Including Ham Radio Fun!

NOVEMBER 1996
ISSUE #434
USA $3.95
CANADA $4.95

International Edition

73® Amateur Radio Today

NSD's Demise Exaggerated:

See Page 4...

World's Tallest Mobile Antenna!

Magical Audio Filter

Top-Loaded 2m Vertical

Power Supplies-Antennas-Etc.

0 74851 08725 1 11>

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

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

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

★ JST-145 COMING SOON ★

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

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

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

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

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

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

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

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

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

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

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

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

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

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

JRC *Japan Radio Co., Ltd.*

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

CIRCLE 159 ON READER SERVICE CARD

Finally – A Professional-Quality Receiver to Monitor Weather Broadcasts!

NEW **Our new RWX is a very sensitive and selective Hamtronics® grade receiver to monitor critical NOAA weather broadcasts.**

Excellent 0.15µV sensitivity provides good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast.

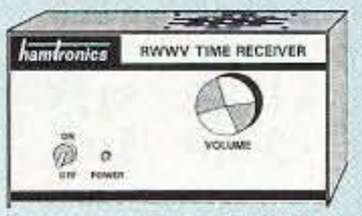
Essential for airports, police and fire departments, CAP, broadcast stations, state and local emergency managers, amateur repeaters – anyone needing a professional quality receiver. Because of its reasonable price, it is also handy for bikers, hikers, boaters, hunters, farmers – or anyone who needs up-to-date weather info and emergency warnings, even from distant stations.

Small enough for emergency or portable use, it can even be powered from a small 9-12V battery when needed. Crystal controlled for accuracy; **all 7 channels provided** (162.40 to 162.55).

You can buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only $79
- RWX Rcvr kit with cabinet, speaker, & AC adapter $99
- RWX Rcvr wired/tested in cabinet with speaker & adapter $139

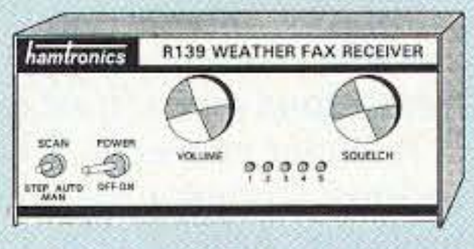
WWV RECEIVER



NEW Get time and frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

- **RWWV Rcvr** kit, PCB only **$59**
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter **$89**
- **RWWV Rcvr** w/t in cabt with spkr & adapter **$129**

WEATHER FAX RECEIVER



Join the fun. Get striking images directly from the weather satellites! A very sensitive wideband fm receiver **optimized for reception of NOAA APT and Russian Meteor weather fax** images on the 137 MHz band.

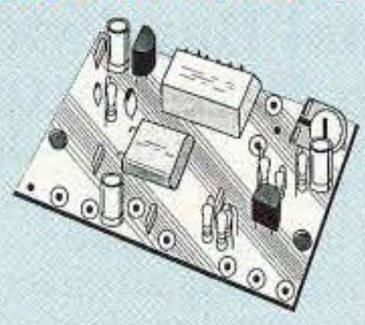
The R139 is lower cost and easier to maintain than synthesized units. And it is designed from the ground up for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all five satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and AC power adapter $189
- **R139 Receiver w/t** in case with AC power adapter $239
- Internal PC Demodulator Board and Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SUBAUDIBLE TONE ENCODER/DECODER

NEW **Access all your favorite closed repeaters with TD-5 CTCSS Encoder/Decoder**

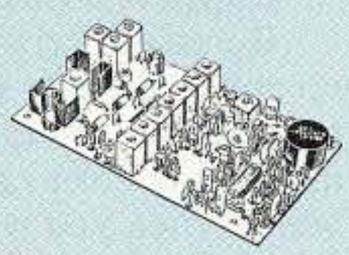


Encodes all standard subaudible tones with crystal accuracy and convenient DIP switch selection. Comprehensive manual also shows how you can set up a front panel switch to select between tones for several repeaters. Receiver **decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver.

- **TD-5** CTCSS Encoder/Decoder Kit ..... only **$39**
- **TD-5** CTCSS Encoder/Decoder Wired/tested **$59**

HIGH QUALITY VHF & UHF FM XMTR AND RCVR MODULES

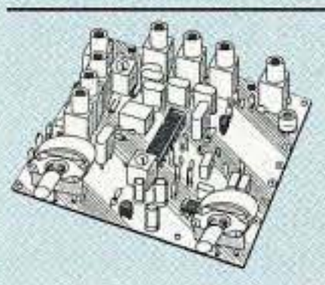
FM EXCITERS: 2W output, continuous duty.



- **TA51:** for 6M, 2M, 220 MHz .. **kit $99, w/t $169.**
- **TA451:** for 420-475 MHz. ..... **kit $99, w/t $169.**
- **TA901:** for 902-928 MHz, (0.5W **out)**.....**w/t $169.**

VHF & UHF POWER AMPLIFIERS.

Output levels from 10W to 100W **Starting at $99.**



FM RECEIVERS:

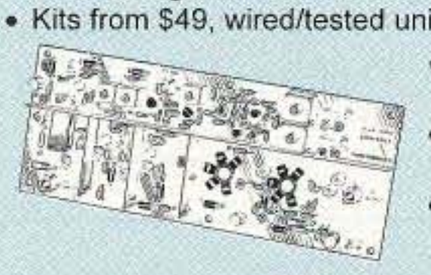
- **R100 VHF FM RECEIVERS** Very sensitive – 0.15µV. Superb selectivity – both crystal and ceramic IF filters, >100 dB down at ±12kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. ..... **kit $129, w/t $189**
- **R144/R220 RCVRS.** Like R100, for 2M or 220 MHz, with helical resonator in front end.....**kit $159, w/t $219**
- **R451 FM RCVR,** for 420-475 MHz. Similar to R100 above. .....**kit $129, w/t $189**
- **R901 FM RCVR,** 902-928MHz ..... **$159, w/t $219**

TRANSMITTING AND RECEIVING CONVERTERS

Go on a ham satellite adventure! Add another band for the next contest. Thrill in the excitement of building your own gear, and save a bundle.

No need to spend thousands on new transceivers for each band!

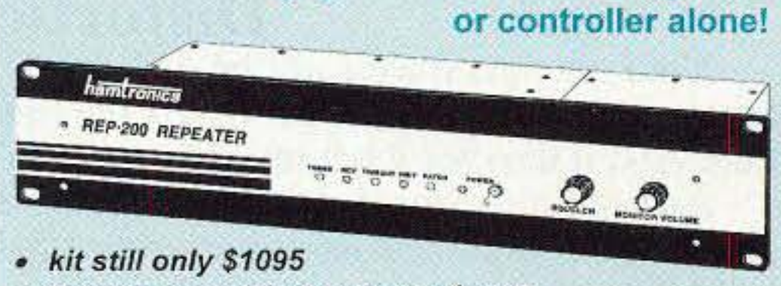
- Convert vhf and uhf signals to/from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Kits from $49, wired/tested units only $99.



- Xmitting converters (at left) for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

Get more features for your dollar with our REP-200 REPEATER

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



- ***kit still only $1095***
- ***factory assembled still only $1295***

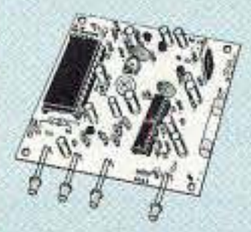
50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.) **FCC type accepted** for commercial service in 150 & 450 MHz bands.

Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** ..... only $100.

REP-200C Economy Repeater. **Real-voice ID**, no dtmf or autopatch. ..... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. ..... Kit only $695, w&t $995.

You'll KICK Yourself If You Build a Repeater Without Checking Out Our Catalog First!



Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ..... **only $49/kit, $79 w/t**

CWID. Traditional diode matrix ID'er. ..... **kit only $59**

CWID-2. Eprom-controlled ID'er. ... **only $54/kit, $79 w/t**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ..... **$59/kit, $99 w/t**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ..... **only $99/kit, $149 w/t**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. ..... **kit only $99, w/t only $149**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ..... **$379 w/t**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ..... **kit $89**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you. .. **kit $49**

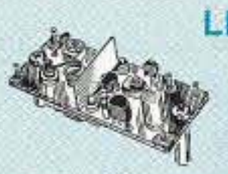
LOW NOISE RECEIVER PREAMPS

LNG-( ) G_AA_S FET PREAMPS

STILL ONLY $59!

- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

LNW-( ) ECONOMY PREAMPS



ONLY $29 kit, $44 wired/tested

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

- **Buy at low, factory-direct net prices and save!**
- **For complete info, call or write for free catalog.**
- **Order by mail, fax, or phone** (9-12 AM, 1-5 PM eastern time).
- **Min. $5 S&H charge** for first pound plus add'l weight & insurance.
- **Use VISA, Mastercard, Discover, check, or UPS C.O.D.**

See last month's ad for more products

Our 34th Year!

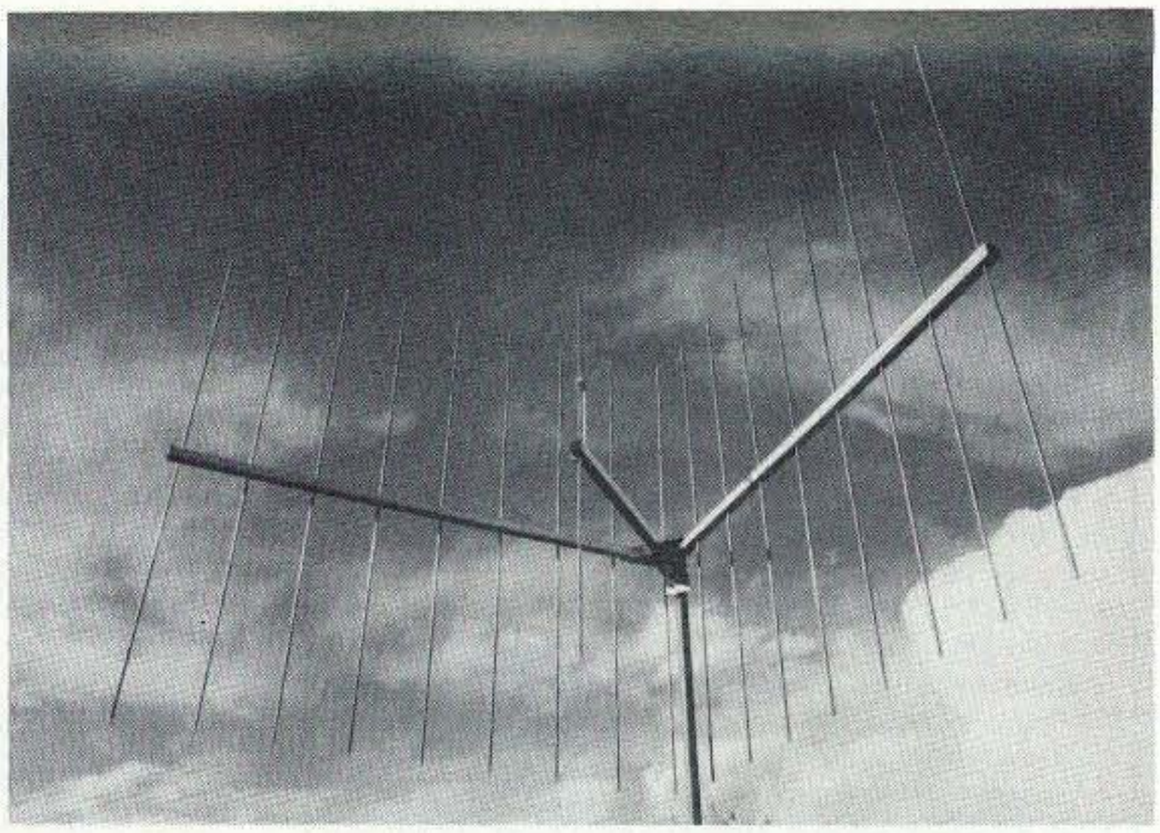
hamtronics, inc.

65-D Moul Rd; Hilton NY 14468-9535

Phone 716-392-9430 (fax 9420)

Corner Beam?

Big Forward Gain
Wide Backward Rejection
Exceptional Bandwidth
Distortion Free Pattern



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

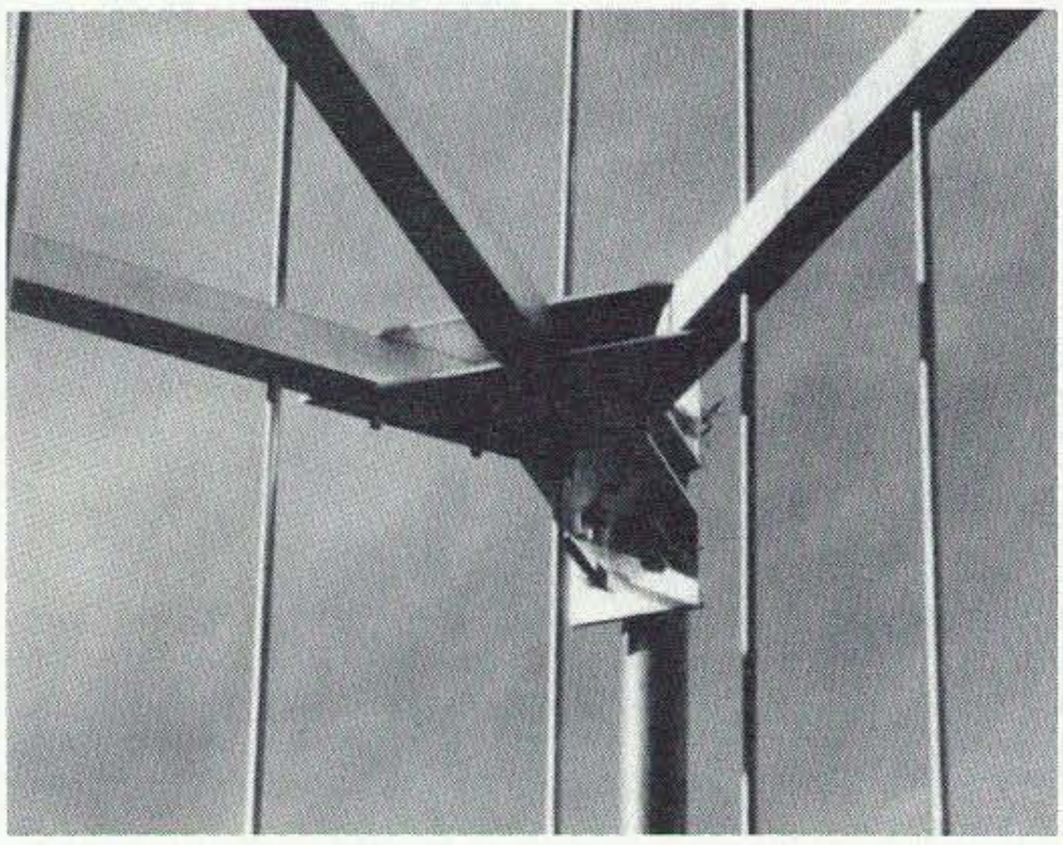
An omnidirectional antenna radiates uniformly in all direction, and it also hears noise and interference from every direction.

A directional antenna not only sends your signal where you want, it hears the signal it's pointed at, rejecting others. It also lets you operate with minimal power, cutting interference you inflict on other stations.

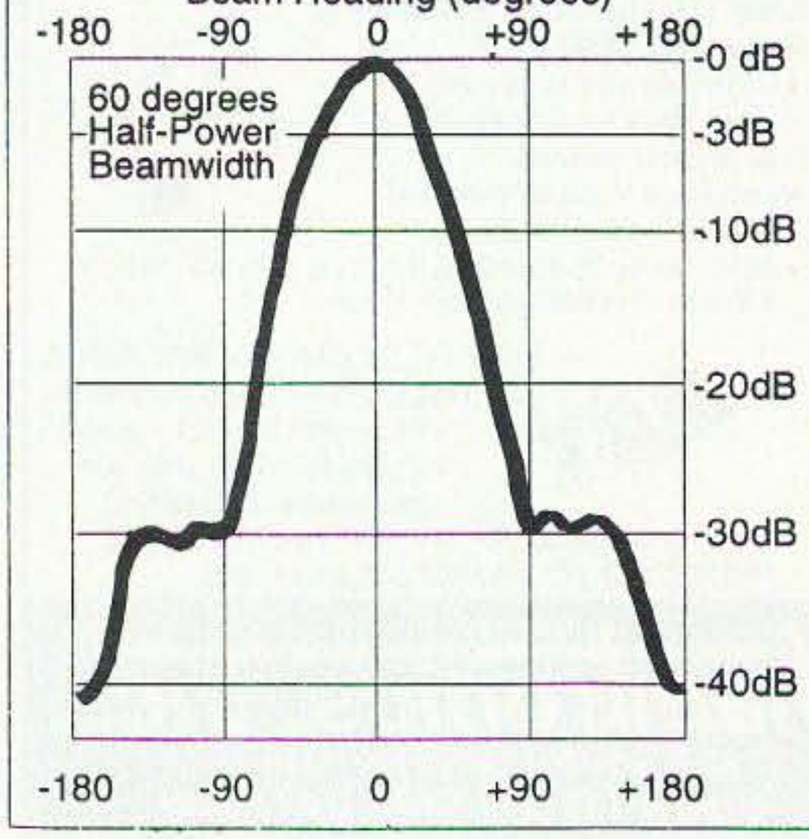
CornerBeam's clean sharp pattern without sidelobes or spikes reaches past the noise and interference to get the message through. Its wide rear rejection lets you null out strong nearby signals to reduce interference.

Look what CornerBeam does:

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



Measured CornerBeam Pattern



Corner Beats Yagi

A yagi with the same gain would have a 10-ft boom. Yagi bandwidth would be less than half. More important, CornerBeam produces no side lobes, no back lobes.

Improved Data Communication

Because CornerBeam's pattern has no unwanted side spikes, phase noise is reduced to a minimum. The result is reduced data error rate, faster packet circuits. When you want a distortion free signal, think CornerBeam, not yagi.

CornerBeam for Repeaters

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

Bandwidth Pays Off

With its exceptional bandwidth, your CornerBeam can be put to work right out of the box without special tweaking. It can serve you now when you're working repeaters with an FM handheld, and later when you set out to work satellites or go after small signal DX at 144.2 MHz.

CornerBeam can still be your beam when you join MARS at 143/148 MHz or team up with the sheriff's communications interface team at 158 MHz.

Scanning Too?

CornerBeam's gain & bandwidth extend monitoring range from aircraft to to marine & public service frequencies.■

On the Internet
www.itsnet.com/~radventr

Corner Beam Models

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

Construction: Aircraft aluminum. Booms are square. Elements are solid rod. Stainless hardware included for tower and mast mounting accepts up to 1.5" dia. mast and may be rotated for vertical or horizontal polarization. Connector is SO-239 for VHF, N female for UHF. Dual-Band antenna has separate driven elements, weighs only 10 pounds.

Dimensions given in table are for reflector elements & booms.

Options: Commercial Frequency $45.

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

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

☐ Yes, I want Performance in My Corner!

___Send my CornerBeam: __2m, __220MHz, __70 cm, __Dual 146/435.

___Options: __DualBand Duplexer, __Commercial/Marine. Frequency:_____

Name_____Amt. Enclosed_____

Call_____ Phone_____

Street_____ Unit_____

City_____ State_____Zip_____

AntennasWest
Box 50062-S Provo UT 84605

InfoPak $1

Tech 801 373 8425 Fax 801 373 8426

Order Hotline **800 926 7373**

CIRCLE 57 ON READER SERVICE CARD

THE TEAM

Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
Priscilla Gauvin
Joyce Sawtelle
David Underwood

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister WA5ZIB
Dave Miller NZ9E
Joe Moell KØOV
Carole Perry WB2MGP
Jeffrey Sloman N1EWO

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan
Helen Senechal

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA by
Quad Graphics

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

73 Amateur Radio Today

Including Ham Radio Fun!

NOVEMBER 1996
ISSUE #434

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

REVIEWS

HAM RADIO FUN SECTION

On the cover: Roger Grady K9OPO readies the ATV ground station to track the WindTrax balloon flight (see page 46). Photo by Bill Brown WB8ELK.

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

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107.

The entire contents ©1996 by 73 Magazine. No part of this publication may be reproduced without written permission of the publisher, which is not all that difficult to get.

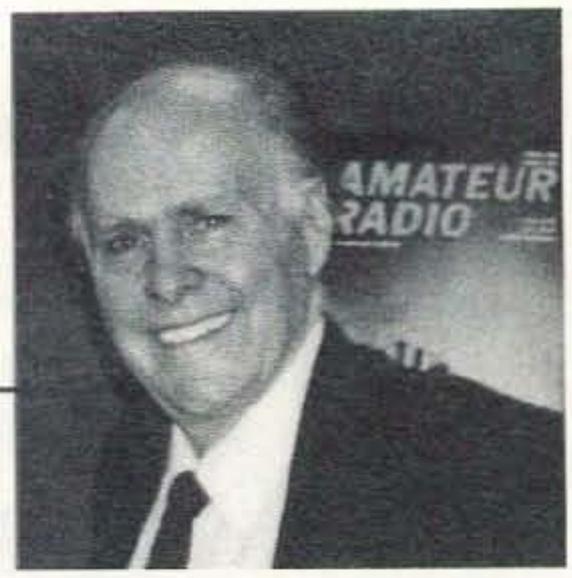
The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: Reading this constitutes your agreement to, within a fortnight, share with at least one non-amateur the thrill of your first days as a ham. Or, if you aren't yet a ham, find one to share his/her story with you. It's contagious.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Tampa: November 23rd

Yep, controversial Wayne Green speaketh! Come see what all the fuss is about. From noon until 2 p.m. at the Tampa Hamfest I'll be talking a blue streak and answering questions. On anything, so come armed. Yes, I'll talk about the possible futures for the hobby. Yes, I'll talk about religious issues such as CW. Yes, I'll talk about the hobby going to hell in a handbasket. Yes, I'll talk about the adventures amateur radio affords, and the excitement that pioneering new modes provides. Yes, I'll explain the secret for making all the money you want. Yes, I'll talk about how you can add at least 20-30 years to your life, if you're interested. These are exciting times, with cold fusion emerging as a new power source, with new discoveries about water, magnetism, health maintenance and repair, the mind and its repair, aliens, UFOs and other ridiculous stuff getting more real as you look into them.

Yes, I'll explain about some of the exciting books you can read to get your mind working again. Did NASA really fake the moon landings or has Wayne been conned by a clever new book? Have there really been highly advanced past civilizations? Do you have any understanding of how digital radio and television are going to change things? And how you may be able to benefit in a big way from these changes? There are billions to be made in these emerging technologies. Are you just going to passively watch it all happen, or will you get in there and help?

Bill Gates was there first with microcomputer software. Steve Jobs was there first with a single-board computer. They've done fairly well as a result. They saw opportunities and actually did something about them. Motivation. Determination. Perseverance. Never Say Die! Okay?

Hey, don't forget to have lunch early so I won't have to listen to your stomachs growling. Besides, that'll help me put you to sleep.

An Engineer Shortage?

Between an article in the *L.A. Times* and a recent PBS show, my contention that there is a desperate need for engineers has been confirmed. The *Times* article went into detail on the lengths some companies are having to go in their search for engineers. Like the California company that heard about an engineering department in Florida being downsized. They hired the engineers, setting up an office for them in Boca Raton so they wouldn't have to relocate. They then set up a communications system so they could be in close touch with the home office.

Well, we know that more and more software firms are farming out their work on contract to companies in India and Pakistan.

More and more Silicon Valley firms are hiring Chinese. Indeed, some have whole Chinese departments, where many meetings are conducted in Chinese. That makes sense since Asians, on the average, have about a 10-point IQ advantage (yes, they're smarter than us), plus they have an incredibly strong work ethic, something we've managed to virtually eliminate in American youngsters. And the US, compared to life in China, is a golden land of opportunity where hard work and skills pay off.

My proposal is to use amateur radio as a way to interest our kids in electronics so we'll have more American engineers, technicians and scientists in the next century. Alas, few kids today even know amateur radio exists. Our ham clubs, with few exceptions, are making little effort to generate more hams. Does your club get announcements of meetings and other activities listed in the local papers? Has your club made an effort to sponsor radio clubs in local schools? Has your club donated ham magazine subscriptions to local school libraries?

When I got interested in amateur radio the first place I went to was the school library. There I found a really great magazine, *Radio*. It got me fired up to start building ham equipment.

When I give talks to kids in the 5th and 6th grades they get all excited about our hobby. They know about CB, but that's old stuff now. Few have ever even heard about what we're doing. How long are you going to keep ignoring our (your) kids?

Heck, if they start automating our fast food restaurants a whole generation of kids will be unemployed. Hmm, let's see, now if we combined the old Automat system with a microwave for each food slot, customers could get hot sandwiches and stuff without any counter help. And the sandwiches could be precooked and assembled in factories by machines ...

Tech Update

The AIDS cure I described in my February editorial hasn't hit *Time* yet, but it is finally getting published in some medical journals, so the word is starting to get around.

I sent letters to my two senators and representatives in Washington, asking if they were interested in the AIDS cure. One answered, saying I should get in touch with the FDA if I had a problem. So I wrote to the head of the FDA and to the Health cabinet member. You guessed it, after six months, no answer. I also wrote to the editors of *Time, Newsweek, US News, Forbes, Fortune,* and a few other magazines. No answer from any of them.

Is it that no one of importance reads their mail anymore? I read mine, but then I don't count as a person of importance, except in my own mind.

I see that TNT is going to broadcast a film on Amelia Earhart. Well, they haven't contacted me, and as far as I know, I'm one of the few people alive who knows the inside story of her last trip. Frankly, I'm disappointed in you. I've written about this and you haven't passed the word. So I watched the recent TV program about Amelia blunder around, and ditto the author of the recent Earhart book. Tsk. Hey, she was a spy for the Navy, and I knew it *before* she made her trip, as I've explained.

I've been hoping to get some people in Congress interested in the cold fusion developments. I've had every bit as much success in getting answers on that subject. Things have been moving fast in the cold fusion department. The University of Siena, Italy, demonstrated a nickel-hydrogen system which generated lots of power and kept on doing it for weeks after all input was removed. It didn't stop by itself, they had to stop it. This is particularly interesting in that the reaction has been at relatively high temperatures (around 500°F), so it's a more efficient system. The estimates I've seen are on the order of 300 kilowatts from three grams of nickel. The university has not been forthcoming on their system for initiating the reaction, but from the pictures I've seen it doesn't look very complicated. This is obviously not a chemical reaction.

Cold fusion presents a wonderful opportunity for experimenters. First, it doesn't cost a bundle to experiment in the field. Second, it doesn't take a Ph.D. in chemistry or physics, or anything else, for that matter. This is a whole new field and there are few experts yet. You could be one, if you wanted. Third, all of the research in this field so far has been empirical, which means everyone involved is trying this and that, and seeing what works and what doesn't.

Pons and Fleischmann got started with this because they'd run across an anomaly that

Continued on page 9

RAMSEY

Synthesized FM Stereo Transmitter

Microprocessor controlled for easy freq programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit $129.95

Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit..... $34.95
CFM, Matching Case and Antenna Set..... $14.95

RF Power Booster Amplifier

Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit..... $39.95
CLPA, Matching Case Set for LPA-1 Kit..... $14.95
LPA-1WT, Fully Wired LPA-1 with Case $99.95

Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to108 MHz. 7/8"w x 3/8"h x 3/4"h.

FM-5 Micro FM Wireless Mike Kit..... $19.95

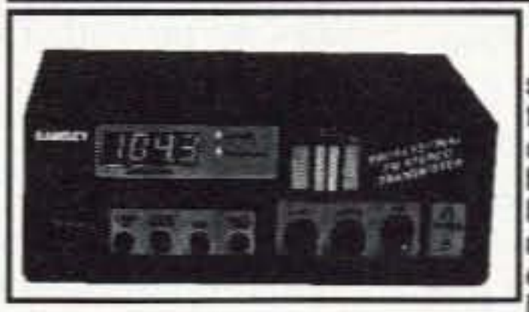
Crystal Controlled Wireless Mike

Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condensor mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and loose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit..... $39.95
FM-6WT Fully Wired FM-6 ..... $69.95

Call for our Free Catalog !

Super Pro FM Stereo Radio Transmitter

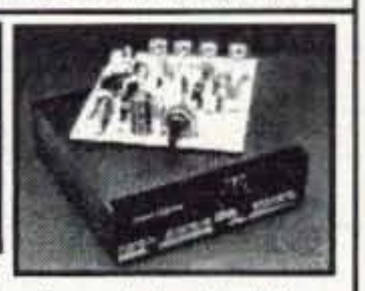


A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes sharp looking metal cabinet, whip antenna and 120 volt AC adapter. Also runs on 12 volts DC.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit $299.95
FM-100WT, Fully Wired High Power FM-100..... $429.95

Speech Descrambler Scrambler



Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. The technology used is known as speech inversion which is compatible with most cordless phones and many police department systems, hook it up to scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC, RCA phono type jacks. Our matching case set adds a super nice professional look to your kit.

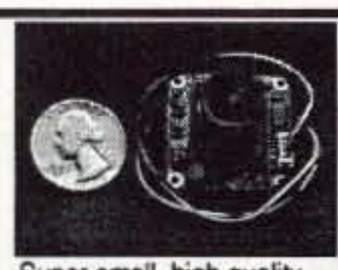
SS-70A, Speech Descrambler/Scrambler Kit..... $39.95
CSS, Custom Matching Case and Knob Set $14.95
SS-70AWT, Fully Wired SS-70A with Case..... $79.95
AC12-5, 12 Volt DC Wall Plug Adapter $9.95

Tone-Grabber Touch Tone Decoder / Reader

Dialed phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit..... $99.95
CTG, Matching Case Set for TG-1 Kit..... $14.95
TG-1WT, Fully Wired Tone Grabber with Case..... $149.95
AC12-5, 12 Volt DC Wall Plug Adapter..... $9.95

Mini-Peeper Micro Video Camera



Super small, high quality fully assembled B & W CCD TV camera the size of an ice cube! Provides excellent pictures in low light (2 lux), or use our IR-1 Infra-Red light source to invisibly illuminate an entire room on a pitch black night! Imagine the possibilities... build it into a smoke detector, wall clock, lamp, book, radio. Exact same camera that's in big buck detective catalogues and stores. Kit includes: fully assembled CCD camera module, connectors, interface PC board kit with proper voltage regulation and filtering, hook-up details, even a mini microphone for sensitive sound! Two models available: Wide Angle Lens 3.6mm/f2, adjustable focus lens, 92 degree view; Pinhole Lens 5.5mm/f4.5, 60 degree view. The Pinhole Lens is physically much flatter and provides even greater depth of focus. The camera itself is 1.2" square. The Wide Angle Lens is about 1" long, Pinhole Lens about 1/2", interface PC board is 1" x 2" and uses RCA jacks for easy hook-up to VCRs, TVs or cable runs. Power required is 9 to 14 VDC @ 150 mA. Resolution: 380 x 350 lines. Instruction manual contains ideas on mounting and disguising the Mini-Peeper along with info on adding one of our TV Transmitter kits (such as the MTV-7 unit below) for wireless transmission!

MP-1, Wide Angle Lens CCD TV Camera Outfit..... $169.95
MP-1PH, Pin-Hole Lens CCD TV Camera Outfit..... $189.95

MicroStation Synthesized UHF TV Transmitter

Now you can be in the same league as James Bond. This transmitter is so small that it can fit into a pack of cigarettes - even including a CCD TV camera and battery! Model airplane enthusiasts put the MTV-7A into airplanes for a dynamite view from the cockpit, and the MTV-7A is the transmitter of choice for balloon launches. Transmitter features synthesized, crystal controlled operation for drift-free transmission of both audio and video on your choice of frequencies: Standard UHF TV Channel 52 (which should only be used outside of the USA to avoid violating FCC rules), and 439.25 MHz or 911.25 MHz which are in the amateur ham bands. The 439.25 MHz unit has the nifty advantage of being able to be received on a regular 'cable-ready' TV set tuned to Cable channel 68, or use our ATV-74 converter and receive it on regular TV channel 3. The 911.25 MHz unit is suited for applications where reception on a regular TV is not desired, an ATV-79 must be used for operation. The MTV-7A's output power is almost 100 mW, so transmitting range is pretty much 'line-of-sight' which can mean many miles! The MTV-7A accepts standard black and white or color video and has its own, on-board, sensitive electret micorphone. The MTV-7A is available in kit form or fully wired and tested. Since the latest in SMT (Surface Mount Technology) is used to provide for the smallest possible size, the kit version is recommended for experienced builders only. Runs on 12 VDC @ 150 mA and includes a regulated power source for a CCD camera.

MTV-7A, UHF TV Channel 52 Transmitter Kit..... $159.95
MTV-7AWT, Fully Wired Channel 52 Transmitter $249.95
MTV-7A4, 439.25 MHz TV Transmitter Kit..... $159.95
MTV-7A4WT, Fully Wired 439.25 MHz Transmitter $249.95
MTV-7A9, 911.25 MHz TV Transmitter Kit..... $179.95
MTV-7A9WT, Fully Wired 911.25 MHz Transmitter $269.95
ATV-74, 439.25 MHz Converter Kit $159.95
ATV-74WT, Fully Wired 439.25 MHz Converter..... $249.95
ATV-79, 911.25 MHz Converter Kit $179.95
ATV-79WT, Fully Wired 911.25 MHz Converter..... $269.95

RAMSEY ELECTRONICS, INC.
793 Canning Parkway
Victor, NY 14564

Order Toll-free: 1-800-446-2295
Sorry, no tech info or order status at this number

Technical Info, Order Status
Call Factory direct: (716) 924-4560

VISA MasterCard DISCOVER

ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $4.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

CIRCLE 34 ON READER SERVICE CARD

LETTERS

From the Ham Shack

Elmer Sinclair KD4JUH. This was prompted by the reading of K9KPM's piece on the May "Ham to Ham" page. Since deciding late in life to get a ham ticket, I have had a fruitless though amusing time looking for the origin of the term "PEP." In explaining it, all references I've found in the amateur radio literature, as well as the answers I've received by raising the question, have reverted to the classical explanation of power using rms values of voltage and current. Some explanations confuse me by carelessly using terms such as "average" when "effective" is meant. The average value of a sinusoidal current is zero; the effective (rms) value is that which will produce the same heating effect in a resistor in the same given time as a DC current of the same value. By deduction, the same is true of a sinusoidal voltage, because V=iR. But i= Q/t, which is a certain charge moving past a given point in a certain time "t"; the standard value of "t" is one second. Furthermore, since power is a function of current, it also has a time component, namely the same one as "i." So what is the meaning of "peak" when used in conjunction with power, as in "PEP"? If it is an event having a time span of less than one second, what is the unit for PEP? If it can be defined with more traditional terms, why don't we?

Troublemaker ... Wayne.

Stephen Early NØSHT. The FCC has been lobbied heavily by a small group of hams who advocate the perpetuation of the Morse code requirements for operators on frequencies below 30 MHz (RR2735). The same group appears to also be upset with the no-code licenses. But without the no-coders the hobby was slowly dying. These new hams are not organized, therefore they have no voice. If the old-timers think the code is so critical, we should have proficiency tests for their license renewal. How about polling the newcomers on the value of the code test?

First, I checked the Callbook to make sure my leg wasn't being pulled by the call. That's a call I'd pay good money for. Look, Stephen, the ARRL is going to do whatever it takes to preserve the code test. The League directors I've known have always said that Novices and Techs aren't really hams, so you can bet their interests are not being considered. A high percentage of the no-coders do not read any ham magazine. Too technical. They aren't interested, by and large, in upgrading. 2m repeaters beats the heck out of CB, and that's that ... Wayne.

Mike Carbaugh WA3HDQ. I've had my ticket since the 10th grade, in 1967. I worked a lot of 6m AM and 2m FM back when 2m was fun. It seems like nowadays each repeater has its own little "group," but I still use an HT in my car during my 52-mile daily commute. I faded away from hamming in the late '70s, but came back when Techs got 10m. I'm using a 40m dipole, thanks to an article in your magazine. I just bought a PK-88 TNC and am looking for a PC. I joined AMSAT and listen to the "birds." The 2m/10m crosslink repeaters are a lot of fun. Try them, if there are any in your area. Clubs should do more for newer hams, and let them do some operating on Field Day, and during contests and special events. And cut down on the business meetings!

On my last 125 10m contacts, 63 were Novice or Tech, 20 were Generals, 24 Advanced, and 18 Extras. Techs seem to have revived activity on the band. I agree with you, and so do many other silent hams: To hell with the code! It's holding many good potential hams back.

If readers will send in a list of the repeaters which offer crossband contacts, I'd love to print a list. Give me the input channel, any coding required, and output crossband frequencies. Back in 1970 my WR1AAB repeater could be toggled to 6m or 10m by users, and it was a ball to use ... Wayne.

Larry Pitt KBØMOT. Wayne, I like your editorials, but I disagree with your comments on the code requirements for the General license. I'm a Tech-Plus, after starting as a no-code Tech. I'll soon be a General. I enjoy the challenge of the code. Don't make the ticket an easy thing to get. I like CW and have purchased a Bencher paddle and top-of-the-line MFJ keyer. I'll bet this letter won't be in the magazine.

You lose! CW is fun and thousands of hams are having a great time using it. But at a time when we are desperate for more hams, the artificial barrier to the hobby could lose everything for us. So let's get in as many newcomers as we can and then sell them on the fun of using the code. You apparently have no problem with the government telling you what to do, whether it makes sense in view of today's technology or not. I am a big fan of small government, and a minimum of it telling us what we have to do. And, other than being a fun mode of communications for us, CW has little else to offer these days. It's as out of date as spark and smoke signals. When I first got on the air in 1938 95% of all ham contacts were via CW. The latest estimates put CW activity at about 5% ... Wayne.

Pete Theiler KI4KN. I always enjoy reading your editorials and, based on your recommendations, I have been reading about the influences of electric and magnetic fields on life processes. Years ago, a friend of mine in Europe used a device that passed a minute electric current (on the order of 50-200 μA) through the body. This was simply a battery, pot, and electrodes. I think it was a commercial device. My friend suffered from fainting spells and other disorders. He swore the device helped him by stimulating his blood circulation and that it also speeded up healing. I had not taken any of this too seriously until I began to read Dr. Becker's *Cross Currents* and decided that there may be something to it. Thanks for your help and keep giving us hell in your editorials; most of us are just too complacent.

Bob Beck's latest claims are that he has over 200 authenti-

CIRCLE 123 ON READER SERVICE CARD

What Can Dual DSPs Do For You?

NIR-12 Dual DSP Noise Reduction Unit
The NIR-12 is the most advanced DSP noise reduction unit available. Unparalleled performance, super-selective FIR filters, fully adjustable center frequency and bandwidth, **both Dynamic Peaking and Spectral Subtraction Noise Reduction**, spectral multi-tone NOTCH filter. All NIR-12 modes are usable simultaneously. Use on all operating modes including AMTOR and PACTOR. Installed between the receiver audio and external speaker. **$349.95**

Eliminate power line noise before it enters the receiver

ANC-4 Antenna Noise Canceller
Eliminates power line noise before it enters the receiver to let you hear signals you did not know were there. Reduces any locally-generated noise typically 50dB. Usable between 100kHz and 80MHz. Noisewhip and wire antenna supplied with each unit. Auto xmit switchover up to 200W. Installed between the antenna and receiver. **$175.00**

JPS Communications Inc.
ORDER LINE: 800.533.3819
http://emporium.turnpike.net/J/JPS/jps.html.

P.O. Box 97757 • Raleigh NC 27624-7757 • USA
Tech Line: 919.790.1048
Fax: 919.790.1456
Email: jps@nando.net

cated AIDS cures, with no known failures so far. But is this enough to interest AIDS activists? No, let's budget a few more hundreds of millions of government money into research for a drug cure ... Wayne.

Ken Young KD4WXW. I have been reading your editorials for a year or so and agree with many of your ideas and suggestions. I'm 15 and have had my license for several years now, but my friends in high school don't really understand anything about our hobby. Last year I decided to start a radio club for my high school and I've managed to get several members. I now have the respect of my classmates and teachers. Do you have any ideas to help attract attention to the club and help build its growth? I love your magazine, especially the antenna construction articles and editorials. Keep it up.

Thanks, Ken, and of course I have ideas on how to build the club. #1 is promotion, and that means articles, letters, meeting notices, activity reports in the school paper, on the school bulletin board, the local newspaper, TV and radio stations. Your members will do more if they're asked to and it's fun. Get any ham manufacturers or dealers in the area to come and talk. Club meetings are show biz where you get local hams active on packet, satellites, DXing, etc., to come and talk. Keep the business part of the meetings to a maximum of 10 minutes. There, that ought to keep you busy. Report back on progress ... Wayne.

Charles Leggatt VE3CFL. Bringing your readers up to date, May of 1997 will be the 500th anniversary of Giovani Caboto's sail from Bristol, England, to find the lands of the Great Khan. This was two years after Columbus had sailed south and discovered the Caribbean Islands, so it was a time of considerable interest in trying to find a sea route to China and the wealth that its silk trade could bring. There is no written proof of where he actually landed, but Newfoundland claims the honor, so that is that.

What is interesting about the area of Newfoundland and Labrador is that 200 years before the Pilgrim fathers set foot in America there was a community of some 1,300 souls who set up a whaling community in Labrador to process whale blubber. After several years, when it became no longer viable, they left, and only their big iron pots are left to remind us of their history. Since no effort was made to plant a flag and claim the land, it remained to be officially discovered.

The British, as you may have heard, have built a replica of Caboto's vessel, *The Matthew*. It has been undergoing sea trials for some months now and seems to be able to take a good bashing without sinking. It will set sail from Bristol, England, in May 1997, its destination Bonavista, Newfoundland. There will be 45 days of celebration with *The Matthew* circumnavigating the island. After that, it will proceed to the U.S.A. for further celebrations. The Cabot family tree extends to the U.S.A., and perhaps the most obvious member is your famous Cabot-Lodge.

What is Canada doing? Well, to start with, Newfoundland has really gone all out to prepare for *The Matthew*'s arrival. The Brits held a wonderful week of festivities in Bristol called The Festival of the Sea. Including Canada, five nations were represented and more than seven hundred vessels from all over the world were huddled in Bristol Harbor. Newfoundland, the Brits told us, had the best contingent of all the countries visiting, and since I was there, I can vouch for their correctness.

In Toronto, just under two years ago, a couple of Toronto sailors, Robert O'Brien of the National Yacht Club and John Dunford from the Mimico Cruising Club (both ex-Newfoundlanders), decided it would be a grand idea to get together a bunch of fellow sailors and sail the 1,900

Continued on page 15

QRX . . .

Caught In the Web

Kenwood Communications Corporation now offers an extensive FTP site that includes many Kenwood service bulletins and application notes dating back to 1975. A complete file directory is available at http://www.kenwood.net, or visit the site directly at ftp://ftp.kenwood.net.

Hams Turn Out In Airline Disaster

Some 125 Hams from the Greater New York City/Long Island vicinity contributed more than 2500 volunteer hours to support recovery operations in the wake of the TWA Flight 800 disaster on July 17.

The New York City Red Cross originally requested communication to Suffolk, which was arranged on UHF, linking Nassau and Suffolk Counties and New York City. A call also went out to Sid Wolen K2LJH, of Azden in New Hyde Park, New York, to supply additional radios, which the company was able to do.

As the situation developed, the Red Cross's mission became feeding the 2000 to 3000 rescue workers at the "crash site" (US Coast Guard Station) and to provide mental health support for the workers and the victims' families. The local telephone company, NYNEX, donated cell phones, but these initially were useless, with 3000 rescue workers and thousands of members of the press severely overloading the local cell. NYNEX set up a high-capacity site the second day, but that had its limitations also.

Ham radio worked, however, and ARES organizations were able to provide communications links between the American Red Cross HQ in Yaphank, New York, the lead Red Cross official at the site, and the Red Cross official at the morgue.

Although the recovery efforts continue, amateur radio support concluded during the last weekend in July.

Walt Wenzel KA2RGI, of the Region IV RACES, offered some lessons learned during the support effort. Among them:

You can't always count on 2m repeaters alone to provide coverage (the Flight 800 recovery effort, in fact, relied on a 70cm repeater).

ECs should keep a database of available equipment that can be loaned to operators who turn out.

Prospective volunteers should be reminded that while duty shifts are usually eight hours, they can often be 10 or 12 hours long. "People have to remember that having two batteries does not mean they have long-term power for handhelds," said Wenzel.

Coordination among ECs is key to success and individual volunteers must also coordinate their involvement with those in charge and not "just show up to assist." Volunteers also should not make statements to the media as this just adds to the confusion.

Even those with little or no public service experience can be valuable in an emergency situation, Wenzel said. "Do not think because you have not been involved for long with emergency communications or amateur radio that you cannot assist," he said. "Most people that can assist are new and are learning, and if you have checked into club nets and ARES or RACES nets, then you have the basics needed to assist." From *Harmonics*, official publication of the South Jersey Radio Association.

Newly Discovered Computer Viruses

•FEDERAL BUREAUCRAT VIRUS: Divides your hard disk into hundreds of little units, each of which does practically nothing, but all of which claim to be the most important part of your computer.

•PAT BUCHANAN VIRUS: Your system works fine, but it complains loudly about foreign software.

•PBS VIRUS: Your programs stop every few minutes to ask for money.

•ELVIS VIRUS: Your computer gets fat, slow, and lazy, then self-destructs, only to resurface at shopping malls and service stations across rural America.

•ROSS PEROT VIRUS: Activates every component in your system, just before the whole thing quits. Then space aliens land at your daughter's wedding.

Lifted from *The Open Squelch*, official newsletter of the Van Wert Amateur Radio Club.

It's a Bird! It's a Plane! No, it's...

A joint AMSAT-Germany/AMSAT-North America presentation in July announced that the next ESA (European Space Agency) Ariane 5 mission, AR 502, launch will be carrying AMSAT's Phase 3-D International Satellite.

After the failure of the first Ariane 5 launch in June, a board of inquiry presented the ESA with recommendations that should be considered for the next mission. Dr. Meinzer, Phase 3-D project leader, was quoted saying, "We have been given strong assurances that ESA has taken the recommendations of the AR 501 Inquiry Board to heart and are now 'rolling up their shirtsleeves' to correct those deficiencies in time for the Ariane 502 launch. I am sure that the ESA will do all that can possibly be done to insure our launch is successful."

AMSAT is committed to promoting space and communication research by constructing and controlling amateur radio spacecraft. It is a nonprofit organization that has been employing volunteer labor and using donated materials and services along with governmental assistance for over twenty-five years. To date it has launched over two dozen communications satellites.

From *AMSAT News Release* #96-05.

Generous QRPers

One quietly altruistic event during the fun of the "Four Days in May" at Dayton this year was the collection of several hundred dollars to purchase solar panels for lighting in a small, very poor village in El Salvador. The panels will be taken to El Salvador this winter by Jo-Anna Dobbs GØOWH, who will spend a month working with a support group for the village. Mrs. Dobbs, wife of Rev. George Dobbs G3RJV, of Lancashire, England, takes unpaid work leave and provides her own fare. All funds raised by the support group go directly to the village, for primary health care and cooperative production.

Also, for many years, usually unknown to members, the G-QRP Club has sent free *SPRAT*s, books and parts to many people in the third world who want to be involved in amateur radio but lack the funds. This year, in conjunction with NorCal, the G-QRP Club plans to ship 20 Epiphyte SSB kits to Asia for young amateurs who cannot buy equipment. Current plans are to ship kits to India and Pakistan, but suggestions from overseas members about other potential recipients are welcome.

Taken from an editorial by Rev. George Dobbs G3RJV, in *SPRAT, The Journal of the G-QRP Club.*

Radio Lollipop

Miami Children's Hospital has the first in-hospital pediatric radio station in the country: *Radio Lollipop*, staffed by volunteers, hospital staff, and patients, will broadcast live from a booth adjacent to the Child Life Playroom.

"*Radio Lollipop* provides hospitalized children with a way to escape the boundaries of illness by using their imaginations and becoming active participants in programming," says Renay Blanchette Rouse, project manager. The children will be able to take part in the programs, choose records, or answer quizzes by using special phones from their bedsides.

Radio Lollipop is an international not-for-profit organization established in 16 major children's hospitals around the world, including Great Britain, Australia, and New Zealand. It was first launched in 1979. 73

NEVER SAY DIE

Continued from page 4

seemed worth checking out when palladium and deuterium were put in a lithium bath. It was much the same with Hydrosonics in Georgia, which has been manufacturing steam heating systems that use a new approach to water compression to heat the water. Then their customers started remarking on how efficient their systems were, so they tested one and found it was more than 100% efficient. Hey, what's going on here?

What fields have you become an expert in? For that matter, what have you done with your life that has contributed even a little bit to the advancement of society? One of the things that really disappointed me when I started going to the reunions of my old submarine buddies from WWII was that few of them had ever done anything of any significance since our time on the submarine. Indeed, that was the most important thing many of them have ever done.

It just isn't that difficult to become an expert in some field. In almost any field. When the microcomputer came along in 1975 I decided I'd have to learn how the darned things worked. I went out and bought a stack of books on computer theory and started reading. When I found them almost impossible to understand (they were terrible ... college texts), that gave me the idea to start *Byte*. I knew there would be hundreds of thousands of people in the same fix as a result of this revolutionary development.

No one knows yet how cold fusion actually works, so anyone new to the field is starting out fresh. Actually, a newcomer has an advantage. One of the things that has hurt cold fusion has been the know-nothing scientists who, because they don't have an explanation for what's happening, have been refusing to believe it. Their position is that every one of the research labs that has claimed positive results has made serious errors. It can't happen. It hasn't happened. Everyone is mistaken. One scientist, Professor John Huizenga of the University of Rochester, and one journalist, Gary Taubs, have staked their reputations on this with books they've published.

Amateurs have a great advantage in that they aren't limited by what they know, only by what they don't know.

So the next time you start reading about digital voice, digital data compression, video compression, or a crypto algorithm, don't blonk out your eyes like that stupid old orphan and her 70-year-old dog; put on your pioneer hat and head for the hills of learning. How's that for some creative clichés? Blonk that metaphor!

Black & White

I'll bet you didn't know that the argot spoken by blacks was originally a white language. That's right, what is now spoken by our uneducated poor blacks came over from the south and west of England in the 17th

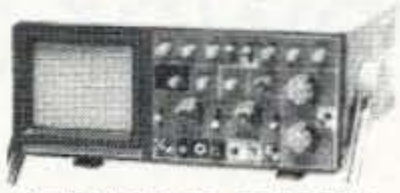
Continued on page 18

CALL TOLL FREE
(800) 292-7711 orders only
Se Habla Español

C&S SALES
EXCELLENCE IN SERVICE

CALL FOR A FREE 60 PAGE CATALOG!
(800) 445-3201

AFFORDABLE, HIGH QUALITY ELENCO OSCILLOSCOPES
2 YEAR WARRANTY



STANDARD SERIES
S-1325 25MHz $325
S-1340 40MHz $419

Features:
- TV Sync
- 1mV Sensitivity
- X - Y Operation
- High Luminance 6" CRT
- Complete Schematic
- Plus much, much more!!

2 FREE probes included with each scope!!

DELUXE SERIES
S-1330 25MHz $459
S-1345 40MHz $549
S-1360 60MHz $749

Features:
- Delayed Sweep
- Automatic Beam Finder
- Z Axis Modulation
- Built-in Component Test
- Dual time base
- Illuminated internal gradicule
- Plus all of the features of the "affordable" series!!

MX-9300
Four Functions in One Instrument
Features:
- One instrument with four test and measuring systems:
  - 1.3GHz Frequency Counter
  - 2MHz Sweep Function Generator
  - Digital Multimeter
  - Digital Triple Power Supply
- 0-30V @ 3A, 15V @ 1A, 5V @ 2A

$479.95

Sweep Function Generators

B&K 20MHz Function Generator
Model 4040
$425

- 0.2Hz to 20MHz
- AM&FM Modulation
- Linear & Log Sweep
- Counter Range 5Hz to 30MHz
- 5 Digit Display
- Made in USA

GF-8026 w/ Frequency
- Linear and Log Sweep
- .02Hz to 2MHz
- Counter Range 1Hz to 10MHz
- 4 Digit Display

$225

Model XP-581
4 Fully Regulated Power Supplies in One Unit
4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A + 1 Variable - 2.5 - 20V @ 2A
Ideal for laboratories, service shops and hobbyists.
$85

Fluke Multimeters
70 Series
Model 70II $69.95
Model 73II $97.50
Model 75II $135.00
Model 77II $154.95
Model 79II $175.00
80 Series
Model 83 ..... $235.00
Model 85 ..... $269.00
Model 87 ..... $289.00

M-1700
Digital Multimeter
11 functions including freq to 20MHz, cap to 20µF. Meets UL-1244 safety specs.
$39.95

Model M-6100
Features Computer Interface and Free Software

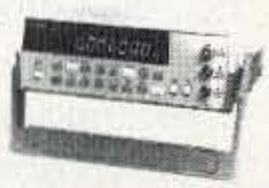
- Freq to 2MHz
- Cap to 4µF
- Large 3 3/4 LCD Display
- Three Hold System
- Audible Continuity
- Diode Test
- Auto Power Off
- w/ RS-232 Cable
- Relative %
- True RMS AC

$125
- Optional M-110CF to measure temp. $39.95

B&K Model 1688
High Current (25 DC amp) Power Supply
- Variable 3-14VDC
- 25 amps @ 135V
- Thermal Protection

$249.95

1.3GHz Universal Counter
Model F-1300
- Period
- Frequency
& 8 other functions
$225



XK-550 Digital / Analog Trainer
Elenco's advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular and square wave forms. 1560 tie point breadboard area.
XK-550
Assembled and Tested
$169.95
XK-550K - Kit
$139.95
Tools and meter shown optional
Made in USA

Kit Corner over 100 kits available

Model AR-2N6K
2 meter / 6 meter Amateur Radio Kit
$34.95

Model AM/FM-108K
AM/FM Transistor Radio Kit
$29.95

M-1005K
Digital Multimeter Kit
$19.95
6 functions and Transistor Test

TR-18K Cassette Recorder Kit
with training course
$15.95

WE WILL NOT BE UNDERSOLD
UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8% Sales Tax

C&S SALES, INC.
150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 520-9904 (847) 541-0710
http://www.elenco.com/cs_sales/

15 DAY MONEY BACK GUARANTEE
FULL FACTORY WARRANTY
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 184 ON READER SERVICE CARD

It's easy for you to present a nice welcomed gift to any student in your life or any ham ... a gift that that keeps on giving ... a 73 subscription. You can even give a 73 subscription to your child or grandchild's school library. Please call now! 800-274-7373 ... only $24.97.

Amplifiers, ATV Down Converters & Hard to Find Parts

LINEAR AMPLIFIERS

HF Amplifiers
PC board and complete parts list for HF amplifiers described in the **Motorola Application Notes and Engineering Bulletins:**

AN779H	(20W)
AN779L	(20W)
AN 762	(140W)
EB63	(140W)
AR305	(300W)
AN 758	(300W)
AR313	(300W)
EB27A	(300W)
EB104	(600W)
AR347	(1000W)

2 Meter Amplifiers (144-148 MHz)
(Kit or Wired and Tested)
35W - Model 335A, $79.95/$109.95
75W - Model 875A, $119.95/$159.95

440-450 MHz Amplifiers
(SSB-FM-ATV)
100W - Model KEB 67, $159.95

ATV Down Converters
(Kit or Wired and Tested)
Model ATV-3 (420-450)
(Ga AS - FET)
$49.95/$69.95
Model ATV-4 (902-926)
(GaAS - FET)
$59.95/$79.95

HARD TO FIND PARTS
- **RF Power Transistors**
- **Broadband HF Transformers**
- **Chip Caps** - Kemet/ATC
- **Metalclad Mica Caps** - Unelco/Semco
- **ARCO/SPRAGUE** Trimmer Capacitors

We can get you virtually any RF transistor!
Call us for "strange" hard to find parts!

DIGITAL FREQUENCY READOUT
For older analog transceivers
TK-1 (Wired and Tested)$149.95

For detailed information and prices, call or write for a our free catalog!

ADDITIONAL ITEMS
Heat Sink Material
Model 99 Heat Sink (6.5" x 12" x 1.6"), $24.00
CHS-8 Copper Spreader (8 "x 6" x 3/8"), $24.00
Low Pass Filters (up to 300W) for harmonics
Specify 10M, 15M, 20M, 40M, 80M or 160M
HF Splitters and Combiners up to 2KW

Add $4.50 for shipping and handling

CCI Communication Concepts Inc.
508 Millstone Drive • Beavercreek, Ohio 45434-5840
Phone:(513) 426-8600 • FAX (513) 429-3811

CIRCLE 99 ON READER SERVICE CARD

Switching Power Supplies

Different Is Good!

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

Let's review: An AC line operated linear supply normally consists of a step-up or step-down power transformer, followed by a diode rectifier, dual-diode rectifier pair, or a four-diode bridge rectifier package. The transformer's output voltage is applied to the rectifier circuit and the pulsating DC output from the rectifier is then sent on to be filtered by an RC (resistor/capacitor) or an LC (inductor/capacitor) filter section. The resulting voltage is then either used directly, or further processed by one of the many solid-state regulator circuits that are available to the equipment designer today. The entire process is easy for most of us to picture, and entirely linear (non-digital) in its makeup. This is the typical power supply that we've all learned to build and troubleshoot.

But just when you thought that you had it all down pat, along comes those new "switching power supplies" to add confusion! What gives? Is this just someone's brainchild to make life complicated, or are there real-life advantages to switching supplies?

As it turns out, switching power supplies really do have several advantages going for them. Traditional linear supplies are shamefully inefficient. They're often 50% (or less) efficient! That means that only half (sometimes less) of the input power is converted into the operational power needed by the device being run from the supply and the rest is dissipated as heat. One reason for this high level of inefficiency lies in the amount of "overhead" voltage necessary (the over- voltage needed ahead of the regulator circuit to make sure that it maintains regulation over widely fluctuating current demands). Another is the difficulty (and expense) in designing an efficient 60 Hz power conversion transformer. By contrast, switching supplies can be designed to be 85% efficient or better, resulting in considerably less heat loss and in less need for robust components within the supply to dissipate that heat. Switching supplies are smarter, smaller, lighter, and produce less wasted heat than do their linear counterparts.

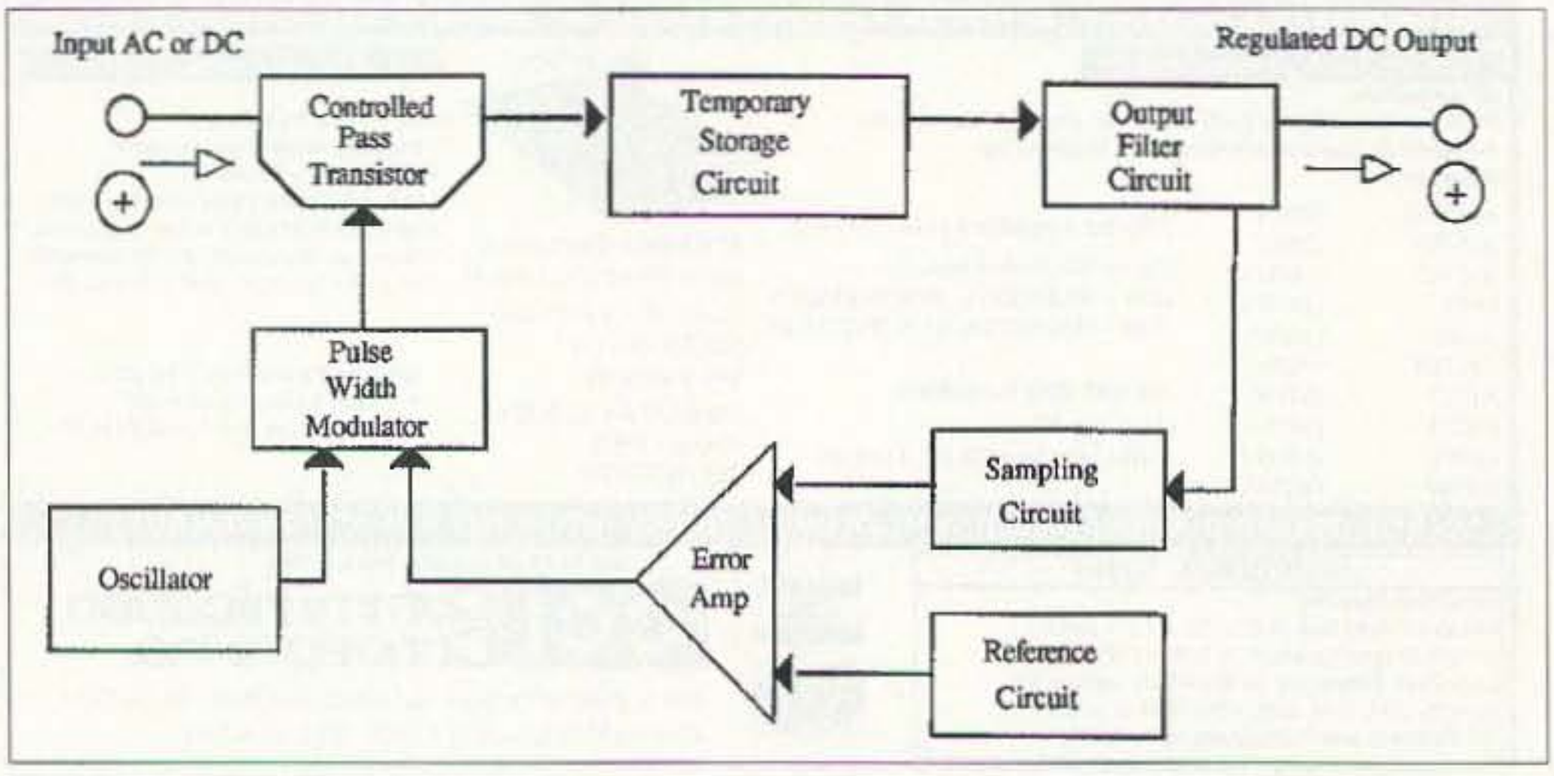


Fig. 1. *The block diagram of a switching power supply.*

But that's not all!

There are additional advantages to switching supplies. They'll operate over a greater range of voltages and currents than will a linear supply; the input voltage can actually be lower than the output voltage; and the output voltage can be of the opposite polarity from the input voltage. These last two features are not even *possible* with true linear supplies.

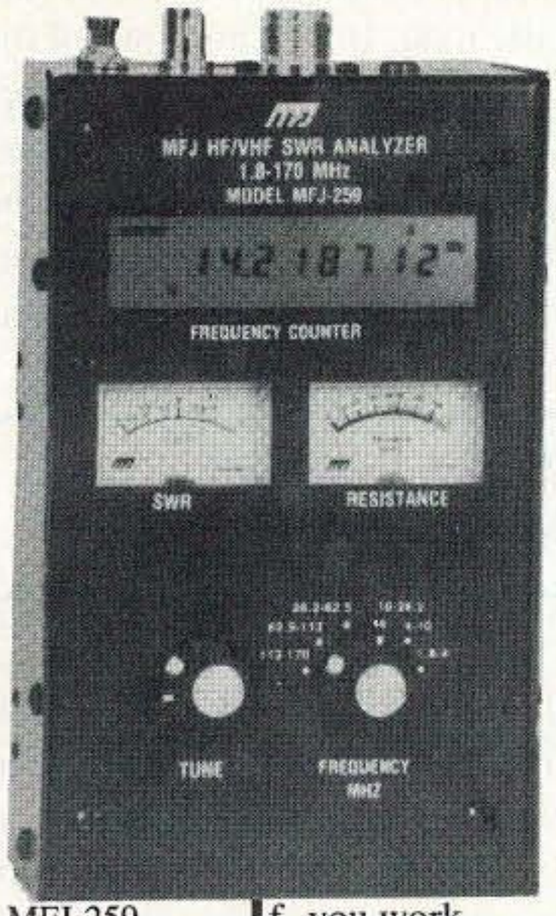
How is all of this accomplished? It's getting more and more important for all of us to know how, because switching supplies are showing up more frequently in computers, video monitors, consumer electronics, and of course, amateur gear. In order to be able to troubleshoot switching supplies when something goes awry, we have to at least be minimally familiar with the theory of operation of these relatively new devices, so here we go. Follow along with the help of the block diagram in **Fig. 1** while we explore the various elements that make up an average switching supply—it's not all that tough—just a different way of looking at power supplies.

The nitty-gritties

It's easiest if we begin with a slightly different mindset than when we're thinking about linear supplies. Instead of actual voltages and currents, I'll be using the term "energy" (which is what voltage and current really is) and then view what happens to this energy in terms of circuit "blocks" instead of tracking the electrons though each component part. I think that it makes it easier to picture what's happening.

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**

What the MFJ-259 Does

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!

RF Resistance Meter™

Does 2:1 SWR mean 25 ohms or 100 ohms? *The new MFJ-259 tells you at a glance!*

Now you can measure RF resistance up to 500 ohms at minimum SWR -- instantly -- on MFJ's *exclusive* side-by-side RF Resistance and SWR Meters!

Take the guesswork out of building matching networks and baluns for your antennas.

Watch the effects of spacing on radiation resistance as you adjust your antenna.

Here's What You Can Do . . .

Find your antenna's true resonant frequency from the shack.

Tune the antennas on your tower and watch SWR change instantly as you make each adjustment. You'll know exactly what to do by simply watching the display.

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.

Nearest Dealer/Orders: 800-647-1800
Technical Help: 800-647-TECH(8324)
• 1 year **unconditional** guarantee •30 day money back guarantee (less s/h) on orders from MFJ • **FREE** catalog

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

MFJ . . . making quality affordable

Prices and specifications subject to change © *1995 MFJ Enterprises, Inc.*

The input rectified line voltage is first introduced into a controlled pass transistor block (shown in **Fig. 1**), much like a pass transistor regulator circuit in a linear supply. Immediately following the control device is a temporary storage circuit. It consists of an inductor, a capacitor and a diode. The temporary storage section is important, and something of a deviation from what we normally think of as the typical filtering section in a linear supply. To understand what happens, cast your mind back to Electronics 101: An inductor opposes any change in current (by developing a counter EMF) and is able to store energy within its own magnetic field. If neither of these properties of inductors sounds particularly familiar to you, you might want to go back and study up a bit on inductors in any basic electronics text, or you can simply take them on faith, but it's important to keep them in mind when analyzing how a switching supply does what it does.

Basically, when an inductor begins to carry current, its counter EMF opposes the change, causing the current to increase at a logarithmic rate, rather than all at once. The same effect is true in reverse; when the inductor is giving up its energy, there's a "reluctance" to the change, and the decrease is likewise at a logarithmic rate. This permits the inductor to store and release energy at a naturally controlled rate and facilitates the action of the switching power circuitry.

Jump over to **Fig. 2** momentarily. Once the supply is operational and the inductor has built up a magnetic field around itself, it supplies the energy stored in its magnetic field to the capacitor which acts as a reservoir for that energy, holding it until it's needed by the load (the device being powered). So the inductor and capacitor work in tandem, building up the energy to the level deemed necessary in the design, temporarily storing it, then releasing it as needed into the circuitry being powered in a controlled fashion. The diode in **Fig. 2** simply provides the directional path for current flow.

"These last two features are not even* possible *with true linear supplies."

Now, here's the neat part:

The control element that I mentioned earlier determines how much energy will be permitted to build up within the temporary storage circuit, based upon the demands of the final load circuitry. It does this by monitoring the "ideal" design energy level, and then automatically adjusting the control element to permit more or less energy into the storage block, based upon that design ideal. Unlike the normal regulator circuit in a linear power supply, however, the control element in a switching supply pulses the pass transistor on and off, many times each second, and varies the duration (or duty cycle) of those pulses, to match the energy level needed by the final circuitry being powered. It's called pulse-width modulation and it can react very quickly and efficiently to meter the amount of energy permitted to pass through the temporary storage block, all within fractions of a second.

Going back to **Fig. 1**, we see that the output of the temporary storage circuit is fed into an output filter circuit (or block) and on to the load. But a sampling of the output is also fed into an error amp, along with a reference voltage. A reference oscillator's output is fed to the pulse width modulator and used to determine the number of pulses sent to the control element each second. An error voltage from the output sampling and reference circuit blocks is also fed into the pulse width modulator and used to determine exactly how wide those pulses will be. It's similar to a phase-locked loop in a digital frequency synthesizer in some respects, but the analogy shouldn't be carried too far. A switching power supply is unique, but not completely unlike other circuitry common in ham gear these days.

It's important to remember that the output sampling block, the feedback block, and the reference oscillator block all exist to inform the control element how much outside energy to permit into the storage loop block at any instant in time. Thinking in these terms requires that mindset mentioned earlier—somewhat different than when analyzing how a conventional linear power supply works. The pulse-width modulation (or duty-cycle modulation) places the theory of a switching supply more into the digital domain than in the linear or analog domain. The control element of the supply is pulsed on and off, using pulses of varying duration, rather than a continuous and smoothly varying sampling voltage as in a linear supply. Perhaps now you can agree why looking at a switching power supply in terms of blocks or sections is easier to visualize. Since switching supplies are somewhat complex, breaking the supply down into these categories lessens the confusion that might otherwise result when first looking at the schematic diagram of

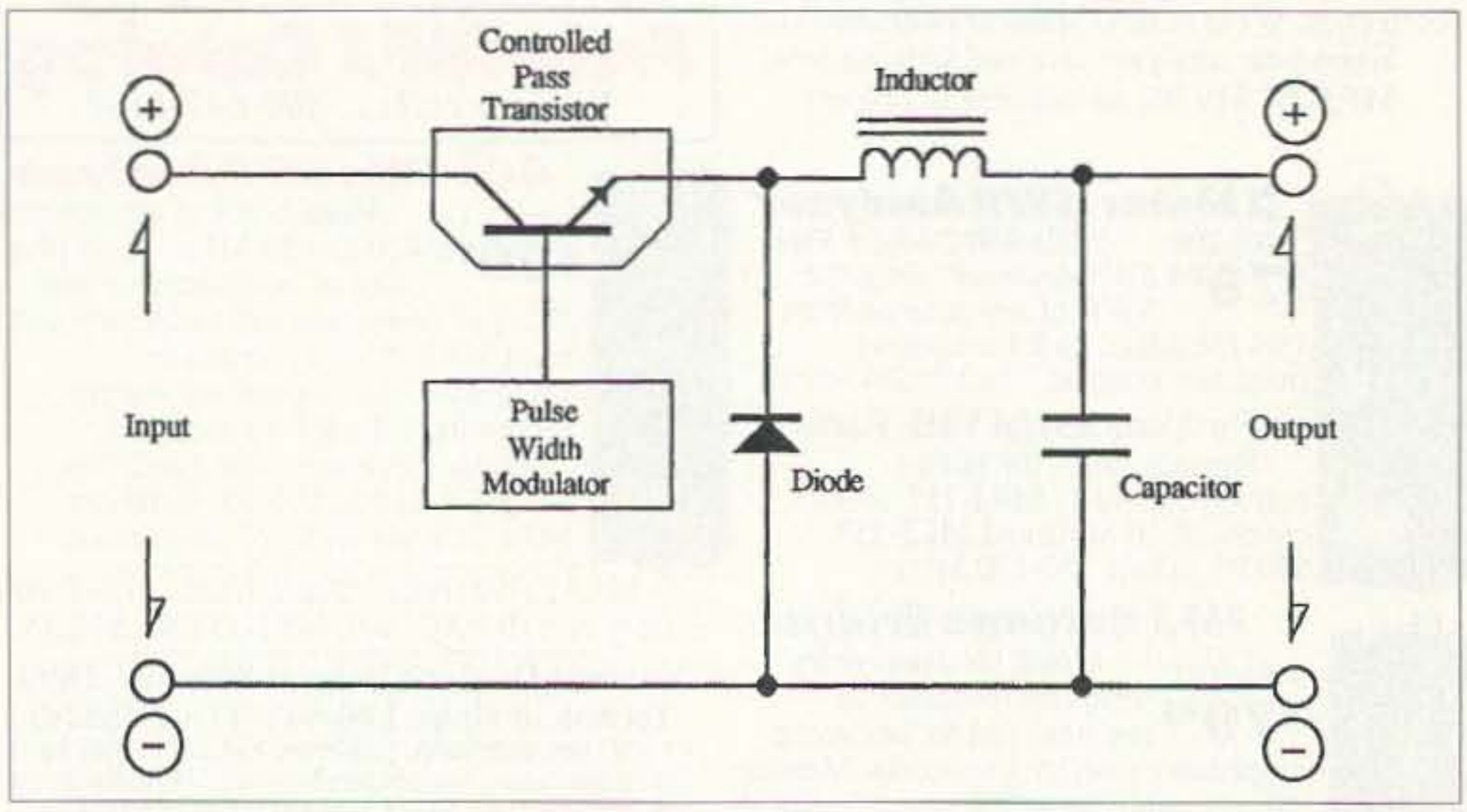


Fig. 2. *In this step-down circuit, the output voltage is lower than the input voltage by a given amount and the output is primarily supplied by the discharging of the capacitor, with some additional energy supplied by the inductor as needed, but the inductor's main function is to replenish the charge on the capacitor.*

ASTRON CORPORATION
9 Autry
Irvine, CA 92718
(714) 458-7277 • FAX (714) 458-0826

NEW

SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-25	20	25	4.2
SS-30	25	30	5.0

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

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

PERFORMANCE SPECIFICATIONS

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

SL SERIES

• LOW PROFILE POWER SUPPLY

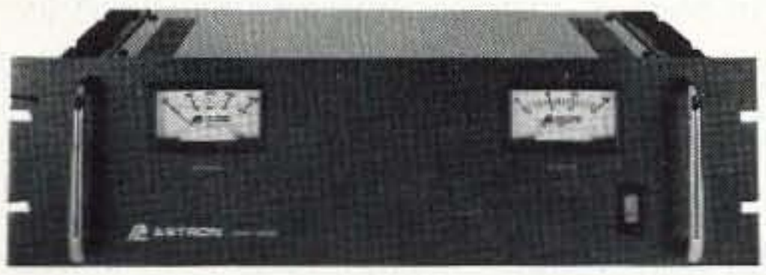
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

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

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

• Built in speaker

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

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

CIRCLE 16 ON READER SERVICE CARD

one of these odd-looking ducks. Thinking in terms of blocks or sections also can be helpful in troubleshooting a switching supply—by examining what is and what is not present—in terms of all of the necessary elements.

The three basic types

Getting back to some of the details now, I mentioned earlier that a switching supply can either step up or step down the input voltage, even if the input voltage is lower than the desired output voltage. Stepping down is easiest to see; when the supply is operating normally, energy stored in the inductor's magnetic field and in the capacitor's dielectric is supplied to the output load circuitry via the capacitor's discharging—with the inductor recharging the capacitor as well as supplying some of the load current itself. Remember also that the temporary storage section component configuration in **Fig. 2** is used for this purpose. When stepping up the output voltage, however, the temporary storage section is configured somewhat differently (see **Fig. 3**), with the result that the inductor's energy is summed with the capacitor's energy, in a circuit that's reminiscent of the classical cascaded voltage doubler circuit. That configuration results in a higher voltage on the output than was present on the input for low current demand applications. When polarity inversion is called for, the control and storage elements are configured differently again (see **Fig. 4**), resulting in the positive and negative sense changing positions between the input and output. It does this by allowing the inductor to reverse charge the capacitor. Once again, **Fig. 2**, **3** and **4** show each of the three possible conditions and the basic control/storage element configurations needed to achieve them.

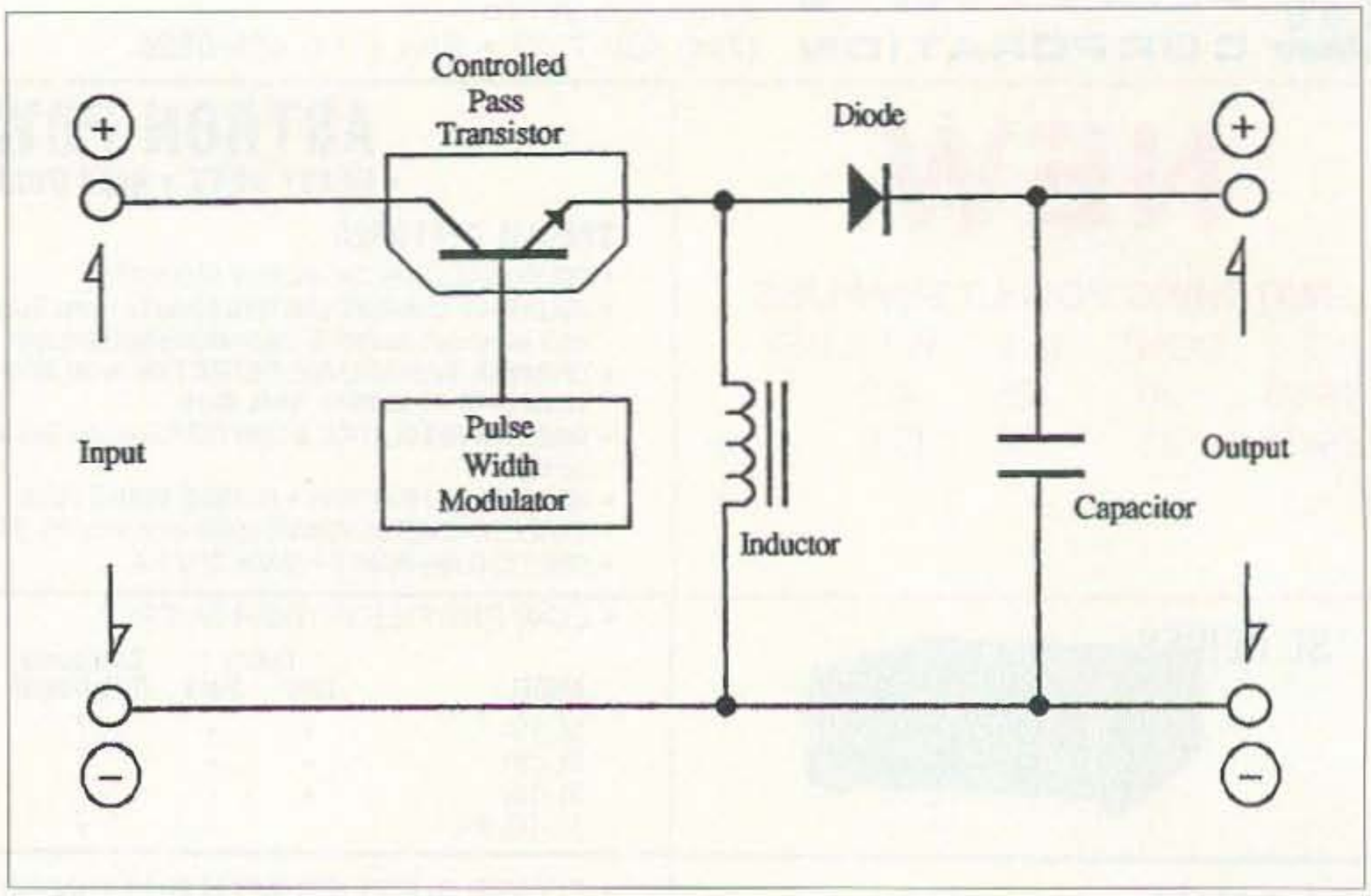


***Fig. 4.** This polarity inverting circuit functions as a "flyback" circuit, supplying energy from both the inductor and the capacitor, but with the inductor charging the capacitor in a reverse direction from the input polarity sense. An inverting circuit like the one shown can be either step-up or step-down in terms of the final amount of output voltage.*

A somewhat different approach

Another variation on the switching power supply, one that finds its home in higher current applications (such as might be found when powering a typical 100 W amateur HF transceiver), is shown in **Fig. 5**. Instead of using a relatively heavy and inefficient 120V to low-voltage-transformer (as older linear supplies would do), this line-voltage-to-14V supply first rectifies the 120 volts, filters it, and applies the high-DC line voltage to a pair of transistor driver stages. These driver stages are switched on and off at a high frequency (controlled by the driver oscillator) and this high-frequency pulsating DC then is stepped down to a high-current, low-voltage DC by a more efficient high-frequency transformer and a pair of high-current switching diodes. The advantage is a much lighter, smaller, more efficient transformer, and considerably easier to filter high-frequency pulsating DC. Better control over the amount of input energy is also possible by utilizing pulse modulation control circuitry as discussed before.

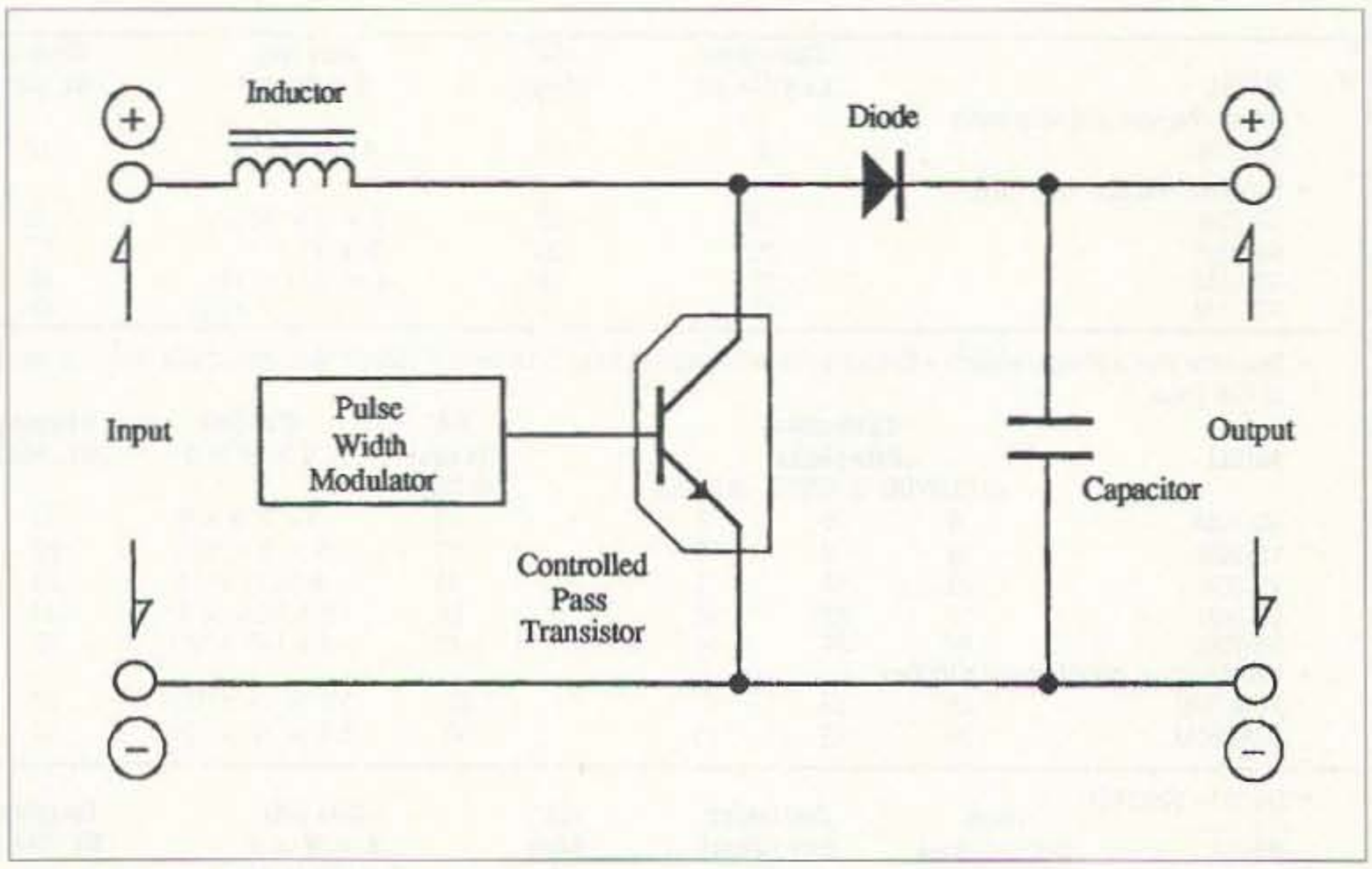


***Fig. 3.** In this step-up circuit, the output voltage is higher by a given amount than the input voltage, since it consists of the cumulative total of the energy supplied by both the inductor and the capacitor.*

"The square waves generated in digital switching are rich in harmonic content."

The reduction in size and weight by using high frequency switching—as opposed to the 60 Hz line frequency

Hoka Code 3 Gold

"The most advanced Digital Signal Processing PC program for the analysis and decoding of HF data communications!"

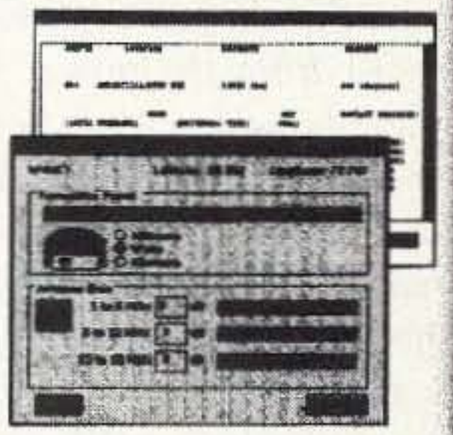
Code 3 Gold makes decoding easy for the novice and expert. Unlike the CW/RTTY decoders, Code 3 is an exclusive auto classification that tells you what you are listening to (30 + modes) and automatically sets you up to start decoding. Automatic analysis and oscilloscope functions are both selectable from almost anywhere in the program. The six Main Menu screens make moving around the Code 3 Gold program a snap. Code 3 is the most sophisticated and emcompassing decoder available. The 26 standard modes include:Package includes: Code 3 Gold software, audio-digital converter and RS232 cable, all ready to go! **Requirements:** IBM compatible, MSDOS with 640kB of Ram, CGA or better monitor.

- Morse
- RTTY/Baudot/Murray
- Sitor CCIR 625/476--4 ARQ - Navtex
- AX25 Packet
- Facsimile all RPM (up to 16 gray shades at 1024 x 768 pixels.)
- Autospec - Mk's 1 and II
- DUP-ARQ Artrac
- Twinplex
- ASCII
- ARQ6-90/98
- SI-ARQ/ARQ-S
- SWED-ARQ-ARQ-SWE
- ARQ-E/ARQ1000 Duplex
- ARQ-N-ARQ-1000 Duplex Varient
- ARQ-E3-CCIR519 Variant
- POL-ARQ 100 Baud Duplex ARQ
- TDM242/ARQ-M2/4-242
- TDM342/ARQ-M2/4
- FEC-A FEC100A/FEC101
- FEC-S
- FEC1000 Simplex
- Sports info 300 baud ASCII
- Hellscreiber-Synch/Asynch
- Sitor
- RAW (Normal Sitor but without Synch.)
- ARQ6-70
- Baudot F788N
- Pactor
- WEFAX

Available options:
- Option 3 Piccolo • Option 4 Coquelet
- Option 5 4 special: ARQ & FEC systems, TORQ-10/11, ROU-FEC/RUM-FEC., HC-ARQ (ICRC) and HNG-FEC
- Option 8: SYNOP decoder

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.

Electronic Distributors
325 Mill Street N.E.
Vienna, VA. 22182
Ph: 1 703 938 8105
FAX: 1 703 938 4525

EDCO

Exclusive North and South American Distributors

LETTERS

Continued from page 7

nautical miles to Newfoundland to meet up with *The Matthew* when it arrives in Bonavista. They called themselves "The Newfoundland Flotilla '97," and set about finding a few sailors who would be willing to brave the mighty St. Lawrence River and join them in the adventure. Well, they have certainly been successful, because at the time of writing some 76 sailors have signed up to be part of the Flotilla. This does not include some 25 American sailors who want to join the Flotilla in Bonavista. The Toronto Italian community is also involved, and they are considering a commitment to obtaining one hundred Flotilla sponsors at $10,000 apiece, the proceeds going to charity. The City of Toronto is sponsoring the Newfoundland Flotilla '97 Log Book, and all the skippers will be invited to City Hall for a luncheon and presentation of the Log Books just prior to their departure.

What about the ham side of things? Well, over a year ago I decided that a venture such as the Newfoundland Flotilla had to have a Chief Radio Officer and he could not qualify for that high title unless he could arrange a Special Events callsign. So I started with the Canadian Government Department of Communications. They naturally wanted full historical information, which was supplied, and then I waited. After a long wait, I phoned and asked why the delay, and was told that they thought that this was the first time in Canadian radio history that a maritime mobile unit had asked for a Special Events callsign. You see, Ontario's callsigns start with either VE or VA, followed by the number 3. Quebec has the number 2, the Maritime Provinces number 1, and Newfoundland starts with VO, not VE or VA. The Canadian Feds had to write to each of those Provinces and ask them to allow the Flotilla to pass through their territory without having to change the Special Events callsign. They got the Provinces to agree, and the Flotilla, when it sails in the May of '97, will do so with the callsign "CF3NYC." We have not set up a frequency and transmission time schedule yet, but that will be settled in the next two to three months.

If any of your readers want to find out more about the Newfoundland Flotilla '97 they can write to: Robert O'Brien, Chairman Newfoundland Flotilla '97, c/o National Yacht Club, 1 Stadium Road, Toronto, Ontario, Canada M5V 3H4. Or, E-mail: NFFLOTIL97@aol.com. CompuServe is: 75333,3243 @compuserve.com. There is a host of information available through these two mediums, so go to it. If there are any vessels who want to join the Flotilla write soon and get on the mailing list.

Darn, I sold my yacht! ... Wayne.

Bill Riley K9IMG. I enjoy reading your "Never Say Die" column. Recently, you mentioned the Council of La Raza, and that you did not know who they were. Another identical group is The Council por la Causa. These are Hispanic (Mexican) lobby groups that aim to get more federal funds.

They send their members to lobby the federal and state governments for more money, based upon their facts showing discrimination and a need for more and cheaper housing, housing repair, LIEAP (Low Income Energy Assistance Program) money, food banks, medical care, prenatal care, bilingual education, Head Start, ad infinitum. Our liberal Congress dutifully allocates more money. The federal agencies HUD, FEMA and DHSS collaborate with the Hispanics so they know exactly how to apply for these federal funds. The local agencies disburse the money, keeping 10% for administrative costs. This local agency can be a community action council, a council of government, immigrant services, or one of a number of peace and social justice coalitions.

These local agencies, always headed by a liberal activist Democrat, have a liberal activist Democrat staff that are all paid big salaries with a full range of benefits, even though most

Continued on page 69

switching—is quite dramatic, making for much more portability in high current supplies. One tradeoff that should be mentioned, however, is the potential for RFI from the power supply itself, especially when used near ham radio gear. This is true of all of the supplies talked about so far. The square waves generated in digital switching are rich in harmonic content; it's just a fact of life in the digital domain. Switching power supplies must be well designed, well constructed, and well shielded if operation near radio reception equipment is anticipated. Recognized name-brand supplies usually take every precaution in this area, but some RFI may still be experienced, just as with any other digital circuitry. Modern ferrite devices are generally used to help keep RFI from becoming an overwhelming concern, and all shielding must be replaced when these supplies are reinstated after troubleshooting.

Another difference between switching power supplies and their linear counterparts is in their cost; switching supplies are often 2 to 3 times more expensive because of the additional circuit complication and RFI proofing that's needed. There's a price for smaller size and greater efficiency, but it's often worth it.

Troubleshooting considerations

When troubleshooting a switching vs. a linear supply, the switching supply is much more difficult to analyze for faults. It's almost imperative that a schematic diagram be available; and a "theory of operation" and voltage chart can also be real timesavers. The best way to approach the problem is stage by stage. Try to isolate the fault on the basis of which stage, then which component in that stage, is behaving incorrectly. With the feedback loops at work, it's sometimes difficult to make that determination in a switching supply. If that's the case, try to analyze how the feedback loop can be interrupted and replaced with a fixed reference supply instead, just for the time being, until the problem can be isolated and corrected. This approach is sometimes the only way to avoid chasing your tail when working on any circuit that contains service-defying feedback stages.

"This approach is sometimes the only way to avoid chasing your tail when working on any circuit that contains service-defying feedback stages."

Most of the problems in switching supplies will be the same ones found in any other power supply—poor solder joints, broken wires, poor switch or variable control contacts, overheated parts, open or shorted components, or integrated circuits that are off-specification. Then there are the more esoteric problems! I ran into one recently myself, in a computer VGA color monitor using a switching power supply. It would change its width and brightness at times (because the regulated output voltage was changing), all by itself, and seemingly without any real reason, until I finally located the culprit. I was pretty well convinced that the controlled pass transistor package was the source of the problem, because tapping on it would often cause the fault to occur. I was ready to try hunting one down when I became suspicious of something else that the manufacturer had used in this particular monitor—a cream-colored adhesive that was used to hold some of the heavier parts down on the top of the printed circuit board. A couple of years back, I'd experienced similar adhesives becoming partially conductive as they aged, particularly when they became very brittle, as the adhesive on this board had. Furthermore, the way that the adhesive had been applied, a potential short circuit track existed between the line voltage bridge rectifier and the circuit common point, if in fact the adhesive itself had become partly conductive. Just on that bet, I removed (more correctly, chipped off) the adhesive in that area that would have completed a short, and as suspected, no more voltage variation. I removed the remainder of the adhesive in other locations just as a precaution, which only serves to illustrate that power supply problems come in many sizes and colors—just as in any other circuit! It's impossible to list all of the potential variations, but knowing how something is *supposed* to work, and playing a few hunches, can often pay dividends. 73

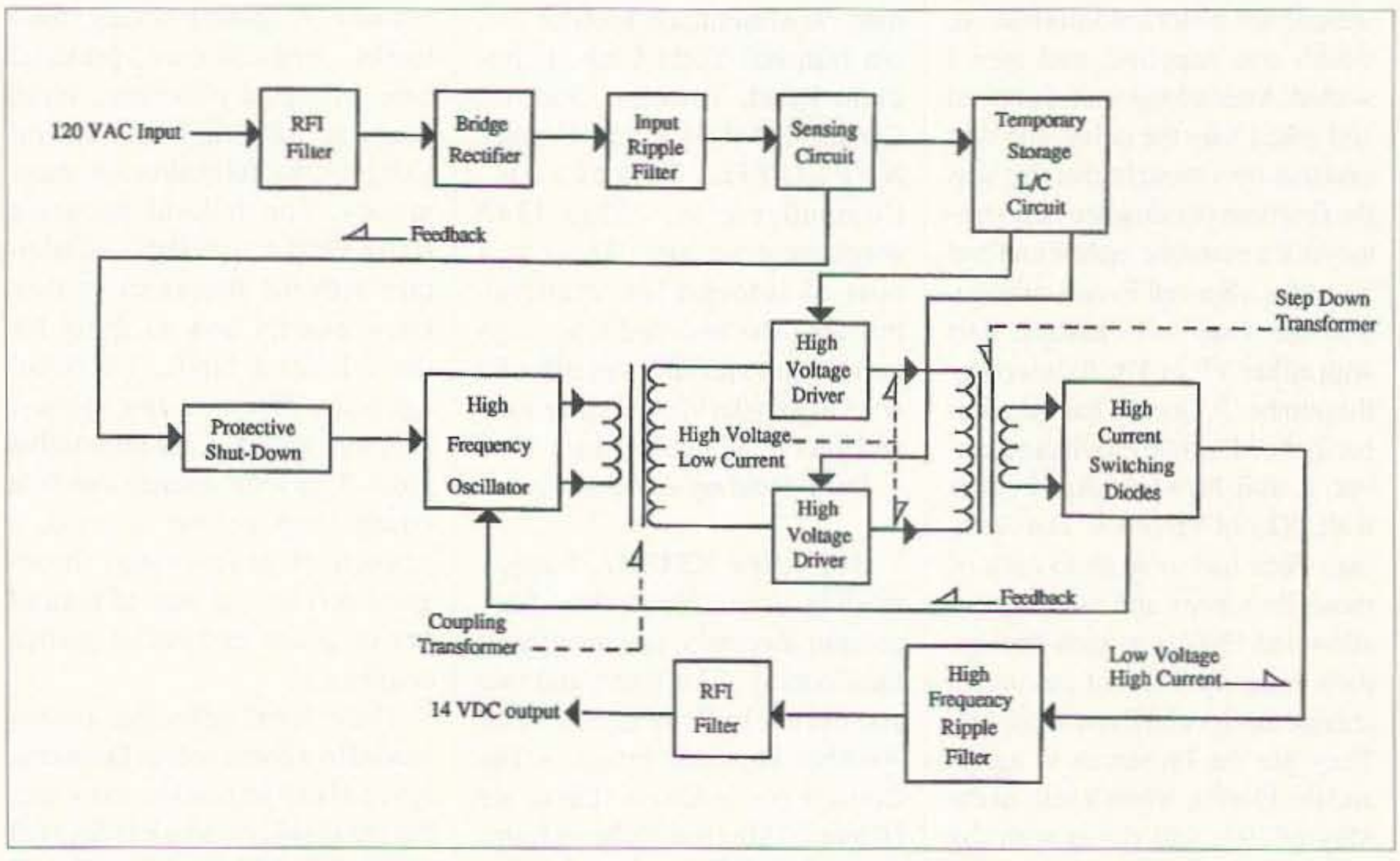


Fig. 5. *One variation on a high current, low voltage high-frequency switching power supply from a recognized name-brand amateur radio equipment manufacturer.*

Number 17 on your Feedback card

Designing RF Probes

A simple one-hour test equipment project.

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

An RF probe is used to directly measure the level of RF voltage present at a particular point. It is normally used with a digital multimeter (DMM) to indicate the voltage level as a DC voltage which is equivalent to the RMS value of the RF being sampled.

However, the level of RF being measured provides useful information only when the probe has been designed for use with a specific meter. The design of our RF probe is a function of the DC input resistance of the meter we intend to use with it. It can provide accurate information when used with a different meter that has the *same* DC input resistance, but will be inaccurate if the input resistance of the new meter differs from that for which the probe was designed.

Our probe design is somewhat unusual because we want to know the RMS value of the RF voltage we measure, and the probe actually detects and rectifies the peak RF voltage. Thus, it will be necessary to reduce the rectified DC derived from the peak voltage to a level equivalent to the RMS value of the RF at the probe tip. It is impossible to measure RMS voltage directly, except with a wide bandwidth oscilloscope. Therefore, we must design the probe circuit to do this for us.

The circuit

Fortunately, this is simple. All we need to know is the DC input resistance of the specific meter. We'll use a commonly available full-function DMM which, in this example, has an input resistance of 10 megohms.

Fig. 1 shows the circuit of a common RF probe, easy to make and use. It's also very easy to design so it will be accurate. C1 and C2 are usually 0.01 µF monolithic or ceramic disc capacitors. C1 acts as a DC blocking capacitor to prevent any DC voltage at the tip from entering the probe. C2 is a filter capacitor to smooth any variations in the DC voltage rectified by D1, normally a germanium diode.

"Can your analog meter be used instead?"

The rectified DC voltage at the cathode of D1 is at about the peak level of the RF voltage at the tip. Resistor R1 must have a value which will reduce this peak value to the desired RMS level. Because the peak voltage of a sine wave is 1.414 times the RMS value, R1 has to drop this excess voltage so the meter indication will be accurate. Because we know the meter has an input resistance of 10 megohms, we can calculate the value of R1 as follows:

10,000,000 x 1.414 = 14,140,000
14,400,000 - 10,000,000 = 4,140,000 ohms (4.14 megohms)

R1 should be 4.14 megohms (for use *only* with a DMM which has a 10 megohm input resistance).

This calculated 4.14 megs value is not a standard value, so we'll have to use two or three 1/4W resistors in series to make up the required value. We can either measure individual resistors from our stock of parts to come as close as we can, or we can do it the easy way by choosing 5% resistors and adding their value to come close to the desired value. For instance, a 2 megohm resistor and a 2.2 megohm resistor in series will produce 4.2 megohms, ±5%. Since this combination is only 60,000 ohms higher than needed, it is such a tiny percentage of over 4 megohms that it can be ignored. Electronics is a world of tolerances and percentages; as long as we come close to the value we need, it will work just fine.

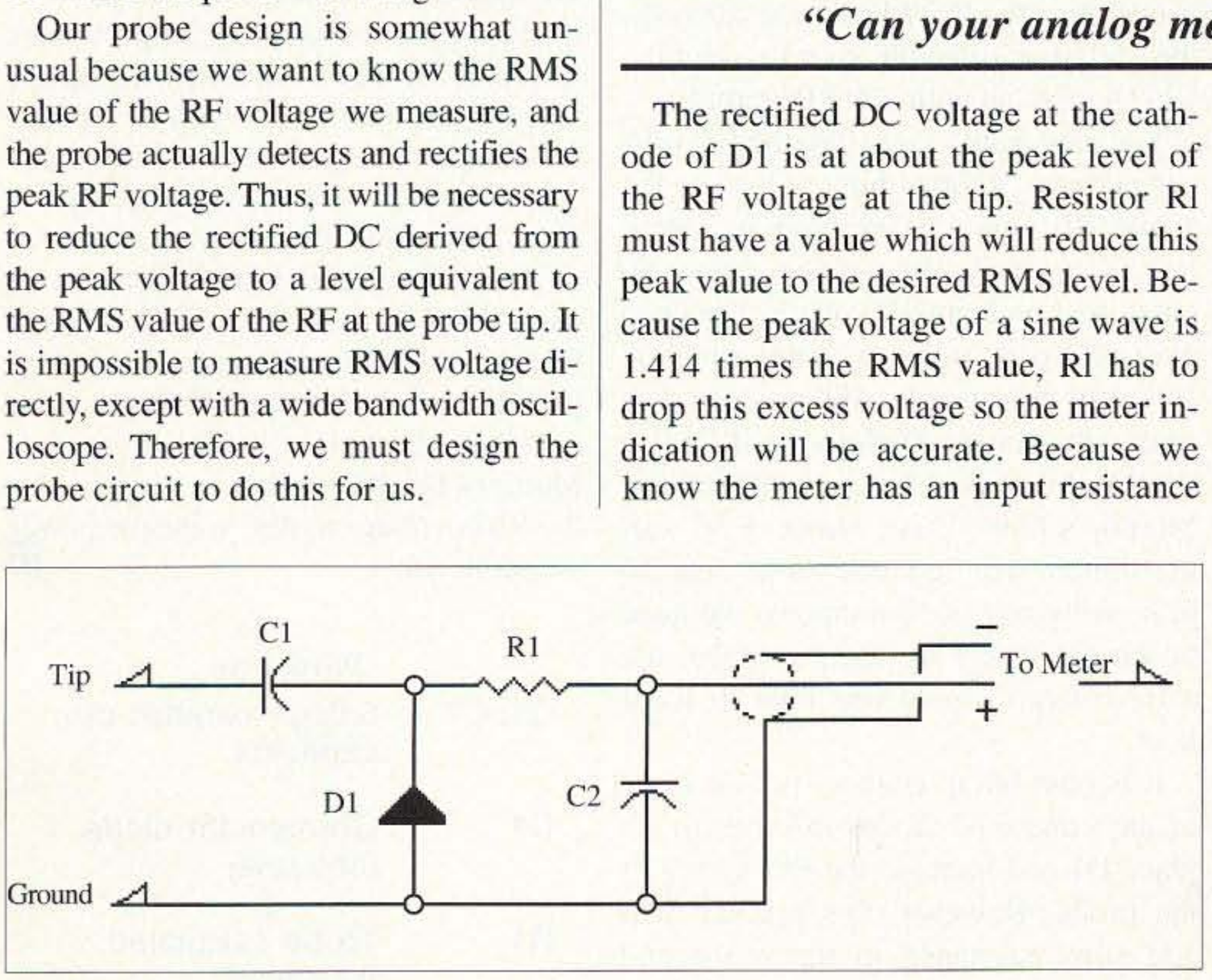


Fig. 1. *It doesn't get much simpler than this.*

Analog meters?

Can your analog meter be used instead? Sure, but you have to know the input resistance of the analog multimeter on the DC range setting you're going to use with your RF probe. For instance, there are FET multimeters available, most of which have a constant DC input resistance of 100k on all ranges, but this is the *only* type multimeter for which this

statement is correct. For this meter, Rl will have a calculated value of 41,400 ohms.

For other analog multimeters the input resistance will be different for each range. These meters are specified to have an input resistance of "X" ohms per volt. This value will be listed in the operator's manual or leaflet which is supplied with the meter or, in some cases, will be marked on the meter face.

Voltage

After you have determined the ohms-per-volt rating of your meter, you choose the specific voltage range with which you will use your RF probe. The full-scale voltage of this range will be used to calculate the value of Rl in **Fig. 1**.

As an example, consider a typical 20k ohms-per-volt multimeter, of which there have been more produced than probably any other except for the pocket-size 1k ohms-per-volt multimeters. We will calculate for both a 30-volt and a 50-volt range because these meters vary among manufacturers. You probably will have one or the other on your meter.

20,000 x 30 = 600,000 ohms input resistance
600,000 x 1.414 = 848,400
848,400 - 600,000 = 248,400 ohms (Rl)

20,000 x 50 = 1,000,000 ohms input resistance
1,000,000 x 1.414 = 1,414,000
1,414,400 - 1,000,000 = 414,000 ohms (R1)

Since we don't want to chance burning out D1 in our probe, we don't want to exceed the maximum allowable peak inverse voltage (PIV) that it can withstand. For the lN34 and lN34A the PIV is 60 volts. The lN270 will take 80 volts, the 1N191 will handle 90 volts, and the lN67A tops out with 100 PIV rating.

You may want to measure the RF voltage across a 50 ohm dummy load so the actual RF output power can be calculated. The peak RF voltage across 50 ohms will be from 10 volts at 1 watt to over 387 peak volts at 1,500 watts. A 100 watt transmitter will produce 100 peak volts across 50 ohms, so if Dl is a lN67A this would be an invitation for Murphy's Law to take effect. A 50 watt transmitter will produce more than 70 peak volts across 50 ohms, so we must be careful where we use the probe. It's a lot easier to build one than to fix it later.

It is possible to connect two or more of the same type diodes in series to replace D1 and increase the PIV rating of the probe. However, this practice will add stray reactance to the probe and affect its accuracy.

Although our RF probe is handy when working with transmitter powers of no more than about 30 watts, it is most useful when adjusting the RF voltages produced by VFOs, the local oscillator output to mixers in both transmitters and receivers, and intermediate stages and some driver stages in transmitters. Power levels as low as 50 milliwatts will be easily detectable with our probe.

"If D1 is an IN67A, it's an invitation for Murphy's Law to take effect."

Construction

Now we need a probe body to put the circuit in, and we will need a metal tip. When the few components have been soldered together with very short leads, using a heat sink to protect the diode from the heat of soldering, we will need a shielded wire to connect the probe to the meter, and a red and a black plug to connect the shielded wire to the meter sockets. We will also need a ground lead and clip for the probe.

Depending upon the physical size of the component parts, especially Cl and C2, we can take apart a cheap office-type ball-point pen or a felt-tip pen for the probe body. RG-174 miniature coax, or even RG-58, can be used for the shielded wire. A small nail soldered to the lead of Cl makes a nice tip. A short length of insulated stranded wire and an alligator clip make a good probe ground.

For hams using low power—30 watts output or less—this probe plus Ohm's Law will allow the accurate measurement of RF power developed across a 50 ohm dummy load. The RMS voltage measured with the RF probe divided by the 50 ohm resistance of the dummy load will determine the RF current. Multiply the RF current in amperes by the RMS voltage to determine the power output in watts. 73

Parts List

C1, C2	0.01µF ceramic disc capacitor
D1	Germanium diode (see text)
R1	To be calculated (see text)

NEVER SAY DIE

Continued from page 9

century, brought over by English whites, who mainly settled in the South. The blacks are carrying on a heritage from their slave ancestors imported from England, not Africa. The development of public education in England eventually replaced this argot with standard English. Now it lives on in the American black culture, separating those who speak it from much hope of success in dealing with whites, or in getting well-paying jobs. It's one way blacks make sure that other blacks will provide a permanent black underclass.

Big Bummer

Yes, I've been on your case, trying to get you to stop sitting there like a lump in a bog and to stick a test prod into that jumble of gray goo in your head to jump-start some action. Our hobby is broke and needs fixing. Heck, it needs reinventing.

Sure, I keep coming up with ideas, but instead of generating your own in response, what I'm getting most of is apathy, with a secondary pile of kvetching. Yes, I'm complaining, but I'm not surprised or upset. After all, this is the same reaction I'm seeing to the call for ideas on how to solve our major social problems ... like welfare, the deficit, crime, the so-called drug war, and so on.

Heck, you're not even particularly upset over how much you're paying in taxes, which on the average these days is taking all of your wife's pay. And this is despite endless TV exposés showing you how your money is being wasted on crop supports to rich farmers (even tobacco supports!), rip-offs of virtually every federal bureau by crooks, enormous stockpiles of useless military supplies, and so on. There are a whole bunch of books exposing this stuff, showing where hundreds of billions are being wasted. Ho hum, right?

Getting back to amateur radio, I made a suggestion for a new approach to the hobby several years ago which just came back to

Continued on page 27

A Low Current Light

Great for portable operation.

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

Portable operation at night on camping trips poses a problem. Even the lowest current incandescent bulb eats a lot of power, so when your station is powered by a small gel cell battery, as are most portable QRP stations, every milliampere that can be saved for communications is precious. Also, the usual white light from a flashlight or even a pilot lamp is a magnet for every nearby flying insect.

"Because these yellow LEDs have an expected life of 50,000 hours, they won't burn out just when you need them most."

There are "giant" LEDs 10 cm in diameter in clear plastic which produce a bright red light. They require 1.8 VDC at 20 mA. These are produced as replacements, several in a cluster, for automotive taillights and brake lights. I don't know of any source for these; I found one surplus several years ago and tried it out—I found that red light is no good for reading dials, meters, and switch positions. It also attracts its share of insects.

The best choice is yellow light. Unfortunately, most yellow LEDs produce very little light, and also require a dropping resistor which wastes precious milliamperes in heat. Much better are the T1-3/4 yellow LEDs (Mouser 509-HPY5066X). Nine of these 1.5V in series across a 12V battery draw only 17 mA, with no dropping resistor needed. And, because the LEDs have an expected life of 50,000 hours, they won't burn out just when you need them most.

Although using eight LEDs would seem to make more sense in a 12-volt system, the ninth LED helps to prevent excess current when a gel cell battery has been freshly charged and its terminal voltage exceeds 12 volts. It also allows the nine LEDs to be mounted in a 3 x 3 arrangement to concentrate the light.

Construction

The LEDs should be mounted as close together as possible to better concentrate the light. Be sure to observe the correct polarity of each LED. The longer lead is the anode. While reverse polarity won't harm the LEDs, no light will be produced.

Although this is not the brightest light in the world, it will attract very few insects and the light produced is quite adequate for operating your rig and keeping a log. 73

Get The Picture!

VHF Wx Satellite Decoding
Call or write for our free catalog
Software Systems Consulting
615 S. El Camino Real
San Clemente, CA 92672
Tel (714)498-5784 Fax (714) 498-0568
CIRCLE 250 ON READER SERVICE CARD

WANT TO LEARN CODE?
Morse Tutor Gold from G.G.T.E. is the answer for beginners and experts alike.
*Get the software the ARRL sells and uses to create practice and test tapes; and **Morse Tutor Gold** is approved for VE exams at all levels.
*Since 1987, GGTE has guided nearly 20,000 hams and prospective hams around the world through proven structured lessons and a variety of character, word and conversation drills. Straight forward menus make the process simple and fun.
*This program features easy and speedy self installation; random character drills with the characters you select; and you can create your own drills or import text files. You can type what you hear or copy by hand and see the results one line at a time. Pick the Farnsworth or the standard method; select the tone frequency most comfortable for you or select your code speed in tenths of a word per minute. For all DOS computers. You are always in command.
Certified by Sound Blaster
Morse Tutor Gold uses your internal speaker or sound board. And, if you use a sound board **Morse Tutor Gold** supports volume control.
Sound Blaster and the Sound Blaster Compatibility Logo are trademarks of Creative Technology Ltd.
Available thru dealers, the ARRL, or send $29.95 + $4 S&H (CA residents add $2.32 tax) to: GGTE, P.O. Box 3405, Dept. MS, Newport Beach, CA 92659 Specify 5 1/4 or 3 1/2 inch disk.
CIRCLE 193 ON READER SERVICE CARD

Pico-J rolls up and hides in his 4-ounce pocket-sized holder, waiting like the Genie in a bottle till you need full-quieting signal pouch.
Call him forth and his glistening black weather sealed lines reveal a sleek end-fed halfwave antenna ready to hang anywhere. Suspend in the apartment closet or patio doorway. Attach Pico-J to window glass or curtain rod. He needs no radials for broadband low-angle omni halfwave gain.
Carry Pico-J with you for emergencies. Hang in the motel when on the road. He improves range, boosts reception, saves batteries.
Pico-J comes ready for work with 72" isolated coaxial feedline and gold pin BNC. Typical edge-to-edge SWR under 1.2:1. Hand-crafted in the U.S.A.
Pico J
Info $1 Box 50062-D Provo, UT 84605
Models 2 Meters 440MH Dual Band add $6
Antennas West Order Hotline 801-373-8425
19.95
CIRCLE 89 ON READER SERVICE CARD

Can You Top This?

The world's tallest mobile antenna?

Jim Ford N6JF
2415 College Drive
Costa Mesa CA 92626

If you've ever driven on Pacific Coast Highway in Huntington Beach, CA, or been at Southern California's TRW Ham Swapmeet, you've probably seen what is most likely the world's tallest mobile antenna. These have frequently been spots for Don Daily AA6GE to set it up.

It's mounted on top of his 1976 Ford van and can support many antennas, going from about 11 to 160 feet! Impossible, you say? Well, I thought so until I saw it.

You say, "This surely must be guyed." Well, it is, sometimes. At 160 feet the antenna is far from straight unless it is guyed, but he has driven around with it at 160 feet (1 mph?). Don, licensed since the mid '50s, and familiar for many years as WA6EKD, is no stranger to big projects. From Riverside (CA), in 1969 through 1971 he had an eight-element 105-foot boom 20 meter yagi on his homemade self-supporting 130-foot tower. It was secured with 20 tons of concrete! By profession, Don is a plant maintenance engineer and his knowledge of machine shop tools, processes, and materials is evident in all of his projects.

The details

The bottom of his Space Needle, as he calls it, is made from 6.5 inches of 1/2" wall-thickness 7075 T6 aluminum. The remaining tubing is made from 6061 T6 aluminum, with the 120-foot level having a 2.5" OD. This was the level at picture time, with a rotator and small horizontal 2 meter beam at that point.

When in use as an antenna and not as a tower, it tapers to 3/4 of an inch at 150 feet. A CB-type whip adds an extra 10 feet, for a total of 160 feet. The pole is insulated from the van with four 1' x 1' x 1-1/4" phenolic blocks so it can be used as an antenna or tower. The total weight of all his antenna poles, which are stored in large-diameter white PVC tubes, is 800-900 pounds. The bottom section is guyed to his van with 1/2" braid, which is the type of line used on yachts and has a test strength of 18,000 pounds. The gin pole used for raising the antenna uses XLS 900 5/8" braid line rated at 27,000 pounds.

Don's experiences

Don doesn't always put up the 160-foot monster, but he frequently has antennas over 100 feet. Often, the only guys used are those that are attached to his van. He has mounted four 19-element 2 meter antennas on his Space Needle at 80 feet! He has setup time down to 45 minutes, and claims that there haven't been any scary wind episodes. He has operated a 70-foot antenna in 40 mph winds. Ham operation on 160 meters is difficult for many of us because of the large antenna length required, but Don likes the 160 band since he can put up a full-size 1/4 vertical!

"It was secured with 20 tons of concrete!"

When asked if he would rather have a motor home or house trailer, Don says no. He thinks a trailer or motor home might not be strong enough for his purposes, and besides, they would have a difficult time getting to some of the places where he likes to operate. He likes to operate as near the ocean as he can, to get the benefit of an ocean ground, or from mountain peaks for the quiet location and terrain enhancements. In his experience, a good HF mountaintop location is one which drops off rapidly.

To say he gets good signal reports from his van is an understatement, but the good reports are due in part to his ability to pick good locations. I visited

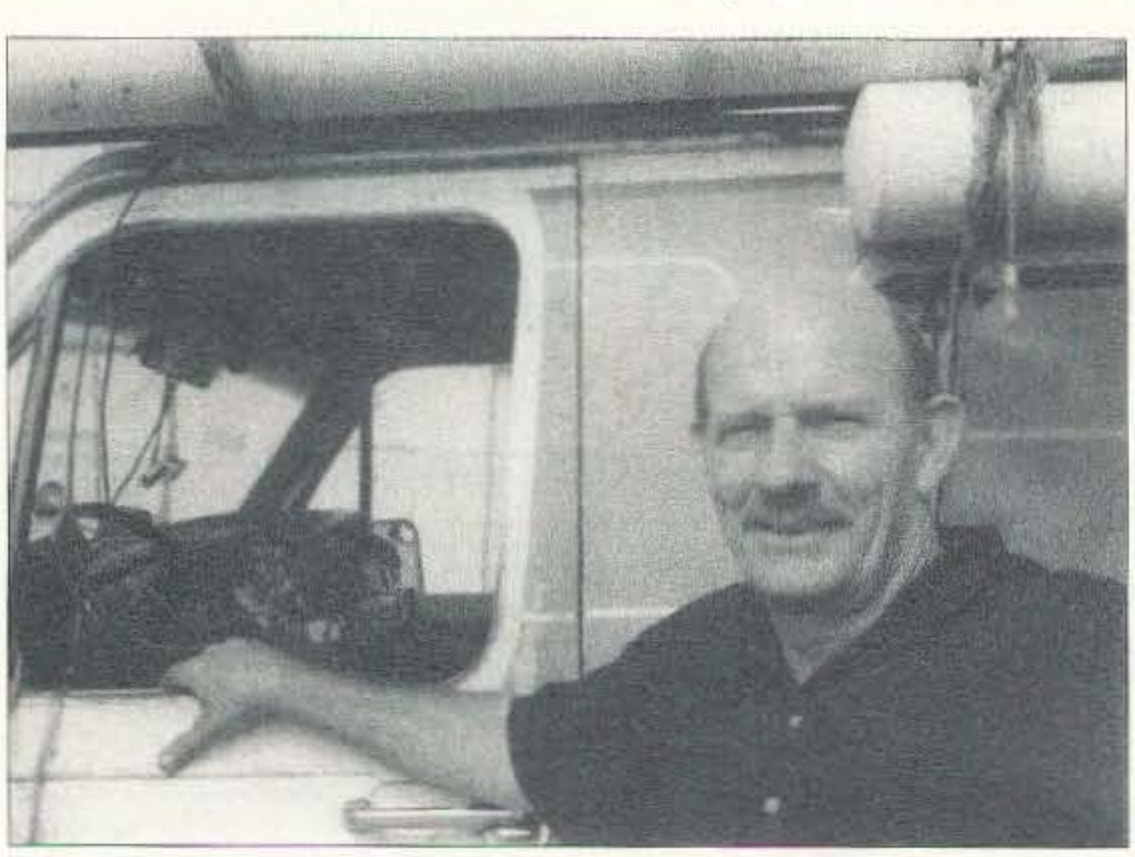


Photo A. *Don Daily AA6GE.*

him one time when he was at a location near the top of Modjeska Peak in Orange County, CA. And I do mean the top because he definitely needed the winch mounted on the front of the van to get up the last 50 yards.

Don is planning a replacement for his aging '76 Ford van, but with all the customization and airbag suspension on his present van it may take a while to bring it up to his standards. Big-time mobile is not new to Don. He has used this van with somewhat smaller antennas for the 15 years I have known him. And yes, if you wondered, Don has been single since two years before the van.

Fully loaded, the van weighs as much as 10,300 pounds, but it was only 9,500 pounds at the time these pictures were taken. He is equipped with 10 100-pound batteries! This allows three- or four-day desert and mountain radio DX trips. He has worked over 250 countries and most of the US counties in this van.

Don is usually equipped for operation on 160 meters to 1296 MHz, but recently sold some of his less-used VHF and UHF gear and used the money for some of his other hobbies. He bought a trailer and mini 4WD military surplus vehicle called "The Mule" about a year ago and uses them for gold mining and astronomy trips. This allows him to carry two 650 watt generators, one 1 kW, and one 3.5 kW. The 3.5 kW generator is needed when

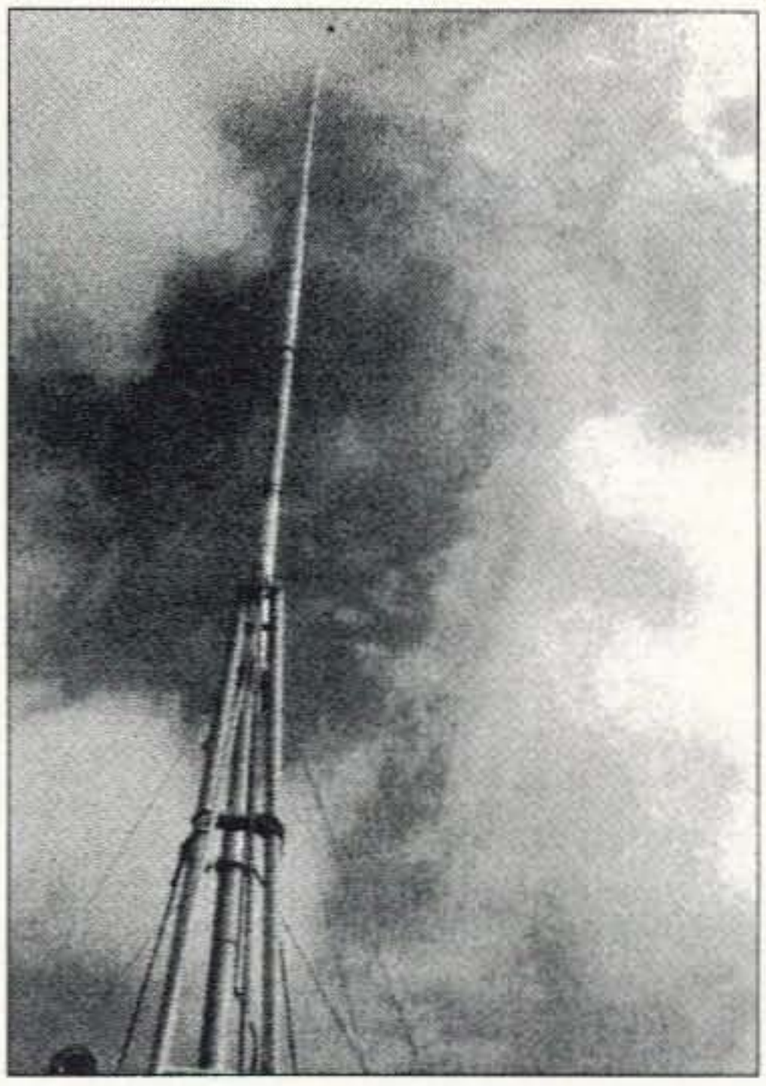


Photo B. Looking up at 120 feet.

he wants to use his kW HF amplifier, consisting of a pair of 3-500Z tubes. He also has solid-state amplifiers for VHF, and one for HF for battery operation when not running the tube amp. His well-secured van is a ham contest station on wheels.

I've seen this and many other of Don's antenna projects evolve over the last 15 years, but I am still amazed. Safely completing a project like this is not for many of us. Don would like to claim the world's highest mobile antenna. If you see AA6GE going down the road, give him a Morse code HI beep on the horn. 73

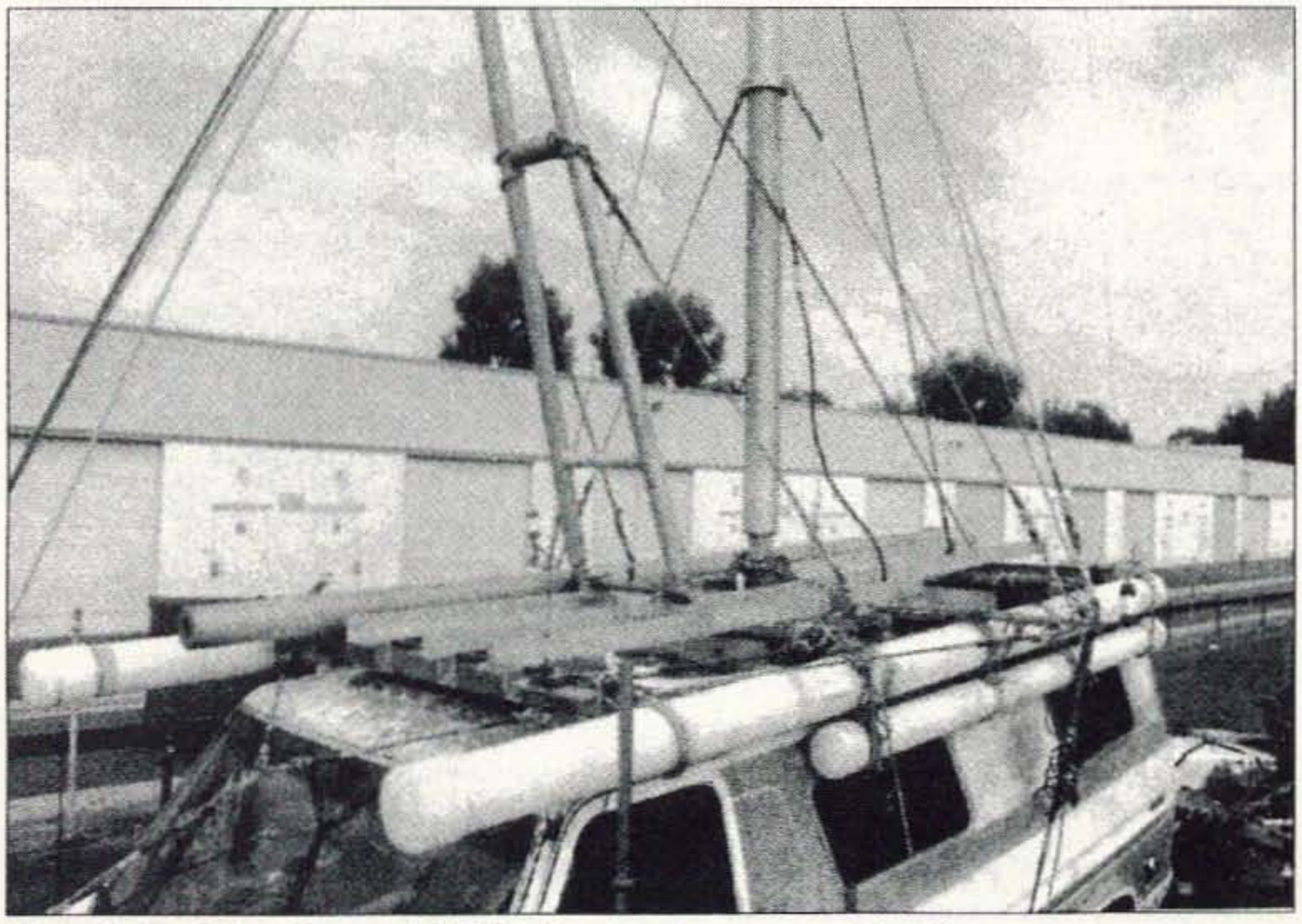


Photo C. Roof view. Do you think Don has ever been on a sailboat?

ALL ELECTRONICS CORPORATION

ATARI "JAGUAR" CONTROLLER/KEYPAD

Cool-looking game controller for the Atari Jaguar system. Erogonomically designed black box has 12 button keypad (0-9, * and #), separate A,B,C buttons, pause and option buttons and a four-way direction button.7' cable terminated with hi-density DB-15 connector. 6.5" X 5" X 1.65"

$2.50 each

CAT # EX-18

10 for $20.00

SPECIAL PRICE BI-COLOR LED

RED/ GREEN diffused.
T 1 3/4 (5mm) Three Legs
Center cathode.
CAT# LED-63

35¢ each

100 for $29.00 • 1000 for $250.00

STEREO 3.5 MM EXTENSION CABLE

6' shielded cable with stereo 3.5 mm mini-phone plug one end, 3.5 mm jack on other end.

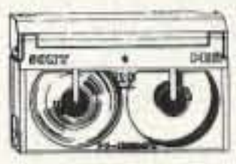
$1.25 each

CAT# CB-357

10 for $10.00

"HI-8" CASSETTES (USED)

SONY Hi-8
Top quality, metal particle 120 minute video cassettes. Used for a short time, then bulk-erased. Each cassette has its own plastic storage box. Satisfaction Guaranteed.



$3.00 each

CAT # VCU-8

10 for $28.00 • 100 for $250.00

ORDER TOLL FREE
1-800-826-5432
CHARGE ORDERS to Visa, Mastercard, American Express or Discover

TERMS: *NO MINIMUM ORDER.* Shipping and handling for the 48 continental U.S.A. $5.00 per order. All others including AK, HI, PR or Canada must pay full shipping. All orders delivered in CALIFORNIA must include local state sales tax. Quantities Limited. NO COD. Prices subject to change without notice.

CALL, WRITE FAX or E-MAIL for our *FREE* 64 Page CATALOG
Outside the U.S.A. send $2.00 postage.

MAIL ORDERS TO:
ALL ELECTRONICS CORPORATION
P.O. Box 567
Van Nuys, CA 91408
FAX (818)781-2653
E-Mail allcorp@allcorp.com
Internet - http://www.allcorp.com/

CIRCLE 194 ON READER SERVICE CARD

The 48-46 Antenna

The CCD antenna is now available for the amateur bands.

Harry Longerich W4ANL
Rte 1, CV 9
Fredericksburg TX 78624

What is the 48-46 antenna? It consists of 48 pieces of wire interconnected with 46 capacitors. The technical name is "Controlled Current Distribution" antenna, or CCD. It's been around for a long time in the commercial broadcast field, and recently it was configured for use on the amateur bands. An excellent description and analysis of the CCD antenna is available in both References 1 and 2; these are worthwhile reading.

Rather than making a dipole out of two continuous lengths of wire, the CCD antenna uses capacitors to vary the phasing of the currents in the antenna to ensure that the most possible current is distributed to all sections of the antenna. These capacitors are inserted in series with the elements, about one every yard, for the complete length of each dipole element. In the 48-46 antenna each side of the dipole is made up of 23 capacitors and 24 sections of wire, each 35 inches long. The dipole is center-fed with open wire line via a transmatch. The 48-46 antenna uses a new approach to mounting the capacitors, and I also give some hints on how to build a simple RF detector to make sure the antenna currents are properly distributed.

Why consider a CCD antenna? Well, it has several distinct advantages over the conventional dipole:

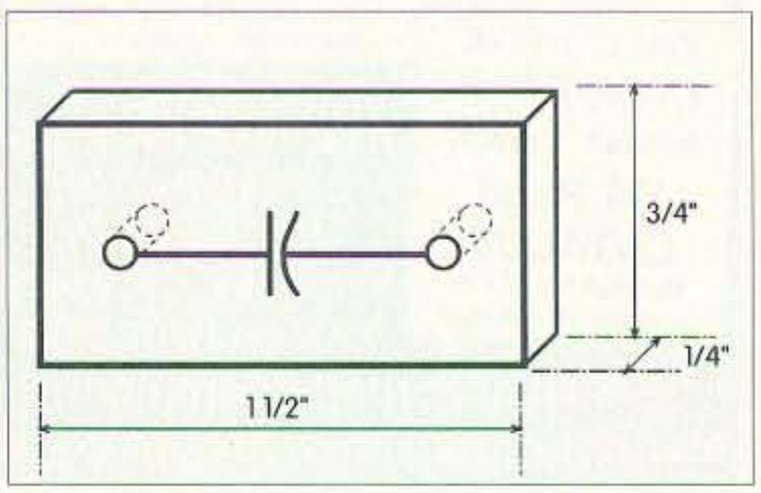


Fig. 1. *Lucite or Lexan insulator with capacitor.*

(1) It has about 3 to 4 dB gain over a conventional dipole at the basic design frequency.

(2) There are minimal high voltage loops on the antenna.

(3) There are no end effects of any consequence.

(4) The antenna may be erected in any manner, shape, or form—whatever suits your real estate.

(5) The entire antenna radiates. A dipole has about 67% radiation efficiency. The CCD approaches 97%.

"When conditions are right, I can copy European stations 5 x 9 plus on 75 meters."

(6) The CCD antenna, when used with an antenna system tuner, will have a gain on the fundamental design frequency and will operate on all higher amateur bands. It will not work properly on frequencies lower than the design frequency.

(7) The CCD antenna may be erected close to the ground without seriously affecting the efficiency of the radiated signal.

(8) This antenna is very quiet when used in the receive mode.

(9) Construction is straightforward (though time-consuming—96 solder connections are involved in building this type of antenna).

(10) The feed-point impedance will vary between 275 and 325 ohms, and will require the use of a balanced line or a 6:1 balun when used with a coaxial feedline.

Construction details

Initially, I built a 7 MHz CCD antenna. Though it is not difficult, construction does take some time. I started by cutting 48 pieces of wire, 35 inches long, with a 1-1/2-inch pigtail at each end, making each piece a total of 38 inches overall. I used Teflon™-covered wire, 16-gauge stranded. I used covered wire because here in Texas we have occasional severe weather, and precipitation static can be a problem. The covered wire reduces this type of static. Because there are no high voltage loops on the antenna, using covered wire does not cause undue losses.

In order to simplify measuring the wire to 35 inches, I built a simple jig on a piece of 1-inch by 2-inch wood, drove in two nails, 35 inches apart, and bent the wire at the 35-inch dimension. I judged the 1-1/2-inch pigtails. After cutting and stripping the 48 lengths of wire, I cut 49 pieces of Lucite™ (you can use Lexan™ if it's available) and drilled them as shown in **Fig. 1**. The Lucite insulator provides a means to connect adjacent wire elements as well as a way to mount the series capacitors.

When mounting the capacitor, it is important to provide sufficient capacitor lead slack to relieve stress on it. Obtaining the capacitors shouldn't be a problem. I bought 60 390 pF silver micas rated at 200 volts, with a tolerance of 5%. They cost nine cents each at a surplus outlet. The 200-volt rating will safely handle the legal amateur power level. One reason for buying 60 capacitors was to insure that I would have 46 capacitors that were within the 5% tolerance rating. Nine capacitors did not meet the requirements. Using polyester capacitors is better, but they are more

expensive. If possible, buy capacitors with long leads; it simplifies connecting them to the wire elements. Once the capacitors were mounted and connected to the wire elements, I covered them and the leads with RTV compound. This provides an excellent weather seal.

Check the current flow

Before you erect the antenna in its final location, install it about four feet above the ground. Remember, it does not have to be in a straight line; install it to suit your real estate. When you have erected the antenna at the four-foot level, use a simple RF sniffer (**Fig. 3**) and excite the antenna with 3-5 watts of power. Start at the feed point and work to either end of the antenna. At the feed point you will have some indication of current. It makes no difference what the reading is; whatever it is, use that as the reference reading. Work your way to the end of the antenna. As you approach a capacitor the reading will decrease a bit, but as you travel to the end of the wire element the reading should again increase. If a reading should drop off after moving away from the capacitor, you have a problem in that section. It could be a bad capacitor, broken lead, or poor solder connection. Correct this before proceeding further with the measurements. Remember: When making these measurements, do not change the power output of the exciter.

Installation

Once you have ascertained that the current flow is uniform throughout the entire length of the antenna, you are ready to install it on your real estate. The length of the feedline is immaterial but, of course, the shorter the better. The lowest point of my 3.5 MHz antenna is four feet high. The center of the antenna is about 35 feet, and it is mounted among 40-foot trees, through branches and close to buildings. When conditions are right, I can copy European stations 5 x 9 plus on 75 meters. The 7 MHz antenna is also among trees, and I can work VKs, 5 x 8 – 9, using 100 watts when propagation conditions warrant.

This is exciting

One of the problems of living in Central Texas is that ground conductivity is very poor. To overcome this, I installed a #16 copper wire, buried one inch in the ground, and followed the exact pattern of the erected antenna. Initially, when I excited the antenna with 5 watts, the RF sniffer indicated a reading of 29 microamperes. With the ground wire in place and 5 watts of excitation, the RF sniffer indicated 33 microamperes at the ends of the antenna. What this told me was that the antenna was passing more current, and the radiating efficiency had increased. Reference 2 states that the use of capacity-loading disc screens at the ends of the antenna will increase the radiation resistance, improve current distribution, and almost completely eliminate end effect. The end caps I use are illustrated in **Fig. 2**, and they are mounted vertically, about three feet above the ground wire. The resonant frequency of the antenna was lower, so I eliminated one section from each end and the frequency was about 6.995 MHz. I again excited the antenna with 5 watts and

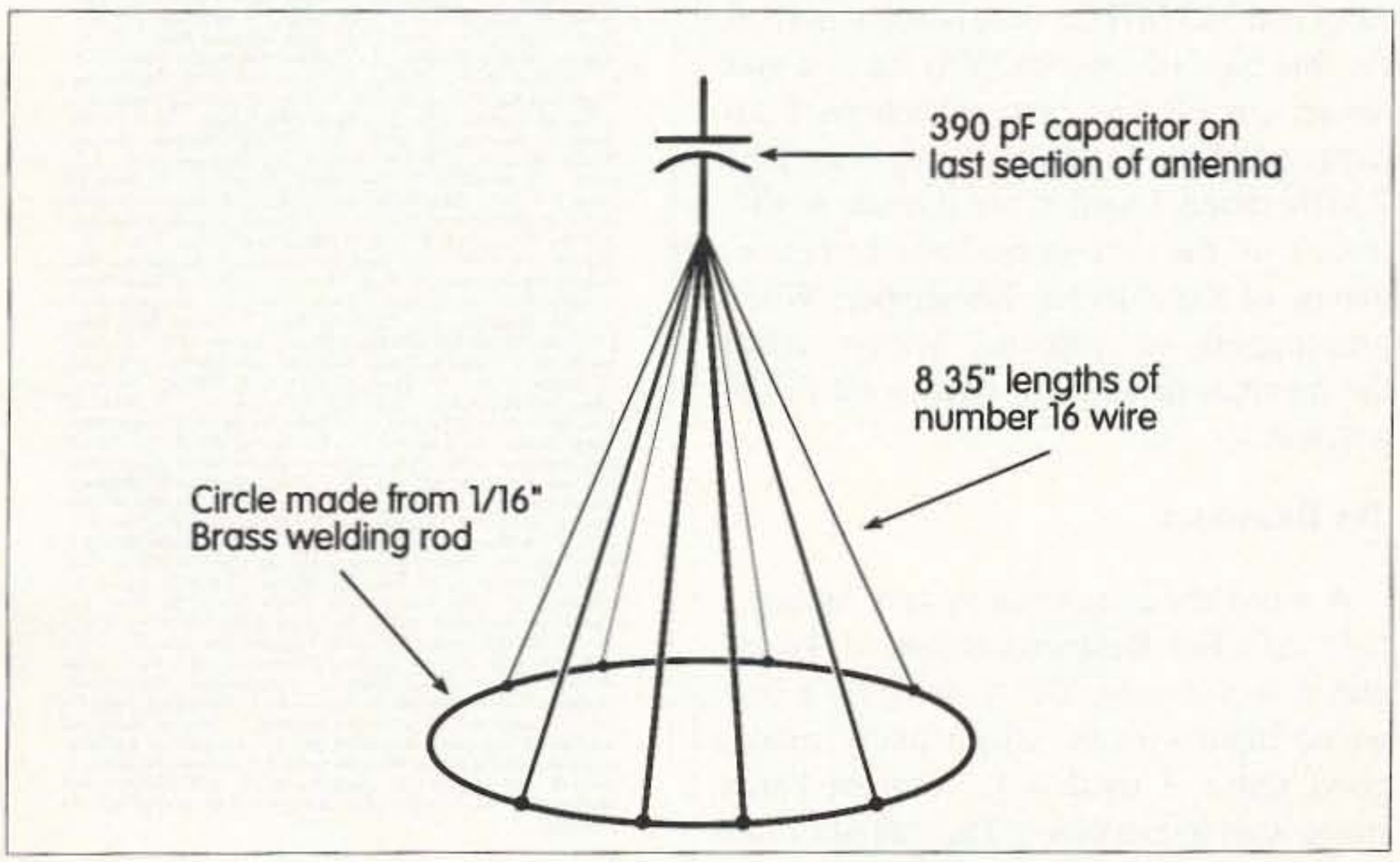


Fig. 2. End capacity hat for 7 MHz CCD antenna; two required.

Pocket Morse Code Trainer

Learn Code Faster & Easier
Better than code tapes
Take it anywhere to practice
Light weight & compact

The Deluxe Pocket Morse Code Trainer

**Selectable code rates from 3 wpm to 33 wpm*
** Plays standard or Farnsworth*
** Size 1" x 3.8" x 2.4"*
** Runs 40 hrs on one 9 v battery*

1) Plays continuous fresh random code (Selectable letter groups, ie A-Z, 0-9, & more)
2) Preprogramed random character playing
3) Interactive training (Excellent for beginners)
4) Continious newly generated QSO (1 million different QSO like the General exam)
5) Preprogamed QSO to check accuracy
6) Continuous random words Playing

The Ultimate Pocket Morse Code Trainer

It has all the above features plus
1) A 16 character LCD display which allows you to check yourself during or after a QSO
2) Internal amplified speaker.
3) Selectable random character playing. (Select which character or numbers to practice)

Call 214-350-0888 Price $99.00
Add 2.50 for a mono ear piece & 3.50 for a stereo head set
Visa/MC accepted Add $6.00 S/H + 8.25% Tx
Computer Aided Technology, 4088 Lindberg Dr, Dallas, Tx 75244

CIRCLE 276 ON READER SERVICE CARD

FREE!
NEW CATALOG
CALL TOLL FREE: 1-800-JAN-XTAL
Quality Crystals and Oscillators for:
AMATEUR BANDS • CB • MARINE VHF
SCANNERS • MICROPROCESSORS • PAGERS
P.O. Box 60017 • Fort Myers, Florida 33906
VISA (941) 936-2397
JAN Crystals

160-10 G5RV QuickKits ™
created by AntennasWest Box 50062-S, Provo, UT 84605

Fast & Easy to Build
• Fail-Safe visual instructions
• No measuring or cutting
• Everything included
• Finish antenna in minutes
Quality Components
• Presoldered Silver Fittings
• Kinkproof QuietFlex wire
• Fully insulated, wx sealed, no-corrode, low noise design
Tune All Bands Incl WARC

• Double Size G5RV 204 ft 160-10 Dipole	$59.95
• Full Size G5RV 102 ft 80-10 Dipole	$39.95
• Half Size G5RV 51 ft 40-10 Dipole	$29.95
• Quarter Size G5RV 26 ft 20-10 Dipole	$24.95
• ReadyMade 102 ft G5RV	$50.00
• ReadyMade 51 ft G5RV/2	$40.00
• 200' Dacron 250# line	$11.95

Want Plans, Patterns, Data? Order TechNote #124-D $6.95 ppd USA
Order Hot-Line: 1-800-926-7373 Add $5 P&H

CIRCLE 116 ON READER SERVICE CARD

Handheld Repeater Controller

Spectrum Electronic Products introduces the world's first handheld repeater controller. No larger than most handheld radios, the **HRC-10** converts a single or dual-band radio into a full featured simplex or duplex repeater system. Key features of the **HRC-10** include voice IDer, DTMF Control and programming, hang and time-out timers, Digital Voice Operated Squelch (DVOS™), telemetry tones, and private voice mail slot. **$299**

http://www.spectrum-usa.com
800-566-2788 - fax 408-336-9461

CIRCLE 69 ON READER SERVICE CARD

EVERY ISSUE OF
73 Amateur Radio Today on Microfiche!

The entire run of 73 from October 1960 through last year is available.

You can have access to the treasures of 73 without several hundred pounds of bulky back issues. Our 24x fiche have 98 pages each and will fit in a card file on your desk.

We offer a battery operated hand held viewer for $75, and a desk model for $260. Libraries have these readers.

The collection of over 600 microfiche, is available as an entire set, (no partial sets) for **$285** plus $5 shipping (USA). Annual updates available for $10.

Satisfaction guaranteed or money back!

BUCKMASTER
6196 Jefferson Highway
Mineral, Virginia 23117
540:894-5777·800:282-5628
Internet: info@buck.com
Fax 540:894-9141

CIRCLE 168 ON READER SERVICE CARD

CUBEX QUAD ANTENNA CO.
40 YEARS OF QUALITY ANTENNAS
SKYMASTER H.F. KITS FROM $275.95
PRE-TUNED H. F. QUADS FROM $379.95
Quad Antennas From 2 Through 40 Meters
2 METER 4 EL. PRE-TUNED $44.95 + $7.00 S&H
6 METER 2 EL. PRE-TUNED $69.95 +$15.00 S&H
BEST PRICES ON DOUBLE BRAIDED "DACRON" ANTENNA ROPE
visit our new web site http://www.cubex.com
Write Or Call For Free Catalog
2761 SATURN ST. "E" BREA CA 92621
(714) 577-9009 FAX (714) 577-9124

CIRCLE 166 ON READER SERVICE CARD

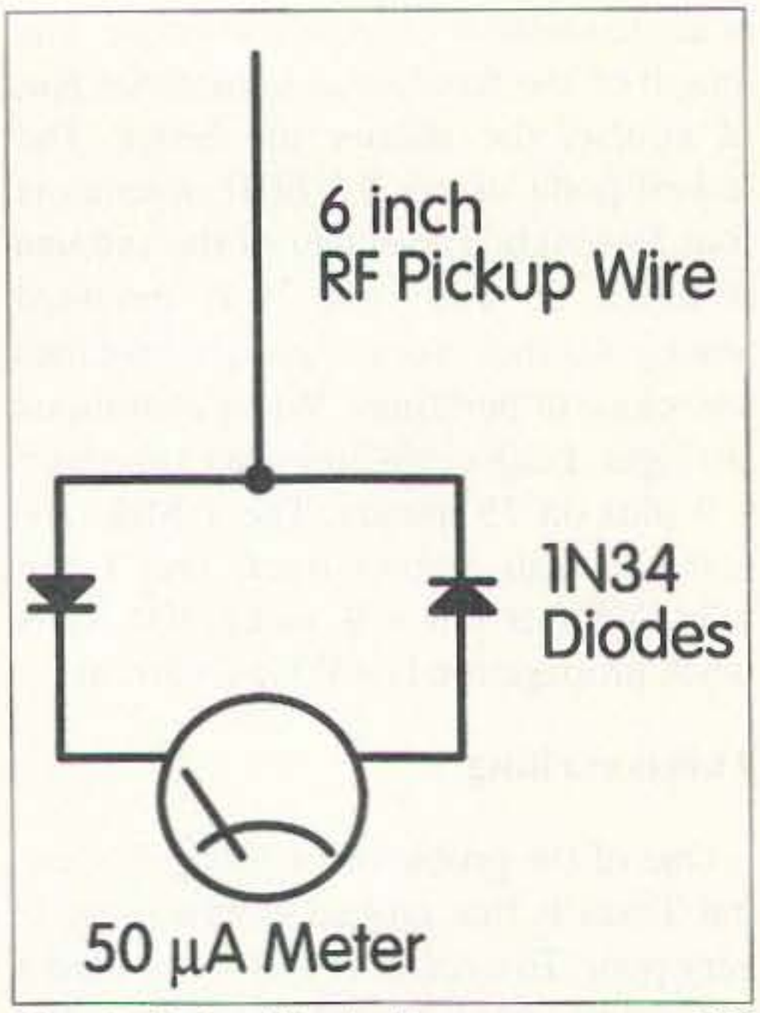


Fig. 3. RF sniffer (will operate up to 100 MHz).

the reading at the end cap was 41 microamperes, an increase of 8 microamperes—another substantial gain increase.

A word about feeding the antenna: If you plan to use coaxial cable, I suggest you use a 6:1 current balun mounted at the feed point of the antenna. The use of an antenna system tuner is a definite plus when using coaxial cable. I personally prefer using a balanced line. A good-grade 300-ohm TV twin lead will work well with powers up to 500 watts. A 450-ohm balanced line will also work. A tuner must be used with both of these lines.

Frequency check

Before you erect the antenna you may want to try to check the resonant frequency with a grid-dip meter. You'll be in for a surprise. My 7 MHz antenna resonates at 6.995 MHz, which is about normal for this type of antenna. You may, if you desire, cut off one or two sections from each end of the antenna to bring it into the 7 MHz range. I tried it, but it made no difference in the current readings or performance of the antenna. Remember: When grid-dipping an antenna, always make the measurements at the feed point of the antenna.

Try this tuner

A word about antenna system tuners: I built AG6K's Balanced Balanced Tuner[3] and it is a beauty. This tuner uses a balanced input system, which really makes good sense. I used a 1:1 current balun made with ferrite cores. The output of this tuner is balanced, no balun is required, and the efficiency is excellent. With my 7 MHz CCD antenna, I was able to obtain a 1:5:1 SWR from 7 MHz to 29.99 MHz. For those of you who like to experiment, I recommend trying this tuner. I have also used a conventional LC network tuner which worked very well, but it was a bit cumbersome when switching to bands other than 7 MHz. Any good grade of commercial tuner may also be used with good results.

Designer's choice

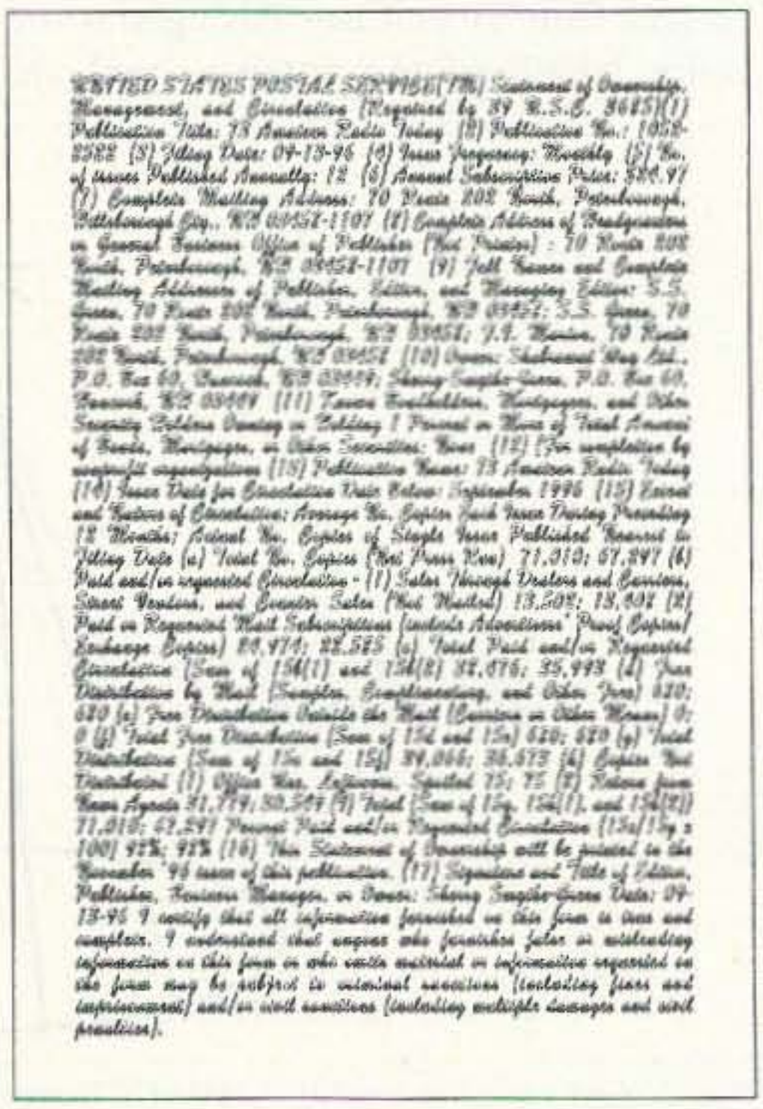
This antenna may be erected in any configuration that suits your real estate. I have erected them as inverted Vs, bi-square, and even lying on the ground. Rest assured, they will perform. My present goal now is to cut down some trees (when the XYL isn't looking) and try two 7 MHz CCDs, spaced about 18 feet apart, and reverse the feeds for east or west directivity. If anyone has had the opportunity to try this, or has any input on the CCD antenna, please let me know the results. 73

References:

1. Harry A. Mills, Gene Brizendine, "Antenna Design: Something New," *73 Amateur Radio Today*, October 1978.

2. Harry A. Mills, Gene Brizendine, "The CCD Antenna - Another Look," *73 Amateur Radio Today*, July, 1981.

3. Richard L. Measures AG6K, "A Balanced Balanced Antenna Tuner," *QST*, February 1990.



UNITED STATES POSTAL SERVICE (The) Statement of Ownership, Management, and Circulation (Required by 39 U.S.C. 3685)(1) Publication Title: 73 Amateur Radio Today (2) Publication No.: 1058-2522 (3) Filing Date: 09-13-96 (4) Issue Frequency: Monthly (5) No. of issues Published Annually: 12 (6) Annual Subscription Price: $26.97 (7) Complete Mailing Address: 70 Route 202 North, Peterborough, Cheshire Cty., NH 03458-1107 (8) Complete Address of Headquarters or General Business Office of Publisher (Not Printer): 70 Route 202 North, Peterborough, NH 03458-1107 (9) Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor: S.S. Green, 70 Route 202 North, Peterborough, NH 03458; S.S. Green, 70 Route 202 North, Peterborough, NH 03458; J.J. Marion, 70 Route 202 North, Peterborough, NH 03458 (10) Owner: Shalimar Way Ltd., P.O. Box 60, Emerald, NH 03449; Sherry Snyder-Green, P.O. Box 60, Emerald, NH 03449 (11) Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities: None (12) [For completion by nonprofit organizations (13) Publication Name: 73 Amateur Radio Today (14) Issue Date for Circulation Data Below: September 1996 (15) Extent and Nature of Circulation: Average No. Copies Each Issue During Preceding 12 Months; Actual No. Copies of Single Issue Published Nearest to Filing Date (a) Total No. Copies (Net Press Run) 71,910; 67,847 (b) Paid and/or requested Circulation - (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales (Not Mailed) 13,208; 13,602 (2) Paid or Requested Mail Subscriptions (include Advertiser's Proof Copies/Exchange Copies) 50,474; 42,585 (c) Total Paid and/or Requested Circulation (Sum of 15b(1) and 15b(2) 63,676; 56,993 (d) Free Distribution by Mail (Samples, Complimentary, and Other Free) 630; 630 (e) Free Distribution Outside the Mail (Carriers or Other Means) 0; 0 (f) Total Free Distribution (Sum of 15d and 15e) 630; 630 (g) Total Distribution (Sum of 15c and 15f) 64,006; 56,673 (h) Copies Not Distributed (1) Office Use, Leftovers, Spoiled 75; 75 (2) Returns from News Agents 31,779; 30,569 (i) Total (Sum of 15g, 15h(1), and 15h(2)) 71,910; 67,247 Percent Paid and/or Requested Circulation (15c/15g x 100) 99%; 99% (16) This Statement of Ownership will be printed in the November '96 issue of this publication. (17) Signature and Title of Editor, Publisher, Business Manager, or Owner: Sherry Snyder-Green Date: 09-13-96 I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including multiple damages and civil penalties).

Number 25 on your Feedback card

Hamtronics R139 Weather Satellite Receiver

Enjoy monitoring atmospheric conditions and the satisfaction of building the kit!

Larry R. Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03455

I'm not really sure *why* I got interested in satellite weather reception, but I remember exactly *when*. A member of the local radio club was putting on a demonstration at a club meeting. He had assembled a very simple interface, using perhaps a single chip and a cap or two built into a 25-pin D-sub connector hood. One end of this hooked to his receiver, the other end to his computer. Using a piece of demodulator software he obtained from the Internet (as freeware, no less), he was able to decode HF weather facsimile pictures—quite respectable pictures, too, except that most of them were of very interesting cloud formations out over unrecognizable areas of the ocean someplace. As my interest grew over the next few weeks, I found that most of these HF transmissions are intended for ships at sea. This meant that my chances of receiving highly detailed photos of the weather surrounding my home QTH in the hills of New Hampshire were pretty slim. However, while doing research on weather transmissions in general I found out about something even better than the HF transmissions. It was apparently possible to receive the broadcasts from the satellites themselves—in real time—as they were going overhead. This made much more sense than worrying about trying to capture some out-of-date military transmission on the HF bands. At the time I realized that this project would be a little more complicated than mounting an IC inside a DB-25 hood, but I decided to go ahead with it.

My research took me through several magazines, a few books, and one highly recommended manual (*The ARRL Weather Satellite Handbook*). I found that the satellites I wanted to receive all worked in the 137 MHz band. These were the American (NOAA), Chinese (Feng Yun), and Russian (METEOR) birds. The NOAA satellites were more "available"—that is, they passed overhead more often, and more of them were still transmitting useful data. In addition, the NOAA birds transmitted both visual and infrared images as they circled the earth. These satellites circle the earth in near-polar orbits, meaning that from a given location, each of them may be in range several times a day. In any case, there were three main components needed in any decent station capable of receiving the polar orbiting automatic picture transmission (APT) satellites—a receiver, a demodulator, and an antenna system. I felt that my first step should be the receiver. Once I had that built and could determine whether or not I could actually hear any satellites, well, then I could decide if I wanted to actually spend some money to find out what the pictures looked like.

"It's possible to receive the broadcasts from the satellites themselves—in real time—as they go overhead."

According to my sources, there were two main choices for the 137 MHz receiver. The first was an actual 137 MHz radio designed for satellite reception. The second was to use a modified scanner. The reason that an off-the-shelf scanner needed to be modified had to do with the bandwidth of the APT signal. The weather satellites transmit a signal modulated with a 2400 Hz tone, at ± 15 kHz deviation. This is three times the level used in most normal communications gear. While it would be possible to receive these signals on a normal receiver, much distortion would result due to the lack of modulation acceptance, and the results would be unsatisfactory. I found it was possible to modify a scanner to eliminate the IF selectivity, which would allow the wider signals to pass through. Unfortunately, this would allow unwanted signals to pass through as well. Since I lived near an airport I was already worried about the effect of the nearby aircraft band transmissions. I decided that a widened IF, coupled with the wide front end of the scanner, would be more trouble than it was worth. I decided to shell out the bucks for a real receiver.

Photo A. *The completed R139 Weather Fax Receiver.*

After reviewing the options, I chose the R139 Receiver from Hamtronics, Inc. The R139 represented a good compromise between cost, performance, and bells and whistles. The R139 comes as a five-channel crystal-controlled unit, with scanning capability. It has a 0.2 µV sensitivity, due to its low noise dual-gate FET RF amp circuitry. Modulation acceptance is 38 kHz, meaning it's designed just for the bandwidth of the polar orbiters. A tunable front end is

used to provide plenty of rejection to off-channel signals. The R139 also has separate outputs for speaker audio, demod output, and a special line to control a tape recorder. I found that I could save quite a few dollars by building it myself, so I ordered the kit.

Assembly of the main board took a couple of leisurely evenings, and I finished up the alignment and cabinet installation on a Saturday morning. As is usual for Hamtronics, the board and components were of very high quality. Documentation was not a step-by-step installation procedure—the builder is given some credit (and responsibility) for knowing what he or she is doing. The assembly instructions consist of about a dozen paragraphs, giving hints and pointers about each group of parts. More specifics are given about the size of parts to install at a given time than about which part goes where: "After a group of shorter parts like these are installed, you can put in taller parts like L3 and L2." This prevents the assembler from making any moves that will make life difficult later, while still giving him the responsibility to choose the order of assembly.

Once the assembly is complete, it's time for alignment. Note that you do indeed need a signal generator for this procedure (a friend with a signal generator works just as well). The documentation does provide step-by-step information on the alignment of the receiver, as well as several hints and suggestions as you go along. (Note that the slug-tuned coils require the use of a .062" square tuning tool. If you don't have one, make sure to order one along with the R139. They're cheap compared with the suffering experienced when you break a coil slug on Saturday night because you tried to use the wrong tool, and you can't get a new slug until Monday, and you'll never know all weekend if your receiver is working or not. Not that the author has ever had this experience...)

***Photo B**. A sunny day in New Hampshire. This infrared image stretches from the tip of Florida all the way north to the bottom of Hudson Bay. The bars on the right border are the synchronization signals that are transmitted at the beginning of each line.*

Once the unit is aligned, it's time to hook it up to the demodulator and the antenna. Connections are easily made through a 9-pin D-sub connector on the rear panel. My first attempt was simply to set the squelch and turn up the volume as I went about my business in the house. Within an hour I was hearing a reassuring "tick-tock" coming from the speaker, using just a VHF discone antenna. I hooked the demod output to a tape recorder, and connected the TAPE CONTROL output of the R139 to the REM IN of my tape recorder. Nothing happened. I figured that the open collector output in the R139 couldn't sink enough current to start the motor on my 1970s vintage tape recorder, so I added a small relay to do the job, which corrected the problem. (I later found that this was carefully explained in the part of the instructions I hadn't bothered to read, but that didn't diminish my feeling of accomplishment at having engineered the solution myself.) I started recording passes, and worked on figuring out how to get my demodulator to work.

The first several images I demodulated were confusing—nice cloud formations, some land masses—but I couldn't for the life of me figure out where they were being taken. I had no idea of the scale; was that chunk of land a peninsula on Cape Cod, or was it Florida, or maybe the tip of South America? Not only that, but since some passes are received going north to south, and some south to north, the upside-down land masses can be very difficult to recognize. (This inverted orientation can be corrected with the viewing software.) Finally, on a Saturday morning I heard a pass going over. I came into the shack and found that I was out of tape in the tape recorder, so I demodulated the image directly from the R139. As the picture crept down the screen, line by line, I could make out some clouds, then a big lake, then some more lakes, then—Hey! The Great Lakes! Nine-Land! My old stomping grounds! There were a few clouds over Minnesota and Lake Superior, but northern Wisconsin was as clear as a bell. Elated, I immediately called my parents (Harry and Jean) back in Wisconsin and informed them that I could tell they had clear weather at their house. They were quite unimpressed, even when I explained the amazing advances in technology that allowed me to tell them this. When you've lived from telegraphs to cell phones, and from crystal radios to CNN, I guess it's hard to be excited about a simple satellite receiver. But I sure was!

"A great way to get into satellite weather reception."

As the weeks passed, I collected more and more images, some impressive, some not so exciting. The R139 dutifully turned on the tape recorder and recorded each pass, whether it was going directly overhead or photographing someplace I wasn't interested in. In addition to these unwanted passes I found that I wasn't getting as large or as clear a picture as I should have. My simple discone antenna wasn't up to the task of pulling in enough signal for quality satellite photos; I obviously had to fine-tune the system. First, I needed to find out how to use my demodulator and software more effectively so I could choose the satellite and pass I was interested in. Second, I needed to upgrade my antenna system to something more appropriate to the demands of extra-terrestrial transmissions. But in the meantime, my Hamtronics R139 Weather Fax Receiver was pulling in the pictures, and I was busy printing out images to impress the guys at work.

All in all, the Hamtronics R139 Receiver is a great way to get into satellite weather reception. Although not a kit for the first-time builder, if you've got a project or two under your belt and have access to a signal generator for the alignment, the R139 is a top-notch receiver for the money. For more details contact: Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535 or call: (715) 392-9430. 73

NEVER SAY DIE

Continued from page 18

mind. When I wrote a set of rules and regulations for Jordan back in 1970 I proposed something along this line, with the call prefixes reflecting the progress a Jordanian amateur had made.

The recent Boy Scout Jamboree On The Air (JOTA) reminded me of my idea of setting up a similar merit badge system for hams. We could have one for working all states on any particular band and mode. Another for working 100 countries on a band and mode. 20m-SSB, for instance. 40m-RTTY. 160m-CW. With badges for packet, slow-scan, satellites, and so on. If we want more CW activity, why not offer a badge and certificate for using CW to work and states and 100 countries? Ditto packet, and so on.

With a set of goals like that we wouldn't need six different license classes.

If You're So Smart ...

Okay, as a ham you are a communications expert. Well, you're supposed to be. That's what you've conned your non-ham friends and the FCC into thinking, right?

So what do you really know about communications, other than kerchunking some repeaters or adding still more garble to a pileup? If someone were to ask you about pagers, what could you tell them? How much do they cost? What's their range? Where do you get 'em? What frequencies do they use? What services are available? Can you use them around your own business?

And what can you tell people about fax-modems? The Internet, CompuServe, Prodigy, bulletin board systems, and so on?

There are almost endless communications services out there. Now, if you, as a bona fide federally licensed communications expert, can't answer even simple questions about 'em, imagine how confused the average business person is when faced with choices of telephone switches, cellular telephones, teleconferencing, security systems, computer networking, and so on. All this is so far beyond the average person to deal with that you have a tremendous opportunity to make some money ... once you know your stuff.

No, you don't know all the answers now, but with your ham background, at least you can understand the questions and you have some clues on where to find the answers. Knowledge is not only power these days, it's money. There are at least 10 million small businesses that could be benefited by better communications, security, and computer systems. That's one heck of a market.

How long do you think it would take you to become an expert on pagers, just to pick one field at random? You need to get literature from the manufacturers, dealers, and service companies. You'd want to read a couple books on the subject. Are we talking six months? One month? A week?

Next you'd want to visit some of the companies involved in the business and talk with them. Find out their problems, what success stories they have, which equipment they think works best, and so on. Couple months in your spare time?

Now that you have a good understanding of the technology and the players, and have the contacts you need, what should you do next? My recommendation would be to sit down at your computer and write a brief handbook on the subject ... maybe 32 pages. Write it for the nontechnical average business person. Explain the benefits your service provides and show how the costs are small compared to the benefits. You can make the handbook look professional by printing it on a laser printer. The first hundred copies can be made on a copy machine. That's the way I do my booklets until the demand gets out of hand.

This will provide you with some sales literature for your new communications consulting service. With your name as the author, this certifies that you are an expert. Now you're in a position to send letters to local businesses offering the first phase of your communications consulting services.

Once you know your stuff on pagers it's time to pick the next business you're going to learn. If you've made any efforts toward selling your pager expertise, by now you'll know what questions business people are asking about other communications services. You might tackle fax-modems next.

Same deal. Get the literature. Read the books. Talk with the manufacturers, dealers, and services. Help some friends for free, learning on their money. It's always best to use other people's money (OPM) as much as possible when you are learning.

Within a year, if you make any kind of an effort at all, you'll be Mr. Communications in your town, and you'll have dozens of small businesses turning to you for solutions. In the communications business you make money on sales, on installations, and on service. Great business. All communications equipment breaks, so the service business is wonderful. And computers, being the most complicated of all, break the most often. Plus there are viri, incompatible software, static electricity, errant magnets, and so on to help keep you living comfortably.

Oh yes, it won't hurt to become an expert on magnetic fields and go around with your gaussmeter and help people avoid possibly harmful fields. There are some inexpensive gaussmeters on the market that do a wonderful job.

And when your customers want to know whether cellular telephones are harmful or not, you'll know the answer and be able to give them a reprint of an article from *73* on the subject.

There's no reason for any ham with even the slightest amount of gumption not to be living in comfort and have as big a ham station and antenna farm as he (or she) wants.

Expert Help Needed

If you are already an expert on any phase of communications, how about writing an

Continued on page 33

See the FUN you've been missing!

Every day more and more hams are enhancing their enjoyment of ham radio by adding images to their conversations. Join the fun!

new ***Pasokon TV*** Lite ..... $30 + $3 shipping.
Pasokon TV Classic ..... $200 + $5 shipping.

Absolute Value Systems
115 Stedman St. #7
Chelmsford, MA 01824-1823
(508) 250 0611

http://www.ultranet.com/~sstv

CIRCLE 351 ON READER SERVICE CARD

ONV SAFETY BELT
P.O. Box 404 • Ramsey, NJ 07446
800-345-5634
Phone & Fax 201-327-2462

NEW FROM ONV
FULL-BODY HARNESS

ONV Safety Belt with Seat Harness
$89.95
+$6.00 UPS
Visa M/C Check
OSHA
We Ship Worldwide
Order desk Open
7 Day/ Week

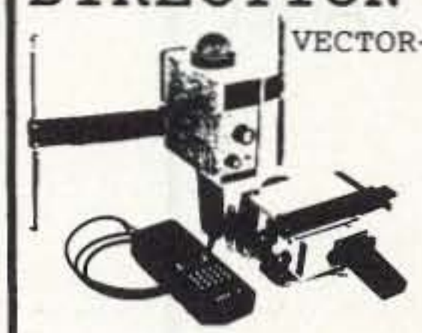
ONV Tool Pouch $15.95

WITHOUT SEAT HARNESS
• Adjustable to 42" waiste • Special Safety Lock
• 5,000 LB. TEST • OSHA
+$6.00 UPS
$74.95
Large to 56" add $10.00
ONV Tool Pouch $15.95
Visa M/C Check

TOWER CLIMBING LANYARDS
3 feet with large gorilla hook to clip on ONV Safety Belts. For use on towers, latters, etc.
NOW FEEL SAFE CLIMBING TOWERS
$39.95
+$6.00 UPS

CIRCLE 102 ON READER SERVICE CARD

DIRECTION FINDERS



VECTOR-FINDER
HAND-HELD PHASE SENSE ANTENNAS FOR VHF DIRECTION FINDING. USES ANY FM RCVR. ARMS FOLD FOR STORAGE.

TYPE VF-142 144-220 MHZ $139.95
TYPE VF-142Q LEFT-RIGHT LEDS & AUDIO, 144-220 MHZ $239.95
TYPE VF-142QM SAME AS Q MODEL EXCEPT FREQ.144-500 MHZ $289.95
TYPE VF-121Q SAME AS VF-142Q PLUS 121.5 MHZ ELT FREQ $379.95
CALL ABOUT HF DF, ATTENUATORS
ADD $4.50 S/H
CA ADD TAX

RADIO ENGINEERS
7969 ENGINEER RD, #102
SAN DIEGO, CA 92111
619-565-1319 FAX 619-571-5909

CIRCLE 58 ON READER SERVICE CARD

Number 28 on your Feedback card

A QRP SWR/Power Meter

Just by recalibrating the MFJ-860.

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

The MFJ-860 cross-needle SWR/PWR meter is a small 4-1/2" x 2-1/4" x 3" (WHD) lightweight instrument which provides simultaneous indications of SWR and forward and reflected RF power in two switch-selected ranges of 30 and 300 watts into a 50-ohm load. The meter face also includes a 0-to-6-watts scale which can be used for QRP operation after completing the modification in this article.

Only your QRP transmitter, a dummy load, and a small screwdriver are needed to do the job. After this modification there will be two ranges as before, but one will be 6 watts full-scale forward and the other will be 30 watts. No hole drilling or soldering will be necessary, unless you decide to add a switch and capacitor to provide a choice of average or peak output power.

Calibration

Remove the two screws holding the clamshell case together and place the top aside. Turn the instrument with the right side facing you. You will see four black trimpots mounted at the upper left of the printed circuit board (**Fig. 1**). The upper row, from the panel side to the rear, control forward and reverse power levels on the current 30-watt range. This will be recalibrated to indicate 6 watts full-scale. The lower row of trimpots, from the panel side to the rear, control the forward and reverse power levels on the current 300-watt range. This range will be recalibrated to indicate 30 watts full-scale.

Because of the values of trimpots used by MFJ, recalibrating both ranges is easier than attempting to change the 300-watt range to indicate 6 watts full-scale.

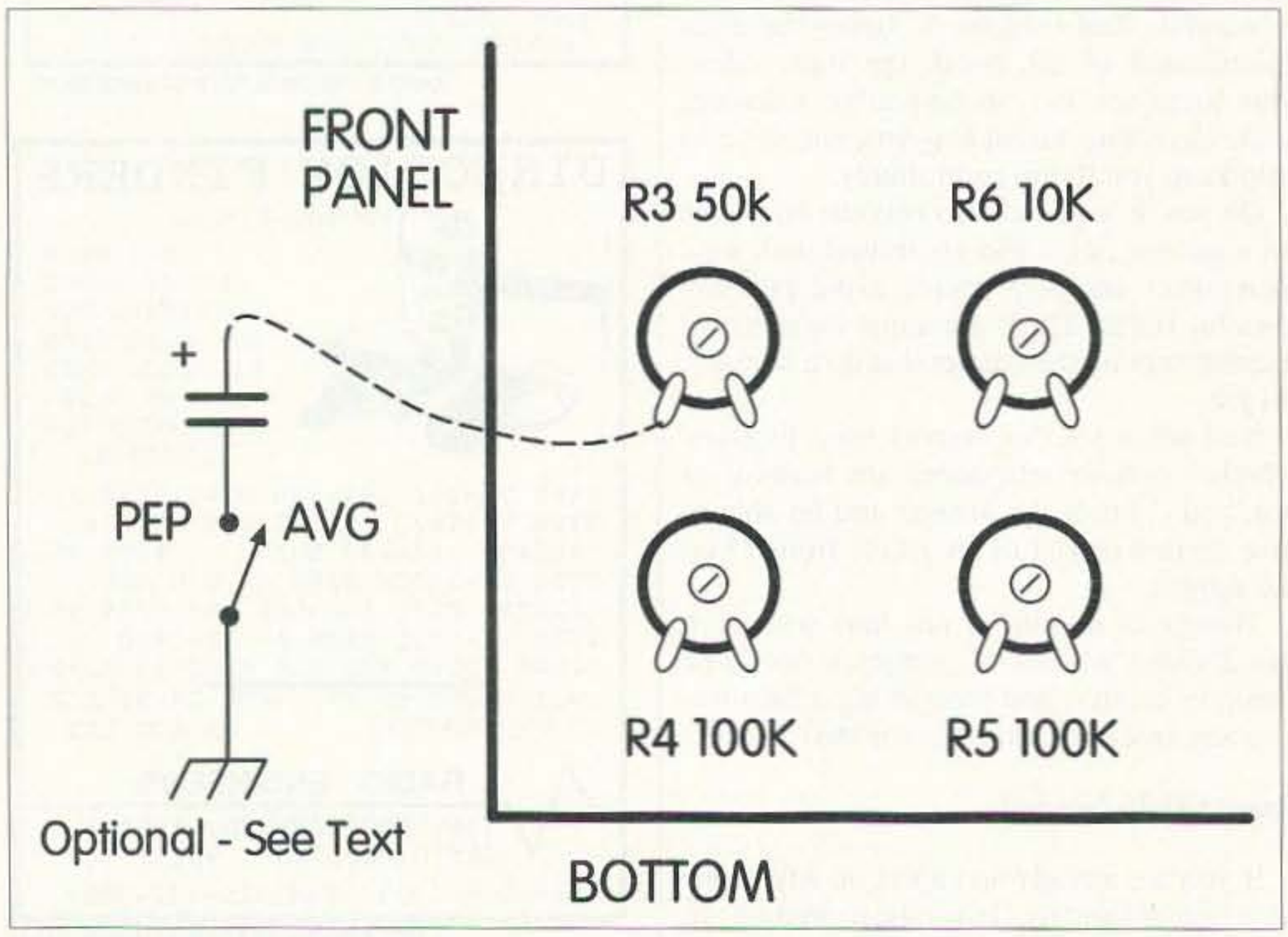


Fig. 1. Identification of calibration trimpots.

Connect a 50-ohm dummy load to the antenna connector on the rear deck. Connect the output of your QRP transmitter to the transmitter connector on the rear deck. Put the range push-button switch on the panel to the 30-watt range. Turn on and key your QRP transmitter, setting it to any exact wattage between 1 and 6, but preferably 5 watts. **Note:** If you connect a coaxial tee to either connector on the rear you can use your RF probe and DMM to accurately set the RF power output. A reading of 15.81 volts indicates 5 watts into 50 ohms.

Assuming you have 5 watts of RF input, adjust R3 (50k) until the meter indicates 5 watts on the lower "Forward" scale on the meter face, midway between the numerals 4 and 6. This completes calibrating the 6-watt forward power range.

Now change the range switch on the panel to the 300-watt range. With the same 5 watts input, adjust R4 (100k) until the meter indicates 50 on the upper portion of the "Forward" scale. This point is 5 watts on the new 30-watt scale, and completes its calibration.

Now unkey your QRP transmitter and reverse the connections on the rear deck with the dummy load hooked up to the transmitter connector and your transmitter hooked up to the antenna connector.

Check that the range switch is still in the 300-watt position, key your transmitter to apply 5 watts in the reverse direction, and adjust R5 (100k) until the meter indicates 50 on the upper side of the reflected scale, then unkey your transmitter. This completes calibration for reflected power on the new 30-watt scale.

If you can reduce transmitter output power to 1 watt you can calibrate the reflected power range on the new 6-watt scale, as follows:

"Only your QRP transmitter, a dummy load, and a small screwdriver are needed to do this job; no hole drilling or soldering are required."

Warning: Do not apply more than 1.2 watts in the reverse direction on the new 6-watt range—you can easily destroy the meter. Reduce power from your transmitter to 1 watt, a reading of 7.07 volts with the RF probe into 50 ohms. This should be indicated at 10 on the upper "Reflected" scale because the range switch is still set for 300 watts. Place the range switch in the 30-watt position (the new 6-watt range). Adjust R6 (10k) *very carefully* until the meter indicates 1 watt on the lower "Reflected" scale. This adjustment is touchy because 1 watt indicates with R6 very near the zero resistance end of its rotation. Unkey your transmitter. This completes recalibration of the MFJ-860. If desired, you may change the panel markings on the range switch from 30 to 6 watts, and 300 to 30 watts.

Adding Peak/Average Power Switching

Refer to **Fig. 1**. There is more than enough room on the panel, either between the meter and PC board or between the PC board and the right end of the panel, to mount a small toggle switch. The electrolytic capacitor (22 µF) is suggested, but you can use any size that provides the time constant you prefer when indicating peak power output. It can be tucked wherever it is convenient. Its voltage rating is unimportant because the leads carry only very few DC volts. With the toggle switch OFF, the meter will indicate average (rms) power. When the switch is ON, as when operating SSB, the meter will indicate peak RF power.

About SWR

The MFJ-860 meter is so calibrated that SWR is indicated on the red arc where the needles cross. The ideal situation is to show no reflected power, indicating an SWR of 1:1. If you were able to calibrate *both* reflected power ranges you can read SWR on either range. However, if you were unable to reduce power to 1 watt, and therefore could not calibrate the reverse range on the 6-watt forward range switch position, you won't be able to determine SWR on this range. In this case, tune up on the new 30-watt range where the SWR indication will be accurate.

Conclusion

Remember, when using the new 30-watt range, divide the power indication by 10 to determine your power output. For instance, 50 on the "Forward" scale indicates 5 watts output.

If you operate at or close to the 5-watt output level and use SSB, leave the meter set on the new 30-watt scale. The PEP of a nominal 5-watt SSB signal will peak at around 8 watts, which will be off-scale if you use the new 6-watt scale. 73

VOL.6 ULTIMATE MODIFICATION BIBLE
NEW UPDATED WITH MORE INFORMATION
OVER 1000 MIKE WIRING CODES FOR CB AND HAM RADIOS.
OVER 500 CB POWER/MODULATION BOOST INSTRUCTIONS.
OVER 200 MODIFICATIONS FOR CB PLL's.
OVER 225 MODIFICATIONS FOR HAM RADIOS.
OVER 50 COMPLETE SYNTHESIZED CRYSTAL CHARTS WITH INSTRUCTIONS.
OVER 20 PRECALCULATED MODIFICATION CRYSTAL CHARTS.
OVER 30 SCANNER MODIFICATIONS AND TEN METER RADIO MODIFICATIONS.
LINER SCHEMATICS AND ANTENNAS/COAX db GAIN/LOSS CHART **$29.95**
KDC SOUND ORDERS ONLY: 1-800-256-9895 MONEY ORDER/
P.O.BOX 8622 , GRANGERLAND, TX 77302 MC/DISC/VISA/CK.

CIRCLE 151 ON READER SERVICE CARD

Desert Storm Solar

10 watt DesertStorm panel is size of open 73 magazine, weighs 1lb, and delivers 600mA for 12v charging or direct operation. Tough, Solid, with no glass to break. So rugged Uncle Sam used this for spotter communications and portable repeaters in Desert Storm.
Ready to use. $169. Add $5 S&H. Info $1.

AntennasWest
Box 50062 Provo UT 84605
Order HotLine
801 373 8425

CIRCLE 340 ON READER SERVICE CARD

$40 Special To Charge You Up...
Periphex Power Packs for Longer QSO Time

replacements for		regular price
CNB-153	STANDARD 7.2v 1100ma	$58.50
PB-33	KENWOOD 6v 1200ma	$49.00
FNB-26	YAESU 7.2v 1100ma	$60.00
EBP-22S	ALINCO 12v 800ma	$65.00

Now Only $40 Each

- One Year Warranty
- Matched cell construction
- Long life, extended operating time

NEW! replacement packs for ALINCO DJ-191 series! Please call for pricing!

We also offer:
Camcorder Batteries • Accessories • Cordless Phone Batteries
Custom Battery Packs • NiCad Cells • Lithium Cells
Cellular Batteries

PERIPHEX inc.
the only thing low about our charge is the cost...
1-800-634-8132
Available from your dealer...

Add $4.00 Shipping & Handling for first battery • $1.00 for each additional battery - U.S. only • MA residents add 5% tax. • Special Expires December 31, 1996

Periphex, Inc. • 300 Centre Street • Holbrook, MA 02343 • (617) 767-5516 • (617) 767-4599
http://home.navisoft.com/periphex

CIRCLE 68 ON READER SERVICE CARD

Number 30 on your Feedback card

A Dirt-Cheap Broadband 80 Meter Vertical

The "outhouse" antenna.

Carroll R. Markivee WØRKU
71 Cedar Ridge
Eureka MO 63025

Efficiency is the hottest topic in antennas, according to articles I have read recently. In my book, the most efficient antenna is the one that puts out the most signal for the least money. That means using what you have or can get cheaply, both hardware and geography, to the best advantage. By my standards, one of the most efficient radiators is a length of wire and one of the most efficient supports is a tall tree or anything else that is high and dry.

The second most important topic is the SWR. Most 80m antennas have a low SWR over only two or three hundred kHz of the band. You have to choose the low end, the high end, or somewhere in the middle, but you usually can't operate over the entire band without an antenna tuner or transmatch.

The antenna I'm describing has a low SWR over almost all of the band. The SWR is less than 2:1 from 4.0 MHz. Down to 3.58 MHz! Below 3.58 MHz it's still below 2.5:1. You don't need to keep retuning a box to use this antenna. A single coil-and-capacitor matching section is used to connect the coax to the antenna.

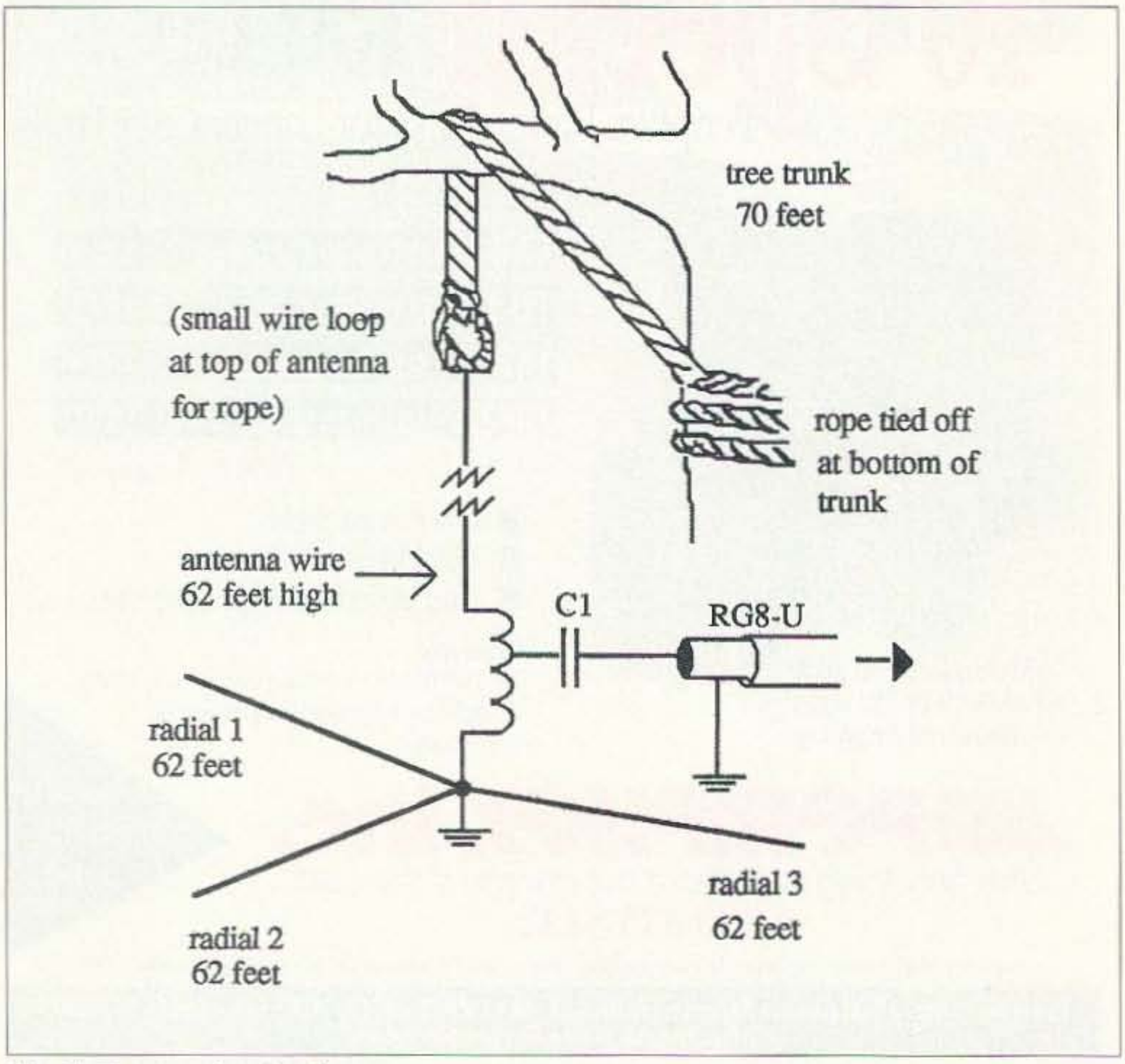


Fig. 1. Construction details.

Construction

Using a slingshot launch (with a 50-pound fishing line and a two-ounce lead sinker), I pulled up a 62-foot length of wire. I intentionally made it shorter than a quarter wave. This antenna needs a coil at the bottom to resonate it on 80m. The coil is inserted between the bottom of the vertical wire and the ground, as shown in **Fig. 1**.

The ground connection is a metal stake driven four feet into the earth near the bottom of the antenna. The antenna is always grounded for DC. Three 62-foot radials are laid on the ground. They can be buried or raised above the ground a few inches, whichever is more practical, but don't raise them very high (you will understand why very soon).

I used an old piece of coil stock (B&W #3022, and 16 microhenries, according to the label). The original coil was 14-gauge wire, eight turns per inch, one and three-quarters inches in diameter and four inches long. Four turns had broken off, so it was only 14 microhenries when I checked it on the inductance meter.

The bottom end of the coil was connected to the metal stake and the top end to the antenna wire, which was hanging down from a branch. Holding my dip meter next to the coil I found that the system resonated at 3.75 MHz.

Tuning

Matching this to the coaxial feedline was easier than I expected. Since the feed point is right at ground level, you can adjust the match until it is exactly what you want without raising and lowering the antenna for each adjustment.

Using a QRP setting with 5 watts output on my Century 21 rig and operating at 3.75 MHz, I connected the rig to the top end of the coil with a two-foot piece of 52-ohm coax through the SWR bridge. The shield of the cable and the ground lug on the Century 21 transmitter were both connected to ground. The SWR bridge was right at the transmitter output.

At first there was a high SWR. The coil at the base of the antenna required a capacitance to compensate for the inductance. I tried various sized surplus capacitors at the point where the feedline was attached to the coil, in series with the feedline.

The voltage is low at this point when the antenna is resonant. This means you can use any variable capacitor, even one with a low voltage rating, without worrying about it arcing between the plates. However, you will need a large amount of capacitance.

It took 600 pF to match the feedline to the antenna, and a tap down the coil eight turns from the top with the feedline connection. That gave four microhenries above the feed point (between the feed point and the bottom of the antenna wire) and 10 microhenries below the feed point (between the feed point and ground).

Each adjustment was recorded on paper, with its SWR, so that if I went too far in one direction, either in tapping on the coil or adding or subtracting capacitance, I could go back to where I had been.

The results

The tree branch was actually higher than the length of the wire, so I doubled over some of the fishing line. This gave me the safety of having the high RF voltage, at the top end of the antenna wire, a little lower than the tree limb supporting the antenna. Thus, no arcover was likely to occur from wire to wood if things got damp up there.

The actual SWR readings (checked at the feed point, at a point halfway between the antenna and the shack, where the remote coaxial switch is located, and at the shack connection) were: 1.6:1 at 4.0 MHz, 1.4:1 at 3.9 MHz, 1.1:1 at 3.8 MHz, 1.4:1 at 3.7 MHz, 1.9:1 at 3.6 MHz and 2.5:1 at 3.5 MHz.

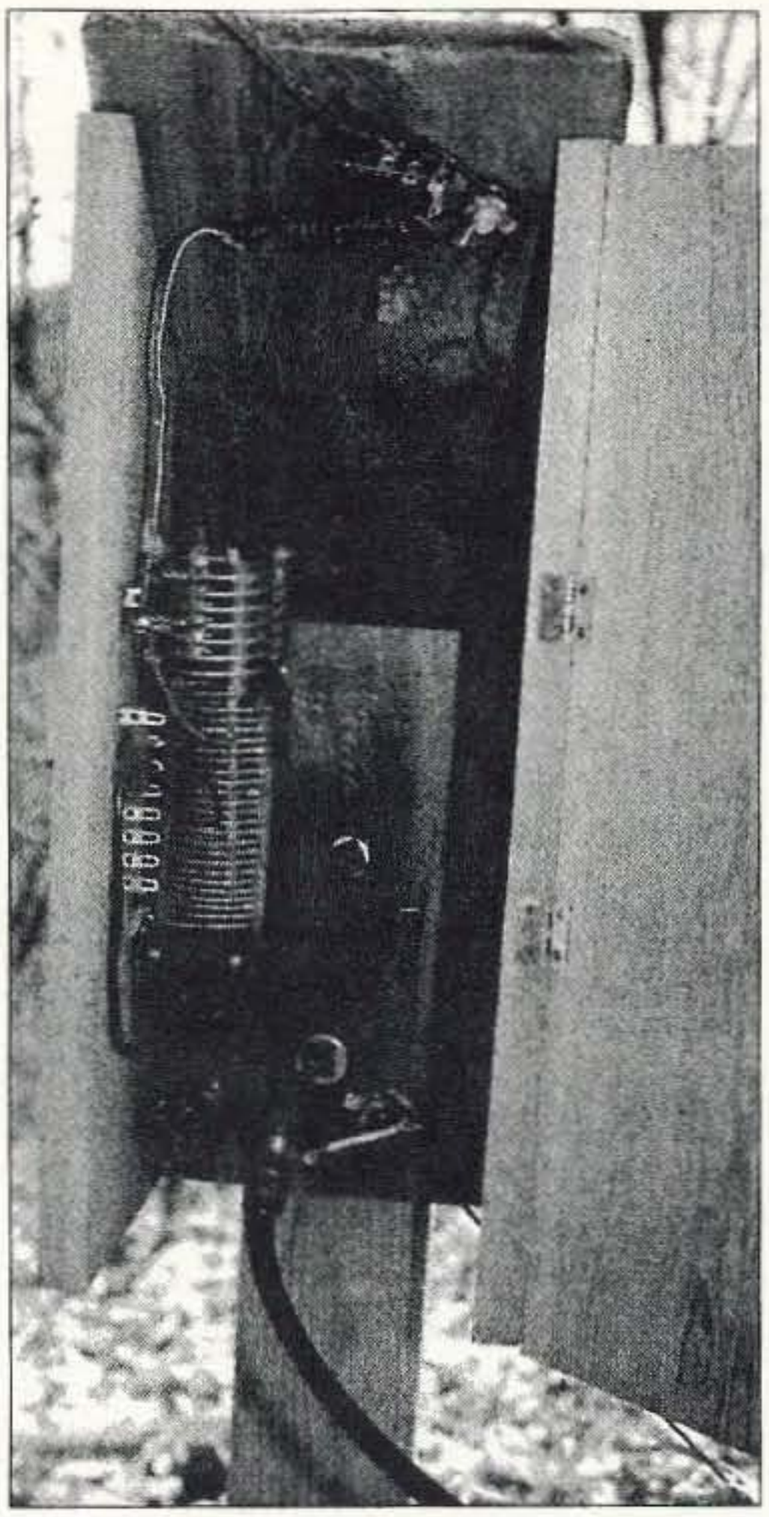


***Photo A.** WØRKU's 80 meter vertical, with its "outhouse" enclosure.*

The antenna works throughout the entire 80m band at full power, without the use of a tuner. Since I'm new to digital radio, I have recently been using it at 3604 kHz for the Midwestern RTTY net and some PACTOR contacts between 3600 and 3620 kHz, with excellent results.

Its performance on the DX portion of 80m (3690-3700 kHz) is excellent. The best DX contact was Croatia on 3694 kHz. Some of my contacts say "strong signal," without my asking for a report.

It's also excellent for rag-chewing on 75m. The Breakfast Club net control on 3973 kHz gives me good signal reports, even when he can't hear some others.

To keep moisture and dirt out of the coil and capacitor network, I constructed a little cedar box (see Photo A). The roof is sloped for water runoff, and it looks like a little "outhouse" for squirrels. I haven't cut out the crescent moon on the front door yet, but I did put a lock on the door! 73

GRUNDIG YB-400

"The compact model most preferred by our panelists for listening to major worldband stations ... audio quality is tops within its size class."
Passport to Worldband Radio

Here's everything you want at a price you can afford. The **Grundig YB-400** covers LW, MW, FM and all of SW. An illuminated LCD reads to 1 kHz on SW. Enjoy smooth SSB with fine tuning knob. Tune your favorite stations instantly with keypad entry or 40 memories. Other features include: dual digital clock-timer with snooze and dial lock. Switches for: Wide-Narrow, Local-DX and Hi-Low Tone. Supplied with six AA cells, carry case, wind-up antenna, manual and *Grundig Wave Guide*. #0040 **$199.95** (+$6)

Universal has a limited number of like-new **Factory Reconditioned YB-400s**. All accessories and same one year limited warranty. #1704 **$149.95** (+$6)

For a limited time, we will include a **FREE radio stand** with your YB-400 purchase. An $8.95 value!

universal radio inc.

Universal Radio
6830 Americana Pkwy.
Reynoldsburg, OH 43068
◆Orders: 800 431-3939
◆Info: 614 866-4267
◆FAX: 614 866-2339
http://www.universal-radio.com
Quality Communications Equipment Since 1942

BROADCAST TRANSMITTER

The **FMS2** studio quality transmitter is FULLY crystal controlled and programmable to any FM broadcast frequency.

Unit features; ALC, 2:1 compressor, audio buffer / amplifier, pre-emphasis, roll off filter, stereo generator, digital PLL tuning, 75 MHz-125MHz bandwidth, 500mW power output and a special introductory price of only $295.00 US.

SCHEMATICS FOR UNIT $27 *CATALOG 800-504-1178*
FAX POLL INFO 416-243-1067 *TEK LINE 416-243-2260*
wavemach

CIRCLE 245 ON READER SERVICE CARD

Next Day **QSLs** *Two-Color Rainbow Assortment*

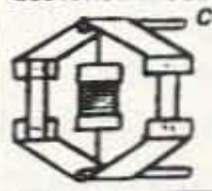
Baraboo, Wisconsin
Sauk County
K9ZZ
Info $1

Call Today & We Ship	*Next Day*	*2nd Day*	*ASAP*
100	*$29.95*	*$24.95*	*$19.95*
200	*$39.95*	*$34.95*	*$29.95*
400	*$49.95*	*$44.95*	*$39.95*
500	*$54.95*	*$49.95*	*$44.95*
1000	*$99.95*	*$89.95*	*$79.95*

Antennas West
(801) 373-8425
All orders ppd 2nd day air/ priority mail.
For overnight air delivery add $10.
Box 50062-S, Provo, UT 84605

CIRCLE 5 ON READER SERVICE CARD

THE SOTRON
COMPACT ANTENNAS FROM 160-10 METERS
NO TUNERS
NO RADIALS
NO RESISTORS
NO COMPROMISE
SIX EXCELLENT REVIEWS JUST DON'T HAPPEN BY CHANCE
CALL US FOR A FREE CATALOG.
*See review in Oct. 73, 1984 CQ, Dec. 1988 *Sept. 73, 1985 Mar. W.R. 91 March 73, 1986 NOV. 73, 1994



BILAL COMPANY
137 Manchester Drive
Florissant, Colorado 80816
(719) 687-0650
VISA MasterCard

CIRCLE 42 ON READER SERVICE CARD

73 Review

Now You See It, Now You Don't

You won't get stuck with this TapeTenna antenna kit.

Marshall G. Emm AAØXI/VK5FN
2460 S. Moline Way
Aurora CO 80014

I'm not an old-timer, precisely, but I fondly remember when the letters "CCR" stood for "Creedence Clearwater Revival," and not "Conditions, Covenants, and Restrictions." Nowadays, PRB-1 notwithstanding, more than half of us live in places where they threaten to take you to court if you put up something that even looks like an antenna. Since we hams are inventive by nature, there have been all kinds of solutions to this problem, usually involving an attempt to make an antenna look like something else. HAMCO's TapeTenna kits make it possible to build real antennas, and make them disappear.

We're also intelligent consumers. Lemon products don't survive long enough to get reviewed, so I expected TapeTenna to work in accordance with its advertising promises. I was surprised, though, by the extent to which it exceeded its claims and the amazing applications I have found for the material in and around my shack.

TapeTenna secrets

The first secret to the TapeTenna kit is of course the tape itself, a highly conductive self-adhesive copper foil. The kit includes an instruction manual, connectors, and a generous amount of the tape—two rolls, for a total of 216 feet, so you will have enough for an 80m dipole and several other antennas. TapeTenna tape is pure copper, half an inch wide by about 3+ mils (.0035") thick, with a high-tech adhesive that will stick to just about anything, including bare masonry. The basic idea is that you use it just like wire except that you stick it onto things—walls, windows, roofs, chimneys—rather than hanging it between supports. And the tape is paintable: Once you've stuck the tape onto the wall of your apartment, for example, you can paint over it and it will literally disappear. The adhesive is conductive, so you can make connections simply by sticking one piece of tape to another. And since it is pure copper, it solders like a dream.

The second secret is the comprehensive instruction manual, which includes designs and specification for lots of different antennas, and a lot of basic antenna theory which will give you the basis for experimentation. There are diagrams to clarify the instructions, and a beginner will be making effective stealthy antennas in no time. In fact there is so much useful information about antenna design and construction that it wouldn't be going too far to describe the TapeTenna manual as a concise antenna handbook.

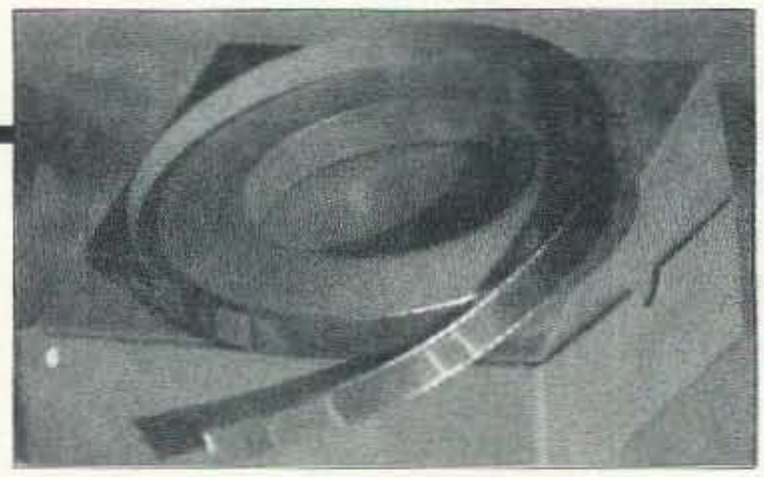


***Photo A.** The TapeTenna.*

"It's an idea that seems so obvious you have to wonder why it hasn't been done before."

The third secret is the huge range of non-antenna uses you can find for the tape. The manual gives some indication of this, with coils wound on PVC pipe, open "wire" feedlines, etc., but it seemed for a while that I was finding a new use for it every five minutes. For example, I had an RF shielding problem with a device in a steel box. Running TapeTenna tape around the inside of the box fixed the problem. And in the process of removing a circuit board component, I pulled a little piece of track off the board—fixed it in about 30 seconds with a tiny TapeTenna "band-aid."

Traditional antenna designs

I built a couple of the antennas described in the manual, and they worked perfectly—it really is just a matter of using the tape instead of wire. There are some limitations, of course. I suspect that at UHF and above the width of the tape might become a factor in calculations, and of course you do need something to stick it onto.

My first project was a 2m J-pole which is stuck to the side of my chimney. I was expecting a bit of directionality due to the closeness of the chimney, but it appears to be "radio transparent." I also built a "roll-up" J-pole for use with my HT when traveling. It's a six-foot strip of vinyl with the antenna stuck onto it, and a connector at the bottom end. The whole antenna rolls up into a cylinder measuring about an inch in diameter by five inches long. I can hang it up near a window in a hotel room in about 10 seconds flat. J-poles are great 2m antennas and it's no surprise that HAMCO now offers a separate "Tape J" kit.

The other tape antenna I built was a 20m dipole which is stuck to the ridge of my roof. Due to stray capacitance (induced by nails in the roof, impurities in the shingles, etc.), it will be necessary to adjust the length of a dipole as compared with the free space calculations, but adjustment is a snap—you shorten it by cutting with a utility knife. If you need to lengthen it, you're in for a pleasant surprise if you've ever had to splice wire—with TapeTenna you just stick another bit onto the end!

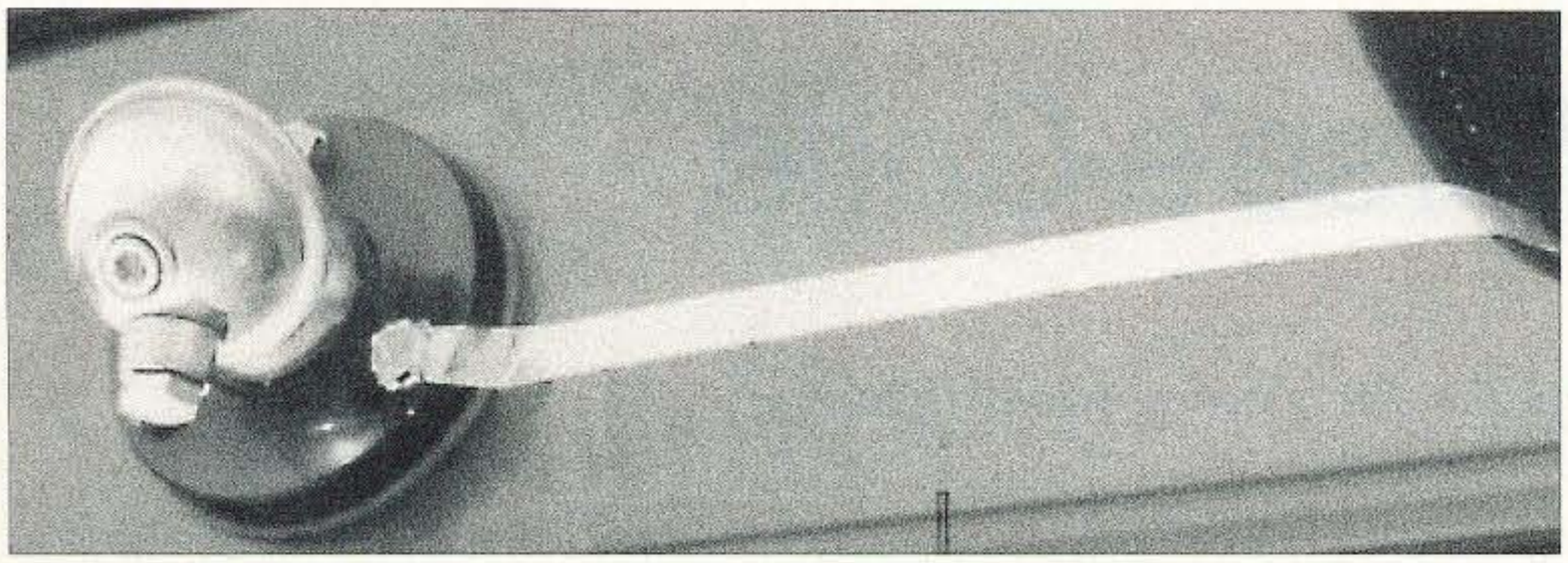


***Photo B.** TapeTenna mount on a plastic van. TapeTenna copper tape provides the ground.*

Going mobile

I have a particular problem with mobile antennas—my vehicle is a Chevy Lumina APV. "APV" is supposed to mean "All Purpose Vehicle" but it also stands for "All Plastic Vehicle." The body is made entirely out of composite materials. Nothing even resembling a ground plane for a radio antenna. TapeTenna to the rescue! For years I put up with a poorly performing quarter-wave vertical for 2m. It was mounted on one of the side windows using a "trunk lid mount" and the addition of three copper tape radials made a substantial difference in its performance. In order to reduce the "visual impact," I cut the tape in thirds lengthwise and applied one of the three radials more or less horizontally on the top of the van, and the other two running down the window at 45 degrees from the mount.

Another option, described in the manual, is an inverted V stuck onto the back window. And I've calculated that I could stick a 10-element beam on the roof, with a gamma match made out of, well... tape!

2m mobile antennas are easy. In contrast, HF mobile looked like it was going to be impossible. All HF mobile antenna designs assume that there is a lot of metal in close proximity to the base of the antenna. You can argue all day over whether the car body is acting as an RF ground, an elevated ground plane, a counterpoise, or some combination of the above. Doesn't much matter if you don't have any metal to start with. I found very quickly that in my plastic van, the chassis does *not* do the job. Period. What few metal components there are appear to be electrically isolated, and in fact all electrical components are grounded by wire back to the battery rather than through the body or chassis. Solution? I ran a continuous strip of TapeTenna material around the bottom outer edge of the van, following the contours of the wheel wells and bumpers, and connected it to the "grounded" bolts of the antenna mount. SWR immediately dropped from 3:1 to 1.2:1 on 10, 20, 30 and 40m, the bands for which I had resonators. I doubt this is a permanent solution because the tape is exposed to water, dirt, and other road hazards, but it has held up for several thousand miles and, when it becomes necessary, it will be simple enough to replace it with a similar loop inside the van.

A thousand uses?

If there is ever a ham radio Scheherazade, she could entertain the Sultan with a thousand and one stories about using TapeTenna. It's an idea that seems so obvious you have to wonder why it hasn't been done before. Well, some of it *has* been done before, with burglar alarm tape, or copper foil tapes designed for other purposes, like stained glass work (extremely expensive and with questionable adhesives). These alternatives are often less than a third of the thickness of the TapeTenna material and correspondingly less likely to withstand mechanical stresses. In fact, burglar alarm tape is *designed* to break! It's hard to solder aluminum, and the copper tapes are expensive, with adhesives of debatable durability. TapeTenna brings it all together with a very specialized tape material at a reasonable price, with a wealth of good ideas and instructions.

Availability

TapeTenna kits are available ($64 postpaid, Tape-J kit $23 postpaid) by mail order *only* from: HAMCO, P.O. Box 25, Woodland Park, CO 80866. 73

NEVER SAY DIE

Continued from page 27

article for possible publication in *73* to help newcomers to the field? They need to know the suppliers, the publications, have a list of recommended books, how distribution works, what frequencies and services are available and their average costs ... things like that.

If we can get a series of articles to help *73* readers come up to speed on business communications services, that'll help a bunch of hams build some spare-time income, and maybe be able to take their new consulting businesses full-time as entrepreneurs. So what's out there in BBS software? In security products and services? In video conferencing? Satellite services?

Or are you happy with your old ham gear and not enough money even to buy a subscription to *73*? Tsk. The money is out there in great big gobs, you just have to make a little effort to grab it. And that means turning off the ball games and doing some homework instead. Get off that couch, put down that can of beer, brush off the pretzel crumbs, and get cracking. I don't care if you're 20 or 70, you can learn new things and it'll be some of the best fun you've ever had. Heck, I'm 74 now and I'm tackling a whole new branch of physics ... one which not even the best scientists in the world understand yet ... cold fusion. Now *that's* exciting.

I'd love to know more about communications, so I'll be reading any articles submitted for my own edification as well as yours. That means they've got to be simple enough so I can, duh, understand them.

Cover Contest

An old ham friend of mine, who is probably libido-challenged, suggested that I run a cover photo contest for hams with gorgeous wives, daughters, or granddaughters clad in swimsuits doing ham things. Well, it works for *Sports Illustrated*, so what the hell! Keep in mind that a vertical format fits the cover best, even if the young lady prefers more horizontal activities. Was it Cleopatra who said, "I'm not prone to argue?" If your model has a call, so much the better. Hey, I mean a ham call, not a pager number. Send her up your tower, or maybe a hilltop with an HT—heck, use your imagination.

I can make do with 35mm, but a larger negative will make a sharper picture if you can borrow a good camera. Let's see what you can do! Watch out, *Playboy*.

"Anyone Can Talk"

In editing an article on keeping CW alive I can across that observation by the author. Well, yes. But in my 48 years of on-the-air experience, very few people have bothered to learn how to talk interestingly to strangers. Somewhere around 90% of the contacts I've made could have been made with a recording, at least until I've managed to blast

Continued onpage 37

Morse's Code

How the Tech's terror was invented.

Beth Price KC8ALW
913 Middlebury Drive North
Worthington OH 43085

Samuel Finley Breese Morse tried everything. In his 81 years of life he was an artist, inventor, photographer, teacher, and he even ran for Congress and for Mayor of New York City. Even so, he was poor until fairly late in life. Morse was a fascinating man—a real genius. So how did he get the idea for the telegraph? For Morse code?

He was born in 1791 in Charlestown, Massachusetts, the oldest of the three children (out of 11) who survived. His father, Jedidiah, was a minister, the author of the first book of American geography, and a friend of George Washington. His mother, Elizabeth, had a grandfather who was president of Princeton College.

As part of a family tradition, he went off to Yale College at 14, where he was very bored. Only the electricity classes held his interest. In class he even made his own batteries. However, he had always wanted to be a painter, so when he graduated in 1810 he went to study art in Europe, funded by his not very enthusiastic parents. He developed into a very good painter and several of his works were accepted by the Royal Academy in London. In 1832 he ran out of money and headed home.

On the voyage home, he got to talking with some of the other passengers about sending messages by electricity through wires. This excited him so much that he spent the rest of the trip making notes and drawing diagrams for an invention he called the "telegraph."

Once home, since no one wanted paintings of landscapes or mythical heroes such as he had painted in Europe, he had to resort to painting portraits. While traveling from town to town he met and married Lucretia Walker. They soon had three children: Susan, Charles, and Finley. Supporting his family while working on his invention was difficult, so he invented a water pump for firemen and a marble cutter. He even turned to teaching painting and photography. One of his photography students was Mathew Brady, who would later become famous for his Civil War photographs. Later on, Morse even painted President Monroe, the entire Congress, and Marquis de Lafayette, a French general. Even so, most of his money went into developing the telegraph.

However, before the telegraph was finished, Lucretia died. Morse, heartbroken, left his sons with his brothers and his daughter with Lucretia's sister and went back to Europe to paint.

He returned to the United States to market his telegraph, demonstrating it in 1837 to a group of influential men. Only one of them, Alfred Vail, was interested in financing it. Vail agreed to become a quarter partner with Morse, to help him build a sturdier model. Soon, Morse took on two other partners, Leonard D. Gale, and Joseph Henry, a scientist, to help him.

"The telegraph was invented at a time when most people didn't know what electricity was."

The telegraph

It was a simple design, but it was his own. He made his own wire by soldering little pieces together and wrapping them with cotton thread for insulation. The invention itself was a long wooden strip with notches filled with metal on top, which was called a port-rule. The port-rule was underneath some electrical contacts. When it was drawn underneath them, it caused the contacts to open and close, opening and closing an electrical circuit. Morse had 1,700 feet of wire strung around the room where he experimented, ending at a receiving site, where it recorded a dot-and-dash-type message on a strip of moving paper tape. The tape was drawn by a clocking device. A pen directed by an electromagnet wrote the dots and dashes. However, the port-rule was slow, a problem which led to the invention of the faster-operating code keyer.

In 1842, Morse and his partners set up another demonstration, this time with several miles of wire stretched underwater from Battery Island to Governors Island in New York. Just before the demonstration the wire got caught in a ship's anchor, and when the anchor was raised, the crew cut the wire. Morse's invention was thought to be a hoax.

Finally, Morse got to show his telegraph and code to the United States government in 1844. The wire was strung from Washington D.C. to Baltimore, over 37 miles of land. He tapped out his now-famous message, "What hath God wrought?"

From then on life was easy for Morse—money was no longer a problem. In 1848, Morse was married again, to Sarah Griswold. Together they had four children, and Morse bought a mansion near Poughkeepsie, New York. With spare time on his

hands, Morse ran for Mayor of New York City and for Congress (he lost both times).

Meanwhile, the telegraph's importance grew. Within 10 years of Morse's first message, 23,000 miles of wire were laid, and thousands more were laid each year. By the time of his death in 1872, the lines had stretched from California to India. Messages that would have taken two to four weeks to send by mail now took less than a day by telegraph. By the beginning of the Civil War the telegraph had become the mainstay of worldwide communication—though it had been invented at a time when most people didn't know what electricity was. Morse helped to start the way of life we know now.

Morse code

From the time Morse first got the idea for the telegraph to the time of its making, he also worked on codes. When he was working on the port-rule telegraph he even had a code book. In it, there were certain codes for different names, dates, and places. However, this really limited the contents of the message, and the code book was not practical.

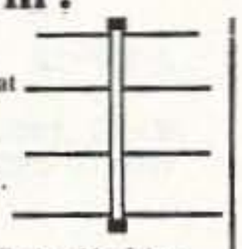
Then Morse came up with a code that is now called American Morse code. This is a code consisting of dots and dashes (said as "dits" and "dahs") which stand for letters of the alphabet, numbers, and punctuation. Although American Morse is not used today, the code we do use has the same concept. Today, we use International Morse code. It's different from American Morse because there are differences in the code for letters. American Morse has spaces in between some elements of the code, and some dahs are longer than the normal one. In International, the dahs stay the same length. A dah is three times the length of a dit. The space between the elements of the code is the length of a dit. The space between letters is three times the length of a dit, and a space between a word is seven times the length of a dit.

Morse made the most frequently used letters the shortest and easiest to send. The letter E is the most commonly used letter in the English language, and it is a single dit. Letters like Q and Z are longer and more difficult to send. To figure out the frequency of the letters, Morse went to a local printer and looked through the print box. He wrote down how many pieces of type were on hand for the printer to use for each letter of the alphabet. However, most of the code came straight from Morse's head. He claimed that the hardest part of his invention was designing the code. 73

Note: Beth's mother, father, and sister are all hams. She wrote this as a school project and her father, Mike, thought it was something the local ham club might like to print in their newsletter. He was right, so this is a reprint from the *Radiogram*.

Walking-Stick Beam?

Hold it in your hand—it's a walking stick made of aluminum with rubber ends. But inside are all the elements of a 4 element yagi that goes together in 2 minutes. Ready for the T-Hunt. Ready to get your signal out of a hole into the repeater. No little bits to drop and get lost. Everything fits clean and tight and tough. 2meters $79, 70 cm $49. Weighs only 1 lb. Add $6 Shipping & Handling. Info $1.



AntennasWest
Box 50062-S Provo UT 84605
Order HotLine
801 373 8425

CIRCLE 324 ON READER SERVICE CARD

Mr. NiCd THE BEST BATTERIES IN AMERICA!

AUTUMN '96 SPECIALS!

For ALINCO DJ-580 / 582 / 180 radios:			
EBP-22 pack	12.0v	600mAh	$29.95
EBP-22nh pk.	12.0v	1000mAh	$36.95
EDH-11 6-cell AA case			$14.95
For ICOM IC-02AT & REALISTIC HTX-202 radios:			
HTX-202 pack	7.2v	1400mAh	$29.95
BP-8 pack	8.4v	1400mAh	$32.95
For KENWOOD TH-22 / 42 / 79 radios:			
PB-34 pack	9.6v	600mAh	$34.95
For KENWOOD TH-27, 47, 28, 48, 78 radios:			
PB-13 pack	7.2v	700mAh	$25.95
For YAESU FT-23, 33, 73, 411, 470 radios:			
FNB-10 pack	7.2v	600mAh	$23.95
FNB-11 pack	12.0v	600mAh	$24.95
For YAESU FT-530 / 26 / 76 / 416 radios:			
FNB-26 pack	7.2v	1200mAh	$32.95
FNB-27 pack	12.0v	600mAh	$34.95
For YAESU FT-11R / 41R / 51R radios:			
FNB-31 pack	4.8v	600mAh	$34.95
FNB-38 pack	9.6v	600mAh	$44.95
For MOTOROLA MicroTAC Cellular Phones:			
CPMO-850x	6.0v	1200mAh	$23.95

Mail, phone, & fax orders welcome! Pay with MC / VISA / DISCOVER / AMERICAN EXPRESS!

CALL OR WRITE FOR OUR FREE CATALOG!

Mr. NiCd - *E.H. Yost & Company*
2211-D Parview Rd., Middleton, WI 53562
Phone(608) 831-3443 / Fax(608) 831-1082

CIRCLE 114 ON READER SERVICE CARD

World's best ham weather station*–only $379

Others from $179

The ULTIMETER 2000 tracks more than 100 values to help you alert others to dangerous weather extremes and protect your own equipment.

Features superbly accurate: • barometric pressure • 3-hr. pressure change • indoor/outdoor humidity† • dew point† • wind speed/direction • indoor and outdoor temperature • wind chill temperature • rainfall†.

Instant access to: • current values • today's highs and lows • yesterday's highs and lows • long term highs and lows • time/date for all highs/lows • rain totals† for today, yesterday and long term • alarms, and much more. Easy to install. **Over 100 weather monitoring values in all!**

Versatile 4 mode serial port makes it easy to record data automatically or monitor values remotely by phone, modem or radio link.

*Even *WeatherWatch Magazine* (May, '96), known for its hard-hitting, authoritative reviews, concludes "the best we have seen."

The **ULTIMETER 2000** is a great value, too — only $379 plus shipping. (†Optional sensors add'l.)

Other models starting at $179.

The world's best for Ham Radio Operators

This ultra-reliable Weather Station is your first alert to changing local weather conditions, gives you up-to-the-second data to transmit via A.P.R.S. or on SKYWARN and A.R.E.S. networks.

Tells you when high winds threaten so you can crank down your tower and safeguard other equipment. Shows speed and direction simultaneously. A patented low-impedance wind sensor resists RFI and improves reliability. 40 ft.cable can be extended to over 1000 feet with full accuracy.

1-800-USA-PEET
or 908-531-4615 FAX 908-517-0669

PEET BROS. COMPANY
1308-6117 Doris Ave., Ocean NJ 07712

Our 21st Year © 1996 Peet Bros. Co.
Visit our Home Page at www.peetbros.com

Top-Loaded Vertical for 2 Meters

A small antenna with capital T performance.

Thomas M. Hart AD1B
54 Hermaine Ave.
Dedham MA 02026

Not long ago, I purchased a book by John Devoldere ON4UN titled *Antennas and Techniques for Low Band DXing* (1994, ARRL Publications). I was amazed at the variety of antennas used on the 160, 80, and 40 meter bands in the endless quest for a really BIG signal. One popular antenna design on these bands is a top-loaded or "T" antenna.

"If you are vertically challenged and need to compromise on physical dimensions, this antenna might be the solution."

Refer to **Fig. 1** for the basic shape of top-loaded antennas as well as the dimensions that I am using in my scaled-down version. In general, this class of device is characterized as a short vertical with top-wire loading. The difference between the actual height of the antenna and a natural quarter wavelength is approximately one-half the length of the top section. Due to real life variations in terrain, grounds, radials, construction materials, and all of the rest, a fair amount of cutting and pruning is usually necessary.

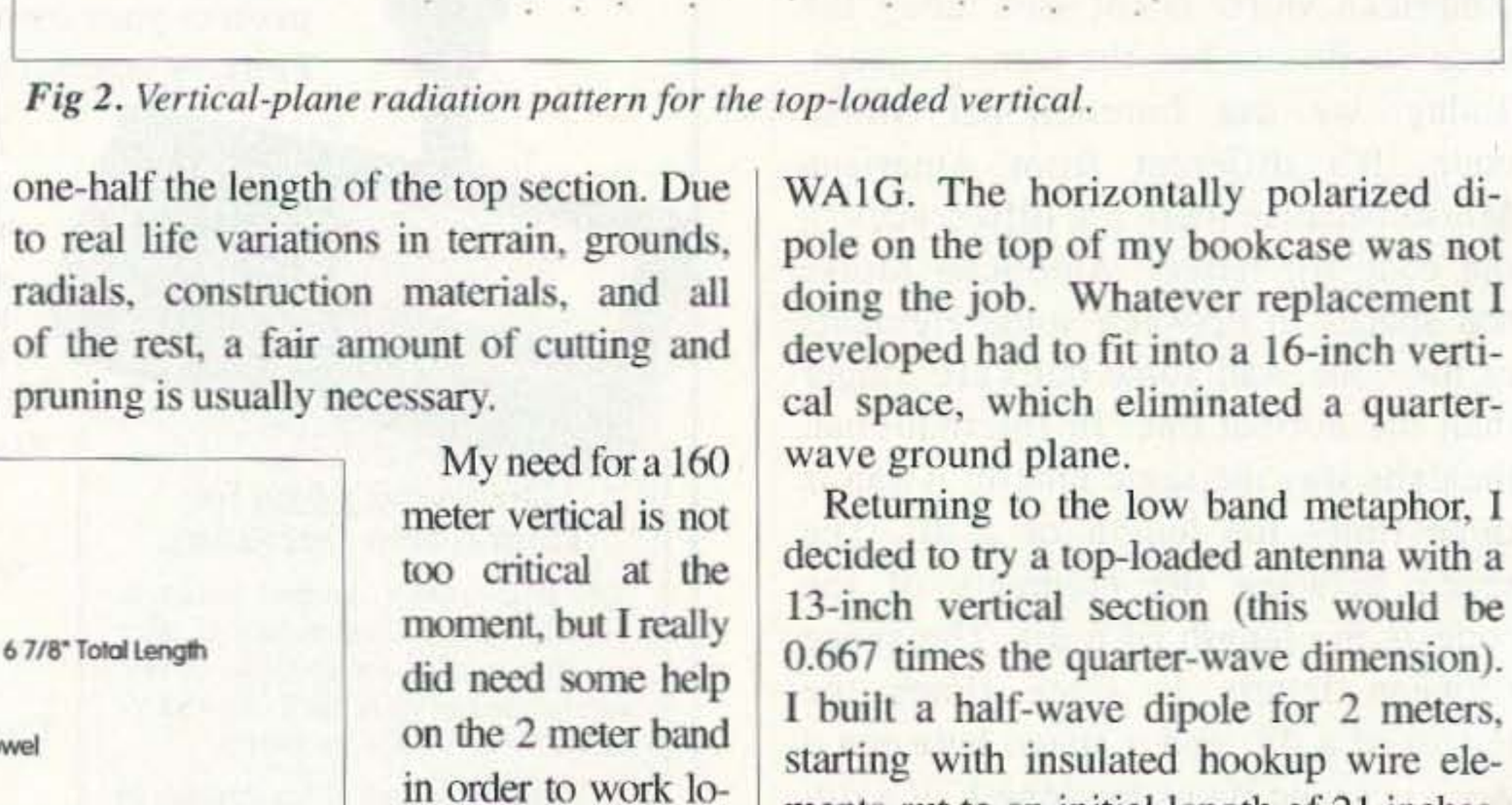


Fig 2. Vertical-plane radiation pattern for the top-loaded vertical.

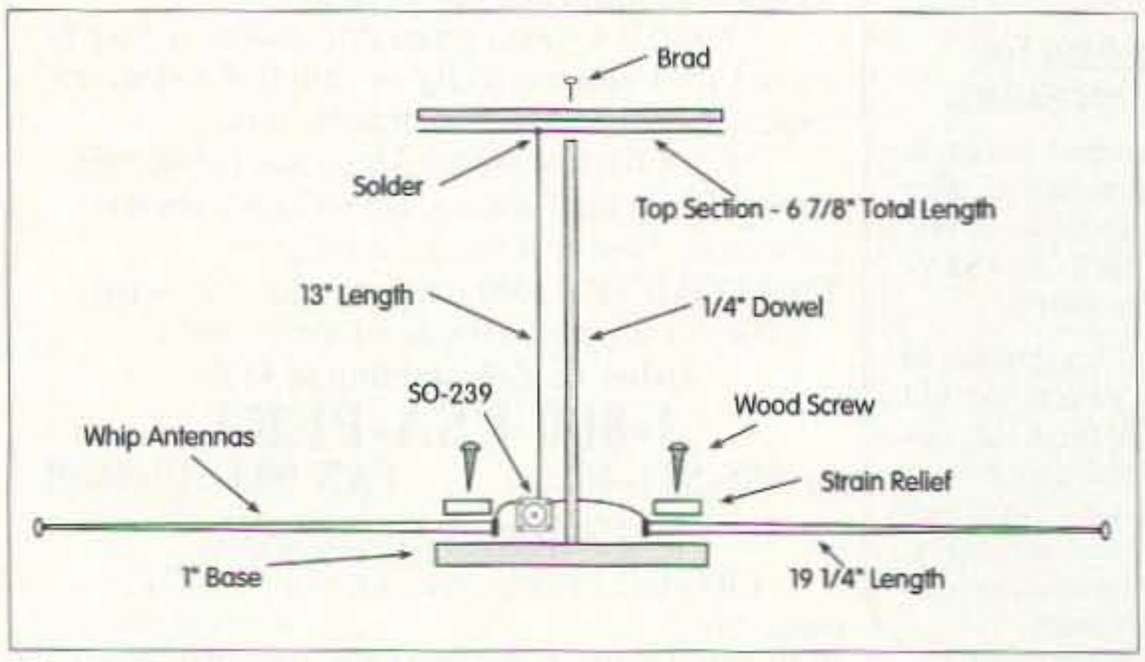


Fig. 1. The 2 meter top-loaded vertical with 2 radials.

My need for a 160 meter vertical is not too critical at the moment, but I really did need some help on the 2 meter band in order to work local packet stations. I am particularly interested in using the 145.69 contest/DX packet system at the QTH of Bruce WA1G. The horizontally polarized dipole on the top of my bookcase was not doing the job. Whatever replacement I developed had to fit into a 16-inch vertical space, which eliminated a quarter-wave ground plane.

Returning to the low band metaphor, I decided to try a top-loaded antenna with a 13-inch vertical section (this would be 0.667 times the quarter-wave dimension). I built a half-wave dipole for 2 meters, starting with insulated hookup wire elements cut to an initial length of 21 inches. Using a 2 meter SWR meter, I carefully pruned until I had an SWR of 1:1. This provided the physical dimensions for a quarter wave length. The end of the dipole attached to the center of the coax feed line was then cut to a length of 13 inches and a

top section soldered to the far end (at the center of the top section). The next step was to carefully trim the top loading section in order to return to an SWR of 1:1 using the previously tuned remaining dipole element as the other half of the antenna. The final step was to build a wooden frame to hold the newly tuned vertical element, add two horizontal radial counterpoises (collapsible whip antennas) and make the final adjustments. The final tweak was needed to restore the SWR to 1:1; this involved nothing more than setting the length of the two radials.

How does it work? I am quite satisfied and have been able to do my packeteering very nicely. The antenna was easy to build and cost only pennies. The accompanying antenna pattern generated by the EZNEC software package shows that the antenna is omnidirectional and has a low take-off angle, both very desirable for my application. The top loading avoids the mechanical and electrical problems associated with building and using coils at the base or midpoint of a short antenna. The use of collapsible whip antennas as radials simplifies the construction as well as the tuning, and provides rigid elements. If you are vertically challenged and need to compromise on physical dimensions, this antenna might be the solution. 73

Manufacturers if you would like to have your new products reviewed in 73, please call Fran at 800-274-7373 for details.

NEVER SAY DIE

Continued from page 33

the other chap out of his rut—if you call the Grand Canyon a rut.

Being good at anything takes work and practice. Even sex. And being good at talking on the air is no different. I have never found a skill of any value that didn't take a lot of work and practice. Flying, horseback riding, scuba diving, skiing, and so on are not God-given talents, they're skills, and so is the "gift of gab." It's a hard-won and very valuable "gift."

Let's be honest, oh great communicator, have you ever tape-recorded a few of your contacts and then listened to them critically later? Of course you haven't, or else you'd have done something about the situation a long time ago. "The rig here is"—oh, good grief!

Pointers

When you read the newspapers and magazines, look for interesting items and cut them out. Read 'em over a couple of times so you'll be able to talk about them. The "Only In America" series in Seligman's *Fortune* "Keeping Up" column has great fodder. "Hey, did you read about ... ?"

Unless you've done almost nothing to take advantage of the opportunities amateur radio has provided you for adventure, you should have at least a few interesting stories to tell. Make notes and post 'em where you can see 'em when you're operating. Remember, when you're talking with someone you owe it to them to keep your attention focused on what they're saying, so you're not going to have a lot of time to organize your thoughts. Having some reminders posted helps.

It's a little late now, but you might get your grandchildren started in the right direction by suggesting that they start keeping a collection of the jokes they've heard—otherwise they're going to forget 99+% of 'em. No good salesman is without a solid opening joke, and you shouldn't be either. Hey, did I ever tell you about the RPI grad who was in line for the guillotine when the contraption stopped working? "Hmm, maybe if you tighten that little screw up there."

I'm reminded of the RPI physicist who called in while I was being interviewed by Art Bell on his Coast-to-Coast radio show back in May. I'd been explaining about cold fusion developments and he called in to tell me that cold fusion was impossible because there were no gamma rays being detected. I tried to explain to him that when experimental results conflict with theory, it is theory which should give way. No sale. The listeners loved it.

The most important aspect in making your contacts interesting is to listen and ask questions. The more you get the other chap talking about himself, the more interesting the contact is going to be for him. If you listen to me on the air I'll give you clues on things to ask about, but I'm going to be asking you a lot of questions. Like what kind of work did you do before you retired? Are you doing anything now that takes advantage of the skills you built while you were working? Stuff like that. And if I find any area of mutual interest, we'll have a memorable contact.

Yes, I had fun working new countries when I first got a big antenna up in the air and could work anything I could hear—and could hear everything. But now I'm into quality instead of quantity. I haven't counted how many countries I've worked in years. Sure, I used to go through a country list and check off all those I'd worked. Now I just check off those I've visited.

Sometimes I don't get anywhere getting the other guy to talk, no matter how I try. A

Continued on page 42

HamCall™ CD-ROM
US & International - Over 1,290,000 listings

Now with beam heading, distance, user-editing, photos and much more!

The HamCall CD-ROM allows you to look up over 1,290,000 callsigns from all over the world. The same CD works in DOS, Windows 3.x, Windows 95, and Macintosh.

On a PC running Windows or DOS, you can look up hams by call, name, address, city, state, ZIP, call sign suffix, and county. PC's can also view photographs, EDIT records, and calculate BEAM HEADING and DISTANCE. Macs can retreive by call, last name, and ZIP.

- Supported by many BBS systems and logging programs.
- Displays approximate latitude/longitude for most countries.
- Calculates beam heading and distance from your home QTH automatically.
- Prints standard 1-up labels.

Also on HamCall are over 110,000 cross references from old to new calls, over 1,400 photographs, over 7,000 e-mail addresses, and much, much more. We will publish your PHOTO, QSL card, and/or BUSINESS CARD for free, just send it along with a signed permission slip allowing us to use it in our products. Price remains $50.00 plus $5.00 shipping U.S. and $8.00 international shipping.

VISA BUCKMASTER MC
6196 Jefferson Highway
Mineral, VA 23117
540:894-5777 • 800:282-5628 • 540:894-9141 (FAX)
E-mail: info@buck.com

CIRCLE 56 ON READER SERVICE CARD

POWER POCKET

12V/2.0 Amp Hours of dependable power, in a convenient soft case. Simply insert the cigarette adapter plug normally used in your car's lighter to instead plug into the POWER POCKET. The POWER POCKET provides hours of extended talk time, up to 6 times longer than standard battery packs!

- Emergencies – Special Events – Search & Rescue – Hiking – Cycling – Hamfests – Field Day – Etc.

Without power, your HT is useless! Don't be caught without a POWER POCKET when you need it most.

- Compact slim design that is light weight, only 30 ozs., with a belt loop and shoulder strap included.
- 110V Wall Charger included. Charge rate: 6-8 hours from complete discharge.
- Sealed lead acid case, can be recharged to 100% without memory effect of NiCads.

The POWER POCKET is available from most major Amateur Radio Dealers, or contact:

NCG COMPANY
1275 N. Grove Street
Anaheim, CA 92805
(800) 962-2611
(714) 630-4541
Fax (714) 630-7024

CIRCLE 54 ON READER SERVICE CARD

The Magical Audio Filter Revisited

Updating a dandy little receiver helper.

Jim Pepper W6QIF
44 El Camino Moraga
Orinda CA 94563

Almost any receiver can be improved by the addition of an outboard audio filter, whether for CW or phone reception. A good filter can help you hear the stuff you want to, and get rid of the garbage that's interfering.

An article of mine in the November 1983 issue of *73* (Jim Pepper W6QIF, "The Magical Audio Filter," page 14) resulted from my looking for a null and peaking circuit. I found a design in the N*ational Semiconductor Linear Applications Manual* that provided a nulling circuit (January 1972, pages AN31-14). It turned out that it also had, as an integral part of the design, a peaking circuit. I modified their design to use a variable resistor rather than a capacitor to vary the null frequency.

Several readers wrote to say that the circuit worked well, but they had some trouble with the circuit oscillating. This was primarily due to the output stage, an LM-383. Since then I've made some improvements, so the circuit now produces a filter with an attenuation of almost 50 dB at 2 kHz, as compared to the original 20 dB. Now I'm using an LM-386,

"It's an easy weekend project."

which gives a very stable, though reduced, output. To get the increased selectivity I added one more stage to the circuit. I used a Max-295, an

Photo A. *Magical Filter II, front view.*

8th-order, low-pass switched-capacitor audio filter (SCAF), which gives approximately -50 dB per octave, as compared to -6 dB for a single-pole filter.

There are two positions for the filter: one rolling off at approximately 1 kHz for CW, and a second at 2.5 kHz for phone. The two positions are front-panel selectable by NB/WB switch (S3). See **Figs. 1A** and **1B** for the response curves. The response curves were derived from voltages measured at the output of the LM-386 and compared to the voltage from an audio oscillator output. Since the output circuit also contributes to the rolloff, I chose to set the volume pot at a point where the output voltage of the LM-386 was equal to the voltage from the audio oscillator (the LM-386 has a gain of 20 dB.). The reference voltage was also chosen when the frequency was 1 kHz.

The null circuit is the same as my original design. It is used to eliminate steady carriers, but is a little difficult

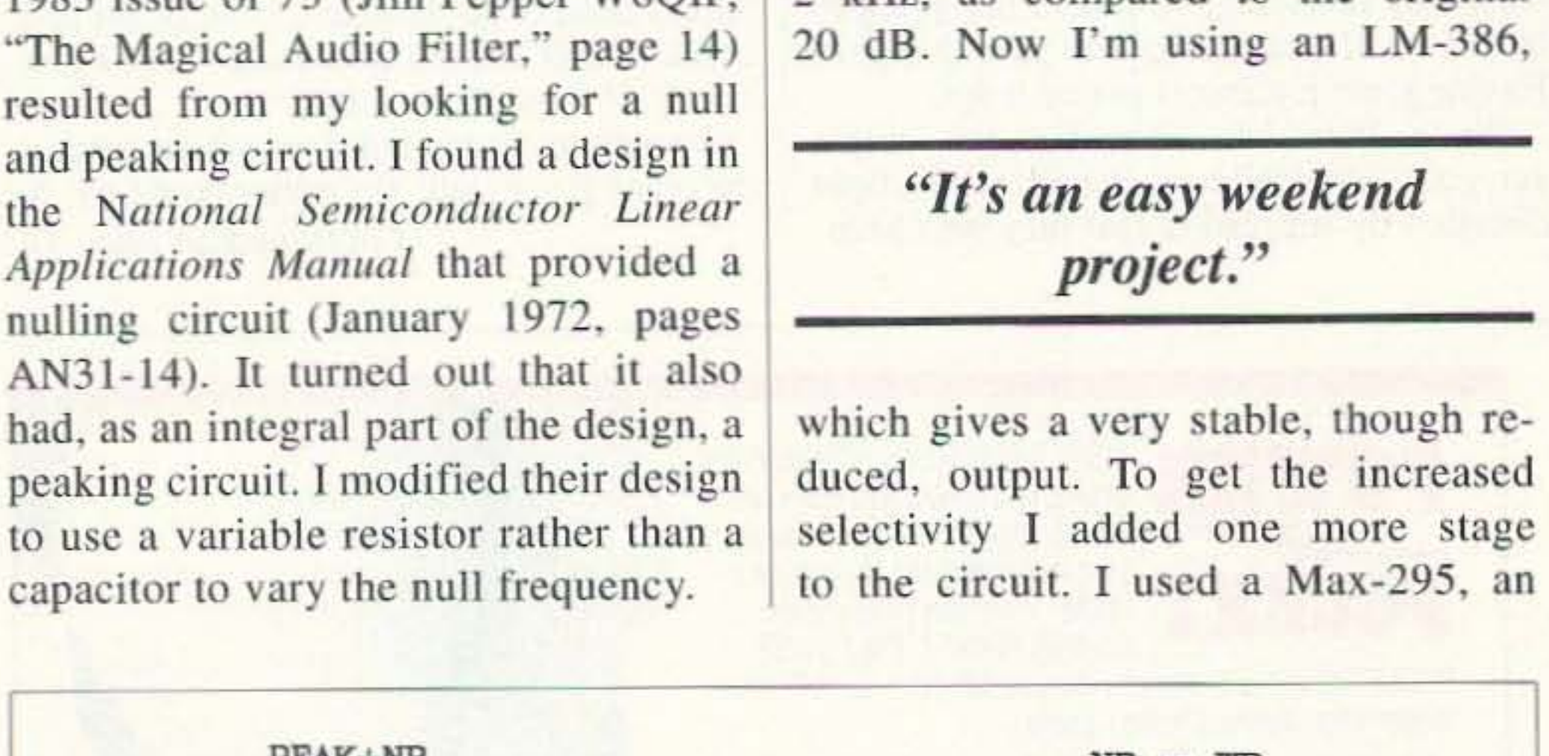


Fig. 1. *Response curves for the two filter positions. **A)** Rolling off at approximately 1 kHz for CW. **B)** At 2.5 kHz for phone.*

to use on CW signals because it is so sharp and provides about 20 dB of attenuation.

The peaking circuit is still maintained and the peak frequency is front-panel adjustable, varying from 500 Hz to 1500 Hz, and centered around 800 Hz. It provides about 20 dB of peaking. To prevent my having to jump to the volume control when it is switched in, I put in a fixed attenuator to drop the incoming signal by 20 dB. Thus, when the receiver is tuned off to the side of the signal, the background noise is also reduced by this. factor. The peaking circuit can be turned off for phone reception by closing S1.

This outboard filter circuit is designed to be plugged into the headphone output of the receiver, so no additional internal wiring changes are necessary. The LM-386 provides plenty of output to drive a speaker. The input to the unit is controlled by the receiver volume control and is set to prevent overloading the filter circuits and output stage. An additional gain control (audio pot) is available on the front panel to control the output level of the unit. The control is designed to be either AC-operated or from a 9 volt battery.

The unit is made on a PC board (available from FAR Circuits, 18N640 Field Court, Dundee IL 60118) and housed in a 4" x 3-1/4" x 2-3/16" metal enclosure. The parts location is silk-screened on the PC board to aid in construction. There is only a minimum of wiring necessary, which includes wiring the front panel switches. The pots and transformers are mounted on the PC board.

The hole diameter for the switches on the panels is 1/4", and 5/16" for the pots. As an aid to drilling, I found that a piece of 2x4 lumber inserted in the chassis makes an excellent backing for drilling.

Mount all PC board components and wire the front panel switches and speaker jack before putting the board into the box. It's a good idea to check the unit's operation before inserting it in the box. The AC wiring and the wire for the speaker plug can be temporarily connected to the PC board at this time. (Note: Be sure that the body of the male phone plug goes to the ground on the board. The tip goes to the input point.)

MAKE CIRCUIT BOARDS THE NEW, EASY WAY

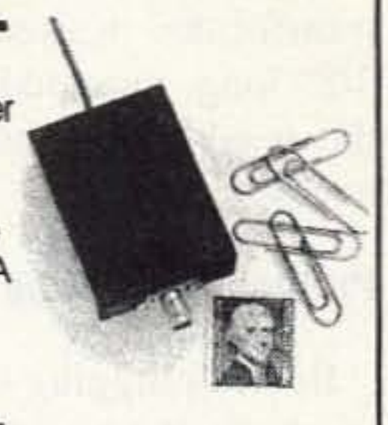
WITH TEC-200 FILM

JUST 3 EASY STEPS:

- Copy circuit pattern on TEC-200 film using any plain paper copier
- Iron film on to copper clad board
- Peel off film and etch

convenient 8 1/2 x 11 size
With Complete Instructions
SATISFACTION GUARANTEED
5 Sheets for **$4.95** 10 Sheets only **$6.95**
add $2.00 postage
The MEADOWLAKE Corp.
Dept. O • PO Box 1555 • Oneco FL 34264

UHF VIDEO TRANSMITTER



Miniature 200 Mw p.e.p. Video Transmitter Built tough. Housed in a black anodized milled aluminum case with stainless steel SMA antenna connectors & screws.
Available either at 434 mhz or 423.25 mhz
Using SAW Resonator technology

$279 plus s/h $5
Check, Money Order, Visa or Mastercard
CA Res. add 8.25% tax

TECHNICAL

Modulation Type:	A.M.
Voltage:	12 vdc - 100 ma
R.F. Output:	200 mw PEP
Frequencies:	434 Mhz, 423.25 Mhz Specify when ordering
Dimensions:	17/8"L x 1-3/8" W x 5/8" H 47mm L x 34.5 mm W x 15 mm H

A.I.G., INC.
P.O. Box 642057
Los Angeles, CA
90064-2057
TEL: 310 821-6770
FAX: 310 821-6690

WE SHIP WORLDWIDE
Barry Electronics Corp.
WORLD WIDE AMATEUR RADIO SINCE 1950
Your one source for all Radio Equipment!

For the best buys in town call:
1-800-990-2929
Los Precios Mas Bajos en Nueva York
WE SHIP WORLDWIDE!
Export orders expedited.
Special export prices.

WHEREVER I GO, I TAKE MY RADIO.
SPECIALIST IN RADIOS:
•BUSINESS •MARINE
•AVIATION •HAM RADIOS
•SCANNERS

KITTY SAYS: WE ARE OPEN 7 DAYS A WEEK
•Sat. 10-5 •Sun. 11:30-5 •M-F 9-6 *Come to Barry's for the best buys in town.*

MOTOROLA SP10, SP50, P110, GP300, GP350, M120, GM300, GR300 repeaters, & SM50
We serve: Governments •Consulets •Embassies •Overseas and •Domestic orders.

Yaesu Vertex Portables
FTH-2070 dual band VHF/UHF 5 watts VX500, FTH 2008/7008/VTR VH-2500, 5000 repeater.

CONTACT US FOR THE LATEST IN BUSINESS AND HAM RADIOS, SHORTWAVE RECEIVERS & SCANNERS. MOTOROLA, YAESU, ICOM, KENWOOD, ALINCO, STANDARD, MAXON, RELM, JRC, KING, SONY, GRUNDIG
BRAND NEW Long Range Repeater service for business

"YAESU HAM & VERTEX BUSINESS RADIOS" FT51-R, FT-8500. FT-10, FT-11, FT-2500, FT-3000, FRG-100B, FT-1000D, FT-50R, FT-5200, FT-840, FT-900AT, FRG-100, VXR-5000 repeater 25 watts, VHF or UHF. Marine Mobile VXM-100.

ICOM
HAM, MARINE, BUSINESS AND AVIATION RADIOS
281-H, 2000-H, 2350-H, A-22, IC-77, IC-706, IC-707. NEW F30LT/F40LT, H16, U16, V100, and repeaters.
SHORTWAVE RECEIVERS
R-1, R-100, R-7000, R-9000, R-71, GP-22A.

KENWOOD

ANTENNAS
A-S, AES, Cushcraft, Hy-Gain, Hustler, KLM, METZ, Urban, MODUBLOX, TONNA, Butternut, Multi-Band

NEW — 220 MHz BUSINESS RADIOS WITH REPEATERS

Business Radios:
Motorola, ICOM, Maxon, Yaesu, FTH 2008/7008, etc, Uniden, Regency, Relm
Marine ICOM: M10A, mil, etc.
Aviation ICOM: A22, A200

TH-79A(D) Kenwood

FT-51R Yaesu

"TS-50S", TS450S/AT, R-5000,TS-850S, TM 241/A441A, TR-751A, Kenwood Service Repair, TS140S, TS690S, RZ-1, TS-790A, TS950SD, TH 79A(D), TH28/48A, TM-941A, TM-741A, TM-733A, TM-641A, TM-742A.

• Shortwave Radios
• Scanners
• Best Prices

MOTOROLA RADIOS EXPORT & DOMESTIC CALL FOR PRICES

FM & AM BROADCAST TRANSMITTERS STOCKED

SATELLITE PHONES & BROADCAST EQUIPMENT

MARINE RADIOS
ICOM M7, M11, M56, M700TY, M800, AVIATION PORTABLE ICOM A22, MOTOROLA, TRITON MARINE

Save money on batteries. Call for Special Prices.

Surveillance Devices Available

Linear Amplifier
Ameritron, Icom, Kenwood, Yaesu

SHORTWAVE RECEIVERS STOCKED

Barry's supplies all MFJ products Call us direct.

Shortwave Receivers
Drake•Grundig•JRC•Sony•Yaesu•ICOM
Call 212-925-7000
Sattelite telephone in suitcase for worldwide use

Wide selection of SW & Amateur Publications

Computer Interfaces
Stocked: MFJ-1270B, MFJ-1274, MFJ-1224, AEA PK-88, MFJ-1278T, PK-900, PK-232 MBX W/FAX, DRSI PRODUCTS DSP 2232

Antenna Tuners:
MFJ, AEA AT-300, ICOM, KENWOOD, YAESU, VERTEX

COMMERCIAL & HAM REPEATERS STOCKED. WRITE FOR QUOTES

KANTRONICS
KAM PLUS Etc.

2 Meter, 440, 220MHz Band-Pass Filters from DCI

CB Radios Stocked
148GTL, Washington, Ranger 2950-70, Antennas: Wilson, Antron, etc. Power mikes w/beeps - ECHO - SilverEagle etc.

ALINCO DJ- 580T, DJ-582T, etc.

Domestic & Special Prices for Export
GP300, GM300, P110, FP50, etc.

MOTOROLA AUTHORIZED DEALER
KACHINA COMMUNICATIONS DEALER

Radios for Business, Government
Stocked & Serviced
Call or FAX for Great Prices!

AUTHORIZED DEALER
SONY
Shortwave Radios Stocked

AMPLIFIERS STOCKED:
RF Concepts
Mirage
TE Systems

BIRD Wattmeters & Elements In Stock

Telephone Autopatch
Patches telephone calls from your radio to phone line. Great for making and receiving phone calls where there are no phone lines. Simple to use. Write or fax for inquires.

Privacy scramblers for radios and phones. CALL

ANTENNAS: AEA, AlphaDelta,ANLI, Antenna Specialist, Barker & Williamson, Comet, Cushcraft, Diamond, GAP Hy-Gain, Hustler, Larsen, Etc. Watt-Meters Stocked.

Electron Tubes
3-500Z,
572B,6JS6C,12
BY7A, & 6146B

DIGITAL FREQUENCY COUNTERS
OPTOELECTRONICS model 1300 H/A, 0-1300MHz 2300, 2210 H, 0-2200 MHz, 2600H, UTC-3000, 2610

Long-range Wireless telephone for overseas. CALL

BENCHER PADDLES
BALUNS, LOW PASS FILTERS
IN STOCK

MIRAGE/RFC Amplifiers
ASTRON POWER SUPPLES
Belden Wire & Cable, Int'l Wire
OPTOELECTRONICS STOCKED

Shortwave Radios
Drake, JRC, Lowe, ICOM, Kenwood, Yaesu, Sony, Grundig & Sangean.
Write or Call for Prices

Hy-Gain Towers will be shipped direct to you FREE of shipping cost.

Amplifiers, HF/VHF/UHF
AMERITRON, etc.

GARMIN GPS RECEIVERS

BARRY ELECTRONICS CORP., 540 BROADWAY, NY, NY 10012 (Five blocks N. of Canal St., between Spring & Prince St.) FAX 212-925-7001 Phone 212-925-7000

New York City's LARGEST STOCKING TWO WAY RADIO DEALER
COMPLETE REPAIR LAB ON PREMISES

"Aqui Se Habla Espanol"
BARRY INTERNATIONAL
FAX 212-925-7001 Phone 212-925-7000
For Orders Call 1-800-990-2929

Monday-Friday 9 AM to 6 PM
Saturday 10-5 PM / Sunday 11:30-5 PM

Subways: #6 Spring St. stop, N. or R. train to Prince St. stop F train to Houston St. stop.
Bus: Broadway bus to Prince St. stop, Path train to 9th St./6th Ave.

COMMERCIAL RADIOS STOCKED:
•MOTOROLA •ICOM
•MAXON •STANDARD,
•YAESU •RELM etc.
We serve municipalities, businesses, Civil Defense, etc. Portables, mobiles, bases, repeaters...

SALES FINAL

Technical help offered upon purchase

We stock: AEA, Alinco, Ameco, Ameritron, Antenna Specialist, ARRL, Astatic, Astron, B&K, Belden, Bencher, Bird, Buttemut, CES, Cushcraft, Codan, Daiwa, Eimac, Henry Heil, Hustler, Hy-Gain, Icom, KLM, Kantronics, Kenwood, Larsen, Maxon, MFJ, Mirage, Motorola, Nye, Palomar, RF Products, Shure, Standard, TUBES & Tube Cartons, Uniden, Yaesu, Vibroplex, Duplexers, Repeaters, Scanners, Radio

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
DEALER INQUIRIES INVITED PHONE IN ORDER & BE REIMBURSED
COMMERCIAL RADIOS STOCKED & SERVICE ON PREMISES.
EXPORT orders shipped immediately. CALL

FAX: 212-925-7001

CIRCLE 41 ON READER SERVICE CARD

To help support the PC board if the transformer is used, use 6-32 screws 3/8" long, mounted as indicated, with the head on the top side of the PC board.

Preliminary testing

Before plugging in the ICs, it is best to check the various voltages on the board. Plug in the AC cord and turn on the AC SW. If the unit is still in one piece you can check the voltages at the regulators. Also check the voltage on pin 7 of the Max-295 (IC3); it should read no greater than 10.5 volts. The SCAF is rated 11V max. If the voltages are correct, turn off the power and insert the ICs. All number 1 pins of the ICs go to the rear of the board.

Connect the input plug to the receiver output and plug in an external speaker or headphones. Turn on the receiver and filter. Set the filter audio gain to about one-third on. Place the filter in the bypass position (S2 in FILTER OUT). Turn up the receiver volume control to a good listening level with a CW station tuned in. If the signal is breaking up on peaks, the input is too high.

Set the PEAK switch (S1) to OFF or closed position and the bandwidth switch (S3) to WB. Tune the receiver to a fairly loud CW signal to your desired copying pitch. Switch (S2) the filter to the IN position. Turn the PEAK switch (S1) to ON, or open position, and adjust the PEAK control to give the loudest volume. There should be a pronounced increase in volume if the circuit is working correctly.

Next, tune the receiver off frequency from the CW station to about 1.5 kHz higher. Change the WB/NB switch (S3) to NB. You should note a change in the signal level. Switch out the peaking circuit and note the increase in background noise. Now rotate the NULL pot in a clockwise direction. At about the three-quarter position you will find that the signal reduces in volume. If all these tests work as expected, it's time to put it in the cabinet.

Copy the drawing for the front panel by placing it on a clear laminating material (available at stationery and variety stores), cutting it to size. Be sure the drawing is full-scale. I found that if I stuck the artwork on the panel with

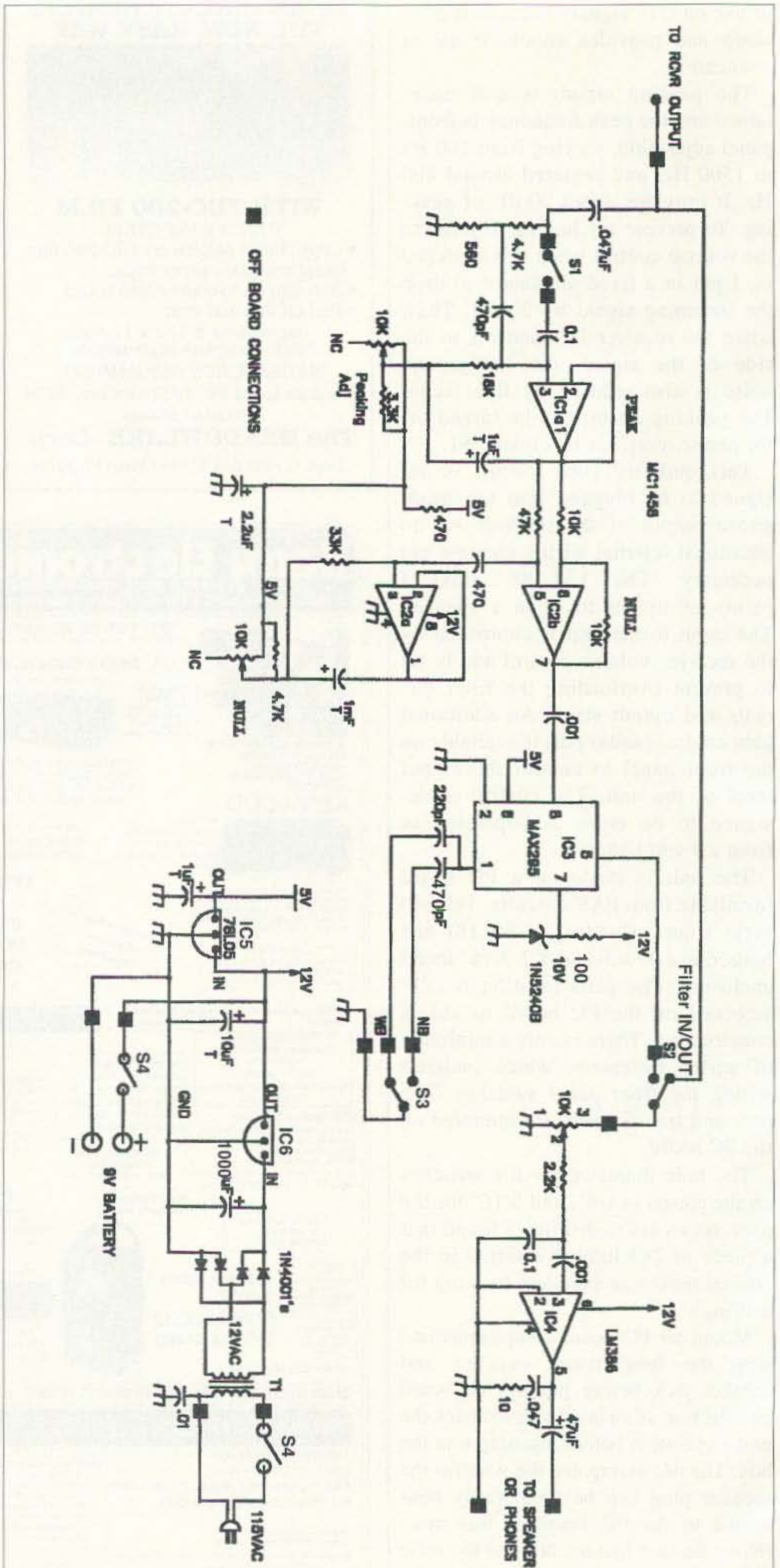


Fig. 2. Schematic for the Magical Filter II.

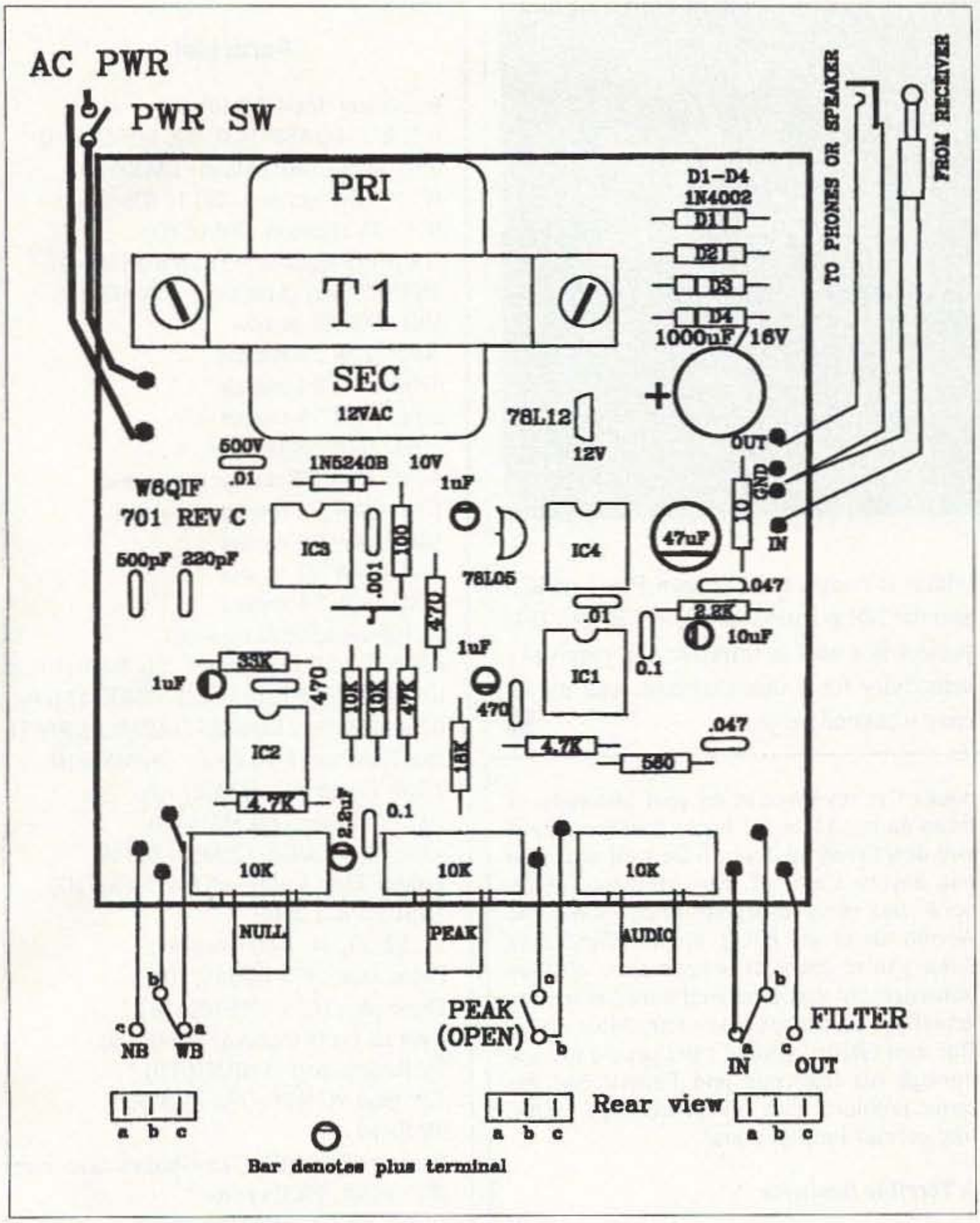


Fig. 3. Magical Filter II board parts placement diagram.

a thin coating of white carpenter's glue it was easy to cut out the holes for the pots and switches with a hobby knife.

Next, connect the AC wiring and speaker plug as shown on the assembly drawing. Prewire the two cables through the rear panel before you insert the PC board; this way the connectors can be left on the cables. Be careful that the AC switch terminals do not touch the transformer frame.

It will be necessary to place 1/8"-thick space washers on the three pot shafts to properly mount the PC board to the front panel. The PC board pots will slide into the front panel and nuts can be applied at this time. The front panel switches can also be mounted now. Be sure they are properly oriented to comply with the panel labeling. If not, they can always be rotated later on.

Battery operation

If you want to use the filter for portable operation you can replace the transformer with a 9V battery. The battery can be held in place by a wire soldered to the holes available for the primary and secondary leads to the solder pads of T1. Connect the battery *minus* lead to ground and the battery *plus* lead to ON/OFF switch S4. The **Parts List** indicates which parts can be left off. A worthwhile addition might be an LED to indicate when the battery power is on. If both types of operation are contemplated, an external connector for a battery can be used.

Conclusion

I have used this unit with my direct conversion receiver as well as with my FT-840, and have found it very useful.

DUPLEXERS

★ *QUALITY* ★ *SERVICE*
★ *PRICE*
WE'VE GOT IT ALL!

Our Bandpass-Reject Duplexers with our patented B_pB_r Circuit® Filters provide superior performance... especially at close frequency separation.

PHONE 817-848-4435
FAX 817-848-4209

WACOM
PRODUCTS, INC.
P.O. BOX 21145 • WACO, TX 76702

CIRCLE 78 ON READER SERVICE CARD

INSURANCE
Computer & Radio Equipment

HAMSURE coverage follows your equipment wherever you take it. Theft from vehicles, earthquake, water damage and all other hazards including surges. Insure all your equipment and accessories (except towers and antennas but including rotors), media and purchased software.

Low Premium ***Low Deductible***

HAMSURE
7901 Laguna Lane
Orland Park, IL 60462
800-988-7702 Anytime
E mail: hamsure @ aol.com

VISA *Available only in the 48 continuous states* MasterCard

CIRCLE 78 ON READER SERVICE CARD

All Aluminum

Chassis Kits	Rack Shelves
Cabinet Kits	Rack Equipment
Assembled Cabinets	Antenna Grounding Kits
Slope Box Kits	Tower Mounted Box Kits
UHF & VHF Antenna	Dipole Hangers
Power Divider Kits	Other Enclosures

Small sheets Aluminum and Brass
UHF / VHF Antenna Parts

Byers Chassis Kits
Charles Byers K3IWK
5120 Harmony Grove Road • Dover, PA 17315
Phone 717 - 292-4901
Between 6PM and 9:30PM EST. Eves.

CIRCLE 222 ON READER SERVICE CARD

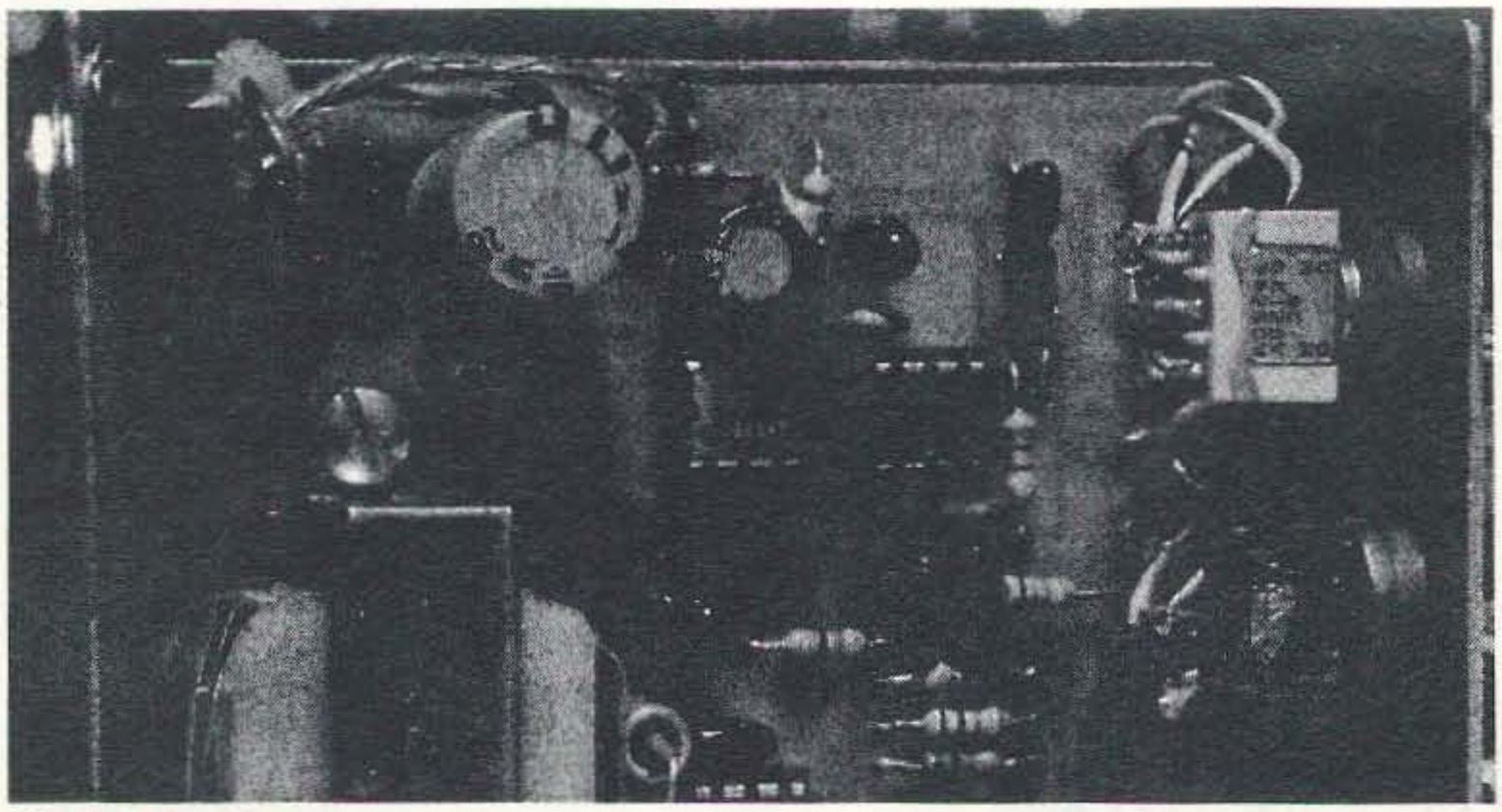


Photo B. Inside view.

My 840 does not have the CW filter, but this unit does a job that is almost as good. You might want to improve the NB position even more on your filter. This can be done by changing the 470 pF capacitor, which is connected between Pin 1 of IC3 and the NB position of S3, to 620 pF. This project is a way to improve any receiver's selectivity for a minimal cost, and it's an easy weekend project. 73

Parts List

Instrument Box 40UB101 (D)
IC1, IC2 Op AMP 1458 - MC1458CP1 (D)
IC4 Audio AMP LM386 - LM386 (D)
IC6* 12V regulator - 78L12 (D)
IC5 5V regulator - 78L05 (D)
10k pot (3 required) - 31CW401 10K (D)
1N4002* Rect (4 required) - 1N4002 (D)
10Ω 1/4W 5% resistor
100Ω 1/4W 5% resistor
470Ω 1/4W 5% resistor
560Ω 1/4W 5% resistor
2.2kΩ 1/4W 5% resistor
4.7kΩ 1/4W 5% resistor (2 required)
10kΩ 1/4W 5% resistor (2required)
18kΩ 1/4W 5% resistor
33kΩ 1/4W 5% resistor
47kΩ 1/4W 5% resistor
.001µF capacitor (2 required)
470pF Cer 5% (3 required) - 21CB470 (D)
047µF Mylar™ (2 required) - 23BK347 (D)
0.1µF Mon-Cer (2 required) - 110Z5U104K50V (D)
1µF Tantalum (3 required) - 18EM510 (D)
2.2µF Tantalum - 18EM522 (D)
10µF Tantalum - 18EM610 (D)
47µF Elect Radial - CEM16-0047 (D)
1000µF Elect Radial* - CEM16-1000 (D)
.01µF cer disc 500V
S1, S2, S3, S4 SPDT switch
Phone Jack 1/8" - 16PJ011 (D)
Phone plug 1/8" - 17PP102 (D)
8 pin socket (4 required) T02-08 (D)
9V Battery snap - 12BC010 (D)
12V trans PC brd* - 273-1385 (R)
9V Battery
Panel Laminate 65059 - C-Line Product (variety store)
IC3 MAX295CPA Filter
10 volt zener* - 1N5240B (D)
2 3/4" Knob (4 required) - 274-415 (R)
1 1/2" Knob (2 required) - 274-220 (R)

(D) = DC Electronics, Box 3203 Scottsdale Arizona 85271 (+ S/H $4.00)
(R) = Radio Shack

* Delete if 9V battery is used.

PC Board (Magical Filt 701 Rev. C), available from: FAR Circuits, @$6.00 + $1.50 s/h (per total order). FAX orders accepted (847) 836-9148; Visa/MC orders please add $3.00 service charge per total order.

NEVER SAY DIE

Continued from page 37

chap the other day had been retired for years and the highlight of his day was going out to lunch with his wife. Other than that it was playing golf. Period. Sigh.

Of course if all you want to do is fill in year after year of signal reports in your log, that doesn't take anything but time. Yes, I did that for a while. Been there, done that. Ditto the 75m net where nothing of substance ever was discussed. Done that too. Well, it does give you a feeling of belonging to a group. But that was 50 years ago and W1KPL, W1MLJ, and W1IF are all long gone. They're all Silent Voices now. They smoked. Oh, W2MSV was fat, so he died young. Ditto W2MAM.

If you're short on interesting things to talk about, read a book! Read any one of the books I've reviewed in my past editorials, or those on my $5 list of books you're crazy if you don't read, and you'll be well armed to talk anyone's ear off. Hey, read the NASA book and drive everyone crazy about the Apollo shots all being bogus. They may think you're crazy to believe such obvious nonsense, but you'll be well armed if anyone actually wants to discuss facts. Most don't. But then Galileo couldn't get people to look through his telescope and Pasteur had the same problem with his microscope. Little tiny germs? Preposterous!

A Terrible Business

When Chuck Martin WA1KPS told me he was going into the ham radio business as a dealer I warned him not to do it. I explained that it was probably one of the worst businesses he could go into. Thus was Tufts Radio launched. Well, Chuck eventually found out for himself what he'd gotten into. His love of amateur radio was stronger than his sense of reality and overrode my warnings. Yes, he eventually went bankrupt.

In a recent editorial I pointed out that ham dealer margins are far below those of almost any other business. I cited a figure of 25% instead of the more normal retailer 50% minimum. Well, it didn't take long before a few ham dealers put me straight. I was wrong. Yes, Uncle Wayne mis-wrote. I was assured that the margins for ham dealers on most rigs is more like 7%. And out of that comes 2% for the credit card and 1% or so for freight costs. This is gross profit, not net. The dealer still has plenty of overhead that has to come out of the 4% he has left. Like the store rent, warehouse space, taxes, insurance, personnel (including health insurance), heat, light, water, building maintenance, advertising, telephone, copiers, computers, bookkeeping, office supplies, shipping materials, and so on. Having built a chain of computer software stores I know the drill on retailing.

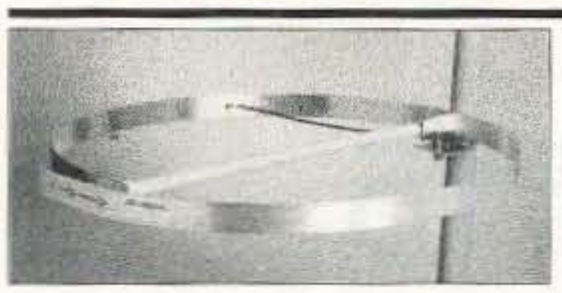
Do I have an answer for this? No, I'm stumped. It's illegal for the dealers to get together and set prices so everyone can make a buck. And, as a consumer, I'm not about to pay more for something than I have to, so when one supplier has a lower price, that's where I buy. And I'm willing to forego some service to save money.

Continued on page 52

TNT Today's No-Tune Multiband Antenna
No pruning. No tuning. No knobs to twist.
TNT is No-Tune on 80 cw, 40, 20, 17, 12, 10. TNT/2 is No-tune on 40, 20, 10. Work other bands w/ tuner. DX &Gain rise w/ frequency.
Ready to Use
Includes isolation balun & 99 ft RG8x
Kink-Proof
Wx-Sealed
Low Noise
No Traps or Resistors
Insulated to 3000 V
Rated 500 Watts
The modern coax-fed version of the classic off-center fed windom.
Technote 126--$6.95 ppd
TNT Windom $89.95 135 ft. long +$6 P&H
TNT/2 Windom $79.95 67 ft. long +$7 P&H
AntennasWest
Box 50062S, Provo, UT 84605
Order Hotline 800-926-7373
CIRCLE 135 ON READER SERVICE CARD

(208) 852-0830
Check Out Our Specials!
We're On The Web.
http://www.xmission.com/~rossdist
Over 9000 HAM Items In Stock, All Prices Cash FOB Preston
E-Mail - rdc@rossdist.com
ROSS DISTRIBUTING COMPANY
78 S. State Street, Preston, Id. 83263
Hours Tue.-Fri. 9-6 - 9-2 Mondays. Closed Saturday and Sunday
CIRCLE 254 ON READER SERVICE CARD

New Products



Try On This Halo

The Homeowners' Association Gestapo giving you static about your antenna? Want to work real ionospheric skip DX on 6 meters? Here's a heavenly new item from Advanced Electronic Applications, Inc.

The HALO-6 will allow you to use your new multiband transceiver on 6 meters at the lowest possible cost. It comes as an easy-to-assemble kit—about 30 minutes to put it together—for $69! It's so flexible it can squeeze through attic openings and other tight spaces; you can even support the antenna with fishing line in your attic. The higher you mount the HALO-6, the higher performance you will realize. Minimum mounting height is six feet, great for mobile users and antenna-restricted operators. No matter how you mount the HALO-6, you'll benefit from its omnidirectional radiation pattern and its low angle of radiation. See your dealer or call AEA's 24-hour Literature Request Line at (800) 432-8873 for more information.

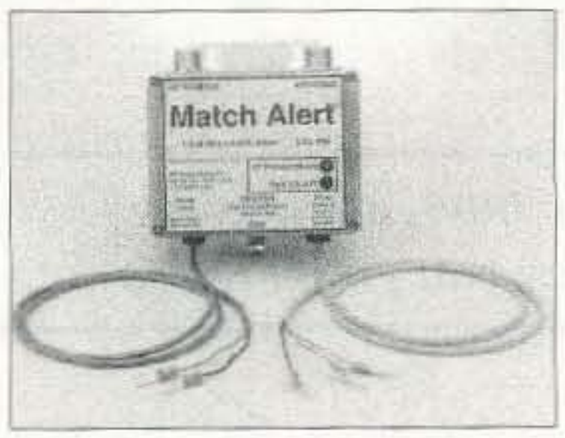
Ham-Panel 440

And now for something completely different: Ant-Panel Products has just come up with this intriguing antenna panel. Only 18 by 24 by 2 inches thick, the Ham-Panel 440 is a high-performance 90° beamwidth antenna with a VSWR less than 2:1 from 435 to 450 MHz.

Built in a sturdy enclosed frame, it can sit on the windowsill of your apartment, dorm room or office, and project your signal out of the building with a gain four times better than your old J-pole! The very high front-to-back ratio of the Ham-Panel 440 minimizes the effects of movement behind the antenna *and* RFI/TVI *and* computer noise in receivers. For more information or to purchase the Ham-Panel 440 ($119.95 plus shipping & handling, and tax if applicable), contact Ant-Panel Products, 530 East Fifth Avenue - Suite 12, Naperville IL 60563. Phone/FAX (630) 778-0793.

I Think They're Onto Me...

CCTV introduces the GBC Colorsentry Model CCD-835C color camera. OK, so you're not James Bond. It's still cool, this inconspicuous (smaller than a pack of cigarettes) 4mm lens color camera. If you ever want to photograph something discreetly, the CCD-835C has a 1/4" sensor, a resolution of 325 lines and a sensitivity of .5 lux. It comes complete with a 12VDC power module and 1/4-20 universal mounting. Other lenses are available—2.5mm wide angle, 6.5mm, 8mm and 12mm—making the CCD-835C camera perfect for any application where size and secrecy are important. For more information, contact CCTV Corp., 280 Huyler Street, South Hackensack NJ 07606; Phone (800) 221-2240 or (201) 495-9595; FAX (201) 489-0111.



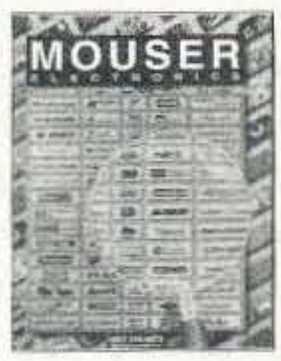
Check Your VSWR!

RF Applications has announced the availability of the Match Alert, designed to offer economical protection for HF transmitting systems. The microprocessor-based Match Alert monitors VSWR and provides a fast visual and electrical alarm if a preset VSWR level is exceeded (eight levels are switch-selectable, and an LED lets you know when RF is detected). The $129.95 you spend now for the Match Alert could save you a lot more, down the road.

For further information, write to: RF Applications, Inc., 9310 Little Mountain Road, Mentor OH 44060. Phone (800) 423-7252 (international (216) 974-1961); FAX (216) 974-9506. Internet http://www.rfapps.com, or E-mail to sales@rfapps.com.

Free RF Neulink Catalog

RF Neulink has issued a new 28-page wireless telemetry catalog featuring crystal-controlled and synthesized wireless transceivers, transmitters and receivers—and the SkyLine RTU, a digital/analog data acquisition and control module. For your free copy, contact RF Industries, Neulink Division, 7610 Miramar Road, San Diego CA 92126. Telephone (800) 233-1728 or (619) 549-6340; FAX (619) 549-6345; or E-mail: 102061.2261 @compuserve.com.



Mouser Releases New Catalog

Mouser's newly updated electronics component catalog offers more than 67,000 products from more than 125 manufacturers. An excellent guide for both buyers and engineers, this catalog provides complete specification drawings and guaranteed up-to-date prices. Mouser also provides same-day shipping on all stocked products. For a free catalog call (800) 992-9943; E-mail catalog@mouser .com; or visit Mouser's Web site at http://www.mouser.com. Nationwide sales: (800) 846-6873; FAX (817) 483-0931.

"You Want It? We Got It!"

Like to pore over small-print parts catalogs looking for the unusual and rare—and finding some real bargains? Get a copy of the International Microelectronics catalog! It's true—they've got it! They specialize in overstock, surplus, and discontinued electronic components, and this may just be the source you've been seeking so you can finish up that project. International Microelectronics, P.O. Box 170415, Arlington TX 76003. Phone (800) 999-0463; FAX (817) 473-0525.

Two New Mobile Antennas from Premier

The 24-inch PNC-2 and its 37-inch sibling PNC-4 are now available from Premier Communications; they're both 2 meter/70 cm and deliver maximum signal gain for their size.

The PNC-2 has 2.1 dB gain on 2 meters, 3 dB gain on 70 cm, and handles 100 watts of power. It is set for near 1:1 SWR at 146.50 MHz and it's quite broadbanded: it also covers 130-165 MHz and 400-480 MHz and works great for receiving to 900 MHz.

The PNC-4 is a higher gain antenna optimized to 2 meter and 70 cm operation. It has 3 dB gain on 2 meters, 5.5 dB gain on 70 cm, handles 100 watts, and includes a tilt feature with locking base. Both models are pretuned and ready to install on mounts, and are sleekly designed in black chrome.

Both models have two-way base fittings that mate with UHF/SO-239 sockets or MNO/Motorola-type mounts. Premier carries mounting accessories for new installations. For more information, contact Premier Communications, 20277 Valley Blvd., Walnut CA 91789. Telephone (800) 666-2654; FAX (909) 869-5710.

Add On A PowerClear

About the size of a paperback book, the PowerClear from SGC can be used with any non-DSP transceiver (HF or VHF/UHF) or other audio device to improve audio quality and noise/interference reduction.

Features include flexible audio input/output connections—audio from transceiver, telephone, scanner, cassette recorder, etc. can benefit from ADP enhancement. The operator has full control of audio filters; push-buttons activate the notch filter as well as noise reduction and SNS. An internal amplifier with front-panel volume control allows room-filling audio even when driven from line-level sources. Lots more neat stuff, too, including all the LEDs to let you watch your tuning.

Contact your SGC dealer for price and availability. Call SGC (800) 259-7331 for the name of your nearest dealer.

Number 44 on your Feedback card

STSPLUS, Version 9615

A satellite tracking program from RPV Astronomy.

Thomas M. Hart AD1B
54 Hermaine Ave.
Dedham MA 02026

Recently, I decided to take a look at software for tracking amateur radio satellites. My expectation was that I might be able to locate some of the more audible space vehicles and listen to their communications. I had visions of tracking the *Mir* space station or the NASA shuttle and hearing QSOs with ground stations. About the last thing I ever expected was to become a satellite chaser and actually make contacts.

A telephone call to the ARRL computer bulletin board system allowed me to download a variety of satellite programs and to try them out for free. This is a software distribution channel called "shareware." Try a program; if you like it, pay the registration fee (this is done on the honor system). If you are interested, the BBS is at (860) 594-0306 and uses standard telecommunications protocols from 1,200 to 28,800 baud.

After testing the various downloads, I decided that the STSPLUS software (released in April 1996) offered the features best for my needs. In fact, it has many neat features that I will probably never use, as well as all of the things that I really want. The program is offered by:

RPV Astronomy
David H. Ransom, Jr.
7130 Avenida Altisima
Rancho Palos Verdes CA
BBS: (310) 541-7299 (2,400-14,400 baud)
Cost: I contributed $20, the suggested amount.

Features

STSPLUS is a DOS program that will operate happily under Windows 3.1 (I have tested this; I have not tested it under Windows 95, but would expect it to work). Installed, the program requires 1.8 megabytes of hard disk space, including a 600 kilobyte manual that can be eliminated to save room. The program recommends an Intel (or compatible) 80386 or higher processor and works best with a math coprocessor. I am not aware of a Macintosh version.

The program setup is quite easy. Load the software into a suitable directory and set the latitude and longitude of primary and, if desired, secondary locations. Set the time, update the Keplerian elements (see below), and away you go on the great satellite chase! The program predicts, lists and shows a graphic of satellite passes by time, azimuth, elevation and range. All of this works on EGA, VGA, SVGA and LCD monitors. Mapping is available in a variety of formats and resolutions. Orthographic (spherical) or rectangular projections are available at the press of a single key. In the orthographic mode, the view may be changed from primary location to secondary location or to satellite-centered. Circles of visibility for the satellite or ground station are available. Zoom options run from 100% to 4,000%. Audible alarms (alerting you to times when the satellite is in range) are user-selectable. NASA ground station locations can be switched on and off the map as desired.

"Set the time, update the Keplerian elements, and away you go on the great satellite chase!"

Time options include real time, simulated time and fast time. The simulated time and fast time options allow you to observe the satellite during a particular pass and gauge the possibility of contacting other desired locations. You can specify local or UST, as well as standard or daylight times.

Doppler shift is an important consideration in satellite work. As a satellite approaches, the apparent frequency increases; as it retreats, the apparent frequency decreases. As a practical matter, the ground-based transmission and satellite return will seldom be on the same frequency. Many amateurs use separate transmitters and receivers in full duplex to compensate. Others use software to estimate the up/down differences and compensate manually with a single transceiver. The final ploy is to simply send on the receive frequency and hope the other station is tuning up and down looking for contacts.

One of the most important features of any program is the documentation. I have never seen a better and more complete manual for any other program. If you decide to print the "doc" file, load the printer and be prepared for a press run of 181 pages. I converted the file to Microsoft Word format and used a number 8 font with two columns per page in order to limit the size to a more modest 40 pages after some judicious editing.

The opening menu offers the following selections:

1. Convert Keplerian data to program file.
2. Read standard Keplerian file for program use.
3. Make pass predictions.
4. Tabulate pass predictions.
5. Set launch time/date.
6. Real time satellite data.
7. Select files/paths.
8. Set time and date.
9. Jump to DOS shell.
10. Set options.
11. Run the program.

How about the bottom line? I give STSPLUS software an "A+" without qualification. It's rare to find a program without those foibles and incongruities that make computer usage a frustrating experience. The graphics are perfectly suitable, menus are intuitive and printer output has clear and concise formatting. After two months of testing, I've found the predictions accurate, and haven't found any problems.

Computer systems do not need to be the latest Pentium running at 200 MHz. A more modest computer can produce the pass predictions in due course. The data can be printed and used to determine when the target is in range.

Footprints are the circles on the ground in line of sight with the satellite. These represent the area covered by the satellite signal at any given time.

Length of pass ranges according to the type of satellite and angles of acquisition. I've been tracking a Low Earth Object (LEO), namely the RS-12 satellite because this operates on Mode K. I have HF gear suitable for satellite work, but no VHF or UHF equipment. I have found passes to range from three to 18 minutes. When the satellite is in range, you have to work fast. The experience is similar to contesting, especially if you wish to make multiple contacts. When the Phase 3-D satellite goes up (next year, possibly), I may be in a position to access a high orbit bird that remains in sight for extended periods.

"I've had the chance to meet a new group of hams from Costa Rica to Scotland and make contacts with them in their homes, cars and campsites."

Approximately 250 SSB and CW contacts have provided 35 confirmed states and several countries. What's better, I've had the chance to meet a new group of hams from Costa Rica to Scotland and make contacts with them in their homes, cars and campsites.

Some info and tips

A few observations on satellite operations may help those who have never used them in the past:

Keplerian elements are factors used to compute the location of satellites. This data is available from the ARRL, AMSAT, the RPV Astronomy BBS (above) and many other sources.

Equipment can be quite simple. I am using Mode K, which is a 15 meter uplink and a 10 meter downlink. A simple transceiver with dual VFOs (a Kenwood 430 in my case) and a modest antenna (G5RV at my house) are all that is needed.

Operational aids come in many forms. I have found that a map of the RS-12 satellite footprint centered on my location is very helpful. My footprint is simply a photocopy of a map of North America trimmed to the appropriate size and marked with 360 degree points. After running STSPLUS predictions, I draw a line tracing the starting and ending points of each pass in order to have a sense of where the bird is at any point in time. I am able to visualize the path to various targets this way without using the computer. The size of any satellite footprint is provided by the STSPLUS program when in operational mode.

Further information on satellites is available from many sources. Numerous books on amateur and weather satellites are in print. Amateur radio periodicals print monthly updates on satellite operations. Finally, AMSAT promotes all aspects of this fascinating activity. 73

From Micro Computer Concepts **RC-1000 REPEATER CONTROLLER**

• Autopatch • Reverse Autopatch
• User Programmable CW ID, Control & User Codes & Timeouts

Manual with schematics • 90-Day Warranty
Wired & Tested w/ manual $199.95

VISA MasterCard
Micro Computer Concepts
8849 Gum Tree Ave.
New Port Richey, FL 34653
813-376-6575

CIRCLE 160 ON READER SERVICE CARD

REPEATER HEADQUARTERS
Make "Commercial Quality" repeaters from GE and Motorola Mobiles
• 45 Watt VHF Micor from $99
• 40 Watt UHF Master II from $199
Conversion Information Available!
http://www.versatelcom.com
VersaTel Communications
Orders: 800 456 5548
Info: 307 266 1700
FAX: 307 266 3010

CIRCLE 259 ON READER SERVICE CARD

FREE CONSTRUCTOR'S CATALOG!

25% OFF FIRST ORDER!
ORDER TODAY! ($30.00 MINIMUM ORDER)
VISA MasterCard

Rack Chassis

MODEL	W x D x H in.	A*	B**	MODEL	W x D x H in.	A*	B**
1RU5	19 x 5 x 1.75	35.00	45.50	3RU17	19 x 17 x 3.5	56.00	68.25
1RU7	19 x 7 x 1.75	37.75	50.00	3RU5	19 x 5 x 5.25	47.50	59.25
1RU10	19 x 10 x 1.75	40.00	51.50	3RU7	19 x 7 x 5.25	50.00	62.75
1RU12	19 x 12 x 1.75	46.75	61.00	3RU10	19 x 10 x 5.25	52.75	65.00
1RU15	19 x 15 x 1.75	50.00	63.25	3RU12	19 x 12 x 5.25	59.00	74.50
1RU17	19 x 17 x 1.75	53.25	65.50	3RU15	19 x 15 x 5.25	62.25	77.00
2RU5	19 x 5 x 3.5	37.75	48.00	3RU17	19 x 17 x 5.25	65.50	79.25
2RU7	19 x 7 x 3.5	40.00	51.50	XTRA PANELS F& R		15.00	20.00
2RU10	19 x 10 x 3.5	42.50	54.75	FRONT & REAR PANELS CLEAR FINISH STANDARD. ADD /B FOR BLACK OR /G FOR GOLD. PLUS ADDITIONAL $5.00 (AT TIME OF ORDER)			
2RU12	19 x 12 x 3.5	49.50	63.50				
2RU15	19 x 15 x 3.5	52.75	66.00				

PRICES INCLUDE WORLDWIDE SHIPPING!
*A = Cont. U.S., CANADA & MEXICO; **B = Rest of WORLD
*MUST MENTION AD FOR DISCOUNT

SESCOM, INC.
ORDERS 800-634-3457 ■ FAX 800-551-2749
OFFICE 702-565-3400 ■ FAX 702-565-4828
SESCOM, INC. 2100 WARD DR., HENDERSON, NV 89015
SESCOM, INC. is not responsible for inadvertent typographical errors and prices and specifications are subject to change without notice.

Smart Battery Charger

JUN 87 QST
BY WARREN DION N1BBH

FOR GEL-CELLS or LEAD ACID BATTERIES.
Features: Precision temperature tracking voltage reference & three mode charging sequence. Standard kit is for 12V @ 1/2 or 1 Amp, user selectable. Can be connected to the battery indefinately, will not overcharge. Weighs 2 pounds and measures 4"W x 5½"D x 2½"H. Finished enclosure included in kit.

Complete Kit Only $59.95
Assembled & Tested $79.95

CA Residents add 7.75% sales tax. S&H: $5.00 (insured). Foreign orders add 20%. For more info or price list; send legal size SASE (55¢) to:

MasterCard A&A Engineering VISA
2521 W. La Palma #K • Anaheim, CA 92801
(714) 952-2114 • FAX: (714) 952-3280

ATV

Ham Television

Bill Brown WB8ELK
139 Angela Dr. Apt. B
Madison AL 35738
bbrown@hiwaay.net

Early in the morning of August 24th, hams, students and lots of vehicles laden with ham equipment began to arrive at a small field next to Purdue University in Lafayette, Indiana. No, this wasn't a delayed Field Day exercise. It was another in a series of WindTrax balloon launches.

The WindTrax program

Back in July of 1988, Bob McAuliffe W9PRD, Bill Brown WB8ELK and Chuck Crist WB9IHS launched Indiana's first high altitude balloon carrying ATV and 2m equipment. The spectacular results of this first effort resulted in a continuing series of flights. Early on, Chuck saw the possibilities that balloon flights could offer for aerospace education. Since a balloon can reach the edge of space very economically, it became practical for students to actually build a simulated satellite and fly it.

Doug Craig, a local teacher in Franklin, Indiana, who taught an aerospace class, teamed up with Chuck to involve his students actively in the development and the flight of a balloon payload. Their first flight in October of 1989 involved nearly 20 students who participated in the launch, flight and recovery of their simulated satellite project. Their satellite package contained TV cameras, voice and TV transmitters, and a radar reflector. The FAA and the Indianapolis air traffic control center were able to track the satellite and reported its location back to the student tracking team.

As a result of this flight, students learned through hands-on participation about satellite communications and problem-solving during a complex project. The project was so successful that the Indiana Department of Education has certified the first Aerospace Technology course in the US.

A series of flights throughout the past two years has involved students from Indiana universities, high schools, middle schools and elementary schools. In 1993 Chuck WB9IHS, along with five others, formed a nonprofit corporation named WindTrax, Inc., to help schools and teachers participate and find resources and funding for these projects.

***Photo A.** Terry Hudson KT9V prepares the ATV payload for liftoff. (Photos by Bill Brown WB8ELK.)*

The Purdue WindTrax system

The basic WindTrax system consists of at least two TV cameras, a voice repeater and GPS tracking. The ATV package for the Purdue flight was built by Terry Hudson KT9V and contained two B/W TV cameras. One camera pointed straight up toward the balloon and the other looked out over the horizon. A small car compass was mounted directly in front of the horizon camera to give the ground observers a direction reference (this worked very well). The Wyman Research TV transmitter put out around 1.5 watts on 4339.25 MHz into a 1/4-wave whip mounted on the bottom of the payload. Control of the camera views and the Elktronics video ID was accomplished via a touch-tone control board and a Standard C508A miniature 2m HT. The large disk sticking off the side of the package provided a way to minimize the tendency of balloon packages to spin wildly (the many holes create drag and help to keep the package from spinning).

Purdue University's payload was coordinated through Ed Delp N9YTE and Dave Filmer WB9QPG. Dave built up an APRS system consisting of a Garmin GPS board, a MIMS packet controller board, and an Agrelo Engineering VHF transmitter. This payload weighed very little due to the small size of the packet controller and 2m transmitter. This payload did not fly due to problems with the GPS receiver.

The crossband voice repeater payload was designed and built by Paul Bohrer W9DUU. With an input on 144.300 MHz, this payload retransmitted on 444.85 MHz (modified Tekk FM transmitter) and 52.525 MHz (converted baby monitor transmitter).

The flight

As the tracking and ground stations were being assembled along the edge of the field, preparations began on the balloon flight train. Roger Grady K9OPO brought out his telescope, complete with a television camera adapter and monitor. During the flight he could see the balloon system clearly, even when it was over 30,000 feet high.

Just before inflating the balloon, a large trailer with lots of small doors on the side arrived at one end of the field. Within minutes a huge commotion distracted us all. Over 650 carrier pigeons had been released; they circled around the field once and headed off towards their homes. It turned out they were racing back to Detroit (220 miles away) at speeds between 40 to 60 mph. Now if only we could make an ATV system that would fit on a pigeon ... what a ride that would be!

Although the wind started kicking up during balloon inflation, the liftoff was smooth. It was a beautiful sight to see the balloon heading up to the edge of space. The video downlink showed panoramas of the Purdue campus, as it drifted off on its journey. The video dropped out shortly after liftoff (it turned out to be an overheated video modulator transistor), but came back as the inside of the package cooled. We were all treated to views of the blackness of space and the curve of the Earth. The car compass in the field of view of the horizon camera worked well and gave us a good idea of where the camera was pointing.

The crossband repeater worked great. Even mobile stations from Pennsylvania could be heard

"The Indiana Department of Education has certified the first Aerospace Technology course in the US."

***Photo B.** (l to r): Paul Bohrer W9DUU, Victoria Pratt, Terry Hudson KT9V, Mark Garrett KA9SZX, Al Wolfe WB9OIH and Dick KC9AY recover the payload from the middle of a cornfield. (Photo by Bill Brown WB8ELK)*

working through the repeater. The 1/4 watt output from this repeater has been heard more than 400 miles away during several recent flights. It also provided a great way for the chase crew to keep in touch as they tracked the balloon's progress.

The chase

Four chase vehicles and one chase plane went after the balloon shortly after launch. Two of the chase crews had either Doppler or left-right DF equipment onboard. One car used a large beam with success.

After the balloon burst (over 100,000 feet up), the package began its parachute ride back to earth. The downlinked video signal gave us some great landmarks. I-74 could be clearly seen during the last couple of minutes before landing.

Paul Bohrer W9DUU and Dick KC9AY were close enough to actually see the parachute as it descended into a corn field. Kim Miles KB9JQO was tracking the ATV signal with a left-right DF box aboard his airplane. Two vertical antennas for the 70 cm band were sitting on the dash of his plane. He could easily track the balloon, just as if he was tracking a VOR airplane beacon. Kim caught up with the payload and circled it as it came in for a landing. Mark Garrett KA9SZX and Al Wolfe WB9OIH were tracking the signals with a large beam and were just a mile west. Terry Hudson KT9V was a mile east at landing. I was tracking the signal with just a two-element quad with my friend Victoria. We all converged on a large farm to ponder the best way into the field.

It turned out that the balloon had landed as far from any road as it possibly could (one of Murphy's Laws for balloons). Not only that, but after tromping through a soybean field for about a mile, it appeared that the payload was on the opposite side of a rusty old fence another 100 yards into a field of very tall corn!

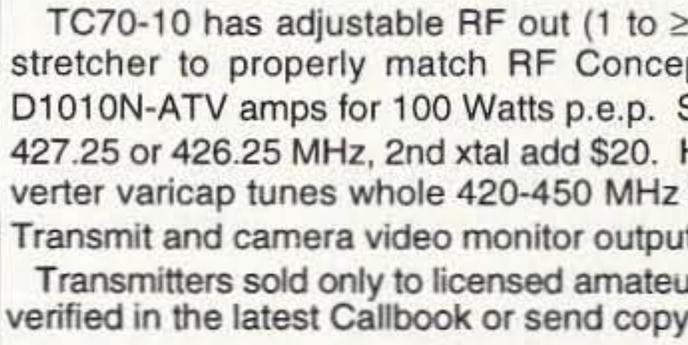
I watched my portable TV set from the soybean field as the rest of the crew headed into the corn. It wasn't too long before I saw a pair of tennis shoes (Mark KA9SZX) walk in front of the camera lens and heard distant shouts of glee! Everything was recovered in great shape, although the chase crew and vehicles were thoroughly coated with dust and pollen.

Future flights

As of the time of this writing, another balloon was flown from Eastern Elementary Middle School in Greentown, Indiana. The crossband repeater was heard as far away as 410 miles by Bob Wilson WA4ZZW in Priceville, Alabama. In two weeks another flight is scheduled to be flown from New Augusta Public Academy of Indianapolis, Indiana. For more information about the WindTrax program and upcoming flight announcements, check the World Wide Web at: http://klingon.cs.iupui.edu/~pacer/new_augusta/windtrax.html. This online site is courtesy of Indiana University, Purdue University at Indianapolis, Dept. of Computer and Information Science. *Thanks to Chuck Crist of WindTrax, Inc., for the above information.* 73

AMATEUR TELEVISION

GET THE ATV BUG



≥10 Watt pep Transceiver

Only $499

Made in USA

Full Color and sound

Snow free line of sight DX is 90 miles - assuming 14 dBd antennas at both ends. 10 Watts in this one box may be all you need for local simplex or repeater ATV. Use any home TV camera or camcorder by plugging the composite video and audio into the front phono jacks. Add 70cm antenna, coax, 13.8 Vdc @ 3 Amps, TV set and you're on the air - no computer or other radios necessary, it's that easy!

TC70-10 has adjustable RF out (1 to ≥10w p.e.p.) and sync stretcher to properly match RF Concepts 4-110 or Mirage D1010N-ATV amps for 100 Watts p.e.p. Specify 439.25, 434.0, 427.25 or 426.25 MHz, 2nd xtal add $20. Hot GaAsfet downconverter varicap tunes whole 420-450 MHz band to your TV ch3. Transmit and camera video monitor output. 7.5x7.5x2.7".

Transmitters sold only to licensed amateurs, for legal purposes, verified in the latest Callbook or send copy of new license.

Hams, call for our complete 10 pg. ATV catalog

Everything you need for 400, 900 or 1200 MHz ATV.

(818) 447-4565 M-Th 8am-5:30pm pst Visa, MC, UPS COD

P.C. ELECTRONICS

Email: tomsmb@aol.com

24 Hr. FAX (818) 447-0489

2522 Paxson Lane Arcadia CA 91007

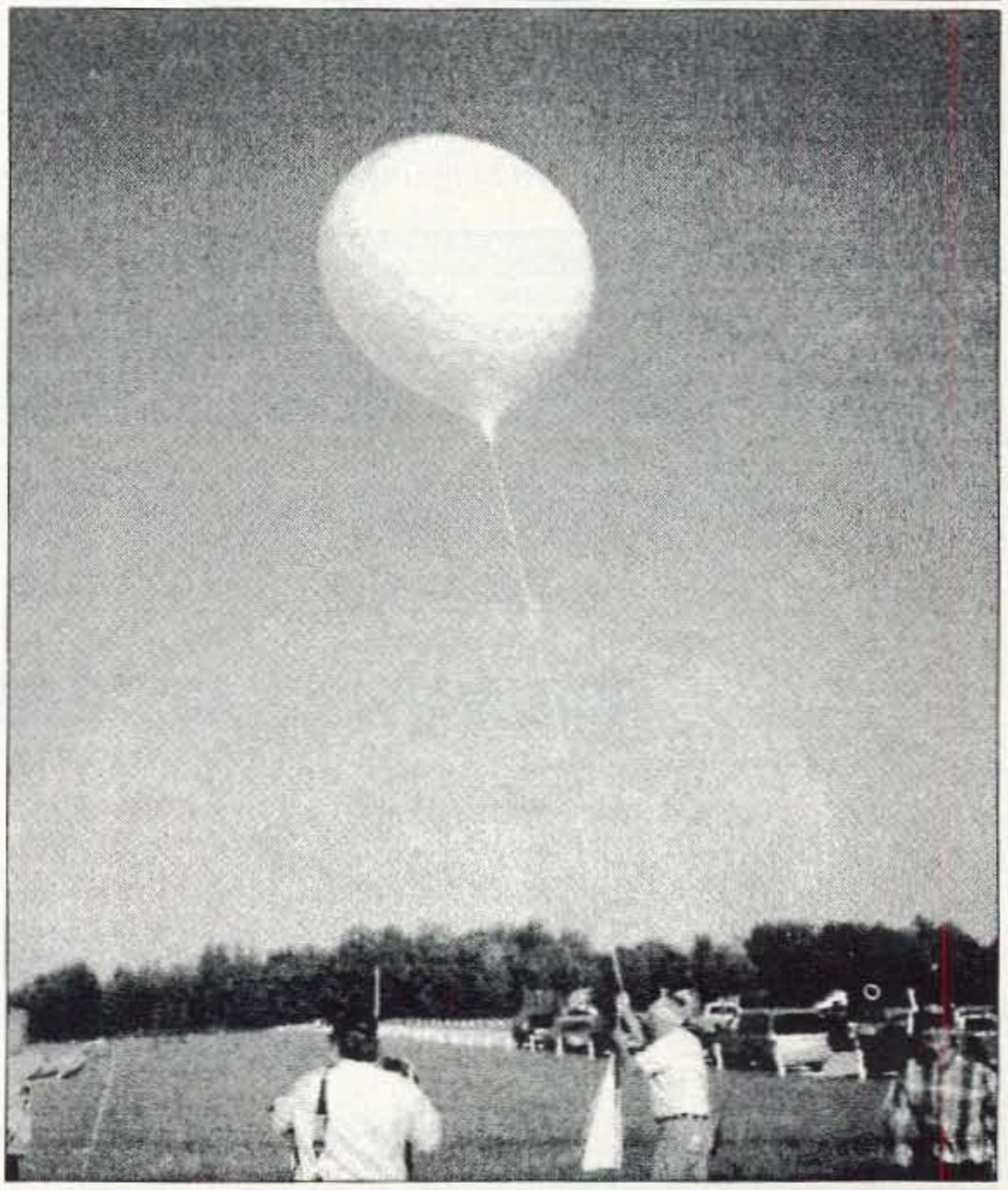


***Photo C.** Kim Miles KB9JQO tosses the payload into the air as the balloon heads on its way to over 100,000 feet. (Photo by Victoria Pratt)*

Hams on the Radio Information Highway, Part 1

The World Wide Web will help you enjoy ham radio more than ever.

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703

You may smile at the message, "The band sure seems dead to night—maybe all the hams are over on the Internet ... hi." It came across my PACTOR screen the other evening when I asked a fellow ham if he used the Internet. Of course, he meant his remark to be taken as humor. After all, aren't serious hams content to communicate over the airwaves? By airwaves, we must include club meetings and the occasional "hot-air session" at the coffee shop. So, maybe, that isn't so different from the Internet.

But what about the Internet? What can it do for you? Did you know there are over 500 ham radio related sites on the World Wide Web (WWW) of the Internet? I didn't—until I started checking out ham sites a few weeks back. There truly is something for everyone, from the non-ham who would like to know more, to the most advanced DXer, contester or experimenter. Hams the world over are interested in other hams. It happens at clubs, over the air, and now it is fun and easier than ever to exchange information quickly with thousands of polite, friendly and helpful hams on the Internet. For the ham or wannabe ham, the safe, comfortable world behind the keyboard can be ideal for exchanging ideas with other hams willing to share their hard-earned knowledge.

Just for openers: Did you know there is a web page that allows you to access current callsign information? It's http://www.ualr.edu/htbin/callsign.exe. It took me less than 10 seconds to get the data back on my call after entering KB7NO. That is *fast*, especially when compared to the time it takes to use the print version I have on the shelf. Don't let all those long strings of itty-bitty letters intimidate you. You can often access a web site by clicking a hyperlink reference. Then you can save the address in your "bookmark" for an automatic "revisit" another day.

If you use Netscape© (see **Fig. 1**), you can easily find any of hundreds of ham-related web sites and news groups, as well as ham files you can download from the Internet. The easiest way to enjoy "instant success" is to go to the World Wide Web and put one of the search engines to work. Once you get to the search page, you will find a box to type in the subject you want information about (amateur radio). Click "Search" and you are on your way.

"It's obvious why some people are hooked on the Internet."

You will also find this includes most of the manufacturers, such as Icom, Kenwood, Yaesu and many others, who provide equipment for our hobby. These commercial folks are doing their best to make your visit to their "virtual store" worthwhile, and some of their bargains are offered only on the web sites.

The real excitement begins when you stop at sites such as the University of Arkansas Little Rock Amateur Radio Club home page where the online callbook referred to above is located. This well-appointed page can also link you to the

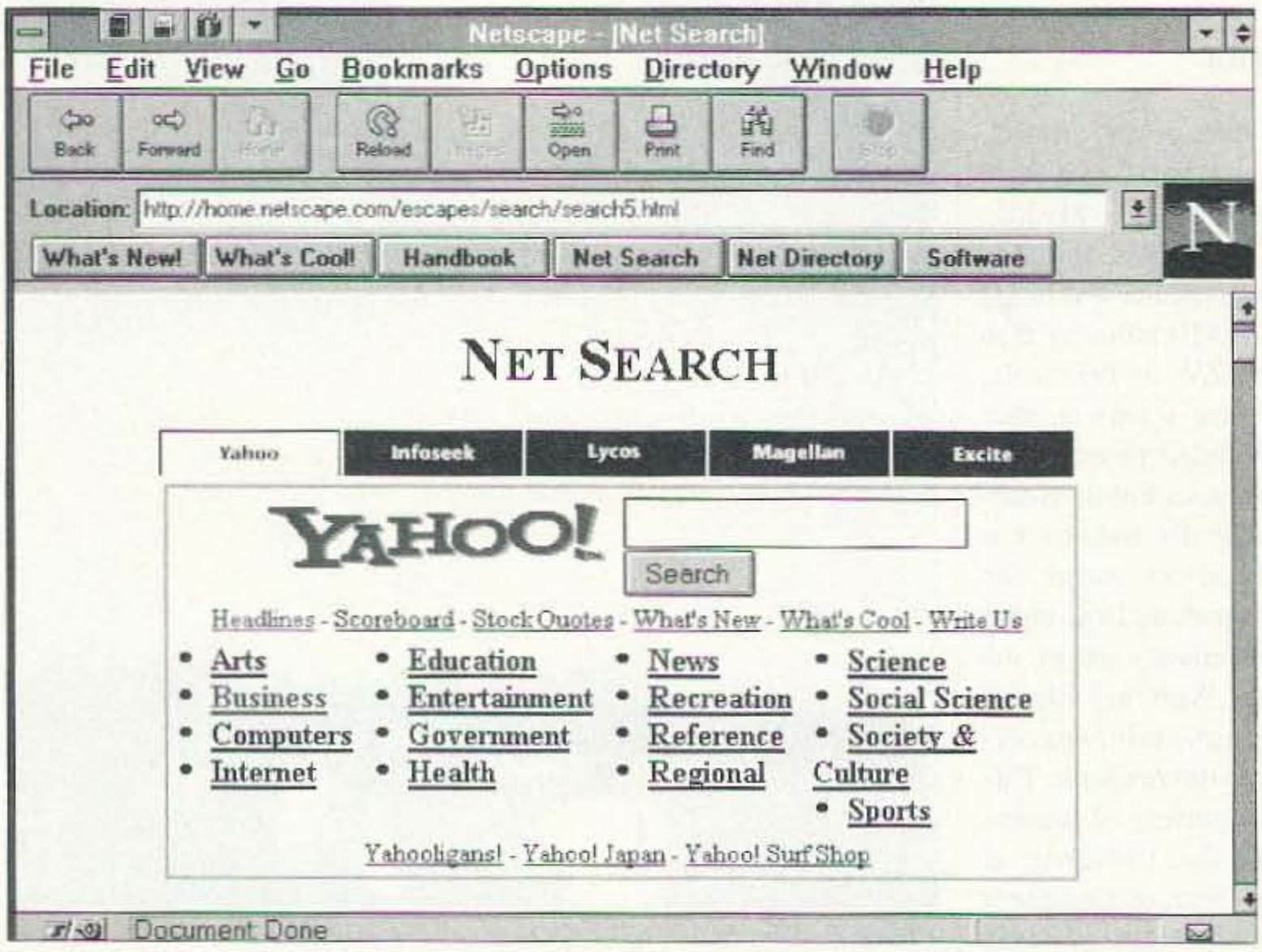


Fig. 1. *Netscape features five different search engines. I suggest Yahoo! for simplicity and speed, at http://www.yahoo.com.*

MFJ TUNERS

MFJ-949E Deluxe 300 Watt Tuner

More hams use MFJ-949's than any other tuner in the world!

More hams use MFJ-949's than any other antenna tuner in the world!

Why? The world's leading antenna tuner has years of proven reliability and can match any real antenna!

Tunes *any* Antenna

The MFJ-949E tunes out SWR on dipoles, verticals, inverted Vs, beams, random wires, mobile whips, SWL.

Use coax, random wire, or balanced lines with *heavy duty* 4:1 balun.

Full 1.8-30 MHz Operation

1000 volt tuning capacitors, extra heavy duty inductor switch, Teflon® insulators and proper L/C ratio gives you arc-free operation 1.8 to 30 MHz. Handles 300 watts PEP SSB.

***Lighted* Cross-Needle Meter**

MFJ's *lighted* Cross-Needle Meter shows you SWR, forward and reflected power *simultaneously*. Read peak/average on 300/30 watt ranges.

$149.95 MFJ-949E

Super Antenna Switch

8 position *super* antenna switch selects two coax fed antennas, random wire/balanced line or built-in dummy load for use through your MFJ-949E or direct to your transceiver.

***QRM-Free PreTune*™**

MFJ's *QRM-Free PreTune*™ lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load.

***Full Size* Dummy Load**

A *full size* -- 3/4 inch diameter by 5 inches -- non-inductive 50 ohm dummy load *easily* handles 300 watts of abusive tune-up power.

***Custom* Inductor Switch**

The inductor switch is *custom* designed to withstand extremely high RF voltages and currents.

***Superior* Cabinet**

Each MFJ-949E cabinet is chemically treated and has a new tough scratch-proof *vinyl* cladding. You won't find a tougher, longer lasting finish anywhere.

Detailed logging scales and legends are *permanently* silk screened on a *real* aluminum front panel and back panel.

***Superior* Construction**

Every MFJ-949E uses Teflon® insulating washers, wing-nut for ground post, fire-retardant epoxy glass PC board, heavy .063 inch thick aluminum chassis, heavy gauge wire, custom cabinet.

***No Matter What*™ Warranty**

Every MFJ-949E is backed by MFJ's famous *No Matter What*™ unconditional warranty. We'll repair or replace your MFJ-949E (at our option) *no matter what* for a full year.

In Stock at all Ham Dealers!

More hams use MFJ tuners than all other tuners in the world! Why settle for an imitation when you can have the real thing?

Famous MFJ-989C 3 KW Tuner

MFJ-989C **$349.95**

More hams use MFJ-989s than any other 3 KW tuner in the world!

The rugged MFJ-989C handles 3 KW PEP SSB and covers 1.8 to 30 MHz including all MARS and WARC bands.

MFJ's new *AirCore*™ Roller Inductor, three-digit turns counter and spinner knob gives you exact inductance control for absolute minimum SWR.

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

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-needle SWR/Wattmeter, antenna switch, built-in dummy load, balun, convenient flip-stand -- all in a sleek, compact cabinet.

MFJ's *versatile* 1.5 KW Tuner

MFJ-962C **$249.95**

Use your barefoot rig now and have the capacity to add a 1.5 KW PEP amplifier later! Lighted Cross-Needle SWR/Wattmeter. *6* position antenna switch, *Teflon*® wound balun, ceramic feedthru insulators for balanced lines. 1.8-30 MHz. 10¾x4½x14⅞ in.

MFJ's *portable*/QRP Tuner

MFJ-971 **$89.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, *30/300 or 6 watt QRP* ranges. 6x6½x2½ in.

MFJ's *super value* Tuner

MFJ-941E **$109.95**

The new MFJ-941E gives you a 300 watt PEP tuner with *lighted* Cross-Needle Meter. Covers 1.8-30 MHz.

Antenna switch selects 2 coax lines (direct or thru tuner), random wire, balanced line or external dummy load. 4:1 balun. 1000 volt capacitors.

Free MFJ Catalog

Nearest dealer/Free Catalog . . . 800-647-1800

2 Knob *Differential-T*™ Tuner

MFJ-986 **$299.95**

The MFJ-986 Differential-T™ 2 knob tuner uses a differential capacitor to make tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only one best setting. 3 KW PEP. 1.8-30 MHz.

Roller inductor makes tuning smooth and easy. Turns counter lets you quickly re-tune to frequency.

Lighted Cross-Needle Meter reads SWR/forward /reflected/*peak*/average power in 2 ranges. Current balun reduces feedline radiation and forces equal currents into unbalanced antennas.

MFJ's *mobile* Tuner

MFJ-945E **$99.95**

Don't leave home without this mobile tuner! The MFJ-945E extends your antenna bandwidth -- don't stop to go outside and adjust your mobile whip.

New MFJ-945E now includes 6-Meter operation and has tuner bypass switch. Small 8x2x6 inches uses little room. Lighted Cross-Needle SWR/Wattmeter with lamp switch. 1.8-60 MHz. 300 watts PEP SSB. **Mobile mount**, MFJ-20, $4.95.

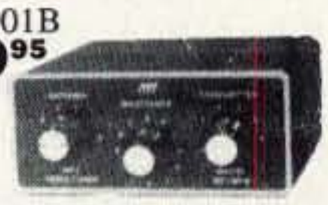
MFJ's *6 Meter* Tuners

The MFJ-906 has lighted cross-needle SWR/Wattmeter, bypass switch. Handles 100W FM, 200W SSB. For coax fed antennas. MFJ- 903, same as MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-903 **$49.95**

MFJ-906 **$79.95**

MFJ's *smallest* Versa Tuner



MFJ-901B **$69.95**

The MFJ-901B is our smallest --5x2x6 inches --(and most affordable) 200 watt PEP tuner --when both your space and your budget is limited. Great for matching solid state rigs to linear amps.

MFJ's *random wire* Tuner

MFJ-16010 **$39.95**

Operate all bands anywhere with any transceiver with the MFJ-16010. It lets you turn a random wire into a transmitting antenna. 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 inches.

MFJ's VHF or UHF Tuners

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

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 in. Simple 2-knob tuning for mobile or base.

MFJ's *artificial* RF Ground

MFJ-931 **$79.95**

Creates artificial RF ground. Eliminates or reduces RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire.

http://www.mfjenterprises.com FAX: (601) 323-6551

•1 year *unconditional* warranty •30 day money back guarantee(less s/h) on orders from MFJ •**Add s/h**

MFJ ENTERPRISES, INC.
P. O. Box 494, Miss. State, MS 39762
(601) 323-5869; 8-4:30 CST, Mon- Fri
Technical Help: (601) 323-0549

Prices/Specs subject to change . © *1996 MFJ Inc.*

MFJ . . . the world's most trusted name in antenna tuners

Fig. 2. *The Tucson Amateur Packet Radio homepage is an excellent place to get up to speed on packet and all that goes with it, at http://www.tapr.org.*

W1AW page, their own amateur station page, *Yahoo!*, FCC Part 97 database, and two great ham general interest sites.

When I first visited this site, I encountered one of the Internet gremlins. Two of the links did not work that day; so many systems are interconnected that occasionally the input acquires a hiccup and a link won't work, but problems of this nature usually heal within a few hours or days. You get used to it (I simply went on to other sites). You can always go back another time. The results will probably be even better when you do return.

Looking further, AMSAT presents its own exciting page (http://www.amsat.org/amsat/AmsatHome.html) where they tell all about their program and how hams are making it possible. There is a display of actual photos of the work as it is being performed on the amateur satellites.

The Tucson Amateur Packet Radio home page (**Fig. 2**) is very well done. This is a "must-see" for anyone with even a fleeting interest, up to and including those deeply involved in digital concepts.

Another great web page you won't want to miss is NØXIC's Amateur Radio Resource (**Fig. 3**). Marc has put an enormous effort into this presentation. You can get information on becoming a ham, find answers on about any ham topic and there are links to many web sites and other web sites. You can easily satisfy your need to read—and then some. On this page, you will see over 75 references with links to other ham-related sites that require only the click of a mouse to provide you with another world of information to absorb.

"Manufacturers want to make your visit to their 'virtual stores' worthwhile, and some bargains are only offered on the websites."

I printed a copy of this web page to keep for reference. On my hard copy, I marked 21 places to visit as time permits. They include many informative sites with extensive information about amateur satellites, solar activity and solar images, antennas, and club web sites.

Marc's page is only one example of what many hams are doing to make traveling the Internet pleasant and informative for the rest of us. There are many more such interesting sites, and the creators are constantly upgrading them to make our surfing ever more productive.

The marvel of the hyperlink makes all this so easy that I can see why folks are hooked on their own niches of the Internet. You look at one of these web pages and find an invitation to click a hyperlink line with the mouse and you are suddenly in another ham area and it may just as easily lead you to another. Before you know it, the XYL is ringing the dinner bell.

All this makes a great tool for you to connect with hams who are helping others in just about every facet of our great hobby. Yes, if you haven't already gone on line with your computer, now is the time. There are a number of hams who check in regularly on this "land-line" based system. (Actually, the Internet doesn't rely solely on phone hookups. If it will make you feel better about participating, there are radio and satellite links discretely working in the system as well.)

Now, I am going to tell you how easy this is to do (if you aren't already doing it). You won't need a degree in computer technology, and you won't even be required to pass a code test. If you have a relatively modern computer such as a Windows-based IBM compatible or a Macintosh, you have most of the equipment covered.

The cost isn't outrageous to add a modem to one of these computers and the software is relatively low-buck. You will spend about $70 to $120 for a good modem. Many new computers are sold with the modem installed. The current standard is rated at 28,800 bits per second (bps). I am still using a 14,400 bps modem which "they" say is barely adequate. It is doing an OK job for me, but if you purchase new, go with 28,800 bps.

The modem is easy to install in the IBM style computer. Just remove a cover at the back of the chassis to expose the end of the slot that makes room for the phone lines and plug it in. Macintosh folks always have an Apple guru lurking nearby for advice, and they assure me Macs are at least as easy to configure as my clunky 486 IBM clone.

Once your modem is installed, you need terminal software to tell the modem to ring a telephone somewhere, and you are nearly ready. Most modems come with a trial package of software to get you going. If you are going to go strictly with a phone connection to the Internet, you will need to find an Internet Service Provider (ISP).

You have several choices when choosing a provider. Some of it depends on where you live and if that

Michigan Radio
SALES SERVICE

NEW ADDRESS

Local & Tech 1-810-771-4711, Service 1-810-771-4712, Fax Service 1-810-771-6546

Terms do not include shipping. Price and availability subject to change without notice. Most orders shipped same day. COD's welcome ($5.50 & shipping)

VISA MasterCard DISCOVER AMERICAN EXPRESS

OPEN
MON-FRI 10-6
SAT 10-4,
SUN CLOSED

23040 Schoenherr, Warren, MI 48089
1-800-TRU-HAMM (orders only)
(800-878-4266)

Convert Excess Equipment to CASH We buy good clean, used equipment Estate Sales

results in long distance charges to connect. You may fare better if you check with one of the major online services such as America Online, CompuServe or Prodigy and take advantage of their Internet access. The rates of the major services are competitive. You just need to find one that is close and has a fairly high-speed connection (minimum 9600 bps).

A good provider will answer your questions and be sure you get going in the right direction. He is likely to have software for little or no cost that will be just the ticket. The current favorite Internet "browser" (terminal program that decodes what's on the Internet and displays it on your monitor) is Netscape and it's free! I am using the latest version, 2.01, that I downloaded over the Internet directly from the company as a 90-day "evaluation" copy. One day, we'll all have to buy the finished product, but for now .... Your Internet provider can tell you how to get your first copy, and how to get the only other piece of software you need; a "dialer." The standard of the industry is Trumpet© and an

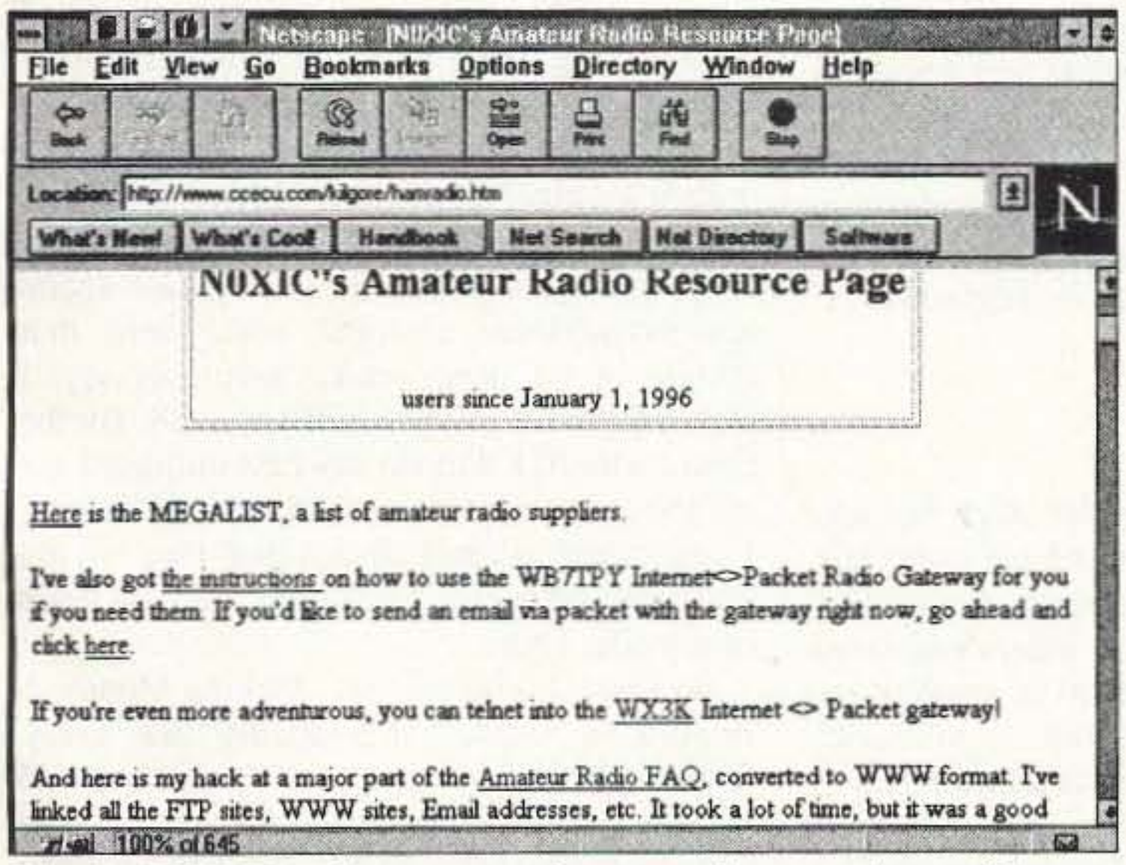


Fig. 3. NØXIC's references touch on nearly every facet of ham radio—a worthwhile visit at http://www.ccecu.com/kilgore/hamradio/htm.

QUADS
5 Band 2 Element Quad **$289 Complete**
Many other models available
Call for brochure today.
UPS Shippable
Lightning Bolt Antennas
RD #2, RT 19, Volant PA 16156
412-530-7396 FAX 412-530-6796

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

WGP87034 **All About Cubical Quad Antennas** by William Orr and Stuart Cowan "The Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. $11.95

TAB 3270P **Practical Antenna Handbook**–2nd edition by Jos. Carr. This 560-page book is a treasure. Starts with fundamentals, explains propagation of all kinds, and provides a ton of easy antenna projects. $26.95

AR4734 **ARRL Antenna Book**. Best and most highly regarded info on antenna fundamentals, transmission lines, design, and construction of wire antennas. $30.00

WGP87107 **All About Vertical Antennas** by William Orr. Comprehensive coverage of amateur communications. $11.95

WGP87042 **Beam Antenna Handbook** by William Orr and Stuart Cowan. Everything you need to know about beam design, construction, and operation. $11.95

WGP87077 **Simple, Low-Cost Wire Antennas For Radio Amateurs** by Willliam Orr and Stuart Cowan. Low-cost, multi-band antennas; inexpensive beams, "invisible" antennas for hams in "tough" locations. $11.95

AR4661 **ARRL's Antennas & Techniques for Low-Band DXing** can be your ticket to low-band success. $20.00

evaluation copy is available that will cost you $25 (money well spent) when you register it within the first month of use. If you don't register, it self-destructs.

If you are using Windows 95©, you can configure that operating system to make the connection for you without using a dialer such as Trumpet. However, it is a little tricky and you will need some specific guidance. Though I haven't made the installation myself, I have the step-by-step instructions from Netscape to do this. I furnished them to a friend who still had to call his ISP to fill in a few blanks left out of the instructions. Now his works faster than mine. I guess that means I must break down and install the Windows 95 someday.

One of the really neat features of the new version of Netscape's search page is the option of most of their search engines to not only perform web searches but to search the newsgroups for material by topic. It all works great and you must be careful—don't get hooked. You could easily run out of time for life's necessities (chasing DX, rag-chewing, repairing your antenna, etc.)

Next month, we will explore Usenet newsgroups. 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Books for Beginners

TAB4354 **Beginner's Handbook of Amateur Radio** by Clay Laster W5ZPV. 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. $22.00

W5GWNV **No-Code Video, Manual, Part 97 Rules** by Gordon West Learn how to be a ham radio operator $29.95

W5GWNC **Technician Class License Manual: New No-Code**–by Gordon West This book covers everything you need to become a Technician Class Ham. Every question and answer on the examination is found in this one book. FCC Form 610 application. $9.95

XTAL-1 **The Crystal Set Handbook** by Phil Anderson WØXI. Want to give a kid an exciting present? Or maybe yourself? Crystal sets are alive and fun. Here's a whole book packed with crystal set circuits that anyone can build. Now start saving those oatmeal boxes, okay? 133 pages. $10.95

Code Tapes

73T05 **Genesis 5 wpm code tape** This beginning tape takes you through the 26 letters, 10 numbers and necessary punctuation complete with practice every step of the way. $5.95

73T06 **The Stickler 6 wpm code tape** This is the practice tape for those who survived the 5 wpm tape and it is also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm $5.95

73T13 **Back Breaker 13 wpm code tape** Code groups again at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. $5.95

73T20 **Courageous 20+ wpm code tape** Go for the extra class license. $5.95

73T25 **Mind Boggler 25+ wpm code tape.** $5.95

Where's the Beam?
Unobtrusive DX Gain Antennas for 80 thru 10
• Easily hidden • Install Fast • Fixed or Portable •
There's a 20 meter antenna with real DX Punch hidden in this picture. You can't see it, and your neighbors can't either. But it works DX barefoot anyway. How about a low profile 80/40/30 m-bander? Or a 2 element monobander for the attic? All easily fit the pocketbook--Priced $29 to $99.
Work DX without telling the neighbors
Infopack $1
Box 50062-R, Provo, UT 84605
AntennasWest
(801) 373-8425
CIRCLE 332 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 42

You probably saw the TV exposé of what happens when a Wal-Mart® or Sam's® comes to a town. The lower prices soon put all local competing merchants out of business, often leaving main street looking like a ghost town. Then, if the Wal-Mart doesn't make enough profit, it folds up and leaves the people with no place nearby to shop. The local stores don't come back. Most of them had been in business for several generations of family ownership. And who's going to start a clothing or department store in a small town today when a discount monster can open up at any time and wipe everything out?

The next obvious step in the ham field is for the manufacturers to eliminate the no longer needed middlemen by going factory direct. This is what Swan did many years ago. But they got forced out of business by the then still strong dealers who wasted no time in telling any ham customer how rotten the Swan junk was.

Back when I started *73* in 1960 I had over 850 ham stores carrying the magazine. Today there are an estimated 50 ham stores left, and many of those are hurting. I'm sure the retailers who are left really appreciated it when *QST* ran an article on how to whip-saw dealers to get the lowest prices.

With so few dealers, much of their business has to be done by mail order if they are going to survive, which makes it even easier for the major manufacturers to be in direct competition. And since few dealers these days are able to handle repairs … well, you get the picture. If the dealers are going to survive they'd better organize in some way, otherwise the handwriting is on the wall. Radio Shack®, catering to the no-coders, is skimming the cream, and all it takes is a couple of feet of floor space in their stores. If that.

Snow Job

Art Bell W6OBB called the other day and asked if I would be a guest on his radio talk show again. My last guest shot on his show resulted in several thousand letters and faxes and generated a lot of interest in amateur radio, including a bunch of new *73* subscribers. I also generated a good deal of interest in my list of "books you're crazy if you don't read." The list had 49 books at the time. The list brought in a bunch of letters recommending other books that really should be on the list. I bought 'em and read 'em. In some cases the listeners were right, so I've added the books to my list. It's up to 88 books now, and I've got a stack of over a hundred more recommended books sitting here yet to be read. Some look really interesting, too. Nope, no fiction.

So I said okay, let's do it again. I was on with Art for four hours. I forget what all we talked about, but we started off with amateur radio, with me explaining that as a direct result of my interest in the hobby I've had some amazing adventures and a wonderful career. Imagine, working in your major hobby!

For the first few days after the show I was getting a stack of letters about 18" high every day. Over 4,000 in the first week. Plus my poor fax machine was grinding out faxes day and night. This happened a week before the Dayton HamVention, so I was sure glad I'd decided not to go this year. I've been spending about 18 hours a day opening letters, duplicating my booklets, and then addressing, stuffing and mailing envelopes.

My most popular booklet is the five-buck 28-page recommended book list. It has a discussion of each book. The books cover many aspects of health, education, history, science, etc. Many are books I've reviewed for you in my editorials. Maybe you noticed.

Rich? Why Not?

My next most popular book was the one I wrote as a result of the requests from my first guest shot last November. Art and I had been talking about TVI and I suggested that the best solution was the one I went for—living on a 200-acre farm with no neighbors within a mile. Art pointed out that this takes money. I said that, heck, making money is easy, once you know the secret. Our social and educational systems make sure that 99.9% of us never make much money. I didn't figure it all out until I was 28. By the time I was 30 I'd made my first million. I got off the quiet desperate treadmill to oblivion. I was upset when I discovered that by not knowing the secret I'd wasted over 10 years of my life. Drat!

So I wrote a booklet on "Making Money, A Beginner's Guide." It's selling like crazy. Oddly enough I wrote a very similar book 35 years ago and couldn't sell it to young possible entrepreneurs, even at $1. Now those same people are in their 50s and they're beginning to

Dear Readers,

73 needs your help! 73 really appreciates your sending your feedback cards to us. Now, we'd like to know something about you and your hamshack.

Return this survey and take part in 73's random drawing of all the survey responses received by December 16th, 1996. The winner will receive $100.00 cash and a Life Subscription to 73 (okay, so you are already a "lifer"...enter anyway and give your "prize" to your grandchild). We'll announce the winner's name in our February '97 issue. So, please answer the questions below on an 8 1/2" x 11" sheet of paper and return them to:

73 Amateur Radio Today
70 Route 202 North
Peterborough NH 03458
Attn: F.I. Marion

FAX at (603) 924-8613 or
E-mail: Design73@aol.com

Be sure to include your name, callsign, address, and phone number. Keep those reader service cards and the feedback cards coming. Good luck!

It's a survey! It's a drawing! Win a prize and money!

1.) a. Do you subscribe to *73* Amateur Radio Today?
b. What do you like most about the magazine?
c. What do you like least about the magazine?
d. If you're not a subscriber, why not?
e. Where did you get this issue?
f. What other radio magazines do you subscribe to?

2.) a. How old are you?
b. How long have you been involved with amateur radio?
c. What encouraged you to become involved with amateur radio?

3.) a. Do you belong to any radio clubs?
b. Which ones?
c. What do you do at meetings?
d. Have you or your club participated in any beneficial projects in your community?
e. Describe.

4.) How many hours per week do you spend on this hobby?

5.) a. Do you ever fill in and return 73's feedback cards?
b. If not, why?

6.) a. Do you send in the reader service cards?
b. Do you contact 73's advertisers because you saw their ad in 73 Magazine?
c. Do you tell them where you saw their ad?
d. Do the advertisers usually respond to your request for information?
e. How many products have you purchased from our advertisers in the last 6 months? 12 months?

7.) a. Do you find 73's product reviews helpful in selecting new equipment?
b. Do you contact any of the companies after reading a review to get more information?

8.) a. Do you read the "New Products" section?
b. Do you ever make purchases based on what you've seen there?

9.) How many "ham" related purchases have you made in the last 6 months? 12 months?

10.) a. Are you planning on making any large purchases in the next six months? If so, what? How much do you plan to spend?
b. If you read reviews of this product, would it influence which brand you would purchase?

11.) Of the major manufacturers, which 3 brands makes up most of your ham equipment?

12.) a. Do you purchase kits?
b. If so, what brands?

13.) Do you enjoy construction articles?

14.) a. Have you been on a DXpedition?
b. When and where did you go?
c. Did you do or see anything worthy of writing an article for 73?

Thank you for participating in this survey, good luck in the drawing.

wise up that there are very not many downsides to having a bunch of money, and surprisingly few benefits to poverty. Worse, they're the ones being downsized as computers and communications technology shrinks the management layers in larger companies. Suddenly they're faced with a need to find a new career, something they've never really considered before. There's just no market for ex-middle managers in their 50s. That's something for anyone still dependent on a paycheck to consider.

Bell's program covers the country pretty well. I've gotten letters from the Virgin Islands, and from every state.

But even with four hours I didn't get to talk about many interesting controversies such as past lives, reincarnation, near death experiences, out of body experiences, UFOs, contactees, Roswell, and stuff like that. Or go into detail on just how crummy our medical and school systems are and what can be done to fix them. How we have one of the most expensive medical systems in the world, and yet we're near the bottom in health. And ditto our school system.

But I did get to talk about the fun of making ham satellite contacts and things more dear to your heart. I talked up new communications modes and the pioneering fun and adventure they provide instead of grinding out routine hello-good-bye, please QSL contacts endlessly for years. Or calling into a roundtable or repeater, the ham version of hanging around the corner.

Adventure lies in wait, tapping timidly on your door. How much do you know about spread-spectrum communications? Well, if you don't, then dammit, learn. And then start writing articles so we can get some other readers fired up. There is no question in my mind that spread-spectrum digital communications is either going to be our main future system for communications, or we'll lose the whole hobby as the FCC sells off our frequencies.

Plan Ahead

Mankind does not have a good record for considering the future, so why should we expect anything but temporary expediency from the FCC? The Commissioners are political people; servants, not savants. They bow to the pressures of immediate money, and who the hell cares about what effect this might have on the 21st century? Or even beyond?

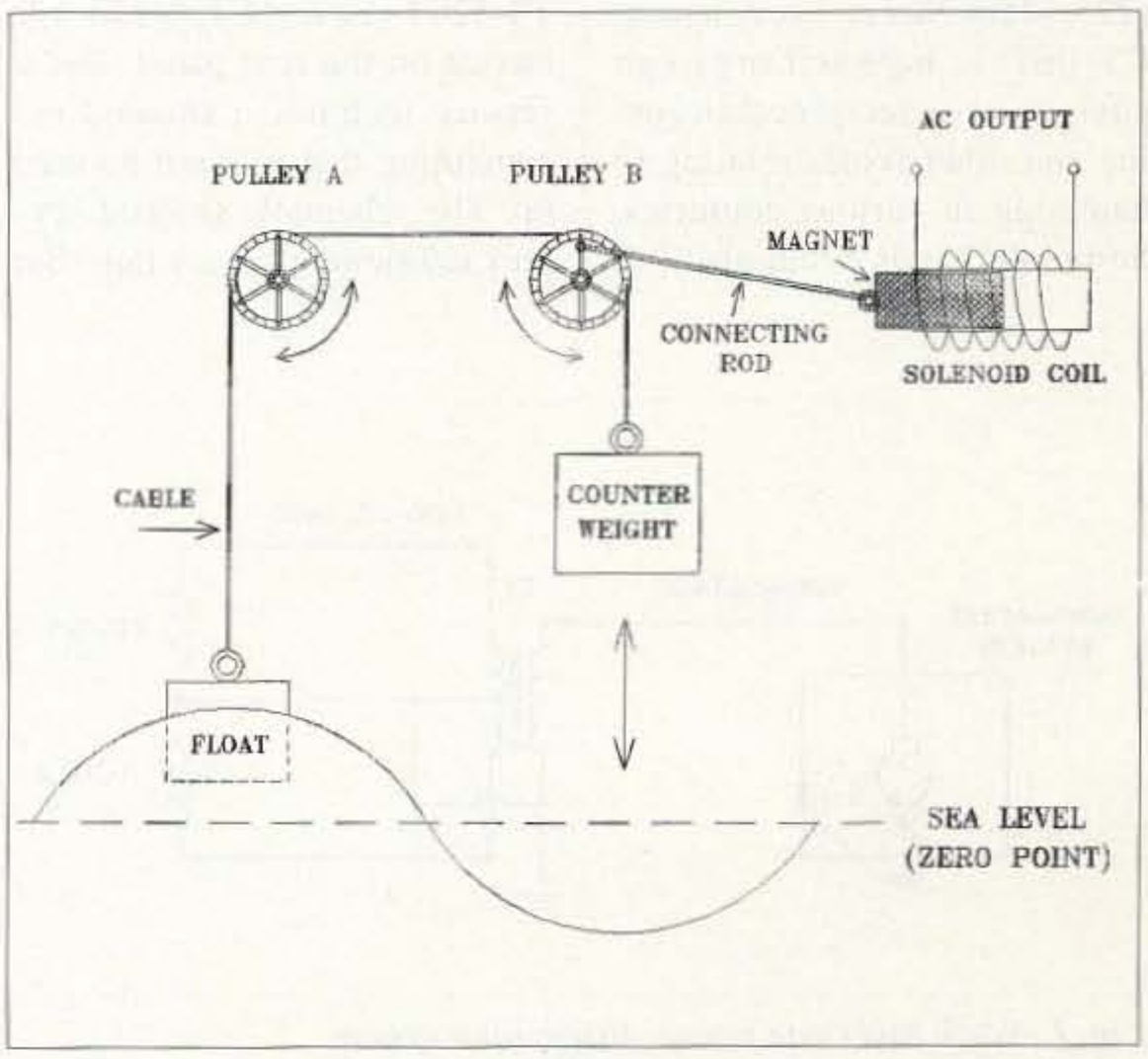
Continued on page 55

Number 53 on your Feedback card

UPDATES

The missing figure in "Free Energy"

Drawing your attention to September's article "The Amateur's Guide to 'Free Energy' Devices," **Fig. 1** on page 10 is actually **Photo A** seen also on page 18. For those who caught that before we did and were wondering how the heck the generator pictured could harness ocean waves, here's what **Fig. 1** really looks like:



CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041
E-mail: carrjj@aol.com

AC Power Overseas

You make the big decision: You'll go on a worldwide DXpedition, see the sights, ham from exotic locations, pick up a few souvenirs, and take about a gozillion color pictures. All you need to do is get a passport (takes from three to eight weeks, sooner if you can prove urgency with a ticket that shows an imminent departure date—bring a note from your mommy), stop by a few consular offices to obtain visas (don't want to get arrested at the airport), pack some clothes and the ham rig and take off. Right? Wellllll, maybe not.

There are a number of things that must be tended to before leaving. Not every country is going to let you operate, or, for that matter, even bring radio gear into the country. The ARRL (225 Main Street, Newington, CT 06111; hq@arrl.org) can advise you on reciprocal licensing and other issues relating to hamming in various countries. Some old hands could also tell you about the specifics of each country (bribes? never ... I think they're called "paperwork facilitation fees"). One chap told me that a certain Latin American country almost always imposes a huge import tax on radio gear brought into the country in the cargo hold of the aircraft, packed in factory boxes. On the other hand, if you carry the radio under your arm, and make it look a bit old, a $20 bill to "facilitate paperwork" seems to do the trick. He's done that with a couple rigs, including a TS-440 recently (would you believe it, the guy's a missionary ... *they* don't "facilitate paperwork," do they?).

"Bribes? Never ... I think they're called 'paperwork facilitation fees.'"

Another major issue is the matter of AC power for the rig. Many ham rigs are equipped with AC power mains selector switches on the back of the rig (or of the power supply if it is separate). In other cases, there are taps on the transformer for different voltages. For example, one species of the TS-520 I saw had a 120/240 volt switch on the rear panel. But a service technician showed me something that was not hooked up. The schematic showed several additional primary taps that could accommodate primary voltages of 100 to 380 volts, depending on which was hooked up. It only makes sense. After all, why would the manufacturer make different transformers for different countries when a few taps cover a lot of QTHs?

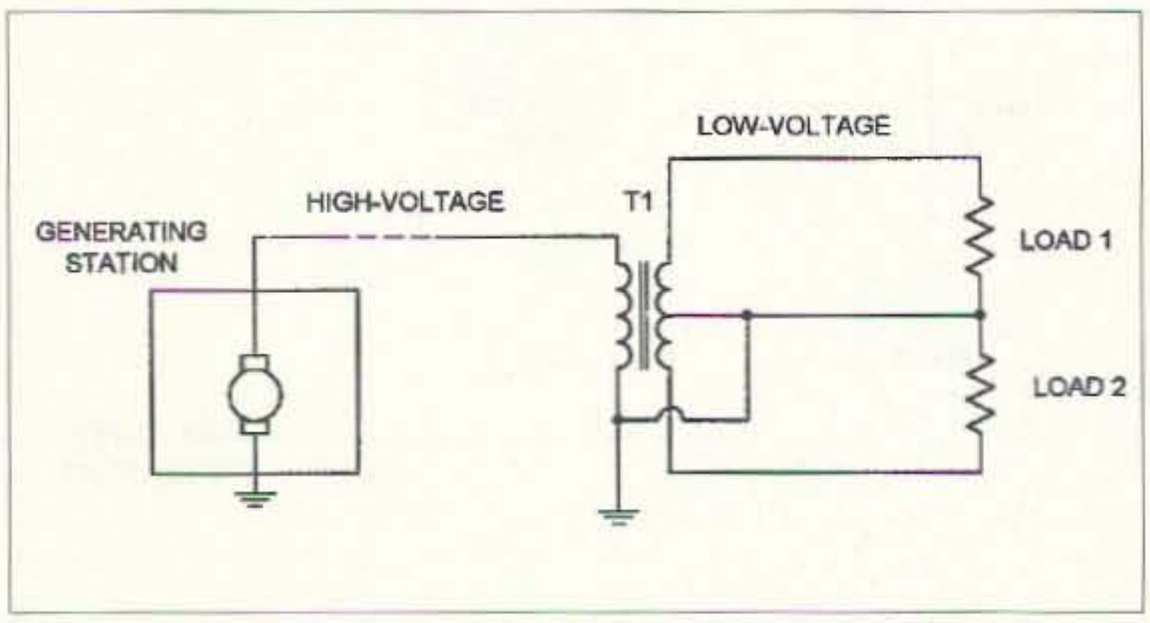


Fig. 1. North American power distribution system.

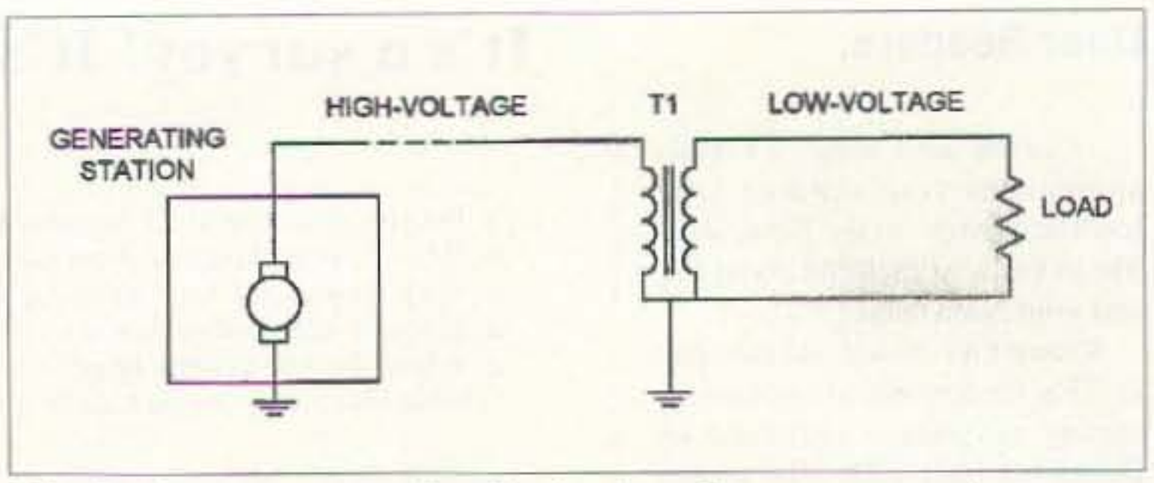


Fig. 2. Alternate power distribution found in some countries.

In some cases, you will need an external transformer adapter for the power supply. Don't rely on those little transformers that run your electric shaver, for they are too low-powered. Isolation transformers come in 1:1 and 2:1 ratios, so they can accommodate a variety of power situations. The most useful of those have a 120 volt AC outlet on one side, and a plug and voltage selector on the other. Transformers of that sort are not rated for power (i.e. watts), but rather are rated for volt-amperes (VA). VA is the same as watts, except for the power factor.

Power distribution systems

Fig. 1 shows the standard AC power distribution system in North America. The generating station produces high voltage AC power. It is distributed at high voltage so that the current is reduced (for any given wattage), and that makes transmission through lossy transmission lines less of a headache. It will go through a number of step-down transformers, but I've shown only the one outside your house. It will have a high-voltage primary, and a 240 volt center-tapped secondary. The center tap is grounded. If you want a 240 volt outlet, then you take the voltage across the two ends of the transformer. But if you want 120 volts, then you take the voltage from ground to either end. Two "circuits" can be served (shown as LOAD 1 and LOAD 2). Of course, in a real system there are switches, fuses, circuit breakers and a distribution box as well as the transformer shown in **Fig. 1**.

Many overseas locations use the same type of distribution system, although the voltages may be different from those used in the United States and Canada. Other countries use a single secondary distribution system, such as that shown in **Fig. 2**. The voltages available will be listed in the form 120/240, or whatever voltages are actually present. This system is pretty much the same up to the primary of the transformer, but the secondary is not center-tapped. The voltage listed for those countries will be only one level.

Various plugs and sockets are found around the world. **Fig. 3** shows some of the different types of plugs that will be found. You will need to either buy adapters to go from our system to theirs, or buy new plugs when you arrive.

A booklet for you

If you want detailed information about plugs, voltages and so forth, the U.S. Government can supply a little book for $9.95. Ask for *Electric Current Abroad*, publication number PB91-193383. Write to National Technical Information Service, U.S. Department of Commerce, Springfield VA 22161. Call 1-800-553-NTIS, or in the Washington, DC, calling area, 1-703-487-4650.

Connections ...

I can be reached via snail mail at P.O. Box 1099, Falls Church VA 22041, or via Internet E-mail at carrjj@aol.com.

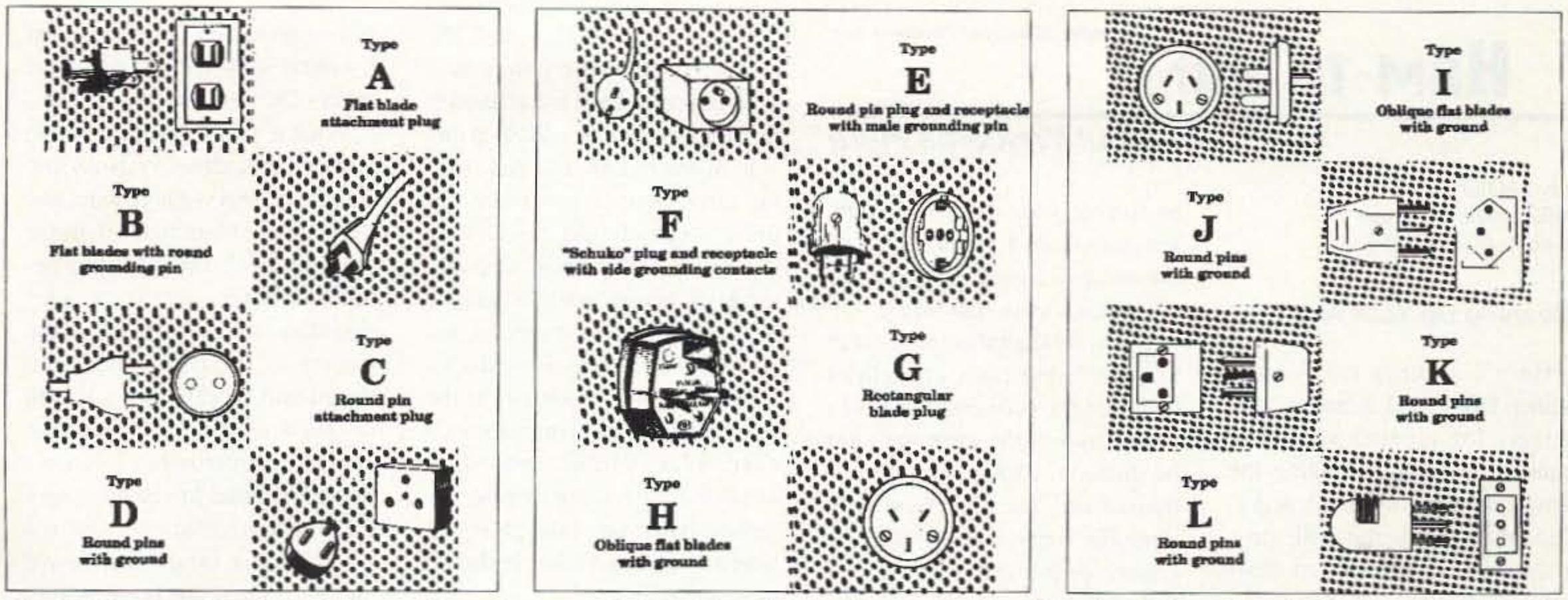


Fig. 3. Plugs and sockets (in domestic and commercial use) found in various countries. (Reprinted from Electric Current Abroad, *with permission of the International Trade Administration.)*

NEVER SAY DIE

Continued from page 53

When America was discovered the Europeans came over, got rid of the Indians, and then started exploiting the land in every way they could. They dug for gold, silver, lead, coal, oil, and so on. They cut down the forests and planted crops. They just about wiped out those annoying buffalo and much of the other wildlife (like wolves). I think there's a small area of virgin forest left someplace in Pennsylvania. Never mind what this cutting of forests has done to our land, water, and the whole ecosystem. If you're interested in the long-term changes cutting down forests makes, you'll want to read *Living Water* by Alexandersson (ISBN 0-946551-1-57-X, 162p, 1995, Gateway Books). He explains why it is impossible to make a Stradivarius violin anymore. The new growth forest trees grow too fast to make the solid kind of wood they had 200 years ago. There *isn't* any more. They're even busy clearcutting the virgin forests of Borneo to build houses in Japan.

We talk about the world's oil supplies maybe lasting another 50 years. Well, we have to make sure people right now have jobs, and who the hell cares about what problems we're leaving for our grandchildren. And their grandchildren. That's fine as long as you refuse to read what is known about reincarnation. Did you know that the Council of Constantinople in 533 AD eliminated the concept of reincarnation from the Christian religion?

Between ham radio, cold fusion, our major social problems, and the weird stuff, I can liven any talk show, so if you know a talk show host, please have him get in touch with me so we can drum up a few more hams. It's Wayne Green, Peterborough NH 03458. I even check Design73@AOL.com now and then.

Not that we can honestly blame the government, nor even the big corporations which run the government, about ignoring the future. After all, most of us are doing the same thing ourselves by smoking, drinking, using drugs, getting fat, and other forms of there-is-no-tomorrow slow suicide.

Prestige, a Zero-Sum Game

Our universities and our scientific elite are powered almost entirely by the prestige game, and the bottom line for the universities and our country is zero. Our scientific elite produce endless scientific papers about minutia, slicing the baloney ever thinner.

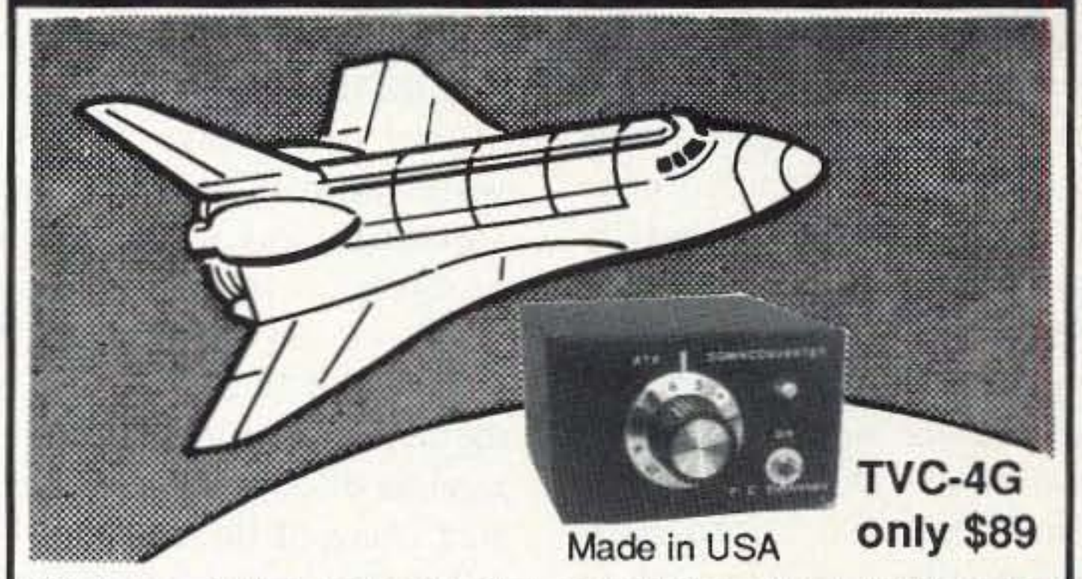
If you think I'm exaggerating then you haven't done much work with a college or university. I have, and with several. And you certainly haven't read any books on the state of our colleges today. Like the wonderful book by the president of Hillsdale College, George Roche, *The Fall of the Ivory Tower*. Yes, of course it's on my list of books you're crazy if you don't read.

Okay, so what? So our colleges are turning out mush-headed semi-literate, drive-deprived graduates. And this is the vanguard we're depending on to compete in the 21st century global market?

I tried hard to help Rensselaer Polytechnic Institute pull itself out of its 19th century time warp and leapfrog into the 21st century. I consulted with the faculty and the president of the college. I donated a bundle and became a Patroon. I was put on the Board of Overseers and then ignored (along with the other Overseers). I was enormously honored by being appointed to the RPI Council, where I was again largely ignored. "Just shut up, call the alumni and ask for money." I was named their first Executive In Residence. On the thin positive side, I revamped

Continued on page 76

AMATEUR TELEVISION



TVC-4G only $89

Made in USA

SEE THE SPACE SHUTTLE VIDEO AND GET THE ATV BUG

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to Spacenet 2 transponder 9 or weather radar during significant storms, as well as home camcorder video from other hams. If it's being done in your area on 420 - check page 538 in the 95-96 ARRL Repeater Directory or call us, ATV repeaters are springing up all over - all you need is one of the TVC-4G ATV 420-450 MHz downconveters, add any TV set to ch 2, 3 or 4 and a 70 CM antenna (you can use your 435 Oscar antenna). You dont need computers or other radios, it's that easy. We also have ATV downconverters, antennas, transmitters and amplifiers for the 400, 900 and 1200 MHz bands. In fact we are your one stop for all your ATV needs and info. We ship most items within 24 hours after you call.

Hams, call for our complete 10 page ATV catalogue.

(818) 447-4565 M-Th 8am-5:30pm
P.C. ELECTRONICS
2522 Paxson Ln, Arcadia CA 91007

Visa, MC, UPS COD
Email: tomsmb@aol.com
24 Hr. FAX (818) 447-0489

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

Cleaning Up Your Act!

Here's another tip for the Alinco DR-1200T 2 meter transceiver, for cleaner sounding transmit audio when using the supplied electret hand mike. Though the particulars will vary, it should be applicable to other radios.

Electret condenser microphone elements are inexpensive and have very "flat" response curves, but they require an external source of low-voltage DC power to operate the built-in FET preamp. An electret element puts out so little energy that preamplification is needed immediately, and an FET preamp is built into the element as an integral part of the tiny package. The external voltage to power the preamp usually comes from the transceiver with which the microphone is being used, although a battery within the mike's case can also be used. When the transceiver supplies the mike power, it usually comes in on one of the unused mike connector pins, and generally from the transceiver's +5 VDC Vcc line. If that line also feeds any digital ICs, and filtering of the Vcc line isn't close to perfect, the +5 VDC line can sometimes introduce noticeable digital noise superimposed on your mike audio.

Listen to your transmitted signal on another receiver—with the CTCSS encoder off and in a quiet room—to see if this might be true in your case. If anyone has complained about your on-the-air audio quality, make the quick test mentioned above.

If you get digital noise or other unidentifiable pops and clicks from time to time on your transmitted audio, the cure may not be difficult, depending on your transceiver. You can try simply more filtering—right at the mike connector pin that supplies the DC to the mike element, in the form of an additional capacitor from that DC pin to ground (trying different values to see if there's any improvement). If that doesn't work, which is often the case, then it's on to the next step, which is what I did with my own DR-1200T.

Probing around with a little battery-operated, solid-state, high gain audio amplifier (via a .1 µF disc cap), I "listened" to the various DC lines in the DR-1200T. Some points are much noisier than others, some lines very "clean." It's a situation that may be difficult to predict from the schematic alone, but it's a cinch with the little "noise tracer" amplifier! By the way, this idea works in many other troubleshooting areas as well (hum problems, cross-talk, noise spikes, etc. on the DC lines). In my own DR-1200T, I found that the output pin on the 7808, 8 volt regulator (IC-1) sounded very clean, so I changed the DR-1200T's mike voltage source from the +5 VDC Vcc "noisy" line to the +8 VDC "clean" line. In the DR-1200T it's something of a chore, but still doable. The reason is that Alinco uses PC board traces to feed the mike connector, and the connector itself is part of the "display" PC board, so traces must be cut and rerouted. Other radios, with individual "actual wires" being fed to the mike connector, may be easier to convert.

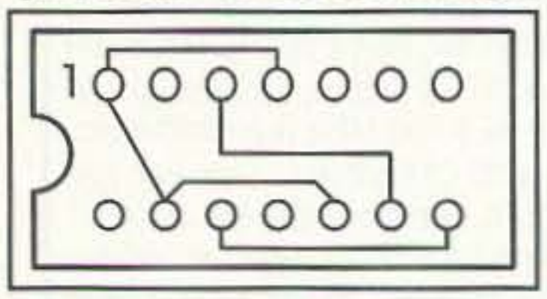


Fig. 1. *The 74LS74 is notorious for the number of jumpers needed, and serves as a good example of how Frank KB4ZGC's idea can be implemented to avoid the "under-PC-board jumper jumble."*

On the rear (foil) side of the display board, two jumpers will need to be added to reroute the +5 VDC line around the mike connector. Since the display board is a double-sided PC board, the opposite component side must also have one trace cut; no jumpers need be added on this side of the board. You can trace the circuit out if you wish, but these steps should effectively isolate pin 5 of the mike connector; now "clean" +8 VDC can be brought up to the connector, via a new "direct" wire, from the +8 VDC regulator mounted on the rear wall of the transceiver's case. The circuit board is crowded, the traces close together, but if you take plenty of time and common care, it should go smoothly.

More

Another side to the "clean DC" issue is obtaining a reasonably noise-free mobile environment. Mobile noise can be that which is only perceived in the mobile's own receiver, and that which may also be impressed upon the mobile's transmitted signal. Both can be problems, in that the solution is often "cut and try."

There are a few things, however, that every good mobile installation should automatically include, whether in a car, motor home, boat or private plane.

First (as touched upon in John Ayers AA1IC's tip in last month's column), is running a separate "clean" battery feed—one that only feeds the ham transceiver—directly from the vehicle's battery. Hopefully, such a "dedicated" feed will be relatively free of switching noises generated by computers, the ignition system, vehicular sensors, etc. The feed should consist of a separately fused battery run made with a gauge of wire heavy enough so that the voltage drop across the wire's resistance is insignificant at full transmitter power drain. Often, this alone will solve many mobile noise problems. But if it doesn't, here's a simple test you can perform to see if the noise is from radiated energy or if it's coming in via the DC power feed. Simply disconnect the radio's antenna. Does the noise disappear? If so, then it's radiated noise being picked up by your antenna; that's generally more difficult to troubleshoot. If it doesn't disappear—or if enough still exists to be a problem—then it's likely to be coming in via the radio's DC power feed.

What if you've run a separate power feed, directly from the battery, of heavy-gauge wire, and a significant amount of noise persists with the antenna removed from the set? You can try shielding the feed cable from the battery to the radio, using the shield and jacket from a length of RG-8 coax from which the center conductor has been removed. It shouldn't be necessary for most installations, but it's worth trying (and inexpensive enough) when the noise is persistent. If shielding the feed cable doesn't do it, then a choke in series with the DC power to the transceiver may help. Parts Express™ (1-800-338-0531) lists commercially-made chokes up to 4.7 mH, made of #14 wire, and exhibiting 0.52 ohm of resistance or less. They also carry computer grade very high capacitance power capacitors (one farad!) that will not only help filter noise, but will also smooth out any voltage variations from peak surges during SSB voice operation—the next best thing to having the battery itself right behind the radio.

If most of the noise you hear in your mobile transceiver is coming in via the antenna, then you'll have to settle in for some real hunting. Ignition system wiring is usually the best place to begin, either installing new resistance ignition wires or going full tilt into a specially-made shielded system; it mainly depends upon how much noise you can comfortably live with. Today's cars also can have one or more computers controlling vehicular functions. Computers generate square waves by the score, and square waves have lots and lots of harmonics; many of these harmonics will appear within the ham bands. Some of the slip-on, thread-through, clamp-over ferrites available today will tame computer generated noise and harmonics without having the slightest ill effect on the computer control system (they only absorb unwanted RF energy). Where they're needed and how many

will be necessary is the "cut and try" part mentioned earlier; it's anyone's guess. Usually, it's best to start at the computer's input and output leads, installing the ferrite cores as close as possible to the shielded computer case itself. From there, it's the sensors on the various parts of the engine that can be given attention, again, as close as possible to the sensor body itself. A shop manual for the vehicle is almost a must at this point. Avoid any bypassing that requires direct electrical contact with the vehicle's electronics; try to stick to non-invasive ferrite absorptive devices or you'll run the risk of compromising your vehicle's control circuitry. Perhaps most importantly, take your time and attack the problem systematically and in small chunks, and thoroughly check out each step you make.

A spicy DIP chip

From J. Frank Brumbaugh KB4ZGC/W4LJD: "I've found this wiring technique to be helpful at times, so I'm passing it on to others who may want to try it. Sometimes Dual Inline Pin (DIP) chips (particularly those in the 7400 family or even the venerable NE-555) require a number of jumper connections among several of their pins to make everything operate correctly. This can result in a jumble of wires or a complicated PC board trace layout in order to accomplish the task. But here's another approach: Carefully solder very fine wires—taken from an untwisted short length of ordinary stranded hookup wire—and make some of those jumper connections right on the bottom of the chip itself. Take care to avoid any shorts, and make the connections high on the IC's "legs," but prewiring some chips like this can save a lot of underboard crosswiring later on. This jumper prewiring can be done on the IC sockets instead, before installation, if your project uses sockets instead of the chips themselves soldered directly to the board. Even if it isn't practical to prewire every jumper needed, the more you can eliminate using this technique, the neater the finished board will appear. Take a look at **Fig. 1** for a couple examples of this technique."

Moderator's note: Frank has a clever idea here; it might also be a good idea to note on the project's schematic which jumpers are hidden, perhaps showing them in dotted outline.

Never assume

Last fall I made a "lights on" alarm (a buzzer sounds when the lights are left on without the engine running) for one of my cars that was missing this feature from the factory. The circuit worked like a charm on the bench and ditto when I installed it in my car. Then the cold weather came. When the temperature dropped below freezing, the circuit still worked, but the buzzer would sound for a few seconds (even when it wasn't supposed to, that is) when the lights were on but the car *was* running. The colder it became outside, the longer the circuit would take to operate correctly. My wife, Sue KA9UCK, is very patient, but it was even getting to *her*!

The problem turned out to be in the relay I had chosen to key the buzzer on and off; a small, sealed, good-quality relay, but it was also very temperature-sensitive. Apparently, the contact arms in it deformed enough in the subfreezing temperatures to make contact when they shouldn't have, but after heating up just a bit (from current flowing through its coil), the relay operated correctly. I thoroughly tested the replacement relay in my lights-on circuit for temperature sensitivity (by putting it in the freezer for a while) before committing it to the underdash of my car again! Case closed, lesson learned.

We've all run into these problems with equipment that doesn't operate as expected under all extremes of temperature, and it might be a worthwhile effort if you were to jot down some of the more interesting ones you've encountered and I'll include them in the column at some point in the future.

Cold testing a piece of mobile gear is relatively easy; just put it in the freezer for a while. Heat testing is a bit more tricky. The inside of a closed vehicle can reach very high temperatures during the summer months, but testing for extreme heat—by putting the item into an oven—is often dangerous. You don't want to damage your gear with the test! Has anyone devised a reasonably safe heat-test setup, for subjecting mobile ham equipment to summer heat extremes, without too great a risk of permanent damage? You folks in the desert areas should be experts on this one!

Mood lighting

From R. Gary Bartlett VE1RGB: "To me, there is something very calming and perhaps a bit romantic (in the old-fashioned sense of the word) about a ham radio station that makes use of the built-in panel and edge lighting that comes fitted in most ham gear as the primary radio room lighting. It's sometimes necessary to supplement the equipment lamps with some sort of external spot lighting to illuminate a work surface or control panel, but the use of dimmer, rather than brighter, lighting is often a better choice. Having spent some time as an electronics systems operator on a Canadian military subhunter aircraft, often at night, I suppose that I feel most comfortable under the dim light of an operations area, but I've a hunch that many other hams feel the same way. I still enjoy listening on 3.4793 kHz, late in the evening, as the Gander and Shanwick Oceanic Air Traffic Controllers are trading position reports and vectoring their flights across the Atlantic. I try forming a mental picture of where all of those airplanes are, and what they're doing, where they're going and the many countries and companies they represent.

"How can you replicate this mood in your own shack? In our aircraft, we used what was known as a Grimes light, which had a selectable clear and red front lens. It also had a dimming pot and a focusing adjustment. It came with a helical coil cord (like a telephone handset cord) and a quick-disconnect mount, so the light could be removed for viewing some deep, dark recess if needed. In an aircraft, that's usually down

Cable	Frequency in MHZ						
RG/U Type	10	50	100	200	400	1000	3000
6A	0.04	1.90	2.70	4.10	5.90	9.80	23.00
8, 8A, 213	0.551	.30	1.90	2.70	4.10	8.00	16.00
Belden 9913	0.41	.64	1.00	1.60	2.50	4.50	**
Belden 9914	**	1.10	1.60	2.40	3.50	6.00	**
Belden 9888	0.60	1.20	1.70	2.70	4.20	7.80	14.20
Belden 8214	0.60	1.20	1.70	2.70	4.20	7.70	14.20
8X	1.10	2.50	3.70	5.40	8.00	13.50	26.00
9, 9A, 9B, 214	0.66	1.50	2.30	3.30	5.00	8.80	18.00
11, 11A	0.66	1.60	2.30	3.30	4.80	7.80	16.50
14, 14A, 217	0.41	1.00	1.40	2.00	3.10	5.50	12.40
218, 219	0.24	0.62	0.95	1.50	2.40	4.40	9.50
Belden 9915	**	0.60	0.80	1.20	1.90	3.50	**
34, 34B	0.32	0.85	1.40	2.10	3.30	5.80	16.00
55B, 223	1.20	3.20	4.80	7.00	10.00	16.50	30.50
58	1.25	3.15	4.60	6.90	10.50	17.50	37.50
58A, 58C	1.40	3.30	4.90	7.40	12.00	24.00	54.00
59, 59B	1.10	2.40	3.40	4.90	7.00	12.00	26.50
62, 62A	0.85	1.90	2.70	3.80	5.30	8.70	8.50

** No data available

Table 1. Transmission line loss table for coaxial line (all values are in dB of loss per 100 feet).

near your left foot, where a dropped pencil could easily jam the mike foot switch. If you have any military surplus stores in your area, it might be worth checking with them to see if they have anything resembling what I've just described. You might also peruse any RV or camper supply catalogs, and/or dealers in your area, since lights of a similar type can sometimes be found in recreational vehicles. Even if you can't locate the exact Grimes light, you might be able to modify a light that is readily available, putting a little of your ham ingenuity to work.

"Try to stick to 12 or 24 volt lighting if you can; it's much safer and easier to use than the much higher line voltage systems. A husky 12 volt transformer, properly fused, is all that's need for an AC low-voltage lighting setup, or your station's 12 volt DC power supply can be used to power some lamps, as long as the supply's current limitations and adequate fusing precautions are observed.

"Dimming the lamps on an AC system requires a rheostat capable of dissipating the correct amount of wattage, whereas a DC system is able to use some of the modern adjustable regulator chips and a simple pot to vary the light output from your low-voltage lamps. An LM-317T is a good one to look into for this purpose (see the drawing in **Fig. 2**).

"External wiring to the lamp fixtures themselves should match the fuse rating and current drain of each lamp in a leg, and the use of insulated and adequately marked terminal strips makes changing or expanding the system a breeze. Low voltage wiring is much easier to work with than its line voltage counterpart, but care still must be exercised to ensure that all wiring and connections are safe and low resistance. Keeping an up-to-date diagram is desirable and not at all difficult to maintain.

By the way, if you happen to run across some particularly good hardware (fixtures, connectors, extensions, etc.) in implementing this idea, please send them to this column's moderator so that we can all share in your discovery."

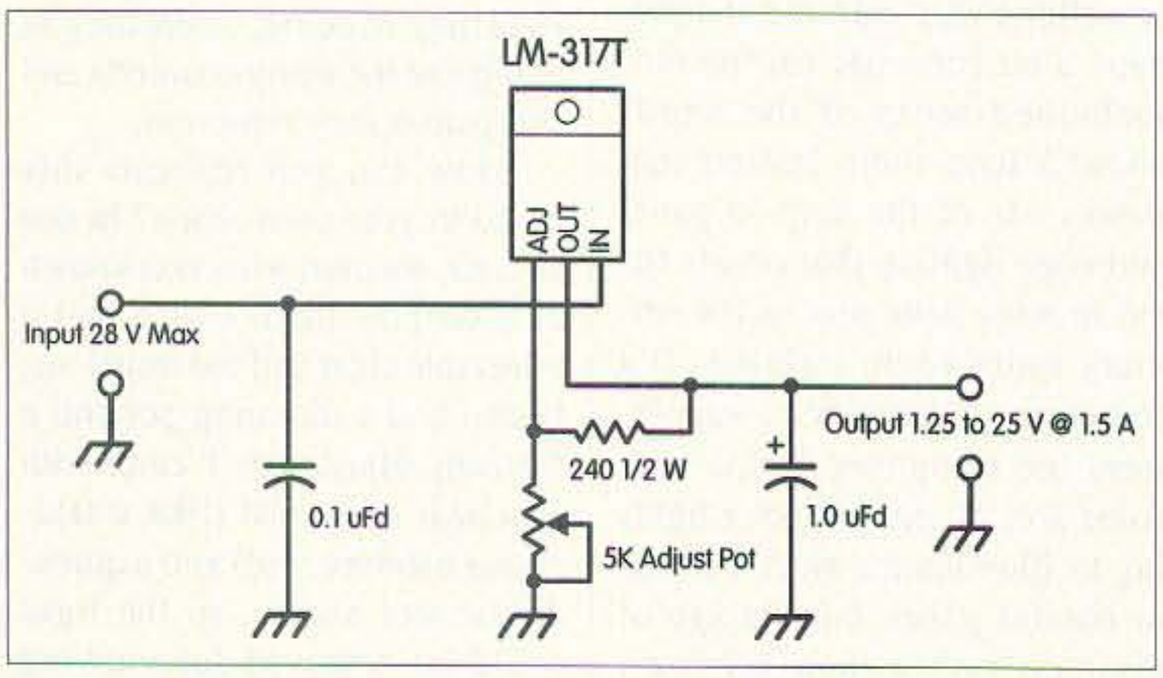


Fig. 2. A simple DC control circuit for use with the low voltage station lighting fixtures described in the text.

Super table

From John McDermott N4YIC: "Here's a reference table of popular coaxial cable line-loss data that you can add to your 'Ham To Ham' pinups! It's certainly not original, but it does provide a fair amount of information in one easily posted piece (see **Table 1**). It lists 32 coaxial cables, along with the normal loss data, from 10 MHz all the way to 3,000 MHz (3 GHz) in an easy-to-read format. I hope it's as useful to others as it has been in my ham station."

A charge slip

Here's a tip for those of you who might own the Yaesu FT-209RH or FT-709RH handheld transceivers specifically, but may apply to other models of handhelds as well.

There are usually two choices for recharging a handheld's battery pack: 1) using the optional drop-in charging stand via the charging contacts on the bottom of the battery pack, or 2) charging the pack with the small wall-cube transformer/rectifier via a little charging jack on the bottom or back of the pack. But wait, here's a third alternative—one that allows you to customize a bit.

The Yaesu FT-209RH uses a "slip-on" battery pack, slipping on from the side of the transceiver, and then locking into place (many others use a similar scheme). My wife and I have two of the Yaesu handhelds, and a couple of the FBA-5 alkaline cell cases too. These are the battery cases made by Yaesu to house disposable alkaline cells, but instead, I've opted to install AA NiCd rechargeables into the FBA-5. This lets me put in new NiCds (or disposable alkalines) any time I wish (ever try to open a "normal" sealed NiCd pack?). The downside is that the FBA-5 doesn't have the familiar charging contacts on the bottom, not being meant to house rechargeables and also so that the user doesn't accidentally drop it into a desk charger with non-rechargeable

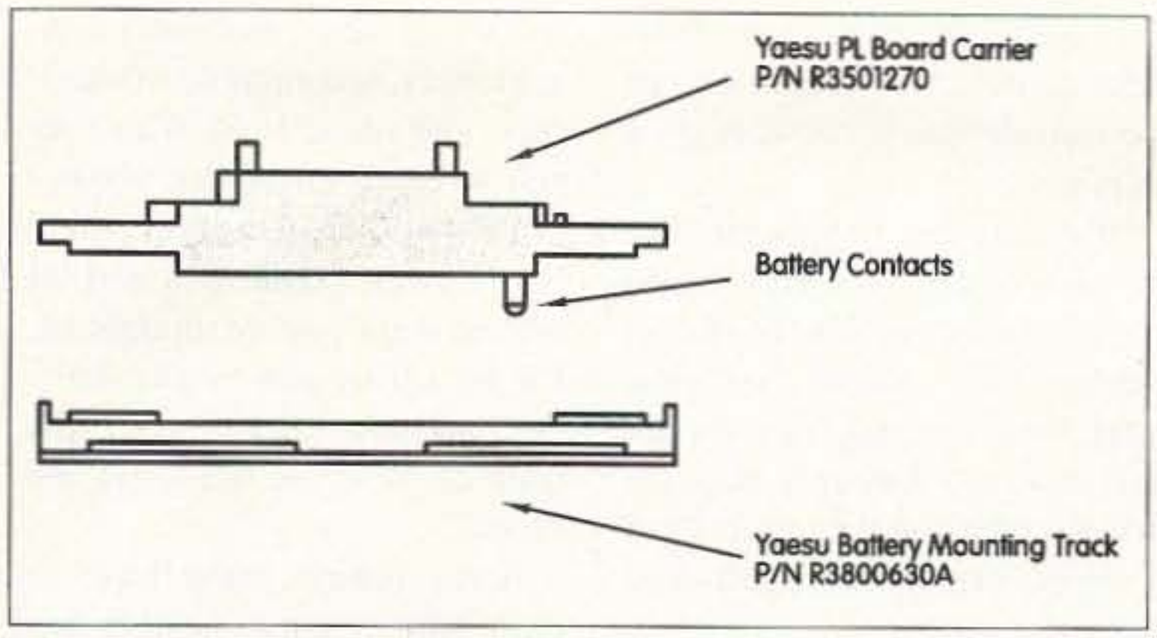


***Fig. 3** . Side view of the Yaesu parts needed to make the slip-on charging adapter described in the text.*

alkaline cells installed. In order to use NiCds with it, the cells must be physically removed each time recharging is needed—not the handiest of methods.

I wrote to Yaesu's Parts Department and inquired about the possibility of purchasing the battery mounting track and the battery contact plate assembly for the FT-209RH. These are the two pieces that are normally mounted on the bottom of the handheld itself for holding the battery pack in place and to make electrical contact with the pack's output pins. My reasoning was that if I had these two essential parts, I could build a "slip-on" charger housing for my FBA-5 packs, making recharging them a snap (pun intended). Yaesu quoted a very affordable price for the two parts that I needed (their R3800630A and R3501270), which are shown in **Fig. 3**, so I went ahead and ordered them, completing the job with the addition of the simple input jack and charge indicator circuit shown in **Fig. 4**. I'm now able to use the standard Yaesu NC-18B wall cube, along with the new slip-on adapter, for charging the NiCds in my FBA-5 packs, while the LED "continuity" indicator shows indication that the batteries are charging. Overall, a nice accessory to the battery lineup for these handheld transceivers. Of course, the slip-on charger can also be used with the normal non-openable NiCd packs too, providing you with a low-profile travel option.

Gobs of mods

More on the topic of equipment modifications: There are a number of BBSs (bulletin board systems) around the country with copious quantities of interesting modification files for commercially made ham equipment, all ready for downloading. And you don't necessarily have to have a packet station to access these files, though many full service packet BBSs also support equipment modification file downloads. But if you're not yet into packet, all that you really need is a computer with a fairly modern telephone modem and a terminal program that permits uploading and downloading of files. With just that minimum, you can make contact with many amateur radio

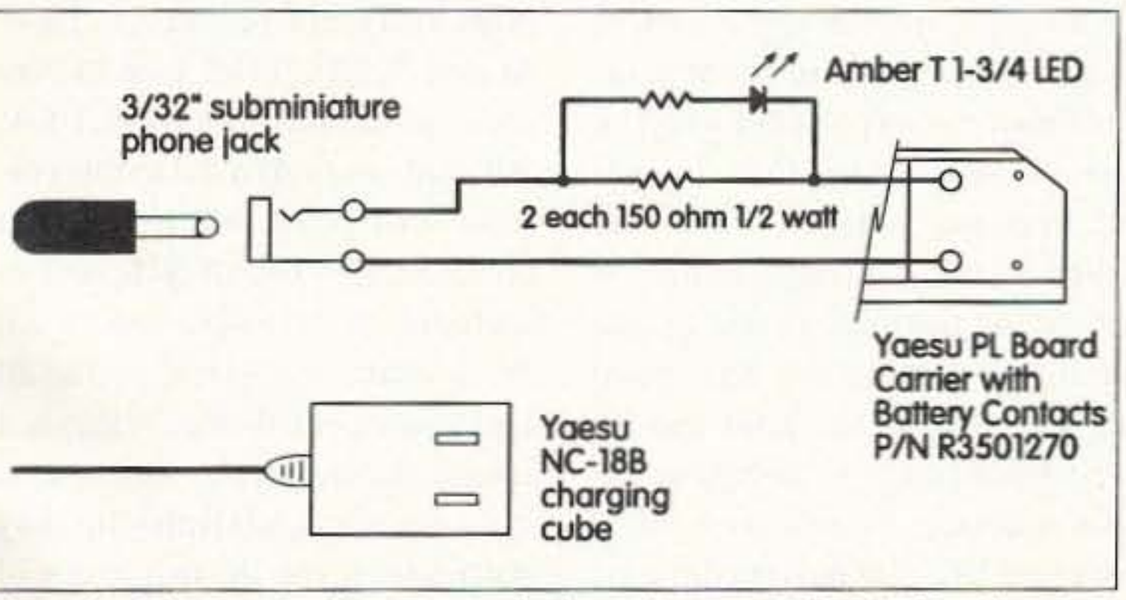


***Fig. 4.** Schematic diagram of the slip-on FT-209RH charging adapter described in the text.*

CAT-300 Repeater Controller

Attention Repeater Owners
Finally a repeater controller with a TI voice synthesizer and full feature autopatch incredibly priced at ***$299.00.***

Features Include:

- ✓ *Voice Synthesizer*
- ✓ *(412) Word Vocabulary*
- ✓ *Twelve Voice Messages*
- ✓ *Two Voice Identifiers*
- ✓ *CW Identifier*
- ✓ *Full Feature Autopatch*
- ✓ *User Speed Dials*
- ✓ *Emergency Speed Dials*
- ✓ *Reverse Autopatch*
- ✓ *DTMF Key Pad Test*
- ✓ *DTMF Repeater Access*
- ✓ *DTMF Repeater Muting*
- ✓ *(56) Control Functions*
- ✓ *Remote Control Switches*
- ✓ *Hardware Logic Inputs*
- ✓ *DVR Controller Ready*
- ✓ *Female Voice & Sound Effects*
- ✓ *Programmable Courtesy Tones*
- ✓ *Programmable Codes and Timers*

Write or Call for a brochure describing the CAT-300 Controller, including schematic, voice word list, and control functions.

CAT-300 Controller Board $299.00 Wired and Tested

Computer Automation Technology Inc.
4631 N.W. 31st Avenue, Suite 142
Fort Lauderdale, Florida 33309
Phone (954) 978-6171 Fax (407) 488-2894
http://www.catauto.com

CIRCLE 268 ON READER SERVICE CARD

WE DON'T BUILD THE MOST, WE JUST BUILD THE BEST!

- Our LM-470D is now redesigned to hold 15 ft. of antennae at 70 mph!
- Tri-Ex builds the finest in crank-up, free-standing or guyed towers.
- All towers are complete with rigid concrete base mount.

CALL OR WRITE FOR A FREE CATALOGUE!

VISA
MasterCard

Tri-Ex®
TOWER CORPORATION
7182 Rasmussen Ave. • Visalia, CA 93291
Where engineering and quality come first!

TO ORDER CALL 800-328-2393
FAX 209-651-5157

CIRCLE 22 ON READER SERVICE CARD

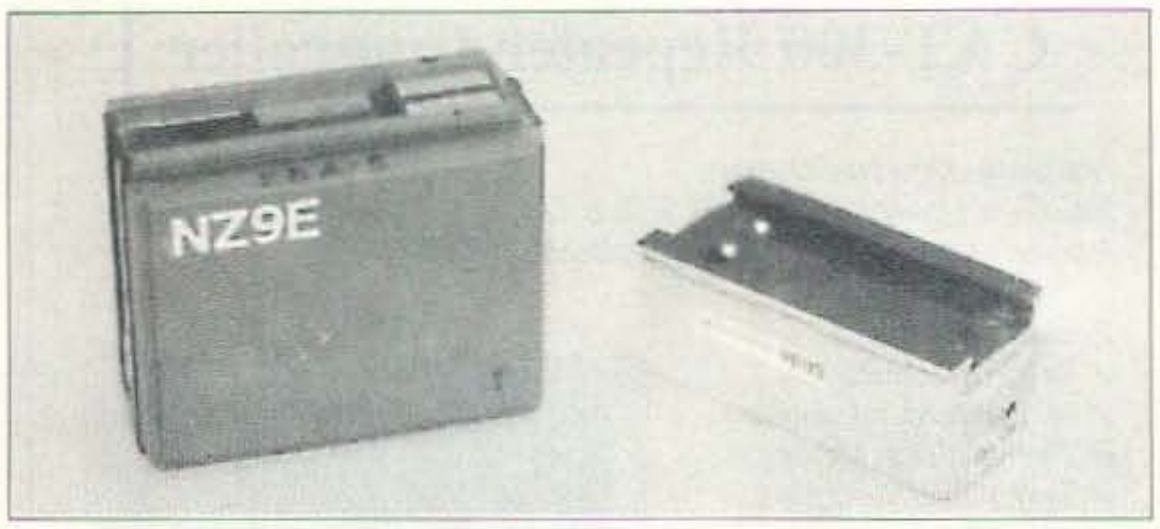


Photo A. *The Yaesu FBA-5 battery pack is shown on the left, the slip-on charging adapter on the right.*

oriented telephone BBSs who welcome ham callers from outside the group of normal users. Check around with local club members, or on your local 2 meter repeater, to find out the phone number of the popular ham telephone BBSs in your area.

One system that I've explored is run by Bill Cohn N9MHT in Schaumburg, Illinois, and operates under the name "The Precision Board." Bill encourages any ham, from anywhere, to call his system at (847) 985-9544, 24 hours a day. When you first sign on, you'll be guided through a few easy-to-answer questions, just to get acquainted. Then, as with many such telephone BBSs, you can quickly download Bill's ALLFILES.ZIP file, sign off, unzip the downloaded file, then browse through the listing offline, to see exactly what specific program files might be of interest to you (the shareware file for unzipping the ZIP file is even available if you don't already have it). You can then call back later to download just those files of specific interest (many are in the zipped format), keeping your telephone charges to a minimum and not occupying the board any longer than needed. The Precision Board is affiliated with the Arlington Communications League (ACL), a suburban Chicago ham radio club, and has hundreds and hundreds of files (programs) dealing with amateur radio, as well as general computing utilities and games. Some of the programs are Freeware (no strings attached), others are Shareware (where the user is encouraged to pay for the use of the program after a free trial period, if you like the program and plan to use it regularly).

It's also a good idea not to just "take" from any BBS, but also to "give" a bit back, in the form of uploading interesting programs that you might have that are also of a Freeware or Shareware nature; don't upload commercially purchased software that isn't intended for secondary users. Like a repeater system that you regularly chat on, a telephone BBS SYSOP can always use an extra dollar or two to help with line charges, equipment operating costs and system upgrades.

Remember, these are volunteers who've put up their own gear for our benefit—don't be a rude "guest" in their electronic den. The same courtesy should apply to sysops within the HF/VHF/UHF amateur digital network as well. They're giving their time, energy and equipment for our convenience, in the traditional ham not-for-profit spirit.

Getting wired

From Mike Hall KE4GBE: "Next time you attend a hamfest or computerfest, keep an eye out for someone selling multicolored computer ribbon cabling; it makes great hookup wire for general electronic project construction use. The multicolored ribbon is much simpler to identify, but even the all-gray ribbon cables can be utilized if you mark both ends of the individual wires with tiny dots (1, 2, 3 , 4, etc. dots) using a black fine-point felt-tipped marker pen. The flat computer ribbon cable I'm referring to is generally very good quality, stranded, easy to strip and tin, and will make your home-brew projects look much more professional. There is naturally some inter-wire capacitance, but it usually won't have any serious drawbacks in non-critical circuits. I've also seen twisted-pair computer interconnect ribbons that have automatic resistance to inductive coupling from the outside due to their twisted format.

"I'm sure that I'm not the first to 'discover' this tip—even Heathkit used sections of ribbon cables for some of the interchassis wiring in their kit designs—but I simply thought that I'd mention it again in case it's been forgotten or overlooked by some."

Moderator's note: Good suggestion, Mike. Of course the multicolored ribbon cable can also be separated into individual colors for use as regular single-circuit hookup wire when distinctive colors will be helpful in troubleshooting later on. It's a good way to collect a wide variety of short hookup wires of every color imaginable without having to buy long reels of each color.

That wraps up another month of "Ham To Ham." As you've no doubt noticed, I'm still using too many of my own ideas and suggestions in the column—I need more input from all of you if we're to keep on exchanging ideas each month through the pages of *73*. I've mentioned it before, and it's true: This is your chance to express some of the neat and interesting ideas, solutions, tips or suggestions that you've found handy in your ham radio career. Jot them down and send 'em on to me at the address in the above this column—there's a very good chance you'll see them in print here in one of the future issues. You needn't be an "old-timer" to have had worthwhile experiences; I've received a number of good ideas from relative newcomers to our hobby. Often techniques that can apply to ham radio are picked up from your professional experiences on the job, or sometimes they're just inspirational flashes that come when walking through a store or thumbing through a catalog and seeing something that has "good application for the ham shack" written all over it. Amateur radio touches on so many other areas of life's experiences: outdoor structural and wiring techniques, indoor shack and workshop ideas, computer conveniences, test equipment shortcuts, and on and on. Whatever you've experienced that you believe would be helpful to others is fair game; send it in and let me see what you've thought of. I'll be sitting out by the mailbox, and it's kind of cold this time of year, so don't let me down!

And as always, many thanks to those who've contributed to this month's column:

J. Frank Brumbaugh KB4ZGC/W4LJD
P.O. Box 30 - c/o Defendini
Salinas PR 00751-0030

R. Gary Bartlett VE1RGB
24 Lawrence Place
Wellington NS B2T 1A3
Canada

John E McDermott N4YIC
7977 Deward Ct.
Manassas VA 22110-3120

Mike Hall KE4GBE
8131 Browning Circle
Acworth GA 30101

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73* for any equipment damage or malfunction resulting from information supplied in this column.

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

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
PO Box 2508
Fullerton, CA 92837

Buckeyes vs. Wolverines

Football season is in full swing and Thanksgiving will soon be here. Unless you live in the Southern Hemisphere, you're in for some colder temperatures and shorter hours of daylight. Will that bring a halt to hidden transmitter hunting in your area? T-hunters in Florida and Southern California have relatively good weather all year long, but you have to be more hardy to go on radio direction finding (RDF) contests in Midwestern states.

Weather doesn't deter the intrepid transmitter trackers of southeast Michigan and northwest Ohio, where "foxhunting" is what they call it. The Toledo Radio Amateur Club holds a mobile hunt each month. "The fox can be anywhere within a 20-mile radius of the University of Toledo," says Vince Vasselo KB8TEP. "All he has to do is get a signal into the repeater. He must either transmit on the repeater input or tell the hunters what frequency the hidden beacon is on. It isn't specified how often he has to transmit; we try to keep it at least every minute or so. Intermittent signals like that tend to encourage people to use their maps. The first finder wins the hunt. Once everyone comes in, we have a drawing for who will be the fox the next month."

Another fan of traditional find-the-foxbox hunts like this is Mark Drolias N8IQX of Dearborn, a suburb of Detroit. "We have had many cleverly disguised beacon hunts," he says. "Guys have built camouflage electrical utility boxes and hung them on telephone poles, along with conduit cut for the right frequency and wires dangling to make it look like it belonged there. One hooked a windshield wiper motor up to a beam and set it on a tripod in a bunch of weeds, with the beam sweeping back and forth as it transmitted."

Lately, a different type of hunt is gaining popularity in the Motor City area. "We changed our hunting strategy within the last year to keep the hunts moving and to get more in," says Steve Sable N8NYU from Maybee, Michigan. "We now have 'tag' hunts on Saturday nights. The first fox takes off from the starting point in his car and has a half hour to find a good place to hide. He must stay with the vehicle. Once he gets stationed and starts to transmit, we have just a half hour to find him. The first person who finds the fox has a half hour from that point to go find his own place to hide, while the rest of the hunters continue searching for the first one. Once fox #2's half hour is up, his hunt starts, whether everybody has found the first one or not. This goes on for four hours and we usually get in six hunts."

Steve's group, the Radio Active Communications Club, holds tag hunts on the second Saturday of the month, while the Maumee Valley Monitoring Association of Ohio holds tag hunts on the fourth Saturday night. It's about 50 miles from Detroit to Toledo, so it has become a tradition for Detroit area hunters to go to Toledo hunts and vice versa, just like the age-old football migrations. "We get four or five teams on a low day, up to 15 on a good day," says N8IQX. "When my wife and I go down to hunt in Ohio, we don't get back until 1 or 2 a.m., but we work afternoons so it's OK. It's fun, but lots of wear on tires."

Mark prefers the format of tag hunts. "The fox can use any power or polarization," he says. "He can transmit a little or a lot, with any on/off timing. When he sees people in the area, he can stop transmitting for a while if he wants. After the last hunt of the evening, we meet up for some food. Tag hunts are good because a beginner can come out without knowing anything about foxhunting, and by the end of the night have found several foxes and gotten a good grasp of it. On the other hand, with a beacon hunt, it's over once you find it and you have to wait a month before you can come out and hunt again."

"You have to transmit from your car, but if you throw a tent over it to hide it, that's legal," KB8TEP adds. "We want everyone to stay in their cars because it's safer. If people come out to ride along, we make them handle the gear. Some really take to it.

"Usually our hunts are on 146.565 MHz simplex," Vince continues. "Occasionally, we throw in one or two hunts on one of the 440 MHz repeaters. Some 70 cm repeater owners are real happy that we are interested in doing some hunting on that band. Another time, for a change of pace, the target was mobile and everybody at the start was told to team up and work together to catch him, instead of competing."

Whereas law enforcement personnel are used to seeing vehicles with strange antennas here in Southern California, Midwestern officers are more curious and suspicious. N8NYU says, "Whenever we hide in a city, we try to notify the police department two weeks in advance. People think we're hunting UFOs or seeking signals from burglar alarms, so they call the authorities. A lot of times, we get pulled over and questioned. On our last hunt, the guy who was the fox got stopped. They said they were going to confiscate all his equipment because he had a scanner in his vehicle. We all quickly converged and showed them the scanner laws for Michigan. That got him off."

"People think we're hunting UFOs."

Quads vs. yagis

Expect to see a variety of RDF gear if you go T-hunting in the Toledo/Detroit area. Steve says, "When I started hunting about five years ago, our antennas consisted mainly of PVC pipe frames with copper piping for elements. They were hand-held antennas; we would stop alongside the road to get a fix and then continue on. With time, we graduated to 2- or 4-element cubical quads with active or step attenuators. Quads were made of PVC pipe booms with Fiberglas™ spreaders and telephone wire elements. Then we began to mount these antennas so we would not have to exit the vehicle. Some made mounts to go through sun roofs, but most made brackets to mount the mast through the passenger window."

Steve and his hunting partner, Chris Theisen KK8K, use a Cubex 4-element quad. "We tried a through-the-window mount and that worked, but rainy and windy weather caused problems," says Steve. "Some of our runs to the fox were made at a little above normal speeds, making it difficult to hold onto the assembly. We once snagged the quad on a low hanging branch, which almost lifted Chris from the seat as he hung onto the mast for dear life. That's when I decided a change was in order.

"I built a wooden holder for my truck bed (**Photo A**). A Ford windshield wiper motor is mounted in the bottom center of the frame (**Photo B**). In the center of the crossboard is a bearing around the mast. We found that without it, there was too much binding of wood rubbing against wood. To show beam heading, I drilled a hole all the way through the mast about six inches above the bearing and inserted a clear plastic tube and a lamp, which connects to a 9 volt battery for lighting at night."

Steve controls the motor with a left-right toggle switch in a home-brew box inside the cab. "We found that applying the full 12 volts turns the antenna too fast for tracking," he says. "To drop the voltage and slow the turning,

Photo A. *N8NYU's motorized quad mounts into the bed of his Chevy pickup with C-clamps. (Photo by Steve Sable N8NYU)*

I added a small toggle switch and a series 4.5 ohm 10 watt resistor. Both speeds are useful; high is for checking if the fox signal is 180 degrees out and then low speed is used once you're on the track of the fox signal. With this system, weather is no longer a factor."

Of course N8NYU's setup is a head-turner as well as a beam-turner. "Every time we're in traffic and people pull up next to us, we just sit there straight-faced and sweep the thing back and forth," he says. "Usually, they are still sitting at the light when we take off. If folks have enough courage to inquire, they want to know, 'You guys from the cable company?'"

According to KB8TEP, most Detroit area T-hunters use vertically-polarized quads, while Toledo hunters prefer horizontally-polarized yagis. Vince uses a 3-element yagi, about three feet above the roof. "I seem to have no trouble with cross-polarized signals, even in downtown Toledo," he says. "I guess I am used to them and know what to expect."

Lately, a few hunters in both contingents are trying Doppler RDF sets. When the fox signal is vertically polarized and strong reflected signals are not present, a Doppler does well. "It's all flat out here," Vince says. "So when you are mobile, the Doppler leads you right to it. At the last hunt the first, second, and third place teams were Doppler hunters."

But others disagree, saying that there are enough reflections (multipath) to cause grief to Doppler hunters in many locations, especially if the signal source is horizontally polarized, as it can be in the Toledo hunts. "The Dopplers still find the transmitter," says N8IQX. "But they have not come in first on hunts like that. Users can tell when it's horizontal, they say the signal is more 'wavy' sounding."

When you hunt with the Doppler, you lose that feel for how far away you are," KB8TEP adds. "I compensate for that by keeping an extra receiver with the antenna off in the car to tell when I get close. It helps, because sometimes you go another block and it goes away, so you know you went too far. Some of the guys feel they have some other tricks that will mess up the Dopplers. It will be interesting to find out if they do or not when they get to be the fox."

Jammers beware

Training and practice from the friendly RDF contests are helping keep the air waves in both cities clean. KB8TEP says that Toledo hams have established an interference committee through ARRL, but most of the QRM they have found has been accidental. "I have gone after two stuck transmitters," Vince says. "One fellow had been talking to someone in his shack and set his clipboard down. It keyed the mike of his HT connected to his antenna. I happened to notice the dead carrier, called up Tony Everhardt N8WAC and we went out. My car was in the shop that night so I had to do it with my wife's car and a handie-talkie. We triangulated, found the house, checked the front and behind, and saw the antenna up there, but we didn't know who it was. We ended up with three hams at the scene, so one stayed out on the road and two of us walked up to the door. It turned out to be a ham and he thanked us profusely.

"Another time, someone keyed down solid on a packet frequency," Vince continues. "I got a call from the BBS sysop and we tracked it to a house. We had four cars parked across the street and a woman walked out. We asked if there was an amateur radio set in the house and she said her son was a ham. Then she went back and as we were listening, we heard a jumble of things being moved around and wires being pulled, then the signal quit."

N8IQX is the ARRL Official Observer Coordinator for Michigan, where malicious activities are more common. He says, "Every time I have done a talk at a club, I tell them that if they have a foxhunt group on their repeater, they will have the quietest repeater in town.

"When we first put our RDF crew together, we tracked someone who was jamming the weather net," Mark recalls. "And last year we may have caught a security guard at a retail outlet. A lot of jamming was going on and we got a heading into this parking lot. We saw the guard look at us, then everything stopped and we never heard it again.

"A police department about 50 miles west of Detroit lost a handheld two years ago. Then someone began jamming a paramedic frequency, starting every evening after school. A friend of mine got wind of it and we went out. By nightfall, we had determined which part of the city it was in. A few people returned the next day and zeroed in on the house. The police realized at this point who it was, a problem kid. They went to talk to his father at work and the dad said, 'Let's go home and look.' They found the unit in the house, along with a bunch of stolen cellular phones. The neat thing was that the battery was dying on the handheld, but we were still able to get enough signal to pin it down to the house."

Not only do the Buckeye and Wolverine T-hunt groups like to have joint hunts, they want to hunt over a wider area together. According to N8IQX, "At least once a year we would like to do an all-day hunt for the entire Midwest. Beacons would be hidden around a large area, both metropolitan territory and some woods. We want to promote it enough to get hunters from Michigan, Ohio, Indiana, Illinois, Wisconsin, and Kentucky."

The first attempt at such a wide area hunt took place this spring. N8IQX says they picked the last weekend of April, which had been the weekend of the Dayton HamVention in years past. He would like to make it an annual event on that weekend, now that the HamVention has moved to mid-May. KB8TEP enjoyed that hunt. "We had a couple fixed beacons and then we went into tag hunts after that," he says. "It went really well, though we didn't have many people from outside our area."

You, too?

This column begins the ninth year of "Homing In" in *73 Magazine*. There has been no shortage of things to cover in the world of RDF during that time. More and more readers are discovering the fun of both mobile T-hunting and international-style radio-orienteering. Hams are increasing the use of RDF skills for public service and for self-policing.

There is a good chance that a club near you is now holding hunts and you could be involved. Check the "Homing In" site on the World Wide Web for lots of local T-hunting links and E-mail correspondents like N8NYU (ssable@foxberry.net) for Detroit and KB8TEP (vincev@juno.com) for Toledo. There are 31 local contacts on my site as I write this. No doubt there will be lots more by the time you read it. Point your browser to http://members.aol.com/homingin/ and leave me an E-mail note while you're there.

In the coming months, I'll have some new RDF projects and reviews of new commercial RDF gear, including a new microprocessor-based Doppler set that is getting a thorough checkout in my van right now. Let me know what RDF topics you would like "Homing In" to cover. Write to the address atop this column, or send E-mail to Homingin@aol.com. 73

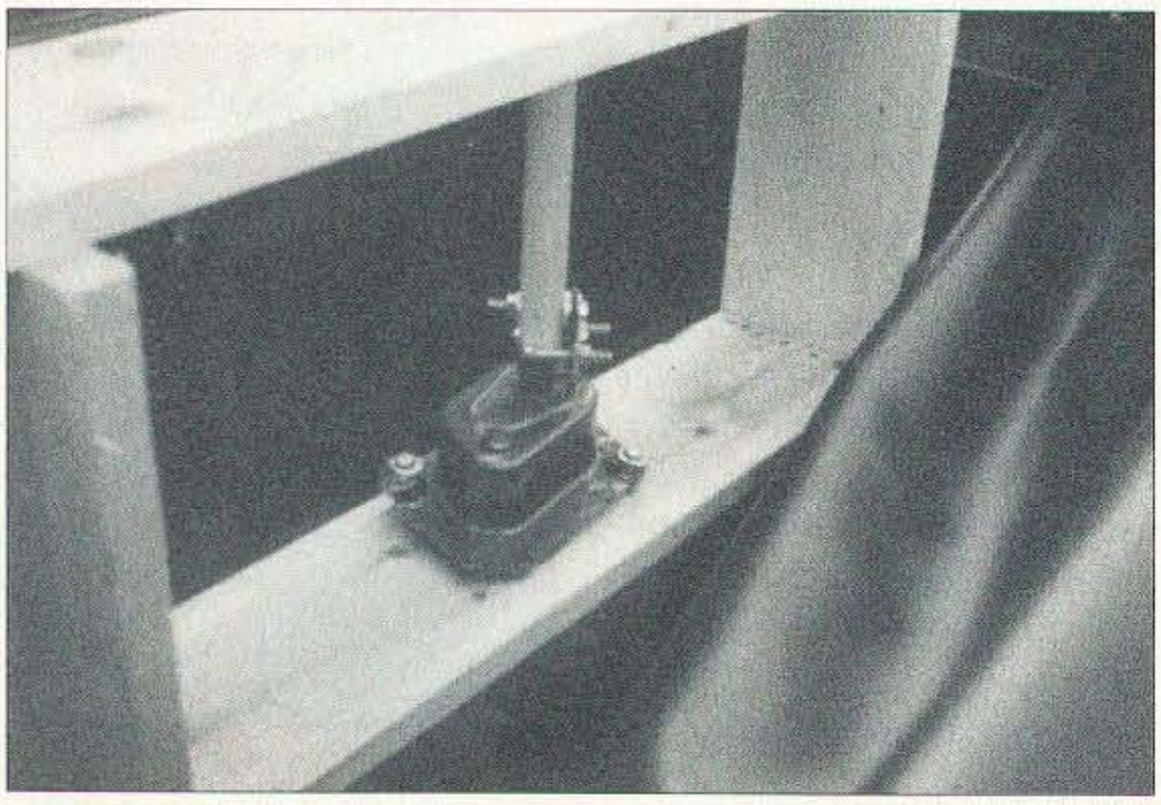


Photo B. *A Ford windshield wiper motor turns N8NYU's mast. Steve says it is important to use the matching Ford bracket to attach the mast to the motor. (Photo by Steve Sable N8NYU)*

Number 63 on your Feedback card

HAMS WITH CLASS

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

Preparing to prepare the class

The start of the new fall term brings with it all the usual "teacher-type stuff" that one has to do in order to get the school year off to a good start. After more than 18 years of teaching, I am still amazed at the enormous amount of preparation that has to go into laying a solid foundation for the school year. There should definitely be a course in the teacher methodology programs in college on "The Value of Preparedness."

After the class and I discuss the appropriate rules of behavior at our ham shack, and the children are all excited about speaking on the air, I always notice a few of them looking a bit apprehensive. I've developed the perfect thing to introduce at this time. I will say something like, "Probably a few of you are worried that you won't know what to say to the person you will meet on the air." Inevitably, I will then see knowing nods and smiles, as though I've just read their minds. I can almost hear a collective sigh of relief as I pass out a list of questions for them.

Use questions

Over the many years of teaching ham radio to 6th, 7th, and 8th graders, I've come up with a list of pivotal questions for the children to use to help them develop some interesting conversations with different folks they will encounter on the air. Obviously, the questions have to be modified according to the background and age of the other person. But it gives my kids a place to start. They feel comfortable holding a sheet of questions in front of them at the beginning. After the second or third time, most of the kids don't need the list. It's a good ice-breaker!

First, the children write out their first names phonetically. Everyone loves to do this. They write out their own background information, like names of brothers and sisters, where they've lived before coming to New York, what their hobbies are, what their favorite school subject is, what singing groups they like, what sports they're interested in, and so on. Now they know they can always fall back on these things in the conversation.

When it comes to asking questions, I tell them never to ask anything that can be easily answered with a "yes" or "no" response. Why not take advantage of this wonderful "live" resource we have? When speaking with other children I like my kids to learn about the differences between their schools in different parts of the country. Are they studying the same things? How much homework do they get? How's their cafeteria food? Most importantly, I list questions that will show how much they have in common with other children. No matter where a child may be from, they all dread tests and report cards, no one likes homework, and all kids like to complain about teachers and too much work.

"Never ask anything that can be easily answered with a 'yes' or 'no' response."

When speaking to adults, a good question is, "What do you do (or what did you do) for a living?" The children can then ask the other person to describe their workday. What role did ham radio play in the career choice? Is this a good job choice for a young person to consider?

Where are you talking to us from? This question often leads to fascinating responses ... everything from submarines, airplanes, bicycles, motorbikes, boats, to beaches, lighthouses, the Pentagon, the United Nations, the Johnson Space Center, and on and on. Most hams like to share with the children what influenced them to get into the hobby. A good question to follow up with is, "What's the most memorable, or funny, or exciting, or unusual contact you've ever had?"

If you brainstorm with your classes when making up the question list, you will be sure to get some interesting responses. A good classroom discussion can always follow an "inappropriate" question. It's important to teach children that when something offends another person, or invades their privacy, then it stops being fun. This is a hobby to be enjoyed by the participants. In my opinion, discussions about political beliefs or religious principles are better saved for other venues. Respect for other people, being open-minded about differences amongst people, and having an inquiring mind are all side perks that come with the teaching of ham radio to young people.

The importance of being prepared yourself for a lesson is obvious to a good teacher. The importance of passing that technique on to your students is even more important. Have fun! 73

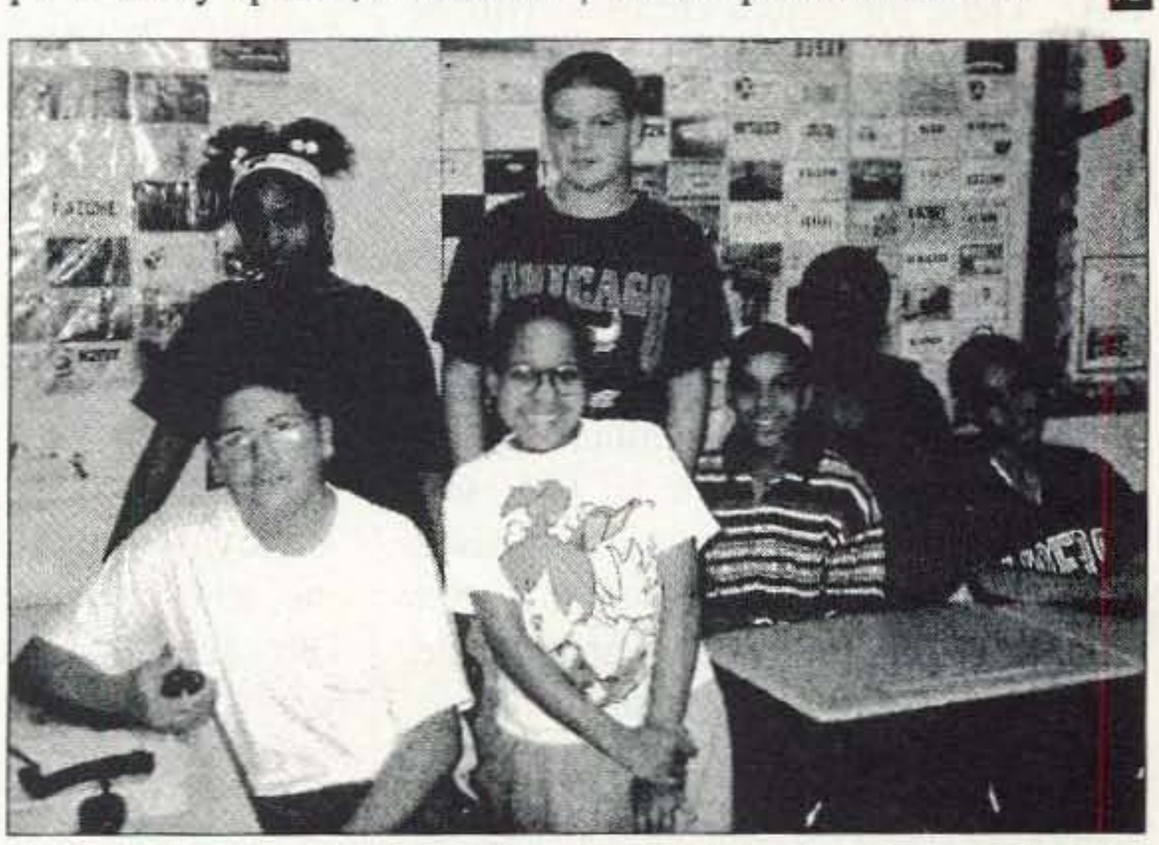


Photo A. A prepared list of questions gives kids lots of confidence at the mike.

MultiMode
TMC BayPac™ NEW
SITOR A/B
ARQ/FEC
BAUDOT
PACKET
NAVTEX
FAX 480
AMTOR
WEFAX
SYNOP
ASCII
RTTY
SSTV
CW
More...
BP-2 Packet Only $49.95
BP-2M MultiMode $69.95
+ $5 Shipping & Handling
The best little packet modem just got better! Building on the tradition of the BP-1 Packet Modem, we are very proud to announce the BP-2 and BP-2M. The BP-2 is a new and improved version of our famous BP-1, while the BP-2M expands your horizons even further with MultiMode operation! So, whether you have been waiting to automate your CW, checkout AMTOR or just copy Weather Fax - Now is the time for you to jump in and join in all the fun!
Tigertronics INCORPORATED
Call Today! 1-800-8BAYPAC
800-822-9722 (541) 474-6700 Fax 474-6703
World Wide Web: http://www.tigertronics.com
VISA MasterCard
Tigertronics, Inc. 400 Daily Ln. P.O. Box 5210 Grants Pass, OR 97527
CIRCLE 269 ON READER SERVICE CARD

Ham Radio Fun

Communications Simplified, Part 11

Peter A. Stark K2OAW
PO Box 209
Mt. Kisco NY 10549

The superheterodyne receiver, described in the previous installment, is the cornerstone of modern electronics. The superhet is used in car radios, hi-fi receivers, TV sets, cordless and cellular phones, and even radar detectors. Although the basic block diagram of a superhet is the same regardless of the kind of receiver, there are still quite a few differences between different receivers. We have already looked at some of these differences, such as double-conversion or using a converter instead of separate mixer and oscillator. Let's look at some others.

RF frequency range

Different receivers tune in different ranges of radio frequency signals. For example, a commercial AM radio will tune from 550 to 1650 kHz, while an FM radio will tune from 88 to 108 MHz; a TV set will receive signals between 54 MHz and about 850 MHz, while a radar detector will receive signals around 10 GHz. Thus, the actual circuitry will be different as well. Depending on the frequency range, the antenna will be different, the RF amplifiers and mixers will be different, and even the oscillator must be different.

AM broadcast signal strengths tend to be higher, and so AM broadcast radios usually don't have an RF amplifier (except in car radios), while an FM radio will almost certainly have one. This is usually a cost issue, but there are often technical reasons as well. For example, radar detectors do not have an RF amplifier because amplifying RF signals at radar frequencies is just too expensive. High frequency communications receivers, on the other hand, almost always have an RF amplifier stage—sometimes they even have two.

Selectivity

The required selectivity depends on the bandwidth of the signal. Selectivities often range from just a few hundred hertz (for receivers designed for receiving Morse code or slow-speed digital signals) to 6 MHz (for a TV receiver).

The proper selectivity is often obtained with several tuned circuits tuned to the IF frequency, often with double-conversion to provide lower selectivity without having image problems (see the previous part of this series). But other kinds of filters are also used sometimes, such as ceramic or crystal resonators, or SAW (Surface Acoustic Wave) filters. These kinds of filters use mechanical rather than electrical resonance, to provide a narrower bandpass. But more important, they provide a more stable and repeatable response without having to be individually adjusted.

"But more important, they provide a more stable and repeatable response without having to be individually adjusted."

Stability

They say that a good politician is one who, once bought, stays bought. The same is true of receivers—once a receiver is tuned to a station, it should stay tuned to it. When it does, we say that it is stable; when it doesn't, then we say that it *drifts*.

In a superheterodyne receiver, stability is most affected by the oscillator. In general, oscillator stability is most of a problem when the carrier frequency is high but the bandwidth is small. In this case, even a small percentage change of the oscillator frequency can cause the signal bandwidth to be different from the passband of the receiver.

For broadcast AM receivers, stability is not much of a problem, except perhaps in car radios whose temperature may change tremendously from the time you start driving on a cold day until the heater warms up the entire area under and around the dashboard.

Oscillator drift at higher frequencies is much more of a problem, and so the FM radio's oscillator will probably be quite different. Oscillators in AM radios tend to be spread out on a printed circuit board, while oscillators in FM radios will be very compact, and may even be enclosed in a shielded metal case to prevent outside conditions from affecting the circuit. An automatic frequency control (AFC) circuit (described later) may be used to keep the frequency constant. The AM radio will probably use a converter, whereas the FM radio will most likely use a separate oscillator and mixer.

Another difference lies in the detectors—an AM radio may contain a simple diode to rectify and demodulate the carrier, while an FM radio might use a Foster-Seeley discriminator or some other type of FM detector.

Since the bandwidths of AM and FM signals are different, the IF frequencies will be different. AM radios tend to use a 455 kHz IF (frequencies between 250 and 500 kHz are also sometimes used), while the FM radio will probably use 10.7 MHz.

AM/FM radios will use a combination of the above. Most such radios have completely separate RF and mixer/converter sections for each band, but use a common IF section for both. They do this by connecting a 455 kHz IF transformer in series with a 10.7 MHz IF transformer, and using the same transistor to amplify both. There will be separate AM and FM detectors, but then a common audio amplifier for both. There is obviously an art to getting the most performance from the least number of components.

Once you leave the simple, inexpensive AM and FM broadcast receiver and go either to a more expensive hi-fi or car stereo set, or to the type of receiver used in communications (amateur as well as commercial), then new circuits and options come into play. The rest of this section describes some of these.

Types of oscillators

Some radios (such as the typical home broadcast receiver) are frequently retuned from one station to another; others (like taxicab or oil truck radios) may stay tuned to one particular frequency their entire life. Thus, the oscillator in one radio may be tunable, while the oscillator in another radio may be fixed on one frequency for years. Oscillator design is therefore an important part of the whole design.

Inexpensive radios (such as pocket transistor radios) generally use simple LC oscillators; the frequency is set by an inductor and capacitor. Since components tend to change size and value as the temperature changes, special temperature-compensating capacitors are often used to try to keep the oscillator frequency constant. Even so, many FM radios need an AFC or Automatic Frequency Control circuit to keep the radio in tune because otherwise the LC oscillator would still drift.

Single-frequency radios, on the other hand, generally use *crystals* to set the oscillator frequency. As shown in **Fig. 1**, a crystal is a small piece of quartz, roughly the size of a dime. It has a plated area on each side, and is clamped in its holder between two thin spring-like wires. Because it is only held on its edges, it is free to vibrate.

Quartz is the same piezo-electric material we discussed at the beginning of this series. It converts between electricity and motion: When you bend it, it generates a voltage; if you connect a voltage to it, it bends. In this case, the small disk of quartz has a natural resonant frequency, typically in the range of 0.1 to 25 or so MHz, depending on its size. If you connect it in the feedback path of an amplifier, the amplifier starts to oscillate at the resonant frequency of the crystal. This frequency is very stable, and remains constant (within a tiny fraction of a percent) over a long time.

Crystals must be ordered for the specific frequency you need. Some frequencies (such as the 3.579545 MHz color-burst frequency in a TV set) are used so often that the crystals are mass-produced in huge quantities and cost less than $1 each; crystals for other frequencies may have to be individually made at substantially greater cost.

"These crystals are often (wrongly) called third-overtone crystals."

You may remember that we said crystals typically resonate in the range of 0.1 to 25 MHz or so, whereas the first oscillator in many radios may need to oscillate at much higher frequencies. A higher frequency can be produced in one of several ways.

A typical case might be an amateur radio which needs a first oscillator frequency of 136.24 MHz. This is usually done by using a crystal around 15 MHz, which oscillates on its third harmonic of 45.41333 MHz. Instead of oscillating in one piece, the crystal oscillates in one-third sections at approximately three times its fundamental frequency. This is its third harmonic, which should properly be called its second overtone, but these crystals are often (wrongly) called third-overtone crystals.

Once the crystal generates the 45.41333 MHz signal. A *tripler circuit* then multiplies the frequency by three to make the required 136.24 MHz. A tripler circuit is an amplifier which purposely distorts the signal to produce harmonics; a tuned circuit in the output then selects the third harmonic and deletes the rest. (A doubler would be tuned to the second harmonic; although it is possible to build quadruplers, quintuplers, etc., this is seldom done because of technical problems. Instead, combinations of doublers and triplers are usually used.)

Since crystals have a fairly limited range of frequencies, it is common to use chains of doublers and triplers to multiply the frequencies up to what is needed, or else use digital dividers (flip-flops) to divide the frequency down to a lower value.

Multiplying frequencies up to a higher value by using doublers and triplers is easy for certain values. For example, multiplying a frequency by 12 is easily done with a tripler and two doublers (since 3x2x2=12), but multiplying by 11 or 13, or most other numbers, cannot be done with doublers and triplers. Instead, we use a phase-locked loop (described shortly).

AGC, AVC, AFC, and BFO

This alphabet soup describes a few other circuits often found in receivers. The *automatic volume control* (AVC) or *automatic gain control* (AGC) circuits are basically the same. In each, the output of the detector is sampled to determine how strong a station is. On strong

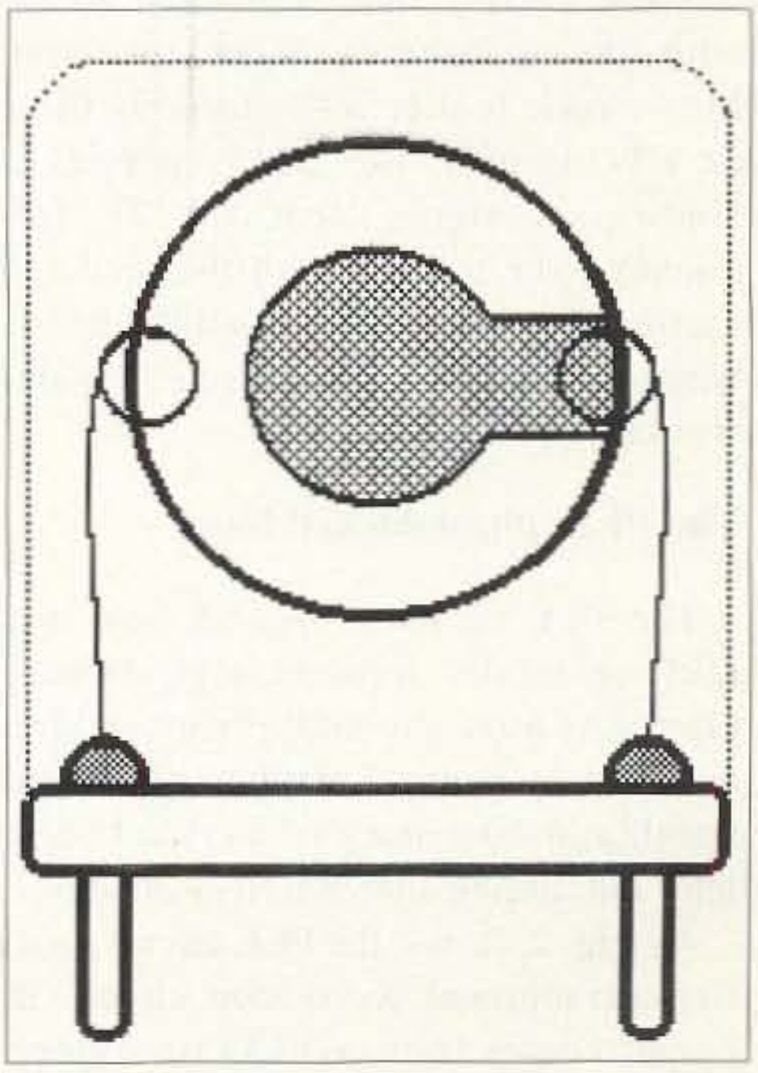


Fig. 1. A quartz crystal.

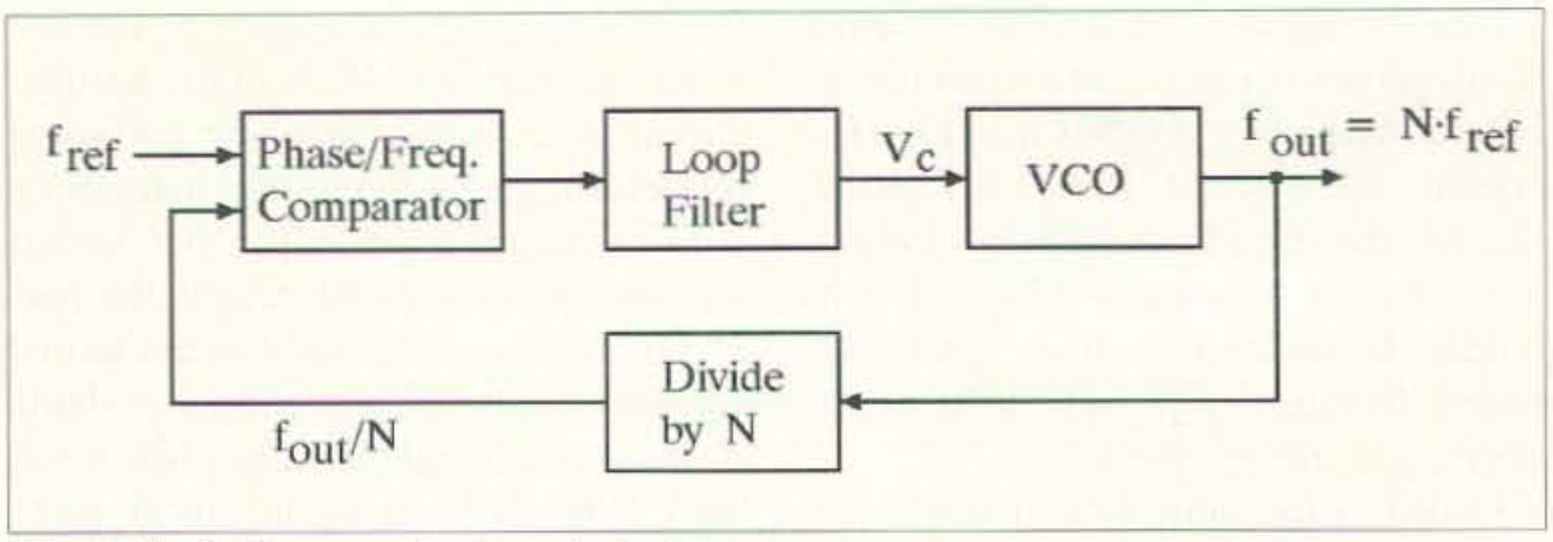


Fig. 2. *Block diagram of a phase-locked loop.*

stations, this circuit lowers the gain of the IF amplifier, while on weak stations, this circuit increases the gain. Since strong signals are amplified less while weak signals are amplified more, the result is to make both strong and weak signals sound the same.

An *automatic frequency control* (AFC) circuit is used in those FM receivers whose oscillators tend to drift in frequency. While modern receivers with phase-locked loop oscillators don't need the AFC circuit, almost all other oscillator circuits tend to drift and therefore can use AFC. The AFC circuit checks the received signal at the detector to see whether the radio is correctly tuned to the station. If it's not, then it sends a correction signal back to the oscillator, forcing it to either increase or lower its frequency to bring the station back into perfect tune.

The *beat frequency oscillator* (BFO) is used in some older receivers to receive Morse code and DSB or SSB transmissions. When receiving a DSB or SSB signal, the BFO supplies the missing carrier that is needed to go with the sideband(s). When receiving Morse code (called a *Continuous Wave* or CW signal), the BFO supplies a continuous signal near the IF frequency, which beats with the received carrier to produce an audio tone; this is what the operator hears and decodes from Morse code into text.

The PLL (phase-locked loop)

The PLL or *phase-locked loop* is a fairly recent development in electronics. One of its uses is to multiply crystal frequencies by unusual numbers; it has the stability and accuracy of a crystal oscillator but, unlike a crystal, it is tunable.

As **Fig. 2** shows, the PLL circuit looks like a traditional servo loop circuit. Its output comes from a VCO or *voltage-controlled oscillator*. This oscillator generates the frequency we want, but instead of the frequency being controlled by a knob or control of some sort, it is controlled by an input voltage V_c. The VCO can oscillate over a wide range of frequencies, and V_c tells it what frequency to output. Usually, if V_c is high, the output frequency is high, while if V_c is low, the output frequency is low.

Besides going to the output, the f_{out} signal also goes through a digital circuit which divides its frequency by some integer N. N is usually a variable number, which can be dialed in from some front-panel control, or perhaps is set by a small computer chip in the radio.

The output from the divider circuit is a feedback signal, which now has a frequency f_{out}/N. It is sent back to a *phase/frequency comparator*, which also receives an input reference signal whose frequency is f_{ref}. The comparator looks at the two inputs, and compares their frequencies. If the frequency of the signal coming back through the divider is lower than the input signal f_{ref}, then the comparator sends out an error signal which goes through the loop filter to the VCO and tells the VCO "raise your frequency, it is too low." The VCO frequency then goes up, which raises both f_{out} and the feedback signal to the point where the two inputs into the comparator match. (Of course, if the feedback signal was too high in frequency, the comparator would tell the VCO to lower it.) In this way, the PLL varies the VCO frequency up and down so it can lock it at the value that makes the two inputs into the comparator equal. When this happens, we say that the loop is *locked*.

In operation, the f_{ref} input signal usually comes from a crystal oscillator, and is very stable. Since the digital divider circuit divides by a number N which is also exact (it is an exact integer), the output signal f_{out} is exactly equal to N x f_{ref}, and is therefore also very stable.

The secret of the system lies in the divide-by-N circuit. This is a digital circuit which, with just minor changes, can divide by many different values of N, and each different N produces a different output frequency.

For example, suppose you needed an oscillator tunable to any exact point between 10 and 20 MHz. It would be almost impossible to get that sort of accuracy from an LC oscillator, and it would be very expensive to use 10 different crystals, one for each frequency. Instead, you could use a PLL with a 1 MHz crystal, and a divider which can divide by any integer between 10 and 20. If the crystal was accurate to, say, ±0.001%, then the output frequencies would be just as accurate. A PLL used like this to generate many different output frequencies is called a *frequency synthesizer.*

Phase-locked loops are very common today. If you have a car radio with a digital readout, it most likely uses a PLL to set the exact receive frequency. Before PLLs, a six-channel walkie-talkie needed six crystals for the receiver, and another six for the transmitter, just to set the frequencies; modern synthesized walkie-talkies can access hundreds of transmit and receive frequencies with just two or three crystals.

"The secret of the system lies in the divide-by-N circuit."

Before we leave phase-locked loops, we should mention a few other uses.

One use is as an FM detector. Suppose we replace the divide-by-N circuit with a plain wire (which makes N equal to 1, so the output frequency is the same as the input reference frequency). Further, let the f_{ref} signal, rather than being a very stable reference signal, be an FM modulated signal (perhaps coming from the IF amplifier in a receiver). As the signal frequency deviates back and forth, the PLL will keep the loop locked, forcing the VCO frequency to vary up and down in step with the input signal. The V_c signal going into the VCO tells the VCO what it has to do to match the input frequency change. In other words, the V_c signal goes up and down with the frequency—it is the demodulated output.

The PLL has one very useful characteristic: Given enough time, it can lock onto an input reference signal, even if that signal is buried in noise. It is therefore an excellent circuit for detecting very weak signals. Furthermore, since the VCO output frequency is the same as the input frequency—but without the noise— the PLL can be used to "clean up" noisy signals. The disadvantage, however, lies in the words "given enough time." The more noise there is in the input signal, the slower the PLL will lock up; hence, the signal must deviate slowly or the PLL will unlock and lose it.

Direct digital synthesis

Direct digital synthesis is a newer way of generating adjustable, yet very precise, frequencies. This approach has only become practical in the last few years, with the arrival of some very fast integrated circuits.

Fig. 3 shows the idea. The top waveform in the figure shows a typical sine wave you might want to generate. The first step is to take some very careful measurements of the height of the wave. For example, at the very left, we show an amplitude of 0 volts. A bit further on, the wave has a height of 0.174 volts. A bit farther on, the height is 0.342 volts, and so on. You do this for the entire length of one cycle.

The next step is to build a digital circuit that stores these measurements as binary numbers, and that can output them at high speed. The trick is to control the output speed so that the measurements come out at the exact instant when the wave should be at that amplitude. For example, if you took 10 measurements of the sine wave, and wanted an output of 1 MHz, then you would need 10 x 1,000,000, or 10,000,000 numbers to be output in exactly one second. You can see why this requires some very fast circuitry.

Once you have this digital circuit, which is spitting out numbers at a very fast rate, telling you how high the wave should be at any particular instant, you need to convert those numbers back into voltages. This is done with a *digital-to-analog converter,* which accepts the digital numbers and converts them into analog voltage.

Since the digital numbers represent specific points on the curve, and not the full sine wave itself, the output is the lower curve shown in **Fig. 3.** While this sort of looks like a sine wave, it has a lot of steps in it which represent the missing data. Fortunately, these steps represent high frequency signals which are easily removed with a low-pass filter, giving us a sine wave again.

An interesting article in the August 1993 issue of *73* showed how to use the Harris HSP45102DC direct digital synthesizer IC to build the "Julieboard" transceiver. The Harris IC is the digital IC which outputs the digital values for the sine wave; you just tell it the frequency you want, and it outputs the values at just the right rate to put the frequency right on the dot.

Subcarriers

A subcarrier is a carrier which is carried on top of another carrier. Here is an example of a common use: Suppose you have some music, such as what I call elevator music, which you'd like to broadcast to paying customers in a city. But you don't want to spend money to build a broadcast station; moreover, you don't want the music to be interrupted by commercials or even station call letters. You also don't want the public to hear this music for free, because you want to charge your customers for providing them with commercial-free background music for their stores or buildings.

For this application hi-fi music isn't needed, so let's suppose that the music has a frequency range up to perhaps 5 kHz or so. So you amplitude modulate it onto a carrier of, say, 91 kHz. The result is a 91 kHz carrier with sidebands extending from around 86 kHz up to about 96 kHz. These frequencies are well above human hearing, but still too low to efficiently transmit over the air—the antenna would be too long.

You therefore make a deal with a local FM broadcast station to transmit this signal for you. Because your carrier frequency is well above the range that the ear can hear, they can mix it into their audio signal without their own listeners being able to hear it. So we now have a main carrier (the FM station's carrier between 88 and 108 MHz) which carries both the regular FM station's signal, as well as your carrier signal, which occupies 86 to 96 kHz. Your carrier is now a *subcarrier,* riding on top of another carrier.

The system just described is actually quite common; FM stations call it an SCA subcarrier, and may use it not just for background music, but also for foreign-language programs, paging signals, or even digital data such as stock market prices. Another example is the color subcarrier in a TV signal; this is a 3.579545 MHz subcarrier, riding on top of a standard TV signal, that carries the color information.

Stereo FM

Stereo FM is another example of how a subcarrier is used to carry additional information on an FM signal, but it is a bit more complicated than the plain SCA approach. **Fig. 4** shows one way to do this. (Actually, **Fig. 4** shows how this was done in early stereo transmitters; modern transmitters use a digital approach called TDM, but its explanation will have to wait until a later section.)

The signals from the left and right microphones of a stereo signal are amplified by two audio frequency (AF) amplifiers, and sent to a *matrixing circuit* consisting of four resistors. Resistors R1 and R2 take the left and right signals (called L and R in the figure) and mix them into a signal called L+R. This *sum* signal combines the left and right signals into one for those listeners who have a mono rather than a stereo receiver. These listeners therefore get all audio, though both the left and right channels play through a common channel.

At the same time, an inverter takes the R signal and inverts it into a signal called -R. Resistors R3 and R4 combine this with the left signal into the L-R signal. This *difference* signal represents only the difference between the left and right channels. For example,

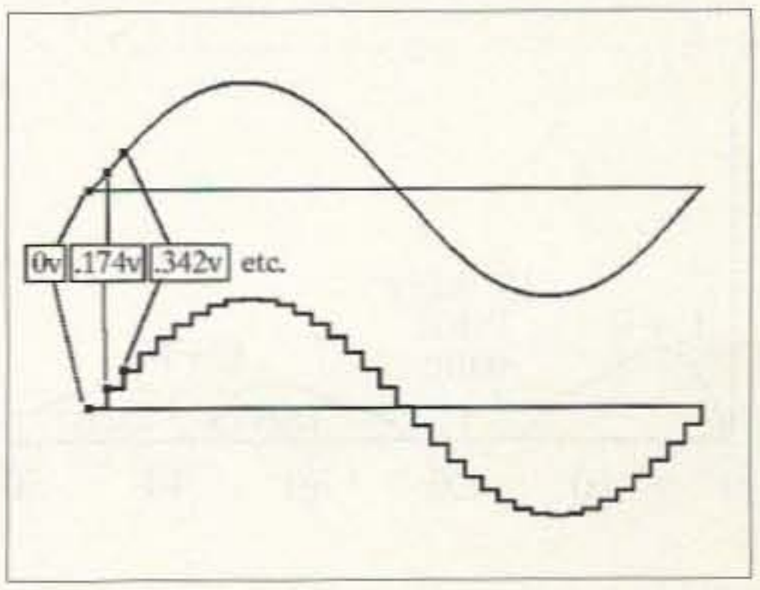


Fig. 3. *Digital synthesis of a sine wave.*

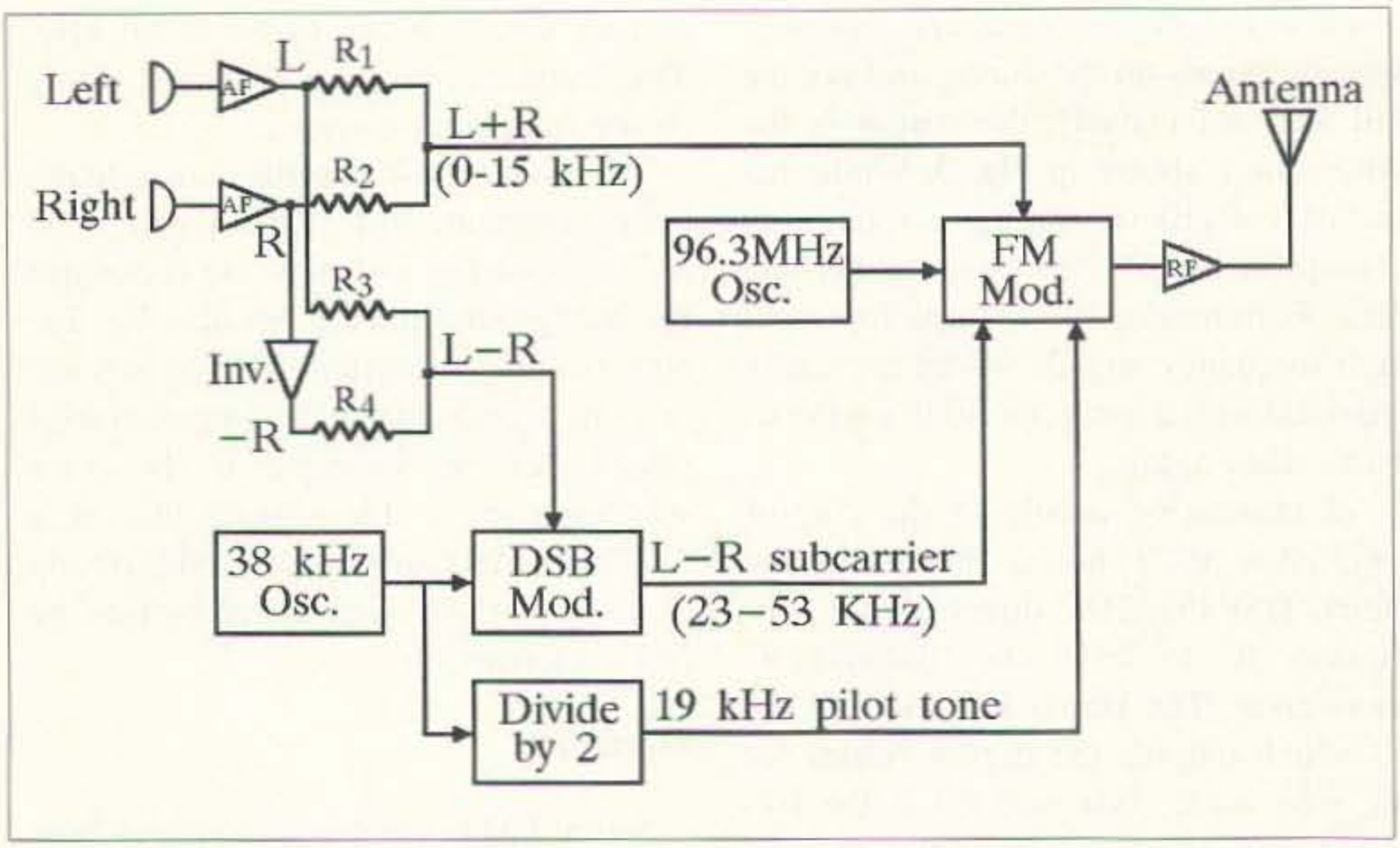


Fig. 4. An FM stereo transmitter.

if a singer is picked up equally by the left and right mikes, the two signals will cancel out (since the R signal is inverted) and not appear in the L-R signal. Instruments at the left or right, on the other hand, will appear mainly in one channel or the other, and so will not cancel out.

The L-R signal is modulated onto a 38 kHz subcarrier in a double-sideband (DSB) modulator. If the audio extends from about 0 to about 15 kHz, then the sidebands will extend ±15 kHz out from the subcarrier, or from about 23 kHz to about 53 kHz.

At the same time, the 38 kHz carrier signal is divided by 2, to produce a 19 kHz signal called the *pilot tone*. This signal is exactly 1/2 the frequency of the 38 kHz carrier.

All three of these signals—the main L+R audio signal, the DSB L-R subcarrier, and the pilot tone—are fed to the main FM modulator, which modulates all three of these onto the main FM station carrier (shown as 96.3 MHz in this example.) The 38 kHz subcarrier (or actually, its upper and lower sidebands, since the carrier itself is not there) therefore becomes a subcarrier on the main carrier. **Fig. 5** shows the resulting spectrum, which looks like this:

- Main L+R signal , up to 15 kHz
- Pilot tone, 19 kHz
- L-R lower sideband, 23 to 38 kHz
- Missing carrier (not shown), 38 kHz
- L-R upper sideband, 38 to 53 kHz
- Room for possible SCA subcarriers, from 53 to 100 kHz

With signals extending up to a possible 100 kHz, the overall bandwidth of the FM signal can be up to 200 kHz.

Why is the subcarrier DSB rather than plain AM or FM? For two reasons. First, it is not FM because an FM subcarrier at any reasonable modulation index would have an excessive bandwidth; it would extend down below 23 kHz, and start to interfere with the main L+R channel. And it is not AM because that would increase overall noise. Remember that each time a subcarrier is added to the main carrier the volume level of the main signal (the L+R signal in this case) has to be reduced to prevent the overall signal from being over-modulated. By omitting the subcarrier itself, and including only its sidebands, less reduction of the main signal is needed. This provides a louder, less noisy signal to listeners far away from the transmitter.

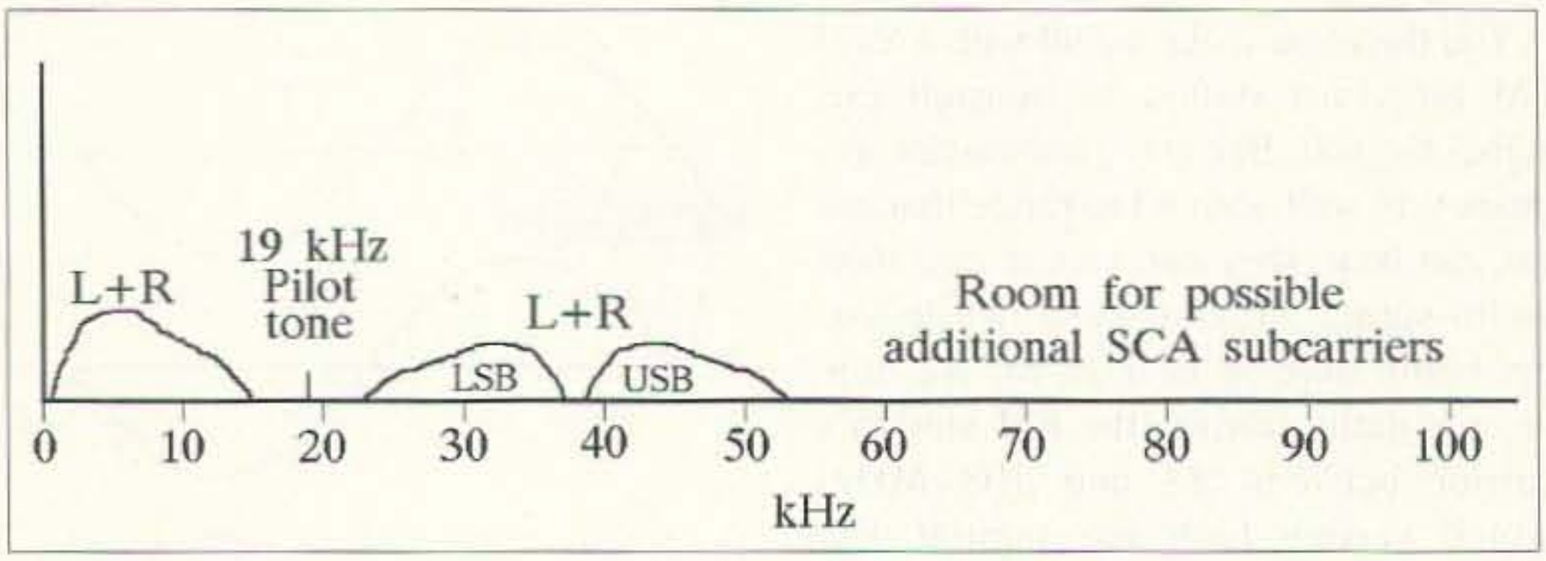


Fig. 5. Stereo FM spectrum.

But, as we mentioned in a previous installment, DSB is not normally used for transmitting music or high quality audio since it is too difficult to re-insert the carrier exactly halfway between the two sidebands. This is where the 19 kHz pilot tone comes in—the receiver will double its frequency to 38 kHz, exactly midway between the two DSB sidebands. The pilot tone is transmitted at a very low level, just strong enough so it can be separated out and its frequency doubled. In this way, the pilot tone helps the receiver provide a carrier at exactly the right frequency, so that the DSB signal can provide good quality audio after all.

Once the receiver demodulates the L-R signal, it uses another matrixing circuit to mix the L+R and L-R signals and produce the pure left (L) and right (R) signals. This is usually shown with the following equations:

(L+R) + (L-R) = 2L (pure left)

and

(L+R) - (L-R) = 2R (pure right)

This rather complex approach to stereo has two inherent advantages. First, the L+R main signal provides a compatible signal for listeners with mono receivers; compatibility was a very important criterion when the FCC decided on this stereo system. Second, The L-R signal is somewhat more prone to noise pickup than the L+R signal; since it is mixed equally into both the left and right channels, the noise comes equally out of both channels. This is more acceptable to listeners than having one good channel and one bad channel. And if the noise does become too high for comfort, the user can always switch the receiver back to mono mode; the radio then receives only the L+R signal, which avoids the noise of the L-R signal.

Incidentally, in addition to the stereo subcarrier, FM broadcast stations can also have one or two SCA subcarriers. Though adding all these signals does reduce the overall signal-to-noise of the station, the economics of charging extra for SCA channels does make it attractive to many stations. 73

Number 69 on your Feedback card

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the February issue, we should receive it by November 30. Provide a clear, concise summary of the essential details about your Special Event.

OCT 26

HOLLAND, MI The Holland ARC will sponsor the Lakeshore Hamfest and Computer Expo, 8 AM-1 PM, at the Holland Christian H.S. Vendor set up Fri., Oct 25th, 6 PM–9 PM. To reserve tables, call *(616) 772-0367*, or mail to *Hamfest, c/o Peter Venlet, 536 Huizenga St., Zeeland MI 49464-1423*. VE Exams will be available. Talk-in on 147.060 and w/ 94.8 pl.

MONTREAL, QUEBEC The Montreal South Shore ARC will hold its annual Hamfest at Place Desaulniers, 1023 Taschereau Blvd., Longueuil PQ. Set up Sat., 6 AM–9 AM. Open to the public 9 AM–3 PM. Wheelchair accessible. Talk-in on 145.390(-). Contact *Francois Drien VE2FDA, 160, Rolland Crescent, Greenfield Park PQ, Canada J4V 2Y2. Tel. (514) 672-9994; Fax: (514) 672-9361. E-mail: fradrien@ulix.net. Packet: VE2FDA@VE2RKY.#MTL.PQ.CAN.NOAM.* Visit the Hamfest WEB page: *http://www.cam.org/~pfisch/hamfest.html.*

NOV 1

FEEDING HILLS, MA The Hampden County Radio Assn. will hold its annual Auction at the Feeding Hills Congregational Church on North Westfield St. (next to the intersection of Route 187 and Route 57). Items are limited to amateur radio, electronics, or computer. Doors open at 6:45 PM. The Auction begins at 7:30. Free admission. The H.C.R.A. retains 10% (up to a maximum of $10). For complete rules or directions, contact *Steve WA1EYF, (413) 596-6216 before 10 PM.*

NOV 2

ENID, OK The Enid ARC Hamfest will be held 8 AM–5 PM in the Hoover Bldg. at Garfield County Fairgrounds. Talk-in on 145.290 or 444.400. VE Exams by W5YI at 1 PM. Contact *Fred N5QXJ, Tom N5LWT, Dick N5HEL, or Jeff N5UBY at EnidARC@AOL.COM;* or write to *Enid Amateur Radio Club, P.O. Box 261, Enid OK 73702.*

NOV 3

KAUKAUNA, WI The Fox Cities ARC annual Hamfest will be held at the Starlite Club, corners of Hwy. 55 and Cty. Rd. JJ. Reg. for VE Exams starts at 8 AM, testing starts at 9 AM. No walk-ins after 9 AM. Bring original license plus 2 copies, and a photo ID. For exam info contact *Larry Siebers KD9IA, (414) 757-1167.* Talk-in on 146.52 simplex or 146.76 Rptr.

NOV 9

HERSHEY, PA A Special Event will be hosted by the Central PA Rptr. Assn. at Hershey Armory, off 422. For details contact *Harold Baer KE3TM, 619 W. 2nd St., Hummelstown PA 17036; Tel. (717) 566-8895.* Ask about VE Exams.

MONTGOMERY AL The Montgomery ARC will host the 19th annual Montgomery Hamfest and Computer Show, in Garrett Coliseum at the South Alabama State Fairgrounds on Federal Dr. Flea Market set up 3 PM–8 PM Fri., Nov. 8th, and 6 AM–7:30 AM, Sat., Nov 9th. Doors open to the public 8 AM–3 PM CST. VE Exams on-site beginning at 8 AM. Bring original and a copy of your current license, picture ID, and $3.00. Talk-in on 146.24/.84 W4AP. Rag-chew on 146.32/.92 (with phone patch ±), 147.78/.18, 449.50/444.50. Flea Market reservations are encouraged. Nearest lodging at Coliseum Inn across the street; call *(334) 265-0586* or *1-800-876-6835.* For info or reservations, contact *Hamfest Committee, c/o 2141 Edinburgh Dr., Montgomery AL 36116-1313;* or phone *Phil at (334) 272-7980 after 5 PM. Fax: (334) 365-0558; E-mail: WB4OZN@worldnet.att.net.*

MYRTLE BEACH, SC The Grand Strand ARC Hamfest will be held 9 AM–4 PM at Myrtle Beach H.S. Talk-in on 147.120. For info, contact *Matt McGuire KF4AIT, (803) 215-0474;* or *David Berry KE4OOW, (803) 248-9401.*

NOV 10

BRANFORD, CT The SouthCentral CT ARA will hold its 17th annual Flea Market at the Branford Intermediate School, 185 Damascus Rd. Sellers 7 AM, buyers 9 AM. Wheelchair accessible. VE Exams. Talk-in on 146.01/.61. Reservations by mail only, no later than Nov. 1st: SASE to *SCARA, P.O. Box 705, Branford CT 06405-0705.* For info call *(203) 483-0856, 24 hrs.*

NOV 17

BENSON, NC The Johnston ARS, Inc., will hold "JARSFEST96" 8 AM–4 PM at the American Legion Complex on Hwy. 301 N. For info contact *Bill Lambert AK4H, 8917 Hwy. 50 N., Benson NC 27504. Tel. (919) 894-3352, eves. 7 PM–10 PM.*

NOV 30

EVANSVILLE, IN The 4th annual E.A.R.S. Evansville Winter Hamfest will be held 8 AM–2 PM (Central time) at Vanderburgh County Fairgrounds. Set up at 6 AM. Contact *Neil WB9VPG at (812) 479-5741;* or write to *EARS, 1506 S. Parker Dr., Evansville IN 47714; or E-mail EARSHAMaol.com.* The Hamfest Web Site is *http://users.aol.com/earsham/earsham.html.* Talk-in on EARS wide area Rptr Network 145.150(-) Evansville/146.925(-) Vincennes. Alternate: EARS Rptr. 145.110(-).

LITCHFIELD, IL The Central Illinois/St. Louis Area ATV Club will hold their 10th Annual Banquet at the Ariston Restaurant in Litchfield, beginning with a Happy Hour at 5 PM and Dinner at 6:30 PM. After the meal, there will be various award presentations to members. Those active or interested in ATV are invited to attend. Contact *Scott Millick K9SM, 907 Big Four Ave., Hillsboro IL 62049. Tel. (217) 532-3837,* or *E-mail to smillick@cnmnet.com.* Reservations are required in order to attend.

NEWTONVILLE, MA An Amateur Radio and Electronics Auction will be held by the Waltham ARA and 1200 RC at Newton Masonic Hall, 460 Newtonville Ave. For more info contact *Eliot Mayer W1MJ, (508) 664-0773, W1MJ@AMSAT.ORG.* The Auction Web Page is *http://ourworld.compuserve.com/homepages/emayer/auction.htm.*

SPECIAL EVENT STATIONS

NOV 9–10

LAKE HIAWATHA, NJ The Irvington-Roseland Amateur Club will operate the club station, K2GQ Nov. 9th and 10th 1400Z–2100Z, in celebration of the club's 51st Anniversary, "IRAC the Next 50 Years." Operation will be in the General portions of 80, 40, 20, and 15; the Novice portion of 10 meters, and 146.52.

NOV 30–DEC 1

PLYMOUTH, MA The Whitman ARC will operate Station WA1NPO at historic Plimoth Plantation, in commemoration of Thanksgiving. Freqs.: 3.970, 7.270, 14.270, 18.140, 21.370, 24.970, and 28.370; 1400Z–2100Z hrs. each day. A special QSL card will be sent to Hams and SWLs sending an SASE. Also, a 7 1/2" x 10" certificate with the Mayflower II in the background is available for the event. All replies must be sent to *Whitman ARC, P.O. Box 48, Whitman MA 02382.* 73

LETTERS

Continued from page 69

have no formal education and are unqualified. Their goal is to create a bigger demand for their services, which increases the need for the agencies' services, which in turn means bigger budgets, with promotions and salary increases for all.

Most local agency administrators quickly learn that they can get away with expenditures such as parties (conferences), cell phones, cars, plush offices, et cetera, because the federal and state agencies are dependent upon local expenditures to justify their bigger budgets. This is going on from Florida to California. Most northern states that have no need for migrant farm workers are not aware of this.

I know this because I worked five years for the Western Arizona Council of Governments (WACOG) in Yuma, Arizona. The description I have given is an accurate assessment of what I witnessed going on. Their local Congressman, Ed Pastor (a liberal Hispanic Democrat) is all in favor of this.

Be sure and pay lots of taxes, Wayne. The people at these agencies and on the other give-away programs appreciate it.

Well, it 's easy to see why we have more people working for the government than in manufacturing. We don't want their children to go hungry so let's push Congress to increase our taxes and give everyone a raise for a job well done ... Wayne. 73

Number 70 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153

Over the past few months, we have covered the what, why, and how of radioteletype; this month, let's take a look at the where.

From the beginning of amateur radioteletype, hams have clustered their activities at the low end of the ham bands, in order to facilitate contacts as well as minimize interference to other forms of communications. For "standard" Baudot radioteletype, look around the low end of 80 meters, at 3620 kHz, or on 20 meters near 14080 kHz, most times of the day. You certainly may find RTTY on other frequencies, but these are good starting places on HF.

On VHF, you will do best to check around on local repeaters, as local custom puts AFSK RTTY all over the place. In some areas, activity may be concentrated near 145 MHz, while in others it may be up near 147 MHz. Other bands' activities may be similarly influenced by local practices. Ask around.

Help on CD-ROM

While our activities may be confined to the ham bands, radioteletype itself is hardly so confined. A useful tool for searching for some of those frequencies has been put out by Jeorg Klingenfuss, in the form of the 1996 Super Frequency List, a CD-ROM which stores all kinds of broadcast information.

The revised software of this disk runs under Windows 3.x® or Windows 95®, and features concurrent word search facilities and individual tables to evaluate some 8,500 entries with the latest schedules of all international broadcasting services on shortwave. The English and German search engine can seek out radioteletype stations and sort them by frequency, identifier, country or language, or combinations of keys. **Fig. 1** is a screen shot of a search for Hebrew language stations, showing the kind of information available. There are even other lists of 1,000 abbreviations and 12,820 formerly active frequencies, all on one compact disk. The current price is DM60, and the disk is available from Klingenfuss Publications, Hagenloher Str. 14, D-72070 Tuebingen, Germany. For more current information on this, or other Klingenfuss publications, check out Jeorg's home page at: http://ourworld.compuserve.com/homepages/Klingenfuss/ and let him know that you read about him in this column.

"What exactly would I need, besides the C-64 and a 2 meter transceiver, etc., to be packet capable?"

Help wanted

David Sebastio (sebastio@teseo.it) has been studying for an Italian ham license, and may well have it by now. He has been looking for RTTY and ham applications for the Mac. This has been a long-standing problem, which has been addressed here before. I have found some material on America

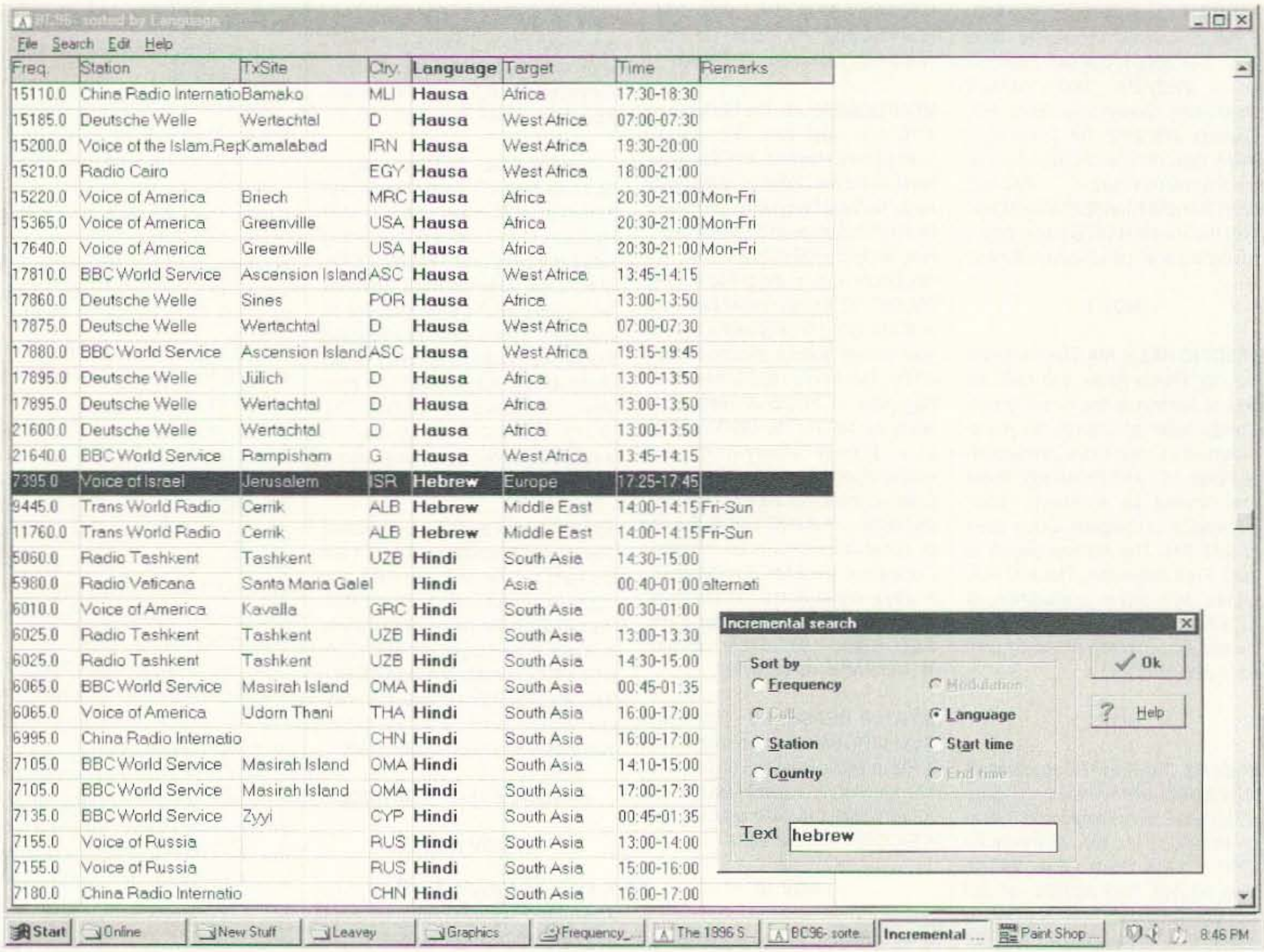


Fig. 1. A screen shot of the Super Freq List in use.

Online™, but precious little elsewhere. Readers with good information are invited to send contributions to David, who I am sure would appreciate it, as well as to bring such material to my attention. Depending on size, we may be able to offer some of the material on the RTTY Loop Home Page.

Speaking of that home page, some miscellaneous notes include a word of thanks for the comments to Mike Stapp (stapp001@gold.tc.umn.edu), a regular reader of this column and visitor to the page who, along with others, has offered suggestions and comments. Watch the page for implementation of some of these items in the future. Hopefully, Antonio Hernandez Garza XE2HWH (hgarza@bestit.dgit.seit.mx) has used some of the material from the RTTY software collection to get his Kenwood TS-530S onto RTTY with his PK-232. I look forward to hearing from Mexico on this. Dale Fravel N2LWY (dlf@rfpo1.rfc.comm.harris.com) is looking for information on DS RTTY, as well as software to accomplish this mode. Again, any of you who have information for Dale, please send it to him, and let me know about it, too, OK?

Using old equipment

Michael Shovan WB2KHE, says that he has enjoyed reading "RTTY Loop" almost as long as *73* itself. While not yet equipped for the mode, he still finds the topic of interest. His only practical exposure was with the big, old, clunky monsters the wire services used to provide for radio station news departments as late as the mid-'70s (when he was last in the "biz").

Some years ago, he tried the RTTY receive program for the CoCo but couldn't get it to work, especially with a direct feed from a shortwave broadcast receiver headphone jack. (The program was keyed into an executable file from the magazine listing and stored on disk.) He had always wanted to make it work, but never got to pursue it.

Fig. 2. The CD-ROM Klingenfuss 1996 Super Frequency List.

Packet quickly put an end to all that for him at the time.

Well, Michael, as originally printed, there were a few errors in that listing, which prevented it from working as published. A correction ran a few months later. So, anyone who is still running a CoCo is cautioned to check for that correction before putting fingers to keys. As to those "old, clunky monsters," watch it—many, many hams are still using those machines. I also appreciated Michael's remarks about my other page, A.J.Recordings, the official web page for Al Jolson. You all can check that one out at: http://www2.ari.net/ajr/recs/. Notice the subtle difference in URL from the RTTY Loop Home Page.

Speaking of those old monsters, another Italian reader, Guido Sesani (bonefish@gpnet.it) sends a message detailing his problems. An old SWL, he recently rejoined the world of RTTY with an old Telereader CWR 670E (do not smile please!!) and a Yaesu FRG-100. He wrote because he absolutely does not remember how the Telereader works, and the only transmissions he gets clearly are CW. So, once again, I ask all of you if anyone has an original manual for the Telereader, a copy of which could be sent to Guido. Drop him a message if you can help him, and let me know so that I can thank you as well.

C-64 help

A reader with a piece of equipment not so old, but not so new, either, is Harry Johnson NV7K/6 (panda@northcoast.com) who writes:

"I have been reading your column in *73* for a long time, even though I am not active in any way on any of the digital modes. I do enjoy reading it anyway. I have enjoyed looking at the web sites that you mention each month, and for various reasons have included some on my hot list. I just did so with the RTTY Loop Home Page. Very interesting.

"I have a C-64 sitting in a box and have for some time had some randomly recurring thoughts about using it for packet. I have read some about 'poor man's packet,' etc., and know that there are terminal-emulating programs for the C-64 that facilitate its use for packet. As you can see, I am totally inexperienced in the digital modes. Anyway, what exactly would I need, besides the C-64 and a 2 meter transceiver, etc., to be packet capable? Where is the necessary software available?

"People usually snicker softly when I mention the C-64, and say 'Use your PC!' I use the PC for too many other things, and the C-64 is just sitting there. My expectations are not excessively high, anyway. I would just like to have the ability to communicate with some friends via packet."

Harry, there are a lot of C-64s on RTTY, and they get out just fine. Anyone who would snicker at you would probably do the same to someone driving an inexpensive car, but it will take you to your destination just as well as a luxury model. Among the solutions I have seen, the most elegant may be the old Microlog ART-1 system, being sold by G & G Electronics of Maryland for less than $50. Check with them and see if they still have any left, at (301) 258-7373, and tell them you read about it here. If they have run out by the time this is published, they may well have a handle on other solutions to your problem.

Several times in this month's column the RTTY Loop Home Page has been highlighted as the source of information, and the means of contacting me. Those of you with Web access can check it out for yourselves at: http://www2.ari.net/ajr/rtty/. There have been thousands of hits there to date. I have not said much about the RTTY Loop Software Collection lately; next month I hope to highlight a few new programs in the pot. Meanwhile, drop me a line and let me know what you are looking for, or what you have to contribute. E-mail me at: ajr@ari.net, or on America Online at: MarcWA3AJR, or on CompuServe at: 75036, 2501, or scrawl me some snail mail via the post office box above. Just do it! 73

"The Klingenfuss CD-ROM can seek out radioteletype stations and sort them by frequency, identifier, country or language, or combinations of keys."

Been on any DXpeditions?

Write about it (them).
Call Fran at 800-274-7373
for 73's free
Writer's Guidelines.

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave
San Diego CA 92119
Internet: clhough@aol.com

2304 MHz and above microwave transverters

Last month I discussed some of the conversion aspects of the Qualcomm synthesizer and our Microwave Group's use of this surplus material. Those of you interested in obtaining the PC board to modify it into a functioning local oscillator may contact me at the above address.

The best example I can give is shown in last month's photographs from Kiotsugi Tanumara JG1QGF. He made a very simple, neat packaging of the synthesizer that is not only attractive in layout, but also extremely straightforward in operation.

The Qualcomm synthesizer outputs frequencies in the 2160 to 2700 MHz range. Some units are restricted to a lesser frequency range determined by a more tightly constructed VCO on the PC board. These units will not go below 2400 MHz and thus are used with 10 GHz transverters requiring a 144 MHz IF and a local oscillator at 2556 MHz. This arrangement makes for a perfect fit of VCO capabilities and VCO performance.

The synthesizer frequencies I use are based on the use of a 144 MHz multimode radio as the IF (intermediate frequency), and various multiples of the output from the synthesizer as the injection frequency. For example, to operate on 2304 MHz, I use an LO (local oscillator) frequency of 2160 MHz (2160 + 144 = 2304). To operate on 3456 MHz, a local oscillator of 828 MHz is quadrupled, mixed with the IF, and output as 3456 ((4 x 828) + 144 = 3456). If I want to get on 1296, the 2304 is divided by two before mixing ((2304 / 2) + 144 = 1296). Ten gigahertz operation is available well ((2556 x 4) + 144 = 10368).

What system you use for a local oscillator, be it a crystal oscillator or a more sophisticated synthesizer, doesn't matter. What is required here is a local oscillator that is accurate; accuracy is the prime ingredient and reigns supreme. The alternative is frequency uncertainty and an unstable oscillator. It will work but it's like driving a car—you must continuously adjust your system just like the steering wheel. To a radio system this approach is impractical and is considered a bottom-dollar solution.

Now, with the local oscillator in tow and a simple practical filter to construct with again simple components, try putting together a converter for one of the frequencies you have chosen to construct. The choice of frequency is yours, but I would suggest that you select one for which you already have some of the components on hand in order to hold down the cost of components. If you attempt a converter for which you must purchase all the components this will undoubtedly become a somewhat expensive project. Projects should be fun and interesting, and should not cause pain to the pocketbook. While we will make available all the components that we have on hand to help you construct some of these converters, make use of supplies you can find locally to hold down your costs. We are presenting several completed system ideas to demonstrate how we attacked the construction area on different frequencies. Almost all of the material can be obtained from us; more on that later.

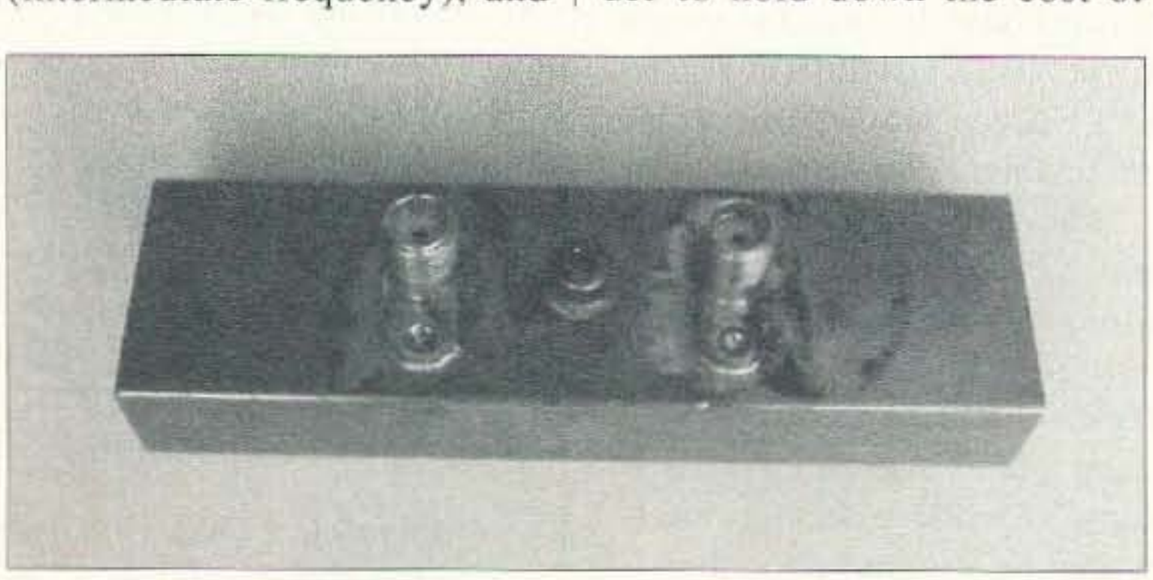


Photo A. *The waveguide filter, constructed out of 10 GHz waveguide 1" x 1/2" x 3" long. The connectors used were long-tip SMAs, and the screw was a 4/40 brass screw and lock nut.*

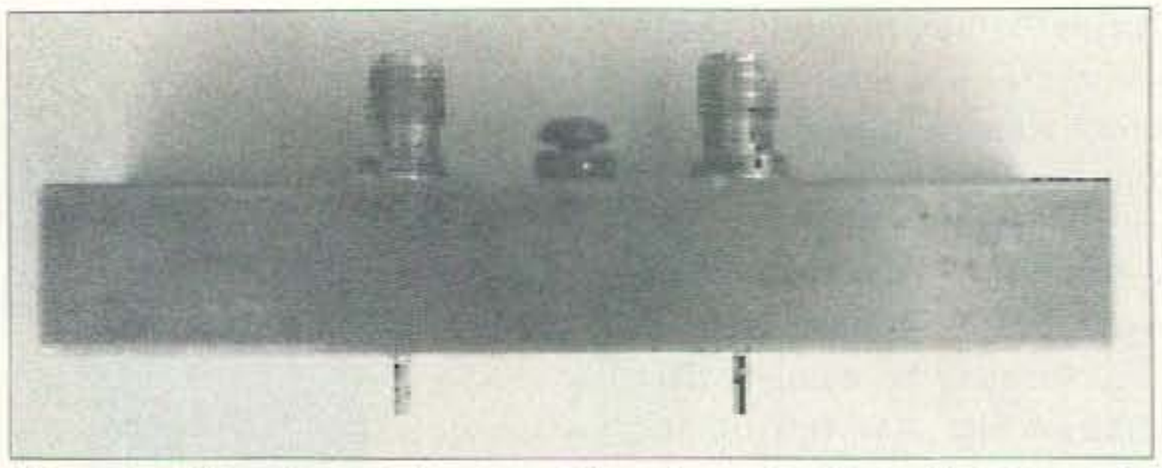


Photo B. *Side view of the same filter shown in* ***Photo A.*** *Notice the long pins on the coaxial connector protruding and soldered on the rear wall of the waveguide. The 4/40 screw is centered in the waveguide between the two coaxial SMA connectors. In the case of lower frequency filters, the screw is replaced by a Johanson microwave variable capacitor.*

"This might seem a little unusual—using a single amplifier for a dual purpose—but it works well in low power systems."

More on the filter

The next item I want to cover is the filter that we introduced last month. The filter shown in **Photo A** is quite a simple one, and even when constructed with dimensional inaccuracies, it will still be capable of reasonable operation. The limits of your construction depend mainly on the components used for the capacitor and on its physical size and value. The filter response curves will be affected by the distance between the coaxial connectors, the size and value of the filter, and the size of the waveguide used. If you are in doubt and have several SMA long-stem coaxial connectors to experiment with, construct several of various lengths. I used 1/2" spacing in almost all of my filters.

This spacing from the variable Johanson capacitor was acceptable in performance, to my tastes. For a more exacting filter in terms of loss and bandwidth characteristics, try constructing a few and select the best method you have at hand. Remember: If you change the ingredients you will change the type of cake you are baking. It should not matter to a great extent if you use different types of connectors and variable capacitors. Just keep in mind that if you stray far, you must be prepared to adjust the circuit to suit the components used. I stayed with miniature SMA coaxial connectors and RF suitable high Q RF variable Johanson capacitors in my construction.

I don't have a pile of the very small units used in the 3456 filter; try using a brass screw and experiment with the size, starting with a 4/40 (which I used at 5760 MHz). For 3456 MHz maybe a 10/32 brass screw, or even a 8/32, would be suitable. I don't know, but for us the 4/40 was just the ticket at 5760 MHz. Give it a try. Experimentation is what amateur radio is all about. **Photo B** shows the side perspective of the

Advertisers' Index

R.S.#		page
•	A & A Engineering	45
351	Absolute Value Systems	27
•	Advanced Info Group	39
194	All Electronics Corporation	21
57	Antennas West	2
89	Antennas West	19
116	Antennas West	23
340	Antennas West	29
5	Antennas West	31
324	Antennas West	35
254	Antennas West	42
332	Antennas West	52
16	Astron Corporation	13
41	Barry Electronics Corp	39
42	Bilal Company	31
168	Buckmaster Publishing	24
56	Buckmaster Publishing	37
222	Byers Chassis Kits	41
184	C & S Sales, Inc.	9
123	CCTV Corp.	6
99	Communication Concepts	9
276	Computer Aided Technology	23
268	Computer Automation Technology	59
•	Cubex	24
13	Doppler Systems	75
114	E. H. Yost	35
•	Electronic Distributors	15
•	Gap Antennas	CV3
193	GGTE	19
78	Hamsure	41
•	Hamtronics, Inc.	1
42	Isotron	31
•	Jan Crystals	23
158	Japan Radio Co.	CV2
•	JPS Communications	7
151	KDC Sound	29
•	Lightning Bolt Antennas	28
•	Link Communications Inc.	9
•	Meadowlake Corp.	49
86	MFJ Enterprises	11
86	MFJ Enterprises	49
•	Michigan Radio	51
160	Micro Computer Concepts	45
193	Morse Tutor Gold	19
248	Motron Electronics	79
114	Mr. Nicd	35
64	Mouser Electronics	57
54	NCG	37
102	ONV Safety Belt	27
•	P.C. Electronics	47
•	P. C. Electronics	55
•	Peet Bros.	35
68	Periphex	29
•	Radio Book Shop	51
•	Radio Book Shop	52
•	Radio Book Shop	76
•	Radio Book Shop	84
•	Radio Book Shop	86
•	Radio Book Shop	87
58	Radio Engineers	27
34	Ramsey Electonics	5
254	Ross Distributing	42
167	Sescom, Inc.	45
•	Sirio Antenna	CV4
250	Software Systems Consulting	19
69	Spectrum Electronics	24
269	Tigertronics	63
22	Tri-Ex Tower Corporation	59
•	Universal Radio	31
259	Versatel Communications	45
104	Vis Study Guides, Inc.	87
191	W & W Associates	73
•	Wacom Products	41
245	Wavemach Communications	39

When you buy products from these advertisers, please tell them that you saw their ads in 73.

Subscribe to 73 right now...call 800-274-7373 (9-5 Monday-Friday EST).

BATTERIES

BUY DIRECT FROM US, THE MANUFACTURER!

YAESU

	FNB-2	10.8v @	600 MAH
	FNB-4	12v @	750 MAH
	FNB-4A	12v @	1000 MAH
*	FNB-10(S)	7.2v @	1200 MAH
	FNB-12(S)	12v @	600 MAH
	FNB-17	7.2V @	600 MAH
	FNB-25	7.2v @	600 MAH
	FNB-26	7.2v @	1200 MAH
**	FNB-26(S)	7.2v @	1500 MAH
	FNB-27	12v @	600 MAH
**	FNB-27(S)	12v @	800 MAH

**1/4" longer than FNB-27

	FNB-31	4.8v @	600 MAH
	FNB-33(S)	4.8v @	1500 MAH
	FNB-35(S)	7.2v @	600 MAH
*	FNB-35(S)(S)	7.2v @	1500 MAH
	FNB-38	9.6v @	600 MAH

*1 1/3" longer than FNB-38 case

BATTERY ELIMINATORS AVAILABLE

Special

FOR THE MONTH OF NOVEMBER

10% OFF

on ALL

KENWOOD

Replacement Batteries

Look for December's Special of the Month

MONTHLY DISCOUNTS APPLICABLE TO END-USERS ONLY

Powerpac+®

6 V for Camcorders & 12 V for 2-way

Prices and specifications subject to change without notice.

W & W ASSOCIATES

800 South Broadway, Hicksville, NY 11801

WORLD WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE

NYS residents add 8 1/2% sales tax. Add $4.00 for postage and handling

MADE IN THE U.S.A.

SEND FOR FREE CATALOG AND PRICE LIST

In U.S.A. and Canada Call Toll Free:(800) 221-0732 • In NY State Call:(516) 942-0011 • Fax:(516) 942-1944

CIRCLE 191 ON READER SERVICE CARD

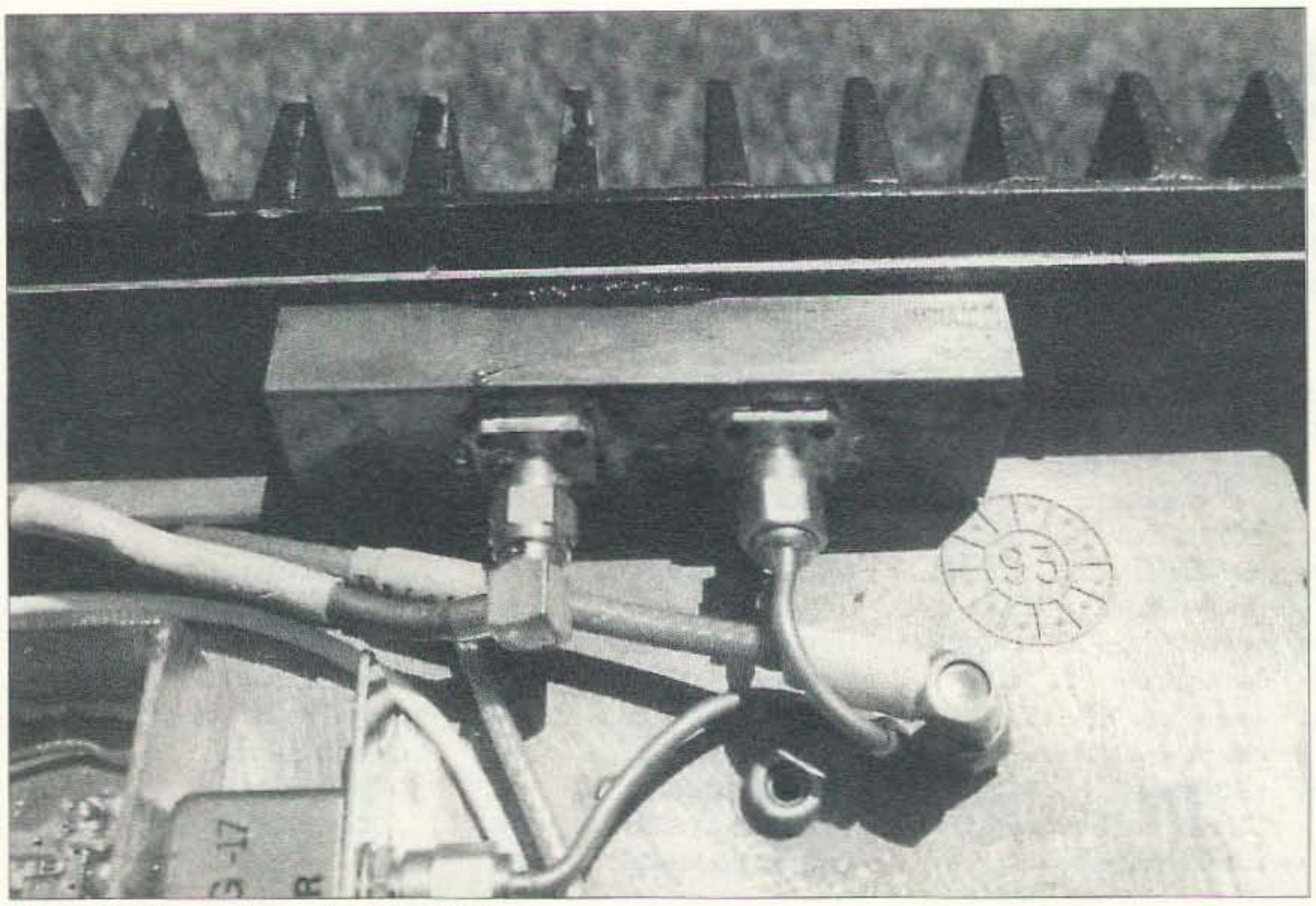


Photo C. Filter to be used at 3456 MHz.

filter constructed for 5760 MHz. You get a good view of the center pin going through the waveguide and soldered to the far end section of it.

This type of filter construction is typical, with little change other than using a variable capacitor for the lower frequencies and a brass screw for higher frequencies. The brass screw is still a capacitor in effect as it is setting a value of capacitance when the screw nears the bottom of the waveguide bottom. In this application, the value of the screw is something near 1 pF of capacitance. It might look like a screw but it is a capacitor in effect. I will probably get letters correcting me on that point but this was the easy tack to take, in describing why a screw can replace a capacitor.

Photo C is a close-up of a filter used in a 3456 MHz transverter that I constructed. The goop on top of the filter is a blue silicone RTV automotive gasket material. I used it to hold the filter in place on my cabinet side wall to prevent the filter from rattling around. Using RTV allows easy removal and replacement of material that doesn't require grounding. If at a later time an improvement is incorporated, changes can be made very easily by removing the RTV and rearranging components, as mounting holes and nuts and bolts are not required.

Transceiver construction

Now for constructing the main transceiver. What does it take to construct a simple transceiver? Well, after you select an IF frequency that determines your local oscillator frequency to operate on a specific frequency, all you need is some coaxial switching and a mixer to function. Of course, this is a very basic system, the minimum needed to communicate. See **Fig. 1** for a diagram of this basic system.

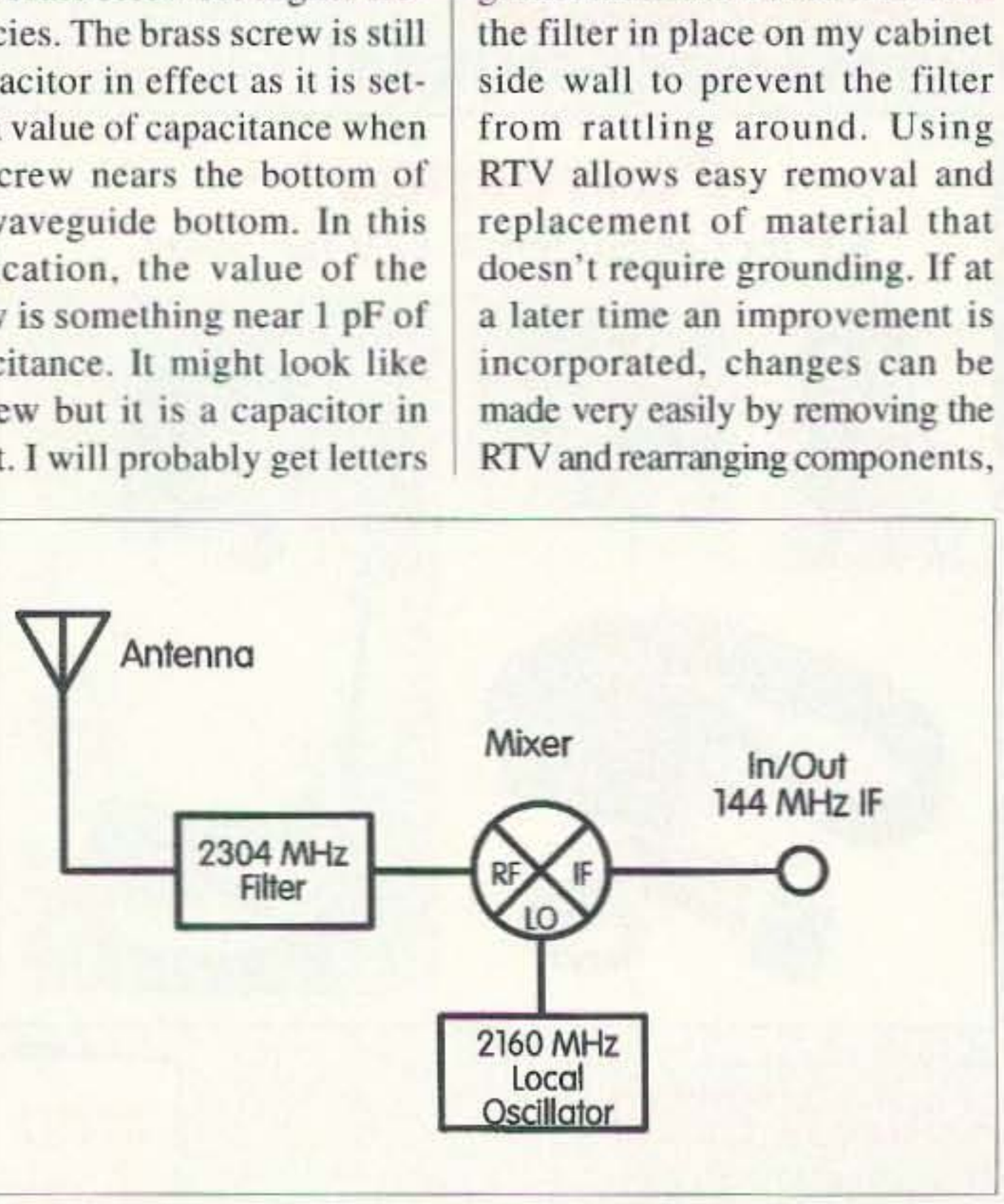


Fig. 1. Basic minimum RF transceiver using a local oscillator mixer and an RF filter. The simplicity of this arrangement allows operation without using coaxial relays. It is a "Peanut Whistle" low power rig, but works quite well.

A local oscillator, a mixer, an IF transceiver (2 meter in my case), coaxial relay switching, and a filter to prevent out-of-band RF radiation are all that is required. Improvements can include a receive preamplifier and a transmitter amplifier to beef up the mixer output level. When the basic system uses a mixer and just a filter, the antenna is a direct connection to the mixer, and is bidirectional. This system does not require coaxial switching due to this bidirectional connection. When any amplification is inserted in this path it directionalizes the path and requires coaxial switching.

Depending on your selection of RF amplification, there could be two different types of coaxial switching scenarios. The first and most common arrangement uses an individual receive RF preamp and a separate transmit amplifier. This most familiar, common arrangement of amplifiers requires two single-pole double-throw coaxial relays (SPDT) to accomplish RF switching. See **Fig. 2** for this RF switching configuration.

The other amplifier scenario is accomplished with a single RF amplifier serving both functions as an RF preamplifier for receive and an RF amplifier for transmit. This might seem a little unusual—using a single amplifier for a dual purpose—but it works well in low power systems. The RF switching trick to pull this arrangement off is to use an RF transfer relay. This type of relay is quite different from the SPDT used in the example described above.

"It might look like a screw but it is a capacitor in effect."

What makes a transfer relay special is that it has four connections for the RF switching path, with two connectors tied to each other at any one time. When it is operated, it reverses its path connection and makes contact to the other two connections, "transferring" the input and output connections. See **Fig. 3** for a diagram of a transfer switching configuration.

When you use a transfer coaxial configuration, the RF amplifier is tied between two fixed poles of the transfer relay. One of the other poles (coaxial connectors) that are vacant is tied onto the mixer RF port; the other is tied to the antenna. Which switching state the transfer relay is currently in depends on where you left the transfer relay

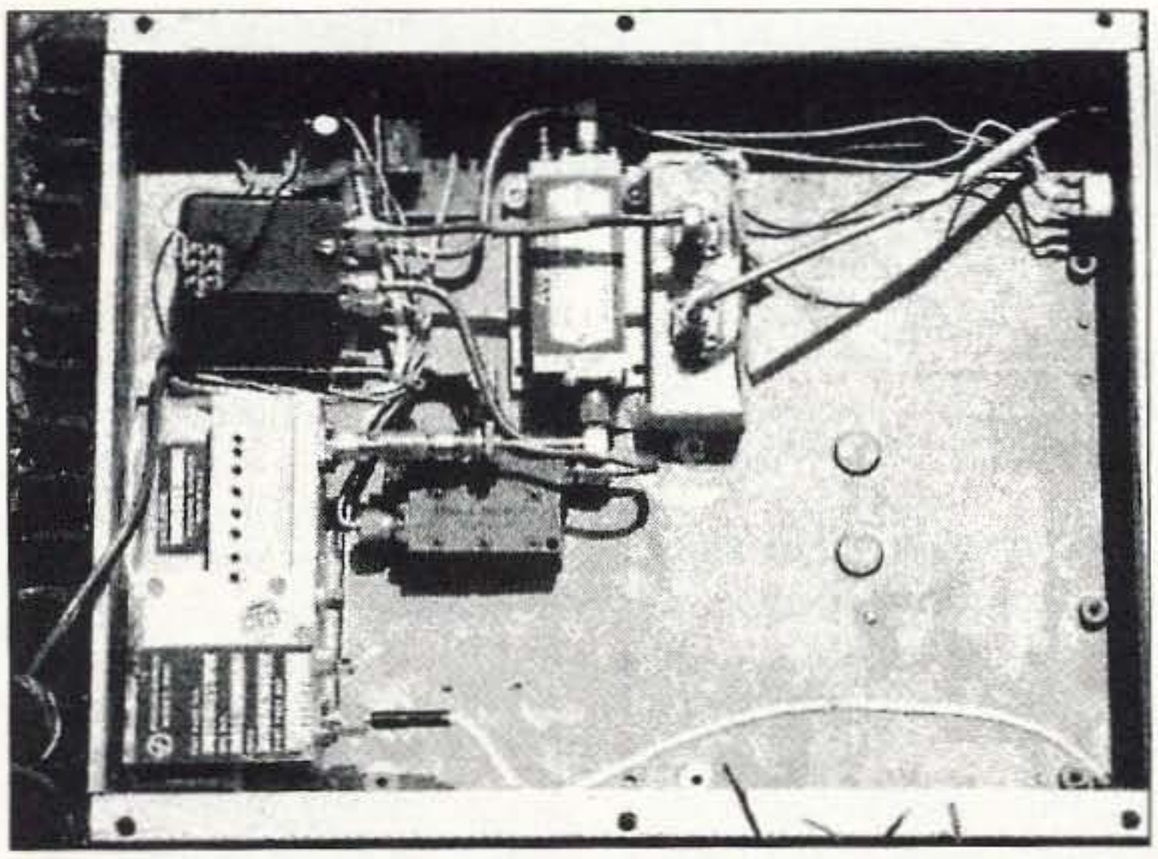


Photo D. Full view of the completed 3456 MHz transceiver/converter.

switching state. This relay is not a typical normally-open or normally-closed contact arrangement, but rather a latching relay. With a latching relay, it's a teeter-totter type of switch. It takes a DC voltage applied to a specific contact to change the switch direction. As the switch is operating it also opens the DC control voltage to the appropriate relay coil.

To transfer back to the original state (let's call it the receive state), you must apply a DC voltage to the other relay coil. Again, only a short pulse of DC is required as it also opens in this teeter-totter fashion. The point to note is that there are two relays in a transfer relay and they only use a momentary DC current to switch. This means quite a current savings from the battery operation point of view.

An SPDT coaxial relay requires current all the time that you want it to remain switched. To confuse the point, most SPDT relays are of this type but they can exist in a momentary relay function. In either case, the SPDT relay can be either momentary or continuous. From an operational point of view, the switching is the same with either relay.

Choose your relay with care, making sure it will function at the frequency you want to use. Almost all SMA type miniature relays that I have come across will handle modest power in the 10 watt range, up to and including 10 GHz, with little problem. An ohmmeter test for operation might show good results, but a loss test at the RF frequency you intended to use will show if it is usable or not.

Well, there you have some of the considerations that we have used to construct our transceivers. None of these units is a real powerhouse transceiver, but they do function and have all made contacts that were quite respectable. I hope that they show you that these rigs are not too cumbersome to construct, and that they can be repeated with other types of components that you might have on hand. That's the main thrust: Construct a rig for your frequency and put it on the air.

Sure, I could sell you something just like all the other supply houses, even though I work out of my home. However, my venture into amateur electronics is for fun and enjoyment, and, hopefully, to help you get something off the ground and on the air. I can't say it enough: Use your junk box, and always keep an eye out for new items to add to it. A well-stocked junk box will help you hold down costs on projects.

Letters and comments

Just one for the road this month: From time to time I am asked to design some big project gratis. In some cases this involves some basic idea with which someone wants help. Some have far-reaching implications, as in the case of (no names here) who wanted me to design a "worst-case engineering nightmare type of radar for aircraft collision avoidance." Well, I assigned that request to the round file for obvious reasons and liability questions. Recently, however, a friend gave me the solution to the design problem. I thought it worth repeating.

The solution to the worst-case radar aircraft avoidance system is as follows: "You should have pointed (him) towards new optical passive laser technology. A non-coherent diffuse electromagnetic wave source in the terrahertz region. This is used, together with a detector connected to a neural network, to determine the presence of objects. Triangulation from two detectors is used to estimate distance."

So simply put and with flair. I love it!

Well, that's it for this month. I will continue on the quest for converters for our microwave region, and stay with simplicity as best as I can. Best 73 Chuck WB6IGP clhough@aol.com (soon to change to Pacific Bell Internet Services). 73

Turn page for ***Fig. 3.***

Fig. 2. *RF coaxial switching using individual RF receive preamplifiers and separate RF power amplifier devices.*

TRANSMITTER LOCATION

Direction Finding System Tracks Down

- **Stuck Microphones**
- **Cable TV Leaks**
- **Jammed Repeaters & Cell Sites**

Models available with computer interface, synthesized speech, for fixed or mobile use, covering 50 MHz to 1 GHz. Call or fax for details

CIRCLE 13 ON READER SERVICE CARD

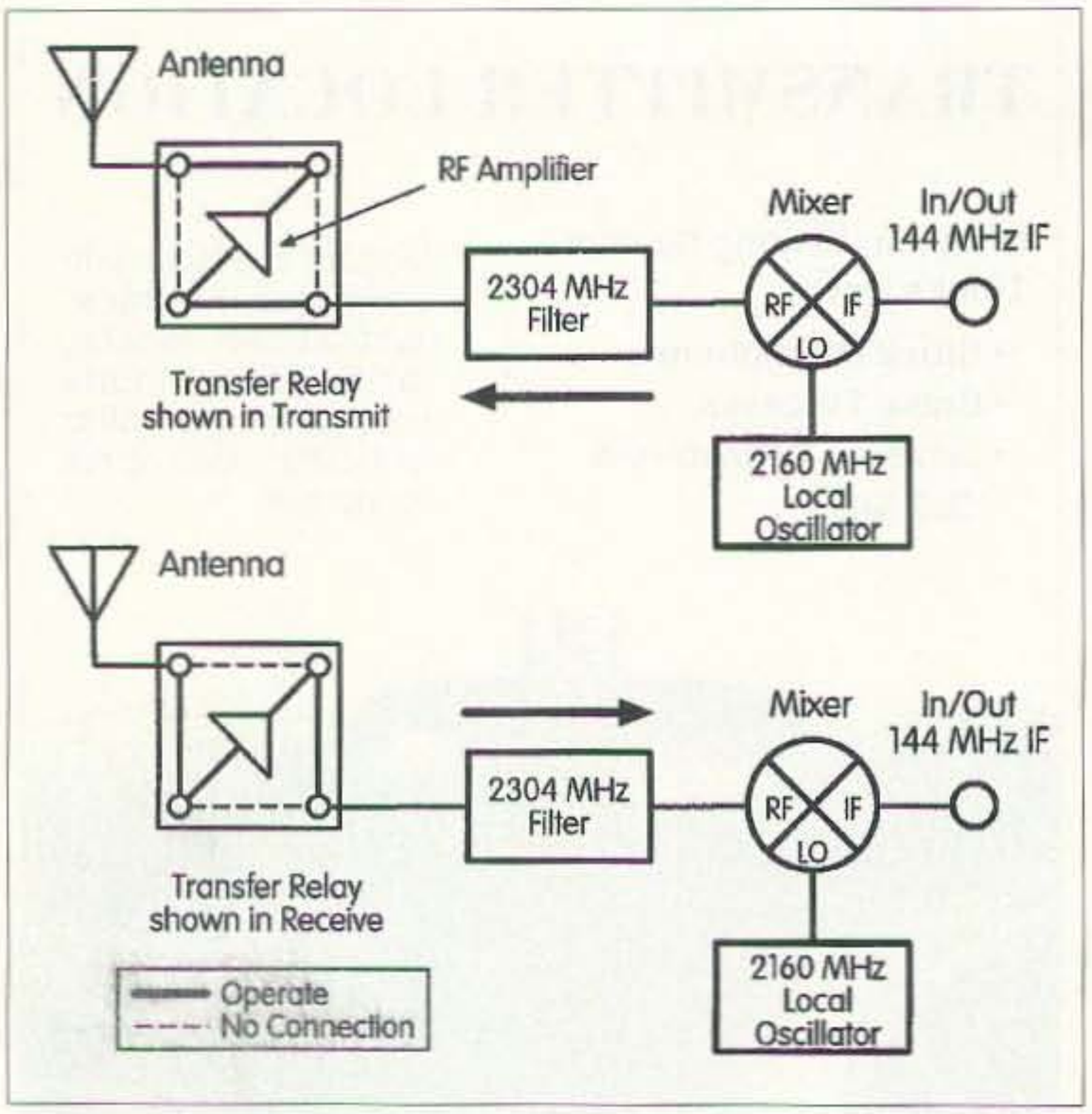


Fig. 3. Switching system using a transfer relay and a single RF amplifier, used for receive and low power transmit applications. This is the next step up from the basic mixer-filter-only approach in microwave transverters.

NEVER SAY DIE

Continued from page 55

their business incubator program, which won the prize as the best in the country for 1995. But I couldn't fight the total domination of the faculty's prestige game. I didn't want titles and battle ribbons to wear, I wanted results. Well, I got a few, but just a fraction of what I'd hoped for.

Then there was my adventure with the trustees of Central New England College, where as a consultant I tried to help them reorganize before it was too late. The faculty fought every inch of the way, and won. The result was that the college folded and everyone lost.

It was a similar story at Hawthorne College, only this time it was the students who called me as a consultant to try and save their college. Heck, I came close to buying the college just so I could make it into a model of what a college could be, with zero tuition and no government support. But the entrenched faculty prestige mindset, supported firmly by the accreditation bureaucracy, made me back off. The college folded.

Universities should make a fundamental decision. Are they going to be R&D laboratories, or teaching institutions? The two haven't mixed successfully yet. Their goals are just too far apart.

I went to college because that was what anyone who could afford it was supposed to do and I didn't know any better. I almost totally wasted four years. That was 50 years ago, when colleges weren't as bad as they are today, and I'm still grumbling. It's interesting that few successful entrepreneurs (according to an *Inc.* magazine survey) bothered to go to or finish college, thus putting themselves a few years ahead of college grads in the workplace. Well, you can get more details on my philosophy for making money in my $5 booklet on *Making Money, A Beginner's Guide*. Is Bill Gates a college grad? Steve Jobs? Just to name two billionaires that I happen to know personally. You bet they're not.

Rock

Amateur radio, in addition to providing my life with adventure, has also helped me get work—which can (and should) also be an adventure. In this case it was Graham Claytor W2MYL, one of my fellow RTTY pioneers

Continued on page 79

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

The Last Skeptic of Science by René. We all know there have been a bunch of ice ages, right? Wrongo, says René! And that the moon causes the tides. That volcanoes are caused by magma leaking from the earth's core. That the transmutation of elements is difficult. That the earth, with it's iron core is a big magnet. Plus a bunch of other blasphemies, which René disproves most convincingly. Heck, we all know that two materials of different weight will fall at the same speed in a vacuum. Galileo proved that once and for all. Could Galileo have been wrong? You betcha. René spins out one after another of thoroughly accepted scientific truths and slays them. Boy, will you have things to talk about after reading this baby! 179p, 81/2 x 11. Order **SK** $25 from Radio Bookshop.

NASA Mooned America by René. The proposition that the Apollo flights were all faked and NASA never got anyone to the moon is patently ridiculous. I'm still waiting to hear from anyone who has read this book and still believes the moon landings weren't the biggest hoax in history. René has done his homework thoroughly and cites 30 darned good reasons why he thinks we've all been lied to. 176p, $8^1/_2$ x 11. Order **NA** $25 from Radio Bookshop.

Cold Fusion. Look, you ignored my blandishments to get involved with repeaters, which would have led you into getting rich via cellular telephones. Then you ignored my pleas to get involved with personal computers. So you're not a Bill Gates, Paul Allen, or Steve Jobs. You can't say I didn't try. The next biggie is going to be cold fusion. You can get an Overview report on the subject for $2 (order **CFO**) from Radio Bookshop. Or you can jump in and subscribe for 12 issues. The special *73* subscriber rate is $75 instead of $98. Warning, some of the articles are technical, some are on experimental systems. Order **CF-sub** from Radio Bookshop. Motorola and Bechtel are already jumping in on this new technology, yet the leading American researcher in the field had his lab in his garage and had less than $5,000 invested. He's now working for Clean Energy Technology Inc. (CETI).

The Book List by Wayne Green. This is a list of 83 books that I say you are absolutely crazy if you don't read. And none of this "I don't have time to read" crapola. These books are the best books I've found in a whole bunch of fields. Many were recommended by readers as being top notch. It's time to become educated on health matters, our school system, our corrupt government, history, science, communicating with plants and animals, child development, the occult, and so on. Order **BL** $5 from Radio Bookshop.

AIDS Cure. Can a simple $19 electrical (for the parts) gadget you should be able to build in an hour cure the dread "incurable" AIDS virus? Plus clean out any other virus, microbe, yeast, parasite, or fungus in the blood? This approach was discovered by the Albert Einstein College of Medicine and then kept secret. The medical industry's worst nightmare is a cheap cure for expensive diseases. Are tens of thousands of people dying unnecessarily? This has the original Beck device, plus a reprint of the May *73* Miller unit. Can this even cause a weight loss for fatties? And can the magnetic pulse unit used to zap the HIV virus out of lymph glands be used to regrow male pattern baldness? Order **AIDS** $10 from Radio Bookshop.

The Junk Box Power Supply

A short course on power supplies.

Don Crowder N5TWH
Central Texas C & E
P.O. Box 349
Kingsland TX 78639

Every time you turn around these days, it seems you need a power supply. The kids have dozens of electronic toys and we adults have more than a few of our own that use lots of expensive batteries. All these gadgets seem to have jacks on them for external power, but the little wall transformer type power supplies are expensive in their own right. Luckily, most of us have junk boxes full of transformers, diodes, capacitors, and transistors. The experimenters' books and magazines are full of power supply circuits but most of them are built around one or another integrated circuit. Granted, these are excellent circuits, but "chips" have lots of legs, they cost more, take more time to assemble and test, and you never have the right chip in your junk box anyway.

Well, here's a nice, simple, discrete transistorized regulator that's usable between 3 and 24 volts and which can be assembled in a couple of hours or less. Since none of the component specifications or values are critical, you probably already have the parts. There's more here, however, than a neat, easy power supply. This is a pretty good short course on power supplies in general, and you may even learn a trick or two.

The transistors

The whole electronics industry uses NTE numbers for replacement transistors so these numbers are shown (see **Fig. 1**), but you can look up the number of the transistor you happen to have and, if it crosses to the NTE number, it's usable (that's called a back-cross). If you don't have a cross reference book, then call your local parts distributor and beg.

The zener diode

The zener value should be 2 volts larger than the desired output voltage. Zener values can be increased, in increments of .6 volts, by placing them in series with ordinary diodes (like the 1N4000 series) installed in opposite polarity. For example, where an output of 9 volts is desired, requiring an 11 volt zener, let's say that all you can find in the junk box is a 9.1 volt zener. You can add three ordinary silicon diodes to get a value of 10.9 volts, which ought to be close enough to serve. The zener's power rating is unimportant (see **Fig. 2**).

The transformer

Even serious technicians can't always figure out which of the odd transformers, in that box out in the garage, are suitable for a given voltage and current requirement, but with some common sense and practical knowledge, you can make a fairly close "guesstimate."

First, you need an old appliance cord (in good shape) with insulated clip leads on the end opposite the plug. Before

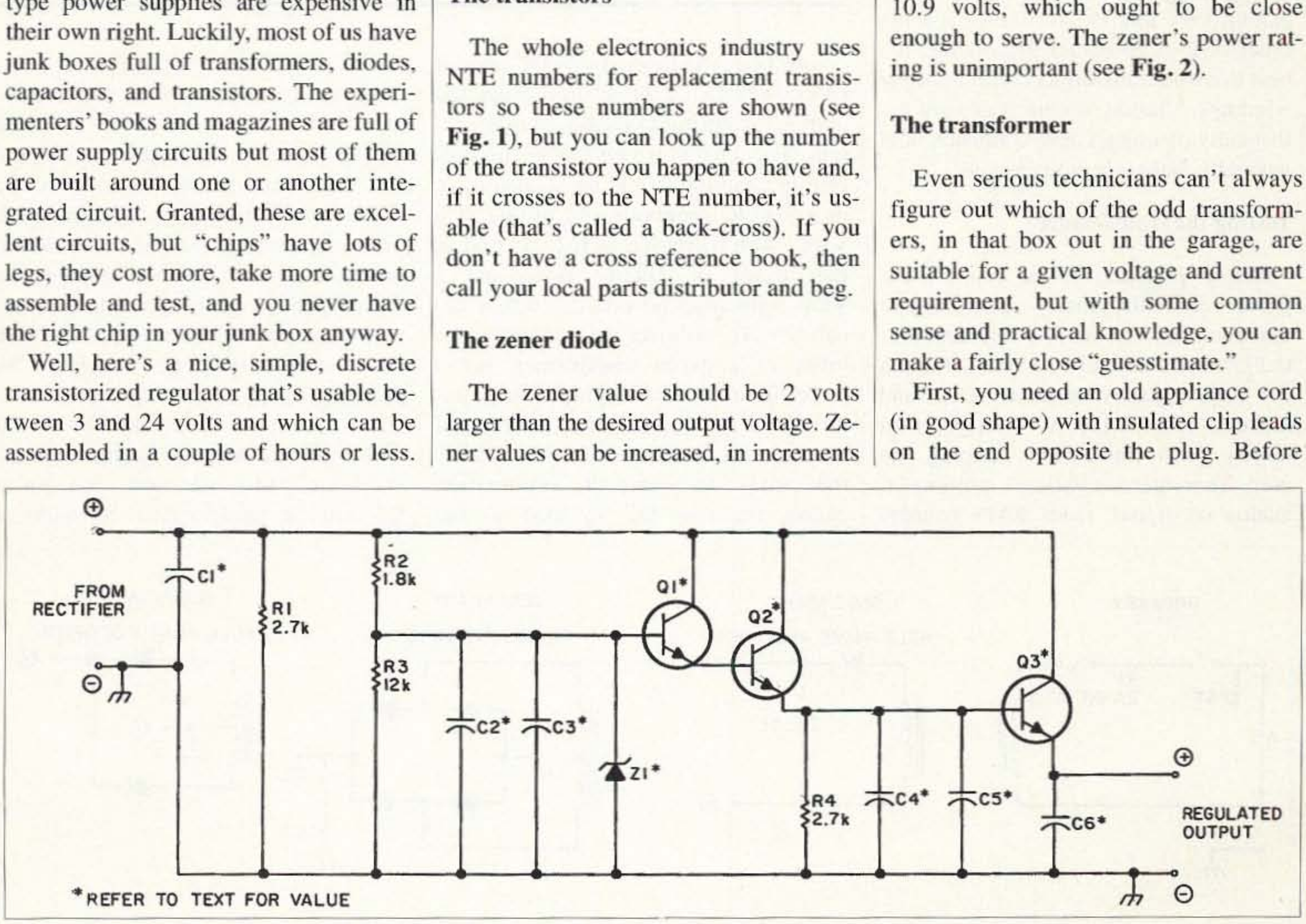


Fig. 1. Schematic diagram of the Junk Box Power Supply regulator circuitry.

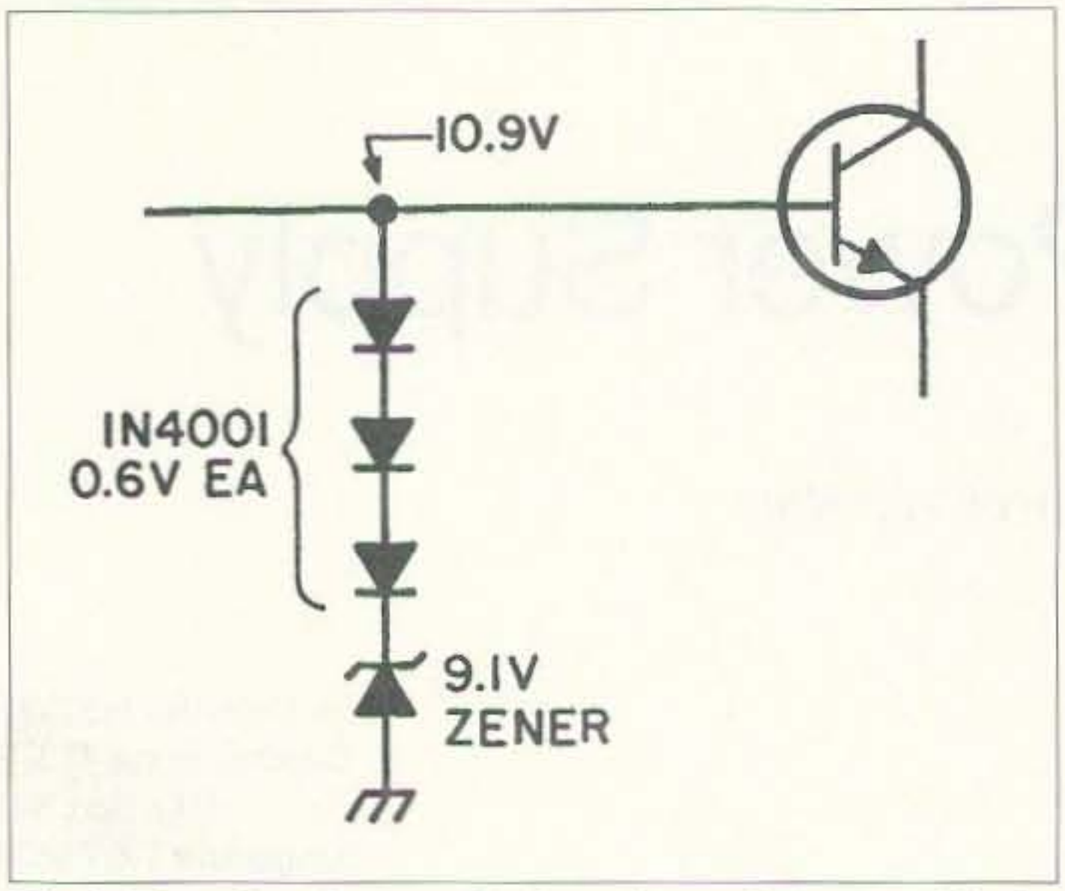


Fig. 2. The value of a zener diode can be easily increased by the addition of several ordinary rectifiers.

testing an unknown transformer, use an ohmmeter (R x 1) to determine which wires represent separate windings (by checking continuity) and note which windings exhibit resistance over 100 ohms. The windings with higher resistance can be safely treated as the primary ones. Secondary windings, in the voltage range we are seeking, normally exhibit very low DC resistance (on the order of 2 to 20 ohms). If possible, it's best to avoid transformers with multiple windings. Unused windings are not esthetically pleasing, cause confusion, and generally make a person nervous.

Testing the transformer

Before plugging it in, connect the power cord to the primary and a meter to the secondary (set for AC volts and, initially, a scale around 100 volts). Plug in the cord, adjust your meter scale, and make a note of the AC voltage, then *(safety first)* immediately unplug the cord. Your "garden variety" multimeter, analog or digital, reads RMS voltage. The filtered raw DC obtained from this transformer, assuming the use of a single diode (half-wave rectifier) or a bridge rectifier, will be 1.414 times the measured AC voltage. In the case of a full-wave rectifier, the filtered raw DC is reduced by half. For example, a 12.6 volt (AC) transformer feeding a half-wave or bridge rectifier will yield 12.6 x 1.414, or about 17.8 volts DC at the filter capacitor where a center tapped 12.6 volt AC transformer feeding full-wave rectifiers will yield 17.8 / 2, or about 8.9 volts DC at the filter capacitor (see **Fig. 3**).

"This is a pretty good short course on power supplies in general, and you may even learn a trick or two."

As a rule, the filtered raw DC should be close to twice the desired regulated output for optimum usable output current. The 17.9 volt raw DC in the preceding example would be ideal for use in a 9 VDC regulator, but usable at 6 VDC, with increased heat generated in the circuit, or equally usable at 12 VDC with reduced output current capability. To estimate the current capability of a given transformer, get a large assortment of high-power resistors, hook an amp meter to the filtered output, and clip resistors across the circuit in whatever combination causes the raw DC to load to the desired regulated output voltage. The transformer's current rating is approximately 3 amps (regulated at half the raw DC value) and this method is linear (half the size of a fist ought to be good for around 1.5 amps; twice that size for around 6 amps) but it only applies to transformers with a single secondary. I know this method sounds silly, but a crusty old super-tech once decreed "Mess not with that which works." ("Mess" was *not* the word he used.) Thus was born Dirty John's Axiom, because of which hundreds of young fellas have been better off.)

Design and Construction

The type of rectifier diodes used is unimportant as long as their voltage and current ratings are sufficient for the circuit's needs. If a bridge rectifier is used, it isn't necessary to find a fancy single unit molded bridge assembly; scrounge up four suitable diodes and build your own. A fused output lead is advisable, with the fuse's ampere rating selected to be around twice the expected output load. This circuit is good for a maximum output current of around 5 amperes. To increase the current capability to 8 amperes, connect Q2 to a good heat sink and use two identical transistors in parallel for Q3. The output pass transistor, Q3, must be installed on a heat sink and have adequate ventilation. Installation, and subsequent servicing of Q3 can be made easier by using a

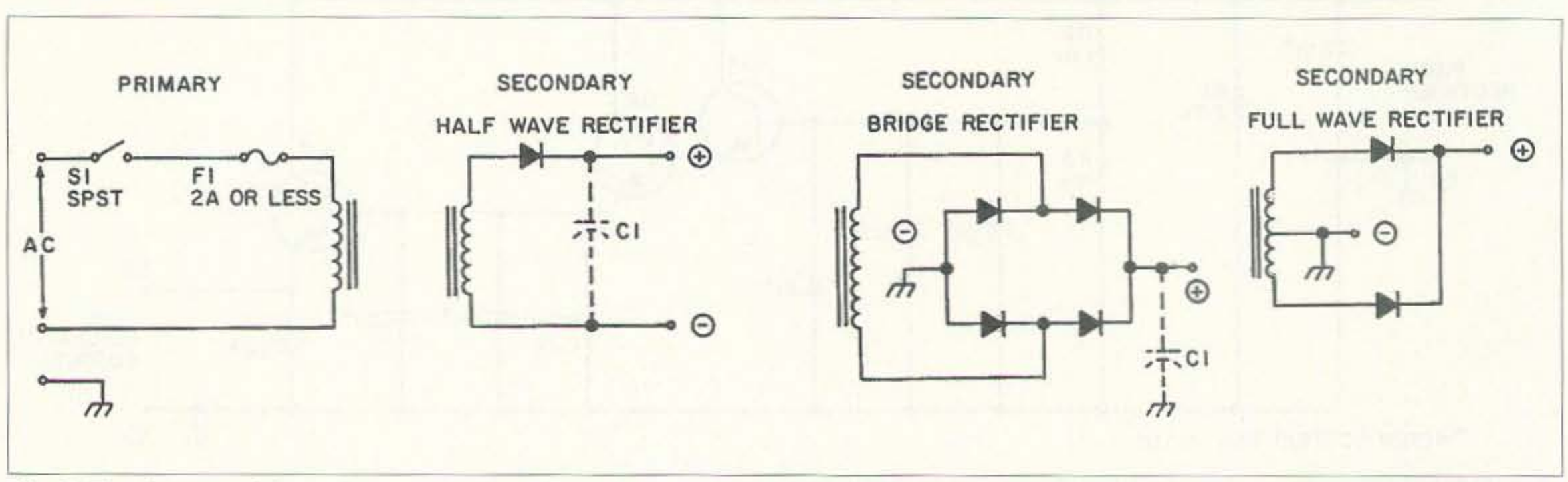


Fig. 3. The three possible configurations of rectifier circuit: Choose one based on the transformers and rectifiers you have available.

socket. If two output pass transistors are used, they can be effectively equalized by installing them three or four inches apart on the heat sink, bridging the emitters with a six-inch piece of solid #16 or #14 bare copper wire, and making the emitter connection, from Q2, to the exact center of this solid wire (this can also be done for the collectors but take care to locate the wires well clear of one another). Quick and easy access to the output can be accomplished by using the two-pin quick disconnects, found in auto parts, hardware, and big variety stores. Remember that the insulated positive lead goes on the supply; the uninsulated positive lead goes on the jumper for whatever gadget you're powering (see **Fig. 4**). This configuration prevents an uninsulated live contact from coming in contact with ground.

If you don't have a single large electrolytic suitable for the filter capacitor (C1) you can use several smaller values, since capacitors in parallel are additive, to build up the desired value. Resistor R1 is a bleeder resistor that serves to discharge the filter capacitor when the circuit is turned off and should be rated for at least a half watt, but the other resistors in the circuit can all be quarter-watt.

Parts List

Q1: 2N2222A (NTE 123)
Q2: 2N5296 (NTE 152)
Q3: 2N3055 (NTE 130)

Capacitors

C1: Electrolytic; 10,000 microfarads, or larger, rated for at least twice the raw DC voltage.
C3 and C5: Electrolytic; minimum 100 to 500 microfarads, rated for at least twice the desired regulated voltage.
C2, C4, and C6: Non–polar, ceramic, Mylar™, or polyester; .005 to .1 microfarads, rated for at least 50 volts or better.
Zener diode

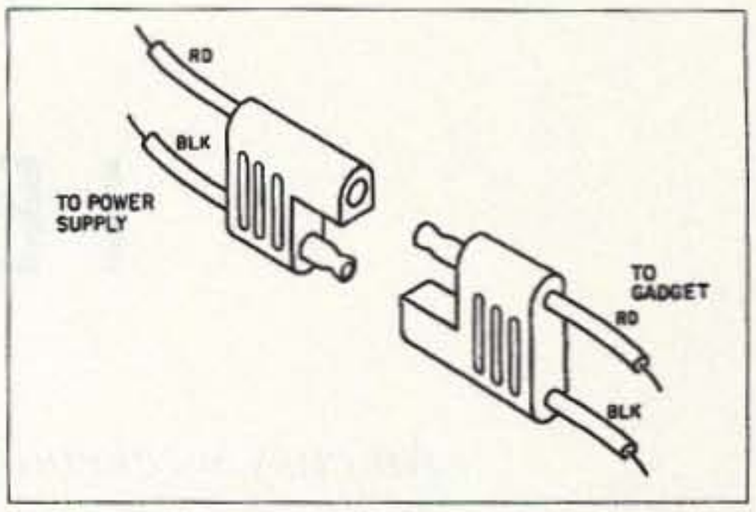


***Fig. 4.** The proper configuration of the two-pin quick-disconnect connector.*

If current demand below 500 mA is required, simply reduce capacitor values by one third and use 2N2222As for all three transistors.

Remember, the batteries you save will feel like money in your pocket, not to mention that you'll use up some of that stuff you've been hoarding in your junk box for the last decade or two, and (here you must imagine a string orchestra playing something stirringly patriotic) on account of those unused batteries not going into a landfill, you'll be helping promote a cleaner planet as well as a better way of life for America. (Truth, justice, and the Hamerican way.) 73

NEVER SAY DIE

Continued from page 76

and the vice president of Pacific Gas and Electric, who got me a great job. The president of the company's wife needed a general manager for her Music Research Foundation. My background in both music and as a professional psychotherapist clinched the deal.

One of my responsibilities was to organize and run monthly meetings which were attended by some of the top psychiatrists, psychoanalysts, and psychologists in the New York City area. At these meetings these professionals discussed the research that had been done on the use of music in psychotherapy.

The end result of this was that I wrote a book which the Foundation proudly published, *Music and Your Moods*. My first book!

Now, let's leap to 1996, understanding that I have a pretty good background in both music and psychiatry, and a recent scientific report that made a lot of sense to me. You're aware that our bodies have a number of sympathetic frequencies that are used during biofeedback. Well, it turns out (surprise!) that our bodies (minds) also are sensitive to rhythms.

In experiments done on both rats and people, classical music has enhanced learning. Rats, for instance, exposed to classical music learned to figure out and remember mazes 43% better than a control group. Another group, exposed to rock music, came in at 85% below the control group. Which may help to explain the phenomenal increase in attention deficit disorder in children in the last couple generations.

If you've read Chris Bird's *Secrets of the Soil*, like I asked you to (it's on my list of books you're crazy if you don't read), you know that farmers who play music for their crops get larger, better lasting crops and have fewer problems with pests. Classical music, that is. When rock 'n' roll is played the plants are stunted and the fruits and vegetables of much poorer quality.

Well, I'm glad to see scientific, controlled tests agree with my intuition. For some reason I've always liked classical music and disliked rock. That's probably what's responsible for my attention surplus disorder. No, we never had any classical music around the house when I was young. My first exposure was

Continued on page 87

Motron ELECTRONICS
310 Garfield St Suite 4
PO Box 2748
Eugene, Oregon 97402
http://www.motron.com

TxID-1
TRANSMITTER FINGERPRINTING SYSTEM
TxID™ Software and IBM/Compatible circuit card.
NOW SHIPPING VERSION 2 SOFTWARE
WITH AUTOMATIC MATCH AND COMPARE!
TxID™ TxPorter™
EXTERNAL ADAPTER FOR MOBILE OPERATION.
CONNECTS THE TxID TO YOUR LAPTOP COMPUTER!
TxID-1 FINGERPRINTING SYSTEM WITH SOFTWARE $699.00 Plus
TxPorter™ MOBILE OPERATION ADAPTER $249.00 S/H
Call for more information.
Info: (541) 687-2118 Fax: (541) 687-2492

CIRCLE 248 ON READER SERVICE CARD

I Built It Myself!

An easy weekend project—build a variable-voltage power supply.

L. VanProoyen K8KWD
8330 Myers Lake NE
Rockford MI 49341

Although most of us have a couple of 12-volt power supplies around, they usually wind up being dedicated to permanent duty. Most of us need a power source with fairly good voltage regulation for projects we're working on, and I frequently need some odd voltage like 5 or 9 volts. So I built a supply that provides DC voltages between 3V and 16V at up to 5A, and it's small and light enough to be portable. It's turned out to be a very handy supply for general bench use.

The circuit

I used an LM317T three-terminal adjustable voltage regulator to control a power transistor that regulates the output voltage level. It's a simple circuit, but quite effective in providing a stable output voltage over a wide current range. The LM317T is capable of handling up to 1.5A by itself. By adding a power transistor, the current regulating capability of the circuit is effectively multiplied severalfold. In this case, with a 2N3055, this regulator circuit can safely handle up to 10A (the maximum rated collector current for a 2N3055 is typically 15A). The circuit is shown in **Fig.1.**

"A defunct piece of consumer electronics might be an excellent source."

The maximum current a supply like this can deliver is mainly limited by the transformer. I used one rated for 25V at 4A continuous duty because I had it lying around. Any available transformer with a secondary winding of 18 to 25 VAC at 2 or more amps will work. A defunct piece of consumer electronics (e.g., a VCR or old transistor TV) might be an excellent source. Obviously, the voltage and current capabilities of the supply will depend on the transformer you have available.

I used a 10k, 10-turn pot for voltage control because I happened to have one, but any 5k to 15k pot will work. Pots, together with dials similar to the one I used, turn up frequently at flea markets. I wanted to limit the variable range of my supply to be within the range of the meter I used, a 15V job, so I added a half-watt 6.8k resistor in parallel with the pot to get the desired adjustable range. You can experiment with this resistor's value to tailor the range you want. The meter is a stock item at Mouser™, but any meter can be made to work.

The remainder of the circuit is fairly conventional. I used discrete rectifier diodes in a bridge circuit, but a full-wave bridge rectifier assembly, such as the Mouser unit, could also be used, so long as you select one with adequate current and voltage ratings. The filter circuit comprises two 4,700 µF capacitors, one at the bridge and the other at the output. It provides a respectively low ripple output. If you need a supply with even lower ripple, add more capacitance.

The application notes on the LM317T advise adding a 0.1 µF bypass capacitor at V_{in}, and 1.0 µF at V_{out} (pins 1 and 2, respectively). I used 35W VDC tantalum capacitors for this; however, these are

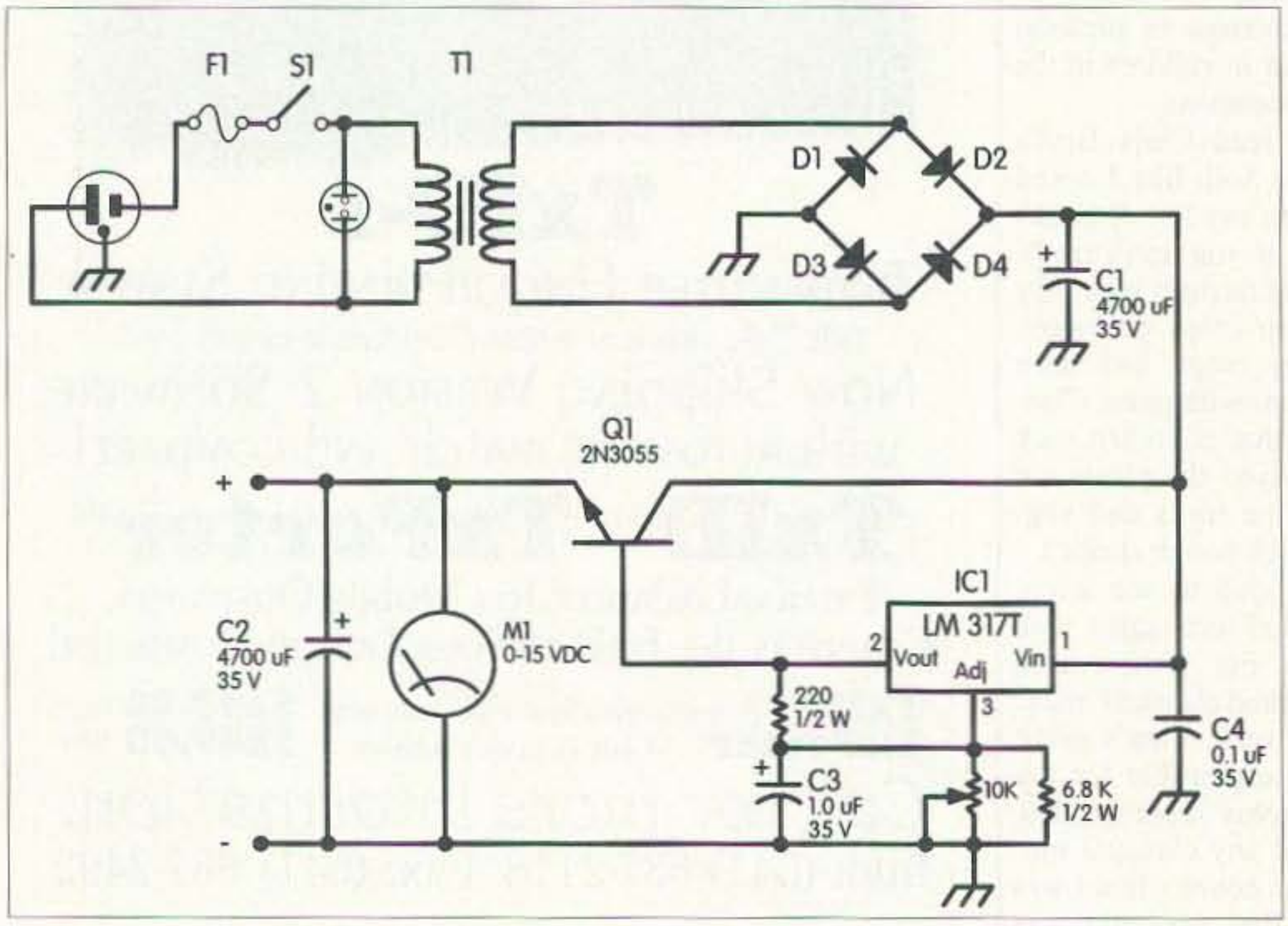


***Fig. 1. The** variable voltage utility power supply circuit.*

not essential. They provide for general circuit stability and good transient response characteristics—traits I wanted for my supply. The application notes also show a nominal 240-ohm value for the resistor between pins 2 and 3 of the regulator IC, but I've found a standard 220-ohm resistor works fine.

Construction

The enclosure shown in **Photos A** and **B** is one marketed by Radio Shack™, but an adequate one can also be ordered through Mouser (#563-CU-3011A, for example).

The layout is up to you. I wanted binding posts on the front panel, but you may prefer them on the rear. Again, Mouser stocks several types of binding posts, and I've seen them at flea markets.

The regulator and power transistor should be mounted on some kind of heat sink. Also, if you use a bridge rectifier assembly, it may require heat-sinking too. I used an "L" bracket, made from a piece of scrap aluminum, visible in **Photo B**. This has proven just fine where the average current runs 2 to 3 amps. You might want to use a standard heat sink if you intend to run higher average currents for extended periods. This could be mounted on the rear panel. Heat sinks and mounting hardware kits, including mica insulators, etc., are stocked by Mouser.

I included a rear-panel fuse holder and a front-panel pilot lamp and power switch as accessories, and used a three-wire grounded AC line cord. These items are definitely "junk box" parts—use whatever you have on hand. Just make sure the lamp voltage and switch current ratings are correct for this circuit. The wiring is essentially point-to-point, using a couple of five-lug tie points to mount the small components associated with the regulator circuit. I soldered connections directly to the regulator and transistor by bending their pins into lugs with needle-nosed pliers. After completing the wiring, I used a couple of tie-wraps to neaten the job.

***Photo A.** K8KWD's variable-voltage utility power supply.*

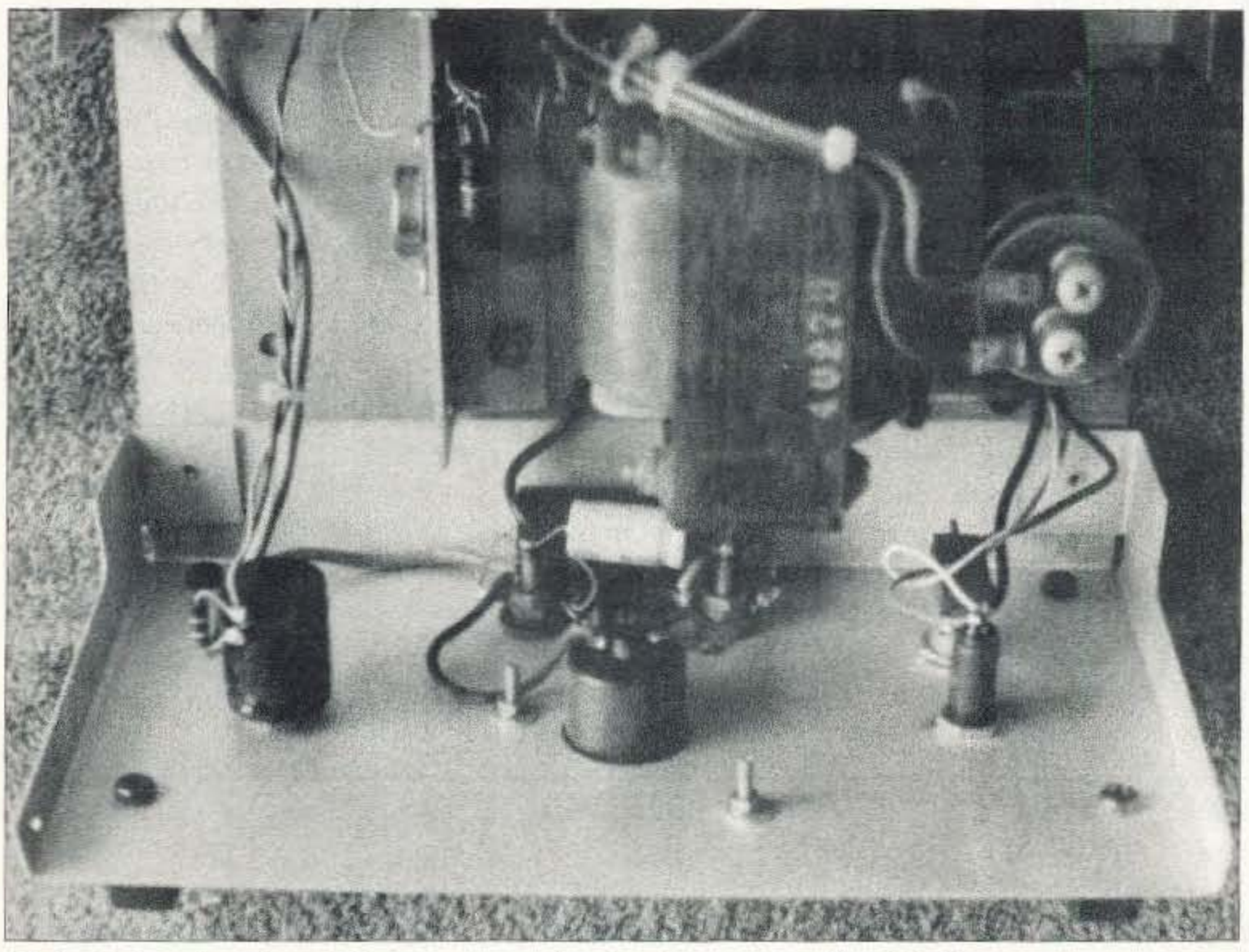


***Photo B.** Interior view of the power supply, showing construction details.*

Operation

I've used this supply for a variety of things, such as a battery charger and a temporary power supply for a 2 meter rig. I mainly use it as a test supply when I'm building something new. It's handy because I frequently need 5, 9, or 12 volts, etc., and I simply dial it in. 73

Parts List

T1	Power transformer, 120 VAC pri., 24 VAC @ 4A sec. (Mouser 553-F8-24)
M1	0-15 VDC voltmeter (Mouser 39TM601, or equivalent)
Q1	2N3055 (Mouser 511-2N3055)
IC1	LM317T (Mouser 511-LM317T)
D1-4	Rectifier, 6A @ 50 PIV (Mouser 583-BR605)
C1-2	4700 µF @ 35 VDC (Mouser 539-SKR35V4700)
C3	1 µF @ 35 VDC tantalum (Mouser 539-SKR50V1.0)
C4	0.1 µF @ 35 VDC tantalum (Radio Shack 272-1432)
F1, S1	Lamp, as available

Ask Kaboom

Your Tech Answer Man

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

Still stressed out!

Last time, we were examining the effects of the three kinds of stress that damage electronic gear: mechanical, electrical and thermal. This time, let's take a look at the components themselves and how the three stresses affect each one.

Semiconductors

Mechanical stress is rarely a factor in semiconductor failure. You can throw a transistor or an integrated circuit across the room all you want, and it'll still work. That wasn't always the case, though. Early point-contact devices and germanium parts were mechanically fragile, but that era ended around 30 years ago. Today's parts are quite hardy. You pretty much have to crush modern semiconductors to kill them.

Electrical stress is another matter! While bipolar transistors will stand plenty of abuse, overvoltage can punch holes through their junctions, shorting them out. All semiconductors exhibit this failure mode, but CMOS and FET parts are much more susceptible to it than are bipolars. Typically, "overvoltage" situations occur when inductance is involved, such as with tuned circuits leading to antennas in the output stages of radio transmitters; that's why SWR is a problem for solid-state output stages. Another common culprit is a transformer or other coil in a switching power supply. The reason inductance causes trouble is that it can transform current into voltage. The result is that voltages can be present which are actually higher than the power supply voltage used to generate the signals, and those voltages may not be entirely predictable, as in the SWR example above.

Pulling a lot of power through semiconductors doesn't directly destroy them, but the resulting heat sure can. Probably more semiconductors are blown by their own heat than by anything else. Of course, small-signal stages don't make significant heat (at least unless something goes seriously wrong), because the currents involved are quite small; so, at today's low circuit voltages, the resulting power in watts is very tiny, typically in the milliwatts. Output stages and power supply circuits, though, can make quite a bit of heat. Why do semiconductors get hot? It comes down to resistance and efficiency; all semis have some resistance (as does anything besides a superconductor), so none is completely efficient. The product of inefficiency is heat. Analog circuits, in which the active elements are often in their linear regions (somewhere between fully on and fully off), are the least efficient, because the semiconductor is acting as a variable resistor. Digital circuits, which turn on fully saturated (as far as they can go), are considerably more efficient, but even they produce their share of heat. That's why heat sinks are both important and common, and why today's big microprocessors often have those little fans on top of them.

"You can throw a transistor or an integrated circuit across the room all you want, and it'll still work."

Externally generated thermal stresses are rarely a problem for semiconductors. I suppose it's possible for one transistor to generate enough heat to damage another one mounted on the same heat sink, but it certainly isn't likely. With semiconductors, most thermal problems result from internal heating.

When semiconductors fail, they can become either open or shorted. Many open parts end up that way after being momentarily internally shorted; the resulting "overcurrent" then overheats the part and opens the junctions. That's why you may find an open transistor and a blown fuse at the same time!

Capacitors

There are so many kinds of capacitors that it's hard to classify them all as the same parts! The major kinds, including electrolytic, ceramic and plastic, have different characteristics, both in operation and failure.

"Caps shouldn't get hot!"

Resistors

Mechanical stress sometimes fractures power resistors, especially when they're hot, but resistors are generally hard to break. They can be easily snapped when bent, though, as they are rigid and brittle, much like glass or clay. So, if you sit on your HT, expect some broken resistors. (Of course, the PC board will probably be so far gone that it won't matter.)

Pulling too much power through a resistor is the easiest, and most common, way to destroy it. In tube gear, resistors actually used to catch on fire now and then, but that's pretty rare today. More likely, a resistor killed by an over-power situation will show some blackening, and it may even be cracked in half, but it won't be burned to a crisp.

It's important to remember that resistors are supposed to generate heat; that's the natural product of resisting current flow. Of course, it's not the heat we want, it's the resistance itself, because it limits current flow or reduces voltage. But, we can't escape the heat. That's why resistors are rated in watts; the heat generated is directly proportional to the power (in watts) going through the resistor.

Resistors are not active elements, so they don't cause their own demises, at least not very often. In the vast majority of cases, a failed resistor means something else has gone, too, causing a short circuit that pulls excessive power through the resistor. That's an important clue to remember when you're servicing a circuit and come across a burned or opened resistor (they virtually never fail shorted). Look for the connected semiconductor and check it out; either it or something driving it will be shorted.

Electrolytic capacitors, including tantalums, use a thin oxide layer to electrically separate the two sides. That layer gives them properties similar to those of semiconductors, particularly where mechanical and electrical stresses are concerned. It's pretty hard to physically damage an electrolytic cap unless you step on it, but a voltage significantly higher than the part's rating will punch holes through the oxide and short out the part. Plenty of electrolytics die from "overvoltage". But, don't manufacturers take the voltage rating into account when the circuits are designed? Of course they do, but some circuits exhibit voltage variations that exceed the caps' ratings. Also, failure of another part can subject a capacitor to voltages not anticipated by the circuit designer. For example, if a 5-volt regulator shorts out and feeds 12 volts to a circuit intended for 5 volts, some 6-volt tantalum caps may get blown in a hurry. In my experience, regular aluminum electrolytics are quite a bit more tolerant of short-term overvoltages than are tantalums; those little things short out very easily. I've seen plenty of shorted tantalums, even in circuits where the voltages never exceeded the caps' ratings. I consider tantalum caps to be among the least reliable parts in our products. Why use them? They offer lots of capacitance in a small package, are closer to their rated capacitance than aluminum caps, and are stable over time. I still don't like the things, simply because they short out so often.

Internal heating of an electrolytic capacitor indicates a problem, except in very rare circumstances. Basically, caps shouldn't get hot! When one does, it's probably getting ready to die. I've seen some

electrolytics in switching power supplies that got noticeably warm in normal operation, but even they didn't get hot. Usually, a hot cap means it's leaking, so it's acting like a resistor. If you see a hot cap, change it, unless you're sure it should be that way.

Externally generated heat can kill electrolytics, though, mostly through drying the electrolyte out of them over a period of years. I've seen some whose capacitance slowly went down until the cap couldn't do its job, because it was basically an open circuit. The heat of tubes used to do that to electrolytics all the time, and the caps were made out of paper in those days, making the problem even worse. With today's sealed aluminum parts and cool circuits, it shouldn't happen, but it still does now and then. The dried-out caps I've seen have all been near heat sinks that got very hot in normal operation, like you might find in the output stages of RF and audio power amplifiers. A smart designer will keep the caps away from the heat sinks.

Ceramic caps are among the most reliable parts in existence. They can be shattered by strong force, but, unless you bend one, you won't break it. And, unless something has exceeded their voltage ratings, you'll probably never see a bad one. I've only seen two, I think, in all the years I've been in electronics! The basic design is pretty foolproof: two plates separated by a ceramic insulator. It doesn't take much thickness for the ceramic to withstand pretty high voltages. Still, some small ceramic caps are rated at around only 50 volts, which isn't all that high. I've never seen a shorted ceramic part, and the two open ones I've run into have both had mechanical failures where the leads connected to the plates.

As with all caps, internal heating should not occur. Some ceramic caps used to be coated with a wax-like substance which would bubble if the cap got hot. Modern caps don't use the stuff. External heat could damage a ceramic cap, I suppose, but I haven't seen it happen. The things are pretty indestructible.

Well, I think we've covered enough for one column, so we'll continue this next time. Until then, 73 de KB1UM. 73

Number 73 on your Feedback card

HAM HELP

We are happy to provide Ham Help free on a space-available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double-spaced, on a full 8-1/2" x 11" sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully. A 1, for example, can be misread as the letters I, i, l, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

WANTED: Manual and schematic for an RCA 8-channel, 3-band crystal scanner, model 16S300. Please contact *Glenn Torres KB5AYO, 584 Central Ave., Reserve LA 70084.*

WANTED: Manual for KENWOOD 2m TR-2500 HT. I'm particularly interested in programming instructions. Also, I need connection instructions to install an SS-32 S MP CTCSS Tone Encoder Board. Will pay all costs. *Ron Zemljak N7LDQ, 140 Maude S Canyon, Butte MT 59701. Tel. (406) 494-5453.* Thanks.

I need schematics for HEATHKIT SB300 and SB400. Also a partial manual for Model SB313. *Robert Schlegel N7BH, 2302 286 Street East, Roy WA 98580.*

NEEDED: Manual/schematic and help for ROBOT SSTV Camera and Monitor 70. Also, is anyone out there using an AMIGA Computer with their ham radio? *Tony Bodo WA9YOZ, 4623 E. 25th Ave., Lake Station IN 46405.*

WANTED: A copy of the tube data test chart for a MERCURY Model 1101 Tube Tester. I will gladly pay for the info. Thanks. *Bill Axsom K4GDI, 2098 E 500 N, Rushville IN 46173.*

Number 83 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

New Fuji in orbit

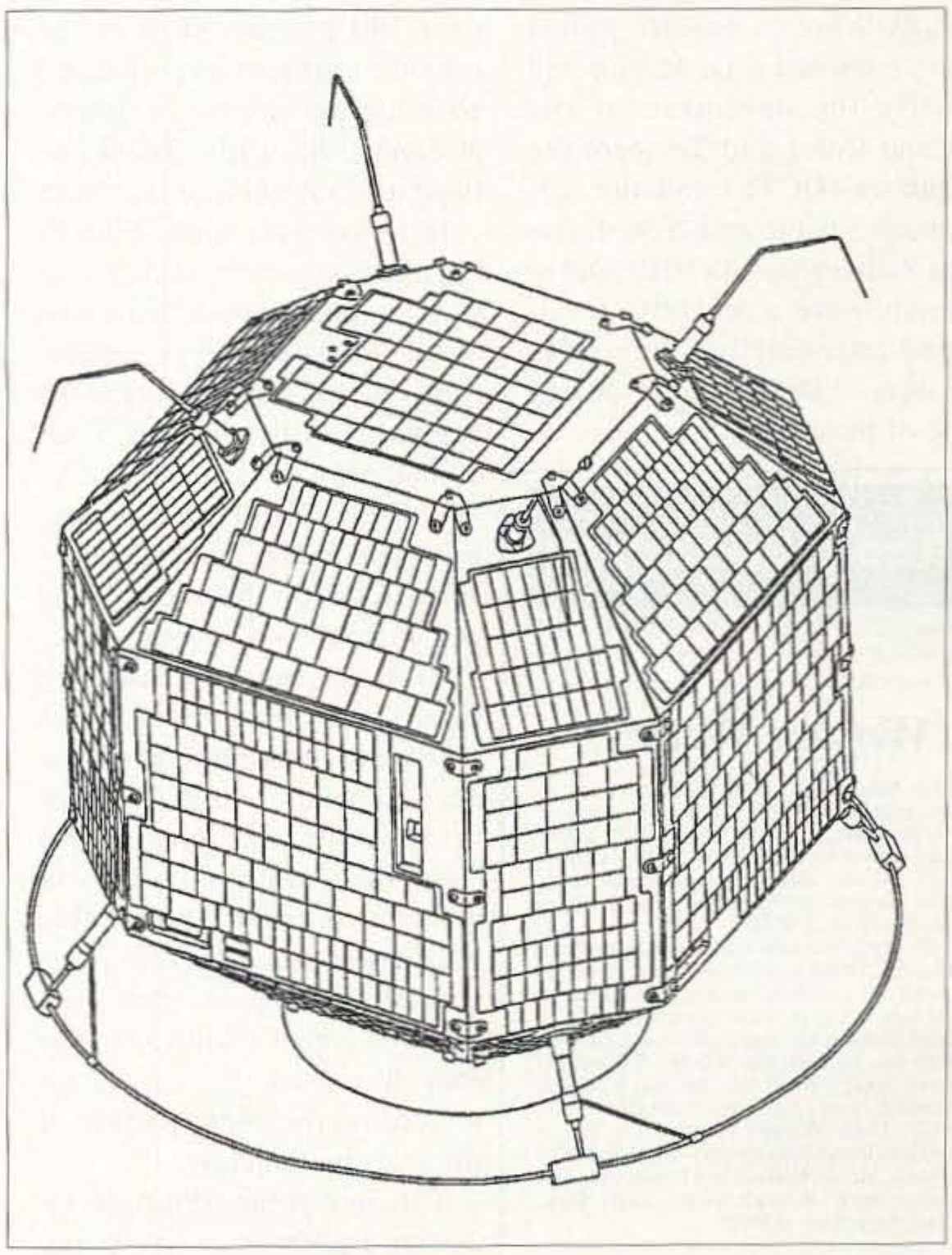
On Saturday, August 17, 1996, Fuji-OSCAR-29 was sent into orbit from the Tanegashima Space Center in southern Japan. Our newest Orbiting Satellite Carrying Amateur Radio was launched on a Japanese H-II rocket with the Advanced Earth Observing Satellite (ADEOS) by NASDA (Japan's National Development Agency). F-O-29 is performing well. It has both digital and analog Mode "J" transponders and promises to be an exciting addition to the hamsat fleet.

The rocket

NASDA has been in the space business since 1975. The latest and largest production launch vehicle is called the H-II, developed to meet the demands for large spacecraft of the 1990s. It is a two-stage vehicle capable of delivering a two-ton satellite to geostationary orbit.

The first H-II rocket was launched in early 1994 carrying the Orbital Re-entry Experiment (OREX) and other smaller payloads. Later that year the Engineering Test Satellite-VI (ETS-VI) was placed in orbit by the second H-II rocket. The third H-II test vehicle also carried multiple payloads and was launched in March 1995. One of the payloads, the Space Flyer Unit (SPU), operated as an orbital unmanned laboratory for various experiments. It was retrieved using the robot arm on the Space Shuttle Endeavour by astronaut/mission specialist Koichi Wakata.

Fuji-OSCAR-29 went to orbit on the fourth H-II vehicle. This version of the H-II included two Small Solid Boosters (SSB) on



the first stage to accommodate the payload weight and a large fairing around the satellites. The liquid-fuel rockets for both stages use liquid hydrogen and oxygen. The H-II launcher with payload stands around 150 feet, just a bit shorter than the Space Shuttle with external fuel tank.

ADEOS

The ADEOS satellite is the largest satellite Japan has ever developed, weighing approximately 3.5 tons. While the H-II rocket system can place two tons in geostationary orbit, it is also capable of sending nearly four tons to this mission 's target orbit, 800-km high, and sun-synchronous. After full deployment, ADEOS, with its solar array, has a wingspan of nearly 100 feet. The main body, with antennas and sensors extended, is nearly 35 feet long and 22 feet thick.

The main objectives of ADEOS are to acquire global environmental data, develop and verify the operation of the Ocean Color and Temperature Scanner (OCTS) and the Advanced Visible and Near-Infrared Radiometer (AVNIR), and to demonstrate a recently developed inter-satellite data relay system. ADEOS has a design life of three years.

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Wayne Writes!

WG5 **Submarine Life In World War II** by Wayne Green W2NSD/1 60p. Wayne's stories of his adventures on the USS Drum SS-228 on five war patrols in the Pacific in 1943-1945. What's it really like on a submarine when you are being depth charged? And what's the day to day life on a submarine like? $8.00

WG6 **Uncle Wayne's Caribbean Adventures** 96 pages. Wayne's adventures scuba diving all around the Caribbean, visiting ham operators, and sight seeing. If you are interested in how to travel economically, you'll get some great ideas from this. He starts out with his "Diving, the Wimp Sport." You'll love the visit to eleven islands in 21 days trip. A measily $8.00

WG7 **Uncle Wayne's Travels**–52 p. Wayne travels to Russia, London, Aspen, and St. Pierre, Munich, Vienna, Krakow, and Prague without it costing nearly as much as you might think. Cheap for you too, at $8.00

JAS-2, FUJI-3, F-O-29

Prior to launch, the new Japanese hamsat was called JAS-2. After launch it became Fuji-3. Its two predecessors were called JAS-1A and JAS-1B before their launch, and Fuji-1 and Fuji-2 after launch. The addition of the "OSCAR" designation was made later. Project OSCAR in California built the first ham-radio satellite over 35 years ago. OSCAR-1 transmitted a simple CW beacon on 2 meters for a few weeks until re-entry. Fuji-OSCAR-29 has a complex array of computer systems and radio gear in its small frame, and should last several years. Fuji-OSCAR-20 has been in orbit for six years, and is still doing a great job, when properly illuminated.

"The H-II launcher with payload stands around 150 feet, just a bit shorter than the Space Shuttle."

F-O-29 has 26 sides, giving the basic octagonal shape a spherical look. It is about 20 inches wide and weighs just over 100 pounds. Most of the outside surfaces are covered with high-efficiency, gallium-arsenide solar cells. Thanks to these new solar cells on the large exterior surface area, F-O-29 has plenty of power available for the communication and command systems. Power generation is more than 22 watts at the beginning of life in orbit. F-O-20 had only 10 watts available, and F-O-12 only 6.5 watts. Enough power is available on F-O-29 to run all the experiments and computers simultaneously.

Attitude control is achieved using a sun sensor, geomagnetic sensor and magnetorquer, all under computer control. The goal is to spin the satellite at 10 rpm along the vertical axis, perpendicular to the orbital plane. This will keep the 2 meter, ring-shaped turnstile antenna continually aimed earthward. The four 70 cm whip antennas are located on the upper portion of the satellite structure.

The final polar orbit for F-O-29 has a perigee, or low point, around 860 km. The apogee, or high point, is just over 1300 km. The slightly elliptical orbit can provide users with better low-earth- orbit DX opportunities during apogee times.

JA Uplink	145.900 to 146.000 MHz
JA Downlink	435.900 to 435.800 MHz
JA Beacon	435.795 MHz 100mW CW
JD Uplink	145.850, 145.870, 145.890, 145.910 Mhz AFSK (FM) 1200 bps AX.25 Manchester 9600 bps FSK on 145.870 MHz only
JD Downlink	435.910 MHz 1200 bps BPSK (SSB) AX.25 using PSK modem or 9600 bps FSK (FM) AX.25 using standard 9600 bps modem or "Digitalker " FM voice

Table 1. Band plan for Fuji-OSCAR-29

Communications

All uplinks are on 2 meters, with downlinks on 70 cm. This frequency combination is typically called Mode "J," in honor of the JAMSAT-built transponder that went into orbit on AMSAT-OSCAR-8 in 1978. Mode "J" has become the primary transponder configuration for many digital and analog amateur-radio satellites.

F-O-29 's digital package uses 1200 or 9600-baud AX.25 packet protocol, with four discrete 1200-baud, FSK (frequency-shift keying) uplink channels (145.85, 145.87, 145.89 and 145.91 MHz), and one PSK (phase-shift keying) channel for the downlink on 435.91 MHz. The 9600-baud FSK uplink is on 147.87 MHz. The corresponding 9600-baud FSK downlink is on 435.91 MHz, same as the 1200-baud PSK transmitter. The 1200-baud and 9600-baud speeds do not operate simultaneously, but are scheduled by the ground-control station.

The analog transponder is 100 kHz wide and inverting. A lower sideband signal transmitted by a ground station high in the transponder uplink passband (145.9 to 146 MHz) will be heard on upper sideband low in the downlink passband (435.9 to 435.8 MHz). Most communications can be heard near the center of the downlink near 435.850 MHz. Typically, CW operation is below the center, while voice is used above center. The total transponder power output is 1 watt. A 100-mW CW beacon is associated with the analog transponder on 435.795.

An additional "Digitalker" system has been added to F-O-29. It will allow voice messages to be uploaded to the satellite for continuous repeating transmission on 435.91 MHz FM when the packet system is not active. The FM signal should be easily heard with only a hand-held scanner or HT.

"Thanks to the gallium-arsenide solar cells, F-O-29 has plenty of power available."

More information

Additional data about the newest hamsat can be easily found on the Internet. The best source is from the Japanese Amateur Radio League. The URL (Universal Resource Locator) is: http://www.jarl.or.jp/jarl/jas-2/. Another good source of information can be found at the Southeast Michigan Area AMSAT Net web site: http://www/wwnet.com/~jsmyth/index.html. Don't forget the home page for the Radio Amateur Satellite Corporation. It's URL is: http://www.amsat.org. More information about NASDA, the Japanese version of NASA, can be found at: http://www/nasda.go.jp/. F-O-29 promises to be a lot of fun, in addition to being a valuable orbiting resource. 73

QRP

Number 85 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Egad! It's November already. There may be just enough time to throw one more project together before the holidays.

Since time is rather short, I'll look at several easy-to-build kits. Many of these kits cost under fifty bucks. All of them can be assembled by beginners in a few hours. Experienced builders can be using the kits in less than half an hour.

The "easy" kits

Here is one for the rest of us. Designed by Wayne Burdick N6KR, it's about as simple as you can make a transceiver and still be able to make contacts with it. The rig is called the 49er.

In a nutshell, the 49er is a very tiny transceiver built for operation on 40 meters. Depending on the supply voltage, you can expect to see about 250 mW with a 9 volt battery, and about 500 mW at 12 volts.

Frequency control is by VXO. The fundamental crystal frequency is 7.040. Depending on how you assemble your unit, you can expect to see around 7.037 to 7.042 MHz. Your mileage will vary.

The 49er also sports full QSK operation and very low current demand on receive. Best of all, there's not a single toroid to wind!

Space restrictions do not allow me to reproduce the entire circuit description or the artwork for the PC board.

Condensed circuit description

The 49er is based around a NE602 mixer. This mixer is the entire direct conversion receiver. By using a panel-mounted capacitor with a series inductor, the crystal can be pulled up and down in frequency about 5 kHz. The NE602 is the oscillator.

To help keep down AM detection, Wayne uses a tuned circuit ahead of the NE602. A brute force RF gain control is available so you can ride herd on the incoming signal. This gain control is also used as the volume control. There is no separate volume control used in the 49er.

On the transmit side, there are only two stages, a buffer and a PA. Emitter keying is used on the buffer. The PA is biased for class C operation.

Odds and ends

I have not built a 49er. I know many, many people have. Even though this is a really simple project, at most the 49er will do half a watt. You should be a well-seasoned low power freak to tackle milliwatting on 40 meters.

The 49er does not have a sidetone. That will be up to you. The 2N3866, the final, gets very upset at the least amount of SWR on the feedline. A really good 50 ohm load will be required at all times, unless you have access to a barrel of 2N3866s to use up.

You can get a PC board for the 49er from: Jim Gates, 3241 Eastwood Rd., Sacramento CA 95821. The price is $5. Make checks out to Jim Gates, *not* to NorCal. Price includes shipping.

The DYI keyer

This is one of my favorites! The DYI keyer is a very simple digital CW keyer. It makes perfect dots and dashes. It is *not*, repeat *not*, an iambic keyer. The DYI keyer does not generate a sidetone either.

But, on the other hand, it's very, very easy to assemble. Using only two simple CMOS ICs and a handful of parts, just about anyone can put the keyer together. There's nothing different here from the basic design of the original version. However, I did add .1 inch headers for the input and output lines. Also on a .1 inch header is the speed control. This makes connecting the DYI keyer into your existing rig really easy. It also gives the finished project a commercial look. The DYI keyer is $15 postpaid. Get one by sending a check or money order to me at the above address.

From the repair bench

I have a 2 meter transceiver on all the time for packet. Even though the rig is running from the battery bank and its nominal 12.5 volts, the dial lamps burned out. Thinking "This is no biggie," I placed a call to the manufacturer for replacement lamps. Whoa! Replacement lamps for this rig are $4.65 each! To make matters even worse, there are *six* lamps.

Looking though the current Hosfelt catalog, I spied some lamps that should work. At a buck a shot, why not give them a try? As it turned out, they are a perfect fit. I'm telling you this because these lights may be just what you have been looking for. They will easily fit between the dial and subchassis of an HW-9. They would be great for lighting up the meter on your HW-8. With a bit of work, you could press some in between an LCD digital panel for backlighting. And you just can't beat the price! If you're interested, the part number is 25-290. Oh yes! Call Hosfelt at (800) 524-6464; ask for one of their catalogs.

Hot HW-9s

Right after the Dayton HamVention, I got calls about HW-9 rigs running with very hot finals. I've been down this road before, but it's worth one more trip.

If your HW-9 seems to be producing more than 4 watts of power, it's very likely generating more RF as well. Along with the fundamental frequency, there's all kinds of stuff squirting out of the transmitter. This problem seems to occur more often than not on 15 meters and 10 meters.

Perhaps the best giveaway is if one or both of the finals are running hot. So hot, in fact, that you'll leave a patch of skin on the heat sink if you touch it.

The fix is generally easy. Most of the time, one or more stages before the final are out of tune. Go back and retune the mixers and oscillators. Don't necessarily go after maximum power. Follow the directions to the letter. In eight out of 10 cases I've had on my repair bench, retuning the mixer/oscillator stages fixed the problem. You may have to replace one of the final transistors if you're unlucky.

New QRP transceiver from Ten-Tec

Yup! That's right. Ten-Tec will be selling a new 40 meter transceiver kit. Maybe by the time you read this. Right now, most of the details are still kinda gray. Specific features have not been announced, but look for full CW QSK, a Ten-Tec tradition!

If you would like to send Ten-Tec your ideas of the perfect QRP rig, or fixes to old problems with current QRP technology, send them to: Scott Robbins KY2P, c/o Ten-Tec, 1185 Dolly Parton Pkwy, Sevierville TN 37862.

The OHR-100 from Oak Hills Research

Another new rig from Oak Hills Research is underway which will replace the very popular Explorer II. The new rig, called the OHR-100, will be a single-band CW transceiver. You can pick any band you want, *except for 15 meters*. Dick has put a lot of work into this new transceiver and has made dozens of improvements. Look for a true sine wave sidetone oscillator. Also, for improved receiver performance, a double-tuned bandpass filter.

By the time this hits the newsstands, the OHR-100 should be shipping. The price is $159.95. The OHR-100 is available from: Oak Hills Research, 20879 Madison St., Big Rapids MI 49307.

Books and more books

There's an old saying that "You can't work 'em if you can't hear 'em." Most of us have no idea when to even begin listening. But there's help from Bob Brown NM7M. His book *The Little Pistol's Guide to HF Propagation* may be the ticket between static crashes and filled log books. You can pick up one of Bob's books from: World Radio Books, ETC, P.O. Box 189490, Sacramento CA 95818.

I'm getting down to the bottom of the stack of HW-8 handbooks. They are still only $11, and that includes first class postage. DX is $14 airmail. By the way, if you're in VE land, the price is the same as for US, $11. When these are gone, there will be no more printed. Get your copy from me at the address at the top of this column. 73

A 20-Foot Sky Hook

Build it for less than $10!

Joseph M. Plesich W8DYF
173 Brockton Road
Steubenville OH 43952

If you have a need for a neat little mast in the 20-foot category, here's one that is inexpensive and easy to construct. In fact, you can have this one up in less than an hour and have enough change from a ten-dollar bill to buy a cup of coffee.

This mast is not a new idea of mine, but I like it so much that I'd like to share it with you. I first read about it in Ed Noll's *Easy-Up Antennas*, published by Howard Sams, a book that should be in the library of every ham who likes to play with antennas.

"You can have this one up in less than an hour and have change from a ten-dollar bill to buy a cup of coffee."

To construct this mast, go to your local builders' supply store and buy two pieces of 10-foot schedule 40 PVC pipe—one 2 inches in diameter and one 1.5 inches in diameter. While I was buying the pipe, I picked up some 1/4-inch by 3-inch bolts with nuts and lock washers to connect the two pieces of pipe. I also bought two 3-inch eyebolts to put at the top of the mast.

When I got home, I laid the two pipes end-to-end on the patio. I slid the smaller pipe into the larger one about a foot. Next, I drilled two 1/4-inch holes about 9 inches apart and fastened the two pieces of pipe together with the 1/4-inch bolts, nuts, and lock washers. At the top of the mast I drilled two 1/4-inch holes in the smaller pipe and put the eyebolts in these holes. I cut two pieces of 3/32-inch black Dacron™ rope about 40 feet long and put them through the eyebolts. These ropes can be used to haul up an antenna, or be used as guys. The mast is now complete.

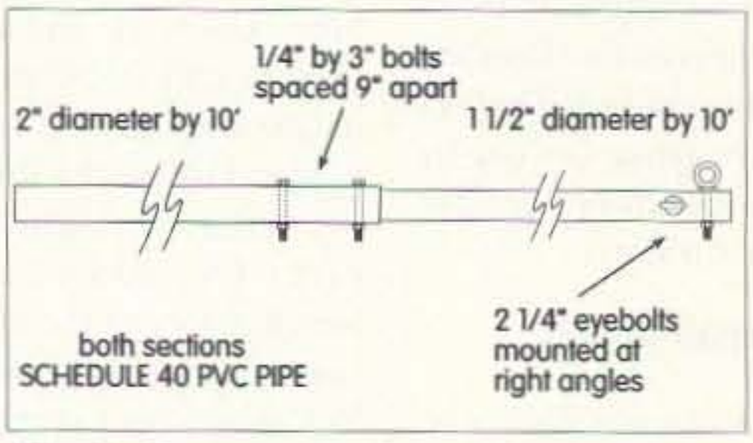


Fig. 1. *Construction details for the 20-foot sky hook.*

Next, I pounded a fence post into the ground and lifted the mast onto it. The mast is surprisingly light and easy to handle—except in a strong wind. However, I made the mistake of buying a lightweight fence post. When I slipped the mast over it and started to pull my antenna up with the rope, the fence post bent. I rummaged through the garage, found a piece of TV mast, drove it into the ground, and slipped the mast over it. The bending problem was cured. Next time, I'll spend the extra buck and get a heavy-duty steel post.

Now that you have found out how simple and inexpensive this mast is to construct, here are some suggestions on how you can use it:

- You can use it to hold up the center of an inverted-V antenna. Use the same type of mast, only with one section of pipe, to hold up the ends of the antenna.

- Construct a vertical for 10, 12, 15, or 20 meters by running a wire up the length of the mast. Feed it with coax at the bottom, and don't forget the radials.

- Plant three or four of these masts around your property and use them to hold up a triangle or loop antenna.

- Use it to support the ends of your sloper.

- It makes a great lightweight mast for Field Day and portable operation.

Currently, I'm using one to hold my 300 ohm feedline away from my house so it doesn't touch the roof or gutter. As you can see, there are many uses for this simple mast. I'm sure you will be able to think of others to fit your particular needs and location. Build one or two and see for yourself. 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Great ARRL Books!

AR1996 **The ARRL 1996 Handbook** includes the latest innovations in ham radio, plus all the fundamental data. $38.00
AR1086-4 **ARRL Operating Manual** Information on how to make the best use of your station, including interfacing with home computers, OSCAR, UHF-VHF. $18.00
AR4173 **Now You're Talking! All You Need To Get Your First Ham Radio License**–A complete study guide for the Technician and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. $19.00
AR4734 **ARRL Antenna Book**. Best and most highly regarded info on antenna fundamentals, transmission lines, design, and construction of wire antennas. $30.00
AR0402 **Solid State Design** Good basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment $15.00
AR4661 **ARRL's Antennas & Techniques for Low-Band DXing** can be your ticket to low-band success. $20.00
AR3851 **Hints and Kinks** Ideas for setting up your gear for comfortable efficient operation. $10.00
AR3185 **The Satellite Experimenter's Handbook** by Martin Davidoff K2UBC Expanded and revised. Focusing on satellites built by and for the international radio amateur community $20.00
AR4645 **Satellite Anthology** The latest information on OSCARx 9 throu 13 as well as the RS satelittes, the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! $10.00
AR4483 **Weather Satellite Handbook** by Dr. Ralph Taggart WA8DQT. Expanded and revised to reflect today's weather-fax satellite technology. $20.00
AR4653 **Companion Software for Weather Satellite Handbook** 5-1/4" MS-DOS floppy $10.00

PROPAGATION

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Special for November

November is expected to be a very quiet month compared to October. You may expect some geophysical disturbances around the 1st and 2nd, and again around the 22nd and 23rd. The remainder of the month will see conditions between Fair and Good. The best days are likely to occur between the 6th and 15th, when the ionosphere is expected to be quiet. With luck, we may see elevated solar flux values (75-80 or so) during this period. Do not expect miracles, however, as we're still in the sunspot doldrums, and probably will remain there at least for another three or four months. I'm hoping to be able to forecast a vigorous Spring '97 HF propagation season.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

NOVEMBER 1996

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P	2 P
3 P-F	4 F	5 F-G	6 G	7 G	8 G	9 G
10 G	11 G	12 G	13 G	14 G	15 G	16 G-F
17 F	18 F-G	19 G-F	20 F	21 F-P	22 P	23 P
24 P-F	25 F	26 F-G	27 G	28 G-F	29 F	30 F-G

10-12 meters

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

15-17 meters

DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the U.S.

20 meters

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

30-40 meters

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

80 meters

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar), and also short-skip during hours of darkness to 1,500 miles or more.

160 meters

Following the usual summertime slump, this band ought to begin to come alive again during the hours of darkness when QRN permits. Try the days marked (G) on the calendar for best results. DX toward the east until midnight, and to other areas afterwards until dawn. Short-skip to 1,500 miles will prevail when the band is quiet. W1XU. 73

NEVER SAY DIE

Continued from page 79

when I was about seven and my family had dinner at a friend's house where he played his classical records. It was love at first hearing for me. From then on I'd often ride my bike the 10 miles to his house just to listen to his records. The first record I ever bought (I still have it) was Strauss' Tales from the Vienna Woods and The Blue Danube.

Are you exposing your children and grandchildren to "good" music, or letting other kids suck them into rock as a way of life and probably resulting mediocrity?

Maybe I should reprint my recommended 100-CD classical library list that I published in *CD Review* for people who don't know what's "good." I'll add it to my list of things I should do when I have time. 73

QUICK, AND SIMPLE!!!
Flash cards NOVICE thru EXTRA theory. Key-words underlined. COMPACT - EASY Over 9000 sets used.
A card for each question!
NOVICE $11.95
TECHNICIAN $10.95
GENERAL $9.95
ADVANCED $19.95
EXTRA $14.45
Shipping 1 - $4.00
2 or more - $5.00
Call Today!
1-800-OKK-HAMS
VIS STUDY GUIDES
P.O. BOX 17377
HATTIESBURG, MS 39404
CIRCLE 104 ON READER SERVICE CARD

Number 88 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)–comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine,* Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the January 1997 classified ad section is November 12, 1996.

UNIQUE HAND-CRAFTED CALL SIGN PLAQUES. Rustic pine board hand painted by artist with 20 years experience. Send SASE for free brochure with design descriptions. **Hamprints**, P.O. Box 23, Mark IL, 61340. BNB5002

BRIGHTEN UP YOUR SHACK! Eleven page Compendium filled with ideas, tips, and instructions for building Illuminated Maps. Send $5.00 (TX res. add $0.41 tax) to **Pineapple Paradise Radio Co.,** P.O. Box 370692, El Paso TX 79937-0692. BNB005

SURPLUS electronic test equipment for sale at deep discounts. Write, phone, or fax to request the current list. **Jim Stevenson,** 3401 Sunny Slope Road, Bridgewater NJ 08807. Phone: (908) 722-6157, Fax: (908) 722-6391. BNB2084

MORSE CODE COMPUTER INTERFACES $49.95, with CW Filter $79.95, Free Shareware and Ham Catalog. **Dynamic Electronics**, Box 896, Hartselle AL 35640, (205) 773-2758, FAX (205) 773-7295. BNB1034

IT'S BACK! The return of the HW-8 Handbook! Second printing. Modifications for the Heath QRP rigs. First class mail $11. DX add $4 for airmail shipping. **Mike Bryce, WB8VGE,** 2225 Mayflower NW, Massillon OH 44647. BNB404

Wanted

Ham-related photos for possible cover pictures. Contact Frances at 800-274-7373 for details.

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925-5899, 8-4 ET. BNB964

DSS BIBLE. New Book Includes: Software, Schematics, Chip Programmer Plans, Reviews & More! $49.95 VISA/MC **TELECODE** 1-520-726-2833. BNB1024

PRINTED CIRCUIT BOARDS for amateur radio and hobby projects.hhh://www.cl.ais.net/farcir or SASE **FAR CIRCUITS**, 18N640 Field Ct., Dundee IL 60118, (847) 836-9148. BNB5013

MAHLON LOOMIS, INVENTOR OF RADIO; by Thomas Appleby, (Copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O.Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

WANTED: Western Electric Audio Equipment. Amplifiers, pre-amps, tubes, speakers, parts, mixing boards, etc. **1-800-251-5454.** BNB1050

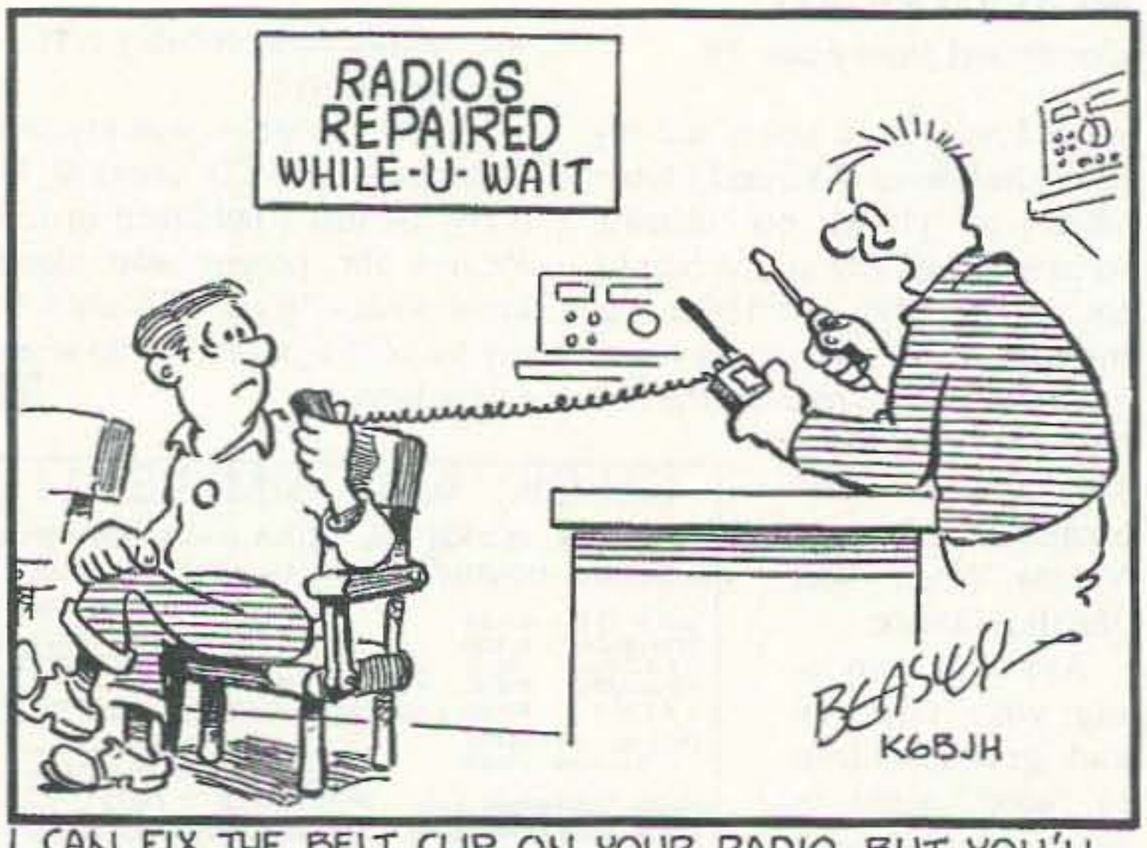
HOME AUTOMATION. Become a dealer in this fast-growing field, **1-800-838-4051.** BNB2032

BREAK THE CODE BARRIER: Psychologist & Extra Class operator has developed an amazing hypnosis tape that allows you to master any code speed easily and quickly. To order send $14.95 + $3.00 S&H to **Dr. Hal Goodman,** P.O. Box 184, Eastport ME 04631. For more info. send SASE. BNB2031

TIRED OF IRONING? PCB service. No $ setup, free scanning available. **FIRST PROTO**, 4201 University Drive, #102, Durham NC 27707. (919) 403-8243. BNB5005

RF TRANSISTORS TUBES 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, ETC. WESTGATE **1-800-213-4563.** BNB6000

ASTRON power supply, brand-new w/warranty, RS2OM $99, RS35M $145, RS5OM $209. Call for other models. **(818) 286-0118.** BNB411



I CAN FIX THE BELT CLIP ON YOUR RADIO, BUT YOU'LL HAVE TO GET OFF THE REPEATER FOR A FEW MINUTES!

Radio Bookshop
ORDER FORM

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 4 weeks for delivery. (Prices subject to change without notice if suppliers increase prices or new editions cost us more.)

ITEM	TITLE	QTY	PRICE	TOTAL

Shipping: All orders add $5.00 handling *plus there is an additional at cost shipping charge added to all foreign orders. We ship UPS where possible, please give us street address.

S&H*
TOTAL $

Make checks payable to "Radio Bookshop."

Foreign Orders: Chose one ☐ surface shipping ☐ air shipping
(Surface delivery may take 2-3 months.)
*Note: The actual foreign shipping costs will be additional to the regular shipping and handling fees.

Name _____ Phone _____

Address _____

City _____ State ____ Zip ____ Country ____

$10 minimum for credit card orders

Total Paid $ ☐Check/Money Order ☐AMEX ☐MC ☐VISA

Card # Expires

Signature Date

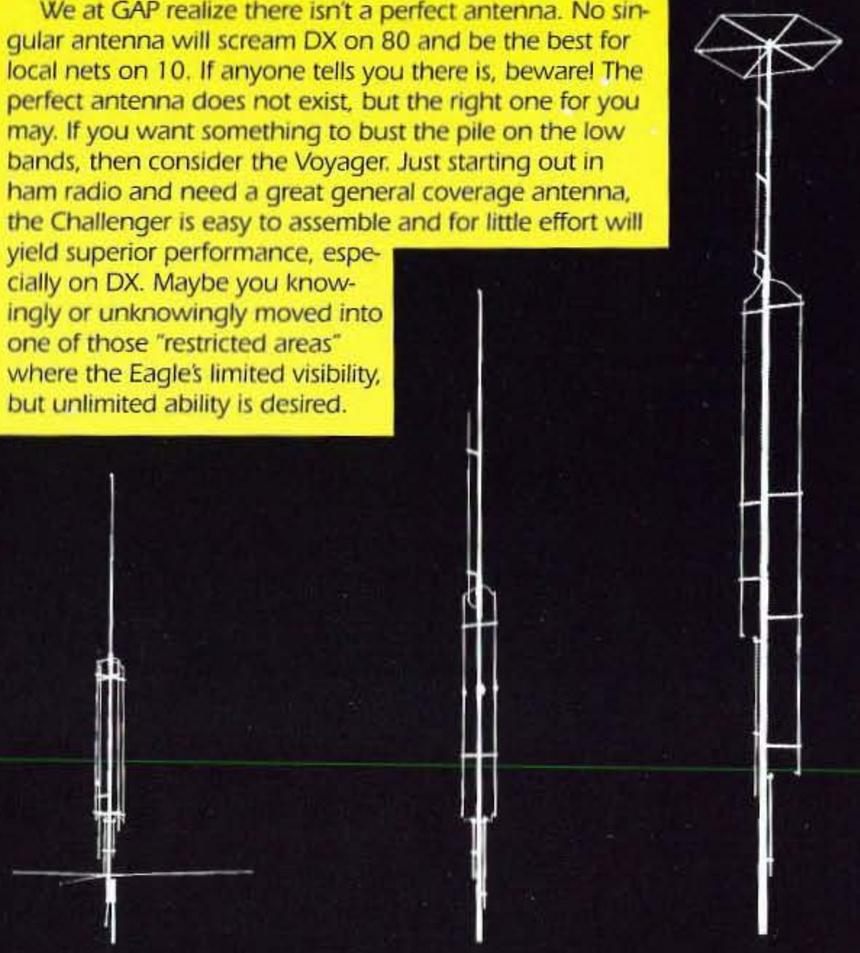
Telephone: 603-924-0058, 800-274-7373, FAX 603-924-8613

Mail: Radio Bookshop, Dept. 1096, 70 Route 202 N, Peterborough NH 03458

☐ YES, Send me 12 issues of 73 at the low rate of $24.97 (save 47% over the cover price). Canada add $7 plus $1.40 GST; Foreign add $19 surface; $42 airmail.

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."

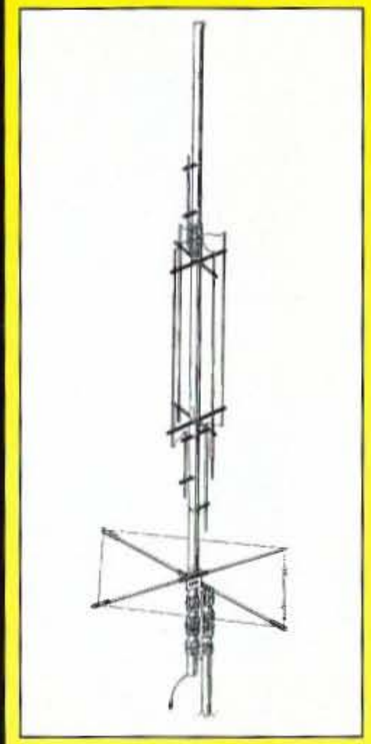
73–"This is a real DX antenna, much quieter than other verticals."

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.

MODEL	BANDS OF OPERATION											HT	WT	MOUNT	COUNTER-POISE	COST
	2m	6m	10m	12m	15m	17m	20m	30m	40m	80m	160m					
Challenger DX	■	■	■	■	■		■		■	■		31.5'	21 lbs	Drop In Ground Mount	3 Wires @ 25'	$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

GAP ANTENNA PRODUCTS INC.
6010 N. Old Dixie Hwy.
Vero Beach, FL 32967

TO ORDER, CALL
(407) 778-3728

DISCOVER VISA MasterCard COD

Connect to the world !!

A full range of cellular antennas is available: hole mount, magnetic mount, on-glass and base station.

SKA 900 1/4

SKA 901 1/4

SKA 900 C

SKA 901 C

MICROCELL MAG

SGM 900

SIRIO antenne
46049 VOLTA MANTOVANA - MN - ITALY - Tel. (39) 376/801515 - Fax (39) 376/801254
NORTH AMERICA OFFICE: TORONTO - CANADA - TEL. (519) 650 9277 - Fax (519) 650 1779