

Including Ham Radio Fun!

FEBRUARY 1998

ISSUE #449

USA \$3.95

CANADA \$4.95

73[®] Amateur Radio Today

International Edition

17m Copper X-Beam

Hey, Try This Delta Loop!

Get Ready for the Big One!

Basic Computer Interfacing

Reviews:

Ten-Tec 2m-to-10m Transverter

Advanced Design's CodeKey

Paddlette Micro Keyer



SYNTHESIZED VHF FM EXCITER & RECEIVER MODULES

No more waiting for crystals!



Hamtronics is pleased to announce a new line of its vhf fm transmitters and receivers, popular for repeaters, voice and data links, control, telemetry, and other demanding applications.

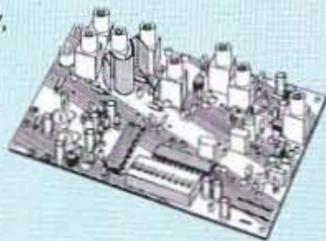
T301 Exciter and R301 Receiver provide high quality nbfm and fsk operation on 144-148 MHz (and 148-174 MHz for export and gov't services). Features include:

- Dip switch frequency selection.
- Exceptional modulation for voice and ctcss.
- Very low noise synthesizer for repeater service.
- Direct fm for data up to 9600 baud.
- Commercial grade tcxo for tight frequency accuracy in wide range of environmental conditions: 2ppm -30 to +60°C.
- In stock for same day shipping.

T301 EXCITER

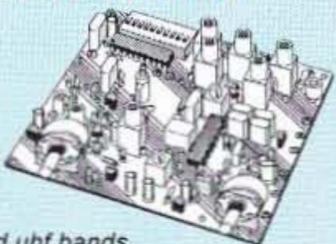
Rated for continuous duty, 2-3W output.

- Kitonly \$109
- TCXO option ...\$40
- Wired/tested ...\$189 (includes TCXO)
- Inquire about models for higher frequencies.



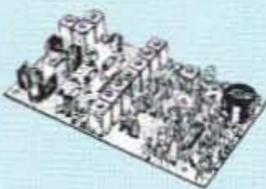
R301 RECEIVER

- Kitonly \$139
- TCXO option ...\$40
- Wired/tested ...\$209 (includes TCXO)
- Our traditional crystal-controlled receivers and exciters are still available for all vhf and uhf bands.



CRYSTAL CONTROLLED VHF & UHF FM EXCITERS & RECEIVERS

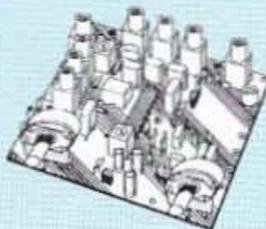
FM EXCITERS: 2W output, continuous duty.



- 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.



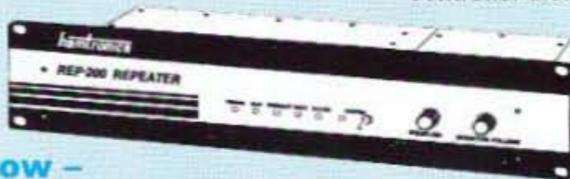
FM RECEIVERS:

- R100 VHF FM RCVR Very sensitive - 0.15µV. Superb selectivity - both crystal and ceramic IF filters, >100 dB down at ±12 kHz, best available anywhere, flutter-proof squelch.

- For 46-54, 72-76, 140-175, or 216-225 MHz. kit \$129, w/t \$189.
- R144 RCVR. Like R100, for 2M, 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.

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

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



Now - 2 meter machines in stock for next day shipment!

- 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.

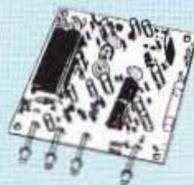
REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. Kit only \$795, w&t \$1195.

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.

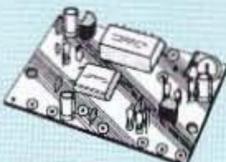
COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. \$379 w/t.

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.

SUBAUDIBLE TONE ENCODER/DECODER



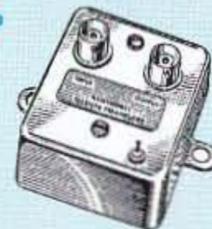
Access all your favorite closed repeaters!

- Encodes all standard CTCSS tones with crystal accuracy and convenient DIP switch selection.
- Comprehensive manual also shows how you can set up a front panel switch to select tones for several repeaters.
- 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

LOW NOISE RECEIVER PREAMPS

LNG-() GAAS FET PREAMP
 STILL ONLY \$59, wired/tested

- 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.



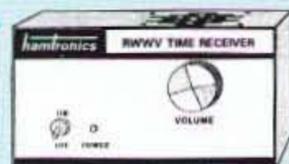
LNW-() ECONOMY PREAMP
 ONLY \$29 kit, \$44 wired/tested

- 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.



WWW RECEIVER

Get time & 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 WWW on 10 MHz. Performance rivals the most expensive receivers.



- RWW Rcvr kit, PCB only \$59
- RWW Rcvr kit with cabt, spkr, & 12Vdc adapter \$89
- RWW 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 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



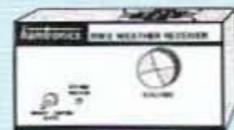
WEATHER ALERT RECEIVER

A sensitive and selective professional grade receiver to monitor critical NOAA weather broadcasts. 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. 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



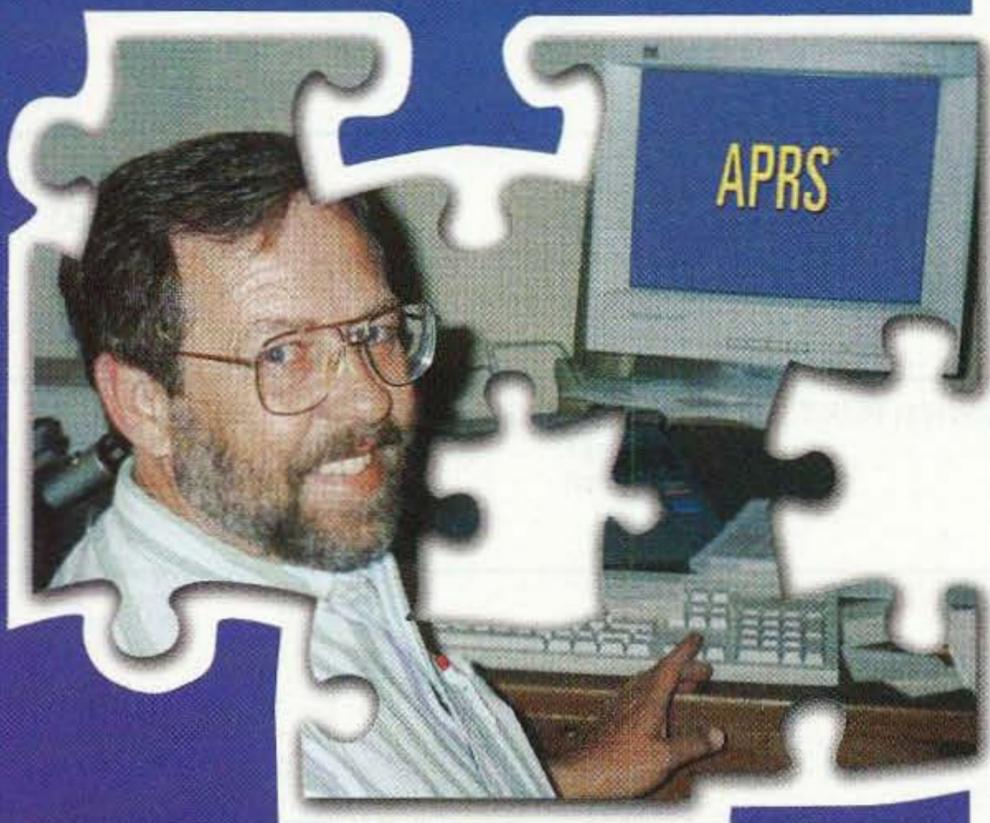
Buy at low, factory-direct net prices and save!
 For complete info, call or write for complete catalog.
 Order by mail, fax, email, or phone (9-12, 1-5 eastern time).
 Min. \$5 S&H charge for 1" lb. plus add'l weight & insurance.
 Use Visa, MC, Discover, check, or UPS C.O.D.



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Are you **missing**
out on some
fun?



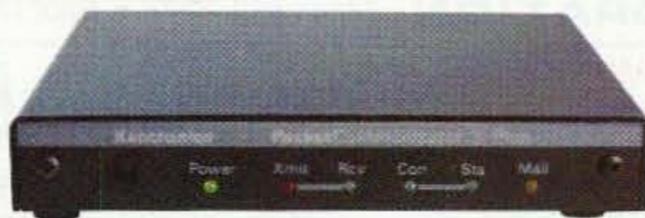
Use **more** of
your **privileges**—
Go **Digital!**

Are you only using a small portion of your ham radio license? Here's just some of the fun you may be missing!

- APRS® Position Reporting and mapping
- Easy Satellite Communications
- Displaying and printing WEFAX weather maps
- Paging via Amateur Radio
- DX spotting and getting those rare contacts
- Packet bulletins, traffic, e-mail and news
- Telemetry-remote sensing and control
(KPC-3 Plus and KPC-9612 Plus)

Kantronics offers a number of ways to enjoy the growing field of digital communications. Choose the unit that suits your interests and your budget. All Kantronics units come with a one-year limited warranty and can be upgraded when firmware updates become available.

NEW! KPC-3 Plus



- 1200 bps - Now with more features!
- Packet, GPS/APRS, Host, KISS and WEFAX modes
- Personal Mailbox (PBBS) now supports multiple calls
- Copies NWS EMWIN with optional software
- Remote access, sensing and control with two A/D and two control lines
- KA-Node or option K-Net networking capability
- PBBS 100k, expandable with optional 512k RAM
- Uses external power or internal 9v battery
- NEWUSER mode and online help

NEW! KPC-9612 Plus



- 1200 port AND second port of 4800 ~ 38,400 bps
- Most modes/capabilities of the KPC-3 Plus and POCSAG (paging)
- Unique design allows the addition of *another port, high or low speed**
- KA-Node or K-Net option works with multiple ports
- Remote access, sensing and control capability
- Telemetry transmission capability
- NEWUSER mode and online help

NEW LOOK! KAM Plus



- Same great KAM Plus performance in an attractive new package!
- Dual port VHF/HF (1200/≤300 bps) multimode TNC
- Packet, GPS/APRS, Host, KISS, WEFAX, CW, RTTY, AMTOR, PACTOR and G-TOR™
- 100k personal mailbox standard, expandable with optional 512k RAM
- Remote access capability
- Real time, battery backed clock
- NEWUSER mode and online help

Kantronics

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SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0



SS-25M With volt & amp meters
SS-30M With volt & amp meters

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		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
SL-11A	•	•	7	11	2 5/8 x 7 5/8 x 9 3/4	12
SL-11R	•	•	7	11	2 5/8 x 7 x 9 3/4	12
SL-11S	•	•	7	11	2 5/8 x 7 5/8 x 9 3/4	12
SL-11R-RA		•	7	11	4 3/4 x 7 x 9 3/4	13

RS-L SERIES



• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 1/2 x 6 1/2 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/2 x 7 1/4	7

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 x 19 x 8 1/4	16
RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

RS-A SERIES



MODEL RS-7A

MODEL	Colors		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
RS-3A		•	2.5	3	3 x 4 3/4 x 5 3/4	4
RS-4A	•	•	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A		•	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	•	•	5	7	3 3/4 x 6 1/2 x 9	9
RS-10A	•	•	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	•	•	9	12	4 1/2 x 8 x 9	13
RS-12B		•	9	12	4 x 7 1/2 x 10 3/4	13
RS-20A	•	•	16	20	5 x 9 x 10 1/2	18
RS-35A	•	•	25	35	5 x 11 x 11	27
RS-50A	•	•	37	50	6 x 13 3/4 x 11	46
RS-70A	•	•	57	70	6 x 13 3/4 x 12 1/2	48

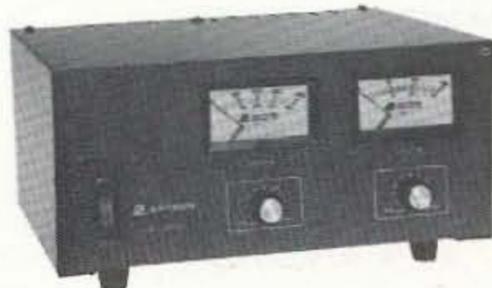
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46
RS-70M	57	70	6 x 13 3/4 x 12 1/2	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)			ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC	@10VDC	@5VDC			
VS-12M	9	5	2	12	4 1/2 x 8 x 9	13
VS-20M	16	9	4	20	5 x 9 x 10 1/2	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13 3/4 x 11	46
VS-70M	67	34	16	70	6 x 13 3/4 x 12 1/2	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	22	10	50	5 1/4 x 19 x 12 1/2	50

RS-S SERIES



MODEL RS-12S

• Built in speaker

MODEL	Colors		Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
RS-7S	•	•	5	7	4 x 7 1/2 x 10 3/4	10
RS-10S	•	•	7.5	10	4 x 7 1/2 x 10 3/4	12
RS-12S	•	•	9	12	4 1/2 x 8 x 9	13
RS-20S	•	•	16	20	5 x 9 x 10 1/2	18
SL-11S	•	•	7	11	2 3/4 x 7 5/8 x 9 3/4	12

THE TEAM

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FEBRUARY 1998
ISSUE #449

73[®] Amateur Radio Today

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On the cover: Solar-powered repeater station VE7RVA was built by the Fraser Valley Amateur Radio Emergency Services Society and sits atop 3,000-foot-high, windswept Sumas Mountain in British Columbia, Canada. Photo courtesy of Will Imanse VE7BID. See article in February 1997 issue.

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

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NEVER SAY DIE

Wayne Green W2NSD/1



Alarmist

My dictionary says an alarmist is one who is easily or too easily alarmed. I hope, in this case, that I'm an alarmist. This has to do with the recent news articles on Saddam Hussein's concentration on building weapons of mass destruction (called WMDs in the biz). His highest priority seems to be chemical and biological agents (germ warfare). Baghdad denied that Iraq has ever tried to develop biological weapons—until Hussein's son-in-law defected to Jordan and spilled the beans. He then unwisely went back to Iraq and was executed.

We know that Hussein has imported tons of the ingredients for making nerve gas and biologicals. We know that Qaddafi has been making biological weapons. We have no reason not to suspect Syria and Iran of doing the same. We also know that these countries are not only our sworn enemies, but also have a history of supporting terrorism.

One terrorist with a spray can of botulinum toxin, walking through an airport terminal concourse, could infect thousands, including pilots and flight personnel. A few hours later planes will be falling and our hospitals unable to cope.

Then there's smallpox. We know that several unfriendly governments have this beaut. Historically, 30% of the people infected die a miserable, painful death. That's the 30% with the weakest immune systems. Have you been keep-

ing yours at industrial strength, or will you be one of the first to go?

Once smallpox had been eradicated almost 20 years ago they stopped vaccinating people against it, so a few aerosol sprays in public places could trigger a plague which could kill millions. There isn't enough vaccine left to vaccinate more than about 3% of our population, so we'd have to quarantine any infected areas and wait to see who survives.

If something like this happens there's going to be a big demand for two things. One will be communications, and two will be Bioelectrifiers to clean the virus or microbes from the blood. Say, have you built one yet? Or are you going to wait for that sudden announcement on TV some night that terrorists have just struck Manhattan, Washington and Chicago? Any old Boy Scouts out there who feel the need to Be Prepared? I was in Troop 34 when I was a kid.

If anthrax or any other agents are suddenly used I know I'm going to be glad I have my immune system going strong, and backed up by a Bioelectrifier, just in case, to keep it strong.

If Iraq, Iran, Libya, Syria, or the Serbs decide to attack us, what are we going to do in return, atomize their countries? Not likely. Or is it? By coincidence, several prophets, who have remarkable success records, are predicting a third world war to kick off in the next year or two.

Hey, just dismiss me as Chicken Little so you won't miss watching Monday Night Football.

But, just in case, how are you set for emergency power? Will your local repeater operate without commercial power? Is your HT in good shape? Does your club have an emergency van that can communicate with other emergency and government services?

I might point out that my non-alarmist record is pretty good. I didn't suck in on the global warming or cooling campaigns, nor the ozone hole scare, nor the awful dangers of increased CO₂ in the air. I've explained the who and why of the Freon™ and CFC hoaxes. How many of these bogus "scientific" scares did you buy?

But I am concerned about the potential for terrorists to unleash chemicals or biological agents which could do one heck of a job on us, or they might even end up setting off one of those missing Russian suitcase nuclear bombs in downtown Manhattan.

Though I disagree with almost everything Clinton does, I do hope they don't nuke Washington, considering Clinton's Gore insurance. Just as Quayle served to protect Bush from assassination attempts, I suspect Gore could be doing the same for Clinton.

It's De Bunk

Oh, the horror. Oh, the humanity! Just remember the media agonizing over the meltdown at Chernobyl. I

don't recall any of the TV "news" shows or magazines putting the accident into perspective. Scientists added up the pluses and minuses, reporting that during its 25 months of life Chernobyl Unit 4 saved far more lives from coal-fired pollution than it took (or will ever take) by radiation.

Okay, so much for that hysteria, now let's tackle that pesky ozone hole which is threatening to expand and douse us all with lethal ultraviolet rays. It turns out that those scientists not looking for grant money assure us that historical records show that the ozone layer is self-healing and that most of the chlorine which reaches the stratosphere comes from natural sources. Note that the dread ozone hole has been appearing over the south pole, far away from the wicked CFC polluters, not in the much nearer Arctic.

It's estimated that the world's industry produces about 750,000 tons of chlorine per year. The Mt. Erebus volcano in the Antarctic puts out 1000 tons every day.

Global Warming?

Well then, how about global warming? Yep, the carbon dioxide is increasing in our atmosphere, but historically there's been no link between CO₂ and world temperatures. What it does do is increase the growth of trees, which have increased by 25% in this century. Just read the Dixie Lee Ray book, which is reviewed in my *Guide*.

As I pointed out in a recent editorial, complete with a photo, the ice buildup at the poles has been increasing, not melting. According to Dr. Zwally of NASA the ice caps have been accelerating in their growth and are now increasing by about eight inches a year. That's an area over twice that of the US, so that isn't trivial.

Canada's glaciers are growing too. They're larger now than any time in the last 60,000 years, according to Dr. Miller of the University

of Colorado. And it's the same in Alaska, Norway and around the world.

What's doing all this? If you're interested in understanding the ice age cycle from a scientific view, you'll want to invest in Robert Felix's *Not By Fire, But By Ice*. It's an easy (well, I should say uneasy, if apocalyptic threats tend to make you nervous) read. It's \$16 from Sugarhouse Publishing, Box 435, Bellevue WA 98009; (800) 310-1764, ISBN 0-9648746-9-5, 256pp.

It turns out that every time the Earth's magnetic field reverses all hell breaks loose. Felix points out that there are at least a couple thousand underwater volcanoes in the Pacific Ocean and that recent reports show that more and more of them are recently active and pouring 2150° basalt into the ocean. Gee, you don't suppose this could have any connection to the recent record high temperatures in the Pacific we call *El Niño*? Nah.

It turns out that ice ages don't gradually happen. They're so sudden that they have been responsible for endless mass extinctions. They wiped out the dinosaurs a few million years ago and the woolly mammoths just recently (11,500 years ago). It flash-froze them with flowers still in their mouths. Slowly-frozen meat rots. The mammoths were frozen so quickly their meat is fit to eat today when they're defrosted.

They recently had 21 inches of rain in one day in California. If it had been a little cooler that could have been 210 inches of snow. That's 17.5 feet! You don't dig your way out of anything like that. You put on your snowshoes and climb out a third-story window. Hmm, there aren't very many three-story homes in California, are there? Too bad.

But it couldn't snow in Southern California, could it? How about the recent unseasonable snows that covered Colorado and the whole Midwest? Then there was the Blizzard of '96, which smothered

the East Coast, a record. In July 1996 snow fell in parts of South Africa and France. We're seeing record floods and unseasonable snow storms while the environmentalists are fretting about global warming.

Looking at the historical record as found in tree rings, the geological dating of earth layers and ocean core samples it turns out that ice ages start in an amazingly short time and are coincident with the precession of the Earth as it wobbles on its axis. Felix says that this 11,500-year event causes a reversal of the Earth's magnetic field which, in turn, triggers the eruption of thousands of volcanoes along the tectonic plate edges, 80% of which are under the oceans. The resulting warming of the water then causes more evaporation of the oceans into the atmosphere, where it falls as snow on the polar areas, bringing on a new ice age instead of global warming. Greenland is already getting six feet of new snow a year and Antarctica has recently been getting 18 feet!

The end result will be a growing ice pack which will cover a good deal of the US and a drastic lowering of the oceans. And all this could be well along in the next 20 years.

The most recent USDA charts of what crops can be grown where clearly show the Earth cooling. Farmers in the Dakotas and Minnesota are already changing to hardier crops. It won't be long before wheat won't grow fast enough to be planted as the seasons get shorter and shorter, so they're changing to rye. We could have some major food shortages in the next few years, and it isn't going to get better.

Of course Felix may be wrong, but he sure has the weight of historical research on his side.

Gordon-Michael Scallion K1BWC is predicting the same massive

volcanic eruptions, but he's seeing the warmer ocean as melting the polar ice, thus raising the sea level around 250 feet or so, making major changes in the map of the world. Either way, all this mayhem is predicted to start happening in the immediate future. Hold tight and keep your emergency gear up to snuff.

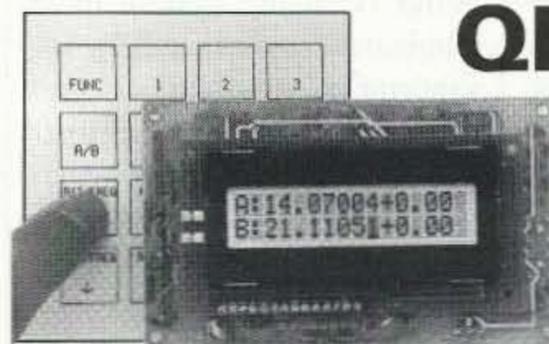
A Thousand Volcanoes?

Why, I wondered, would a reversal of the Earth's magnetic field cause volcanoes to start erupting? René theorizes that the flow of salt water in the ocean through the Earth's magnetic field generates enormous amounts of current in the surface of the Earth and this results in the making of volcanoes. He explained how this works in his *The Last Skeptic of Science*, where he and a friend set up an experiment using two large carbon electrodes and a welding power supply. They were trying to make diamonds by run-

ning an electric current through a carbon-based powder.

When they turned on the power the powder heated up and after a couple of days they had a miniature volcano erupting. They turned off the power, but it kept right on going and they had a tough time smothering it. Later they sent out the resulting magma to a lab for analysis. Nothing in the original mix had an atomic weight over 20, yet the assay came back with elements as high as bismuth (83), which is heavier than lead. Read the book for the details.

So here we'll have the same result, but on a world scale. Then the volcanic heat warms the oceans, changing the ocean currents, which generates even more electrical current. It's the perturbation of the magnetic field by the Earth's wobble, coupled with the magnetic fields generated by the solar flares as the sunspots shower the Earth with high electrical currents (which we can see as the aurora), that creates the instability. We



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LETTERS

From the Ham Shack

Michael R. Borer WL7CKB, Anchorage AK. Dear Wayne, I read the Henry Ruh KB9FO article with great interest and enthusiasm, and had to sit down and respond. I believe that Mr. Ruh has a very good idea, and has obviously spent a great deal of time thinking this out, but in a number of instances he has taken some good ideas to a ridiculous extent. Mr. Ruh seems to have forgotten a very important salient point: Amateur radio has been, is currently, and will continue to be, as long as we have the spectrum, a *hobby!* Hobby, as defined in the *Oxford Modern English Dictionary*, is "a favorite leisure-time activity or occupation." What Mr. Ruh is proposing is just a more complicated and expensive ARRL system, though his suggestions, in my opinion, have a lot more merit than the current system.

Mr. Ruh seems to be attempting to force everyone into a single mold, instead of allowing each individual to choose his or her own way, as befits their interests. This is tantamount to telling artists that they must paint portraits or still lifes when their interests lie with scenes and landscapes. Or to tell a philatelist that he will collect 19th century English stamps, when his interests lie in North American areas. Mr. Ruh, with his suggestions, is continuing to promulgate the "contest mentality" that encourages one to

notch his microphone with as many contacts as possible, like the Old West gunslingers who cut a notch in their pistol grips for each kill. Now please don't get me wrong, I am not against contests, I'm just not interested, as I'm sure others are. I guess that I just prefer rag-chewing to racking up numbers.

He is also continuing to promulgate the "religion of the key," CW. Again, though I am not advocating a total discontinuance of this mode of communication, he seems to be placing an undue amount of importance on an outdated, outmoded, overglorified means of communication.

I, for one, am not interested in wallpapering my radio room with all of the awards that the various amateur organizations promote, even though I do enjoy collecting QSLs. So far, most of his suggestions for a better licensing system have eliminated most chances for advancement for me, for one. And what about the hams who either are not interested in advancement, or who don't want to go beyond the "Adventurer" class? According to Mr. Ruh, it seems that he is proposing an ultimatum: Either advance or get out. Again I must remind Mr. Ruh that amateur radio is a hobby, and unlike a job or profession, where one must continue to advance so as to receive a larger paycheck, a hobby, and this one in particular, does not accept

any remuneration. Therefore, if people are happy where they are, why should they be forced to do things that they don't have any interest in doing?

One other rather salient objection to some of Mr. Ruh's proposals—those primarily concerning long distance VHF contacts, and attending various hamfests. What about those of us who live in Alaska or Hawaii, and must span thousands of miles to make a single contact out of our states, on VHF? Yes there are occasional 6 m openings that allow for limited contacts, but in over two years of monitoring 2 m SSB, I have yet to hear anything outside my own state. Yes, I know that there is always satellite communication, but that does require quite an investment, not only in money and equipment, but in the space to use it, which for some urban dwellers can be even more difficult to obtain than that required for some HF bands. And as to attending all those hamfests, with the extended travel requirements just to arrive "out there" (the Lower 48, in my case), a person could go bankrupt just in airline charges alone.

You might conclude, from my criticisms, that I found little to no merit in Mr. Ruh's suggestions, but that could not be further from the truth. I wholeheartedly congratulate Mr. Ruh on this, his work in progress. I find a lot of merit in his proposals, and I laud the "rough draft" and encourage him to keep up the good work, to network with other current amateurs, and to try to incorporate a multitude of other ideas. I realize that my ideas and opinions do

not necessarily represent the ideas and opinions of others.

But from my narrow-minded point of view, I firmly believe there is some merit in my suggestions or objections, and there may be something that can be taken from this to improve Mr. Ruh's plan, or at least to make it more palatable to a greater majority of currently licensed amateurs.

Philip Ingraham W2OSY. In a span of 64 years it has been my privilege to visit the vast regions of our Arctic and Antarctic. I have had pleasant conversations with many citizens of a large majority of all countries. I have discussed world affairs with world leaders, ship captains, the rich, the poor and the humble as well as the famous. I have been where there was disaster, and in a small measure, tried to help those involved.

My friends out there have never questioned me as to my status, education or dislikes—just friendly conversation as over the backyard fence with a neighbor whom they considered a friend. I witnessed the birth and rise of the vacuum tube as well as its demise. More recently, the electronic miracles are difficult for an 81-year-old to follow and work with. It is my belief that ham radio will never die. The young will respond to its never-ending thrill as I did when I first smelled the odor from a hot vacuum tube, the energy from which helped me to visit far off places. Oh yes, things will be somewhat different. Change is the only permanent thing we have. All is perspective—the result is change.

know that sunspots and weather changes are coupled. What we don't have a record of is the combination of the effects of Earth's precession and sunspots.

Both Scallion and Felix are predicting massive ocean warming from volcanoes. Scallion figures the warmer oceans will melt the polar ice, raising the

oceans, and Felix says the polar ice is going to grow into another ice age, lowering the oceans several hundred feet. René proposes that the lopsided buildup of ice at the poles will cause the Earth itself to suddenly move the poles to the tropics, quickly melting the old polar ice, and that new polar ice will build

up in what used to be the tropics.

Unless they're all wrong, we'll know who is right in a year or two. But any of the three scenarios is likely to wipe out a few billion people.

Past ice ages have been sudden, with several wiping out 90% or more of all life. Mass extinctions. The geo-

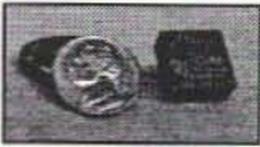
logical records are clear—these have happened many times.

Richard Noone in *5/5/2000* is also predicting doom for us. He proposes that the Earth's crust can slip, and this is likely to happen when all the planets line up on May 5,

Continued on page 43



Wireless Video Headquarters



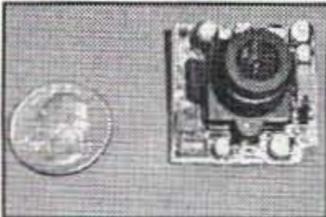
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- C-2000 Video Transmitter Cube.....\$89.95**
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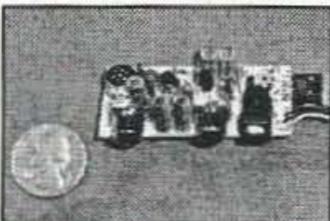
If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout'. These cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, these are super IR (Infra-Red) sensitive! Available with Wide-angle (80°) or super slim Pin-hole style lens. Both run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our Interface board (below) for Audio sound pick-up and direct wire connection to any Video monitor or TV video/audio input jacks. Fully assembled.

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- CCDWA-2 CCD Camera, wide-angle lens.....\$99.95**
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CCD Camera Interface Board

Here's a nifty little kit that eases hook-up of your CCD camera module to any video monitor, VCR or video input TV set. The board provides a voltage regulated and filtered source to power the camera (CCD Cameras require a stable source of power for best operation), sensitive electret condenser mike for great sound pick-up and RCA Phono jacks for both audio and video outputs. Runs on 11 - 20 VDC.



- IB-1 Interface Board Kit.....\$14.95**



Budget TV Transmitter

Transmit audio and video to any TV set with this fully assembled transmitter. Although not tiny, it still offers some neat features. Takes standard 1 volt p-p video and audio and transmits on any UHF TV channel of your choice from 17 - 42. Has rugged metal case, includes AC adapter, whip antenna and even RCA phono plug patch cords! Can also run on 12 VDC.

- VS-2 Video and Audio Sender, Fully Assembled.....\$29.95**

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See in total darkness with one of our CCD video cameras and this IR illuminator! IR light can't be seen, illuminate the scene with IR and a CCD camera 'sees' just fine. The array of 24 extra high intensity LEDs are invisible to anybody - except for aliens and Casper! Runs on 12 VDC. Illuminates similar to that of a bright flashlight.



- IR-1 IR Illuminator Kit.....\$24.95**

MicroEye CCD Camera & Transmitter Combo

We married together one of our quality CCD cameras, a sensitive electret microphone and a small TV transmitter to give you a super neat - and tiny - all in one, 'knows all, sees all, hears all' package! Small enough to fit into a cigarette pack and powerful enough to transmit up to 150' to any standard TV set. Tunable to operate on TV channels 4, 5, or 6 and runs on 9 to 20 VDC. The sensitive mike picks up normal voice within an average size room. Ideal for private detectives, investigators, hobbyists, babysitters, model rocketeers, RC airplanes and other uses limited only by your imagination. Camera module is fully wired and the transmitter unit is an easy to build kit that goes together in an evening. Includes all parts, handsome jet-black case and clear, concise instructions with ideas for use. And, don't forget, our CCD cameras are very sensitive to IR light - just add the IR-1 IR Illuminator kit for see-in-the-dark operation!



- ME-2000 MicroEye TV Transmitter Combo\$149.95**

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The Wavecom Sr. has all of the features above plus adds the capability of transmitting your TV/DSS/VCR remote control signals from the receiver unit back to the transmitter unit. This is great for controlling your DSS satellite receiver or VCR from any room in the house. We also offer the small internal transmitter module assembly for those who wish to make their own concealed video transmitter system. Module is about the size of a couple of matchboxes and includes microwave patch antenna.

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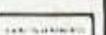
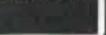
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QRX . . .

FAR Scholarships Available

The Foundation for Amateur Radio, Inc. (FAR), a non-profit organization with headquarters in Washington DC, plans to administer 66 scholarships for the academic year 1998-1999 to assist licensed radio amateurs. The Foundation, composed of over 75 local area amateur radio clubs, fully funds nine of the scholarships with the income from grants and its annual Hamfest. The remaining 57 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from \$500 to \$2500, with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maryland, New Jersey, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin, are encouraged to announce these opportunities at their meetings, in their club newsletters, during training classes, on their nets and on their World Wide Web home pages.

Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 1998, from:

FAR Scholarships
6903 Rhode Island Avenue
College Park MD 20740.

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(C)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purposes of the Amateur Radio Service.

Hams to the Rescue!

On November 22, 1997, three students from Franklin Pierce College, in Rindge, New Hampshire, went for a hike. That in itself is not unusual. These three young men, however, decided to hike up 3,165-foot Mount Monadnock, in Jaffrey, New Hampshire. They began their climb around 3:00 in the afternoon. The weather ceiling was down to about 2,000 feet, which meant the top third of the mountain was obscured by

clouds. Nightfall would be at 4:19 p.m., and winters in New Hampshire can be ... well, wintry.

One of the students, a licensed ham from New York State, carried a small two-way radio. By 6:15 p.m. they were ready to concede that they were lost, and called for help. They were completely disoriented in the snowy darkness, they had no compass or matches, and their only flashlight battery was failing (it went out at 9:37 p.m.).

The heroes of what could have been a tragic misadventure were two New Hampshire women and a repeater known as "Henry, the Keene Machine," a reference to the nearby city of Keene, New Hampshire. Henry (K1TQY/RPT), situated on Hyland Hill in Westmoreland, 15 miles from Mount Monadnock, picked up the students' distress call and relayed it to others in Cheshire County. Henry's trustee, Dawn Cummings K1TQY, immediately took charge of communications. Roberta Bennett N1WTY of Jaffrey telephoned the emergency information to Monadnock State Park Manager Michael M. Walsh, then drove to Walsh's office at the base of the mountain with her two-way radio and her young son N1XZE.

For the next four hours the ladies and Henry provided the link between the hapless, increasingly miserable students and the search party. Walsh, himself hampered by darkness and inclement weather, was able to give the students instructions and encouragement as he worked his way to their position.

The students were found at 11:03 p.m.

Amateur radio has often been dismissed as outdated and unnecessary, but those three grateful students and their loved ones can testify to its importance in emergencies.

Those New Forms

As of January 1, 1998, amateur radio license applicants may only submit FCC Forms 610, 610A and 610B that carry an edition date of September 1997. Previous editions of Form 610 will not be accepted for filing by the FCC or by Volunteer Examiner Coordinators (VECs).

The major change on the new form is a certification to the effect that the applicant has "read and will comply with Section 97.13(c) of the Commission's Rules" regarding RF radiation safety and the amateur service section of OST/OET Bulletin No. 65, Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

Section 97.13(c) says that before you transmit "from any place where the operation of the

station could cause human exposure to RF electromagnetic field levels in excess of those allowed," you must perform an RF environmental evaluation if your transmitter PEP exceeds the following limits.

160-40 meters: 500 W

30 meters: 425 W

20 meters: 225 W

17 meters: 125 W

15 meters: 100 W

12 meters: 75 W

10 meters: 50 W

VHF (all bands): 50 W

70 cm: 70 W

33 cm: 150 W

23 cm: 200 W

13 cm: 250 W

SHF/EHF (all bands): 250 W

If the routine environmental evaluation indicates that the RF electromagnetic fields could exceed the maximum permissible exposure limits, you must take action to prevent human exposure.

The new 610 forms may be obtained from the FCC Web site [<http://www.fcc.gov/formpage.html>], or by FAX at (202) 418-0177 (request index, or: for Form 610, use form code 000610; for Form 610A, use form code 006101; for Form 610B, use form code 006102). The FCC Forms Distribution Center will accept FCC forms orders at (800) 418-3676.

Individuals may also get copies from the ARRL (225 Main St., Newington CT 06111) by sending an SASE with 32 cents postage for each Form 610 requested.

CW Forever

You must have, at times, thought into the past,
Where some things go out, while others last,
What comes to my mind is the Old Morse Code,
That has weathered the storms from any abode.

To talk with one's fingers is surely an art,
Of any info you care to impart,
In most conditions the signals get through,
While the same about phone is simply not true.

Those dits and dahs cut through the trash,
Of nearby noise or lightning's crash,
To the sensitive ears of the ham receiver,
Who records this data with ardent fever.

He knows he's doing something unique ...
(In such poor conditions, that's quite a feat!)
To roger the message that came off the air,
These brass pounders sure do have that flair.

They say Morse ops are a dying breed,
But don't despair, there's always that need,
That when conditions get rough for the new automation,
Rest assured, there'll be a need for your station.

CW is dying? Believe it never,
This mode will be 'round forever and ever,
But one thing is sure, what we really need,
Is to relay our knowledge to the younger breed.

To carry the torch, long after we're gone,
To send Morse Code through the air like a
song,
When at last, Silent Keys pull that final lever,
We can rest in peace—it's CW forever.

By WA1TBY, TNX W8WFB, in the Dixie Amateur
Radio Club May 1997 newsletter.

Attention, Teslaphiles!

You may recall articles by John Wagner W8AHB urging more recognition of Nikola Tesla and his contributions to science—73 published one in our January 1996 issue, and a followup in June 1996. In our "Letters" department in the August 1996 issue, Bernard S. Finn of the Smithsonian replied in detail to Mr. Wagner's articles. Interested readers may wish to look up those issues; it would be simpler, though, to check out the Web site at [<http://www.concentric.net/~jwwagner>]. T-shirts celebrating Tesla's life and works are also available in adult sizes (S, M, L, XL, \$20, and XXL, \$22, post-paid). Make checks payable to Dexter Community Schools and mail to John W. Wagner, 3890 Tubbs Road, Ann Arbor MI 48103-9437. All proceeds go toward the casting of museum-quality bronze busts of Tesla to donate to leading universities.

Hamvention and Hara Arena Sign Landmark Agreement

On Wednesday, November 12, 1997, Hamvention General Chairman Richard Miller N8CBU and Hara President Johnny Walker signed a contract to hold Dayton Hamvention at the Hara Complex through the year 2003. This is the longest contract in their business relationship.

Dayton Hamvention is responsible for adding over \$7 million annually to the Dayton economy. This will translate to over \$35 million over the contract.

In the year 2000 the Dayton Hamvention will be the site of the American Radio Relay League National Convention. The Dayton Hamvention will hold its 50th in the year 2001. It will also play an important part in the "2003 Celebration, the 100th Anniversary of Powered Flight" in honor of the Wright Brothers.

The Dayton Hamvention has been working with local businesses and the community to improve the 1998 event, to be held May 15-17.

From the *RF-Carrier*, official newsletter of the Dayton Amateur Radio Assn., December 1997.

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CIRCLE 68 ON READER SERVICE CARD

Wouldn't You Really Rather Drive A BUIC?

The Basic Universal Interface Circuit ties your computer to your rig. Part 1: hardware.

L. VanProoyen K8KWD
8330 Myers Lake NE
Rockford MI 49341

My wife recently made me an offer I couldn't refuse: "Get that dump you call a ham shack cleaned up—or else!" Since then, I've been trying to simplify the configuration of my radio equipment to eliminate clutter (wires and boxes all over the place). One area of clutter that came to my attention was my computer interfaces. Since I frequently

use a computer connected to one or more of my radios, I wanted to streamline the interconnecting cables and equipment needed to do this. Because my equipment lineup tends to change from time to time, I began looking for a single "universal" means of interfacing my computer to whatever radio I happened to have (or be using) at the time.

It seems that most radios, ICOM and Kenwood types notably, provide a computer interface at TTL levels—whereas most computers since the Commodore 64 include only an RS-232 level interface for serial communications. To connect my computer generally requires an interface unit of some kind, and these are boxes that sit around and may require additional lines for operating power, etc. This all adds to my clutter problem. I see that some of the newest radios are starting to include direct RS-232 connectivity, but most still need outboard hardware. This article is a description of how I solved my clutter problem with an easy-to-build, inexpensive, in-line, computer-powered interface that will work with most ICOM or Kenwood radios of recent vintage—and could, with minor modifications, also be used with others. I have also included information about software requirements, including sample program listings, to show how easy and fun it is to experiment with radio computer control.

The basic interface

While similar in the general requirement, namely conversion and inversion of RS-232 levels to TTL, ICOM's

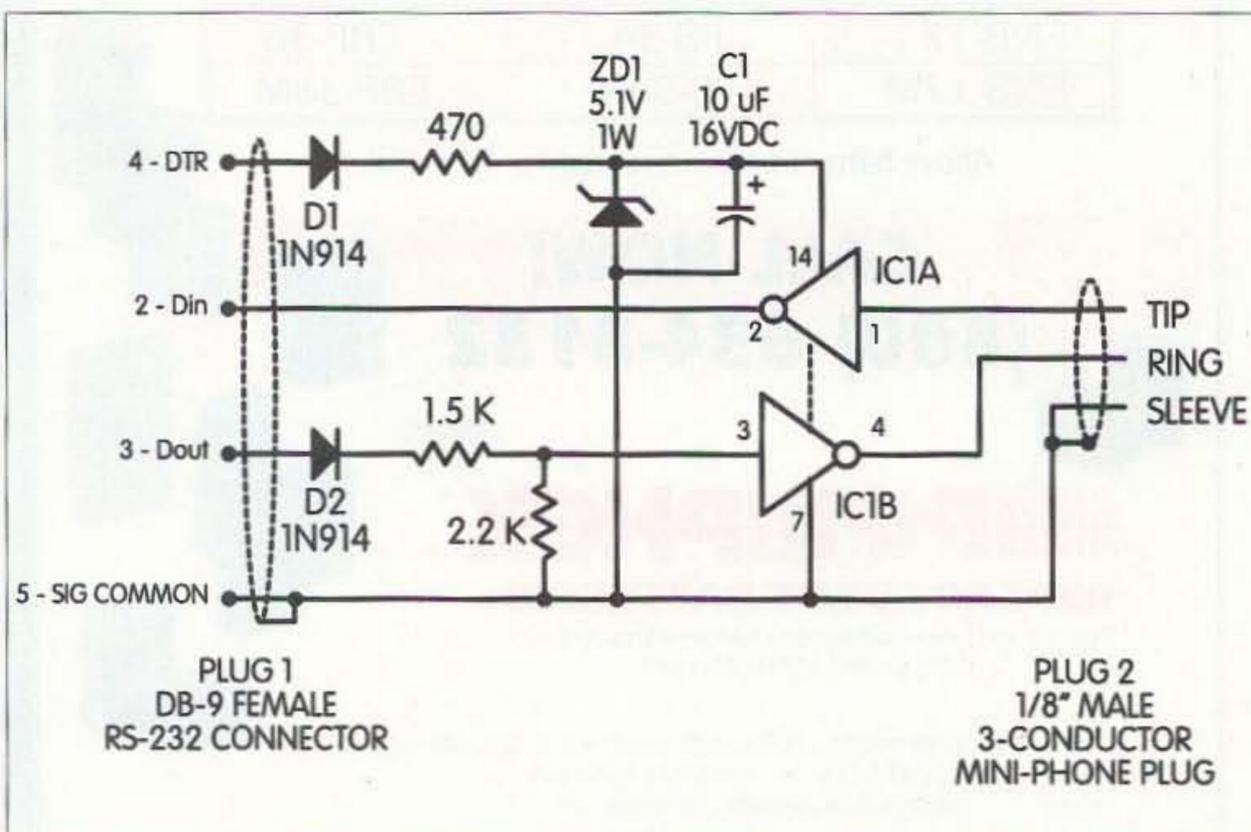


Fig. 1. The universal RS-232/TTL level converter basic circuit. All resistors 1/4 W, 10%.
10 73 Amateur Radio Today • February 1998

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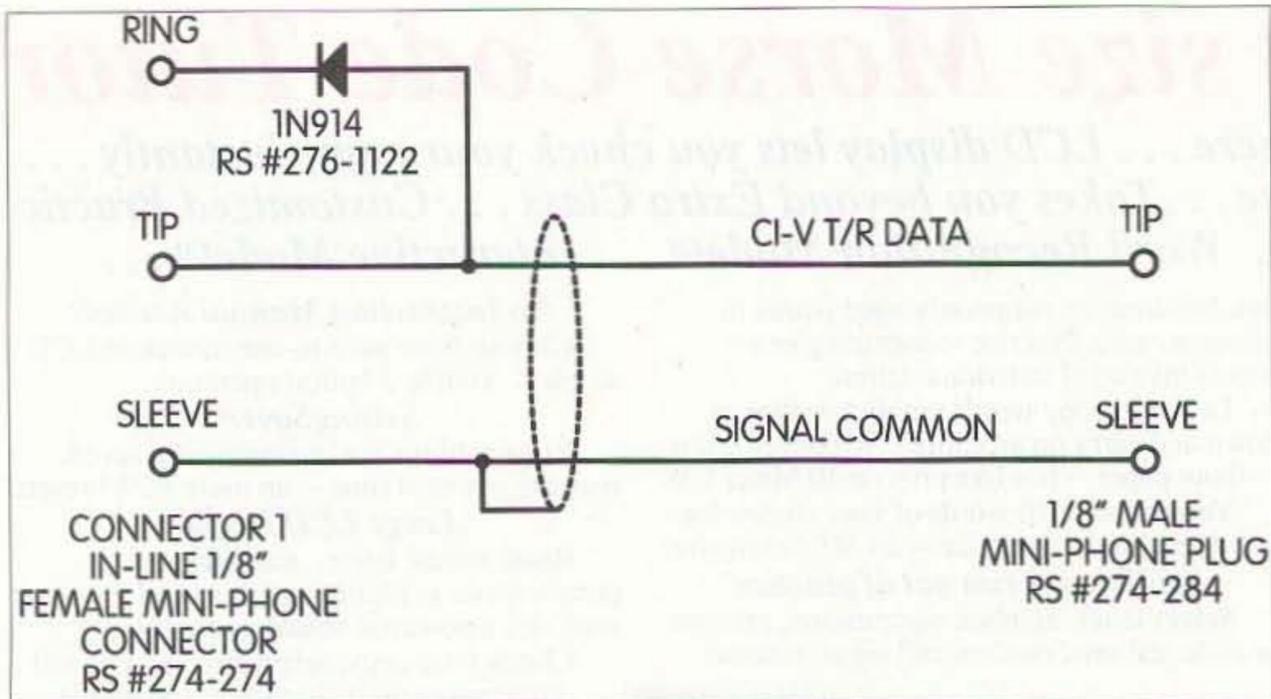


Fig. 2. The ICOM CI-V adapter cable circuit.

CI-V interface differs considerably from that used in various Kenwood radios. ICOM's CI-V data interface is a single transmit/receive data line, while Kenwood uses the more traditional separate TxD/RxD lines for computer communications. There are also considerable differences in the specifics on how the software needs to work between these types of radios, but more on that later. Fig. 1 is the circuit I finally developed, and its design was driven largely by the criteria of keeping it simple and using locally available parts. Fig. 2 is the circuit I use as an ICOM adapter cable, and Fig. 3, a

Kenwood adapter cable. Photo C shows the complete in-line assembly.

The heart of the circuit is a 74HCT04 hex-inverter chip stocked by Radio Shack™ stores (among others) nationwide and selling (at this writing) for 89 cents. I chose this CMOS implementation of the standard 7404 TTL chip because of its high speed and low current characteristics, and its tolerance for abuse despite being marked as a static-sensitive device. I have previously used this chip in several applications other than the one described here and never had a failure, even after hitting the inputs with more than 15 VDC, or

accidentally using a source supply near the same value. Also, I have not found a need to use special "static-sensitive" handling precautions with this chip; the interface circuit for this article was constructed by soldering interconnecting wiring and components directly to the chip's leads. (Photo B shows the basic interface circuit.) I would recommend using an IC socket, however, to reduce the risk of zapping the chip during construction. Use of a socket also makes changing the chip much easier should it surprise us and fail prematurely.

Circuit notes

I decided to do a three-wire RS-232 implementation even though the Kenwoods support hardware handshaking (RTS and CTS). The main reason I did this was the availability of a two-circuit in-line phone connector that enabled me to keep it an "in-line" device. Since I used a hex-inverter chip for the basic interface, this leaves four unused gates that could be used to carry CTS and RTS between the radio and computer, if your primary interest is for Kenwood radio applications. Fig. 4 shows a possible means of conveying these signals via the basic interface circuit should you wish to implement this. Incorporating the details of Fig. 4 will require using cables with more wires than I used and coming up with some other scheme for connecting the radio interface cable (e.g., wiring the Kenwood DIN connector directly to the basic interface circuit), but it may be worth it if you intend to use some commercial software products, as many of these require these hardware handshake signals.

The circuit is powered using the computer's data terminal ready (DTR) line. This signal sits at some negative voltage when off and changes to +10 VDC or more when active, depending on the computer. I used a series diode (1N914) to prevent reverse polarity powering the chip during periods when DTR is off, and I used a series dropping resistor (470 Ω in my case) and zener diode regulator (5.1 volts) to complete the "power supply" for the interface. Most computers supply the

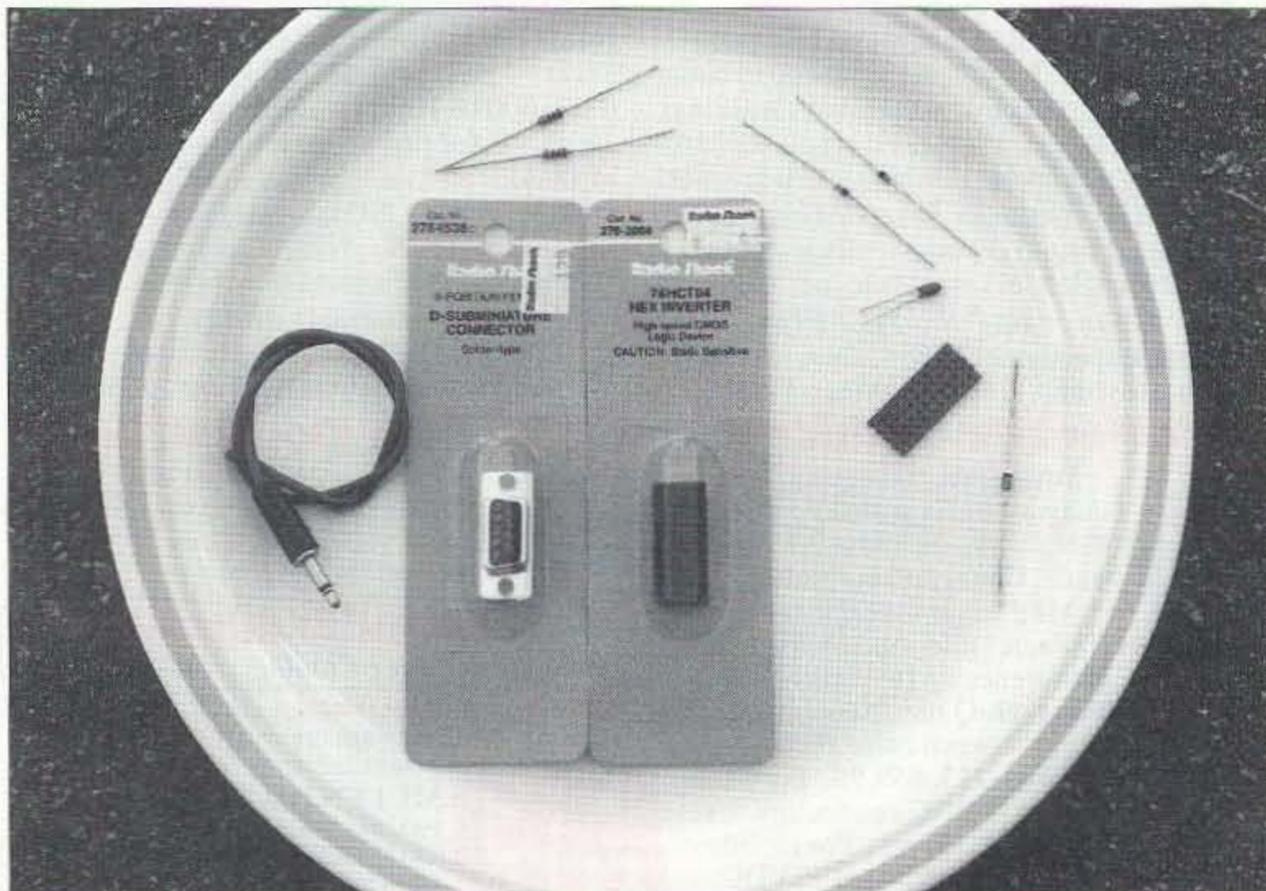


Photo A. Components used in building the basic universal interface circuit.

various RS-232 control signals to work into a 2 k Ω to 5 k Ω load, so there may be some voltage sag when using this line as a power source, but the CMOS chip's draw is negligible. If your computer's DTR line runs much higher than +10 volts, the 470 Ω resistor may have to be changed to 1 k or so.

My computer's RS-232 levels (I use a Compaq™ notebook for my radio stuff) vary between ± 10 volts, so I designed the interface around a +10 volt supply. Since my computer is battery-operated a lot of the time, its RS-232 levels often drop to seven volts or so as the battery discharges. This does not seem to affect proper operation of the interface. To keep the computer D_{out} line level within reason at the chip's input, I used another series diode (1N914) together with a voltage divider made up of a 1.5 k Ω and 2.2 k Ω resistor. If your RS-232 level is much greater than eight to nine volts, it may be advisable to increase the 1.5 k Ω value. As mentioned earlier, the 74HCT04 seems quite tolerant of minor overloads.

The DIN line to the computer as produced by this interface circuit is not exactly RS-232 specification in that the signal never goes negative. Most computer RS-232 inputs look at anything less than +2 volts as an indeterminate level, however, and declare the input false. I've tested this circuit in this application at 19,200 baud with several computers and never experienced a problem, and I've also used similar circuits in other applications at baud rates of 56 k and found this scheme to work fine.

The ICOM adapter

Circuit details for the ICOM adapter are shown in Fig. 2. It consists of a three-conductor in-line female mini-phone

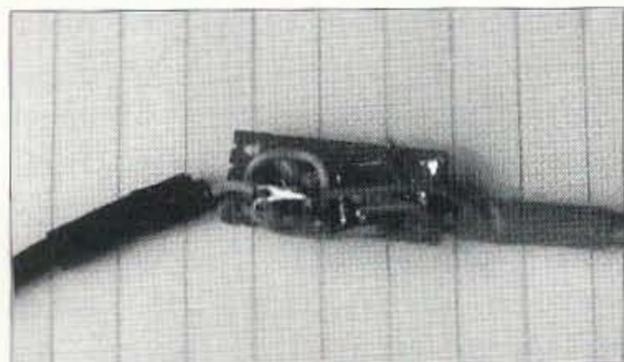


Photo B. Construction details of the basic universal interface circuit.

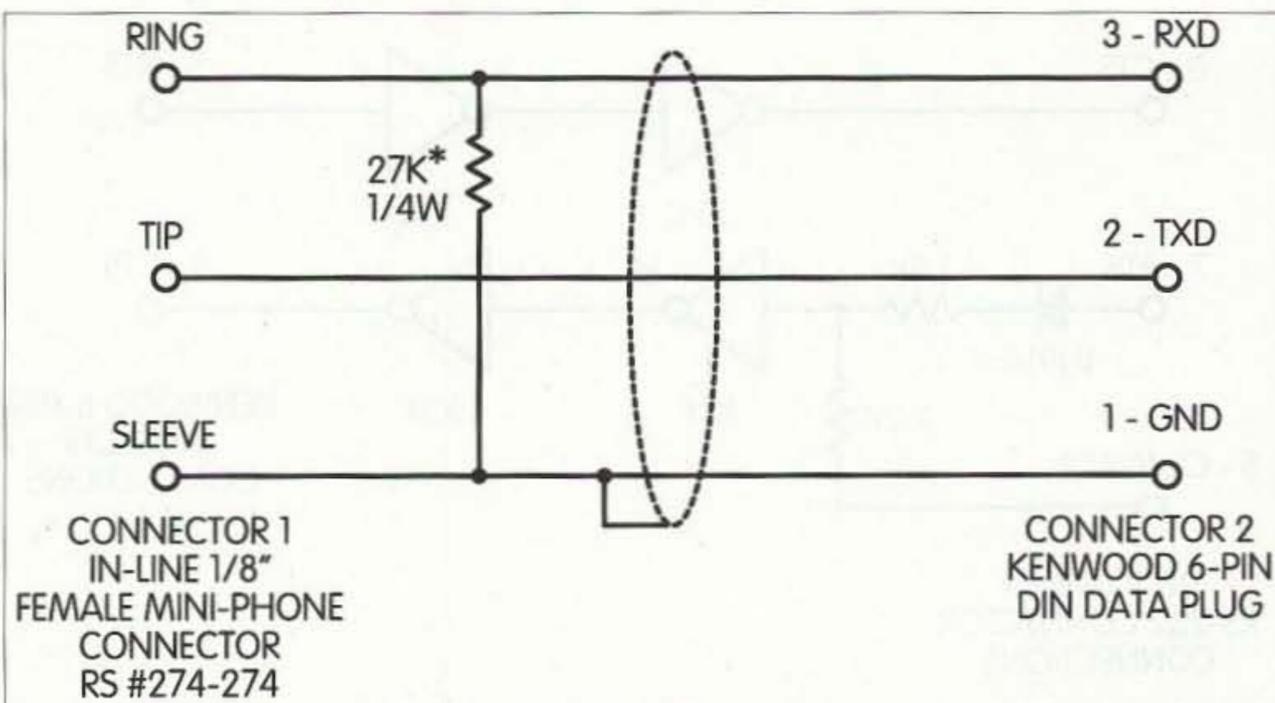


Fig. 3. The Kenwood adapter circuit. *Use of this resistor is optional. It was included to make basic circuit (and radio) less susceptible to static charges.

connector that mates with the basic interface unit's male connector. There is a 1N914 "signal combiner" diode installed at this connector, which serves to allow (conduct) sinking the CI-V line following data on the Radio Data In line from the basic interface circuit. It also allows the CI-V line to sink the Radio Data Out line without having to also sink the Radio Data In line, which it wouldn't otherwise be able to do, being a relatively high impedance source. Photo D shows this diode installed at the connector.

ICOM's CI-V interface can support up to four radios. Should you wish to connect additional radios to this system, simply daisy-chain additional 1/8-inch CI-V plugs to the one at the adapter and run them to your other ICOM rigs.

The Kenwood adapter

The Kenwood adapter is basically a connector adapter cable that takes signals from the three-conductor plug used with the basic adapter and pipes them to the appropriate pins of the six-pin DIN connector used with many Kenwood radios for computer interface connections. The single trick in building this adapter will be getting the right DIN connector, but if one can not be found locally, it can be obtained directly from Kenwood. Photo E shows an adapter I made up together with a variation I've used with the TS-50 in which I "pushed" the insulated

wires directly onto the pins of the rig's CN-6 connector (located inside the radio on the bottom circuit board). I included a 27 k Ω resistor in my Kenwood adapter cable, mounted at the three-conductor connector as a precautionary load to reduce the risk of static discharge damage should the cable be hot connected. Use of this resistor is probably not necessary, but I tend to be somewhat conservative about these things. Many Kenwood rigs include a 10 k Ω load on their TxD line internally.

Construction

Component layout is not at all critical when building this circuit, so I built mine to fit inside a half-inch-diameter piece of tubing I had. Tubing like I used is available at most hardware stores in a variety of sizes. I usually buy it by the foot.

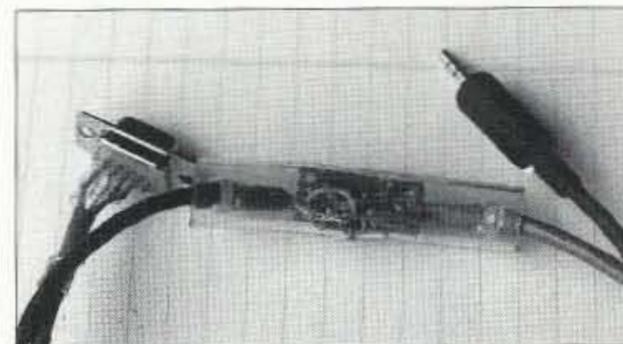


Photo C. The complete basic interface assembly is shown protected by a section of plastic tubing. Tie-wraps looped through slits in the tubing and around the cables ensure mechanical integrity of the assembly.

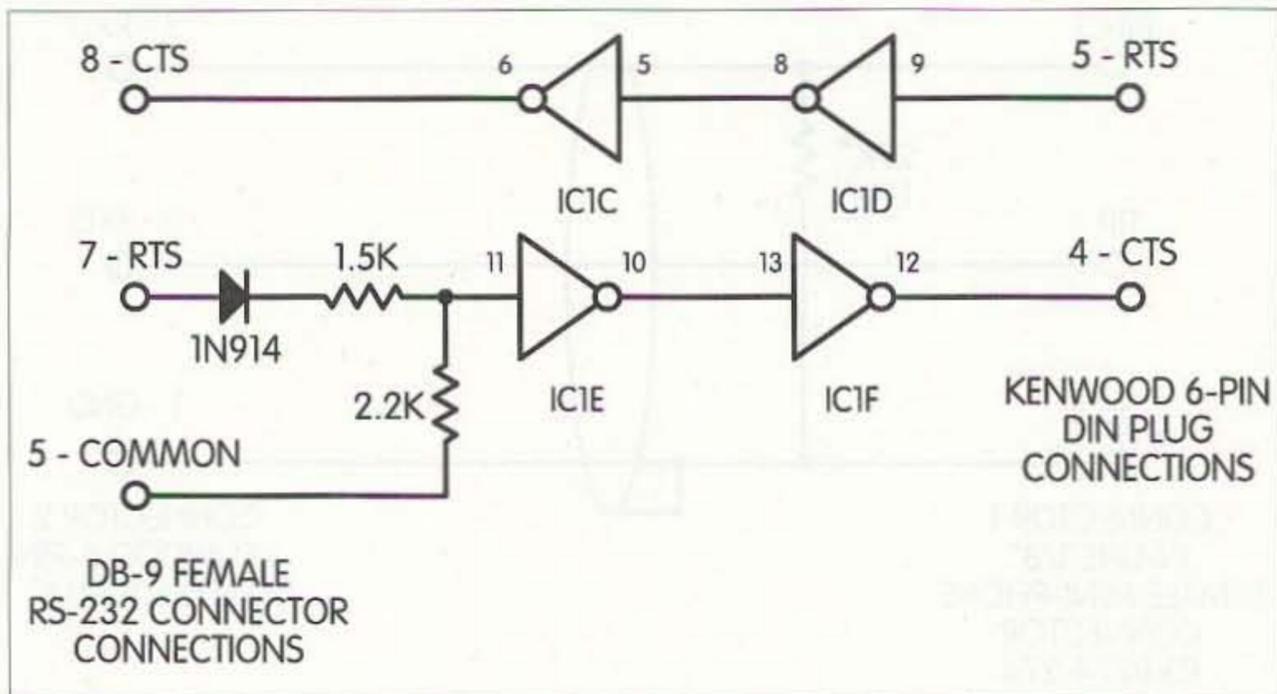


Fig. 4. Additions to the basic circuit to accommodate RTS/CTS control for Kenwood applications. Many commercial software programs for Kenwoods require hardware handshaking to work properly.

In keeping with a "low profile" approach, I elected not to use a socket for the IC, opting to solder directly to its pins sticking through the perfboard "chassis." Similarly, I attached the input/output cables by directly soldering the cable leads to their connection points on the perfboard chassis. I would recommend using an IC socket. Input and output are misnomers for these cables, by the way, since both cables are actually bidirectional.

I used a point-to-point wiring technique, with insulated jumpers to connect the various "points," as required. After assembly and test, I slipped the plastic tubing over the circuit assembly. I then secured the two cables to the tubing using tie-wraps looped



Photo D. Construction details of the ICOM CI-V adapter showing the 1N914 diode mounted inside the three-conductor 1/8-inch phone connector.

through 1/8-inch slits I had cut into the tubing using an X-Acto™ knife. This provides good strain relief for the cables and results in a neat and durable cable assembly (see **Photo C**).

Since RS-232 lines tend to be noisy, I recommend using shielded cables for this application. I used a four-conductor cable for my run between the computer's RS-232 port and the interface circuit and a two-conductor shielded cable from the interface circuit to the two-circuit 1/8-inch phone plug.

I connected the shield of the four-conductor cable, at the RS-232 connector end, to one of the four wires (a green wire in my case). I let the shield float at the interface board end, and used the (green) ground wire (only) to connect to the interface board. Use of suitable ferrite beads over the cables might be necessary should you notice an objectionable amount of noise. I didn't have any problem with my setup.

Preliminary tests

Before connecting this cable assembly to anything, I would recommend making a few ohmmeter checks. First, I suggest checking continuity between signal ground (RS-232 connector, pin 5) and the sleeve of the 1/8-inch plug. 0.2 Ω or less would seem appropriate for this. For this test and those following, it is assumed that you're using a



Photo E. Kenwood adapters for the basic universal interface circuit. The top adapter is used with a TS-50 by "pushing" the wire ends on to the pins of CN-6 (the TS-50's interface connector). The bottom one is essentially a plug adapter for Kenwood radios that use DIN-type interface connectors.

nine-pin RS-232 connector. If you're using a 25-pin type, you should translate the referenced pin numbers accordingly.

Next, I would check resistance between signal ground (RS-232, pin 5) and pins 2 and 4, respectively. Typically, you should see 100 Ω or more here.

If your ohmmeter can't supply much current (typical of FET-type meters), use the diode-check function if you have one; otherwise, these tests may be inconclusive. Generally, what you're looking for is an obviously unusual reading that would be indicative of some wiring error.

Finally, I suggest checking from the tip and ring of the 1/8-inch plug to all wired RS-232 pins. You should typically see readings greater than 50 k Ω . Any reading of less than 15 k Ω would be reason for suspicion here. Also, I generally use an ohmmeter to check ICs pin by pin for possible shorts.

After making the resistance checks, I would suggest powering up your radio and plugging the CI-V plug into the radio *only* (assuming you have built the ICOM adapter and have an ICOM radio). A short circuit here won't hurt anything, but a 90-volt spike might! Once connected, check the voltage at the CI-V plug tip. You should see approximately +5 volts if all is OK.

If everything is checking out thus far, it's time to see if the circuit is working. To do this, you'll need some communications software. I used the terminal program packaged with Windows™, but any terminal program should work as long as you configure it correctly and it brings up DTR. I configured for COM1, 9600 baud, eight bits, and software flow control. Kenwood radios typically run at 4800 baud, so if you have a Kenwood, I'm afraid you'll have to wait for the section next time describing Kenwood's software.

As a quick check with the terminal program, typing "FA" should generate a reply from the radio if all is working. The remaining paragraphs in this section deal with checking out the CI-V interface operation with an ICOM radio—a trickier process than checking out a Kenwood.

With ICOM radios, I generally configure the CI-V port address for 48 h (my IC-706's address), auto baud, and transceive enabled. Some older ICOMs may not offer auto baud, and if this is the case, you will have to reconfigure both the software and the radio for a matching baud rate they both support. Once configured and connected, you can test to see if you are receiving data by giving your radio's VFO knob a spin. Data will appear on your screen as gibberish since it is binary in nature,

but the point of this test is to simply confirm that data is getting through.

Should this test fail, I suggest checking voltages. You should see +5 volts at the CI-V plug tip (plugged into the radio and the radio on), +10 volts at DTR, -10 volts at TxD, and near zero at RxD. If you don't have DTR, for example, you might try another communications program, because you need DTR to get the rest.

Verifying that the interface can send data is a little trickier, but at this point, you can test functionality by monitoring the +5 volts at the CI-V plug tip (remember, it must be plugged into the radio because the radio sources this five volts).

While watching the meter, hit a computer key. You should see a slight flicker in the +5 volts each time you hit a key. A scope will show the +5 volts dumping, if you happen to have one and are ambitious enough to pull it out and connect it up.

At this point, if the interface appears to be functional, continuing checkout requires selection of one of two options. You may elect to use a commercial software package designed for ICOM radio control, or you may want to experiment with developing your own. Some custom software is required, unfortunately, because writing and reading data to and from ICOM radios involves sending and decoding little data "packets." Next time: software. 75

Parts List

C1	10 μ F 16 VDC tantalum (RS #272-1436)
D1, D2	1N914 diode (RS #276-1122)
IC1	74HCT04 hex inverter (RS #276-2804)
Plug 1	DB-9 female connector (RS #276-1538)
Plug 2	1/8" male 3-cond. mini-phone plug (RS #274-284)
ZD1	5.1 V, 1 W zener (RS #276-565)

Table 1. Parts list.

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Tutorial and Tester for JFETs

Big learning from a little project.

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When you want to design with a JFET and have only data sheet characteristics, you're in a bind for critical information. The data sheets for JFETs may be close enough for device selection but not close enough for design. Data sheets often show characteristic spreads of five or 10 to one and don't give "typical" values. Of course, you can assume that the typical value is the average of the maximum and minimum values and hope the transistor in your hand is typical.

That's a lot of assuming. It would be comforting to know what you're actually working with. This tester measures forward transconductance g_{fs} and drain current I_D for either N-channel or P-channel depletion-mode JFETs.

Forward transconductance g_{fs} is an AC characteristic, the change in drain current I_D for a change in gate-source voltage V_{gs} . The drain current is a DC characteristic, I_D vs. V_{gs} . The relationships of JFET characteristics are given in equations in later paragraphs. Suffice it to say that g_{fs} is a function of I_D , and when I_D is maximum, g_{fs} is maximum.

Note that g_{fs} is a critical parameter because it must be known to calculate the gain of an amplifier, which is $A_v = R_L g_{fs}$, where R_L is the drain load resistance.

The operating point is defined by I_D and V_{gs} . The resistor needed to produce the desired source bias voltage can be calculated with the equation $R_s = V_{gs} / I_D$, where V_{gs} is the gate to source voltage and I_D is the drain current corresponding to V_{gs} .

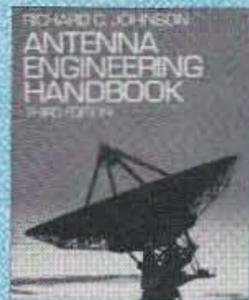
The JFET tester has three sections: 1) a test signal generator; 2) a measurement circuit; and 3) power supplies. The test signal, a 1 kHz 0.2 V_{p-p} square-wave, exercises the device under test (DUT). The measurement circuitry converts the square-wave output of the DUT to a DC voltage that is proportional to g_{fs} . The power supplies provide unregulated but low ripple +15 V and -15 V for the DUT, the op amps in U2, and +8 V (regulated) for the oscillator.

The test signal generator shown in Fig. 1 uses two sections of a CMOS CD4001 NOR gate U1 connected as inverters for the oscillator. Any two CMOS inverters can be used. For example, two sections of either a CD4011 or CD4009 will work equally well. The frequency of oscillation is determined by R1 and C1, $f_o \approx 1.2R1C1$. R2 just limits the current in the input protection circuit of U1A. R1, R2, and C1 can be 10% tolerance parts. The frequency of the test signal

is not critical, but its amplitude is. The output swings from V_{DD} to V_{EE} . Therefore, the V_{DD} voltage applied to U1 must be regulated to produce a constant-amplitude test signal. V_{DD} is arbitrarily chosen to be +8 V and the output swings from +8 V to 0 V. The 8 V_{p-p} output of the oscillator is divided by R3, R4, and R5 to produce a 0.2 V_{p-p} signal and a 0.1 V_{p-p} signal. If a different V_{DD} is used, the values of the resistors used in the divider must be changed. The test signal applied to the DUT must swing from 0 V to -0.2 V for N-channel JFETs and from 0 V to +0.2 V for P-channel devices. Level shifting of the divided oscillator output required for different polarity devices is accomplished in U2A. When the +0.2 V signal is applied to the inverting input of U2A, the output swings from 0V to -0.2 V. The divider is loaded by the inverting input of U2A in series with R6. This loading must be taken into consideration when calculating the values of R3, R4, and R5. The inverting gain is set by the ratio R7/R6. The noninverting gain is $1+R7/R6$; therefore, when the inverting gain is unity the noninverting gain is two. When the 0.1 V signal is applied to the noninverting input, the output is 0 V to

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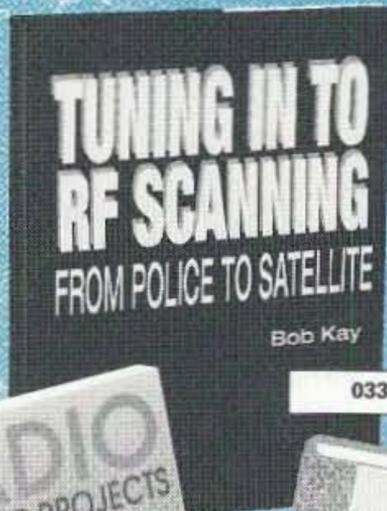
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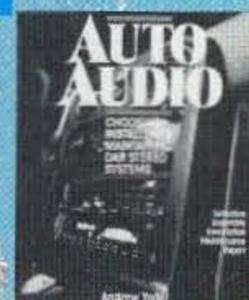
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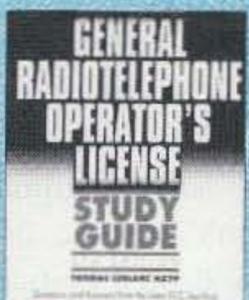
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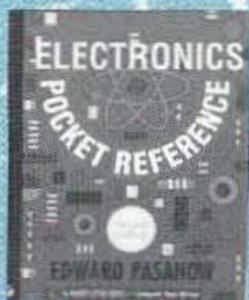
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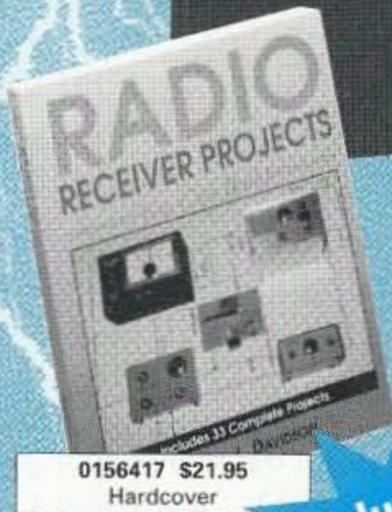
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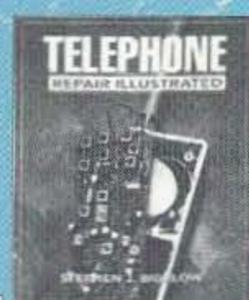
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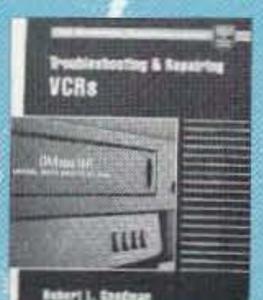
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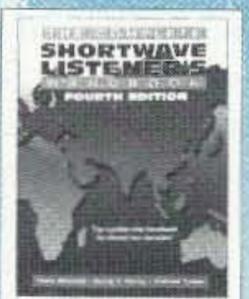


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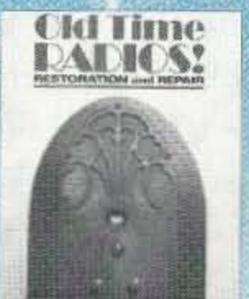
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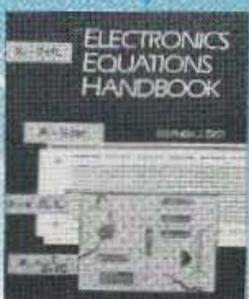
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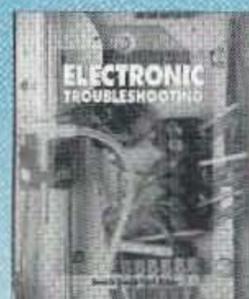
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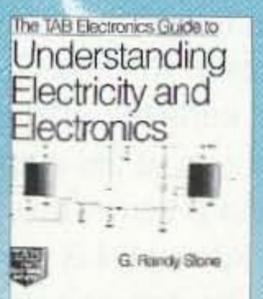
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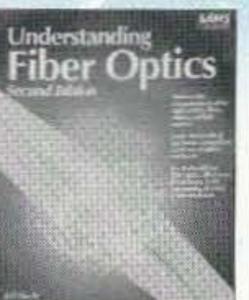
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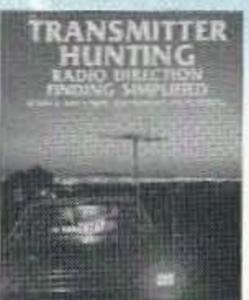
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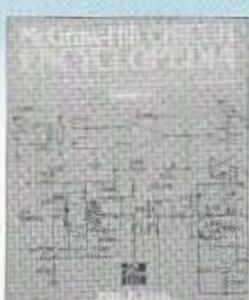
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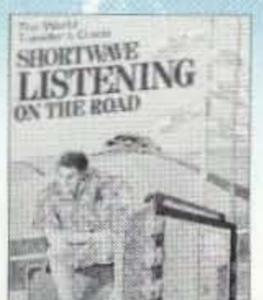
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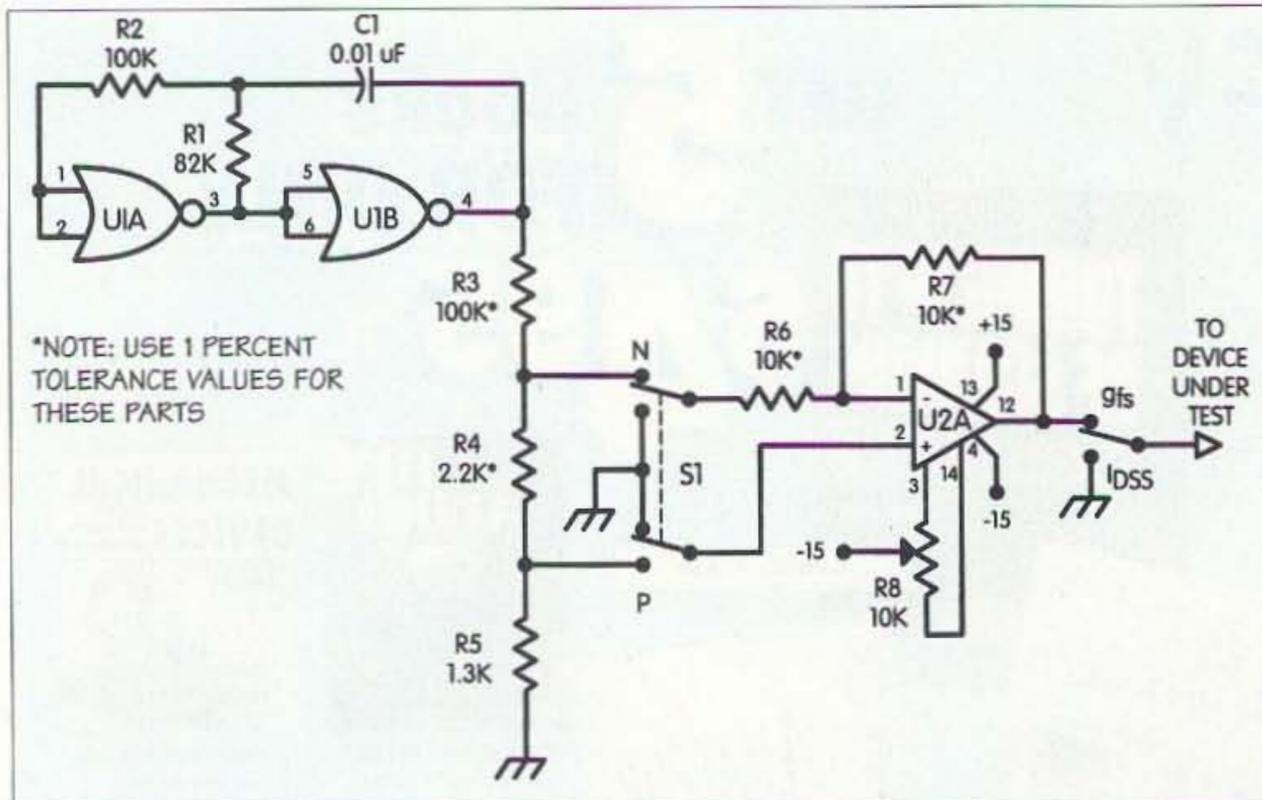


Fig. 1. The test signal generator produces 0 V to +0.2 V_p or 0 V to -0.2 V_p.

+0.2 V. The noninverting amplifier input resistance is very high and does not load the divider. Since the input to the DUT must be very close to 0.2 V, the resistors R3 through R7 should be 1% tolerance parts (commercial equivalents to RN55DXXXF). The 10 kΩ pot R8 nulls the offset of U2A. Adjust R8 for zero at the output of U2A when the input is zero—that is, when the junction of R3 and R4 is grounded.

The square-wave test signal at the gate of the DUT swings from 0 V to 0.2 V. This implies an average (DC)

value of 0.1 V. Therefore, the indicated value of g_{fs} is the g_{fs} when $V_{gs} = 0.1$ V. The gate current is a few picoamps when the gate is reverse-biased (negative for an N-channel device, positive for a P-channel) but rises rapidly when forward-biased. The input signal to an amplifier should not drive the gate positive, but for maximum g_{fs} , the peak of the signal should drive V_{gs} to just zero.

The DUT and metering circuit is shown in Fig. 2. The square-wave test signal (output of U2A) is applied to

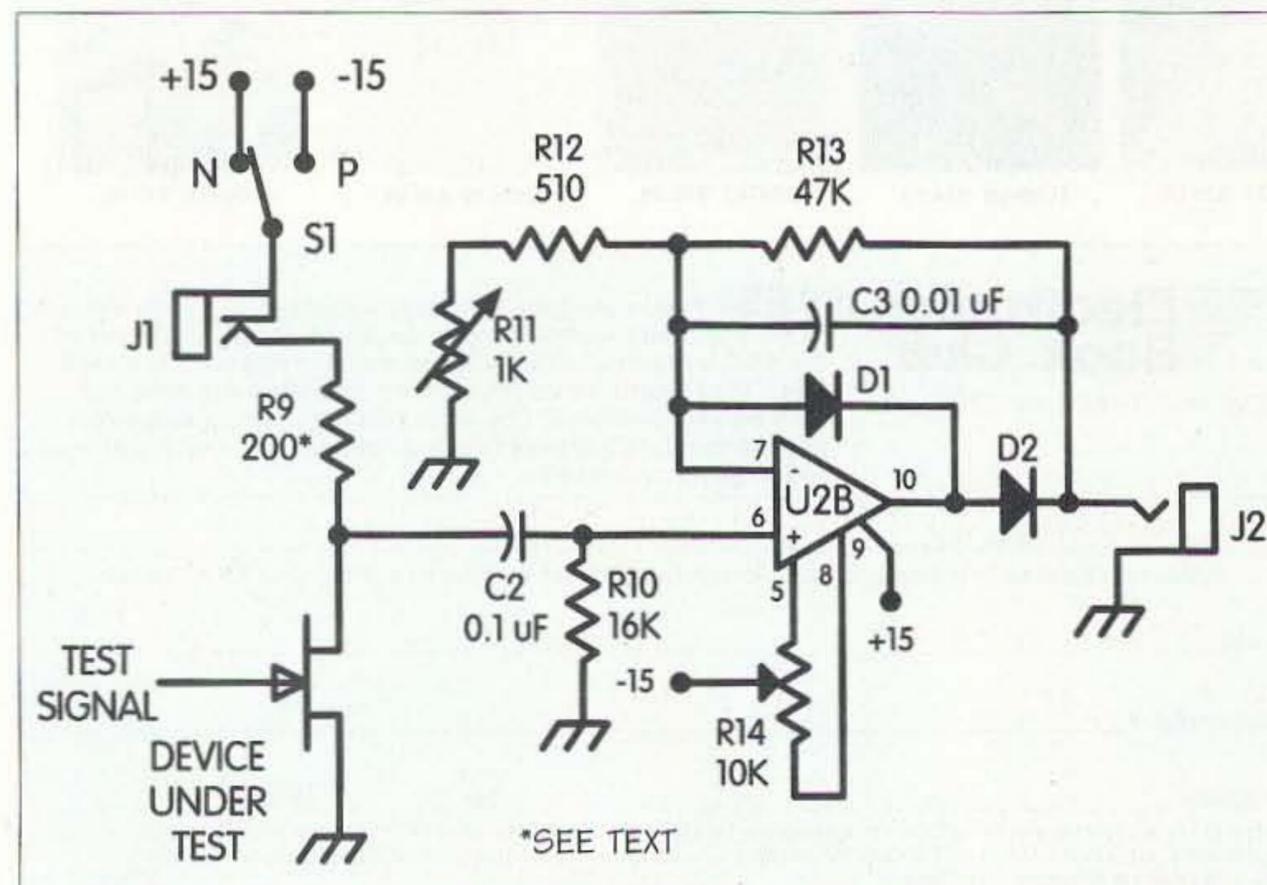


Fig. 2. The measurement circuit output indicates I_D and g_{fs} .

the gate of the DUT. The output of the DUT is capacitively-coupled to the precision rectifier U2B to eliminate any DC component. The output of the DUT is rectified to produce a DC voltage that is proportional to $g_{fs}R9$ of the DUT. The DC voltage at the output of the precision rectifier can be measured with an internal voltmeter, or a bench voltmeter can be used in J2 (Radio Shack #274-252) to save the cost of panel meters. The resistance of the voltmeter need not be high; a 1 kΩ/V basic analog movement is acceptable. However, the resolution and readability of a digital multimeter (DMM) is a definite advantage. A current meter in the insulated shorting jack J1 (Radio Shack #274-255) allows a bench milliammeter to indicate I_D . At first glance it would appear that the current meter could be placed from source to ground, but the typical 25 mV voltage drop across the meter would be significant when compared to the 100 mV DC component of the input.

The drain load R9 of the DUT is chosen to be 200 Ω to ensure sufficient drain-source voltage even when the drain current approaches 50 mA. The minimum drain-source voltage V_{DS} must be greater than “pinch-off” for measurement of meaningful g_{fs} . “Pinch-off” is the V_{gs} necessary to put the DUT in the constant-current operating region. For long-channel JFETs, “pinch-off” is about V_{off} . For short-channel devices, pinch-off V_{off} is higher, but most devices pinch-off with less than 8 V gate to source.

The gain of the DUT and the precision rectifier is scaled to produce a DC output of 1 V when g_{fs} is 1 mS (1000 μmhos). The gain of the DUT is 0.2 when the g_{fs} is 1 mS: $A = 1 \times 10^{-3} \times 200 = 0.2$. The capacitively-coupled 1 kHz input to the precision rectifier is a square-wave that swings from +20 mV to -20 mV when the DUT's g_{fs} is 1 mS. The precision rectifier has a gain of 50 and the output is +1 V_{DC} when the input is +20 mV_p. The gain of the precision rectifier is set by the ratio R13/(R11+R12). R12 limits the range of gain adjustment from 31 to 94. The adjustment of gain is a one-time procedure that compensates for errors in the

tolerances of R9, R12, and R13. The diodes D1 and D2 should be switching diodes similar to the 1N4148 or 1N914.

U2 is shown as an MC1747 (dual 741 op amps) but any general-purpose internally-compensated op amp can be used. The input offsets of the 741 are specified as 5 mV voltage offset and 200 nA current offset maximum at 25°C. These offsets can produce a DC output in excess of 250 mV unless they are nulled out. The 741 has provision for nulling the offsets with an external trimmer pots (R8 in Fig. 1 and R14 in Fig. 2).

Adjustment of the tester is straightforward and only needs to be performed once:

1) Null the offsets of U2A: Connect a jumper from the junction of R3 and R4 to ground and adjust the trimmer R8 to zero the output of U2A.

2) Null the offsets of U2B: Without a DUT in the socket, adjust R14 to just produce zero at the output J2. Note that the output of U2B can not be driven negative so the adjustment must be for the output to be just zero.

3) Set the gain of the precision rectifier. Connect a jumper between the gate and drain terminals of the empty DUT socket to apply the output of U2A ($0.1 V_p$) directly to the drain terminal. Adjust R11 to produce 5 V on the voltmeter at J2. That's it.

To use the tester, turn off the power, plug the voltmeter into J2, select the polarity of the DUT with S1, plug the JFET in the socket, and turn on the power. The voltmeter in J2 will indicate 1 V for $g_{fs} = 1 \text{ mS}$. A milliammeter in J1 indicates I_D at $V_{gs} = 0.1 \text{ V}$. Close S2 and the current meter in J1 indicates I_{DSS} . In passing, be aware that a JFET can operate with drain and source interchanged and not all JFETs have the same pinouts. While most JFET pinouts have the gate at pin 3, some have the gate at pin 2. Pins are numbered from left to right looking at the flat side of a TO-92 package.

The power supply for the tester shown in Fig. 3 provides +15 V for N-channel JFETs, -15 V for P-channel JFETs, and $\pm 15 \text{ V}$ for U2.

The actual voltages are not critical. Anything greater than 12 V will do,

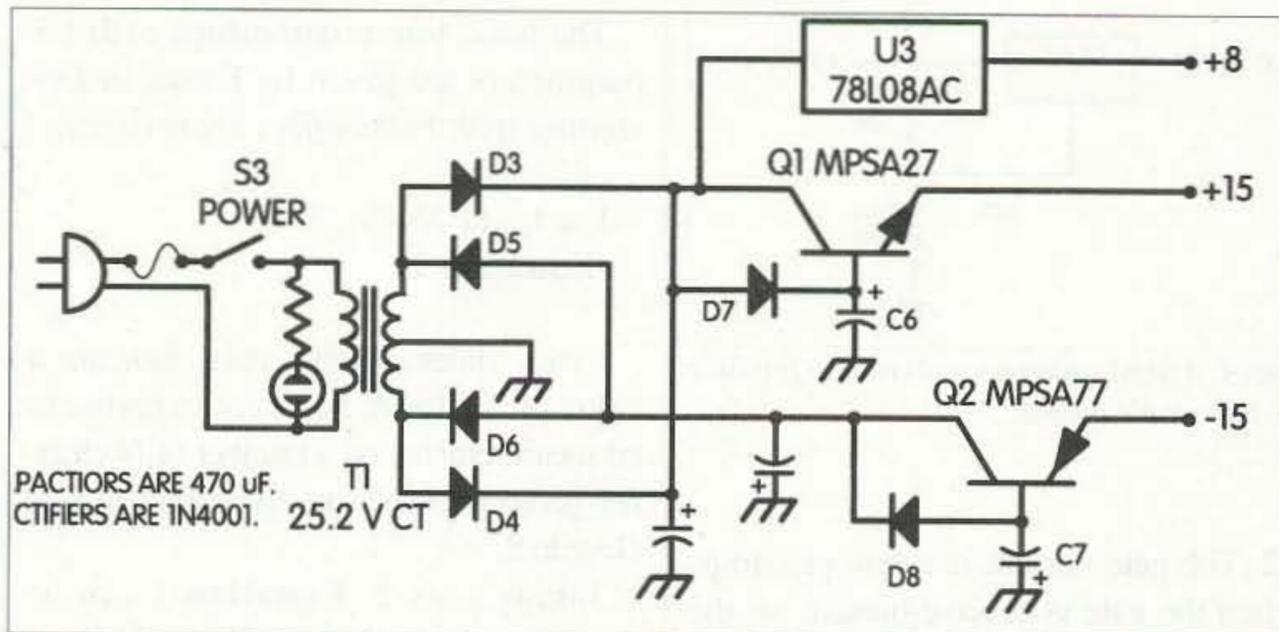


Fig. 3. The power supply has low ripple. Note: All capacitors are 470 μF ; all rectifiers are 1N4001.

but 15 V provides a little more headroom for a high-current DUT. The ripple on the voltage applied to the DUT must be low, because the metering circuit has little discrimination between the 1 kHz test signal and the 120 Hz ripple. The V_{DD} for the oscillator is critical in that it determines the amplitude of the test signal. A regulated +8 V $\pm 5\%$ for the oscillator is provided by U3, a 78L08AC three-terminal positive voltage regulator. The power supply shown can provide more than 50 mA with peak-to-peak ripple less than 1 mV_{pp}, but a DUT drawing 50 mA may cause V_{DS} to fall below pinch-off—in which case g_{fs} will be indicated a little bit high.

The power supply shown uses a Radio Shack 25.2 VCT transformer, #273-1366, to produce 17 V_p. A 24 V center-tapped power transformer will produce about 16 V. D3 and D4 form a positive full-wave rectifier, while D5 and D6 form a negative full-wave rectifier. The diodes in the power supply can be any silicon rectifier—the 1N4001 is an economical choice. The capacitors are all 470 μF 35 WVDC, Radio Shack #272-1018. Filter capacitors C4 and C5 reduce the +15 V and -15 V ripple to about 1 V_{pp} when the load current is 50 mA and less for lighter loads. The ripple is further reduced by the de-rippers Q1 and Q2. The capacitors C6 and C7 at the bases of Q1 and Q2 are charged by D7 and D8 and discharged by the base currents of Q1 and Q2. The voltage at the emitters is approximately 0.6 V below the

voltage at the bases. The h_{FE} of Q1 and Q2, Darlington transistors, is greater than 10,000, so the base current is only 5 μA when the collector current is 50 mA. With perfect capacitors, the ripple voltage would be 88 μV_{pp} . It is safe to say that the ripple voltage is less than 1 mV.

Voltage for the 1 kHz test oscillator U1 in Fig. 1 is provided by the voltage regulator U3 in Fig. 3 or Fig. 4. The absolute voltage is not critical, but it must be well regulated. The 78L08AC has a tolerance of 5%. Therefore, the test signal amplitude can be in error by 5%. For the greatest accuracy, U3 can be made a 78L05C, a 5 V $\pm 10\%$ regulator and the output adjusted to exactly 8 V with the variation shown in Fig. 4. The voltage across R21 is a nominal 5 V, the output of the regulator. R22 is adjusted so that the voltage across R21 and R22 is exactly 8 V. The current in R21 is nominally 10 mA and the current in R22 is 10 mA plus the bias current of U3. The bias current can be as high as 1.5 mA so that a 500 Ω variable R22 can have a voltage drop variable from 0 V to 5.75 V. The output of the supply can be varied from 5 V to 10.75 V.

A less complex test fixture shown in Fig. 5 measures I_{DSS} and V_{gs} . The values of I_D , V_{off} , and g_{fs} can be calculated with these measured values. A calculator that computes squares and square roots makes the calculations easy. With the proper polarity voltage applied to the drain with S1, the drain current I_{DSS} can be measured by shorting the gate resistor R1 to the source with

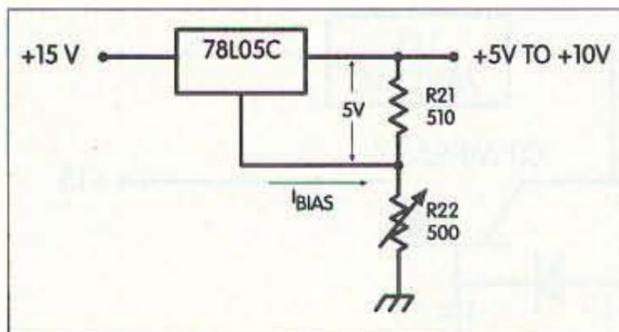


Fig. 4. A fixed voltage regulator can produce an adjustable output.

S2. The gate current is a few picoamps when the gate is reverse-biased, so the voltage drop across R1 can be ignored. V_{gs} can be measured by connecting R1 to ground with S2. V_{gs} is the voltage across R_s . I_D is V_{gs}/R_s . Accurate calculation of I_D requires that R_s be precisely known. With these measured and calculated values of I_{DSS} , I_D , and V_{gs} , the other parameters of the DUT can be calculated.

The basic interrelationships of JFET parameters are given by Evans in *Designing with Field-effect Transistors*:

$$I_D = I_{DSS}(1 - V_{gs}/V_{off})^n \quad \text{(Equation 1)}$$

Evans states: "Some texts indicate a value of 3/2 for n; however, experimental measurements on a number of N-channel geometries indicate the exponent n is close to 2."

Taking n as 2, Equation 1 can be rearranged to solve for V_{gs} and V_{off} :

$$V_{gs}/V_{off} = 1 - \sqrt{I_D/I_{DSS}} \quad \text{(Equation 2)}$$

$$V_{gs} = V_{off}[1 - \sqrt{I_D/I_{DSS}}] \quad \text{(Equation 3)}$$

$$V_{off} = V_{gs}/[1 - \sqrt{I_D/I_{DSS}}] \quad \text{(Equation 4)}$$

$$g_{fs} = 2I_D/(V_{gs} - V_{off}) = 2\sqrt{I_D I_{DSS}}/V_{off} \quad \text{(Equation 5)}$$

where

I_D = drain current for the particular value of V_{gs}

V_{gs} = gate-to-source voltage

I_{DSS} = the drain current when V_{gs} is zero

V_{off} = gate voltage required to reduce I_D to zero

g_{fs} = the forward transconductance; the change in I_D for a change in V_{gs} , $\Delta I_D/\Delta V_{gs}$

Given I_D , I_{DSS} , and V_{gs} , V_{off} can be calculated with Equation 4. With V_{off} known, g_{fs} can be calculated with Equation 5.

The power supply for the simplified tester can be any source of 12 V or so that can supply the necessary I_{DSS} . S1 can be used to switch the polarity for N-channel and P-channel transistors, or the supply can be reversed manually. S2 connects the gate to the source when I_{DSS} is measured or to ground when V_{gs} is measured. R1 in the gate of the DUT limits the gate current if the gate is forward-biased. The value of R1 can be anything from 10 k Ω to 100 M Ω . R_s can be any value from 10 k Ω to 20 k Ω , but it must be precisely

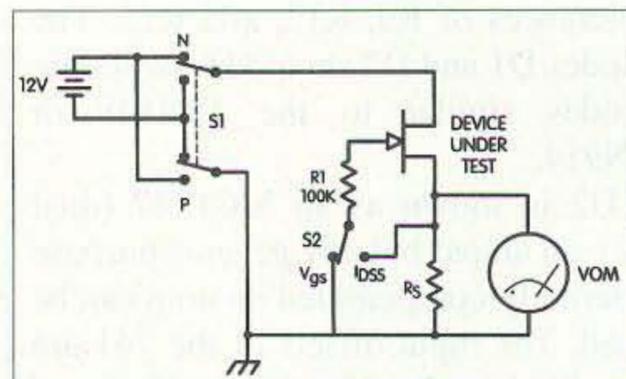


Fig. 5. A simplified tester provides essential information.

known. The resistance of the voltmeter shunts R_s when V_{gs} is being measured. Therefore, when calculating I_{DSS} , the parallel combination of the voltmeter resistance and R_s should be used. However, if the voltmeter is 2 M Ω or greater, its resistance can be ignored. While an analog VTVM is satisfactory, the readability and resolution of a digital multimeter is very desirable. The shunting effect of R_s while measuring I_{DSS} must also be recognized. When R_s is 10 k and the meter resistance is 30 Ω (typical for a 1 mA movement), the meter will read 0.03% low and can be ignored.

With g_{fs} determined, a low-frequency amplifier can be designed or the operating point of a VHF amplifier can be established. The value of g_{fs} is valid for frequencies at which lumped constants are appropriate. Above 100 MHz, S-parameters are more appropriate for the RF concerns, but the bias needed can be obtained with the parameters found with the tester.

When a number of transistors are to be evaluated, the tester shown in Figs. 1 through 3 can eliminate calculations and save time. While the calculations required with the simple tester are not tortuous, they can be a bother if several devices must be evaluated.

The tester is a convenient thing to have around if you do much homebrewing. When it comes time to troubleshoot (test) your design, you don't know if you're testing the construction, the design, the components, or the test equipment. If the component's parameters are only vaguely known, you're starting in a deep hole. A tester of some sort is a great help in filling that hole.

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All-Copper 17 Meter X-Beam

A nearby hardware store, a free afternoon ...

Ed VanOverloop WA2UGT
106 North 5th Street
Park Ridge NJ 07656

I recently decided that I would like to have a beam for my current favorite HF band, 17 meters, so I reviewed my collection of antenna articles and books on the subject for an easy-to-build design. After checking out my usual local sources of antenna construction materials, I discovered that building even a simple aluminum yagi would present both mechanical and supply problems. On the other hand, I found that I could easily put together an all-copper X-beam from locally available materials.

Our nearby Home Depot™ building supply store had everything I needed! Even using all new materials, the cost would be just over \$30. I estimated that the antenna could be on the air in less than four hours from the start of construction.

The main beam elements are standard ten-foot lengths of half-inch residential-grade copper water pipe, with 14-gauge stranded copper wire added to the element ends to achieve resonance. The copper water pipe is supported by a simple pine and plywood base in the shape of an "X". This yields a surprisingly light total weight

of just over eight pounds. **Table 1** contains a parts list, **Fig. 1** shows a side view of some of the construction details, and **Fig. 2** is a bird's-eye view of the antenna.

Construction is quite straightforward and should be no problem for anyone who is even a little bit handy. The pine and plywood pieces are cut to size, sanded, and given a coat of orange shellac as a wood sealer. The base and crosspieces are then assembled, using wood screws, and the entire assembly is given two coats of a good outdoor enamel paint. The two 10-foot copper pipes used as a director are connected with a 90° copper elbow and soldered using a propane torch.

Once the wood base and the copper director assembly are ready, the copper elements are mounted on the wooden base by using one-quarter-inch plastic tie wraps passed around the copper pipes and through four 5/16-inch holes drilled in each of the one-inch by three-inch support arms. (I used short pieces of the cut-off plastic tie wraps to insulate the copper pipes from the wooden support pieces.) Be sure to space the two radiator feedpoint ends

17 Meter X-Beam Parts List

Qty.	Description
2	1" x 3" x 5' pine boards
1	12" x 12" x 1/2" exterior plywood
1	30" x 30" x 1/2" plywood brace (see Fig. 1)
1	1-1/4" pipe flange
4	1/4" x 1-1/2" bolts, washers, and nuts
1	1-1/4" EMT connector
1	1-1/4" EMT thin-wall electrical conduit 18" long
1	1/2" copper elbow
4	1/2" x 10' copper water pipe
24	1/4" wire tie wraps
26'	#14 gauge stranded copper wire

Table 1. Parts list.

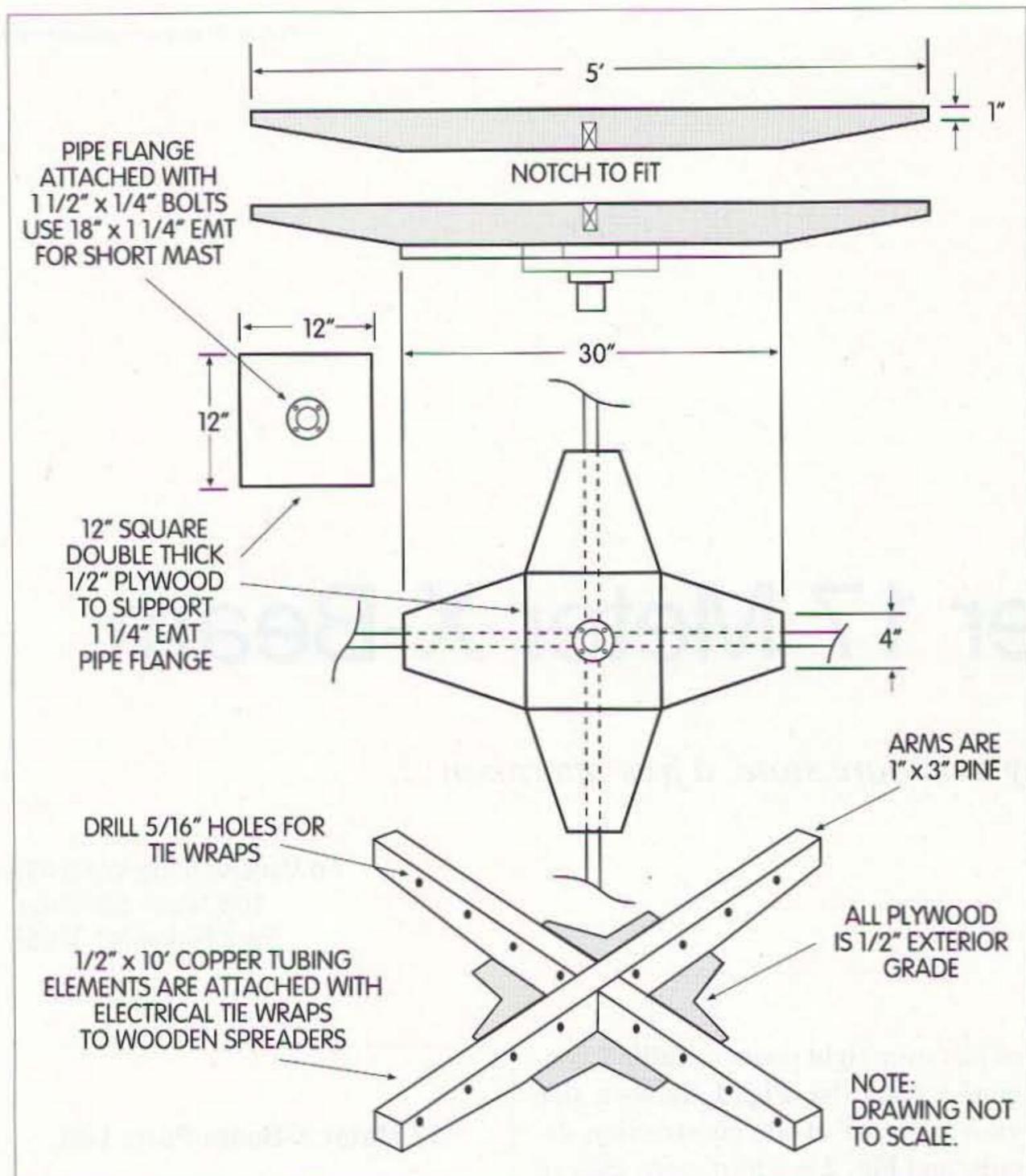


Fig. 1. X-beam pictorial.

about one inch apart and at least one quarter inch from the director assembly.

The copper-wire pigtailed are then soldered to the ends of the copper pipe (as indicated) and the wires are connected together with 30- to 50-pound-test fishing line. The other ends of the copper pipes are also joined together with fishing line and tie wraps passed through small holes drilled in the element ends. All copper elements are then coated with a clear spray finish to reduce corrosion.

The completed antenna is now ready to be mounted on your favorite rotator, and connected to your rig using 50-ohm coax feedline. It does not matter which radiator receives the center conductor of the coax and which receives the shield. The coax should have an eight-turn, six-inch diameter, RF choke coil wound right at the feedpoint connection to act as a balun and keep all of the RF

energy at the antenna. Finally, be sure to seal the end of the coax to protect it from the weather.

Once the installation is complete, go down to your shack, turn on your rig, and see how well your new X-beam works! The first thing I did was measure the SWR. I found it to be flat at 1.4:1 from band-edge to band-edge. I plan to install a simple hairpin match across the feedpoint to bring the SWR down to 1:1; but then again, I'm a purist. You may decide that an SWR of 1.4:1 is fine.

At this point, I decided to get on the air and make some contacts. The first contact was deep into Russia, and I received a 5-8 report. Shortly thereafter, I received a 5-9 from Istanbul, Turkey, after busting a pileup. Pleased with the initial performance, I spent the next several weeks comparing the X-beam to my old standard antenna, a full-wave 80-meter horizontal loop.

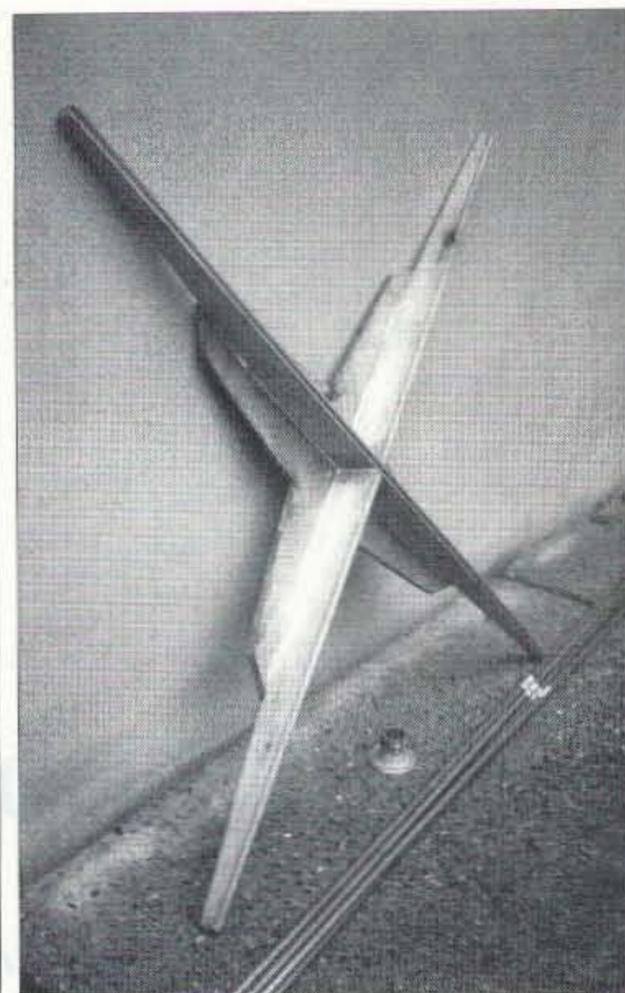


Photo A. Shellacked and ready for assembly.

I have already worked six-band DXCC (with over 140 countries on 17 meters alone, using this loop antenna and a 100-watt rig), so I feel that the 80-meter horizontal loop is a more than adequate performer to use as a comparison antenna for my new beam. It came as a pleasant surprise to find that the X-beam was between one and four S-units better than the large multiband wire antenna on 17 meters.

The X-beam has a two to three S-unit front-to-back ratio, and a three to four S-unit front-to-side ratio. My friend Chris WB2VVV modeled the X-beam using an antenna-analysis computer program, and found that the "X" is actually better than a conventional two-element yagi in every performance category!

Why this easy-to-construct and highly effective lightweight antenna has been mostly ignored is a mystery to me; but if you have an urge to build something, you will find this antenna hard to beat on a dollars-per-dB basis. The design may be adapted to any band between 10 and 20 meters using the measurements in the chart shown at **Table 2**.

For the mathematically inclined, I have included some formulas which I found to be helpful in designing the X-beam (see **Table 3**). Of course, depending on the materials used, the

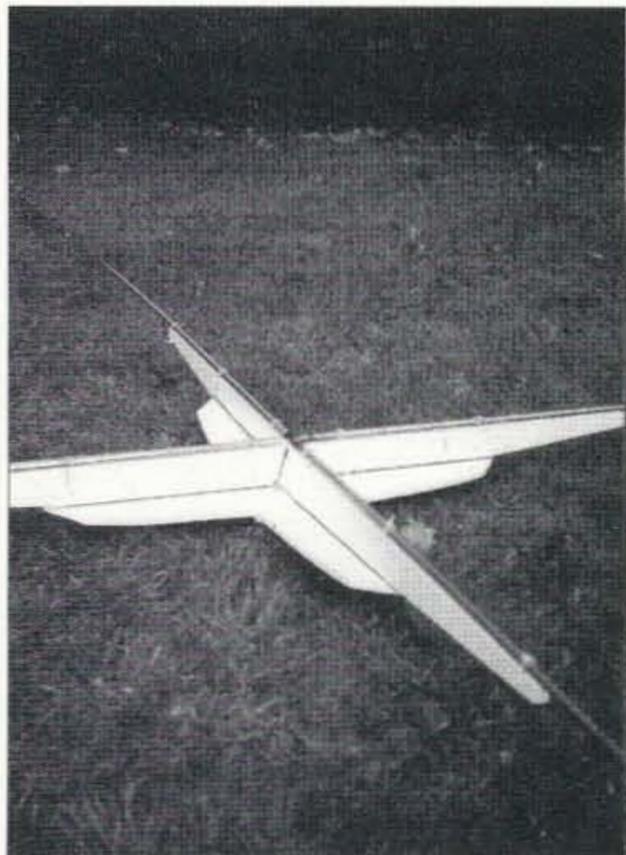


Photo B. Painted and ready for mounting.

Approximate Phone Band Dimensions			
Frequency (MHz)	Element Lengths	Pigtail Lengths	
		Radiator	Director
28.500	6' 10.0"	3' 9.0"	3' 3.0"
24.950	7' 9.5"	4' 4.0"	3' 9.5"
21.300	9' 2.0"	5' 0.0"	4' 4.0"
18.140	10' 0.0"	6' 6.0"	5' 10.0"
14.275	13' 8.0"	7' 5.5"	6' 5.5"

Table 2. Approximate phone band dimensions.

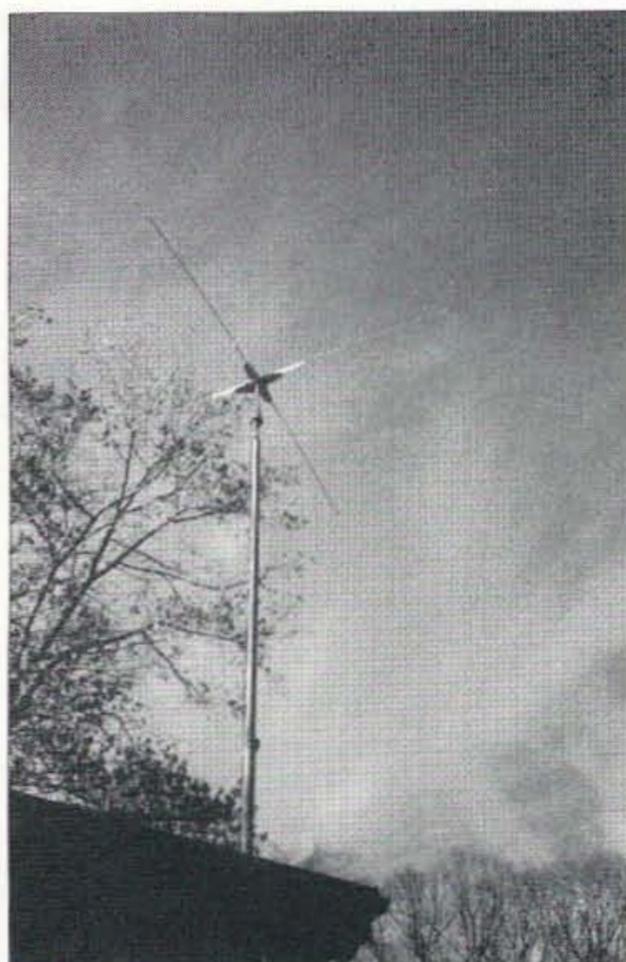


Photo C. Flying high at 40 feet.

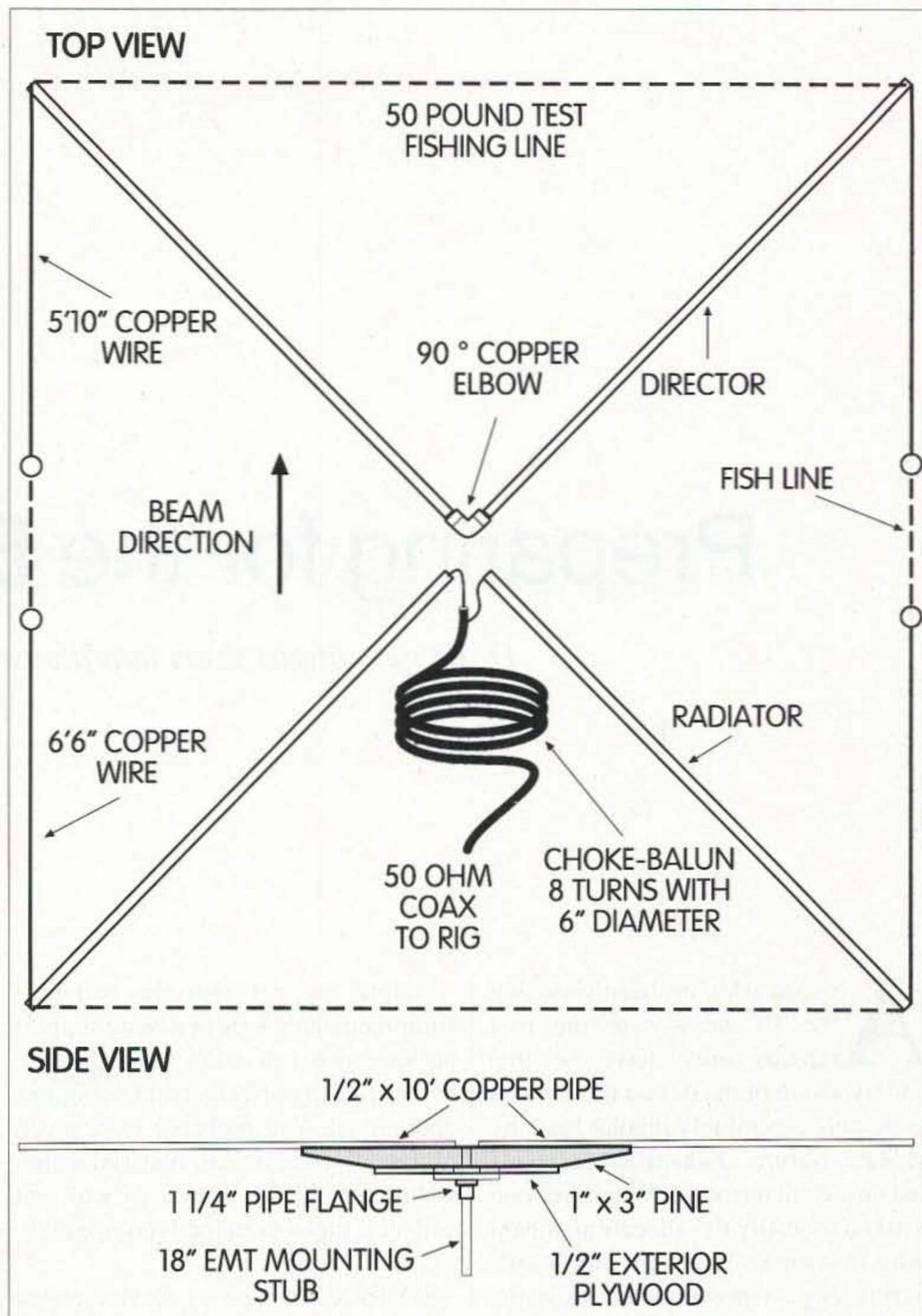


Fig. 2. Bird's-eye view.

actual dimensions of the antenna needed to obtain resonance may be slightly different than the calculated lengths. The dimensions of my 17-meter beam do not agree with the lengths calculated by using the formulas because I wanted to use ten-foot arms for the radiator and director elements. Do not use full quarter-wavelength elements for the radiators or director, as the favorable beam characteristics will downgrade.

Note: While the physical design of this antenna is all mine, the formulas

and idea for building one of this type came from an article by Brice Anderson W9PNE in the 1985 *ARRL Antenna Compendium*. My thanks to Brice ...

X-Beam Formulas	
Radiator Arm Length (feet)	195 / f (mHz)
Radiator Pigtail (feet)	106.5 / f (mHz)
Director Arm Length (feet)	195 / f (mHz)
Director Pigtail (feet)	92.5 / f (mHz)

Table 3. X-beam formulas, from information by Brice Anderson W9PNE.

Preparing for the Big One

Don't get caught short in a disaster!

Peter L. Barker XF1/KB6ASH
La Jolla de Los Cabos AB-506
San Jose del Cabo
B.C.S. 23400 Mexico

Anyone who has been watching the TV news over the past months must have become acutely aware of the devastation that is caused on a seemingly regular basis by Mother Nature, industrial accidents and now even terrorists. Whenever one is asked to justify the allocation of ham radio frequencies to our use, the words "emergency communication" leap to the lips, but how many of us are really prepared to operate our equipment effectively in an emergency?

When the emergency strikes, it's too late to try to throw together an emergency operation; however, a little preparation can make all the difference between helplessly licking one's wounds and providing a valuable service to your community and emergency services.

This article is not aimed at members of organized emergency response teams such as RACES and ARES, although the ideas apply equally well to them, but at the ham who has the basic equipment and may just need to organize some simple items to enable them to function in a disaster situation.

Before we get into the technical equipment, let's look at a basic support package that can make the difference between being effective and being just operational. You probably have much of this information and material somewhere around the house, so why not collect it together before you need it?

- A list of emergency service phone numbers for your area.
- Frequencies of any existing emergency nets, including those you *can't* work with the equipment you presently own.
- City, county and state maps (waterproof ones if available); copies of any special grid maps issued by local emergency services.
- Supply of pens, markers, paper clips and note paper. Steno pads are easy to use, and you can attach a pen to them with a short length of string.
- Good-quality flashlight, spare batteries and bulb (Maglite™ type).
- Small battery-powered clock with backlighted face. A digital alarm or something similar that you can set to

UTC and 24-hour format is best, as many emergency nets operate using UTC time.

- Copies of personal ID and ham license.
- Repeater directory or list of all state repeaters and PL tones.
- Bottled water and snack items, like individually-packaged granola bars, that will keep well.

The items should be stored together ready for use in a sturdy container marked as emergency equipment and with the owner's name and callsign. Strong plastic tool boxes are widely available in many sizes often in various bright colors. These boxes, while not waterproof, do provide compartments and are fairly weather- and dust-resistant. It is a good idea to seal the kit with a cable tie so that you can see if someone has disturbed it and "borrowed" something! Pick bright colors as they are easier to find in a confused area or situation. It is also a good idea to attach some reflective tape to the box; it really stands out when swept by

a flashlight. If cost is no object, very strong watertight cases are available, but be prepared to pay almost as much for the case as for the contents!

What equipment is best for emergency use? For equipment to be of any use it must operate independently of mains electricity and on widely-used frequencies. Your microwave gear or six meter equipment will not be of much use. Most importantly, it should be reliable equipment with which you are thoroughly familiar. If you are fumbling around trying to figure out how to enter a PL or adjust the radio you will be more of a liability than a help.

Probably the most useful radios are a rugged two-meter handheld and a compact HF rig that operates on 12 VDC. It is a bonus if these radios will receive outside the ham bands, so that broadcasts from various aid agencies can be monitored.

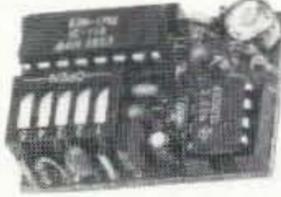
A word of caution: Most radios that receive outside the ham bands can be modified to transmit on other frequencies, too. Unless you are specifically authorized to use other than ham frequencies, you do so at your own risk. Even in an emergency you may be subject to legal sanctions for transmitting on other than ham frequencies. If you are the party in a life-threatening situation, however, it probably wouldn't result in any action by the FCC.

Powering the equipment

Unless you are working on this project as a group, you will probably not be investing in a gas-powered generator to run your equipment, so we will examine the battery-power option.

For a VHF rig, there are several options. Rechargeable batteries that fit directly on the radio are fine for short-term use, especially if you are in the listening mode most of the time. However, even if a couple of fully-charged spares are on hand, the transmit time is very limited. Recharging the battery packs can also be a problem if the emergency extends over several days or is in a remote location. Solar chargers can be constructed, but to deliver a rapid charge, the panel size and cost are significant and, of course, they require pretty much direct sunlight to deliver a useful output.

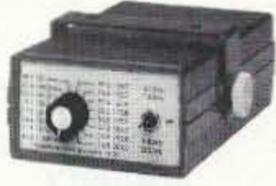
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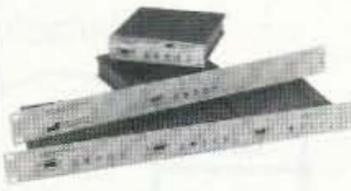
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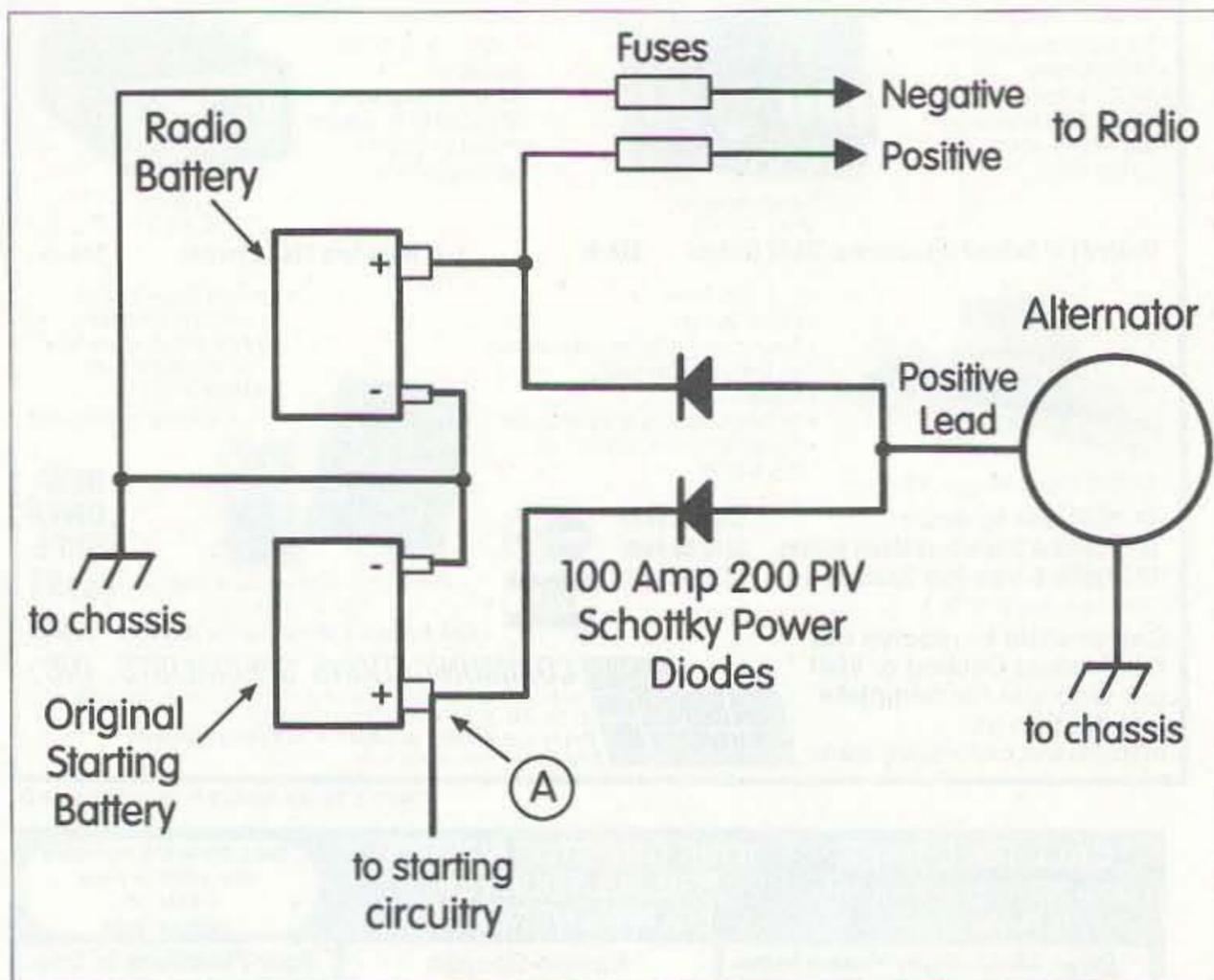


Fig. 1. Dual battery system. If the alternator has a "sense" lead, connect it to point A. If there is no sense lead, check the charge regulator to see if you can adjust it to deliver about 0.3 volts more to compensate for the voltage drop across the diode. If there is no sense lead or adjustment, the batteries may not develop a full charge.

The easiest alternative is to use the manufacturer's pack for alkaline cells or make an outboard battery pack that takes "C" or "D" cells. These outboard packs can be fashioned to clip onto a belt, and if "D" cells are used, will deliver 15-20 times the life of an "AA"-cell-filled pack. Alkaline batteries have a long shelf life and now even come with built-in testers.

For a semi-fixed location, a good supply can be provided by a 12-volt gel cell. They are readily available on the surplus market and if carefully selected can provide excellent service. They are available in many sizes. The six to eight amp-hour version will provide many hours of continuous use for an HT even on

high power. It may be stating the obvious, but be sure that your HT can safely operate on 12 volts. If not, you will need to make an adapter (suitable circuits using a few easily found components can be found in the *ARRL Handbook* as well as many other ham radio sources).

Powering an HF rig is more of a challenge. It is reasonable to assume that you will not be carrying the rig around while operating but even this is possible with some of the sub-compact models now available.

The almost universal source of emergency power for HF rigs is the 12 V storage battery. In descending order of desirability and cost they are:

- 1) Gelled electrolyte, marine storage;

- 2) Standard electrolyte, deep cycle;
- 3) Automotive starting battery.

Option 1 is significantly more expensive than the other two but has several special characteristics that make it worth considering: It can be stored in a discharged condition for extended periods without damage; it can be recharged at a very high rate (but requires a special charge controller); it cannot be spilled and can even operate under water (just insulate the terminals); and it does not emit any explosive gases when charging. A typical 95 Ah battery will cost in the region of \$220.

Option 2 is the most popular and easily available. They are designed to be repeatedly discharged to the 50% point with no damage if recharged shortly afterwards. They are available in many sizes; the most common is the 105 Ah unit available everywhere in the \$55 to \$70 price range.

The third option should only be considered if no other is available. The automobile starting battery is designed to deliver a very heavy current for several seconds and then be immediately fully charged. It does not survive many deep discharges. If you're planning to use a battery installed in a vehicle for an emergency supply, do not run into the common trap of running it so low that you cannot start the motor to move or recharge the battery. A separate radio battery is strongly advised. Using a couple of power diodes on a good-sized heat sink will allow both batteries to be charged simultaneously, while delivering the majority of the charge to the battery most in need. This hookup (Fig. 1) allows the radio to draw only from its own battery, leaving the starting battery charged for its intended purpose. Similar units are available from automotive and RV parts suppliers.

The amount of operating time that can be expected from a fully charged battery is quite variable depending on transmission mode, transmit to receive ratio and to some extent ambient temperature. Many modern rigs seem rather touchy about the lowest voltage at which they will reliably operate. Although they are nominally rated for 12 V, their specifications are given

Band	Inductance	Number of Turns	Turns to Occupy	Antenna Length A
80 m	40 μ H	35	3.5"	15' 6"
40 m	25 μ H	21	2.1"	8' 1/2"
20 m	8.8 μ H	14.5	1.5"	4' 2"

Table 1. Different bands require different turns.

for operation on a voltage of 13.8 V, the voltage of a fully charged battery on a float charge. If you are considering a new rig for emergency use, check the minimum operating voltage. The ideal would be one that would operate reliably down to 11.5 V.

The "standard" 100 W rig consumes between one and two amps on receive, and around 20 amps on voice peaks in SSB. The average current used on transmit is, however, much lower. If we consider a 4:1 listen/talk ratio, a figure of 6 Ah per hour of operation would be a usable ball park figure. This would allow at least 10 hours continuous operation from a fully-charged 105 Ah battery before recharging becomes necessary. Unless you are a net control station, you may find you talk much less than 15 minutes per hour, and can also reduce your output power to conserve your battery.

If you are going to be working as a group on an emergency plan, it is a very good idea to consider agreeing upon a standard connector for all power leads. The cigar lighter connector has been pressed into service for everything from cellular phones to spotlights; but a much better alternative is a Molex™-type connector. These are widely available in an extensive range of ampacity and pin configurations. Whatever you decide upon, be sure it is polarized. When in a hurry, or poor light, even the most careful operators have hooked up a red wire to a black terminal.

Skywires and spikes

When operating under less than ideal circumstances and with limited power, a reliable and effective antenna is an essential piece of gear. You shouldn't rely on moving existing antennas or throwing something into the car at the last minute.

For VHF emergency work using repeaters, the usual vehicle-mounted antenna or a good radio-mounted antenna will normally suffice. But much emergency traffic is handled simplex to liberate the repeater, if it is still operational, for longer-haul traffic or information broadcasts. For simplex work, an antenna that can be given some

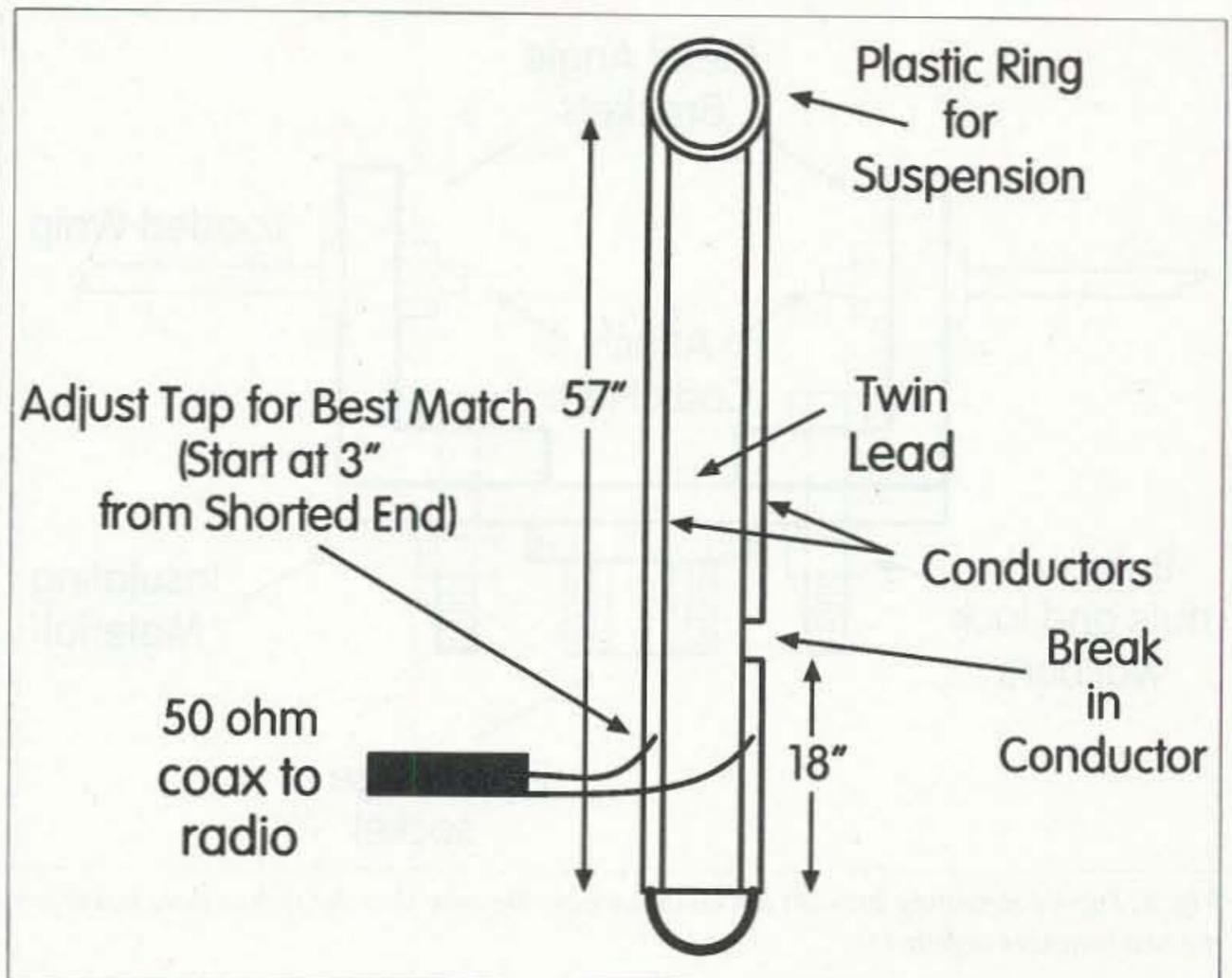


Fig. 2. Twinlead "J" antenna. Antenna shown is for 2 m. It is quite broadband. It can be scaled for 220 MHz or 440 MHz.

physical height is worth much more than a more powerful radio. A simple, effective antenna that works very well in this situation is a flexible J-pole made from twinlead and fed with 50 ohm coax. It can be rolled up and stored easily in the emergency kit, and you can suspend it in the clear from trees and structures using thin twine or monofilament. This antenna does not need a ground plane to radiate well and shows a lot of gain over the lossy rubber ducky.

The "J" type of antenna (Fig. 2) has appeared in many construction articles in 73 and other publications, and is available commercially from several advertisers in the magazine.

An antenna for HF use is not so simple. Most mobile-type antennas look attractive for emergency use; however, almost every model requires a good ground against which to operate. If you only need to operate from a vehicle, this is satisfied by the capacitive coupling of the vehicle body to the ground; but if the antenna is removed from the vehicle, a substitute for this must be found. In a building, a long balcony railing or even handrail may serve if it allows the antenna to be mounted so as to be clear of walls, wires or metal structures. It is also

possible to operate a mobile antenna against three or four raised ground radials cut to the operating frequency, but this is cumbersome at best and a poor system for rapid deployment. If you have two of the loaded whip mobile antennas, you can fashion a center bracket (Fig. 3) and operate the pair as a dipole. This will also work with the units with multiple loading coils and whips. Even if they are not quite identical or of the same make, it will generally function better than a single mobile antenna and a makeshift ground system.

As most HF emergency communication is over medium or even short range and on the lower frequencies (see my article, "Shooting Straight Up" in December 1996's 73 *Amateur Radio Today*), height is not as important as it is for working DX. A robust simple dipole fed with coax, or a doublet fed with twinlead and a tuner, is the most versatile. It can be slung between two trees or buildings, hoisted on one support in the middle, stretched out from a building or post as a sloper and even bent around to fit an irregular space. These antennas are described in almost every ham manual and can be constructed by even the most "appliance operator" sort of ham.

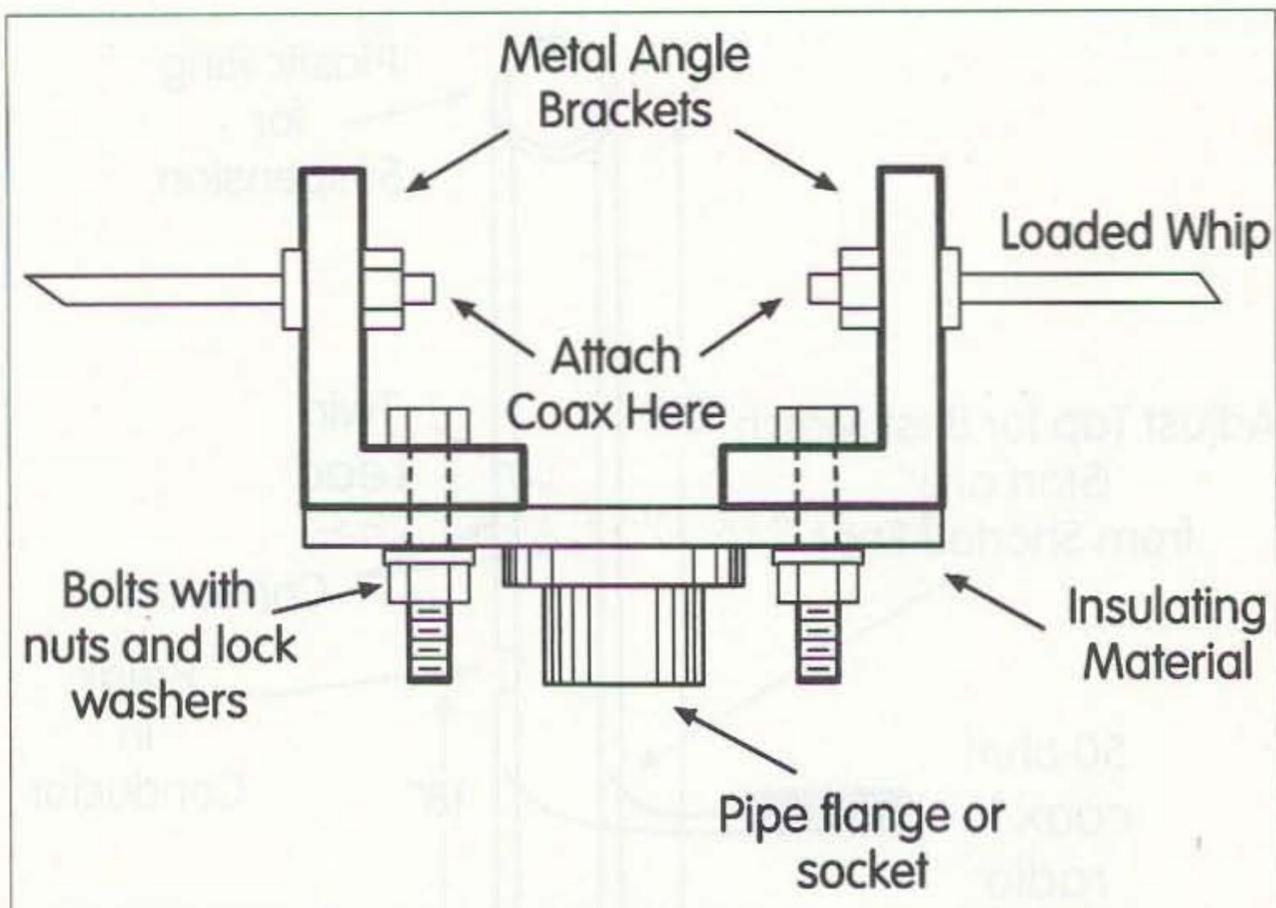


Fig. 3. Dipole mounting bracket for mobile whips. Be sure that the flange does not short the two brackets together!

Size can be a problem with a resonant dipole on 80 and 40 meters so an inductively shortened dipole may be something you want to consider for this kit. A dipole can be shortened to one half the usual length if coils—not traps—are inserted at the correct point. The coils should have a reactance of about $950\ \Omega$ at the operating frequency and be installed $1/16$ th wavelength from the feedpoint in each leg of the dipole. A further $1/16$ th wavelength of wire completes each leg (Fig. 4).

Commercial versions of both regular and shortened dipoles are also

available from advertisers in this publication.

Whatever you choose as an HF antenna, some simple practical concerns arise. Store the antenna in a manner that allows it to be deployed without having to spend hours untangling the beast. Winding the sections on empty plastic two-liter soda bottles is a simple solution. The whole antenna and feedline should be stored in its own container. A five-gallon paint bucket or plastic cargo box is a good choice. Include with the antenna a good length of light cord or heavy

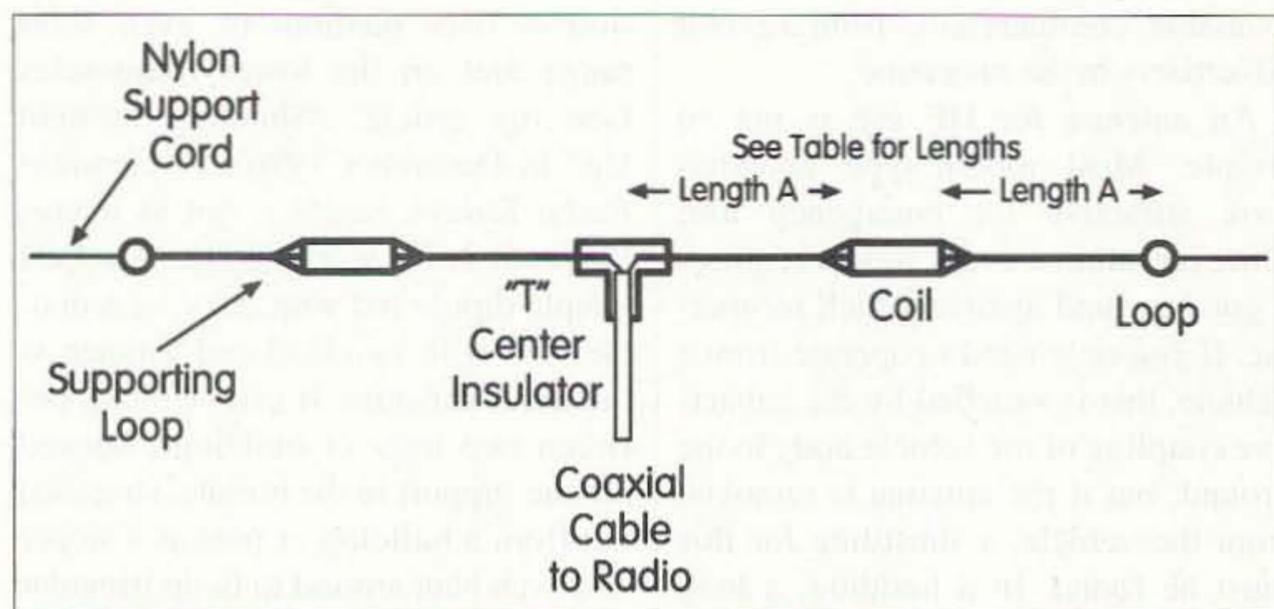


Fig. 4. Shortened emergency dipole (not to scale). The coil can be wound on PVC or other insulation former using 16-gauge magnet wire. The form should have an outside diameter of 2-1/2 inches. Spread turns evenly. The shortened antenna has a narrower bandwidth than a standard dipole; a tuner will be needed for full band coverage.

monofilament to attach the radiator to its supports. A slingshot and a few fishing sinkers allow the support line to be fired over many prospective supports.

As always, when raising emergency antennas, be aware of power lines and machinery. Never use power line structures as antenna supports. Even power lines that appear to be "dead" may still carry sufficient voltage to be lethal and may re-energize without warning. Machinery may also restart suddenly when power returns. Don't add to the emergency by becoming part of it!

Whatever type of antenna setup you plan, it is likely to be less than optimum when strung up for use. It is a very good idea to pack, with your radios, a small mobile-type tuner with built-in SWR meter. The tuner, of course, does not make the antenna any better, but will match the impedance of the antenna to the radio. Modern solid state rigs have protection circuitry that backs off the RF power if it detects even a small mismatch. The tuner will satisfy the radio's need to "see" a $50\ \Omega$ impedance. If you plan to use a doublet fed by twinlead on several frequencies, a tuner will be essential.

Accessories and tools

No emergency preparedness package would be complete without a basic tool and spare parts kit. It is preferable that this is a dedicated selection of materials that is not raided for other purposes. The whole point of the package is that it is ready and complete for immediate use. The following list is not intended to be exhaustive but to get you thinking along the right lines.

- Special tools, if required, for any of your equipment
- Fuses for all fused leads
- Medium and small straight and cross point screwdrivers
- Set of jewelers' screwdrivers
- Needle nosed pliers
- Diagonal wire cutter
- 12-volt soldering iron, cored solder & strips of sandpaper
- Small clamping pliers
- Simple volt/ohm meter with probes
- Penlight, spare batteries & bulb

- Several feet each of red and black hookup wire of various gauges
- 50 feet or more of light antenna wire
- 50 feet of RG-58 coax with connectors & two barrel connectors
- Assortment of coax, power and crimp connectors. Even if you use fully-soldered coax connectors under normal conditions, consider using simpler crimp-style UHF connectors for this kit.
- Small tube of silicone sealant and assortment of PVC & duct tapes
- Combination wire stripper and crimp tool. You may also want to consider a small battery charger and extension cord in the event that power returns or someone has a generator running.

As a retired engineer and offshore sailor, I believe that it is impossible to have too many tools. The emergency tool kit cannot pretend to cover every eventuality and still remain compact and portable. The above collection will address most field-repairable problems and temporary installations and, apart from the wires, can be contained in a small plastic tool box or roll.

With all these specially assembled kits, it's a good idea to mark the tools distinctively—colored plastic dips are available. This helps to locate and retrieve them in the clean-up phase of the emergency. You should also put an inventory check list inside the lid of the container.

A final, more subtle, preparation is to spend a little time listening or participating in controlled nets, and listening to professional communicators handling emergencies. The communications procedures and disciplines you will learn are exactly those that will enable you to be an asset if called upon to work emergency traffic. Learn to communicate facts only, not rumors, and if you have nothing important to add to the traffic, remain silent.

If you think that all this preparation for something that may never happen is a lot of work for nothing, you may be right.

And if you *are* right, you should be thankful!

73

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Saluting the Flag

Another twist to the delta loop.

Doug Person W4DXV
10306 Yandem Court
Charlotte NC 28269
[ki6bq@amsat.org]

Over my 36 years in ham radio, I have found building and experimenting with various antennas to be both my primary area of interest and a source of great satisfaction. Antennas remain an area of experimentation that is still accessible to the average amateur. With a few trees, some wire, a few insulators, and a length of coax, you can build a number of different and interesting antennas.

After building and evaluating a number of dipoles, longwires, windoms, and verticals, I've come to have a favorite antenna: the full-wave loop. And here is yet another variation of that venerable wire antenna for you to try: the flag delta loop. This antenna and its method of construction will work equally well on all HF bands and six meters.

While full-wave loops are certainly not new, they are about as easy to construct as a dipole and offer a few advantages over the more common half-wave wire antenna. Full-wave loops exhibit a small amount of gain (about 2 dB) over a dipole, tend to have a lower angle of radiation, and appear to be less sensitive to being operated closer to the ground. I'll refrain from making any comparisons more

scientific than these. I would prefer that you build this antenna, compare it to what you are using now and see for yourself how well it performs.

The "flag" configuration solves many of the problems I face at my QTH, and perhaps ones you face at yours as well. Let me explain. I live in what has become the classic modern suburban subdivision—where CC&Rs (covenants, conditions, and restrictions) prohibit most types of radio antennas. At least they prohibit *conspicuous* antennas. When made of thin wire with black components and hidden among the trees, wire antennas go largely unnoticed. And what isn't noticed is certainly in keeping with the spirit of most CC&Rs, which exist to maintain the neighborhood's beauty. (Actually, they exist to maintain the subdivision's sales appeal, since the developer probably is responsible for enacting the CC&R. But that's another issue and I'll refrain from stepping up on my soapbox right now.)

My lot has a number of trees along the back of the property line. Within them and between them is my antenna farm. When you are trying to erect an inconspicuous wire antenna in a tree, it

is better to keep as much of the wire and coax as you can near the trees to hide it among the leaves and shadows. If an antenna and feedline are hanging out in plain sight in the middle of your backyard, it might attract the very unwelcome attention of your nosy neighborhood association's architectural committee.

The flag delta loop is suspended from a tree the same way a triangular flag might be suspended from a flagpole. The feedpoint is at the bottom angle. By doing this, the feedline, matching section and most of the antenna's weight is supported by the vertical support rope. The feedline is also kept close to the supporting tree and thus remains far less conspicuous. A second horizontal support line is used to pull the triangle open. Since there is practically no weight on the horizontal support line, you can use something as light as fishing line for increased stealthiness.

Putting the flag delta loop together is very easy. It's certainly no more difficult than the average dipole and, owing to its very broadband nature, it's far more forgiving of dimensional errors. All that is required to build a flag delta

loop is three insulators, an SO-239 or similar connector, enough wire for the band of your choice, and a small length of RG-59/u for a matching section.

I use the small, glass-filled, dark gray Hy-Que™ insulators that usually cost less than a dollar each. I buy a handful of them at every hamfest I go to. The wire I use is 18-gauge solid copper stranded. I found a 500-foot spool in the electrical department at the local home improvement center for 11 dollars. That's far less than three cents a foot, and a real bargain. They usually sell it by the foot for wiring ground connections in lamps and appliances. The extra thinness of 18-gauge adds to the stealthiness of my antennas and means my line is considerably lighter than the typical 14-gauge wire more commonly used. I have had no trouble pumping a kilowatt of single sideband RF into it and it certainly seems strong enough for all of the wire antennas I've built. Any wire, however, will work just fine—as long as it is strong enough to form the vertical side of the triangle and support the matching section and coax.

Now let's build a flag delta loop antenna. You can make one for any band you like using these same calculations and construction techniques. I will describe for you the building of a 20-meter flag delta loop.

To begin, we need to determine a few dimensions. To calculate the amount of wire needed to form the loop, I have found that the formula

$$\text{loop length} = 1023/\text{operating frequency}$$

consistently results in loops that resonate right where I want them to. I realize that most books will indicate a constant of 1005, which is the value I originally used. My experience with this number was that the loops were consistently too small. After five or so successful antennas, it was clear that 1023 is much closer to the desired loop size.

A 20-meter loop would then be calculated as:

$$1023/14.175 = 72.17$$

The total amount of wire needed for a 20-meter loop would be 72 feet and two inches. You divide this value by

three to get the three equal sides of the triangle, resulting in 24 feet 2/3 inches per side. Because the antenna is so broadbanded, you can safely forget the extra two inches in total length, leaving you with a convenient 24 feet per side.

Full-wave loop antennas have characteristic impedance of about 100 ohms. This is actually quite usable, since it will result in an SWR of about 2:1. However, it is a simple matter to bring the 100 ohms down to a more acceptable 50 ohms by using a quarter-wave matching section of RG-59/u coax.

To calculate the total length of the matching section, we have to consider two factors. First, we must determine the size of an electrical quarter wavelength. And second, we must factor in the velocity factor of the coax used for the matching section. There are two types of RG-59/u coax generally available—solid dielectric and foam dielectric. The velocity factors of these two are 66% and 78% respectively. I will assume that you are using the more common foam dielectric coax (available from Radio Shack™) that I use and therefore our velocity factor constant is 78%.

What exactly is a velocity factor, you are wondering? The short answer is simply that RF energy travels more slowly in a solid medium such as coax than it does through space. The velocity factor expresses how much more slowly. Any explanation more involved than this would be physics, and I'd rather talk about antennas.

Applying our two factors, the formula for calculating the length of the 20-meter matching section is

$$\text{matching section length} = (246/\text{operating frequency}) \times \text{velocity factor}$$

or

$$(246/14.175) \times 0.78 = 13.53 \text{ feet}$$

Since the matching section, like the loop itself, is very broadbanded, we can safely consider that 13.53 is close enough to 13 and a half feet to call it 13 feet 6 inches.

Now let's build our antenna. Assuming that you have a coil of wire to start with, attach the free end to one of the insulators, leaving a few inches extra

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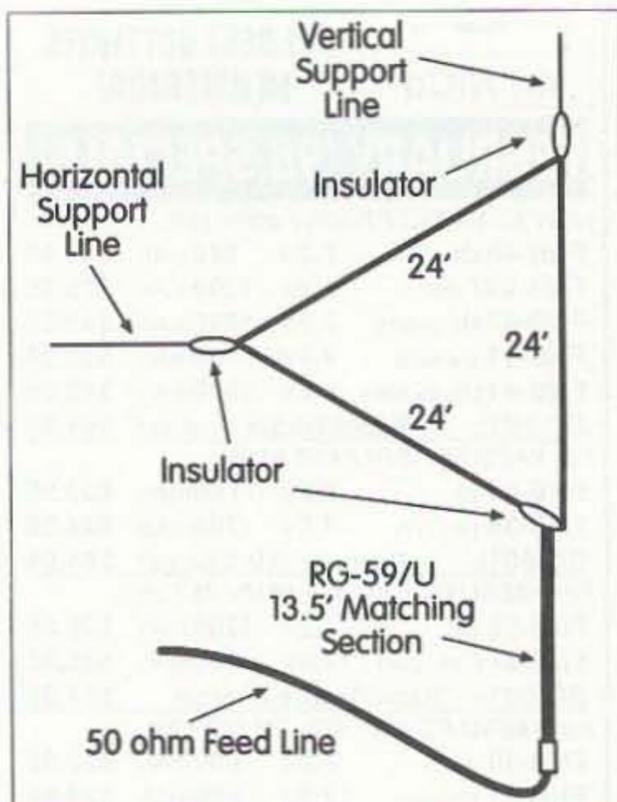


Fig. 1. Twenty-meter flag delta loop.

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free for attaching the matching section. I can suggest two ways to secure the wire to the insulator. One method is courtesy of Mike Zuckerman WB2IVN, who likes to loop the wire back through the eye. When the loop is pulled tight, the wire is reasonably secure. The method I use is to pull the wire straight through the eye and then solder a small loop of wire above and below the insulator to lock it in place. If you plan to do this, it's easier if you slide the other two insulators onto the wire before attaching the bottom one.

From the bottom insulator, measure the first side of the triangle, unrolling the wire carefully. You want to avoid pulling the wire off the roll from the side because this will leave it in a state where it will have a strong desire to tangle and kink. Mark the end of the first side, 24 feet for 20 meters, with a piece of tape or a marking pen. It helps a lot to have someone assist you with the measuring. From the mark, measure the second side of the loop, marking the second apex in the same manner as the first one. Finally, measure the last side, mark it, give yourself a few additional inches, and cut the wire.

To use Mike's method of looping the wire through the insulators, slide the first insulator down the wire to the first mark. Loop the free end back through the eye of the insulator and pull all the wire through until the loop is tight. Repeat this process for the second insulator at the second mark. If you are going to use the wire loop method, then slide both insulators to each mark and solder the loops in place.

To create the matching section, I use an SO-239 for the junction to the 50 Ω feedline. I strip and solder one end of the RG-59/u to the connector and then measure the length, leaving an extra two inches for creating pigtailed for soldering the matching section to

the loop ends. You can get fancier by using a conventional center insulator such as the Hy-Que (the same brand and construction as the end insulators). If you choose to do this, then attach PL-259 connectors on both ends of the matching section and use a double female to connect the matching section to the feedline.

If you're wondering which side of the loop to attach the center conductor to, it really doesn't matter. I always connect it to the vertical side. Once you have the matching section complete and soldered to the loop ends at the insulator, be sure to seal it from the effects of the weather with coax seal or electrical tape.

After the flag delta loop is assembled, you'll need to get a line into the top of your tallest tree. My favorite method is a slingshot, a one-ounce fishing weight and a spool of 25-pound test fishing line. This method takes practice and is not for everyone. If you try it, keep in mind that sometimes the line breaks and that a one-ounce weight retains considerable energy and can cause serious damage to a person or property on the receiving end if not used with care.

I have a 20-meter dipole which favors the southeast and northwest. I put my new flag delta loop up favoring the northeast and southwest, hoping to improve my performance into Europe and Asia. After a few hours of operating with my new loop, I found the results to be beyond my best expectations. Signals from Europe were as much as three to four S-units stronger on the loop than on the dipole. Part of this is obviously due to the improved orientation. Nevertheless, some of it reflects the fine performance of the flag delta loop.

After a month of operating regularly with the flag delta loop, I am convinced that it is an excellent antenna. With my 800-watt amplifier on-line, I have cracked more pileups and worked more DX than at any other time in my ham career. I have since added a 17-meter version and will soon install a 15-meter loop as well. I hope you enjoy your flag delta loop as much as I have enjoyed mine.

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If you want to gauge the spirit, loyalty, and enthusiasm of radio amateurs who operate vintage amateur radio equipment, dial in to the Drake Net on Saturday evenings at 8:00 p.m. EST at 3.865 kHz. You'll find that the participation is broad-based, the conversation invariably lively, the horsetrading almost frenetic, and the dedication to circa-1970 tube-type gear contagious—especially if you hang around the frequency long enough.

Many reasons can be cited for supporting this high level of commitment. For example, the most zealous participants point out that tube equipment, in spite of its age, continues to produce a level of audio quality clearly superior to the more modern gear. They vehemently argue their position that almost any radio amateur armed with a VOM and the operator's manual spec sheet can troubleshoot a problem and undertake an electrical fix without being overwhelmed by the complex integrated circuits and layers of tightly packed circuit boards.

They also acclaim the benefit of the higher output from the rugged final tubes that reduces the need for an amplifier in the vast majority of casual

(non-DX pileup) on-the-air QSOs. They quickly add the fact that linear amplifiers operate more efficiently when driven with the higher output. They claim that dollar for dollar, pre-owned, high-performance, well-maintained equipment is easily within the affordable range of a larger number of operators—especially the newer hams—than is solid state gear.

They even note with a great sense of satisfaction (and ultimate vindication for their position) that tube gear was removed from military mothballs and placed on line as a result of the poor performance of solid state equipment in the harsh environment of Desert Storm. They go on and on in defense of the glow-in-the-dark rigs, but the arguments, in a nutshell, are based on the principle that you're getting more (and a better) bang for the buck.

A can capacitor catch-22!

When the inevitable parts replacement or rebuilding of a vintage piece of gear is necessary, tubes and other discrete capacitor and resistor components that cluster around the underside of the tube sockets are readily available

from a variety of sources. Admittedly, catalog retailers often extract their pound of flesh for a dead special item they know to be in demand. They're responding to the first law of economics: The price of an item varies inversely with supply—so what else is new?

Amateurs are well aware that certain vacuum tubes, once commonplace, are now worth their weight in gold. If you combine the need for that component and the lack of discretionary time in today's lifestyle to ferret out reasonably priced replacements, the path of least resistance is: Bite the bullet and send the check for the part.

It may help to soothe the pain of the cash outlay to mentally amortize the price over the number of years it will be in use. Try it. It works almost all the time.

If you're not pressured, more affordable sources of supply may be explored. Consider a posting on the Internet or a packet bulletin board. Listen in or leave a listing on one of the many Horse Traders' nets. (See the June, 1997, issue of 73 for a complete schedule of these nets.) You can always plan a visit to a local hamfest to rummage around for your needs.

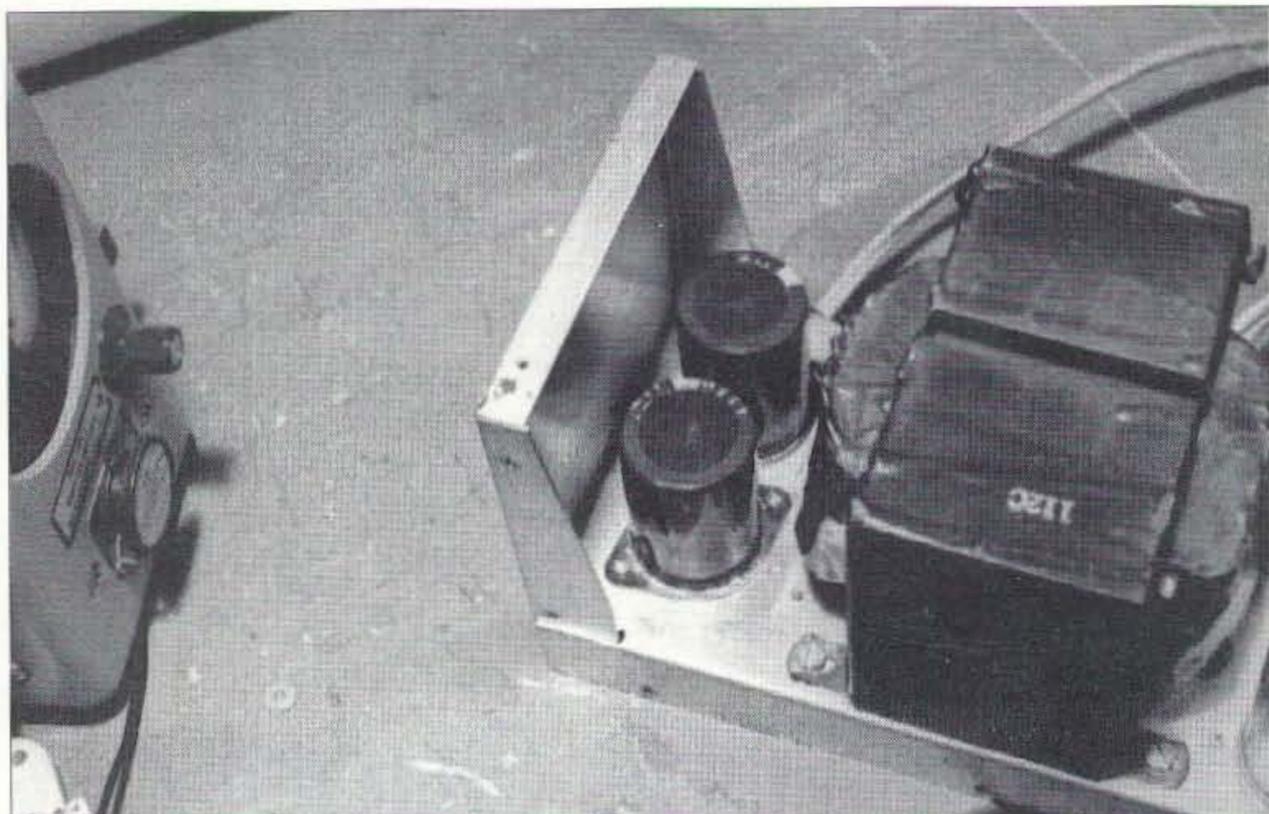


Photo A. A view of the replacement capacitors nestled comfortably on the Drake AC4 chassis. The caps were epoxied to the wafers and then reinstalled with the original mounting hardware. The capacitors' low profile makes them ideally suited to height-restricted power supplies. Note that the banded sides of the capacitors (indicated by the light colored block on the top) face in the same direction. This reduces the wiring runs when series installed by polarity (see text).

However, what you won't find in any of these sources, no matter how hard you look, is the typical power supply can-type capacitor with sufficient values and an accompanying high breakdown voltage rating. They simply aren't being manufactured on any great scale due to the proliferation of low-voltage, high-current solid state radio equipment being made to replace tube gear. Consequently, there's simply no demand for that value of component. If any New Old Stock (NOS) surfaces, view it with suspicion—

capacitors tend to deteriorate over the years and their shelf life is limited. It's almost a catch-22 situation in which there is no practical solution to a real-life paradoxical dilemma: The older, the better, but the older, the better the chances it won't work, too. So what can you do?

We're in luck!

You will find that the garden variety glow-in-the-dark finals of a transmitter/transceiver require about 650–700 VDC

for maximum output. Many manufacturers of vintage tube rigs utilized the voltage doubler circuit to obtain the correct level of power utilizing a transformer with sufficient current capacity but wound with only a moderate level of voltage output.

Size and cost constraints combined with good engineering practices resulted in the selection of this compromise method for achieving the necessary power requirements. The problem for the rebuilders today is that the two series-connected capacitors required for a typical circuit (see Fig. 1), each with a 350–450 VDC breakdown rating, haven't been available inexpensively from new stock for some time. When they do show up in the listings of various retail sources, they are never priced at less than \$16–\$18 per unit. Until recently, buying them at that price was a bummer—especially if a bunch of them were needed.

Because of the sticker shock, I'm convinced that many amateurs reluctantly retired their defunct equipment and relegated it to a dark corner under the bench. But things are looking up! It may have escaped your notice, but a retail parts catalog supplier began offering recent-manufacture, low-profile, high-capacity capacitors at \$4.50 each (see end of article) that are perfectly suited for a rebuilding project. The good news is that they exceed OEM values and their short three-inch height allows mounting even in the lowest-profile power supply chassis.

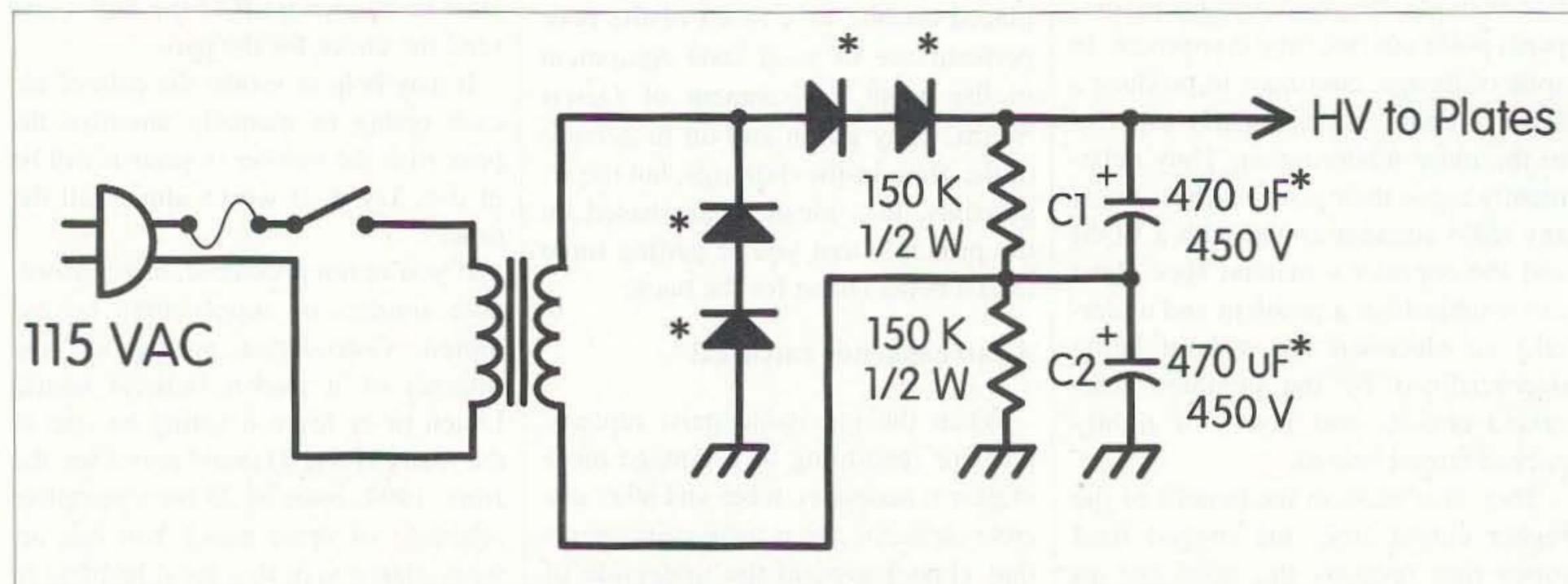


Fig. 1. Typical power supply voltage doubler circuit. *Denotes components to be replaced.



Photo B. It's a good practice to group power supply diodes by their value. In this case, the component with the .555 range readout will be placed in the second container from the right. Note how the majority of diodes cluster between .549-.551. Use this grouping for a long string of diodes in a full-wave bridge, since there are a sufficient number of closely related parts to complete the task.

At that price, don't hesitate to dust off that junker power supply and get it up and running for only a small cash outlay. If, on the other hand, you see a blown power supply junker rig being tailgated at a local hamfest, keep the secret to yourself about the cheap and easy fix, bring it home for a song, and get to work. If that sounds good to you, read on!

When to rebuild

You'll generally know you have a capacitor problem when your rig goes dead—usually in dramatic fashion. Accompanying the large bang is a puff of smoke and the acrid odor of fried components. It's a horrifying experience, but the dead silence and the lingering wisps of smoke are conclusive evidence that reconstructive surgery is definitely in the cards. You may be alerted to a less dramatic demise of your supply when you receive a signal report that indicates an audio hum level. However, no matter how the problem manifests itself, the repair procedures are straightforward and cost-effective.

The first thing to do before removing the bottom cover is to unplug the rig and wait for the filter capacitors to discharge fully. I can't imagine any set of circumstances when getting jolted would be considered a rewarding experience. Before opening up the case, check to determine if the fuse blew. Have a spare on hand when the rig is repaired and ready to be fired up.

Determine the location of the HV components by referring to the radio's schematic diagram and parts pictorial. Locate the high voltage rectifier section and look for evidence of leakage from the capacitors. Don't hesitate to smell around. The nose knows—and it will help you zero in on the culprit(s). The failure of these capacitors is generally what causes the problems, so examine this area first.

As the capacitors age, the semi-liquid insulating material begins to escape the confines of the capacitor. Eventually, the loss of the dielectric allows the foil plates to contact each other, resulting in a short circuit. The rest is history.

At other times during the capacitor's mid-life crisis, it may begin to bulge and ooze dielectric, signaling an impending

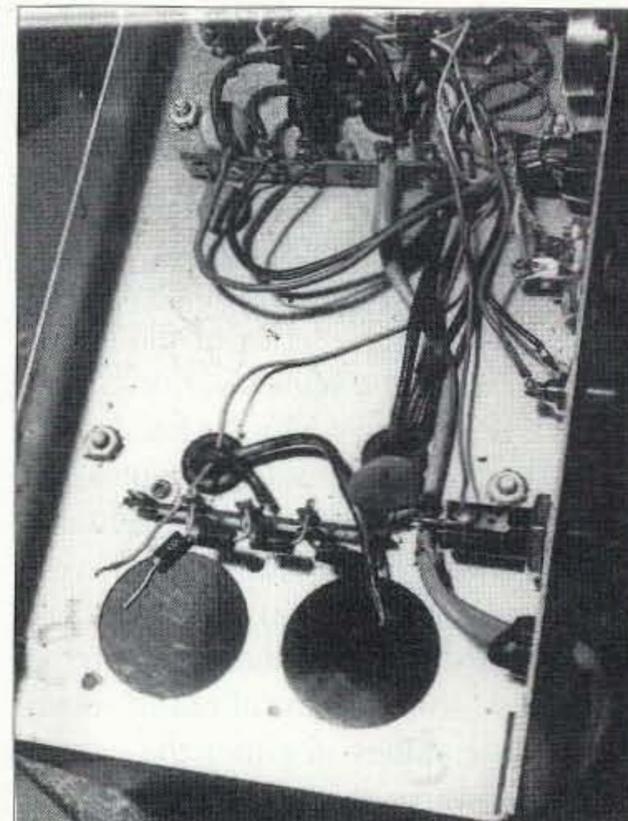


Photo C. Each of the four replacement voltage doubler diodes has been mounted on a terminal strip. Note that the banded ends are all pointed in the same direction. When the capacitor C1 is reinstalled, the high voltage plate wire (visible next to the diode) and that diode will be soldered to the (+) terminal. You will notice that one transformer lead passing through the grommet is attached at the midpoint of the diode string. The longer transformer lead to the right will be connected to the midpoint of the two capacitors (see text). The back side of the diode string is soldered to the grounded terminal strip.

problem. Eyeball the area immediately below the caps for the telltale sign (white crusty material) of leakage. The deterioration is similar to a leaking dry cell battery in the last throes of its life cycle.

Prepare yourself mentally for the replacement of all the HV rectifier capacitors even though only one cap may be at fault. You can be assured that the rest will soon follow. Spare yourself grief down the line and tackle the complete rebuilding job at the outset.

Which parts should I replace?

It's always a good idea, and not particularly expensive or time-consuming, to rebuild the entire portion of this circuit, including the replacement of all the complementary components. There aren't many additional parts and you won't have to worry that a reinstalled part will fail at some inopportune time.

If you're not rebuilding a Drake AC4 doubler or screen circuit, take a careful look at your particular wiring configuration. Note any slight differences in parts placement. It's important to remember that all power supply wiring begins with transformer AC that's rectified through a series of diodes. To filter the ripple, a high level of capacitance is utilized to purify the DC.

It's perfectly acceptable to substitute components with higher capacitance values and greater breakdown voltages, so don't be alarmed if the replacements' specs don't match up perfectly—but be careful not to substitute lower values in either the capacitance rating or the operating voltage. That's a definite no-no and the use of an underrated component only invites a circuit failure later on.

Before getting in there for the surgery, it's a good idea to make a quick pictorial of the circuit. Label your drawing with wire color codes, diode positioning, and capacitor \pm orientation. You don't have to be Rembrandt. A crude drawing will suffice as long as it's detailed.

During the disassembly process, you will often find that resistors may have short leads, so attempt to desolder them—especially if they appear to be in good condition and replacement is not contemplated. Check out their ohmic values before reinstalling them in the circuit. Remove all excess solder and clipped leads from terminal strips. Cleaning up that area will make reassembly a breeze.



Photo D. Use some two-part epoxy to affix the phenolic wafer to the capacitor. Note that the banded end with the elongated zeros is the negative terminal. If care is exercised, the wafers can be recycled.

Match your diodes!

It's a good idea to purchase an extra supply of diodes. They don't go bad and it makes good sense to keep spares around the shack. Use your analog or digital VOM on the ohms (or Diode Check) scale to measure the front-to-back ratio and categorize each diode according to its value.

Manufacturing tolerances have been improved greatly, but these components will always work more efficiently when they are installed in closely matched groups. The range of readout values will become evident to you as you begin the sorting process. For the high voltage doubler circuit, select four diodes that have nearly identical parameters. Small differences are inconsequential.

When you're ready to install them in the circuit, make certain to observe the polarity. Follow the banding and arrow to determine orientation. Continually refer to your pictorial to double-check that the parts are correctly positioned. When wiring in the capacitors, the correct polarization is absolutely essential. That information should have been carefully marked on your layout drawing. You'll find the removed capacitors were mounted on a phenolic board and insulated from chassis ground.

After so many years, the wafers may be brittle. Exercise care when you straighten out the twist-lock tabs in order to remove the capacitor. Don't be alarmed if the wafer disintegrates. They're available inexpensively from a parts supplier listed at the end of this article. They can also be fashioned from a piece of perfboard, some Plexiglas™, or a small section of circuit board, provided you remove the copper cladding and—of course—the components.

You don't want a path to chassis ground. Since our replacement capacitors have no tabs, the easiest mounting procedure is to simply epoxy the capacitor to the wafer and reinstall the entire combination on the chassis utilizing the original mounting hardware.

Wire up the new capacitors following your pictorial. Keep the leads short. The hookup technique isn't

overly critical, but it does make the job appear professionally wired. You'll find that the replacement capacitor has a single gray band imprinted on its side with an elongated zero to indicate negative (-) polarity. Keep the \pm orientation in mind, since they will be series-connected with the minus of one terminal wired to the plus terminal of the other.

Again, positioning is not a critical factor. If you overlook this step it's not terribly serious, but it does reduce the wiring runs.

Begin by soldering one end of a jumper to the negative terminal of capacitor C1 and connect the other end to the positive terminal of C2 (don't solder at this time). Solder the remaining (negative) terminal of C2 to ground with a jumper. If you're simply replacing a single cap, the exchange is less complicated—but the polarity orientation must be observed.

Solder four diodes in series with the band/arrow facing toward the B+ terminating point. Solder the wire on the back end of the diode string to chassis ground. Attach the front lead of the diode string to the HV (B+) tie point. Use one of the ungrounded terminals on the strip or use the positive lead of C1 as the terminus.

At the diode midpoint, connect one lead from the power transformer. Connect the remaining transformer wire to the midpoint jumper lead on either the negative of C1 or the positive of C2. Solder the two bleeder resistors across each of the capacitor terminals, along with any other wires connected at these points. Make certain that the HV lead from the tube's plate circuit is attached at the HV output end.

Double-check your wiring before the smoke test!

If you don't consider yourself a power supply rebuilder whiz, get someone to check the correctness of your wiring. Failing that, take a walk around the block and return with a clear head and take another look. This will help to verify that all is in order. When you're certain the circuits are

Continued on page 86

Meet the Paddlette Micro Keyer

Who could imagine a knees-ier way?

Mike Bryce WB8VGE
955 Manchester Ave. SW
North Lawrence OH 44666

Although CW is no longer a requirement for becoming a ham radio operator, it's still a lot of fun. From users of the most expensive microprocessor-controlled rigs to QRP home-brew aficionados, hams still find a way to use CW.

But I'm surprised by how many hams are still pounding brass. I find it especially true when they are portable or mobile. It's not that they really want to carry a hand key around; there's just been nothing available to use—until now.

The Paddlette

The Paddlette is a very small iambic key. Its footprint is only one inch by one and three quarters inches. It weighs less than two ounces. It has only two moving parts. There are no springs or needle bearings or lock nuts used in the Paddlette. And, as my wife likes to say, "It's cute."

The Paddlette is made of solid brass and stainless steel. The base material is a composite plastic. Some of the finer details of the Paddlette include fine pitch adjustment screws—56 turns per inch, compared to the 32 turns used by other keyers. This allows you to adjust the gap smoothly from .016" down to

zero. The magnetic hold-down feature keeps the Paddlette from walking all over the operating table.

Because the Paddlette is so small, a simple magnetic hold-down system is used. There are two magnetic surfaces: one on the Paddlette, the other removable. (These magnets are really the flexible magnetic strips of which refrigerator magnets are made.) The removable

magnet has one of its sides coated with an adhesive. You stick this magnetic strip to the tabletop (or whatever else you want to stick it to) and the Paddlette then sticks to the strip. It's much easier done than said!

There is one drawback, however. You only have one try at attaching the adhesive magnetic strip. Once down, it's down! My Paddlette came with a

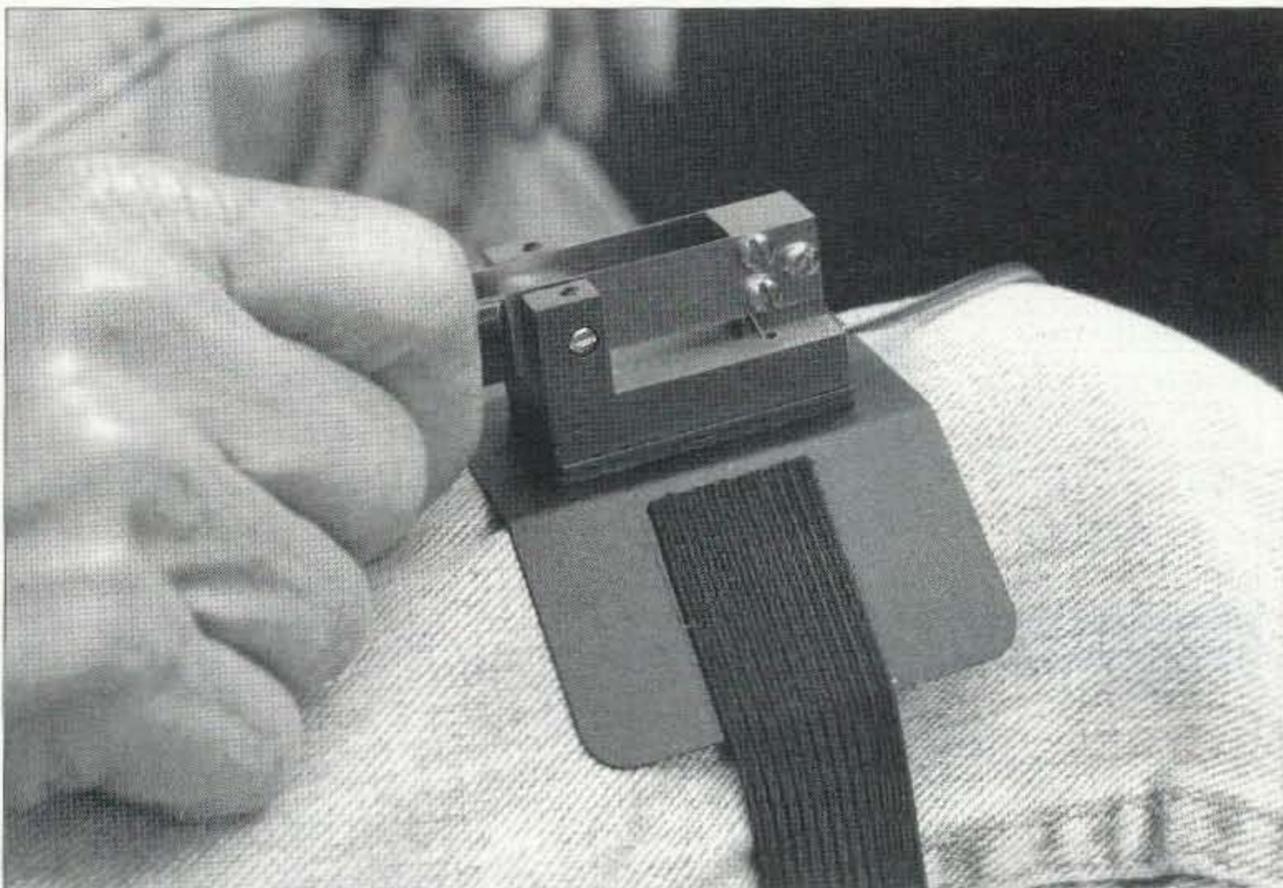


Photo A. The Paddlette micro keyer.

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spare strip. The magnetic strip should be easy to find at any hobby or craft stores.

Using the Paddlette

You need to make the necessary connections between the Paddlette and the electronic keyer you plan to use. Three wires, three minutes. Now, all you have to do is give it a try!

I found the action of the Paddlette to be just fine for me for the most part, although the tension between the paddles is a bit weak for my taste.

If you're used to slapping a key around the desk, the Paddlette will be a disappointment.

No, it's not a precision-made German instrument, but it more than does the job.

It's small, so some of those ops with larger hands may find it hard to use. The Paddlette key paddle would be at home in portable or mobile use. It's cute, but I'm not sure about using it at home. Perhaps my worry is that I'd lose it in the clutter on my operating table.

There is one accessory that is quite unique to the Paddlette. It's a knee mounting plate. This gizmo attaches to your leg with a strip of Velcro™. You mount the Paddlette to the knee mount using the same magnetic system. Now you can run mobile CW from your car without having the keyer bounce all over the place. While I'm no mobile CW op, I did give it a try with my ICOM 706. It's a slick way of keeping the Paddlette in one spot as you travel down the road. The knee mount is an extra-cost option for the Paddlette.

I found the Paddlette iambic paddle key to fit right in with portable and mobile use, as well as my pocketbook (\$38.50 postpaid, \$44.95 for paddlette and knee mount). And if you don't mind its small size, it would work just fine at home, too. Besides that, it's cute!

For further information, contact the Paddlette Company, P.O. Box 6036, Edmonds WA 98026; (425) 743-1429. Bob Hammond KI7VY is the owner.

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The Price Is Right

... and Ten-Tec's 1210 T-Kit is fun to put together, too.

R.W. Purkey W9NUP
7732 Red Oak Street
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It has always seemed more than a little strange to me that in the era of orbiting amateur satellites, HF rigs with every bell and whistle imaginable, and new FM rigs being produced at the rate of "the radio-of-the-month club," manufacturers are still using the same old designs for SSB and CW from a decade ago for VHF and above. I don't know of any VHF rig that has DSP, for example. Not to mention that the price tag for these old designs is sometimes more than for a current-design HF rig. To overcome this, many amateurs have been using transverters.

Transverters are simply transmitting and receiving converters in one box. No audio, just RF. The most widely known type of receiving converter is the cable TV converter where multi-channel TV signals are on the input and the local oscillator changes frequency to the mixer resulting in output on channel 3 or 4. In the Amateur Service, the local oscillator is at a fixed frequency and the output is in a given bandwidth such as 28 to 30 MHz. A transmitting converter is simply the reverse. Now combine a receiving converter and a transmitting converter with one local oscillator and you have a transverter. As you can see, by using a transverter you retain all the features of your HF

rig, such as DSP, scanning, FM, etc., without laying out major bucks to duplicate what you already have.

So how do I get a transverter?

Well, you can build or buy. If purchased ready-to-operate, some will cost as much as a low-end HF transceiver. That somewhat defeats the purpose and leaves us with building. There is much to be said for creating your own super whatever from scratch, but at VHF and above you had better have a lab or access to one. So let's talk kits. After 40 plus years of kit building I can tell you, from experience, that there are kits and then there are *kits*.

Ten-Tec, famous for their HF radios, has recently added kits to their product line under the label T-Kits. The latest addition is the Model 1210 two-meter transverter. Since I wanted to add two-meter SSB to my station at a reasonable price, I bought one. Considering the price, I thought this would be a lightweight design that might at least still turn out to be a good conversation piece at the next hamfest. Wrong!

What you get is a small (5-1/2 inches by 3-3/4 inches) double-sided PC board with plated-through holes and excellent silk screen and solder

mask; two ICs; 13 transistors; 25 diodes; and a handful of resistors, capacitors, and inductors of various types, shapes, and sizes. Also included is a heavy steel case with aluminum chassis and heat sink. The cabinet is punched and painted, ready for mounting parts.

The assembly manual is great. In addition to easy, step-by-step instructions, there are color x-ray views of the PC board and test-as-you-build sections. The binder allows it to lie flat on the workbench—no using a brick to keep the book open with this one. Also provided is a table of test voltages at various points to aid in troubleshooting if required. The overall schematic diagram is on an 11- by 17-inch sheet of paper separate from the manual. On the reverse of the schematic are the locations of parts for the six construction phases and an overall view of the board. Although these pages are also in the manual, it keeps you from having to turn pages back to find component locations for the phase you are working on.

With the usual assortment of kit-builder's tools in hand, the 1210 went together in a smooth and orderly fashion. Testing is done at the completion of each phase and builds on previous construction. Reviewing these sections is an excellent aid for troubleshooting.

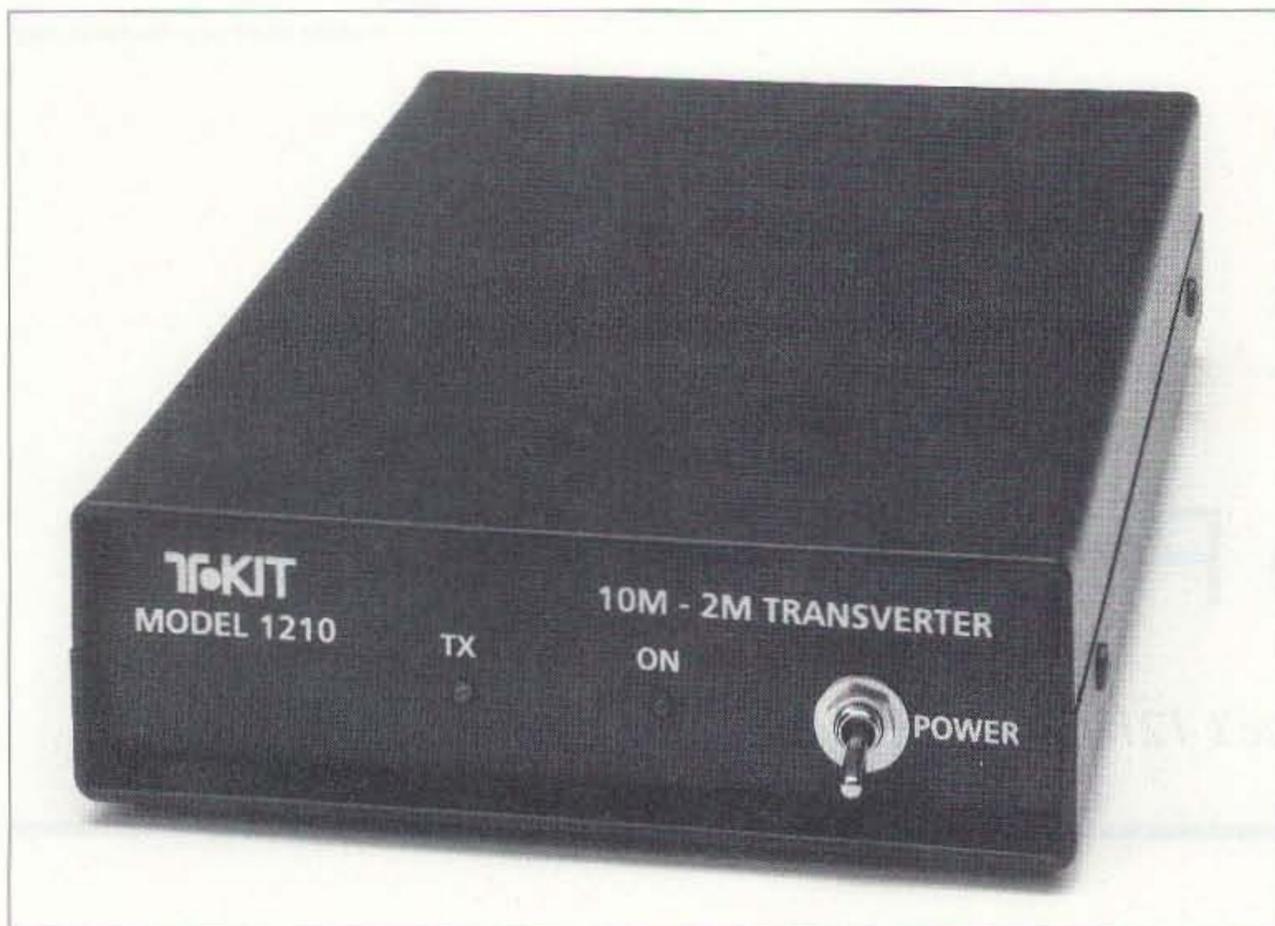


Photo A. The Ten-Tec T-Kit 1210.

The circuit design is solid and does not depend on "magic" or endless tweaking to make it work. Input voltage is specified at 13.8 volts DC at two amps on transmit for 10 watts output. Lower voltage can be used (11 to 12 volts), but power output will decrease. In the receive mode, a modest 100 mA is required.

A triple-output MB3756 regulator supplies voltages for the entire transverter with the exception of the last three stages of the transmitter amplifier (which are powered directly from the 13.8-volt source). RF-sensed switching of a few tenths of a watt places the transverter in transmit mode.

Provision is also made to enable the transmit side without an RF input. The 58-MHz crystal oscillator is doubled, filtered, and used for local oscillator injection to a double balanced mixer. The 28-MHz input/output of the mixer is amplified on receive and passed through a bandpass filter to the HF radio. The 10-meter signal supplied to the mixer can be anywhere between four and 20 watts, as an internal 20-watt load and adjustable ALC are part of the design. This feature becomes especially attractive when you realize that most transverters require the builder to construct external attenuators to provide milliwatts of power from a radio delivering watts.

On the two-meter side of the mixer, input signals are routed through two stages of filtering, one broadband and the other tuned, to a single MOSFET providing approximately 14 dB of gain with a two dB noise figure. Two tuned circuits couple the preamp to the mixer. In the transmit mode, a JFET and a triple-tuned bandpass filter amplify the mixer output to four more bipolar stages, boosting the output to 10 watts on CW, FM, or SSB while ensuring spectral purity.

Base bias to the final is controlled in the conventional manner of a diode used as a temperature sensor. On the collector side of the final are two stages of low pass filtering—one is a PCB stripline inductor, feeding a PIN diode T-R switch.

Unique to this VHF transverter design is the ALC. A sample of the output is rectified and sent to an op amp where it is compared to the power output control, thereby maintaining a constant output power. Input powers of four to 20 watts are acceptable. There are no relays and all switching is electronic with the exception of the on/off switch.

Construction begins with the 116-MHz local oscillator. As noted in the manual, a frequency counter is used to set this precisely on frequency. If you do not own or have access to a counter,

a VHF scanner set to either 58 MHz or 116 MHz will get you by until you're on the air and can copy some other reference signal. Simply set the scanner to either frequency and tune the oscillator for best quieting. I rough-tuned mine with a counter and then, after the entire unit was working, set the HF radio to 30.000 MHz (146.000 MHz through the transverter) and used the counter and a dummy load to set my frequency. By this method, any errors in the HF rig frequency accuracy are accounted for. There is a test point on the board for tuning the LO for maximum output. It does require a DVM or VTVM and is also the only test point there is.

A signal generator for tuning the input and output of the RF preamplifier is preferred. If you do not have one, acceptable results may be obtained by tuning these coils while copying a local station and watching the S-meter on the HF radio. The post-mixer coils are very broad and do not require adjustment other than setting the slug to the top of the form.

There are no tricks to setting up the transmitter. There are three slug-tuned coils and two capacitors to adjust. Simply follow the manual and have a VHF SWR bridge and dummy load on the output. The pot for setting the bias on the final is a bit touchy, but with a little patience idling current can be set precisely.

What would any review be without nit-picking? OK, here it is.

First, the slug-tuned coils. The slugs are very fragile and thus require the correct tuning tool. The manual suggests using a plastic tool but does not make reference to a particular type. It also suggests using miniature screwdrivers.

I would avoid this method at all costs. A bit of a heavy hand and the slug is cracked. I did find that a General Electric® mobile radio plastic tool fit well. Perhaps in the future Ten-Tec will make available the correct tool or give the name of the model and supplier.

Second is the supplied wire. It is plastic-coated and therefore susceptible to heat from soldering irons. RG-174 is supplied with the kit for input and output connections and it too has a

plastic jacket and inner conductor insulator. Teflon™ wire and cable make for really neat-looking connections without the worry of melting the plastic. I found some miniature 50-ohm Teflon cable and wire that had been discarded in an old commercial two-way radio. Only a foot of cable is needed.

Third, remember I said the bias pot was a bit touchy? An inexpensive 10-turn PC-mount pot would make this job a snap.

Finally, in the instructions for two of the three hand-wound coils, you need to mount them on the board after having installed C-59 in Phase 3. If you install the coils first, the form can be used to hold the coil in place until after they are soldered, lessening the chance of distorting the coil or shorting turns.

Using the supplied crystal for the LO, the transverter operates from 144 MHz to 146 MHz with an HF rig used as the IF in the 28 MHz to 30 MHz range. If you wish, a 59-MHz crystal could be substituted in the LO, and with an HF transceiver operating in the 26-MHz to 30-MHz range the entire two-meter band could be covered.

There is no provision for bypassing the transverter for HF operation. The only way to go from VHF to HF is by changing the coax from the transverter input to the HF antenna. After eyeballing the case, I believe there is just enough room between the front panel and the PC board to install a small rotary switch. I think that an additional coax connector on the rear panel could be installed as well. The satellite operator who wishes to use this unit as an IF will have to install a coax connector on the rear panel and split the transmit and receive sides. These are issues that make for interesting future articles.

The Ten-Tec 1210 is one of those kits that is fun to put together. Mine was assembled in about 20 hours, from opening the box to putting it on the air. For the record, after completing alignment I can copy a .15 µV CW signal generated by my Cushman CE-3 using a Yaesu FT-840 as an IF. The FM 12 dB SINAD measurement indicates approximately .4 µV which is about what the FT-840 measures on 10

meters. With four watts out of the Yaesu, I measured 10.5 watts out on 146 MHz to a Bird Termaline. Other stations report the unit sounds as crisp and clean as the FT-840 on HF, which is the idea anyway.

Anyone can build this kit if he can follow directions. Depending on the builder's level of expertise, the time required may be longer or shorter. I would strongly urge anyone unfamiliar with kit building or soldering to find an Elmer to help out and give guidance. There are some areas of the PC board that are tight. Patience will pay off. Good lighting is essential to any project and in my case a jeweler's loupe and bifocals were a necessity. For those who do not feel comfortable building a kit, Ten-Tec plans to make the 1210 available wired and tested in the future.

Priced at \$139, the kit is hard to beat. All the bells and whistles of your present HF radio are retained. If you have an old 10-meter rig lying around, or even a converted CB, this is an inexpensive way to get good performance on VHF.

Further information is readily available from Mr. Gary Green in the T-Kit department of Ten-Tec—phone (423) 453-7172. I found him to be pleasant, understanding, and informative before and after the sale.

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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 May issue, we should receive it by February 28. Provide a clear, concise summary of the essential details about your Special Event.

FEB 2

SUN CITY, AZ An amateur radio equipment auction will be held at 7 p.m. by the West Valley ARC at St. Clement of Rome Catholic Church Social Hall, 15800 Del Webb Blvd., Sun City AZ. Free admission. The club keeps 10% on equipment sales. Talk-in on 147.30+. Contact *George N7JSA* at (602) 933-0854, or E-mail [watgl@juno.com].

FEB 7

NORTH CHARLESTON, SC Stall High School in North Charleston, located near I-26 and Ashley Phosphate Rd., is the location for the 25th Annual and Original Charleston Hamfest and Computer Show, sponsored by the Charleston ARS. Doors open at 8:30 a.m. and close at 4 p.m. Setup is 5 p.m.-9 p.m. Fri., and after 6:30 a.m. Sat. 8 ft. tables are \$8 in advance, \$10 at the door, as long as they last. No tailgating allowed until all tables are sold inside. Make check payable to C.A.R.S. Hamfest Committee, and mail with an SASE (by Jan. 23rd), to *Jenny Myers WA4NGV*, 2630 Dellwood Ave., Charleston SC 29405-6814. Tickets are \$5 at the door (includes 1 prize ticket). VE exams will be given on site. Please bring original and copy of your amateur license, any CSCEs you have, and two IDs, one with a photo. All testing will be on a walk-in basis and will begin at 12 noon. For further info call *Ed KE2D* at (803) 871-4368; or E-mail [efrank@charleston.net]; or call *Doc W4MUR* at (803) 884-5614. For further hamfest info, contact *Jenny Myers WA4NGV* at (803) 747-2324, or E-mail [brycemyers@aol.com].

FEB 8

LATROBE, PA The Chestnut Ridge ARC Hamfest and Computer

Show will be held 8 a.m.-3 p.m. at the American Legion, 1811 Ligonier St. in Latrobe. Take Route 30 to Route 982 north. Follow signs. Talk-in on 145.15(-600) K3JDU rptr. Admission \$2, tables \$10. Send payments to *CRARC*, Box 175, Loyahanna PA 15661-0175.

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds in Mansfield, starting at 7 a.m. Tickets \$4 in advance, \$5 at the door. Tables \$9 in advance, \$12 at the door, if available. Reservation deadline is Jan. 15th. Talk-In on 146.34/.94 W8WE. For info, advance tickets/tables, send SASE to *Pat Ackerman N8YOB*, 63 N. Illinois Ave., Mansfield OH 44905; or phone (419) 589-7133 after 6 p.m. EST.

FEB 14

TRAVERSE CITY, MI Cherryland ARC's 24th Annual Swap-n-Shop will be held at Immaculate Conception Middle School, 8 a.m.-12 noon. VE exams will be held following the Swap, at 1 p.m. and 4 p.m. Pre-register, or register at Swap only. Talk-In on 146.86. Call *Joe W8TVT* at (616) 947-8555; or *Chuck W8SGR* at (616) 946-5312.

FEB 15

BRIGHTON, CO The Aurora Repeater Assn. will hold its annual Swapfest from 8 a.m.-2 p.m. local time, at the Adams County Fairgrounds, 9755 Henderson Rd., in Brighton. VE exams available. Talk-In on the N7PVN/R 147.15(+). Contact *Wayne Heinen NØPOH*, P.O. Box 473411, Aurora CO 80047-3411; Tel. (303) 699-6335; or E-mail [nrclg@aol.com].

ROCK ISLAND, IL The 27th annual Davenport (Iowa) ARC Hamfest/Computer Show will be held at the QCCA Expo Center, 2621 4th Ave., Rock Island IL. Handicapped accessibility. Free parking. The hamfest features a large indoor flea market and commercial exhibits; food available, door prizes. Talk-In on the WØBXR 146.28/.88 and 146.04/.64 rptrs. Tickets are \$5 in advance, \$6 at the door (under 14 free). For more info, send an SASE to *Kent Williams K9UQI*, 4245 10th St., East Moline IL 61244-4154; voice (309) 796-0718 (4 p.m.-9 p.m. only, please); FAX (309) 796-0629 (24-hr.); or E-mail [k9uqi@arcsupport.com].

FEB 21

RICKREALL, OR The Salem Repeater Assn. and the Oregon Coast Emergency Repeater Assn., Inc., will sponsor the 1998 Salem Hamfair and Computer/Electronic Swapmeet at the Polk County Fairgrounds in Rickreall. Doors will be open 9 a.m.-3:30 p.m. Swap table setup will be Fri., Feb. 20th, 6 p.m.-8 p.m., and Sat., Feb. 21st at 7 a.m. Self-contained RV spaces available. Features include swap tables, commercial dealers, meetings and seminars. For more info, contact *Evan Burroughs N7IFJ* at (503) 585-5924. To download a copy of the flyer and pre-registration form, surf the net for [http://teleport.com/~n7ifj/srflyer.htm].

FEB 21-22

CINCINNATI, OH The 17th annual Great Lakes Division and Computer Convention (formerly Cincinnati ARRL 1998), will be held at Cincinnati Gardens and Exposition Center. A 24 hr., 7 day-a-week phone line is already in operation for vendors and others seeking info. Call (513) 661-0201. If you wish to fax the convention, please use (513) 531-3834. These lines will inform you regarding vendors, tickets, flea market spaces, and forums. Cincinnati Bell's Answer-Link will allow the appropriate convention staffer to return calls and give the latest information quickly.

FEB 22

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will hold its

44th annual Hamfest at Emidio's Party Center, 48 Bath Rd. (corner of State and Bath, approx. 6 miles south of the Ohio Tpk.). The doors will be open 8 a.m.-2 p.m. Admission \$4 in advance, \$5 at the door. Tables reserved before Feb. 6th are \$8; at the door, if available, \$10. Please call for details regarding VE exams. Contact *Dan Adkinson KC8CFJ*, P.O. Box 2222, Stow OH 44224; Tel. (330) 923-9045; or E-mail [hamfest@neo.lrum.com]. Talk-In on 147.87/.27 W8VPV.

DEARBORN, MI The Livonia ARC will present its 28th Annual Swap 'n' Shop, 8 a.m.-3 p.m. at the Dearborn Civic Center, Dearborn MI. For info, send a 4" x 9" SASE c/o *Neil Coffin WA8GWL*, Livonia ARC, P.O. Box 51532, Livonia MI 48151-5532; or call the club phone line, (313) 261-5486. Check the Web page at [www.larc.mi.org].

FREEPORT, NY The Long Island Mobile ARC Indoor Hamfair will be held rain, snow, or shine, at Freeport Armory, Babylon Turnpike, Freeport NY. The event will be open 9 a.m.-2 p.m., and features amateur radio equipment, computers, dealers, ARRL and LIMARC information, CB equipment, TV, and a VHF tune-up clinic. General admission \$6, children free. Vendors: All spaces \$25 (includes one 6 ft. table and admits one person). Special close parking and/or drop off area for vendors. Vendors admitted at 7 a.m. Advance registration only. No day-of-sale spaces. For a reservation form, E-mail *Hamfest Chairman Rich N2WJL* at [N2WJL@juno.com]. Send your check to *LIMARC*, P.O. Box 392, Levittown NY 11756-0392. Limited selling space—only some have electricity. Free parking for buyers. For more info, call the LIMARC 24-hr infoline at (516) 520-9311; or write *LIMARC* at the address above. Check out their Web page at [http://members.aol.com/RaySk/LIMARC1.HTML].

FEB 28

LAPORTE, IN The Cabin Fever Hamfest, sponsored by the LaPorte ARC, will be held 7 a.m.-1 p.m. at the LaPorte Civic Center. The event will also feature computers. Admission \$5. Tables \$5 each. Talk-In on K9JSI 146.610

(131.8 pl) and 146.520 simplex. For further details, contact *John N9ROH, LPARC, P.O. Box 30, LaPorte IN 46352. Tel. (219) 326-7182 evenings.*

MILTON, VT The Northern Vermont Winter Hamfest, sponsored by the Radio Amateurs of Northern Vermont, will be held 8 a.m.–3 p.m., at Milton High School, Route 7, in Milton. Features include a flea market, auction, dealers, book sales, forums and exhibits. VE exams will be given at 9 a.m. and 2 p.m. Commercial exams at 2 p.m. Admission is \$3; free for under 18 years. Tables are free while they last. Please call for large setups. Talk-in on 145.15 rptr. Contact *W1SJ at (802) 879-6589; E-mail [wb2jsj@vbi.champlain.edu].* Check the Web for [<http://www.ranv.together.com>].

MAR 15

MAUMEE, OH The Toledo Mobile Radio Assn. (TMRA) will hold their 43rd Annual Hamfest/Computer Fair, 8 a.m.–3 p.m., at the Lucas County Recreation Center, 2901 Key Street, in Maumee. For details send SASE to *TMRA, P.O. Box 273, Toledo OH 43697-0273; or Paul Hanslik N8XDB, P.O. Box 273, Toledo OH 43697-0273. Tel. (419) 243-3836.*

MAR 21–22

BETHPAGE, NY The Long Island Mobile ARC will present a weekend Ham Radio Course at

Briarcliffe College, 1055 Stewart Ave., Bethpage, NY, Sat., Mar. 21st through Sun., Mar. 22nd, 9 a.m.–6 p.m., for anyone interested in obtaining their entry level amateur radio license. There is no pre-requisite for registering, just a desire to become a ham. No minimum age limit, but we recommend age 10 and above. The cost per person is \$35. This includes the workbook, lunch each day, and refreshments at breaks. It does not include the exam cost of \$6.25. There will be a number of instructors, including LIMARC Past President Norm Wesler K2YEW, current LIMARC President George Tranos N2GA, and current Vice President Rob Todaro N2JIX. For more info, please call the LIMARC 24-hour info line at (516) 520-9311; or E-mail to *N2GA@aol.com*. Registration is limited, so please reserve now to secure your spot. Indicate age if less than 18. Please make checks payable to *LIMARC* for \$35 per person. Include name, address, phone, and E-mail address. Send to *LIMARC Weekend Class, P.O. Box 392, Levittown NY 11756.*

MAR 22

GRAYSLAKE, IL The Libertyville and Mundelein ARS, assisted by the North Shore Radio Club, will hold "LAMARSFEST '98" at the Lake County IL Fairgrounds in Grayslake. This large indoor radio, computer, and electronic swapfest will be open 8 a.m.–2 p.m.; setup

is at 6 a.m. Advance commercial setup by arrangement. Admission is \$5 at the door. Swapfest tables \$10 each. Wall tables \$15. Commercial tables \$25. Table reservations until March 14th. No additional charge for power. VE Exams. No tailgating. For info and reservations, contact *Dave Gudewicz KB9KDA, LAMARSFEST 98, 5 Brigantine Lane, Grayslake IL 60030. Tel. (847)-937-8227 until 9 p.m. Talk-In on 147.345(+)* NSRC rptr., and 146.52 simplex.

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their Hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

FEB 14

FARGO, ND The Red River Radio Amateur Club and the Kiwanis Club of Fargo will operate KØZWG in celebration of the 16th Anniversary of their cooperative Handi-Ham Project. The station will operate during the 40th annual Kiwanis Pancake Carnival. Operation will be from the downtown Civic Center, Centennial Hall, 8 a.m.–5 p.m. CST (1400Z–2300Z). Operation will be in the lower 25 kHz of the General 20

and 15 meter bands—both CW and SSB. For QSL, please send QSL and SASE to *Mr. Jim Mowery KØZWG, Horizons Manor, 2500 Broadway, #1006, Fargo ND 58102 USA.*

FEB 14–15

ALEXANDRIA, VA The Mount Vernon ARC will operate K4US 1500Z–2200Z to commemorate George Washington's Birthday. Operation will be in the lower General 80–15 meter phone subbands and 30–17 meter CW. For a certificate, send QSL and a 9" x 12" SASE to *MVARC, P.O. Box 7234, Alexandria VA 22307 USA.*

APACHE JUNCTION, AZ The Ocotillo Amateur Radio Group will operate Station KJ7FG, 1400 UTC Feb. 14th–2400 UTC Feb. 15th, in celebration of the 86th Anniversary of the Statehood of Arizona. Operation will be 20 meters only, 14.260/.360. QSL for a certificate with a 9" x 12" SASE to *K6RLS, 5228 N. Idaho Rd., Apache Junction AZ 85219.*

FEB 20–22

MARQUETTE, MI The Hiawatha ARS will operate K8LOD, Feb. 20th–Feb. 22nd, in the General portion of 80, 40, and 20 meters, in conjunction with the UP 200 Sled Dog Championship. In order to get a commemorative certificate, send an SASE to *Rich Schwenke N8GBA, 21 Smith Lane, Marquette MI 49855.*

NEVER SAY DIE

Continued from page 6

2000. René says the Earth has no bulge and thus can easily be flipped so the poles move to the equator. Noone expects about the same thing, but just with the crust sliding. Either way all hell will break loose, with mile-high waves, and lots of earthquakes, and volcanoes blackening the skies. Well, at least he's giving us a couple more years to worry about it than Scallion is.

The worst worrywart seems to be Ed Dames, who says the Big One will hit in April 1999. In late November he predicted a massive solar flare to hit us in December

which would screw things up, but not kill us. The 1999 flare, he said, would wipe out all life above the ground. Hey, where's my shovel? Dames said that he and his family were headed for the South Pacific in the next few days.

Scientists Unconvinced

A recent Gallup™ poll of their survey of several thousand scientists reported that only 19% have so far been convinced that global warming is actually taking place. So, despite the hysteria of some political groups, if the end of the world is coming, it isn't likely to be from our CO₂ emissions. Bad science.

The Bottom Line?

Will we be nuked by terrorists? Biological or chemical attacks? Shifting polar areas? A new ice age? A third world war starting in the Middle East? A killer solar flare? Or will we continue on as we have with our school, health care, and political systems gradually worsening? Watch the evening TV news for developments—unless all the radio and TV stations get blasted off the air, then see what, if anything, you can find on the ham bands.

Well, in many ways we've made a mess of things, so maybe wiping the slate clean and starting over wouldn't be a bad idea.

The biggest bumper may be that Saddam, buried deep underground in a bunker, may be one of the few survivors.

Prophecy

The more I read about prophets, the more bewildered I get. Like you (I suspect), I'm so totally tied to the physical experience of time that I don't understand how time travel can be possible. The clock ticks off the seconds—then the minutes and hours. There is no going back, except in memory—which is a pretty good time machine in a way. Being a pragmatist, I'm not a disbeliever in time travel, I just

Continued on page 49

Electronic Construction from A to Z

Conclusion: You too can be Mr. Fix-It!

Marshall G. Emm N1FN/VK5FN
2460 S. Moline Way
Aurora CO 80014
[n1fn@mtechnologies.com]

This is the last article in our series on basic electronic construction, and I hope you don't even need to read it! If you've been with me from the start, you probably have a brand-new, working, VM-110 AC Voltage Monitor (see Parts 1-3), installed neatly in an enclosure with a nice label.

But what if it doesn't work? Don't despair. The odds are very good that you can figure out what is wrong and fix it yourself, through a process we mistakemakers refer to as "troubleshooting."

A sensible approach is to ask yourself, "What did I do wrong?" If you can determine that you did nothing wrong, look for a problem in the circuit board, and then a faulty component. If you still haven't turned up the problem, it's time to send it back to its maker. Odds are pretty good you'll get it back with a polite note that it was your fault after all—they found a goof that you missed in the umpteen times you checked everything.

Step One: Take a Break

Seriously! You are probably "too close" to your project and if you saw something one way when you installed it you will probably see it the same

way when you check it—unless you have let a bit of time go by and can approach the problem with a fresh eye.

People who write for a living often think they can adequately proofread their own material. People who edit for a living know better. And I know from personal experience that I often find mistakes in an article when it comes back in proof form. It takes a while for that to happen, so my eyes see what is actually on the page rather than what I "think" I put there.

Exactly the same principle applies in electronic construction. You checked the diode when you installed it, and it looked right when you checked it. Forty-eight hours later you're wondering how you could possibly have put the darned thing in backwards.

There is also a certain amount of anxiety associated with troubleshooting your own work. You put a lot of time and effort into building it, not to mention dollars, and it's all wasted if the thing doesn't work. This anxiety makes it easy to jump to conclusions, take shortcuts in checking your work, and seek someone else to put the blame on.

If you just heave a big sigh and put your project away for a day or two

before trying to fix it, you will come back to it with a fresh eye and a good attitude, and much better prospects for success.

Let me give you a concrete example. I recently finished a project late one night and was just devastated when it didn't work. My immediate inclination was to tear into it and fix it immediately, but instead I heaved a big sigh, put it on the shelf, and forgot about it for two or three days. When I came back to it ... well, it, um ... it worked. I'd only made one tiny mistake the first night—I forgot to turn the power supply on. OK, my face is a little red over that—but maybe it will help you to avoid similar problems.

The procedures I am going to describe are just guidelines. It's a system that works for me, but I take liberties with it sometimes and you shouldn't feel that you have to do everything I'm going to describe, or do it in the same order.

Don't be embarrassed to ask for help. If you know somebody who is a builder, ask him to cast an eye over your work. You might be surprised how easily someone else can see a problem that you have overlooked.

And most of your peers are going to be delighted to be asked, because most hams are helpful and it's also an opportunity to show off.

Lazy Man's Step Two: Check Components and Connections

I call this the lazy man's approach because it is easy, but it is also time-consuming. You check all of the components and soldering (but don't try to do both at the same time).

In checking the components, you need to check three things—the value, the orientation (for polarized components like diodes and electrolytic caps), and that they are installed in the correct location. Go through the instructions step by step and check each step off as you go through the sequence. You may also wish to consider going through the instructions in reverse order (just like adding a column of numbers), to give you a slightly different perspective.

Pay particular attention to any "left-over" holes on the board. It's quite possible that there are supposed to be some empty holes because the design of the circuit has been changed or to make provision for options and modification, or testing. It's also possible that you left a component out! Hold the board up to a light and look for the holes.

In checking the soldering, use as strong a magnifying glass as you can find (a 10x loupe is perfect) under good light. What you are looking for are poor connections (cold joints, or connections with a rough finish or no sign of solder flowing up the component lead) and solder bridges—solder which has flowed between adjacent tracks or connection points. If one is available, refer to the solder track diagram when you can't be sure whether a connection is intended. If you don't have the solder track artwork you will have to refer back to the schematic, which can be a real pain. So here's a hint for your next project—if a copy of the art is not supplied, photocopy the solder side of the circuit board before you start. When you are checking the soldering, you are looking at mechanical detail without any regard for "where you are" in the circuit—start at

one corner of the board and work your way through to the other side in reasonable stages so you can be sure you have examined every square millimeter.

Sometimes you will encounter a "whisker" solder bridge or the tiniest trace of circuit board material across two tracks. Use your hobby knife, or the edge of a small screwdriver, or (best of all if you have one) a dental pick to scrape the board material between the tracks to remove the bridge. Often I have been able, literally, to *feel* a bit of solder or conductive material that was all but invisible to the naked eye.

If you have checked all the components and all of the soldering and you haven't found anything to fix, you have two choices—send it back to the maker or start over with the method outlined below.

Probably you will get your circuit working with the above approach, but Murphy's law says no matter what order you check your work in, the problem will turn out to be in the very last component or joint that you check. You can save a lot of time by applying the following method, especially with more complex circuits.

The Real Step Two: Isolate the Problem

You don't have to be an electronics engineer to have some idea of what the various parts of the circuit do. The instructions probably tell you in general terms, and common sense can be pretty useful too. And it's quite likely that some parts of the circuit are working perfectly. We're going to go through this in stages, and in some cases if you detect a problem you will immediately see the cause and the solution. But if not, don't despair—isolating the problem is only the first of a lot of things we can do.

Look at the power supply first. Make sure that you are connecting the correct voltage, with the correct polarity.

Locate circuit ground, because you will need to connect to it for many measurements. Incorrect connections to it are a common source of problems. Circuit ground, or the "ground plane" of the circuit, is usually a large-ish track, often all the way around, or

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most of the way around, the perimeter of the board, with interior tracks directly connected to it. When in doubt, use your multimeter to check continuity back to the power supply connection.

With the power supply turned off or disconnected from the circuit, set your VOM (volt-ohm-milliammeter) or DVM (digital volt meter) on its continuity or ohms setting and check whether there is continuity across the positive and negative power supply connections. If there is, then you almost certainly have a dead short and should look for a solder bridge between a supply track and ground.

Turn the power supply on (but don't connect it to the circuit yet) and measure the voltage to be sure that it is the required voltage for the circuit. If you are using a battery, check its voltage. Then connect power to the circuit and recheck the voltage on the plus and minus tracks beyond the actual connection points (thus proving that the power supply connection is OK).

If you haven't turned up anything so far (or if you have found a problem, and fixed it, but it still won't play), measure the current drawn by the device, by connecting an ammeter in series with the positive voltage supply. Be careful, because many inexpensive multimeters will only measure a very low level of current, e.g., 100 mA. Make sure your meter is rated for current greater than the maximum current that your device should draw. If you are drawing no current, then you have the opposite problem from a dead short. You have an open circuit somewhere in the power supply end of the circuit. If you are drawing current but not the correct amount, you have a problem with one or more of the later parts of the circuit.

Once you've performed the steps described above, it's time to get down to brass tacks. There are two approaches you can take, and sometimes both are necessary. You can follow the power, and you can follow the signal.

For any part of your circuit to work, it will have either power supply and usage characteristics, or some sort of input and output, or both. In the case of an audio amplifier for example, you have signal in, signal out, and power.

To check power supply and usage characteristics, it helps to have a chart of voltages at various test points such as the pins of integrated circuit chips. If your project included such a chart, you probably won't need much more. Just check the indicated voltages and look for a problem in the immediate area of the test point if the voltage is not as specified.

If you don't have a chart of reference voltages, you can still achieve much the same effect by tracing the power supply lines on the schematic diagram. It's quite possible that you won't know exactly what voltage should appear at a given point, but if there is no voltage at all you have located a problem.

You can also check for continuity between many integrated circuit pins and ground (with the power disconnected, of course). Look at the circuit diagram, find the grounding points, and check them. An open or missing connection to ground can be just as problematic as an "extra" one!

"You can follow the power, and you can follow the signal."

To follow the signal, you probably need to know a bit more about how the circuit works. There are three kinds of signals that you may be able work with—audio, RF, and digital.

Audio signal tracing can be done with a pair of headphones connected to a pair of test leads. Probe the circuit at various points along the signal path by connecting the grounded or "common" side of the headphones to the circuit board ground, and the "hot" connection (usually the tip on a standard phone plug) to the test point. You can start at either end of the audio path. If you are starting at the source, you follow the signal until it disappears, which tells you approximately where the problem is. If you are starting at the output, you follow the path until the signal appears, which tells you the same thing.

RF signal tracing is a bit more difficult. Two possible approaches are to use a simple diode and capacitor circuit as detailed in The ARRL Handbook (or

of course an RF voltage probe if you have one). The probe circuit rectifies the RF and produces a DC voltage which can be measured with your multimeter. Be careful, though, not to confuse RF and DC voltages, because both will be present at some points in the circuit.

The second approach is to bypass suspect stages. If you are working with a receiver, for example, you can find the input and output points for a filter, and use a clip lead to bypass the entire filter. If you suddenly have a working receiver, you know the problem is in the filter stage.

Digital signal tracing is generally beyond the scope of this article, but in many simple circuits you can easily determine whether a specific point should be "on" or "high" (commonly +5 V) or "off" or "low" (commonly less than +1 V). For example, the keying output of an electronic keyer is controlled by one specific pin on one specific chip, which is "high" when a dit or dah is being sent.

Step Three: Clean It Up!

No matter how carefully you solder, there is bound to be some flux residue on the track side of the board. Depending on how much there is, and what type of flux it is, it may be difficult to see problems. I know I said (in Part 1, November 1997) that you probably shouldn't bother removing the flux, but it's a lot easier to work with a clean board when you are trying to find a problem. It's fine with me if you want to clean the board before performing step two (above), but keep in mind that cleaning the board may introduce problems that weren't there before.

If you are using ordinary resin-core solder, you can buy a very expensive solder flux remover at your local radio parts store, but the easiest material to remove excess flux with is acetone. Acetone is probably better known (and certainly more readily available) as nail polish remover. You'll probably find several varieties in your local grocery or drug store, and this is one of those cases where a brand name means nothing. Buy the cheapest they have, but do look for one that is described as

"non-oily" or lists only acetone on the ingredients label. This time we're lucky, because it's usually the more expensive name brands that have the added oils, emollients, and perfumes. If you can't find a pure acetone nail polish remover on the shelf, ask the pharmacist—he'll probably sell you a small bottle of it at a very reasonable price. And don't overlook your neighborhood hardware superstore, where you'll probably find a quart bottle of acetone for about the same price as four ounces of nail polish remover.

Here's how I do it. I put the circuit board in a metal baking dish (a/k/a a cake pan), solder side up, and pour a generous amount of acetone over it. Quickly, before the acetone evaporates, I scrub over the board with an old toothbrush. The process is repeated until the entire board has been done, at which point the areas done first will be dry and showing a milky haze. This is a very thin coating of dissolved and re-deposited flux, and it should be removed by giving the board another rinse in acetone. Make sure the board is thoroughly dry before you take it back to the workbench and try to do anything with it.

If you are not using resin-core solder, you should use whatever solvent is recommended by the manufacturer. If you are using a water-soluble flux, for example, you can clean the board with warm water (with a small amount of detergent in it), but you must expect it will take longer for the board to dry than if you use a volatile solvent. And you *must* wait until the board is thoroughly dry before trying to do anything else with it.

Step Four: Find and Fix

Assuming you have localized the problem, or determined that it is in a particular area of the circuit, it should be relatively easy to narrow it down even further to a specific component or circuit path.

Since the odds are still pretty good that the problem is a soldering fault, you might want to try the "wiggle test." Basically, you just press on each component with a fingertip and wiggle it a bit to see if the circuit suddenly

starts to function. Note that this should only be done with *low power* circuits! In fact, you should probably not use your fingertip in the first place. Use the eraser end of a pencil, or a nonconducting tuning tool.

Look at the components and the soldering again, and see if you can find:

- a solder bridge
 - a poor connection
 - an incorrect component value
 - an incorrect component orientation,
- or
- an incorrect component placement.

If you don't find anything wrong, then it is time to see whether you have a faulty component. There are three things you can do to check components.

Measure the value. You will need to examine the schematic to determine whether the component can be measured "in circuit." In many cases a component will have to be removed from the circuit, although sometimes (e.g., with most resistors) you can get away with just unsoldering one end of it.

Substitute another component. If you happen to have another component of the same value, you can swap it in and see if it fixes the problem. Often you can use a "close" value as a temporary substitute if you can't find an exact match, and if you are lucky that will tell you whether the original component was in fact faulty.

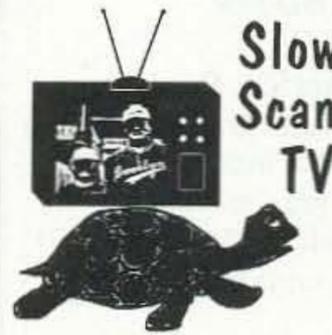
Bridge the component. You need to be careful with this one, especially with components in the power circuit, but often you can safely bypass a component long enough to see if doing so will make the circuit function, in which case the component is probably faulty.

Naturally, there will be circumstances where it is absolutely impossible to determine that a component is faulty. Examples that come immediately to mind are ceramic resonators, integrated circuits, and many transistors. If you suspect that such a component is faulty, and can't prove it by swapping in another one from your junk box, it's time to get in touch with the manufacturer.

Lazy Man's Step Five

If you are tired of messing with it, and have the money, and/or are just downright lazy, by all means pack it up

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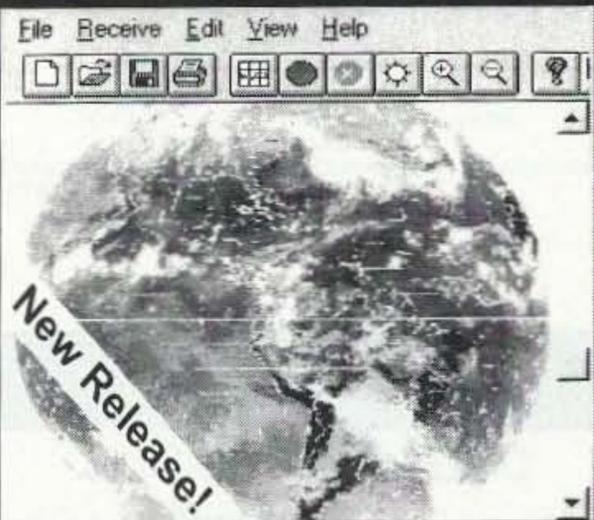
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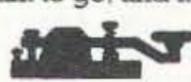
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and send it back to the manufacturer. Check the documentation for instructions which will often tell you the specific fee that must be sent, or whether you need to arrange for a "return authorization."

The Real Step Five

Don't give up just yet! If you've made it this far and your project still doesn't work, it is time to get in touch with the manufacturer, but you may still be able to fix it with a bit of help. Call them, or send them an E-mail, or write to them, with as complete a description of the problem as possible, and what you have done to try to fix it.

Most people who sell kits to (or design projects for) the amateur radio community do so as a labor of love, and they want you to succeed!

Many of them will fix a nonfunctioning kit without charge, or at a very reasonable cost, and often they will send you replacement parts or spend so much time trying to help you that they couldn't possibly break even on that particular sale.

Here are some of the reasons you should get in touch before sending it back:

- Someone else may have had the same problem and there is a known "fix."
- The manufacturer may have found out that one of the instructions can be misinterpreted.
- At the very least, the designer of the project will understand the circuit fully and can often provide an accurate diagnosis based on your description of the problem.

If you have to send it back, don't sweat it. It has happened to just about all of us, including yours truly. There's no shame in admitting you are not an electronics engineer (unless, of course, you have a degree that says you are!). And if it turns out that it was something you messed up, well, we learn from our mistakes ...

Most suppliers will meet you halfway, too. If the problem was their fault, they won't charge you for the repair (and some won't even charge you the freight to get it back to you). If it was your fault, then you certainly shouldn't mind paying a reasonable

price for a remedy. In all my years of building kits, I have had four or five which have required help from the maker (up to and including sending it back), one that I didn't bother sending back because it was cheaper and easier to order another one and start over (the second one worked and gave me a comparison unit to get the first one going!), and only one that resulted in an irreconcilable difference of opinion and a demand for a refund.

Here's a Horror Story

That one unfortunate situation is worth dwelling on, but please note that these were folks whose kits have nothing to do with ham radio and therefore will probably not be encountered by most of you.

I won't name them, because I'm sure they have either cleaned up their act by now or gone out of business. The kit was a power supply, and the problem was a faulty pass transistor and, probably, a fault in the basic design.

Using most of the techniques described above, I determined that I had built it properly, but the malfunction pointed to the transistor. I swapped another one in and it still didn't work, so I decided to send it back after speaking to one of their "technical" people. There wasn't a whole lot of communication because the guy didn't speak much English, but he did authorize me to send it back on the understanding that I would pay if the problem was my fault.

There was just something the slightest bit "off" about these people, so I put the original transistor back in, double-checked the soldering, and photographed both sides of the board before sending it back.

They "fixed" it, charged my credit card \$35 (the kit cost \$29 to start with!), and said the problem was a cold solder joint on the pass transistor. Well, guess what? I had a close-up photograph that clearly showed the soldering on the pass transistor, which was just fine. I had a close-up photograph of the other side of the board that showed they had in fact replaced the pass transistor. And, to put the icing on the cake, the thing still didn't work.

I called them up and they denied that they had done anything but resolder the connections, and claimed that it was working when it left them.

When I told them I had a photograph they started to give me the old shuck 'n' jive, so I demanded a refund, which they refused. So I got the refund through the credit card company after a whole bunch of paperwork.

The moral of the story? There are at least two:

- Know whom you're dealing with, and if it is someone outside the normal range of amateur radio suppliers, take precautions.

- As with any transaction, on the Internet or at your local gas station, the best form of credit card security is a card provider who will go to bat for you.

Wrapping it Up

Your kit probably worked the first time you tried it. If it didn't, you were probably able to fix it all by yourself. If you couldn't, then you've probably sent it back and got it fixed, perhaps paying a fee which you can regard as a tuition payment.

In any case, you're finished with it now and can start thinking about that next project—perhaps a keyer, or an audio amplifier, or even a transceiver!

As I write this I have already started to receive a considerable amount of correspondence resulting from Part 1 back in the November issue of 73. I understand that many of you have even sent in the "feedback" card (thanks!). When I started this series, I was concerned that it would be difficult to find the right level of detail for the beginning kit builder, but I am highly gratified by the response and just thrilled that it has convinced some of you that you can do it!

I hope that when you build your next project, you will write it up for publication. You don't have to be an expert, and you don't have to be a "writer." What counts is your ability and willingness to share your experience. 73 de N1FN. 73

NEVER SAY DIE

Continued from page 43

don't understand what the rules may be for those who have achieved it—and we have some strong hints that there are time travelers.

But what about people who seem to be able to predict the future? How is this possible? If the future is written, then in how much detail? Can we change future events?

You've read about Nostradamus and his prophecies. They are truly amazing—if you haven't read about them, get a book on his quatrains. How could he predict Hitler so accurately 400 years earlier? Or the exact date, 200 years later, that someone would exhume his bones?

Washington reported that at his lowest point at Valley Forge he was visited by an angel who showed him that the revolution would be won and a union formed. He was also shown the Civil War and that the North would win.

Then there's Dannion Brinkley, who died twice and went to Heaven, where he was shown the future, as reported in *Into The Light*. It's reviewed in my *Guide*. He was shown the Gulf War, including the date, place and the combatants—and he reported this 20 years before the war.

I've had Gypsies tell me about things that would happen later, and they did, just as predicted. I remember a tea leaf reader on Fifth Avenue in New York. I'd just joined the Navy in 1942, but the navy base was out of uniforms so they gave me three weeks' leave. I was scheduled to go to Bliss Electrical School (now Montgomery College) in Maryland in a few weeks to learn about electronics and radar. The Gypsy looked at my tea leaves and said it was strange. Though I was in civilian clothes she saw me in uniform. At that time it was illegal for the military to wear civvies without special permission. She saw me going into a big building with many others and coming out as #1. I didn't know what she meant, but when I graduated from Bliss a few months later I'd won top honors.

I'd always been a C- student in high school and college, so this was something I never would have predicted.

The more I've read, the more I've found reports of prophets who have been very successful in predicting the future. One book, *Cosmology*, by Bevy Jaeger, explains how anyone can develop the ability to predict the future. If you've been brainwashed by skeptics into thinking that dowsing is baloney, then you need to read some books on the subject and start trying it yourself. With some experience just about anyone can learn to dowse for anything they want. You can dowse for water, minerals, or dowse

a person to find where their illness is located. Or dowse a map to find where something is. One of the best of this genre is *Vibrations* by Owen Lehto. It's in my *Guide*, along with a source.

Yes, I saw the "Alan Alda *Scientific American Frontiers*" TV show debunking dowsing and other paranormal phenomena. What a crock!

But then dowsing is no more mysterious than the ramifications of quantum mechanics or the structure of the atom, of which do we have little more than theories.

It seems as though every time we try to go beyond where we can see, we come up with theories which are exploded when we extend our vision. Everyone could plainly see that the Sun went around the Earth every day—until the telescope came along. The idea of bacteria was ridiculed until the microscope was invented. Of course scientists refused to look into it, just as they'd refused to look through the telescope.

Prophecy, despite uninformed skeptics, is alive and well—we just don't have a clue as to how or why it works. But we do know that it is a skill that anyone can develop.

Continued on page 79

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I'm bored!

Ham radio is a wonderful hobby encompassing all kinds of activities, from worldwide voice, CW, RTTY, and SSTV, to VHF/UHF, microwaves, satellites, ATV and even spread-spectrum experimentation. Yet, if you've been a ham for awhile, you will undoubtedly come to a day when you'll look at your rig gathering dust in the corner and think, "I'm bored!" Somehow, the act of saying "five by nine, thanks for the contact" to somebody in Finland just isn't as exciting as it once was. And, with the Internet filling your E-mail needs, not to mention plenty of hours, you may not have fired up your packet TNC in quite awhile. Is ham radio pointless? Are you finished as a ham?

Not by a long shot! Of course, we humans get bored easily—it comes with having big brains. After all, a kitten can spend a lot of happy hours with a ball of string, but how long would it satisfy us? And that's the essential nature of boredom with radio: doing the same thing over and over again. Oh, sure, you've heard it time and time again—get out and try some new facet of the hobby. It sounds good, but sometimes it also sounds expensive or very time-consuming. And you may feel like you don't know enough, or you just may not know where to begin. So, let's take a look at ways to have fun with radio that might just re-pique your interest in hamming.

What's the point?

Somehow, in this "buy it, plug it in, and talk" era, we've gotten the notion that the purpose of ham radio is to talk to each other. Nothing could be further

from the truth! Folks, barring a nuclear disaster or a major earthquake, the consumer communications systems in place today far outperform anything you can do with a two-way radio, at least for voice communications. For a start, cell phones are full duplex, allowing you to talk and listen at the same time. Fax machines let you zap a document anywhere you want it, in seconds. Personal computers and the Internet give you high-speed, graphical communications and interactions way beyond any amateur digital communications system yet devised. So, if you're in ham radio just to yak, you'll have fun for awhile and probably make some new friends, but you'll get tired of the whole thing after a few years.

At one time, ham radio provided the only long-distance communications besides the commercial telegraph. In those days, range was limited. That's how the ARRL came into being: as a way to organize stations into nets and pass messages in a reliable, regulated fashion. Obviously that's no longer a relevant use, except perhaps in some grand-scale national emergency. However, with the large-scale, consumer-accessible satellite networks now being planned, even emergencies should be covered by more advanced technology than an HF rig and a dipole, or an HT.

So, if talking isn't really the point of ham radio, just what is? Well, it's still handy for public-service events like parades and marathons, but low-cost VHF services like the family radio service and GMRS can handle that just fine. Besides, running comms for the occasional parade hardly justifies all the legal and

spectral infrastructure required to keep amateur radio in place. No, there has to be something else, and there is!

The point of ham radio is *learning*, and it always was, right from the first spark transmission. It was the experimenting and learning of individuals that made radio possible in the first place. In the beginning, *all* radio was amateur. It became a business only after hams made it work. (Our thanks for that was having our spectrum privileges chopped up, and being relegated to frequencies people thought they couldn't use to make money.) Perhaps you figure that, by now, everything that can be known already is, so why bother to reinvent the wheel? True, the basics are very well established, and plenty more beyond that. But everything? Hardly! A lot of today's technology, from cell phones to the use of SSB in military aircraft, came out of advancements either created or refined by amateurs. The game isn't over yet!

So, what's left? Most of the uncharted waters these days are either digital, at extremely high frequencies, or both. Does that mean you need a Ph.D. to make anything new? No way! Heck, I discovered a little thing myself: the self-biasing, linear application of power MOSFET transistors as RF amps, at gains way higher than what's in the books, and with fewer parts, too. Was I inventing some microwave, high-speed digital link? Nope, I was just fooling around with building a little 80-meter transmitter, and I found that the transistor would do something it wasn't supposed to be able to do. Sometimes it's that simple.

OK, not everyone is a technical junkie. Many hams today don't even know how to solder. If you don't, then *learn*. It isn't hard, and it isn't expensive. Even if you never plan to build anything, you'll undoubtedly need to resolder the mike connector on your mobile rig one of these days, because the wire breaks after a few years. I've had

to do it to every rig I've ever had for more than a year or two. The point I'm making is that ham radio is not a consumer electronics playtoy, and the shipping box is not your only recourse when things go wrong (although you should use it while the radio is in warranty, of course). It's a technical hobby, it always was, and it should continue to be one! Even if you never get past Ohm's law, you'll have gained way more insight than the average person has, and you can begin to see how things work. Even if you never build anything, at least you'll have begun to see things in a structured, logical fashion. And that can lead to all kinds of insights later on.

Once you can solder, consider building a kit. There are lots of cheap, easy-to-construct kits that will give you a wonderful introduction to electronics, integrated circuits, etc. And, you wind up with a fun gadget! It doesn't have to be a ham radio device, either. One of these days, I'm going to order one of those stereo FM transmitter kits. I'm not sure why ... they just look like fun. And, I'd like to learn a little more about the fine details of how the stereo multiplexing is really done. Why? Because it's interesting! Plus, who knows, it might lead me into some new idea I'd never have thought of without it. Besides, it would just be cool to be able to send stereo program material around the house.

Not only do kits give you hands-on experience with real chips and circuit boards, they often include enough basic theory of operation to give you some insight. If you make a little receiver, you'll probably have to learn how to align it. By doing that, you'll understand what an IF is and what it really does in a way no book or article alone could impart. The next time you see a radio not working right, you may think, "Hmmm, that reminds me a lot of how my kit was before I aligned the IF stages."

Once you've completed a couple of kits, give some

HAMS WITH CLASS

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Raising student expectations

Now that the school year is well underway, I try to stand back and assess the responses of the students to the ham radio program. As most teachers know, the techniques that worked in an inner city school five or 10 years ago do not have the same effectiveness today. Children are now coming into the classrooms with different backgrounds and a whole new set of needs that are reflective of today's problems in society.

There are times when I think my career as an intermediate school teacher includes as many skills in social work and psychology as it does in pedagogical techniques. As professional

educators and instructors we must keep abreast of the latest research and findings in the areas of student motivation and expectations. Keeping this in mind, I recently attended a seminar that addressed these very problems.

Because of the unique nature of what I teach (amateur radio as a tool to motivate in other curriculum areas), I need to keep my students motivated enough not only to do the work, but to keep them interested enough to want to get a ham radio license. A technique I've long recommended in this column is to have a variety of activities going on during the 40-minute period so that the children don't get a chance to become bored. I do 15 minutes of theory, 10 minutes of

code practice, and the rest of the time on the radio.

The popular question that got addressed at the seminar was, "Why is it that in a group of children with the same academic ability, some do well in school while others don't?" Marianne Miserandino, a researcher at Beaver College in Glenside, Pennsylvania, suggests that students who are more successful in school tend to believe in their ability to do well and they want to learn more. The children in the study who exhibited those traits reported feeling more curious and participated in, enjoyed, and persisted longer at school tasks, Miserandino says.

In contrast, she adds, "Those children who were uncertain of their ability and motivated by external reasons lost interest in school, didn't partake in as many activities, felt anxious and bored, and suffered a decline in their academic performance."

Why were some of the children's perceptions of their abilities at odds with their test scores? In part, Miserandino believes, it's because they formed



Photo A. The "Wow!" factor shows on the faces of motivated students who enjoy ham activities.

their self-impressions by comparing themselves with peers or teachers' impressions.

"Having ability or potential is not enough to enjoy success in school or in life," says the psychologist. "Talent and potential will be wasted unless children believe they possess ability and have the freedom to use it."

In the ham radio program with 6th, 7th, and 8th graders, I attempt to go in "Pursuit of the Wow!" If I can get at least a few

thought to making something from scratch. No, I'm not suggesting you become a circuit designer, although I certainly wouldn't discourage that, either. I'm just talking about building something from the schematic in a magazine article. 73 has plenty of them. Also check out some of the general electronics magazines. They often have plans for audio and video gadgets, as well as various other home toys. Now and then, you'll even see something you couldn't buy in the store if you wanted to. Remember, to be commercially available, a device has to be salable to hundreds of thousands of people, or more; nobody can stay in business making products only a few hundred or a few thousand people may want. That doesn't hold true of construction articles, though! Often, they present projects that very few people will actually build. As

long as many readers will read and enjoy the articles, and perhaps learn something from them, publishers will publish them.

I recommend that when you're just starting out, you avoid the harder stuff, such as tiny surface-mount gadgets, UHF and microwave, and very complex things like full-featured transceivers. After all, you'd get pretty frustrated trying to play Chopin études without learning your scales first, right? Give yourself a chance to get comfortable with construction techniques before you go for the big stuff. Besides, the thrill of seeing something you built actually work is about the same for the small stuff as it is for the bigger devices, at least at first.

Other ways

OK, so building things is a fun way to learn. What other things make radio interesting? Teaching, for one. Show someone else how it all works. Got

kids? Teach them to solder, too! And don't leave the daughters out of the room; electronics is gender-neutral. Of course, be awfully careful when kids and soldering irons get together; the potential for injury is real. I remember dripping molten solder on my leg when I was seven. It really hurt, and the scar took years to heal. Of course, I never soldered while wearing short pants again, but it didn't dissuade me from picking up the iron an hour later, either. Just be careful.

Other fun things to try: build a QRP kit, make a dipole, and take it camping. Most QRP kits are for CW, simply because CW rigs are easier to make. There are some for SSB, though, which means you could do RTTY with a laptop or palmtop computer, too. It may be dull to point the beam at a country and work a station or two from home, but I promise it won't feel

that way when you snag one using two watts from the woods! That simple "five by nine" report will feel pretty thrilling. Even if it comes from a neighboring state. And, it may very well come from halfway around the world!

Built or done something cool? Write about it! You don't have to be an established writer to get it published. If you can write clearly, and have something interesting to relate, it's likely to get printed.

Well, there are lots of other fun things to try, but you get the idea. Operating is fun, but it gets old. Explore some of the other facets of radio, learn something, and you'll find yourself enjoying the hobby more than you could ever imagine.

By the way, they don't call me "Kaboom" for nothing. I've had a few radios go "kaboom" in my time, and every one of them was worth it for what I learned! Until next time, 73 de KBIUM. 73

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On October 4, 1957, the Union of Soviet Socialist Republics launched an artificial satellite called *Sputnik 1* into low Earth orbit. It was basically a metal ball containing two transmitters and some batteries, adorned with sweptback antennas. As a scientific experiment and a propaganda tool, it was the coup of the century. Its effect on the global space community was permanent. The scientific objectives of the

mission were to learn how to place a satellite in orbit, to provide data on atmospheric density by calculating orbital lifetime, to test radio and optical tracking methods, to study radio propagation through the atmosphere, and to determine the best methods of internal satellite pressurization.

Soviet space

Like our American space program, the Soviets really got

"Wow!" reactions out of the kids, then I know I'm on the right track. Boring, irrelevant lessons will never rate a "Wow!" from children. The enthusiastic teacher who assures all students that they will love all that ham radio has to offer, and that it will be fun to learn all the radio "stuff" because it will make them smarter in their other classes at school, has a built-in high motivation to learn.

In my experience, many of the students I see come with preconceived notions that they won't be able to do the right thing on the air. I always stay behind them at the "shack" to offer support and encouragement. I tell them not to worry about running out of things to say, because I'm right there—and I never run out of things to say.

A good example of how high expectations and lots of encouragement really make a difference is what happened in my class last week. One of my 7th graders had been having a really hard time of it in school. He was being tested for all kinds of special programs in an attempt to get him into a more appropriate learning environment for his special learning needs. Chris did very well learning a few letters of Morse code. Of course, I

made a big fuss over this and let him work with a little code practice oscillator during his lunch time. In no time at all, he became more proficient at the code than most of his classmates.

Here is a boy who knows he's doing "something wrong" in every other classroom. When he comes to ham radio class he is one of the "stars." There is never a discipline problem in my room with him. Last week he was welcomed into the world of ham radio by hams in St. Maarten, Jamaica, and Puerto Rico on 20 meters. Chris had a smile on his face ear to ear. He felt even more special when I had him tell about his "contacts" to the rest of the class. I really believe that because both the class and I came to "expect" that Chris would always be good in ham radio class, he was good.

There are so many success stories for a teacher lucky enough to be using a ham radio in the classroom. Everyone starts out on equal footing, so students who have never succeeded at anything in school before have a chance for a new beginning. I always think of my dad's words to me when I began teaching many years ago, that "No child ever has to rise to a low expectation." 

moving with rocket technology shortly after World War II. We had our German scientists and V2 rockets, and they had theirs. But work on new rocket designs was driven by military goals.

The late 1940s were a period of nuclear weapon design and refinement. During the early 1950s, efforts were focused on methods of delivering these weapons to the perceived enemy. Intercontinental ballistic missiles were the desired medium. Research and test launches became common on both the eastern and western fronts.

Sergei Korolev was the team leader behind the R-7 ICBM in the Soviet Union. This launcher was capable of delivering thousand-pound nuclear warheads from Russia to the United States. It was first tested in 1956 and represented a mix of all the space and rocketry knowledge in the Soviet Union at that time.

In its ICBM configuration, the R-7 would become known as the SS-6 (or OTAN) Sapwood, but as a space capsule launcher the name was SL-1. It was simple, utilitarian, modular, and very reliable. Early launches were from a site near the town of Tyuratam, later to become known as the Baikonur Cosmodrome.

Sputnik 1

"Sputnik" is Russian for "traveler," and *Sputnik 1* (also known as PS-1) went into orbit on an SL-1 rocket. The satellite was a polished, pressurized (1.3 atmospheres of nitrogen) aluminum sphere, just two inches shy of two feet in diameter and weighing 183.4 pounds. Over 60 percent of the mass was batteries. The antenna system was four sweptback whips. Two were 7.8 feet long, and the other two were 9.4 feet each.

Sputnik 1 carried two small transmitters that sent CW "beeps" on 20.005 and 40.002 MHz. During the pause time on one transmitter, the other unit was on the air. The repetition of the beeps could be correlated with the onboard temperature. Signals were received for more than

three weeks until the batteries gave out.

While launch was on October 4, 1957, the satellite did not re-enter the atmosphere until January 3, 1958. The orbit of this first man-made space vehicle was low, but it was still high enough to orbit the Earth over 1,400 times before the effects of atmospheric drag took over. The apogee, or high point of the orbit, was 947 km and the perigee, or low point, was 228 km. The orbital period was 96.17 minutes per orbit. After the successful launch, rocket designer Sergei Korolev was quoted as saying, "It was small, that very first artificial satellite of our old planet, but its insistent signal resounded across the continents and among all their peoples like the realization of humanity's most daring dream."

Sputnik 40 Years

On February 20, 1997, the radio club FR5KJ of the Jules Reydellet College in St. Denis on Réunion Island and the Polytechnic Laboratory of Nalchik Kabardine Balkar Republic (Russian Federation) signed an agreement via video conference to commemorate the launch of *Sputnik 1* by building a scale model for launch from the space station *Mir*. L'Aeroclub of France and the Russian Astronomical Federation also participated.

Students at the two schools were tasked with the design and construction of the satellite. The Russian students would build the satellite body while the French students would take care of the electronics.

Work at both schools began in earnest. By July, the group in Russia had shipped the completed space frame to France for final integration. That same month AMSAT-France President Bernard Pidoux F6BVP brought the satellite to the AMSAT-UK Colloquium in England. Between scheduled talks, Bernard demonstrated operation of the satellite in one of the rooms adjacent to the lecture hall.



Photo A. Full-size model of Sputnik 1 that toured the US during the Soviet Space Exhibition in 1991.

The satellite is almost eight inches in diameter, has a shell of polished aluminum, weighs three kilograms, and has sweptback whip antennas.

The system design is very simple. A temperature sensor is attached to an audio oscillator that frequency modulates a 48.6 MHz oscillator. This drives a tripler to get the frequency up to 145.820 MHz in the two-meter band. A pulse oscillator turns the transmitter on and off in a fashion that emulates the beeping signal from the original *Sputnik 1*. An amplifier follows for an output power of 200 mW that is fed to a power divider with phase shifting to create a circularly-polarized signal using the four whip antennas.

Two electronic assemblies and one space frame were sent to the *Mir* space station on board a Progress resupply rocket. Although it was hoped that *Sputnik 40 Years* could be hand-launched from *Mir* on the 40th anniversary of the launch of *Sputnik 1*, delays occurred. The new "*Sputnik Junior*," as some called it, was released by Cosmonaut Pavel Vinogradov while Anatoly Sloyvov filmed the event from the Kavant 2 airlock on November 3rd. As it turns out, this was the 40th anniversary of the launch of *Sputnik 2*.

During construction and after launch, the satellite has acquired a few names such as *Spoutnik-40-Ans*, *Sputnik 40 Years*, PS-2,

RS-17, and *Sputnik, Jr.* Shortly after launch it was suggested that the satellite be given an OSCAR number. The best suggestion was Sputnik-OSCAR-31.

The resultant transmissions from the commemorative satellite could be heard on mobile radios, HTs, and scanners. Two days after the satellite was released from *Mir*, the Houston AMSAT group got some curious stares while standing in a parking lot in southwest Houston listening to beep sounds on little radios during lunch hour.

Stations interested in the satellite's temperature devised ways to measure the frequency of the beep tone. A tone frequency of 1208 Hz corresponded to 10° Celsius, while 1290 Hz represented 30° Celsius. Enthusiasts and educators found the simple temperature measurement exercise more interesting when results over several days were plotted together showing a gradual decrease in internal temperature. The internal batteries were chosen to provide one to two months of operation. The orbit should last for at least a year.

For those who heard the signals from the satellite, QSL cards and certificates are available. The official QSL manager in Europe is F1FY, but a special certificate is available for reception reports (with an IRC—International Reply Coupon) sent to the FR5KJ Radio Club,



Photo B. RS-17/Sputnik-40-Ans (Sputnik 40 Years) on display at the AMSAT-UK Colloquium in July 1997. (WØSL photo)

103 Rue de la Republique, 97489 Saint Denis Cedex, Réunion Island, France. All submissions for certificates should be sent in before the end of February.

More history

If you would like to find out more about early space history

and *Sputnik 1*, NASA has an excellent series of Web pages beginning at the URL (Universal Resource Locator) [<http://www.hq.nasa.gov/office/pao/History/sputnik/index.html>]. For additional data about *Sputnik 40 Years*, check out [<http://www.oceanes.fr/~fr5fc/angspoutnik.html>].

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Photo C. Bernard Pidoux, president of AMSAT-France, with the RS-17/Sputnik-40-Ans at the AMSAT-UK Colloquium. (WØSL photo)

Let Us Know!

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Send your stuff to Joyce Sawtelle in the Editorial Department, *73 Magazine*, 70 Route 202 N, Peterborough, NH 03458.

HAM TO HAM

Your Input Welcome Here

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Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. Part 1 of that series was printed last month; part 2 follows:

Lightning protection: what your mother never told you!—Part 2

In the first part of this series, we gave you some little-known lightning statistics; showed that while we can't control when or where lightning might strike, we can exercise some control over how much damage it will cause; stressed the importance of a single low-impedance ground system; and briefly outlined how such a system can be implemented in your own ham radio installation. Much more detail will be following in the coming months, so stay tuned!

Picking up where we left off and changing gears slightly for a moment, remember that the energy in a lightning bolt covers a broad range of spectrum, from DC on up through the UHF frequencies. We hear lightning strikes in our HF receivers and we see it on our UHF television sets ... it's RF. Whenever we're dealing with RF energy, simple resistance measurements are no longer adequate—system impedance must also be considered. System impedance certainly includes DC resistance, but it also takes into account inductive and capacitive reactances. The higher in frequency we go, the more the system impedance will be determined by these inductive and capacitive reactances. With this in mind, let's continue.

Three techniques to improve conductivity

Every conductor has measurable inductance. Similarly, ground conductors (radials) exhibit normal inductance before they go below grade. Once in conductive ground, most of the inductance of bare conductors and ground rods is also shunted by the Earth's conductivity.

If the soil at the grounding location is not very conductive, several techniques will improve the situation. First, increase the surface area of the conductor to decrease its normal inductance. Second, replace the soil with coke breeze, bentonite clay, or other doped soil to increase its conductivity and help shunt the inductance of the in-ground bare conductors. Third, install additional bare radial runs, with attached ground rods, to effectively parallel the inductance, thereby reducing the overall system inductance. Adding a drip system to keep the soil moist can be effective. In some locations it may be necessary to utilize all of these techniques for the best results.

Conductor surface area

The most effective material for a ground system conductor is bare copper strap. Because lightning has a large portion of its energy in the UHF range, it will behave like an RF signal. Energy (the surge current) will primarily be conducted on the surface of a conductor (the RF "skin effect"). RF currents within a round conductor will not make use of the round conductor's large cross-sectional area because of this "skin effect." The so-called "skin effect" forces RF signals mainly toward the surface of a conductor. With a

1.5 inch (or larger) flat strap (of at least 26 gauge or 0.0159 inches), both of the large flat outside surfaces will be responsible for conducting the surge. So large, flat, bare copper strap is the best choice for your ground radial system.

Soil doping

Water, in its purest form, is an insulator. Ionic salts, mixed with water in the soil, create ionic soil. The Earth is a conductor due to the number of ionic salts naturally present in the soil. So conductivity can be improved by adding more ions to the soil.

Soil doping is accomplished by either adding water or a saline solution to the soil around the grounding system. If the soil already has a sufficient amount of naturally occurring salts, adding water will free the ions in those salts, improving conductivity. The more ions (salts) available, the less water needed to reach a given level of conductivity.

If few natural ions are present, additional salts such as Epsom ($MgSO_4$) or rock salt ($NaCl$) can be added to the soil to increase its conductivity. Depending on the amount of rainfall, doping the ground system radials with four pounds of salt per 10 linear feet, and 10 pounds per ground rod, can substantially improve the ground's natural conductivity. The length of time that this doping treatment will last will depend upon the rainfall in your area and the percolation factor of your local soil. Note: Adding salt will damage lawns, trees, grasses and other plantings. The addition of salts will also decrease the life of the metals used in the grounding system by corroding them. In addition, you may face pollution charges.

Ground radials

Radials are the most cost-effective grounding technique when considering system impedance, material cost, and labor for installation. If one radial gives "X" resistance, then two

will deliver an equivalent "parallel rule" plus about 10 percent. The "parallel rule" is the same familiar formula used for calculating resistors in parallel. The rule only applies, however, when the soil has the same conductivity over the entire radial area. Also note that after the first two radials, we must double the total number of radials each time to achieve the parallel-plus rule.

Radials have an effective length limit. If the surge energy has not been launched into the soil within the first 75 feet, the inductance of the radial will prevent any further effective propagation of the lightning strike. As a general rule of thumb, all radials should be at least 50 feet long, but no longer than 75 feet.

Ground rods should be placed along the entire length of each radial. The most cost-effective spacing between rods for normal (grassy) soil is two times the length of a rod into the ground. For example, if eight-foot rods are used, they should be placed on 16-foot centers (8 x 2). If the soil is not a good conductor (e.g., very dry or sandy), additional ground rods should be used with closer spacing to reduce the natural inductive impedance.

Ground measurement

Since most soils are stratified, the best way to determine the effectiveness of a ground system is to measure it ... at various depths. The simplest way to determine the sub-layer conductivity is to measure the first ground rod, one foot at a time, compared to a reference ground rod, using an earth resistance meter, as the new rod is hammered into place. This technique can provide a profile of the lower layers relative to the first foot. Most earth resistance meters measure only DC or low frequency AC resistance of the ground system. Since the fast rise time of lightning strike energy is predominately RF energy, the inductance of the ground system is important. Without using expensive specialized test methods, the

only way to ensure a low-impedance ground system is to follow the suggestions previously presented for conductors, doping, and radials.

That's all from Roger and Ron Block for this month. Be sure to check back next month for more of their advice on keeping your ham station reasonably safe from the devastating effects of a lightning strike ... their series will continue in this column throughout the rest of 1998. You can also read the entire text immediately, by calling up the special bulletin "Protection to Keep You Communicating," at PolyPhaser's home page on the World Wide Web at: [http://www.polyphaser.com/].

And now, a few updates to some past Ham To Ham columns ...

The mysterious capacitor ... update

From Wray Lemke KI4XS: a note regarding the piece in the August 1997 "Ham To Ham" column by Ken Guge K9KPM, and his experiences with and warning about the dangers of humid air being trapped inside the connecting block of an antenna. Ken's conclusions were right on the money! "I read the piece from Ken K9KPM and thought I'd offer our experiences in the marine electronics field. Here's what we've found: Take an object with a volume of air inside, such as a ship's radar dome or some air dielectric coax. Now heat it up in the July sun, then rain on it and cool it off rapidly. The air inside the object will decrease in volume creating a considerable vacuum which can suck in an amazing amount of water ... right past gaskets and other forms of weather sealant schemes. The solution (as Ken suggested) is to either make the open interior space truly airtight, or to leave a vent hole so that the air pressure can equalize during rapid temperature changes."

Moderator's note: K9KPM originally suggested filling the

void in a connector or connecting block with an RF inert material, to keep humid air out by simply not providing any room for it! Still a wonderfully simple solution.

More power to you ... update

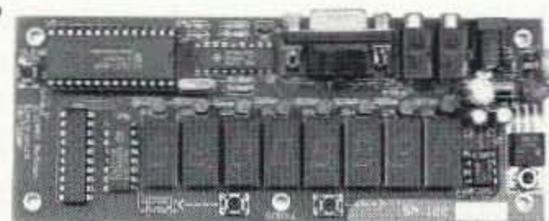
From Ariel Elam K4AAL: "In the October 1997 'Ham To Ham' column, Stephen Reynolds NØPOU offered a tip on using an abandoned electric range 240-volt breaker as a potential source for a dedicated power feed into the ham shack: '... when our electric stove finally gave up ... we decided to replace it with a gas unit instead. I now had a 240 volt, 40 amp circuit on my current fuse panel that was available for other usage, namely my ham station! I ran #8 gauge wires to a new sub-panel in my shack, being careful to follow all of the electrical codes for my area, and I now have plenty of power conveniently available for just about anything imaginable, of either a 240 volt or 120 volt nature' (quoted from Stephen's original tip).

"Stephen's idea is a good one, but if the rated capacity of your main breaker panel isn't now at full capacity (ampere-wise), you may not have to wait until a major appliance is replaced to provide a separate feed to your ham shack. Lots of folks don't realize that most service panel manufacturers now make 'tandem' or 'twin,' half-size circuit breakers these days. The half-size breakers are two individual circuit breakers built into one standard-size breaker case. As a result, two tandem circuit breakers may be used to replace two full-size breakers, freeing up two spaces for a two-pole breaker that can then be used to feed a 240-volt ham shack sub-panel. Again, as Stephen suggested, make sure that your service panel is rated for the extra current that may be needed (particularly if you're adding a husky linear amp), and be familiar with and always follow your own local electrical codes to the

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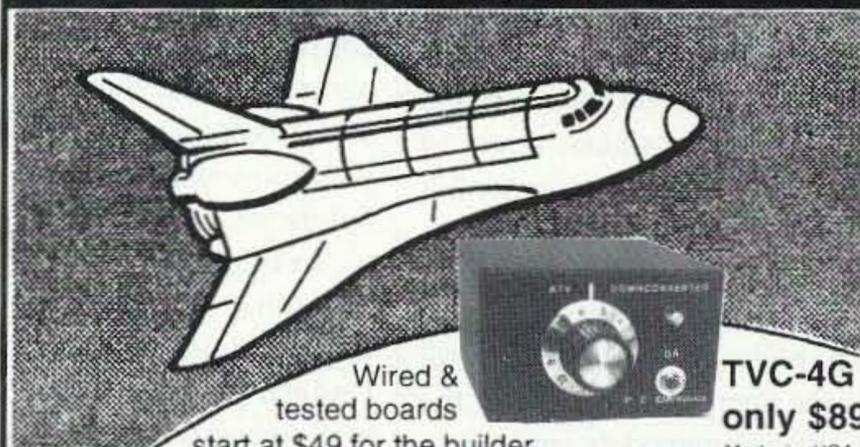
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letter. Seek out the help of a licensed electrician if you don't know the electrical codes, don't have the experience needed to work with high-current AC, or don't have the means to do-it-yourself."

Moderator's note: Thanks for the information, Ariel. I wasn't aware of the half-size breakers myself. Even if you need to hire a licensed electrician to do the job, just knowing that the whole service box may not need replacing makes the task of a separate service feed for the shack seem a less daunting project.

Recycled tubing ... update

From Jon Seaver N8SUA: This timely warning: "With reference to Bob Boehm NBEXF's contributions presented in the May 1997 'Ham To Ham' column, as a practicing paramedic and ER nurse, I'd like to share a few concerns. While there may be some practical ham radio uses for discarded medical tubing, etc., there also is some potential for danger in recycling what is essentially medical waste. This is, after all, the 'Age of Universal Precautions.'

"'Universal Precautions,' for those of you who are not in the sick-people business, refers to the procedures taken by health care workers to protect themselves from acquiring blood-borne disease-causing agents. The highest profile among these is the agent causing AIDS, the Human Immunodeficiency Virus or HIV. We should always act as if any fluid originating from the human body is teeming with your

least-favorite germ or virus. Never allow contact between your skin and any potentially infectious material. If you don't think that you have any cuts or scrapes on your hands by which germs can enter, simply immerse them in alcohol for a few seconds. That stinging pain identifies all the little portals of entry which could be utilized by whatever germ you might encounter.

"So before you undertake to recycle medical waste, consider that you might be exposing yourself and, worse yet, your family, to a variety of undesirable organisms. Among the agents you may not want to invite into your home is a species of Staph Aureus (which is resistant to every antibiotic currently available). Another is known to physicians and nurses as "VRE," for Vancomycin Resistant Enterococcus, which is also immune to nearly everything we have to throw at it. Is the utility of that piece of tubing worth the risk?

"On the other hand, perhaps you may have access to supplies that are being discarded, simply because they're outdated and not considered fit for use on human patients. These should pose no undue risk, but make sure that you know what you're getting before you grab!

"Examples of potentially useful items are *unused* plastic bags containing IV solutions. Drained of their contents, they might be used for fashioning a rain-guard for your handheld transceiver. I've cut off the end that contains the port for inserting the tubing, and then carefully made a small slit for the BNC connector of an HT to poke through. Another potentially useful item is the foil overwrap sometimes found on bags of pre-mixed IV solutions, or used to package "splint rolls" of plaster or Fiberglas™ casting material. These might provide some protection against the dreaded Electro-Magnetic Pulse or could also find use as an antenna attenuator for near-field foxhunting.

"But please, don't recycle anything if you have any doubts whatsoever about its exposure to disease-causing organisms—it just isn't worth the risk."

Moderator's note: Jon brings up a very valid point with regard to attempting to reuse discarded medical supplies that come from unknown sources, and of unknown infectious state. In the May 1997 column, however, both Bob Boehm and I were referring to medical tubing that came from our own hospital experiences, and therefore of intimately familiar origin. I would hope that no one would ever attempt to scrounge such tubing from any other source, so it's worth noting the dangers Jon mentions.

Hex on them!

From time to time, original equipment manufacturers seem to put extra effort into thwarting the do-it-yourself product servicer from gaining entry into his own equipment ... for whatever reason. The oddball assembly screw is one of their favorite means! I recently ran into one such effort used by a manufacturer of computer power supplies. They used assembly screws that appeared to be of the Torx™ variety (six-pointed star), yet an ordinary Torx driver wouldn't fit them. Upon careful examination (dragging out my trusty magnifying glass!), the reason became clear ... the star-shaped recess of the screws also contained a small male center pin! See Fig. 1. Apparently the Torx driver that the manufacturer uses to assemble the unit has a hollow shank, whereas most consumer Torx drivers have solid shanks ... so of course they won't fit.

Not about be outsmarted, I found that I was able to insert a small, straight-bladed screwdriver into the Torx recess, immediately next to the center pin (see Fig. 2), and snap off the pin with a quick, calculated blow from a small hammer. A bit more primitive than I prefer to be when trying to open up a

piece of equipment, but it worked. I was then able to remove the screws with my standard Torx bits. Just an idea to keep in mind if you happen to run into the same situation. By the way, there was also no way to "grab" the sides of the truss-head-shaped screw with locking-grip pliers, another technique that sometimes works for oddball screws. A "hex" on manufacturers who get cute with their hardware!—de NZ9E.

Murphy's Corollary: A lost piece is always found in the last place you'd think of looking ... so next time, it might pay to look there first!

Many thanks, as always, to this month's contributors:

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If you're missing any past columns, you can probably find them at 73's "Ham To Ham" column home page (with special

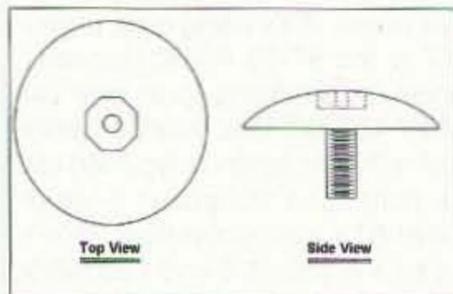


Fig. 1. One version of an assembly screw used by some equipment manufacturers apparently to thwart the efforts of equipment owners to do their own servicing.

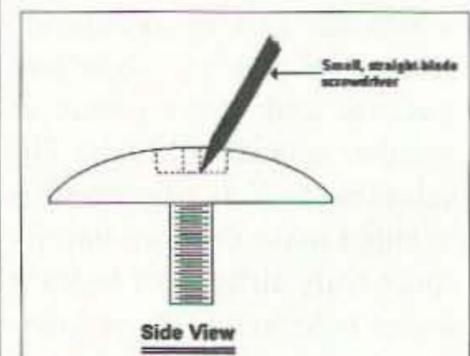


Fig. 2. NZ9E's answer was to chisel off the offending center pin with a small screwdriver.

Low Power Operation

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Last month, we began by repairing a broken VFO capacitor in the Heathkit HW-8 transceiver. Since the HW-8 is a direct conversion rig, the operation of the VFO is paramount! But don't get me wrong: A dead VFO makes for a dead superhet transceiver just as well.

Because most of the gain in the receiver is done at audio levels, a fingertip is by far the best signal injector made for a direct conversion receiver! I'll have some receiver repair tips next month, but for now, we'll look at fixing an HW-8 with a dead transmit band or two.

Dead band on a working radio

For right now, I'll assume you have an HW-8 with a working VFO. Use your frequency counter to verify that the VFO is in fact working and on the correct frequency. The VFO inside your HW-8 should operate between 8.645 MHz and 8.895 MHz. Lightly couple an accurate frequency counter to the emitter of Q3, the emitter follower for the VFO. As in last month's column, don't get upset if the VFO

is not 100 percent right on frequency. Just be sure it's running and between 8.645 MHz and 8.895 MHz.

One very common problem with the HW-8 is having one or more bands that are kaput! It's not at all uncommon to find 80, 40, and 15 meters working correctly, but the 20-meter band dead. Sometimes the rig will transmit on 20 and not receive or perhaps the other way around. There are two avenues to take. We'll look at the dead transmit side of 20 meters first. Remember, although I'll use the 20-meter band as an example, the troubleshooting guide and fix apply to any of the HW-8 frequency bands.

No receive

Perhaps the best place to start is the receiver. In the HW-8, each band has its own frequency-dependent components. When the operator selects a particular band, by pushing in the corresponding button, 12 volts is routed to a switching diode. In this way, only one transistor in the RF amplifier is required to cover all the frequencies covered by

the HW-8. This not only reduces circuit complexity, but lowers assembly costs as well. Can you just imagine what a mess it would be inside an HW-8 if there were a multi-layered rotary switch instead of the push-buttons?

By applying 12 volts to a selected diode, the diode conducts, and in effect turns the tuned circuits "on." This is known as diode switching. The Heathkit Company was really into diode switching, as most of their ham gear used some form of it. I'll bet money Heathkit bought 1N914 diodes by the trainload!

In the HW-8, with the 80-meter band button in, diodes D1 and D5 are turned on. Diode D1 conducts and places C1, C3, and the preselector C301A in circuit. This combination feeds the gate of the receiver front-end amplifier, Q1. At the same time, diode D5 conducts and places

inductor L5, C15, and C16 in the drain lead of Q2. By using only two diodes, we have selected over a half dozen tuned circuits.

Since each band has its own tuned circuits, finding the cause of a particular dead band is not that difficult. If you have one dead band, but the other works, bet the farm it's a switching diode. I've had a case or two of a diode becoming leaky. This causes an overall reduction of sensitivity to the rig.

It's somewhat rare, but be sure the switching diodes are being fed the proper voltage from the band switches. I've found in two cases that the +12 volt feed wire had broken off on the switch terminal. Usually, this is caused by flexing the wiring harness or from a nicked wire during assembly. The diodes must see +12 volts to be biased on.

Instead of checking the diodes, I've found it best to replace the suspect ones. Remember that

thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rsta.com/hth].

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 nor 73 for any equipment damage or malfunction resulting from information supplied in this column.

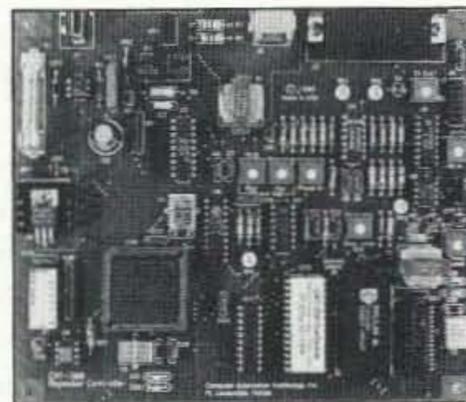
Please send any ideas you have to NZ9E at the address at the beginning of the column. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions on any particular tip to the originator of the idea, not to NZ9E nor to 73 Magazine. Thank you ...

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HOMING IN

Radio Direction Finding

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homingin/]

"Radiogoniometrie Sportive" in Montreal

I love visiting new places. Sure, I can have instantaneous communications with people in the far corners of the world via ham radio, when band conditions permit. But to me, there's nothing like viewing firsthand a mountain sunset, an immense cathedral, or a rare bird species.

Ham radio adds to the enjoyment of any vacation, whether or not you take any radio gear with you. Traveling with hams and meeting them in places you visit means instant friends and added adventures. With hidden transmitter hunting (T-hunting) becoming more popular in cities and towns all over the world, it's not too difficult for me to find fellow radio direction finding (RDF) enthusiasts wherever I go.

Canadian capers

Despite having months of freezing weather every year, hams in Montreal, Quebec, have done mobile T-hunting for quite a while. Long-time "Homing In" readers may remember the story of a snowy Montreal T-hunt in the January 1994 installment. I wrote at the time that I wanted to go T-hunting there on my next visit.

In July 1997, I received an E-mail from Jacques Brodeur VE2EMM, telling about Montreal's mobile T-hunting, or "radiogoniometrie sportive" as they call it (Photo A). He was also excited about his club's RDF equipment projects based on 8-bit PICmicro™ microcontrollers by Microchip Technology, Incorporated, commonly called PICs. Realizing that April WA6OPS

and I would have a free Saturday in Montreal in October, I replied to Jacques and asked if there would be a T-hunt on that day. He promptly replied that they would schedule one just for the occasion!

To say that the T-hunters of Montreal rolled out the red carpet for us would be quite an understatement.

For twelve hours, we were chauffeured, fed, and entertained by some of the most hospitable hams we have ever met. Of course, the highlight for me was the T-hunt, a regular activity of Union Metropolitaine des Sans-Filistes, the largest French-speaking amateur radio club in the world.

The day was quite cool, but fortunately there was no snow. (It waited until the day after we left.) Nine teams gathered at Pointe Aux Trembles for the 2 p.m. start. Claude Houde VA2HDD explained the rules: 20 mile radius boundary, first team to find the transmitter wins, take a numbered tag when you find it.

Other than nearby Mount Royal, the hunt area is relatively flat. There are very few hills, tall buildings, or other good reflectors of VHF signals. Doppler RDF

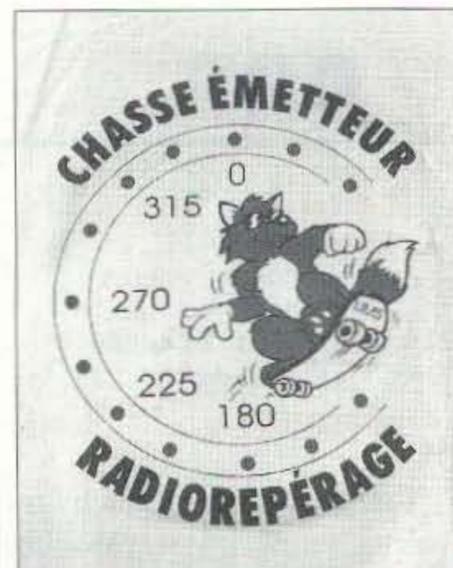


Photo A. Montreal RDF enthusiasts proudly wear T-shirts with this logo. UMS stands for Union Metropolitaine des Sans-Filistes.

sets perform best in this type of terrain, so such gear is quite popular with the Montreal hunters (Photos B and C). All but one team's vehicle had one on board. Most of them were home-built.

One drawback of two-meter Doppler installations is that they have less sensitivity than amplitude-based setups that use the receiver's S-meter, an RF attenuator, and a beam or quad directional antenna (Photo D). Sure enough, the hider's signal was very weak at the starting

you should replace both diodes in the suspect band. The diodes used for the receiver are D1, D2, D3, D4, D5, D6, D7, and D8. The mixer amplifier uses diodes D16, D17, D18, and D19. If one of these diodes is out, both receive and transmit for a particular band will be affected. The mixer amplifier, Q4, must have the proper tuned circuit active before the HW-8 will operate.

While we've been focused on the receive end, the same applies to the transmit side of the HW-8. Diode switching is used to turn on the various tuned circuits for the transmitter as well. Diodes D31 through D37 select the proper tuned circuits for the transmit driver, Q8.

The heterodyne oscillator, Q6, requires that the proper crystal be inserted into its circuit. Diodes

D22 through D29 accomplish this feat.

The heterodyne oscillator requires some more attention. Here, the diodes switch various crystals into Q6's circuit. With the HW-8 now around 20 years old, there's a good chance that one or more crystals is either not working or way off frequency. Here again, one or more bands may appear dead.

To check the heterodyne oscillator for proper operation, very lightly couple a frequency counter to the base of Q7. With the 80-meter band button pressed in, the counter should read 12.395 MHz. Check each band for proper operation by selecting the band (push in the corresponding button) and noting the frequency on the counter. Here's what you're looking for: 80

meters—12.395 MHz; 40 meters—15.895 MHz; 20 meters—22.895 MHz; 15 meters—29.895 MHz.

So, here's what you should look at if you have a working HW-8 with a dead band.

If the receiver is dead on a single band, check for proper +12 volts from the push-buttons to the switching diodes. Check for proper operation of the mixer amplifier, Q4 and Q5. Replace diodes on suspect band.

If both the receiver and transmitter are dead, do the above and also check heterodyne oscillator Q6 and Q7. Check for proper frequency of the heterodyne crystals.

It's rare, but a broken wire on switch sections "F" and "D" will cause a "dead transmit" problem. These sections switch the tuned circuits in and out of the collector of the final RF power

transistor, Q9. There are no diode switches used here. Pay particular attention to the center conductor of the sub-mini coax going to the push-button switches. A wire nick during assembly 20 years ago may cause the wire to break today.

Wire breaks on the center conductor of the coax going to and from the "RF GAIN" control will give you a dead receiver, but a working transmitter. Also check to see if the coax center conductor has broken off as it enters the circuit board beside the T/R relay.

That's about all this month. Next time, we'll look at some of the receiver problems that plague the HW-8. We will also look at some of the all-time favorite modifications to the HW-8 QRP transceiver. 73



Photo B. Louis Tremblay VA2JX and daughter Viviane won the hunt using this mobile 32-LED Doppler setup. He also uses a GPS unit.

point, so all the hunters hauled out the beams and quads they keep on hand for such situations (**Photo E**).

Because mileage traveled is not considered when determining the order of finish in this club's T-hunts, something special is needed to keep them from becoming road races. The one-to-two-mile-wide St. Lawrence River serves this purpose well.

Running south to north through the boundaries not far from the starting point, it presents a partial barrier with only a limited number of places to cross. The river and the islands in it can affect signal propagation, too.

Jacques and I were a two-person team on this Saturday, his first T-hunt in his new van. I played navigator, the word "played" being important because I was

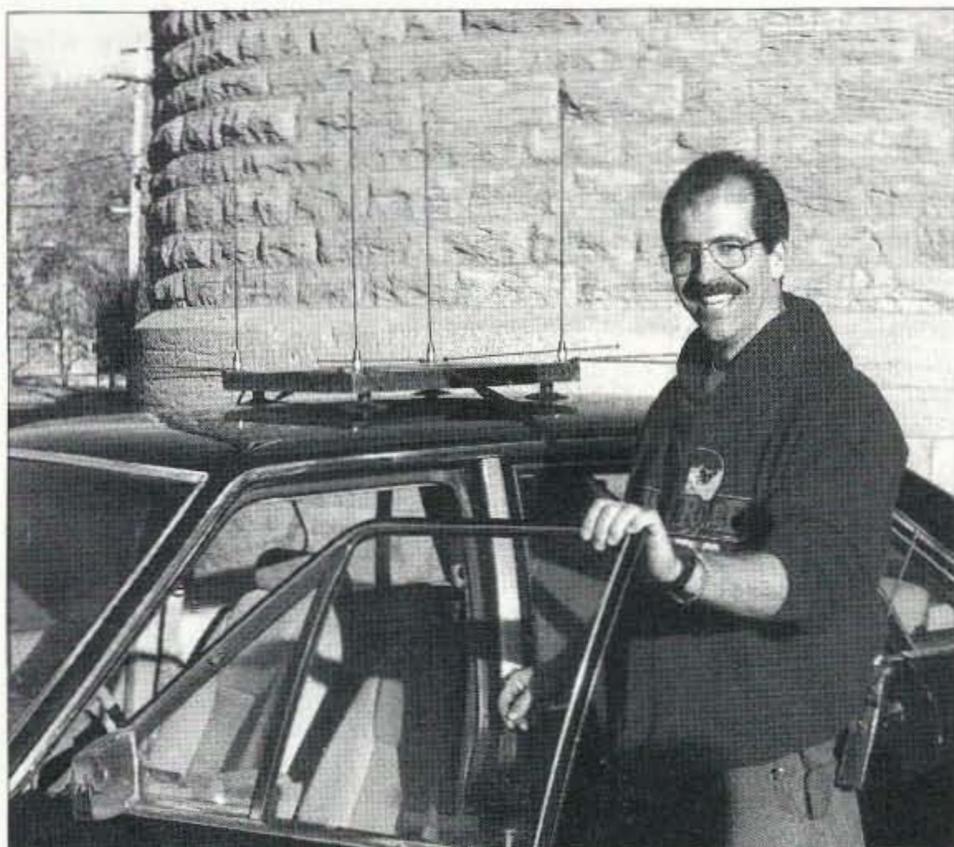


Photo C. VA2JX and his rooftop-mounted Doppler antenna set.



Photo D. This team has an elaborate rooftop mount for the two-meter mobile RDF quad, with a surplus radio-compass inside to indicate direction.

completely unfamiliar with the territory and thus totally unqualified for the job. The starting bearing was generally to the southeast and the weak signal led us to believe that the fox would be found near the hunt boundary. After drawing the bearing line on the map, we decided to take the main road south for seven miles to the first bridge in that direction where we could go east across the river. This would be the fastest way to get to a fox near the boundary along our line of bearing.

Where's the signal?

Jacques' Doppler displayed weak signal bearings as we left the starting point. After about a mile, the signal faded out. We continued to follow our game plan, but the signal was still not copyable after we crossed the river. Unless the hider was using a very sharp beam pointed at Pointe Aux Trembles, we should be getting a much stronger signal here. Perhaps the fox was much closer to the starting point.

We decided to go north again via a road on the east side of the river. Sure enough, the signal came up as we began to approach the original bearing line.

Doppler indications were erratic, so on two occasions we stopped, got out and used the quad to try to get a more precise bearing. As we arrived at the bearing line on our map, it appeared that the signal source might be in the river, on one of

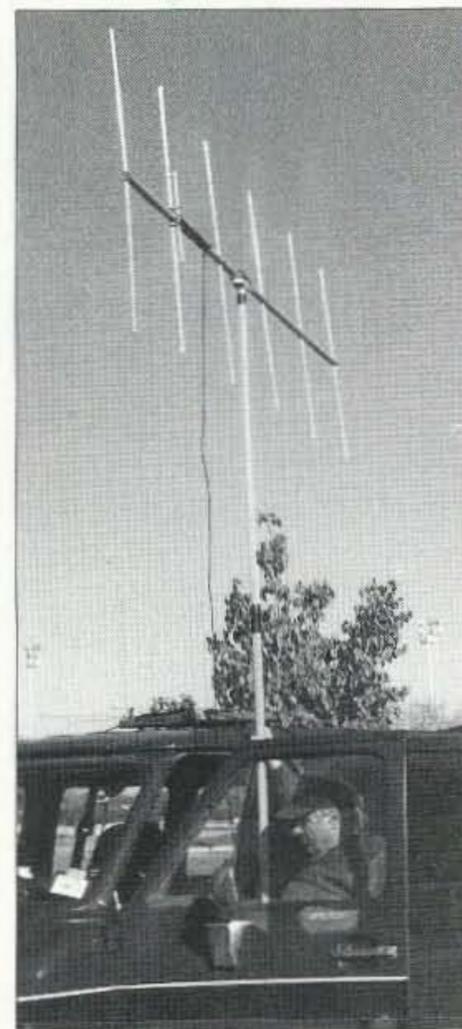


Photo E. Ron Racine VE2ESX needed this yagi antenna to get a bearing at the start point.

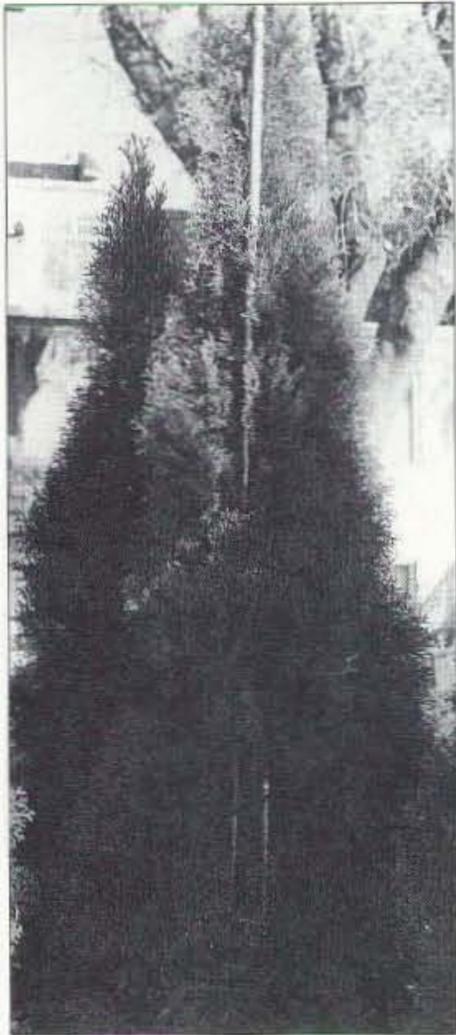


Photo F. The hidden T's copper pipe J-antenna was nearly concealed in a tree.

the islands, or perhaps back on the starting side.

Oh, no! Had the hider pulled a fast one on us? I told Jacques

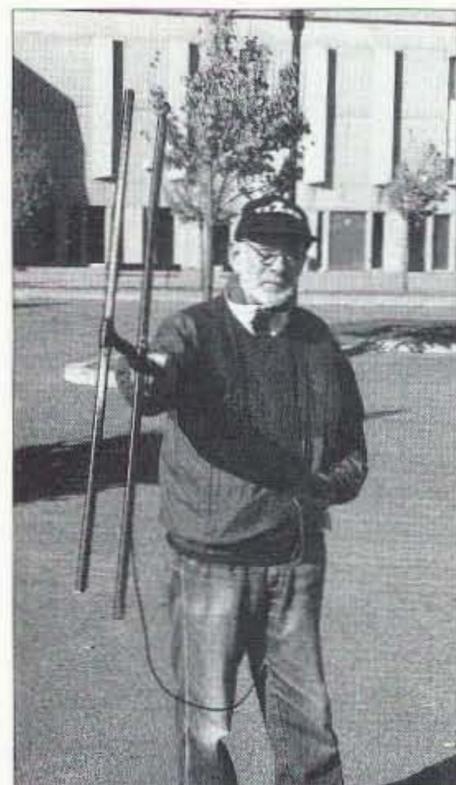


Photo G. When Rene Camirand VE2ND gets out to hunt on foot, he uses a ZL Special antenna made from twinlead mounted on a PVC pipe frame. Plans for this antenna are in the book *Transmitter Hunting—Radio Direction Finding Simplified*, available from 73's Radio Bookshop.

of several occasions when southern Californians had put micropower Ts only a few hundred yards from the starting point, placed so that the hunters did not pass by as they departed the hilltop. When the signal disappeared, most of them just thought this was the normal result of lower elevation. They traveled for dozens of miles before realizing they had been snookered. Could this be happening to us?

Jacques and I kept going, trying to get enough additional bearings from different locations for triangulation to determine which side of the river VA2HDD's T was on. He assured me that the fox could not possibly be on one of the islands, because it would take a boat to get there. As we came to the little town of Varennes, the signal suddenly rose from the noise. Perhaps we were finally closing in.

We soon ended up in a church parking lot across the street from a shoreline green belt with "you are here" signal levels. This was only about two air miles across the river from the starting point. Jacques handed me a two-element beam made from the snap-out elements of a TV antenna. An offset attenuator (plans in the *ARRL Handbook*) was in a box fastened to the boom. I hooked it to my handie-talkie, Jacques grabbed a similar beam for himself, and off we went on foot.

The rest was easy. Despite being well concealed inside a small evergreen tree (**Photo F**), the transmitting J antenna was not hard to track down. No doubt the very low power fox signal was weakened further by the antenna's contact with the tree. Our strange bearings on the eastern shore were probably caused by the "river effect." T-hunters in many places have noticed this phenomenon, whereby a river or canyon acts as a waveguide to funnel nearby radio signals. False bearings from up and down river are common under these conditions.

We finished in fourth place. "Not outstanding, but honorable," says Jacques. Besides, the

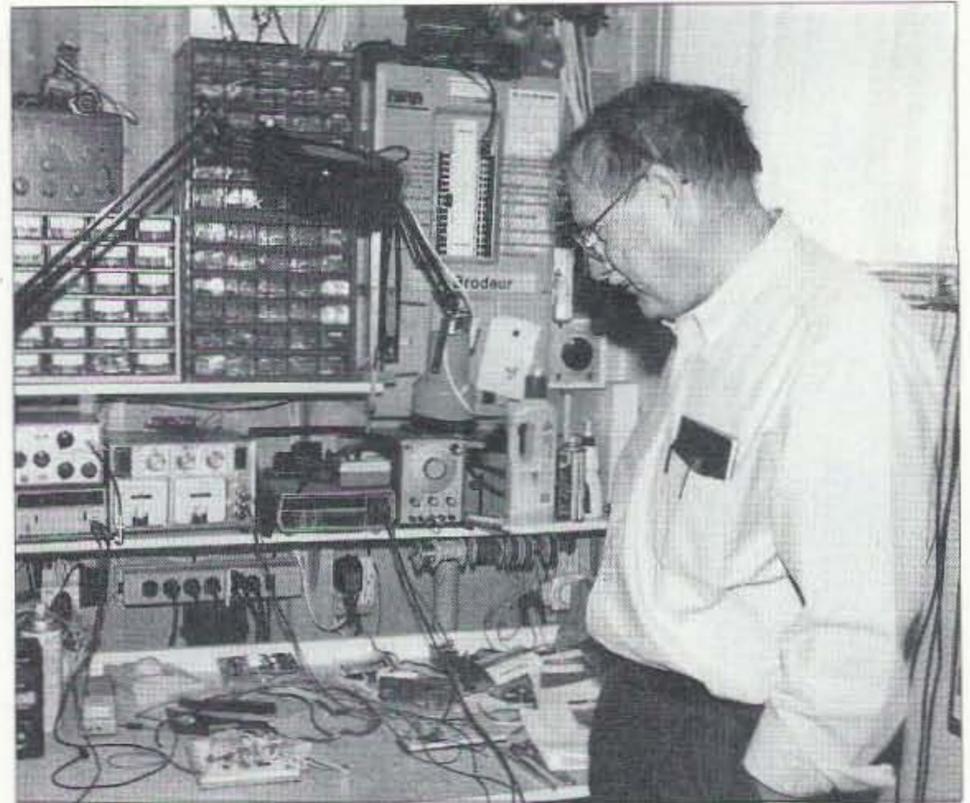


Photo H. Jacques Brodeur VE2EMM looks over a new PIC project on his workbench.

end of the T-hunt was just the beginning of our fun. Rapid-fire conversations in the parking lot continued as we compared notes on Doppler and ZL Special antennas (**Photo G**). There was also plenty of discussion about rules and techniques for T-hunts. Before long, every team had arrived.

As the sun set, thirty members of Union Metropolitaine des Sans-Filistes headed for a local tavern for good food and more talk. François Tremblay VE2JX had prepared certificates for all the hunt participants and wanted me to pass them out. I'm sure they enjoyed my valiant attempts to pronounce all the French names. April knows a little French, but fortunately, it wasn't needed. Almost everyone spoke fluent English and they even seemed to understand me when I forgot to slow down as I spoke.

PIC projects

Many RDF enthusiasts are home builders, but the ones in Montreal seem far above average. Apparently the long Quebec winters are conducive to basement experimenting. Last winter, Jacques taught a 10-session workshop on microcontroller hardware and firmware for 10 members of the club (**Photo H**).

Then they all went forth to dream up ham radio uses for PICs.

François Tremblay VE2JX (twin brother of hunt winner VA2JX) is a firefighter who works long shifts. Fortunately, he hasn't had too many fires to fight, so he had time to design a multifunction fox controller with potential uses in both mobile T-hunts and international-style radio-orienting.

Jacques decided to experiment with PICs as a way to simplify the construction of Doppler RDF sets and to add functions. His first attempts at signal processing didn't work well, but he kept trying and now has a functional unit that worked just fine when I hunted with him. I hope to feature Montreal's PIC projects in future "Homing In" columns. Watch for them.

The Montreal experimenters have a Web site, of course. You can link to it, as well as to local RDF-related Web sites and "Homing In" correspondents in more than 73 other locations around the world by browsing the "Homing In" site. The URL is at the beginning of this article.

If T-hunting in the February snow isn't for you, head to Orlando for the 1998 Hamcation convention. Tim Starr AE4NJ invites "Homing In" readers to the Hamcation mobile T-hunt on

THE DIGITAL PORT

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

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You may wonder if any of the kits for sale or projects you read about are worth the hassle to put together or whether it is simply better just to purchase a ready-made unit and plug it in. After all, I did it. I have to admit I learned a lot from some new experiences with that little modem I have written about during the last few months. Things never quite worked like the book said, but they *worked* and afforded a form of success.

A death in the shack

After a long period of bug chasing, my little multimode modem bit the dust. The manufacturer said he would check it over and repair it if necessary. It would only cost \$40, about half of what I spent in the first place. The problem with the modem is obvious. There is a bubble on one of the transistors.

I am not up to speed in replacing surface-mount components and the idea of parting with repair bucks made the top of my wallet suck shut. I told the service tech on the telephone that there were alternatives. For instance, there was a schematic included with the documentation for one of the programs furnished with the little rascal.

St. Valentine's Day, starting at 5 p.m. He says there will be at least one transmitter to find in a public place away from the convention grounds, and he promises a "big prize." For more information on this event, send an E-mail directly to Tim [ae4nj@aol.com].

He said to go right ahead and try assembling one of the units from information available, that was my choice. I hung up the phone with a smile like a cat whose mouse had just run into a puddle of honey. Life just isn't complete unless I can prove something, even if it is only to myself.

Something new (and cheap)

I recalled seeing an enticing Web site with a schematic and a parts list. I bookmarked it in my Netscape. It is "K7SZL's Unofficial HamComm Home Page" [www.accessone.com/~mayhan/]. I revisited it with increased interest. I printed the schematic plus the parts list, whizzed on down to the local Radio Shack™ store, and purchased enough parts to lay out the board without connectors. I wanted to scope out the cable needs first. Anyway, I had spent a total of \$8.75 and this included some duplicates in the packaging. Not bad so far.

I spent about an hour laying out parts on a little all-purpose board and started assembly. I am not a bona fide production-caliber radio tech and it went a little slow, but it went. Before the end, I managed to work myself into a corner a few times. The main thing that would improve the layout would be to make two more of these.

The good part about this is you are working with all audio circuitry. Length of leads is not critical and neither is positioning of components. My eyesight is getting such that I must use a magnifying glass to check the solder joints, but by exercising due care, all went well.

When it got down to choosing cable connectors, the recom-

mended female 25-pin connector matched the cables I have to the computers. The cables I had made recently to the radios all had telephone RJ12 connectors on them. Another trip to Radio Shack for one each of these connectors. Another \$6.

You can see in **Photo A** that the leads are a little long, as I was leaving room for revisions—especially at enclosure time. The little circuit board measures a little under two inches by three inches.

The test

It was now time to plug it in and watch it play. The connection to the desktop computer didn't have many choices—simply use the cable that fit. The other end to the radio did offer choices. The easiest option was to use the cable that was made up to fit the mike connector on the front of the ICOM 735.

It receives

I tuned around 14,285 and heard several RTTY signals. With the HamComm 3.1 software up and running, I tuned to the strongest signal and, hard to believe, there were intelligible words flowing across the monitor screen!

Will it transmit?

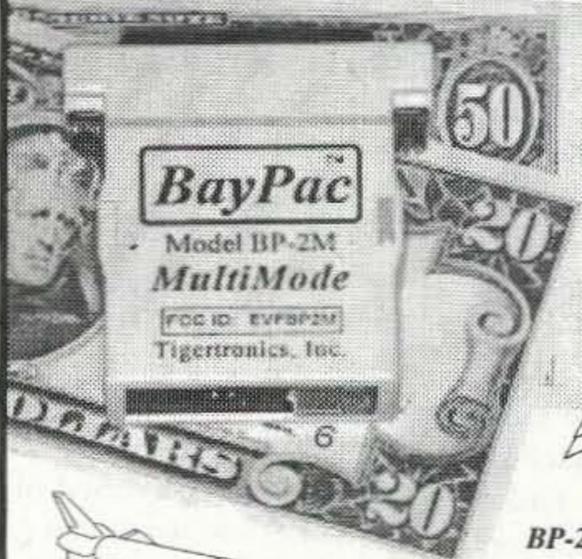
Now came the acid test. Suddenly, I couldn't recall the key combination to change over to transmit. A little awkward, but I pulled down one of the menus and found that all that was necessary to make the change either way was to pull down that menu and hit Enter. Okay, now what? I found that if I typed, then hit Enter, it would key the transmitter and send what was typed.

Fabulous—the old commercial modem had never cooperated like that. I waited until Fritz W7EPY

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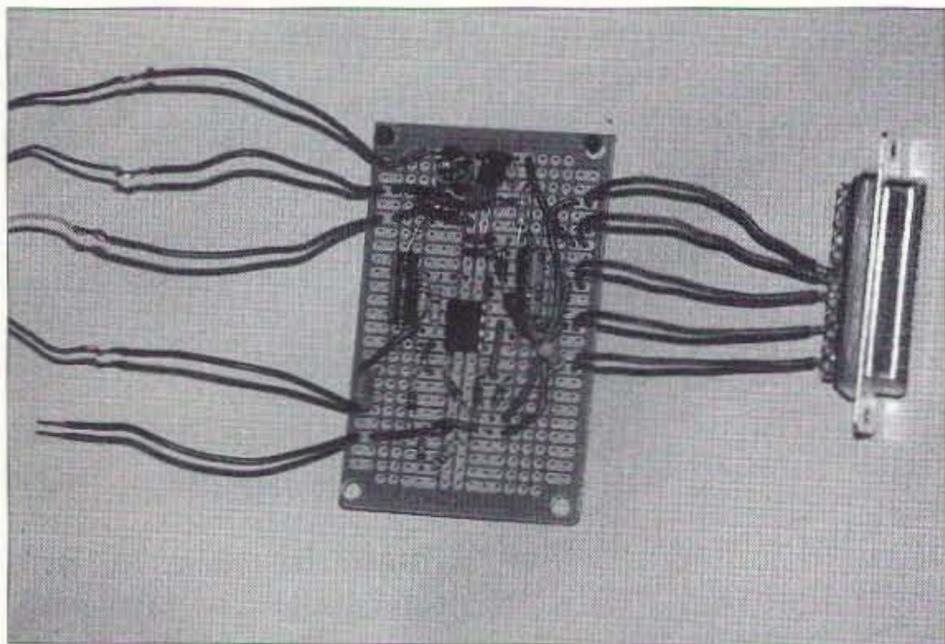


Photo A. Here is KB7NO's serial modem as it was plugged in for the first RTTY QSO. The extra wire is a redundant ground in the event a separate audio feed was needed. Layout is not critical since it is audio circuitry, but it could stand to be a lot neater. The RS utility board number is 276-150; this board appeared to offer the best chance for a minimum of jumpers. The long leads to the jacks were intended to make experimenting simple. But there was no experimenting!

called CQ and gave him a shout. He came right back. I had made the first contact with the project within ten minutes of plugging it in. I didn't think until later that Fritz had told me he was running 300 watts. I hadn't even turned on the amplifier which is often needed on that mode under current conditions, so this was a good test.

Anything that works first try is a truly great experience. For a few dollars I had assembled a serial modem to replace the relatively expensive failed commercial modem and it worked better than the other had when new. There was one drawback. This modem will not work with VHF packet.

I sent E-mail to Terry K7SZL and thanked him for the use of his schematic to enhance the pleasures of my shack. I asked if he knew of a schematic for a modem for VHF packet. He replied and we exchanged messages for a few days.

The makings of a new project

I did find the schematic in question. I thought I had seen one on a BayCom-related Web page, but that site wasn't re-

sponding. I checked every packet link I could find for a couple of hours with no success. Then I tried something just too simple. I ran a search for "baycom schematic." Up popped only one site, and it was the right one! It is [www.industry.net/c/mn/_swpacket].

This site contains a self-extracting file that becomes a text file and a schematic. This is great, except that the schematic requires the CompuShow viewer from CompuServe to view and print it. I brought the image up in an old crippled DOS version of that program and I could see it was intact.

So, I downloaded the latest version from CompuServe and I now have a print labeled "BayCom schematic." It resembles a blueprint which I call a "blackprint" (reversed black and white) and would not copy well on my copier, but I saved it as a .TIF file so it is more easily transported. I sent a copy off to Terry because he had not seen one either and was curious about the innards.

I will see if I can have a measure of success with that circuitry. If I do, I will consider mounting both boards in one enclosure if that is feasible. That

is a decision to come. The first order of the day is to get a project going and up and running.

Freebies

Last month I mentioned a source for packet through a soundcard. I am quite a way from having this up and running, but here are the developments.

Some very interesting and informative E-mail arrived from Paulo CT1DTA, who is using the PCFlexNet approach to packet radio with a serial modem. After experiencing Paulo's enthusiasm, I took another look at the site: [<http://dt10td.afthd.th-darmstadt.de/~flexnet/index.html>]. It is still complex, but there is hope. This site, among other things, contains an intriguing approach to doing packet through the soundboard of your computer with no modem or TNC. And did I mention that the programs are free, with not even a shareware fee involved?

In addition to the above page, there is a site by Tom Sailer HB9JNX/AE4WA linked to it which evidences a large amount of work dedicated to making this project manageable for the average ham. This is at [www.ife.ee.ethz.ch/~sailer/pcf/pcfindex.html]. From there you are directed to download areas for the necessary modules.

There was a little education involved as I determined which of the modules was the most important for me. They say you need the FLEXNET.EXE for anything you do with this system. That is found in a compressed file, PCF.LZH, whose location required a careful search.

Forced to get smarter

The fun part, and real education for the day after downloading PCF.LZH, came when it was time to more fully appreciate what the LZH extender represented. It is associated with the LHA program (new to me),

which is necessary if you are to use the file. This made me read the documentation for the Windows 95[®] zip program (which can be downloaded from a myriad of sites).

The documentation clearly states you must acquire LHA213.EXE and install it on the hard drive, open a window in the zip program and type in the path to the LHA program. The procedure is described in detail and went flawlessly after I found a copy of the LHA program on CompuServe. I didn't look, but I am sure it is available elsewhere. When you find it, you will be pleased to know it is free.

In the end, the PCF.LZH archive contains eight files, including a piece of documentation which starts with four pages in German, then (whew!) a translation into English. The all important FLEXNET.EXE file is among the eight.

I also downloaded two other recommended files. In the end, there is the promise that amateur packet can be run without a TNC or modem—just with the software and the soundboard. Plus there is a module to allow this to run under Windows 95. That will be interesting to see.

In reading the documentation thus far, it would appear this may not be a simple matter of bringing up a Windows[®] program while working with other applications. The instructions indicate that the DOS modules must be in place and they may not allow other programs to be up and running. Such is the life of the experimenter. As long as it doesn't cause smoke in the shack, I will go for it to see it work.

If you have questions or comments about this column, please E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO. 73

VHF and Above Operation

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Frequency reference oscillator stability tips

This month I want to cover a circuit that can be incorporated into your station's test equipment for either improved timebase accuracy or as a marker harmonic generator for general testing. It can also be used in conjunction with frequency counters which have external timebase inputs to improve operation. If the frequency counter does not have an external input for the timebase oscillator, the circuit can be used to measure and correct the internal oscillator adjustment to proper operation.

With the construction of a simple TTL frequency divider, other marker frequencies can be obtained, depending on the innovation of the constructor and his needs. Stability is an important issue, and there are a few things you can do to either assemble a reasonably good unit or improve the operation of an existing one.

First, let's get into what makes a unit unstable, or the flip side for one that moves in frequency and does not stay put. The simplest circuit that can be constructed is a basic crystal oscillator. It is composed of a transistor or TTL gates and a few resistors and capacitors, along with a crystal. This circuit is usually constructed on top of a circuit board and powered by a battery or low-voltage power supply.

There are several problems with this type of circuit and several benefits. On the plus side, it's small, functions reasonably well, and oscillates

somewhere near the crystal-marked frequency. On the negative side, as it is a simple basic circuit, it will drift in frequency about the marked one due to voltage, temperature, and the loading effects on the oscillator (depending on what you connect the device to). Loading can be looked at as the same as using some of the oscillator's power in the output. When you affect the oscillator in any way, the circuit changes ever so slightly and the frequency of the crystal becomes affected by the power being used in the load. Multi-stage oscillators reduce this loading effect by drawing very lightly on the oscillator and then amplifying the signal.

There are several other considerations to be taken into account, including capacitive loading and leakage from the main oscillator to the output without going through the intended circuit. This leakage occurs when oscillator energy jumps over circuitry through stray coupling paths between the actual oscillator and the third stage of such a circuit. In this jumping over there is coupling between the first stage and the third, with minimal going through the second stage.

It would be like having 1 MHz energy being coupled into the output of a divide-by-10 circuit. In this case, there would be both 100 kHz and 1 MHz present on the output. You can see what I am getting at: signals going around circuitry and re-combining in the output.

How, then, do you design a good oscillator, and what are the

properties that make an oscillator great? Looking at some very high accuracy frequency standards, we might not be able to duplicate their excellent construction and circuitry details, but we can adapt several of these features into a good facsimile.

Attributes of a good frequency standard include very tight voltage regulation and low AC ripple (hum and noise) on the DC component used to power the oscillator. A stable temperature environment for the crystal oscillator and associated oven temperature control circuits are also needed. To improve temperature stability, there are usually two ovens. One is a slow time-constant oven directly affecting the crystal oscillator. The second

heater is a faster time-constant oven wound over the first one to help stabilize the environment of the assembly.

The inner oven might have a temperature cycle that takes a day of operation before it is able to hold a temperature to a very small range. The outer oven might only take a few hours to achieve this same or nearly same temperature stability. All this is going on to hold the crystal to a single exact temperature and prevent it from being affected by outside effects such as the garage door opening or drafts.

To protect this assembly from drafts and other small temperature effects, the inner and outer

Continued on page 70

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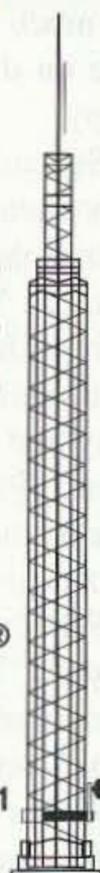
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Letter from Down East

... where at least one ham won't clam up.

Dr. Harold I. Goodman W3UWH
7 Perkins Road
Eastport ME 04631

There you are running anywhere from 100 to 1,000 watts. The ham at the other end is receiving you 5-9-9 plus. You, on the other hand, are receiving him/her at about 3-3-9. You've got your gain cranked open almost all the way, straining to pick up as much as you can of the signal. He/she on the other hand has "armchair" copy.

Second scenario: You are running anywhere from 100 to 1,000 watts. The ham at the other end is receiving you 5-9 plus 20. You, on the other hand, are receiving him/her at about 2-2. You have your gain cranked open almost all the way and have just asked, for the tenth time, "Please repeat your suffix." He/she on the other hand has "crystal clear broadcast-quality" reception.

What's going on? Why, it's QRP, of course. Ten minutes later, he/she is congratulating him- or herself on another state or country added to the QRP list. You are going to lie down for a few minutes to settle your jangled nerves before you can face any more radio operations.

To add insult to injury, *they* are the ones who will get the awards. Not you, not the one who was straining and put-

ting out all the effort, but them. That's right, the only reason the contact was made in the first place was that you were willing to work hard while they had it easy, and they get the credit.

This is just not fair. So I have a suggestion to make. From now on, any QRP station that wants an award must

"I may be getting old but I'm still pretty sure that the letter 'v' does not have six dots in it!"

work another QRP station running the same amount of power. Then, and only then, will the awards mean anything, and the rest of us will have a longer life expectancy.

Another thing. A few weeks ago I got into a rag-chew on 20 CW with a group of old-timers. Most were using straight keys and a few were using electronic keyers. We were going at a comfortable rate somewhere around 20 wpm. Everybody was easy to copy and it was a pleasure. Later that day I moved up into the General/Advanced

portion of 20 CW and worked a few stations. They all were using electronic keyers and going about 15 to 20 wpm. The only problem was that I could not understand half of what they sent. I could not tell where one letter stopped and the next letter began. I may be getting old but I'm still pretty sure that the letter "v" does not have six dots in it.

This is just not fair. So I would like to propose another "Q" sign. To QSD, which means "Your keying is incorrect, your signals are bad," we add QSC. QSC would mean "Your keying is so sloppy it doesn't even resemble Morse code—come back when you have learned how to send, 73 and good riddance."

There you are in this massive pileup trying to reach an extremely rare DX station. From your location, it's a part of the world that you have never been able to reach before. He keeps taking list after list and you have been trying for at least 20 minutes. Finally, just before you are ready to give up, you hear your call as number 10 on the new list. Patiently you listen to one station after another exchanging call signs and

Continued on page 86

A Krystal Kludge

A book excerpt from The Xtal Set Society.

William Simes WØIZC
9320 Lowell
Overland Park KS 66212

As long as I can remember, building things has been a favorite pastime. As a kid, building things from junk was a necessity. As a retiree it's a fascination which led to the assembly described here. Hopefully, some of the findings will be of interest to xtal set experimenters.

The circuit is shown in **Fig. 1**. It consists of a loop antenna, a tuning capacitor, a detector, and a sound transducer. The components are interconnected with clip leads (Radio Shack™ part number 278-1156).

The loop

Our house is located three miles from WDAF and six miles from KMBZ. Both are five-kilowatt stations. I was pleasantly surprised to receive signals from each station using only a tuned loop antenna with a crystal detector. This was particularly surprising because the loop was in the basement! Of the loop configurations I've tried, the one shown in **Fig. 2** and **Fig. 3** is my favorite. The taps at each turn can be used for changing inductance and for load matching. The loop can be readily removed from its base for storage. In my case, when the loop is not in use, it hangs from two hooks fastened to a basement ceiling joist.

The base stores easily between joists. The maximum inductance of the loop is about 210 μH . Lower values of inductance are accessible using the taps. As measured from the outside (no. 1 tap) to the Nth tap, the inductance is approximately $2.25 \times N^2 \mu\text{H}$.

The capacitor

To my knowledge, the capacitor used here is unique. In an attempt to make the capacitance of a Leyden jar variable for the tuning loop, I covered the outside of a half-gallon fruit jar with Reynolds® wrap, put a copper strip inside, and connected the strip and foil to the loop terminals. This was paralleled with headphones in series with a diode. I listened as saturated salt water was poured in the jar. Sure enough, as the level rose, stations came and went. When I replaced the fruit jar with a two-liter soda bottle, performance improved. The bottle capacity changed about 100 pF for each inch change in electrolyte level. The inconvenience of a one-way variable capacitor, operated by pouring electrolyte from one container to another, left too much to be desired. What was needed was a sealed bottle that allowed capacity to be increased or decreased without electrical connections

to the electrolyte. The need was met with the holder and bottle configuration shown in **Photo A**.

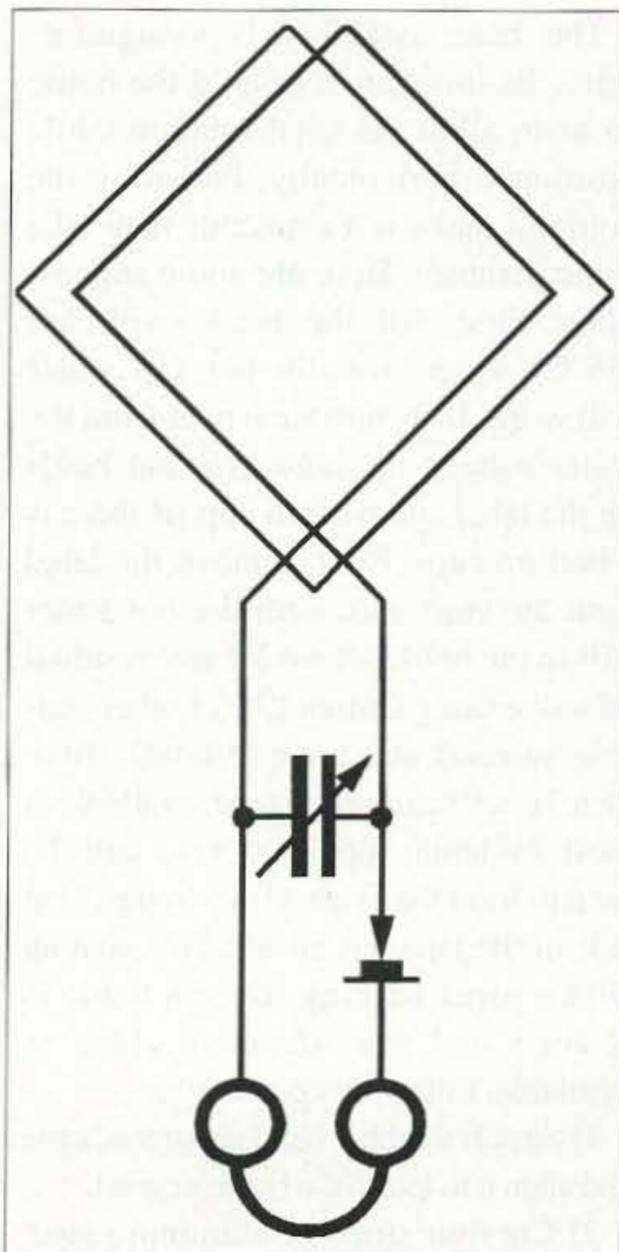


Fig. 1. Schematic of the Krystal Kludge set.

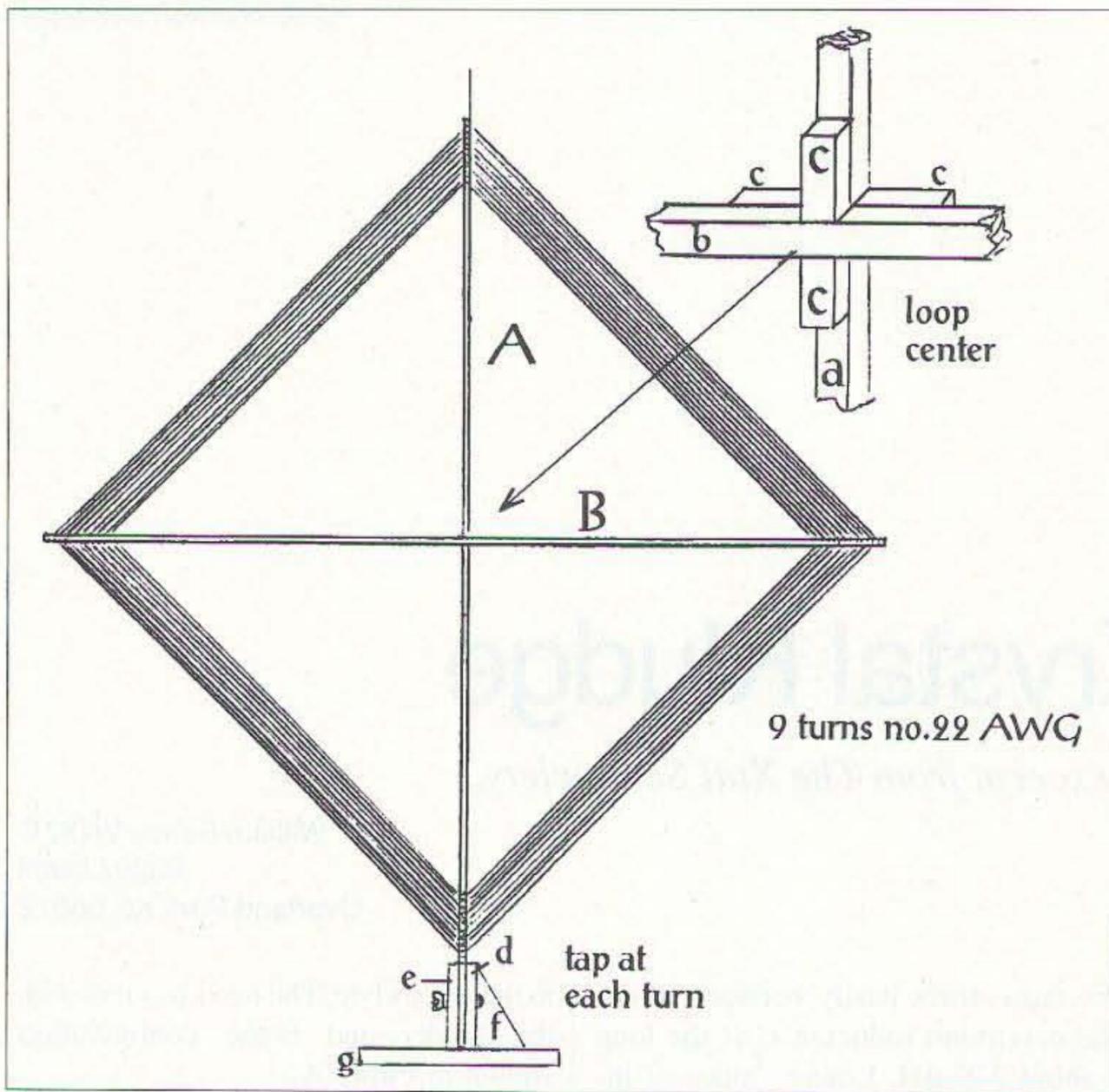


Fig. 2. Loop antenna.

The base assembly is straightforward. Its function is to hold the bottle so as to allow its axial rotation while positioned horizontally. Preparing the bottle to make it a capacitor may take some patience. Here are some suggestions: First, fill the bottle with hot (55°C) water; usually hot tap water will work. In a short time heat from the water softens the adhesive that holds on the label and bottom cup (if there is a bottom cup). Next, remove the label (and the cup) and, with the hot water still in the bottle, clean off any residual adhesive using Gumout™ (or other suitable solvent) and a paper towel. Two-inch Tuck™ aluminum tape, available at most building supply stores, can be used to form the external electrodes. One side of the tape has an adhesive coating with a paper backing. Once a bottle is cleaned and the aluminum tape is available, follow this procedure:

1) Stretch a rubber band about the bottle and align it to locate the bottle's center.

2) Cut four strips of aluminum tape, each seven inches long. Adjusting the

tape position after its adhesive makes contact is difficult, so, before removing the backing, fold over about half an inch of tape along its long edge. Make the fold with the backing on the outside of the fold.

3) Carefully remove the backing from all but the half-inch fold-over.

4) Pull the tape taut and align its unfolded edge with the lower edge of the centered rubber band. Apply the tape to the bottle.

5) Once the tape is in place, remove the backing from the folded section.

6) Remove the entire backing from another seven-inch length of tape. Pull the tape taut and align its edge with the exposed adhesive on the folded edge of the tape already in place. Make the contact between the two strips of tape and between the second tape and the bottle. Smooth out any wrinkles.

7) Repeat this procedure to apply the electrode to the upper half of the bottle.

8) Fold up the corners of the half-inch ridges on both electrodes. This exposes some electrode surface without adhesive, allowing clip lead contact to both halves of each electrode.

An electrolyte is needed to complete the electrolytic variable capacitor. Saturated salt water works. It is cheap and it is benign. I found the unloaded signal level of a local station tuned with the salt water capacitor to be about 27 mV. The same station tuned with an air dielectric capacitor showed an unloaded level of about 150 mV. By adding 21 ohms in series with the air capacitor, the signal level matched that of the salt-water capacitor. There are,

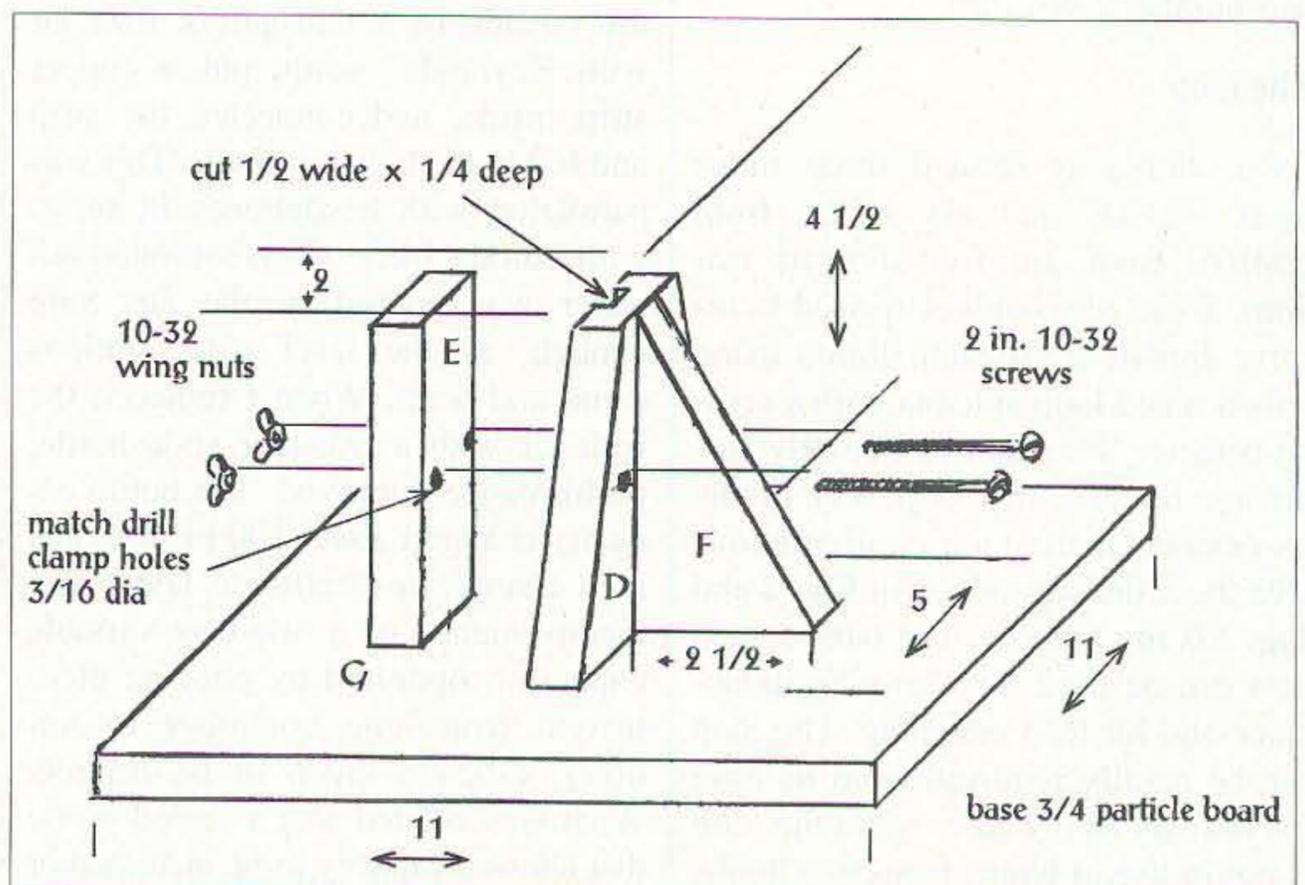


Fig. 3. Loop base detail (dimensions in inches).

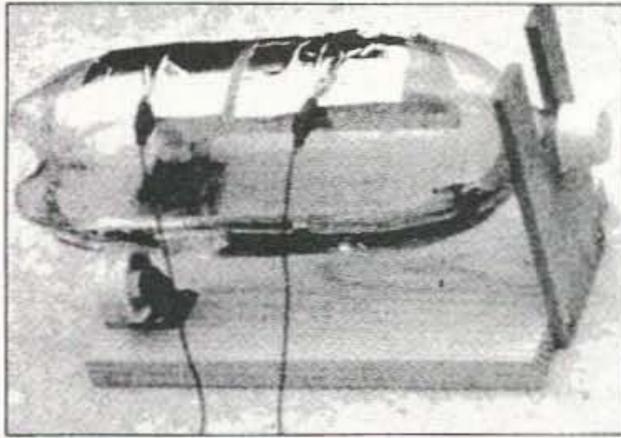


Photo A. Capacitor assembly. Bottle rests on 1-5/8-inch casters.

of course, stronger electrolytes. Here is one that worked better:

One quart of water was added to an empty bottle with external electrodes attached as described above. To this, 100 ml of muriatic acid (31.4% HCl) was added. It behaved as a capacitor, but the capacity didn't change much when the bottle was rotated. The conductive wet coating inside the bottle left the electrolyte area inside the bottle poorly defined. This was corrected by adding a pint or so of kerosene which provided an insulating layer that floated on the electrolyte. The capacity then changed as expected when the bottle was rotated. The signal degradation using this capacitor was equivalent to adding six ohms to the air capacitor. Its tuning range was about 100 to 480 pF. Oil floating over the electrolyte further reduces the trapped air volume and the bottle distortions associated with temperature-induced volumetric changes. On the other hand, it also tends to increase weight. Replacing the base cup on the bottle could prevent this distortion.

The detector

The 1N34A diode is handy, cheap and works every time. However, for the purist bent on a junk assembly, try this. It's tacky, but it worked for me. Find a mousetrap, preferably one that hasn't served its intended purpose. Remove the bait holder and trip wire. That leaves only the spring-load rectangular business piece. This wire piece is then used to hold the galena firmly against the wood base. In so doing, it makes good electrical contact with the galena and provides a contact on which to fasten a clip lead. A small jelly glass with a suitable length of fine wire fastened to its top with a rubber band makes a functional cat whisker. After a few turns of the fine wire on the clip lead clip, the edge of the glass makes a good anchor for the clip lead (Photo B). The fine wire can be removed from a section of stranded hookup wire. Now position the jelly glass assembly so the cat whisker makes the right contact with the galena and you have a detector. Again, it's tacky, it's functional, and it's sometimes a good conversation piece for an otherwise uninterested visitor.

The transducer (headphone)

High-impedance store-bought headphones work well. For the purist again, the piezoelectric transducer made from a cat food can is recommended. Such a device is detailed in Vol. 6, No. 3 of the *Xtal Set Society Newsletter*.

As a rural kid, I could only get Dr. Brinkly on my crystal set. Now I'm



Photo B. Krystal Kludge set.

geographically blessed with a location where a crystal set can receive many stations (not always better programs). A more geographically challenged crystal set experimenter may need younger ears to share my results.

William Simes' article is an excerpt from the Xtal Set Society's new book, Crystal Set Projects: 15 Radio Projects You Can Build. You can check out more crystal set projects and the Society's bimonthly newsletter at [www.midnightscience.com]. The book is available for \$17.45 including shipping directly from the Xtal Set Society, P.O. Box 3026, St. Louis MO 63130, or call (800) 927-1771.

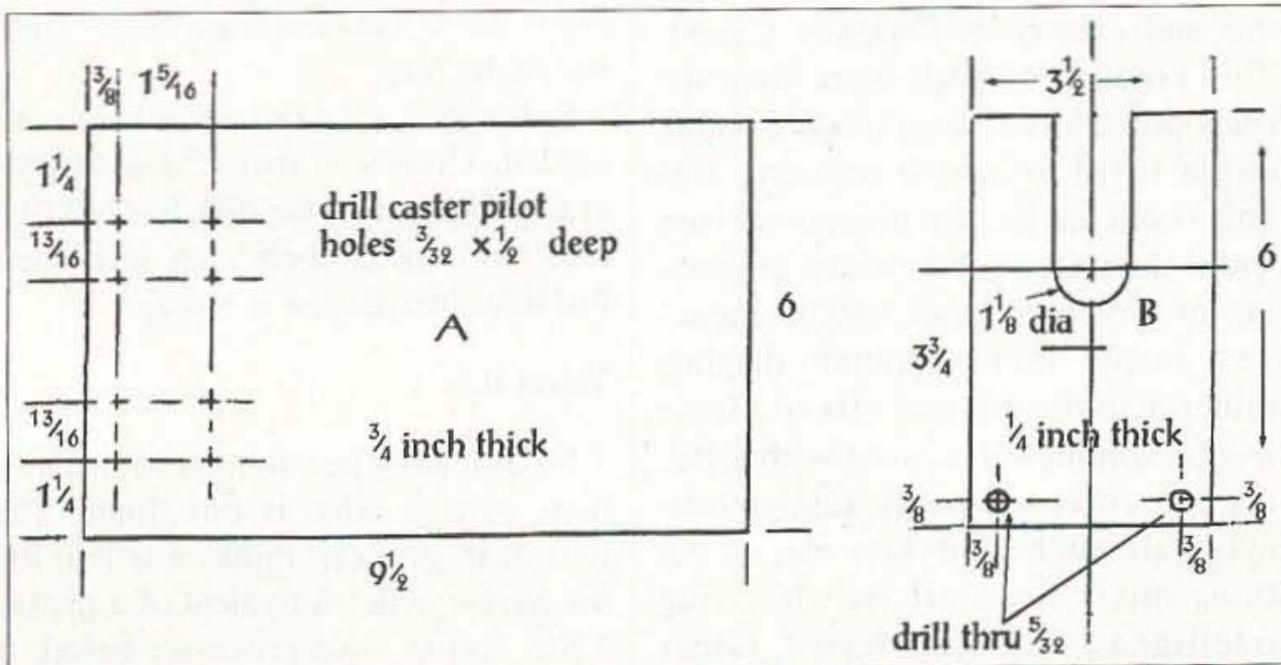


Fig. 4. Details of base for capacitor assembly (dimensions in inches).

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CIRCLE 182 ON READER SERVICE CARD

Advance Design Labs' CodeKey

Put this gizmo to work for you!

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

There's much controversy these days over if and when Morse code, or CW, will be phased out of amateur radio licensing requirements. Whatever your stand on the issue, the fact is that Morse code is still quite popular on the HF bands, and it shows no prospect of disappearing, even if it winds up no longer being a requisite for entry into the hobby. Tune down around 14.010 MHz or so any time the 20-meter band is open, and you'll hear plenty of signals. If you're like many of us, though, you may not have used code enough yourself to keep up your receiving skill. Ever wonder what those 35-wpm spectrum blasters are actually saying?

If you can't keep up by ear, there's always your trusty computer. CW-decoding software is pretty much free for the asking. But, how well does it work? If you've tried the software-only approach, you've discovered that it works pretty poorly. Sure, if the sender is also using a computer to generate perfectly timed code, and there's absolutely no QRM (yeah, right!), you'll get some of the text, and might even be able to figure out what's being said. In general, though, computers make lousy code copiers. Why?

Not meant for machine

With its variable-length characters and peculiar timing, Morse code was never intended for machine copying. While a well-trained brain can do amazing things with it, the code just doesn't easily fit into the regimented, consistent way a machine interprets information. Does that mean it's impossible to do any better than common code-copying software?

No! In fact, it's quite possible for a specially-tailored machine to do a respectable job of copying Morse. Advance Design Laboratories, Inc. realized this and created its CodeKey CK-53. This product is much more than the usual phase-locked-loop modem whose output is fed to generic software. This little board has its own microprocessor, and is dedicated solely to the processing of CW. It outputs ASCII characters ready for computer display, rather than the ons and offs of Morse itself. Although best used with a PC, it can even be used with dumb terminals (although you lose the keyer functions), since all the decoding intelligence is on the board, rather than being in the computer.

Almost ready to go

The board comes pre-assembled. Like many modern electronic products, it's built to a density scale that would be pretty hard for most homebrewers to cope with if they had to build it from a bag of parts, and the instructions state that it's not for the inexperienced user. I found, however, that it was quite simple to connect and use, and I think anyone who can solder properly and wire up a DB-25 connector should have no trouble with it. Beyond soldering on a couple of LEDs and wiring up the cables, there's nothing to do. It's almost ready to go, right out of the box.

Software for DOS computers is included. Unlike so many bloated programs these days, the disk has just two files, and one of them's an automated installer. Installation is a snap.

What it is

So, if it's not just another Morse modem, exactly what is this thing? The best analogy I can think of is that it's the Morse code equivalent of a packet TNC. Being microprocessor-based, it has many commands and settings that

let you tailor it to your specific use and style, just like a typical TNC. Although it doesn't use DSP technology, the reader employs a CMOS digital phase-locked loop and analog filters controlled by the on-board micro. For instance, you can set the noise threshold and the analog gain, and even the PLL bandwidth has wide and narrow settings! That sort of close interaction between the analog, PLL, and micro-processor stages is what gives this device such an advantage over the modem-and-software approach.

Upon first opening the very well done manual, all those options looked a bit daunting. As it turned out, though, the thing worked quite well with its default settings, and I didn't have to set anything beyond my comm port in order to view code on my screen.

The device can receive at speeds beyond 35 wpm. It has a 512-byte (character) transmit buffer, and about 8 k of saved message buffers. It can transmit files from disk (so you won't have to manually send that brag file over and over), and will even automatically ID your station every 10 minutes. It can log received data to disk. There's even an on-screen tuning indicator, along with the tuning LEDs on the unit. As a keyer, it offers relay-isolated contacts, and will send at whatever speed is being received unless you tell it otherwise.

As I mentioned, the manual is very well done. It's in 8-1/2 by 11-inch format and stapled together, which seemed chintzy to me until I started using it. Then, I found it handy to have such big pages, and the lack of a binding let the book stay open to whatever page I picked. Excellent drawings of the board and connector layouts made wiring up cables easy. Connections are shown for both 25-pin and nine-pin PC-style connectors. Sadly, no hook-ups for Mac are shown, nor is there any Mac software. Most hams are using PCs, so I guess they concentrated on that platform. Explicit instructions are given for making all of the connections. I, for one, regard good documentation as a tremendous plus for any product, and this one's a winner, despite a few typos.

Let's do it

OK, I had everything wired and running. I powered up the board from my benchtop 12-volt supply. Now, I tuned the band and, hey, it's reading code! Signals my old modem-and-software system wouldn't have made any sense out of, this thing decoded very decently. The LEDs made it easy to tune the rig to the optimum point for the device's filters, even without glancing at the on-screen tuning indicator.

Performance

No code reader can beat the human brain, nor should you expect it to. Well-sent code was displayed nicely, but even the best code often had words run together. Weak signals decoded better than I'd expected, but there were plenty of errors when signals faded down low or QRM got heavy. The unit did a surprisingly good job of reading hand-sent, straight-key code, but it did not do well with "swung" Morse, in which the sender alters the normal 3:1 timing relationship of dots and dashes. In all fairness, my own personal "wetware" decoder doesn't do too well with that either! Luckily, few operators swing their timing anymore (thank goodness).

The keyer portion of the device is much like other memory keyers, which is to say it's quite nice. It lets you put received data, such as name, QTH, or callsign into the transmit buffer, so you won't have to retype it. All functions are controlled from the computer keyboard, and the relay-isolated output lets you connect the unit to tube rigs or those with unknown keying requirements, without worrying about blowing anything up.

Summary

This is a well-done product that can enhance your ham radio experience. It could also be successfully used on the shortwave bands, letting you see what all that high-speed code is all about. (Of course, you're out of luck if the signal is encrypted.) It does a very respectable job of decoding CW, and it beats the old modem-and-software routine any day of the week. If you like CW, check this thing out!

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ABOVE & BEYOND

continued from page 63

oven are inserted into a controlled-temperature chamber. In many circuits, the device used is nothing more than a sophisticated custom-made Thermos™ bottle with a hole through the sealing cap for bringing leads out to run the circuitry.

Actual construction of the device containing the oscillator would look like a three dimensional sandwich containing the inner oscillator circuit, protected with some insulation, and covered by the first inner oven. Then more insulation such as Styrofoam™ and the outer oven and still more insulation like a thermal blanket to hold the unit snugly in the Thermos bottle. It's kind of like constructing a ship in a bottle, but making sure that everything is insulated (thermally) from each other, and that all voids are minimal.

Can we duplicate the circuitry or is this too complex? Yes we can, if we start out with an oscillator circuit that is not a simple unit but has several stages to isolate the oscillator from the output, and incorporates voltage regulation! We ran into a suitable unit, a 10 MHz TCXO oscillator that had internal

temperature adjustment and 10-volt voltage regulation. The oscillator was made to function on +12 volts and ran on 35 mA of current so as to not produce much heat on its own account. There is a variable capacitor access hole on the oscillator side to set the unit to frequency.

Construction can be as simple as placing an insulated unit on its own in a Thermos bottle and letting the ambient temperature do its trick. Or you could create a very slow time-constant single oven to maintain some preset temperature above a normal high ambient, say 90 degrees. Why slow time-constant temperature control? Because a fast temperature control will overshoot its mark and be running continually, either trying to catch up, or (when it cools down), trying to reheat the unit.

A very slow control reacts over a longer time period and will ultimately remain quite fixed at some mean temperature point you select. This will continue when inserted in a Thermos bottle, as it, and all the components in the bottle, will maintain the same temperature.

If you have an oscillator already, or have put together something similar to this, I

outlined previously how you ensure you have a good accurate unit.

There are several methods to accomplish the necessary calibrations for achieving a specific point of stability in your oscillator. Time and frequency standards are broadcast by the government's National Bureau of Standards, now renamed NIST. The calibration of your oscillator can be accomplished by comparing it with one of these transmissions. The simplest of them all is WWV, which broadcasts frequency standard information at 5, 10, 15, and 20 MHz exactly. Their frequency is compared at the source to extremely accurate reference oscillators.

To compare your oscillator, you only need a receiver capable of receiving these frequencies and to make an audible beat note adjustment minimizing the difference between your oscillator and WWV. This method is capable of making an adjustment that is accurate to 1 part per MHz. Not too bad, but this is just the start of what could be a very accurate comparison.

The reason you are not able to make exact reference is that on these frequencies transmission via the atmosphere affects the exact frequency and changes it slightly. A more accurate transmission is at the VLF or

Very Low Frequency of 60 kHz. Here the atmosphere does not impart as much of a change on the signal and better resolution can be obtained. Other sources include LORAN, GPS (Globally Positioned Satellite), or even calling up NIST on the telephone and obtaining voice time readings. There is even a service on the Internet that will adjust the clock of your computer to exact or nearly exact time.

More information can be obtained from the NIST information published on their Internet page at [<http://rio.bldrdoc.gov/timefreq/>]. This is the best informational page covering most of the frequency standard information that is available—and it's free. Can't beat that for good information, so give it a look-see.

Just in case some of you can't locate a suitable oscillator for trying some of these methods that I have covered, I will be glad to provide one for experimentation. I have come across a suitable oscillator with specs that are quite good. I have a large number of "pulls" that were rejected for one reason or another. I suspect these units fail to meet original temperature specs over a great range. I have short-term tested them and junked any that fail to function, are way off frequency, or have any other malady. Instead of

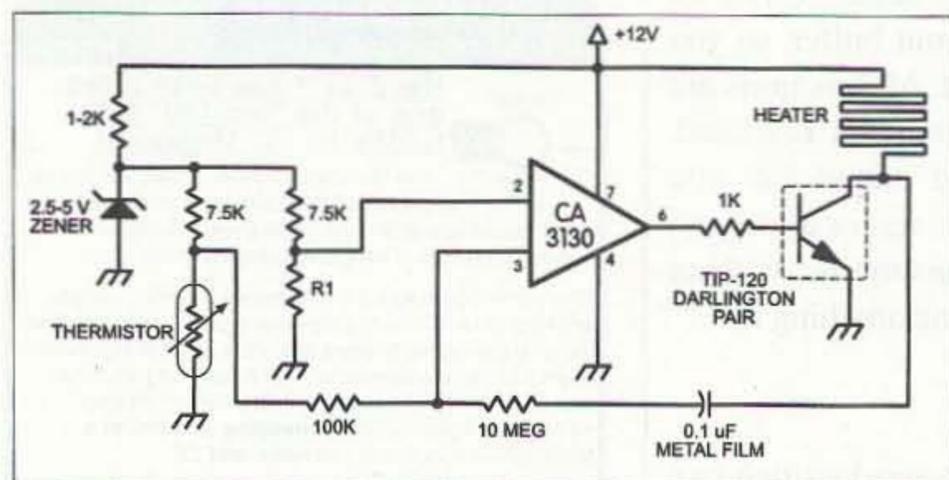


Fig. 1. Schematic diagram of simple one-stage temperature control circuit using a 3130 op amp. R1 is selected to reflect the temperature of the thermistor's resistance at the calibration point selected. The heater can be a large number of turns of #36 enamel wire or nichrome resistance wire to provide a suitable load (10 to 20 Ω) for the TIP-120 Darlington transistor. The thermistor selected was a 10 k Unicurve™ device, but others will work. It should be in direct thermal contact with the oscillator's metal container for best results. R1 = thermistor temperature at regulation point. For example, if thermistor used is 678 Ω @ 100°, then R1 = 678 Ω .

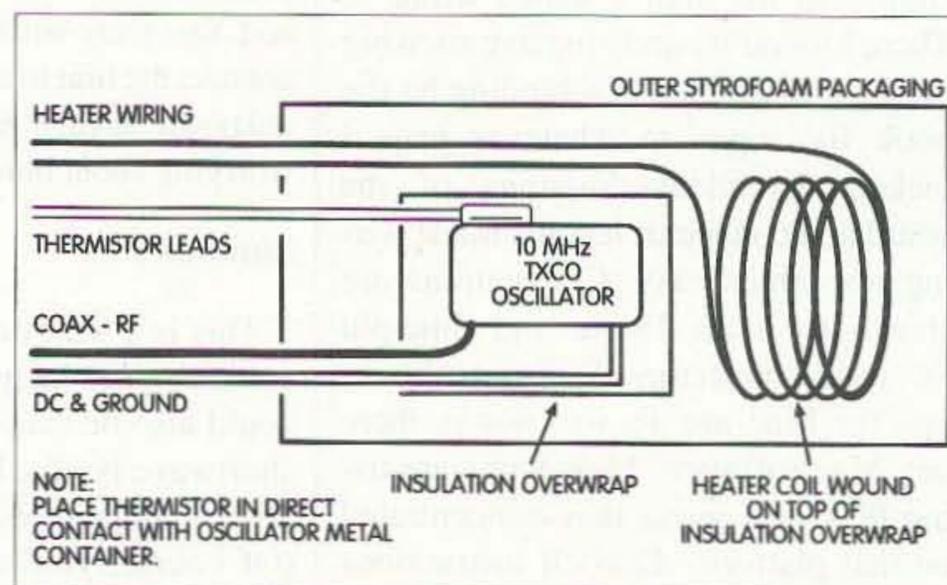


Fig. 2. Diagram of TXCO 10 MHz oscillator with oven wound on outer case of main oscillator. Wire insulated from main oscillator and complete unit packed in Styrofoam insulation before insertion into temperature-controlled chamber (Thermos). Cut small holes for leads to exit bottle through plastic cap.

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getting into labor-intensive testing to certify them better, I will make them available for \$10 (US) each postpaid.

Whether you purchase one of these units or use one you have on hand, the principles are the same in the construction of a reference oscillator. The only possible changes relate to size, operating voltage, and stability of the oscillator you locate. Give it a try—I'm sure you will be pleased with the results, even if you house your existing oscillator in a Styrofoam compartment. Home-brewing can be lots of fun, and a good, stable crystal oscillator can be a valuable asset to your test bench as an aid to calibrating receivers or as a standalone reference.

A parting thought would be to include a mention of the crystal that is selected for one of these very high accuracy units. Crystals are cut from raw material at different angles, and different cuts give different effects. The crystals chosen for primary

frequency standards are specifically cut to exacting standards and are not likely to be found separate from the units they are used in. Crystals need constant attention as they "age" as time goes by and need readjustment from this age effect. As crystals get older, they either drift off frequency or become quite stable or "aged" in.

Remember, anything you do to improve the stability of your current oscillator will be beneficial to your station and your frequency calibrations. I hope this gives you some idea of what is going on in a commercial standard (and why they're so expensive).

Well, that's it for this month. Next time, I plan to get into filters for our lower microwave bands, passing on some interesting details on filters I have constructed and comparing them to some very high-quality ones currently being manufactured for these amateur bands. If you have questions, just drop me an E-mail. 73, Chuck WB6IGP.

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR

P.O. Box 473

Stevenson MD 21153

[ajr@ari.net]

Last year, we were looking at the "orphaned" status of owners of AEA equipment, with the demise of that company. With many of you having a PK-232 in the shack, this became more than a trivial problem.

Take the case of Ed Williams WB4GDH/mm/VK6AJR, who writes:

"I read your 'RTTY Loop' in 73 Magazine. A friend of mine on another ship here in MED/SEA wants to buy a PK232MBX, but it looks like AEA went out of business and stopped making them. Do you have any idea where he might pick up one, or something similar? We only have E-mail here through the military E-mail system and can't get on the Internet with our setup."

Well, Ed, first of all let me compliment you on the VK6 callsign, I do like the suffix! As I indicated in the November 1997 column, Timewave, Inc., purchased all of the assets of AEA. This leaves us with two different issues: repairing older equipment, and purchasing new gear.

For the ham with older AEA equipment, Timewave has expressed a liberal repair policy. They indicate that they can provide repair services on all products built by Timewave, and most data products built by AEA since 1990. Their ability to repair AEA data products, such as multimode data controllers and TNCs, is limited by parts availability and special test equipment to test the products. Timewave has a limited supply of AEA custom parts that will be used until the supply is exhausted. In most cases it is not possible nor cost-effective to obtain a new supply of custom parts.

Unfortunately, Timewave has few, if any, parts available for products like the MP-64 and Doctor DX, which were built for Commodore computers. They suggest you consider updating to a PC-based system. Very low cost used PC equipment is readily available at ham swapfests and on-the-air ham swap nets.

By the way, as stated before, the AEA antenna and Antenna Analyzer product line was acquired by a different buyer, Tempo Research of Vista CA. Any service or upgrade requirements on those items should be directed to:

AEA

Tempo Research Corporation

1221 Liberty Way

Vista CA 92083

(760) 598-8900

FAX (760) 598-4898

AEA sold a variety of products over its 20-year history. Timewave cannot repair most of the non-data products because they have few spare parts, but they may have technical data on those products. Their working knowledge of the non-data products usually will be quite limited. Please inquire about specific products.

In particular, the antenna tuner products, the LA-30 linear amplifier and the WM-30 SWR/power meter were manufactured by Vectronics in Canada for AEA. Vectronics is now owned by MFJ. They suggest you contact MFJ to check on the availability of spare parts for these products. You may have to determine the equivalent Vectronics model number to get help from MFJ, since

Continued on page 74

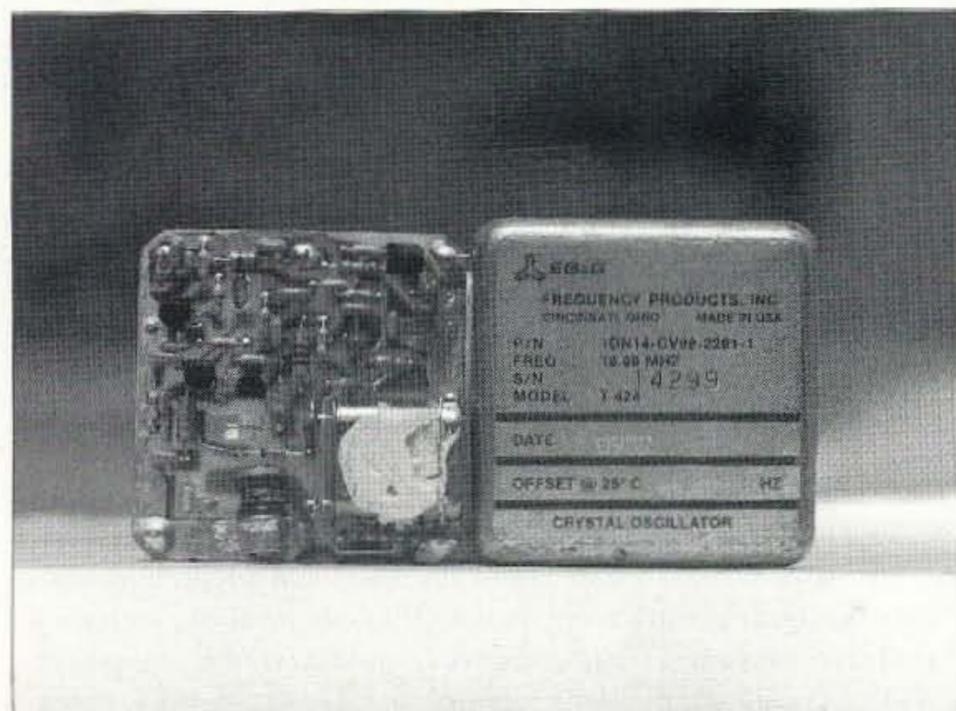
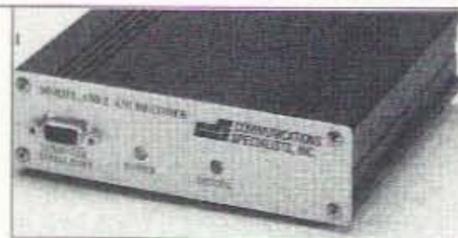
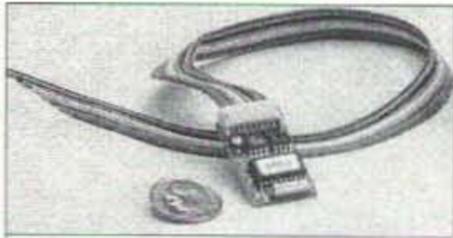


Photo A. Surplus 10 MHz TCXO oscillator from EG&G used in this example. Unit on left has case removed to show internal components. White thermal compound on crystal is hiding part of temperature-controlled components for internal original control of temperature/frequency. Unit requires 12 volts DC at 35 mA.

NEW PRODUCTS



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Communications Specialists' ANI-1 miniature automatic numbering identification encoder is a microprocessor-based PCB that provides instant identification of mobile and portable two-way radios—a simple, economical way for public service, utility and delivery companies (among others) to identify system abusers and manage airtime more efficiently. The postage stamp-sized ANI-1 uses a high-speed multi-tone sequence for data transmission on an RF channel and is compatible with links and repeater systems.

Incoming unit ID and status message transmissions can be decoded and displayed on a personal computer by using the ANI-2 Station Decoder, which displays up to 100 received messages on your computer screen in real time. It comes complete with programming kit, including all cables, software programming disks, and power supply, and, like the ANI-1 Encoder, is available with immediate one-day delivery and a five-year warranty. The ANI-1 Programmable Encoder is priced at \$39.95; the ANI-2 Station Decoder is \$299.95; fleet pricing is available. For more information or to order, contact Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92865-4296. Call (800) 854-0547 or FAX (800) 850-0547 from the US and Canada; overseas customers may call (714) 998-3021 or FAX (714) 974-3420.



MFJ Expands Time!

Well, the numerals on the clock face are bigger. Seriously, the MFJ-118 JUMBO LCD™ 24/12 hour ham station clock has high-contrast digits one and a quarter inches high—you'll be able to read them from anywhere in your ham shack. You can choose whether you want 24-hour UTC or 12-hour format; the MFJ-118 also displays year, month, date, and day of the

week—in English, Spanish, German or French.

The MFJ-118 has a 100-year full calendar and is quartz-controlled for accuracy. The tough black plastic case is only five and three quarters inches by two and a half inches by half an inch thick, and it'll stand up or hang on the wall. It uses an easily-replaceable AAA battery, and of course it comes with MFJ's famous "No Matter What" one-year warranty.

For your nearest dealer or to order, call toll-free (800) 647-1800; FAX (601) 323-6551; or write to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville MS 39759. Check out the Web site at [<http://www.mfjenterprises.com>].



Beef Up Your Handheld

The power of a 35-watt base station with your two-meter handheld? Sounds too good to be true, but Cutting Edge Enterprises has done it—and it won't require a second mortgage! Just plug your handheld into the PowerPort RF-35, grab the carrying strap and take it wherever you go. The removable side pockets hold your HT and accessories.

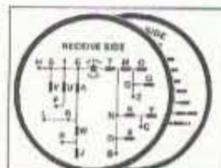
The rechargeable RF-35 is fully self-contained, with nine amp-hours of on-board 12 VDC power so you can keep communications going all day, without a break. With two and a half hours of solid transmit time and unlimited standby, the RF-35 will outlast your handheld battery! If you don't need that much stamina and want something even lighter, the RF-35 Jr. will still give you three quarters of an hour of talk time and unlimited standby, and it only weighs three pounds.

The PowerPort RF-35 is ready to go, right out of the box. It's fully charged and comes with an RG-174/U cable with BNC connector for your HT, and a mini "J" antenna is tucked into one of the accessory pockets—instant fun or emergency communications for only \$179.95! The RF-35 Jr. is \$159.95, and both are available from Cutting Edge Enterprises, 1803 Mission Street, Suite 546, Santa Cruz CA 95060; telephone (800) 206-0115 for more information or to order.

Don't Toss This Coin

Here might be the way to introduce someone you love to Morse Code. This "Decoder Coin," from Hall Brothers Manufacturing Company, has an alphabetically arranged "send" side and a logic trail "receive side" that makes it easy for even a beginner to follow the dots and dashes to find the correct letter. The instruc-

tion sheet is brief and clear, and Hall Brothers left space



on the brass coin to drill a 1/8-inch hole to make a key chain or zipper pull of it. For ordering information, contact Hall Brothers Manufacturing Company, 380 N. 400 E., P.O. Box 1010, Morgan UT 84050-1010; telephone (801) 829-3232 or FAX (801) 829-6349.

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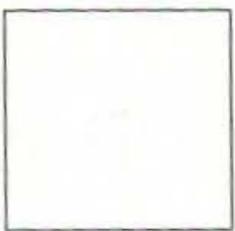
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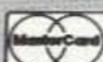
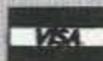
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More on magnetometers

Previously, this column has discussed the model FGM-x magnetic fluxgate sensors sold by Fat Quarters Software, 24774 Shoshonee Drive, Murrieta CA 92562, USA; (909) 698-7950 (voice) and (909) 698-7913 (FAX). Erich Kern of Fat Quarters recently sent me a recording he made of some sort of magnetic event. Checking with some experts on the matter revealed that it was a severe magnetic storm. Some ham operators

use magnetometers (some very crude) for propagation studies. Let's talk a little about calibrating and using these instruments (besides, even if you don't want to use the magnetometer for propagation studies it makes a dandy science fair project!).

Calibration of the sensors

The FGM-x devices are not precision instruments out of the box, but can be calibrated to a very good level of precision. The calibration chore requires

you to generate a precise magnetic field in which the sensor can be placed. One way to generate well-controlled and easily measured magnetic fields is to build a coil and pass a DC current through it. If the sensor is placed at the center of the coil (inside), then the magnetic field can be determined from the coil geometry, the number of turns of wire, and the current through the coil. There are basically two forms of calibrating coil found in the various magnetic sensor manuals: solenoid-wound and the Helmholtz pair.

Fig. 1 shows the solenoid coil. A solenoid is a coil that is wound on a cylindrical form in which the length of the coil (L) is greater than or equal to its diameter. This type of coil is familiar to radio fans because it

is used in many L-C tuning circuits. The magnetic field (H) in Oersteds is found from:

$$H = \left[\frac{4\pi N I L}{10\sqrt{L^2 + D^2}} \right]$$

Equation 1

Where:

H is the magnetic field in Oersteds.

N is the number of turns-per-centimeter (t/cm) in the winding.

I is the winding current in amperes.

D is the mean diameter of the winding in centimeters (cm).

The winding is usually made with either #24 or #26 enameled or Formvar®-covered copper wire. The length of the solenoid coil should be at least twice as long as the sensor being calibrated, and

RTTY Loop

continued from page 71

Timewave has no cross-reference information available.

All units which are damaged beyond repair (examples are lightning damaged, burned circuit board traces, and fire damaged) will be returned to the owner with no charge and a letter stating the unit is not repairable. The letter will contain the manufacturer's suggested retail price and the model number of the current Timewave product that is functionally equivalent to the damaged unit. This information is usually required by insurance companies in order to file a claim for replacement of a damaged unit.

Checking their Web site at [http://www.timewave.com/amprods.html] yields the information, for example, that upgrading an old PK-232 to the latest generation of PK-232MBX costs just \$100, and includes a hardware upgrade and manuals.

So, it would seem that Timewave has given a new life to users of AEA equipment. Check out their Web site, or give them a call at (612) 452-5939

and tell them that you read about it in "RTTY Loop"!

Regards to Jon A. Moreshead KA3JNZ, who passes along the observation that a program which may help Ted Bear W6RHB with his V20 laptop is Super Morse, a program written in Turbo Pascal for IBM compatibles. It can be configured for use via the COM port with a simple interface, the diagram for which is included in the DOC file. This program is on Disk #7 of the RTTY Loop Software Collection, and is an excellent Morse program. Thanks, Jon!

While we're talking about handy software, Bob Lewis AA4PB passes along the information that he "ran across a terminal program you may wish to let the readers know about. It's called EasyTerm for Windows™ and it now supports the HAL P38 Clover card as well as a number of other controllers."

EasyTerm is a Windows program that supports the AEA, Kantronics, and HAL controllers. It appears to support all of the options and modes of the individual controllers, and features ANSI color displays and a host of other features. There are

even built-in logging and contesting modules. All of this can be yours for about \$50. You can review the information about the program on the Web site at: [http://www.tiac.net/users/henley/eztpage.html].

After you purchase the program, the author states that updates are free of charge. Check it out, and let me know what you all think.

Another program discussed here a while ago was BMK Multy. Well, discussed and discussed is more like it. I have mentioned this program, and hinted about it, but have not been able to point anyone in the right direction. Well, thanks to Jerry KØHZI, we now have an address. The USA distributor is:

Schnedler Systems AC4IW
25 Eastwood Rd.
P.O. Box 5964
Asheville NC 28813

and the address for the author, G4BMK, is:

Grosvenor Software G4BMK
2 Beacon Close
Seaford, E. Sussex BN25 2JZ
England UK

I hope this helps out some folks who have been looking for this somewhat elusive piece of software.

When it comes to software that is less elusive, though, don't forget to check out the RTTY Loop Software Collection, mentioned above in conjunction with Super Morse. This growing collection of programs of interest to the digital amateur spans a dozen and a half disks. Check out the full list online at the RTTY Loop Home Page [http://www2.ari.net/ajr/recs/] or send me E-mail at the above E-mail address, or send a self-addressed, stamped envelope to the post office box, and I'll send you a copy of the list.

I appreciate your continued support of this column, now nearing the end of twenty-one years of continuous presence in *73 Magazine*. Through the years we have covered every aspect of digital communication from Model 15s to Pentium IIs, and we still have more to do. Let me hear from you about yesterday's, today's, or tomorrow's "RTTY Loop." 73

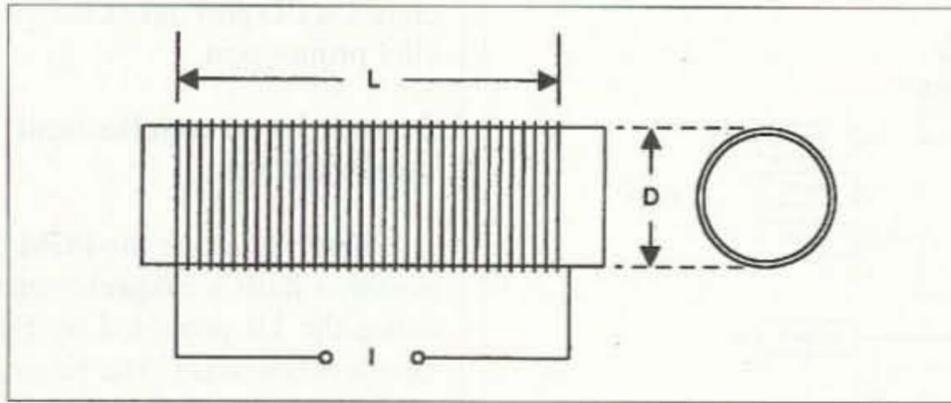


Fig. 1. Solenoid coil.

the sensor should be placed as close as possible to the center of the long axis of the coil.

The Helmholtz coil is shown in Fig. 2(a). It consists of two identical coils (L1 and L2) mounted on a form with a radius R, and a diameter 2R. The coils are spaced one radius (1R) apart. The equations for this type of calibration assembly are:

$$H = \frac{0.8991NI}{R}$$

Equation 2

and

$$B = \frac{9.1 \times 10^3 NI}{R}$$

Equation 3

In the practical case, you usually know the dimensions of the coil, and need to calculate the amount of current required to create a specified magnetic field. We can get this for the Helmholtz pair by rearranging Equation 2:

$$I = \frac{RH}{0.8991N}$$

Equation 4

The coils are a little difficult to wind, especially those of large diameter (e.g., four inches). One source recommends using double-sided tape (the double-sticky stuff) wrapped around the form where the coils are to be located. As the wires are laid down on the form they will stick to the tape, and not dither around.

Fig. 2(b) shows the type of assembly that can be used for either the solenoid or Helmholtz

coil. I first saw this type of assembly in a college freshman physics laboratory about 25 years ago. It consists of a PVC pipe section used as the coil former. End caps on the coil former also serve as mountings. The mounts at either end consist of smaller segments of PVC pipe and nylon (nonmagnetic) hardware fasteners. Another segment of PVC pipe, of much smaller diameter than the coil former, is passed through the former from one end cap to the other, so that its ends protrude to the outside. This pipe forms a channel into which the sensor can be placed. The base is a plastic or wooden box (again, nonmagnetic materials). One thing nice about this type of assembly is that the sensor is always in approximately the same position in the coil, close to the center of the field.

A magnetometer project and kit

Fig. 3 shows the circuit for a simple magnetometer based on the FGM-3 fluxgate sensor. It can be obtained in kit form from Fat Quarters Software. The connections to the printed circuit board are shown in Fig. 4. This device takes the output frequency of the FGM-3 and passes it through a special interface chip (U1), and then to a digital-to-analog converter to produce a voltage output.

The sensitivity switch (S1) produces the following sensitivities when the FGM-3 sensor is used (S1 Position/Sensitivity): 4/±150 gamma; 3/±250 gamma; 2/±550 gamma; and 1/±1,000 gamma.

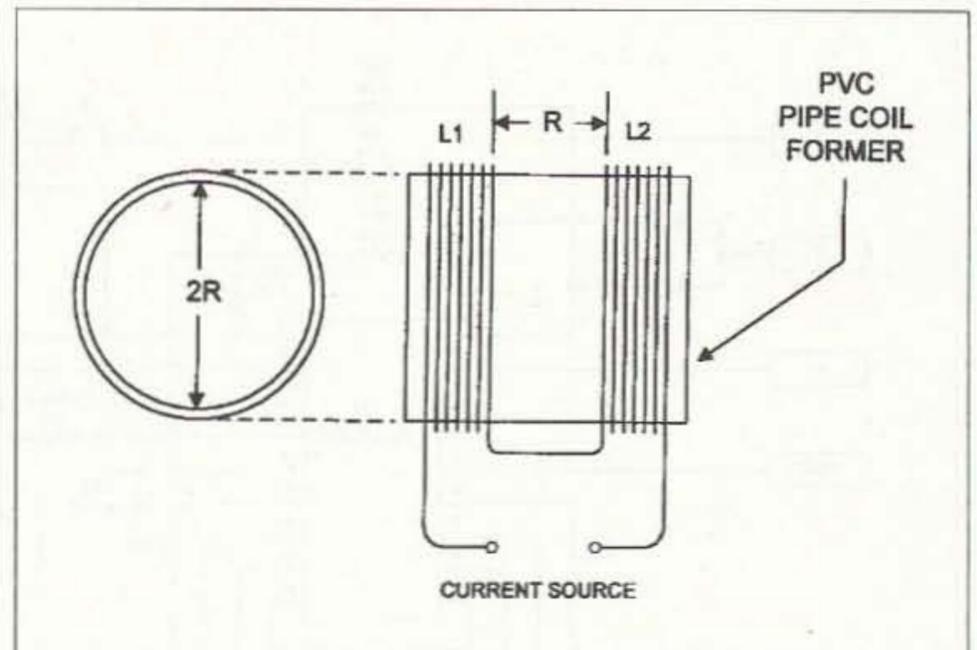


Fig. 2(a). Helmholtz coil.

These ranges translate to a DC output voltage between 0 and +2.5 volts. If the FGM-3h sensor is used instead of the FGM-3, then divide the sensitivity figures by two. These figures are approximate. If greater accuracy is needed, then each sensor should be individually calibrated.

The heart of this magnetometer project (Figs. 3 and 4), other than the FGM-3 device, is the special interface chip, Speake's SCL006 device. It provides the circuitry needed to perform magnetometry, including Earth-field magnetometry. It integrates field fluctuations in one-second intervals, producing very sensitive output variations in response to small field variations. It is of keen interest to people doing radio propagation studies,

and who need to monitor for solar flares. It also works as a laboratory magnetometer for various purposes. The SCL006A is housed in an 18-pin DIP IC package.

The D/A converter (U2) is an Analog Devices type AD-557. It replaces an older Ferranti device seen in the Speake literature because that older device is no longer available. Indeed, being a European device, it was a bit hard to find in unit quantities required by hobbyists on this side of the Atlantic. The kit from Fat Quarters Software contains all the components needed, plus a printed circuit board. The FGM-3 device is bought separately.

The external connections are shown in Fig. 4. The circuit is designed to be run from nine-

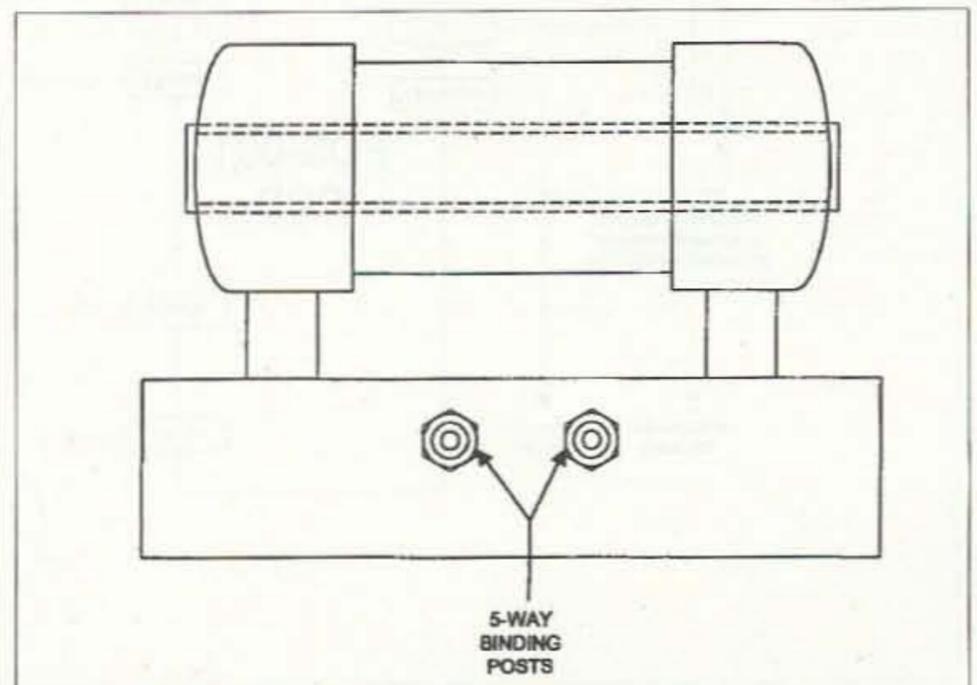


Fig. 2(b). Coil mounting assembly.

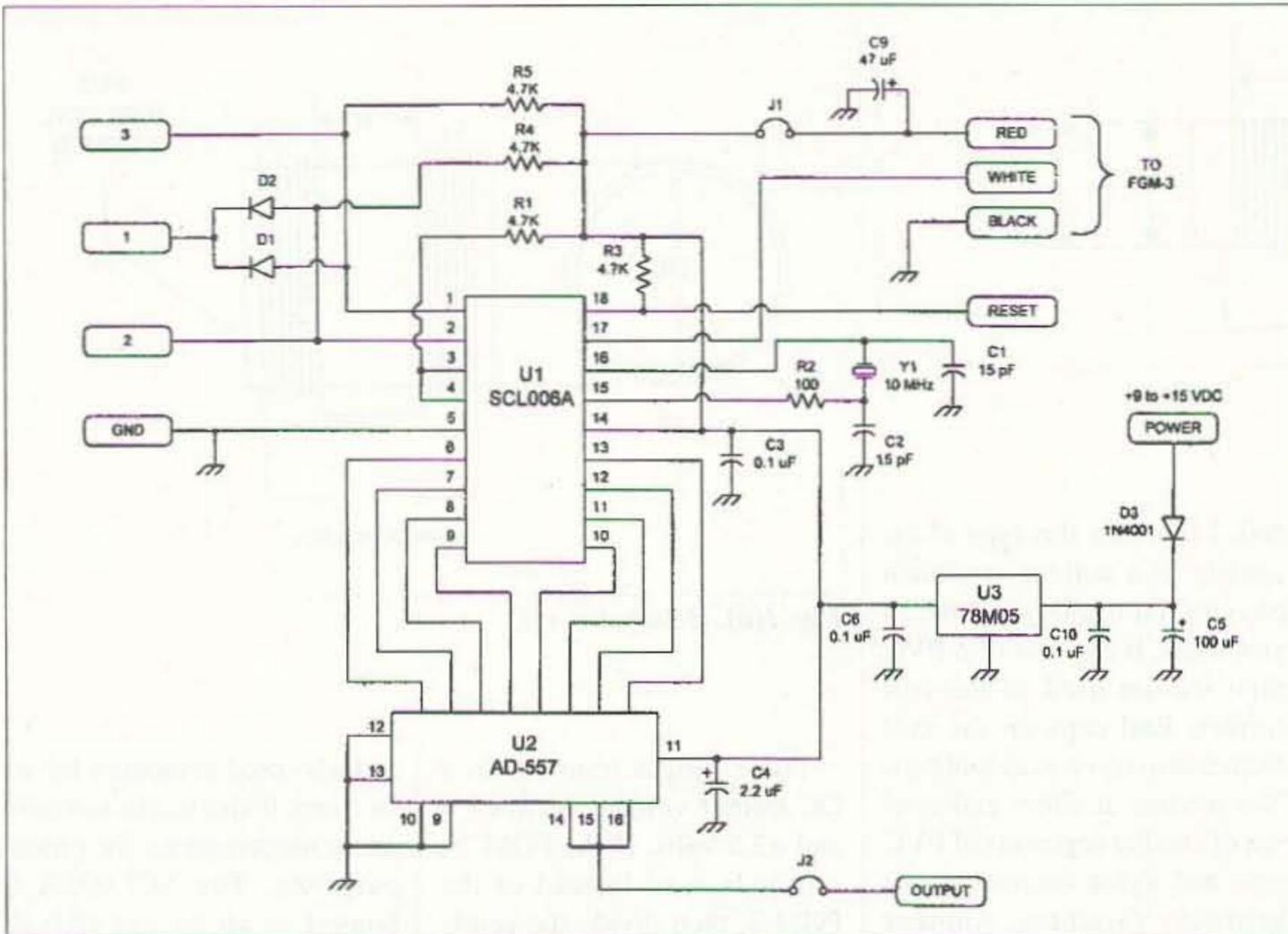


Fig. 3. Magnetometer circuit.

volt batteries so that it can be used in the field. A sensitivity switch provides four positions, each with a different overall sensitivity range. The output signal is a DC voltage that can be monitored by a strip-chart or X-

Y paper recorder, voltmeter, or fed into a computer using an A/D converter.

If you intend to use a computer to receive the data, then it might be worthwhile to eliminate the D/A converter and feed

the digital lines (D0-D7) from the SCL006A directly to an eight-bit parallel port. Not all computers have that type of port, but there are plug-in boards available for PCs, as well as at least one product that makes an

eight-bit I/O port out of the parallel printer port.

Sensor head mechanical construction

When evaluating the FGM-3 sensor, I built a magnetometer using the kit provided by Fat Quarters Software. The printed circuit, switches, and meter were mounted on a small, sloping-front cabinet. The goal was to build a sensor head that could be rotated to find the magnetic field (the FGM-x sensors are direction sensitive).

The solution was to place the sensor inside a 0.75-inch (19-mm) PVC plumbing "tee" connector. Three end caps were provided, one for each port on the "tee." The end cap that was on the down stroke of the "tee" is fitted with a 0.25-inch (6.35-mm) stereo phone plug. When this plug is mated with a phone jack on the top of the project's case, it can be rotated at will.

The sensor is mounted horizontally in the crosspiece of the "tee," while the wires are routed to the down stroke section. The sensor is held centered in the cylindrical PVC "tee" with small plugs made of Styrofoam™ or some other material.

I used a hobbyist's razor knife to carve the larger-size foam "peanuts" of the sort used for packing fragile items for shipping. The finished sensor assembly is mounted on top of the project's case. 73

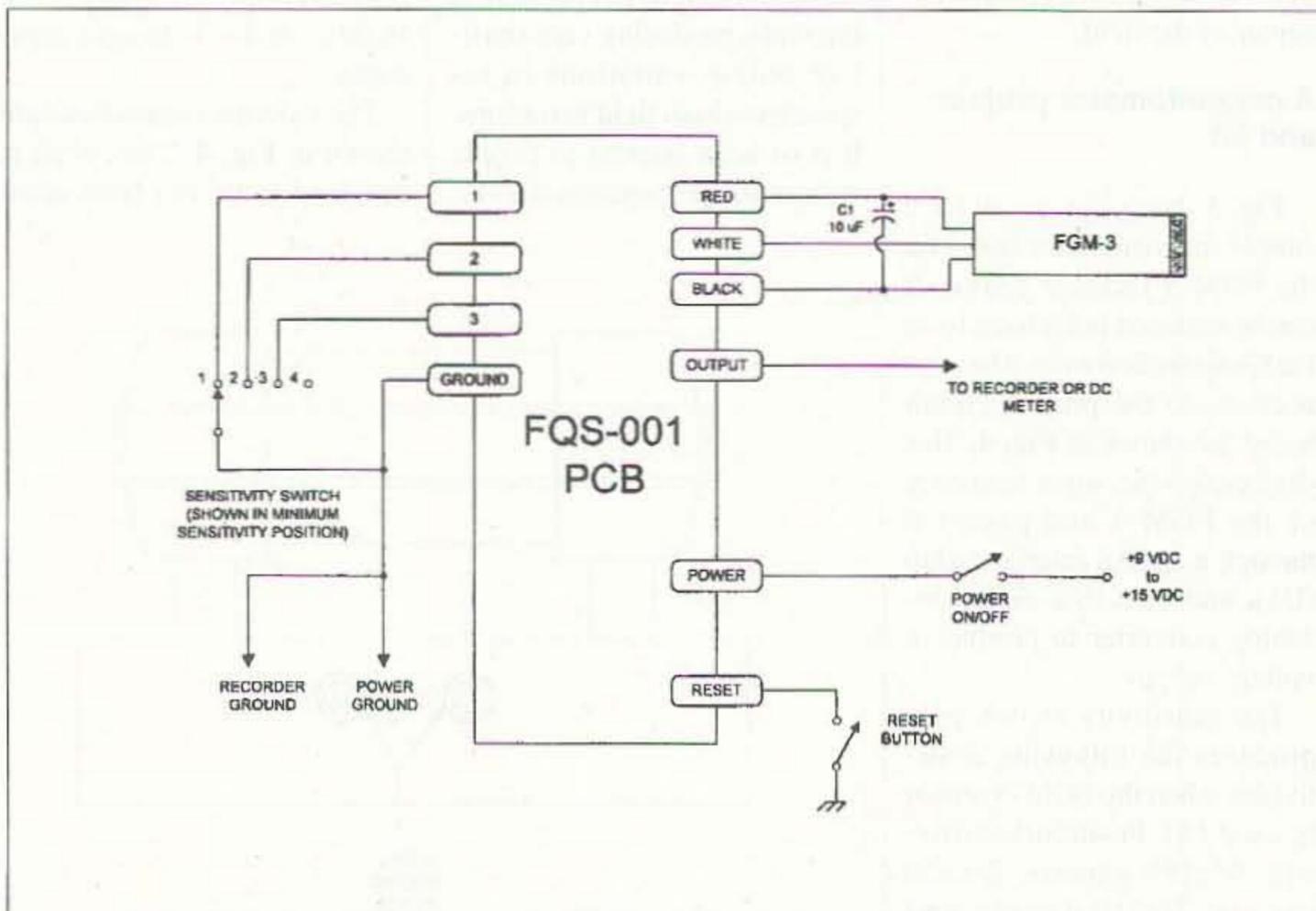


Fig. 4. Printed circuit connections.

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Scrounger's Delight

Meet the Minnesota miser's magmount.

Peter A. Bergman NØBLX
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Brainerd MN 56401

Building and experimenting with antennas is a fascinating part of amateur radio. At one extreme you will find enormous steerable arrays for moonbounce or satellite communications and at the other, simple little whips and verticals.

I was planning to build a set of phased verticals for use on the HF bands and decided to do some experimenting and modeling with a two-meter array first. This gave me some experience on the workbench before I had to start procuring the materials and doing the work on the larger antennas.

The first order of business was to produce some quarter-wave magmount antennas. I've built a number of these in the past using SO-239s, grommets and bolts, and what-have-you to mount the whips, and wasn't quite satisfied with the results. I wanted something that was cheaper, more durable, and more weather-resistant than any of these. One day, while waiting to have my car repaired, I found what I was looking for literally lying at my feet—discarded tubeless tire valve stems.

These valve stems meet all the requirements mentioned above and require a minimum of modification to

make them part of a really good, home-brewed mobile antenna mount.

The place I usually start with one of these antennas is finding an aluminum can and a magnet that match. I have gotten magnets from defunct speakers, but generally I'm able to get a good supply at hamfests. Sometimes I walk around the supermarket with the magnet looking for cans and sometimes I walk around the hamfest with the can looking for magnets. I get fewer strange looks at the hamfest. Usually, Vienna sausage cans are pretty good and Kiwi cans are sometimes a match too, but I can't eat that much shoe polish.

Once I have a magnet that will just fit into the can I've chosen, it's time to prepare the can. I've used full-sized sausage cans but prefer to lower their profile a bit. Keeping in mind that room must remain for the grommet, coax, magnet, and valve stem base, trim some material from the top of the empty, clean can. A pair of household scissors will do the job, but use your own—not your significant other's good ones.

Usually, all you'll need to remove is the rim of the can. Then, very carefully, make parallel uniform cuts

around the cut edge so that the excess material can be folded inside. I've found it helpful to make a ring of #14 or #16 solid wire to fit the inside diameter of the can. The ring is placed inside and the tabs are folded over it. This produces a reasonably smooth edge and helps fill in some of the gaps which might remain between the can and the magnet.

Next, drill the holes for the grommet, grounding bolt, and valve stem. I have found that a "step-drill" such as those made by Unibit™ is very helpful when working with thin flexible material like these cans. At this time, the area around the inside of the grounding-lug hole should be cleared of any lining



Photo A. Components of the Minnesota miser's magmount. (Photo by author.)

material which might be present, to ensure a good connection with the coax braid.

If you want to paint the can to match your vehicle, now is the time to do so. I generally don't, since it makes the antenna look like an auto wart—with a hair growing out of it. If you decide to paint the can, make sure you rough up the outside with fine sand paper. Then wash it with soap and warm water, and rinse and dry thoroughly before attempting to paint.

Until now everything has been pretty straightforward, but here comes

the interesting part. The problem encountered in the past has always been the base-to-radiating element insulator. A used tire valve stem makes a neat solution. It provides a strong, flexible mount with adequate insulation at mobile/portable power levels.

When collecting valve stems, get them complete with the valve core and the cap. Make sure the bottom flange has not been torn in the area where the assembly engages the hole in the can. Used valve stems are frequently available for the asking at tire sales and repair shops.

The modifications necessary to make the valve stem assembly work in this application are minimal. First, drill a hole through the top of the cap to pass the wire you have chosen for the whip. Next, remove the valve core and nip off the brass top portion above the main part of the threads, being careful not to deform them. Then nip off just enough of the bottom to allow the internal parts to fall out. This should leave a threaded brass bushing with an inside diameter sufficient to pass the whip.

After installing the rubber parts and the grounding lug, select a piece of coax and install a connector to match your rig. The old rule for feedline length is: enough to reach from the antenna to the rig. For mobile installations, I prefer RG58 since it seems to survive repeated door slammings better than RG8-X, although the loss is a bit higher. But even at 440 MHz, a typical length of RG58 is only going to lose one dB in all. Using 9913 would cut that to about 0.27 dB but good luck if you try it on a mobile setup. Unless you drive an oil tanker to work.

If the top of the can you selected looks a little too floppy to suit you, install a suitably sized "fender" washer as shown in Fig. 1.

Installation of the whip comes next. I've used a number of materials in the past, including #14 house wire, aluminum rod salvaged from TV antennas, coat-hanger wire, and my favorite, copperclad-steel antenna wire. The house wire is okay but is so soft I spend a lot of time thinking I ought to straighten it. The aluminum is out for this application because it is hard to solder and the coat hanger won't do because the YL takes inventory too often. Ditto, the broadcast antenna from her car.

When making a quarter-wave whip for two meters, I like to start with about two feet of wire. I figure that if I start with a couple inches too much, I may waste that couple inches, but if I start with a bit less than enough, I've wasted all of it.

Slide one end of the whip through the valve core far enough to make it easy to solder it to the coax. Mark the

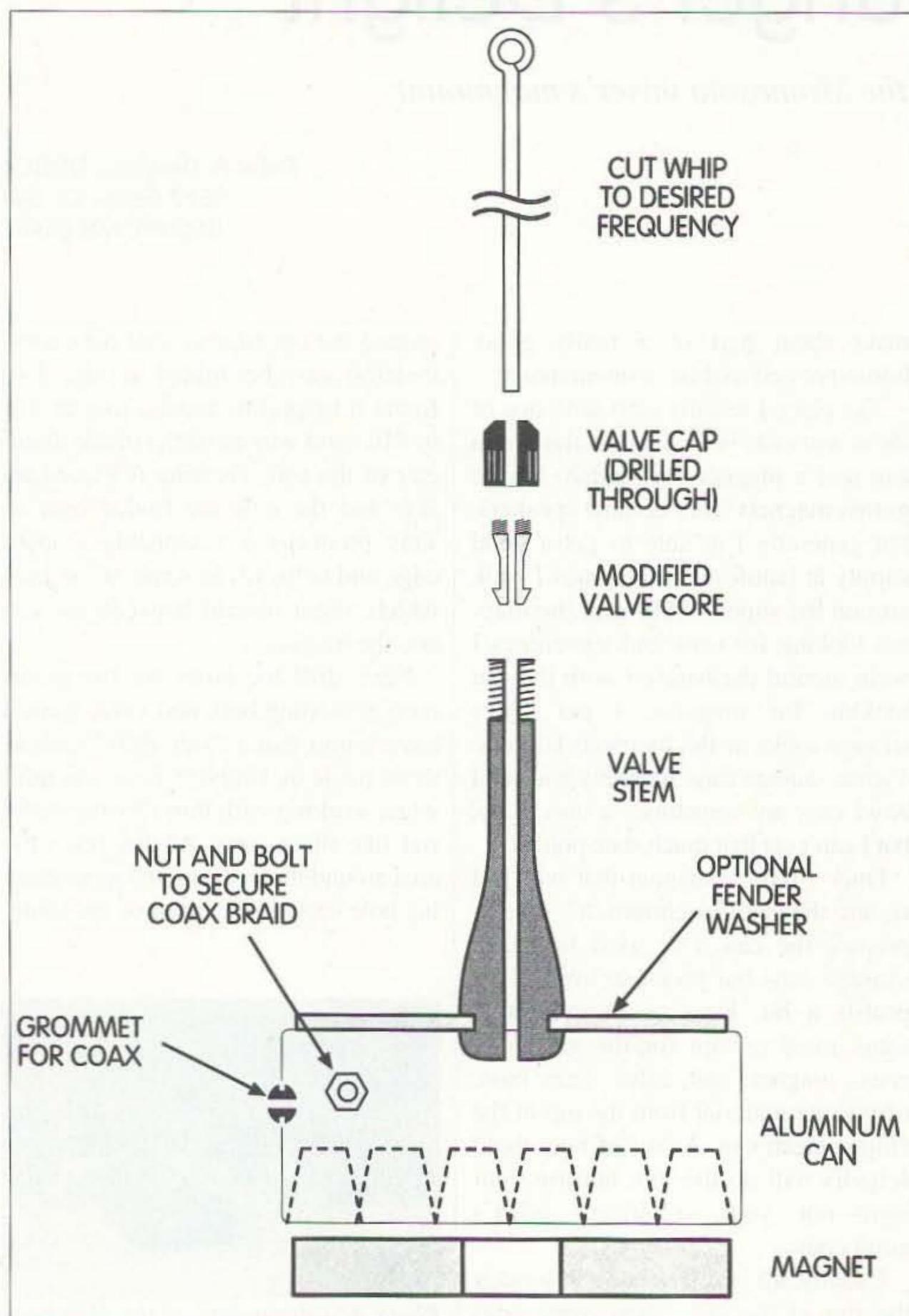


Fig. 1. Diagram of the magmount antenna.

wire just above the top of the valve stem. Then slide the wire out and clean it so that it shows bright shiny metal from the mark to the bottom. Now, install the "modified" valve core and measure the distance from the top of the stem to the top of the core. It should be about 3/16-inch but may vary depending on how severely you modified the core. Place a second mark on the whip material 3/16-inch or whatever distance you came up with down from the first mark. Remove the core from the stem and slide it onto the whip to the second mark you made. Solder it in place, being careful not to slobber solder all over the outside or on the threads.

Now you can screw in the whip assembly and install the coax you measured earlier. Install the magnet temporarily and slide the whip through the hole in the valve cap. Now you're ready to trim the whip length for the lowest SWR at the desired frequency. When you start trimming the whip, remember that you don't have to take off much material to move the resonant point 100 kHz, and once you have cut it off, it is hard to put it back. That is why we install the magnet temporarily at this point.

Also remember that we do not want to leave the top end of the whip sharp and pointy. A pointed end on the whip will have more trouble with static discharge and is not as safe. Remember what Mom said: "You could put your eye out with that thing!"

I have tried a number of methods of blunting the top of the whip and the simplest I have found is to curl the top of the whip into a small "eye" and coat it with solder. Form the eye while the whip is still a bit too long, and then measure the SWR again. If the whip is still too long for the target frequency, keep curling. After you have made a few of these whips, you'll probably develop an eye for it and know when to stop cutting and start forming the eye.

Once you have the whip trimmed to the proper length, it is time to install the magnet permanently. If the magnet is a bit loose, wrap it with a strip of duct tape until it is a press-fit into the

can. Then glue it into place. I prefer RTV cement because it withstands weather and vibration well.

Whether you decide to use the guidelines presented here or try a design of your own or build some other device, using something you have made yourself is always gratifying. 73, have fun, and keep your stick on the ice. 73

NEVER SAY DIE

continued from page 49

Psychometry

Is time travel just science fiction? Or is it not only possible, but available to anyone and usable for practical purposes? If you could travel into the future (and come back), how would you use the information you could glean? One obvious practical application would be to take a good look at a future newspaper, note where some stocks are then, and invest in the appropriate ones now.

Bevy Jaeger, in her book, *Psychometry*, explains how you can develop your ability to do just that. I found the book fascinating.

As I mentioned when I reviewed Owen Lehto's book, *Vibrations*, my grandfather taught me how to dowse when I was a kid. We lived on a small farm (150 acres) in northern New Hampshire with a fireplace and a wood stove in the kitchen being the only heat sources. No electricity. No running water. No indoor toilet, just a backhouse out in back of the hundred-something-year-old barn. Dowsing didn't make any scientific sense, but it worked.

We have an awful lot to learn about ourselves. About past lives and reincarnation. I've regressed dozens of people to past lives. It's easy, and everyone has 'em. About Heaven and Hell. About near death experiences (NDEs). About out of body experiences (OBEs). About remote viewing, which is real enough so our beloved government has spent millions using it.

About how we can communicate with plants and any other life forms. About how our own cells are in communication with us, even when separated by thousands of miles, or even in someone else's body as with an organ transplant or blood transfusion. About how twins raised apart have so many coincidences. About serendipity. About how we can make things happen that we want, as explained in the *Dilbert Future* book. About ghosts. About telepathy, psychokinesis, clairvoyance, and fortune

telling. About angels, spirit guides, and where composers and writers get their inspiration from.

The no-brainer approach is to dismiss all this as hogwash. That's *The Skeptical Inquirer* and the *Scientific American* approach. But that's no more honest than the *National Enquirer* approach of accepting anything, and then grossly exaggerating it.

When I read Bevy's book I accepted her challenge, picked up a letter at random, held it in my left hand (that's the input hand for right handed people), and let anything at all come to mind. I immediately saw a huge waterfall. Hmm. I tried again and got smaller falls, but still waterfalls. Then I opened the letter and found it was from someone in Sioux Falls, SD.

Several of the books in my *Guide* to books you're crazy if you don't read have to do with similar subjects. This stuff isn't baloney—I've had too many personal experiences with it. We need to do more research and see if we can't tie everything together.

Getting back to Bevy and her book. She's helped solve many crimes with her psychic abilities. Her book explains how you can develop yours. And you *do* have them. If you are interested in seeing

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's Five Buck Books:

98 Books You're Crazy if You Don't Read. Brief reviews of books that will help make you healthy, wealthy, and wise. If you are sick you did it to yourself through messing up your body. This is probably the single most important five bucks you'll ever spend.

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Grist I. Fifty of Wayne's recent non-ham oriented editorials. They're about almost anything and guaranteed to almost make you think. You'll sure have things to talk about on the air other than your antenna and the weather.

Grist II. Fifty more non-ham editorials. Even more fascinating stuff to think and talk about.

what the future stock prices are going to be, Bevy explains how you can develop this ability. So why not try it and at first make pretend stock investments and see how much you would have made if you'd used money? Once you know what you are doing you'll be set to make all the money you want and spend some time helping me to make our country better.

The book is available from Aries Productions, Box 29396, Sappington MO 63126. It's \$6, 119 pages, ISBN 9 100035-08. I'm not sure how much they charge for s/h. Buy several and give them to friends.

Lehto, in his book, explains how you can dowse almost anything you want. You can even find something on a map.

When I get some time I've got five other books that look interesting on divining that I've got to read.

Coincidence

I've been reading about the Great Pyramid again, and the more I read, the more questions arise. Was it by plan or just a coincidence that the Great Pyramid of Giza is located at exactly 30° North and 30° East? Is it a coincidence that the pyramid is built on one of the few (or only) flat granite foundations in the world which could support its enormous weight? Is it a coincidence that it is located at the exact center of all the land masses of the Earth? Is it a coincidence that the sides face exactly north, south, east and west? Is it a coincidence that the measurements of the pyramid embody logarithms to the base *e*? That another measurement shows the distance in light years to the North Star at the time the pyramid was built? That the concave sides of the pyramid are the exact same arc as the curvature of the Earth?

And so it goes. The more you read, the more the coincidences pile up! How old is it? The estimates range from 4600 years ago to 12,500. With all of our high technology and massive equipment today we could not duplicate

the Great Pyramid. Yes, it was supposedly built before the invention of the wheel. The massive blocks were cut to watchmakers' tolerances and put exactly into place. Millions of them. A tomb for the pharaoh? So why was he buried hundreds of miles away?

The periphery of the pyramid, divided by twice its height is equal to *pi*, to several decimal places. And this was thousands of years before geometry was developed. The periphery in Jewish inches is 36,524. By coincidence there are 365.24 days in a solar year. It gets worse, the four sides are of slightly different lengths, with the number of inches varying exactly by the lengths of the four seasons.

The average height of all of the land on Earth is 5,449 inches. By coincidence (naturally), this is the exact height of the pyramid.

The coincidences go on. Get a book or two on the subject and see for yourself. This is a lot more interesting to talk about on the air than what rig you decided to buy.

A New Paradigm

Most of us old-timers in amateur radio are living in the past and are doing our best to ignore the realities of the 1990s. Since I first started making 40 meter CW contacts and phone on 160 meters with a 6L6 crystal oscillator modulated by another 6L6 60 years ago, I qualify as an old-timer, so I can speak with some authority.

I spent years at my workbench building ham, audio and other electronic equipment. My cellar was filled with enough parts so I could build just about anything. When I moved to New Hampshire from Brooklyn in 1962 it took four vanloads to move me.

But, as I saw the changes transistors were making, I held a huge auction of my stuff in 1965 and almost gave away tons of surplus equipment and parts. Big boxes of tubes for a buck. Thousands

of tubes. I wanted to find good homes for my collection.

So here we are, coming to the end of the 1990s, and the world is so changed from the one I knew in the '30s, '40s, and '50s, that it really is a different world. That was back when we had over 850 ham radio stores around the country; back when American companies were the major manufacturers of ham gear—Hallicrafters, National, Hammarlund, Gonset, Barker & Williamson, Technical Material, Harvey Wells, Multi-Elmac, Thordarson, Stancor, Bud, Millen, Eico and Heathkits, and so on. It was when I could go downtown to Cortlandt Street, in New York, and shop at dozens of radio stores for parts. It was when the Allied Radio catalog was like a telephone book.

Today we have around a hundred ham dealers and no parts houses like we had in the old days.

But then it was not just possible, but *practical* to build your own stuff. Oh, hams stopped building receivers soon after the first commercial ham receivers were made available, but we still built our own rigs, our VHF equipment, RTTY, and so on—and we had a ball doing it. I spent so much time at my workbench that eventually I'd twisted my pelvis by standing most of the time on one foot. A chiropractor showed me the X-rays.

Once Japan took over our consumer electronics industry we no longer made parts in America. Gone were the bargain surplus parts from manufacturing overruns. Companies ordered more parts than they needed because it was cheaper to sell off or throw away the overage than to not have enough parts for a production run of equipment.

As ICs replaced discrete parts, even the parts stores in the Akihabara section of Tokyo (their version of our old Cortlandt Street), gradually blew away.

Today's reality is that most commercial equipment uses as many ICs as possible, with

a minimum of discrete parts. This makes it almost impossible for us hams to either modify or service the stuff. When it stops working we have to send it to the factory service department. And rolling our own, unless it comes in kit form, is getting less and less practical.

Yes, it was fun building. I loved it. But that was another era. Yes, it was great when we could fix our equipment when it broke. But that's impractical now.

In the days when we designed and built our own stuff it was important for us to learn radio and electronic theory. You fixed a receiver by having the right test equipment and the know-how to signal trace. Now you put it back in the box and let UPS handle the problem.

When my HT stops working I don't take it to my workbench where I have a bunch of test equipment. Heck, all of my test gear was stolen years ago by past 73 editors and I've seen no good reason to replace it. Tube testers? Har-de-har. Transistor testers? They don't use many transistors any more. A signal generator? How'm I going to trace anything in that tiny rig?

So why are we asking theory questions on the ham exams? Because we always have. Why are we still testing for Morse Code? Because we always have. So we have us old-timers living in a world that's only left in our minds. And we have the new generation, grumblingly memorizing the Q&As to pass our ham tests, which are a relic of long gone days. By not being interested in upgrading, even to General, they're telling us loud and clear that it's time for the old-timers to rethink what this hobby is all about. But getting the average old-timer to think is a challenge that I have been successfully failing at for years.

The newcomers already outnumber us old-timers, but unfortunately they have no national organization to help them express their interests or bring them together. So, for

the foreseeable future the Old World Order and the Balderberg group will keep patching the Great Wall of CW to keep the infidels from polluting our HF bands.

When the microcomputer revolution started it was fueled by thousands of hobbyists who were building their own personal computers, led by *Byte*. Take a look at today's shriveled issues of *Byte* and see for yourself that people, and youngsters in particular, are no longer technically inclined.

In the ham hobby the newcomers are refusing to join the ARRL by the hundreds of thousands. Computer hobbyists today want to use computers, not design and build them. Hams today want to use ham gear, not design and build it. The ARRL directors, all being old-timers, have been hard-nosed about maintaining our traditions, no matter how out of date with reality. So, instead of our having five to 10 million hams we have maybe a couple hundred thousand even remotely active. And just about zero clout. And that'll only be a problem if another service comes along that wants our frequencies, or if the new FCC Commissioners wise up.

Class of '38

Whew! With the help of a lot of luck and some good living choices I've managed to be active in amateur radio for 60 years. My first contacts were back in 1938 on 40 meters, back when everyone was crystal-controlled. And on 160 m with a 6L6 crystal oscillator modulated by a 6L6, driven with a carbon mike.

160 was a ball, with groups of three to six of us all working duplex. It was just like sitting in a room with everyone. By 1940 the FCC had outlawed that kind of nonsense.

I was living in Brooklyn at the time and had a map with every ham in Brooklyn marked on it. I visited many of them, a kid on roller skates. I remember Stan W2ET, who, even though blind, built all of his own equipment.

In 1941, just before World War II broke out, I won the Eastern New York section in the ARRL's Sweepstakes Contest. Wow! The next thing I knew Pearl Harbor had been attacked and we were all off the air for four years.

In 1942 I joined the Navy as a Radio Technician 3/c and went through their electronic schools in Maryland, San Francisco, and Pearl Harbor. As an Electronic Technician 1/c I was assigned to the Drum SS-228 in 1943 and made five war patrols. From there, in 1945, I taught school at the Submarine Base in New London until my discharge in 1946.

I was on the air on December 7th, 1941 and back on again the day the FCC again opened the bands in 1945, using the 2-1/2 m transceiver I'd built in 1939.

It was my ham ticket that paved my way into the Navy and it has guided most of my life ever since.

Go Navy

A note from K6DC asks me, as an old Navy man, to have you check out the NSS Web site at [<http://www.members.aol.com/k6dc/nss.html>].

Merle says that Don Stoner W6TNS/4 is poking the keys for the project, since he was at NSS during WWII with his mom and dad (K6HX). Check it out, you old swabbies.

IRS Collapse?

Will the "Millennium Bug" destroy the IRS? That's the year 2000, which older computers will be unable to handle. It'll look like 1900 to them.

Last year the IRS's chief information officer Arthur Gross admitted to Congress that its \$4 billion, 11-year attempt to modernize its computer system had failed. They have 63 aging mainframe systems and I don't think they even can guess how many microcomputers. They have a staff of 7,500 just involved in computer maintenance, and \$1 billion a year for that budget.

Their whole information system is apparently a terrible mess, with many systems unable to communicate with others. The old mainframe systems have as high as 30% of their software written in assembler language, which few programmers today even understand. That's just one step above machine language! Will the IRS be able to fix 62 million lines of "noncompliant" code by June 1999, thus allowing their systems not to crash as the Millennium Bug hits? But there are some little problems—like missing code records in the field offices and missing manuals everywhere. Their system is spread out in three major computing centers, with 60 of the mainframes in 10 regional field offices—and none of the mainframes yet programmed to deal with the year 2000.

What can they do? There aren't enough assembly language programmers left in the world to update their present antiquated systems, even if they had the documentation needed to help them put in the patches. And there surely isn't enough time to start over from scratch.

Apparently they've been adding one patch after another as problems have arisen. But due to the complexity of the system, these patches have, lacking the manpower and time, been implemented without being tested, and that's led to more and more bugs in the system.

So today the IRS has a hopelessly outdated system which is near collapse and seemingly unfixable. Then, to cap it, the year 2000 mess is inexorably approaching.

Maybe it's almost time for Congress to get serious about a flat tax and retirement for the IRS staff. With unemployment at record lows, we might be able to find work for them in the private sector.

What will happen if on July 1, 1999, when the fiscal year 2000 starts, the IRS computers grind to a halt? When the revenues suddenly stop, what's going to happen to T-bills and T-bonds which banks and

money markets have trillions invested in? Our whole financial system is a house of cards anyway, so something like this could topple everything, suddenly making our dollar bills worthless. The ugly new hundreds, too.

If you don't understand the flimsiness of the Western banking system you need to read chapter III of *The Delicate Balance* by John Zajac. It's only \$15 from John at (408) 226-0750. Wayne sent you.

It'll be interesting to see what happens. Stay tuned.

Our Ham Megapublisher

The League sent me an ad for their 1998 *Handbook*. Now, I knew the ARRL had a bunch of publications, but until I looked over the list they sent with the *Handbook* promotion, I hadn't realized the extent that publishing is the League's main business. I counted 92 ARRL publications on their order blank. Plus a bunch of cassettes, videos and CD-ROMs. As they say, if you want to know what's going on, just follow the money. The League may be masquerading as a membership organization, but the reality is that they are a giant publishing company. That's where the money is, and that's where their interests lie. Now shut up and re-elect your old director.

Those Pesky EMFs

Did you get sucked in by the National Cancer Institute stories claiming that there was no evidence that power line electromagnetic fields increase childhood leukemia risks? A couple of 73 readers "proved Wayne wrong" by sending me newspaper clippings on the NCI releases. If the reporters had read the fine print in the NCI report they'd have found four places where it was admitted that there was a statistical increase in acute lymphoblastic leukemia in children exposed to power line magnetic fields in excess of three milligauss. Researchers dismissed as a

fluke a 24% increase in leukemia risk for children exposed to high magnetic fields.

The leading researcher in the field is Professor Ross Adey K6UI, who is the author of many papers and books on the subject. It must be extremely frustrating to Ross to see these NCI distortions getting such media coverage.

As Ross has pointed out, our cells are electrical and any stray magnetic fields tend to disturb the communications between cells and in their replication. Whenever you pass a magnetic field through a conductor it generates a voltage, so it's no wonder that 60 Hz fields can increase leukemia in children, whose cells are growing and expanding at a high rate.

Those Pesky Vaccinations

For any readers who think I got carried away by the Walene James book on the dangers of immunization, there's a six-page article in the Oct-Nov issue of *Nexus* magazine confirming these dangers and backing up James' reports of her research. I was offered a flu shot the other day. No thanks! I prefer to eat right and keep my immune system strong so it can reject colds and the flu.

Lasers

Unless you've insulated yourself from the real world, you've been reading about the use of lasers for communications. They're wide-band enough to be capable of handling 100 TV channels. It would take about a half second to send a complete encyclopedia via a laser.

Some years ago, when I was having fun on 10 GHz, I proposed using the simple transceivers we can make for that band for repeater links and control. That would free up big chunks of the 450 MHz band. With the directivity of dishes, almost every repeater in Southern California could be controlled on the same channel without any interference.

But now, with lasers, those could be used for repeater

control and monitoring. Or are we going to continue to stay 20 years behind the current technology? Well, I suppose that's better than staying 80 years behind with CW.

More Moon Madness

René's book, *NASA Mooned America*, in which he claimed that the Moon landings never happened, either is wrong or we've all been had by the greatest hoax in history. A \$40 billion hoax.

René gave 30 compelling scientific reasons why he doesn't believe that man has yet visited the Moon. I mentioned in an earlier editorial that, lacking moisture, the dust on the Moon should not have shown the clear footprints and Rover tire tracks. Several readers jumped on this, claiming that even very dry dust of some kinds can hold footprints. Hmmm, maybe.

Now I've learned that Fred Whipple of the Smithsonian, as cited in *Exploration of the Moon* by Branley, said that dust particles would become tightly packed together without gases to filter in between and separate them. An experiment to verify this was done by Dwain Bowen of North American Aviation. He released a steel ball into a container of fine dust, where it promptly sank. When the same ball was dropped into the same dust, but in a near vacuum, the dust had formed a hard crust that stopped the ball at the surface. Thus, either all of the photos showing footprints and tire tracks on the Moon were faked or else there had to be an atmosphere there. No mention has ever been made of our astronauts discovering any atmosphere on the Moon.

Indeed, with the Moon supposedly having one-sixth of Earth's gravity, any atmosphere would have soon been dispersed into space.

So, could the Moon actually have more gravity so it could hold air? Calculations for the mass of the Moon, using its path around the Earth and the Sun, give us an accurate estimate of its mass. And,

unless Newton was wrong, this also tells us how much gravity it should have.

William Brian, in *Moongate*, raises questions on this. He points out that the neutral point, where a space ship would change from the Earth's gravitational attraction to that of the Moon, has been calculated to be from 22,000 to 25,000 miles from the Moon, depending on its distance from the Earth at the moment. The average is 23,900 miles. This figure was published in a number of reference books, including the *Encyclopedia Britannica's* 1960 edition.

Now we go to a 1969 book by Werner Von Braun, who sure ought to know, in which he gives the neutral point as being 43,495 miles from the Moon. The 1973 *Britannica* gives us 39,000 miles. Now, for these figures to be correct, the Moon's gravity would have to be 64% that of Earth instead of 17%. What's going on here? Even if the Moon were made of solid lead it wouldn't have that much mass.

Brian has analyzed the data on the speeds and times NASA has released of the Apollo craft and the numbers are so far out of whack that they just don't make any sense.

It gets worse. If the Moon does have the gravity which would put the neutral point at 39,000 miles, then our space capsules would have to carry more fuel in order to slow down to land. The amount of fuel required and the tanks to hold it would be almost as large as the entire rocket used in the Apollo launches, doubling its size. So obviously that didn't happen.

If the Moon's gravity is 1/6th that of Earth the astronauts should have been able to jump seven feet in the air, even in those bulky suits. Their best jumps were about a foot. Just like on Earth. Which suggests that either the Moon's gravity is close to that of Earth or else they weren't there. Brian looked over the films of their Moon walks and noticed that one had to help the other get back

up when he stumbled, and that they all got tired climbing even low hills. Heck, they should have been bounding around like kangaroos and hoisting themselves up the ladder to the LEM with their arms. Which they didn't.

Photos with the Sun in the background showed the sky lit up like it is here on Earth. If there is no atmosphere in the Moon, there should have been nothing to light up the sky.

It comes down to: The photos from the "Moon" either were taken on a Moon with about Earth's gravity and air, or they were faked here on Earth. If it does have that much gravity, then where's the missing mass needed? Or do we have to throw out Newton's laws?

I am now convinced that when President Kennedy said we'd send a man to the Moon and got Congress to budget for it, that when NASA found that the mission was impossible with the technology at their command, they were faced with either losing about \$40 billion and probably NASA, or faking it. I further believe that NASA, probably with the help of the CIA, had to manage a string of murders (as detailed in René's book) of potential whistle-blowers to keep the hoax a secret.

Juke Boxes

When I was a kid juke boxes had a stack of 78 rpm records in 'em. Nowadays it's CDs and a capability for storing 500 songs. The next step shouldn't be a big surprise—juke boxes with the recordings all in memory which is updated via a telephone.

When I was in college I'd buy 78s which had been used in juke boxes for a dime each. One side of the more popular records was well worn, but the other was brand new. I have a 1940 picture of my mother in front of Sam Goody's store on Cortlandt Street in NYC, where he sold used juke box records for a dime. Sam obviously did well.

Continued on page 86

The Official 1997 "Never Say Die" Index

A three-volume reprint of Wayne's editorials, in large type, is available from Radio Bookshop for \$15.

Volume I:

January 1997

Resolution — Resolve now to make major changes in your life.
 The Camel's Nose — Congress smells money selling our bands.
 ARRL Worried — But has no plans other than to ask for money.
 The Michigan Miracle — State budget is balanced, debt retired.
 Those pesky ETs — Have they been visiting for millennia?
 Rejuvenation — An update on the magic of the Bioelectrifier.
 Cesspool — 14.313 is still garbage. ARRL doing nothing.
 Professors and Beards — Do beards go with low self-esteem?
 Vegetizing — Wayne's coleslaw dressing recipe.
 Government Control — Forcing your beliefs on everyone.
 Oxygen — How to cope with the decreasing oxygen supply.
 The Value of College — Putting college costs into perspective.
 Schools — Costs are way up and education is way, way down.
 Magnetic Healing — We sure have a lot to learn about this!
 Bioelectrification — Done with two dimes and a 27V battery.

February 1997

"The Weather Here ... " — A plea for better radio conversation.
 The Dennis Lee Debacle — *Caveat emptor!*
 Grist — Two collections of my editorials.
 Boilerplate — 43 of my ham-oriented editorials in a \$5 reprint.
 Shocking — Electric fence jolt cures virus!
 Memorial — What are you contributing to the world?
 Congratulations! — The gov't is now taking 50.4% of your pay.
 Justice — Our so-called criminal justice and correctional system.
 AIDS, HIV, and Other Baloney — Let's face the truth.
 Dr. Fisher Disagrees — But not a whole lot.
 Scientists — They play the prestige game, but make little money.
 Fluorides, Again — Report available showing genetic damage.

Do It Yourself! — It's time to sit down and write.
 Placebos — Powerful medicine if we learn how to use 'em.
 What Is the Truth? — Weird things are happening.
 Day Care — What kids should be learning, not what they are.
 Portable Classrooms — Bringing education to the kids.
 Arrested! — Yes, your ARES card can get you arrested!
 Nondisclosure Agreement — Another product you can make.
 Okay, Gadgeteers — Get busy and make a million.
 Selling Music — Selling ethnic music to restaurants.

March 1997

Schools Finally Reinvented — The Sudbury Valley School.
 Mooned Again — Were the Apollo trips a \$40 billion hoax?
 Scientist Welfare — The supercollider, hot fusion, HAARP, etc.
 Pork Chop Hill — More examples of congressional pork.
 Superhuman — Let's study people with unusual abilities.
 Virus! — How can a virus travel via UV light?
 DX News — Working it, and visiting DX hams.
 Bum Tubes — Look for a tube tester at flea markets.
 Death Sentence or Wake Up Call? — Cancer.
 Money Is the Root — "Money is our downfall."
 NOYB — Excising your personal data from Lexis-Nexis records.
 Star Trek™ Nonsense — Galactic battles? Ridiculous!
 The Fat Life — 34% of us are clinically obese and will die early.
 Hamfests — They're dying. Here's how to improve them.
 Speed — CW and packet are years behind current technology.
 Half Our Population — We should have five million hams.
 Intruders — Hams selling ham band gear for commercial use.

April 1997

The Handwriting — The disappearance of HF ham operators.
 More Bio-E News — More miracles have been reported.
 The Freon™ Hoax — Did DuPont™ dupe us all on this one?
 School Costs — Cut 'em in half and improve the product.
 Building Skills — My list of skills it's advantageous to build.
 von Däniken Again! — The pyramids made out of concrete?
 Weird Forces — How the "pyramid effect" was discovered.
 Another Gloom and Doomer — Countering rising CO₂ levels.
 The Federalist Papers — Weakness = subjugation, not peace.

Sharks! — Can shark cartilage really help cure cancer?
ZL Media Flurry — Media ado when ZL youngsters placed 14th.
Self-Abusers — Smokers and alcoholics make lousy employees.
State of the Art — We need to sell kids on amateur radio.
Parenting — Is not intuitive. Read or screw up your kids.
Wayne's "Been-There-Done-That" list.

Volume II:

May 1997

220 Pffft? — Will we lose the rest of the band to the LEOs?
East vs. West — American ham license growth vs. the Japanese. Ugh!
Bad Apples — K3ZO wins an award for rude behavior.
The Code Again — The code prevented DeForest from getting a ham ticket.
Our Story — Let's get ham stories into the newspapers and on TV. Or else.
Talk Radio — The Art Bell W6OBB show - coast to coast. Wow!
Hey! Wake Up! — Are you still commuting to work? Yuk.
Cancer — Half of you will get it unless you change your wicked ways.
Screw The Generals — Like General Motors™ and General Foods™.
Shortchanged — Our country is run by the crooks. Am I exaggerating?
Wayne Disappeared? — If I keep making waves it could well happen.
The Magic Bullet — In praise of the Bioelectrifier. Build one.

June 1997

Bio News — More praise for the Bioelectrifier. Built one yet?
Pirating — Another business opportunity for the motivated.
FCC Swat Teams — Indecent talk is now illegal! Calling all lawyers.
Positive Action — A better approach to the LEO problem.
Conspiracy — Unless you make a fuss we're going to get screwed. Again.
CC&R — Watch out for the fine print!
Red-Green — Foods fall into two groups. Are you eating the wrong one?
Flight 800 — It started late. Guess what plane was supposed to be there?
Ear Plugs — Yes, I should shut up and stop trying to motivate you.
Revolution! — Wherein I again try to motivate you. And probably fail.
Good PR — A few clubs get stuff into the papers. Too few.
It's Too Late — You've graduated college so your education is complete.
Secrets — Actually, the gov't is pretty good at keeping 'em.
Fried Brains — Scientist proves cell damage. Permanent damage.
Diehards — Cold fusion update, and why it's working so well.

July 1997

What More Can I Say About Hamfests? — They're dying.
NASA Confirms Cold Fusion Excess Heat! — And it only took eight years.

Nut Case — I plead guilty to being a bona fide nut. With an explanation.

Quid Pro Quo — Welcome to Glen Baxter K1MAN's empire (in his mind).

Xtal Sets — They're easy to build; great stuff for kids.

Oh Oh Ozoned — Yes, we've been suckered again. Big surprise.

Tandy Shakeup — Have they finally canned president Roach?

The Last *Callbook*! — Yup, it'll just be on CD from now on.

Business Incubation — How to successfully start new small businesses.

Clubbing Us — Ham club president idiocies.

Mooned Again — We're still looking for ETs in the wrong places.

The Ham Impact — Tell me about *your* adventures.

Those ARRL Proposals — Rearranging the deck chairs on the Titanic.

Books For Crooks — A new kind of prison library proposed.

Guts — One person can make a big difference ... but only if he tries.

Distant Learning — Using books and videos.

Another War Lost — The wars on drugs, poverty, cancer have been lost.

August 1997:

Milestone — My 75th birthday! But most of my close calls were ham-related.

To Recap — How 73 got started. Well, it seemed like a good idea.

Sucker — Are you fat, dumb and unhappy? Most of us are.

Books — Radio Bookshop, *CQ Magazine*, and the book biz.

Viva CW — The slowest way to communicate.

Vanity, Vanity — Why I'm still portable 1 after 35 years.

Six Flags™ — The game park was great; the amusement park was a bomb.

Avoiding Shots — You don't have to let 'em poison your kids.

Water — Are you still drinking city or town water? Forsooth!

FCC News — Much easier reciprocal operating a-coming.

Liar Liar — Bribery is impeachable. Art. II, Section 4: the Constitution.

Boiled Silver — An update on making colloidal silver.

DVD — Those pesky new digital video disks.

My goals: Make hamming more fun, help you be healthier and happier.

Volume III:

September 1997

Happy Birthday 73! — Wherein we start our 38th year of publishing.

Medical Update — Why the Bioelectrifier is being ignored by doctors.

Our Oblate Spheroid — Can the poles suddenly shift to the tropics?

Basics — Here's a recommended electronics fundamentals book.

Antiques — Breaking loose from the FCC straightjacket.

Webbing It — We're going to start listing Web sites of interest.

The FDA — How the FDA crushed a doctor with a proven cancer cure.

Shooting Kids — More proof of the immunization scam.

Making Your Hobby Pay — Writing articles for 73 can pay off!

Gutted!— More unnecessary surgery. There's a better way. While I'm at It — You really do need to get UVs into your eyeballs.

Snowballs From Heaven — Some as big as a house are hitting the Earth.

Those Moon Rocks — Did they really come from Antarctica?

Baloney! — If you disagree with me, have you done your homework?

Dim Bulb — Can the light of reason prevail? Not likely.

Crop Circles — Weird, and there's no known way for us to make 'em.

Call Me Stinky — What poisons are you putting on your skin?

Your Tax Dollars At Work — Funding tyrants. The new Haitian mess.

New Hams — Yep, 95% of the new hams are Techs.

Laughing All The Way — Another good weapon against that killer stress.

DVD — Digital video disks hold nine times more data.

Pesticides — They're only needed for sick crops. Wash 'em off!

Autism — Caused by DPT shots.

Reinventing Hamfests — Hamfests are slowly dying — new ideas needed.

Commercial Exhibitors — Coddle them. Give them a forum.

Speakers — How to get speakers who will draw crowds.

Hamfest Committees — How to build attendance at hamfests.

Food — Have good food available. Beer is a bad idea.

Those Suffering Wives — They need more entertainment at hamfests.

Bringing In The Techs — It's going to take a special effort to get 'em.

Cleaning Up — Sneaky way to clean up our foul-mouthed hams.

October 1997

Addiction — The cigarette addiction is one of the worst.

Get Off Your Duff — And start writing articles.

Why Doctors Are So Bad — They're prisoners of a lousy system.

Those Darned Fluorides Again — They're killing 60,000 of us a year!

Change — Leaders embrace change; the sheep hate it.

Can 200 million Americans Be Wrong? — They may be right about UFOs.

Murdering Millions — Winding up the bloodiest century in history.

Those Pesky Crop Circles — Can they be the plans for a spaceship?

Crash — By 2012 we'll have 0% General Class Licensees.

Hamfest Report — Dennis WB8QWL's proposals to revive 'em.

Covering It All Up — Technology breakthroughs from Roswell crash.

Gold Brick Or Lead balloon? — Throwing away the key to success.

Science, Hard and Soft — The two are merging, confusing scientists.

Timing... ..is everything, and my timing has been very good.

Viva Dilbert! — Scott Adams' new book has a serious, practical side.

HIV Update — The Bioelectrifier seems able to do almost anything!

November 1997

The End Is Near! — New Year's Resolution: Try something new.

Take the Express — The secret of success is unveiled.

Medical Science? — Like all sciences, it rejects new ideas.

Smoking — If you're still smoking, don't read this.

Music Soothes — Stress kills ... good music is a good antidote.

Educating Our Own Children — Sure it takes time, but it's worth it!

Paying For Preschool — An innovative proposal.

Mea Culpa — We get too soon old and too late smart.

Magnets — Some magnetic healing miracles.

Forgetting Things — The mercury and Alzheimer's connection.

Health Tompoopery — Whom can you trust? It sure ain't easy!

The Deficit — P.J. O'Rourke solves the deficit problem.

Budget Baloney — The latest agreement is just another con game.

Our Unconstitutional Congress — Roosevelt opened the pork barrel.

An AIDS Vaccine? — Billions more wasted on drug company welfare?

Even More Medical Mischief — The *Penthouse*-reported cancer cure.

A Head of My Time — Snap-on skates for city use invented!

Another Excuse — More info on smoking and birth defects.

Space Radiation — It's a killer beyond the Van Allen Belt.

The Bright Side — The Web will relieve pressures on our HF bands.

Industry Blindness — The power companies don't want to know.

Elemental Energy — A new name for the cold fusion phenomenon.

Faster! Faster! — How we can triple data transfer.

December 1997

The Magnetic Motor — Wayne rides the Takahashi scooter.

Big Brother — Jammer needed for automatic speed traps.

Skip This — Princeton's psychic experiments.

The Ice Caps Are Melting! — Oh, baloney!

Biocommunications — Is there an instantaneous wideband medium?

QRM Reduction — Stiffer FCC tests to weed out lazy hams.

Runny Noses — Airborne microbes and viruses abound.

OK Conspiracy? — Fertilizer bombs really, really stink.

Jobs — The job market is changing. You'd better, too.

Birth Defects — 99.9% are invisible, but they're sure there.

Takes All Kinds — The beach-ball repeater jammer.

Paparazzi — Condemning the tabloid buyers.

Kids — Whew, we sure need 'em as hams.

L-Fields — Fields of life you can measure and use.

Doctors — Putting 'em into perspective. We need 'em.

Roswell — A high Pentagon official spills the beans.

The UPS Strike — Factors you may have missed.

Heritage — What crap are you feeding your kids?

A Roaming ROM — ARRL put repeaters on a ROM.

Tear Apart Your Tube Supply

continued from page 36

wired OK, replace the fuse, take a deep breath, and flip the switch. You'll know in an instant if all is well. The pilot lamps will glow and the filaments will come to life. It's a great feeling when a job's well done and your gear is on line. By your efforts, you've contributed to keeping the vintage equipment running and performing right up there with the newer rigs on the block.

Parts suppliers

All Electronics
905 S. Vermont Avenue
Los Angeles CA 90006
(800) 826-5432

Capacitors: Nichicon 470 μ F @ 450 VDC, catalog #EC-4745

Rectifier diodes: 1N5408, 1000 V @ 3 A

Antique Radio Supply
6221 S. Maple Avenue
Tempe AZ 85283
(800) 706-6789

Phenolic twist-mount can insulators:
#SH-120 73

Letter from Down East

continued from page 64

signal reports. QSB is beginning to take hold as he finally comes to the last station ahead of you. You listen to him acknowledge that station and give a signal report. Then that station comes back. He starts out with a song and dance about how his wife's sister's neighbor has a daughter living in a town near by and is he familiar with the town and has he ever heard of Whatchamacallet's daughter. QSB is getting worse and it takes five or six minutes just to exchange this information. Then, as if that were not enough, he wants to know what the weather is like and what equipment he is using and goes on to describe *his* weather and his equipment in minute detail. Finally, he signs and you hear the beginning of your callsign just as the QSB finally bites. You're right ... you never did get to confirm the contact.

This is just not fair. I would like to propose a rule that says anytime someone hogs a rare DX station, his callsign should be sent in to the authorities in charge of awards, and he/she should have 10 DX contacts deducted from their list of DXCC. A second offense calls for a deduction of 25 DX contacts from the list and a third offense calls for a six-month restriction to using only two meters. 73, Hal. 73

NEVER SAY DIE

continued from page 82

Finish Your Spinach

I see in *Business Week*, p.106E36, 11/10/97, that "most major health organizations recommend eating five to eight servings of fruits and vegetables every day." Well, I'm glad I'm not alone in preaching this gospel. The article goes on to point out that, "These foods contain not only basic nutrients but also disease-fighting compounds known as phytochemicals, many of which can help ward off cancer, heart disease, and diabetes."

So much for a cold cereal, white toast and coffee breakfast. Or coffee and Danish.

Dr. Douglass of *Second Opinion*, in whom I have a good deal of confidence, says we should be eating three apples a day and two bananas.

How about you, oh sinner? Are you eating your vegetables? Or are you determined to head for an expensive hospital stay and plenty of medical care and drugs before you die several years before your otherwise time?

Frozen veggies are okay, but not as good as raw. Canned veggies just don't count. If it comes in a box or a can, it's probable that it isn't good for you.

Nursing Homes

You probably missed the *Time* report on Nursing Homes in their Oct. 27th issue. Since over half of you are headed for one unless you make some major changes in your lifestyle, you'd better read that report and see what you're going to be getting into. Will this be enough to keep you out of McDonald's®, Pizza Hut® and Dunkin' Donuts®? I doubt it. Your mouth is gradually going to make you a dribbling, hobbling, veggie.

Your body needs raw fruit and vegetables, sunlight, lots of distilled water, exercise, the vitamins, minerals and en-

zymes missing in today's food supply, and a freedom from being poisoned. You are not likely to get any of these in a nursing home or convalescent hospital, so what you are going to do is get sicker and die, like everyone else there. And it's going to be horrendously expensive.

One study of California nursing homes showed that more than 7% of the people who died were victims of utter neglect—a lack of food or water, untreated bedsores, and so on.

You are making your own choice on your future with your present lifestyle. But, of course, like smokers, you are helpless to make the needed changes, no matter how terrible the consequences and the suffering you'll endure eventually.

Hey, I love the taste of pizza and fried chicken. I love doughnuts and Danish, a juicy steak, barbecue and premium ice cream. But the tradeoff is sickness and a shorter, much more painful life. Your choice. 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.

How to Generate \$1 Million In Extra Sales

In this video Wayne explains how almost any company can generate lots more sales using PR instead of advertising. Learn the secrets of how to write and get your PR releases published. Learn how to get product reviews which are pure gold for sales. Not one company in the ham industry is taking full advantage of the power of PR. This is something most ad agencies know little about. The video is a paltry \$42.95ppd.

World's Fastest Code Course

The old, hard way, to learn the code is to start slow and gradually speed up. In that direction lies madness. The Blitz Method is to start at 13 or 20 wpm immediately. Yes, tapes are available to help. Use T-5 to learn the characters. T-13 will get your General ticket with a few hours work. T-20 ditto for Extra. The tapes are \$7 each and are as nasty as Wayne could make them.

FREE

Wayne has a whole bunch of booklets you'll enjoy — like *How to Make Money*, *The Bioelectrifier*, *WWII Submarine*, *Caribbean*, and other *Adventures*, *Editorial Collections*, *Instant Morse Code Course* for the truly lazy, *Reading Guide*, *Cold Fusion*, and etc. Ask for FREE 16p list of WAYNE'S STUFF.
Order **Wayne's Stuff**

PROPAGATION

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Encouraging signs of activity on the sun are becoming more frequent as this is written (November 1997), and the solar flux has recently hovered in the 80-90 range, 40 percent better than what we've seen for the past few years ... so take heart, DXers, things are on the way up. But don't expect miracles, as DX conditions in winter near the bottom of a sunspot cycle are never great, and they tax your operating skills to the limit.

You can expect the first and last weeks of the month to provide seasonally Good (G) conditions and the middle two weeks seasonally Fair (F) conditions on the HF bands. See the accompanying calendar and band-by-band charts to pick and choose your times and bands for operating.

The days between the 19th and 22nd are likely to exhibit Poor (P) operating conditions due to an ionospheric disturbance which will increase signal absorption and produce weak and watery sounding signals on normally decent DX paths, particularly those closer to the north and south poles.

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 US.

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.

FEBRUARY 1998

SUN	MON	TUE	WED	THU	FRI	SAT
1 F-G	2 G	3 G	4 G	5 G	6 G	7 G-F
8 F	9 F	10 F	11 F-G	12 G	13 G-F	14 F
15 F-G	16 G	17 G	18 G-F	19 F-P	20 P	21 P
22 P-F	23 F-G	24 G	25 G	26 G	27 G	28 G

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

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.

Remember to let me know how these forecasts are working for you. Your feedback is much appreciated. W1XU.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	14	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	14	7	7	7	14	21	21	21	21
AUSTRALIA	21	14	14	14	7	7	7	7	7	7	14	21
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	7	14	14	14	14
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JAPAN	14	14	14	14	14	7	7	7	14	14	14	14
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PHILIPPINES	14	14	14	14	14	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	7	14	14	14	14	14
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