, and seemingly *more* contests. Actually, it will be the same contests with far more participation. And the best aspect of *more* is that *more* of us will have *more* fun with amateur radio.

73, Alan, K2EEK

The Mode Warrior

The AEA DSP-232 Multi-Mode Data Controller

DSP 232 AEA MULTI-MODE

NEW

The AEA DSP-232

The DSP-232 multi-mode data controller—is *the* mode warrior. AEA engineered the first DSP data controllers nearly four years ago. AEA's PK-232MBX is the most popular data controller ever. Now, AEA has combined the power of Digital Signal Processing technology with affordability. We are proud to introduce the AEA DSP-232, our newest multi-mode data controller. It offers state-of-the-art DSP signal filtering, advanced modem performance, cutting-edge features, and an eye toward the future.

The Modes

Operate all the popular modes on two computer controlled radio ports. 9600 and 1200 bps VHF packet come standard. HF packet, PACTOR, AMTOR/SITOR, RTTY, CW, TDM, and NAVTEX—all standard. Plus, when new modes come out, like PACTOR II, this unit will handle them. Whatever your license class, the DSP-232 is your ultimate digital platform today and for years to come.

The Processor

At the heart of the DSP-232 is a high-speed Digital Signal Processor providing superior filtering. AEA data controllers are known for excellent filtering and shape-factor—the DSP-232 goes a step beyond. Noise is not a problem with the steep-skirts created by the analog to digital filters. Coupled with the memory ARQ, hardware HDLC, and DCD state machine, the DSP-232 is truly a warrior for all modes—battling through noise so you connect.

The MailDrop

Full PakMail™ MailDrop facilities for packet, PACTOR, and AMTOR are included. The DSP-232 comes standard with 18K (32K RAM) of dynamically allocated mailbox space and is expandable to a whopping 242K (256K RAM)! You even control what call signs have access to your mailbox.

The Future

Where other TNC manufacturers are spending money marketing their outdated hardware, AEA is developing innovative, new equipment. Look at the features. Look at the price. Look at all the AEA computer software available. You will see that the DSP-232 was designed to be a powerhouse for all skill and budget levels. As with other AEA data controllers, we've designed the new DSP-232 to handle whatever the future brings, making this your digital platform for the next decade.

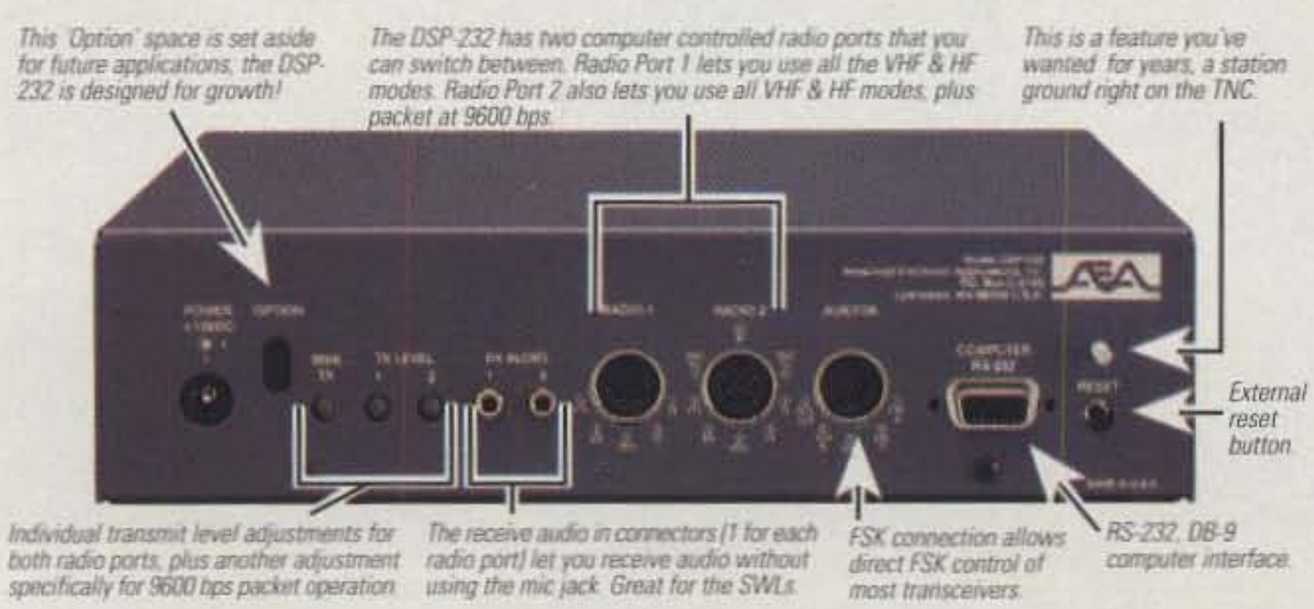
This is the right machine for advanced digital users. A smart choice for beginners because it's loaded with features now and will grow as you do in the years to come. The tradition of the PK-232 continues with the new DSP-232.

Includes

The AEA DSP-232 comes with a detailed manual, two RX audio cables, one 2.1mm power cable, one 8-pin and one 5-pin DIN radio cable, one PC-comp. DB-9 male-to-female RS-232 serial cable, one wire loop-back jumper, one 5-pin DIN plug for FSK/AUX connections, and a limited one year warranty.

You don't just buy the front of a data controller. . .

Why not just use a PCB data controller? Why not go for the smallest data controller? Take a look at the back of AEA's DSP-232 and you will see why. We have built our controllers to make life simpler for you. There are more input connections, more output connections, more external adjustments, and room for future growth and upgradability. PCB data controllers are difficult to work with. Small controllers don't provide proper connections and expandability. AEA engineered the DSP-232 to be compatible with the equipment you have now, to offer convenient adjusting, and to be upgradable for future applications.



Features

- Fast Digital Signal Processor (DSP)
- Upgradable for new operating modes
- 9600 & 1200 bps VHF/UHF packet
- PSK satellite modems built in
- 300 bps HF packet, PACTOR, AMTOR/SITOR (ARQ & FEC), RTTY (Baudot & ASCII), CW, TDM, NAVTEX
- Two switchable radio ports with rear-panel AFSK pots for both ports and another pot for 9600 bps packet
- 18K (32K RAM) PakMail™ Mailbox expandable to 242K (256K RAM)
- GPS firmware compatible with GPS, Loran, ARNAV, and ULTIMETER-II™. Allows for remote control, polling, auto GPS initialization, plus more!
- Automatic threshold command
- SIAM™ automatically identifies HF signals & switches to them
- PACTOR memory ARQ
- Gateway firmware which works as a packet node and identifies TCP/IP, TheNet, and NETROM stations.
- DCD state machine for 9600 & 1200 bps packet
- PACTOR, AMTOR, & Packet MailDrop
- LED readout displays system status
- Up to 19,200 bps terminal baud rate
- Full-duplex Packet capability
- Optional AEA WeFax receiving software available for DOS & Windows™
- Optional AEA ACARS™ software
- Compatible with most all popular control programs including AEA's own PakRatt for Windows 2.0, PC PakRatt II for DOS, & MacRatt 3.0

Call AEA's 24-Hour Literature Line for more information on the DSP-232 at (206)712-8054 or use CompuServe to download files at 76702,1013

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AEA *Connect with us*

ANNOUNCEMENTS

•Oklahoma County American Red Cross Special Event Station – Those operators who worked at the Red Cross during the Oklahoma City bombing are holding a Special Event station to thank Americans for their support on behalf of the Red Cross. They will be on from 9:02 AM April 19 to 9:02 April 20 on 14.250, 7.250, 3.875, 21.300, and the 146.925 repeater. For a certificate send an SASE to Mike Cox, 9908 S. Douglas Avenue, Oklahoma City, OK 73139.

•Northeast Connection Supporters have scheduled a fox hunt for April 13. The first three hunters to locate the fox will receive prizes. All others will receive certificates of appreciation. For more details, contact Sid, KB2RNQ, or write to P.O. Box 551, Central Valley, NY 10917.

•The following Special Events are scheduled for April:

• **/VOA**, Piscataway, New Jersey; The Piscataway ARC; to commemorate the WWII operation of Voice of America relay station WBOU; April 6–7; operation on CW Novice portions; Phone, lower third of the General portion of the 75 through 15 meter bands and the Novice portion of the 10 meter band; and RTTY operations on 80, 40, and 20 meters. For certificate, send QSL and SASE to station worked.

KA1NMA, Plymouth, Massachusetts; Bay Colony Astronomical Society; to commemorate Astronomy Day 1996; 1700–2100Z April 20; operation in the Novice section of 10 meters on 28.455 MHz and intermittently on 146.52 FM. For QSL, send SASE with card and report to: Robert A. Johnson, ARS/ KA1NMA, B.C.A.S., 7 Morton Park Road, Plymouth, MA 02360-3554.

KB2UYI, Fairfield, New York; Fort Herkimer ARC; to commemorate the Town of Fairfield Bicentennial; 1400–1900Z April 6; operation in the 20 meter General phone, 40 meter Novice CW, and 40 meter General portion, 2 meters 145.110. For certificate, send QSL and SASE to Madeline Loiacano, AA2AT, 96 Grove St., Ilion, NY 13357.

W2DMC, Nanuet, New York; Crystal Radio Club; to celebrate the 65th anniversary of the club's license and ARRL; 1500–2100Z April 28; in lower 50 kHz of the General 40 and 20 meter phone subbands and Novice 10 meter phone subband. For certificate, send QSL and 9 × 12 SASE to Thomas J. Nervegna, AA2RD, 13 Amanda Court, Monsey, NY 10952-4138.

KB4GET, Appomattox Courthouse National Historical Park, Appomattox, Virginia; Southside ARA; to commemorate the ending of the U.S. Civil War in 1865; 1400Z April 13 to 1400Z April 14; SSB in the General portions of 40 and 20 meters. For QSL send SASE to Robert M. Driskill, Rt. 2, Box 107D, Keysville, VA 23947.

W4CN, from the 122nd Kentucky Derby, Louisville, Kentucky; Amateur Radio Transmitting Society; to commemorate The Run for the Roses; 0001Z April 27 to 2400Z May 3; operation 3.850, 7.250, 14.250, and Novice 3.725, 28.400, and 7.125. Send name, address, and QSL to Shelby Summerville, KI4DC, 6506 Lantana Court, Louisville, KY 40229-1544.

W4UCJ, Thomasville, Georgia; Thomasville ARC; to commemorate the 75th Annual Rose Festival; 1700–2300Z April 26 and 1100–2000Z April 27; in lower portion of the General 80, 40, 20, and 15 meter phone subbands and Novice 10 meter phone subband. For certificate, send QSL and 9 × 12 SASE to TARC/Rose Festival Station, P.O. Box 251, Thomasville, GA 31799.

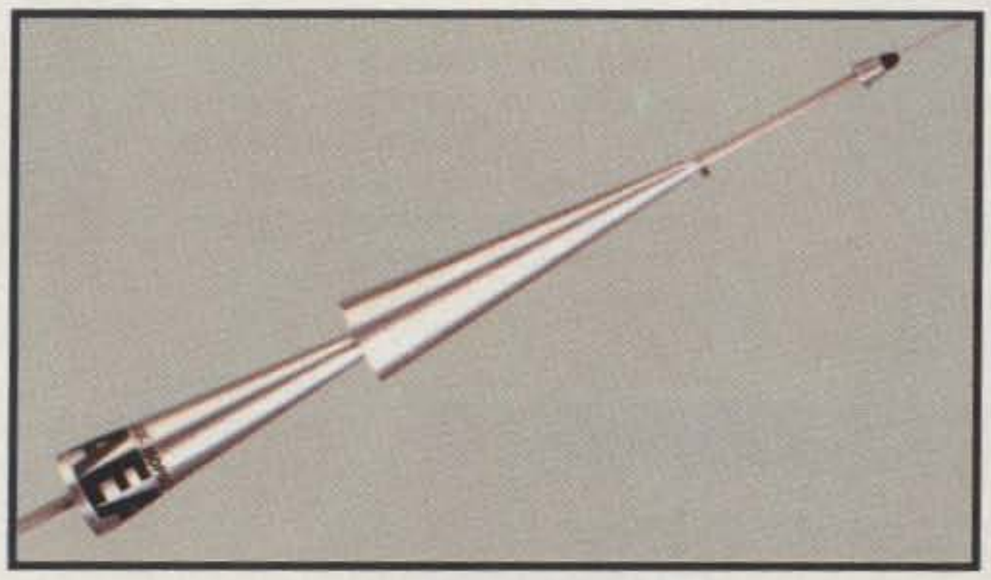
WB6DWY, from The Valley of the Moon Hamfest, Sonoma, California; The Valley of the Moon ARC; to commemorate the City of Sonoma and the Valley of the Moon's historical heritage; 1700–2200Z April 21; operation on 20 and 40 meters at 7045, 7250, and 14250 MHz during the hamfest. QSL

(Continued on page 114)

Go Far With an Antenna From AEA

IsoLoop

- A 35" loop antenna that performs like a full-wave dipole cut to the length of the frequency being used.
- The ideal compact antenna for amateurs facing antenna restrictions or space limitations.
- Efficiency ranges from 72% on 20m, rising to 96% on 10m.
- High-Q design results in narrow bandwidth.
- Frequency range: 10-30 MHz, continuous.
- Omnidirectional, comes with manual tuner.
- Optional automatic tuner available.



IsoPole

- Patented decoupling cones give you maximum gain possible on the horizon for the length.
- Unique conical shape means lowest feedline pick-up of computer hash noise of any competing antenna.
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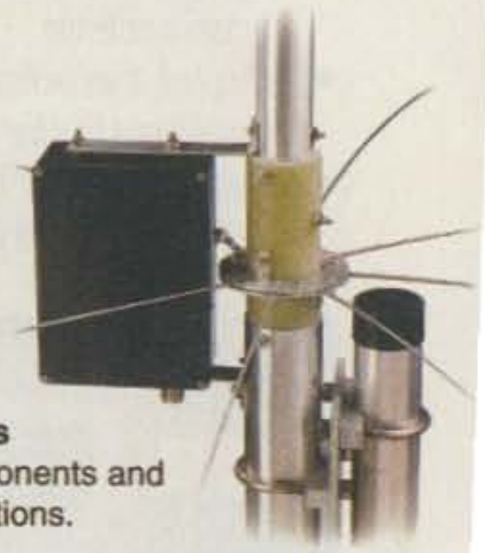

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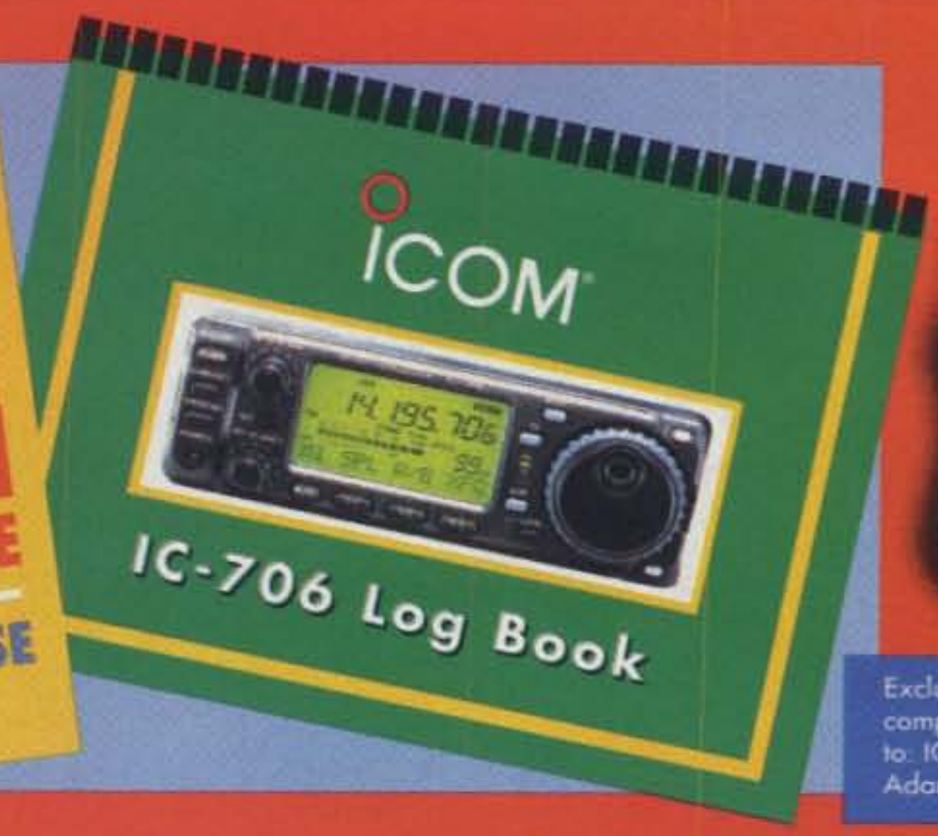

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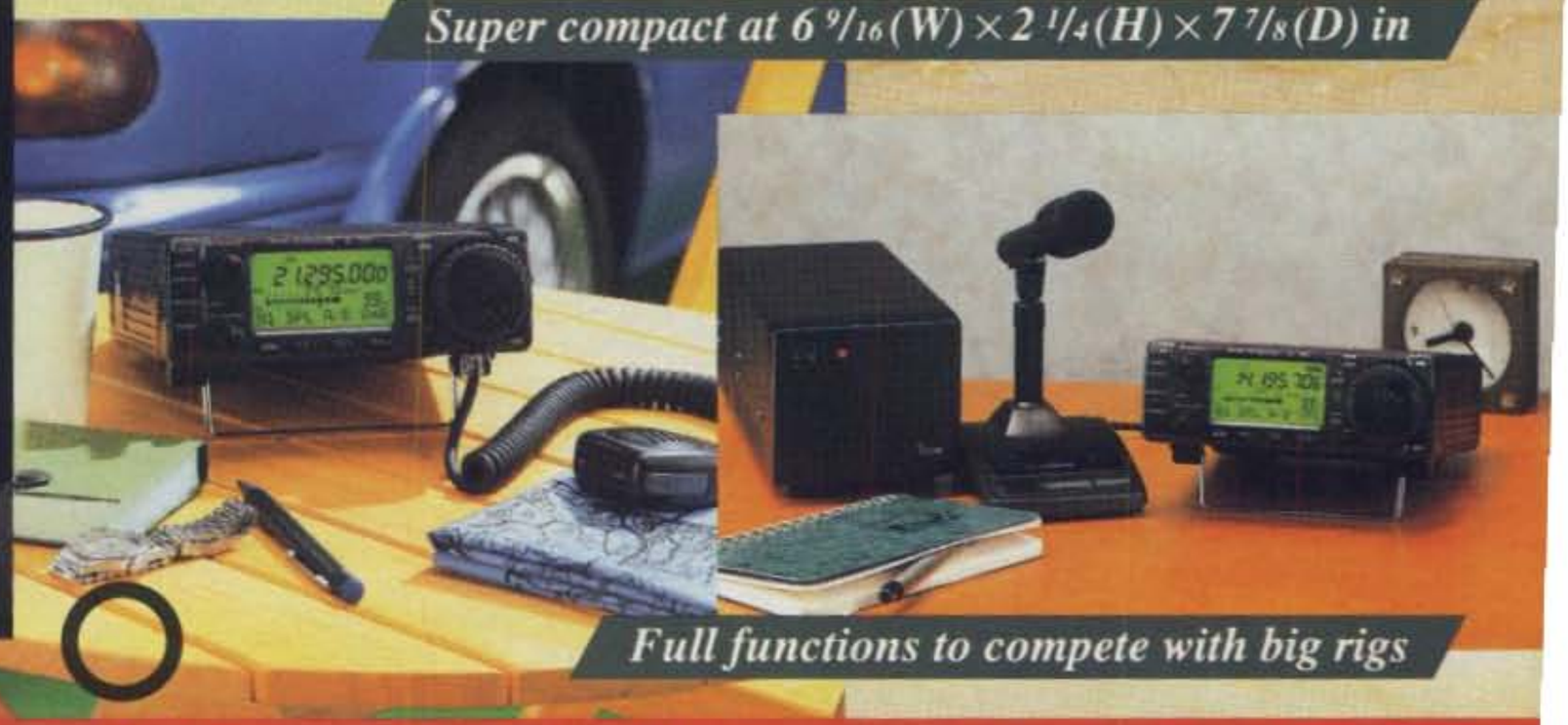

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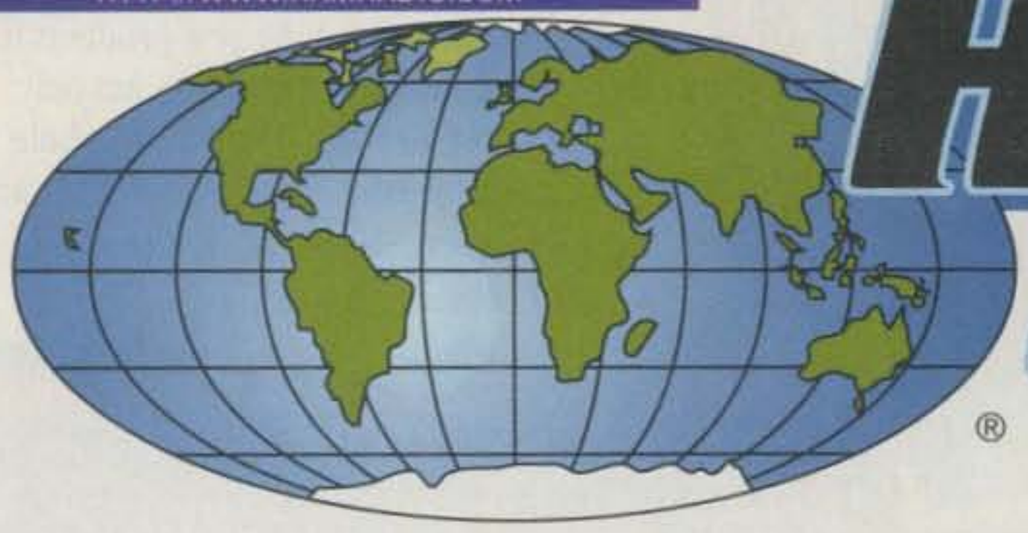

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How To Stay at The Top of The DXCC Honor Roll Until You Reach At Least Age 100

In this article Professor Heisseluft reveals top DXers' secret plan to live to age 100 or beyond.

BY PROFESSOR EMIL HEISSELUFT*

Lauton Institute
Grossmaul-an der Donau, Austria

There's a joke among DXers to the effect that one way to get to the top of the DXCC Honor Roll is to outlive the other members of the Century Club. And while the ranks of those who have "worked 'em all" is growing, there will, unfortunately, continue to be turnover at the top, especially among older members whose total country scores, including deletions, are in the 380s. Now Professor Heisseluft reveals details on a research project at the Lauton Institute that is intended to uncover ways of slowing the aging process. The work is sponsored, in part, by three radio amateurs, all of whom seek to stay at the top of the Century Club's Honor Roll for a long time to come.

Alan, K2EEK

Dear readers, I am about to reveal the details of a research project at the Lauton Institute's Genetic Engineering and Research Center (GERC)[1] that will astound you! The research, sponsored in part by three very wealthy radio amateurs living in the United States, Europe, and Japan, is intended to discover and develop a new drug that will slow the aging process. Once they have taken this drug, and once they are assured that their aging processes have been slowed, the trio will apply for DXCC, confident that they will remain at the top of the Honor Roll for decades to come.

For reasons due to professional ethics, I cannot reveal the names or calls of the operators involved. But I can tell you a little about them. Believe it or not, none has yet applied for DXCC! Each of them, however, has all of the current, activated countries worked and confirmed. In addition, the U.S. amateur, who lives in the northeastern part of the country, has all but one of the deleted countries worked and confirmed, missing only French Indo-China (FI0). The European and Japanese operators both are missing two deleted countries; the former is missing Netherlands New Guinea (JZ0) and Java (PK1), while the latter is missing Saar (9S4) and French India (FN8). Actually, the Japanese operator worked a station in what used to be called French India at 0320 GMT on December 21, 1950, but it was too late for him to earn separate-country credit.

The idea that life could be extended, perhaps indefinitely, has cast a spell over humankind for thousands of years. Today we spend billions of dollars every year on creams, cosmetic surgery, and the like in a vain attempt to stall Mother Nature's onslaught! However, according to Dr. Leonard Hayflick, a distinguished scientist who once taught at the University of California at San Francisco and Stanford University, and who now is working in the area of biogerontology, it should be possible in the next century for most people to reach 100 years of age or more in pretty good health.[2] In pursuit of this goal, Hayflick focused his efforts on the genetic basis for cell aging. For his discoveries in this area, biologists now refer to the threshold where cell aging begins as the "Hayflick Limit."

The staff of the Lauton Institute was indeed fortunate to have Dr. Hayflick present his theories at the Center during the summer of 1991. At that time our scientists were just beginning to work on a means by which to prevent chromosomes from losing a substance known as telomere. As seen in fig. 1, it was the loss of telomere, we believed, that caused cells to die.[3] When Dr. Hayflick confirmed our findings on telomere, we were elated. But there was a problem. Funding, which never was available in great amounts, now was running low. And to make matters worse, some of the people

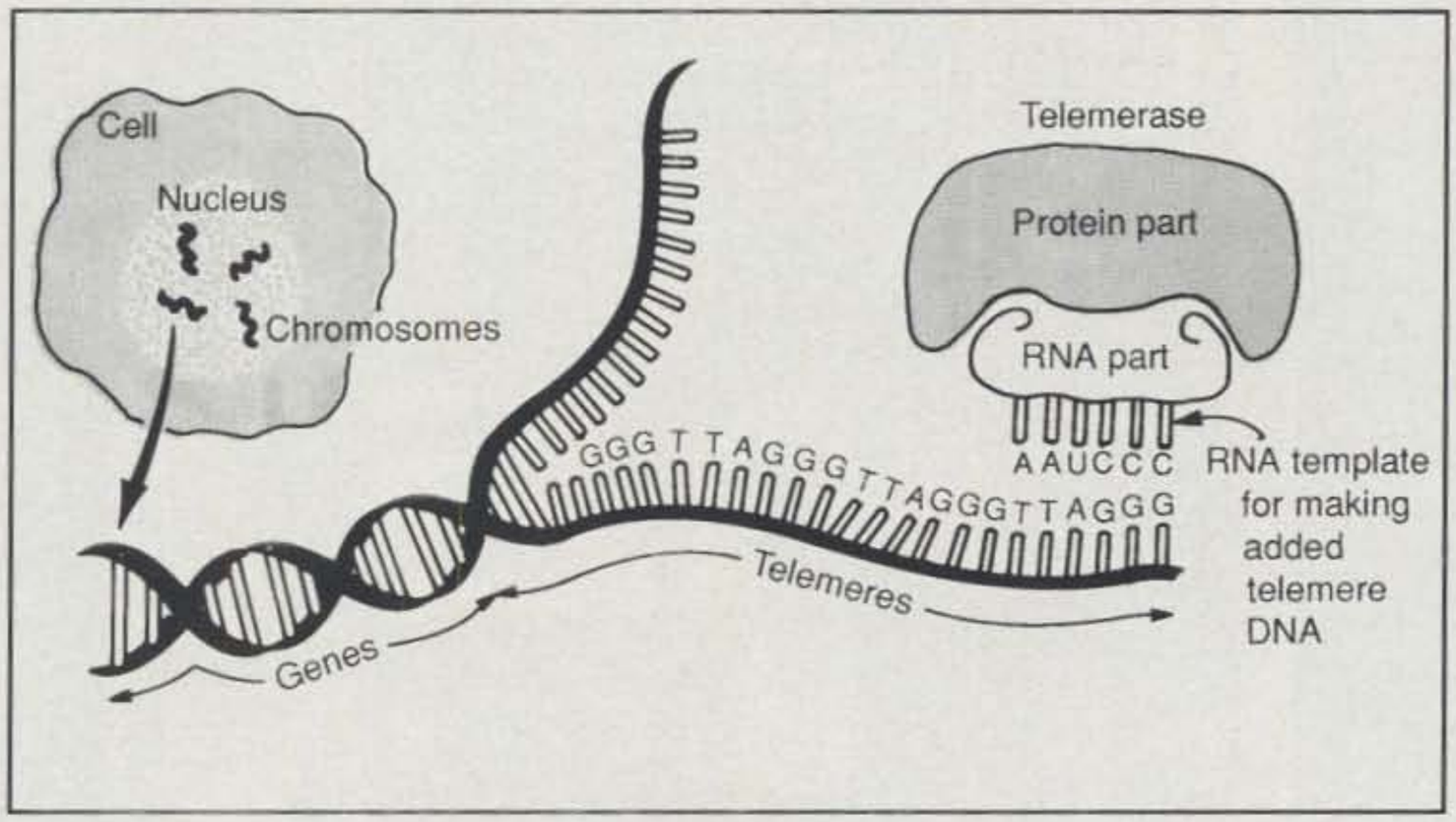

Fig. 1– When most human cells divide and duplicate their chromosomes, the tips, which contain DNA sequences called telemeres, cannot be copied. With each round of cell division, then, a small amount of the tip is lost. Eventually, a cell loses all of its telemeres and begins losing genes (the pieces of DNA that tell the cell how to produce proteins). Finally, the cell dies. (Modified after B. Rensberger, 1995[3])

**Professor Heisseluft currently is in Germany, where he is negotiating a stategic alliance with a large Pharmaceutical corporation for commercialization of drugs developed by the Lauton Institute. Correspondence to the professor may be directed him via CQ.*

responsible for the Institute's budget did not take our work seriously.

It was then that I remembered a conversation I had had over ten years ago with several amateurs at the DX Forum of the Dayton Hamvention. A number of very well-known DXers were lamenting the fact that while it might be possible to reach the top of the Honor Roll, and while it might even be possible to stay there for some time into the future, it was almost impossible to amass the high country totals, including deleted countries, that really set some of the old timers apart from the crowd. Furthermore, given how difficult it was to reach the top, wouldn't it be great to hold this position for decade after decade?! These were DXers, mind you, who had total country counts in the 370s and 380s. After the conversation broke up, the three DXers mentioned above (two men and one woman) approached me privately with a proposition: *If they put up the money, would the Lauton Institute begin a research program on how to stop people from aging?* I must admit that I didn't take them seriously at the time, and I promptly tucked the whole idea away in the back of my head. But with the visit from Dr. Hayflick and with my new awareness of what GERC had accomplished in biogerontology over the past few years, I knew what I had to do.

Springing into action, I contacted the three amateurs who had approached me in Dayton some years earlier, and I briefed them on the work of the Center. I indicated that the drug development program had progressed to the point where GERC was about to begin clinical studies on telomere retention, but that funding was a problem. Within days, each of the three sent a check to the Lauton Institute for amounts ranging from $3.1 to $4.5 million. We were astounded! But with additional funding now available, the work could proceed in earnest.

To date, GERC has successfully completed Phase I (safety) studies on a drug called *TelePRO®* and now is moving into Phase II studies that are intended to determine dosage levels. If all goes well, the Center should initiate Phase III studies for *TelePRO®* effectiveness within a year. Even the Institute's budget committee is getting excited, and funding from major endowments is now flowing to the program in quantities heretofore unheard of.

TelePRO® should be available in Europe in about two years, my friends, although doses are initially expected to cost $2600 (U.S.) per month. And by agreement with the Institute, the first commercial users of this miracle drug will be the three amateurs who provided funding at a critical time in the drug's development. With their aging processes slowed, they will then apply for DXCC. When they do, you will know what has happened by the simultaneous addition to the Honor Roll of a W2, a G3, and a JA1, all of whom probably will have the highest totals—current plus deleted countries—of any Century Club member listed.

Footnotes

1. Heisseluft, E., "Threat to Molecular Electronics from Microbes Produced by Genetic Engineering," *CQ*, April 1982.
2. Hayflick, L., *How and Why We Age*, Ballantine Books, New York, 1994.
3. Rensberger, B., "'Immortal' Cancer Cells Are Killed in Lab Tests," *The Washington Post*, September 1, 1995. ■

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TEN-TEC

The Yaesu FT-1000MP Transceiver

BY DOUG DeMAW*, W1FB

A reviewer of amateur equipment faces a challenge when attempting to describe the performance and countless features of a complex transceiver such as the Yaesu FT-1000MP. In-depth descriptions of the significant highlights would require many *CQ* pagesand this is not practical. I will focus mainly on the features and performance characteristics that make the FT-1000MP a truly unique piece of equipment. I prefer to avoid calling these features "bells and whistles." Rather, let us consider them as practical tools for the operation of the transceiver. Certainly, the FT-1000MP deserves more dignity than comes with the use of catch phrases. A mundane repeat of the narrative in the operating manual will not be used here. Emphasis will be on performance characteristics.

My impression of this transceiver is that it is designed particularly for the dedicated contester and DXer. It should appeal also to the casual type of operator. I would classify this transceiver as "user friendly" compared to some other modern transceivers I have operated. It required roughly four hours of my time to feel comfortable with the many features of the FT-1000MP, even though I may never need to use some of them.

The Yaesu FT-1000MP transceiver.

The FT-1000MP Receiver

The transceiver has what is called a SUB VFO or SUB RECEIVER, which in effect provides two receivers in one box. Concentric AF gain controls permit stereo reception of two receive frequencies at the same time. This is especially useful for working splits, because the operator can listen to the DX station's frequency and his or her own operating frequency to monitor pileups and choose the best moment to call the DX station. Each receive system has its own S-meter and digital frequency display. Different modes and IF bandwidths can be used during simultaneous reception.

The receiver system covers from 100 kHz to 30 MHz. The main receiver has IFs at 70.455 MHz, 8.215 MHz, and 455 kHz. The SUB RECEIVER has IFs at 47.21 MHz and 455 kHz. Whenever I test a multiple-conversion receiver, I want to know how well the manufacturer has suppressed the spurious responses (birdies). A careful check was made of the amateur bands from 160 through 10 meters with the antenna disconnected. I was able to find but nine birdies (1882, 1892, 3586, 3686, 3886, 7127, 7177, 28,170, and 28,835 kHz). Each of them was barely discernible. They did not register on the S-meter. These spurs are not audible with the antenna connected. This is a remarkable piece of design work.

The receiver dynamic range is specified as 108 dB at 50 kHz signal separation, with the preamplifier (IPO) turned off and the 500 Hz IF filter engaged. Measurement with my test setup yielded a similar DR number (106 dB). Certainly, this receiver is designed to withstand the onslaught of very strong signals from nearby and afar, within and outside the amateur bands.

The receiver is extremely sensitive on all bands. I was able to discern a 0.1 microvolt signal from my URM-25 generator on all amateur frequencies with the receiver preamp turned on and the attenuator turned off. The FT-1000MP attenuator has steps at 0, 6, 12, and 18 dB. I normally operate with 12 dB of attenuation when the preamp is turned on. Otherwise, the band noise will often hold the S-meter at S5 to S8, depending upon the amateur band I have chosen and the prevailing QRN level.

Notable among the appealing features of the FT-1000MP receiver is the crisp, clean audio output. Although the audio output power is rated at a modest 1.5 watts into a 4 ohm load, there is no noticeable "square waving" (distortion) at high audio levels when using the built-in or accessory SP-8 speaker. I could find no evidence of cross-over distortion (fuzziness) at very low CW signal levels.

The receiver is equipped for the AM, SSB, CW, and FM modes. A squelch circuit is included. It functions in all modes. I measured the squelch sensitivity at approximately 1.8 microvolts for AM, CW, and SSB. For FM, reception is roughly 0.32 microvolt. The main and subreceivers have independent squelch controls.

Receiver antenna selection is done from the front panel. The operator has the choice of antenna A or B by virtue of a panel switch and separate jacks on the rear of the unit. A third option (RX antenna) can be chosen at the front panel. It is activated during RECEIVE, but the main station antenna (A or B) kicks in during TRANSMIT. This is an excellent feature for those who use Beverage or loop antennas for low-noise reception when chasing DX. Also, the A-B option is beneficial when changing quickly between two selected amateur bands during contests.

AGC selections are OFF, FAST, SLOW, or AUTO. In the latter mode the receiver self-adjusts for the normal AGC characteristic, depending on the selected mode (fast for CW, slow for SSB, etc.). I keep this control set at AUTO.

The available receiver IF bandwidths are 250 Hz, 500 Hz, 2.0 kHz, 2.4 kHz, and 6 kHz. The FT-1000MP arrived with filters for 500 Hz, 2.4 kHz, and 6 kHz. Optional filters for other bandwidths may be purchased and installed by the owner. The 500 Hz CW filter is a Collins-Rockwell mechanical type. Filters may be installed for 8.215 MHz and 455 kHz, thereby providing improved skirt selectivity and wideband noise reduction by virtue of the second or "tail end" filter. I installed the optional pair of 2.0 kHz IF filters to narrow the SSB bandwidth on receive. As is true of all narrow SSB filters, the fidelity is reduced (lows are restricted) somewhat, but not nearly as much as when a 1.8 kHz filter is used. Reception at the 2.0 kHz bandwidth is acceptable with regard to audio-output quality when QRM is present. However, I prefer to use the 2.4 kHz bandwidth for routine operation.

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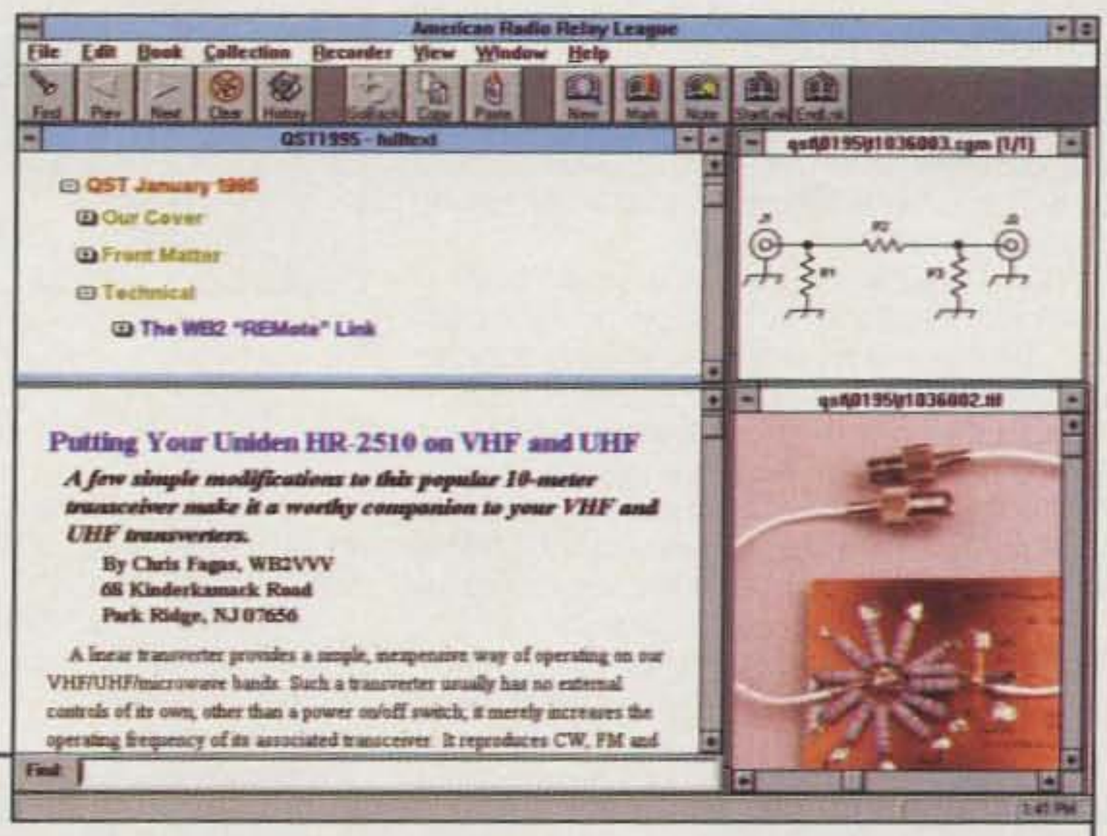

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CIRCLE 176 ON READER SERVICE CARD

incremental tuning (CLARIFIER) circuit. In both modes the RIT can be offset by ±10 kHz by means of a slow tuning control knob. The offset progression is displayed on a bar-graph type of readout, which shows where zero offset occurs. For many DXing applications the user may prefer to utilize the RIT rather than the separate SUB VFO for transmitting or receiving during split operation.

More Receiver Features

I should mention that the FT-1000MP has an excellent notch filter. It can be adjusted to null any heterodyne that is within ±1.2 kHz of the center of the IF passband. When the EDSP filter is activated, it can be used as a multiple notch filter to seek out and null any number of interfering heterodynes. As new beat notes appear, it finds them and notches them out. I detected minimal degradation of the receiver audio quality while using the EDSP notch feature. The automatic notch circuit works only in the SSB mode.

The transceiver has two noise-blanker choices. One of them is for short-duration pulses. The other is for attenuating long-duration pulses. A noise-blanker threshold control is located on the front panel. It may be adjusted for both NB1 and NB2 operation. The FT-1000MP noise blanker creates the same problems as most other blankers do when the blanking level is increased significantly. Signals become distorted and off-frequency strong signals are heard on the receive frequency, owing to degradation of the receiver dynamic range. I have found the blanker to be very effective in attenuating certain types of line noise in my area. The slower the repetition rate of the noise pulses the more effective the blanker becomes.

The Yaesu MD-100A8X desk microphone.

The EDSP filter has four noise-reduction positions that are especially helpful for taking the raw edges off noise pulses. I prefer the first position to reduce the annoying effects of loud atmospheric hiss noise that arrives via the antenna. The greater the EDSP noise reduction level, the more pronounced the reduction of the receiver audio fidelity (not distortion).

IF SHIFT and IF WIDTH are standard features in the transceiver. The width control functions in all modes but FM. This control does not shape both slopes of the IF response at the same time (other receiver width controls do). Rather, the user has the option of pulling in the upper or lower skirt by rotating the WIDTH control left or right to reduce QRM from the upper or lower side of the receive frequency.

The SHIFT control is used to reposition the receiver IF passband with respect to the displayed frequency in all modes other than FM. The passband frequency may be increased or lowered in accordance with the knob setting. The SHIFT control can be used in combination with the WIDTH control to further reduce QRM from signals that are close to the receive frequency. Both of these controls operate in an effective manner with minimal impairment of the audio quality.

Built-In DSP Circuit

Enhanced Digital Signal Processing (EDSP) is an important state-of-the-art feature of the FT-1000MP. It can be used in both the transmit and receive modes. It operates at audio frequencies. The filter characteristics can be programmed to suit the operator's needs, or the user can use the default settings that exist at the time of purchase.

Four microphone audio responses can be selected by using the menu procedure. This feature enables the operator to tailor the transmit audio for his voice characteristics and/or the response of the microphone. The choices on transmit and receive are bandpass, low pass, high pass, and "mid cut." The latter option allows emphasis on the high and low ends of the audio range.

During receive, all filter responses other than bandpass are preset. The user can program the bandpass characteristics for the low- and high-cutoff limits he prefers. The SSB high-

MFJ *HF/VHF* SWR Analyzer™ with RF Resistance Meter

Read your antenna SWR from 1.8-170 MHz . . . 10-digit LCD frequency counter . . . RF Resistance Meter™ . . . smooth reduction-drive tuning . . . simple-to-use . . .

MFJ-259 **$239.95** If you work with antennas, MFJ's revolutionary new *SWR Analyzer™* is the best investment you'll ever make! Now you can diagnose a wide range of antenna problems instantly with one easy-to-use instrument.

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The MFJ-259 gives you a complete picture of your antenna's performance anywhere between 1.8 and 170 MHz -- you can even check SWR outside the ham bands without violating FCC rules. Set the bandswitch and tune the dial--just like your transceiver. SWR is displayed instantly!

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Tune critical HF mobile antennas in seconds -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on a single band, or analyze multiband performance over the entire spectrum from1.8 to 170 MHz!

Measure inductance, capacitance, resonant frequency of tuned circuits, transmission line velocity factor/impedance/loss.Test RF chokes, transformers, baluns.

Adjust your tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259 is really *four* test instruments in one: an accurate RF signal generator, a high resolution 170 MHz frequency counter, *RF Resistance Meter™* and an *SWR Analyzer™*.

Free Manual

MFJ comprehensive 18 page instruction manual is packed with useful applications -- all explained in simple language you can understand!

For free manual write or call MFJ.

Take It Anywhere

The MFJ-259 is fully portable, powered internally by 8 AA batteries or 110 VAC with MFJ-1312B, $12.95. It's in a rugged all metal cabinet that's a compact 4x2½x6¾ inches. Take it to remote sites, up towers, on DX-peditions -- anywhere your antennas are located.

For rough service, pick up a convenient **MFJ-29B**, $24.95, padded carrying pouch to keep your MFJ-259 close at hand and looking like new.

How Good is the MFJ-259?

MFJ SWR Analyzers™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Professional installers and technicians use them worldwide.

Get More by Paying Less

With the MFJ-259, you get full 1.8 to 170 MHz coverage, simple operation, instantaneous readings, a high accuracy frequency counter and MFJ's exclusive *RF Resistance Meter™*-- all for a low $239.95.

1.8-170 MHz *SWR Analyzers™*

MFJ-249 **$219.95** **MFJ-249** *HF/VHF SWR Analyzer™* has all the features of MFJ-259 but less RF resistance meter. Includes 1.8-170 MHz *continuous* coverage, 10-digit LCD frequency counter and smooth vernier tuning.

MFJ-209 **$109.95** **MFJ-209** *HF/VHF SWR Analyzer™* is same as MFJ-259 without LCD frequency counter and RF resistance meter. Has jack for external frequency counter. MFJ-249/MFJ-209 are 4x2½x6¾ inches and uses 8 AA cells or 110 VAC with MFJ-1312B, $12.95.

Carrying Pouch with Window

MFJ-29B **$24.95** **Tote** your MFJ-259/249/209 *SWR Analyzer™* anywhere with this custom Carrying Pouch.

Made with a special foam-filled fabric, it cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Clear protective frequency display window and cutouts for knobs let you use it without taking it out of pouch. Fully-adjustable webbed fabric carrying strap has snap hooks on both ends. Wear around waist or over shoulder.

Keep your analyzer safe and looking new!

MFJ-29, $19.95, no window or cutouts.

Dip Meter Adapter

MFJ-66 **$19.95** **Plug** a dip meter coupling coil into your *MFJ SWR Analyzer™* and turn it into a sensitive and accurate bandswitched dip meter.

With a dip meter you'll save time and take the guesswork out of winding coils, measuring inductance and capacitance, measuring velocity factor and electrical lengths of coax. Determine resonant frequency of tuned circuits and measure Q of coils. Set of two coils cover 1.8-170 MHz depending on your *MFJ SWR Analyzer™*.

Free MFJ Catalog

Write or call . . . 800-647-1800

10-160M *SWR Analyzer™*

MFJ-207 **$79.95** **If** you're an HF man, this compact MFJ-207 *HF SWR Analyzer™* will help you build 10-160 Meters antennas that'll make working DX almost routine.

Just plug in your coax to find the SWR of any HF antenna on any ham band 10-160 Meters. Has jack for external frequency counter. 7½x2½x2¼ inches.

Bandswitch Dip Meter™

MFJ-203 **$99.95** **The** MFJ-203 is a sensitive *Bandswitched Dip Meter™* that covers all ham bands from 160-10 Meters. There are no plug-in tuning coils to keep up with or break.

Has detachable coupling coil, dual FET oscillator, op-amp meter amplifier and jack for external frequency counter. 7½x2½x2¼ in.

2 Meter *SWR Analyzer™*

MFJ-208 **$79.95** **MFJ-208** 2 Meter *VHF SWR Analyzer™* finds the SWR of any antenna from 138-156 MHz. Jack for external frequency counter. 7½x2½x2¼ inches.

For Commercial VHF Radio

Same as MFJ-208 but for commercial VHF. **MFJ-217**, $79.95, covers 30-50 MHz and **MFJ-218**, $79.95, covers 150-170 MHz.

MFJ Antenna Bridge

MFJ-204B **$79.95** **Great** for determining feedpoint resistance of antennas and for designing impedance matching networks. Measure RF resistance up to 500 ohm. Covers all ham bands 160-10 Meters. Built-in resistance bridge, null meter, tunable oscillator-driver, frequency counter jack. 7½x2½x2¼ inches. Use 9 volt battery or 110 VAC with MFJ-1312, $12.95.

440 MHz *SWR Analyzer™*

MFJ-219 **$99.95** **Read** SWR of any antenna 420 to 450 MHz -- just plug coax of your antenna into SO-239 connector, set frequency and read SWR. Uses microwave integrated circuits and microstrip technology. Jack for external frequency counter. 7½x2½x2¼ in.

MFJ-219N, $99.95, sames as MFJ-219 but with "N" connector.

MFJ-219/218/217/208/207/203 uses 9 volt battery or 110 VAC with MFJ-1312B, $12.95.

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side cutoff range is 1000 to 4500 Hz. The SSB low-side range is 100 to 1800 Hz. The CW bandwidth (bandpass mode) can be set for 60, 120, or 240 Hz. The default setting is 240 Hz. The bandwidths are similarly adjustable for the AM and digital operating modes. The filter responses, once programmed by the operator for the various modes, come up automatically when changing the operating modes.

Having used an outboard receive-only DSP filter with a different transceiver for some months prior to acquiring the FT-1000MP, I greatly appreciate the convenience of having EDSP as an integral part of the transceiver. The ability to use the filter on transmit is an additional convenience. The EDSP filter operates smoothly and effectively in all of its modes.

Transmitter Features And Performance

Operating modes for the FT-1000MP transmitter are AM, CW, FM, FSK, and SSB. The user can operate in the RTTY and packet modes by virtue of the FSK provision. The FSK shift frequencies are 170, 425, and 850 Hz. Maximum FM deviation is ±2.5 kHz. Packet shift frequencies are 200 and 1000 Hz.

Power output is adjustable up to 100 watts. On AM, the power output is limited to 25 watts. Although manual power control can be done from the front panel, the user may invoke the menu system to set the output power for a selected maximum level.

The FT-1000MP has excellent spectral purity of the output signal. All harmonics are at least 50 dB below peak power at 100 watts. I live in a rural area where the nearest TV station is 30 miles distant. My reception is by way of a rotatable Yagi. I have experienced zero TVI, even though Channel 13 is 90 miles away. SSB carrier suppression is better than 40 dB below peak power. A check of the unwanted sideband suppression yielded a number of –52 dB.

Although I am unable to observe the slightest suggestion of frequency drift with the transmitter or receiver sections of this transceiver, two optional master reference oscillator TCXOs are available to those who demand the utmost in high stability for special applications, such as long-term HF packet monitoring under wide variations of temperature. The TCXO-4 provides ±2.0 ppm stability from 0 to +50 degrees C, whereas the TCXO-6 is rated at ±0.5 ppm over the same temperature spread.

Speech Processor

Incorrect operation of the FT-1000MP speech processor will result in the same dreadful signal quality that comes from other HF transceivers when the operators fail to use the correct setup or when they insist on using excessive compression. However, I have been able to obtain reports of good signal quality when I followed the set-up instructions in the Yaesu manual. I try to use no more than 5 dB of compression for any application. I generally hold the compression to 3 dB—just enough to give the signal a touch of "presence." Correct processor operation requires setting three controls for the prescribed mic gain, the ALC level, and compression magnitude. Adjustments are made while observing the appropriate bar-graph displays. These selectable readout scales make proper adjustment foolproof. (When all else fails, read the manual!) The built-in transmitter monitor can be used with earphones to check the quality of your SSB signal when adjusting the processor or the microphone frequency response.

Built-In Keyer

CW operators will be impressed with the FT-1000MP keyer. It may be used in the break-in delay (VOX) or full-QSK modes at the flip of a switch. In the QSK mode it is necessary to use the transceiver "barefoot" if the linear amplifier is not designed or modified for full break in. The keyer can be programmed to operate in the IAMBIC 1, IAMBIC 2, or BUG formats. The dot-dash weighting can also be programmed to suit the user's taste. The default dot-dash ratio is 3:1. Keyer delay may also be changed by using the menu system. The switching time of the CW carrier waveform can be programmed from 0 to 30 milliseconds.

A four-digit number can be programmed for contest work. There are front-panel provisions for matching the CW sidetone to the pitch of the other station's CW note after you have it tuned in.

Built-In Tuner

The FT-1000MP includes an antenna matching circuit that operates over a range of 20 to 150 ohms (3:1 SWR points). This is not only beneficial when operating directly into an antenna, but when using a linear amplifier; the tuner compensates for the mismatch that may be presented by the amplifier input circuit. After you use the tuner once on your favorite band or frequency, the system recalls the previous settings from the memory during reception whenever you tune to the same part of the band again. There are 39 tuner memory channels.

Memory Structure

There are memories galore in the FT-1000MP. You have 99 regular memories to work with, plus nine special programmed limit memories and five "quick memory bank" (QMB) memo-

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters -- with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives you high efficiency for more power radiated. The result? Stronger signals and more Q-5 QSOs.

Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved by using separate full size radiators for 2 through 20 Meters and highly efficient end loading for 30, 40 and 75 /80 Meters.

You get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR and it handles 1500 watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

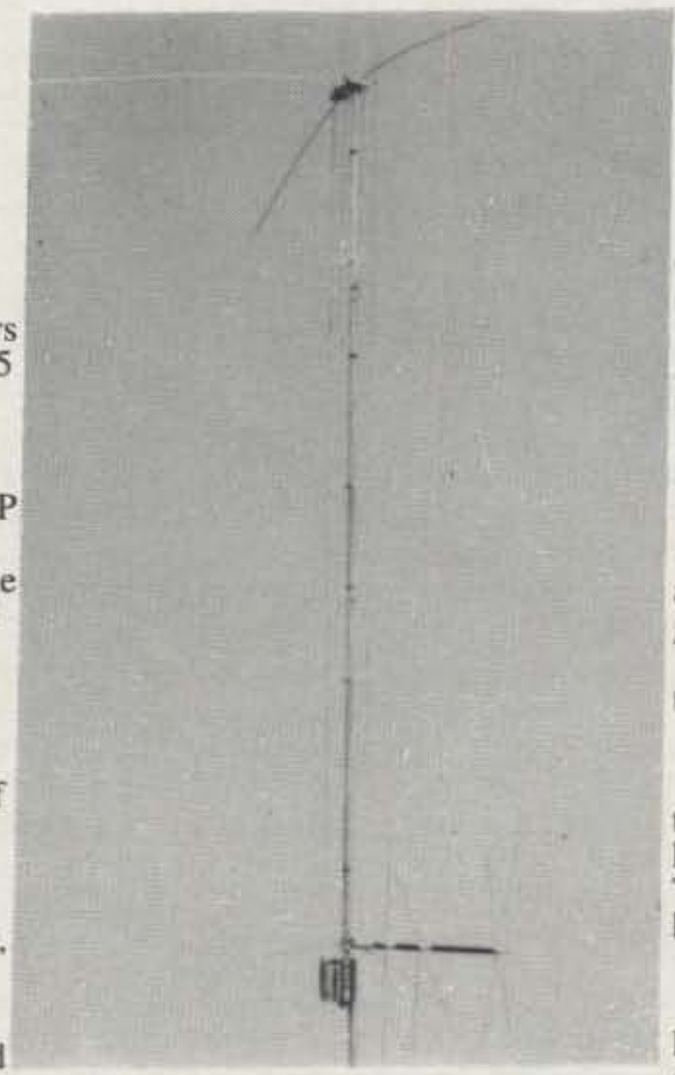
It's easy to tune because adjusting one band has minimum effect on the resonant frequency of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- on small lots, backyards, apartments, condos, roof tops, tower mounts.

Separate *Full Size* Radiators

***Separate** full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.



MFJ-1798
$269.95

This forms a very large equivalent radiator and gives you incredible bandwidths.

These radiator stubs provide automatic bandswitching -- there is absolutely *no loss* due to loading coils or traps.

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with Teflon® coax and *can't* saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is used in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant Teflon® covered wire.

Teflon® is registered trademark of Dupont

MFJ *Super Hi-Q Loop*™

MFJ-1786
$299.95

MFJ's *tiny* 36 inch diameter *high efficiency* loop antenna lets you operate 10 to 30 MHz *continuously* -- including the WARC bands!

It's ideal where space is limited -- apartments, small lots, mobile homes, attics, motor homes.

Enjoy both DX and local contacts when you mount it vertically. You get *both* low angle radiation for excellent DX *and* high angle radiation for local close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ-1786 *Super* Remote Control has *Auto Band Selection*™. It auto-tunes to your desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune push buttons and built-in two range *Cross-Needle* SWR/Wattmeter lets you quickly tune to your exact frequency.

All *welded* construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter *round* radiator -- not a lossy thin flat-strip -- gives you highest possible efficiency.

Each plate in MFJ's *superb* tuning capacitor is welded for low loss and *polished* to prevent high voltage arcing. It's welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches and a continuous *no-step* DC motor for *smooth precision* tuning.

A heavy duty 1/8 inch thick ABS plastic housing with ultraviolet inhibitors protects it.

MFJ-1782, $269.95. Same as MFJ-1786 but remote control has only fast/slow tune buttons.

Super 80/40M Vertical

MFJ-1792
$159.95

Designed as a *high performance* antenna for 80 and 40 Meters, the MFJ-1792 features a *full size* quarter wave radiator for 40 Meters - - that's a full 33 feet of ruthless radiating power.

End loading -- the most efficient form of loading -- is used for 80 Meters. It's accomplished by a virtually lossless 4½ foot capacitance hat and a high-Q coil wound with Teflon® wire on a *low-loss* fiberglass form.

The *entire length* radiates power.

High strength 6061-T6 aluminum tubing, super strong solid fiberglass insulator, *Frequency Adaptive L-Network*™, heavy duty *swing* mount. Handles 1500 watts PEP. Requires guying and radials, counterpoises or ground screen.

MFJ-1793, $179.95. Same as MFJ-1792 but includes *full size* 20 Meter quarter wave radiator.

Box Fan Portable Loop

MFJ-1780
$229.95

No, it's not a fan -- it's a high efficiency portable loop antenna that's about the same size and shape as a 2x2 foot box fan, complete with carrying handle.

Carry it like a suitcase, tuck it in a corner of your car or check it as baggage on a plane.

When you get there, set it on a table or desk and enjoy ragchewing or DXing.

All welded construction, covers 14-30 MHz *continuously* including WARC bands, handles 150 watts. Remote control has fast/slow tune buttons. Separate control cable not needed.

MFJ *halfwave* Vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed!

MFJ-1796
$199.95

Operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- with this MFJ-1796 *ground independent halfwave* vertical antenna! No radials or ground ever needed!

It's only 12 feet high and has a *tiny* 24 inch footprint! Mount it anywhere from ground level to tower top -- on apartments, condos, small lots, even motor homes. Perfect for vacations, field day, DX-pedition, camping.

Efficient *end loading*, no lossy traps. *Entire length* is always radiating. *Full size* halfwave on 2 and 6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

Automatic bandswitching, low radiation angle, omni-directional, handles 1500 watts PEP. Goes together in an afternoon.

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ries. The 99 memories can be arranged in five individual groups if you wish to program the system in that manner. The lithium memory-back-up battery has an expected life span of five years. Each stored frequency retains the parameters you select for that frequency, such as the filter bandwidth and the AM, USB, LSB, or CW mode.

The memory system has countless other operating features that are described in the manual. Each stored frequency, when recalled, allows the operator to tune above or below the memory frequency (as when using the VFO) without the stored frequency being disrupted. The memory system allows you to copy from VFO A or VFO B. All 99 memory channels may be scanned, and you can program for the scanning rate you prefer. Memory status, along with all other significant transceiver functions, is displayed brightly in the 1 1/4" × 10 1/2" readout window on the front panel of the FT-1000MP.

The memory system allows operating conveniences for keyer control during contests. For example, the keyer offers six CW message memories. You can store a four-digit contest QSO number that automatically increments/decrements after each call. You can include your callsign (up to 20 characters) and four user messages (each holds up to 50 characters). There is a CQ memory that stores up to 20 characters, such as "CQ CQ CQ de W1FB K." There are other keyer memory functions that are especially useful for contesting.

Menu System

Menu selection and performance settings are accomplished easily by consulting the menu data pages in the instruction manual. You can program 79 transceiver settings with the FT-1000MP menu system. This is done by pressing the FAST and ENTER buttons at the same time, then rotating the MEM/VFO channel knob and observing the memory display letters and numbers as they appear in the readout window. The knob is turned until the desired function, per the menu listings, appears in the display window. Some of the settings operate as on/off switches for changing the functions. Others are adjusted by the operator to obtain specific operating characteristics. I find this system easy to comprehend and use.

Computer Control

The Computer Aided Transceiver (CAT) provision allows you to control the frequency, VFO, memory, and other settings by means of an personal computer. The transceiver contains a built-in level converter that allows a direct connection from the CAT jack to the serial port of your computer. The instruction manual contains many pages of detailed information about how to use your computer to control the FT-1000MP.

Physical Description

I could shorten this report by saying the Yaesu FT-1000MP is a fairly large and attractive black box. Actually, it measures (HWD) 5"H × 16"W × 13 1/2"D (135 × 410 × 347 mm). The weight is 33 pounds (15 kg). The cabinet is black, and the control labels are light gray or off-white color. The display window has readouts that are green, orange, red, and yellow. The front legs of the transceiver are adjustable to permit level or tilted access to the front panel.

I was happy to note that front-panel headphone access has 3.5 mm and standard 1/4 inch jacks in parallel to accommodate both types of phone plugs. Also, there are key jacks on the front and rear panels of the unit. I prefer large transceivers for home-station use (even though the FT-1000MP can be used for mobile operation), owing to my large hands and aging eyes. The FT-1000MP doesn't "walk about" on the desk when it is bumped or when the switches are pushed.

Accessories

You may want to purchase the matching MD-100A8X 600 ohm desk mic ($139) to use with your FT-1000MP. It is color-coordinated and styled to match the transceiver. This mic has switches under the base that permit insertion of a filter which has high boost and low-cut provisions. A spring-loaded up-down scanning ring is located atop the mic for changing the operating frequency and switching between the memories. Although I have an exceptionally bassy voice, all of the amateurs who know me have reported excellent quality from the MD-100 and FT-1000MP.

The user may also purchase the matching SP-8 loudspeaker ($179). It measures 5 1/4"H × 8"W × 12"D. Switches are located on the front of the SP-8 to allow engaging the built-in passive audio filter. This filter can be adjusted for specific bandpass responses. Included is a switch that allows the speaker to be shared by two receivers. Audio quality from the SP-8 is excellent with or without the filter switched in. Yaesu can also provide a set of YH-77STA lightweight stereo headphones ($55).

Contesters should be interested in the optional DVS-2 digital voice recorder accessory ($329). It may be used as a continuous receiver recorder for instant pushbutton playback. The DVS-2 can be used also as a microphone audio recorder for multiple on-the-air playback ("CQ contest," etc.). All data are stored electronically. There are no moving parts.

Also available are the TCXO-4 ($119) and TCXO-6 ($249) master reference oscillators.

Subjective Closing Remarks

Although I try to remain entirely objective when preparing a product review, I must break stride and say that despite having reviewed more than 100 pieces of amateur gear over the years, I am unable to report finding even a picky fault with the FT-1000MP. I've always maintained that nothing in this world is perfect, and that there has to be something negative about each piece of amateur equipment. I definitely struck out this time, at least with respect to my personal expectations for a transceiver.

If there is a shortcoming, it may be that Yaesu does not offer blind amateurs a "talker" that can be interfaced with its equipment. The FT-1000MP is no exception. W8QLR, KE8BW, and some other blind ham friends would like to buy FT-1000MPs, but cannot justify the purchase without having a "digital talker" to aid in setup and operation. Perhaps some day Yaesu will make that important accessory available. I give the FT-1000MP an A-1 rating.

The manufacturer is Yaesu USA, 17210 Edwards Rd., Cerritos, CA 90703 (310-404-2700). Price class is $3300 without built-in power supply ($3600 with power supply). ■

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Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*

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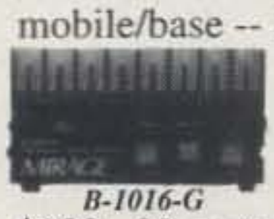
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CIRCLE 5 ON READER SERVICE CARD

ANTENNAS

A Really Good, Cheap Rotatable Dipole For 20 Meters

Here's a simple antenna that you can build without the aid of a machine shop or a bank loan.

BY LEW McCOY*, W1ICP

A recent letter from Jim Holliday, KI7KL, prompted this short article. Jim had read my book on antennas, and it gave him the idea to build a rotatable dipole for 20 meters. His idea was so good that I felt it was worth passing on, along with some ideas for other bands.

Many years ago I designed a rotatable 15 meter dipole that matched 50 ohm cable perfectly. Many amateurs built this antenna and worked scores of contacts with it and got good reports. In fact, the one I built and tested was used for a couple of seasons, and I worked DXCC with it quite easily.

The antenna is very reasonable in cost and quite simple to construct. At the time, I used TV hardware to mount the antenna so that it just cleared my roof, and I rotated it via the armstrong method (reaching out a window and turning it by hand). From an electrical standpoint, the halfwave dipole is, without a doubt, the most efficient antenna devised. Efficiency is easily defined as to what you put into an antenna versus what you get out. The halfwave dipole has an impedance of 70 ohms if it is mounted ½ wavelength above earth ground. How efficient is such an antenna? Well, if you put 70 watts into the antenna, you can expect to get 68 to 69 watts out. Only a small fraction of your power is lost as heat in ohmic losses; the large majority of power is radiated. (And all the computer programs in the world will not disprove that statement!) Believe it or not, a halfwave dipole compared to a three-element close-spaced monoband beam will have about three times the efficiency. Certainly the beam has better directivity and gain, but it does so by sacrificing efficiency.

So let's get to the actual antenna that Jim built. This antenna is very simple to make. It consists of two lengths of electrician's tubing, ½ inch diameter (see fig. 1). The two lengths give us an overall length of 24 feet, which is not enough to get to a halfwave on 20. A halfwave, using 468 divided by 14.250, gives an answer of 32.84 feet. Jim probably could have found some telescoping tubing to extend each end of the dipole, but he found a cheaper and simpler way. He merely dropped each end of the dipole using lengths of no. 14 wire. Two lengths of wire 4 feet 5 inches long added to each end of the dipole does the job.

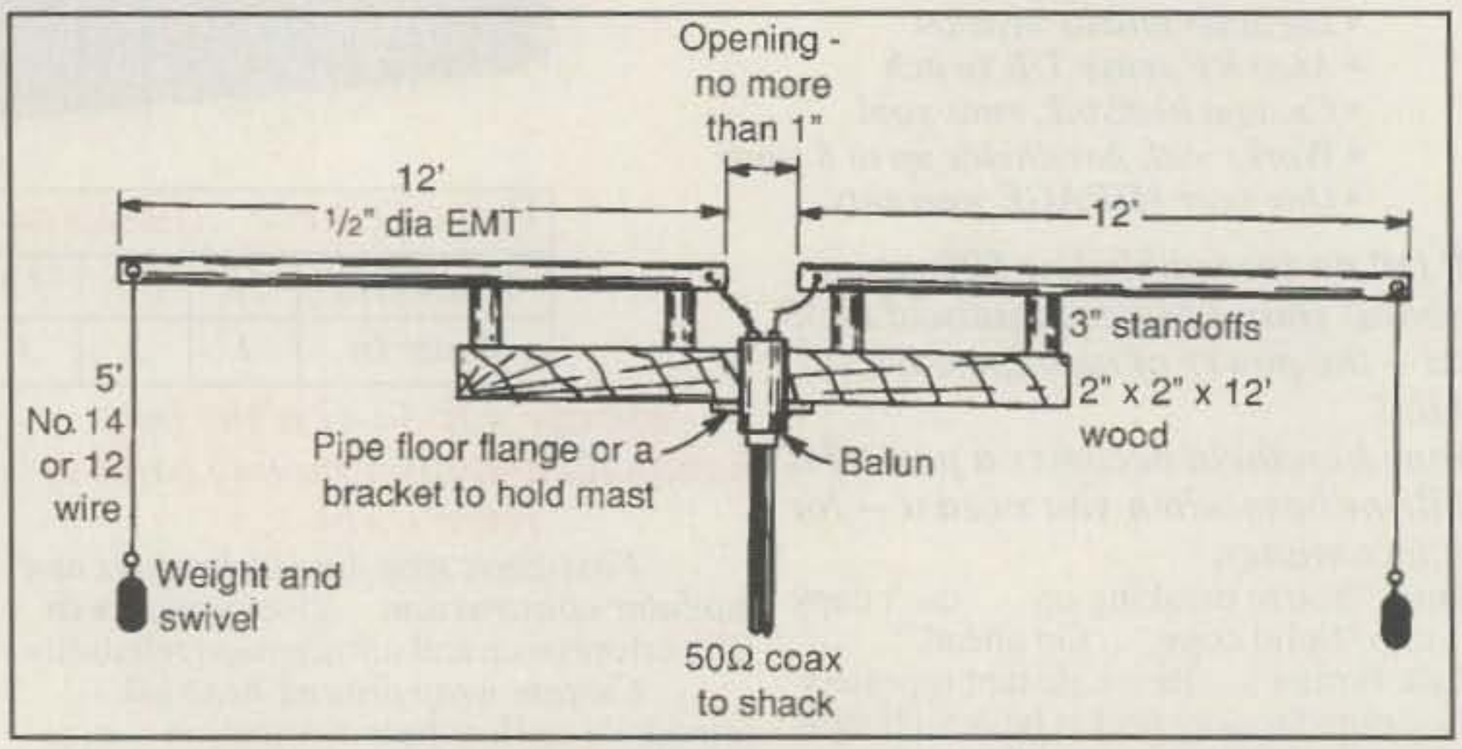


Fig. 1– The mechanical diagram for the 20 meter rotatable dipole. Details of the project are given in the text.

The elements are supported on a length of 2" × 2" wood, 12 feet long. The standoffs to support the elements are made from plastic spacers, although you could get a section of 1 inch diameter PVC and cut off 3 inch lengths to make the element standoffs.

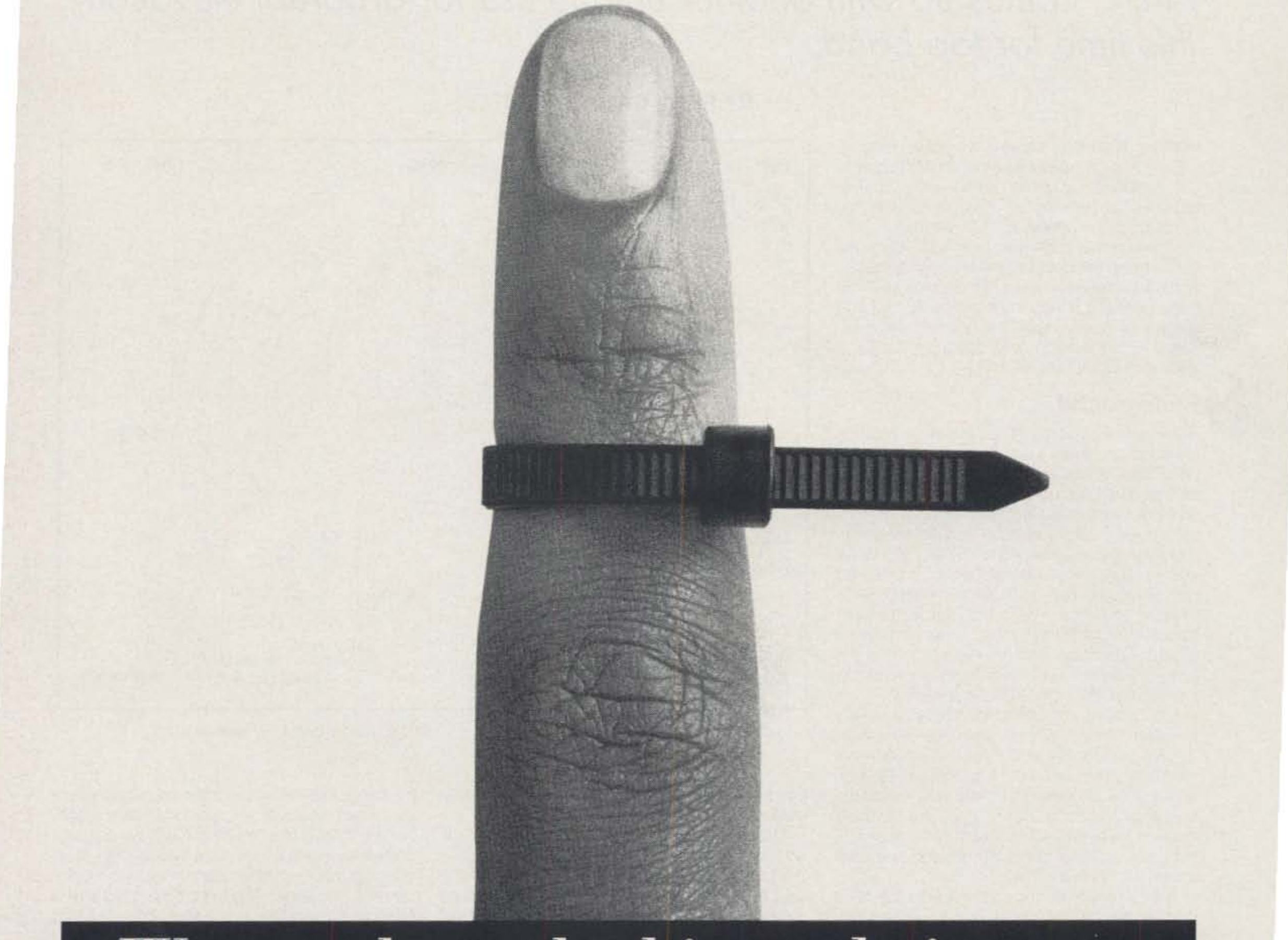
The 2" × 2" is supported by a pipe mounted on a floor flange, which any plumbing or hardware store should have. Jim used a 1 to 1 balun at the feed point—in other words, 50 ohm feed to the balun and then to the feed point of the antenna. I'd like to point out that a balun isn't necessary as long as you are sure that the coax feed-line length is not resonant on 20 meters. A grid-dip meter check on the shield would prove that point quickly for you. If you find a resonance on 20 meters, change the length of the feed line to move the resonance out of the band, and then you won't need to use a balun.

The wire extensions on the element ends are weighted by a 6 ounce fishing weight with a swivel. (If you're not a fisherman, you'll find these swivels and weights in any sporting-goods store.) Jim tells me that with 50 watts, his second contact was with a 5/9 report out of the Sakhlin Islands, and he has worked all over the world with 5/9 signal reports. Try to get your version up at least 30 feet above ground—the higher the better. Keep in mind that you only need to rotate this one-element beam 180 degrees. It has no front-to-back, but it certainly has lots of front-to-side. Oh yes, power limits: the antenna will easily handle 1500 watts with RG8 coax feed.

You could make this antenna for 18 MHz. The length would be 25.8 feet for 18.120 MHz, or just use the formula 468 divided by the frequency in MHz for any of the bands. Good DX! ■

*Technical Editor, CQ, 1500 W. Idaho St., Silver City, NM 88061

Just a reminder.



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CIRCLE 127 ON READER SERVICE CARD

CONSTRUCTION

How To Build A Simple 160 Meter Antenna (With A Bonus)

N4PC comes up with another unique use for arboreal elevation, this time for top band.

BY PAUL CARR*, N4PC

The 160 meter band is a land of intrigue. I have had many telephone calls requesting that I design an antenna for 160 meters that can be erected on a city lot and that will perform well. Here is my response.

This antenna is shorter than a G5RV. It will give a good account of itself on local contacts, and it will also work some of the closer DX. The bonus is that it will do a fine job on 80, 40, and 30 meters. Additionally, it is inexpensive, easy to put into operation, and does not require a backyard full of radials.

Background

A few years ago I came across an interesting antenna in Doug DeMaw's antenna book (*W1FB's Antenna Notebook*, p. 74). The antenna was a vertical loop that consisted of a one-half wavelength of wire that was placed in a rectangular configuration. The antenna was placed in the vertical plane and fed at a lower corner. The upper corner opposite the feed point was open to provide an acceptable feed-point impedance. The horizontal wires were about 95 feet and the vertical wires were about 40 feet 10 inches. This configuration had the physical dimensions I was looking for, so the next step was to model the antenna.

I modeled the antenna using EZNEC by Roy Lewallen, W7EL. When I analyzed the antenna with the top wire at 60 feet, the pattern was vertically polarized with a predicted take-off angle of 26 degrees. This is a very desirable characteristic for a DX antenna, but I wanted more of an overhead component for the local contacts. I changed the dimensions and continued my analysis.

Next I modeled the antenna with the feed point moved to the center of one of the vertical wires, and opened the wire opposite the feed point. This configuration produced the pattern I was looking for (see fig. 1). There was significant energy in the overhead component for reliable local contacts, and the predicted take-off angle was 33 degrees. In both cases the horizontal pattern was omnidirectional. This was what I was looking for on 160 meters, but what was in store for other bands?

The total wire length was one-half wavelength on 160 meters, which translates to one wavelength on 80/75 meters. To keep the impedances at a reasonable value, the wire opposite the feed point needed to be closed. When this was modeled, EZNEC predicted a pattern perpendicular to the plane of the loop and a radiation angle of 22 degrees. This seemed to be a good antenna for DX on 80/75 meters (see fig. 2).

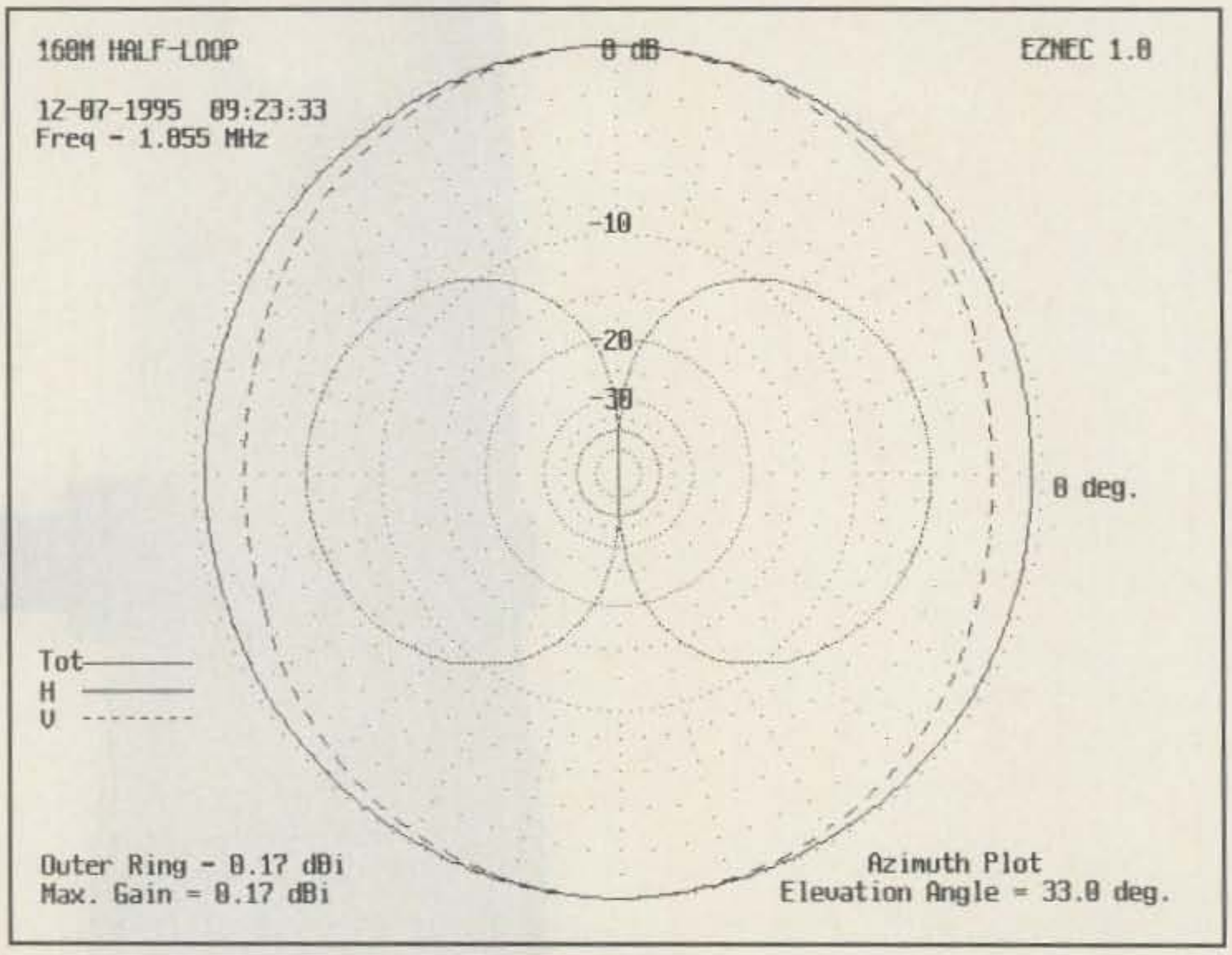

Fig. 1A– The azimuth plot for the 160 meter half-loop antenna.

I could not resist seeing what was predicted for the antenna on 40 and 30 meters. The best patterns resulted when the vertical wire opposite the feed point was open. The resulting pattern on 40 meters was perpendicular to the plane of the loop, and the elevation angle was 18 degrees. The predicted pattern on 30 meters was a 4-leaf cloverleaf with a 15 degree angle of elevation. In both cases, the impedances lend themselves to a balanced feed line.

I had no need for an antenna for the higher bands, but this antenna would probably give a good account of itself on 20 through 10 meters. The pattern will tend to move toward the axis of the wire.

Construction

The antenna is very simple to build. You need 266 feet of antenna wire, six insulators, and a balanced feed line. Measure 133 feet along the wire and cut the wire. Using the first piece of wire as a gauge, cut another wire the same length. Place two insulators on each wire. For the moment just let them dangle on the wire in the same manner you put the coax-connector sleeve up the coax before you attach the connector. These four insulators will be used as corner supports (A) as shown in fig. 2(A). Next connect the loop mechanically via two insulators (B), one becoming the feed point, and the other at the opposite side which can be closed or shorted for 80/75 meter operation.

When attaching the wire to the insulator opposite the feed line, be sure to leave enough wire so you can attach two alligator clips. These will be used to close the loop on 80/75 meters. Measure 21.5 feet from the feed-point insulator and the insulator opposite the feed point and secure the corner insulators. I used nylon cable ties, but you may have a better idea. Place two alligator clips at the non-feed-point ends of the wires. To keep these clips from normally touching, I clip them back to the wire that they terminate. Double check all work and ensure that the feed line is properly soldered. The antenna is ready to go into the air.

Antenna Placement

I am extremely fortunate inasmuch as I am blessed with tall southern pines around my

*97 West Point Road, Jacksonville, AL 36265

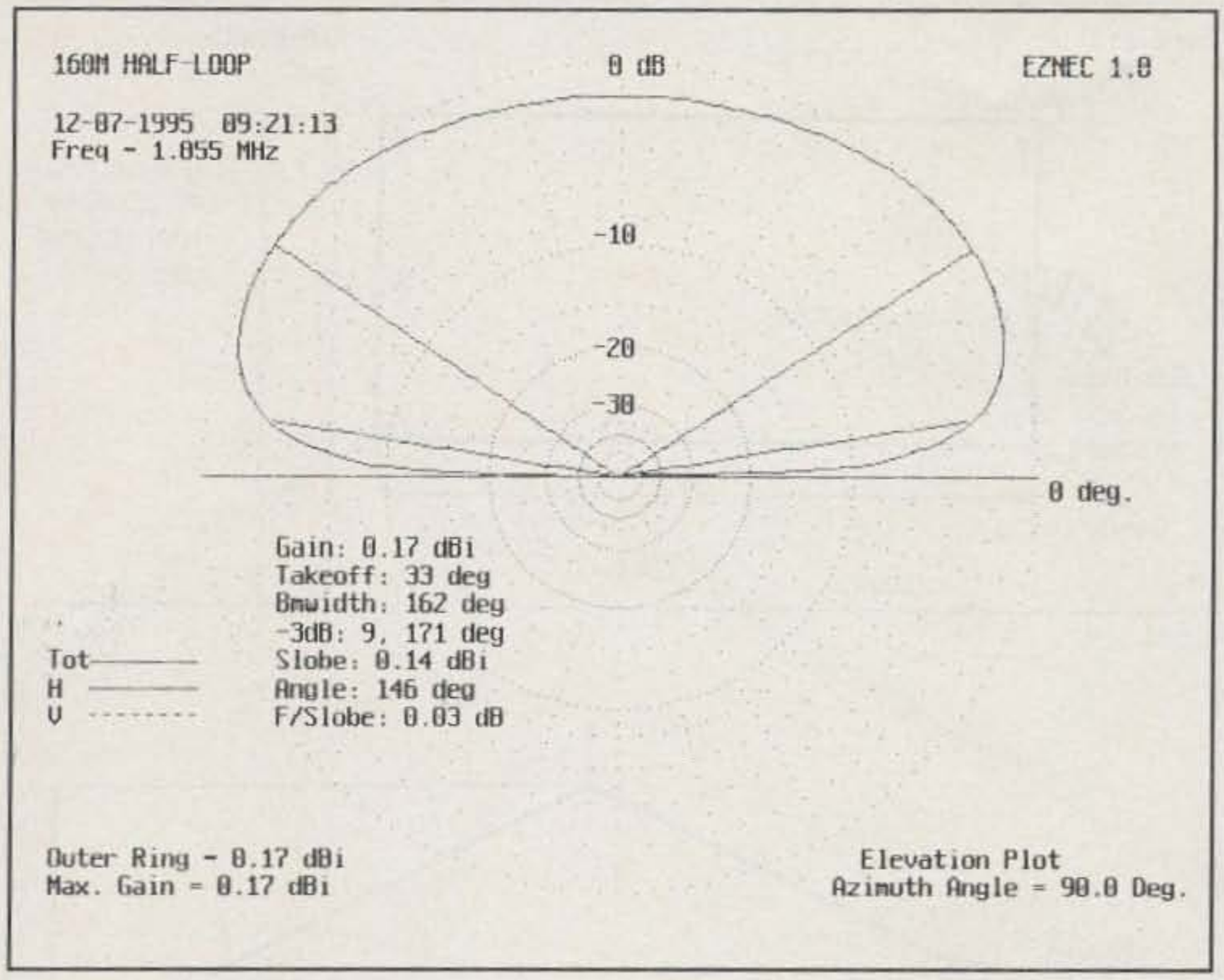

Fig. 1B- This is what the elevation plot looks like.

house. I chose two trees with nice branches about 65 feet off the ground and a horizontal spacing of about 100 feet. I used a slingshot to place a monofilament line across the respective branches, and used the line to pull halyards into proper position.

Use these halyards to raise the antenna into the air. Attach two more lines to the lower corners of the loop to properly tension the antenna, and hold in the proper geometric configuration. Route the balanced feed line away from the vertical wire as far as practical to maintain the impedance. The antenna is ready to test.

Connect the feed line to the balanced output of a transmatch. For test purposes, I used an MFJ-259 SWR analyzer as a signal source. This allowed me to check the antenna fully without putting a transmitted signal on the air. The antenna tuned smoothly across the entire band during this test. Next I ran the same test on 40 and 30 meters. Again the antenna loaded smoothly on both bands. Three bands were completed—one more to go.

I lowered the end opposite the feed point and connected the alligator clips together, which makes it a closed full-wave loop on 80/75 meters. The same test procedure was used to tune the antenna on this band. Again, the test was favorable.

On The Air

I could not wait to put the antenna on the air. I had been listening to a group of amateurs on 1.855 MHz, and I knew these gentlemen were congenial and always ready with a helping hand. I was immediately welcomed and made to feel that I was a part of the group. They were interested in the type of antenna I was using, and they were quick to give the antenna their "stamp of approval."

The initial tests were conducted while using a small linear. The next time I joined the group, I used only my exciter. Again, there were reports of "solid copy" around the southeast. I had only one more test that I wanted to run.

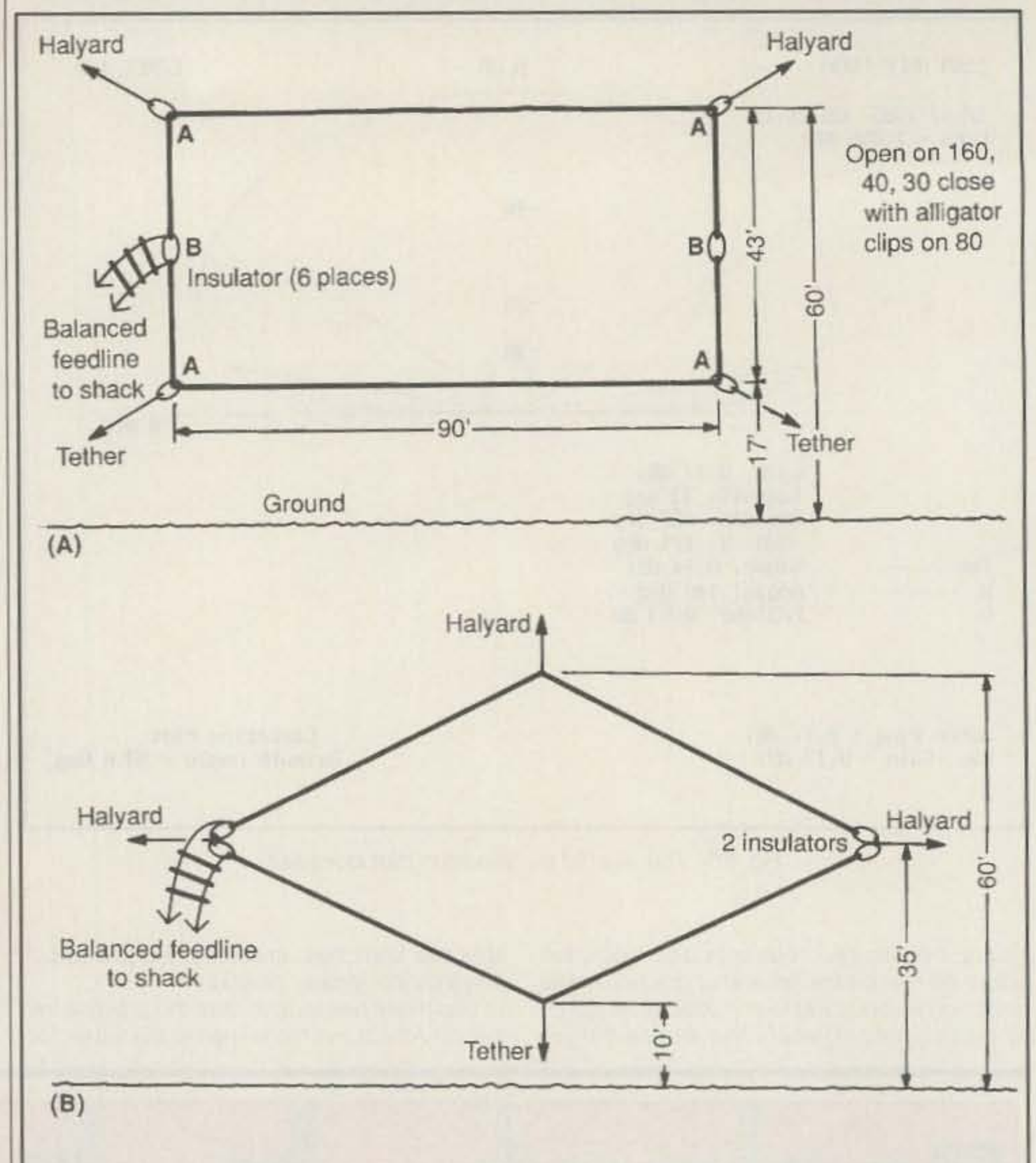

Fig. 2– (A) The basic rectangular configuration described in the text. (B) This variation was suggested by W7ZQ and is applicable for those with only one tall antenna support.

What about QRP? The next night I made my appearance running only 5 watts PEP. The results were the same. I was solid copy across the southeast.

I made a comparative test of the antenna on 75 meters between the loop and a half-wave horizontally polarized antenna placed at a height of 60 feet. The horizontally polarized antenna was superior on signals around the southeast, but on DX signals the loop was better. This seemed to verify the low radiation angle predicted by EZNEC.

I ran a few tests on 40 and 30 meters with this antenna. The results were as I felt they would be. The horizontally polarized antenna was better on stateside stations, and the loop had the advantage on DX stations.

Afterthoughts

I think that this antenna has fulfilled my design requirements. I now have an antenna that will fit on a city lot and give a good account of itself on the "top band." No, it's not the antenna to end all antennas, but I think that it will make many people happy who have heretofore found 160 meters out of reach.

Theoretically, I think the antenna could be considered an inverted "L" with a raised mirror-image counterpoise. Regardless of what it is called, I think it is about the best use of a one-half wavelength of wire for 160 meters that will fit on a city lot.

Shortly after I completed the antenna, I bumped into my friend Jim Lindsay, W7ZQ, on 17 meters and I described the antenna to him. Jim suggested that if an individual had only one tall support, the antenna could be placed in a diamond configuration. I modeled the antenna again using Jim's suggestion and that configuration proved perfectly acceptable (see fig. 2B).

Acknowledgements

My thanks go to the gentlemen who occupy 1.855 MHz in the evening. Their help and encouragement have certainly done a great deal to bring this project to a successful conclusion. If you are so inclined, join us some evening and enjoy a good measure of southern hospitality. See you on 160 meters!

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CIRCLE 156 ON READER SERVICE CARD

CONSTRUCTION

Build A Switchable Impedance Matching Transformer

This ubiquitous device is easy to build and will add many pleasurable miles to your mobile operation.

BY PHIL SALAS*, AD5X

Back in November 1976 John Nagle, K4KJ, published an excellent article in *Ham Radio* magazine entitled "Wideband RF Autotransformers." I built the tri-filar version of his autotransformer and have successfully used it for 1:4 and 1:9 HF matching applications. Unfortunately, this design still didn't give me the variety of impedance matching steps I really need for the various HF mobile and base-station antennas I am always experimenting with.

Jerry Sevik, W2FMI, then published an article in the April 1993 issue of *CQ* magazine. He added one tap to a tri-filar wound transformer, permitting impedance ratios of 1:9, 1:5.75, 1:4, 1:2.25, and 1:1.44. This was just the ticket.

Applications

Generally, HF mobile antennas are significantly shorter than a quarter wavelength, especially for the bands below 10 meters. Additionally, HF base-station antennas also tend to be electrically short for the 80 and 160 meter frequency bands. And, as you probably know, the radiation resistance drops quickly with antenna length (it is a squared function!). Therefore, you need to somehow match this low radiation resistance (plus ground and other losses) up to 50 ohms.

*1517 Creekside Drive, Richardson, TX 75081

There are several ways you can match short antennas. Base capacitive or inductive matching techniques are very popular. In my case, I wanted the flexibility of a switched broadband multi-tap transformer. The W2FMI broadband transformer design shown in fig. 1 gives a highly flexible, multi-impedance matching transformer that can be mounted in a small box.

Transformer Design

W2FMI used a 1.5 inch diameter ferrite core with a permeability of 250. I chose a FT114-61 toroid which is 1.14 inches in diameter and has a permeability of 125. This transformer will easily handle a 100 watt transmitter. And even though the permeability is low, there are enough turns used at the lower frequencies to give adequate transformer impedances. This is due to the lower radiation resistances I am trying to match at these lower frequencies. I chose the 1.14 inch diamter core so that it would fit into a small aluminum box. I used a Radio Shack 270-235 aluminum box with dimensions of $2\frac{3}{4}" \times 2\frac{1}{8}" \times 1\frac{5}{8}"$.

To wind the transformer, first take one wire and create a center tap as shown in fig. 2. Then place three wires together (I held them together by placing heat-shrink tubing on either side of the tap) and carefully wrap the wires around the toroid starting from the center tap—i.e., place the center tap on the toroid and wind five

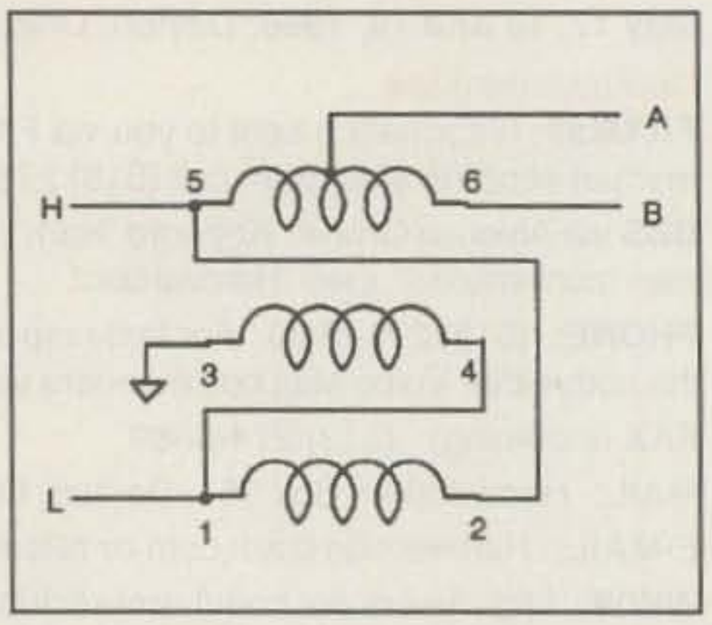
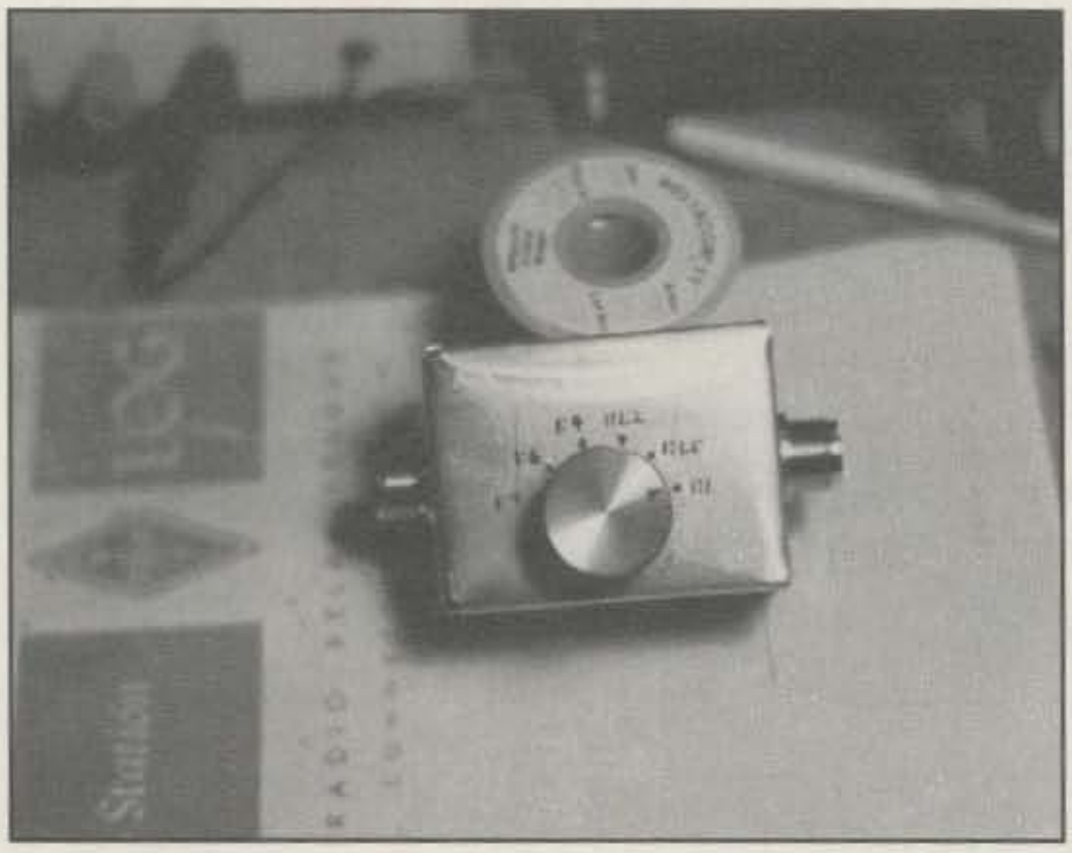


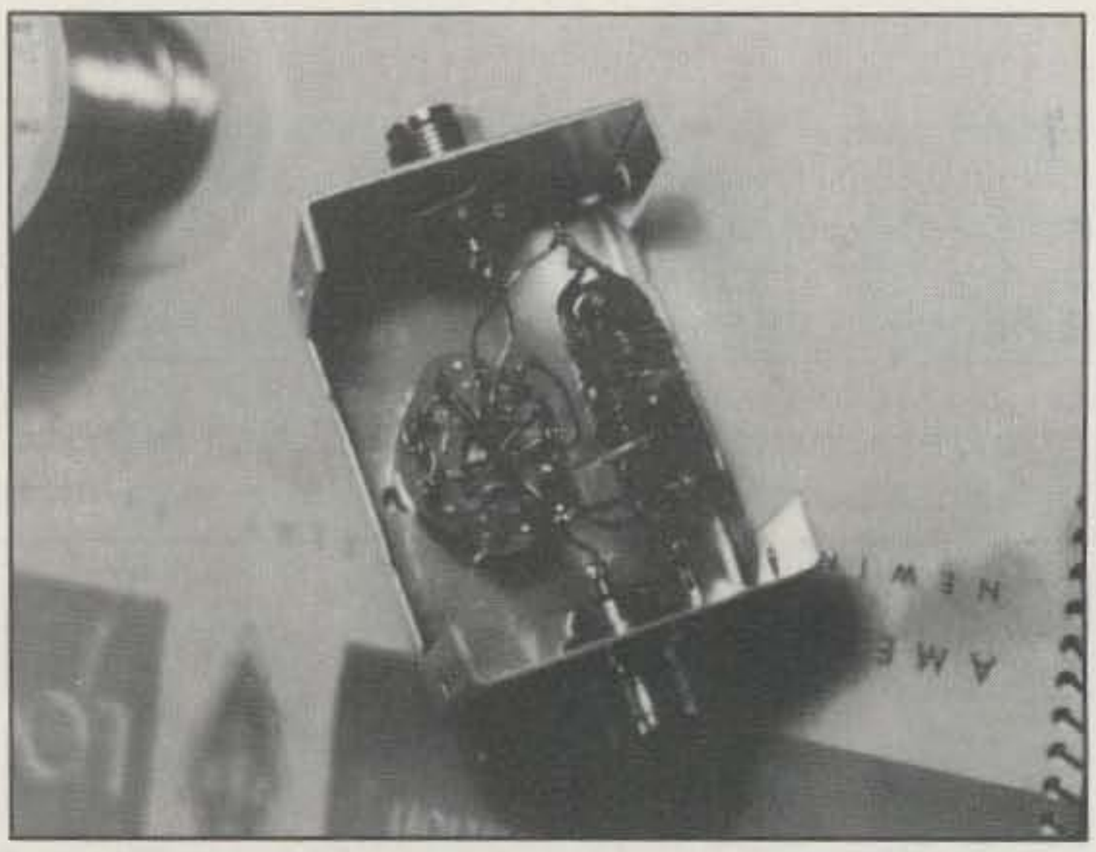
Fig. 1–Shown here is the schematic for the tri-filar-wound transformer.

turns on either side of it. Each non-tapped wire consists of 14 inches of #16 enamel-covered wire. The center tapped winding consists of 16 inches of the same enamel-covered wire.

Finally, I wired up the circuit as shown in fig. 3 so that I could switch easily through all the various impedance options. A Radio Shack 2P-6T rotary switch (RS 275-1386) accomplishes the switching of all impedances as well as a bypass or 1:1 position. Everything mounts nicely in the box as shown in the photograph.



A simple metal utility box is all you need to house the unit. One switch can provide just about any match you require.



This internal view shows the wiring and construction technique. It's really quite easy to build and use.

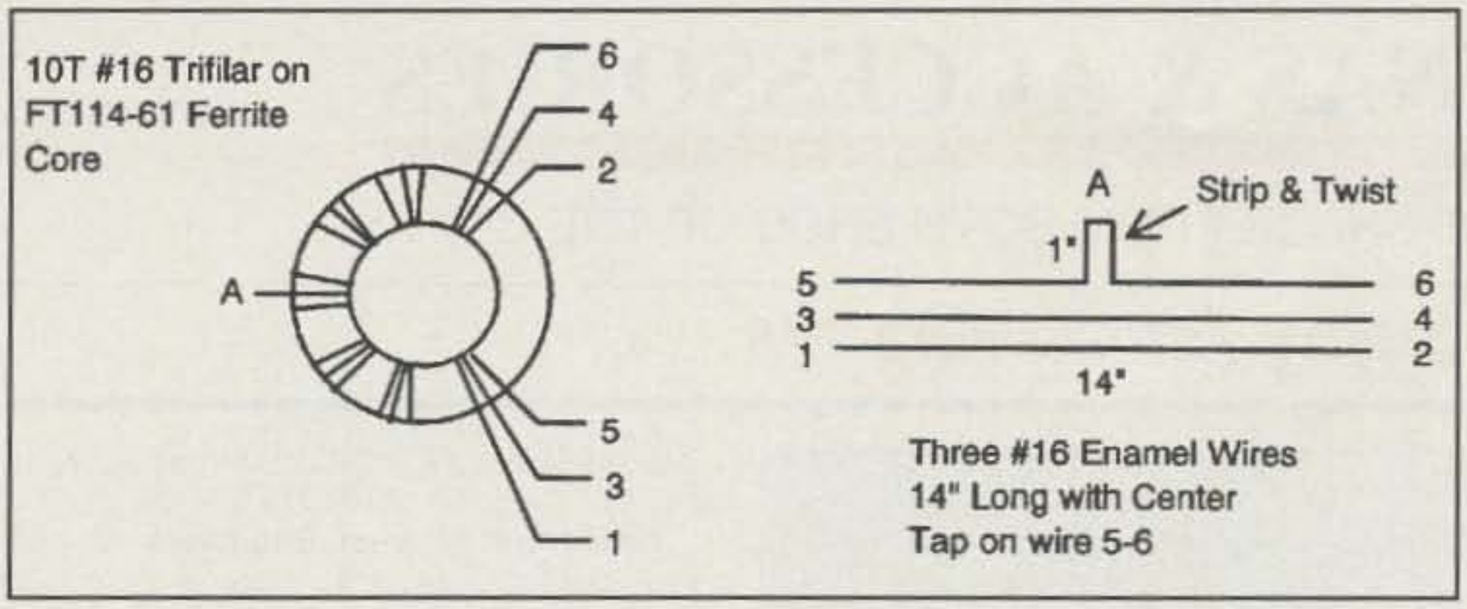


Fig. 2– Winding specifics for the transformer.

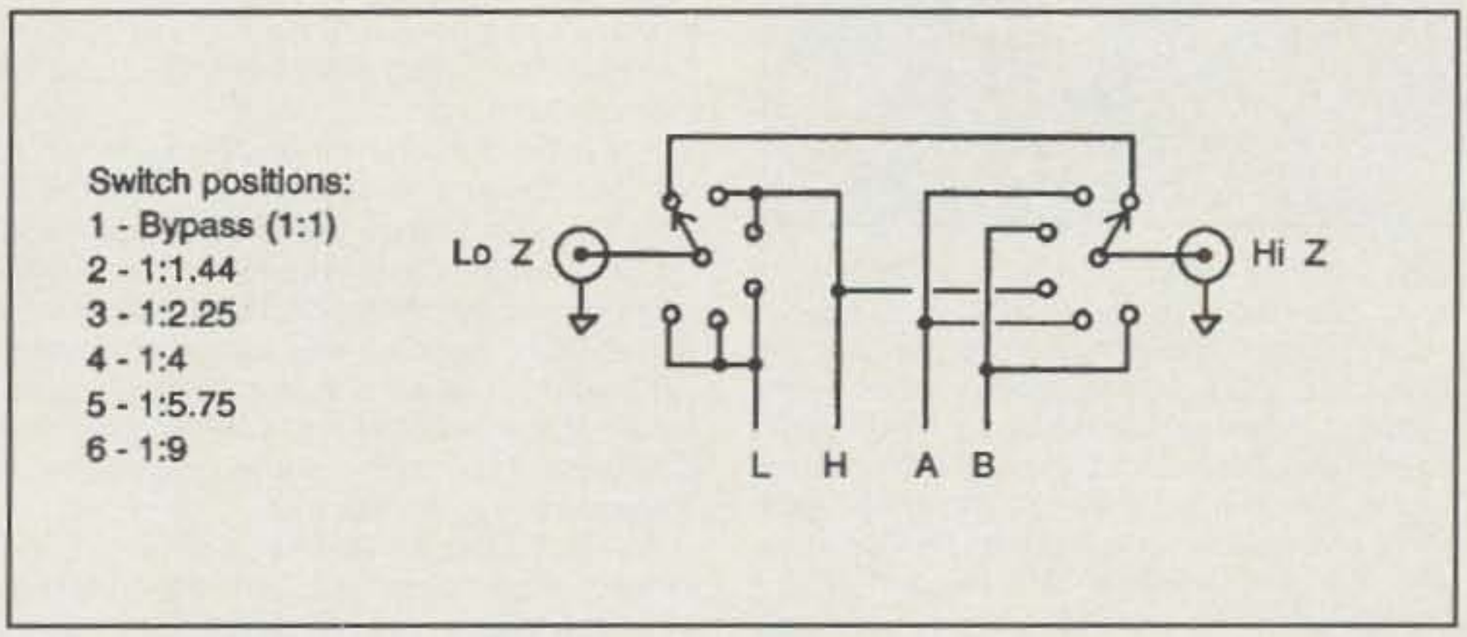


Fig. 3– Details of the switch-box wiring.

Applications

This very flexible impedance transforming box is ideal for quickly determining custom transformers you may wish to build for specific applications. As an example, when I mounted an Outbacker Perth antenna on my little Geo Metro, I quickly found that a 1.44 transformer gave me a good 50 ohm impedance match across the HF bands. This implies that the Perth impedance, along with associated losses, is around 35 ohms. Now the Perth has internal transformer matching that should give close to a 50 ohm impedance, so I was surprised at this. However, I went ahead and wound a custom 1.44 transformer and have had great results with it.

Now for the interesting part. When I recently mounted this same Outbacker Perth on my Ford Explorer, I found that the Perth did provide a 50 ohm match without an external transformer. This seems to imply that the ground losses on the Explorer are much higher (15 ohms or so) than on my tiny Geo Metro! I didn't expect this. I use a Hustler ball-mount mounted right on the side of my Geo, and a hatchback mount on the Explorer (my XYL, N5UPT, is not too wild about having a hole punched in the side of *her* car). However, the hatchback mount is well grounded to the Explorer hatchback, and the hatchback is well grounded to the rest of the Explorer. I need some further investigation here!

Conclusion

That's all there is to it. The W2FMI design, with the appropriate switch wiring, gives you a very flexible impedance matching transformer for many HF antenna applications. ■

BY KARL T. THURBER, JR., W8FX

ANTENNAS & ACCESSORIES

A LOOK AT THE SHACK FROM BOTH ENDS OF THE COAX

Swing Into Spring '96

While the invigorating scent of spring is in the air, we'll focus on some new antennas and accessories products while saving room for more "software stuff" and the like before closing out the column. With that in mind, let's begin with antennas.

Antenna Notes

The Beverage Box. If you're an active low-band (160 and 80 meter) amateur, you know that it's desirable to have a directive receive antenna. There are several low-band receive antennas currently in use by DXers. One is the classic Beverage. Another is the WA2WVL Ewe (as in female sheep) antenna. Both of these skyhooks exhibit good front-to-back (F/B) characteristics and directivity. However, both require impedance matching, and the Ewe needs a preamp for adequate performance.

John Carioti, K2ZJ, offers a receiving antenna product for use by low-band operators that helps ease the installation problems with antennas such as the Beverage, Ewe, and loop. His product is called the Beverage Box.

The Beverage Box contains a 9:1 impedance matching transformer, AM rejection filter, 10 dB RF preamplifier, and more. John says he designed the product so the average amateur could get a Beverage or Ewe working quickly, without winding an impedance transformer and finding a suitable amplifier. He added the 540–1600 kHz rejection filter because many low-band operators must build or buy a separate unit after they install the antenna.

To recall, the Beverage is a directional receiving antenna named for Dr. Harold H. "Bev" Beverage, ex-W2BML, who in the early 1920s described the directional properties and characteristics of this type of longwire. Bev's "The Wave Antenna for 200-Meter Reception" was published in November 1922 *QST*. He also collaborated with Rice and Kellogg to publish the pioneering article "The Wave Antenna" in the February 1923 issue of the prestigious *Transactions of the A.I.E.E.*

While the Beverage generally isn't for transmitting, it's a good receiving antenna. Such directive, relatively low-noise, easy-to-install antennas still are used by radio amateurs, AM broadcast-band DXers, and longwave aficionados to good advantage. However, the Beverage requires some real estate for effective implementation.

Another antenna that looks something like a small-scale Beverage is the Ewe, a wire antenna generally under 60 ft. long and 15 ft. high. It offers some directivity on 160 and 80 meters. The Ewe was described by Floyd Koontz, WA2WVL, in his article "Is this Ewe for You?" which appeared in February 1995 *QST*. Floyd describes several possible variations of the Ewe, including a reversible Ewe for 80 meters, a dual-band 160 and 80 meter version, and broadside and in-line arrays. However, the Ewe requires a low-noise preamplifier to bring signal levels up to those provided by larger antennas.

289 Poplar Drive, Millbrook, AL 36054-1674

One antenna effectively becomes three with the Palomar Engineers MSB-3 Magnetic Switch Balun system, which works over the range 500 kHz to 30 MHz and includes a control box. The balun is designed to mount in the center of a bent dipole. Typically, one dipole leg is oriented north-south, the other east-west. Alternately, one leg can be horizontal and the other vertical. See the text of this month's column for details. (Photo courtesy Palomar Engineers)

K2ZJ's Beverage Box handles antennas having an input impedance of 450–600 ohms, and its use results in a typical output impedance of 50 ohms. Frequency range is 1.8–2.0 MHz, and a unit optimized for 160 meters (1.8–2.0 MHz) also is available. The preamp has a gain of 10 dB and a noise figure of 3 dB. The rejection filter includes a lowpass filter and a 540–1600 kHz rejection filter that offers greater than 50 dB attenuation at 1 MHz. Various models of the Beverage Box are available from $39.95 to $86.95, depending on hardware configuration. A handy grounding device for the Beverage's terminating resistor is $19.95.

For more information, contact John Carioti, K2ZJ, at ZJ Electronics, 6893 Peck Road, Syracuse, NY 13209 (315-635-2016).

Postscript: For more details on Beverages, turn to these sources, which we described in previous columns. They include:

1. Walter J. Schulz, K3OQF's 1993 *The Wave Antenna for Reception of Medium and Long Waves*, $11.95 plus s/h from Radio Bookstore, P.O. Box 209, Rindge, NH 03461-0209 (1-800-457-7373).

2. Vic Misek, W1WCR's 1987 *Beverage Antenna Handbook, Second Edition*, $14.95 from Radio Bookstore.

3. John Devoldere, ON4UN's 1994 *Antennas and Techniques for Low-Band DXing, Second Edition*, $20 plus s/h from the American Radio League (ARRL), 225 Main St., Newington, CT 06111-1494 (860- 594-0200).

New from Palomar Engineers. In April 1993 we highlighted the Palomar Engineers MLB-1 Magnetic Longwire Balun™, a special-purpose high-impedance receiving balun designed with SWLs in mind. The $39.95 MLB-1 works over the range 500 kHz to 30 MHz and connects at the end of a longwire antenna to facilitate using coaxial cable from this point to the radio, minimizing stray signal and local interference pickup.

Since then Palomar's Jack Althouse, K6NY, has introduced a related system, the MSB-3. The MSB-3 Magnetic Switch Balun system also works over the same frequency range and includes the balun itself and an associated control box. The balun is designed to mount in the center of a bent dipole. Typically, one dipole leg is oriented north-south, the other east-west. Alternately, one leg can be horizontal and the other vertical.

The Balun Control Box has a three-position switch that connects the balun to either (1) both wires acting as a bent dipole, (2) one wire only as an end-fed longwire, or (3) the other wire as an end-fed longwire. As a result, the antenna has three different directional patterns, switchable at will to select the best signal or the least noise for the particular frequency and time of day.

The MSB-3 control box operates from 115 VAC and sits by the radio. The coaxial cable sends the received signals down to the radio and concurrently sends power up to the balun; no extra control wires are required. The system is $135 plus $6 s/h.

For a catalog and spec sheets contact Palomar Engineers, P.O. Box 462222, Escondido, CA 92046 (619-747-3343).

The S&S Cable Allbander Doublet. The S&S Cable Company has introduced the Allbander Doublet. It's a wire antenna resonant on all even harmonics of 160 meters. It offers a good match to 50 ohm coaxial feedline on nine amateur HF bands without using traps or other resonating or tuning components.

According to Stu Weltman, WA6NCN, the Allbander Doublet is 170 ft. long and is tuned by a precision length of 450 ohm ladderline to create a conjugate match point at 1.8, 3.6, 7.2, 10.8, 14.4, 18.0, 21.6, 25.2, and 28.8 MHz. Its 2:1 VSWR bandwidth when installed at 50 ft. is claimed to be 75 kHz on 160 meters, 150 kHz on 80 meters, 1.5 MHz on 10 meters, and "whole band" on 40, 30, 20, 17, 15, and 12 meters.

The Allbander Doublet is preassembled and requires only support points and a coax feedline for installation. The antenna uses prestretched #12 gauge copper, 413-strand "wire rope" radiating elements that are flexible and kink-proof. It's fed with 80 ft. of 450 ohm ladderline, which is supplied, and it's supported by a WA1FFL "Ladder-Loc" center insulator

The Palomar Engineers MSB-3 Balun Control Box is part of the MSB-3 Magnetic Switch Balun system. It has a three-position switch that connects the balun to either (1) both wires acting as a bent dipole, (2) one wire only as an end-fed longwire, or (3) the other wire as an end-fed longwire. Thus, the antenna has three different user-switchable directional patterns. (Photo courtesy Palomar Engineers)

(see our December 94 column for its details). A quarterwave coaxial RF choke balun is furnished. The antenna is rated at 1500 watts PEP.

For more information, contact S&S Cable Company, 9010 Forbes Ave., Northridge, CA 91343 (818-895-0803).

The CobWebb. We don't yet have all the technical details on this one, but we wanted to bring to your attention a novel imported multiband HF antenna. This one is the "CobWebb," a reasonably efficient, limited-space antenna designed by Steve Webb, G3TPW, and manufactured by S.R.W. Communications in England. The horizontally-polarized antenna covers the 14, 18, 21, 24, and 28 MHz bands with a square design only 8 ft. on each side.

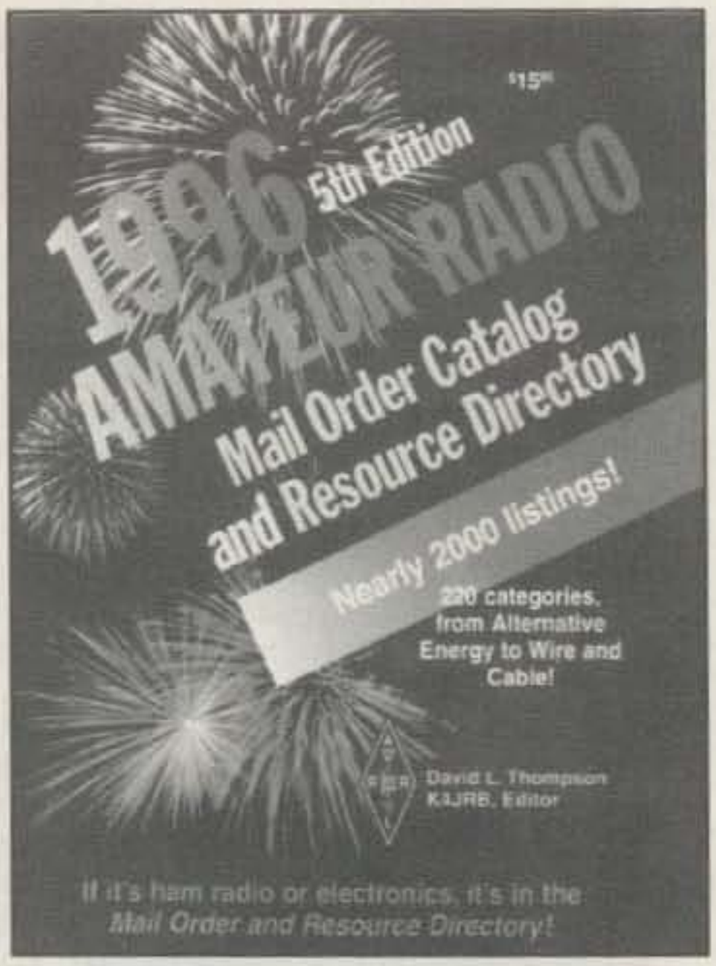
The CobWebb is a very broadband antenna on all bands, yet it still exhibits good efficiency; performance is claimed to be the equal of full-size dipoles on each band. Its pattern is omnidirectional, with virtually no nulls, making it a good choice for DXing from small lots where larger arrays are impractical or not allowed. A T-match and ferrite choke balun are used to match 50 ohm coax on all bands.

The small and lightweight antenna handles the legal amateur power limit and is rated to withstand 100 MPH winds. It's said to be easy to assemble and install, making use of Fiberglass spreaders and supports, as well as a preassembled feedbox and the five resonators. It's $318 plus shipping.

Contact the U.S. importer, Greg Grambor, at WB2GMK Antennas, 2219 High Point Dr., Brandon, FL 33511 (813-653-3131). (The antenna's English manufacturer is S.R.W. Communications, Ltd., Astrid House, The Green, Swinton, Malton, N. Yorks., YO17 0SN.)

Kiwa High-Performance MW Air-Core Loop Antenna. No discussion of low-band antennas would be complete without receiving loops. They're enjoying renewed popularity because they can be physically small yet work well, they can be tuned to a particular frequency, and they can be rotated to take advantage of their directionality. Loops are quieter than single-wires, are less prone to swamping by local BCB stations, and can be used effectively to null out noise and interference.

The Kiwa Electronics MW Air-Core Loop Antenna is an excellent antenna for top-notch AM BCB reception and DXing. The unique, 12



The Amateur Radio Mail Order Catalog and Resource Directory *long has been a comprehensive resource book. The ARRL-published 1996 edition is a one-stop sourcebook of dealers and vendors of electronic parts, components, software, books, tape, and equipment for the radio amateur or electronics enthusiast. The resource directory section includes practical information such as obtaining a license, listings of catalogs, ARRL resources, Q-signals, a glossary, etc. (Photo courtesy ARRL)*

inch circular air-core design offers improved signal reception, and the antenna tunes from 530–1700 kHz using a main and a fine-tuning control, mounted in a separate small box.

The 14 lb. antenna's "tilt control" includes a 3-to-1 gear reduction for precise nulling of local signals and interference, and the tilt can be adjusted to ±90 degrees from vertical. A local/DX preamp switch attenuates strong local signals in the "local" position. A variable output attenuator provides complete control of the signal to the receiver, and dual-output amplifiers let you drive two receivers simultaneously. The antenna can be rotated for maximum signal, and a liquid-filled compass allows bearing measurements. It's $360 plus $14 s/h.

Kiwa also makes or has announced several other products of interest. These include a high-performance RF preamplifier with 10 dB gain having a response from 100 kHz to 30 MHz; an AM BCB rejection filter, which sharply rejects signals below 1.75 MHz; a tropical band (1.8–5.5 MHz) air-core loop antenna; and even a nostalgic "Magic Tuning Eye" analog signal-level meter.

For more information, contact Kiwa Electronics, 612 South 14th Ave., Yakima, WA 98902 (1-800-398-1146). Kiwa is on World Wide Web at http://www.wolfe.net/~kiwa

Software Stuff

HAMCALC. George "Murph" Murphy, VE3ERP, sent us a copy of his "free" HAMCALC software program, which he bills as providing "painless calculations for amateur radio operators." It's a DOS-based collection of calculation routines intended to remove the drudgery of mathematics for anyone who dabbles in electronic design or experimentation. All the routines are user friendly, self-explanatory, and run mostly by menu-driven keystrokes from the main menu or one of four subsidiary menus. There are well over 100 calculation and conversion routines, an on-screen index, helpful hints, various utilities, and a "READ ME" file you can access from the main program menu.

HAMCALC is freeware and is available from the author on a 3.5 in. 1.44 MB diskette for $5 (U.S. funds) to defray costs. Or, you can send a donation to the Canadian National Institute for the Blind Amateur Radio Program, in care of VE3ERP.

Murph also includes a copy of FOTOCALC, a comparable set of "painless math calculations for photographers." This program has many calculation routines relating to filters, electronic flashes, exposure, focusing, lenses, and the like. Contact George Murphy, VE3ERP, 77 McKenzie St., Orillia, ON L3V 6A6, Canada.

Morse Code Made Easy. Ken Bradford offers the DOS-based shareware program Morse Code Made Easy, a menu-driven learning tool that lets you set the pace in learning Morse. It features three menu-selected modes: Lessons, Practice, and Word Test.

You can change the tone, number of words per minute, how many characters are sent at a time, and whether or not the characters are displayed as they are sent. The program checks the user's progress and displays a score based on the level of difficulty. There are 27 lessons arranged from the least to the most difficult. The practice menu option lets you select either "hear what you type" or "type what you hear," and the Word Test selection lets you choose one of 27 word lists that start with short, easy words and graduate to longer and harder words.

The latest version includes a "space multiplier" feature that lets you increase the space between dits and dahs without changing their length. This feature is handy for those who want to hear the dits and dahs as they will sound at the higher speeds but want more time between characters.

Registration is $10. When you register, you'll receive an updated program on either a 3.5 or 5.25 in. disk, so specify disk media and also include $4 for s/h. The program is available from Brad's Software, 4649 Wyoming Dr., Dallas, TX 75211-7843 (214-339-6920). Updates for registered users are $5 plus s/h.

Walnut Creek CDROM Update. We first mentioned Walnut Creek CDROM in the October 1992 column, when they offered about eight discs. Since then, their library has grown to offer about 60 different CD-ROMs or multiple-disc CD-ROM sets, including Fred Lloyd, AA7BQ's popular QRZ! Ham Radio CD-ROM callsign database which we highlighted in a recent column.

Some new titles include the Avalon 3-D tools disc, Giga Games 3 CDROM, Math Solutions CDROM, and NewT for Windows NT CDROM. There also are several new titles on the way, such as the Font Garden and Visions II CDROMs. Recent revisions include updates of the Hobbes OS/2, Scientific and Technical Library, CICA for Windows, and Simtel for DOS and Simtel for Windows.

For an ever-thicker CD-ROM catalog, contact Walnut Creek CDROM, 4041 Pike Lane,

Suite D-902, Concord, CA 94520 (1-800-786-9907). Also, if you're on the Internet, check out their Web site. It's at http://www.cdrom.com/ There's also AA7BQ's QRZ! Web server at http://www.qrz.com/ and the Walnut Creek FTP server at ftp.cdrom.com you can peruse. The latter site has some 52 gigabytes (!) of "stuff for downloading," including most of their CD-ROM titles, which you can sample.

From The Bookshelf

National Radio Club (NRC) Publications. The NRC, an association of mediumwave (MW) listeners and radio hobbyists, offers an interesting catalog of products and publications that's yours for the asking. While most of their pubs relate to MW and not to amateur radio, several of them are of interest to amateurs. There are a number of available antenna publications.

Some of the antenna manuals and booklets include *Beverage and Longwire Antennas Design and Theory, Loop Antenna Design and Theory,* and *Antenna Reference Manual* (Vols. 1 and 2). Also available are several dozen reprints of antenna and other articles published in the NRC's newsletter, "DX News." For a copy of their product catalog, contact the National Radio Club Publications Center, P.O. Box 164, Mannsville, NY 13661-0164. (NRC membership is $24 for U.S. listeners, $25 for Canadians. For membership and subscription information, contact the NRC Subscription Center, P.O. Box 118, Poquonock, CT 06064-0118.)

IRCA Publications. The International Radio Club of America (IRCA) also offers a variety of publications to MW hobbyists. One of their most useful pubs is *A DXer's Technical Guide.* This is a 120-page IRCA book that answers questions on MW receiver and antenna theory and performance improvement, receiver accessories, modifications, and more. It's $6 to members, $8 to others. The second edition is from the IRCA Bookstore, Attn: Phil Bytheway, 9705 Mary NW, Seattle, WA 98117-2334.

The IRCA also maintains a file of articles which have appeared in their newsletter, "DX Monitor," since 1964. These cover a variety of topics including antenna theory and construction, projects, propagation, and more. Copies are available for a nominal charge. For a list of reprints, send $1 to IRCA Reprints, c/o Steve Ratzlaff, 1885 E. Bayshore Rd., Sp 90, E. Palo Alto, CA 94303. (IRCA membership is $25 for U.S. listeners and $27 for Canadians. For membership and newsletter particulars, contact the IRCA at P.O. Box 1831, Perris, CA 92572-1831.)

Transmitting Antennas And Ground Systems For 1750 Meters. For an interesting and comprehensive background on experimental LowFERS (160–190 kHz) antennas, order a copy of *Transmitting Antennas And Ground Systems For 1750 Meters,* edited by Michael Mideke. This is a 60-page, 1987 collection of articles from various LowFERS publications. It's $5.00 postpaid from Max Carter, 46 14th St., Wheatland, WY 82201.

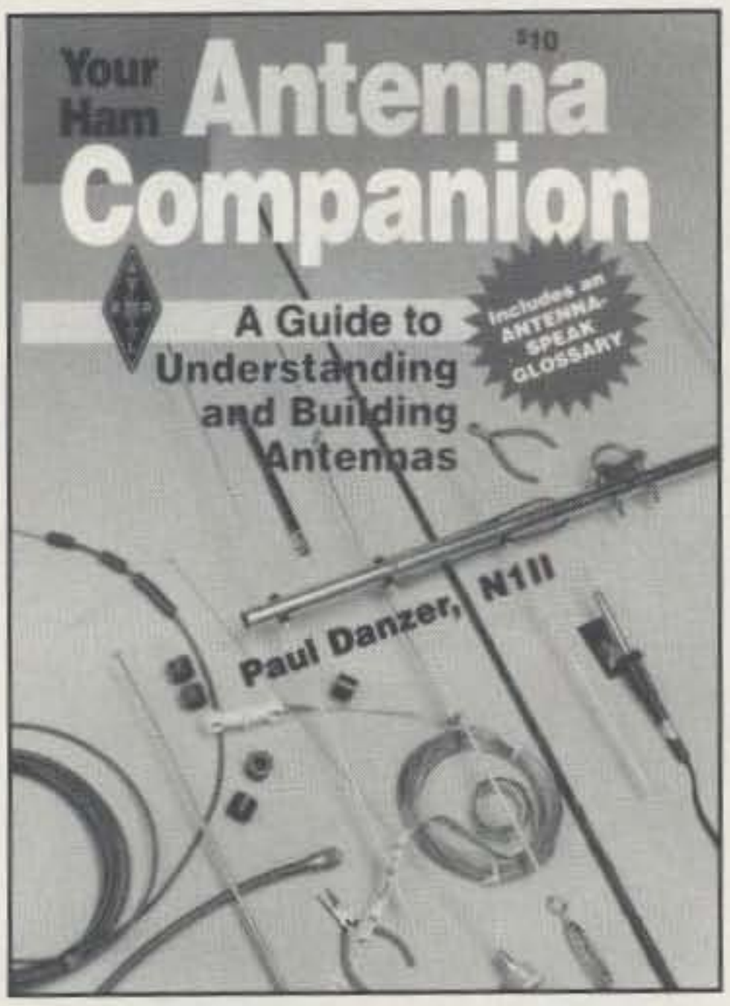
The 1996 Amateur Radio Mail Order Catalog and Resource Directory. In previous columns we have made no secret of the fact that we're a big fan and user of the *Amateur Radio Mail Order Catalog and Resource Directory.* It's long been a comprehensive communications resource book, one that was founded by John Hart, NØOCF, and until recently was published by David Thompson, K4JRB, and his firm, Resource Solutions. But with the latest edition, the *Directory* has a new printer and distributor, the ARRL, although Dave continues as its editor.

The 1996 fifth edition is revised and expanded, to be a one-stop sourcebook of dealers and vendors of electronic parts, components, software, books, tape, and equipment. There are 220 categories in the catalog section, from alternative energy to wire and cable. Listings include the name, address, phone, FAX number, and E-mail address of most vendors, plus a description of the products and services offered. The resource directory section includes practical information such as obtaining a license, listings of free and for-charge catalogs, ARRL resources, Q-signals, a glossary, and more.

The 256-page fifth edition is $15.95 from the ARRL, 225 Main St., Newington, CT 06111-1494 (860-594-0200).

Two More from the ARRL. We'd also like to direct your attention to two interesting ARRL antenna-related books. One is the beginner-oriented, 226-page *Your Ham Antenna Companion,* by Paul Danzer, N1II, published at $10. This 1995 title gives you the information you need to select, build, buy, and use antennas, and it includes antenna designs for the beginner to build a skywire for the first time. Some of the topics covered include hitting more repeaters, deciding what feedline to use, buying a multiband HF vertical, building a VHF ground plane, understanding SWR, and alternatives to an outside antenna.

Jim Kearman, KR1S's 1993 book, *Low-Profile Amateur Radio,* is more than "just an anten-



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HP7000C: UHF 2X5/8 wave, 6 dBd - 8.15 dBi, 440 - 450MHz, GOLD/TEFLON UHF conn., 34.6 inch. long

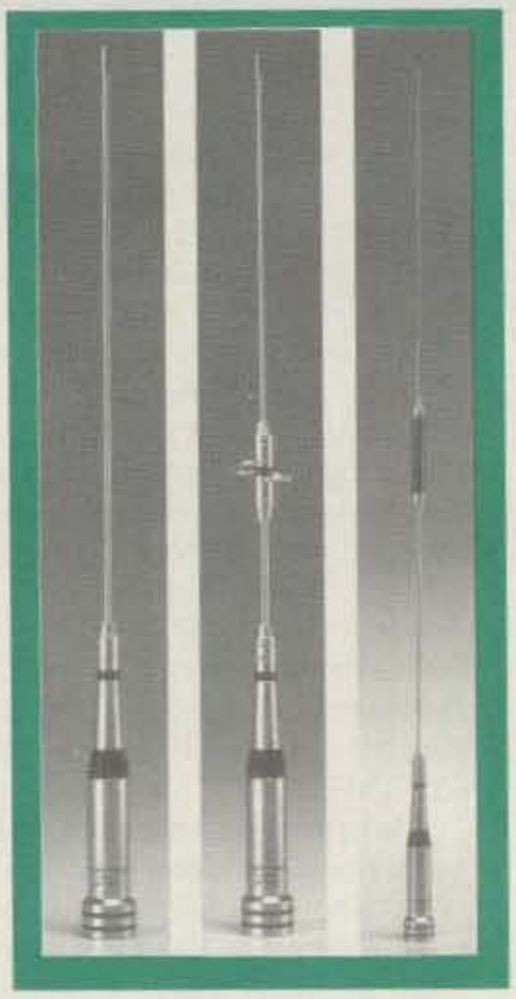
HP7000: UHF 1 X 5/8 wave, 3.2dBd - 5.35dBi, 440-450MHz, GOLD/TEFLON UHF conn., 18.5 inch. long

HP2000: VHF 1 x 5/8 wave, 3.2 dBd - 5.35dBi, 143 - 149MHz, GOLD/TEFLON UHF conn., 48.5 inch. long

HP2000C: VHF 3/4 wave, 4dBd - 6.15 dBi., 143 - 149MHz, GOLD/TEFLON UHF conn., 60 inch. long

HP2070H: VHF 1/2 wave/UHF 3/5 wave, 0 dBd VHF/ 3.8 dBd UHF, GOLD/TEFLON UHF conn., 18.5 inch. long

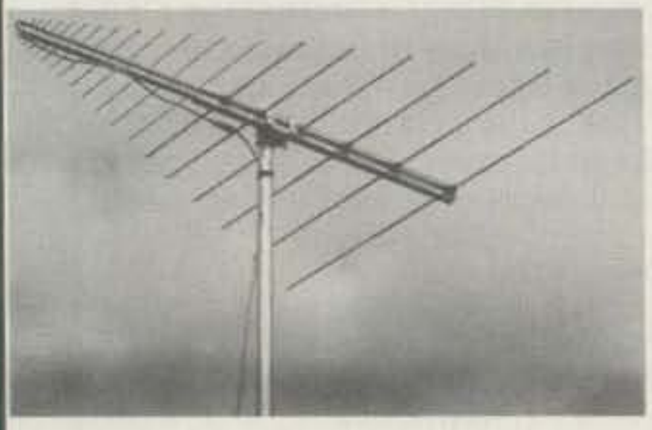
HP2070: VHF 1/4 wave/UHF 3/4 wave o dBd VHF/ 3.8 dBd UHF, GOLD/TEFLON UHF conn., 18.5 inch. long



NEVADA Model 1500

The 1500 offers super high quality, attractive all white fiberglass and stainless steel construction that withstands the very worst of weather, even salt spray along the coast. Custom engineered 500KHz to 1500 MHz super wide band reception, low VSWR dual band 2m/70 cm gain type transmitting antenna rated at 35 watts, all rolled into one! The perfect low cost, heavy duty alternative to flimsy wide band scanner antennas, built to provide peak performance year after year.

Frequency: 500kHz - 1500MHz
Impedance: 50 Ohm
Material: Fiber Glass
Length: 43.3 Inches
Connector: Low Loss "N" type
Mounting: Mast Mounting



Log Periodic Antenna CLP 5130 Series

• Wide Band • Low VSWR • High Gain • Compact Size • Lightweight •

One Antenna Does It All! The **Create** CLP Series offers outstanding performance with high forward gain and low transmitting VSWR of less than 2:1 across a broad range. Extra strong commercial grade aluminum and magnesium construction withstands the worst weather for unsurpassed long-term reliability. Multipurpose horizontally or vertically mounting with included hardware and complete instructions. Can pass as a conventional TV antenna. Perfect for apartment dwellers and those with limited space or antenna restrictions.

CREATE World Wide Excellence with Proven Design

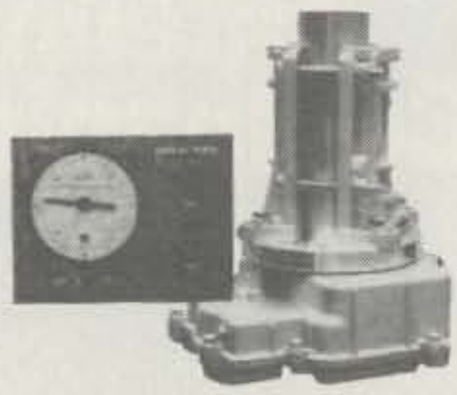
RC5-1
RC5-3 (Preset)

Most popular for smaller antenna systems (A3S, A4S, EX14, KT14, KT34A, etc.). Competes favorably with HAM IV and offers much higher quality at a surprisingly low price.

Model	Roto Tq.	Brk. Tq.	Sq.Ft.	Vert. Load
HAM IV	66ft#	417ft#	15	400
RC5-1/3	43	506	13	880
G800SDX	43-79(2)	288	17	1320(1)

RC5A-2
RC5A-3 (Preset)

RC5A-2(-3) will handle most any antenna system. It out performs the T2X in every department and costs about the same. It's no wonder the RC5A-2 and the RC5A-3 are becoming the big sellers.



Model	Roto Tq.	Brk. Tq.	Sq.Ft.	Vert. Load#
T2X	83ft#	750ft#	20	800
RC5A-2-3	116	1085	25	1540

EMOTO Reliability and High Performance

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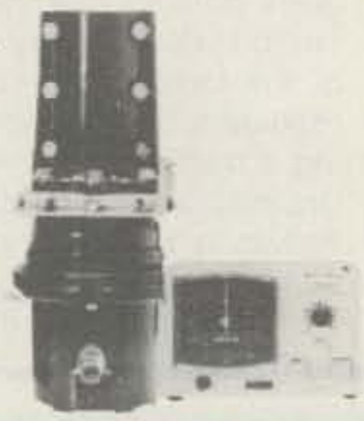
Designed for VHF/UHF and lighter HF beams. Competitive in price and is a runaway for quality and specs.

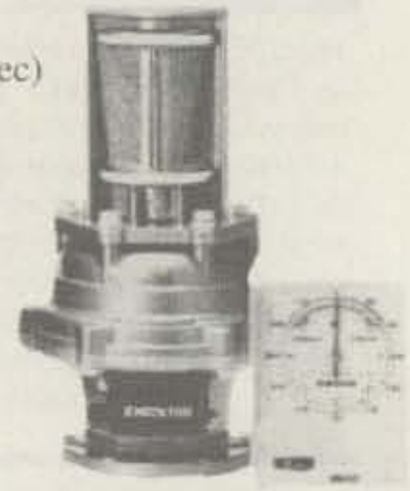
1300MSAX

$GD^2$1800kgm^2
1300MSAX is designed for larger antenna arrays and has forged steel gears that withstand large external forces. Double gear and twin drive design, plus powerful patented braking function. Preset and computer control. 100Volt motor for low power loss over long control cable runs. Compare to HDR300 & Yaesu G2800SDX.



747SRX/ 750FXX

$GD^2$400kgm^2
Use with larger Tri-Band beams, high rotating speed (35 sec) and 470° rotation. Compare 747SRX/ 750FXX to HAM IV. The 750 FXX is computer compatible. Note: 360° controller.



SAT TRACKER ©

Full-featured, state-of-the-art computerized satellite operation of Yaesu and Emoto rotators has never been easier or less expensive... The SAT TRACKER© is here!

FAST- Parallel data processing (not serial like others) that is fast enough for low earth orbit LEO Sats and digital weather satellites!
Compatible with ALL popular tracking software: RealTrak, Instant Track, etc., plus it runs in the background as a TSR (Terminate & Stay Resident) program which allows the user to do other things on a computer while SAT TRACKER© is in full operation. Full support and fully upgradeable. Future upgrades could include: optional transmitter doppler shift frequency control.

EASY- No need to use or tie-up a computer's expansion slots. SAT TRACKER© will run with laptops and notebooks which, of course, have no expansion slots. No complicated, on-board calibration adjustments required! Calibration and setup is quick & easy using the computer's keyboard,
making it simple for the user to make changes at any time- allows accessing full manual override and complete manual control, in a matter of seconds!

NO EXTERNAL POWER NEEDED- No power cubes or 12VDC hookups to fuss with- as SAT TRACKER© gets its power from the rotator's control box. SAT TRACKER© is completely plug-in-and-play with models for both Emoto and Yaesu AZ/EL rotators. AZ- only mode allows full-featured computerized AZ- only control with compatible rotators.

RCSS & SatTracker Pictured

- 8 bit multiplex A to D converter for an accuracy of .72° Elevation and 1.44° Azimuth
- Parallel interface for maximum data transfer and timely control
- Completely laptop compatible for portable operation
- Requires no slots, serial ports or power from your PC
- Fully compatible w/ "Instant Track™", "Real Track™" and other software interface specs
- Runs in the background as a TSR (Terminate and Stay Resident) program
- DOS and WINDOWS™ 3.1 compatible
- Complete user and programmer documentation available

The SAT TRACKER© is a combination of hardware and software which allows you to accurately track all types of satellites or celestial objects from Horizon to Horizon. The system will even assist in accurately tracking rapidly moving low orbit satellites such as the military "LEO" Satellites or Amateur radios' "MICROSAT" Satellites. The SAT TRACKER© can be used in multitude of applications, besides satellite tracking, which require real time computer control of antenna systems. One such application is remote antenna polarity and directional control.

The SAT TRACKER© may be used for real timer monitoring of the orbital paths of multiple satellites while tracking the one of your selection and running your favorite DOS or Windows program. All program drivers were written entirely in Assembly Language. The Programmers documentation includes documented interfaces to C, Pascal, ADA and other high level programming languages for both users and systems integrators who wish to integrate our system into more complex communications systems of their design or choice.

The minimum system requirements are a MSDOS compatible 286 bases system, with an unused parallel interface. The system uses a SASI proprietary software driver which allows us to communicate bi-directionality and faster with our controller interface than a serial based product. Our product, as a stand alone product, does not require any power or slots from your PC. It is designed to allow control from your laptop computer for true portable operation with no loss of serial ports or additional battery drain. All cables, documentation and software are included.

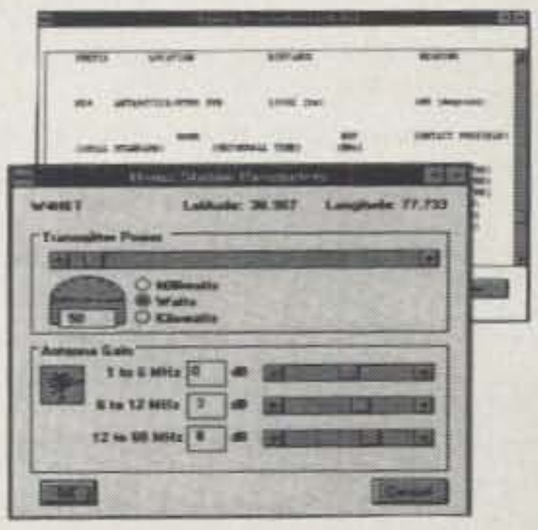
NOVA Software

Nova includes 16 maps in 2 sizes, for a total of 32 maps. Mercator projection (rectangular) with zoom view of any continent, whole-Earth central longitude may be set for Europe, North America, or the Pacific; country name labels on/off; up-to-date political boundaries; easy-to-see satellite footprints; up to 6 satellites plotted simultaneously. Orthographic (view from space) projection with full Earth positioning and manipulation, ground tracks, foot prints, and real-time orbit shapes; up to 6 satellites visible. Sky temperature (3 bands: 50, 136, and 400 MHz) with current satellite and antenna positions. Radar map showing all visible satellites and antenna position. Grid square maps centered anywhere in the world, with point-and-click bearing/distance display. AutoTracking via the popular SASI Sat Tracker, Kansas City Tracker, and AEA ST-1 hardware interfaces. Nova also includes full control of frequency (with or without real-time Doppler compensation) and mode of all modern satellite transceivers: ICOM twins, '970, '820, and others, Yaesu FT-736, Kenwood TS-790. Frequency adjustment is made by on-screen knobs, buttons, sliders, or the keyboard. TX and RX may be adjusted separately or linked (normal or inverted). Frequency control is through a user-selectable serial port via Frequency Manager or the radio manufactures interface (not required with Frequency Manager). 370 memories are available for your local repeaters, etc.,

System requirements:
The combination of SAT TRACKER™ and Nova require only 420KB of conventional memory. Requires a math co-processor, VGA graphics, mouse, and about 2 MB of hard disk space. SAT TRACKER™ and Nova run as DOS or Windows 95.
Call your Dealer for $$$$.

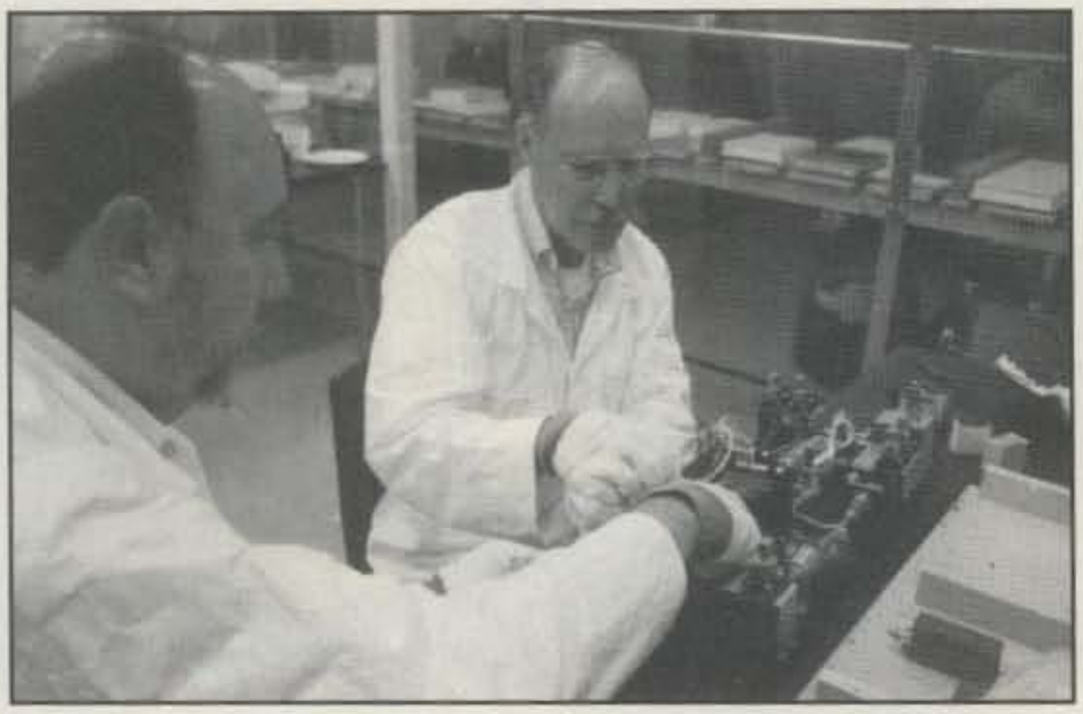
SKYCOM

Skywave Propagation Prediction Software for Windows 3.1/Windows 95

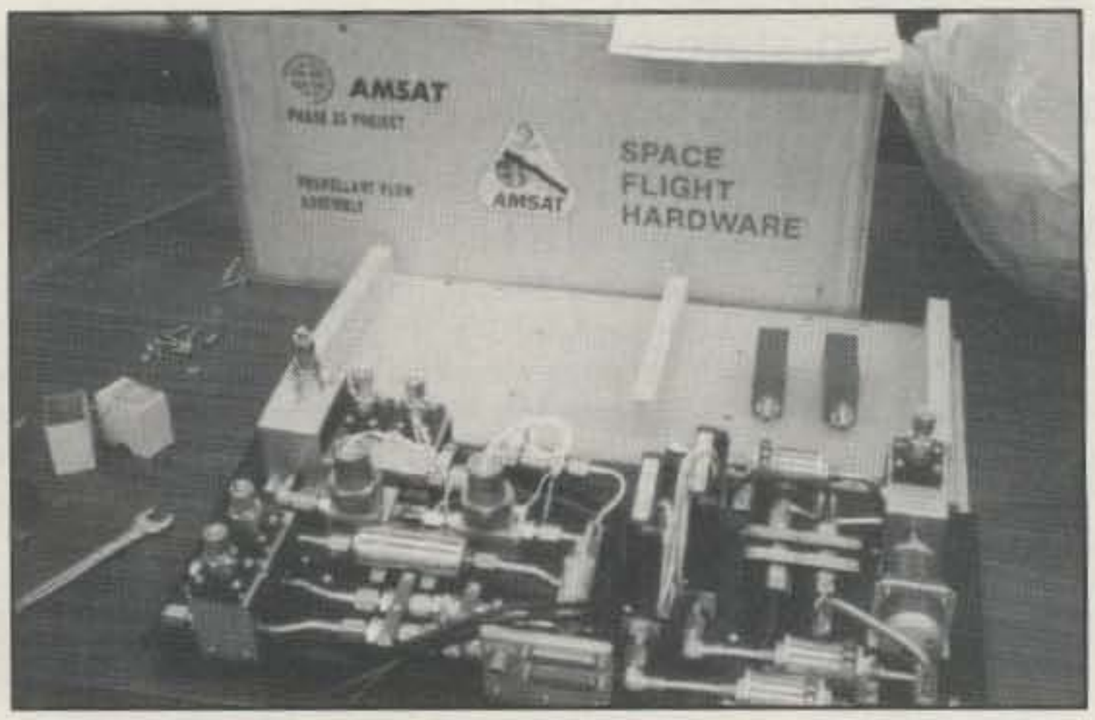


Tell SKYCOM where you are, your transmitter power and antenna gain. Enter the current Sunspot Number or Solar Flux measurement. SKYCOM's windows simplify data entry. Pick a location from SKYCOM's database of over 400 call sign prefixes, using SKYCOM's database search tools or map. You can tailor the SKYCOM database to your own needs by adding additional locations. Instantly obtain prediction reports that tell you the best time and frequency for your transmission. You can also obtain a detailed report that lists the vertical critical frequency, frequency of Optimum Transmission, Signal to Noise ratio, and other data. SKYCOM 2.0 includes an on-line beam heading reference to the direct and long path bearing and distances (in miles and kilometers) from your home station to all locations in the SKYCOM database.

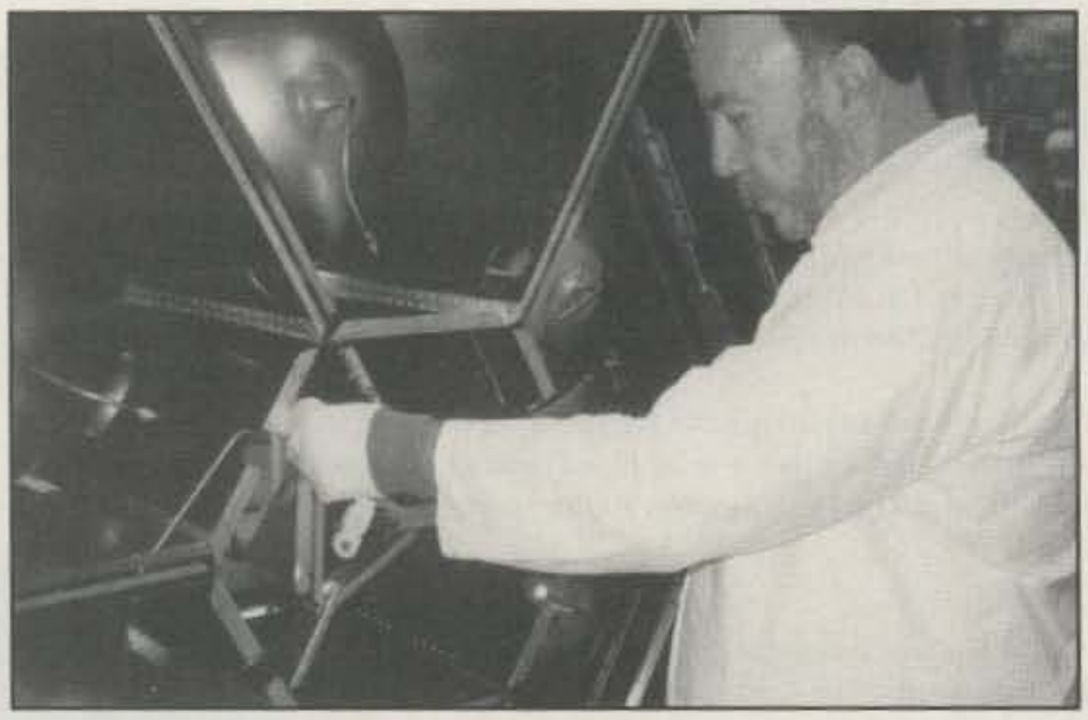
CONTACT YOUR FAVORITE DEALER TODAY!



Here, Dick Daniels, W4PUJ (right), and Mike Garrity, N4OZC (left), perform minor adjustments to Phase 3D's flight model Propellant Flow Assembly (PFA) in the clean room at the Integration Lab in Orlando, Florida. The PFA will control both the flow of hypergolic propellants to the kick motor as well as the flow of ammonia to the satellite's arc-jet positioning motor. (AMSAT-NA photo, Keith Baker, KB1SF)



The Phase 3D's flight model Propellant Flow Assembly (PFA). Valves and piping on the left side of the unit will be used to fuel the spacecraft's propellant tanks on the ground prior to launch, and will also control the flow of propellants to the kick motor while in orbit. Valves and piping on the right will be used to fill the spacecraft's ammonia tanks and later will control ammonia flow to the satellite's arc-jet positioning motor. (AMSAT-NA photo by Keith Baker, KB1SF)



In this AMSAT-NA photo Mike Garrity, N4OZC, installs the mounting bracket for Phase 3D's arc-jet positioning motor into the "bottom" of the spacecraft structure. (AMSAT-NA photo by Keith Baker, KB1SF)

Here students Gene Hansen (left) and Richard Vanderford (right) inspect the completed flight model Phase 3D Specific Bearing Structure (SBS) in the Phase 3D lab at Weber State University in Ogden, Utah. The SBS will carry the Phase 3D satellite to orbit aboard its Ariane launch vehicle. (AMSAT-NA photo by Dick Jansson, WD4FAB)

na book." Its camouflage cover suggests its emphasis. The book is for the amateur who needs to get on the air without attracting attention from places where antennas are frowned upon. While the focus is on low-visibility antennas, it also covers low-power operating, interference problems, and techniques useful in at-home, portable, and mobile operating. The emphasis is on developing on-the-air skills over brute-force power and antennas. The 128-page book is $8 from the ARRL.

Navigating the Internet with CompuServe. If you don't have or don't want direct access to the Internet, you still can access the Net through online services such as CompuServe, America Online, and Prodigy. *Navigating the Internet with CompuServe*, by Wes Tatters, is a $25 Sams.net imprint (Macmillan) book that shows you how to unlock CompuServe's expanding Internet resources. The book introduces the Internet and CompuServe, and it comprehensively covers setting up CompuServe's WinCIM® software for Internet usage. The book also covers important topics such as connecting to CompuServe from the Internet and using popular "Winsock-compliant" client programs on CompuServe.

Contact Macmillan Computer Publishing USA, 201 West 103rd St., Indianapolis, IN 46390 (1-800-858-7674), for a catalog, or look for the book in a local bookstore.

Technical Writing for Technicians. "What, me, a technical writer? But I'm a technician!" Or so you may say. A while back *CQ*'s Managing Editor, Gail Schieber, forwarded to me Warren R. Freeman's new book, *Technical Writing for Technicians*, for review. It's designed not for English majors, but for technicians, to help them build on their existing technical expertise to expand their writing abilities. This one-of-a-kind book should be a "natural read" for technical people who also write amateur radio and electronics hardware and software manuals, as well as for those preparing technical articles for publication.

The 168-page, $19.95 book presents general qualifications for writing, various kinds of manuals and other documentation, writing style, preferred words and phrases, and how to prepare sketches and drawings for print. An example of an actual manual, with clarifying notes, is included, as are several appendices of useful reference material.

If you can't obtain the book in your local bookstore, contact CONTEMAX Publishers, 17815-24th Ave. North, Plymouth, MN 55447 (612-473-6436).

Short Bursts

The CompuServe HamNet Forum. HamNet began in 1981 and is one of the oldest forums on CompuServe. It's also the first of its kind in the online network world dedicated to amateur radio and related topics. It's a place where you can find others who share your radio interests and who can help one another in answering questions, providing comments about new equipment, updating DX and satellite informa-

tion, and more. Scott Loftesness, W3VS, is the Chief SYSOP of the HamNet forum, which you can access on CompuServe by typing "GO HAMNET." Besides the forum proper, there also is a HamNet home page at http://www.webcom.com/~sjl/HamNet_Companion/

HamNet's message area is organized into sections, and within each section, into "threads" of topics. Threading of messages by topic helps keep related messages together so you easily can follow the discussion on a topic. Threading of messages by topic is a feature of online forums, and it makes reading and participating in discussions simpler and more enjoyable.

HamNet's file libraries contain a variety of software, text information, examination schedules, and other information. The libraries, like the message sections, are organized by topic to make searching for files easier. To further help you in searching for files of interest, in each library the SYSOP maintains one file which contains the file descriptions for that library's files. By downloading that file, you can review the contents of the library offline and decide what you want to download the next time you go online. Doing this saves you time and money.

In HamNet's "LIB 0" News/Help file library, the SYSOP also maintains two files with information about all of the files in HamNet's libraries. They are (1) HAMNET.EXE, a full description listing of all (3000+) files in the HAMNET forum library; and (2) ALLFIL.ZIP, a one-file-per-line listing of all files in the library. This file contains name, library number, an indication of shortened size, and a 42-character description of each file.

As with other online forums, you should post your questions directly in the forum, rather than sending E-mail to members. This is because the forums are "communities" where all benefit from asking each other questions and sharing experiences.

You should address general questions to "ALL." When you post a forum message to ALL, all forum members will benefit from the views offered. A forum message addressed to the SYSOP will be delivered to the next HamNet staff member who enters the forum—the best way to get a quick answer to any question about forum operation that you might have. But in most cases, addressing general messages to ALL is best. See you online!

AMSAT Phase 3D Satellite Project Update. A new era in long-distance amateur communications dawned in 1983, when the first Phase III satellite, OSCAR 10, was launched. Today, however, there is only one major amateur radio satellite, OSCAR 13, that's capable of providing consistently reliable intercontinental amateur communications. Unfortunately, it soon will plunge into the atmosphere and be destroyed, probably in December 1996.

The under-construction Phase 3D satellite is envisioned as a replacement for OSCAR 13, but it's more than that. It's the largest and most advanced amateur satellite ever built, being aimed at reducing the cost and complexity of satellite-capable amateur stations, plus adding new frequency and data choices.

We highlighted many details of Phase 3D in last November's column, so we won't repeat them here. We also noted that the launch aboard the European Space Agency's (ESA's) new heavy-lift Ariane 5 vehicle was expected to be from the ESA complex at Kourou, French Guiana, in May 1996.

Unfortunately, there were some technical problems beyond AMSAT's control with the launch vehicle, engine, and ground facilities. The bottom line for Phase 3D is that while there will be a flight taking place in late May, the satellite launch is manifested on the Ariane 502 flight, which isn't expected to be launched before September 1996. While news of this delay is disappointing, AMSAT-NA President Bill Tynan, W3XO, noted that setbacks can be expected in such an ambitious program, but they shouldn't detract from overall program success.

As we pointed out in the November column, the satellite is an international project, with work being done in Germany, South Africa, Finland, Slovenia, the Czech Republic, Belgium, Japan, and other countries besides the United States. Assembly and checkout is taking place in Orlando, Florida. The accompanying photos document progress on the Phase 3D international satellite integration effort, which, fortunately, is progressing nicely.

For information on AMSAT membership, ways to contribute to the project financially, and a current catalog of AMSAT publications and software, contact AMSAT, P.O. Box 27, Washington, DC 20044 (301-589-6062). You also can make contributions to the ARRL Satellite Fund at 225 Main St., Newington, CT 06111-1494 (860-594-0200). And, if you have Internet access, check out AMSAT's Web home page. You'll find it at the Internet address http://www.amsat.org/amsat/AmsatHome.html

Looking Back Five

Five Years Ago in Antennas and Accessories. Now you know what the column looks like in April 1996. But what were the hot topics in April 1991?

In the April 1991 column we discussed the Carolina Bug Katchers from the Lakeview Co.; the Lindsay Specialty Products VHF/UHF amateur antennas; the GAP Challenger DX-V and DX-VI multiband HF/VHF verticals; the Mosley antenna product line; several Yaesu antenna rotors; an update on United Ropeworks' Phillystran® nonmetallic tower guys; the Voyager triangular towers from Glen Martin Engineering; and the then-revolutionary MFJ-207 (HF) and MFJ-208 (VHF) SWR Analyzers.

Turning to software, we described enhancements to the YO and MN antenna analysis software offered by Brian Beezley, K6STI; the WB2OPA LogMaster computerized HF logging system; the Diamond Systems Ham Shack Pro database manager and the LogBook computer logbook; the World Prefix Utility Program for the CQ WPX Award, by Robert Payne, N5KUC; the QQSL V3.0 "Quick QSL" shareware, from Bill Mullin, AA4M/6; the DXbase DX Software System, a logger from Scientific Solutions, Inc.; DOME accounting programs for small businesses, from DOME Publishing Co.; and an update to the Grammatik IV grammar and style checker from Reference Software.

Wrap-Up

That's all for this time, gang. Next time more Antennas and Accessories topics of current interest. See you then.

Overheard: The *real* victor in a dispute is the one who has strengthened himself but not weakened his opponent.

73, Karl, W8FX

BY IRWIN MATH, WA2NDM

MATH'S NOTES

WHAT'S NEW AND HOW TO USE IT

Bargains Galore!

The fact that I sorely needed a new oscilloscope for my home laboratory is what prompted this month's column. My old dual-trace, 20 MHz V-222 Hitachi scope still worked fine, but it was getting much harder to see 50 MHz signals, as they were probably "50 to 100 dB down," or my eyesight was getting worse, or both! Forget the fact that the scope was never meant to work at even 30 MHz, let alone 50, but it did save the day on many occasions. It was clear, however, that if I was going to continue to do any serious RF work, a better scope was a necessity. The ensuing investigation for a replacement (at the right price, of course) led me directly to the growing breed of surplus equipment dealers.

Those of you who do much experimentation are probably familiar with these firms, but I wonder how aware you are of just what is available and how much of a bargain it actually is. For the cost of a foreign import, often you can get premier US-manufactured, top-quality lab equipment. Due to the lack of "exploding" economic growth and the down-sizing and merger of many hi-tech firms, literally "tons" of such equipment is available at prices that are well within the means of the average experimenter.

After browsing through the advertisements in the various electronics-oriented magazines (including *CQ*) and calling for a few catalogs, I came up with a general sampling of what is available. I have tried to vary the offerings from the different companies listed to indicate the scope of what is available. Since most have almost every item, shopping around is highly recommended. If you are in the market for test equipment, you would do well to contact any or all of the companies listed and request a copy of their latest catalog and/or equipment list as I did. It's well worth the call or 32-cent stamp.

Before you deluge me with mail letting me know of all the companies I missed, I should mention that by no means are these the only surplus-equipment dealers around. They simply are the ones I happened to come across in a few hours of casual searching. I'm certain you easily will find more with similar (or even better) bargains. All those listed usually offer re-calibrated equipment that is up to the original manufacturer's specifications, along with instruction manuals and a 90-day guarantee. The list of companies (in alphabetical order) follows.

Danbar Sales Company, 14455 North 79th Street, Unit #C, Scottsdale, AZ 85260 (602-483-6202). Typical offerings include an HP 332A Distortion Analyzer, 0.1% accuracy for $249; an HP 1725A 275 MHz Scope for $625 with two probes; and a Fluke 1911A 250 MHz Frequency Counter for $199.

Fair Radio Sales, 1016 E. Eureka, Box 1105, Lima, OH 45802 (419-227-6573). This long-time surplus dealer's list of test equipment includes militarized versions of many popular items from Tektronix, HP, and similar test-equipment leaders. Their extensive catalog is a "must" for the homebrewer. When I started my company, I bought many pieces of test equipment from Fair Radio, and for more than 25 years on many occasions I have bought various surplus items from them. I have never been disappointed with their offerings.

Fair Radio Sales' extensive catalog is a must for the homebrewer.

The catalog from Tucker Electronics, a pioneer in the field of used test equipment.

Tech-Systems, 1309 Highway 71, Belmar, NJ 07719 (800-435-1516). This company advertises "Over 3000 items in stock," and from a look at their catalog you can believe it. Typical offerings include an HP 331A 5 Hz to 600 kHz Distortion Analyzer for $195, a Tektronix PG501 50 MHz Pulse Generator for $250, and an HP 182T/8557A 100 kHz to 350 MHz Spectrum Analyzer for $1495. They also deal in coaxial and waveguide components.

Test Equipment Sales, P.O. Box 986, Londonderry, NH 03053 (603-434-2544). This is the firm from which I bought my new Tektronix 465 100 MHz scope (for $449). The scope arrived (with a certificate for compliance and original instruction manual) in such perfect condition that you would swear it was brand new! Calibration was perfect, and I was speechless at just how good a deal I had made. If this is any indication of what to expect, I will never buy another piece of "brand new" test equipment for either home or the office. Other offerings include a Tektronix 7CT1N Curve Tracer for $395, a Tektronix FG504 40 MHz Function Generator for $695, and an HP 415E-001 SWR Meter for $275.

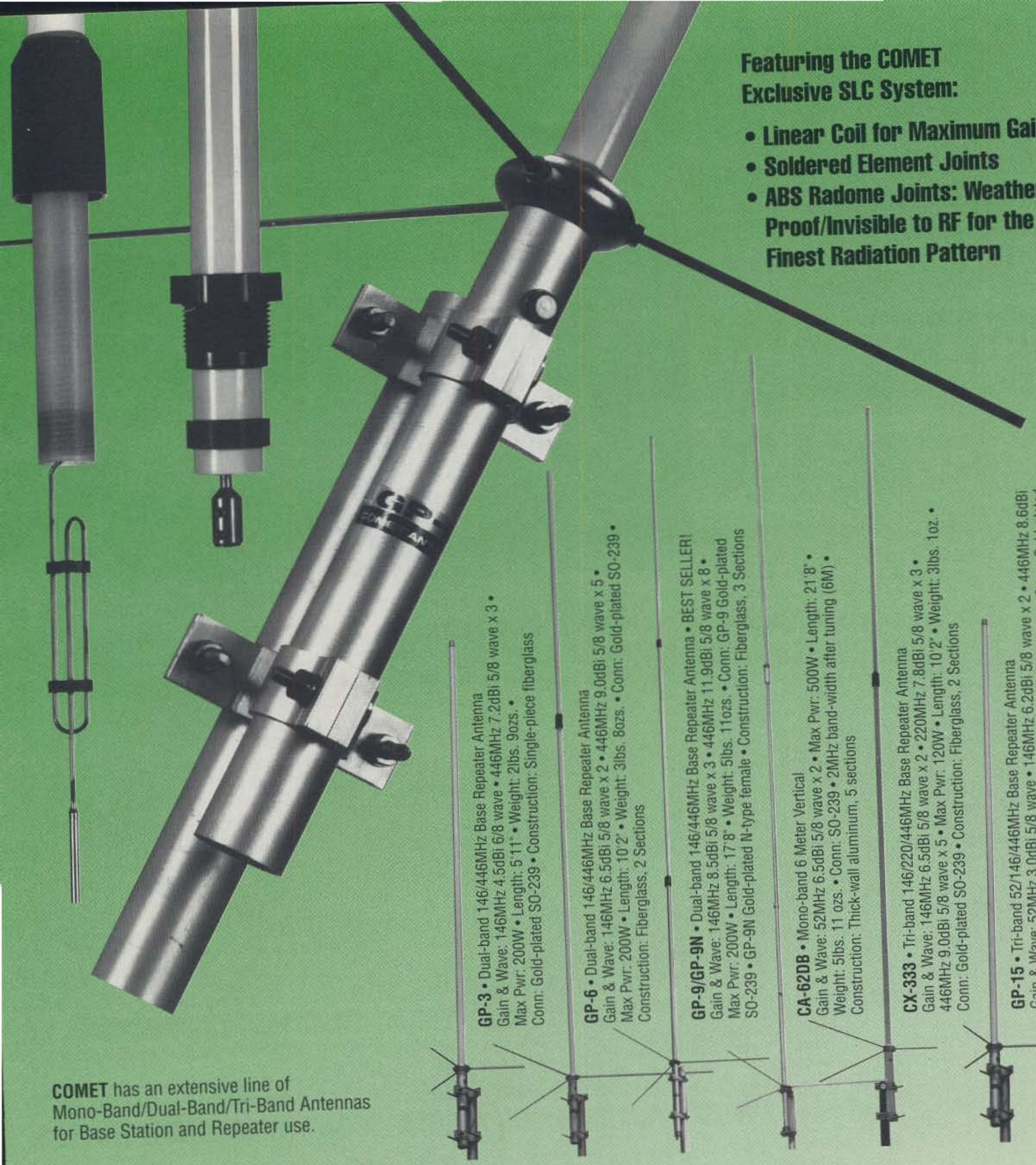
Tucker Electronics, 1801 Reserve St., Garland, TX 75042 (800-559-7388). This company is one of the pioneers in the field of used test equipment. I have also bought from them in the past, and the quality, calibration, and service are excellent. Tucker will also try to locate a specific piece of test equipment for you from the model number (if you know it) or from a description of what it is that you want to measure. Typical offerings include an HP 410C Multi-Function Meter (like a VOM) that allows measurements up to 700 MHz with a special probe (included) for $295, a Sorenson QRD40-2 Programmable Power Supply producing 0 to 40 VDC (.01% regulation) at 2 amps for $295, and an illustrated catalog that is a must. Specials that can't be beat are offered from time to time on older equipment.

Western Test Systems, 530 Compton Street, Unit #C, Broomfield, CO 80020 (303-438-9662). As with the other firms, Western offers a wide range of test equipment covering virtually everything there is to measure, from DC to microwave. Offerings include a Boonton 42B/42-S/3 one MHz to 8 GHz Power Meter for $375, a Tektronix 7D15 225 MHz Universal Counter Timer for $275, a Krohn-Hite Dual HP/LP 20 Hz to 2 MHz Filter for $600, and an HP 3400 10 Hz to 10 MHz True RMS Voltmeter for $250.

Again let me assure you that if I have missed anyone it was not on purpose. Please let me know of anyone else you feel deserves "a plug," and I will be glad to publish details in a future column. I would also like to know of your personal experiences with such dealers. As I have said, the quality of the equipment available from these outlets should allow even those of us on a limited budget to assemble a first-class home laboratory. *(This is not an April Fool's column; the prices quoted above all are correct!—ed.)*

73 Irwin, WA2NDM

c/o CQ magazine



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- **Soldered Element Joints**
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GP-3 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 •
Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. •
Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

GP-6 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 446MHz 9.0dBi 5/8 wave x 5 •
Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 •
Construction: Fiberglass, 2 Sections

GP-9/GP-9N • Dual-band 146/446MHz Base Repeater Antenna • BEST SELLER!
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3 • 446MHz 11.9dBi 5/8 wave x 8 •
Max Pwr: 200W • Length: 17'8" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated
SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

CA-62DB • Mono-band 6 Meter Vertical
Gain & Wave: 52MHz 6.5dBi 5/8 wave x 2 • Max Pwr: 500W • Length: 21'8" •
Weight: 5lbs. 11 ozs. • Conn: SO-239 • 2MHz band-width after tuning (6M) •
Construction: Thick-wall aluminum, 5 sections

CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 220MHz 7.8dBi 5/8 wave x 3 •
446MHz 9.0dBi 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. •
Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

GP-15 • Tri-band 52/146/446MHz Base Repeater Antenna
Gain & Wave: 52MHz 3.0dBi 5/8 wave • 146MHz 6.2dBi 5/8 wave x 2 • 446MHz 8.6dBi
5/8 wave x 4 • Max Pwr: 300W • Length: 7'11" • Weight: 3lbs. 1oz. • Conn: Gold-plated
SO-239 • 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

COMET has an extensive line of Mono-Band/Dual-Band/Tri-Band Antennas for Base Station and Repeater use.

For a complete catalog of **COMET** Antenna products call or visit your local dealer. Or, contact **NCG Company** at 800/962-2611. Use **COMET** products, and enjoy amateur radio to it's fullest!

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CIRCLE 170 ON READER SERVICE CARD

BY BILL WELSH, W6DDB

BILL'S BASICS

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Getting Started—Part IV of V

Here is the fourth part of this five-part article. Back issues that contain the previous installments of the article can be purchased directly from *CQ* for $3.50 each.

The 10 Meter Band

At this point in the 11-year sunspot cycle the 10 meter band has become almost useless for long-range (DX) contacts. However, we soon will turn the corner and start the climb to the peak of the next sunspot cycle. When that happens the 10 meter band will improve rapidly. At its peak this band provides worldwide communications with an antenna that is physically small (about 16 feet long), light, and low cost. The small size and light weight of an excellent directive 10 meter antenna (such as a Yagi-Uda or quad) make it possible to install one on an inexpensive push-up (telescoping) TV mast and to rotate it with a heavy-duty TV antenna rotator. A highly effective, directional 10 meter antenna can be installed at a small fraction of what it would cost to install a triband (10, 15, 20 meter) equivalent antenna. It is interesting to note that one of these relatively inexpensive 10 meter (only) antennas will function at least as well as the much more expensive triband counterpart on the band to which it is resonant. The performance of marginal equipment is usually much worse on 10 and 15 meters than it is on 40 and 80 meters. Consequently, good equipment is needed to obtain optimum results on the 10 and 15 meter bands.

Baluns

The coined name *balun* comes from one function of this RF transforming device. There are fixed and adjustable baluns which typically can be used to match 300 to 300, 75 to 75, 300 to 75, and 75 to 300 ohm circuits in any combination of balanced or unbalanced inputs and outputs. The balance-to-unbalance operation gives the device its name, with *bal* from balanced and *un* from unbalanced. Baluns are marketed in several impedance configurations, and they enable your antenna system to perform more efficiently. However, satisfactory operation can often be realized without a balun. Some baluns are constructed to also serve as an excellent center connector for a dipole antenna.

Whenever you are feeding a balanced antenna (dipole, folded dipole, Yagi-Uda, quad, etc.) from an unbalanced line (such as RG-213/U), it is stated to be advisable to use a balun between your transceiver and antenna. However, I have found that such 1:1 baluns make little (if any) improvement.

Tuners For Balanced Antennas

There is a wide variety of antenna tuners available for use with balanced (two-conductor transmission line) antennas such as the Yagi-Uda, Delta Loop, quad, etc. Some of these devices can also function as a longwire (or random wire) antenna tuner, and many of them can be used to read standing-wave ratio and output power. These devices are nice to have, but they are not always essential to proper operation of antennas. However, balanced wire antenna tuners cancel out feedline inductive/capacitive effects that could otherwise prevent the transmitter from providing its maximum RF output power.

45527 Third Street East, Lancaster, CA 93535-1802

N7ONQ

Floyd S. Ragner
63664 Nehalem Hwy N,
Vernonia, OR 97064

Floyd Ragner, N7ONQ, of Vemonia, Oregon has been interested in amateur radio since he was a grade-school student. His first transmitter was a spark-gap setup which used a Ford coil.

Transmission Lines

It is not sensible to go to the trouble and expense of installing a good antenna and excellent equipment, and then interconnecting the antenna and rig with an inefficient transmission line. Most amateurs use coaxial cable (coax) for their transmission lines because it is convenient to use and easy to install. Coax can do the job well, but you should avoid the use of lossy coax. I often find that new amateurs use RG-58C/U (50 ± 2 ohms) or RG-59B/U (75 ± 3 ohms) coax as their antenna transmission lines. These types of coax are popular because they are thin (less than 0.35 inch diameter), less expensive, and easier to install than their more efficient counterparts.

Unfortunately, RG-58C/Uhas twice as much loss as RG-213/U coax and less than one fifth as much power-handling capability. Similarly, RG-59B/U has almost twice as much loss as RG-216/U coax and less than half as much power-handling capability. What makes the coax situation even is that amateurs often use earlier and less efficient versions of these coax types, such as RG-58/U, RG-58A/U, RG-59/U, and RG-8/U (RG-213/U predecessor). These older types of coax are rated about as well as their newer counterparts, but their loses increase much faster. The losses in these older coax types start to increase from the day they are made, and it is normal for loss to be doubled within two years after they are made, even if they are still in a good environment, such as in a store or warehouse. RG-213/U (50 ±2 ohms, 0.405 inch diameter) and RG-216/U (75 ±3 ohms, 0.425 inch diameter) are preferred antenna transmission lines; they are well worth the extra trouble and expense.

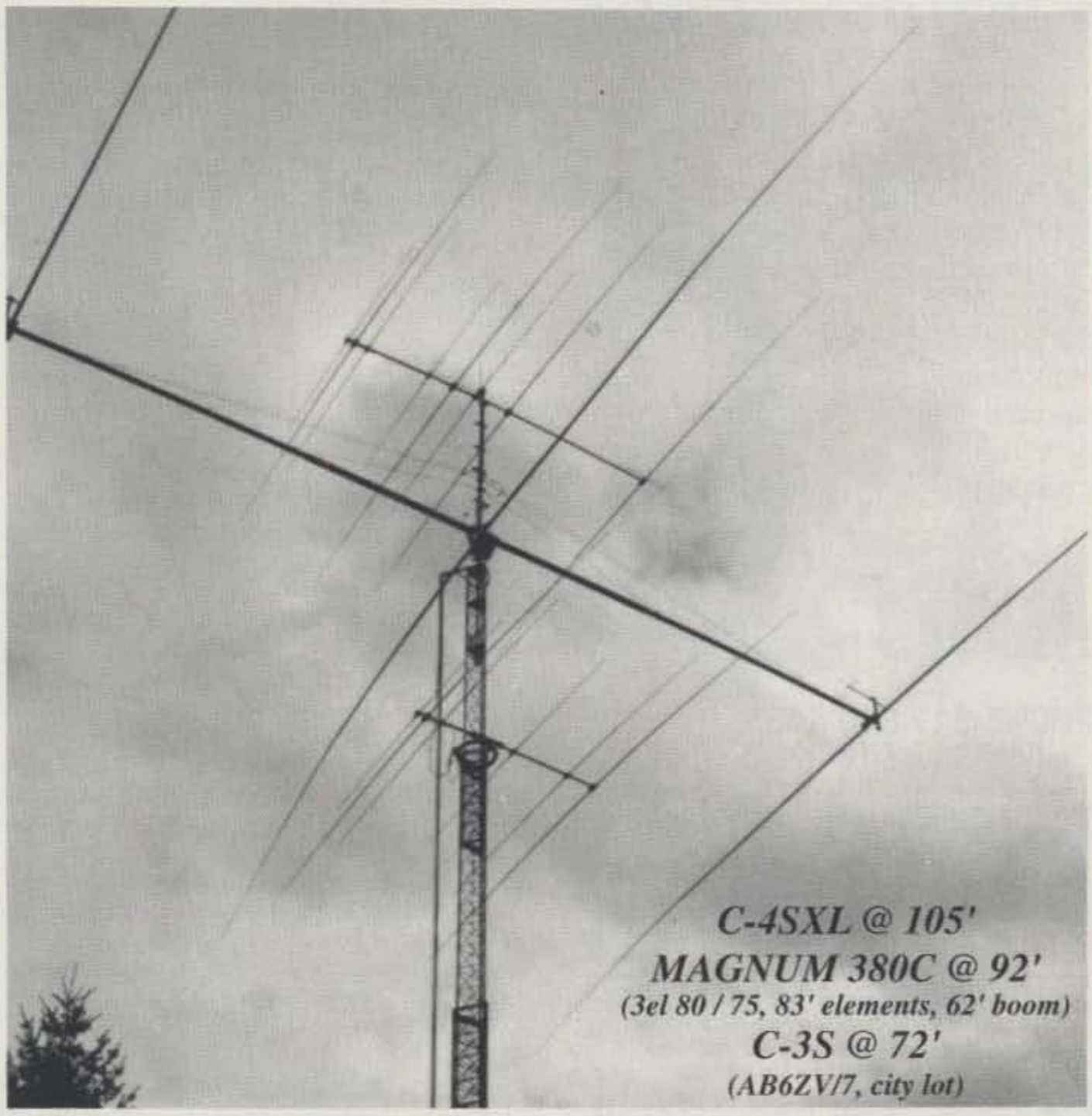
To put this matter in proper perspective, assume that you are operating on 10 meters and that your transmitter is feeding 100 watts to the radio-shack end of a 100 foot long RG-58/U transmission line connected to the antenna. Under these conditions the most power to reach the antenna would be less than 50 watts. This unnecessary loss of useful output power is hard to accept, but it is not the real culprit, which would cost you many long-distance (DX) contacts. The worst thing about using a lossy coax is that the received signals are also greatly attenuated (reduced) as they travel from your antenna to your receiver. Since DX signals are often 2 microvolts (2 millionths of one volt) or less, it is obvious that we cannot afford to reduce signal levels by using lossy coax.

It is sometimes difficult to find a good way to bring antenna transmission and rotator control wiring into the radio shack. If your station is located on the ground floor, it is usually best to run these cables under the house (or through the cellar) and bring them up into the radio shack through a hole (or holes) drilled in the floor. If it is necessry to bring these leads in through a window, it is preferable to construct a window replacement panel containing the required connectors and holes mounted on a

No More "Little Gun"

It used to be that using a tribander moved you into the "little gun" class for local competition. No longer.

Force 12 Classic 3-Band antennas are competitive with monoband installations because that is what they are. These antennas are three horizontally stacked and interlaced monobanders with a common driver cell. Each of the monobanders begins as a 2 element and is enhanced by the presence of the additional elements on the boom. To emphasize the effect of the design, the antennas have about 2.5dBd gain on 17 and 12 mtrs even though there are no elements resonant for bands. The driver is an improved open sleeve, developed and tested by **Force 12** in 1993. It excites 20-15-10 with a 50 ohm feedpoint and does not employ traps or phasing systems. This is the most efficient and simple multiband feed system ever used.



The Classic 3-Band series antennas average 4.5dBd gain on 20-15-10, more than the claimed higher numbers in trapped antenna specifications. For reference, a common 4 element 20 mtr monobander on a 26' boom has about 5.7dBd. When considering that the **C-3** has an 18' boom and the **C-3S** has a 12' boom, you can see these antennas provide a lot of gain for their size.; not only on one band, but on all three. They have no traps to weather or blow up, no phasing lines to deal with and are rated at 5KW. They are also the lightest and have the lowest profile, while maintaining an 80 mph wind rating, with optional higher velocities. Average assembly time for a **C-3** is about 90 minutes and a **C-3S** is about 60. Everything comes ready to go with pre-aligned element-to-boom brackets, bundled elements and Easy-On™ mounting. All that is needed is simple hand tools and a hand riveter (available everywhere or from us). Slide the elements sections together with the supplied anti-oxident, "pop" the rivets, bolt the elements on to the existing brackets and you are done. An RF choke or 1:1 balun should be used for the feedpoint.

The 40 mtr band can be added to either the **C-3** or **C-3S** to make the **C-4** and **C-4S**. The 37' 40 mtr dipole uses the **Force 12** linear loading system for highest efficiency and provides 130 kHz 2:1 coverage. A **C-4C** conversion is available for field upgrades. For those who would like 2 elements, the **C-4XL** is the core **C-3** with a 2el 40 on a 30' boom and the **C-4SXL** is the core **C-3S** with a 2el 40 on a 23' boom. There is also the ***C-3XL***, which is a 3el 20, 3el 15 and 4el 10 on the same boom with three feedlines.

Stacking a pair of these antennas enables a physically small installation to compete with much larger monobanders. The computer model gives about 2.5dB more gain for the stack compared to a single antenna (27-35' vertical spacing); however, those who use stacks know the improvement is more dramatic. Taking into account only the 2.5dB, the stack is about even with a 40+' boomlength 20 mtr monobander; however, the added benefits of the stack, plus diversity in aiming makes a formidible installation. The photograph shows the ***C-4SXL*** for (2el 40 + 20-15-10) stacked above a ***C-3S*** (20-15-10). You might not need the 3 element 80 mtr in the middle! A rotatable dipole for 80/75 on the mast will be another eye-opener. They are available as the ***EF-180S*** (54' long), the ***EF-180B*** (66.5') and the ***new EF-180C*** (83').

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good RF insulation material. If an antenna lead-in panel is to be made, it is usually better to install a double female coax connector in this panel for each line into your shack. Barrel connectors are readily available at good suppliers, and they provide a watertight connection with low RF loss through a panel.

If you have an excess length of coax, do not coil it or leave it in your shack for possible future use. Just leave enough slack in each coax line to reach your gear with no strain and cut off the rest of the coax. Every inch of transmission line causes loss, and it is sensible to cut off unnecessary extra coax. When an extra-long coax transmission line is coiled, it has an inductive characteristic which can contribute to interference and antenna loading problems.

Station Accessories

The major parts of a station have already been covered. However, there are several other items which are important to the establishment of a good station.

Desk or Table. Once you have selected the best location for your station, obtain a large, sturdy table (or desk) to hold your equipment. The table can be metal or wood. If it is metal, ground it to the station ground point at the transmitter's ground stud. The top surface must be large enough to leave plenty of operating room after the equipment is positioned for use. The only way you can send correct code with a handkey is to have your elbow rest comfortably on the surface of the operating table. It sometimes helps to move a table a few inches away from a wall and let the major equipment overhang the back end of the table.

Lighting. Fluorescent lights can produce enough noise to drown out weak received signals. If you experience fluorescent lighting noise, it is advisable to conduct a light-by-light check to determine which ones create the most noise. If it is possible to do so, have the most troublesome lights in your home turned off while you operate. Most fluorescent lighting noise can be eliminated by using shielded (better grade) transformers. The newer RF energized fluorescent tubes can be a worse source of interference than the standard ones.

Clock. It is handy to have a large four-digit clock within easy view of the operating position or on the operating table. Clocks are built-into some equipment. It is good to set the clock to Coordinated Universal Time (UTC), which is common to amateur radio operators throughout the world. Amateurs who work a lot of long-distance (DX) contacts commonly use only UTC on the air and in their records.

Headphones and Speakers

It is extremely important to minimize any possibility that operation of your amateur radio station will disturb others in your home. One major step towards making your station operation acceptable is to use headphones instead of a loudspeaker. The station you are listening to or working on the air may sound great to you, but it is just noise to non-amateurs in your home. Code can have a very piercing quality that penetrates walls, floors, and ceilings too well to suit others. The use of headphones provides the added advantage that it greatly improves an operator's ability to hear weak stations. There is also much less chance that an operator will be distracted from the signal being copied if he/she uses headphones to provide desired isolation from household and street noises.

It is best to get a very good set of communication headphones in the beginning, because it is one thing you most likely won't change, no matter how long you are an amateur. Good communication headphones have a limited (narrow) frequency range, are very sensitive to small input signals, have extremely effective earmuffs, and can easily be adjusted to minimize operator discomfort.

There is no advantage in purchasing high-fidelity earphones that have a wide-frequency-range reproduction capability. Amateurs just need "communication taper" earphones. The normal audio frequency range we listen to on the high-frequency bands is about 300 to 3000 Hertz. An ideal communications headset would include limited frequency response, excellent sensitivity, adjustable head (ear) pressure, replaceable contour-conforming earmuffs, correct impedance, reasonably light weight, rugged construction, dual earphone configuration (covers both ears), and a coiled cord. Some headphone sets have plug leads that can be connected for either high- or low-impedance use, permitting suitable impedance matching to the receiver's output impedance. Good communication headphone sets are not common, but some are available.

Code

Handkeys. It has been my experience that nothing develops confirmed voice-only amateurs faster than bad sending practices. The best way to develop a good fist is to learn how to use a good handkey (manual telegraph key) and to stick with it until your code-receiving proficiency has reached 10 to 15 wpm. Proper spacing between letters and words helps make code pleasant to copy at any speed.

Do not use a junk handkey because that makes it more difficult to develop proper sending technique. Select a good handkey with an adjustable key contacts gap, adjustable return spring (keying) pressure, well-machined (smooth) and adjustable arm pivot points and matching pivot-point receptables, good alignment between the entire upper and lower keying contact surfaces, plus good plating on the keying contacts.

Many handkeys are not acceptable, so take care to select a good one. It is not safe to assume that all handkeys are good, since even some expensive ones are not acceptable.

Avoid the use of a skirt on the knob of a handkey because it tends to encourage improper grasp of the knob, resulting in poorly sent code characters. A skirt is a flat pieceof insulating material about the size of a silver dollar, and it is located immediately below the handkey knob. A new operator would most likely let his/her fingers rest against the top of a skirt. This failure to properly hold the knob impairs normal transfer of force as the wrist is raised and lowered while sending. The resulting degradation of the sending action ruins consistency in the lengths of dits and dahs and causes uneven spacing between the individual parts of code characters.

Some handkeys are mounted on large base plates that raise the knob uncomfortably high above the operating surface of the table. Some handkeys have such poor alignment between the upper and lower keying contacts that very little of the total contact surface functions when the key is closed.

It helps to mount a handkey so it will not move as you send. The handkey can be mounted directly on the operating table, but it is usually mounted on a thin but heavy piece of plastic or wood to avoid marring the table surface. If the handkey is to be attached to a base, the base should not be more than ½ inch thick,

and it should be at least 3 inches wide by 8 inches long. The handkey should be mounted near one end of the base with the key knob towards the center of the base. Modern adhesives make it easy to mount handkeys on a wide variety of base materials. Whether it is mounted on a base or directly on the operating table, the handkey is positioned where it is comfortable to reach when the operator is seated close to the table with his/her elbow on the table, and with the forearm in line with the key.

Rhythm is easily developed while using a good manual (hand) telegraph key. Accuracy is the most important initial objective. Develop good spacing and accuracy. Speed will increase easily and naturally as you work contacts on the air.

Recorded Checks. It is advisable to practice sending off the air before you receive your license. Cut an article out of a newspaper or magazine and record it in code on a tape. Use text that contains an assortment of numerals and punctuaton marks. Add a few worksigns to make your practice text more useful. Set aside the tape and printed article for at least a week, then copy what you recorded. Check it a second time to make sure you copied exactly what you recorded. Next check your copy against the original printed article. It is beneficial to make several such recordings over about one month's time to improve your sending. This system quickly will make you aware of any mistakes you make in sending code.

On-The-Air Practice. Nothing increases code proficiency faster than on-the-air operation. When you must copy what the other operator is saying, you try a lot harder to make perfect copy. It's this natural extra effort that makes actual operation more effective code practice than listening to tapes, records, or other code-practice transmissions. There's nothing more frustrating to me than encountering a beginner who does not operate regularly after we've helped her/him earn a license and set up a station.

Contests. Participate in as many on-the-air contests as possible. Contests provide a wonderful opportunity to work many new stations and countries in a short time. Keep track of local, national, and international contests advertised in major amateur radio publications. You'll win every time you enter a contest because your objective is to increase your code speed, and you'll be doing it!

Goal. When your code receiving speed reaches the point where you are consistently making passing plain-language runs at about 16 wpm, you are ready to pass the code part of your General/Advanced exam. If your theory is good, take the exam right away.

Handkey Use. Don't tap out code with your fingertips; this is extremely tiring and it sounds terrible to others. Use your wrist from the beginning, and you'll quickly develop a smooth and effortless sending style. When you're first learning to send with your wrist, you can minimize any tendency to finger tap by opening up the key contacts to at least one-sixteenth of an inch and adjusting the spring tension to where quite a bit of pressure is needed to close the key contacts. Your wrist easily can provide the force needed to close the key contacts, but your fingers will tire when finger tapping. Consequently, you'll get in the habit of sending correctly. You can set a large coin on the back of your sending-hand wrist and it should stay there if you are sending correctly. Correct sending is smooth and easy. Wrist sending seems difficult to master because we all are accustomed to doing things with our fingers. Nevertheless,

you'll learn that it is easier and better to send by wrist motion than by finger tapping.

A good initial practice is to time dits and dahs using the sweep hand of a clock. Send a dit exactly at each second point during each 1 minute practice run. Similarly, send a dah starting at each exact 5 second point and hold it for 2 seconds. Wait 3 seconds and send another 2 second dah. Repeat this procedure during each 1 minute practice run. Clock exercises can quickly get you into the habit of sending correctly using your wrist.

Sending Speed. Send slowly and carefully. Accuracy is far more important than speed. No one enjoys a contact with an amateur operator who makes a lot of errors, but errorless code sounds good even at the slowest speeds. Sending speed comes naturally, and there's no advantage to sending faster than the speed at which you can send well. Your sending speed is normally faster than your code receiving speed, so make yourself slow down by sending very carefully. If you send code as fast as youcan transmit it, you'll be in trouble if the other amateur answers at the same speed; it will be too fast for you to copy. Don't speed up to work Generals and other higher class (and DX) amateurs you hear in the Novice bands. These experienced amateurs are usually in the Novice bands to give you some code practice and to send you a card. Sometimes they are there because they are very rusty and need the code practice. An experienced operator is much more likely to be tolerant of slow code and errors than a newcomer. Don't hesitate to ask anyone to slow down (QRS) or to repeat information; one-way contacts are not satisfactory to anyone.

Sending Accuracy. Accuracy and rhythm should be the goals of any beginner learning to send code. Make clear corrections of sending errors to avoid confusing the other amateurs. If you goof on the first letter of a word (or a single-letter word such as A), send an error/repeat sign and go back to the start of thelast word you sent without error. If you make an error after the first letter in a word, send the error/repeat sign and go back to the start of the word you were sending when you made the error. It is acceptable to use a series of seven (or more) dits to indicate that you've made an error and that you're going to repeat. It is better to send the question mark, though, as this always means that you are going to repeat information, whether or not you made an error, whenever it is sent out of context.

Bugs and Keyers. It is much easier to develop good sending rhythm (spacing) with a handkey than with a semi-automatic key (bug) or with a paddle and electronic keyer. Many amateurs fail to develop good sending techniques before they start using a bug or keyer, and this results in poor sending that causes unsatisfactory results when they try to complete on-the-air code contacts. Speed should not be the primary objective of new amateurs, because it is far more important to develop good code sending rhythm, which makes you a pleasure to contact at any speed.

When your code receiving proficiency becomes 15 wpm, it is advisable to develop alternate sending capability with a bug or keyer, since either permits you to transmit fast code with very little effort. It is not good to use both a bug and a keyer with the same hand, because their differences in keying actions tend to harm an operator's timing and spacing of code characters. When using a semi-automatic key (bug), the operator sends each dah manually and just makes a single motion to send a series of dits. When using an electronic keyer, dits and dahs are automatically sent as long as the operator holds the paddle to the right or left.

When you are ready to get a high-speed code-sending instrument, select a very good one. Junk bugs and keyers are no bargain at any price. I use a bug for high-speed code operation because that is the device I am accustomed to using. However, if I were starting out now, I would use an electronic keyer with a paddle, which is what I advise my students to switch to when they reach a code reception capability of about 15 wpm. I also advise my students to develop reasonable capability before using any high-speed telegraph keying device on the air.

Writing Instruments. Before leaving the subject of code, I want to advise you to get a good writing instrument to use when copying code. If you use a pencil, use a sharpened one with a number two (or softer) lead. I have had special code-practice pencils made for my students, and these pencils have grade 1½ lead. If you use a mechanical pencil, computer lead shouold be used for copying ease. Computer lead is called *electrographic mark sensing lead*, and it is available from major computer outfits. When copying code with a pencil or pen, it is called copying by stick. If you use a ballpoint pen when copying code, it should not be retractable, because this type of pen has some tip movement each time it is applied to (or removed from) the paper. This motion will slow you down, and it can reduce your code receiving speed. I believe the best code-practice writing instrument is the series of fine-line felt-tip marking pens. Regardless of which kind of writing instrument you use, it should provide a dark (readable) mark with very little pressure required.

Mill/Typewriter. If you are serious about becoming an extremely proficient code operator, you should shift to using a typewriter at about the point where you change to a bug or a keyer. There are special typewriters intended for use by code operators; these machines are called *telegraph mills*. It has been my experience that used typewriter shops sometimes have mills for sale, and their price is usually quite low since few people want them or know what they are. One way to spot a mill is to look for a typewriter that is all upper-case letters and has no markings on the keys. If you are not able to obtain a mill, there is nothing wrong with simply learning to copy code with a regular typewriter. If you do not know how to type, pick up a textbook on this subject at your local public library. It is easy to teach yourself how to type correctly, and you often will benefit from this capability. Naturally, you will have to practice code at a much slower rate when you first switch to a typewriter or mill. However, as your typing proficiency improves, you will be pleasantly surprised by how rapidly your code receiving capability rises.

Summary

This concludes the fourth part of this five-part article. The last part covers QSL cards, instruction manuals, legal matters, rules and regulations, interference, station location, operating, and upgrading.

73, Bill, W6DDB

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- LOW PROFILE POWER SUPPLY

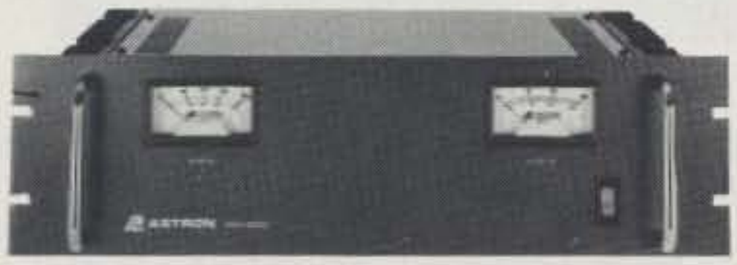
MODEL	Colors Gray	Colors Black	Continuous Duty [Amps]	ICS* [Amps]	Size [IN] H × W × D	Shipping Wt. [lbs]
SL-11A	•	•	7	11	2 5/8 × 7 5/8 × 9 3/4	12
SL-11R	•	•	7	11	2 5/8 × 7 × 9 3/4	12
SL-11R-MC		•	7	11	5 3/4 × 7 1/4 × 9 3/4	13
SL-11R-GE	•		7	11	5 3/4 × 7 × 9 3/4	13
SL-11R-RA		•	7	11	4 3/4 × 7 × 9 3/4	13
SL-11R-EFJ		•	7	11	5 1/8 × 7 1/4 × 9 3/4	13
SL-11MG		•	7	11	5 1/8 × 7 1/18 × 9 3/4	13
SL-15R	•	•	12	15	2 5/8 × 7 × 9 3/4	13
SL-15R-GE	•		12	15	5 1/8 × 7 5/8 × 9 3/4	14
SL-15R-RA		•	12	15	4 3/4 × 7 1/4 × 9 3/4	14
SL-15R-EFJ		•	12	15	5 1/8 × 7 1/18 × 9 3/4	14

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	3 1/2 × 6 1/8 × 7 1/4	6
RS-5L	•	4	5	3 1/2 × 6 1/8 × 7 1/4	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	5 1/4 × 19 × 8 1/4	16
RM-35A	25	35	5 1/4 × 19 × 12 1/2	38
RM-50A	37	50	5 1/4 × 19 × 12 1/2	50
RM-60A	50	55	7 × 19 × 12 1/2	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 × 19 × 8 1/4	16
RM-35M	25	35	5 1/4 × 19 × 12 1/2	38
RM-50M	37	50	5 1/4 × 19 × 12 1/2	50
RM-60M	50	55	7 × 19 × 12 1/2	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 × 4 3/4 × 5 3/4	4
RS-4A	•	•	3	4	3 3/4 × 6 1/2 × 9	5
RS-5A		•	4	5	3 1/2 × 6 1/8 × 7 1/4	7
RS-7A	•	•	5	7	3 3/4 × 6 1/2 × 9	9
RS-7B	•	•	5	7	4 × 7 1/2 × 10 3/4	10
RS-10A	•	•	7.5	10	4 × 7 1/2 × 10 3/4	11
RS-12A	•	•	9	12	4 1/2 × 8 × 9	13
RS-12B		•	9	12	4 × 7 1/2 × 10 3/4	13
RS-20A	•	•	16	20	5 × 9 × 10 1/2	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13 3/4 × 11	46
RS-70A	•		57	70	6 × 13 3/4 × 12 1/8	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	4 1/2 × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10 1/2	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13 3/4 × 1	46
RS-70M	57	70	6 × 13 3/4 × 12 1/8	48

VS-M AND VRM-M SERIES

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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	4 1/2 × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10 1/2	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13 3/4 × 11	46
VS-70M	57	34	16	70	6 × 13 3/4 × 12 1/2	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5 1/4 × 19 × 12 1/2	38
VRM-50M	37	22	10	50	5 1/4 × 19 × 12 1/2	50

ICS - Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

BY DAVE INGRAM, K4TWJ

WORLD OF IDEAS

A LOOK AT THE WORLD AROUND US

QRP '96: Milliwatts and Micronauts

Okay, friends, I have been hinting about a special surprise coming in the next QRP column, and the time of revelation has arrived. Our "mystery project" is the Micronaut; it's an ultra-low-power transmitter for "sport QRP," and everything is lined up to get you started micronauting in high style. One version of the Micronaut is an ideal "first project" for newcomers. Another version introduces the hot new area of microminiature homebrewing to amateurs of all license classes. Yes, and you can build a Micronaut right now using on-hand parts, telephone-order a Micronaut kit from our guest supplier, or go for a full package complete with instruction video on homebrewing with surface-mount components.

We also have another special treat in store for you: more juicy hot sauce. This time the hot sauce plays an active role by serving as the main ingredient in homebrewed batteries to power the Micronaut. Combined with the kits, this dynamic duo cooks up red-hot radio fun at its absolute best. Our special thanks to Frank Miller of Sescom, Inc. for making Micronauts available in "can't miss" kits. He is a real hot wire. Before getting started with the Micronaut project, let's take a "QRP update break" to stamp out any negative vibes stifling low-power communications.

This next true-life saga was written during late November when sunspots were so low you could count them on your fingers and the HF bands above 40 meters were folding by dark.

It's 9 PM. I'm tuning 30 meters with my QRP Plus transceiver (I love this little rig; see fig. 1), and there is only one signal on the band—running S1. Hmmm . . . I'll just leave the rig on while reading and bird sitting our ham-oriented parrot (he calls CQ, has said "hello" to several friends, and also likes CW). A few minutes pass, then an S5 appears calling CQ. It turns out to be ZS5LB, Bert in Dublin, South Africa. Can a scant 5 watt signal contact the other side of the world? Will other callers blow away my QRP signal?

There's no time for hesitation. I call quickly and fast, and he returns to me with a 569. Wow, pinch myself! I sign, and a dozen callers descend on the frequency. ZS5LB starts working them "rapid-fire style."

Yep, it was for real. Five watts outworked the mob! Now that's living, and it's only one of many QRP adventures happening around the country and around the world every day!

We may be at the sunspot's absolute bottom, true, but QRP is hotter than ever. QRP clubs continue to grow, folks continue homebrewing low-power rigs and looking for new ideas to try, and even milliwatting continues high in popularity. An increasing number of QRPers are also getting into big-time microwatting. What's that? Make contacts using less than a milliwatt? Yes indeed, and microwatts really transcend the miles. September '95 *QST*, for exampie, carried a two-page story about Fran, KA3WTF, and Paul, AA4XX, making contact over a 424 mile path using simple wire antennas and a scant 221 microwatts of output power. All of us may not be able to duplicate that feat, but we can still enjoy micronauting between neighborhood amateur friends or tripping up self-proclaimed DX pros at club meetings.

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Fig. 1– So who needs an all-out killer setup when a little low-power rig can span the globe! This is my XYL-approved winter den station for reading, parrot sitting, and working 30 meters with an Index Labs QRP Plus transceiver. Photo was shot using only dim room light (flashbulbs frighten Paco [my parrot's name]) and soon after working ZS5LB in South Africa.

Fig. 2– Photo of my prototype Micronauts and a homemade hot-sauce battery. Circuits were first made by plugging leads of exact components into a white Radio Shack "building block," then moving those parts to perfboard, etc. Note chip components visible through clear keyfob. Pardon poor lighting in the photo; Paco was coaching the photo session.

So, dear friends, are you ready to become a genuine Micronauter? Let's get rolling!

Introducing The Micronaut

This project started out as a curious challenge to fill a miniature Sescom metal box with some unusual or unique item. After pondering the challenge and size of the box (1"H×2"W×2"D), I chose a simple one-transistor transmitter that everyone could build as a fun project. Basic QRP transmitters are a dime-a-dozen, however, so I started including expansions. I made it capable of working in the milliwatt or the microwatt range, turned it into a conversation item by emphasizing packaging more than circuitry, and devised a microminiature version using surface-mount components.

The use of microwatts opened another exciting door: the transmitter could be powered from homemade batteries using genuine Louisiana-type hot sauce (now that's hot!). Bringing in micro construction would also give amateurs a ground-floor introduction to surface-mount technology. Sescom, Inc. encored the plan by making kits of the Micronauts and a low-cost "how to" video on homebrewing with surface-mount components (it's easy, really!).

Our friends reading this column thus have the option of quick-assembling a Micronaut from on-hand parts, building a half-watt Micronaut, or going with Sescom's all-in-one package for the "full size" or "mini" Micronaut. Contact Sescom, Inc. directly at 2100 Ward Drive, Henderson, Nevada 89015-4249 (telephone 1-800-634-3457 or fax 1-800-551-2749) for details and prices on Micronaut kits, enclosures, labels, tools for micro construction, and the video.

My prototype Micronauts are shown in fig. 2. One version is assembled "ugly construction style" on perfboard with its crystal mounted under the board. I built it in 10 minutes in a dimly lit room and it worked right from "power up." Another version was made "open-air style" with components connected only by their leads and fitted into an empty pen case. An experimental third version using micro "chip" components was mounted in a clear plastic key fob (opened with a knife, and later reglued). Hopefully, these ideas will inspire your own creative thinking on unusual enclosures. Great! That's the idea! Build one, shoot a good photo of it, and I'll feature your gem in a future column. Who knows? We may start a Micronaut cult! So much to say, so little time. Let's continue.

Several types of circuits and transistors capable of oscillating with only one volt on their collector were considered and tried, but they proved to be more trouble than they were worth. After a couple of weeks hunting and dinking, I took a serious second look at a plastic-cased 2N2222A. It worked like a champ right down to 2.1 volts (a pair of old watch batteries powered it!). When a stable 2.4 volts was applied, collector current was .6 ma. Total input power was thus 1.440 milliwatts. Assuming an efficiency between 30 and 60 percent, output power was between 435 and 865 microwatts. A quick check with my RF probe and a comparison of QRPp signal levels on my ICOM transceiver's S-meter confirmed the output as between 500 and 800 microwatts. Bingo, a Micronaut!

A trio of quick-made hot sauce cells were then substituted for the watch batteries. Their

CIRCLE 70 ON READER SERVICE CARD

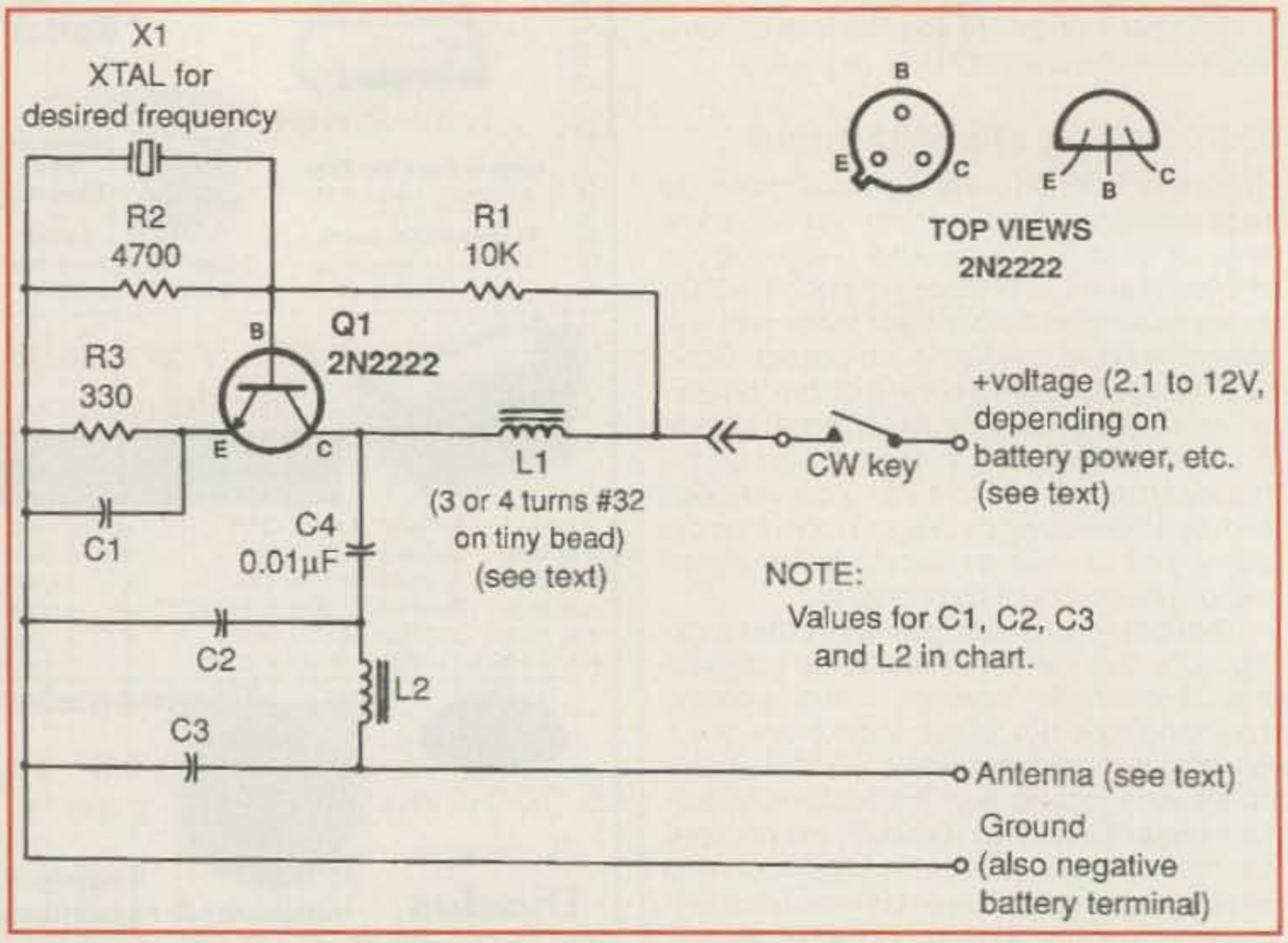

Fig. 3– Circuit diagram of Micronaut. Some folks (especially newer amateurs) lay out components like they appear in a diagram, so I drew this one with that thought in mind. Use 1/4, 1/8, or 1/10 watt resistors, small disc capacitors, and a small HC-18u-cased crystal. Wire key in series with battery positive or negative lead.

no-load energy of 2.8 volts dropped to between 2.3 and 2.5 volts under a .6 ma load—perfect! Three micronauts were then made to ensure the ease of reproduction, and the project was pronounced ready for introduction. I feel confident in saying if you check each component (new or not) before assembly and wire the circuit correctly, it will work at first fire-up.

Now let's discuss some "Tech notes" on the Micronaut's circuit (see fig. 3). R3 (and the battery's voltage) determine output power. The value of R3 can be increased to 470 ohms for lowering input current and output power, or decreased to 270 ohms for raising input current and output power. Twelve or 14 volts can be applied to a metal-cased 2N2222 for raising transmitter output into the 250–500 milliwatt range. If the transistor runs warm to the touch, increase R3's value. Winding 3 or 4 turns of ultra thin wire (number 28, 30, or 32) on a tiny ferrite bead makes a good RF choke. Alternately, slipping a bead (or two) over the collector's wire is sufficient.

Crystal X1 establishes the transmitting frequency. Use a small HC 18/u type in this low-power circuit (conventional type-30 pFd load capacitance or similar—not critical). A quick and easy source of cut-to-your-frequency crystals is Jan Crystals (P.O. Box 60017, Fort Myers, FL 33906 [phone 1-800-JAN XTAL]). If you need a crystal sooner, skip over to your local Radio Shack and purchase a 3.58 MHz crystal from their "parts rack." If a local TV repair shop throws out defunct TVs, you might salvage a crystal from its main board. Also, do not overlook discarded computer motherboards, as many have 14.318 crystals waiting for you to salvage. If you wish to include crystal warping, add a 180 microHenry coil and 300 pFd variable capacitor in series with either crystal lead. It will shift transmit frequency 5 or 6 kHz.

C1, C2, and C3 must match your band of operation (see coil data, fig. 4). The transmitter will work without an output filter or an antenna connected for testing and in-shack demos, but C1 must always be in the circuit. A 9 volt battery makes a convenient power source for testing.

Using an illuminated and/or arm-supported magnifier (so your hands are free) and a 15 or 20 watt iron makes surface-mount construction easy. File the iron's tip to a sharp point, like that of a pencil. Use ultra-fine solder (number 00), and use eyebrow tweezers to handle chip parts. Keep all parts in sealed bags until installation, work on a large white surface, and never, never drop a part (finding it is heck!).

Band	C1	C2	C3	L2	Inductance (uHy)
20 m	270 pFd	270 pFd	270 pFd	12 turns #28 or #30 on T-50-2 core	.720
30 m	330 pFd	330 pFd	330 pFd	13 turns #28 or #30 on T-50-2 core	.980
40 m	470 pFd	470 pFd	470 pFd	16 turns #28 or #30 on T-50-2 core	1.280
80 m	750 pFd	750 pFd	750 pFd	34 turns #30 or #32 on T-50-2 core	5.780

Fig. 4– Band, coil, and capacitor values for the Micronaut. (Note: Operation on frequencies above 20 meters or below 80 meters is not suggested.)

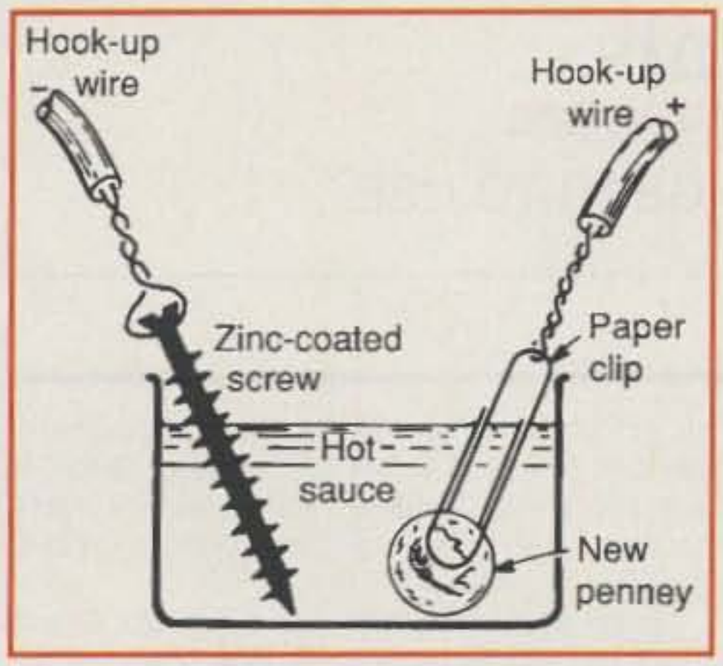

Fig. 5– Sketch of quick-homebrewed cell(s) using Louisiana-type of hot sauce to power a Micronaut. Combination of zinc, sauce, and copper produces voltage. (Discussion in text.)

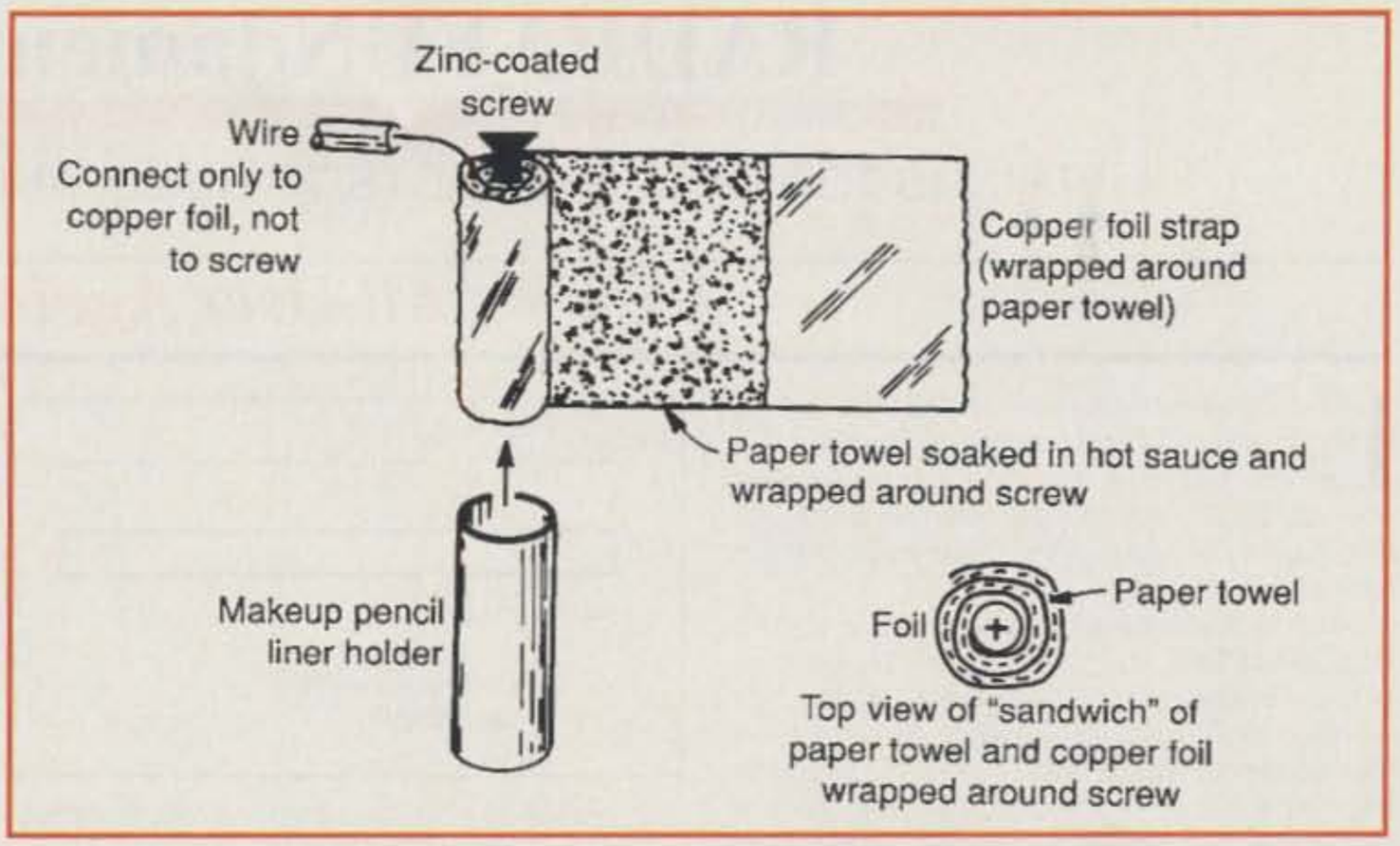

Fig. 6– "Pocketable" homebrewed battery assembly guide. Wrap a cut-to-size length of paper towel moistened in hot sauce around a zinc screw, wrap in copper grounding foil after insulating screw with the paper towel, then slip completed package into small pill bottle.

Strive for neat soldering, check each connection with your VOM as you go, and success will be eminent. Think confidently.

"Juice" For The Micronaut

Although the Micronaut can be powered with a pair of miniature 1.2 or 1.25 volt watch batteries, they simply do not have the class and pizazz of going all out with homemade Edison cells using one of the many brands of Louisiana hot sauce found at your local grocery store. Might tomato juice or orange or lemon juice be substituted? Possibly, but you must consider the facts before making a rash decision. Louisiana is famous for its hot sauces; they are hot, hot, hot, and they will make your little Micronaut a real flame thrower!

Homemade cells can be assembled in several ways. If you prefer the quick and easy approach, start by collecting three or four small drinking glasses or large pill bottles, three or four zinc-coated screws or nails, three or four shiny new pennies, four gem clips, and 8-5 inch lengths of hookup wire. Wrap the end of one hookup wire around one of the zinc-coated screws near its head, then twist it tight for a good connection. This will be the cell's negative lead. Wrap the end of another hookup wire around a gem clip's end, twist it tight, then slip the gem clip on the edge of a shiny new penny. This will be the cell's positive lead. Now place the screw and penny on opposite sides of a glass or pill bottle and pour in just enough hot sauce to cover most of the penny's surface. Do not allow the gem clip to touch the sauce, as it will short-circuit the cell and drop its voltage significantly. Next measure the cell's voltage with your VOM. It should be between .8 and 1.2 volts, depending on screw length and amount of sauce. Assemble two or three more cells accordingly, and then wire them in series for 2.4 to 2.6 volts under a .5 or .6 ma load for Micronauting (see fig. 5).

As of this writing, I have not determined cell life. I will thus say, dispose of the old zinc-contaminated sauce when the transmitter stops oscillating and replace it with a fresh batch. *Remember:* **Do not** use the old sauce—for anything. It will be contaminated.

Say you prefer a more solid and portable hot-sauce battery? Okay, here's another idea. First find two, three, or four small plastic bottles with removable caps like those shown in fig. 6. I used some of XYL WB4OEE's discarded holders for Estee Lauder pencil liners because (1) I found them in our cabinet and (2) when cut ½ inch shorter and wrapped with masking tape, they were the same size as regular "AA" cells. Convenient substitutes are small-diameter pill bottles (with caps) obtained from a local drug store.

Punch a hole in the center of each cap's top and thread/insert a zinc-coated screw long enough to almost reach the bottle's bottom. Next, punch another small hole in the bottle's bottom (or on the cap's side if you prefer top connections like a classic dry cell) and insert a wire you will later crimp to a copper foil strap. Now prepare a "sandwich roll" consisting of a cut-to-fit-bottle strip of copper grounding foil and an equal size/length of kitchen paper towel. Copper (grounding) foil is available from many amateur radio and marine equipment dealers (no, aluminum foil is not a substitute).

Saturate the paper towel in hot sauce, then make a "sandwich roll" around the screw as shown in fig. 6. Do not allow the copper foil and zinc screw to contact each other. Crimp an outer edge of the rolled-up foil to the awaiting positive-lead wire, snap the bottle's cap shut, double-check voltage, and then make two more similar cells. Wire the completed cells in series, and you're ready for Micronauting.

Conclusion

Micronauting is an art, or a sport, depending on your point of view. A good way to start is by contacting neighborhood friends with your Micronaut. (How about some two-way Micronaut QSOs?) Then, too, it's always fun to plug a single 6 inch dangling wire antenna into the Micronaut's antenna socket, hide a miniature key in your pocket, sneak up behind an avid DXer at the club station, and suggest he listen on "XX" kHz (your frequency) for a surprise call. The latter trick also brings good humor at hamfests with on-display transceivers. For serious Micronauting, use a good high-gain, single-band antenna like a Delta loop for transmitting. The receiving station needs a sensitive receiver and full over-the-ear muff 'phone to block out all external noises.

Will there be future Micronauts? Possibly, if interest warrants such. I am already visualizing a MKII version with more exotic circuit and a MKIII version consisting of an all surface-mount transceiver. What's your opinion? As always remember to include an SASE and be patient for replies when writing to me, or let's QSO on 30 meters one weeknight this month!

73, Dave, K4TWJ

BY BILL ORR, W6SAI

RADIO FUNdamentals

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

Déjà Vu All Over Again

In the January 1996 issue of *CQ* I described my full-wave 14 MHz dipole. Since then I've had modest success with it (considering how rotten 20 meters has been of late). I've also heard from readers who are having good luck with the antenna.

Among the letters was one from Richard Bell, WA4BNO. He pointed out that another version of this antenna appeared in the November 1957 issue of *CQ*, nearly 40 years (and four sunspot cycles) ago. The 1957 antenna (fig. 1) consisted of a two-wire flat-top fed at a high-current point by a 450 ohm line. It was designed by Bob Perthel, W9MWD. The flat-top consisted of two No. 16 wires spaced four inches apart by homemade plastic spreaders. Bob was able to use the antenna on 40 and 15 meters, and Richard reports that he could work those bands also with my antenna design, but he required an antenna tuner to do it.

So two versions of the antenna exist—one with coax feed and the other with ribbon feed. Take your choice!

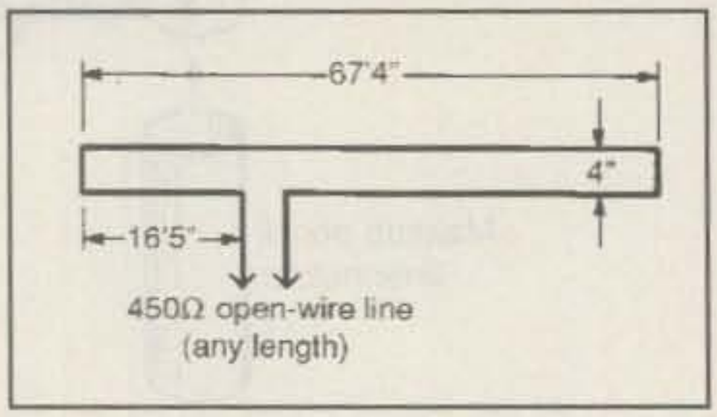

Fig. 1–Full-wave folded antenna for 20 meters by W9MWD (1957).

W6PYK's 160 Meter Backyard Vertical

Antennas for the 160 meter band are a problem unless you are blessed with plenty of real estate. One solution, which a lot of amateurs use, is to go straight up—that is, use a vertical antenna. Once again antenna size is a limiting factor. Not many amateurs have room for a 130 foot vertical and the attendant guy wires!

Paul Scholz, W6PYK, designed a nifty 160 meter vertical for a small backyard. He used it in the early 1980s when he was living in Kentucky. The antenna is shown in fig. 2. Paul's was top-loaded, about 36 feet tall. He used a push-up pole-type TV mast for the vertical. The top loading consisted of four guy wires, each 44 feet long, evenly spaced around the mast. The ends of the guys were tied off to 4 foot ground stakes.

In this design the radial wires are bent back upon themselves in the shape of a "Z" to form a rough square. Each wire is about 126 feet long. The wires do not touch the ground, but are held a few feet in the air by wood stakes.

The base of the vertical is insulated from the ground by mounting it on a square piece of 2 inch lumber. It is held in place by several nails driven into the board around the base.

The antenna is resonated to frequency (1.85 MHz) by means of a small loading coil. This base inductor is placed between the antenna and a 4:1 step-up balun. This matches the approximate 10 ohm fedpont impedance of the antenna to the coax line. The base inductor is a 15 microHenry coil, and about 10 microHenries of it are used to effect a match.

The elevated radial system effectively disconnects the antenna from major ground loss-

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es. Paul noticed no change in SWR from dry to rainy weather. Because of relatively low ground loss, antenna Q is quite high. The 2:1 SWR bandwidth is about 40 kHz.

Paul reported excellent results. With 100 watts he worked into Europe, South America, Japan, and the Marshall Islands. That's not bad at all for a compact, backyard vertical antenna!

The Switching Power Supply (The Early Days)

Changing one DC voltage to another level, or changing DC to AC, has always been a problem. In the early automotive days this was accomplished by charging and discharging an inductor and later by the spark coil. These devices boosted a low DC voltage (6 to 12 volts) to a much higher interrupted (or alternating) voltage that would fire spark plugs in a gasoline engine.

In the early '30s, with the advent of 6 volt tubes, the car radio became practical and improved switching power supplies using a magnetically driven double-pole, single-throw switch to provided interrupted DC which could be stepped up, rectified, and used for plate voltage for the radio's tubes. An early version of this plug-in switch, or vibrator, was called an "Elkonode" (fig. 3). Later models of car radios used full-wave rectification and a full-wave "interrupter" to provide high-voltage DC. This was termed a "nonsynchronous vibrator" (fig. 4).

Upon application of battery voltage, the flexible reed of the vibrator was pulled towards a contact. This produced a pulse of voltage in one-half of the transformer primary winding. At the same time, the magnet coil was short-circuited by the contact, allowing the reed to swing back and touch the other contact. This caused a pulse of voltage in the other half of the primary winding. Simultaneously, the magnet coil was energized, causing the cycle to repeat itself. An approximation of a sine wave appeared in the secondary winding of the power transformer. This action took place at

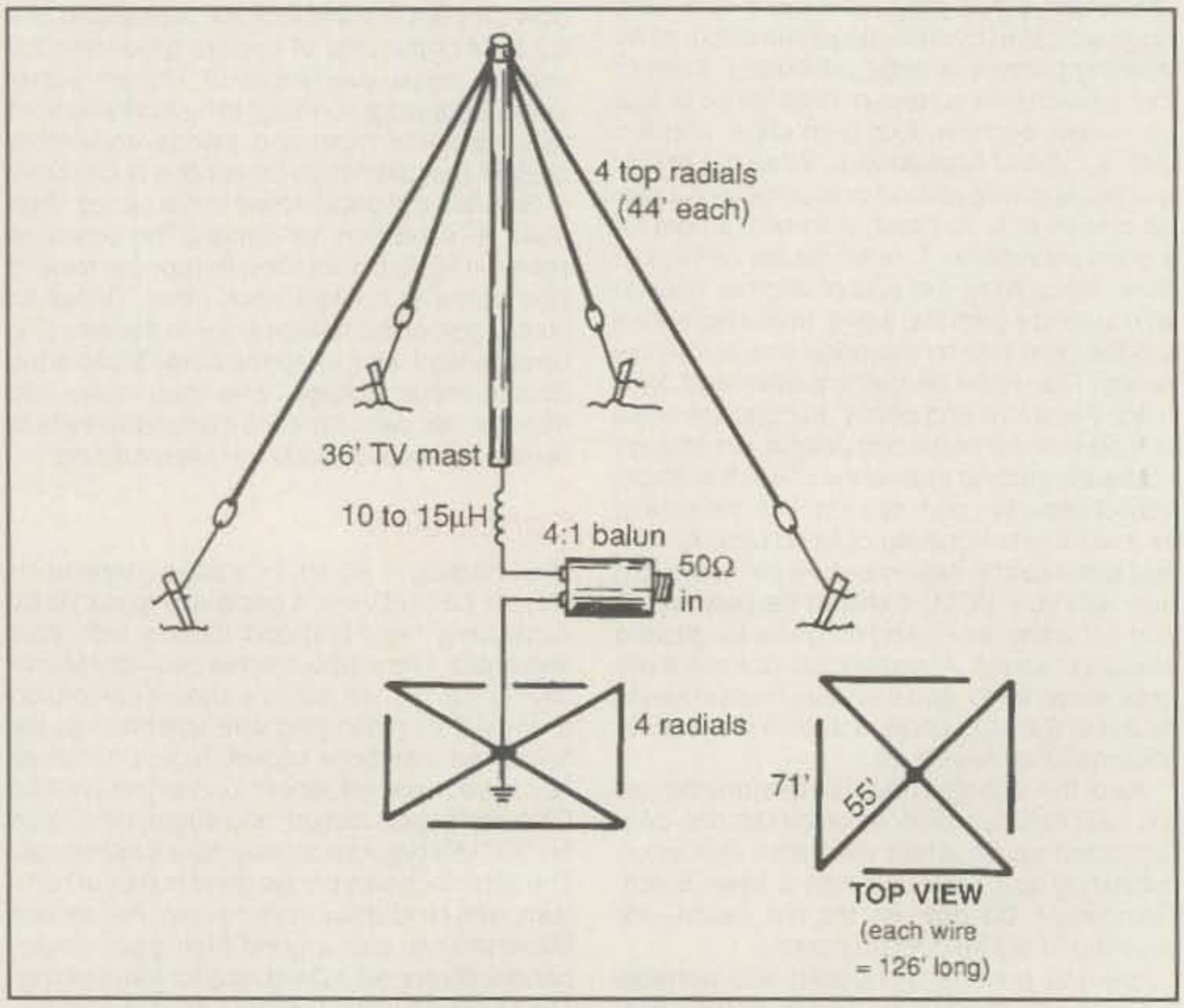

Fig. 2– Compact 160 meter vertical at W6PYK.

about 100 Hz and required plenty of filtering to get the vibrator "hash" out of the receiving equipment!

A second type of switching supply was the "synchronous vibrator" type (fig. 5). Old-time amateurs are familiar with the Mallory "Vibropack," which used a synchronous vibrator with a double set of contacts. The second set of contacts, operating on the secondary, acted to rectify the high voltage. This mechanical rectifier eliminated the rectifier tube. Positive, high voltage was taken from the transformer secondary center tap, and the transformer windings had to be polarized correctly.

The Modern Switching Power Supply

That was then. This is now. The vibrator supply is long gone from the car radio, as transistors and integrated circuits work directly from the primary voltage supply (usually 12–15 volts). However, the switching supply is still with us today, in an improved form. The modern switching power supply is a high-frequency conversion circuit that became practical in the early 1960s with the advent of fast, high-voltage transistors that could operate directly from the rectified primary (120/240 volt) source. Motorola estimates that over 40 percent of the industrial market belongs to switching supplies (*Linear/Switchmode Voltage Regulator Handbook,* Motorola Semiconductor Products, Box 20912, Phoenix, AZ 85036).

The switching supply offers the advantages of high efficiency, light weight, and small size as compared to the run-of-the-mill linear power supply. On the other hand, the switching supply requires a more complex design, generates a considerable amount of electrical noise, and cannot meet some of the performance capabilities of linear supplies. However, when size and efficiency are of primary importance (the aerospace industry, for example), the switcher is the design of choice.

Modern switching supplies operate in the 100 to 200 kHz region and have about a six-to-one advantage in efficiency and size as compared to an equivalent linear supply. Some advanced switchers operate as high as 500 kHz. The savings in "transformer iron" and ease of filtering are obvious.

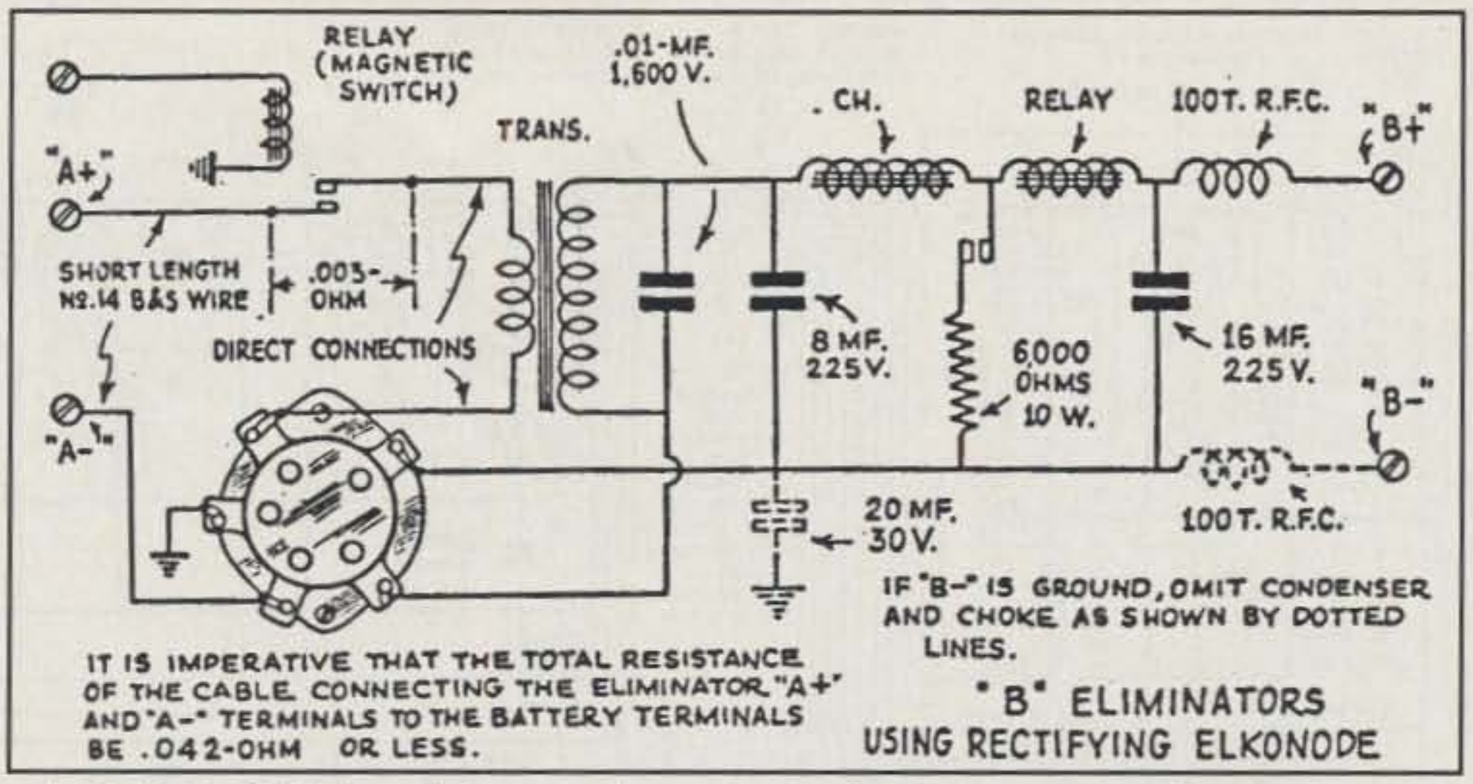

Fig. 3– Early "B Eliminator" for car radio made use of a vibrator-rectifier. (Drawing from June 1937 Radio Craft.*)*

The Switcher Circuitry

The switching supply is relatively complex, being made up of four basic building blocks (fig. 6). The 60 Hz power line is rectified and filtered in the first block. The second block is the high-frequency inverter that chops the rectified

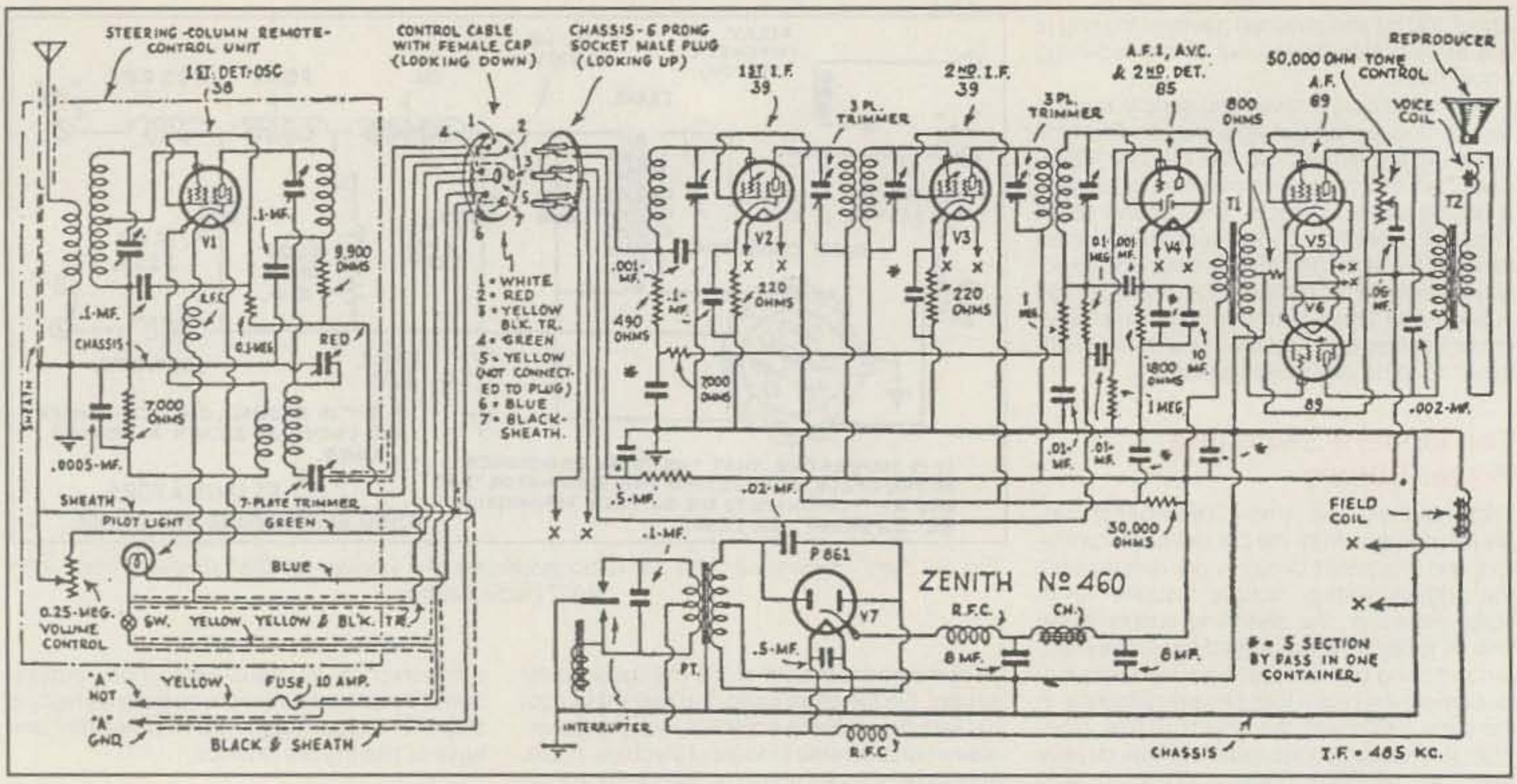

Fig. 4– Complex car radio of 1937 used several tubes and a nonsynchronous primary "interrupter." (Drawing from June 1937 Radio Craft.*)*

voltage at a high rate (20 kHz and up). The voltage is also stepped up or down to the correct level for use by the supply load. The output voltage is again rectified and filtered. The level of output voltage is determined by a fourth block, the control circuit, which generates a separate reference voltage and utilizes pulse-width modulation to attain the desired regulation.

Basically, the on-time of the square-wave signal to the inverter is controlled by the output voltage. As the load is decreased (or input voltage increases) a slight change in output voltage will

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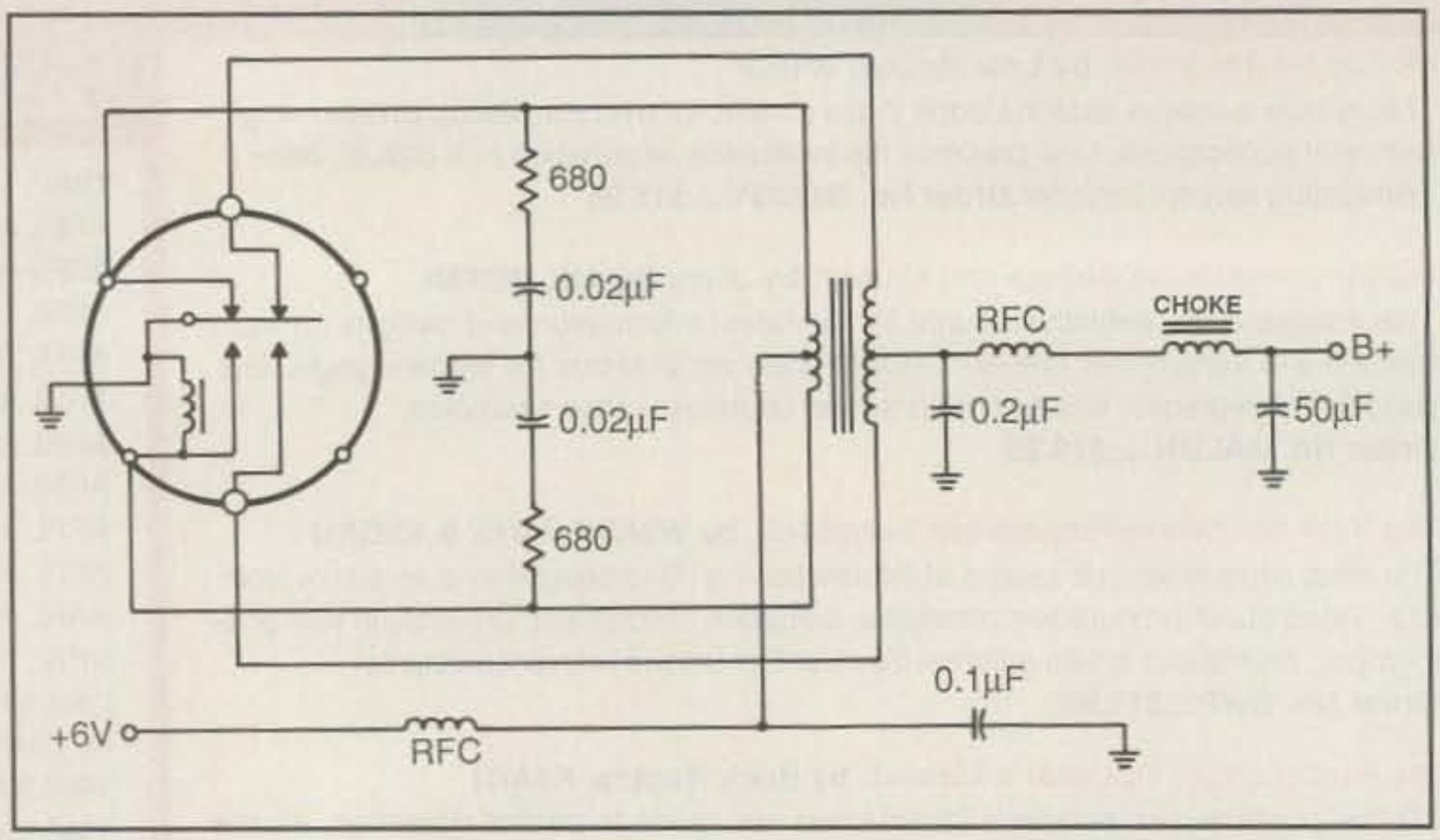

Fig. 5– The synchronous vibrator power is self-rectifying due to the use of a double set of vibrator contacts. Through proper polarization of the transformer windings this mechanical rectification is possible.

signal the control circuit to deliver narrower pulses to the inverter, and conversely, as the load is increased or input voltage decreases, wider pulses will be fed to the inverter.

Other circuits, such as over-voltage protection and reverse current flow protection, are commonly incorporated in the switching supply. One pecularity of the switching supply is that it usually requires a minimum output load at all times to prevent cycle skipping and erratic operation.

So what has this got to do with amateur radio? Isn't the inexpensive linear supply good enough for today's equipment? In the short run, the answer is that the switching supply is too expensive to be competitive in today's market. In the long run, the answer is that the switching supply will end up in the majority of amateur equipment because of its light weight and adaptability.

A typical linear supply for a 100 watt transceiver provides about 13 volts at 20 amperes. It weighs in the neighborhood of 17 pounds. A 100 kHz switching supply of the same capacity weighs about 4 pounds and occupies less than half the volume. You cannot miniaturize the watt, but you can surely miniaturize the supply!

Site Master Antenna Analyzer

In recent columns I've discussed interesting antenna analysis equipment, such as the MFJ-259 HF/VHF SWR Analyzer and the AEA SWR-121 Antenna Analyst. These devices come in various models for use up to 475 MHz. The MFJ unit provides instant readout of antenna-sys-

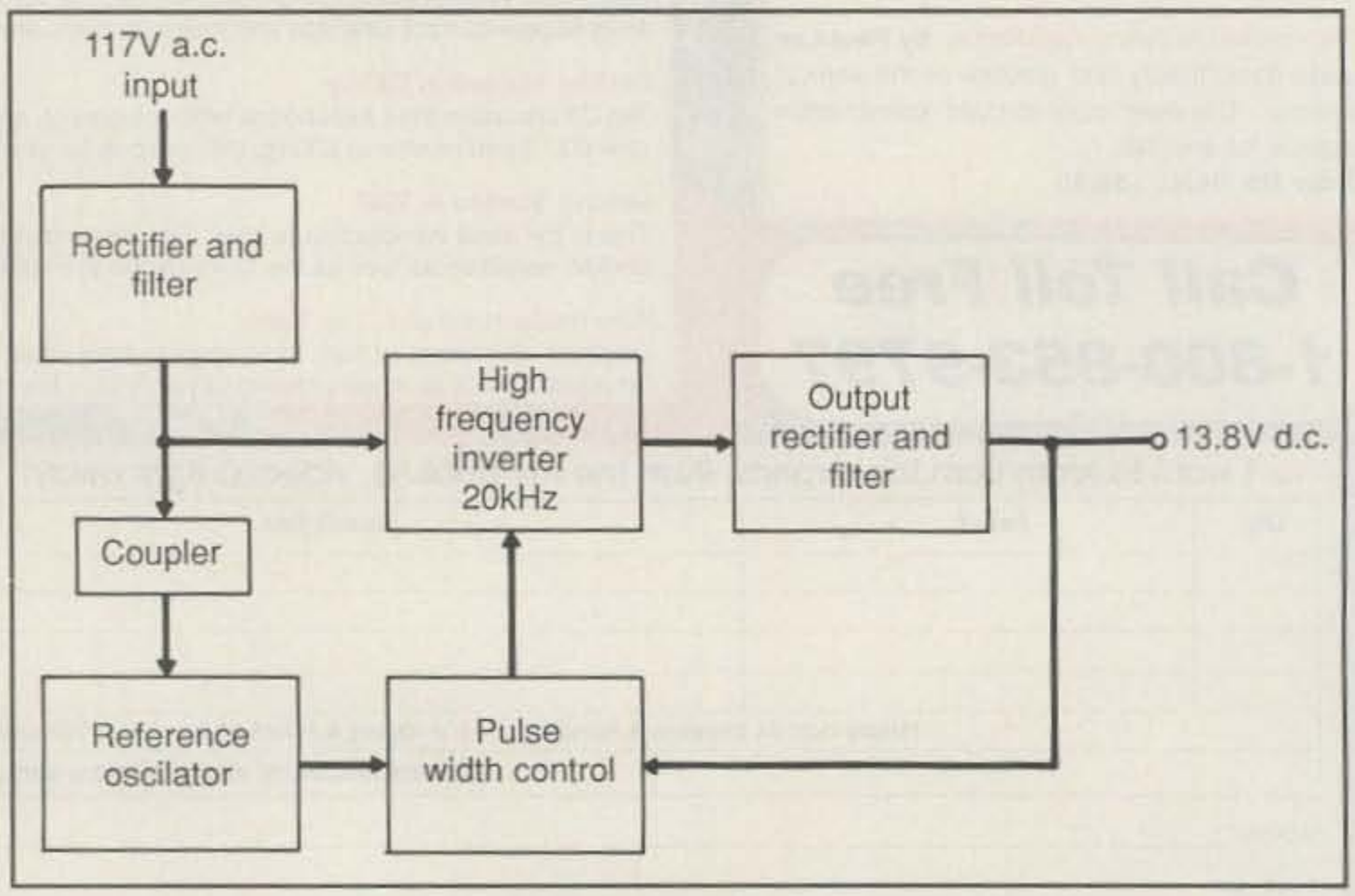

Fig. 6– Block diagram of switching power supply.

The Anritsu/Wiltron Site Master antenna analysis device.

tem resonance and feedpoint impedance at resonance. The AEA provides additional information in graphic form, including SWR curves for the system under test. Both of these interesting instruments are showing up in more amateur's shacks daily.

There's a third antenna analysis device: the Anritsu/Wiltron (Morgan Hill, California) Site Master (see photo). The Site Master combines SWR measurements with the capability of locating transmission-line faults over user-specified bandwidths. Various versions cover frequencies from 700 to 3300 MHz.

The Site Master is designed primarily for use in installation and maintenance of base-station equipment in two-way cellular and PCS services. These compact, rugged instruments combine a reflectometer designed to make accurate amplitude and phase measurements on a coax line, a frequency-synthesized signal generator, a precision SWR bridge, and a receiver. The receiver portion of the instrument is immune to interference from undesired sources, and the Site Master can be used in strong RF fields from nearby transmitters. This 2.2 pound device is specifically designed for rough field service and includes data logging capabilities allowing measurements made over a period of time to be recalled for comparison.

While not an everyday item for the amateur shack, the Site Master can be of great benefit to those individuals and companies working with antenna systems in the lower UHF region. The overall operation of an antenna can be evaluated quickly, visually presented, and then stored for future use. Someday soon, no doubt, a version of this interesting device will be available for the HF and VHF amateur bands.

Acknowledgements

My thanks to the following amateurs who have taken the time to write me. I really appreciate their input and information: W7CG, W6LU, W6UVC, AH6NY, W4SXK, W2NBJ, K6YGK, KM6EH, N2TAI, KD6MOA, and W6CYX. My thanks to all! 73, Bill, W6SAI

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The complete package (Cat. #107-PC) sells for $29.95. For more information contact the AMECO Technical Sales Department, Donna L. Bates, AMECO Corp., 224 East Second Street, Mineola, NY 11501 (phone 516-741-5030, fax 516-741-5031), or circle number 104 on the reader service card.

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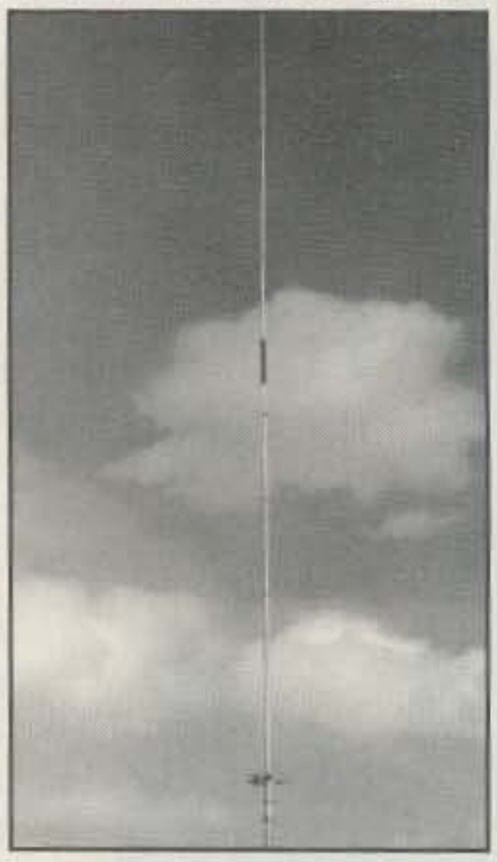

(Continued on page 123)

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All-Mode HF Transceiver **FT-1000MP**

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Only with this combination of EDSP, independently selectable 8.2 MHz and 455 kHz IF filters, and a low-noise DDS local oscillator system can receiver performance without compromise be obtained. You can customize your FT-1000MP by choosing from 20 kHz, 500 Hz, and 250 Hz optional, cascaded IF filters, then zero in on weak signals using Yaesu's exclusive Shuttle-jog Rapid Tuning Enhancement and high-resolution (0.625 Hz) DDS VFO. Without question, the FT-1000MP is the most technologically advanced HF rig today.

EDSP operates in both transmit *and* receive modes. On receive, the EDSP produces enhanced signal-to-noise ratio and significantly improved intelligence recovery during difficult situations involving noise and/or interference. The result of hundreds of hours of laboratory and real-world experimentation, EDSP's 4 preset random noise reduction protocols and 4 digital filtering selections are controlled by easy-to-use concentric controls on the front panel of the transceiver. High, low, and mid-range cuts for voice work are teamed with razor-sharp CW bandpass filters and an automatic notch filter which identifies and attenuates undesired carriers or heterodynes. Also operational in the transmit mode, EDSP provides 4 performance-enhancement pattern selections for different operating circumstances, ensuring best readability of *your* signal on the other end of the path.

Once again, Yaesu's engineers have reaffirmed the vision and dedication of JA1MP which began nearly 40 years ago. See the incomparable FT-1000MP today.

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BY JOHN DORR, K1AR

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Volunteerism and Other Potpourri

April's Contest Tip of the Month

It may seem obvious, but labeling items in your shack such as antennas, amplifier settings, relays, etc., is a must! If you haven't taken the time, revisit this area of shack housekeeping. Many station owners also label their coax feeds, and/or rotator and control lines as well. It just may prevent a catastrophic failure when you get serious in this fall's contest season.

Volunteerism has become one of this decade's popular buzzwords. There simply are not enough days in the week to allow an individual to serve in the hundreds of organizations and worthy causes needing volunteers in one form or another.

I believe the same is true of amateur radio. Without a doubt, volunteerism is one vehicle that can help boost our hobby both in terms of numbers and involvement. Contesters, in particular, are perfect candidates to lead in this area. I wonder, are we taking the opportunity?

You may recall from the 1995 Contest Survey results reported in last month's column that the topic of non-contesting involvement was explored in some depth. The depth of involvement by many of you was encouraging. For this reason, I want to expand a little on these results and suggest a call to action for all contesters to consider.

Based on last year's survey and my own personal experience, contest operators as a whole are very active amateurs. Not only do we enjoy a variety of on-the-air activities outside of contests (i.e., DXing, awards chasing, etc.), we are intimately involved in the technical side of the hobby. The nature of contest operating itself demands the need to push our hobby's technical edge—something that benefits all amateurs in the long run.

While this aspect of our involvement is all well and good, the area that I would like to hone in on this month goes beyond operating and technical achievements. It is an area of commitment that is at the very core of every amateur radio operator's being—serving through volunteerism.

Take a minute and consider the opportunities for volunteerism in our hobby. Without giving it too much thought, some obvious ones come to mind. Being part of the volunteer amateur exam program is a great way to lead in this area. Have you ever experienced the look in another person's eyes as he or she passed the first amateur exam? It can be as rewarding for the examiner as it is for the new amateur. Another related area is classroom teaching. While you may not feel that you have a gift in this area, there are so many other areas besides stand-up teaching in which you can provide assistance. Consider ideas such as curriculum development, producing classroom materials, setting up radio demonstrations, video tapes, etc. Who has better amateur radio experience in this area than a hard-core contest operator who has spent years pushing the hobby to its limits?

Local club involvement, especially non-contest clubs, is another area worth pursuing. There's not a club to be found that doesn't have a need for someone to pitch in and help. And, most clubs are clamoring for experienced amateurs to be those volunteers. Whether it be editing the club newsletter, coordinating Field Day, or offering technical support, the needs are endless. It can also be as simple as giving a talk on contesting to a few clubs in your local area over a planned period of time. Why not consider implementing a "contest university" within a non-contest club to push them along into greater on-the-air activity? The beauty of club involvement is that the results of your labor can be extremely meaningful and immediate.

One of the longstanding traditions in our hobby has been the art of elmering newcomers into the fold. Take a minute and think about the elmer you may have had when you started out. Wasn't he great? Mine was an incredibly patient guy who had all the time in the world for me. I was young and filled with enthusiasm, and he was able and ready to channel that enthusiasm into productive hamming. It's all too easy, after being an amateur for 20 or 30 years, to forget how little we knew about amateur radio when we first started out. There's probably no better way to volunteer than by informally taking a new amateur under your wings of experience and helping him or her along.

Beyond serving ourselves, if you will, is the area of amateur volunteerism which serves the public. We've all heard of the need for 2 meter "crowd control" operators at a parade or other public event. Have you ever served in that capacity? Can you envision the effective communication that could come from a group of contest operators leading the charge in this area at the 1996 Olympics in Atlanta this summer?

Beyond serving in events is getting involved in activities that promote amateur radio to the public at large. Shopping malls, libraries, and other public venues are excellent ways to do this. It just takes people to make it happen. It takes volunteers. My son's school teacher nearly jumped out of her chair last year when I offered to demonstrate amateur radio to her class. Similarly, an amateur radio demonstration conducted by a club in this area at one of our local shopping malls was extremely well received by both mall officials and the public. It exposed amateurs as they are—active individuals who care about serving others and enjoying their hobby, not ogres who live in the dungeons of their basements destroying home electronics worldwide.

I want to take this opportunity to challenge all of us by suggesting a call to action. As the summer rapidly approaches, there's no better time to take some of this month's topic to heart. Let's be honest. In today's day and age, time is a precious commodity—but then again, so is our hobby. Its long-term health is, in part, dependent on what we put into it—not what we take out. Are you up to the task? Can you identify an area to serve and actually follow it through to the end? If you take the challenge, I guarantee that you and amateur radio will be better off for it. Think about it!

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Calendar of Events

Mar.	**30-31**	**CQ WW SSB WPX Contest**
Apr.	6-7	EA RTTY Contest
Apr.	6-7	SP DX SSB Contest
Apr.	6-7	Italian YLRC Marconi Int'l Contest
Apr.	6-7	MARAC SSB County Hunters Contest
Apr.	10-12	DX-NA YLRL CW Contest
Apr.	12-14	Japan HF CW DX Contest
Apr.	13-14	QRP ARCI Spring QSO Party
Apr.	20	Eoropean SSB Sprint
Apr.	24-26	DX-NA YLRL SSB Contest
Apr.	25-26	Int'l HF Contest/Chernobyl Memorial
Apr.	27	QRP To The Field Contest
Apr.	27-28	Helvetia (HB9) Contest
Apr.	27-28	Nebraska QSO Party
May	4-5	ARI International DX Contest
May	4-5	Connecticut QSO Party
May	4-5	Texas QSO Party
May	4-5	Massachusetts QSO Party
May	4-5	MARAC CW County Hunters Contest
May	18	European CW Sprint
May	**25-26**	**CQ WW WPX CW Contest**
June	8-10	ARRL June VHF QSO Party
June	22-23	ARRL Field Day
July	1	RAC Canada Day Contest
July	13-14	IARU HF World Champ./WRTC '96

My Most Memorable Contest Experience

"Operating the very last contest (All Asian) at the W6AM contest station from the historical Palos Verdes site before it was torn down. It was incredible to 'rotate' the rhombics and hear all those open frame relays clack!"—*N6AW*

WRTC '96 Update

If you haven't heard the good news by now, the Northern California Contest Club is organizing the second running of the World Radio Team Championship to be held in conjunction with the IARU HF Contest on July 13–14, 1996. WRTC '90 was an unparalleled event in contest history. First held in Seattle, Washington, two-man teams made up of some of the world's top operators were pitted in a head-to-head competition. In an attempt to emphasize oper-

ating ability, each team ran the same power level and operated from stations with similar terrain, antennas, and geographic location.

WRTC '96 will be taking the best of 1990's events, with 52 teams made up of members of leading contest clubs and individuals around the world competing in a "knock 'em dead" operating event. Although the contest will be the showcase event for WRTC '96, NCCC is organizing a full week of activities for all attendees. You don't have to be an "official" participant or judge to attend!

The competition is sure to be intense in this one. The judges who have been selected read like a who's who of contesters and include K4VX (Chief Judge), G3SXW, I2UIY, JA7RHJ, K3ZO, K4XU, K5RC, K6NA, N6AA, N6IP, N6ZZ, OH2MM, OK2FD, ON4UN, PY5EG, S50A, UA9BA, WØUN, and W7RM!

Over the next few months I'll continue to provide you with updates about what will prove to be one of the most notable operating events in contest history. If you want more information right away, contact Rusty Epps, W6OAT, via postal mail at 651 Handley Trail, Redwood City, CA 94062, or via e-mail at epps@netcom.com.

Rare Form of TMI Discovered!

Okay, I know that this is the April issue, but you have to ride along with me on this one because it's a true story. As we move into the late 1990s, our society's level of health consciousness continues to rise. Gym memberships are at an all-time high, and nearly everyone is thinking about that special piece of health equipment for their basement.

As it turns out, the "AR" house is no exception. Just the other day, we became the proud owners of a brand-new treadmill. You know the kind. It has the advantage of occupying a huge amount of space while rarely ever being used after the first month of ownership!

To be honest, this was my wife's idea. With screwdriver in hand, she proceeded to assemble the unit and power it up while I was exercising my fingers across the room in the NCJ CW Sprint. Suddenly and without warning, I heard a scream while I was sending. Looking over in her direction, I saw her running like crazy. The scenario was something like this: Dit Dit Dit Dit Dit Dit—treadmill FAST; pause, pause, pause, pause, pause—treadmill SLOW. It seemed that my KW on 80 meters got into the electronics of the unit and made the motor take off like a rocket. Well, being the accommodating husband, I immediately stopped operating (mostly because I was laughing too hard). However, I couldn't stop thinking about how contesters were contributing again to the welfare of our fellow man by improving the physical conditioning of our immediate neighbor(s) around the globe during one contest after another!

Dayton Hamvention '96 and The CQ Contest Banquet

Given the possibility that you've been spending a little too much time in the office lately, let it be known one last time that this year's Dayton Hamvention dates have been moved from late April to May 17–19, 1996. In addition, *CQ* has officially taken over managing the logistics for the Dayton Contest Banquet. Over the past three years this dinner has had time to evolve into a truly great event. Put another way, it's much more than just another "rubber chicken" dinner.

As you read this, it's not too late to get your tickets. Be sure to check out our advertisement elsewhere in this issue.

Final Comments

That's it for this month. As always, please remember to send any submissions for the July column to me by May 1.

73, John, K1AR

EA RTTY Contest

1600Z Sat. to 1600Z Sun., Apr. 6–7

This is the 1996 edition of the Spanish RTTY Contest sponsored by U.R.E. It's open to participants worldwide on 80–10 meters.

Classes: Single operator, all bands and single band, multi-single, and SWL.

Exchange: Signal report and Spanish Province/*CQ* Zone (for EA stations). All others just use *CQ* Zone.

Scoring: For non-EA stations—on 10–20 meters, credit one point for contacts in your continent, two points for QSOs outside your continent. On 40 and 80 meters triple your QSO points (e.g., three within your continent). QSOs between stations in the same country are only valid for multiplier credit and have no QSO point value.

Multipliers: Credit EA provinces (maximum 52) and DXCC countries worked per band.

Final Score: Multiply total QSO points times multiplier.

Awards: Various certificates and plaques are available to the winners of each operating category.

Send entries by May 15th to: EA RTTY Contest, c/o EA1MV, Antonio Alcolado, P.O. Box 240, 09400 Aranda de Duero (Burgos), Spain.

Polish "SP" DX Contest

1500Z Apr. 6 to 1500Z Apr. 7

Sponsored by the Polski Zwiagek Krotkofalowcow (PZK), this one is SSB only and is held the first weekend of April, generating a good level of activity by the SPs. Activity is on all bands 160–10 (no WARC bands).

Classes: Single operator, single and all band. Multi-operator, single transmitter (all band only), and SWL.

Exchange: Signal report plus a three-digit serial number. SP stations will substitute their two-letter province abbreviation for the number.

Multiplier: Count the total number of Polish provinces worked (maximum of 49).

Scoring: Three points per QSO times the number of Polish provinces worked.

Awards: Certificates will be awarded to the high scores in each class per country.

All logs must be received no later than April 30th. Send your entries to: Polski Zwiazek Krotkofalowcow, Contest Committee, P.O. Box 320, 00-950, Warszawa, Poland.

MARAC County Hunters SSB Contest

0000Z Sat. Apr. 6 to 2400Z Sun. Apr. 7

The Mobile Amateur Radio Awards Club is sponsoring the 25th running of this event. Mobile and fixed operation from every county in the United States is welcome. Mobiles and portables may be worked each time they change counties or bands.

Exchange: RS(T), U.S. county and state (province/country for others).

Scoring: One point for fixed stations; 15 points for mobiles; US/VE contacts with DX countries are worth 5 points. Final score is computed by the total QSO points times the total number of U.S. counties worked.

Frequencies: 3880, 7240, 14270, 21340, 28340 kHz. Fixed stations should operate above the suggested frequencies and to allow

more freedom for mobiles to operate on clear frequencies.

Awards: Certificates will be awarded to winning fixed stations in each state/province/country; mobiles in each state operating in three or more counties with a minimum of 10 QSOs per county. MARAC plaques to the highest scoring first- and second-place mobile stations in the U.S., North American fixed station, and DX station.

Completed logs, summary sheets, and check sheets must be received by May 8th and go to: Alan Fischer, K8CW, 259 West Cook Rd., Mansfield, OH 44907. Enclose a #10 SASE and two units of postage with your entry for a copy of the final results.

YLRL DX to North America YL Contest

CW: Apr. 10–12 SSB: Apr. 24–26
1400Z Wednesday to 0200Z Friday

This is another popular YLRL sponsored contest open only to licensed women operators around the world.

Classes: Single operator only.

Exchange: QSO number, RS(T), and ARRL section/country. Entries in log must also show time, band, date, and transmitter power.

Frequencies: CW: 3540–3570, 7040–7070, 14040–14070, 21120–21150, 28180–28210 kHz. SSB: 3940–3970, 7240–7290, 14250–14280, 21380–21410, 28280–28410 kHz.

Scoring: Phone and CW are entirely separate contests. DX YLs, including Alaska and Hawaii, may contact the North American Continent. A station may be counted as one point and worked once per band for credit. Multiply the number of QSOs by your total multiplier (sections/countries) for final score. You may apply a bonus multiplier of 1.5 if less than 150 watts is used at all times during the contest.

Awards: Various cups and plaques will be awarded to the category winners. In addition, certificates will be provided to all second- and third-place winners.

Logs are due 30 days after the conclusion of each contest. Mail your logs to: Carol Hugentober, K8DHK, 4441 Andreas Ave., Cincinnati, OH 45211.

Swiss Helvetia Contest

1300Z Apr. 27 to 1300Z Apr. 28

This is a good chance to build up your Canton total for the Swiss Helvetia Award, which requires confirmation from all 26 Cantons.

Classes: Single op (high power or QRP), multi-single, SWL. All entries mixed-mode only.

Frequencies: Use 1.8–28 MHz (no WARC bands) on both phone and CW.

Exchange: RS(T) plus a three-digit serial number. Swiss stations will also include a two-letter abbreviation for their Canton.

Scoring: Only contacts with Swiss stations count. Each contact with an HB station is worth three points. You may only work a station once per band regardless of the mode.

Multiplier: The sum of the Cantons worked on each band (26 per band).

Final Score: Calculate your final score by multiplying your total QSO points by the sum of Cantons worked.

Awards: Certificates will be awarded to the top scorers in each country and each USA and VE call area.

Logging: Indicate a Canton in a separate column for each band the first time it is worked. Check your log for duplicates and include a summary sheet showing the scoring and your name and mailing address in block letters. Also include the usual signed declaration.

The mailing deadline for contest logs is June 1st. All logs are to be sent to: Nick Zinsstag, HB9DDZ, Salmendorfli 8, CH-5084, Rheinsulz, Switzerland.

Nebraska QSO Party

1700Z Sat. Apr. 27 to 1659Z Sun. Apr. 28

Help complete your 5BWAS by operating in this popular QSO party. This contest is for single operators only with operation allowed on all non-WARC HF bands, 160–10 meters. All operating modes are permitted.

Exchange: NE stations—RS(T) plus county (93 maximum). Non-NE stations—RS(T) plus US state, VE province, or DXCC country.

Scoring: Credit one point per QSO for SSB contacts; two points for CW. Final score is calculated by multiplying total QSO points times multiplier.

Awards: Five plaques are available for category winners in Nebraska, US, and overseas, as well as Novice/Tech/Tech-Plus stations. Certificates will also be awarded as appropriate.

Logs and a signed summary sheet must be postmarked no later than May 31st. Send all entries to: Nebraska QSO Party, P.O. Box 375, Fort Calhoun, NE 68023-0375. Enclose a #10 SASE for final results.

BY JOE LYNCH, N6CL

VHF PLUS

ALL ABOUT THE WORLD ABOVE HF

Red Sprites and Blue Jets and Sporadic-E

One of the many items on the World Wide Web is a home page set up by the University of Alaska, Fairbanks. This past fall a group from the University of Alaska presented a paper to the American Geophysical Union on Red Sprites and Blue Jets. On their home page (http://elf.gi.alaska.edu) is an article summarizing their research on these phenomenon associated with thunderstorms.

Among amateurs there is an increasing interest in these phenomena as they relate to propagation. For decades it has been the often-reported myth that thunderstorms cause sporadic-E. (A myth is a story that is not true or false. It is just unsubstantiated). With the work of these scientists, the myth is gradually turning into possible reality. What follows is a digest of some of the material on the above-mentioned home page. It is presented courtesy of the University of Alaska, Fairbanks home page with special thanks to Matt Heavner, a graduate student at the University of Alaska, Fairbanks.

VHF PLUS CALENDAR

April 3	Full Moon
April 7	Poor EME conditions.
April 10	Last quarter moon.
April 13	Moon Perigee
April 14	Good EME conditions.
April 15	144 MHz Sprint (see text for details).
April 17	New moon
April 21	Poor EME conditions. Predicted peak for *Lyrid* meteor shower.
April 22	Highest Moon declination. 222 MHz Sprint (see text for details).
April 25	First quarter and Moon apogee.
April 28	Good EME conditions.

Moon conditions courtesy W5LUU.

Sprites and Blue Jets

Red sprites and blue jets are upper atmospheric optical phenomena associated with thunderstorms that have only recently been documented using low-light-level television technology.

The first images of a sprite were accidently obtained in 1989. Beginning in 1990, about twenty images have been obtained from the space shuttle. *(Editor's note: The shuttle's view of thunderstorms is quite awesome. Lightning strikes seem to travel for dozens of miles.)*

Since then, video sequences of well over a thousand sprites have been captured. Most of these images have been obtained during summer campaigns in 1993 and 1994. These include measurements from the ground and from aircraft. Numerous images have also been obtained from aircraft of blue jets, also a previously unrecorded form of optical activity above thunderstorms. Blue jets appear to emerge directly from the tops of clouds and shoot upward in narrow cones through the stratosphere. Their upward speed has been measured to be about 100 km (65 miles) per second.

In addition to sprites and jets, but possibly related, there have recently been observed from space two other types of unexpected emissions that appear to originate in thunderstorms. Short duration bursts of terrestrial origin have been detected by the Compton Gamma Ray Observatory. They are observed to occur over thunderstorm regions, and their source is believed to lie at altitudes greater than 30 km (20 miles). Finally, extremely intense pairs of VHF pulses (Trans-Ionospheric Pulse Pairs, or TIPPS originating from thunderstorm regions, but some 10,000 times stronger than sferics produced by normal lightning activity) have been observed by the ALEXIS satellite.

Anecdotal reports of "rocket-like" and other optical emissions above thunderstorms go back more than a century, and there have been several pilot reports of similar phenomena. Gamma-ray bursts and TIPPS were discovered less than two years ago. Together these phenomena suggest that thunderstorms exert a much greater influence on the middle and upper atmospheres than was previously suspected.

Sprites are massive but weak luminous flashes that appear directly above an active thunderstorm system and are coincident with cloud-to-ground or intra-cloud lightning strokes. Their spatial structures range from small single or multiple vertically elongated spots, to spots with faint extrusions above and below, to bright groupings which extend from the cloud tops to altitudes up to about 95 km (63 miles). Sprites are predominantly red. The brightest region lies in the altitude range 65-75 km (42–49 miles), above which there is often a faint red glow or wispy structure that extends to about 90 km (59 miles). Below the bright red region, blue tendril-like filamentary structures often extend downward to as low as 40 km (26 miles). Sprites rarely appear singly, usually occurring in clusters of two, three, or more. Some of the very large events seem to be tightly packed clusters of many individual sprites. Other events are more loosely packed and may extend across horizontal distances of 50 km (33 miles) or more and occupy atmospheric volumes in excess of 10,000 cubic km (6,500 cubic miles).

High-speed photometer measurements show that the duration of sprites is only a few ms. The current evidence strongly suggests that sprites preferentially occur in decaying portions of thunderstorms and are correlated with large positive cloud-to-ground lightning strokes. The optical intensity of sprite clusters, estimated by comparison with tabulated stellar intensities, is comparable to a moderately bright auroral arc.

If sprites are only barely detectable by the unaided human eye, in intensified television images obtained from the ground and from aircraft they appear as dazzlingly complex structures that assume a variety of forms.

Early research reports for these events referred to them by a variety of names, including "upward lightning," "upward discharges," "cloud-to-stratosphere discharges," and "cloud-to-ionosphere discharges." Now they are simply referred to as sprites, a whimsical term that evokes a sense of their fleeting nature, while at the same time remaining non-judgmental about physical processes that have yet to be determined.

Blue jets are a second high-altitude optical phenomenon, distinct from sprites, observed above thunderstorms using low-light television systems. As their name implies, blue jets are optical ejections from the top of the electrically active core regions of thunderstorms. Following their emergence from the top of the thundercloud, they typically propagate upward in narrow cones of about 15 degrees full width at vertical speeds of roughly 100 km/s (65 mps) (Mach 300), fanning out and disappearing at heights of about 40–50 km (26–33 miles). Blue jets are not aligned with the local magnetic field.

Why Haven't Sprites and Jets Been Reported Before? Sprites appear to be elusive for several reasons. (1) Sprites only occur above active thunderstorm systems. To see them requires visual access to the region above the storm, unobstructed by intervening clouds, and viewing against a dark stellar background. In most locations these conditions occur only rarely. (2) Sprites are dim and can only been seen with the dark-adapted eye. On average, their brightness compares to moderately bright aurorae. In the human eye, this corresponds approximately to the cross-over threshold intensities of cones of the retina, which respond to color, and the somewhat more sensitive but achromatic parfoveal rods, which permit night vision. The dark-adapted eye most readily sees sprites in parfoveal vision, when not directly looking at them. Thus, they may quite literally appear only as flashes

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out of the corner of the eye. Because of their dimness, sprites cannot be viewed in the presence of nearby bright lights, as would be found in a city. (3) Cloud illumination from sprite-producing cloud-to-ground or intra cloud lightning activity is often orders of magnitude brighter than sprites. This lightning activity can easily distract the casual observer from noticing the fleeting and delicate dance of red sprites high in the sky above the storm raging below. (4) Sprites appear to have a duration of only a few (3–10) milliseconds. This is too brief to permit shifting one's gaze to obtain a visual fix. (5) Sprites occur randomly with only about one percent of lightning strokes. The mere occurrence of lightning therefore cannot be used as an event marker to indicate that a sprite has occurred above a thunderstorm.

When all of these factors are taken together, it is not surprising that sprites have been so elusive. However, they can be seen with the unaided human eye.

How to Look for Sprites and Jets: A clear view above a thunderstorm is required. This generally means the thunderstorm activity must be on the horizon. Additionally, there must be very little intervening cloud cover.

Best viewing distance from storm is 100–200 miles (150–300 km). At these distances sprites will subtend a vertical angular distance of 10-20 degrees. This is 2–4 times the separation of the pointer stars in the Big Dipper.

For observing sprites, it must be completely dark (i.e., no longer twilight). Eyes must be completely dark-adapted. Use same criteria for this as for astronomical observing. If you can see the Milky Way, then it is probably dark enough and the eyes have adapted enough to see sprites.

Fix your gaze on the space above an active thunderstorm. Do not be distracted by underlying lightning activity in the storm. Block out the lightning if necessary using a piece of dark paper in such a way as to still being able to view what is going on above the cloud.

Sprites will be very brief flashes just on the edge of perceptibility. They occur too quickly to follow with the eyes, but their strange vertically striated structure and dull red color may be perceived.

Patience will be rewarded. If the right kind of storm is present and one's viewing geometry is favorable, then there is a greater likelihood of seeing a sprite than of seeing a shooting star or comet.

If you have observed a sprite or any other optical emission above a thunderstorm, please report it to the Geophysical Institute at the University of Alaska, Fairbanks. *(Editor's note: You can do so by sending an email to Matt Heavner at heavner@gi.alaska.edu.)*

Current Research Focus: Intense efforts, both experimental and theoretical, are presently underway to determine the full extent to which these new phenomena form a part of the terrestrial electrical environment. Although optical images seem likely to remain the principal experimental form of "ground truth" in sprite detection, focus has already shifted to employing other diagnostics that will yield more specific information about the detailed physical mechanisms. These include optical spectra, including height profiles, radio (ELF-HF) measurements of the electromagnetic emissions from sprites and their accompanying tropospheric lightning strokes, VLF measurements of associated ionospheric heating

effects, and continuous-wave radar probes of sprites to determine electron densities.

Investigations are underway to ascertain whether they may create locally or globally significant long-lived electrochemical residues within the upper atmosphere. The production of ionized or electronically excited species, by RF electrolysis or other means, could conceivably lead to the creation of reactive species or to the activation of catalytic species that would otherwise be absent.

Speculations: From what is known to date, it may be speculated that sprites or jets, or both, are an integral feature of every thunderstorm system of moderate size or larger in the terrestrial system, and may be an essential element of the earth's global electrical circuit. Further, it seems likely that they have been a part of thunderstorms that have occurred over previous millions of years or longer. One may speculate about the possible occurrences of similar phenomena associated with lightning on other planets where lightning has been detected, most notably Jupiter and Venus.

References: Most recently from the University of Alaska, two Geophysical Research Letters articles have been published: Sentman, D.D., E.M. Wescott, D.L. Osborne, D.L. Hampton, M.J. Heavner, Preliminary results from the Sprites94 Aircraft Campaign: 1. Red Sprites, *Geophys. Res. Letts.*, 22, 1205–1208, 1995. Wescott, E.M., D.D. Sentman, D.L. Osborne, D.L. Hampton, M.J. Heavner, Preliminary results from the Sprites94 Aircraft Campaign: 2. Blue Jets, *Geophys. Res. Letts.*, 22, 1209–1213, 1995.

This research on red sprites and blue jets is being conducted by the Geophysical Institute, University of Alaska, Fairbanks. *(end quote)*

This digest does not do justice to the home page. There are numerous photos of both red sprites and blue jets, plus more detailed explanations about other related phenomena and places you can go for further research.

It has been my contention for some time that sporadic-*E*, thunderstorms, and even aurora are all interelated. As such, they all are tied to the energy emitted from the sun. Perhaps the research work being conducted at the University of Alaska and other locations will finally provide the key to unlock the mystery of the connections.

Amateur Radio and the WWW

In the past several months several dozen (that's right *dozen*) home pages associated with amateur radio have been created. There are a couple of ways of finding out about them. One is to use one of the WWW lookup services. Another is to log onto Ron Klimas' home page (http://uhavax.hartford.edu/disk$userdata/faculty/newsvhf/www/ham-www.html). Ron has set up links to almost all of the home pages and he updates his list monthly. From his page you can go anywhere, including to my home page (http:/www.smu.edu/~jlynch). There you will find the CQ WW VHF Contest rules (which will be published next month in this magazine), as well as other amateur radio related items and items related to my school studies.

One of the fanciest home pages is run by Geoff, GJ4ICD (http://user.itl.net/~equinox). Geoff maintains two newsletters, plus access to European clusters on the VHF+ bands. Additionally, in cooperation with Bob Mobile, WA1OUB, Geoff is working on announcing real-time 6 meter band openings between the North America and Europe.

Another home page for the weak-signal operator is the one maintained by PAØZN (http://www.nitehawk.com/rasmit). On it you can find items related to EME work, including Al Katz's "432 MHz EME Newsletter."

Certainly, there is plenty for you to explore on the WWW. However, don't go there and get lost and forget to get on the air, or I won't be able to report on your activities in this column.

Current Contests

This month begins the annual Spring Sprints. Except for the 6 meter Sprint, all contest times are between 7–11 PM local time. The 2 meter Sprint is 15 April. The 135 cm Sprint is 22 April. Exchange is your grid locator. Rules were in the "Contest Corral" column in March *QST* and results are normally found in the *National Contest Journal*, another League publication.

Current Meteor Showers

The *Lyrids* meteor shower is predicted to peak between 22–23 April. This is a north-south shower, producing at its peak around 10–15 meteors per hour.

And Finally

One of my favorite reading pleasures used to be the stories invented by Hugh Cassady, WA6AUD. Hugh published the "West Coast DX

Bulletin" for a number of years and then retired from that endeavor, only to later take up, for a time, the editorship of *CQ*'s DX column.

I often thought that someday I too could invent bits of wisdom neatly wrapped in a story. This month I am going to make an attempt.

Recent postings on the VHF reflector on the Internet tended to have just a little bit of anti-FM undertone. With that in mind, I want to present the following story:

It seems that there was a wise old amateur who would occasionally be visited by newer, younger amateurs and asked for advice. On one occasion he was asked, "What are the characteristics of the true ham?" He told the following story, which had its origins in southern California:

It seems that one day there was a tremendous racket on 144.200 MHz. This racket occurred at different times during this particular day. It just happened one day and then it went away. Those listening on SSB knew right away what caused the sound. It was one of those FMers transmitting FM on the SSB calling frequency.

There were three or four hams in particular who responded to the sound, all of whom thought they were the ones who caused the problem to go away.

The first ham was an Extra class. He had a powerful station with big beam antennas. He decided to find the location of the offending sound by pointing his big antennas in the direction of it. When he found it, he turned on his linear and let the offender have it. After doing this about three or four times during the day, he noticed that the sound had gone away.

The second to respond was a group of hams who were just an ordinary bunch. They gathered on the calling frequency and chatted endlessly about nothing in particular. When the offending sound came on, they would keep right on talking. Maybe someone would comment about the FMer, but generally they would ignore the sound and pretend that it wasn't there. Finally, at the end of the day, they noticed that it was gone. They reasoned to themselves that they were the ones to get rid of the sound simply by ignoring it.

The final person to respond was a relatively new ham. He had one of those licenses that so many people criticize—a code-free Technician's license. He had just bought a multi-mode radio. On this particular day he heard the same racket that everyone else did while he was listening to SSB on 144.200 MHz—only he did something different.

He switched his multi-mode radio to FM and listened. What he heard was a brand new ham calling CQ. Well, this Technician realized immediately that the new ham had a problem. No one was going to answer him on FM on the SSB calling frequency.

He thought about it but decided against it because he figured that he would only compound the problem. So, he did something else.

This Technician turned on his computer, checked into the World Wide Web and looked up the callsign of the new ham. When he found the ham's address, he decided to get in his car and pay this new ham a visit.

When he arrived at the new ham's home, he knocked at the door and it was opened to him. After identifying himself to the new ham, he was invited in by him.

Both hams found instant friendship with each other. After a time the Technician asked to see the new ham's radio. The new ham brought out the radio, adding that he had purchased it at a swapmeet the weekend before he received notice of his license.

Upon examination, the Technician realized that this was a radio that was a few years older than what was currently on the market. He then remembered that another southern California ham once wrote a review about the radio. In that review, the southern California ham chided the manufacturer of the radio for a flaw that caused the radio to default to 144.200 MHz upon initial power-up.

The Technician told the new ham about this flaw, adding that he had heard him during the day calling CQ with no results. After spending time with the new ham explaining about the FM frequencies and repeaters and reprogramming the new ham's radio, the Technician left.

On the way back to his home, the Technician had a QSO with the new ham on one of the local repeaters. During the QSO he promised the new ham that he would be back to help him with other aspects of the hobby, such as finding a local club, setting up a fixed station, etc.

The wise old ham concluded his story by asking the question, "Which one of the three would be considered the true ham?" Those listening to him responded by saying that it was the Technician. To which the old man replied, "Go and do likewise."

If you have a tale to tell me of your accomplishments, please let me hear from you. You can use the usual routes, the internet, my fax line (405-528-0746), my voice line (405-528-6625), or the mail. Please keep in touch.

Until next month . . .

73, Joe, N6CL

BY DOUG DeMAW, W1FB

DOUG'S DESK

CONSTRUCTION PROJECTS, TECHNIQUES, AND THEORY

Build A Low-Cost Receiver

Complex, high-performance receivers are usually beyond the technical skill of many experimenters. Furthermore, the parts for a sophisticated receiver can be expensive and difficult to find. Do we really need receivers that have dozens of functions, knobs, and switches? It depends entirely upon the operating regimen of the user. DXers and contesters, in particular, require above-average receivers if they are to succeed in their pursuits.

Many of us electronics enthusiasts enjoy building simple receivers, testing them, and using them for routine operating activities. Certainly, the QRP enthusiast with his or her direct-conversion or bare-bones superhet receiver would agree with that. This article describes how to use a low-cost, AM, BC-band transistor radio as a foundation for an amateur-band receiver. Various circuits are presented to accommodate these receivers for CW/SSB reception. The circuits may be added to almost any BC-band receiver, including those used in automobiles.

A Typical BC Receiver

Fig. 1 shows the circuit for an imported transistor radio that operates from +9 volts DC. Most of these radios can be operated from a +12 volt supply without being damaged. The fig. 1 circuit is the heart of the 160 meter superheterodyne receiver seen in the accompanying photographs. Things can become complicated when we try to use transistor radios that are wired for a positive ground (PNP transistors), so try to locate a negative-ground radio to modify. Generally speaking, imported transistor radios follow the fig. 1 circuit pattern, but some may use an IC in the audio-output stage.

A New Mixer and Oscillator

Most low-cost BC-band receivers use a single bipolar transistor for the mixer and oscillator. This stage, along with the ferrite loop antenna, needs to be disabled

P.O. Box 250, Luther, MI 49656

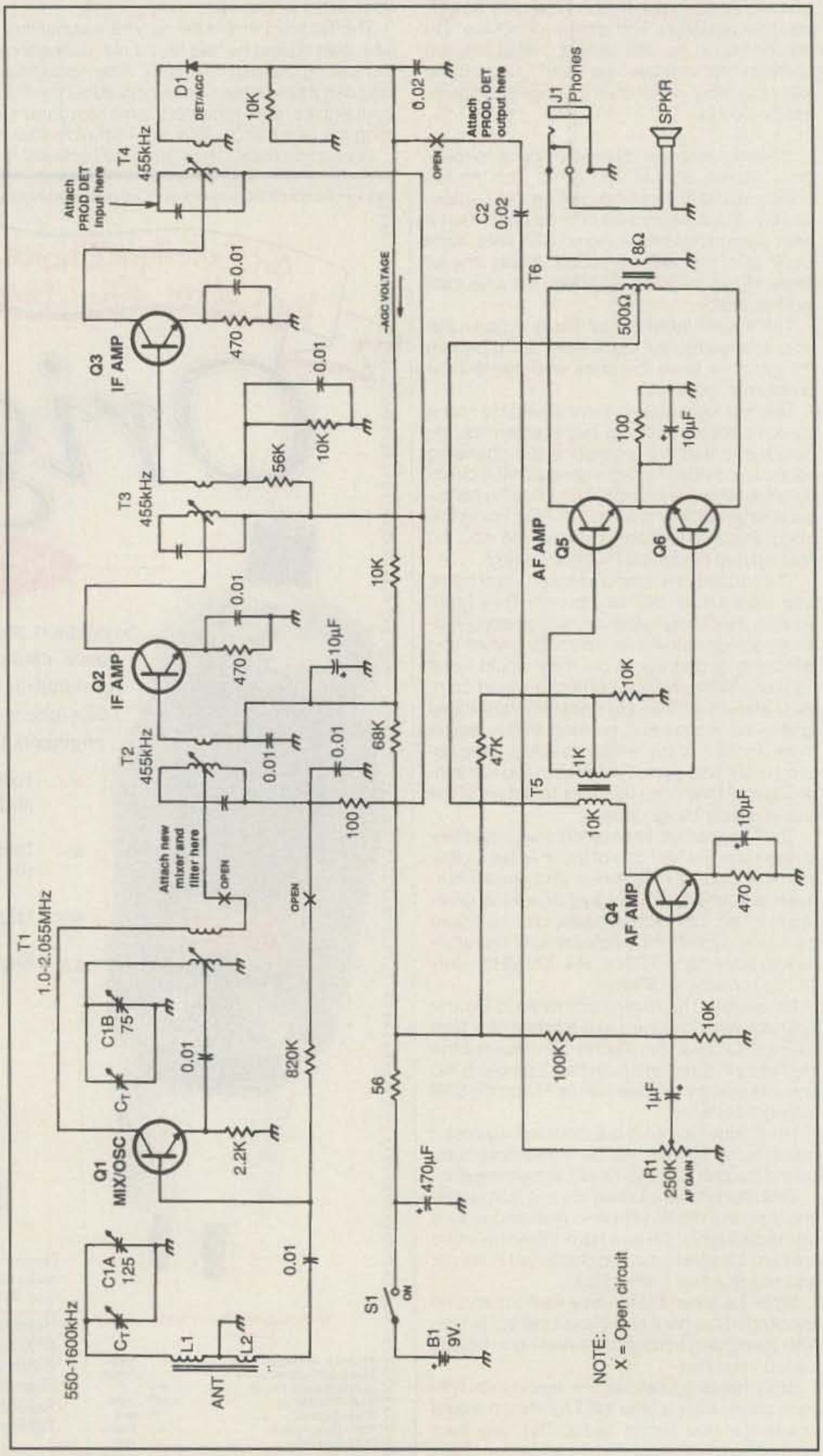


Fig. 1– Schematic diagram of a typical BC-band, AM transistor radio that operates from +9 volts. A receiver of this type provides an inexpensive foundation for a communications receiver. →

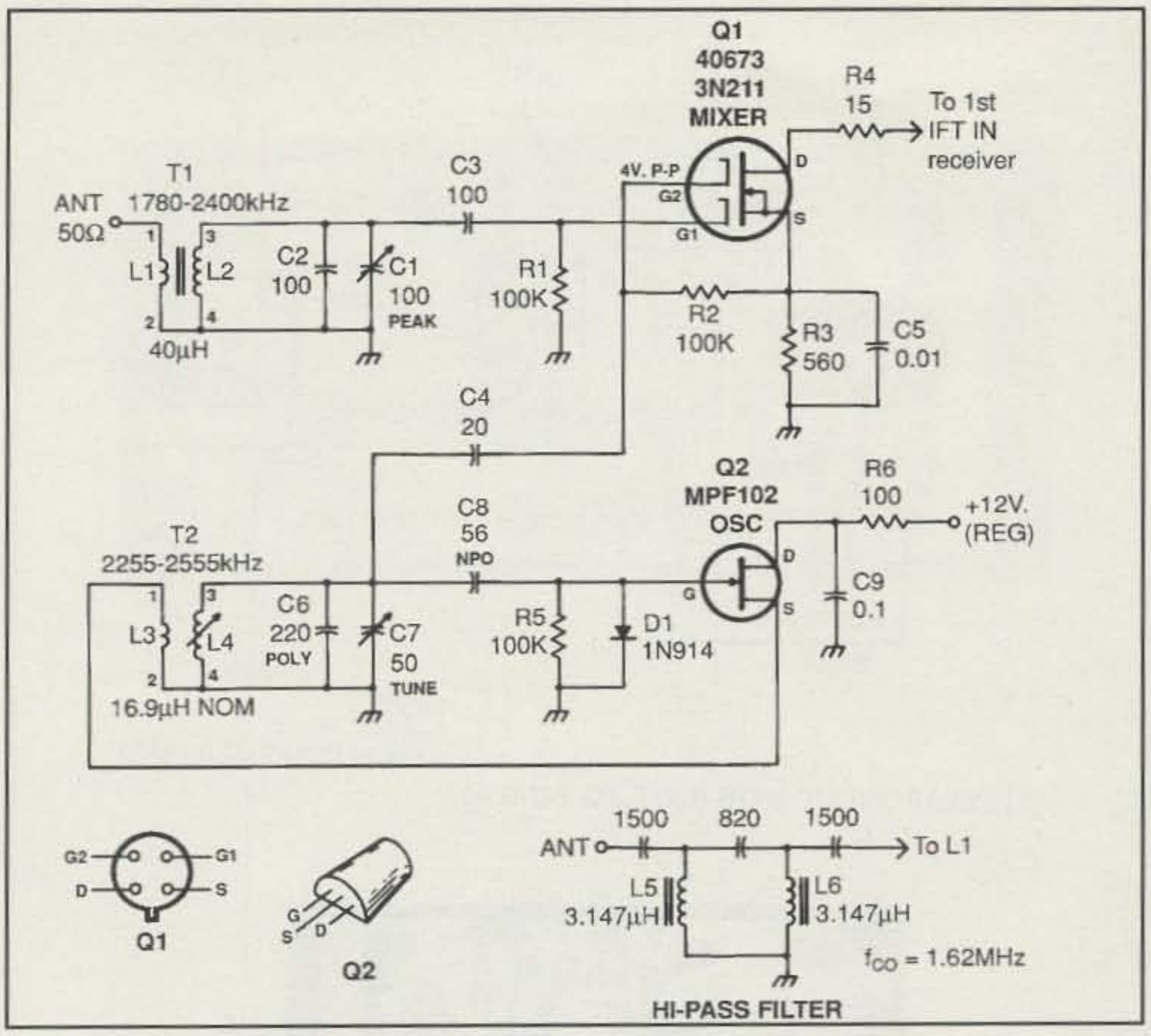


Fig. 2– Schematic diagram of a mixer and oscillator for 160 meter reception. It is used to replace the mixer/oscillator in a BC-band receiver. An optional high-pass filter for removing BC-band signals is shown at the lower right. C1 and C7 are miniature air variable capacitors. L1 has 3 turns of No. 28 enameled wire over the L2 winding. L2 contains 24 turns of No. 28 enameled wire on an Amidon FT-50-61 ferrite toroid. L3 has 12 turns of No. 30 enameled or Litz wire wound over the L4 winding. L4 has 48 scramble-wound turns of No. 30 enameled or Litz wire on the bobbin of an Amidon L43-6 transformer assembly. L5 and L6 have 28 turns of No. 30 enameled wire on Amidon T37-2 toroid cores. Use polystyrene or silver-mica capacitors in the high-pass filter.

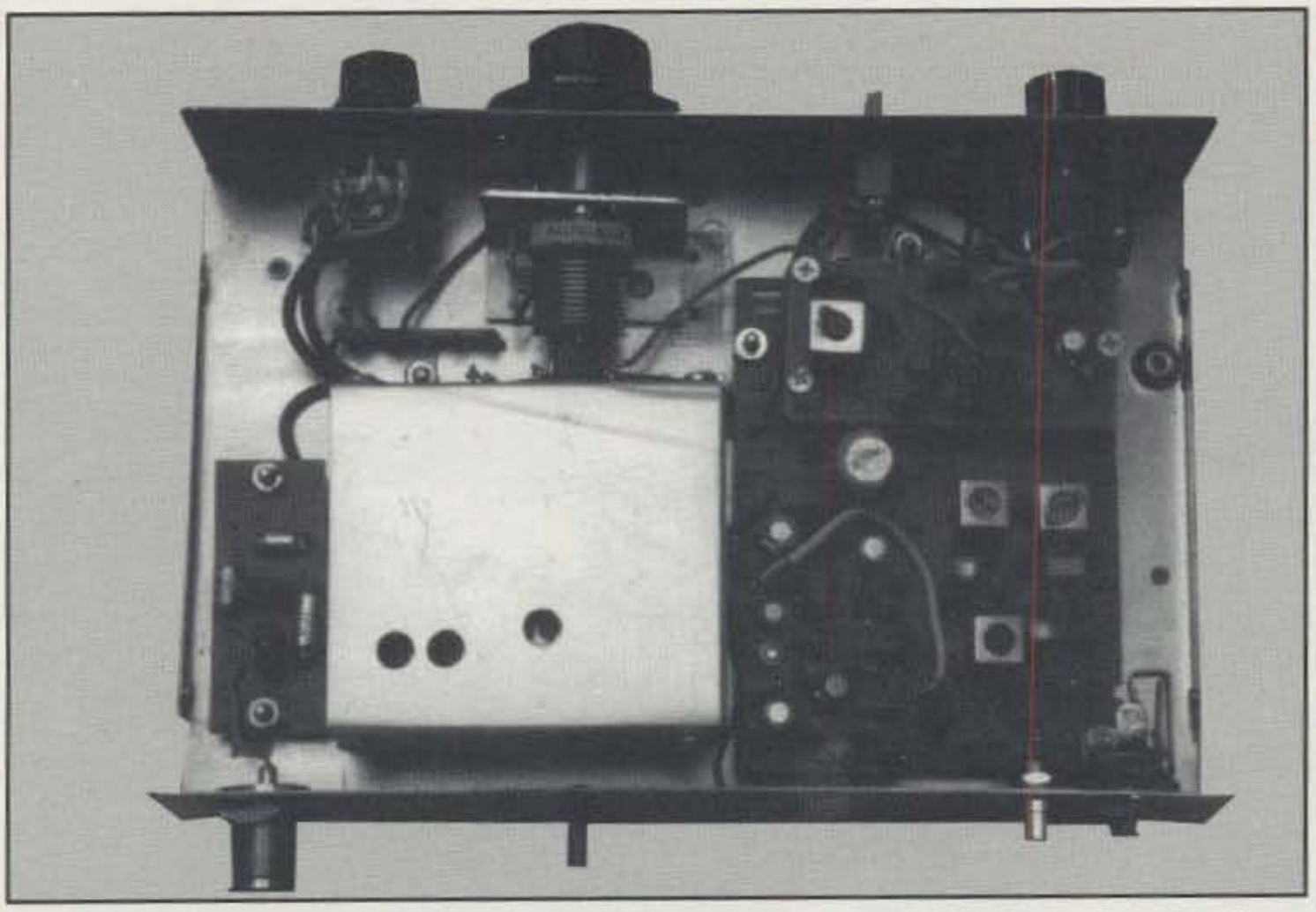
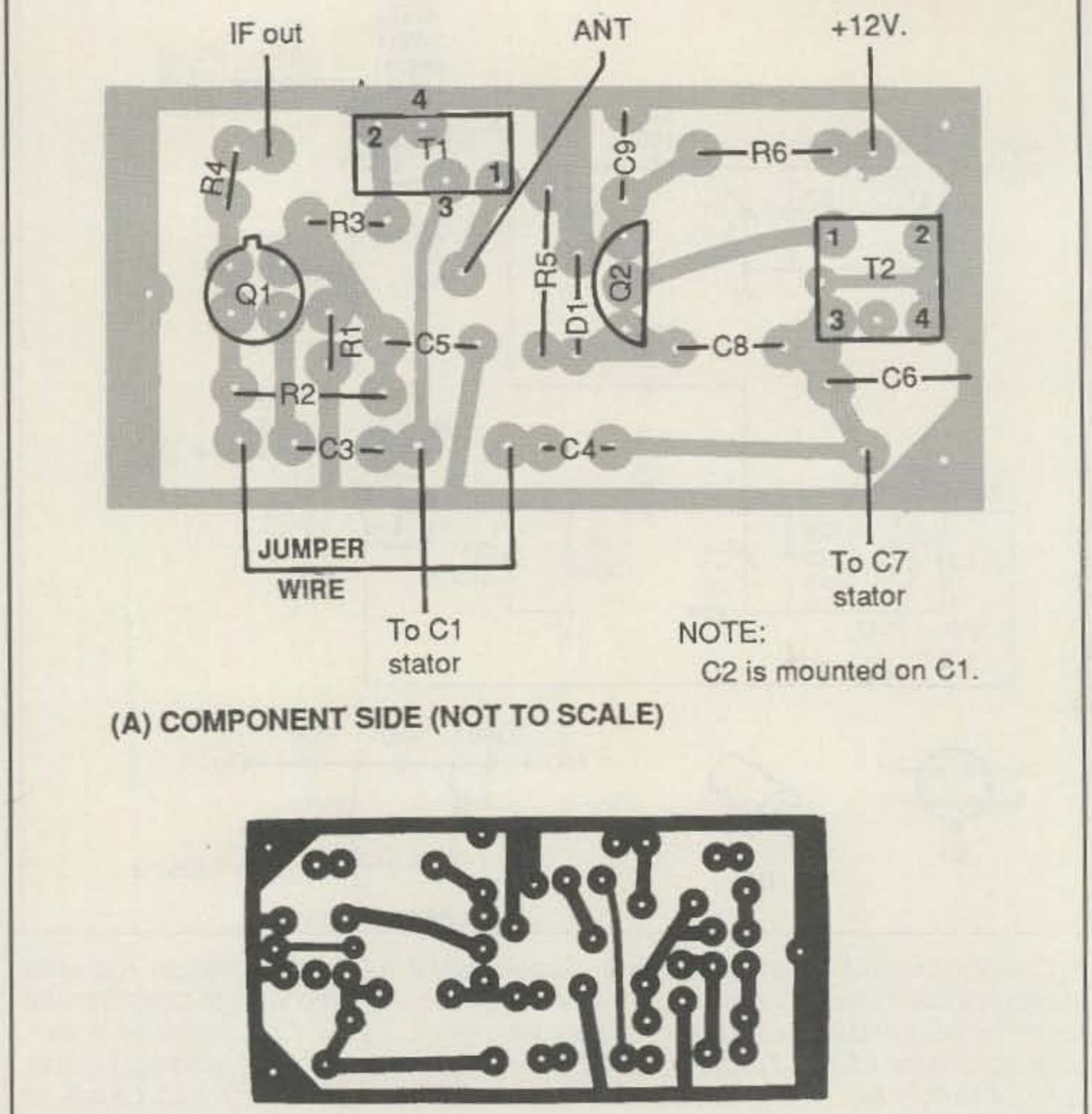


Photo A– Interior view of the modified receiver and its modules. The mixer/oscillator board is atop the main receiver module at the upper right. The BFO is at the lower left in its shield box. The three holes in the cover are for adjusting the BFO for USB and LSB operation. The high-pass filter is at the left of the BFO assembly. The product detector is hidden under the main PC board.



(A) COMPONENT SIDE (NOT TO SCALE)

(B) FOIL SIDE (TO SCALE)

Fig. 3– Parts placement guide (A) as viewed from the component side of the board, and (B) a scale etching pattern as viewed from the etched side of the board.

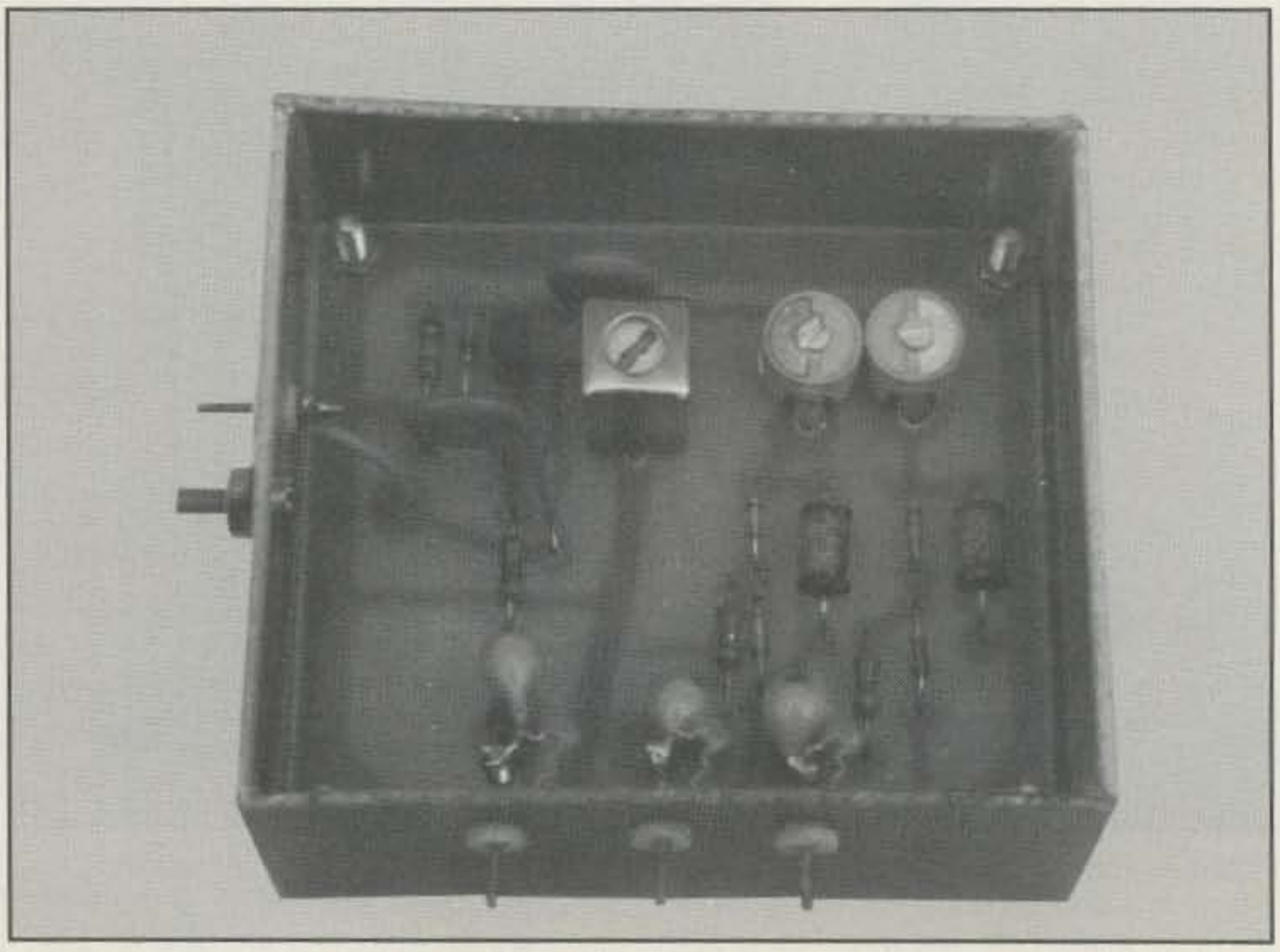


Photo B– Interior view of the 455 kHz BFO. It is housed in a homemade box that was formed with PC-board stock. A press-fit, U-shaped aluminum cover encloses the box.

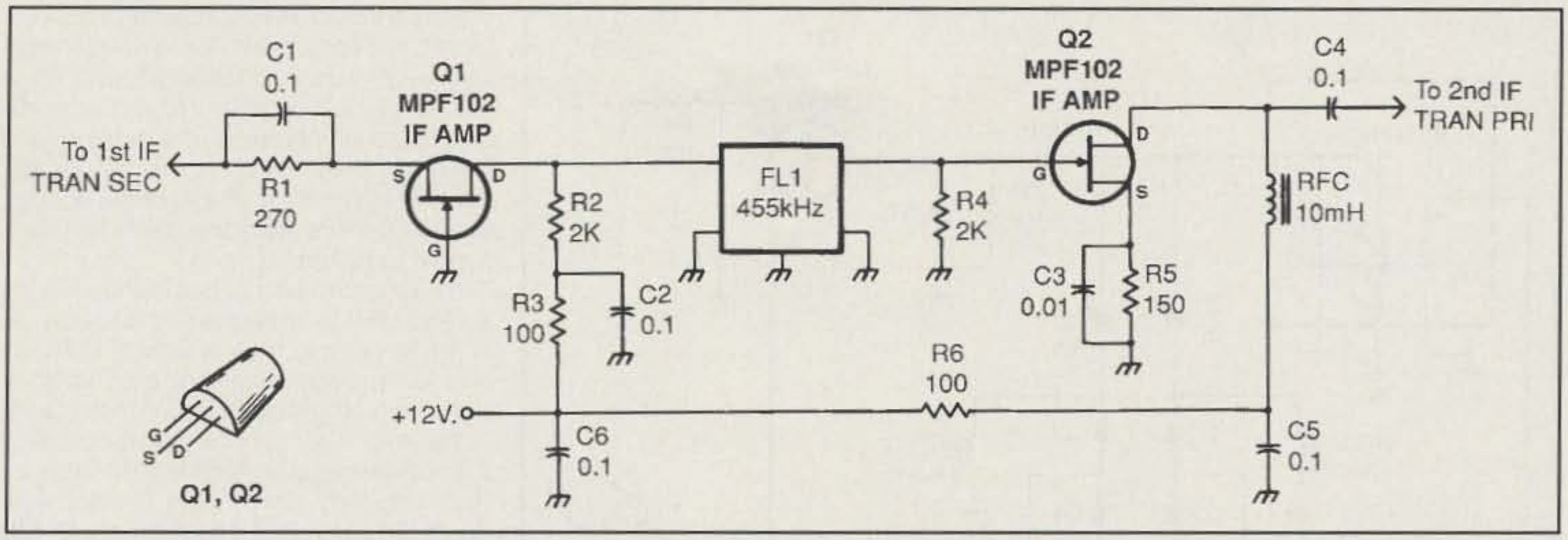


Fig. 4– Schematic diagram of a suggested IF amplifier/filter for addition to the fig. 1 circuit (see text).

or removed. Not only is the oscillator too unstable for amateur use, the harmonics of the oscillator enter the mixer portion of the circuit without attenuation. Attempts to modify and use the existing mixer/oscillator resulted in all manner of birdies and spurious signals appearing in the amateur bands.

Fig. 2 contains the circuit I use to provide reception on 160 meters. A dual-gate MOSFET is the mixer and an MPF102 functions as a tunable oscillator. A PC-board pattern and parts layout are presented in fig. 3. This module is mounted atop the main receiver board, as shown in photo A. The LO injection to Q1 is determined by the value of C4. It should be chosen to provide 4 V P-P at gate No. 2 of Q1. If you do not have a scope for measuring the injection level, use the C4 value shown on the diagram. The output of Q1 connects to the first IF transformer, as did the collector of the original mixer/oscillator transistor. A low-Z antenna input is provided via L1 of T1.

Obtaining Selectivity

You can include a Rockwell-Collins 455 kHz mechanical IF filter if you are able to justify the cost. For CW work you can use a 400 Hz filter. A 2.4 kHz mechanical filter is suitable for SSB and CW reception.

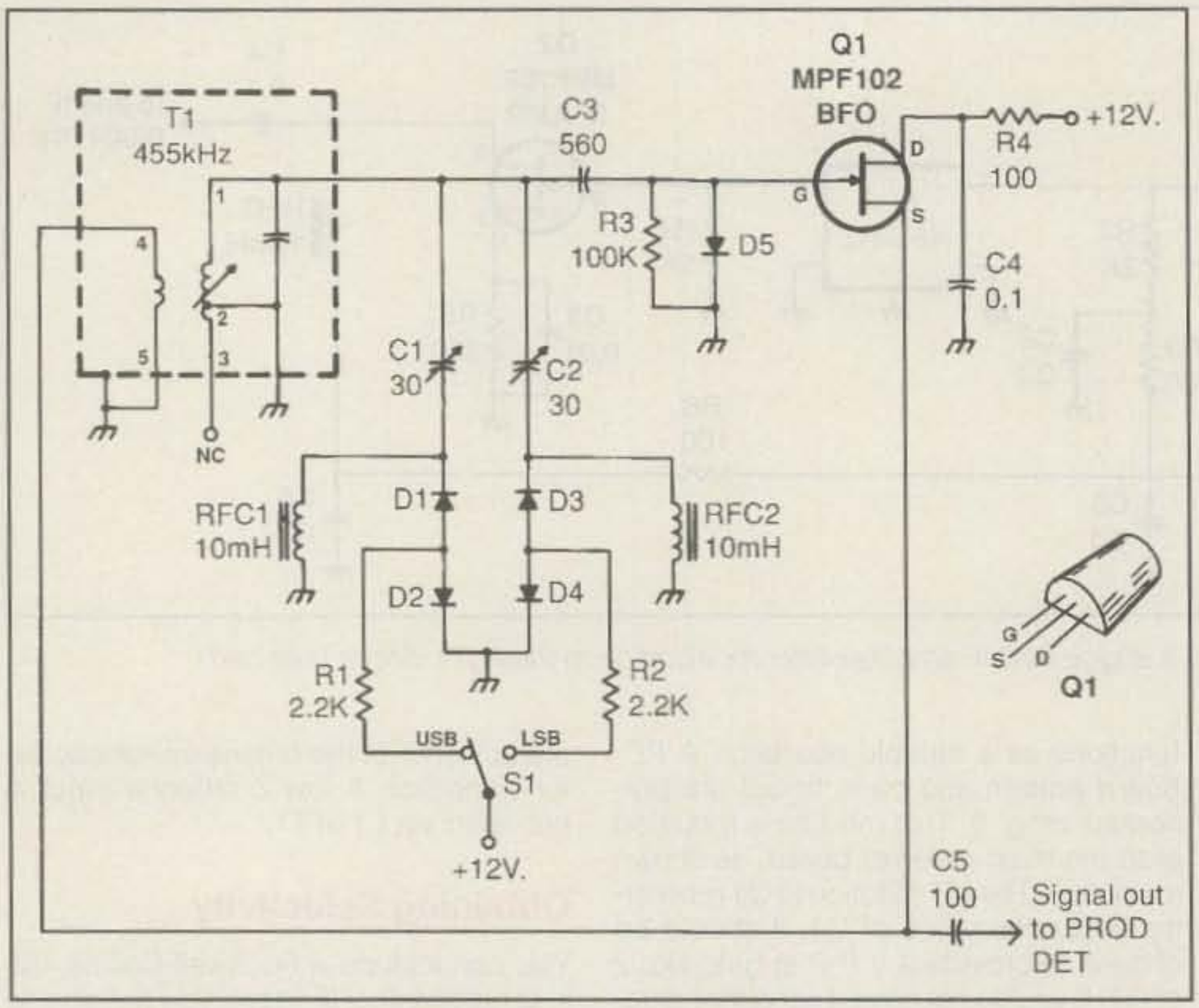


Fig. 5– Schematic diagram of the BFO. C1 and C2 are 30 pF ceramic or plastic trimmers. S1 selects the desired sideband. T1 is a 455 kHz miniature IF transformer (white core) from a discarded transistor radio. All diodes are 1N914 or equivalent.

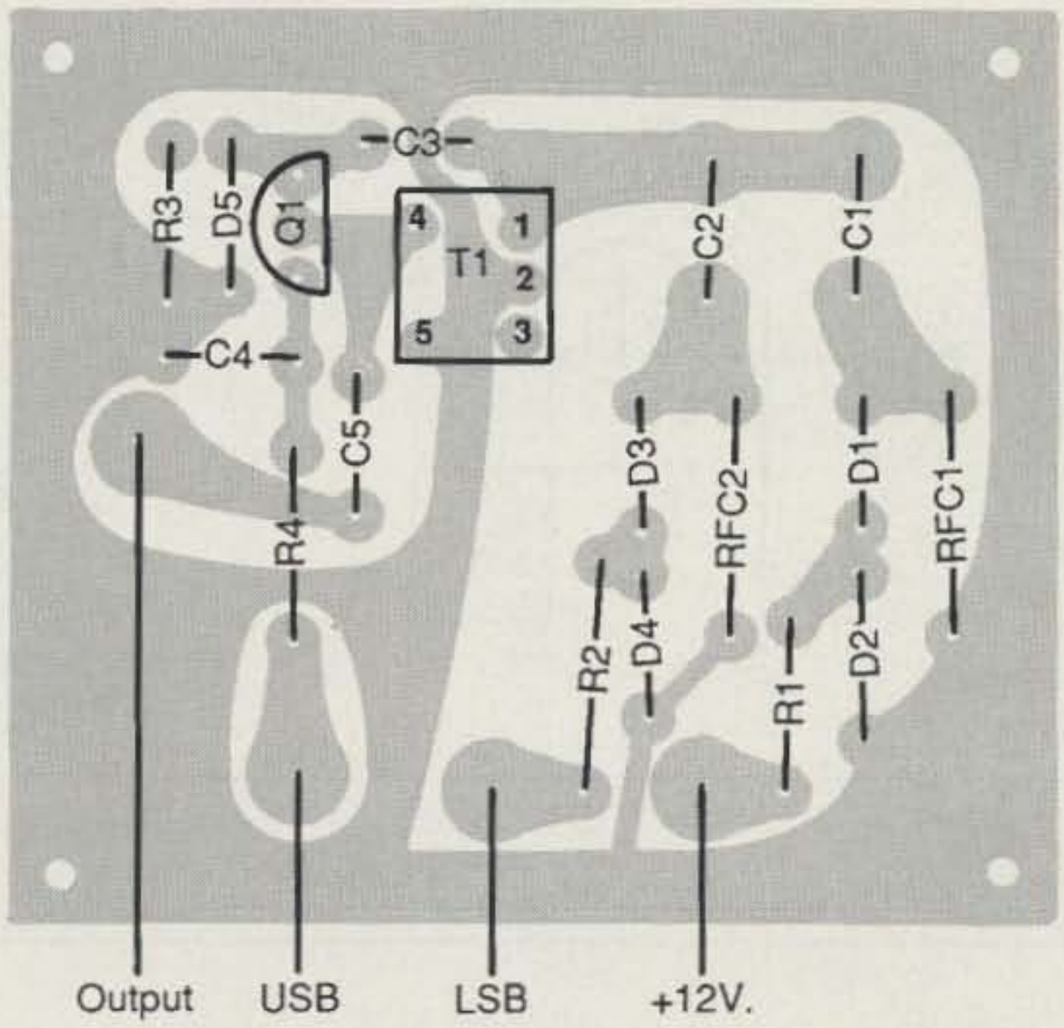
Collins filters often can be purchased at amateur fleamarkets for a reasonable price. Perhaps the least expensive route to take is the use of an RC active audio bandpass filter between the detector and the audio preamp stage (fig. 1). Ideally, the filtering is done ahead of the IF strip, but audio filters are acceptable for use in simple receivers.

A suggested filter circuit is shown in fig. 4. Two JFETs are used to provide an impedance match for a Collins filter. Q1 and Q2 provide sufficient gain to compensate for the 8 dB insertion loss of FL1.

You may want to consider using one of the narrow ceramic 455 kHz AM filters for FL1. Digi-Key Corp. (701 Brooks Ave. South, P.O. Box 677, Thief River Falls, MN 56701-0677; phone 1-800-344-4539 for orders; catalog available) sells one that is 4 kHz wide at the –6 dB response points. The part number for the TOKO filter is TK2330-ND. The price is $2.65. It can be used in the fig. 4 circuit. R2 and R4 need to be changed to match the filter impedance.

A BFO is Needed

Fig. 5 shows the circuit I use for my 455 kHz BFO. A miniature 455 kHz IF transformer from a discarded transistor radio



(A) X-RAY VIEW OF COMPONENT SIDE (NOT TO SCALE)

(B) ETCHED SIDE (TO SCALE)

Fig. 6– Parts placement guide (A) for the BFO PC board as viewed from the component side of the board. A scale etching pattern is seen at (B), as viewed from the etched side of the board.

is used at T1. C1 and C2 are adjusted, respectively, for USB and LSB reception. Coarse frequency adjustment is done with the transformer core. Sideband selection is accomplished by means of D1 through D4, and S1. Fig. 6 contains PC board artwork for the BFO. Photo B shows the assembled BFO in its PC-board box.

Changing The Detector

Although the diode AM detector will work for CW and SSB reception if BFO injection reaches the input side of D1 in fig. 1, a product detector will provide better results. Also, the active detector will produce roughly 10 dB of conversion gain. A practical circuit is given in fig. 7. C3, C6, and RFC1 serve as an RF filter to prevent BFO energy from reaching the audio preamplifier. This circuit connects to the primary of the last IF transformer (high-Z point) rather than to the secondary winding. Retain the diode detector, because it develops AGC voltage for the receiver. Disconnect the audio amplifier from the AM detector diode. Attach C7 of fig. 7 to the audio point from which the AM detec-

tor diode was disconnected. PC-board information for the product detector is supplied in fig. 8.

Bits and Pieces

The photograph of the assembled unit shows how simple the 160 meter receiver really is. The circuit is housed in a CATV converter box that I gutted after buying the item at a hamfest for $1. A false panel, made from PC-board stock, covers the original front panel, which had three switches installed in 3/8 inch holes.

This little 160 meter receiver can be modified easily for 75 or 80 meters by changing the tuned-circuit values for the mixer and oscillator. The mixer tuned circuit must have high Q in order to minimize image responses when using a low IF, such as 455 kHz. It would be practical to use converters ahead of the 160 meter receiver to provide coverage of the bands from 80 through 10 meters.

The interior-view photo shows a small PC board at the lower left. It contains a high-pass filter for rejecting BC-band energy. The filter circuit is included in fig. 2. A high-pass filter of this type is often necessary when the operator lives in an area where powerful commercial AM transmitters are present.

73, Doug, W1FB

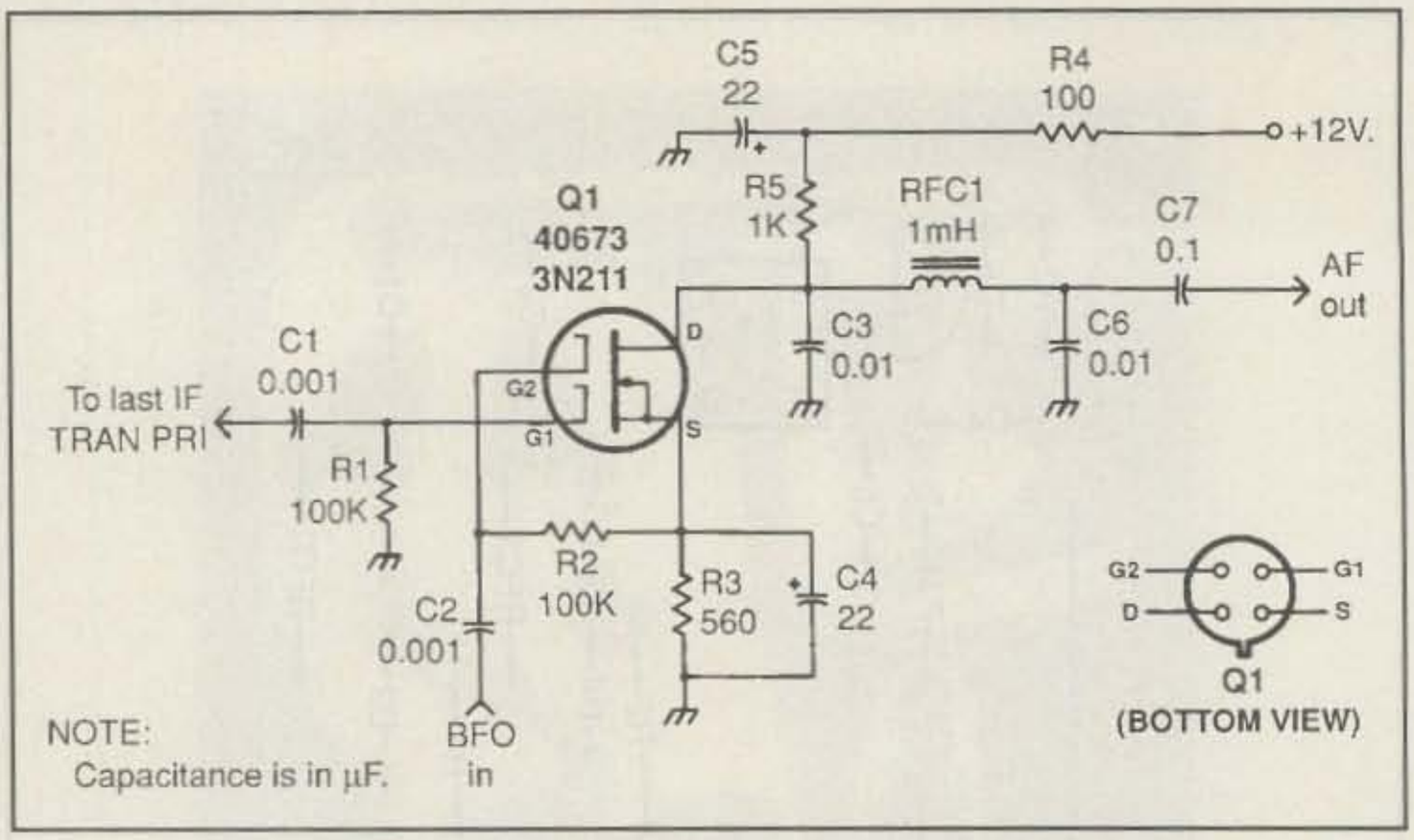
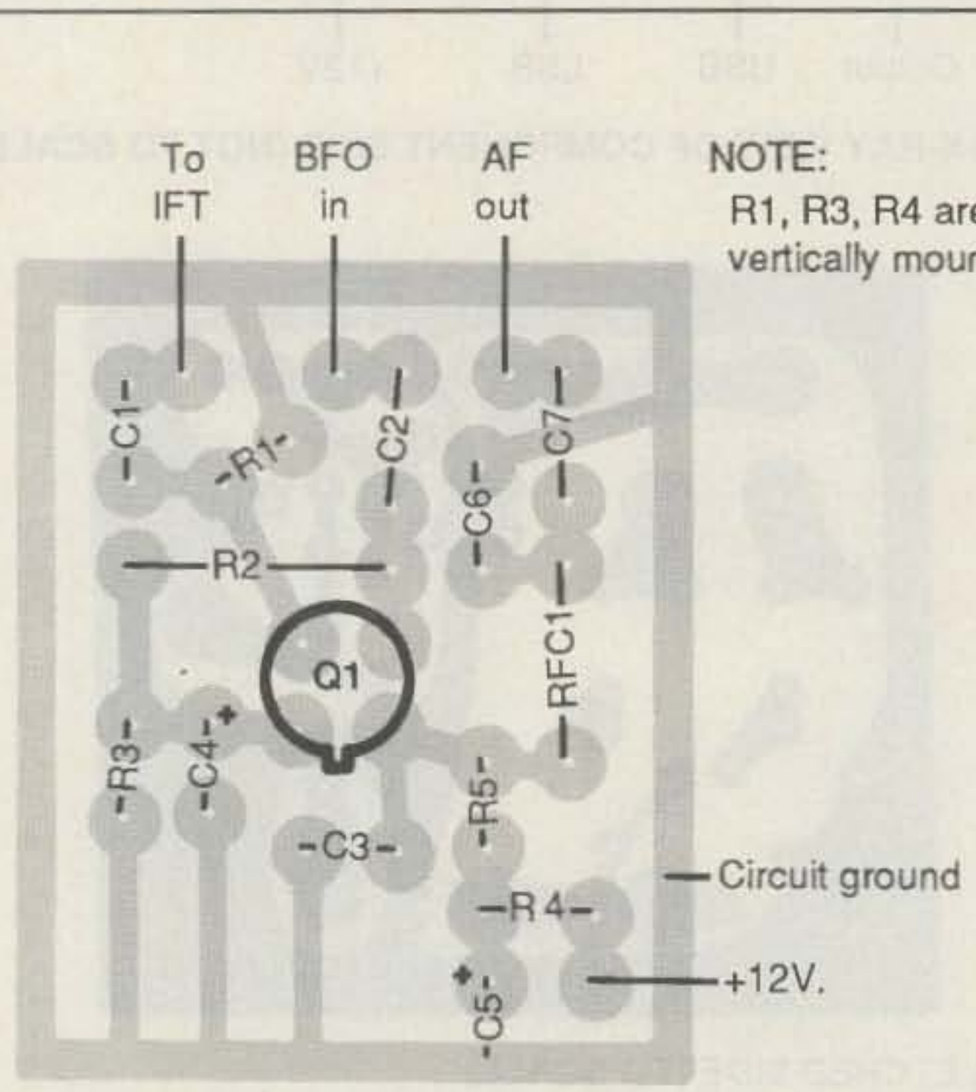
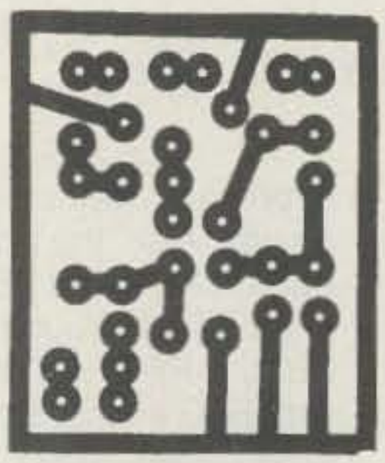


Fig. 7– Schematic diagram of the MOSFET product detector that replaces the diode detector in fig. 1 (see text).



(A) COMPONENT SIDE (NOT TO SCALE)



(B) ETCHED SIDE (TO SCALE)

Fig. 8– Parts placement guide (A) for the product detector PC board, as seen from the component side. A scale etching template is shown at (B). It is viewed from the etched side of the board.

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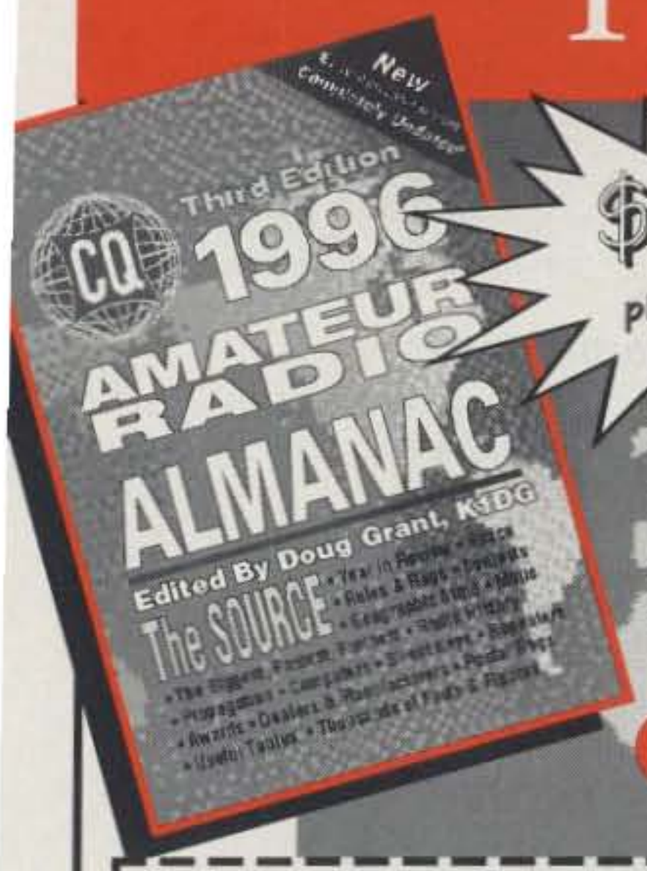
Q: Who was the fastest CW operator in history and what was his speed record?

Q: Where can I find hundreds of ham radio computer bulletin board system locations?

Q: Who has the world's biggest QSL card collection?

The Answer is...



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BY NORM VAN RAAY, WA3RTY

AWARDS

NEWS OF CERTIFICATE AND AWARD COLLECTING

This month we start off the column with the story of yet another CQ USA-CA Award holder:

Nell Devitt, NB6A
USA-CA #888, 10-27-95

By coincidence, USA-CA #888 turns out to be a YL. Nell Devitt, by the luck of the draw, submitted her material just in time to receive #888, a number I'm sure will be coveted by all YL county hunters. Nell sent the following comments in appreciation of all those amateurs who assisted her along the road.

"Early county hunters Earl, W7KOI, and Jack, WØSJE, helped me so much in county hunting. Earl worked me, WB6ERF, in all 50 states, finishing with Alaska on January 17, 1978. My first contact was with 4MPP in Caldwell, Kentucky on December 10, 1969. My last was 4ANV in Brunswick, North Carolina.

"Accumulating counties was second in importance to giving them out; that's what I enjoyed. Traveling from California to North Dakota/Minnesota every year was a challenge, each time trying to go a different route to give out a maximum number of new counties. I really didn't intend to collect counties for myself, until one of my friends urged me to be serious. AB5SL also suggested I hurry up and get a number, as he so inelegantly put it, 'So you will be good for something!' It suddenly became exciting to me to have a number.

"Lots of special friends helped, and each of you knows I appreciate what you have done. Involved in the final excitement and special trips were Ralph, WB4FFV; Cooter, N4EED; John, N8BGF; and Ralph, WA4HXG. Gene, N4ANV, and the two Pats drove to Brunswick, North Carolina to give me (NB6A) my last county on October 21, 1995. It was indeed a wonderful moment. I knew then how Gene, N4ANV, felt when I gave him Monterey, California on January 31, 1980 for his last county.

"I enjoy giving out counties and will continue to do so. The second day after I received USA-CA #888, I began to work counties for the second time. I hope it won't take as long to do it this time. Thanks again, my dear friends."—88s from 888.

CQ congratulates Nell, NB6A, and sends along a return 88 to #888.

USA-CA Awards Issued

USA-CA 500 awards were issued to Jim Dooley, N8LXQ, #2894; Masaaki Tanahashi, JA1PUK, #2895; Jury Nonipko, UT4UZ, #2896; Charles Brown, N5CB, #2897; and Noel A. Beardsley, WD8DON, #2898.

USA-CA 1000: Jim Dooley, N8LXQ, #1401, and Noel A. Beardsley, WD8DON, #1402.

USA-CA 1500: Jim Dooley, N8LXQ, #1169, and Noel A. Beardsley, WD8DON, #1170.

USA-CA 2000: Jim Dooley, N8LXQ, #1073; Noel A. Beardsley, WD8DON, #1074; and Morrie C. Pickler, #1075.

Box 76, Pleasant Mount, PA 18453

HONOR ROLL

500		2000	
N8LXQ	2894	N8LXQ	1073
JA1PUK	2895	WD8DON	1074
UT4UZ	2896	KD5UNX	1075
N5CB	2897		
WD8DON	2898	**2500**	
		NØVWD	1001
1000		N8LXQ	1002
N8LXQ	1401	WD8DON	1003
WD8DON	1402	KB5UNX	1004
1500		**3000**	
N8LXQ	1169	NØVWD	910
WD8DON	1170	N8LXQ	911
		WD8DON	912

The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $4.00. For nonsubscribers it is $10.00. Initial application must be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 76 North Broadway, Hicksville, NY 11801 USA for $2.00. To qualify for the special subscriber rate, please send a recent *CQ* mailing label with your application. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 15, 1991. A complete copy of the rules may be obtained by sending an SASE to Norm Van Raay, WA3RTY, USA-CA Award Manager, Box 76, Pleasant Mount, PA 18453-0076 USA. DX stations must include extra postage for airmail reply.

USA-CA 2500: Dave Simmons, NØVWD, #1001; Jim Dooley, N8LXQ, #1002; Noel A. Beardsley, WD8DON, #1003; and Morrie C. Pickler #1004.

USA-CA 3000: Dave Simmons, NØVWD, #910; Jim Dooley, N8LXQ, #911; and Noel A. Beardsley, WD8DON, #912.

USA-CA All Counties: Dave Simmons, NØVWD, #892; Jim Dooley, N8LXQ, #893; and Noel A. Beardsley, WD8DON, #894.

Awards Available

The Republic of Austria (OE) will celebrate its millennium in 1996. Upon request of the OVSV, the Austrian communications authorities in conjunction with the ITU have authorized all Austrian amateur radio operators to utilize the special prefix "OEM" (M stands for the Latin word "mille," meaning 1000) from 1 January 1996 to 31 December 1996.

WOEM—Worked OEM. This award is sponsored by OVSV on the occasion of Austria's millennium and may be achieved by any amateur radio station and SWLs under the following conditions.

Austrian amateur radio stations may use the special prefix OEM between 0000 UTC 1 January 1996 and 2400 UTC 31 December 1996 for the purpose of celebrating "1000 years of Austria." (For example, OE1XHQ may be on the air as OEM1XHQ.) The OVSV is offering two special awards for this event under the following rules.

European countries: 20 different OEM callsigns, of which at least three must be from callsign areas OEM1 and OEM3.

Countries outside Europe: 10 different OEM calls, including at least two OEM1 and two OEM3.

All bands and modes are valid for this award.

NOEM—Worked 1000 OEM Points. One-thousand points are required according to the following count:

OEM 4, 7, and 9 stations—20 points each.

OEM 1, 2, 3, 5, 6 stations—10 points each.

OEM X stations—30 points each (club stations; first letter of the suffix is X).

A minimum of five different callsign areas must be worked. All bands and all modes are valid for this award. Send your applications (GRC list) with 10 IRCs, DEM 15, or USD $10 to OVSV Diplommanager, Theresiengasse 11, A-1180 Vienna, Austria, Europe.

Your participation in these two short-time awards is very welcome, and you are free to apply for mixed- or single-mode operation.

SPECIAL HONOR ROLL

Dave Simmons, NØVWD
USA-CA All Counties #892
December 11, 1995

Jim Dooley, N8LXQ
USA-CA All Counties #893
January 28, 1996

"My Radio Ham"

The wife of Charles Brown, N5CB, has written a poem which expresses, I'm sure, the feelings of many of our XYLs, or should we call them "Amateur Radio Widows." I thought county hunters might want to share it with their spouses. It was written with love, I'm sure.

The WOEM award issued by the OVSV in conjunction with the ITU in celebration of the Republic of Austria's millennium.

My Radio Ham

By Doris (Betty) Brown

I'm married to a man who's a radio ham,
He messes up my TV and doesn't give a damn.
I get on the phone and nothing's clear.
He yells, "Betty it ain't coming from here,"
Something's happening in the atmosphere,
Hang up the phone for a while my dear."
He says, "I'm trying to work this station and
there's a mighty jam."
But you know how it is with a Radio Ham.
He used to have job with Uncle Sam,
But he gave it all up to be a Radio Ham.
He's got a big mouth, boy can he shout,
I'm always glad to hear when it's "over and out."
I get real mad and he knows I am,
Doesn't bother him, he's a Radio Ham.
He sits there listening with those things on
his head,
If I didn't know him I'd think he was dead.
His code rings out loud and clear,
A sound that's music to another Ham's ear.
He talks to Moscow and Amsterdam,
Lets everyone know he's a Radio Ham.
One day I'm gonna give him a big black eye,
Cause he ain't done a thing about this TV!.
I'm stuck with him and he's stuck with me,
Guess I'll never stop hearing "N5CB."

On A Personal Note

First, let me express my appreciation for all the prayers and well wishes of my amateur radio friends. They do help. Second, I apologize to all of you who have been waiting for your awards or responses to letters. For the past two months I have hardly been out of the hospital long enough to open my mail, let alone prepare the awards or answer the mail. I certainly hope that this siege is over and I can get on with things.

I need to pay tribute to our local ambulance volunteers here in Pleasant Mount, Pennsylvania. Their responses to my calls for help have been marvelous. Once we call 911 (our emergency number), a paramedic is on scene within ten minutes, with the ambulance just a few minutes later, with a full crew. A Mobile Intensive Care Unit (MICU) is usually dispatched at the time of the initial call and meets us on the way to the hospital. The MICU paramedic, in radio contact with the emergency room physician, starts appropriate treatment.

What makes this so notable is that we live in a very rural area and these folks are *volunteers*. Their only pay is the satisfaction they get from helping their neighbors. They are truly angels.

We purchased a cellular phone for safety purposes. If we are on the road and require assistance, it is very useful. (Amateur radio operators are not always around and we don't have two meters.) Well, anyway, during the recent storms and flooding in northeastern Pennsylvania we lost the end of our driveway. Water eroded a two foot wide and eighteen inch deep trench between the end of the driveway and the road. Carol was returning from Philadelphia, so I told her to call me on the car phone and I would meet her at the end of the driveway. Well, folks, she called from a pay phone up in town and said that she tried the car phone and it didn't work. When I examined the phone connections I found that she hadn't attached the antenna when she moved it from one car to the next. Or was I the one who moved the phone? I'll never tell.

Thanks again to all for your prayers, cards, and well wishes. So long until next month.

73, Norm, WA3RTY

DX

BY CHOD HARRIS, VP2ML

NEWS OF COMMUNICATION AROUND THE WORLD

DXing At Sunspot Minimums

Sunspot Cycle 22 will end at 0100Z on Saturday, April 20, 1996—or thereabouts. The Space Environment Center (formerly the Space Environment Services Center, the group that provides the WWV "numbers") has issued its latest prediction of the progress of Sunspot Cycles 22 and 23 based on data from December 1995. They say the current sunspot cycle will bottom out sometime around May of this year; hence my fearless prediction above.

We won't know the month that the cycle hits minimum for at least six months after the fact, because the sunspot minimum is based on the 13-month "smoothed" sunspot number. This smoothed number averages the six months ahead and behind the given month. For example, the smoothed sunspot count for June 1995 is the average of sunspot counts for December 1994 through December 1995. This averaging is necessary because the monthly sunspot count can vary dramatically from month to month, even at the bottom of the sunspot cycle. For example, the raw sunspot count for October 1995 was 21.7, up from 12.3 the previous month. The next month it fell to 9.4. With these gyrations, it is hard to determine the true sunspot minimum, forcing propagation experts to resort to the 13-month smoothed count.

Sunspot Cycle 22 began in September 1986 at a smoothed sunspot count of 12.3. If Cycle 22 does indeed end in the next month or so, it will be less than 10 years in length, a little below the average length. (Many solar experts now believe that the "real" sunspot cycle is about 22 years in length, with two minimums and maximums per "cycle," but we continue to count each maximum as a separate cycle.)

While DXers certainly are pleased to hear that Cycle 22 is reaching a minimum earlier than expected, it is too early to celebrate the return of great band conditions. The number of sunspots is not expected to increase significantly until early 1997. The smoothed solar flux is predicted to remain below 80 right through the end of 1997. For DXers looking for worldwide 10 meter openings, you will have to wait until 1999-2003. Based on the behavior of the past three sunspot cycles, all of which have been higher than earlier cycles, Cycle 23 is predicted to peak in late 1999 or early 2000.

Does this prediction mean that DXers should give up looking for additional countries to work until 1999? The simple answer is no. There is lots of DX to work, even at the very bottom of the sunspot cycle. To demonstrate this clearly, we need to look no further than the 50th anniversary of the post-war DXCC program.

Although the DXCC program began in 1937 and celebrated its 50th anniversary in 1987 with the Golden Jubilee award, all pre-WWII DXCC credits were wiped out, and the current DXCC program began on November 15, 1945, with the return of the amateur bands at the end of the war. November 15, 1995 marked the 50th anniversary of the current DXCC program.

P.O. Box 50, Fulton, CA 95439

KA9WON, T92X, and VE2MCQ. KA9WON is QSL manager for T92X.

To mark the occasion, DX Publications offered an attractive certificate for working 100 or more current DXCC countries on or after November 15, 1995. In other words, start fresh on the 50th anniversary and see how long it takes to work DXCC all over again. The response to this program was very enthusiastic, and clearly showed that DXing at sunspot minimums is not only possible, but can be very worthwhile.

The first DXer to qualify for the award was Jose de Sa, CT1EEB. In 34 hours of operating over three days, Jose was able to work 110 different DXCC countries. While his Portugal location meant that he could work a lot of Europeans on the lower bands with ease, Jose made many long-haul contacts into the Pacific and many contacts with quite rare countries. Jose's log includes contacts with Australia and New Zealand, about as far from Europe as you can get. Among the contacts that would be enviable at any point in the sunspot cycle were contacts with stations in Qatar A9, Burkino Faso XT, Mayotte FH, Kerguelen FT, Guinea-Bissau J5, Cape Verde D4, Mauritania 5T, and Chad TT.

Dr. Don Lynch, W4ZYT, president of the Virginia DX Century Club, earned the second 50th Anniversary award, working 100 countries on CW in only five days. Among the long-haul and rarer DX were Reunion Island FR, Taiwan BV, India VU, Ghana 9G, Chagos VQ, Norfolk Island VK9, and Eastern Kiribati T32.

Don commented: "Please find attached the summary list for my QSOs for the certificate. What a blast! I really hadn't realized what a profusion of DX is around, even at this low point in the sunspot cycle. It's the most fun I've had chasing DX outside of a contest since I went after your 30 Meter Century award. Congratulations on a nice idea!" (Actually, former DX Advisory Committee chairman Bob Beatty, W4VQ, came up with the idea.)

Shinji Mogi, JH8WXF, also managed to snag 100 countries on CW in five days. Among his more interesting contacts were Mongolia, Easter Island, Ogasawara, Minima Torishima, Vietnam, Uganda, and Egypt.

In the first 50 applications for the award, contacts with 39 of the 100 Most Wanted were noted, including 18 of the Top 50 Most Wanted, and three different Top 10 Most Wanted countries: Macquarie Island, Mount Athos, and Burma! More than 200 different DXCC countries were worked between mid-November and the end of January 1996.

Included in the first 50 applications were several from "average" DXers—less experienced operators running barefoot into modest antennas. While a Big-Gun station certainly makes working DX at sunspot minimums easier, it is not necessary. The second-tier stations may take a few more calls to work the DX station, but they can, and will, get through sooner or later.

A close examination of these applications provides some interesting insights on working DX at sunspot minimums. The first is that chasing DX on CW is far easier than on SSB at this stage in the sunspot cycle. There were ten times as many all-CW applications as all-SSB ones. There are several reasons for this. First, there is the inherent ability for CW signals to get through in marginal propagation when SSB

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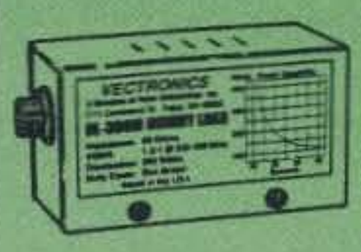
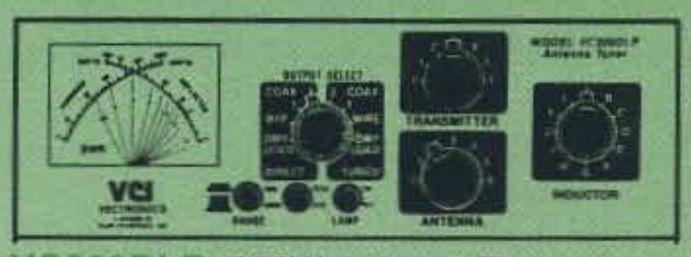
VC300M 300W Mobile Tuner

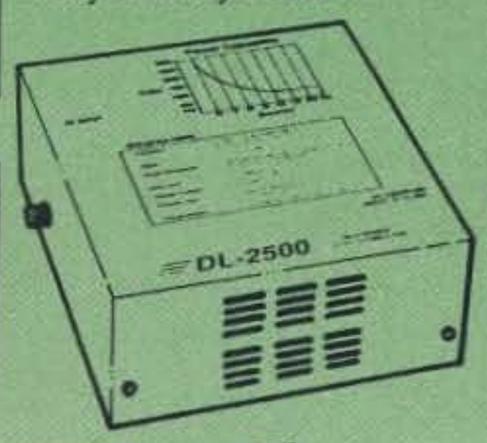


DL300M
300 Watt, 150 MHz, Dry Dummy Load

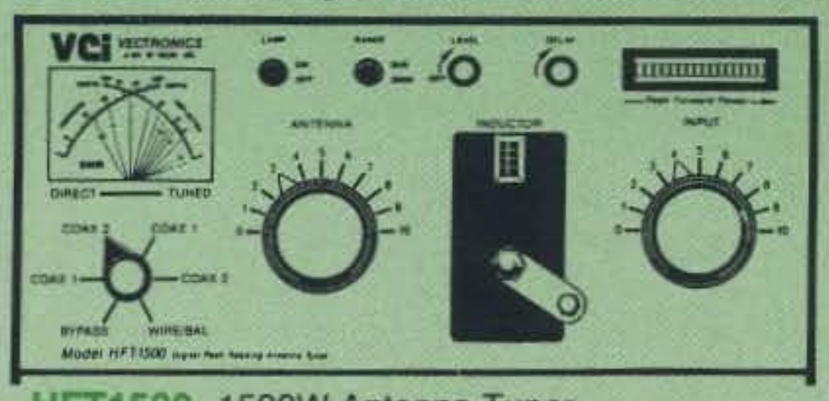


VC300DLP 300W Antenna Tuner

DL2500
2500 Watt, 150 MHz, Dry Dummy Load

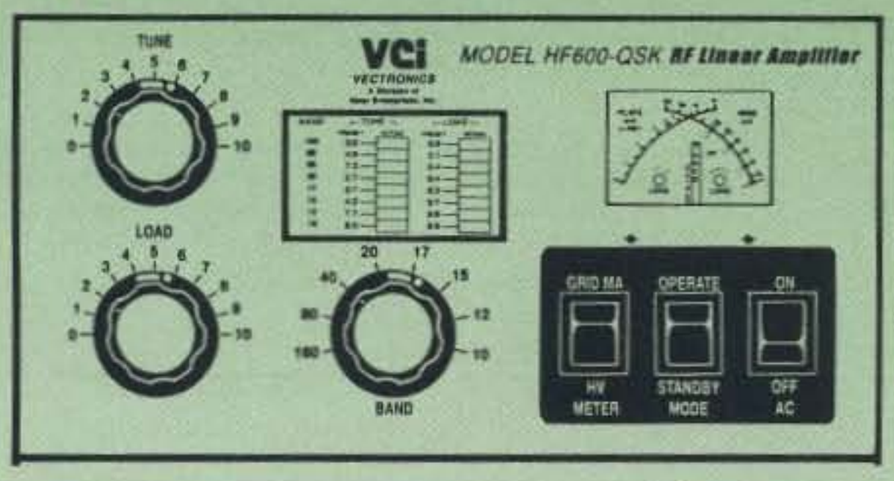


VC300D 300W Digital Antenna Tuner



HFT1500 1500W Antenna Tuner

DL650M
1500 Watt, 650 MHz, Dry Dummy Load



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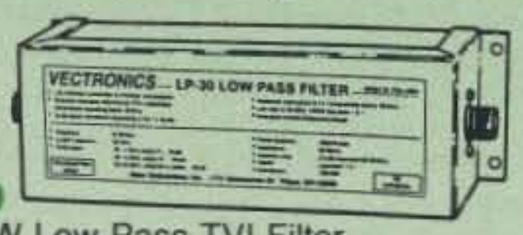

LP30
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(Also available: **LP2500**; 2500W Low Pass TVI Filter)

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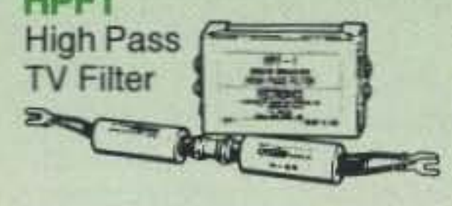

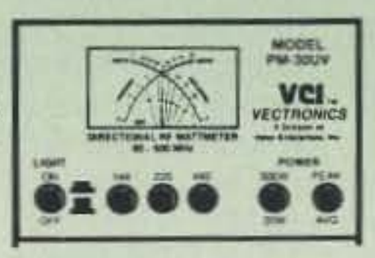

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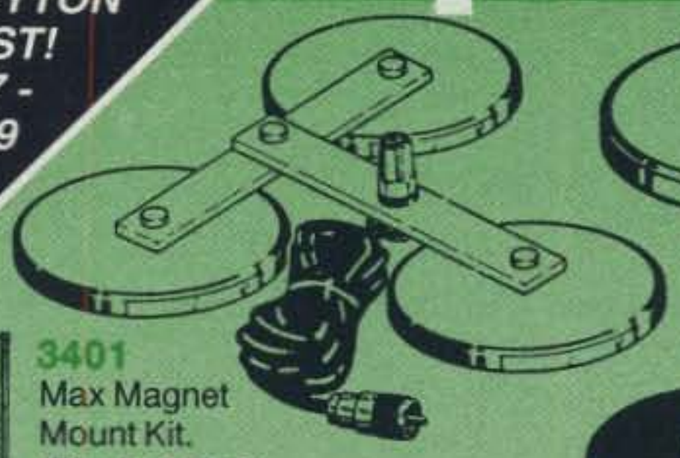

3401
Max Magnet Mount Kit. (Black: **3401B**)

401
5" Chrome Magnet Mount Kit. (Black: **401B**)

401BSO
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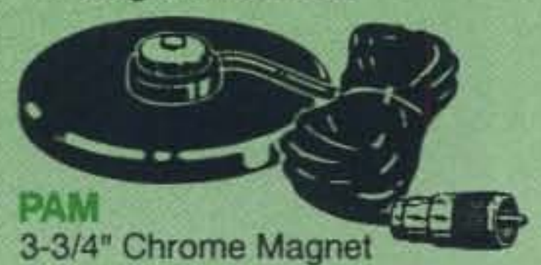

PAM
3-3/4" Chrome Magnet Mount Kit. (Black: **PAMB**)

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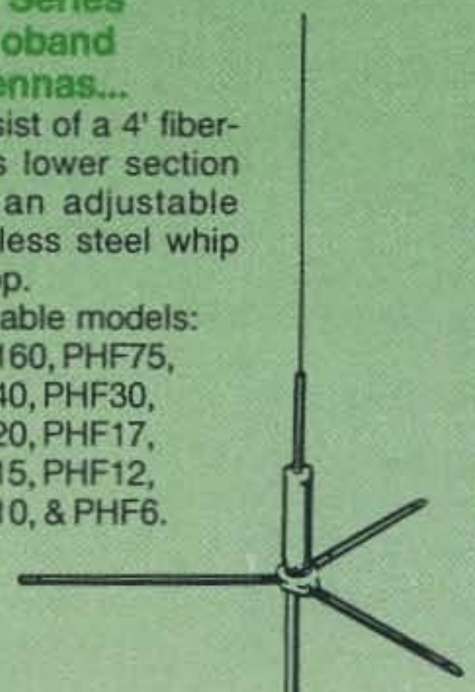

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1724	DU7AF	1726	KK6ZO

Mixed: 450 KDØEY, DU7AF, W7OM, KK6ZO 500 KDØEY, DU7AF, W7OM, KK6ZO 550 KDØEY, DU7AF, W7OM, KK6ZO 600 DU7AF, W7OM, KK6ZO 650 DU7AF, W7OM, KK6ZO 700 W7OM, KK6ZO 750 W7OM, KK6ZO 800 W7OM 850 W7OM 900 W7OM 950 W7OM 1000 W7OM 1050 W7OM 1100 W7OM 1150 W7OM 1200 W7OM, OZ1ACB 1250 W7OM, OZ1ACB 1300 W7OM, OZ1ACB 1350 W7OM, OZ1ACB 1400 W7OM, OZ1ACB 1450 W7OM 1500 W7OM 1550 W7OM 1600 W7OM, I2EAY 1650 W7OM, I2EAY 1700 W7OM, 1750 W7OM 2050 W9IL 2600 UA3FT 2700 UA3FT 2750 UA3FT 2800 UA3FT 2850 UA3FT 2900 UA3FT 2950 UA3FT 3000 UA3FT 3050 UA3FT 3100 UA3FT 3150 UA3FT 3200 UA3FT 3250 UA3FT 3300 UA3FT

SSB: 350 W7OM, IK4THK, W9IL, I2EAY 400 W7OM, IK4THK, W9IL, I2EAY 450 W7OM, W9IL, I2EAY 500 W7OM, W9IL, I2EAY 550 W7OM, W9IL, I2EAY 600 W7OM, W9IL, I2EAY 650 W7OM, IKØFVC, W9IL, I2EAY 700 W7OM, W9IL, I2EAY 750 W7OM, W9IL 800 W7OM, W9IL 850 W7OM, W9IL 900 W7OM, W9IL 950 W7OM, W9IL 1000 W7OM, W9IL 1050 W7OM, W9IL 1100 W7OM, W9IL 1150 W7OM, W9IL 1150 W7OM, W9IL 1200 W7OM 1250 W7OM 1300 W7OM 1350 W7OM 1400 W7OM 1550 IK2DUU 1600 IK2DUU 3900 ZL3NS

CW: 350 JA8AJE, F6BKP, W7OM, W9IL 400 JA8AJE, F6BKP, W7OM, W9IL 450 JA8AJE, W7OM, W9IL 500 JA8AJE, W7OM, W9IL 550 JA8AJE, W7OM, W9IL, F5TFS, 600 JA8AJE, W7OM, W9IL 650 JA8AJE, W7OM, W9IL 700 JA8AJE, W7OM, W9IL 750 JA8AJE, W7OM, W9IL 800 JA8AJE, JA9NPS, W7OM, W9IL 850 JA8AJE, W7OM, W9IL 900 JA8AJE, W7OM, W9IL 950 JA8AJE, W7OM 1000 JA8AJE, W7OM 1050 JA8AJE, PA3BEJ, W7OM 1100 JA8AJE, PA3BEJ, W7OM 1150 W7OM 1200 W7OM 1400 I2EAY 2000 KF7RU, PA0SNG 2200 W8IQ

10 Meters:	KM1I, KK6ZO, I2EAY, YU7FE
15 Meters:	DU7AF, KK6ZO, YU7FW
20 Meters:	KM1I, DU7AF, KK6ZO, YU7FW
40 Meters:	KM1I, W9IL, YU7FW
80 Meters:	KM1I, W9IL, I2EAY, YU7FW
160 Meters:	KM1I
Asia:	KF4BU, KK6ZO, YU7FW
Africa:	KF4BU, YU7FW
No. Amer.:	KM1I, DU7AF, KK6ZO, YU7FW
So. Amer.:	KF4BU, YU7FW
Europe:	DU7AF, KK6ZO, YU7FW
Oceania:	OZ1ACB, KK6ZO, YU7FW

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signals can't. Second, the competition is less on CW for what DX is available, especially on 20 meters. The few DX stations that show up on 20 meter SSB are quickly overwhelmed by strong stations running full power (and sometimes a bit more). Finally, when the maximum usable frequency is below 14 MHz, as it is much of the day at this point in the sunspot cycle, the only available amateur bands are primarily CW—30, 40, and 80 meters. While there is some SSB on 40 meters, for most of the world the band is limited to 7000–7100, the CW subband for stateside amateurs. And the tiny DX window on 75 meters is far more competitive than even 20 meter SSB. Thus, most of the DXing on these bands is on CW.

Another conclusion we can draw from examination of these applications is that an Amateur Extra license is more useful than an amplifier or large antenna farm. Especially on CW and the low bands, the DX is almost all worked deep into the Extra-class subband. On 20 meters some DX stations transmit near the subband edge, 25 kHz up, and listen in the General-class subband. However, these are the exceptions. For real DX success at sunspot minimums, an Extra-class license may well be the second most useful item, right behind the ability to listen patiently.

This suggests that the best way for a developing DXer to spend time at this point in the sunspot cycle is to brush up on CW ability and study for the Extra test! The second best thing to do is to erect effective low-band antennas, as most DX will be worked below 15 meters for at least the next year.

This is not to suggest that the higher bands be ignored. Looking over the applications, I see lots of 15 meter contacts, many long-haul, and also a significant number of 17 meter QSOs. There are even a handful of 10 meter contacts, mostly on north-south paths such as the US to South America. There is always *some* DX available on the higher bands, even at sunspots minimums, but these are not the prime DX bands at this time.

A final observation from the applications: DXing in and around major DX contests is a great way to improve one's country total. Several applicants managed to work 100 countries during the CQWW CW contest. Many others worked contest DXpeditions outside the actual contest. DXers looking to work DXCC a second time might try in and around the CQ WPX SSB Contest March 30–31.

The 50th Anniversary of DXCC is a limited award, and supplies may be gone by the time you read this. To find out, send an SASE to DX

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AA4KT, 199 (26)
K7UR, 199 (34)
NAØY, 199 (26)
WØPGI, 199 (26)
W2YY, 199 (26)
W9WAQ, 199 (26)
W1JR, 199 (23)
VE7AHA, 199 (34)
W1FZ, 199 (26)
IK2GNW, 199 (1)
W9CH, 199 (26)
ACØM, 199 (34)
IK8BQE, 199 (31)
JA2IVK,199(34,40m)
KA5W, 199 (26)
K1ST, 199 (26)
ABØP, 199 (23)
KL7Y, 199 (34)
RA3AUU, 199 (1)
UY5XE, 199 (27)
NN7X, 199 (34)
DL3ZA, 199 (31)
SM6AHS, 198 (12, 31)
UA3AGW, 198 (1, 12)
VO1FB, 198 (19, 27)
EA5BCK, 198 (27, 39)
KZ4V, 198 (22, 26)
K4PI, 198 (23, 26)
G3KDB, 198 (1, 12)
DK2GZ, 198 (1, 24)
KG9N, 198 (18, 22)
KM2P, 198 (22, 26)
I1ZXT, 198 (1, 1 on 40)
GM3YOR, 198 (12, 31)
OE6MKG, 198 (12, 31)
DKØEE, 198 (19,31)
KØSR, 198 (22, 23)
YO3APJ, 198 (29, 35)

The following have qualified for the basic 5 Band WAZ Award:

KI6X, 155 Zones

Endorsements:

DK7YY, 180 Zones

988 Stations have attained the 150 Zone level as of December 31, 1995.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Road, Sudbury, MA 01776. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the Award Manager. Applicants sending QSL cards to a CQ checkpoint or the Award Manager must include return postage. Questions regarding the WAZ Award may be sent to K1MEM with an SASE.

Publications at Box 50, Fulton, CA 95439-0050. Even if the certificate itself is not available, DXers may wish to prove to themselves that they can, indeed, work DXCC all over again, even at the dead bottom of the sunspot cycle.

DXCC News

The ARRL Board of Directors at their January meeting in Savannah, Georgia approved a Membership Services Committee recommendation to add Scarborough Reef to the ARRL DXCC Countries List. The vote was eleven yes, three no, and one abstention. Scarborough is added to the list based on DXCC Rules Section II, Point 2(a) (Separation by Water).

The DXCC Desk announced that the start date for Scarborough Reef is January 1, 1995. Only QSOs made on, or after, that date will be eligible for DXCC credit.

The first accredited operation took place in April 1995. The 1994 DXpedition did not qualify as a land-based operation.

QSL cards will be received by the DXCC Desk starting April 1, 1996. Cards received before that date will be returned without action.

Scarborough Reef is located in CQ Zone 27, ITU zone 50, and counts for Asia in the Worked All Continents award.

Operations Accepted for DXCC Credit:

DAIWA

Rugged Reliability for Today's Amateur!

Power Supplies

High quality, rugged, reliable, crossbar protection, offering easy access or y connectors, cig plug and meters on most models!!

	PS120M	PS140II	RS300	RS40X	PS50TM
Voltage (VDC)	3-15	13.8	1-15	1-15	13.8
Current (ICS)	12	14	30	40	5.2
Current (cont.)	9.2	12	24	32	4.2
Ripple(max.)	3mV	3mV	3mV	3mV	3mV
Regulation	1%	1%	1%	1%	2%
Cooling Fan	NO	NO	NO	YES	NO
Size(inch.)	5x4x9	5x4x9	7x6x9	11x5.5x9	6x3x9
Weight (lbs.)	11	11	18	22	6
Meter	YES	NO	YES	YES	YES

PS-220

• ***NEW from Daiwa!***
Has 16 continuous amps, 20 amps max and you get the same rugged quality you've come to expect from Daiwa.

Daiwa's Accessories offer exceptional quality and at very competitive prices!

DAIWA Headsets

EX-700

• Earphone Mic for Transceivers •

Daiwa's unique flexible ear clip is used to ensure comfortable and firm fitting, making it very practical and ideal for commercial use.

EX-800

• Cap Clip Mic for HandHelds •

User-adjustable clip, Hands free operation, Compact and Lightweight, High sensitivity Microphone for excellent Modulation.

PM-100

• Clip Mic •

Clip-On vest Microphone for Transceivers

Daiwa Switching Power Supply

Compact, Lightweight, Highly Efficient, 40amp supply Auto Switching - 100-117V or 220-240V Input 70 - 132V or 140-264V; crossbar protection.

SS-404

Capable of delivering 40A at all DC output voltages. Additional models are available, CALL today!

SWITCHES

• **Professional Cavity Type Coaxial Switches** •

	CS201	CS201GH	CS401/401G
Freq.	600Mhz/1Ghz	2Ghz	800MHz/1.3GHz
Isolation	60 dB 600MHz	50dB 1 GHz	60dB 300 MHz
Conn.	SO239	N	N

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• Famous Cross Needle Meters •

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BASE

CN101 1.8-150MHz • **CN103M** 140-525MHz w/ UHF Conn • **CN103N** 140-525MHz w/ N Conn.

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CNW 320 3.5-54MHz 150CW
CNW 420 1.8-30MHz, 11 bands 200W
CW 3.5-30MHz
CNW520 3.5-30MHz, 8 Bands, 1KW CW 50% duty
CNW 727N 140-150 (220W) & 430-450MHz (150W)
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CIRCLE 169 ON READER SERVICE CARD

Joe Poole, 9Q5MRC, operates from Goma, Zaire. QSL via his home call, G3MRC.

The WAZ Program

Single Band WAZ

15 Meter CW

264 ..... WZ3Q

20 Meter CW

465 ..... LU2YA

160 Meters

83 ..... K6EID—30 Zones

All CW

85 ..... DL2KUZ 86 ..... KF7JF

All Band WAZ

SSB

4314 ..... IK5PWF 4315 ..... PAØZGD

CW/Phone

7637 ..... DK4MX (CW) 7641 ..... DL5NO
7638 ..... 9A2DM 7642 ..... DL7UXO
7639 ..... S52KM 7643 ..... WD6CKT
7640 ..... IK3OII

RTTY

97 ..... WØRI

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Manager, Jim Dionne, K1MEM, 31 DeMarco Road, Sudbury, MA 01776. The processing fee for all *CQ* awards is $4.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $10.00 for nonsubscribers. Please make all checks payable to the Award Manager. Applicants sending QSL cards to a CQ checkpoint or the Award Manager must include return postage. Questions regarding the WAZ Award may be sent to K1MEM with an SASE.

3A/I1YRL; 3A/IK1OWC; 3A/I2MOV; 3A/I1ZB; 3A/I8FXT; 3W5FM; 4B9CQ; 6Y5/DL1DA; 7P8CW; 7Q7DC; 8Q7CW; 9J2CE; 9N1AN; 9N1SXW; 9R1A; CN2NI; D2RU; DU1/SM5ENX; HI/DL1DA; HSØZCJ; HS/DF8AN; HS/KM4P; J3J; J3X; J3Y; TT8BP; TY8G; VK9LX; VK9LZ; VK9NM; VK9XRS; VR2/DF8AN; VU2/DJ9RB; XT2DP; XZ1A; XY1HT; XZ1X; XZ1Z; ZA5B; ZA9B; ZA/PBØAIO; ZA/PAØHTR; ZK1DI; ZL7CW; ZL7PYD; and ZVØTI.

Upcoming DX Conventions

The first major DX gathering this year is the 1996 International DX Convention April 19–21 at the Holiday Inn in Visalia, California. Pre-registration is $50 (by March 30) to Don Bostrom, N6IC, 4447 Atoll Avenue, Sherman Oaks, CA 91423. Don't miss the Friday evening cocktail party sponsored by DX Publications.

The biggest gathering of the year is, of course, the Dayton Hamvention, pushed back to May 17–19 this year in hopes of warmer weather. Among the major DX events at the Hamvention are the DX Dinner Friday night, the DX Forum at the arena on Saturday, and the many DX hospitality suites at Stouffers, including the Top DX Suite in the Judith Resnick room on the top floor. Stop by and say hello!

The 1996 New Orleans International DX Convention is August 30–31 at the Royal Sonesta Hotel on Bourbon Street in the historic French Quarter of New Orleans. Additional information is available from Wondy, K5KR, at 504-837-1485. This is an excellent, high-class gathering in a wife-approved location. Plan to attend this year.

Upcoming DXpedition

The Central Arizona DX Association is planning a major DXpedition to the Union of Myanmar, a country most of us still call Burma. The group plans to have several stations on the air April 2–11, under the callsign **XZ1N**.

A major DXpedition to Burma is certainly important news. For many years Burma was one of the two Most Wanted countries, the other being Albania. More than 85% of active DXers in 1991 lacked a contact with Burma. The Tex-

Z32KV, UY5ZZ, and Z32TO operated the SAC contest as YUHN. Z32KV qualified for the 50th Anniversary DXCC Award, below.

The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ Master Prefix List. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or confirmation of, present total. If no up-date, file will be made inactive. Lifetime Honor Roll fee is $4.00 (U.S.) for each mode, with no fee for additions.

MIXED

4761 9A2AA	3237 SM3EVR	2834 HAØDU	2478 K8LJG	2140 W8UMR	1913 SM6CST	1532 AE5B	1305 CT1EEB	993 VE6BMX
4323 K2VV	3200 I2PJA	2825 YU7BCD	2471 S53EO	2129 N2AIF	1909 W3KH	1495 KØIFL	1286 HP2CWB	900 JR3TOE
4143 IT9TQH	3145 N4UU	2790 K9BG	2470 K2POF	2122 N6JM	1794 HA8QC	1491 KC6X	1275 YV7QP	840 EA2BNU
3742 EA2IA	3136 YU1AB	2761 IT9QDS	2467 WB2YQH	2111 W6OUL	1773 WB8ZRL	1476 JN3SAC	1270 CT3CU	811 VE6FR
3632 W2FXA	3135 I1EEW	2759 YT7DX	2452 SM6DHU	2059 WB4RUA	1729 VE9RJ	1414 OZ1ACB	1235 AA7FL	785 W2EZ
3507 K6JG	3063 KA5W	2717 SM7TV	2440 S50A	2056 9A4RU	1718 PY2DBU	1394 IK1GPG	1164 YU7EW	689 W4RTE
3482 VE3XN	3048 WA8YTM	2714 KF2O	2362 HA5NK	2049 S58MU	1663 LU8DY	1393 I1-21171	1149 IK2PZG	671 HI8LC
3464 N4NO	3013 UA3FT	2679 I2MQP	2347 S51NU	2039 KBØG	1655 WB3DNA	1392 EA3CWK	1131 G4SDJ	670 KB5OHT
3393 N6JV	2999 9A2NA	2676 N2AC	2227 K5UR	2013 KS4S	1655 IØAOF	1372 WA3HUP	1123 WT3W	
3326 W1BWS	2993 PAØSNG	2566 I2EOW	2227 IK2ILH	2004 W9IL	1606 HA9PP	1369 W9IAL	1038 N4PYD	
3286 N9AF	2974 W9DWQ	2535 HAØHW	2213 DK5AD	1975 G4IBJ	1566 F5NBX	1314 WØIZV	1020 WU1F	
3245 N4MM	2916 YU7SF	2534 4N7ZZ	2164 W4UW	1946 WB2ABD	1556 I2EAY	1310 NH6T	1003 WB2PCF	

SSB

4143 IT9TQH	2709 I1EEW	2223 I2EOW	1902 K5UR	1514 CT1BWW	1312 G4OBK	1070 KØIFL	890 SV3AQR	714 SM6CST
4139 IØZV	2691 N4NO	2212 PY4OY	1811 SM6DHU	1463 AE5B	1306 CT1EEB	1067 IKØJMS	867 I6KYL	706 IK4HPU
3658 K2VV	2660 I4CSP	2206 YU7BCD	1801 K2POF	1462 K2EEK	1305 IK1GPG	1054 EA8PP	853 EA3EQT	681 HI8LC
3622 VE1YX	2611 PAØSNG	2144 CT1AHU	1731 LU8DY	1455 KBØC	1260 K8MDU	1033 N4PYD	851 VE4ACY	658 VE9RJ
3612 ZL3NS	2572 KA5W	2111 4X6DK	1677 N6FX	1455 WN5MBS	1250 NG9L	1027 NH6T	845 LU3HBO	649 VE4ROY
3361 F6DZU	2500 I5ZJK	2108 EA5AT	1665 IK2DUU	1452 W6OUL	1223 T30JH	1000 IT9JPK	827 EA5DCL	614 EA1MK
3258 K6JG	2492 HA8XX	2045 N4UU	1661 K8LJG	1445 N2AC	1188 EA5GKE	996 S51NU	821 YV7QP	610 JA2OCU
3189 I2PJA	2429 I2MQP	2036 EA2AOM	1644 YU7SF	1431 K3IXD	1158 HP2CWB	990 IK2PZG	813 JR3TOE	606 KZ5ZD
2984 CT4NH	2378 WA8YTM	2027 K5RPC	1630 W5AWT	1405 DK5WQ	1147 W9IL	974 EA9BGY	798 HA9PP	601 EA6AU
2885 N4MM	2376 9A2NA	2004 KD9OT	1573 N2AIF	1401 IKØEIM	1145 KBØG	956 DF7HX	798 EA7CRL	
2859 EA8AKN	2319 KF2O	2003 CX6BZ	1565 W7HJM	1391 HA5NK	1141 WA2FKF	931 WU1F	771 AE4MJ	
2788 EA2IA	2309 LU8ESU	1999 KF7RU	1540 OE2EGL	1383 WB8ZRL	1124 EA1KK	923 KF7IO	753 EA1OT	
2780 OZ5EV	2288 WA4QMQ	1969 W4UW	1526 KS4S	1364 I3ZSX	1080 KC6X	918 ZS6Y	732 I2EAY	
2768 F2VX	2228 EA3AQC	1907 IN3QCI	1519 CT1DIZ	1343 IK2AEQ	1074 EA1IF	891 W6RQQ	729 N3DRO	

CW

4089 IT9TQH	2458 N2AC	2027 EA7AZA	1817 W5AWT	1652 VE9RJ	1338 IK2ECP	1053 W9IAL	848 NH6T	602 WT3T
3715 K2VV	2393 W9DWQ	2017 9A2NA	1791 N6FX	1579 W6OUL	1335 JN3SAC	1038 4X6DK	803 I2EOW	602 KB5OHT
3697 WA2HZR	2339 LZ1XL	1999 JA9CWJ	1787 K5UR	1538 I1EEW	1289 HI8LC	1032 W4UW	801 K2LUQ	602 K3WWP
3366 N6JV	2331 WA8YTM	1987 KA7T	1785 SM6CST	1505 G4OBK	1280 EA7AAW	1009 KC6X	798 EA2BNU	
2979 N4NO	2254 YU7BCD	1977 G3VQO	1758 S58MU	1476 DJ1YH	1259 KA1CLV	966 IK5TSS	739 KF7JF	
2956 YU7LS	2251 KA5W	1933 HA5NK	1734 OZ5UR	1467 IK3GER	1254 G4MVA	958 YV7QP	695 HA9PP	
2796 N4UU	2243 G4UOL	1912 K8LJG	1726 ZS6EZ	1445 LU2YA	1249 9A2HF	953 I2MQP	682 KØIFL	
2794 EA2IA	2227 N4MM	1870 TI4SU	1710 KBØG	1443 KS4S	1156 EA6AA	920 W9IL	680 9A3UF	
2747 K6JG	2133 S51NR	1869 KF2O	1692 VR2UW	1395 EA6BD	1122 WB8ZRL	860 YU1TR	651 IK1GPG	
2628 YU7SF	2094 W8IQ	1866 K2POF	1679 N2AIF	1376 I2EAY	1077 EA2CIN	855 PY4WS	647 ZS1AFZ	
2506 K9QVB	2067 S51NU	1842 SM6DHU	1670 I7PXV	1353 EA7TG	1073 AC5K	855 LU3DSI	613 VE4ACY	

as-size southeast Asia country has spent most of the last 50 years under military dictatorship, and has long held a firm line against foreign visitors and investments. The Burmese government went as far as to send a letter to the International Telecommunications Union (ITU) in 1964 saying that amateur radio was not allowed in Burma.

Despite this prohibition, the world-traveling Don Miller, W9WNV, claimed to operate from Burma as **XZ2TZ** in 1965. This operation was a couple of years prior to W9NWV's extensive disagreement with the ARRL over his operations, and the paperwork for this Burma operation did not receive the kind of close scrutiny that later Miller operations would receive. The XZ2TZ operation was the last Burma operation accepted for DXCC for more than 25 years, despite some accusations than Miller was not in Burma at the time.

Then in 1991 Romeo Stepanenko, UB5JRR, staged a high-profile major DXpedition, purportedly from Burma, as **XYØRR.** The operation received close scrutiny and was accepted for DXCC credit. Some Japanese operators claimed some of the accreditation documents were forgeries, but the DXCC credit remained.

In 1995 a crack in the Burmese wall around amateur radio appeared. Some enterprising DXers took advantage of Burma's dropping restrictions on visitors and foreign investment to demonstrate amateur radio. A couple of lim-

QSL INFORMATION

1A0KM to IK0FVC
3D2HI to JA1KJW
3D2RW to ZL1AMO
3D2RW/R to ZL1AMO
3DA0CA to W4DR
3F0T to HP2CWB
3Z1PEA to SP1PEA
4A1C to XE1BEF
4K8F to UA9AB
4L8A to OZ1HPS
4U50UN to W8CZN
5B4ADA/HH2 to 9A2AJ
5N0/OK1MU to OK1DCH
5N0BHF to OE6LAG
5N3/SP5XAR to SP5CPR
5N35/OK1MU to OK1DCH
5N35ALE to DJ2VZ
5N35T to F2YT
5T5SN to F5RUQ
5U7AA to HH2HM
5V7GL to EA5WX
5X4F to KB4EKY
7Q7A to JH1ORL
7Q7EH to W1EH
7Q7RM to G0IAS
7Q7SB to AB4IQ
7X2VZK to OM3CGN
8Q7CW to DK7PE
9A7C to KA9WON
9G1YR to G4XTA
9G5MF to KC7V
9G5SX to G3SXW
9H3RJ to HB9TU
9H3VG to G4PDQ
9J2CW to JF2XTZ
9J2SZ to SP6DIP
9K2MU to WA4JTK
9L1PG to NW8F
9M2TO to JA0DMV
9M6TF to F6BFH
9Q5MRC to G3MRC
9R1A to PA3DMH
9U/EA1FH to EA1FFC
9X/ON4WW to ON5NT
AP2N to AP2MMN
C53HG to W3HCW
C94AI to CT1CKP
CE0Z to K0IYF
CN2EME to F6BGC
CN2NI to F5NII
CN8TM to JR2ITB
CQ5L to CT1BWW
CT1ESV to WA4JTK
CZ0/N0AFW to WA0PUJ
D2EV to DL3KBQ
D68SE to F6FNU
E21EJC to HS1GOS
EA1AAD/P to EA5OL
ED1IRA to EA1BEZ
EG9A to EA4URE
EO50HZ to W3HNK
ES60Q to ES5QA
ET3KV to DL1VU
ET3MW to AD4ES
EW2CR to NF2K
F5CCO/P to F1JRT
FG5FZ to F6FNU
FG5HR to F6BUM
FK8FU to NA5U
FK8GJ to F6CXJ
FO0ZR to K1RH
FP/ND9O to K9GS
FP/W9OP to K9GS
FP5EJ to K2RW
FY5YE to W5SVZ
GB5FI to GW0ANA
HI3/NO2R to WA2VUY
HK100GM to HK3DDD
HL5KY to W3HNK
HL9DC to N7RO
HO2M to HP2CWB
HP1X8H to AD4WU
IY4OTA to IK4QJH
J3J to K9AJ
J55UAB to F6FNU
J67AK to NP2EG
JT1FAU to K6VNX
JW1CCA to LA1CCA
JW5NM to LA5NM
JX4CJA to LA4CJA
JY5SK to WB9YXY
JY60ZH to JY6ZZ
JY8XY to WB9YXY
KC4AAA to NC6J
KC6HN to JF1VXB
KG4CM to N5FTR
KG4ML to WB6VGI
KG4MN to WB2YQH
KG4NA to KD4D
KG4SH to N4KHQ
KG4TJ to W3JT
KG4ZE to K4SXT
KH0T to JA1SGU
LU6Z to LU6EF
LX9UN to LX1NJ
LZ0A to LZ1KDP
LZ4SA to LZ2HM
NP3/AA3BG to N2YXA
OD/N4ISV to N4JR
OH0LQK to OH3LQK
OY5IPA to OZ5AAH
P40E to CT1AHU
P40J to WX4G
P43JB to OH6ZS
P49I to K4PI
PJ4/WA3LRO to K2SB
PY0FZ to PY7ZZ
PZ5JB to N3BTE
R1FJZ to DF7RX
R1MVI to OH2BU
RA0FU to W3HNK
RZ0IWR to WA6AJB
S01MZ to EA2JG
S79JD to F6AJA
S92PI to F6KEQ
SO2WDX to SP2FAX
SP5GRM to SP5ES
T32BE to WC5P
T77BL to T70A
T77GM to I0MWI
T92A to S57MX
T99W to DL1QQ
TA3DD to TA1KA
TI4VSG to WA5TUD
TJ1GG to I2EOW
TJ1PD to N5DRV
TM5ITU to F6IMS
TO5M to K9GS
TY5RF to GM3YTS
TY5VT to K5VT
UA0AZ to W3HNK
UA9FAR to W7YS
UN7JX to N2AU
UR4WWT to WR3L
UR5FAV/MM to UX3FW
UU2JZ to LZ1ZJ
V26TS to KF3P
V31MX to K0BCN
V44KJ to WB2TSL
V51E to K8EFS
V73GT to WF5T
VA9DH to VE9DH
VE8TA to VE2BQB
VK9FN to DK9FN
VP2EFO to K8MFO
VP2EO to WC0W
VP8CQS to SP2GOW
VP8CRE to K4MZU
VP8CSA to DL1SDN
VQ9MG to K7MG
W5JLU to AC5K
WP2AHW to WD5N
X58YZ to YU7KMN
XL2MCZ to VE2QK
XT2DM to F5RLE
XT2DP to WB2YQH
XT2JF to N5DRV
YN2EJG to WD5IQA
YQ0TO to YO5KAU
YS1XS to WD4PDZ
YS1ZV to KB5IPQ
YS9I to KJ5IX
YT9N to YU7FIJ
Z24JS to W3HNK
Z32XA to KM6ON
Z32XX to KM6ON
ZA1AB to OH1MKT
ZA1AJ to OK2ZV
ZA1TAG to IK2HTW
ZA5B to WA1ECA
ZA9B to KE7LZ
ZB2X to OH2KI
ZD7JP to N5FTR
ZD7WRG to WA2JUN
ZD8Z to VE3HO
ZD9CR to KA1DE
ZF2SQ to WA8JTB
ZF8AA to W7VWR
ZK1ATV to LA1TV
ZK1DI to DK1RV
ZK1SSN to SM5BOQ
ZL7PYD to K8PYD
ZS50A to WA3HUP
ZY3T to PY3TD

CQ DX Awards Program

SSB

2177 ..... TI7DBS 2178 ..... N8LIQ

CW

931 ..... K8JJC

SSB Endorsements

320 ..... K7EHI/326
320 ..... WA3HUP/326
320 ..... VE7WJ/325
320 ..... AI8S/325
320 ..... KE5PO/324
310 ..... WA8YTM/318
310 ..... CT1EEB/318
310 ..... WA2FKF/311
310 ..... N6AW/310
275 ..... KN4RI/280
275 ..... N6CFQ/283
150 ..... TI7DBS/161

CW Endorsements

320 ..... N7MC/325
320 ..... WA8DXA/325
310 ..... WA8YTM/311
275 ..... K7EHI/293
275 ..... KE5PO/291
275 ..... N4OT/299
275 ..... K8JJC/290
275 ..... KB8O/276

RTTY Endorsements

250 ..... KE5PO/263

Total number of active countries is 326. The basic award fee for subscribers to *CQ* is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an SASE is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business-size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for airmail reply. Please make all checks payable to the awards manager.

ited operations provided a few lucky DXers with a coveted Burma contact. Following the first Beijing International DX Convention, not one, but *two* separate groups staged major DXpeditions from Burma as **XZ1A** and **XZ1HT**. DXCC administrator Bill Kennamer, K5FUV, was a member of the XZ1A team, and accredited both operations on the spot. Interestingly, the Burma authorities said that recent operations were the first amateur radio licenses issued since 1964!

The recent opening of Burma to several major operations should push Burma not only out of the Top Ten Most Wanted, but perhaps right off the Most Wanted list, as happened to that other once Most Wanted country, Albania.

QSL Notes

PS7KM has a new address: Karl M. Leite, Rua Estacio de Sa 1838, 59054-580 Natal RN, Brazil. Don't put callsigns on the envelope.

QSL to **3V8BB** operation of YT1AD via Hrane Milosevic, Kraljevo, 36206 Vitanovac, Yugoslavia.

9J2BO has a new address: Brian Otter, P.O. Box 34554, Lusaka, Zambia. Again, no calls on the envelope.

8R1K in 1995 CQ WW CW and SSB, 1994 SSB, and 1993 SSB contests should be confirmed via Marko Myllymaki, OH6DO, Kurppakuja 3, 63700 Ahtari, Finland.

73, Chod, VP2ML

Scanners/CB/Weather Stations

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CIRCLE 159 ON READER SERVICE CARD

BY FREDERICK O. MAIA, W5YI

WASHINGTON READOUT

REGULATORY NEWS IN THE WORLD OF AMATEUR RADIO

The Lowdown on Radio Operator Licensing

Amateur and commercial radio operators have two things in common. First, they use the electromagnetic spectrum to transport information, and second, that requires a Government license. An amateur license is required when the transmissions are for hobby purposes. A commercial radio license is essential when the radio equipment is used in connection with a business venture. The General Mobile Radio Service, one of the personal radio services, also requires an individual license.

The Roots of Radio Licensing

Radio communications got its start around the turn of the century when Guglielmo Marconi, an Italian inventor, flashed the first wireless signals across the English Channel. On December 12, 1901 he transmitted the Morse code letter "S" from southern England to St. John's, Newfoundland. The receiving antenna was a 400 ft. wire held aloft by a kite. This was the first successful transatlantic radio transmission.

Amateur radio began soon thereafter. Although he never had a license, Marconi considered himself an amateur, and he inspired hundreds of others to experiment with radio communications.

It soon became apparent that radiotelegraphy was very useful for distress communications at sea. An international conference was held in Berlin in 1903 to consider a common distress call for ships and to provide for wireless communication between vessels and ship to shore.

For the first decade of amateur radio's existence, it flourished without regulation. Twenty-eight bills dealing with radio were introduced into Congress. One bill even sought to have the government (meaning the U.S. Navy) have complete ownership and operation of all radio stations. All of these bills were defeated.

The Wireless Ship Act of 1910 required installation of wireless equipment and operators on large sea-going passenger vessels. Later Congress amended the Wireless Ship Act of 1910 to cover large cargo vessels.

Regulations for further wireless uniformity were adopted by the International Radio Telegraph Conference in London in 1912. To carry out its obligations under that treaty, the United States enacted the Radio Act of 1912. This was the first law for the domestic control of radio communications in general. Historic "Regulation Fifteenth" stated that private (meaning amateur radio operators) could not use wavelengths in excess of 200 meters except by special permission.

The law makers had come up with a regulation which would finally keep the amateur radio operator off the lower frequencies that were being occupied more and more by the commercial and government user. The regulation was signed into law on August 17, 1912 by President Taft, and this restriction continues in force even to this day.

The Radio Act regulated the character of emissions and transmission of distress calls, set aside certain frequencies for Government use, and placed licensing of wireless stations and operators under the Secretary of Commerce and Labor. Radio licensing began that year. It made access to the electromagnetic spectrum a privilege granted only by government approval.

Using the Radio Act as its authority, the radio amateur was "silenced" during World War I and came very close to being permanently silenced. A House bill proposed that all radio communications in the United States be turned over to the U.S. Navy.

One-way broadcasting caught on in the early 1920s with all stations transmitting on the same frequency! The Radio Act of 1927 created a new agency known as the Federal Radio Commission (FRC). The FRC had the authority to decide how much of the radio spectrum each service would get and to grant and renew license applications. The Communications Act of 1934 expanded regulation to wireline services such as the telephone. It also abolished the FRC and replaced it with the Federal Communications Commission (FCC).

The FCC is an independent agency consisting of five commissioners who are appointed by the President. These appointments must be approved by the Senate, and no more than three of the commissioners may be members of the same political party. Among its duties is the allocation of frequency band for the various services within international guidelines.

The FCC determines frequencies, power levels, and callsigns to be used by individual stations and licenses and regulates transmitting stations and radio operators. Licensing exists primarily to bring order to the spectrum and to reduce harmful interference between stations.

Station Callsigns

International agreement provides for national identification of a station by the first letter or the first two letters of its callsign. The alphabet was apportioned among the nations of the world in 1927. The United States uses the initial letters K, N, W, and AA through AL.

Callsigns serve three purposes: they identify the nationality of the station, they identify the type of station, and they identify the individual station. Radio callsigns, in effect, are the "license plates" that identify communications traffic on the radio highways. We covered the amateur station callsign system in February, so we will not go into it again here (see February 1996 *CQ*, p. 110).

Commercial broadcast station callsigns begin with K or W. Calls prefixed by K identify stations located west of the Mississippi River, while W is used east of the Mississippi—that is, except for some long-established stations whose call letters were allocated before the assignment rule was adopted. Station KDKA (Pittsburgh, Pennsylvania), the nation's oldest broadcast radio station, is one example. KDKA, by the way, got started in 1920 when a Pittsburgh amateur radio operator, Frank Conrad, 8XK, began broadcasting to the public from his garage ham shack.

Since the start of broadcasting, stations have had the privilege of requesting specific callsigns. There has been a preference for letter combinations embodying initials of names, places, or slogans. For example, the letters NBC are used for stations owned by the National Broadcasting Co., CBS for those of the Columbia Broadcasting System, and ABC for the American Broadcasting Companies. Some examples of individual station call letters: WGN, Chicago ("World's Greatest Newspaper"); WNYC, (New York City municipal station); WIOD, Miami ("Wonderful Isle of Dreams"); WACO (WACO, Texas); WTOP, Washington, DC ("Top of the Dial"); and KABL, Oakland, California selected its letters to represent San Francisco's famous cable cars.

The FCC is now in the process of permitting amateur stations to select their station callsign letters upon payment of a $30 fee. "Old timers" previously were recognized by one-letter K or W prefixes, or two-letter suffixes. Shortly they will have a lot of "short timer" company! The Vanity Call Sign System promises to be a very popular program indeed! (Again, we covered this in our February column.)

Eligibility For A Personal Radio License

Although there are laws which preclude the monitoring or disclosure of certain radio transmissions, the FCC does not license sets used for reception only. The U.S. government will not license aliens who are representatives of foreign governments.

Personal radio began when the FCC created the Citizens Radio Service in June 1949 to make available to " . . . average citizens [for] uses as broad as the imagination of the public and the ingenuity of equipment manufacturers can devise." In 1959 it was divided into three different classes of stations: Class A, C, and D Citizens Radio. The classes were simply renamed General Mobile (GMRS), Radio Control (R/C), and Citizens Band (CB) in 1976. The FCC eliminated the individual license requirement for citizens band (CB) operators in 1983. Instead, CBers operate under a blanket licensing arrangement.

Radio Control (R/C) is a service for sig-

National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101 (817-461-6443)

License Class	Examination Elements	Basic Frequency Privileges
Novice	Element 2, 1A	Morse code: Portion of 80, 40, 15, 10 meters; and Voice: Portion of 10 meters, 1.25 cm and 23 cm
Technician	Element 2, 3A	VHF and higher frequencies. No HF privileges.
Technician Plus	Element 1A, 2, 3A	Combined Novice and Technician privileges.
General	Element 1B, 2, 3A, 3B	Portions of all amateur bands and all modes.
Advanced	Element 1B, 2, 3A, 3B, 4A	Same as General with expanded voice privileges.
Amateur Extra	Element 1C, 2, 3A, 3B, 4A, 4B	Same as Advanced with expanded code privileges.

Exam Element	Questions/Pass Rate	Description of examination
1A, 1B, 1C[1]	—	Morse code proficiency examination at 5, 13, and 20 wpm
2	30 (22[2])	Beginning (Novice) amateur radio regulations, electronics and operations
3A	25 (19[2])	VHF-oriented amateur radio regulations, electronics, and operations
3B	25 (19[2])	HF-oriented amateur radio regulations, electronics, and operations
4A	50 (37[2])	Exam concerning additional privileges accorded an Advanced Class operator
4B	40 (30[2])	Exam concerning additional privileges accorded an Amateur Extra Class operator

[1]To pass a telegraphy examination, the applicant must either transcribe correctly for one minute or answer 7 of 10 questions which may be multiple choice.
[2]A score of 75% is required to pass a written examination. The number in parentheses is the number of questions that must be answered correctly. All questions are multiple-choice format and are chosen from an approved question set which contains a minimum of ten times the number of questions that will appear in any one examination.

Table I– Amateur radio operator licenses, examination requirements and privileges, ITU Region 2.

nalling or controlling remote devices such as model airplanes, door openers, alarms, or paging beepers. No license is required to operate an R/C transmitter on its authorized frequencies, as long as it is not used to send voice or code messages. Operating low-power radio-controlled model craft on the amateur bands requires an amateur license, however.

The General Mobile Radio Service (GMRS) offers high-quality (FM) land-mobile communications without many of the licensing and operating restrictions of the land-mobile services. The GMRS permits short-range two-way 462/467 MHz shared channel personal and business communications for the licensee and his/her family. The station may not be operated as a common carrier—i.e., the sale of a

License or Permit	Exam Elements	Basic Commercial Radio Operator Privileges
Radiotelephone		
Restricted Permit	No exam required	Permits radiotelephone operation, repair and maintenance at AM, FM, TV broadcast stations, and operation (but not repair/maintenance) of all aviation and certain marine (pleasure craft) stations.
MROP[1]	Written Element 1	Permits operation (but not internal adjustment, repair, or maintenance) of certain commercial marine radiotelephone station equipment.
GROL[2]	Written Elements 1, 3	Permits adjustment, repair, and maintenance of all FCC-licensed aviation, maritime, and international fixed service transmitters. Although not FCC required, the GROL is usually required by broadcast stations and telecommunications companies.
Radiotelegraph		
Third Class R/T	Telegraphy Element 1, 2 Written Elements 1, 5	Radiotelegraph operation at certain coast radiotelegraph stations. Also confers operating authority of the Restricted Permit and MROP.
Second Class R/T	Telegraphy Element 1, 2 Written Elements 1, 5, 6	Authorizes operation, repair and maintenance at ship and coast radiotelegraph stations in the maritime services. Also confers the authority of the Restricted Permit, MROP, GROL, and Third Class Radiotelegraph license.
First Class R/T	Telegraphy Element 3, 4 Written Elements 1, 3, 5, 6	Same authority as the Second Class Radiotelegraph license. Required for those who serve as the Chief radio officer on a U.S. passenger ship. Requires one year of radiotelegraph experience.
GMDSS (Global Maritime Distress and Safety System)		
Radio Operator	Written Element 1, 7	Operate satellite-based maritime emergency subsystems and equipment.
Radio Maintainer	Written Element 1, 3, 9	Adjust, maintain, and repair satellite-based maritime emergency subsystems and equipment.
Ship Radar		
Endorsement	Written Element 8	Internally adjust, maintain, or repair ship radar equipment.

Exam Element	Questions/Pass Rate	Description of examination
Written		
1	24 (18[3])	Basic maritime radio law and radiotelephone operating practices.
3	76 (57[3])	Electronic fundamentals and techniques.
5	50 (38[3])	Basic radiotelegraph operating procedures and practices.
6	100 (75[3])	Advanced radiotelegraph operating procedures and practices.
7	76 (57[3])	GMDSS radio operating practices and regulations.
8	50 (38[3])	Ship radar endorsement. Covers maritime radar equipment installation, internal adjustment, servicing, and maintenance practices. May be placed on GROL, 1st/2nd R/T or GMDSS Radio Maintainer license.
9	50 (38[3])	GMDSS radio maintenance practices and procedures.
Telegraphy		
1	16 wpm[4]	Code groups, one minute solid copy
2	20 wpm[4]	Plain Language, one minute solid copy
3	20 wpm	Code groups, one minute solid copy
4	25 wpm	Plain language, one minute solid copy
Six Months Service		Endorsement on First or Second Class Radiotelegraph license. No examination, but requires six months of service aboard a U.S. ship.

[1]MROP, Marine Radio Operator Permit.
[2]GROL, General Radiotelephone Operator License.
[3]A score of 75% is required to pass a written examination. The number in brackets is the number of questions that must be answered correctly. All questions are multiple choice format and chosen from an approved question set which contains a minimum of five times the number of questions that will appear in any one examination.
[4]Amateur Extra Class operators receive examination credit for the 16 wpm CG and 20 wpm PL telegraphy examinations.

Table II– Commercial radio operator licenses, examination requirements and privileges.

communications service is prohibited. Any person who is at least 18 years old may apply for a GMRS license to operate base, mobile, or repeater stations. It remains the only personal radio service that requires an application filing fee. You apply for a GMRS station license on FCC Form 574.

Eligibility For An Amateur Radio License

Amateur radio began with a few experimenters in the early 1900s. It has since grown to over 700,000 FCC-licensed operators. Ham radio, as it is known, is regulated by Title 47 (Telecommunication) of the Code of Federal Regulations (47 CFR) Part 97.

Anyone who qualifies by examination is eligible to be a licensed amateur radio operator. Exams include tests of the applicant's understanding of the regulatory, technical, and practical aspects of the Amateur Radio Service, as well as tests of the applicant's skills in Morse code telegraphy. The popular Technician Class is the only level that does not require code proficiency. Although in existence only five years, this class now accounts for the most licensed amateur operators.

As a general rule, the higher the class, the harder the exams and the greater the privileges of the license. This is known as the incentive method of amateur radio licensing.

There are no age restrictions. Under reciprocal agreements with a number of nations, alien radio amateurs are authorized to operate their stations while visiting the United States. There are six progressive levels of achievement (see Table I).

Amateur radio is an international communications service. It is primarily meant for individuals who are seriously interested in the technical side of radio itself. It is called "amateur"

because it is noncommercial. No business can be transacted on the amateur radio bands except that which relates to the personal affairs of the operator.

Amateurs can communicate with some two million other amateurs around the world using telegraphy, voice, teleprinting, television, data, and facsimile. The Amateur Service is a voluntary, disciplined communications service guided by five traditional objectives:

1. To provide emergency or public-service communications when normal communications are disrupted;
2. To advance the state of the radio art;
3. To improve individual skills in radio operation;
4. To provide a reserve pool of qualified radio operators and technicians; and
5. To promote international goodwill.

There are two sub-services of amateur radio. An application of the first principle is the Radio Amateur Civil Emergency Service (RACES), which provides for amateur radio operation for civil-defense purposes during periods of local, regional, or national civil emergencies. The Amateur-Satellite Service is "A radiocommunication service using stations on Earth satellites for the same purpose as those of the amateur service."

The amateur service has something for everyone: electronic experimenters can build and modify their own gear; motorists can talk hundreds of miles and even make telephone calls from their cars; shut-ins can "travel" throughout the globe; PC enthusiasts can communicate computer-to-computer using radio modems; and still while others can talk to literally hundreds of different countries. The variety is endless.

Eligibility For A Commercial Radio License

Commercial radio operator licenses may be held by aliens if they are eligible for work in the U.S. See Table II for a list of the commercial radio operator licenses and their examination requirements.

Handicapped persons with uncorrected afflictions may also obtain a commercial radio license which could contain restrictions. Deaf people and applicants who cannot transmit and receive in English are not eligible for a commercial radio license.

Getting An Amateur or Commercial Radio Op. License

In the early 1980s a general trend towards privatization developed at the FCC. In 1982 President Reagan signed legislation authorizing amateur radio operator examinations to be prepared and administered by volunteer amateur radio organizations. The new testing procedure came to be known as the Volunteer Examiner Coordinator (VEC) System. VECs act as the link between the testing community and the FCC, who issues the station/operator licenses. Question pools were developed from which the examination questions would be drawn. The first VE-administered examinations took place in 1984.

The Commission recognized that the amateur testing program was working well and in 1992 initiated rule making which looked toward privatizing commercial radio operator testing as well. In the process, the Commission completely rewrote the Part 13 Commercial Radio Operator rules. The newly privatized commercial radio exams began in late 1993 headed up by COLE (Commercial Operator License Examination) Managers. The COLE Manager is the commercial radio counterpart of the VEC. Your author, W5YI, heads the only VEC organization that is also a COLE manager.

What Does It Cost To Get A Radio License?

The current cost to be administered an amateur radio operator license examination is a maximum of $6.05. This fee began in 1984 at $4.00 to reimburse amateur examination expenses. It has been increased annually based on the Dept. of Labor's Consumer Price Index.

Use Your Free Reader Service Card For More Information On Companies Advertising In This Issue.

The examination fee for a Commercial Radio Operator license examination depends on the examining organization. Our National Radio Examiner division charges $35 per license. There are no additional fees for newly issued commercial radio licenses. Renewals for the five-year term commercial radio licenses, however, are currently $45.

Where Do I Take The Exams?

Both amateur and commercial radio operator license examinations are now widely available throughout the United States and in many foreign countries. Although there are eighteen VEC organizations, the ARRL/VEC and W5YI-VEC account for more than 80 percent of all amateur testing. You can determine the location of the nearest examination location by calling the ARRL/VEC (860-594-0300) or W5YI-VEC (817-860-3800) during normal business hours (Monday through Friday from 8:30 AM to 4:30 PM). All written examinations are multiple choice.

Your amateur license will be granted very quickly. What used to take two or three months now, thanks to electronic filing, takes just a few days! You can obtain your new callsign and begin operating immediately by calling the above numbers. Do not call the FCC, since their line is normally busy.

At this writing the FCC is in the process of extending electronic filing to commercial radio operator applications.

Both the parent ARRL and W5YI Group offer license preparation information in the form of study manuals, cassette tapes, videos, and computer software. The W5YI Group (but not the ARRL) also has commercial radio study material. All of the written examination questions, both amateur and commercial, are known and widely published.

It is important that you obtain the current version of the question sets, since at least one written amateur examination element is revised every July 1st. In July 1996 the Amateur Extra Class question set will change. Several commercial radio operator question pools also changed earlier this year.

Want To Start Your Own Examination Team?

Licensed amateur radio operators holding at least a General Class operator license are statutorily qualified to administer amateur service examinations. The General and Advanced Class licensee may administer examinations for the Novice, Technician, and Technician Plus applicant. Only Amateur Extra Class operators may administer the higher level telegraphy and written exams. Under our Commercial Radio operator testing program, only Amateur Extra Class or licensed commercial operators are eligible to establish a commercial radio test center. Testing fees are shared with examination teams.

It takes a crew of three to conduct a test session. Contact the W5YI-VEC at 810-860-3800 (or 817-461-6443 after regular business hours) if you or your amateur radio club would like to establish an examination team. We'll rush the VE (or commercial radio examiner) application forms right out to you. Once you return them, you will be forwarded the needed examination materials (both telegraphy and written) and complete test administration instructions.

73, Fred, W5YI

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9913 EQUAL FOIL+95% BRAID 2.7dB @ 400MHz		.42/FT	.40/FT
LMR 240 DBL SHLD (8X SIZE)IIIA JACKET 1.7dB @ 50MHz		.41/FT	.39/FT
LMR 400 DBL SHLD IIIA JACKET 2.7dB @450MHz		.58/FT	.56/FT
LMR 400 ULTRA-FLEX DBL SHLD "TPE" JACKET 3.1dB @ 450MHz		.75/FT	.72/FT
LMR 600 DBL SHLD IIIA JACKET 1.72dB @ 450MHz		1.38/FT	1.32/FT
LDF4-50A 1/2" ANDREWS HELIX 1.5dB @ 450MHz	25FT&UP	2.10/FT	
FSJ-50 1/4" ANDREWS SUPERFLEX 2.23dB @ 150MHz	25FT&UP	1.50/FT	
COAX (50 OHM "HF" GROUP)		**100FT/UP**	**500FT**
RG213/U MIL-SPEC DIRECT BURIAL JACKET 1.5dB @ 50MHz		.36/FT	.34/FT
RG8/U FOAM 95% BRD UV RESISTANT JACKET 1.2dB @ 50MHz		.32/FT	.30/FT
RG8 MINI (X) 95% BRD BLK, UV RES JKT(GRY,CLR, or WHT JKT TOO)		.15/FT	.13/FT
RG58/U SOLID CENTER COND 95% BRAID		.15/FT	.13/FT
RG58A/U STRD CENTER COND 95% TC BRAID		.17/FT	.15/FT
450 OHM SOLID 18GA CW LADDER LINE		.12/FT	.10/FT
450 OHM STRD 16GA CCW LADDER LINE		.18/FT	.17/FT
24GA SOLID 4/PAIR UNSHLD LAN CABLE "LEVEL 5" PVC JACKET		.16/FT	.14/FT
RG214/U DBL SILVER SHLD MIL-SPEC	25FT&UP	1.75/FT	
RG142/U DBL SILVER SHLD MIL-SPEC "TEFLON"	25FT&UP	1.25/FT	
ROTOR & CONTROL CABLES		**100FT/UP**	**500FT**
5971 8/COND (2/18 6/22) BLK UV RES JKT. Recommended up to 125ft		.20/FT	.18/FT
4090 8/COND (2/16 6/22) BLK UV RES JKT. Recommended up to 200ft		.35/FT	.34/FT
1418 8/COND (2/14 6/18) BLK UV RES JKT. Recommended up to 300 ft		.47/FT	.45/FT
18GA STRD 4/COND PVC JKT		.20/FT	.18/FT
18GA STRD 5/COND PVC JKT		.22/FT	.20/FT
18GA STRD 6/COND PVC JKT		.23/FT	.21/FT
18GA STRD 7/COND PVC JKT		.25/FT	.23/FT
ANTENNA WIRE (UNINSULATED BARE COPPER)		**100FT/UP**	**500FT**
14GA 168 STRD "SUPERFLEX" (great for Quads & Portable set-ups etc)		.12/FT	.10/FT
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3/16" DOUBLE BRAID "DACRON" ROPE 770#TEST WEATHERPROOF		.12/FT	.09/FT
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50FT RG213/U MIL-SPEC DIRECT BURIAL JKT 1.5dB @ 50MHz			$25.00/EA
100FT RG8/U FOAM 95% BRD UV RESISTANT JKT 1.2dB @ 50MHz			$40.00/EA
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BY GEORGE JACOBS, W3ASK

PROPAGATION

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Solar Cycle Progress

The present sunspot cycle continues to decline steadily towards its demise. The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a mean sunspot number of 11 for December 1995. Daily counts ranged between a high of only 21, which was recorded on December 26, and a low of zero, which took place on the 16th through the 18th, and on the 24th.

December's mean count results in a 12-month running smoothed sunspot number of 18 centered on June 1995. The cycle is measured by the smoothed level of sunspot numbers. A smoothed sunspot number on the order of 10 is forecast for April 1996. The end of Cycle 22 and the beginning of a new sunspot cycle is expected during late 1996 or early 1997.

According to measurements made at Penticton, British Columbia by the Dominion Radio Astrophysical Observatory of Canada, the reported mean level of 10.7 cm solar flux for December '95 was 70. This results in a smoothed number of 77 centered on June 1995. A smoothed value in the mid-70s is forecast for this month.

Telescopic counting of sunspots and the measurement of solar flux both are indices of sunspot activity. While the radio flux measurements are more sensitive than telescopic counting and are not dependent upon weather conditions, the telescopic method continues, since an unbroken record of more than 200 years of such data exists. Solar flux measurements have been made for only the past 50 years.

VOACAP on INTERNET

The Voice of America Coverage Analysis Program (VOACAP) is among the world's most popular computer propagation programs for professionals. It is a modified version of ICONCAP, and has been developed by the Voice of America over the past decade with the assistance of the Naval Research Laboratory and the Institute for Telecommunications Sciences, NTIA. VOACAP produces system-performance predictions for HF communications. It predicts expected signal levels, reliabilities, optimum take-off angle, and several other system parameters for a given frequency, hour, month, and sunspot number. Calculations can be made for point-to-point circuits or for area coverage. In my professional work with HF broadcast stations I find the area-coverage maps produced by VOACAP of particular importance (see fig. 1).

George Lane, Propagation Specialist at VOA and one of the developers of VOACAP, has informed me that the latest revision is now available on the INTERNET, along with documentation. The lack of documentation was a previous drawback to the use of VOACAP outside of professional circles.

11307 Clara Street, Silver Spring, MD 20902
e-mail: gjacobs@clark.net

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for April 1996

	Expected Signal Quality			
Propagation Index.....	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 5-6, 14-15, 18-19, 23	**A**	**A**	**B**	**C**
High Normal: 4, 13, 20, 24, 27	**A**	**B**	**C**	**C-D**
Low Normal: 1, 3, 7, 11-12, 16-17, 21-22, 25-26, 30	**B**	**C**	**D**	**D-E**
Below Normal: 2, 8, 10, 28-29	**C**	**C-D**	**D-E**	**E**
Disturbed: 9	**C-D**	**D**	**E**	**E**

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9.**

B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S9 and S6, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any date of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be fair (C) on April 1st, fair-to-poor (C-D) on the 2nd, fair (C) on the 3rd, good (B) on the 4th, excellent (A) on the 5th and 6th, etc.

The program can be obtained by anonymous FTP from the ftp.voa.govserver. It will be found in the directories/pub/software/voacap, which are clearly marked with appropriate buttons. Use binary mode. Minimum system requirements are at least 500 KB of memory, a hard disk with at least 17 MB available, ANSI.SYS in CONFIG.SYS, at least a 386 processor with a math co-processor, an HP-type LaserJet printer on LPT1 for black-and-white copies, or an HP-type PaintJet printer for color copies.

More information concerning VOACAP can be obtained directly from George Lane by phone 202-619-3468, by fax 202-619-3484, or by e-mail to George_Lane@beng.voa.gov.

April DX Propagation

Spring equinoctial conditions are expected to extend well into April. As discussed in last month's column, this is the time of year when the sun crosses the equator as it travels into northern skies. The hours of darkness and daylight are about equal in both hemispheres, and ionization is nearly constant over most of the world at any given local time. Tran-equatorial propagation is at its best during equinoctial seasons.

During April, 17 and 20 meters should be the optimum bands for DX propagation conditioned during most of the daylight hours, and into the early evening hours as well. Somewhat fewer openings are expected on 15 and 17 meters compared to the winter months, but some fairly good DX still should be possible towards southern and tropical areas, especially during the afternoon hours when conditions are High Normal or better. Few 12 or 10 meter DX openings are expected this month, but an occasional one should be possible from all USA time zones towards South America, and from the western states towards the South Pacific. Be sure to check these bands during the afternoon hours when conditions are High Normal or better.

For a few hours after sunset, optimum DX propagation conditions should be shared among 20, 30, and 40 meters. Good openings to many parts of the world are forecast for these bands between sunset and midnight, and on 40 meters from midnight to an hour or so after sunrise. Some good DX openings should also be possible on 80 meters during the hours of darkness and sunrise. There is also a good chance for some 160 meter DX openings during the same time period.

Seasonably favorable propagation conditions over long paths between the northern and southern hemispheres—for example, to Australasia, South America, southern Africa, etc.—should continue during April on all HF bands.

Thunderstorm activity increases during April in the northern hemisphere, and this should result in increased levels of static on all HF bands, especially 30, 40, 80, and 160 meters.

Ionspheric absorption should continue to increase in the northern hemisphere during April as the sun rises higher in the northern sky. This should result in somewhat weaker DX signal levels during daytime openings, compared to the winter months.

Short-Skip Propagation

For openings between 50 and 250 miles the best band should be 80 meters during the day and 160 meters at night. Between 250 and 750 miles, 30 and 40 meters should be best during the day, 80 meters for an hour or two after sunrise and again from sunset to midnight, and 160 meters from midnight to sunrise. For openings between 750 miles and the one-hop, short-skip limit of 2300 miles, use 17 and 20 meters during the day, 40 meters for an hour or so at sunrise and again from sunset to midnight, and 80 meters from midnight to sunrise. Look for 12 and 15 meter short-skip openings from about 10 AM to sundown, ranging between approximately 1300 and 2300 miles, although at times openings may be as short as 500 miles. There is also the possibility for some 10 meter short-skip openings during the daylight hours over similar distances.

The DX Propagation Charts in this month's column contain DX propagation predictions for

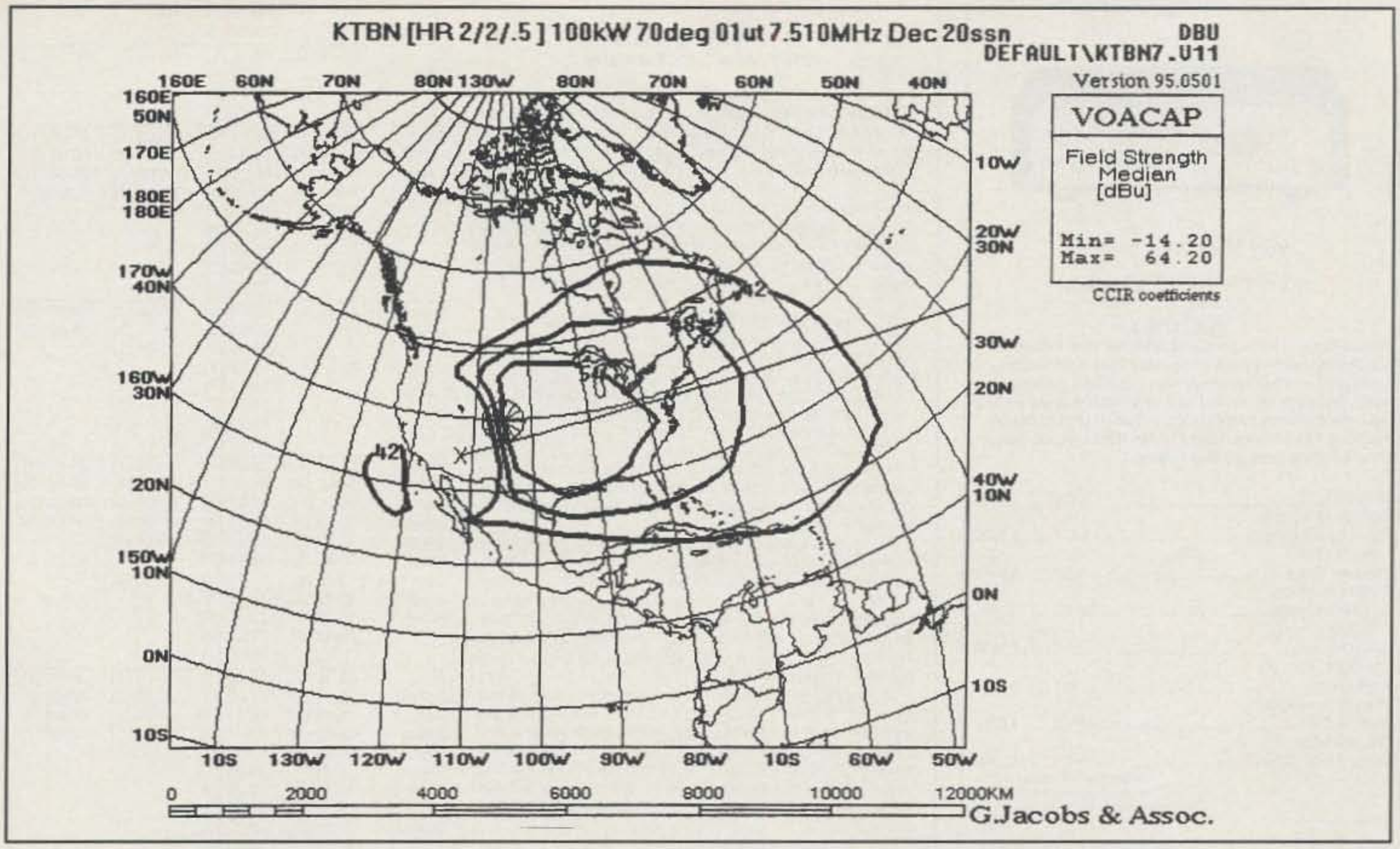

Fig. 1– Typical VOACAP coverage map. This one depicts 54, 48, 42 dBu signal contours for a 100 kw HF broadcast station on 7.510 MHz at 01 UT during December 1995. (KTBN, Salt Lake City, Utah)

HOW TO USE THE DX PROPAGATION CHARTS

1. Use chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4, and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9, and 0 areas; the Western USA Chart in the 6 and 7 areas; and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 meters) for a particular DX region, as shown in the left-hand column of the charts. An * indicates the best time to listen for 160 meter openings.

3. The propagation index is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of days during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *daylight* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts CW, or 1 kw, PEP on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

6. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado 80302.

April 15-June 15, 1996 Time Zone: EDT (24-Hour Time) EASTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	12-17 (1)	05-07 (1) 07-10 (2) 10-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-03 (2) 03-04 (1)	20-22 (1) 22-01 (3) 01-02 (2) 02-03 (1) 22-00 (1)* 00-02 (2)* 02-03 (1)*
Northern Europe & CIS (former Eur. USSR)	11-16 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-16 (2) 16-18 (1)	19-20 (1) 20-23 (2) 23-01 (1)	20-00 (1)
Eastern Mediterranean & Middle East	14-16 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-19 (1) 22-00 (1)	19-21 (1) 21-23 (2) 23-00 (1)	21-23 (1)
Western Africa	12-14 (1)** 10-12 (1) 12-15 (2) 15-16 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-20 (1)	20-22 (1) 22-02 (2) 02-03 (1)	00-02 (1)
Eastern & Central Africa	10-13 (1) 13-14 (2) 14-15 (1)	07-09 (1) 13-15 (1) 15-16 (2) 16-17 (3) 17-18 (2) 18-19 (1)	21-01 (1)	22-00 (1)
Southern Africa	12-14 (2) 14-15 (1)	16-17 (2) 17-18 (3) 18-20 (1) 23-01 (1)	22-00 (2) 00-02 (1)	
Central & South Asia	17-19 (1)	07-10 (1) 14-16 (1) 19-21 (1)	05-07 (1) 19-21 (1)	Nil
South-east Asia	Nil	08-10 (1) 18-20 (1)	Nil	Nil
Far East	17-19 (1)	08-10 (1) 18-19 (1) 19-21 (2) 21-23 (1)	04-06 (1)	Nil
South Pacific & New Zealand	15-18 (1)** 09-11 (1) 15-17 (1) 17-19 (2) 19-20 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-12 (2) 12-16 (1) 16-18 (2) 18-20 (1) 20-23 (2) 23-02 (1)	02-03 (1) 03-04 (2) 04-06 (3) 06-07 (1)	02-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
Australasia	17-20 (1)	07-08 (1) 08-10 (2) 10-11 (1) 15-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-01 (1)	03-05 (1) 05-07 (2) 07-08 (1)	04-07 (1) 04-06 (1)*
Caribbean, Central America & Northern Countries of South America	11-14 (1)** 14-16 (2)** 16-17 (1)** 10-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	04-06 (1) 06-07 (2) 07-08 (3) 08-10 (4) 10-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-22 (2) 22-00 (1)	19-20 (1) 20-21 (2) 21-04 (3) 04-06 (2) 06-07 (1)	21-02 (1) 02-05 (2) 05-07 (1) 03-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile Argentina & Uruguay	12-15 (1)** 15-16 (2)** 16-17 (1)** 08-09 (1) 09-11 (2) 11-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-18 (3) 18-19 (4) 19-20 (3) 20-22 (2) 22-00 (3) 00-01 (2) 01-03 (1)	20-21 (1) 21-04 (2) 04-06 (1)	23-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
McMurdo Sound, Antarctica	Nil	07-08 (1) 08-09 (2) 09-10 (1) 16-20 (1) 20-23 (2) 23-00 (1)	01-05 (1)	Nil

April 15-June 15, 1996 Time Zone: CDT & MDT (24-Hour Time) Central USA TO:

	15 Meters	20 Meters	40 Meters	80 Meters
Western & Southern Europe & North Africa	14-16 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-17 (2) 17-19 (1)	19-21 (1) 21-23 (2) 23-01 (1)	21-00 (1)
Northern Europe & CIS (former Eur. USSR	Nil	07-08 (1) 08-10 (2) 10-14 (1) 14-16 (2) 16-18 (1) 20-22 (1)	20-20 (1)	21-22 (1)
Eastern Mediterranean & Middle East	Nil	07-09 (1) 13-15 (1) 15-17 (2) 17-18 (1) 22-00 (1)	20-00 (1)	Nil
Western Africa	12-14 (1) 14-15 (2) 15-16 (1)	07-09 (1) 12-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	20-01 (1)	Nil
Eastern & Central Africa	13-15 (1)	07-09 (1) 13-16 (1) 16-19 (2) 18-19 (1)	21-00 (1)	Nil
Southern Africa	09-11 (1) 11-13 (2) 13-14 (1)	14-16 (1) 16-18 (2) 18-21 (1)	20-22 (1) 22-00 (2) 00-01 (1)	22-00 (1)
Central & South Asia	17-19 (1)	08-10 (1) 17-19 (1) 19-21 (2) 21-22 (1)	05-07 (1) 19-21 (1)	Nil

South-east Asia	Nil	08-10 (1) 19-22 (1)	05-07 (1)	Nil
Far East	18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 18-20 (1) 20-22 (2) 22-23 (1)	03-05 (1) 05-06 (2) 06-07 (1)	05-06 (1)
South Pacific & New Zealand	15-17 (1)** 11-15 (1) 15-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	16-19 (1) 19-21 (2) 21-23 (3) 23-03 (2) 03-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-13 (1)	00-02 (1) 02-04 (2) 04-05 (3) 05-06 (2) 06-07 (1)	02-04 (1) 04-05 (2) 05-06 (1) 04-05 (1)*
Austral-asia	16-18 (1) 18-20 (2) 20-21 (1)	06-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-16 (1) 16-18 (2) 18-21 (1) 21-00 (2) 00-02 (1)	02-04 (1) 04-06 (2) 06-07 (1)	04-06 (1)
Carib-bean, Central America & North ern Countries of South America	11-13 (1)** 13-16 (2)** 16-17 (1)** 09-11 (1) 11-12 (2) 12-14 (3) 14-15 (4) 15-16 (3) 16-17 (2) 17-19 (1)	00-07 (1) 07-08 (2) 08-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	19-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-07 (1)	21-23 (1) 23-04 (2) 04-06 (1) 00-05 (1)*
Peru, Bolivia, Para-guay, Brazil, Chile, Argen-tina & Uruguay	12-15 (1)** 15-16 (2)** 16-17 (1)** 08-10 (1) 10-12 (2) 12-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	06-08 (1) 08-09 (2) 09-10 (3) 10-16 (1) 16-18 (2) 18-19 (3) 19-20 (4) 20-21 (3) 21-23 (2) 23-01 (3) 01-02 (2) 02-04 (1)	21-22 (1) 22-00 (2) 00-02 (1) 02-04 (2) 04-05 (1)	00-04 (1) 01-03 (1)*
McMurdo Sound, Antarc-tica	15-17 (1)	08-10 (1) 16-18 (1) 18-22 (2) 22-00 (1)	00-06 (1)	Nil

April 15 - June 15, 1996
Time Zone: PDT (24-Hour Time)
WESTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & South-ern Europe & North Africa	Nil	07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (1) 22-00 (1)	20-21 (1) 21-23 (2) 23-00 (1)	21-23 (1)
Central & North ern Europe & CIS (former Eur. USSR)	Nil	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (1) 22-00 (1)	20-23 (1)	21-22 (1)
Eastern Mediter-ranean & Middle East	Nil	07-10 (1) 10-12 (2) 12-13 (1) 22-00 (1)	20-23 (1)	Nil
Western Africa	10-14 (1)	07-09 (1) 12-15 (1) 15-17 (2) 17-19 (1)	20-23 (1)	Nil
Eastern & Central Africa	10-12 (1)	07-09 (1) 12-14 (1) 14-15 (2) 15-17 (1)	20-22 (1)	Nil
South-ern Africa	10-13 (1)	07-09 (1) 13-14 (1) 14-16 (2) 16-17 (1) 22-00 (1)	19-22 (1)	20-22 (1)
Central & South Asia	19-21 (1)	08-09 (1) 09-11 (2) 11-12 (1) 17-19 (1) 19-21 (2) 21-23 (1)	04-07(1)	Nil

each amateur band between 10 and 160 meters for the period April 15 through June 15, 1996. Beginning this month and continuing through the summer and fall, the times shown in the charts will be local daylight time (EDT, CDT, MDT, and PDT).

For more detailed predictions of short-skip openings between distances of 50 and 2300 miles, refer to the Short-Skip Charts, which appeared in last month's column.

A day-to-day forecast of general propagation conditions expected during April is given in the Last-Minute Forecast, which appears at the beginning of this column.

VHF Ionospheric Openings

Chances for some unusual VHF ionospheric openings during April look pretty good. Some auroral-type openings should be possible during periods of radio storminess. Check the Last-Minute Forecast at the beginning of this column for those days during April that are expected to be Below Normal or Disturbed.

South-east Asia	19-21 (1)	07-08 (1) 08-10 (2) 10-11 (1) 21-22 (1) 22-23 (2) 23-01 (1)	04-07 (1)	05-06 (1)
Far East	19-21 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (1) 18-21 (1) 21-23 (2) 23-01 (1)	02-03 (1) 03-06 (2) 06-08 (1)	03-07 (1)
South Pacific & New Zealand (1)*	15-18 (1)** 11-13 (1) 13-16 (2) 16-19 (3) 19-20 (2) 20-22 (1)	06-08 (1) 08-11 (2) 11-17(1) 17-20 (2) 20-21 (3) 21-23 (4) 23-00 (3) 00-02 (2) 02-04 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1)	01-02 (1) 02-05 (2) 05-06 (1) 0 2 - 0 5
Austral-asia (1)*	16-18 (1)** 13-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	06-08 (1) 08-10 (2) 10-12 (1) 18-20 (1) 20-22 (2) 22-02 (3) 02-03 (2) 03-04 (1)	01-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-06 (1) 0 3 - 0 5
Caribbean, Central (1)*	11-14 (1)** 14-16 (2)** 16-17 (1)**	00-06 (1) 06-08 (2) 08-10 (4)	19-20 (1) 20-21 (2) 21-02 (3)	21-00 (1) 00-03 (2) 0 3 - 0 5
America (1)*	09-10 (1)	10-12 (3)	02-04 (2)	0 1 - 0 4
& Northern Countries of South America	10-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	12-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-00 (2)	04-06 (1)	
Peru, Bolivia, (1)*	13-16 (1)** 09-10 (1)	06-08 (1) 08-10 (2)	20-22 (1) 22-02 (2)	21-03 (1) 0 0 - 0 3
Paraguay, Brazil, Chile, Argentina & Uruguay	10-12 (2) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-18 (1)	10-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-23 (2) 23-01 (1)	02-04 (1)	
McMurdo Sound, Antarctica	16-19 (1)	07-09 (1) 16-18 (1) 16-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-00 (1)	03-06 (1)	Nil

*Indicates best time for 160 meter opening.
*I*ndicates best time for 10 meter opening.
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.

Lyrids, a major meteor shower, is due April 22–24. It will probably peak late April 22 or early on the 23rd, with an average of about 15 good-size meteors entering the earth's atmosphere every hour. This should increase considerably chances for VHF meteor-scatter-type openings.

Sporadic-*E* propagation usually begins to increase during April, and it should continue to do so through the spring and summer months. Look for an increase in short-skip openings on both the 10 and 6 meter bands during the month. Most openings on 10 meters should fall between approximately 750 and 1300 miles. Sporadic-*E* openings, as the name infers, may occur at any time of the day or night, but there is a tendency for them to peak between 8 AM and noon and again between 5 and 9 PM local time.

73, George, W3ASK

BY BUCK ROGERS, K4ABT

PACKET USER'S NOTEBOOK

CONNECTING YOU AND PACKET RADIO IN THE REAL WORLD

Let's Talk 9600 Baud

Throughout the world 9600 baud modems are being implemented in TNCs. Thus far the implementation has been demonstrated with great success. There is only one problem: We don't have much choice of radios to interface at 9600 baud!

Last month I covered how we modify the General Electric (Ericsson) Phoenix SX and the Motorola MITREK commercial transceivers for use at 9600 baud. Here are some additional mods that complement last month's MITREK modification.

If you find that some loss of high frequencies occur in the MITREK when using it at 9600 baud, include these changes when making the mods we described in last month's column. I'll describe them as clearly as possible, so you can locate the components to be removed or added (see fig. 1). I can't replicate the actual schematic here.

My references are directed to the low-band 39 to 50 MHz MITREK. At the output of the limiter/detector IC, there is a 75,000 ohm (75K) resistor labeled **R231**. Either remove it and replace it with a 2700 ohm (2.7K) resistor or parallel it with a 3900 ohm (3.9K) resistor. Next locate the capacitor **C240** ".001 mF" (same area, located next to R231) and remove it. Now locate IC 403(A). Across pins 2 and 3 there is a 220 pF capacitor labeled **C451**; remove it. In some MITREKs I've found another 220 pF ceramic cap attached to the same IC (403) on the bottom (solder side) of the board. If you find this cap in your unit, remove it also. I haven't found a label for it on the schematic, so it may have been added as an afterthought.

As I made each of the above changes, I performed tests to ensure that I was making progress. In each change I noted an improvement in the recovered 9600 baud audio, and thus improved data recovery.

211 Luenburg Drive, Evington, VA 24550

Assisted Measurement

I have had some comment from readers who say they do not have a scope to read the signal as they perform the tuning and alignment of this radio. If that is the case, then try this approach.

Use a VOM and set it to a scale near 1 volt and read pin 1 of the round 13-pin receive test socket. Peak the receiver tuning point for maximum signal until you reach coil L208 or the quadrature detector coil. At this point move the meter probe to pin 2 of the meter test socket and max the signal at this point. For the record, you have moved the probe from the output of the limiter/quad detector to the output of the audio pre-amplifier.

I know some of the two-way shop techs will argue that I'm giving you a different approach to the methods they use or may have learned, but this method is for those who have only an FM signal generator and a VOM to work with. I use an IFR 1200S with all the mods and options, but we all don't own a $10,000+ test set and analyzer that covers everything from DC to daylight.

While We're on The Subject . . .

While we're discussing the MITREK tuning and alignment, you might be interested to know the modulation type that I'm applying to the RF signal generator. Don't flip when I say that I'm using a 4800 Hz tone to modulate the on-frequency RF signal.

To ensure that I'm really sweeping the unit to receive 9600 baud, I apply a 4800 Hz tone to the FM RF signal, modulating it at 3 kHz maximum. At the other end of the radio (audio preamplifier output) I have my TNC attached. It is set up to receive 9600 baud.

"How does a 4800 Hz tone relate to 9600 baud?" you ask. Well, let's look at it like I did as I began to experiment with this idea. As it turns out, my idea was not so dumb after all.

The 4800 Hz tone appears to the 9600 baud engine in the TNC as if it is the two halves of the square wave of a 9.6 Kb source. For those who grab the pencil or jump to the keyboard to write Buck a letter and protest that I'm crazy,

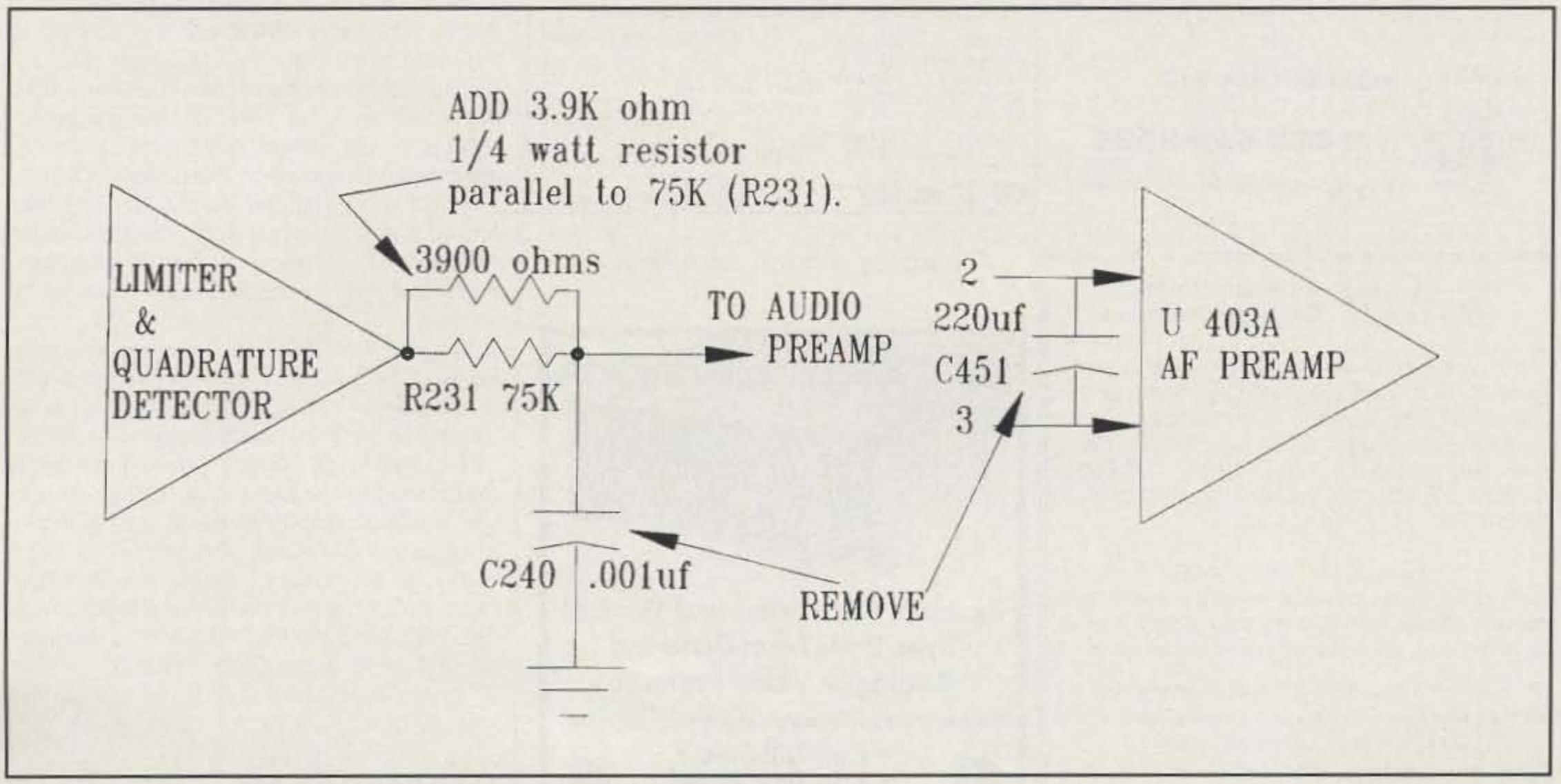

Fig. 1– Make the changes shown above to the MITREK receive audio circuits to improve high-frequency characteristics and better 9600 baud data recovery (see text).

before you leap, you had better go take a look.

You'll find that I'm right! The 4800 Hz tone does make the 9600 baud TNC DCD LED illuminate as the signal reaches it through the (properly aligned) receiver. As you tweak the receiver, watch the DCD LED (some TNC or KPCs will have the DCD LED labeled "RCVE"). It will flicker as you lose signal, and come to full brilliance as you reach peak tune. As it glows brightly (full brilliance), it may be necessary to reduce the output of the signal generator to drop the DCD back to a flicker. **Do not adjust the 4800 Hz level. Reduce only the RF signal level.** This allows you to tweak it further and improve the data recovery far greater than you might have with a conventional alignment.

Don't try the above unless you have a signal generator that has the capability of superimposing the 4800 Hz tone on the on-frequency RF signal.

Tweaking The Transmit Audio Path

I also spent some time trying a few additional "twists" with the audio through the transmit section of the radios. For those who are perfectionists as I am, you may care to include a similar test as I have outlined here.

Burn your EPROM for the TNC-2 or compatible node using the X-1J4 code. The reason I recommend the Dave Roberts, G8KBB, TheNET format is because in this version the X-1J REV 4 has a "CALIBRATE" command that allows you to activate it remotely for tests and alignment. The same applies if you are connected to the RS-232 port of the node. You can send the node the **CAL #, #,** command and it will respond accordingly.

Make sure the radio is operating into a dummy load capable of handling the power output of the radio. If you are connected to the node's RS232 port, issue **ESCape C** and connect to the node. Make sure the TNC/node is set up for 9600 baud operation. Next issue the **CAL #, #,** command. The "hash" or pound sign represents the duration of, and the time between, the tones transmitted by the node/TNC. I use CAL 30, 10, or you can use 30, 10, 30. Either should make the node send the 9600 baud NRZI tones for 30 seconds, then off for 10 seconds, and return a second set of tones for 30 seconds.

While all this is taking place, you may wish to watch the DCD of a TNC attached to another properly aligned 9600 baud receiver to make sure the 9600 baud tones from the transmitting station are correct. This is how I determined the best level and the correct value to use as coupling to the transmit crystal oscillator shown in last month's column.

Just for the record, I use a 2.2 µFd *nonpolarized* (electrolytic) capacitor (Radio Shack 272-997) to couple the DFSK into the frequency modulated stage. Set the radio's deviation (from the 9600 baud TNC DFSK signal) to 3 kHz, *no more, no less.*

Clearing The Air

After some statements I made in an earlier col-

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FT-840 HF Transceiver • **tx:** 160-10m Ham Bands • **rx:** 100kHz-30MHz • 100W •100 memories • Twin band stacking VFOs • optional FM • automatic repeater offset • CTCSS encode • 9⅛"w x 3⅜"w x 9½"d.

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FT-8500 Dual Band Mobile • Compact with new Spectra-Analyzer and FS-10 Smart Controller mic. 50/35W, 5½"w x 1⅜"h x 6 ¼ "d, 2.4 lbs. **FT-8500/MH-39** features MH-39 standard TTP mic.

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FT-900/AT HF Transceiver • **tx:** 160–10m • **rx:** 100kHz–30MHz • 100W • 100 memories • built-in antenna tuner • front subpanel optionally mounts separately from the main body • CTCSS encode with repeater offset • twin stacking VFOS.

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FT-7400H Mobile (left) • 440MHz (35w) • 31 memories • alpha display • track tuning • CTCSS encode • backlit DTMF microphone • 6¼"w x 1⅛"h x 7"d, 3.3 lbs.

FT-2500M 2m Mobile (top) • 50w • 31 memories • CTCSS encode • scan • backlit DTMF mic • 6"w x 1⅛"h x 7"d.

FT-912RH Mobile (right) • 1.2GHz

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FT-11R, FT-11R/HP, FT-41R, FT-51R, FT-51R/HP	$30 Off
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umn that related to 9600 baud systems, I received a lot of mail asking me to explain the modems and TNCs I use for my system. I have several, but for the most part I use the James Miller, G3RUH, design 9600 baud modem.

The G3RUH design is licensed and marketed by MFJ Enterprises Inc., PacComm, and Kantronics. I have to clear the air here, as the G3RUH modem that is used by Kantronics is in the DataEngine, not the modem technique used in the KPC-9612.

The G3RUH modem is easily installed in the TNC of its associated manufacturer—MFJ-9600 being used with the MFJ products, while the PacComm NB96 is used with the PacComm TNCs. AEA has AEA PK-96 1200, 2400, 4800, and 9600 baud ready to plug-n-play TNCs. The Kantronics 9600 baud modem is implemented inside the Kantronics DataEngine (DE-56).

To make this effort work, you must modify the varactor DIRECT FM modulated stages for data input, and connect the receive AF output at the quadrature detector outputs.

Several sysops with whom I'm acquainted are using the MFJ version of the G3RUH modems in the MFJ-1270CQ Turbo TNCs and attaching them to radios with wide receive and transmit bandpass characteristics. It is preferred that a transceiver for 9600 baud have a 16.5 kHz bandpass. This is the amount of bandwidth occupied in the Direct Frequency-Shift Keyed (DFSK) transceiver.

The MFJ-9600 modem design is licensed from James Miller, G3RUH, and is in use worldwide. This modem design gives the packeteer a means of creating a flexible transmit waveform filter design that can compensate for audio differences in many production transceivers. One important feature that stands out in the G3RUH modem that is incorporated into these TNCs is the digital generation of the transmit audio wave-form. The precise shaping limits of the signal bandwidth can be made to tidy up the amplitude and phase response in the receiver dedicated circuits. The result is a compatible filter system within the data detection circuits for optimum data recovery and minimum tries.

Some Final Notes

We have one of two ways to go with packet radio. Either we increase our bands by adding more spectrum (and we know that will never happen), or we get off our duffs now and increase the amount of data that can be transferred in a given time period.

With the files that are being exchanged by packeteers across the country, and the spectrum load that has occurred, the need for a common-sense approach to data handling has arrived. Twelve-hundred baud was okay, but we have reached the limit of the number of calls, connects, and QSOs that can take place on one frequency. Twelve-hundred baud has long since been outgrown.

The same frequency that carries five QSOs (ten target stations) operating at 1200 baud can carry eight or ten times that many QSOs at 9600 baud. Think about it: 9600 baud is eight times faster than 1200 baud.

GAP: THE PERFECT ANTENNA

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

Eagle DX

Challenger DX

Voyager DX

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

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

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

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

The secret is out and people in the know say:

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

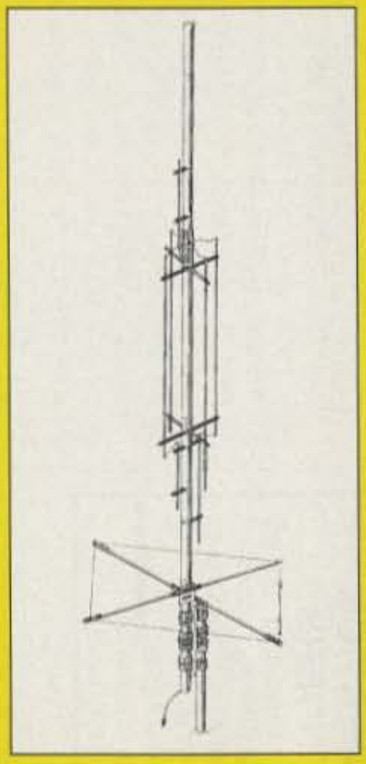
73–"This is a real DX antenna, much quieter than other verticals."

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

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

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

New Release: TITAN DX



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

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Challenger DX	■	■	■	■	■		■		■	■		31.5'	21 lbs	Drop In Ground Mount	3 Wires @ 25'	$259
Eagle DX			■	■	■	■	■		■			21.5'	19 lbs	1-1/4" pipe	80" Rigid	$269
Titan DX (Just Released)			■	■	■	■	■	■	■	■		25'	25 lbs	1-1/4" pipe	80" Rigid	$289
Voyager DX							■		■	■	■	45'	39 lbs	Hinged Base	3 Wires @ 57'	$399

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If you plan to implement a 9600 baud network, try to determine if the transceiver you hope to use employs TRUE or DIRECT FM, and *not* PHASE modulation. The PHASE-modulated transceivers are more contrary in a high-speed data transmission application.

Here is a partial list from my *Packet Radio Operator's Manual* of transceivers that have been modified or are ready to operate at 9600 bauds.

Alinco: DR-1200T, DR-110, DR-112, DR-150, ALR-22, ALR-72, and ALR-709.

Ericsson: (GE) MVP, MVS, Phoenix SX, Ranger II, and MASTR II.

ICOM: IC series 28A, 38A, 228, 271, 290H, 471, and IC-281 & 3200.

Kantronics: DVR 2-2 Data Radio (9600 bps ready when used with the DE-56 DataEngine). The D4-10 can be used with the DataEngine or interfaced with other controllers as defined in the book.

Motorola: MITREK and MICOR.

MFJ: MFJ-8621 and MFJ-8622.

Kenwood: TR series 751A, 7500, 7700; TM series 211, 212, 221, 231, 431; TS series 700 and 770.

Standard: C58 and C140.

Yaesu: FT series 212, 221, and 230.

Although I have made many 9600 baud modifications, I have not performed 9600 baud mods to all of them. Some of the modifications to radios shown in the list above were provided to me by helpful readers of this column. These mods were not tested by me; therefore I, or the publisher do not assume any responsibility for errors or damage resulting from the use of interface and modification information contained in this article. Persons attempting these changes should also be familiar with micro-circuit soldering techniques.

Other Caveats and Precautions

In some transceivers we've found IF pass-band limiting caused by the 455 kHz ceramic IF filter. An R/C network may be needed to broaden or by-pass this filter so the 9600 bps data can reach the discriminator. An alternative would be to exchange the filter(s) for one (MURATA) with a wider band-pass characteristic.

When installing a 9600 bps modem into a TNC, or when connecting the TNC to the transceiver, *use shielded* wire to the transmitter modulator. Use a separate shielded audio wire from the discriminator output for the receive audio.

With the 9600 baud networks and systems we've built, I've not been able to interface the transmit and receive audio using the microphone input and external speaker output. This is because the audio signals at the mic input and the speaker output have gone through both pre-emphasis and de-emphasis, and the audio may not be data worthy. The average 2 meter transceiver was designed for use in *voice* applications. To use the same audio points would load the data path with phase shift and distortion, and that just won't work!

We are having fun at 9600 baud!

73 de BucK4ABT @ WA4RTS.VA.USA.NA

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← **Incoming data**

← **Outgoing data appears here**

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ANNOUNCEMENTS (from page 6)

to VOMARC, 358 Patten Street, Sonoma, CA 95476 with SASE for event certificate.

W7PU, Green Valley Titan Missile Museum, Green Valley, Arizona; Green Valley ARC; 1600Z April 27 to 2300Z April 28; operation on 3.860, 7.230, 14.250, 21.330, 28.450, 145.290/ 144.69. For certificate, send QSL and 9 × 12 SASE to GVARC, 601 N. LaCañada, Green Valley, AZ 85614.

WB8SMC, Dayton, Ohio; The Farout ARC; to commemorate the bicentennial of the founding of Dayton; 0001Z April 1 to 2359Z April 30; operation 25 kHz up from lower General/Novice Phone/CW band edges. Send QSL and SASE to WB8SMC, c/o Charlie Cotterman, 26 Mello Avenue, Dayton, OH 45410-2119.

VA6SG, Tofield, Alberta, Canada; Town of Tofield; to celebrate the fourth Annual Snow Goose Festival; April 14–27; operation on 160, 80, 40, 20, 15, 10 meters SSB and 146.52 FM. QSL via VE6WPY CB address including two green stamps or three IRCs to cover postage. Allow 6 weeks for delivery of certificate.

VE3JW, The Museum of Science and Technology, Ottawa, Ontario, Canada; Ottawa Valley Mobile Radio Club; to celebrate the first anniversary of the opening of the amateur radio station/exhibit at the museum; 1400–2200Z April 14; on SSB 3860, 7260, 14260, 147.300.

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

Apr. 5, **Chesapeake ARS "SPRINGFEST '96,"** The Pavillion at Virginia Beach, Virginia Beach, Virginia. For more information, contact Preston Ipock, N4SHI, 1026 Calloway Avenue, Chesapeake, VA 23324.

Apr. 5–6, **5th Annual Sand Mountain Fest**, The Albertville Recreation Center, Albertville, Alabama. Contact Marshall County ARC, P.O. Box 2811, Albertville, AL 35950; or call Buddy Smith, KC4URL, at 205-593-2516. (Handicapped accessible; exams.)

Apr. 6, **2nd Annual Aiken Hamfest & Computer Show**, Aiken County Jaycee Fairgrounds, Aiken, South Carolina. Contact Doug Glass, AC4WW, 127 Trailwood Ave., Aiken, SC 29803-7602 (803-648-4754). (Exams.)

Apr. 6, **LARCFEST,** Boulder County Fairgrounds, Longmont, Colorado. For more information, send SASE to LARCFEST, LARC, P.O. Box 86, Longmont, CO 80502-0086. (Exams.)

Apr. 12, **19th Annual Rochester Area Hamfest, Computer, & Electronics Show**, John Adams Middle School, Rochester, Minnesota. For information and tickets, contact RARC, Attn. Frank Ingram, NØMXN, 1627 Fifth Ave. S.E., Rochester, MN 55904 (507-288-6569). (Exams.)

Apr. 12–13, **Northeast Mississippi Hamfest & Computer Expo**, Mississippi Complex of the Tupelo Furniture Market, Tupelo, Mississippi. For further information, contact Jack Ellis, KI5QV, Route 4, Box 198-B, Tupelo, MS 38801 (601-842-7255). (Exams.)

Apr. 12–13, **The Oklahoma ARRL State Convention, 50th Hamfest and Computer Fair**, The Coliseum of the Commanche Country Fairgrounds, Lawton, Oklahoma. Contact Bob Morford, KA5YED, 1415 N.W. 33rd St., Lawton, OK 73505; or call 405-355-6120 for more information. (Exams.)

Apr. 13, **S.M.A.R.T. 4th Annual Swapfest '96**, Goochland County Fairgrounds, Goochland, Virginia. Contact Buddy Travis, KA4NNN, at 540-894-0406 for more information. (Handicapped accessible; exams.)

Apr. 13, **8th Annual AARG Hamfest & Computer Show**, Northern Lebanon High School, Fredericksburg, Pennsylvania. Contact AARG, 105 Walnut St., Pine Grove, PA 17963 (717-345-3780); or Lanny Hoffman, KD3TS, 337 N. 19th St., Lebanon, PA 17042 (717-274-2148). (Handicapped accessible; exams.)

Apr. 14, **M.A.R.A. 24th Annual Madison**

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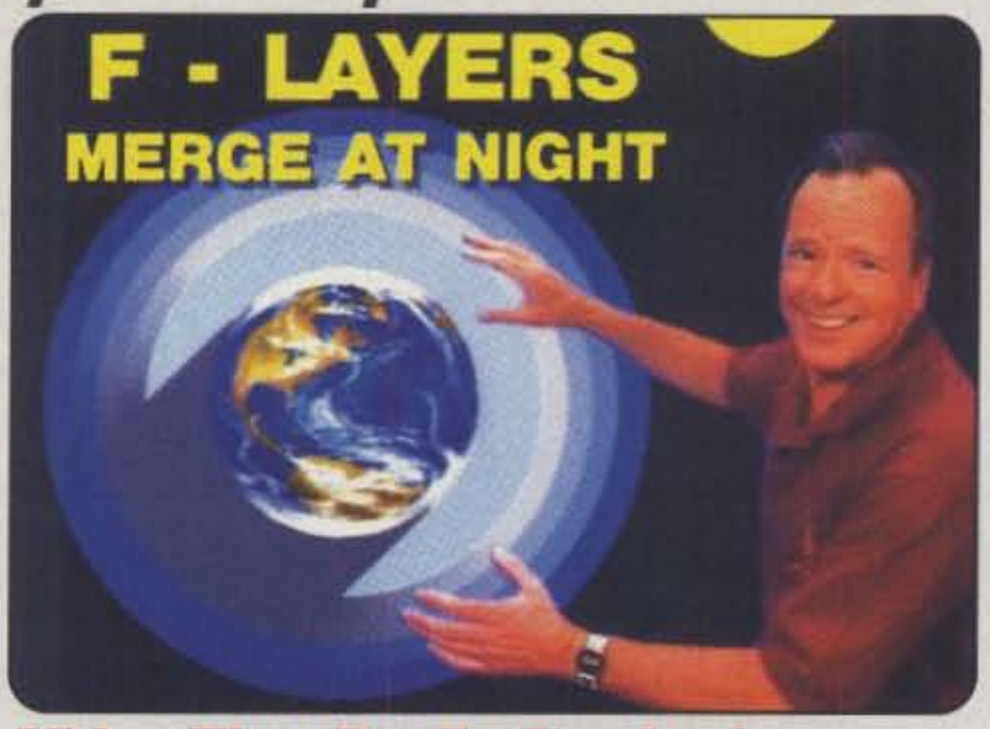

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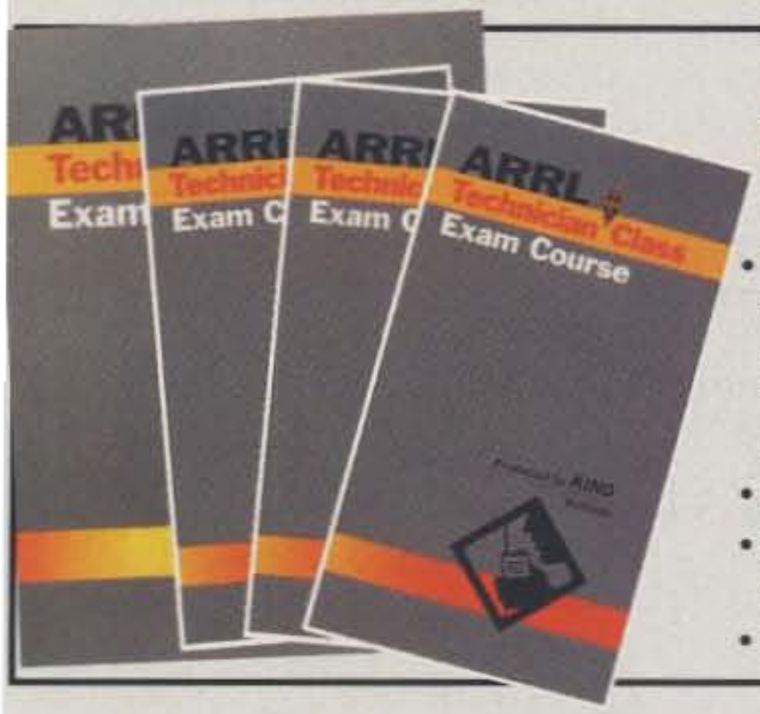

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Swapfest, Dane County Expo Center Exhibition Hall, Madison, Wisconsin. For more info, contact M.A.R.A., P.O. Box 8890, Madison, WI 53708-8890 (608-245-8890).

Apr. 14, **The Framingham ARA Spring Flea Market & Exams**, Framingham High School, Framingham, Massachusetts. To reserve tables, contact Martin Bayes, AA1ON, 508-435-0564; to register for exams, send check for $6.05 payable to ARRL/VEC to Dick Marshall, WA1KUG, 37 Lyman Road, Framingham, MA 01701. (Exams.)

Apr. 14, **Raleigh NC ARS 24th Hamfest, ARRL NCS Convention and Computer Fair**, Jim Graham Bldg., NCS Fairgrounds, Raleigh, North Carolina. Contact Rollin Ransom, NF4P, 1421 Parks Village Road, Zebulon, NC 27597 (phone 919-269-4406). (Exams—to pre-register contact AA4MY at 919-847-8512.)

Apr. 14, **Aurora Repeater Assn. 14th Annual Swapfest**, Adams County Fairgrounds, Brighton, Colorado. For additional information, contact Judi, WDØHNP, at 303-450-6910; or Jan, KA7TYU, at 303-699-1944; or write to Aurora Repeater Assn., P.O. Box 39666, Denver, CO 80239.

Apr. 14, **AK-SAR-BEN ARC Annual Spring Auction**, Millard Social Hall, Omaha, Nebraska. For information, contact Todd LeMense, KGØEJ, 3603 South 89th Street, Omaha, NE 68124 (402-397-7465).

Apr. 19–21, **1996 International DX Convention**, Holiday Inn, Visalia, California. Contact Rick Samoian, WB6OKK, 714-993-0713, for more information.

Apr. 20, **Muskegon County Hamfest, Amateur Radio & Computer Show**, Mona Shores High School, Muskegon, Michigan. For more information, call 616-755-4864. (Exams.)

Apr. 20, **Georgia CGARC Hamfest**, Warner Robins Fairgrounds, Warner Robins, Georgia. For information, call or write Hamfest, c/o Jack, KC4YBI, 412 Todd Circle, Warner Robins, GA 31088 (912-923-5395).

Apr. 20, **Belton, Texas Ham Expo–Tailgate**, Bell County Expo Center, Belton, Texas. Contact Mike, WA5EQQ, at phone 817-773-3590; e-mail: mlefan@vvm.com; expo netpage http://www.vvm.com/laird/hamexpo.html (Indoor tail-gating, spaces available at the door.) (Handicapped accessible.)

Apr. 20, **Gastonia, North Carolina Hamfest**, Karyae Park, Gastonia, NC. Dealers contact Mike, N4AYO, 704-922-3593 evenings. General info contact Bill, WB4TSW, 704-732-1005 or fax 704-434-5832.

Apr. 21, **The Valley of the Moon ARC ARRL Hamfest**, Sonoma Veteran's Memorial Bldg., Sonoma, California. For more information, call Darrel, WD6BOR, 707-996-4494. (Exams.)

Apr. 21, **Moultrie Amateur Radio Klub 34th Annual Hamfest**, Moultrie/Douglas County Fairgrounds, Arthur, Illinois. For information write to M.A.R.K., P.O. Box 91, Lovington, IL 61937, or call for information daytime 217-543-2178 and evenings 217-873-5287.

Apr. 21, **37th Blossomland Blast Hamfest**, St. Joe Kickers Sports Club, St. Joseph, Michigan. For more information, write BARA, 1051 Main St., St. Joseph, MI 49085 (616-982-0404). (Handicapped accessible; exams.)

Apr. 27, **Third Annual SMARTSFEST**, Canterbury Downs, Shakopee, Minnesota. For general information, call Dave, 612-445-8071; for table information call Tim, 612-474-9232.

Apr. 27, **Syracuse Hamfest**, New York State Fairgrounds, Syracuse, New York. For more information, contact Larry Taft, AA2KK, 315-668-8219; or write to LARC Hamfest, P.O. Box 103, N. Syracuse, NY 13212. (Exams.)

Apr. 27, **Amateur Electronics Swapfest**, National Guard Armory, South Dakota State Fairgrounds, Huron, South Dakota. Contact Lloyd Timperley, WBØULX, P.O. Box 205, Huron, SD 57350 (605-352-7896). (Exams.)

Apr. 27, **Albuquerque Tailgate Swapfest & Fleamarket**, St. Paul's United Methodist Church, Albuquerque, New Mexico. Contact Chuck Opdyke, KC5GA, 505-858-0306.

Apr. 27, **L.A.R.C. Spring Break Hamfest '96**, New York State Fairgrounds, Syracuse, New York. Contact Tom Delasin, N2OYN, 4172A Burning Tree Rd., Liverpool, NY 13090 (315-622-1046). (Handicapped accessible; exams).

Apr. 28, **Northwest Jersey Hamfest**, Budd Lake Firehouse, Route 46, Budd Lake, New Jersey. For info call 201-584-6550 (days); 201-770-0242 (eves.).

Apr. 28, **ACARA 17th Annual Hamfest**, at the City Recreation Center, Athens, Ohio. Write to Carl J. Denbow, KA8JXG, 63 Morris Ave., Athens, OH 45701-1939; or via the internet: cdenbow1@ohiou.edu; or via packet: KA8JXG@KA8DRR.OH.US.NA.

Apr. 28, **S.E.M.A.R.A 34th Annual Hamfest, Swap-n-Shop, and Computer Show**, Grosse Pointe North High School, Grosse Pointe Woods, Michigan. Contact Thomas J. Orlicki, N8HLY, P.O. Box 646, St. Clair Shores, MI 48080-0646 (313-527-3497); or e-mail STOSH@NVISION.COM. (Exams.)

Apr. 28, **Mount Beacon Hamfest**, Arlington Senior High School North Campus, Poughkeepsie, New York. For information, contact Ken Akasofu, KL7JCQ, 316 Titusville Rd., Apt. 4, Poughkeepsie, NY 12603-2944 (phone 914-485-9617; fax 914-485-2402). (Exams.)

Apr. 28, **Chicago ARC Ham Auction**, DeVry Institute of Technology, Chicago, Illinois. Bring electronic stuff, equipment, books, etc., before noon. They will sell it for you for 10% donation. For more information, call 312-545-3622.

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A carefully designed Pi/Pi-L output network using the optimum Q for each band gives you exceptionally smooth tuning, extremely wide matching range, full band coverage and peak performance at all power levels.

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Step-Start Inrush Protection™ stops damaging inrush current with a start up sequence that's *easy* on your tube and power supply components.

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Ameritron's exclusive *Multi-Voltage Power Transformer* lets you optimize for different line voltage. You can select from 14 different *primary* voltages from 90 to 140 VAC and 205 to 250 VAC.

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Ameritron's dual illuminated cross-needle meters give you *four separate meters* to monitor your operating conditions -- you can tell right away if something is wrong.

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The fast *custom* T/R (transmit/receive) relay in the AL-80B switches nearly as fast as some vacuum relay QSK T/R switches.

For *lightning fast* QSK operation use the optional external Ameritron *electronic PIN diode* QSK-5 T/R switch or the internal QSK-5PC. Please contact Ameritron for details.

Plus more . . .

An *Standby* switch lets you run barefoot, but you can instantly switch to full power if you need it.

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AMERITRON offers the best selection of legal limit linears!

These 3 rugged linears all use a super heavy duty hypersil power supply capable of 2500 watts!

Ameritron's most powerful amplifier

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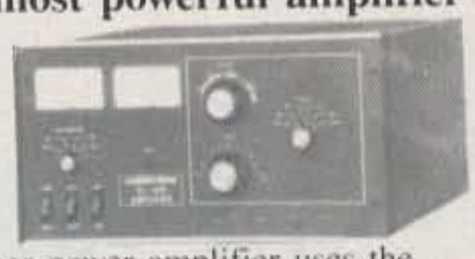

Ameritron super power amplifier uses the herculean Eimac® 8877 ceramic tube.

It's so powerful that 65 watts drive gives you full legal output—and it's just loafing because the power supply is capable of 2500 watts PEP.

Ameritron's Dual 3-500Z linear

AL-82 **$2095.00** Suggested Retail

This linear gives you full legal output using a pair of Eimac® 3-500Zs. Some competing linears using dual 3-500Zs don't give you 1500 watts because their lightweight power supplies can't use the tubes to their full potential.

Ameritron's 3CX1200A7 linear

AL-1200 **$2195.00** Suggested Retail

Get ham radio's toughest tube with the Ameritron AL-1200—the Eimac 3CX1200A7. It has a 50 watt control grid dissipation—12 times tougher than the 4 watt rating of the 3CX800A7—yet you get the same full legal output as you get from a *pair* of 3CX800A7s.

AMERITRON brings you the finest high power accessories!

Legal limit antenna tuner

ATR-15 **$399** Suggested Retail

Ameritron — *the high power specialist* — brings you the ATR-15 antenna tuner that's designed for legal limit amplifiers. Heavy duty silver plated bandswitch virtually eliminates switch failure. High power transmitting capacitors. 1.8-30 MHz. Peak reading SWR/wattmeter. 6 position antenna switch. Selectable 1:1 or 4:1 balun. 5¼ x 13¼ x 13½ inches. Meter lamps uses 12 VDC.

Legal Limit Dummy Load

Oil cooled 50 ohm dummy load. Handle 1500 W for 5 min. SWR under 1.2 up to 30 MHz. Low SWR to 400 MHz. 7½" H x 6 5/8" D. **ADL-1500X** without oil, $39.95. **ADL-1500** with oil, $59.95

ADL-1500X **$39.50** Suggested Retail

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RCS-8V **$149** Suggested Retail

RCS-8V, DC-UHF 5 KW Coax Switch. Replace 5 coax feedlines with one with this Remote Coax switch. Weatherproof box mounts outdoors on your tower or mast. Attractive control unit sits on your operating desk. Low SWR to 250 MHz. Usable to 450 MHz. Low loss. Rated at 5 KW to 30 MHz, 1 KW at 150 MHz. **RCS-8VN, $159.00** with "N" connectors.

RCS-4, $134.00, 4 position HF switch. Similar to RCS-8V. No control cable needed. Handles 1500 watts continuous.

RCS-4 **$134.50** Suggested Retail

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$349 QSK-5 Suggested Retail

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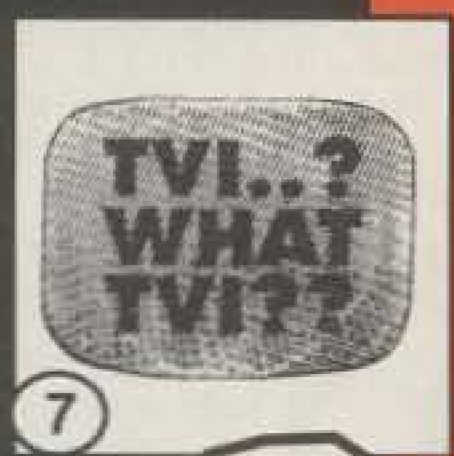

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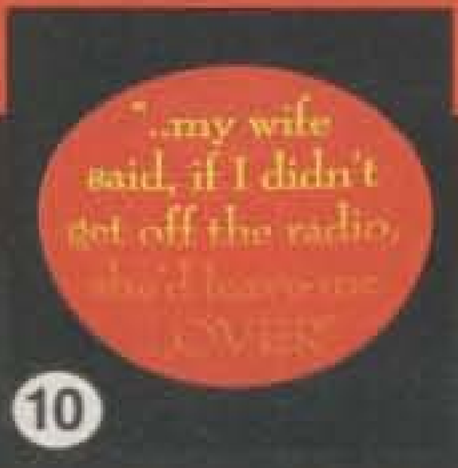

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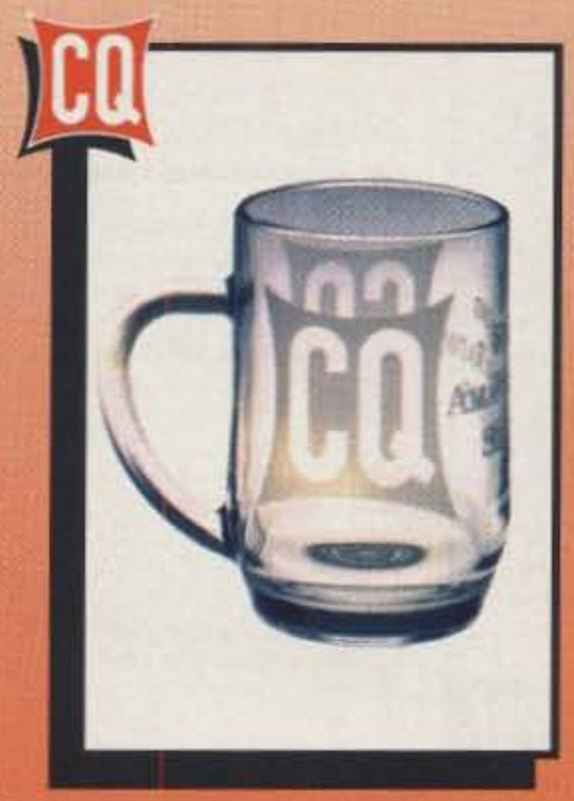

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WANTED: Schematic, voltages, alignment data, WWII HT BC-611-C or similar. Albert Ayling, Boissel, 81600 Gaillac, France.

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SX88 Hallicrafters receiver wanted. Jim, W6OU, 714-528-5652.

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(continued on page 123)

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CQ SHOWCASE *(from page 60)*

optimum gain and wide-area coverage from a repeater or home station.

For more information, contact Cushcraft Corporation, P.O. Box 4680, 48 Perimeter Rd., Manchester, NH 03108 (phone 603-627-7877; fax 603-627-1764; telex 4949472), or circle number 105 on the reader service card.

AVCOM SPA-20A Portable Analyzer And Polarotor Control Box

AVCOM of Virginia, Inc. has a portable spectrum analyzer, model SPA-20A. The analyzer turns any TV into a 950–2050 MHz spectrum analyzer. The SPA-20A allows the satellite system owner to find and identify satellite downlink signals, maximize antenna performance, and troubleshoot system failures. The SPA-20A connects to an existing TVRO system just like a VCR. The Model SPA-20A is available in the U.S. for $389.

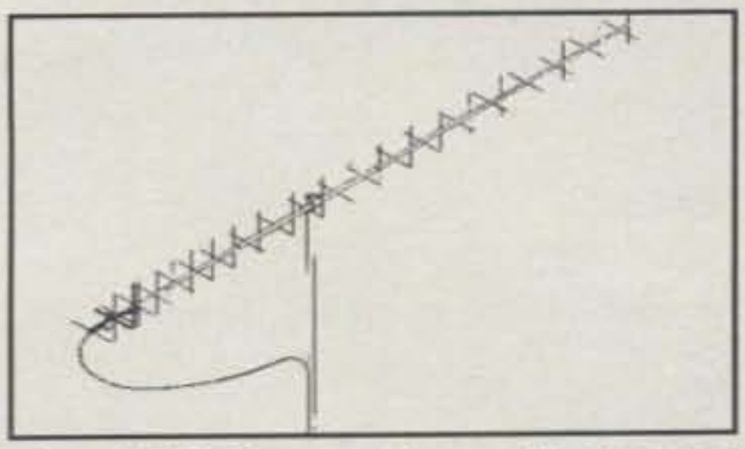
The polarotor servo motor control box, model PRC-1, is a self-contained, battery-powered, microprocessor-based controller that can control servo actuated feedhorns. Vertical and horizontal settings are quickly stored and recalled. The unit is suited to TVRO installers and can be used in conjunction with AVCOM's PSA-37D, PSA-35A, or SPA-20A. The PRC-1 is available in the US for $149.

For more information, contact AVCOM of Virginia, Inc., 500 Southlake Blvd., Richmond, VA 23236 (phone 804-794-2500, fax 804-794-8284), or circle number 108 on the reader service card.

M² 436CP42 U/G Circular Polarized Yagi

The 436CP42 U/G from M² is a new ultra-gain, circular polarized antenna with coverage from 430 to 440 MHz. As part of the ultimate satellite package, its 18 ft. 10 in. boom is the crossboom partner for M²'s 2 meter circular, the 2MCP22. The CP42 is also suited for terrestrial applications such as ATV, repeater operation, and long-haul tropo DX. The antenna is constructed of CNC machined feed components, O-ring sealed connectors, and stainless-steel assembly hardware. Wind survival rating is 100 MPH. Connections inside the machined blocks are embedded in a space-age silicone gel that seals out moisture and improves power handling. The parasitic 3/16 inch 6061-T6 rod elements are centered in the boom to minimize interaction and ellipticity. Insulators are UV stabilized and locked in place with stainless retainers. The central boom section is 1½ inch diameter, tapering front and rear, through 1¼ inch sections to 1 inch tips.

The 436CP42 U/G has a suggested retail



price of $269. For complete specifications and a catalog of M² Products, contact M² Antenna Systems, Inc., 7560 N. Del Mar Avenue, Fresno, CA 93711 (phone 209-432-8873; fax 432-3059), or circle number 106 on the reader service card.

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Whether you're mountain climbing in the Sierras or bicycling across the U.S., as an amateur you not only expect maximum performance from your antenna, you demand it. And no other dual band antenna on the market can out perform Larsen's portable Kūlduckies.™

With an outstanding transmit range and durable construction, our portable antennas offer superb performance for dual band handheld radios. Larsen's Kūlduckie antennas operate as a 1/4 wave at UHF and a loaded 1/4 wave at VHF. Construction elements include a brass wound steel flexible core radiating element. And our loading coils are housed in sturdy polycarbonate plastic for greater durability.

Our KD3 2/70 and KD4 2/70 are designed to provide excellent performance for simultaneous use of VHF and UHF frequencies. Frequency range is 144-148 MHz on VHF and 440-450 MHz on UHF. And each is factory preset to guarantee optimal performance with no tuning required.

KD3 2/70, KD4 2/70

Frequency	144-148/442-448
Electrical	Loaded 1/4 wave at VHF and 1/4 wave at UHF
Impedance	50 ohms
Gain	Unity
VSWR	1.5:1 or less
Power	25 watts
Connector	KD3 2/70 TNC Male KD4 2/70 BNC Male

For performance you can count on, call Larsen toll free at 800-426-1656 (USA) or 800-663-6734 (Canada). Larsen®

NEW
Dual Band HT

Dual Band Handheld FT-51R

Only one Dial/Volume knob required for easier use.

The First Dual Band HT with WINDOWS!

Three dual receive configurations VHF/VHF, UHF/UHF, or VHF/UHF with main band frequency on right or left side. Flexible programming allows transmit on main or sub band.

An 8 character alpha-numeric user help menu scrolls operation instructions in the bottom of the large, backlit display.

Digital battery voltage readout displays condition of battery in use. Scan skip function allows individual memory channel lock-out during scanning mode.

Spectrascope™ displays active adjacent frequencies in real time with relative signal strength.

MH-29A2B
LCD Display Mic with Remote Functions. (Optional)

FT-51R
2¼"W x 4¾"H x 1⅛"D
(2 Watt version shown.)

Specifications

- Frequency Coverage
  VHF RX: 110-180 MHz
  TX: 144-148 MHz
  UHF RX: 420-470 MHz
  TX: 430-450 MHz
- Spectrascope™ Display
- Scrolling User Help Menu
- Alpha-Numeric 8 Character Display
- Up/Down Volume/Squelch Controls & Display
- Selectable Sub-Band TX Mute
- Automatic Tone Search (ATS)
- Digital Battery Voltage Display
- AM Aircraft Receive
- Scanning Light System (SLS)
- 120 Memory Channels (80 w/Alpha-Numeric)
- Large Backlit Keypad & Display
- Automatic Repeater Shift (ARS)
- Multiple Scanning Modes
- 3 Selectable Scan Stop Modes with Scan Skip
- Selectable 6-way Lock Functions
- Automatic Power Off (APO)
- TX/RX Battery Savers Built-in
- Handy Cloning Feature
- 5 Selectable Power Output Levels
- 5 Watt and 2 Watt versions
- Selectable RX Smart Mute™
- Cross-Band & One-Way Repeat Functions
- DTMF Paging/Coded Squelch Built-in

Accessories
Consult your local dealer.

The new FT-51R Dual Band HT is state-of-the-art, and easy to use! So easy, you won't need an operating manual. Its exclusive, scrolling instruction menu located in the large, backlit display "window", guides you through total operation while simultaneously viewing the main display window.

You'll like some of the other new, exclusive features, too. Like Spectrascope.™ This unique feature displays real time, continuous scanning of activity on adjacent frequencies in VFO mode or 8 of your favorite memories. A cloning feature duplicates favorite channels to another FT-51R.

A digital battery voltage display, five power output levels, the largest backlit dual band HT keypad made, Smart Mute,™ two VFOs on both VHF and UHF, as well as available 2 Watt and 5 Watt versions, round out the exciting FT-51R. Plus, the optional MH-29A2B Display Microphone allows you to control volume and also access Memory, VFO, Call Channel, Band Selection and scanning functions. All of this in world's smallest dual band HT radio!

See the FT-51R with "windows" at your Yaesu dealer today!

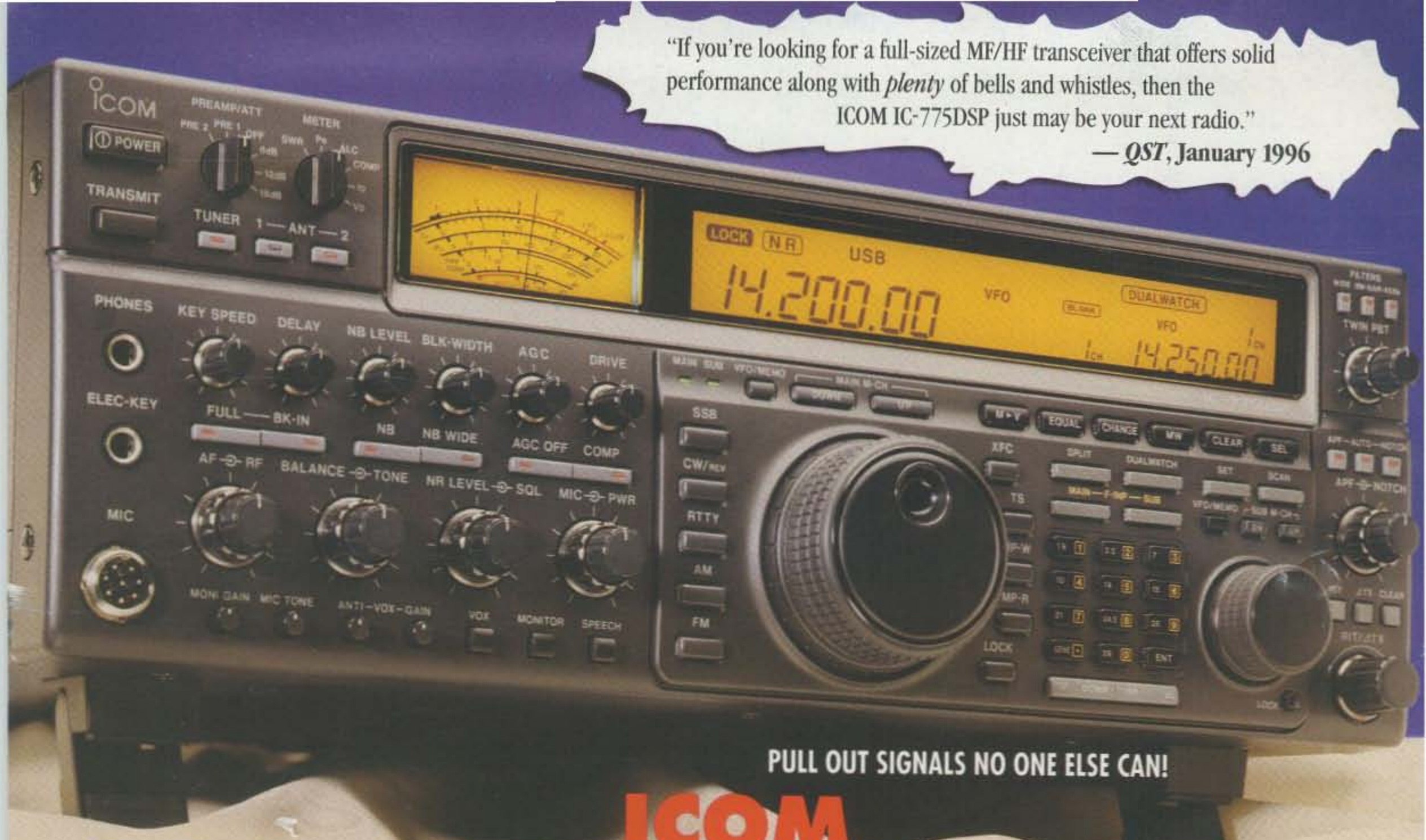
"I can see two frequencies and alpha-numeric all at the same time."

"Scrolling instructions tell me what to do next!"

"I use the Spectrascope to find new contacts faster."

"Yaesu did it again!"

YAESU
Performance without compromise.℠



"If you're looking for a full-sized MF/HF transceiver that offers solid performance along with *plenty* of bells and whistles, then the ICOM IC-775DSP just may be your next radio."

— ***QST*, January 1996**

PULL OUT SIGNALS NO ONE ELSE CAN!

ICOM IC-775 if-dsp

REVOLUTIONARY IF-DSP TECHNOLOGY ON TRANSMIT AND RECEIVE!

UNSURPASSED SIGNAL QUALITY!

Features you've only dreamed of:

- ICOM DSP on Transmit and Receive
- Noise Reduction/Auto Notch
- Twin Pass Band Tuning
- Dual Receive
- 200W MOS FET PA with built-in Power Supply
- Digital Noise Reduction:
  - Digital Low and High Pass Filters
  - Digital Modulation/Demodulation
  - Digital Automatic Notch
  - Digital Ultra-Narrow CW Filter
  - Digital Automatic APF (Audio Peak Filter)
- Rx 100 kHh -29.990 MHz
- New Single Crystal Control DDS
- RTTY/DATA Mode
- HF Packet Ready
- IF Notch
- APF (Audio Peak Filter)
- Quick-Split Function
- Memory CW Keyer
- CW Pitch Control & CW Reverse Mode
- Two CW Key Jacks
- 1Hz Tuning and Display
- Large LCD with new CFL Back Light
- Built-In Automatic Antenna Tuner
- Dual Antenna System
- Selectable Pre-Amp (2 Levels) and RF Attenuator (3 Levels)
- Triple Band Stacking Register
- Built-In Tone Encoder
- VOX
- 99 Memory Channels
- XFC
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- AGC with Adjustable Time Constant
- RF Speech Compressor
- Optional SSB filters
- Optional Speech Synthesizer

General, Advanced & Extra Class Hams Only!

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