73 Amateur Radio Today

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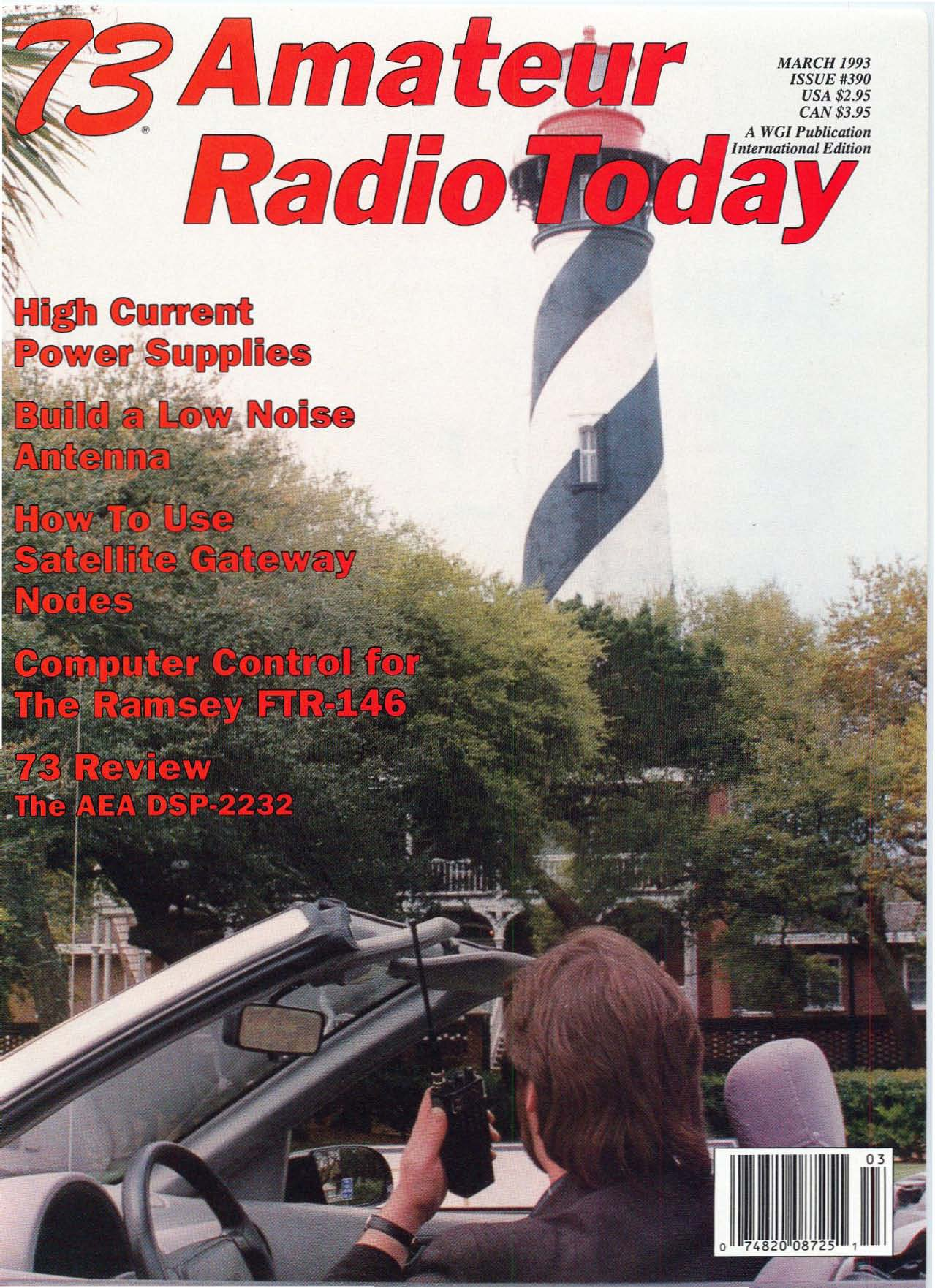

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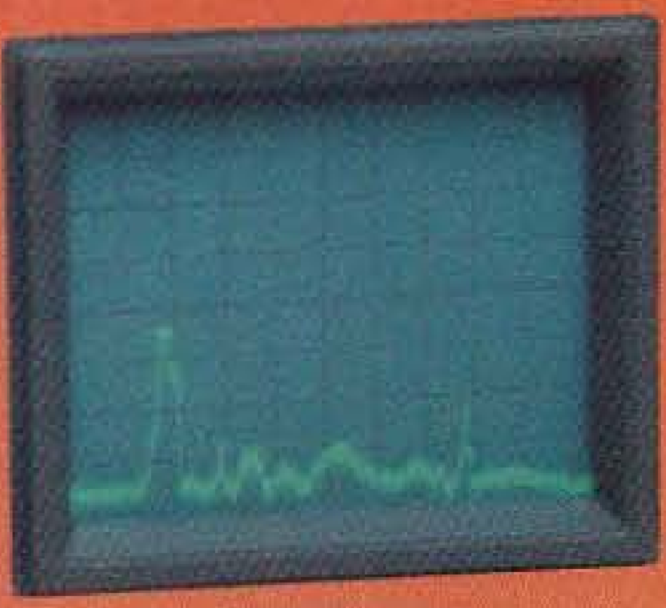

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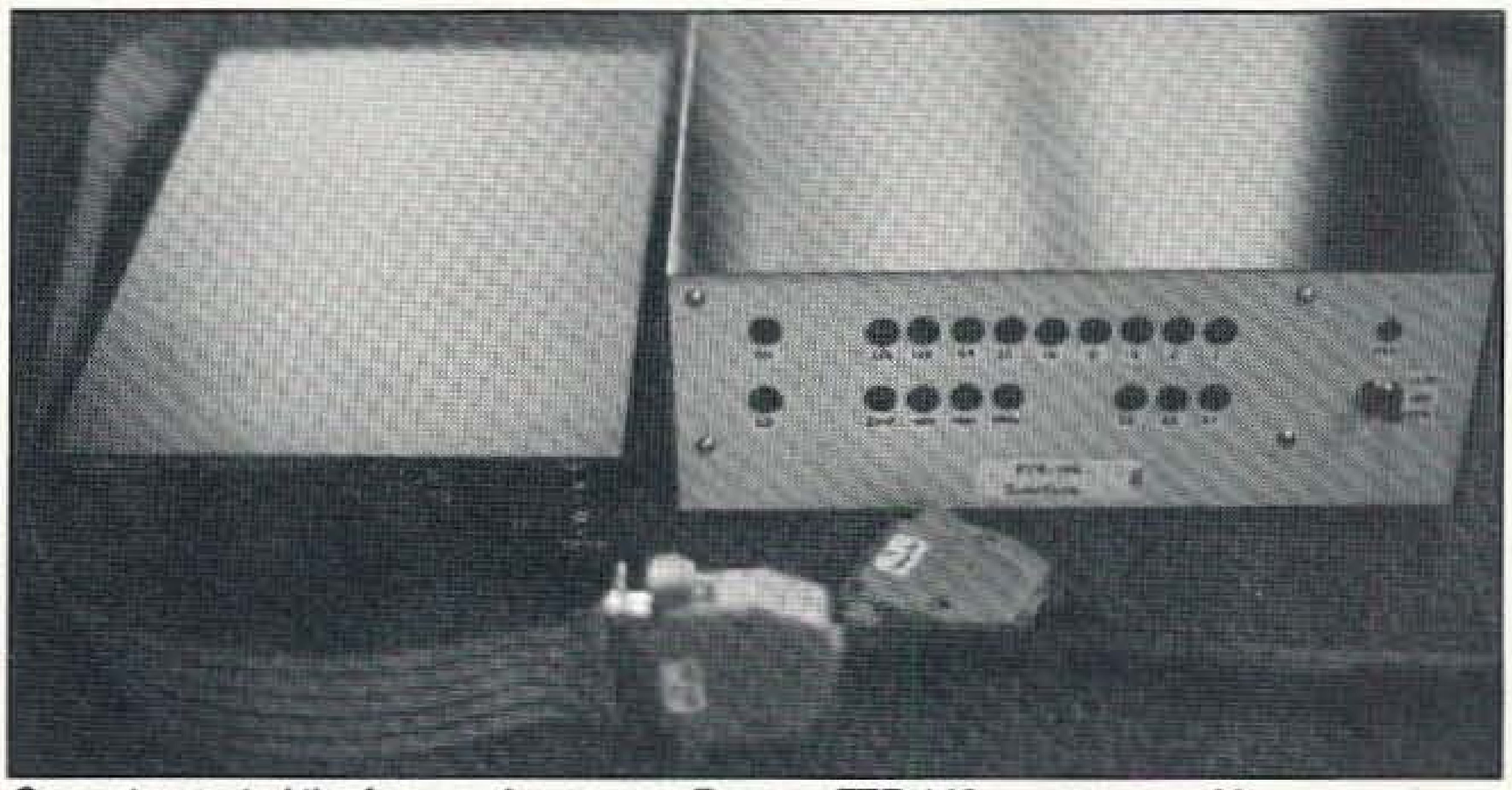

Computer-control the frequencies on your Ramsey FTR-146 . . . see page 60.

Cover: Associate Publisher David Cassidy N1GPH shows his best side to the camera while operating rent-a-car mobile in St. Augustine, Florida. Photo by Kelly O'Dell.

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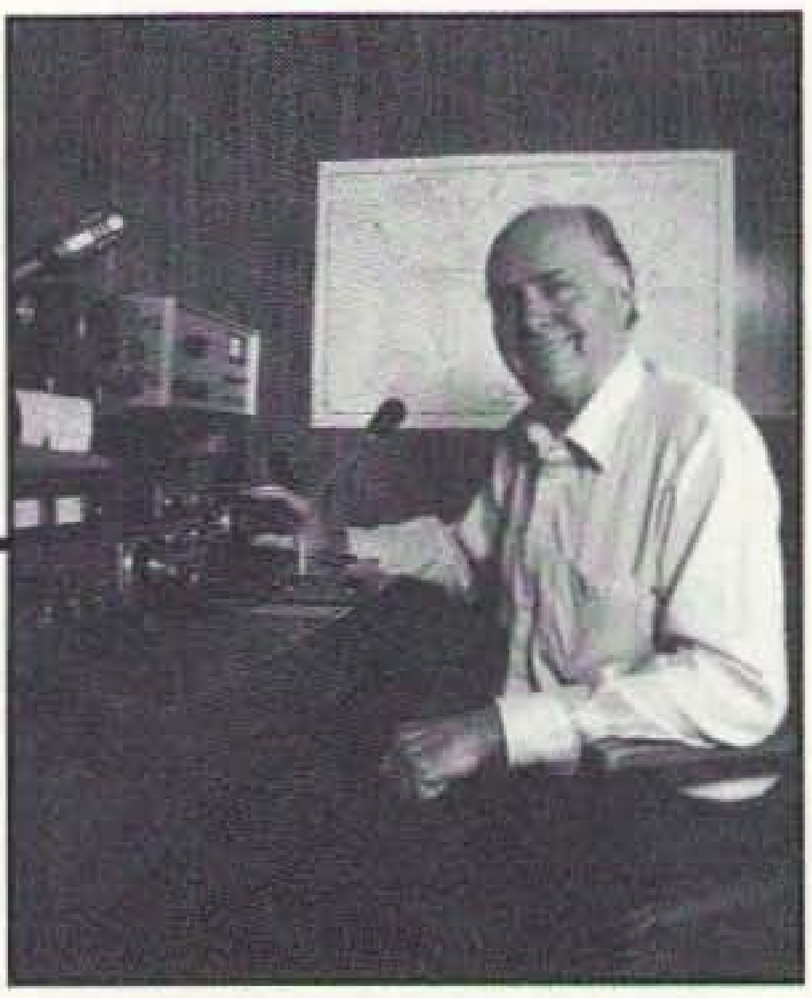
Contract: By casting your eyes upon this tiny type, you have just legally bound yourself in contract with the publisher of *73 Amateur Radio Today* to go out and show a non-ham how much fun amateur radio is. Take 'em T-hunting, show 'em how to set up a QRP CW station in the woods, let 'em make a few DX contacts, show 'em how to build an antenna, demonstrate packet and satellite communications . . . there are 101 fabulously fun things to do, and our future depends on newcomers.

NEVER SAY DIE

Wayne Green W2NSD/1



Another Bummer

A letter from KH6COY mentioned the military being a supporter of amateur radio as a way to preserve frequencies for their use in time of war. Yep, that was one of the unstated benefits of amateur radio back when I was a whipper-snapper . . . back when I still had more hair on my head than on my chest. Well, both war and technology have changed so, far's I can see, this is just another relic of the past.

Sure, when WWII came along and we got whomped at Pearl Harbor, we had to start almost from scratch and build an army and navy, complete with communications. Lordy, when I reported aboard my submarine in 1943 one of the two radios we depended on was still a 1920s-vintage TRF set. That's right, from before the superheterodyne! And when I worked for a few months for G.E. in Schenectady (before joining the Navy) making portable transmitters for the Army, the design had been finalized in 1935. I couldn't believe how out-of-date the stuff was we were building. Apparently no one had made any plans for pursuing a war, so they had to go with whatever they'd been making several years earlier.

Roosevelt quivered with rage when the Japanese bombed Pearl Harbor. His rage should have been with his intelligence people and our military for being asleep, not the Japanese, who did exactly the right thing. They knocked us for a loop and quickly spread out all through key areas of Asia. The Japanese high command wanted to stop us up front, grab a bunch of badly wanted territory, and then sign a peace treaty which would let them hold everything they'd conquered. They misjudged our dudgeon. We then went ahead and gradually out-invented them in radar, out-produced them in weapons, and ground them down. The atomic bomb was just the capping high-tech blow.

In those days we needed the ham bands for military communications. Of course we had a couple years in which to invent and build our electronics and communications systems. War is completely different now. The Persian Gulf war lasted a few days, not four years. Communications systems for war use these days have to be integrated into weapons systems. They have to have been in operation for a long time so the bugs will have been worked out. Whatever radio frequencies the military need today for any wars we can imagine are already in full use.

The military are in no more need of a bunch of ham bands than they are of a bunch of fat old men to draft as operators. In the 1940s our average age was in the low 30s, with 80% of all new hams being teenagers. This is why 80% of all licensed hams were drafted into the military during WWII. And we did indeed make a big difference. I joined the Navy in 1942 and breezed through their electronics school in nine months, emerging as a radio, radar and sonar expert. I had the option of working in a research lab in Washington or going to sea. I chose submarines and as a result had a bunch of exciting adventures.

Today's communications equipment is completely packaged. The frequencies are built in, complete with the security systems. We don't need operators to copy CW anymore. We don't even need technicians to repair broken equipment in the field. If it breaks, a module is substituted or else the whole unit is replaced. How many hams do you know who service their solid-state synthesized rigs when they go blooey? We send 'em back for factory service.

The military have no use these days for hams for anything. They don't even need our bands anymore.

There's a great controversy over what role our military should be geared to play in the future. Are we going to let our media suck us into one adventure after another on the basis of our heart strings being pulled? Is this what we want to spend a good part of our tax money doing?

We're in Somalia now. The pressure is on to get into the Serbian mess. Hussein and the Kurds are at it again. Then we'll be worrying about the extermination of zillions in southern Sudan. And further killing in Ethiopia. We're already faced with a growing interest by Muslim fundamentalists in killing us infidels in around 50 countries. I loved it when the Somalis we were trying to save from starvation stoned us for being Christians. Our media can have a ball getting us involved in endless messes. Maybe we should go into India and pacify the Muslims and Hindus, who've been killing each other for generations. How about the terrible mess in Burma, which I've visited and seen first hand? And the genocide in Timor? Sri Lanka? Chad? What about the native Fijians who want to kill the Indians? The Azerbaijanis want to kill the Armenians and vice versa. How soon can we get Tom Brokaw into the breach?

Now that we've beat communism, all that's left is to whip the rest of the world into submission. But the one thing we're not going to need is any of our ham bands.

What's Cooking?

If you want to live to be 70 and take advantage of the free skiing us septuagenarians enjoy, not to mention getting those full Social Security payments, even if you're still working, you're going to want to have stopped smoking early on, taken it easy on the beer, and kept your weight down. The next time you're wandering around at the Dayton Hamvention, just take a look at how many tons of hamfat you see waddling around. Tsk.

There are plenty of great things you can cook which will help keep your weight down, things which you can whip up in minutes. For instance, there's Uncle Wayne's Onion Slumgullion, which I guarantee you'll love. And it only takes maybe 10 minutes from start to finish.

You dice up a 3" onion, slice a quarter cabbage into quarter-inch strips, quarter a 1" chunk of Polish Kielbasa and then cut the quarters into 1/8" slices. You're almost done. You put all this into a large frying pan with some bacon fat to keep it from sticking, turning it to prevent burning.

While that's cooking, bring two cups of water to a boil in a small saucepan. Add a crunched up package of ramen noodles and cook for three minutes. Strain the noodles to get rid of the water and add the little package of flavoring. By now your onion and cabbage mix should be done. Turn off the fire, mix in the noodles and serve.

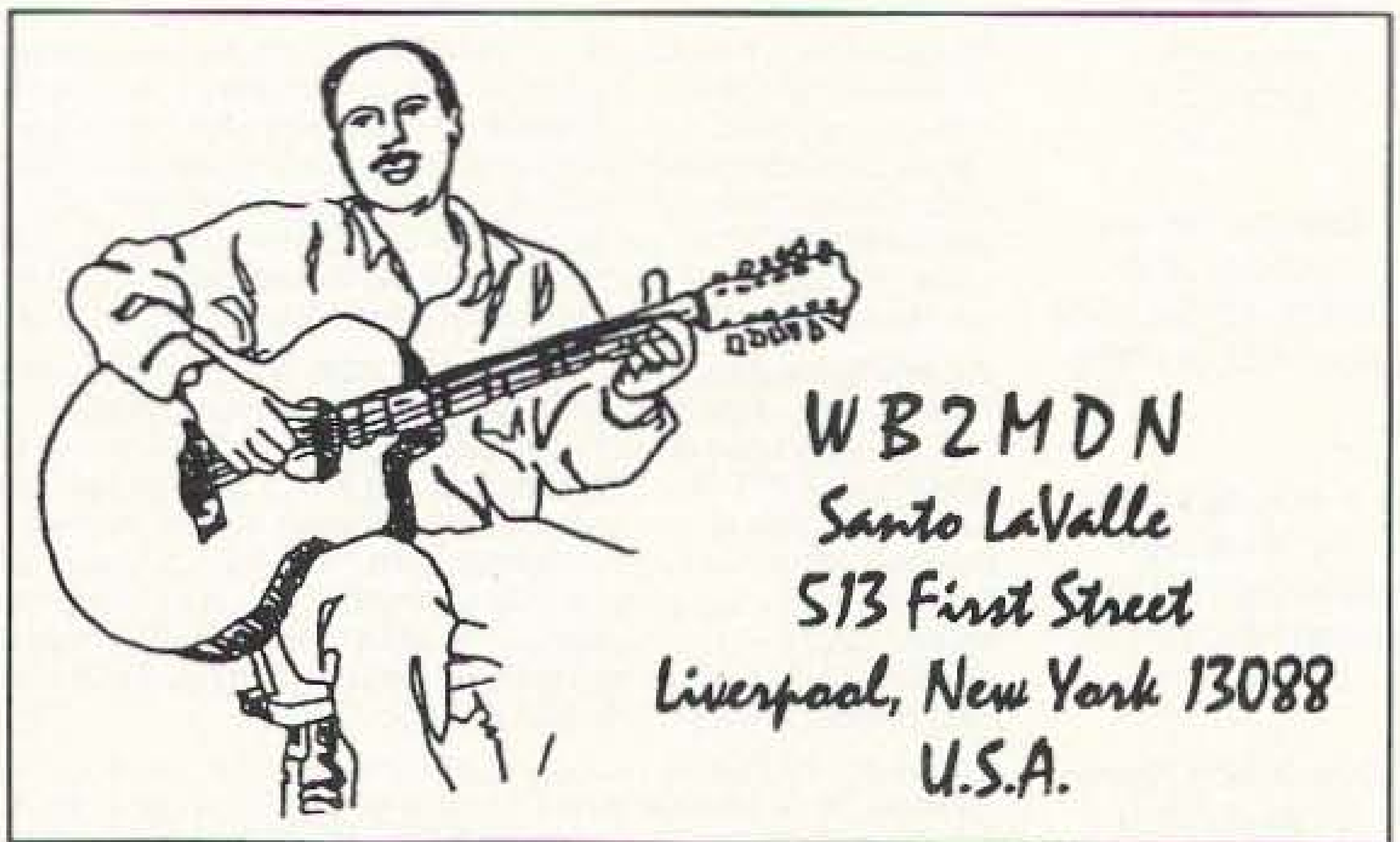
I add salt while I'm cooking, plus plenty of black pepper. You can try it bland, but then give it a try with a heavy pepper hand. Vegetarians can leave out the pieces of sausage. The above makes enough to feed two for a fast dinner. I often make up a double portion and put the leftovers into the fridge to be warmed up in the microwave oven. Tastes like fresh-made.

If you haven't been provident enough to make some homemade applesauce to go with the Onion Slumgullion, you can make some in about five minutes. Allow one medium apple per person and slice into a microwave dish, skin and all. You want to start with a tart apple, like a Baldwin, Cortland, Macintosh, Northern Spy, Transparent, or Duchess, and *not* one of those crummy bland Delicious. Quarter the apple, cut out the core (a grapefruit knife does this well), cut the quarters into four chunks so they'll cook fast. Add a handful of raisins, a couple tablespoons of Brownulated sugar and a half inch of water. Cook about three minutes in the microwave and you'll have a great companion for the Onion Slumgullion.

It's been awhile since I've given the recipe for Uncle Wayne's Hurry Curry, so keep after me and I'll write it up again. It's fast, fabulous, and diet food. Of course, if all you've ever learned to eat is hamburgers, then I can tell you how to make the best hamburger you've ever tasted, and fast too. I enjoy cooking, but I like things I can fix in a few minutes. Ask me about Uncle Green's Beans.

One more thing—how about a low calorie dessert? My favorite is sugar-free Jello with a bunch of fruit in it. The only calories are in the fruit. I prefer to use two large packages of orange Jello (130 calories) and mix in a can of water-packed sour cherries (save the juice, it's delicious to drink), a can of crushed pineapple, and a can of freestone peaches (cut into chunks). This make about four quarts of fruit Jello, which lasts me a couple weeks, a nice low-calorie dessert, even when served with a teaspoon of light cream on it.

Hmm, this is making me hungry.



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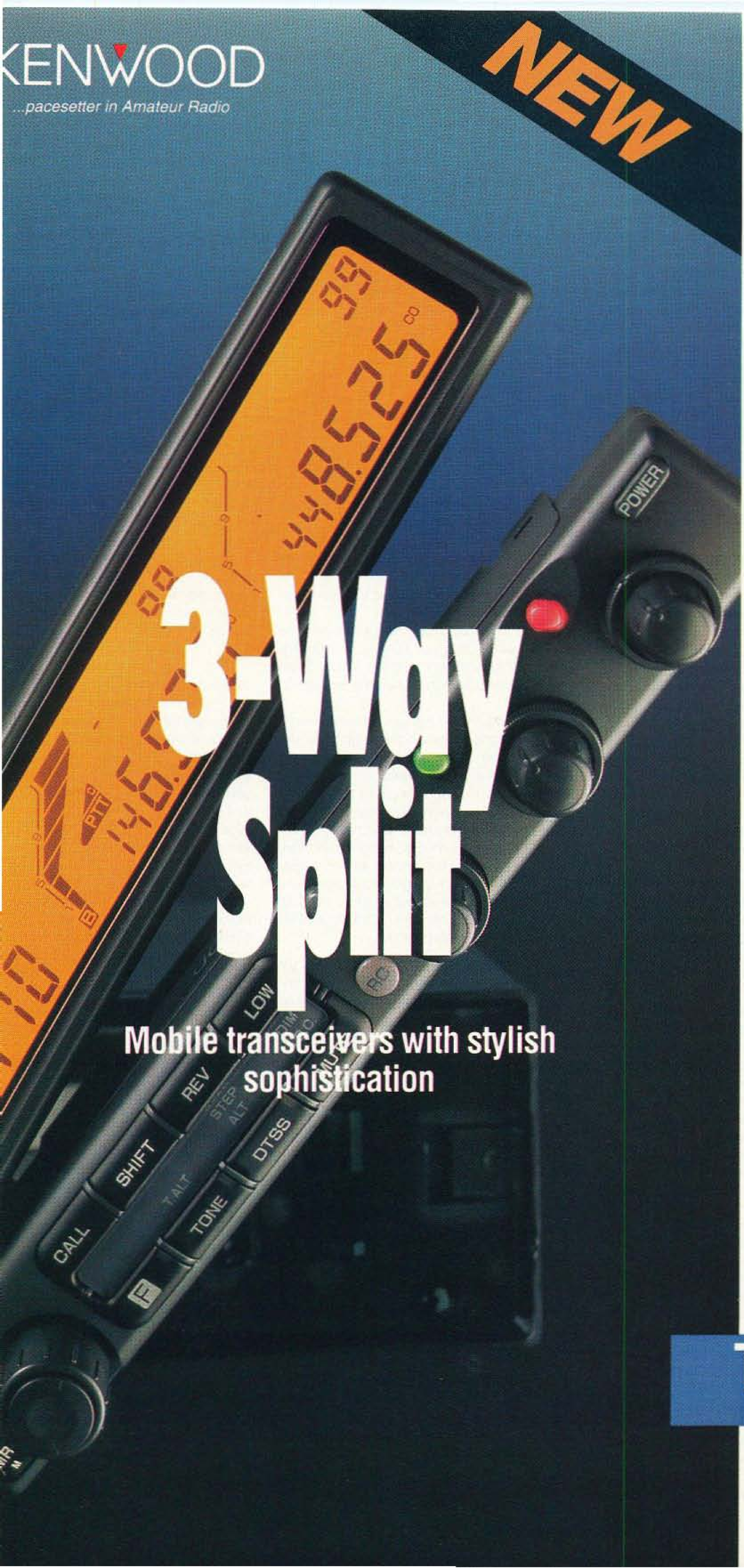
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LETTERS

Number 2 on your Feedback card

From The Hamshack

Michael A. Moore N7RY, Estacada OR Wayne, I see you are searching for comments on the "Dream Station" (November 1992 issue) and I can't resist making a comment or two. For my money, the ICOM 765 transceiver would make a real start on your station. It runs AM/SSB/CW/FSK with over 100 watts out and stays cool doing it. It has quite a few switches and buttons, though fewer than some other current HF offerings, and most of them you can happily ignore. I am not sure if you run much RTTY these days, but if you were going to, the "real" FSK done with a digital synthesizer is light-years ahead of feeding audio to the SSB input.

Now CLOVER is coming out, and we will be back to audio tones into the SSB again, but the 765 is about as clean on SSB as you can find, so it would handle it. It has a nice speech compressor that is clean for SSB as well. Let's not leave out CW—it runs full break-in and has a built-in iambic keyer. You just plug your Bencher or whatever in and you're set.

I have run RTTY and CW contests with the 765, and if I had more time/better antennas I think I could get some real wallpaper!

There are times when 100 watts won't do, so I guess one should have a decent amplifier. I personally like amplifiers that are suited for RTTY use; too few are these days. May I recommend the Ten-Tec Titan or Bill Henry's 3K? (I know Dick Ehrhorn's devices are solidly built but at last glance his units were priced a bit higher.) The Titan will handle key-down RTTY for contesting, and is probably overkill for SSB and CW, but I hate smelling/inhaling smoke in my shack, and I assume you value your lungs equally highly.

My favorite amplifier is a homebrew pair of 4-400s that my father Art K8LXF and I put together 30 years ago, with a huge plate transformer and silver-plated coils, the latter mostly for looks. It has 3/8" solid silver contacts on the coil switches, and has lasted many hours of RTTY FSK. If I cannot work a station with that, it is seldom worth turning the Titan on to try any further until propagation shifts.

Towers are another hassle. The easiest to put up these days are the aluminum towers by Glen Martin Engineering, with a HAZER trolley on them. I use his trolley on 50 feet of Rohn 25G to play with different antennas. If money were no object, the Telrex steel poles that turn would be the ticket for the lower part of the sunspot cycle coming up, but that is not in keeping with Yankee frugality.

Of course, if you want to be up 100 feet or so, it is best to stick with guyed Rohn 45G. (Ken K6SAD has put up 120 feet of 45G by his lonesome self, which I don't advise but offer by way of astonishment.)

I have heard good reports from the KLM beams, but stacked Hy-Gains or Mosleys will outdo even those. If your locale has high winds, as we do here, I favor Telrex beams as they will take ice-rains that thicken the elements several inches without failing in the wind/rain.

Don't forget a quad of phased verticals (or at least one vertical) for the low bands—40, 80 and 160m will have some good times ahead. I have heard some of the more interesting rag-chews on 160m in recent times.

Enough soapboxing; keep up the good fight, and tell it like you see it. Amateur radio needs a dose of Green jalapeños from time to time.

Chuck Reik N8WDH, Garden City MI I would like to comment on the article by John Rehak N6HI reviewing iambic keyer paddles, which appeared in the December 1992 issue of *73*. I found this article to be extremely interesting and informative.

I would like to offer a suggestion that would be of benefit to those of us who are aficionados of the straight key: Perhaps a similar article might be possible. I have no idea what percentage of your readership is of the same bent as I, but I would think that there must be a few of us. Apparently, there are enough of us to warrant making straight keys in quite a variety.

Walter E. Taylor K4VI, Charlottesville VA Wayne, I just read your NSD column in the December 1992 issue of *73 Magazine.*

Your remarks about the rainfall in Ketchikan, Alaska, prompted this reply to you. You were not even close to giving the correct value of the amount of rainfall in other places of the world and the US. Look up the weather records for the interior of Kauai in the Hawaiian Islands. They have averaged over 500 inches of rain a year for many decades. There is a rain forest in India/Pakistan that averages more than 530 inches a year. Both of these places make Ketchikan seem like a desert.

Morris Bleckman N9GVA, Lincolnwood IL I just received my January 1993 issue of *73* and I think you have forgotten me. I am not a builder of radio equipment, I am an operator. I admit I got into ham radio about five years ago without any background in electronics. At this time I operate my ICOM 751A, complete with a 55-foot tube tower (I dug the hole and poured the concrete) and a KT34a tribander, plus a G5RV and an R7 vertical after the HF6V blew down in an ice storm. I also have a 735 on my 40-foot sailboat. All of this was installed by yours truly. And it all works. I even know what end of an iron gets hot BUT I don't build. I welcome articles that discuss problems of equipment and the uses of same.

Again, I am an operator and user of equipment. I want to know more about the uses of test equipment and how to use it. I want to hear about the pros and cons of equipment. I want to know about the differences and how to use them to my advantage. Gordon West WB6NOA was of great help when I installed a 735 in my boat. I phoned Mr. West on a couple of occasions with a tech question concerning mobile installation and he was always helpful. Ditto for Bob Heil about his speakers. Got the idea? I am not into schematics.

Wayne, I enjoy your editorials. I, too, am a WWII USNR type, from 12/07/41 to 12/18/45, most of it as a photomate 1st Class with flight pay in an interpretation outfit. I, too, was a newsreel cameraman for CBS station WBBM TV, and I, too, left the camera and with a partner ended up with the largest 16 mm film processing lab in Chicago. When I sold it to my employees, it was 100% video.

There isn't any way I am going to send $ for your ranting and raving. YOU ARE SUFFERING FROM TERMINAL SANITY. I know the symptoms.

Morris—I agree! I'd love to see more articles on the topics you describe. In fact, why don't you take a crack at writing some!

As for the charge of running so many construction articles, we plead guilty as charged. Our reader feedback cards always, without exception, list construction articles as the number one topic our readers would like to see more of—and we already publish twice what the other ham magazines do . . . David N1GPH

William A. Scherr, Jericho VT Wayne, I thought your piece on RF health hazards was simplistic while trying not to seem so. I use a window mount, Radio Shack telescoping or field-expedient antenna to transmit. I'm still waiting for my ticket, but I am an RTO for my National Guard unit. They told me all about RF radiation in Basic. Short rubber duckies aren't any good, period.

I enjoyed the piece on the micromag antenna, but my XYL still won't let me put one on her jeep.

I like your attitude; keep it up.

Arnold Samuels KH6COY, Ocean Shores WA Wayne, while I agree with you 99.999% of the time, I must take exception with you on something. Oh, I know we can't teach the old farts anything new. I do feel, however, that we have to make a start to teach the new generation of hams that ham radio is not an *entitlement program.* I know we have lost our value to society, but it doesn't have to be that way. I also know that you are aware of the fact that if it were not for the military needing these frequencies in case of an emergency and considering our bands as a contingency we would have lost them a long time ago. I used to sit on CINCPAC's frequency coordinating committee in Honolulu back in the '60s and I know what's in their minds.

I am an old Stuyvesant graduate, and we had a ham station (WB2CLE). I went back for a reunion last June. Yes, you guessed it—no more ham station. It is sad how ham radio has gone down, just like the rest of our educational system. When I started with the Voice of America, about 90% of the engineers were hams. We all had to have 1st class licenses, etc. Not anymore. You are right—ham radio went downhill with incentive licensing. Do you think we can ever turn this thing around?

Now something for *73*'s readers. I just completed computerizing all my old logbooks. What a job! I operated from Wake Island from 1962 to 1966 as KH6COY and KW6DS. I still have a handful of KW6DS cards. If there are any collectors out there who made contact with me and need a card I would gladly oblige if I can verify it. Send a self-addressed, stamped envelope.

T. C., Victoria, Australia As an avid reader of your magazine, I certainly enjoy the up-to-date articles you have. Apart from being economical to build and in the original spirit of build-it-yourself amateur radio, they are also of great educational value. I only wish your distributors did an even better job as I seem to have recent difficulties in receiving my copies. One further problem is that you guys seem to take a long time to get things right—two corrections to the PMP and still mistakes.

One tip to PMP builders which I discovered the hard way was the way pins 6 and 8 were tied together on the original circuit board. It won't work! Pin 6 on the TCM chip has a divided clock output which stops pin 8 from talking to the computer. My suggestion is that you guys ought to set up a lab of your own like the ARRL and duplicate circuits submitted to filter out potential errors like this. You would make life a lot easier for your readers.

Anyway, after all this grumble, as my subscription is due in July 1993, I wonder if you would be so kind as to reward my loyalty with a year's free subscription. After all, our diminishing currency versus yours is gradually making your journal out of reach.

T. C.—We're currently negotiating with a new distributor in your part of the world, so hopefully things will get better soon.

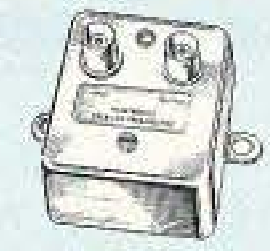
Thanks for the corrections to PMP. We're a small outfit here and we simply can't afford the expense of a testing lab. We rely on our authors to make sure their stuff is clean, and we rely on our readers to tell us when we screw up.

Nice try on the free subscription. Unsuccessful try, but nice . . . David N1GPH.

Low Cost GaAsFET PREAMPS

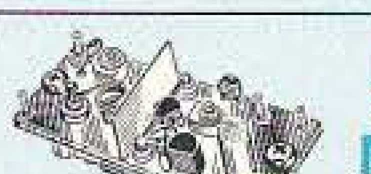
LNG-(*)

ONLY $59 wired&tested



FEATURES:
- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*



LNW-(*) MINIATURE PREAMP

ONLY **$29** kit, **$44** wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

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

LNS-(*) IN-LINE PREAMP

ONLY **$89** kit, **$119** wired&tested

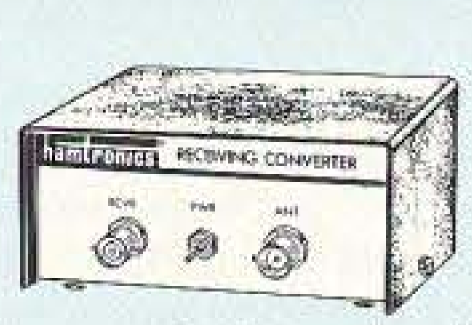
- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Tuning range: 120-175, 200-240, or 400-500.*

HELICAL RESONATOR PREAMPS

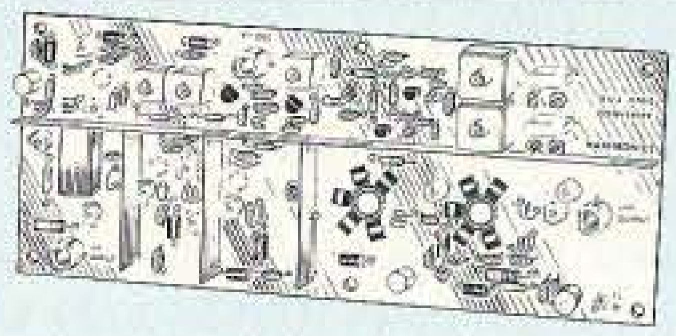
- GaAs FET preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRG-(*),** ***$80 vhf, $110 uhf.*** **Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS



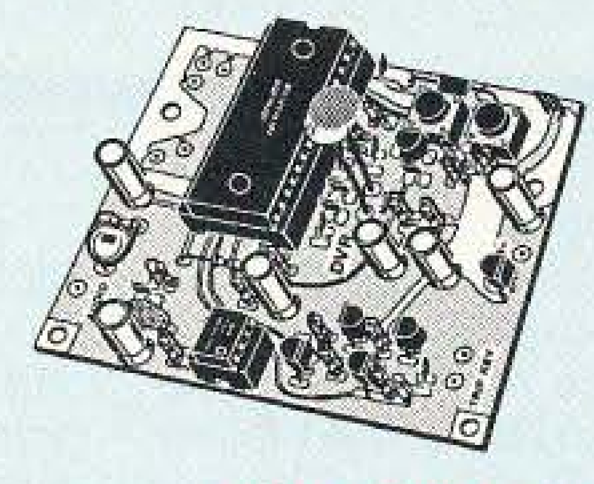
Low noise converters to receive vhf and uhf bands on a 10M receiver.
- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).

TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

ACCESSORIES



NEW **DVR-1 DIGITAL VOICE RECORDER Module.** Primarily a **voice ID'er for repeaters.** May also be used as a **contest CQ caller** or as a **"radio notepad"** to record up to 20 seconds of received transmissions for instant recall. As a **repeater ID'er,** it will record your voice, using either the built-in microphone or an external mic. It can be used with almost any repeater COR module. As a **contest caller,** you can record a message or even several messages and play them through your transmitter at the press of a switch. As a **radio notepad,** you can keep it wired to the audio output of a receiver ready to record up to 20 seconds of anything you might want to recall later. Play it back as many times as you like through a small external speaker. (Call for more information.) ....kit $89, w&t $139

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions ....kit $29, wired & tested $69

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier .... kit $49

CWID. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .... kit $59

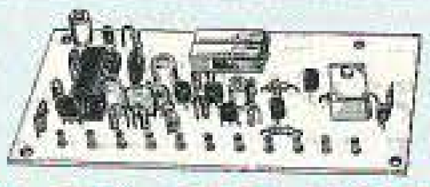
COR-4. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call .... kit $99, w&t $159

TD-2 TOUCH-TONE DECODER/CONTROLLER. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! .....kit $89, wired & tested $149

NEW **TD-4 SELECTIVE CALLING Module.** Economy touch-tone decoder with 1 latching output. Primarily designed to mute speaker until someone calls you by sending 4-digit tt signal but may also be used to turn on autopatch or other device.......................... kit $49, w&t $89

AP-3 AUTOPATCH. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. ....kit $89, wired & tested $149

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



MO-202 FSK DATA MODULATOR. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. ...... kit $49, w&t $79

DE-202 FSK DEMODULATOR. For receive end of link. ...... kit $49, w&t $79

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of MO-96 Modem and special versions of our 144, 220 or 450 MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

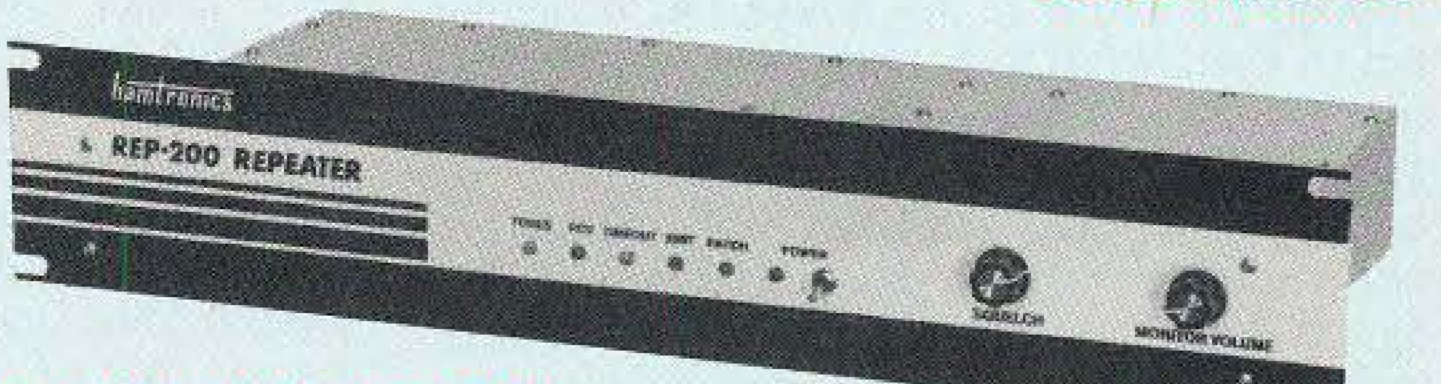
NEW **Real-Speech Voice ID Option Available With DVR-1 Digital Voice Recorder Shown At Left!**

REP-200 REPEATER

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

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit $1095; w&t only $1295!
Voice ID Option $189.



Other models available:

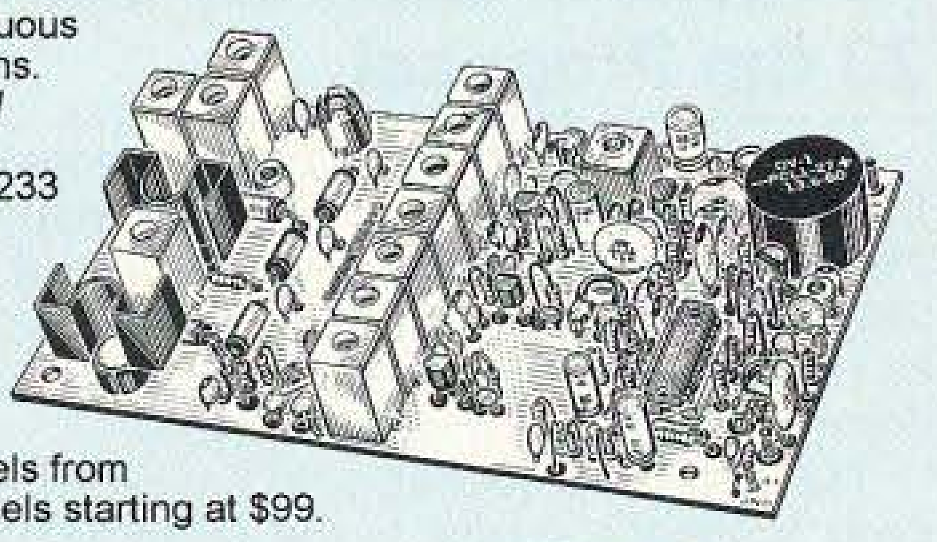
REP-200V Economy Repeater. As above, except uses COR-4 Controller without DTMF control or autopatch. **Kit only $795.**

REP-200N Repeater with no controller. For use with external controller, such as those made by ACC. **Kit only $695, w&t $995.**

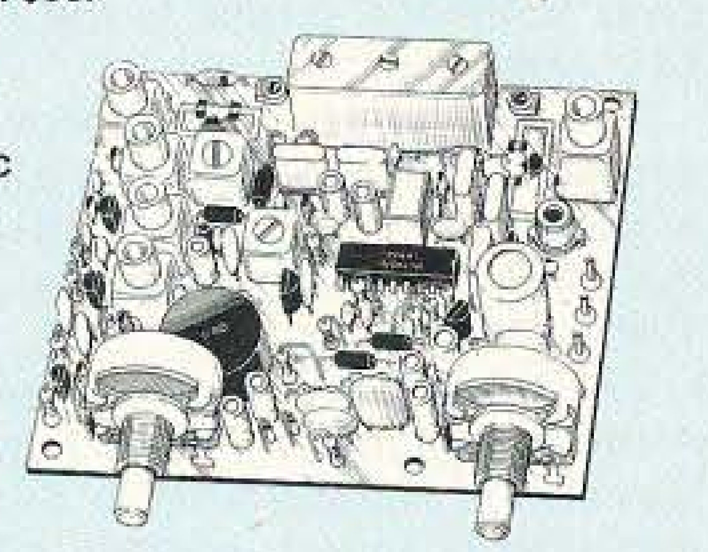
- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- *FCC type accepted for commercial service (hi-band and uhf).*
- **Rugged exciter and PA,** designed for continuous duty.
- Power out 20W 50-54MHz; 15W (25W option avail.) 143-174MHz; 15W 213-233 MHz; 10W uhf; 10W 902-928MHz.
- Available add-on PA's **up to 100W**.
- **Six courtesy beep types,** including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict,** auto-disconnect.
- **Reverse Autopatch,** two types: auto-answer or ring tone on the air.
- Pulse (rotary) dial option available.
- **DTMF CONTROL:** over 45 functions can be controlled by dtmf command. 4-digit control code for each function.
- **Owner can inhibit** autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options.
- Cw speed and tone, beep delay, tail timer, and courtesy beep type **can be changed at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters.**
- Many **built-in diagnostic** and testing functions using microprocessor.
- Color coded **LED's indicate status** of all major functions.
- **Welded rf-tight partitions** for exciter, pa, receiver, and controller.
- 3½ inch aluminum rack panel, finished in eggshell white and black.

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

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



FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***
- **TA51**: 50-54, 143-174, 213-233 MHz ...kit $109, w&t $189.
- **TA451**: 420-475 MHz ...kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.
- **VHF & UHF AMPLIFIERS.**
- For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.



FM RECEIVERS:
- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift. ...kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, GaAs FET front end. ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ...Kits $129, w&t $219.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w&t $219.

- **Buy at low, factory-direct net prices and save!**
- **For complete info, call or write for free catalog.** *Send $2 for overseas air mail.*
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Packet Radio Equipment Needed for Poland Center

Packet radio equipment is needed for "Community-Based Computer Centers" in Poland. The first center was opened recently with a network of five new computers, two printers, a fax/modem, and other peripherals, through the efforts of the American Council for Polish Culture (ACPC) and the support of the Institute for Community-Based Computing (ICBC) of New Durham, New Hampshire. The center, located in Siedlce, an economically depressed region of Poland, is opening up opportunities for young adults, including the disabled, to study and work with state-of-the-art computer equipment and key programs, particularly desktop publishing. While all of the equipment installed at the center has been donated or purchased through the ACPC and ICBC, the community itself is providing the space, utilities and manpower to operate and maintain the center. During 1993, the ACPC and ICBC plan to replicate the Siedlce center in three other communities in Poland.

The U.S. State Department has suggested that the center training opportunities and operations could be further enhanced by improved communications with other parts of the country through the introduction of packet operations. The ACPC, a 501(c)(3) nonprofit organization, is appealing for donations of packet radio components (radios, controllers, antennas, etc.), new or used, for the installation of one complete unit at the Siedlce Center and a unit in each of the three additional centers planned for 1993. Anyone interested in helping by donating equipment is requested to contact: Mr. Marion Winters, ACPC Computers for Poland Project Director, 953 Wellington Road, Rindge NH 03461; telephone (603) 899-6333.

FCC Issues 222 MHz and 23 Cm Proposal

The FCC has proposed several changes in the 222 and 1240 MHz amateur bands. The first would establish a small new subband in the 222 MHz band where repeater stations would be prohibited, in order to enhance weak-signal communications and experimentation.

The second proposal would allow Novice class licensees access to the entire 222-225 MHz amateur band.

The third proposal would allow Novice class operators to be licensees and control operators of repeaters in the 222-225 MHz band and in the 1270-1295 MHz Novice subband of the 1240-1300 MHz band.

The "weak signal" proposal was made by the ARRL in November 1991, following the reassignment of 220-222 MHz to commercial interests. The League suggested a 150 kHz subband at 222.00-222.15 MHz for such weak signal work.

The ARRL at that time also requested expansion of Novice operating privileges to include the entire 222 MHz band, in order to establish a common meeting ground where Novices could sample other modes of amateur operation in addition to repeaters.

The proposed changes in Novice repeater licensee and control operator privileges, which the ARRL did not seek, came as the result of petitioner Michael C. Trahos KB4PGC, who argued that the Amateur Service should follow the General Mobile Radio Service and the Private Land Mobile Radio Services, where user licensees may also be licensees of repeaters without being required to pass any additional examination. The ARRL has not as yet adopted a position on this proposal.

The Commission said it believed there was merit in the petitions of both the ARRL and Trahos, and has asked for comments on the proposed rule changes in P.R. Docket 92-289. No deadline has as yet been set for those comments. *TNX ARRL; Westlink Report #640, December 24, 1992.*

Rescue at Sea

An Illinois ham operator helped to rescue a pair of British yachtsman trapped in a floundering sailboat sinking some five hundred miles off the Florida coast. Former Air Force radio technician Wilbur Warke N9RGE heard the distress call from the sailboat *Que Tal* while killing time before leaving for work on December 7, 1992.

According to Warke, he was monitoring the bands when he happened across a voice with an English accent asking for emergency assistance. Warke was able to get a location on the sinking boat. He relayed that to the Coast Guard, which in turn arranged for the Norwegian tanker *Team Trinta* to go to the sailors' aid.

Shortly before 4:00 p.m. local time, the Coast Guard called back to Warke to let him know that the tanker had the *Que Tal* in sight. A short while later the sailors were rescued and taken on board the *Team Trinta* just before the *Que Tal* sank. The two English sailors were identified as Nicholas Kyriacou and John Briffa. They had set sail from North Carolina on November 2nd with their destination being Aruba. *TNX AAØCR; Associated Press; ARRL; Westlink Report #640, December 24, 1992.*

QCWA Scholars Awarded $7,200 in Nine Memorial Scholarships

Nine 1992 QCWA scholarships—totaling $7,200—have been awarded to students from nine different states. (Applications were received from 49 states this year!)

These educational grants are made each year from interest earned on the QCWA Scholarship Fund, established in memory of their Silent Keys. A total of 14 $800 scholarships will be awarded in 1993.

This year's winners are:

Melissa L. Benish N3FAC, Pittston, PA, will be a junior at Penn State, studying mechanical engineering;

Elena Doerrie KB5DAK, Booker, TX, will be a freshman at Johnson Whales University, studying public relations;

Lesley Goh KD4IPS, Somerville, MA, in her final year working towards a BS degree in computer engineering at the University of Florida;

Martin H. Gruen KA2VLD, Margate, FL, a junior at Stetson University, majoring in biology;

Dustin W. Howell N5ZVY, Minden, LA, studying for two degrees—first a BS in aviation science, then an Associate degree in criminal justice;

Shelly L. Jones KE5DX, Harrison, AR, will be a senior at Southwest Missouri State University, majoring in mathematics;

Diane R. Magen KG5CS, Grand Forks, ND, will be a junior at the University of North Dakota, majoring in aeronautical studies;

Andrew M. Ross KC6OHS, San Diego, CA, will be a freshman at Harvey Mudd University, studying applied mathematics; and

Rebecca Schoenberg, South Toms River, NJ, plans to major in Biology at Tufts University.

ARRL Files on Proposed Business Rules Change

The ARRL has filed formal reply comments to support an FCC proposal to revise the rules on permissible communications by amateurs. The League said that other commenters seeking fine-tuning of the new rules were asking for an unnecessary rigidity in amateur rules. But the ARRL argued against a request by commercial interests to relax the restriction on the use of amateur radio in ordinary news gathering—a request the Commission had previously denied.

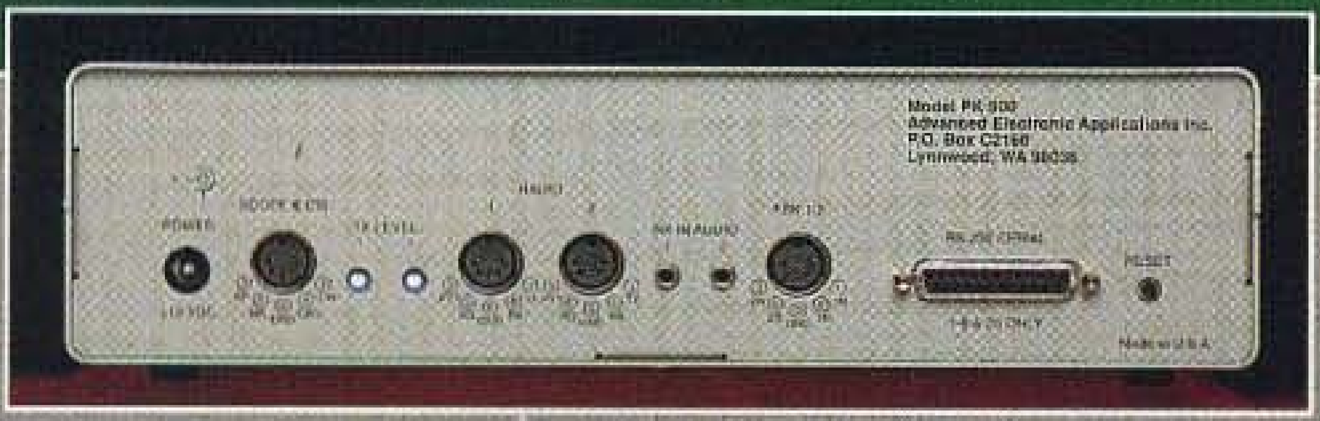
The League had informally submitted a proposal for a change in the rules to the Commission on January 6th, 1992, a change that would restate certain sections of Part 97.113 in order to enable amateurs to continue, unfettered, to perform public service work. The League had not submitted a formal proposal for rule making in the matter. The FCC in April assigned the proposal RM-7895, in P.R. Docket 92-136.

In its reply comments filed December 1st, the League said that trying to be specific in a "content regulation" such as Section 97.113 was impossible. Yet the League agreed that some regulatory guidance would be needed. For example, in the case of amateurs providing communications for events held on a regular basis, the League suggested that weekly events should be considered "regular" and therefore not suitable for amateur support. Yet, annual events would be held seldom enough that amateurs could be the best providers of communications.

The League noted that the National Association of Broadcasters (NAB) and the Radio-Television News Director's Association (RTNDA) were jointly seeking once again to relax the restrictions against the use of amateur radio in day-to-day news gathering, despite having been twice turned down by the Commission on that very subject. The League cited comments from an NAB member and former RTNDA board member who called the plan "self-serving" on the part of the broadcasters and pointed out dangers in amateurs being used regularly as news gatherers.

The League requested that the FCC finalize its proposed restated rule as soon as possible. *TNX Westlink Report #640, December 24, 1992.*

INTRODUCING THE PK-900... NEW FROM THE INSIDE OUT!



IT'S THE NEXT GENERATION IN MULTI-MODE CONTROLLERS.

Now, there's a new standard of excellence in multi-mode digital controllers...the new PK-900 from AEA. It incorporates all of the features which made the PK-232 the most popular multi-mode controller in the industry. But that's just the start. AEA's new PK-900 also features dual port HF or VHF on either port; low cost 9600 baud plug-in option; memory ARQ and VHF DCD state machine circuit; powerful triple processor system; zero crossing detector for the sharpest Gray Scale FAX you've ever seen; and many other new software selectable features.

Inside and out, the new PK-900 from AEA is what other multi-mode controllers will now be measured against.

- Processors used: Zilog 64180, Motorola 68HC05C4, Motorola 68HC05B4
- Data rates: 45 to 1200 baud standard, up to 19.2K baud with external modems
- Dimensions: 11.75" (29.84cm) x 11.75" (29.84cm) x 3.5" (8.89cm) Weight: 4.6 lbs. (2.08 kg)
- Power requirements: 12 VDC at 1.1 amps

Connect with us for what's new in multi-mode controllers.
Call our liturature request line at 1-800-432-8873.

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Constructing High Current Power Supplies

Practical considerations, learned through experience.

by David A. Nordquest KE9ED

Much amateur equipment requires outboard DC, so the most useful accessory in the ham shack is probably the regulated, high current 13.8 volt power supply. In building such supplies, back issues of ham magazines, handbooks, manufacturers' data books, and technically-minded friends can give valuable assistance. Unfortunately, some things have to be learned—or relearned—in the laboratory of the School of Hard Knocks. Here are a few of the practical lessons I learned while building a 30 amp, 723-based supply.

Transformers

Transformers take up the most room in linear supplies, and they differ greatly in shape and size, so your whole layout should be planned around one. Selecting a unit can be a problem. Most hamfest specials appear to be unmarked. If you can determine the open circuit voltage, choose a unit whose voltage rating is about 25% to 33% higher than your desired figure under load. This is a rough approximation only; the proper value will depend on the construction of the transformer.

The handbooks give formulas for estimating transformer current capacity from the cross-sectional area of the windings. A very rough estimate can also be made by observing the wire size. Still, I learned that it is a good idea to put a load on unmarked transformers before going too far in the construction. The sag from a no-load to a load condition varies greatly. I had to abandon my first construction attempt because an old battery charger transformer slumped too much. Unfortunately, my new transformer turned out to be too large for the old chassis.

To check for capacity and voltage sag, I loaded transformers with various high wattage, low ohmage resistors. By taking current and voltage readings for different loads I was able to plot enough points on a transformer load line to estimate the hypothetical short circuit current at zero voltage. A transformer is probably good for 10% or 15% of the estimated zero voltage current. Luckily, my final transformer, a Basler, came with the manufacturer's test report.

Just what voltage is needed at the transformer's secondary depends on many factors: on whether a half-wave, full-wave, or bridge circuit is used; on filter capacitor size; on drops in the rectifiers, pass transistors (about a volt each) and emitter resistors; and on the sag in the transformer. A lower voltage secondary can be used if a separate winding (as in commercial supplies) or a separate small transformer (more practical for the amateur) is used to provide the extra 3 or 4 volts of elbowroom the regulator chip needs. This will save on heat dissipation in the pass transistors. Although my transformer has an output high enough for the regulator, I breadboarded the separate transformer technique and it worked well.

After my first transformer failed to pass muster or supply sufficient current, a friend's donation of a beautiful new 24 volt 32 amp model brought new puzzles. At the output of the filter the voltage rose to about 34 volts, which was too high for the filter caps I had then and for the number of pass transistors I wanted to use. I considered using another transformer to buck the voltage, but found the amount of iron required to be excessive. I experimented with the two primary windings, one of which had taps for input voltages from 100 to 127. Putting the 0-to-100 volt portion of winding one in series with the untapped 110 volt second winding brought me very close to the output I wanted, but just a bit low. Using that part of the first winding between the 100 and 127 volt taps in series with winding two took the transformer output to 19 volts, which rose to 26 or so after the filter, with no load. That was a bit high, but still quite acceptable.

I was pleasantly surprised by the versatility of transformers with dual primaries and multiple taps. For example, if I want to change my 13.8 volt supply to 24 or 28 volts, I can simply reconnect the AC input to the proper transformer primary taps and adjust the regulator pot. (This assumes that other components are suitably rated.) I picked up two smaller units like this for future projects, because they're so useful.

Construction

Once I found my transformer I looked for a larger case. Eventually I cut down one from an obsolete piece of test equipment and replaced the front panels with thick, double-sided circuit board material. Because the frames of some of these cases are drilled and tapped, it is very easy to remove panels for servicing, meter adjustments, etc. The heavy plastic end pieces on this particular chassis provided a convenient location for mounting the pass transistor heat sink. Since the whole heat sink is insulated from ground, the transistors require no mica insulators, which simplifies mounting and slightly improves heat conduction.

I used some surplus GE 100 or 125 amp diodes to construct my full-wave bridge. Unless you get two diodes with reversed anodes and cathodes, be prepared to saw heat-sink material and to insulate the three required rectifier heat sinks (two single and one double) from each other, as well as from the chassis. If the proper mounting hardware is available all the diodes can be insulated and installed on a single heat sink, but a bridge module is an easier solution. I recently saw a 100 amp model at a hamfest for $4, new.

It is a good idea to put bypass capacitors

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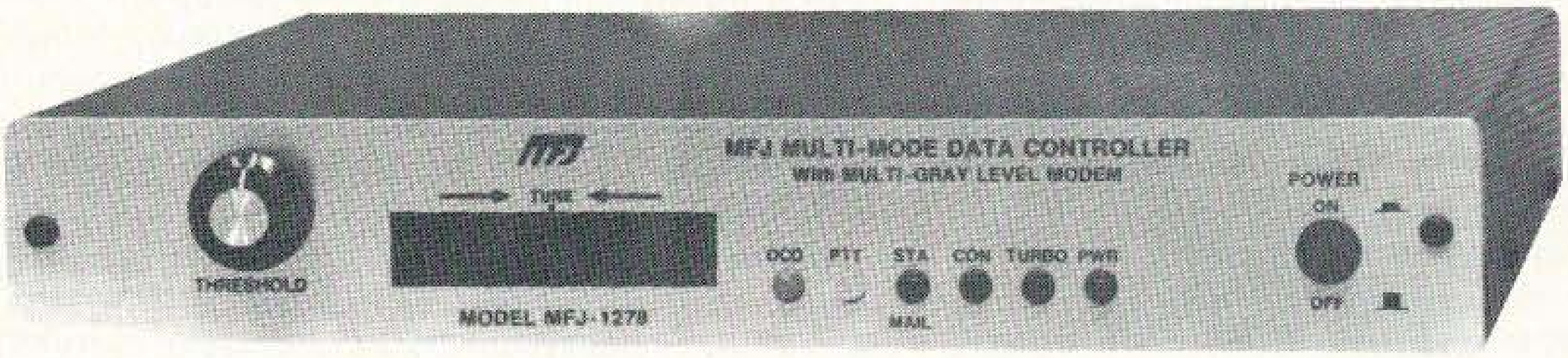

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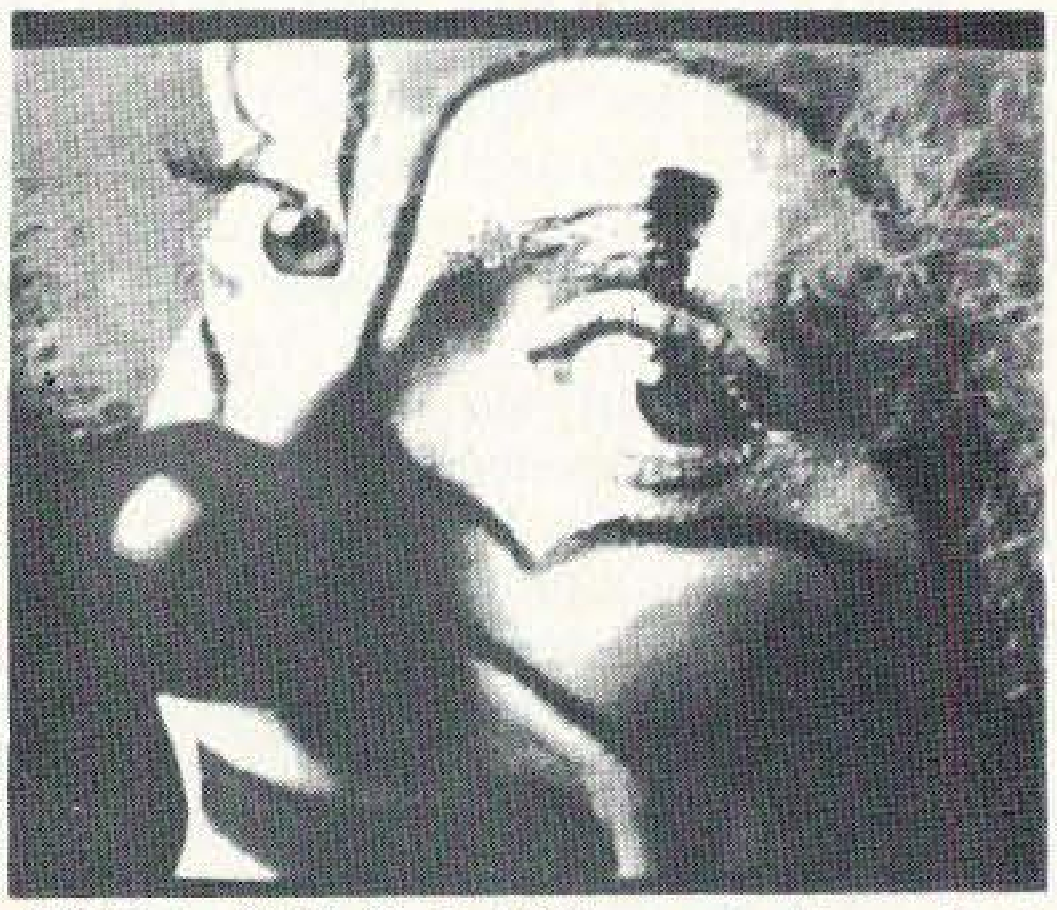

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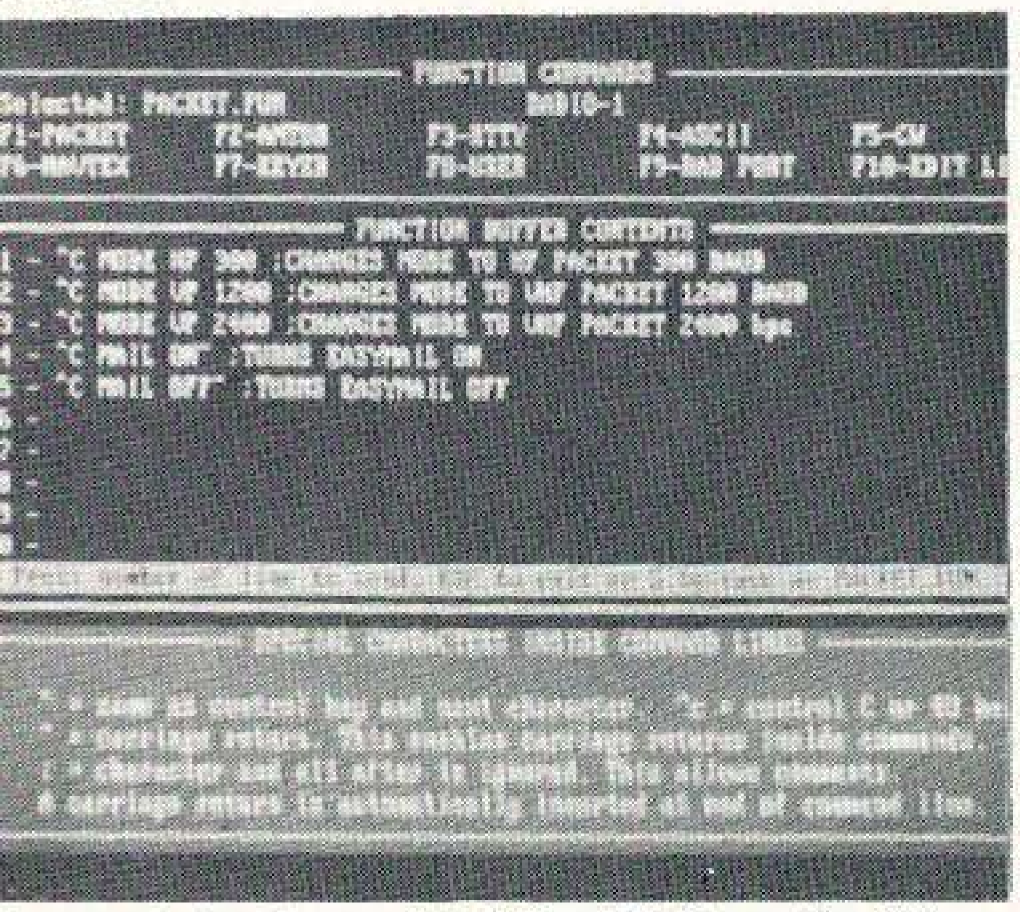

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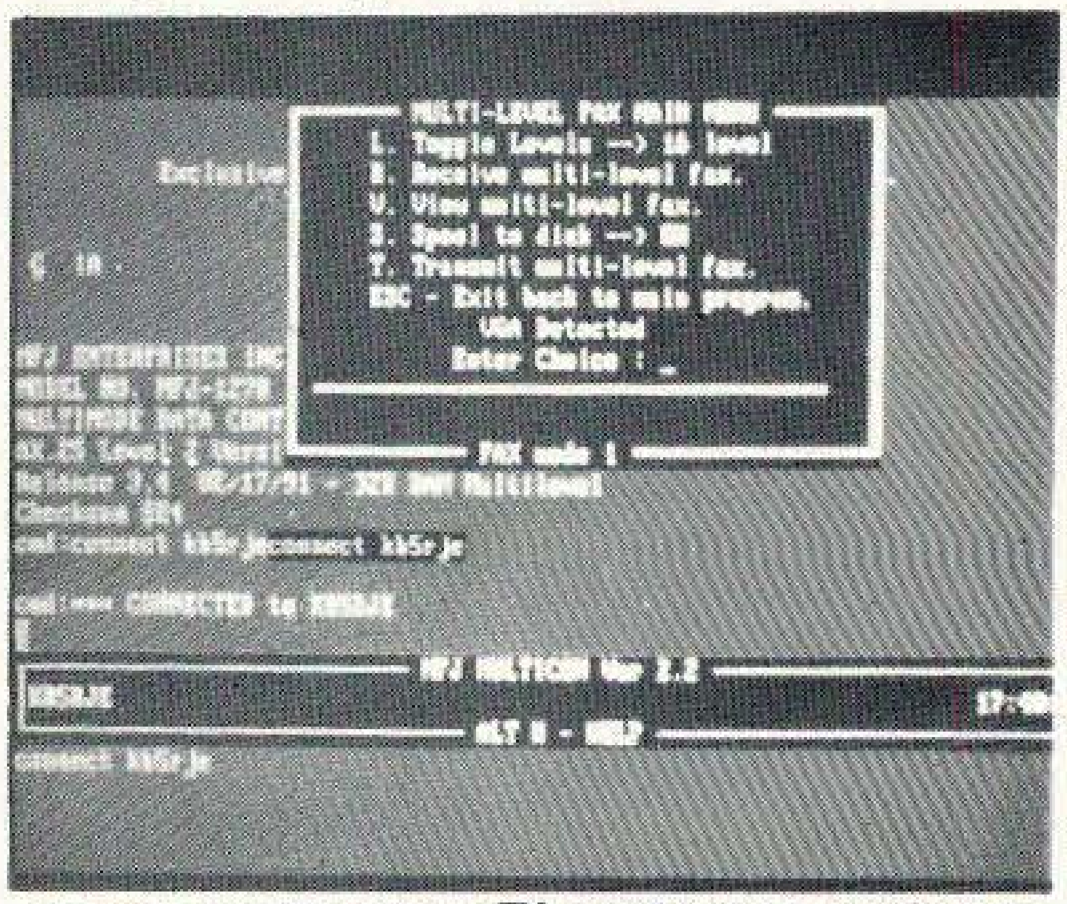

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across the diodes when installing your rectifiers. After my supply was up and running I noticed a strange buzzing noise on an AM radio when I turned the supply on. Holding a capacitor across one diode (carefully!) reduced the noise. Bypassing them all with 0.01 µF ceramic disc caps made the noise vanish. Do this first—that's easier!

Computer-grade filter capacitors are very expensive new, but are readily available for a dollar or two each at hamfests. I eventually found two 67,000 µF, 75 volt units for my supply. The handbooks have formulas for calculating the capacitance needed, according to transformer voltage, voltage and current needed by the load, and type of rectifier used. The 2,000 µF per amp value sometimes recommended as a starting point is only a rough guess. My 134,000 µF value is high, but my diodes are husky enough to withstand the tremendous surges during the microseconds of each cycle when their output voltage is higher than the capacitors'—the only time they can conduct.

For the regulator circuit, I chose the 723 chip for its excellent regulation, current limiting, and remote sense capability. Many designs have been published for this chip, but a couple of my "experiences" (the name we give to our mistakes) may be of interest. Avoid too much gain or too little gain in the drivers between the regulator and the pass transistors. Too little gain will make the 723 over-exert itself; too much may make the circuit highly sensitive and subject to microphonics. Initially, I had the 723 driving a 2N5339, which drove a high-gain MJ4035 Darlington, which drove the pass transistors. The drive current from the 723 was so low it was almost unreadable and the supply output was jittery. Eliminating the 2N5339 solved the problem and the 723 still loafs along with a drive current of 100 microamps at a 2 amp supply output. To ensure stability, I put a 2.7k resistor between the 723 output and ground to maintain a more reasonable and constant load.

Builders who want to avoid the hassle of making their own regulator board may want to try a trick suggested to me by Rick WA3MKT. You can purchase a relatively inexpensive low current, 723-based supply with remote sensing and use the output to drive your pass transistors. If you hook the remote sensing terminals to the main supply output, the small supply will regulate the main one. Although I did not use this technique in my supply, I breadboarded it and it worked well.

If you make your own regulator board, be sure to include a good ground and to run both ends of the divider network (which sets the voltage output) directly to the supply output terminals or to the load. I did not do either at first and my regulation was poor at higher current levels.

Some references emphasize the desirability of using pass transistors of the same designation and lot number. I obtained several 2N3771s, which are much huskier than 2N3055s, and took care to select all from the same lot. I found the gains varied from the mid-teens to about a hundred. Perhaps different lot numbers or even just similar transistors (such as 2N3771s and 2N3772s) with closer gain figures would be as good or better. If you use mixed transistors you will have to design based on the weakest specs. However, gain differences within types are relatively unimportant because they can be swamped by using 0.1 ohm emitter balancing resistors.

Whatever pass transistors are used, their ratings mean little unless they are cooled by an adequate heat sink. Calculating the surface area needed is not at all simple, as the formulas in the handbooks and regulator data books will show. Because amateur-built supplies, like mine, will likely use non-custom transformers, the pass transistors will probably have much more heat to dissipate than in commercial supplies. The number or capacity of the pass transistors and the size of the heat sink should be correspondingly greater than in such commercial units.

Wiring high current supplies is no trivial matter. To avoid unwanted voltage drops, I used two runs of #10 stranded wire, purchased from an electrical supply company, for all heavy current runs. The great advantage of using stranded wire is that it bends more easily, but it is also more difficult to solder to terminal lugs. I took care of that problem by making liberal use of crimp-on ring terminals, which I soldered to the wires for safety.

Some of my terminal lugs had several wires running to them. The positive output jack had two heavy wires from the current limit resistor, one wire from the regulator voltage-setting divider, one from the overvoltage protection circuit, one from the output capacitor, and one from the voltage meter. It would be difficult to solder all those wires properly to the output jack. I terminated them all with ring terminals and made a heavy copper extension for the jack, with a machine screw attached to accept half of the wires. Where I needed wires insulated from each other I used machine screws isolated by bare circuit board material.

With the heavy wire runs I used and with a substantial current resistor already breaking the positive output path, I had no desire to add another break for an amp meter shunt resistor. Instead, I configured a meter as a 1 volt voltmeter and had it read the voltage across the current limit resistor already in place. By playing around with values I was able to get the voltage figure indicated on the meter to correspond to the actual output current. Because the current limit resistor is so low in value (about 0.025 ohms in this supply) the connection between the meter leads and the resistor terminals should be flawless. When mine was not, I read 4 to 8 amps, rather than the 2 a car taillight was actually drawing. Concerning the output voltage meter, almost any sensitivity will do, if the proper series resistance is calculated.

The relatively simple schematics for regulated, high-current supplies may make them appear like easy and inexpensive weekend projects. Inexpensive they can be, with good shopping and the help of good friends. However, when you add in the tuition charges in the School of Hard Knocks, the opportunity costs do not look so trivial. Nor are home-built supplies likely to be as efficient as commercial units unless a custom transformer is available. Still, I've ended up with an excellent supply and will find my next supply project, and any needed repairs, much easier now—especially if some other alumni of the School will report some of the lessons they had to learn. 73

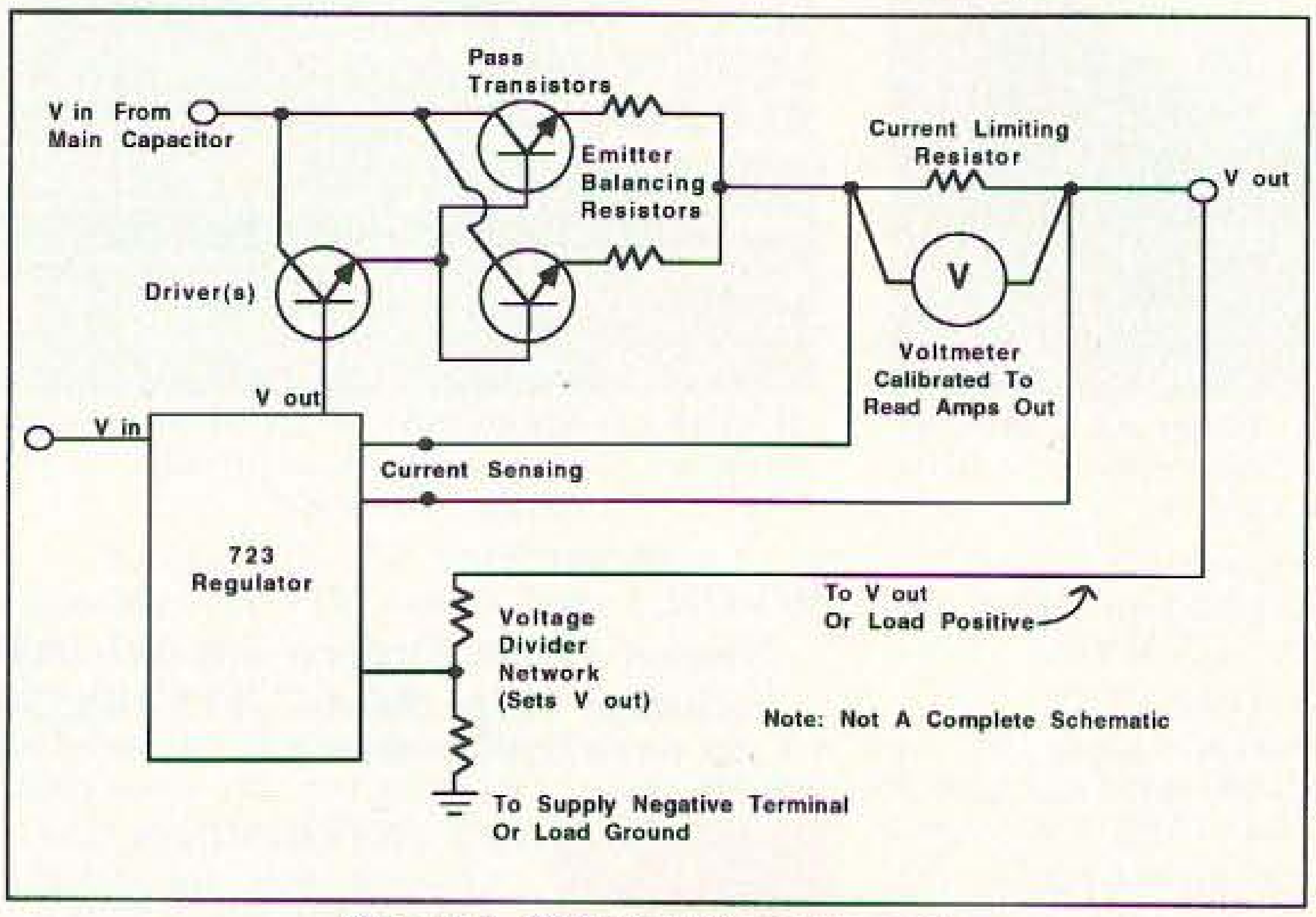

Figure 1. 723 circuit components.

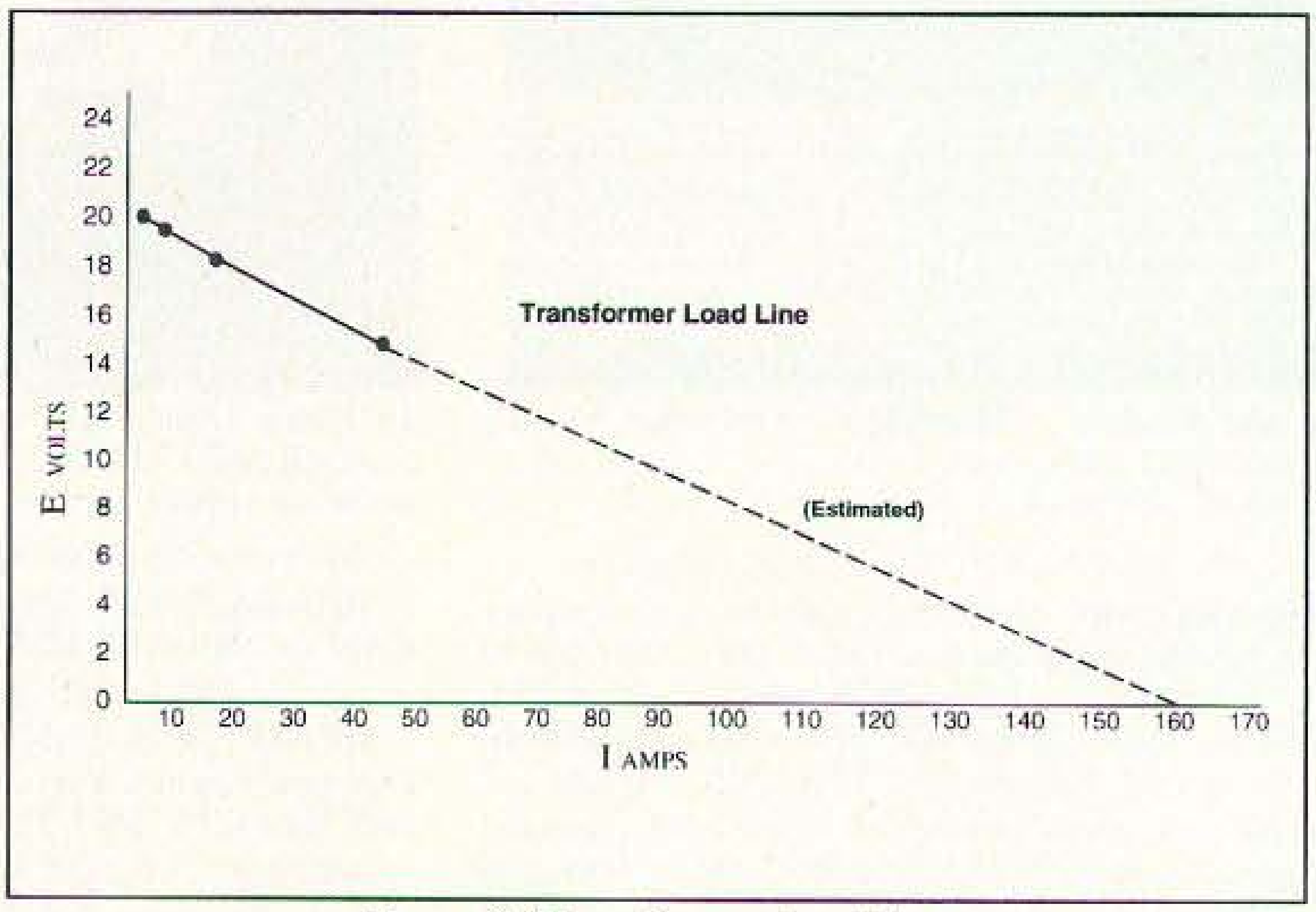

Figure 2. Transformer load line.

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Fiber Optics and Amateur Radio

Is fiber-optic technology in our future?

by Roald Steen AJØN/LA6US

Fiber optics is a segment of the communications industry which is evolving rapidly. While fiber optics is used chiefly for land and undersea communications cables, there are also uses for this technology in amateur radio.

One of the most interesting applications of fiber optics in amateur radio may be as a substitute for coaxial cables. As you know, coaxial cables are lossy. The longer the coaxial cable and the higher the operating frequency, the more the signal will be attenuated in a coaxial cable. The falling cost of fiber-optic receivers and transmitters makes fiber optics an attractive substitute for coaxial cables.

We are used to having the receiver and the transmitter in the shack, but the correct location for these devices is really right next to the antenna. Through fiber optics, it is possible to select these favorable locations for the transmitter and the receiver.

The equipment in your shack could produce both the frequency and the modulation of the signal which you are transmitting. Once these two components of your signal are generated in the shack, they can be fed from a fiber-optic transmitter through a fiber-optic cable to the antenna, where an RF amplifier could be mounted in a weatherproof enclosure.

Both the fiber and the electric power to the transmitter must run up to the antenna. This can be achieved, in the case of a solid-state transmitter, simply by supplying the 12 volts DC, needed to operate the transmitter, through low voltage wiring.

Also, for the receiver front end, the best location is as close to the antenna as possible in order to avoid attenuation of the received signal and pickup of noise. Coaxial cables pick up some electronic noise. By running fiber-optic cable from the receiver front end to the receiver in your shack you eliminate all pickup of electromagnetic noise in the feedline. Fiber-optic cables are completely immune to electromagnetic noise. You can run a fiber-optic cable right next to the most powerful RF devices without any RF getting into the signal propagating through the cable.

Photo A. Fiber optics is a rapidly evolving communications technology which is of interest to the amateur radio community.

Mobile Radios

Manufacturers of mobile radios have started to embrace fiber optics. Some mobile radios now come with a small but advanced control head which communicates with the transceiver in the trunk through a fiber-optic cable. This technology has also been adopted by some mobile amateur radio manufacturers. Aviation and marine radio manufacturers are also adopting the fiber-optic cable as a link between the control head and the transceiver.

Fiber-optic cables can be used for a number of other control and communications purposes. For example, fiber-optic cables may be used to connect one or several remote receivers to a repeater.

A significant advantage of fiber optics over other communications cables is its enormous bandwidth. A bandwidth of gigacycles is possible. This bandwidth limitation is not a limitation inherent in the fiber itself, but rather in the input and output devices, i.e. the optic receivers and transmitters.

The technology of fiber-optic receivers and transmitters is steadily improving. Scientists working for a Japanese company recently fed information at a rate of 20 gigacycles through a fiber-optic cable exceeding 600 miles. This equals a capacity of around 3,000 television channels. Commercial devices are lacking such laboratory records, yet the capabilities of modern commercial fiber-optic systems can be impressive.

Optic Fiber Types

There are three main types of optic fibers. Plastic fibers have high attenuation ratings which limit this fiber type to cables that cover up to a few hundred feet. But plastic fibers are cheap and easy to install, and are therefore an attractive material for short cable runs.

Regular glass fibers have some spreading of the signal, since internal reflections from the edges of the fiber ensure that a signal which is sent from one end is received somewhat smeared out in the other end. This smearing limits the amount of infor-

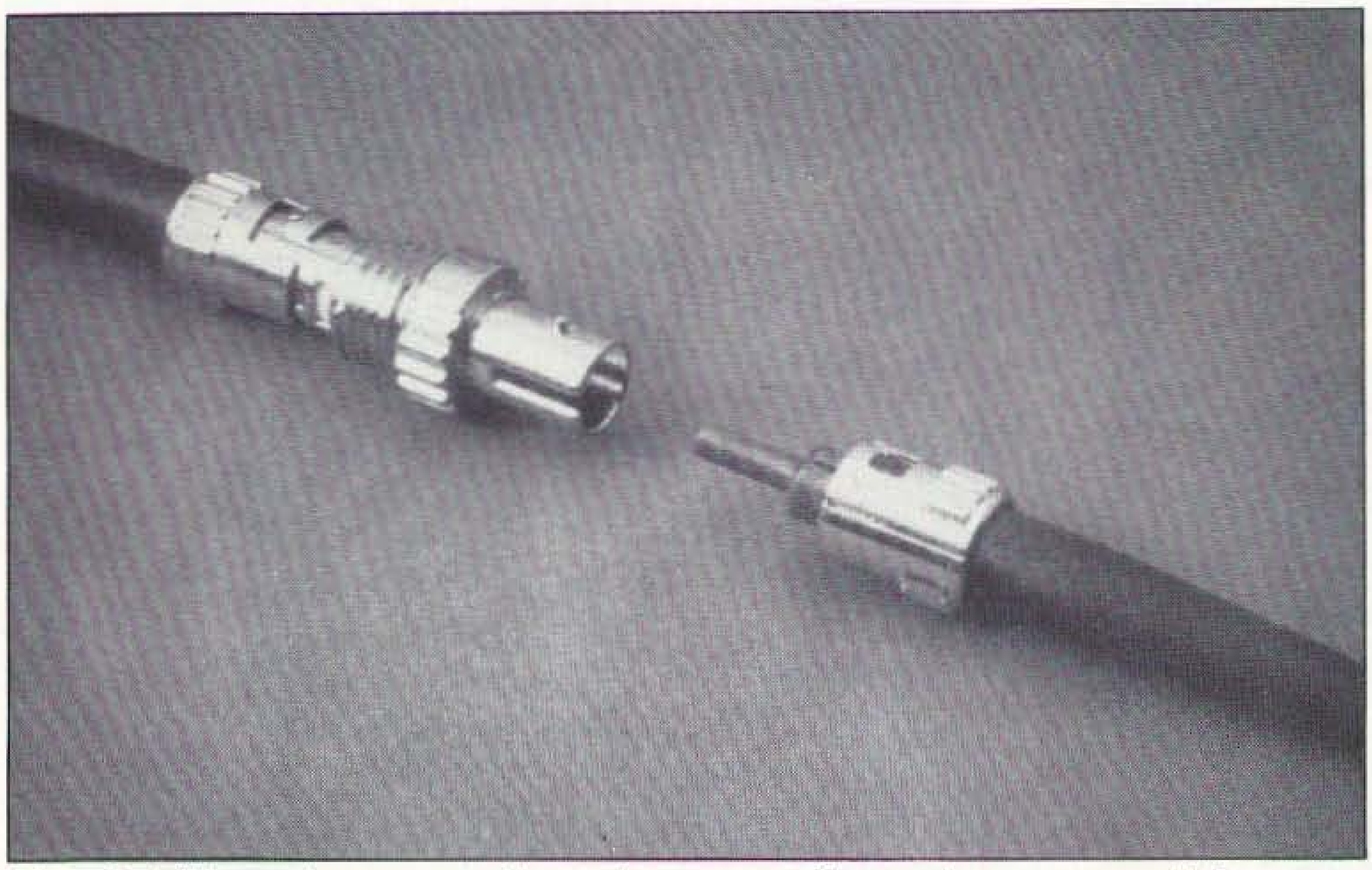

Photo B. A fiber-optic connector. New and easy-to-use fiber-optic connectors with low attenuation are on the market.

mation which can be transmitted. The problem of smearing is especially significant for long cable runs and for circuits that communicate very large amounts of information. This type of fiber, which is the simplest type of glass fiber, is called multimode fiber.

A single-mode fiber is an advanced optic fiber. This type of fiber is used in most long-distance fiber circuits. A single-mode fiber has a construction which keeps the light centered in the middle of the fiber throughout the trip, thereby eliminating the problem of smearing.

Connectors have been one of the challenges of the fiber-optics industry. Early fiber-optic connectors were difficult to install and introduced a considerable amount of attenuation in the circuit. However, many large corporations are now competing in the fiber-optic connector market. Connectors have been developed (partly due to the intense competition) that are easy to install and have very little attenuation compared with early fiber-optic connectors.

Modern high speed computing, called supercomputing, would not have reached its present capabilities without fiber-optic communications between computers, control devices and memory devices.

A fiber-optic cable can carry many more television channels than a coaxial cable. Therefore, more and more cable television systems are adopting the use of fiber-optic cables. In cable television systems the optic fibers are used mostly to connect the studio with distribution amplifiers and similar devices. Relatively few homes have been connected directly to optic fibers for cable television.

But it is likely that more and more homes will be connected directly to optic fibers. Not only may the optic fiber bring television into the home, but also telephone service. The technology exists to allow the same fiber-optic cable to be used for both telephone and for cable television service.

A drawback to telephone service through optic fibers is that the optic fiber cannot bring power to the telephone, unlike a copper telephone wire which serves both as a communications cable and as a power cable for the telephone. The optic fiber must therefore be complemented by copper wires in order to supply the telephone with power. Already, most cables that are laid between telephone switching offices are made with optic fibers instead of copper.

Fiber optics has almost completely taken over for copper in new undersea cables. Currently, there are three transatlantic fiber-optic cables in operation, with a total capacity equivalent to about 200,000 telephone circuits.

A new undersea fiber-optic cable which will connect Europe with the Far East is in the planning stage. This cable will go from Europe through the Mediterranean, the Red Sea, the Indian Ocean and into the Far East. The capacity of this cable could reach the equivalent of more than half a million telephone calls.

The need for repeaters has been a challenge for the manufacturers of trans-oceanic fiber cables. These repeaters need electric power from copper wires, which must be run in addition to the optic fibers in a trans-oceanic fiber-optic cable. The distance that can be covered without repeaters has been increasing due to new fibers, transmitters and receivers. Also, new optic amplifiers may reduce the complexity of new trans-Atlantic cables. Optic amplifiers amplify the optic signal without first converting it into an electric signal. The optic amplifiers also require an electric current supply.

The rapidly evolving fiber-optic technology may offer many interesting capabilities to ham radio. It is therefore well worth the effort to pay attention to this interesting technology and its growing capabilities. 73

FEEDBACK

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73 Review

by Jeffrey Sloman N1EWO

Number 6 on your Feedback card

The AEA DSP-2232

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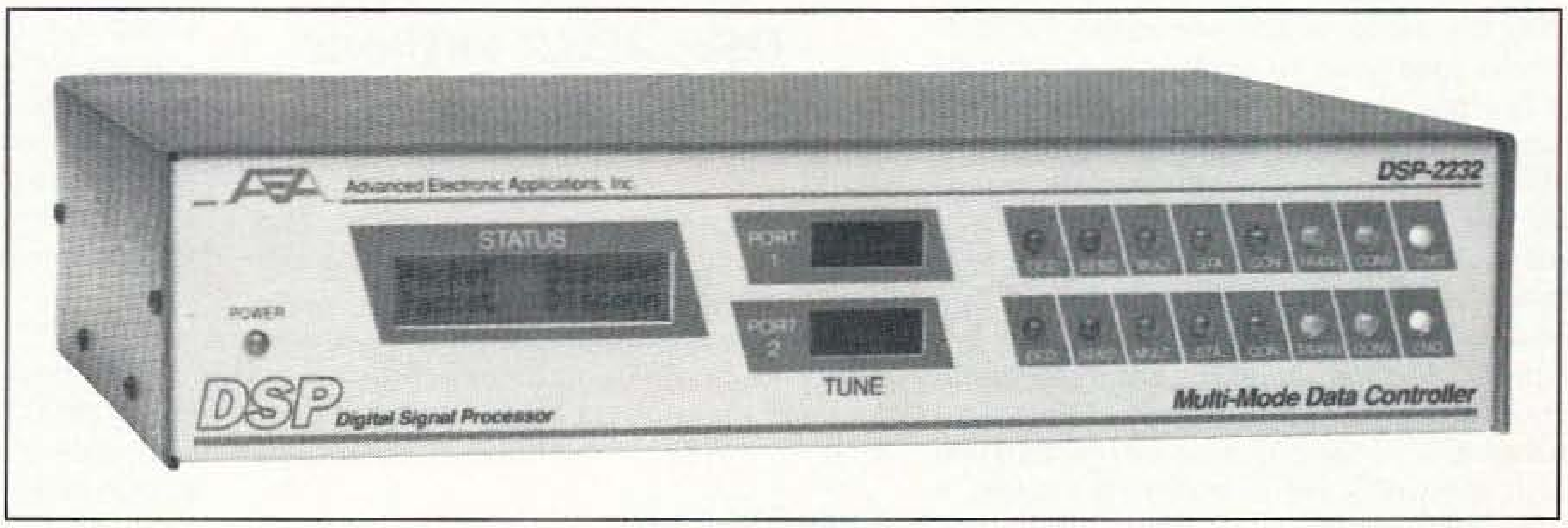
Suggested List Price: $999

DSP—it seems that you just can't avoid hearing these three letters today anywhere analog signals are in use. Amateur radio gear is no exception. Manufacturers of just about anything that uses filters have jumped on the DSP bandwagon—taking advantage of this up-and-coming technology. The subject of this review—AEA's DSP-2232—is a great example of how DSP can bring intelligence and flexibility to a product traditionally hardwired for a job.



The AEA DSP-2232.

What is DSP?

DSP stands for Digital Signal Processing. DSP uses microprocessor technology to simulate analog filter circuits (in the case of the DSP-2232, the filters used in the modems). DSP has two principle advantages over traditional analog filter design. First is performance: A DSP filter can have very good skirt characteristics. The "skirt" of a filter is the slanted line you see on either side of the filter's frequency response when you plot it on paper. DSP filters are exceptionally sharp, much sharper than even very expensive and sophisticated analog designs.

The second attraction of DSP filters is the fact that they are "virtual." That is, they really only exist in the "mind" of the computer as software. This makes impossible things possible. There are things that a DSP-based filter can do that no amount of time, energy, and money could do to an analog filter. For example, DSP can be used to create "adaptive" filters that actually change their characteristics on-the-fly to adapt to changing conditions. The soft nature of DSP filters also means that new filters—hence new modems, for example—are only a download away. A controller like the DSP-2232 need never become obsolete, thanks to DSP. New mode? Download the firmware and you are on the air. (Note: As of this writing, AEA has not yet set up their BBS to allow downloads, but it is their intention.)

Inside the Unit

The heart of the DSP-2232 is a 24 MHz Motorola 560001 DSP chip. This specialized IC provides the modems for all operating modes. The list of supplied modems is impressive:

300 bauds HF packet (FSK)
1200 bauds VHF packet (FSK)
2400 bps packet (DPSK)
1200 bps packet (BPSK—satellite)
HF RTTY (FSK)
Morse
Facsimile
SSTV (256 levels)
9600 bps (FSK—KK9G)
1200/4800 bps ASCII (satellite)
Dual-port 300/1200 or 1200/1200 packet
Dual-port RTTY or AMTOR/1200 baud packet

The DSP-2232 uses a Zilog Z-180 embedded microprocessor to handle protocol conversion—that is, to deal with the logic of maintaining an intelligent connection like packet or AMTOR. On the back of the unit are two radio interface ports which operate simultaneously, allowing true dual-port operations in some modes. The DSP-1232 is a single-port version of the controller, though it too provides radio interface connections which may be used one at a time. These radio connections are traditional 5-pin DIN connectors and the manual provides diagrams for connecting the unit to most popular radios using the supplied cables. The five lines available at the interface are: receive audio, transmit audio, PTT capable of +25 to -40 VDC, squelch input, and ground.

Each radio is also supplied with a direct FSK (Frequency Shift Keying) output—available from a single 5-pin DIN—for high speed operation, and a CW keying output (RCA jack)—positive or negative—for Morse code operation. Next to the CW outputs is a satellite up/down frequency control output for Doppler compensation. The current firmware does not use this jack, though some frequency compensation scheme is in the works.

The computer or terminal device is connected to an AT standard 9-pin D connector which provides RS-232 I/O. The unit is also capable of driving a Centronics parallel printer directly through a 25-pin D connector. Power for the DSP-2232 is a nominal +13 VDC (12-16) @ 1.1 A through a coaxial power connection on the rear panel. No power supply is provided, though a terminated pigtail is included for connection to your shack's supply.

The DSP-2232 is housed in a sturdy aluminum cabinet with an attractively silk-screened front panel. In addition to a full set of standard LED status indicators, the unit sports an easy-to-read backlit LCD display which provides plain text status messages—a very hale feature. Between the LCD and LEDs are two LED bar graph tuning indicators—one for each port.

The Manual

I have mixed feelings about AEA's manuals. As is typical for AEA controllers, the DSP-2232's is quite complete as far as technical information goes. In addition to the extensive radio wiring information, AEA has provided full schematics for the unit. The manual provides step-by-step installation and check-out instructions and extensive tutorials on the various operating modes. Also included is a complete and well-written reference to the commands understood by the controller—though it is not broken down by mode. So, what's the problem?

Most of the beginning users that I spoke to had a hard time getting started using the AEA manual, even with the extensive information provided. It seems that there is no middle ground in reading it. A novice must go through the (potentially) tedious installation process outlined in the manual step-by-step to use it. Though the described procedure is an excellent one, there is much that could be left out unless a problem arises. Many of the users I spoke with found this process daunting—taking nearly a day to complete in some cases. To be honest, though, I'd much rather use an AEA manual with whatever its flaws than most others I have seen. The AEA manual has the information you need, if you can find it.

Compatibility

The DSP-2232 control firmware is essentially the same as the venerable PK-232. This is good news for those of you who wish to upgrade your PK to a DSP—your current terminal software will work. Those using the PC-Pakratt II (or MacRatt) terminal software will find operation the same. One thing that will need to be improved, though, is the 1-bit (black and white) facsimile display. The DSP-2232 can produce gray scale fax images, but PC-Pakratt II cannot use them. Those of you just starting with AEA products will be able to use any terminal program you wish. If it works with a telephone modem, it will work with the DSP-2232—except for fax.

Performance

If performance is the bottom line, then I recommend the DSP-2232 without hesitation. On VHF packet, the unit performs like a champ. This isn't too hard, and most TNCs/controllers do. On HF, though, the DSP-2232 shows what it can really do to pull packet, RTTY, and AMTOR signals out of the mud, which other units will not. AEA has lived up to their own tradition of top-notch HF performance. Though I was not able to test it myself, those I have spoken to who use the DSP-2232 for satellite operations are very pleased with its performance there—the only disappointment being the lack of Doppler shift compensation at this time.

"If performance is the bottom line, then I recommend the DSP-2232 without hesitation."

Some Flaws

The DSP-2232 is not perfect; what is? The good news is that what is lacking is software. All of the complaints are not-yet-implemented features. The frequency up/down control, for example. There is also currently a lack of software to take advantage of the SSTV and gray scale facsimile, but these are on the way. The DP-2232 is a relatively new product using a relatively new technology. AEA has been very responsive in correcting problems as they are brought to light, and adding features as the production schedule allows. For example, a PACTOR upgrade for the unit is due out soon. This will be a software upgrade—proving the value of DSP.

The other area that some might consider a problem is cost. The DSP-2232 is not cheap. On the other hand, "you get what you pay for" applies to this product as much as any. The box is protected against obsolescence by its DSP technology until our digital modes exceed its computer power. This will certainly happen someday, but it isn't an imminent concern.

Conclusion

If the price isn't a problem, I can recommend the DSP-2232 without hesitation. It is truly state of the art. Those of you involved in high speed packet, satellite, or HF operations will have a hard time doing better at any price. The DSP-2232 has a safe future. As the VHF packet and HF digital networks mature, the DSP-2232 will follow with just a change of firmware.

Digital Satellite Gateway Nodes

How to get on OSCAR 22 with an HT.

by John A. Hansen WAØPTV

Ken KE2SR, who lives near Buffalo, New York, is a fairly new Technician class ham who uses his Commodore 64, a Digicom modem, and an HT to communicate on packet radio with hams in Australia, New Zealand and elsewhere around the world via the orbiting satellite OSCAR 22. Impossible, you say? Not at all—he simply uses his local packet satellite gateway node.

The satellite gateway node system is a fairly new development in packet radio satellites. It permits region-wide access by hams with anything from very modest equipment to the latest in digital satellite technology. You don't need a satellite transceiver, you don't need satellite antennas, and you don't need any specialized modems. All you need is a standard barebones packet station that is capable of connecting with your local BBS. The "catch" is that there must be a BBS in your area equipped as a satellite gateway node.

The satellite gateway node software automates the interface between a standard packet radio bulletin board system and a high speed (9600 baud) satellite ground station. All users of the BBS (and all other BBSs in the region) can have access to directories of the files available on OSCAR 22, can mark files to be downloaded the next time the satellite is overhead and have those files imported directly into the BBS, and can upload files to the satellite. In short, they can do virtually everything with the OSCAR 22 satellite that they would be able to do if they spent several kilobucks setting up their own satellite ground stations.

About OSCAR 22

UoSat-OSCAR 22 has been in orbit more than a year now. It was built by the University of Surrey in England and represents the current state of the art in digital satellites. It is essentially an orbiting bulletin board with 8 megabytes of on-board storage. The uplink is on 2 meters and the downlink is on 70 cm. Both the uplink and the downlink are FM and run at 9600 baud. Files can be uploaded and received at a very fast rate. It is possible, for example, to upload a 100K file in about three minutes. Depending on the level of congestion on the satellite, it is possible to receive files from the satellite at about the same rate. On a typical satellite pass of 13 minutes duration, over half a megabyte of data can be obtained. For the most part this data is compressed, so the amount of actual uncompressed data received is quite a bit greater.

Typically, OSCAR 22 passes over any point in the United States six times per day, with three passes in the morning and three passes in the evening. The passes are about 10 to 15 minutes in duration and are spaced about an hour and a half apart. Because of the high data rates used on OSCAR 22, the variety of material available on this satellite is much greater than on a standard terrestrial BBS. In addition to messages between individual hams, there are photographic images taken by the on-board camera; public domain software packages; schematic diagrams; digitized images of hams, their stations and the areas where they live; and digitized voice files. There has been something of an explosion of digital experimentation on this bird as people have begun to appreciate the implications of being able to easily transfer files that are measured in hundreds of kilobytes rather than in bytes or kilobytes.

Ground Station Requirements

Ground station requirements are fairly modest, requiring FM radios on 2 meters and 70 cm and vertical antennas with a preamp on the 70 cm side. As a practical matter, however, most ground stations access this satellite with OSCAR-13-class stations (high gain, directional antennas) so that in heavily populated parts of the earth, such as the United States, access with vertical antennas is difficult. There are a few other difficulties as well. The radios used must be capable of 9600 baud transmission/reception and the TNC used must have a 9600 baud modem. Because the satellite moves across the sky, there is a problem tuning the radio during the pass to correct for the Doppler shift. The technology is available for automatically tuning the radio and pointing the antennas, but it is difficult to accomplish this cheaply.

Satellite tracking software will let you know when the satellite is within range.

UoSat 22 Directory

Msg#	Size	To	From	T Date	Filename	Subject
a6ff	1544	N4OUL	KG4TM	A 11/10	n4oul.zip	More user info 4U
a712	2746	G3CDK	WAØPTV	A 11/10	GW2656.ZIP	Gateway Nodes
a713	978	VK4BRG	WB2WPM	A 11/10	GW8745.ZIP	THANKS QSL
a708	1373	wbØscd	kd8si	A 11/10	jim1.txt	CTS thoughts
a70a	1878	kd8si	wbØscd	A 11/10	leo.txt	Greetings Leo
a70f	762	ZL2ATI	KB2OUT	A 11/10	GW1913.ZIP	HELLO !!
a71c	1869	WB6LLO	K6OYY	A 11/10	wb6llo.zip	CFG FILES & COMMENT
a725	937	KB7CNN	N7RYW	A 11/10	kb7cnn1.txt	Thanks
a731	1876	G3cdk	oh1kh	A 11/10	roddy	In some ways.....
a732	944	oh7by	oh1kh	A 11/10	pali0911	Onnea vaan
a736	1049	JA6FTL	ZS6AQC	A 11/10	JA6FTL02.ZIP	JA6FTL02
a778	1978	wb6llo	KB2MVN	A 11/10	wb6llo	DL THIS FIRST
a779	1646	WB4FIN	KG4TM	A 11/10	WB4FIN.ZIP	SAS_100 on 2 PC's?
a75f	21759	OH1KH	VK3AHJ	B 11/10	Cats..	
a772	816	wb6llo	jh1aoy	A 11/10	WB6LLO11.10	Thanks reply
a74c	404	dl1cr	hb9aqz	A 11/10	101192.aqz	T_B Kaeschtele?
a74d	865	N4OUL	IT9DLN	A 11/10	N4OUL.TXT	USERS INFO DSP-12
a759	12540	Satgat	VK4TTY	A 11/10	rtty	RTTY NEWS
a768	794	SMØTER	VK4KAA	A 11/10	SMØTER02.ZIP	THANKS
a769	800	ZL1ACO	VK4KAA	A 11/10	ZL1ACO03.ZIP	THANKS
a76b	1122	WB8LEM	VK4KAA	A 11/10	WB8LEM03.ZIP	THANKS
a76c	1988	n4oul	tf3lj	A 11/10	n4oul.001	DSP-12 Users List
a76d	751	on6ug	DJ1KM	A 11/10	on6ug.lzh	FT-736R CAT-Ctrl
a786	747	N4OUL	WB4FIN	A 11/10	n4oul01.zip	User Info
a777	864	W6SHP@WD6	N3CXP	A 11/10	myfile	A QUESTION ABT THE 232
a776	60398	vk3ahj	kb2mvn	B 11/10	family.zip	family.pic
a788	327	IØQGR	N4OUL	A 11/10@IØQGR	REPLY	
a787	698	EA4RJ	N4OUL	A 11/10	EA4RJ2	DSP-12
a71d	612	KA7CMF	K6OYY	A 11/10	jack.txt	THANKS
a71f	1006	wb0scd	kd8si	A 11/10	jim3.txt	Doppler feedback
a720	1172	WH6I	N4OUL	A 11/10	WH6I	DSP-12 REPLY
a774	19195	vk3ahj	oh1kh	B 11/10	ron1011.lzh	Small is beautiful..
a775	774	oh7by	oh1kh	A 11/10	palibat.lzh	Bat.it
a78e	794	oh1kh	OH7BY	A 11/10	oh1kh.lzh	Kiitos ja onnea !!
a711	1951	WD4ASW	WAØPTV	A 11/10	GW1695.ZIP	Re: Progress with DOF
a70b	323	WBØSCD	WD8NNG	A 11/10	lloyd.jim	Lindenblad
a726	2040	N4OUL	N7RYW	A 11/10	n4oul1.txt	DSP-12 User

Notes: Neither ZL2ATI nor KB2OUT own satellite stations, yet they appear on this directory as if they did because they are using gateway nodes.
File a776 is a digitized picture.

Figure 1. Typical Uo22 directory file as it appears on the BBS.

A typical Uo22 ground station consists of a modified Yaesu FT-736R (or ICOM 275/475 or 970 or Kenwood TS-711/811 or 790), a 9600 baud modem, a pair of satellite antennas (such as the KLM 40CX and 22C) and a computer-driven rotator (such as the Yaesu 5400). Many other combinations are possible and it certainly is possible to operate Uo22 with less expensive equipment, but this is a typical station configuration.

Enter the Gateway Node

Many people would like to have the benefits of operating Uo22 but are unable to make the investment required. The Satellite Gateway Node software was designed to meet this need. It integrates a fully-automated satellite ground station with a standard terrestrial BBS. It runs entirely unattended and requires little more sysoping than does a stand-alone BBS. Here is how it works.

Twice a day (after each set of satellite passes) a directory of the most recent files available on Uo22 is placed on the terrestrial BBS. BBS users can then read that directory (by simply reading the message containing it) to find out what is available. (A typical directory file is displayed in Figure 1.) The directory shows the file number, the file size, who the file is to and from, the date the file was uploaded, the filename, and a subject for the file. In addition, in the "T" column, it shows whether each file is an ASCII type or binary type file. When BBS users request ASCII files, the files are imported into the BBS as standard messages directed to the individuals who requested them. When BBS users request binary files they are moved to a specified subdirectory on the BBS where they can be downloaded by the users who requested them. In the latter case the user is sent a message telling him that his binary file has arrived.

If a BBS user wishes to obtain any of the files in the Uo22 directory, he merely sends a message to UO22MK @ UO22MK that contains a list of the file numbers he wants. Each time a file is received from the satellite it is placed in a special subdirectory. When someone requests a file from the satellite using the UO22MK procedure, the gateway node first checks this subdirectory to see if the message already exists. If the message exists, it is immediately uploaded to the BBS. If not, it is marked for automatic downloading from Uo22 on the next pass. This is why the system is called a NODE. Files are stored on the gateway node so that a file is never requested from the satellite more than once.

It takes awhile to get used to having to enter a request for a file and then wait until later to actually receive the file. As a practical matter, however, this is what satellite ground station owners have to do as well. Files obviously can only be obtained when the satellite is actually overhead, so users must wait until the satellite comes up, re-

Continued on page 24

Clock It Quick

Tame ripple counter chips.

by Eddie J. Arnold

This article will teach you how to tame ripple counter chips, such as the CD4020, CD4040, and CD4060.

Back in 1988 a guy asked me to build him a timer circuit that would require his kids to put a certain amount of money into a coin slot, thereby allowing them an allotted period of time to watch television. The idea was novel, I thought.

I got the bulk of the circuit working, but not the timing portion. I was using the CD4060 chip in this particular application. I started playing around with certain guessed values to get a "feel" for what kind of time I could expect to receive at respective pinout locations. I was looking for 60 minutes on one pin and 30 minutes on the other, and I also needed 15 minutes on a pin. I can't tell you how many hours I played with that circuit.

The obvious question came to mind: How could I quickly and consistently use the clock portion of the timing chips? This article will provide you with formulas, an example, and even a program written in GW-BASIC. The information presented is straightforward and simple to implement.

Formulas

The following conventions will be used in this discussion:

F = frequency (hertz)
T = time (sec)
2^n = relates to positional value of a positive pin location.

EXAMPLE:
Chip: CD4060
Time: 60,30,15 minutes
Outputs: Three needed for the above times.

Hint: The highest output available is 2^14, and remember that there are no outputs for divisions of 2, 4, 8, and 2048. Design for longest period of time, allowing for pin locations for shorter periods to be detected.

See Figure 1:

Oscillator frequency = 2^N/time(sec)
Select pin #3 (2^14)= dec (16384) = 2^N.Use for 60 minute outputs.
Results: 16384/(t*60sec) = 4.66 Hz = (F)requency
Pin #3 = 60 min.
Pin #2 = 30 min.
Pin #1 = 15 min.

Remember that for the internal oscillator of the CD4060 the following is true:

F= 1/(2.2*R1*C1). Note: 2.2 in the formulas is the time constant for the circuits.
C1 = 1/(2.2*R1*F)
R1 = 1/(2.2*C1*F)

To use the CD4020 and CD4040 you must use an external oscillator circuit, such as the 555 timer. Simply build this circuit so that its frequency output matches that of the one shown on the GW-BASIC program.

Using the Program

The program is based on the assumption that you want to produce a certain time output at a particular pin number of CD4060 and some similar chip.

To use chips other than the CD4060 you must list line #1100 and insert appropriate decimal weights for the pinouts of the chip you intend to use. The commas in line 1100 are to prevent pins that are not outputs from getting mixed with the pins that your chip is using. So, if you modify the program you must align this location properly or else your data will be faulty. (See the program listing.)

There are several possible applications for this program:

1. Trigger tone circuits (ham radio).
2. Base of an extended timer circuit.
3. Time-to-binary-weight converter. (Is this a new thought?)
4. Morse code test timer (words per minute).

Conclusion

TYPE load "time" to load the program. Modify the program to your delight. There is ample room for many enhancements. Save time and prevent brain damage using this helpful program. Have fun!

See the program listing on the bottom of page 24.

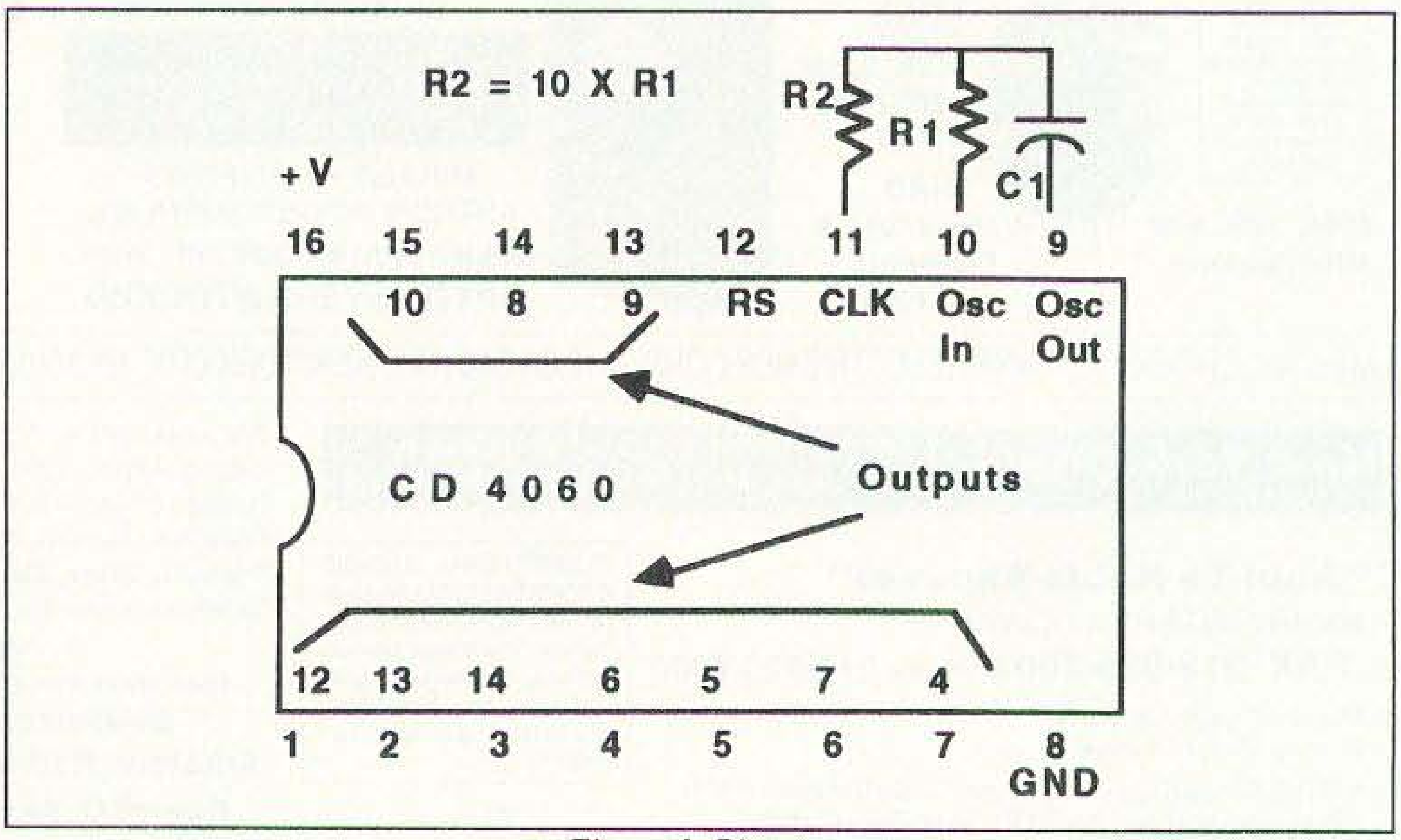


Figure 1. Pinouts.

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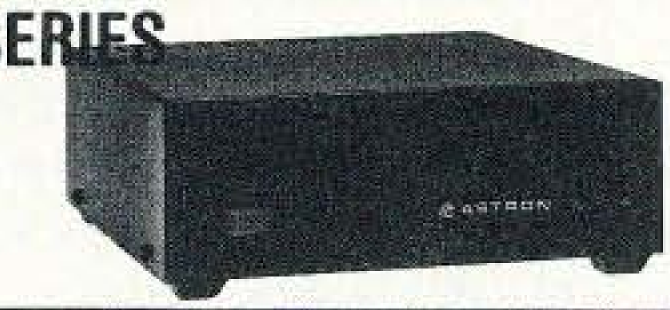
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES



• LOW PROFILE POWER SUPPLY

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

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

RM SERIES

MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

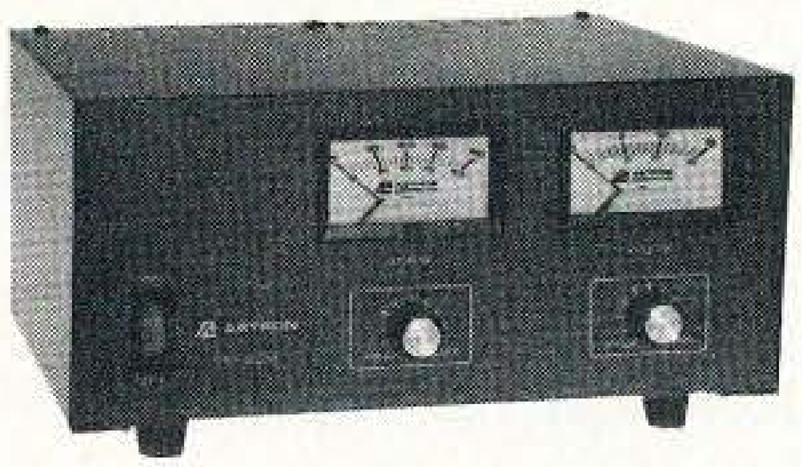
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES



MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

• Built in speaker

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

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

CIRCLE 16 ON READER SERVICE CARD

Digital Satellite Gateway Nodes *Continued from page 20*

gardless of whether they are requesting a file from their own ground station or from a gateway node.

To respond to a message that a BBS user has obtained from the satellite the user can use the SR (send reply) command, just as he would to respond to a message that came from any other source. The response will automatically be routed to the satellite. Furthermore, users may initiate satellite contacts by uploading messages either to other satellite users or to ALL, just as they could on a terrestrial BBS. They do this by using the SB (or SP) command: SB ALL @ UO22UP. The destination UO22UP tells the BBS to route the message to the satellite. Messages that come from satellite gateway node users appear on the satellite just as they would if the gateway node user owned and operated his own satellite ground station. In Figure 1, for example, message A70F is from KB2OUT to ZL2ATI. Neither of these stations actually owns their own satellite ground station, yet they appear on the satellite directory just as if they did. Thus, when you see messages on the satellite directory it is impossible to determine whether they came from satellite operators who used their own ground stations or from satellite operators who used a gateway node.

Once a BBS user has uploaded any message to the satellite, his call and home BBS are placed in a special file of satellite users. In the future, any files that appear on the satellite addressed to this station will be automatically received and imported into the BBS without any action being taken by the BBS users. Thus, the interface between the BBS and the satellite ground station is essentially seamless.

The satellite gateway node is available not only to users of the BBS that is at the gateway node site, but to all other BBSs in the region as well. All the additional BBSs need to do is make sure that all messages that are either @ UO22MK or @ UO22UP are forwarded to the BBS that is at the gateway node site. The gateway node keeps track of the home BBS of each node user and automatically routes all of his or her messages to that BBS. Thus, one gateway node can serve an entire region. In fact, there are significant savings that occur as the service region expands. Since each file is only downloaded once, no matter how many stations request it, as more and more stations use any one gateway node the proportion of file requests that actually involve downloading from the satellite will fall.

How to Establish a Gateway Node

A gateway node consists of a fully-automated satellite ground station (including automatic radio tuning and antenna pointing) and a standard terrestrial BBS. These are fairly stiff requirements (generally in the $3,000 to $5,000 category for everything if purchased new), yet there are a great many such stations currently in existence. Furthermore, since this is no more than the cost of many repeaters, it might be an appropriate project for a club to undertake. Generally, the system will involve a multitasking system such as Desqview, with the BBS running in one window and the gateway node software running in another. Aside from the satellite ground station software (which is available from Compuserve and other sources), all of the software that is needed to run the gateway node is available from the author free of charge. The disk contains complete documentation for setting up the system and a discussion of hardware and software choices that are available. Simply send a formatted disk and a return disk mailer.

It is hoped that the satellite gateway node system will bring the latest in digital satellite technology to many people who would otherwise be unable to participate. It is also hoped that by providing an opportunity for hams to participate in satellite operation without purchasing satellite equipment, congestion on the satellite will ultimately be reduced.

Please remember that amateur satellites are not cheap to build or launch. If you find that you are enjoying using these birds either directly with your own equipment or indirectly using the gateway node system, please support the production and launch of additional satellites by becoming a member of AMSAT. 73

Clock It Quick *Continued from page 22*

```
1000 REM PROGRAM NAME= TIME
1010 REM BY EDDIE ARNOLD :SPRINGHILL,TN
1020      DIM A(20)
1030 CLS
1040 LOCATE 1,25
1050 PRINT"TIME MACHINE 4060"
1060 RESTORE
1070 FOR L= 1 TO 14
1080   READ A(L)
1090   NEXT
1100   DATA 4096,8192,16384,64,32,16,,,,,,512,256,1024
1110 LOCATE 3,10:CT=0
1120 S$="MINUTES"
1130 PRINT"TIME =:"
1140 LOCATE 8,10
1150 PRINT"SPACE BAR TO INCREMENT"
1160 LOCATE 9,10
1170 PRINT"ENTER TO STORE"
1180 FOR T= 1  TO 120
1190 LOCATE 3,20
1200 PRINT USING "_T= ###_ MINUTES";T
1210 A$=INKEY$:IF A$="" THEN 1210
1220 IF A$=CHR$(32)THEN 1250
1230 IF A$=CHR$(13)THEN 1270
1240 GOTO 1210
1250 NEXT
1260 GOTO 1110
1270 CLS
1280 LOCATE 5,20
1290 PRINT"MENU"
1300 LOCATE 8,15
1310 PRINT"(1) INPUT R ,FIND C"
1320 LOCATE 9,15
1330 PRINT"(2) INPUT C ,FIND R"
1340 LOCATE 10,15
1350 PRINT"(3) END"
1360 B$=INKEY$:IF B$="" THEN 1360
1370 IF B$="1" THEN 1410
1380 IF B$="2" THEN CT=1:GOTO 1410
1390 IF B$="3" THEN END
1400 GOTO 1360
1410 LOCATE 5,20
1420 INPUT"WHAT PIN# DO YOU WISH TO USE";P
1430 IF P=7 OR P=8 OR P=9 OR P=10 OR P=11 THEN 1030
1440 IF CT=1 THEN 1470
1450 CLS:LOCATE 6,20
1460 INPUT"VALUE OF R1 (OHMS)";R1:GOTO 1490
1470 CLS:LOCATE 6,20
1480 INPUT"VALUE OF C1 (UF.)";C1:GOTO 1530
1490 F=A(P)/(T*60)
1500 M=(R1*2.2)*F:C=1/M
1510 W=C*10^6
1520 GOTO 1560
1530 F=A(P)/(T*60)
1540 M=((C1/10^6)*2.2)*F:R1=1/M
1550 W=R1
1560 LOCATE 8,20
1570 IF CT =1 THEN 1590
1580 PRINT USING"_C = #######.##_ UF ";W  :GOTO 1610
1590 LOCATE 8,20
1600 PRINT USING"_R1 = ######## _ ohm(s) ";W
1610 LOCATE 9,20
1620 PRINT USING "_TIME = ###_ MINUTE(S)";T
1630 LOCATE 10,20
1640 PRINT USING"_PIN_#:##";P
1650 LOCATE 11,20
1660 PRINT USING"_FREQ: #######.##_ HZ.";F
1670 LOCATE 15,20
1680 PRINT"TO CONTINUE PRESS (Y/N)"
1690 C$ = INKEY$:IF C$ = "" THEN 1690
1700 IF C$ = CHR$(121) OR C$=CHR$(89)THEN 1030
1710 IF C$ = CHR$(110) OR C$=CHR$(78)THEN END
1720 GOTO 1690
```

GW-BASIC program.

Dual Half-Wave Antenna

A ground independent antenna with gain.

by Jack Kuecken KE2QJ

In the early days of broadcasting, Ballentine[1] showed mathematically that the maximum ground-wave field strength would be produced by a 5/8-wave vertical antenna. The 5/8-wave radiator is theoretically 2.9 dB superior to a quarter-wave and 1.2 dB better than a half-wave. Because of the gain advantage, the 5/8-wave vertical is relatively popular in 2 meter mobile applications, despite a few drawbacks.

By 1934, Friis, Feldman and Sharpless[2] at Bell Labs had shown that a vertical half-wave antenna consistently showed a superiority of about 4 dB compared to a vertical quarter-wave, despite the fact that the theoretical advantage is only 1.7 dB. They reasoned that the losses in the counterpoise were much greater for the quarter-wave since the maximum current occurred at ground level. By comparison, the current maximum is halfway up the radiator on the half-wave and the minimum is at ground level.

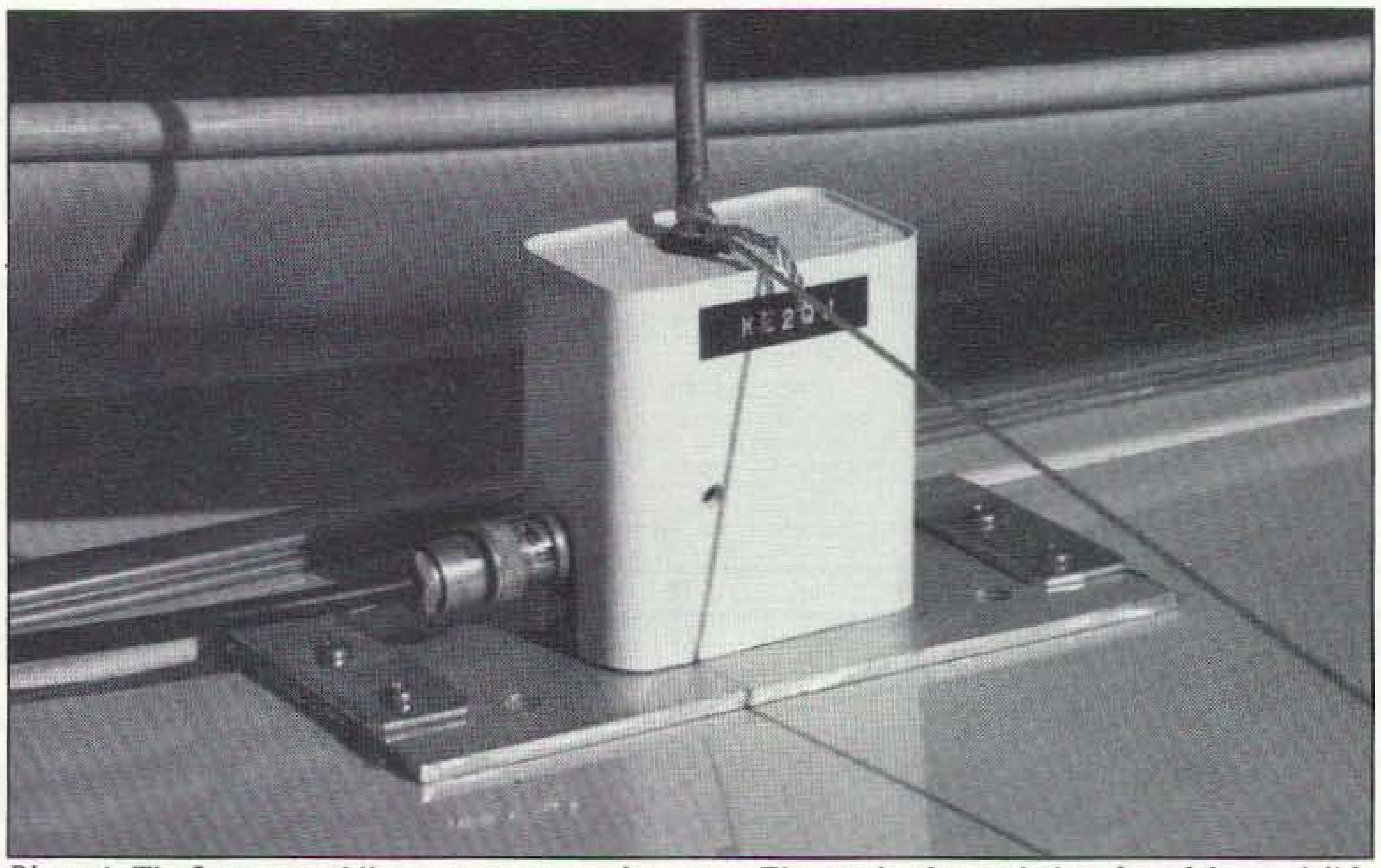


Photo A. The 2 meter mobile antenna mounted on a car. The two hooks catch the edge of the truck lid and the nylon string under tension holds the whole unit on via a hook caught on the lip of the trunk.

Mobile Antenna Background

At the U.S. Army Signal Corps labs, Brueckman[3] showed that for mobile antennas, coupling to the vehicle and dependence upon ground can be minimized by placing a current minimum at the antenna base. This decoupling provided much improved circularity in the radiation patterns and made antenna tuning independent of the vehicle type and size. This work led to a number of developments in military "antennas[4,5]", including the very widely used AS-1729 autotuned antenna, which covers the military 30 to 76 MHz FM range.

For my own 2 meter mobile setup I developed the antenna illustrated in Figure 1. I drive a convertible, which presents several problems. First, you cannot mount the antenna on the roof; second, the car seems to have more electrical noise than a closed sedan. Since the radiating element is a half wavelength high, the current at the base of the antenna is minimal and the coupling to the car skin is minimized. The noise pickup from this antenna is significantly lower than the noise pickup from a quarter-wave type. I have not actually measured the circularity of the radiation patterns on the car but no noticeable nulls exist. Since the 5/8-wavelength antenna does not have a current minimum at the base it does not enjoy the benefits of ground independence.

The small LC network at the base of the antenna provides an efficient transformation from the very high impedance of the radiator (about 2,700 ohms) to the 50-ohm transmission line. The antenna covers the range from 144 to 148 MHz with a maximum VSWR of 1.6 at the band edges and about 1.1 at band center. I found that with a 3" x 5" ground plane the antenna remains matched even sitting on a wooden cabinet! I installed one of these antennas at the peak of my roof for a base station antenna and have been delighted with the results. The lack of a requirement for a counterpoise is a significant advantage.

Two Half Waves in Phase

In the interest of narrowing the elevation pattern and obtaining more gain from the omnidirectional base antenna, I considered using two half-wave vertical antennas, one above the other, phased to add in the far field.

Figure 2 shows that the generator driving the two from a center gap produces currents which are in phase when viewed from a distance, although they are obviously out-of-phase at the generator terminals. The free-space patterns shown in Figure 3 illustrate the results to be expected. The dual half-wave antenna will provide a pattern which is 52 degrees between elevation half-power

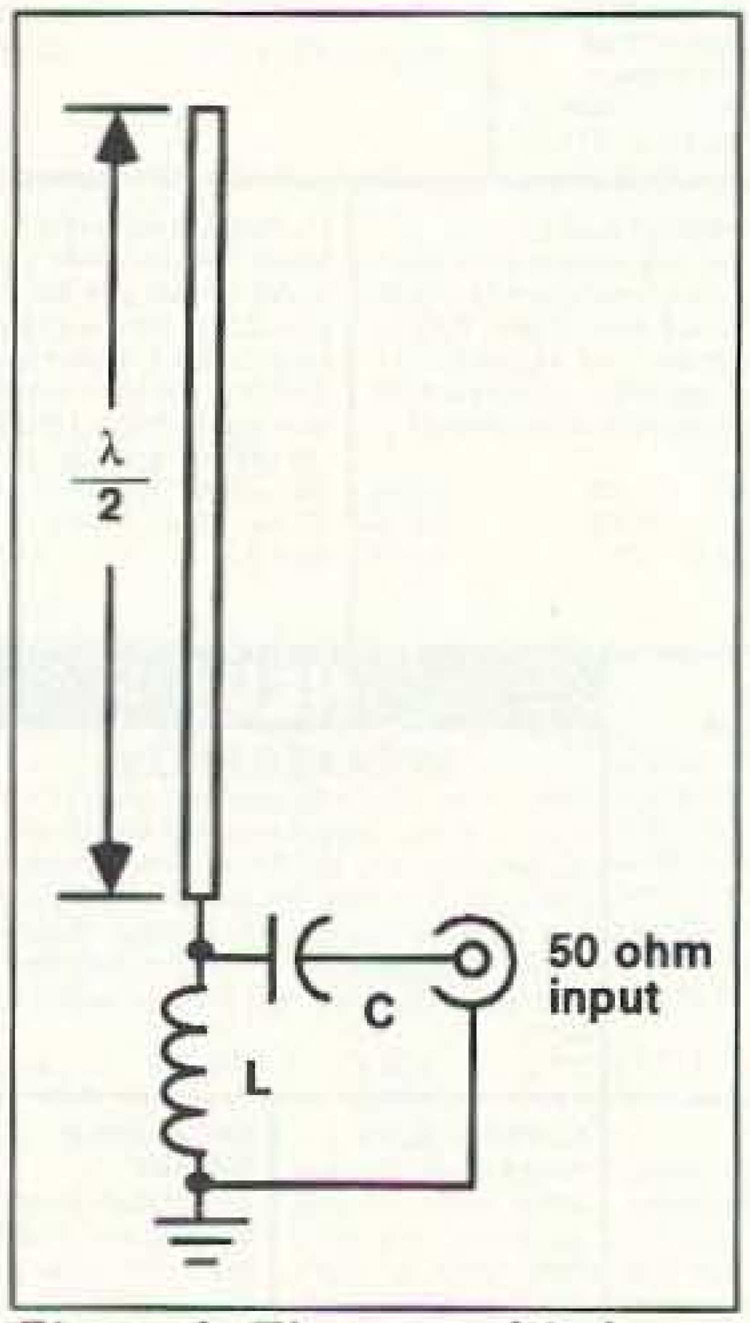


Figure 1. The ground-independent vertical half wave.

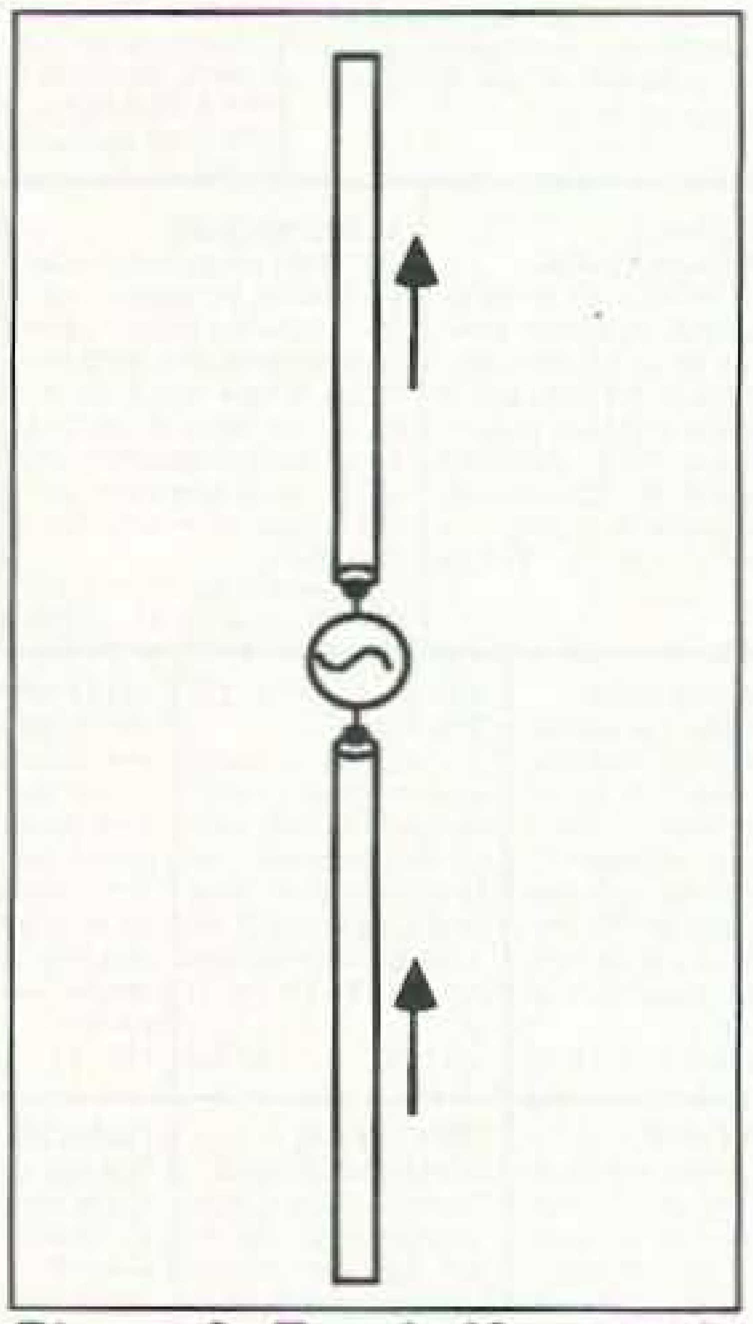


Figure 2. Two half waves in phase.

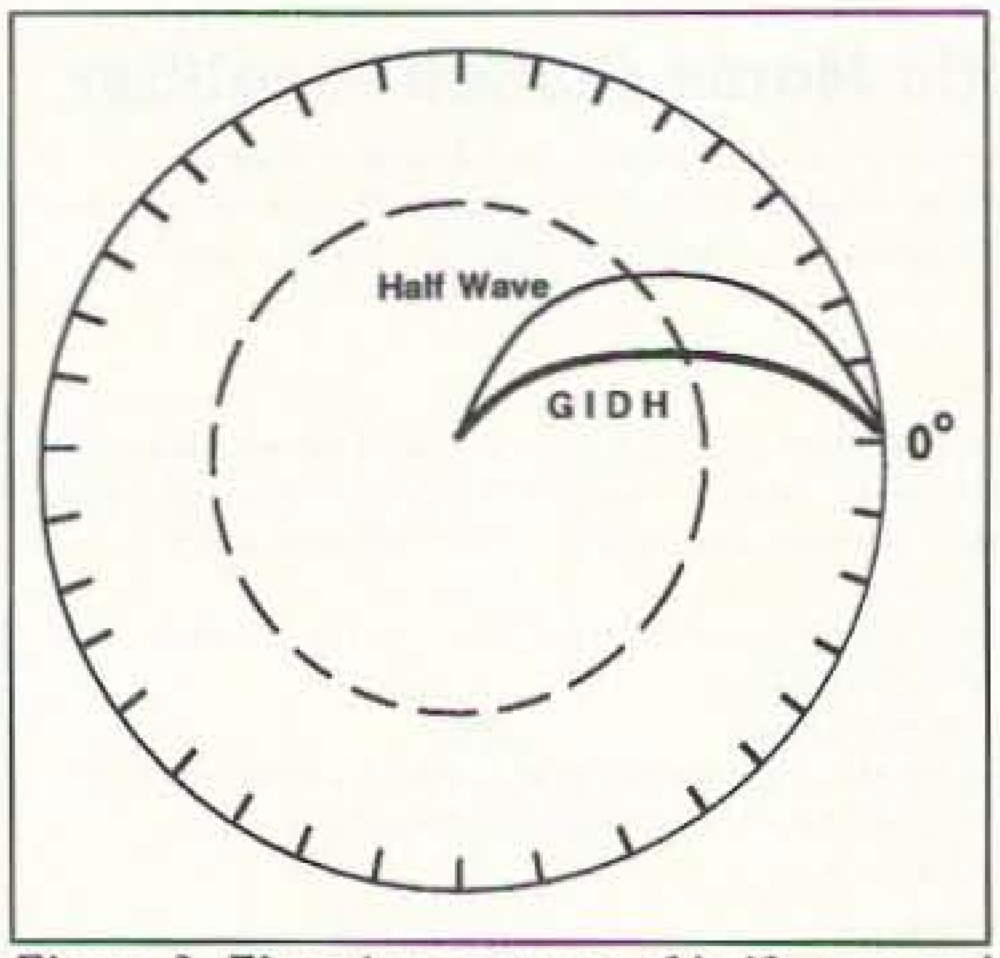


Figure 3. Elevation patterns of half-wave and ground independent dual half-wave.

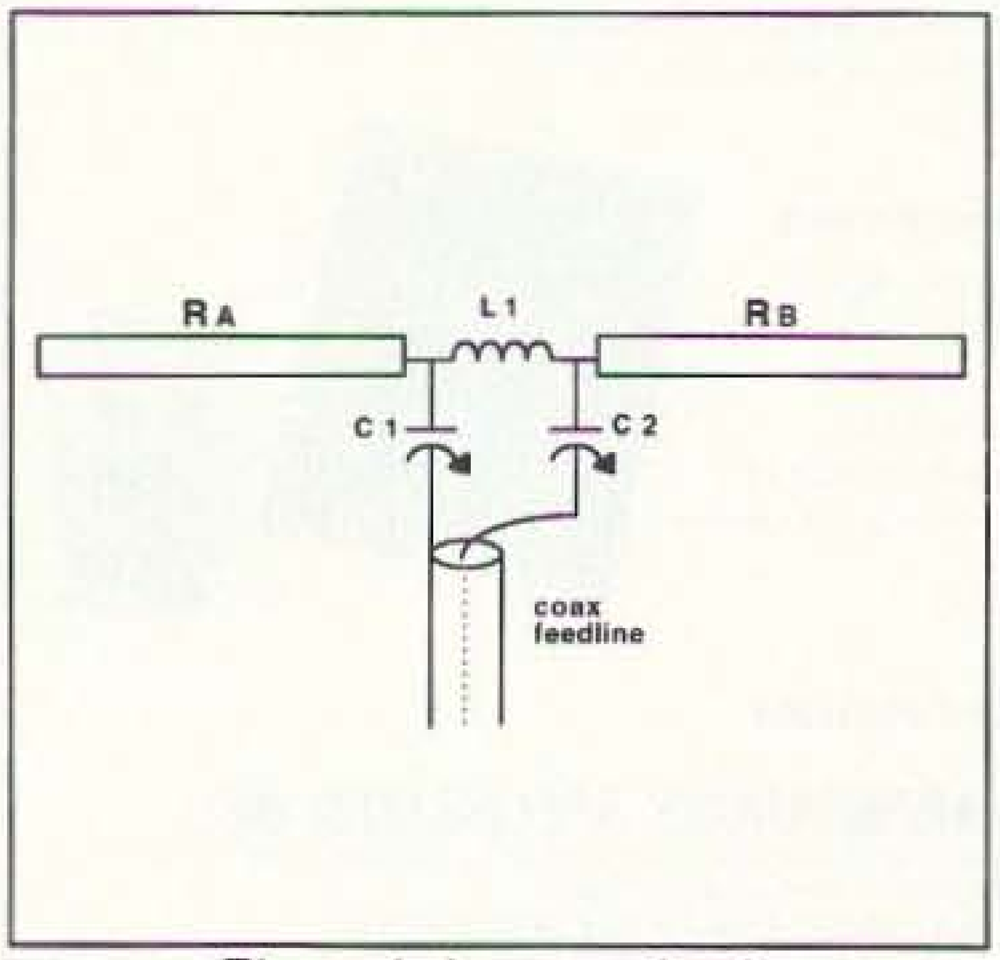


Figure 4. Antenna circuit.

points, compared to 78 degrees for the half-wave. Furthermore, the directivity will be 1.4 dB higher than the half-wave. Note that the elevation pattern has fourfold symmetry and only a quarter of the pattern is plotted.

The narrower elevation pattern is an advantage by itself. For one thing, it reduces the reflections from passing aircraft (which can cause a considerable flutter in the received signal). Secondly, it reduces the reflections from foreground objects, which can distort the pattern.

The Antenna Construction

After several false starts I developed the feed circuit shown in Figure 4. I had some lengths of 7/8" o.d. aluminum tubing from a scrapped array. These were used for the radiators. Experimentally, I found that the highest impedance resonance at 146 MHz, for this tubing diameter, could be obtained with 38" radiators. By jiggering the values of C1, C2 and L1 it was possible to obtain a very good match to 50 ohms. A measurement of current magnitude and phase showed that the radiator currents were equal and in phase as seen in the far field.

Figure 4 is intended mainly to clarify the matching scheme. The construction is shown more clearly in Figure 5. The coax feed cable was actually run up the center of the lower radiator. The dielectric beads at the upper and lower radiator ends are used to center the coax and to provide a measure of tuning. At the center of the lower radiator a shorting

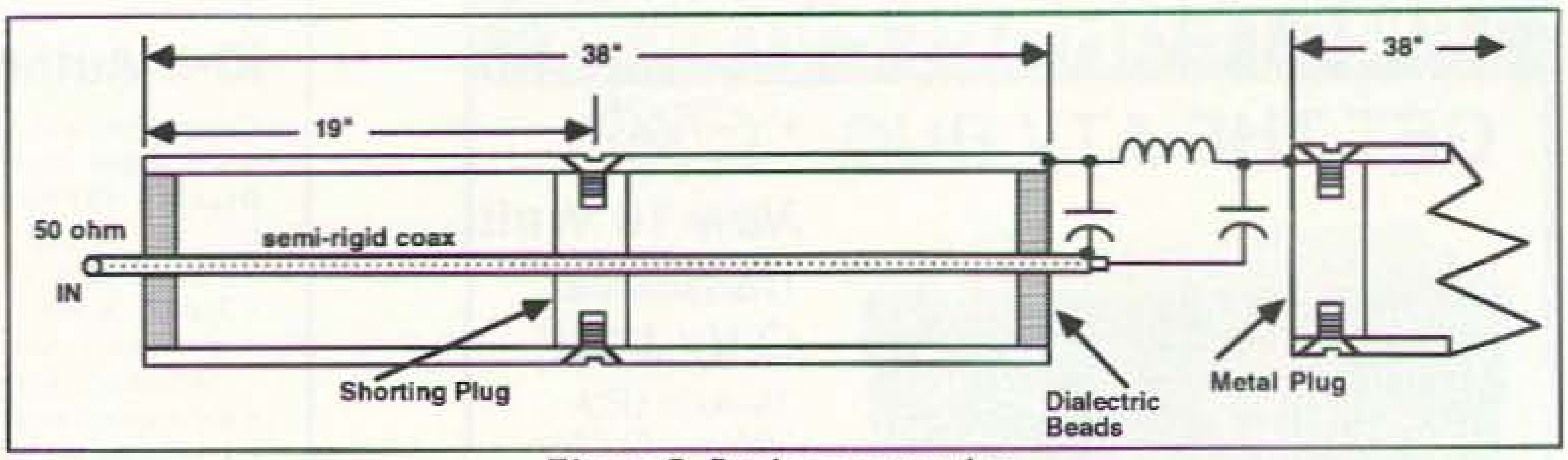


Figure 5. Basic construction.

plug is inserted which shorts the outer conductor of the coax to the inside of the lower radiator, thereby making AB and DC a pair of quarter-wave (not quite) coaxial chokes. The coax used is 0.140" o.d. semirigid 50-ohm cable. If the shorting plug is made of brass it may be soldered directly to the copper tubing outer jacket of the coax. If the plug is made of aluminum, fashion a brass or copper sleeve which can be soldered to the coax and connected to the aluminum with screw pressure. One source for the miniature semirigid coax is Precision Tube Co. Inc., Microwave Division, Church Road and Wissihickon Ave., North Wales PA 19454.

The two little capacitors used are Johanson air variable 0.7-to-10.5 pF units. I picked these up at a hamfest for a few cents. A pair of piston caps might be better since they can handle more power and are easier to tune. The inductor consists of three turns of #16 tinned wire wound on a 3/4" form. We will discuss tune-up later.

The insulators for this unit were made from white PVC water pipe. The construction is shown in Figure 6. The construction technique used on this model is best suited to those who have a lathe available, but other constructions not requiring a lathe are also feasible.

The radiators are, as noted earlier, 7/8" o.d. aluminum tubing. In order to get a good fit, the nominal 1" pipe, which is actually 1.063" i.d., must be shimmed. To do this I cut two 1.25" lengths of the pipe. I then cut out a portion of the circumference so that I could compress the remaining segment into a 1" diameter cylinder. I then slathered some PVC pipe glue on the center piece and the insert and drove the insert in with a soft mallet. Immediately upon insertion, clamp the insulator in a vise to round up the egg shape that develops because of the uneven push of the insert.

The PVC glue dries very fast. When the first end of the center insulator is done, do the other end. After the glue has dried for about a half hour the insulators may be bored out in a lathe to give a good fit for the upper and lower radiators. After the boring operation, the center insulator should have a center window about 1/2" x 1" opened to permit connection to the coax.

The base insulator is made similar to the center insulator except that only one end is equipped with an insert. The base flange is made of any convenient material. It may be either metal or plastic. It must, of course, be strong enough to hold the overturning moment due to wind loads on the radiators. In my case, I made it by laminating two pieces of 3/8" XXXP plastic (a paper-base melamine) and boring the assembly to accept the base insulator outside diameter.

Assembly

To begin with, prepare the ends of the miniature semirigid coax. At each end mark

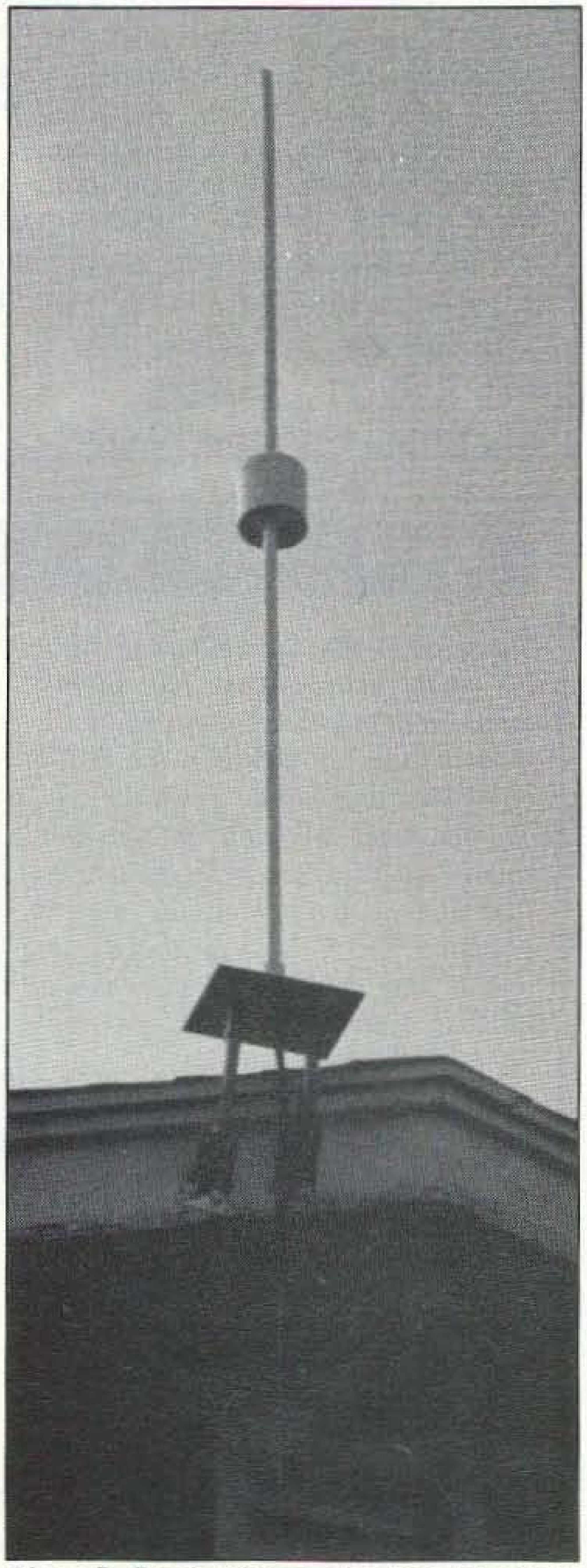


Photo B. Dual antenna, showing the plastic bottle covering the matching network in the center of the antenna and the miniature ground plane.

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off 1/4" from the end and carefully score a circumferential ring in the outer conductor tube with a sharp knife. Grasp the piece with a pair of pliers and gently work back and forth. The outer tube will break circumferentially along the scored ring and the piece can be pulled off. Next, cut the Teflon™ insulation at a point 1/8" from the end of the tube, as shown in Figure 8. Take care at this point *not* to score the center conductor.

If the shorting plug is brass, slide it into position on the coax and solder it into place. If the plug is aluminum, slide the protective brass bushing into place and solder it. The shorting plug should be placed so that the prepared end of the coax projects beyond the end of the lower radiator into the center of the gap between the upper and the lower radiator.

The dielectric beads can be made from polystyrene, G-10 epoxy Fiberglas™, Kel-F, Teflon or other dielectric with a low dissipation factor at 146 MHz. Do not use plexiglas or melamines. These washers are easily turned on a lathe but may be filed out by hand. A perfect fit is not necessary; however, the coax should not rattle too much.

Next, slide the dielectric beads onto the coax. These may be held in place with a drop of epoxy. The beads should be positioned to fall in the open ends of the lower radiator and should hold the coax centered.

The next step is to install the BNC connector. There are cable connectors made to directly accept the semirigid coax but they are not often seen at hamfests. Figure 8 shows how a standard BNC connector can be adapted to this coax. I used a UG-291B/U female so that a normal, male-ended cable can be attached without an adapter. The adapter brushing is used to make the coax fit the connector. First slide the nut, the flat washer and the gasket on the coax. The washer may have to be reamed slightly to fit over the shank of the adapter. The bushing is then slid onto the end of the coax with the flange flush, with the end of the outer conductor and sweat soldered in place. The pin is then soldered to the center conductor and the connector assembled. The piece which normally holds the braid and interfaces to the gasket is not used.

Leads of approximately 1.5" are next soldered to the end of the coax which will go into the insulator. Bend these leads more or less parallel to the axis.

If an aluminum plug is used, drill and tap a radial hole from the periphery of the plug to the hole for the bushing. Insert a 4-40 headless setscrew to lock the bushing in place.

Next, mark and drill a #39 hole 19" up from the base of the lower radiator. Mark the center of the shorting plug and slide the coax into the lower radiator until the mark shows through the hole. Drill and tap for three 4-40 flathead screws to secure the plug. Flathead screws permit one to slide the lower weather seal up the lower radiator.

Next, fasten the center insulator to the upper radiator. This can be a permanent joint. I use a cement used to mend vinyl and leather, found in shoe and leather stores under the names "Shoe and Leather Patch" or "Shoe Goo." An RTV cement can also be used. Slide the radiator 1.25" into the insulator.

Next, slide the insulator onto the upper end of the lower radiator without glue (you may wish to disassemble this joint later). Now drill and tap through the insulator into the upper radiator and lower radiator to make an electrical connection to each. Sheet metal screws may also be used.

Put a terminal lug on the upper and the lower radiators. Additional screws may be

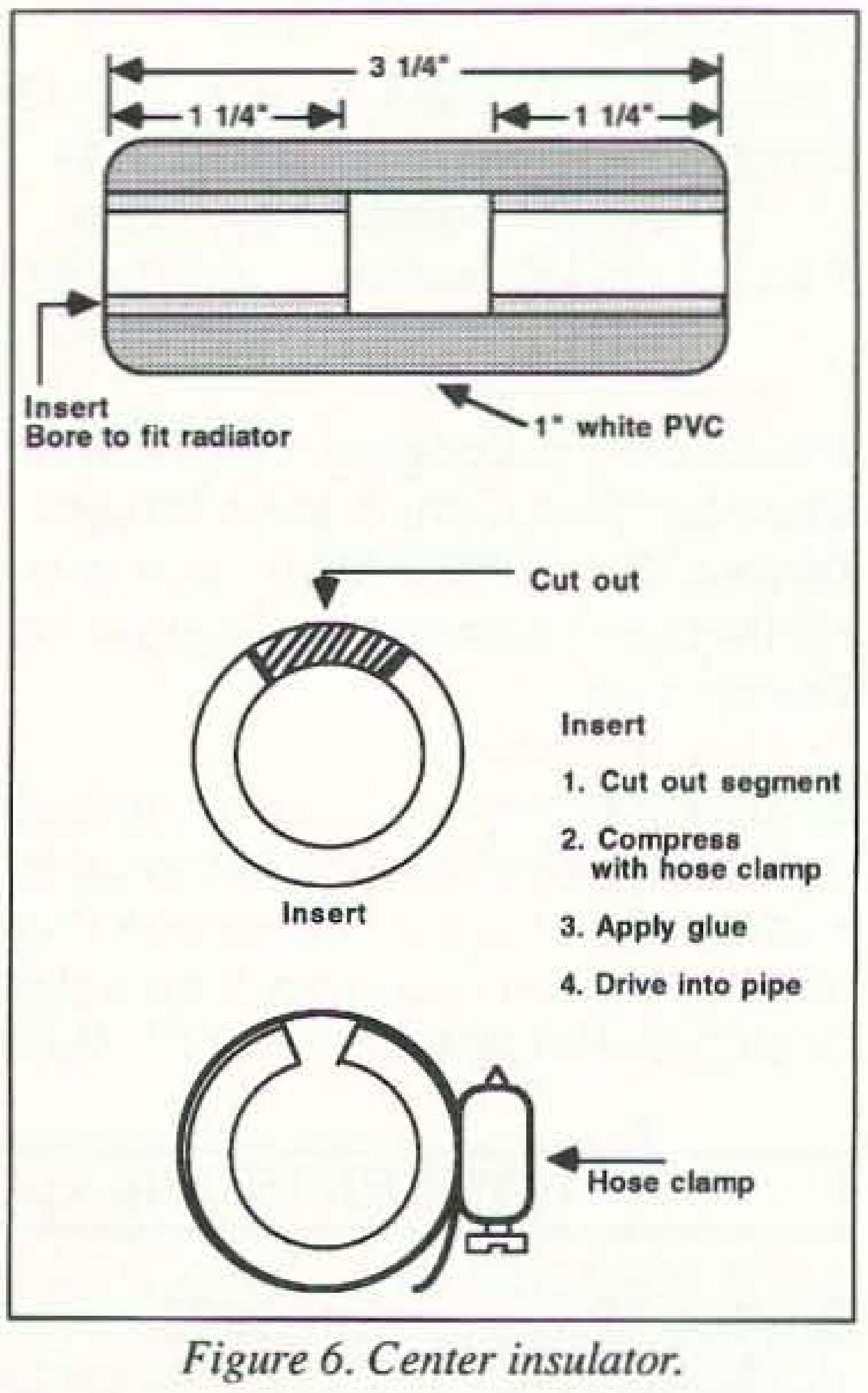

Figure 6. Center insulator.

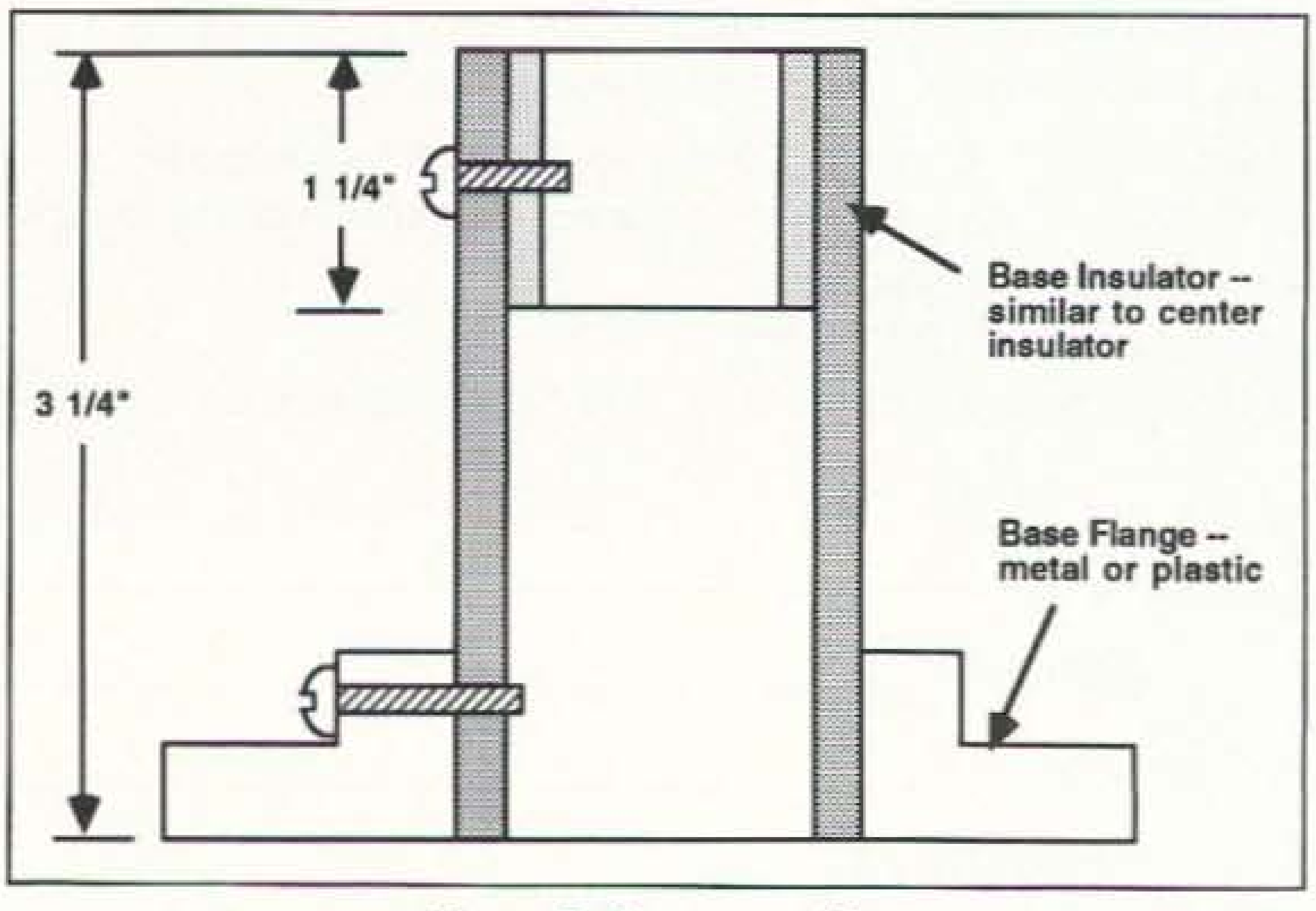

Figure 7. Base assembly.

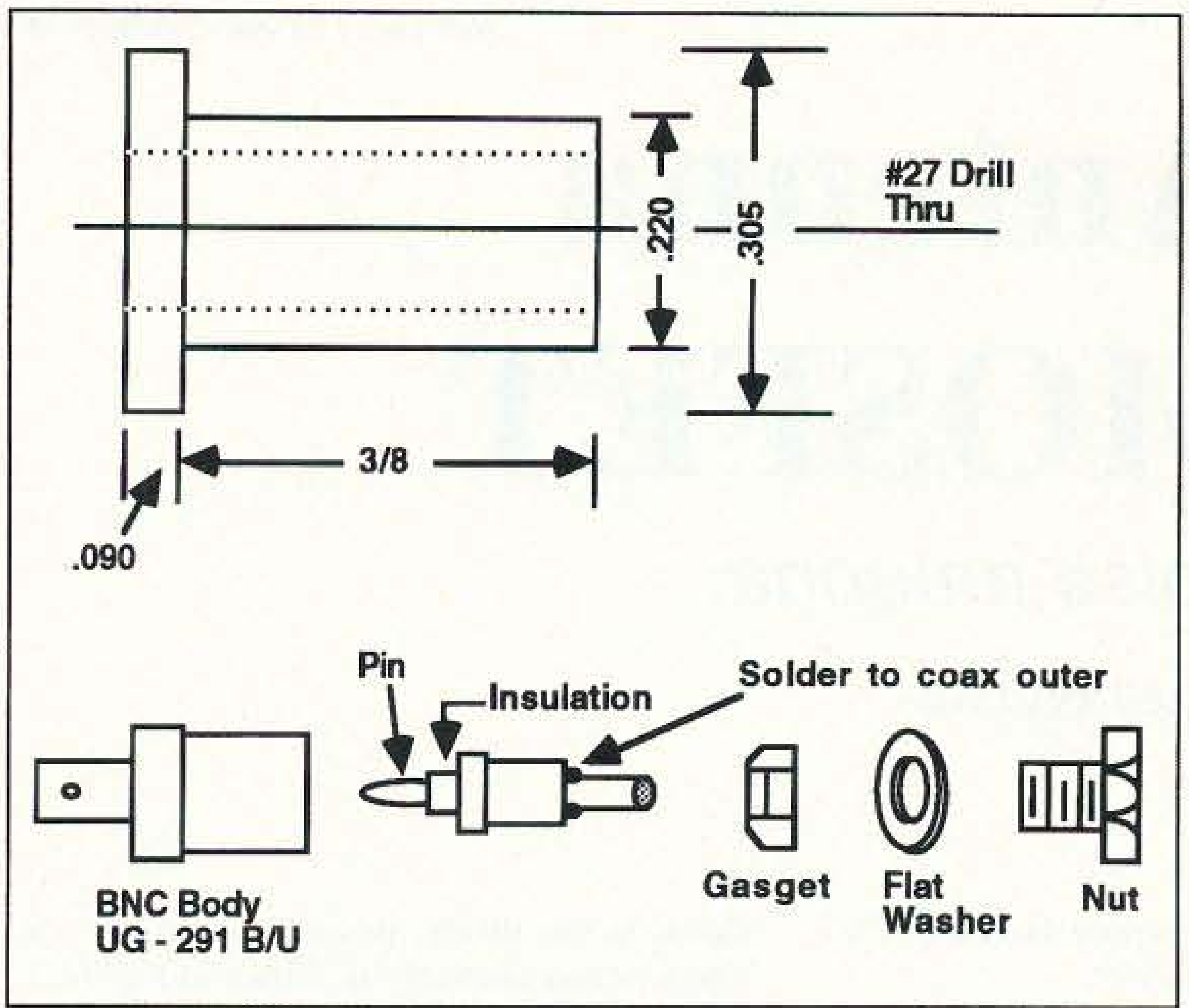

Figure 8. Cable assembly.

added at this point to secure the insulator to the radiators.

Reaching in through the window in the center insulator, pull the leads from the inner and outer conductor out through the window. Solder the coil between the terminal lugs and solder each capacitor between one of the leads from the coax and one of the end terminals on the coil.

Insert the bottom end of the lower radiator into the base insulator and insert the base insulator into the base flange. Mount the antenna somewhere in the open and get ready to tune it.

Tuning Up

For the tune-up procedure you will need a signal source and some form of system to detect the matched condition. A directional coupler or SWR meter can be used; however, I prefer the use of a bridge circuit because it's more accurate. See the *Radio Amateurs Handbook*. In the 1990 edition, Chapter 25, pages 9 and 10 and Figure 21 give suggested circuits.

Set the signal source to 146 MHz. Next, tune the two capacitors for the deepest null available. Try to keep the capacitances equal. The coil was initially close wound; stretch it axially a little bit. This decreases the inductance. Re-null the capacitors, again trying to keep them equal. If the null improves, you went in the right direction. Stretch the coil again and repeat the nulling. Eventually you should reach a point where the inductance is too small and the reflection starts to rise again. Back in to obtain the deepest null possible.

If a reasonably sensitive bridge is used, you will find that as a good null is approached the motion of your body within four or five feet of the antenna will cause the reading to change. It will be necessary for you to de-tune the antenna in such a direction that the match improves as you walk away. Done properly, you should be able to attain a VSWR less the 1.1 :1 at the center of the band, running out to less than 1.7 at 144 and 148 MHz. The Smith chart shown in Figure 9 shows the results of a measurement obtained using a General Radio model 1602B UHF admittance meter. The data has been rotated to the center of the antenna at the feedpoint. The VSWR's represented range is from 1.63 at 144 MHz to 1.45 at 148 MHz. The tuning can easily be shifted to favor one end of the band or the other.

For weather protection, I cut off a plastic bottle and cut a hole through the bottom of the bottle to closely fit around the upper radiator. This is placed upside down over the coil-capacitor assembly. A bead of RTV or shoe cement is used to seal the upper radiator. On the bottom side, the bottle top was similarly fitted around the lower radiator with the flange down. The lower edge of the upper part hangs below the upper edge of the bottom part. These are not tightly fitted or sealed. Instead, they are designed to be drip-proof and so that some air can circulate. My experience has taught that if you cannot get a true hermetic seal, you are better off to arrange matters so that air can circulate and water and condensation can run out.

The open end of the upper tube can be neatly sealed with a wine bottle cork. The brand is not important. My personal taste runs to dry white wines, however, a cork from a sherry bottle would do as well.

For mounting the antenna, a 3" x 5" or 5" x 7" ground plane is adequate. The BNC fitting should be in the center of the base insulator so that the driving cable is protected from rain, etc. No goopy sealing of the cable should be required. If you wish you can insert a rolled sheet of plastic into the bottom of the base insulator to protect the joint. 73

References:

1. S. Ballentine, "On the Optimum Transmitting Wavelength for a Vertical Antenna Over Perfect Earth" *Proc. IRE*, Vol 12, Dec. 1924, pp. 833-839.

2. H.T. Friis, C.B. Feldman and W.M. Sharpless. "The Determination of the Direction of Arrival of Short Radio Waves" *Proc. IRE*, Jan 1934, pp. 47,48.

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4. H. Brueckmann, U.S. Patent 2,913,722 November 1959.

5. J.A. Kuecken, U.S. Patent 3,438,042.

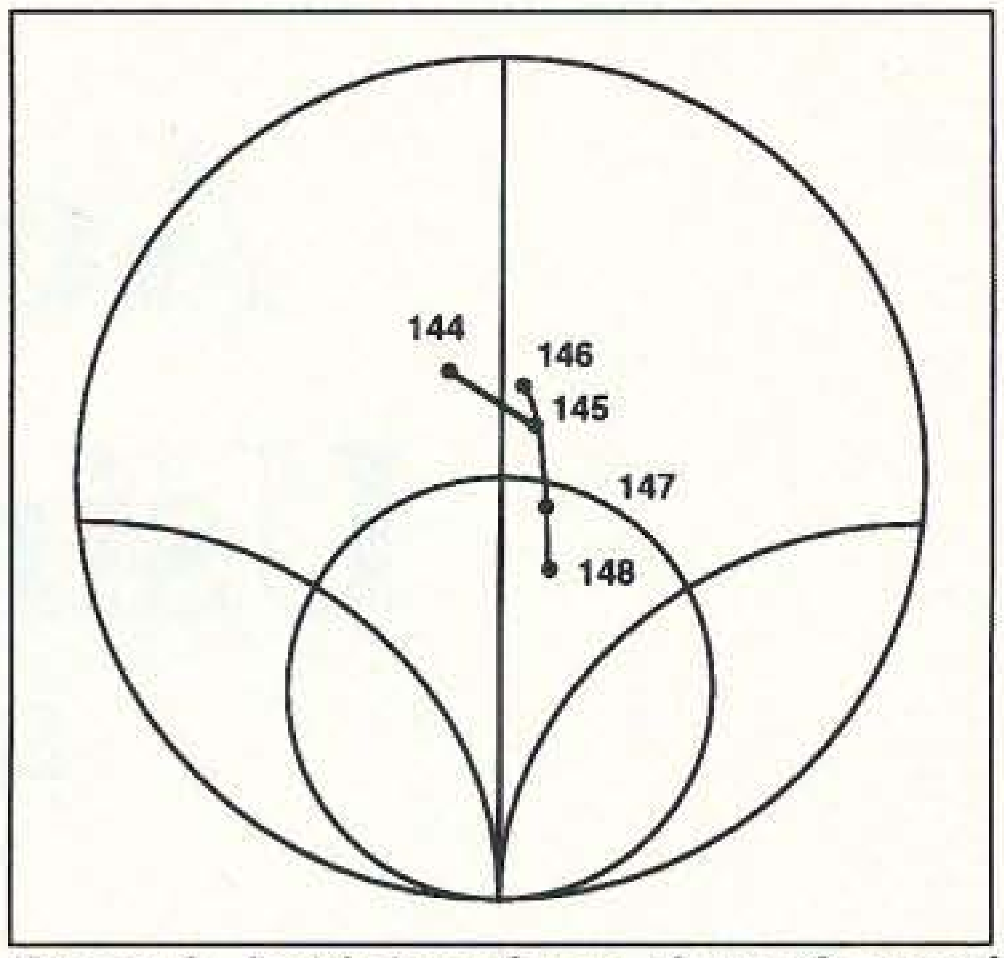

Figure 9. Smith impedance chart of ground independent dual half-wave.

Active Antenna Using a MOSFET

Build a low noise antenna.

by Ken Cornell W2IMB

I first became involved with active antennas back in the late '70s while experimenting with communications on the 160 to 190 kHz FCC Part 15 band. Due to the high ambient noise level encountered in this frequency range, the search for an efficient and low noise receiving antenna was an interesting experimental endeavor. The longwires and 50-foot vertical used for transmitting were noise collectors in most locations.

Quite a few of us LOWFERS (short for "low frequency experimental radio station") started to use various designs of active antennas that consisted of a short whip vertical some three to six feet long with a preamplifier built into the base. The antenna was connected via a random length of coax to a receiver coupler located at the station's operating position. Since it is relatively small and lightweight, it was easy to move it around the homestead and place it in the position offering the best signal-to-noise ratio.

The use of JFETs, such as the MPF102, was popular, and I have offered several designs in some printed articles and in my *Low & Medium Frequency Radio Scrapbook* series.

Using MOSFETs

While experimenting with transmitters on the 510 to 1705 kHz band (again an FCC Part 15 band; 100 mW to a 3 meter antenna,) I found that the Amperex BS170 and the ZETEX BS170P were excellent final amplifiers. They are MOSFETs.

I decided to try them out as an active antenna preamplifier. After quite a few breadboard layouts, I ended up with the circuits shown in Figures 1 and 2. I was quite pleased with its performance.

Since the active antenna consists of a short vertical with a broadband preamplifier, I decided to put the entire unit within a five-foot length of white PVC pipe. Placing a PVC pipe cap on each end would make the unit weathertight. A coax fitting is placed in the bottom cap.

The circuit for the active antenna is shown in Figure 1. Since the coax cable provides two functions—one to feed the antenna to the receiver and the other to supply power to the MOSFET—we need a receiver coupler and a power supply isolator. This circuit is shown in Figure 2.

An SPDT switch is added to the receiver coupler circuit to allow selection of either the active antenna or a reference antenna for comparison purposes, or to select the best antenna for signal-to-noise ratio.

The active antenna circuit is wired up on a 1" width of perf board. I used RG-59U coax cable and installed an F-81 coupler (Radio Shack #278-213), with the long-threaded shank to the inside, in the bottom pipe cap. The antenna assembly is shown in Figure 3.

The actual antenna is a length of 1" aluminum tubing with a hole for a 6-32 machine screw at each end. The top hole is for securing the aluminum antenna tube to the PVC pipe. The bottom hole is for connecting a short length of flexible wire from the tube to the antenna input on the circuit board. A short length of RG-59U coax connected to a CF-59U male "F" connector is used to con-

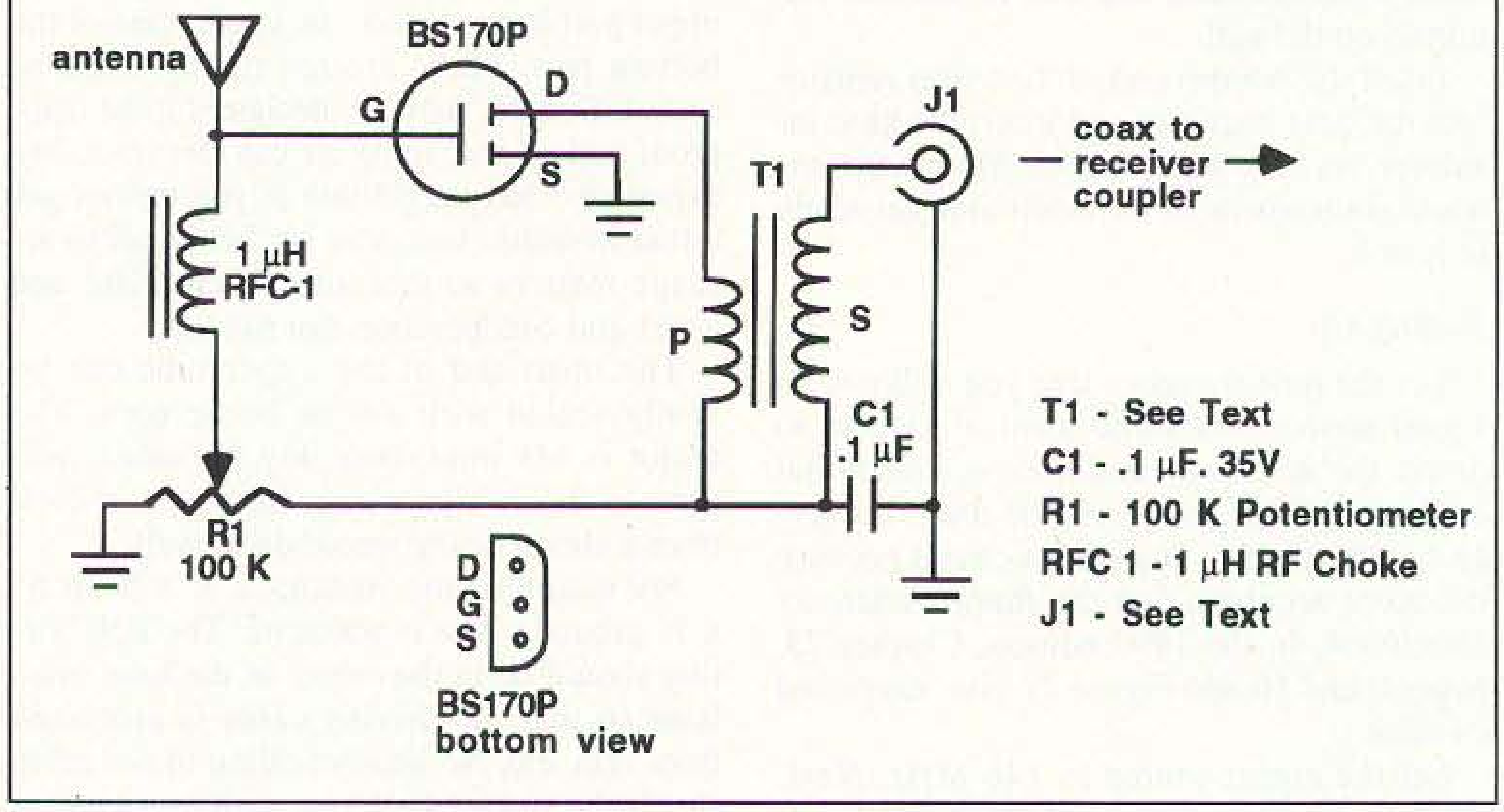

Figure 1. Active antenna.

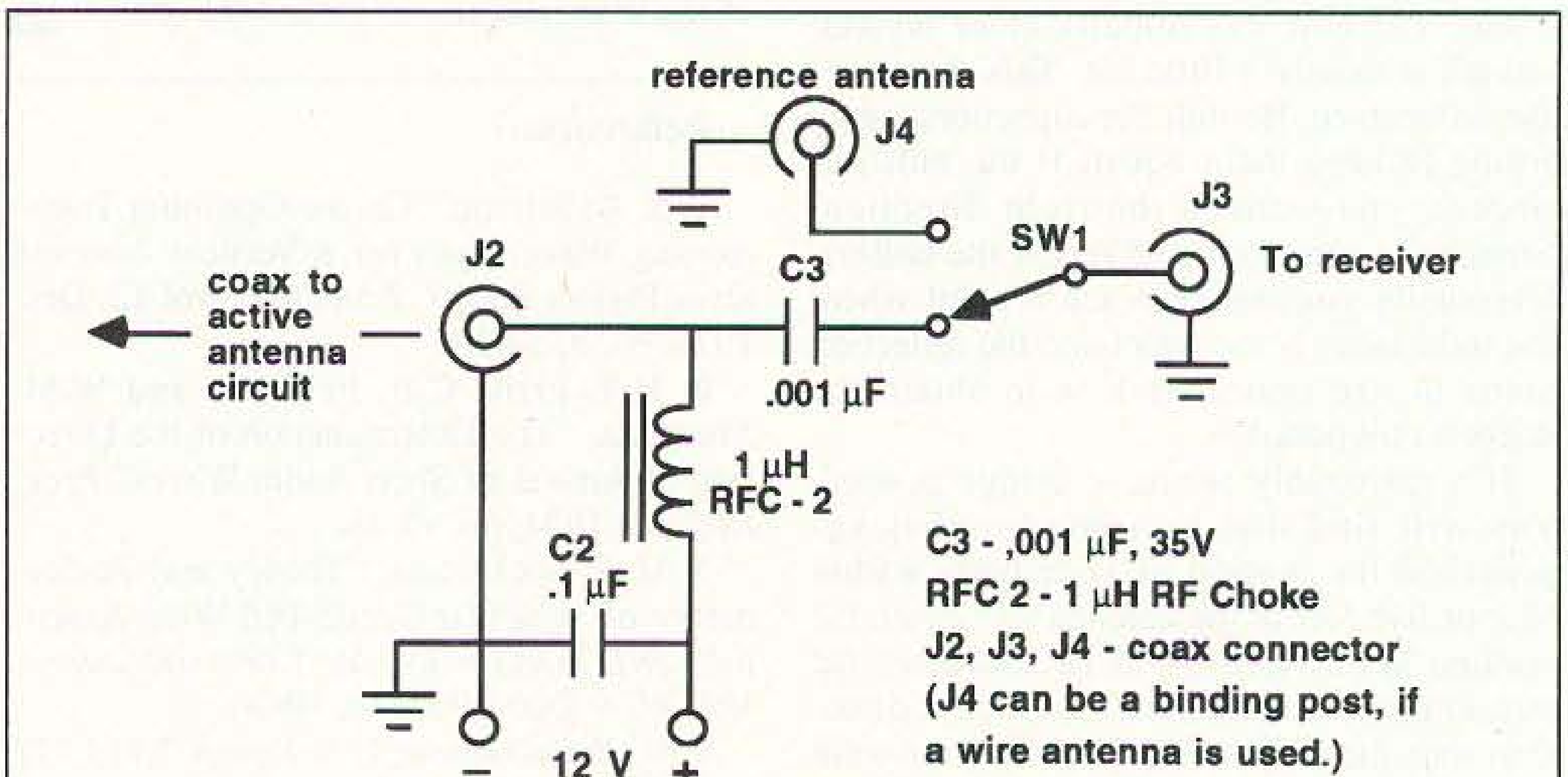

Figure 2. Receiver coupler.

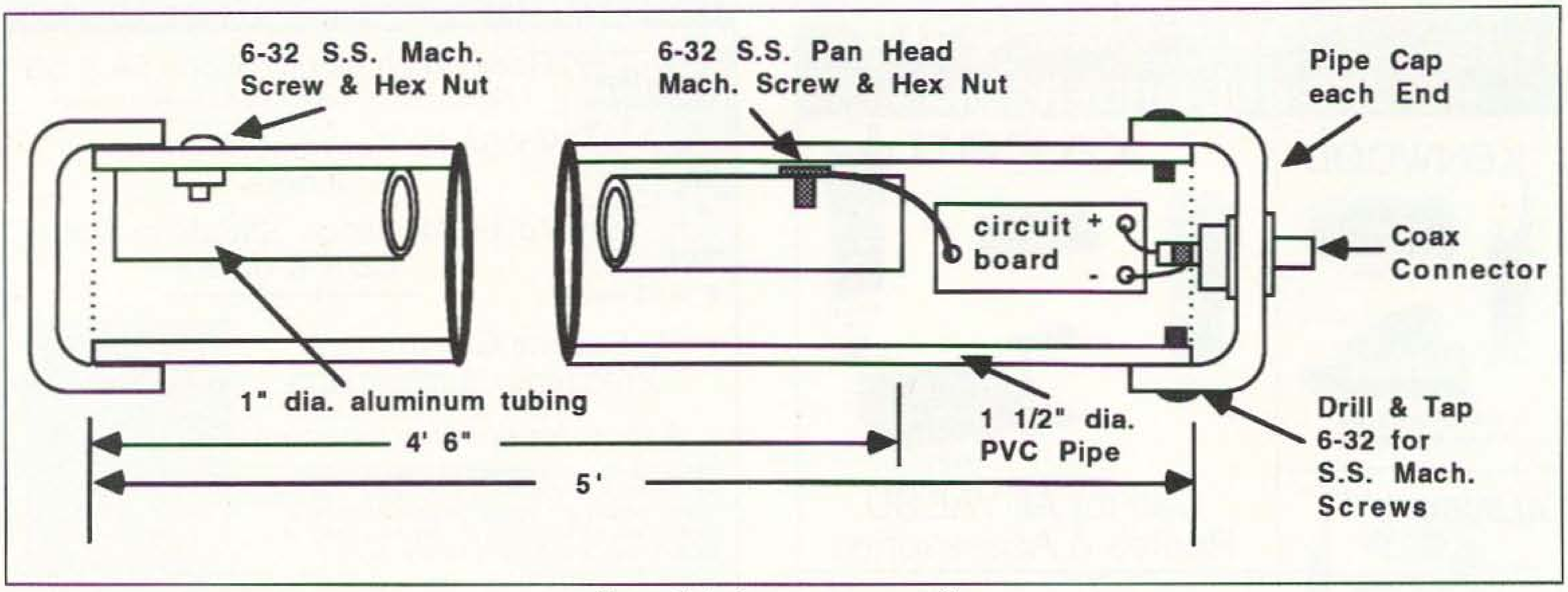

Figure 3. Active antenna assembly.

nect the coax cable feed to the circuit board, as shown in Figure 3.

For testing, connect the coax fitting (secured in the bottom pipe cap) and the antenna to the circuit board, laid out as it would be in the assembly, then connect the active antenna to the receiver coupler and the coupler to the receiver. Apply power. Adjust the 100k potentiometer to provide between 15 and 25 mA to the preamplifier. Then check the antenna for performance. If desired, the potentiometer can be removed and the resistance each side of the arm measured. Fixed resistors could be substituted.

Assembly

The assembly can now be slid into the PVC pipe, starting with the aluminum tube end. The top of the aluminum tube is centered on a predrilled hole in the top of the PVC pipe and the tube is then secured with the machine screw and nut. The bottom pipe cap is firmly pressed on and then drilled and tapped on two sides for 6-32 securing screws. I suggest using stainless steel fasteners.

The antenna is mounted vertically. I used Radio Shack #15-883 4" wall mounts. The "U" bolts that come with the mounts are not wide enough for the PVC pipe so they are not used. The hole spacing of the outer clamp needs to be made wider. I did this by placing the part on a sturdy support with the "V" shape up, then hitting it with a hammer to spread the holes. I then used 2-1/2"-long bolts to clamp the antenna.

The active antenna output transformer "T1" is wound on an Amidon FT50-43 toroid form. The primary has nine turns and the secondary 18 turns. You can use #26 to #30 enameled wire.

I obtained my MOSFETs from Digi-Key Corp., P.O. Box 677, Thief River Falls MN 56701. I used the ZETEX BS170P. I noted that they also list a Philips BS170PH. ZETEX also offers a VN10LP that experimenters may be interested in.

While the turns and ratio of turns on "T1" is what I used, some experimenters may try different windings, depending on their favorite range of frequencies. However, it is a broadband device.

After assembly, caulk the pipe caps and the heads of all screws to insure weatherproofing. I also suggest caulking the coax connector in the bottom pipe cap.

Another scheme for mounting would be to add an eyebolt in the top pipe cap and hang the antenna from a supporting structure. In this case, securing screws should be added to the top pipe cap as in the bottom pipe cap.

Don't just pick a spot to locate the antenna. Use a buddy and move the antenna around to find the quietest location as to the signal-to-noise ratio. Sometimes moving it only a few feet one way or another will make a big difference in the noise level. Also, don't think that adding a long antenna will improve the performance; you will be getting more noise pick-up. The preamplifier will make up for the lack of aperture.

To eliminate the chance of corrosion around the antenna's coax connectors I recommend that, once you have established their location and determined the coax length, you feed the coax directly through the bottom pipe cap and solder it to the circuit board input terminals. Use a cable clamp on the inside and then caulk the cable entry.

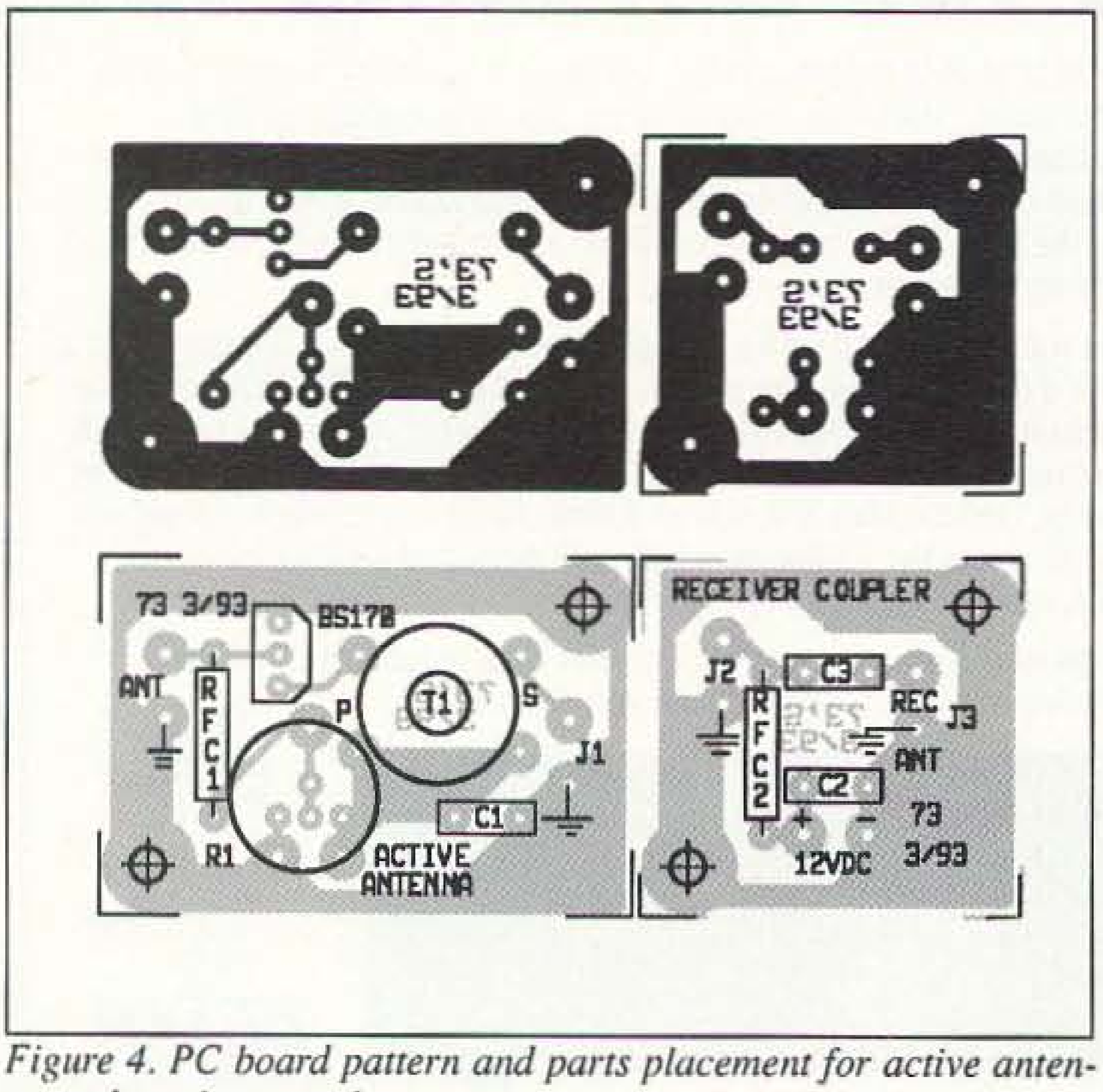

Figure 4. PC board pattern and parts placement for active antenna and receiver coupler.

PARTS LIST

Active Antenna	
T1	See text
C1, C2	0.1 µF 35V disc
C3	0.001 µF 35V disc
R1	100k potentiometer, Radio Shack #271-284
Receiver Coupler	
RFC 1 & 2	1 mH RF choke*
J1	See text
J2 to J4	Your favorite coax connector. J4 can be a binding post if a wire antenna is used for reference.

*1 mH RF choke is for 160 meters and above. For low frequency work (160–190 kHz) try substituting a larger choke, such as 4.7 mH.

Circuit boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4.50 (set of two boards) plus $1.50 shipping and handling.

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Just when you thought great audio and tough as nails construction were luxury features available only on the most expensive models, and just when you thought simple, intuitive operation was a thing of the past, along comes the Alinco VHF-FM HT, DJ -180T.

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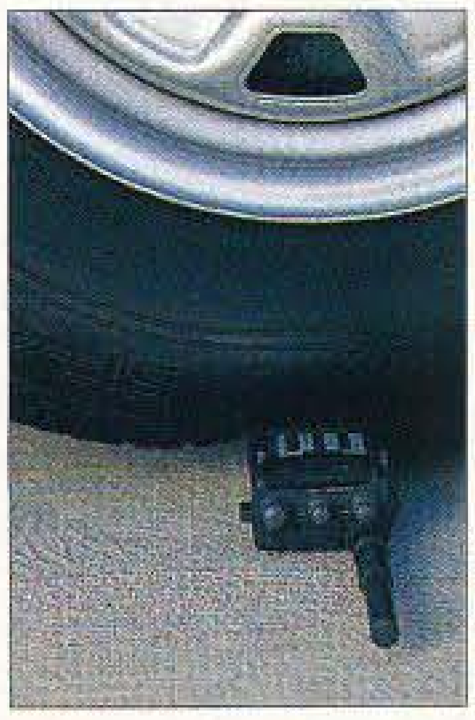

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- Selectable frequency step for quick QSY
- Standard DTMF keyboard
- Low battery indicator
- "Busy" channel LCD indicator
- Key Lock/ PTT Lock functions
- Auto Power Off
- Instant QSY to Call channel
- Monitor button
- Scan Modes
- Battery Saver design
- Supplied with Ni-Cd battery pack EBP-26N for 2 watts output, wall charger, belthook, and strap.
- Optional accessories: EBP'28N Battery pack for 5 watts output, EDH-11 Drycell case, EDC-45 Quick charger, EMS-9 Speaker-microphone, EME-12/13 Headset with VOX/PTT. EME-15 Tie-pin microphone, EDH-12 DC Jack adaptor .EBC-6 Mobile bracket, ESC-18/19 Soft case, EJ-14U 50ch Memory unit, EJ-15U 200ch Memory unit.

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HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

A new high-altitude amateur satellite is expected to be launched and commissioned this April. The French ARSENE satellite is a Phase-3 class satellite with a high orbit and a large complex spaceframe.

The French Connection

Over 15 years ago, a group of amateurs in CNES (National Center for the Study of Space—France) proposed that France should support amateur radio space activity with a major satellite construction project. The idea was submitted to directors at CNES in 1978, where it received favorable response. No financial commitment was required, but the CNES promised support in the form of space-ready parts that were not suitable for future commercial or government projects. The CNES also offered to provide space on an Ariane flight where the entire capacity of the booster was not needed by the paying customer.

The ARSENE satellite program was organized with cooperation from three groups and various individuals. Industry was represented by the CNES, the radio amateurs through RACE (Radio Club de l'Espace) and schools through ENSAE (l'Aeronautique et de l'Espace). The French equivalent of the American Radio Relay League, the REF (Reseau des Emetteurs Francais), joined with RACE to support the program.

By 1979, initial contacts had been made between the three groups involved in the program. They considered proposals for various satellite configurations and final orbits. Complete documentation was expected by the end of 1982 or 1983, with an estimated time for satellite construction of two years. They anticipated launching sometime in 1985. These goals were not met, but instead of dying, the program progressed methodically through the 1980s. Today ARSENE is a reality and is waiting for launch on an Ariane type 42L launcher with the geostationary TV satellite ASTRA 1C from French Guiana.

ARSENE Today—The Satellite

At launch, ARSENE weighs 150.6 kg. It has six sides, not including the top and bottom. The main unit's diameter is 785 mm, the height is 618 mm. Encompassing the maximum extension for antennas and other portions of the satellite, the dimensions increase to almost a meter in diameter and over a meter in height. The satellite will be spin-stabilized around the north/south axis, which will be held perpendicular with the equatorial plane of the earth. Attitude control will be handled by nitrogen jets.

Power for the spacecraft comes from GaAs (Gallium Arsenide) solar panels from Italy generating 60 watts. The communications payload supports a digital Mode B (70 cm up and 2 meters down) and an analog Mode S (70 cm up and 13 cm down). Note Table 1 for a list of operating frequencies by mode. The two modes cannot be operated simultaneously, but will be controlled by a schedule to be determined after launch.

The digital Mode B system represents a departure from the current use of PSK or high-speed FSK in use on most current microsats and Uosats. ARSENE employs standard AFSK (Audio-Frequency Shift Keying) AX.25 packet. With three uplink frequencies on 70 cm and a single downlink on 2 meters, the system can be accessed by anyone using a standard TNC (Terminal Node Controller) in conjunction with appropriate VHF and UHF radios and antennas. No special modems or radio modifications are required.

The 2 meter downlink runs 15 watts out in the high-power mode and 2 watts in low-power. Packet operation is specified at 1200 bps with standard 1200/2400 Hz tones. The system works as a digipeater and does not support an on-board mailbox. The possibilities for such a satellite system are endless, but congestion is expected to be a problem.

The Mode S transponder is 16 kHz wide but will support any type of modulation that is sent on the 70 cm uplink and fits the channel. Power output is 800 mW. The downlink frequency is quite distant from that used for AMSAT-OSCAR-13 (over 40 MHz), so modifications to current Mode S receivers will be necessary.

The Orbit

The desired orbit for ARSENE is equatorial with an apogee (high point of the orbit) of 36,000 km and a perigee (low point of the orbit) of 20,000 km. The Ariane rocket will place the satellites in a geostationary transfer orbit. This transfer orbit is highly elliptical and, due to a low perigee, is not suitable for a final orbit. The ASTRA satellite will then be boosted to a geostationary position over the equator. ARSENE has its own solid-rocket motor. At the apogee of the fourth orbit the main ground control station will command the firing of the internal booster. This will give ARSENE its final orbital characteristics with a period of 17.5 hours. The ground track should closely follow the equator. Good access is expected even for stations above (or below for the Southern Hemisphere) 60 degrees latitude.

Operating with ARSENE

Activity via the Mode S analog transponder will at first be quite light due to the downlink frequency in use. The satellite's operating schedule will likely allocate only a small portion of each day to Mode S. Terrestrial 13 cm systems use 2304 MHz and A-O-13 operates near 2400 MHz. ARSENE's use of 2446 MHz will likely be responsible for conversion and new construction articles. Link margins show that uplink requirements will be similar to A-O-13, i.e. about 300 watts ERP (Effective Radiated Power). This can be accomplished

Continued on page 40

Mode	Uplink	Downlink	Signal Type
B	435.050	145.975	AX.25 AFSK FM
	435.100	"	"
	435.150	"	"
S	435.110	2446.540	Any analog—up to 16 kHz wide

Table 1. Frequency plan for ARSENE.

ARSENE Analog Telemetry Equations

Channel	Units	Parameter	Equation
A3	I	Battery unload current	y=1.664v +0.198
A4	V	Battery end chg. thresh.	y=1.008v +12.94
A5	V	Battery voltage	y=2v +8.72
A6	W	VHF PA output power	y=0.05v^3+0.531v^2+0.25v
A7	V	Primary bus voltage	y=7.152v
A8	I	VHF PA current (10 V)	y=0.365v +0.149
A9	I	VHF PA current (26 V)	y=0.365v +0.149
A11	V	RSSI voltage TC channel	y=v
A13	I	Primary bus current	y=0.619v +0.019
A15	V	First VHF PA voltage	y=9v
A17	I	Solar generator current	y=0.573v
A18	I	DC-DC cnvtr. in. current	y=0.256v +0.02
A19	I	Shunt regulator current	y=0.669v -0.185
A21	I	Battery load current	y=0.174v -0.027
A22	T	Battery temperature	y=14v
A23	T	Solar generator #1 temp	y=-0.679033v^5+9.57784v^4 -51.2412v^3+127.622v^2 -170.345v+97.7918
A24	T	Solar generator #5 temp.	y=-0.679033v^5+9.57784v^4 -51.2412v^3+127.622v^2 -170.345v+97.7918
A38	V	Fifth bat. element vltg,	y=0.982v+3.258
A42	T	Plateau temperature	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A44	T	Shunt regulator temp.	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A46	T	Solar generator #3 temp.	y=-0.771085v^5+10.2258v^4 -51.6250v^3+123.311v^2 -154.219v+62.7882
A48	T	Electro. gates 5-6 temp.	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A53	P	Nitrogen tank pressure	y=69.463v
A54	T	VHF PA temperature	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A55	T	Nitrogen tank #4 temp.	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A58	V	RSSI voltage channel 1	y=v
A60	V	RSSI voltage channel 2	y=v
A62	V	RSSI voltage channel 3	y=v
A69	T	Nitrogen tank #1 temp.	y=-0.337702v^5+4.60193v^4 -25.4481v^3+71.3428v^2 -119.362v+109.681
A71	V	Dosimetre 5 experiment	y=v

Table 2. ARSENE analog telemetry decoding equations from F6BVP. The telemetry value of each channel is between 0-255. This corresponds to a voltage "v" between 0-5 volts. The real value "y" of measured parameters is calculated from the formulas.

Number 12 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Restoring the Classics

It only takes one hamfest to learn an elementary truth: Such events are games of musical junk. That is, people trade favorite or despised rigs and equipment of earlier times for other people's favorite or despised rigs of other times. And, in some cases, spouses cast a wary eye on all that wonderful stuff coming in the back door after every hamfest.

Well, why not put some of that equipment back on the air? I mean it—after all, we don't all need to use a multikilobuck Super Bandbuster IV SSB transceiver with its Flaming Blowtorch 2000 linear amplifier. Besides the ham who simply cannot afford such things (as I was when I was a kid), there are also hams who can afford the Blowtorch and Bandbuster, but who like to work on supposedly antique radios.

Because my electronics experience spans both the vacuum tube era and the solid-state era (which is continuing, of course), I find myself at home with a variety of equipment. If you are not, and want to learn some basic tube theory, then look at any of the earlier editions of *The Radio Amateur's Handbook* or, if you will permit a commercial plug, see my antique radio book from TAB Books in Blue Ridge Summit, Pennsylvania (phone: 1-800-233-1128).

Two pieces from my own collection of radio paraphernalia include the Heathkit DX-60B transmitter and the Hallicrafters SX-100 shown in Photo A. These two pieces of equipment would have made a real dandy Novice and General class station in the late 1950s or early 1960s.

What to Look For

There are several generic things that need to be done on nearly all vacuum era refurb jobs. First, if possible test all of the tubes. This might not be possible, even though at one time nearly every drug store and fast-food joint had a tube tester. Today, only older TV shops and antique radio repairers have them. If this isn't possible, then check the radio for operation and troubleshoot to find weak stages and so forth. My antique radio book gives info on how this job is done.

Next, inspect the chassis, looking for signs of trouble. Look in the vicinity of the power transformers for signs of tar or pitch oozing out. This does not automatically mean that the transformer is bad, but it does tell you that it has been overheated at some point in its career. Note the condition and attempt later to find out whether or not the transformer is good.

Also examine the electrolytic capacitors in the rig (see Photo B). These components tend to dry out over time, and may have to be "reconditioned" or replaced. Reconditioning is done by letting the set work for a couple of hours a day for about a week. On radio receivers that have been stored for many years you may find a high hum level in the output. This symptom indicates that the electrolytic capacitors used in the DC power supply ripple filter are bad. Some of them will reform after being used for a dozen or so hours. I once "reconditioned" a Hammarlund HQ-145 by letting it run for a week or so. The hum level dropped every day, and finally disappeared before the week was up.

The signs to look for on the electrolytic, indicating replacement, are discoloration of the paper (if tubular), bulging (all types), or any oozing of material at the end caps (all types). In most cases, the oozing will be long over and only a gray, white or tan corrosion or dust remains. If you see this material, replace the electrolytic capacitor. Don't even try to refurbish it.

The general rule of thumb for replacing an electrolytic, especially one in the DC power supply, is that you can use one with the same or higher capacitance rating, or the same or higher Working Voltage DC (i.e. WVDC) rating. If the capacitor appears to be bulged, then suspect that a higher WVDC rating is needed for the replacement. Measure the normal voltage across the capacitor and

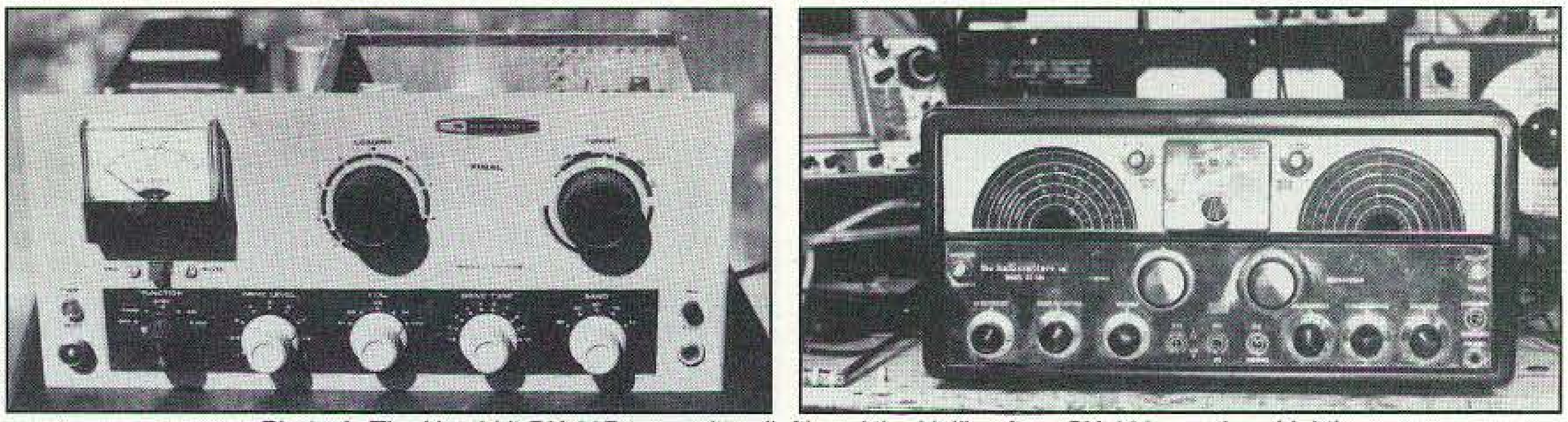

Photo A. The Heathkit DX-60B transmitter (left) and the Hallicrafters SX-100 receiver (right).

then multiply it by 1.20 (this allows a 20 percent margin for error and variation). Next, multiply the WVDC rating of the existing capacitor by 0.80 (also allowing for a 20 percent margin). If the voltage times 1.2 is near (or higher than) the WVDC rating of the capacitor, then opt for the next higher value.

I've seen this problem several times where 350 WVDC capacitors were used in a receiver that should have used 450 WVDC. I recall a medical oscilloscope used for bedside monitoring in hospitals a couple of decades ago. It had a 270-volt DC power supply that used 60 µF/350 WVDC capacitors in the two sides. They were typically found bulged out after a year or so in service. Note that 1.2 x 270 = 324 volts, and that 0.80 x 350 WVDC = 280 volts. Get the point: Under the worst case, which apparently occurred from time to time, we have a 280-volt capacitor in a 324-volt circuit! With 20 or so of those 'scopes in our system, we were replacing electrolytics on a fairly regular basis. While this scenario is a bit extreme, it does happen. We replaced the capacitors with 60 µF/450 WVDC units and never had another failure.

Some receivers use a multisection electrolytic capacitor. These capacitors sit upright on the chassis, and may have either two, three or four electrolytic capacitors in a single metal can (although it might have a paper insulating cover over it). All sections share a single common ground connection, which is the case of the can. Some old-timers would replace an open-circuited section (a fairly common failure mechanism) by shunting a tubular electrolytic across the bad section. This saves the replacement job, and is cheaper than buying the entire multisection electrolytic capacitor. Like many such "solutions," however, it is simple, elegant, easy and utterly stupid. In other words, it's wrong. Why? Because those electrolytics tend to fail later by shorting out. I've seen that happen so many times that I tend to get curmudgeonly and short-tempered when I see it. Besides, in those years when I worked on medical instruments I saw one case where such a repair might have cost a patient's life. A contractor (not one of us in the hospital lab, thank God) had pulled that trick on a defibrillator, and then the main capacitor shorted. When the patient went into ventricular fibrillation, the docs tried to use the instrument, and it failed. Fortunately, there was one nearby on another unit and it was brought to the scene post haste . . . but time was wasted. We'll never know whether proper repair procedures would've saved that life, but I know I'll never be party to such a shabby repair. Such are the lessons of life.

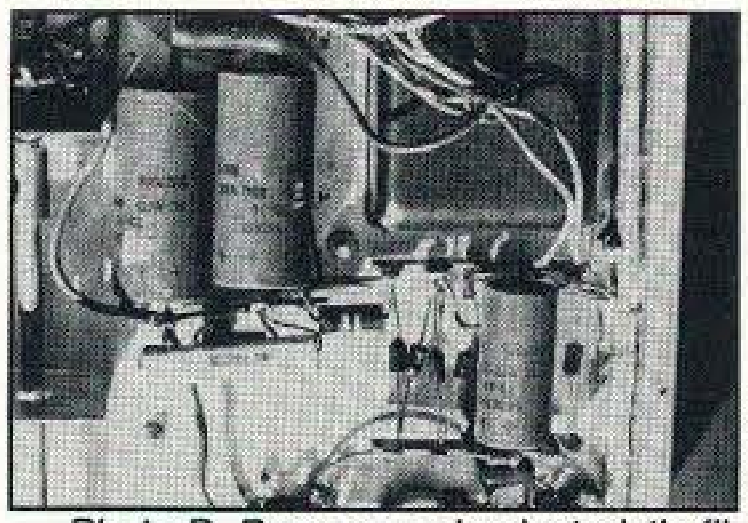

Photo B. Power supply electrolytic filter capacitors are often bad after storage, even when they were good when the rig was first placed in storage.

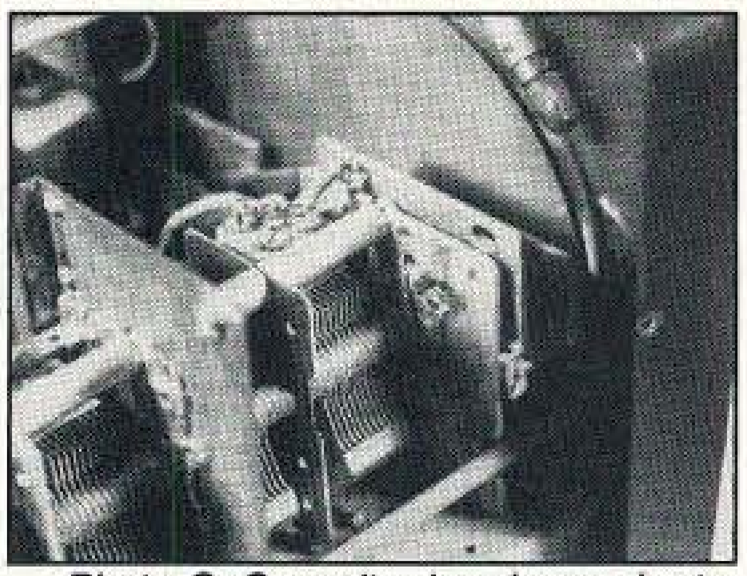

Photo C. Capacitor bearing and rotor ground are often sites of problems in older receivers.

Another thing to check is the condition of the switches and potentiometers in the set. Use switch contact or TV tuner cleaner to spray down each switch, especially rotary types, and each potentiometer. Get the stuff inside the component, and then mechanically operate the switch/pot vigorously eight to 10 times to thoroughly clean the insides. I've found antique bandswitches so corroded that only gentle rubbing with a pencil eraser did the trick. Be careful, especially on bandswitches, to not disturb surrounding circuitry.

On receivers of old you will find a massive main tuning capacitor, a multisectioned marvel of an air dielectric variable. Wonderful sight, those were! However, they are also a pain in the neck after 10 or 20 years of unuse. The front and rear bearings supporting the rotor plates are lubricated. The lubricant dries out with time. In addition, there is a ground spring that connects the rotor plates to the capacitor frame. These (usually brass) springs are the electrical connection. If the receiver intermittently howls and screams when tuned, or is excessively microphonic (howls or screams when touched or vibrated), then suspect either the lubricant or the spring.

The lubricant can be cleaned out with spray cleaner, but be sure not to spray the plates. Be gentle with the spritzer button! Replace the lubricant with white petroleum grease such as LubriPlate, or something similar. Some people claim that silicone grease works as well, but I haven't used it so I can't corroborate the claim. Use a toothpick to apply the grease, and then run the capacitor through its entire range several times.

The ground spring needs to be cleaned, especially under the tip that rests on the capacitor mounting plate. Gently raise it—but not too far—and burnish the metal underneath it and on its bottom side. This trick should reground the capacitor and make the radio work again.

Of course, there may be other problems, and they will require normal troubleshooting procedures to find. Those mentioned above are often due to old age or the abuse of nonuse. 73

HAMSATS *Continued from page 36*

with 30 watts on 70 cm to a 10 dB gain antenna. For the downlink, a GaAsFET preamp and a 2.5-foot dish with coffee-can feed should work.

Mode B will be the most common ARSENE activity. The link margin on the uplink will be the same as Mode S, but due to congestion, it may seem to take much more power at times when the satellite is visible to many users. The high-power 15 watt downlink on 2 meters will be an easy copy on a moderate beam at a home station. While signals may be audible on portable equipment with omnidirectional antennas, the packet copy will likely be poor. Since the orbit is quite high even at perigee, there will be no times when the signals will be overwhelming. They will, however, be consistent and show very little Doppler shift.

The French telecom authorities have assigned ARSENE the callsign FXØARS. Satellite builders have decided to label the AX.25 frames with ARSENE-1, ARSENE-2 and ARSENE-3, depending on which TNC is transmitting. After launch ARSENE will retain its prelaunch name, although there will be no problem with other international groups that may decide to assign an OSCAR number. Depending on the launch status of other hamsats currently waiting for launch, ARSENE may become known as ARSENE-OSCAR-24 or ARSENE-OSCAR-25.

ARSENE DIGITAL TELEMETRY FORMAT

Word	Bit	Module	State=1	State=0
STA	ST1	TNC 1	On	Off
STA	ST2	TNC 2	On	Off
STA	ST3	TNC 3	On	Off
STA	ST4	VHF xmit	CIM TLM	Packet
STA	ST5	VHF pwr.	Low	Normal
STA	ST6	Exp. sply.	On	Off
STA	ST7			
STA	ST8	Squelch	Off	On
STB	ST9	Bat. reg.	On	Off
STB	ST10	OK to load bat	Yes	No
STB	ST11	Bat. load mode	Normal	Housekeeping
STB	ST12	Packet xpndr.	On	Off
STB	ST13	Mode B or S	B packet	S linear
STB	ST14	10V pwr. sply.	On	Off
STB	ST15	Hi pres. gates	Open	Closed
STB	ST16	ACS pwr. sply.	On	Off

Table 3. Significance of digital telemetry bits in words STA and STB of ARSENE's nine digital telemetry status bytes.

ARSENE Telemetry

The single 2 meter downlink frequency will carry telemetry information as well as the digipeated packet activity. The data downlink carries information on 30 analog channels and nine satellite status bytes. The format will be unconnected AX.25 frames. Table 2 shows information on the analog telemetry equations as received from Bernard Pidoux F6BVP via Joe Kasser G3ZCZ/W3. Note that the parameter value is denoted by "y" and the variable "v" is the value sent from the satellite to be used in the appropriate equation. The "Units" column shows the type of measurement for the channel where "V" is voltage in Volts, "I" is current in amps, "T" is temperature in degrees Celsius, "P" is pressure in Bars and "W" is power in watts.

The nine digital-format status bytes include two eight-bit bytes STA and STB that describe the status of 16 on-board systems. Table 3 shows the breakdown of this information. The other seven status bytes include four for message handling and three that represent counter information.

A shareware program (PC) written by FC1OAT to decode telemetry online is available from ATEPRA (Association Technique pour l'Experimentation du Packet Radio Amateur), 23 rue de Provins, F-77520 MONS EN MONTOIS, France, Europe. It is compatible with CGA, EGA or VGA displays and requires only the addition of a receiver tuned to 145.975 MHz FM, a standard TNC and an antenna.

Get Ready

ARSENE promises to be an exciting satellite. Its curious orbit and standard packet system set it apart from any other hamsat available for use by all hams. Congestion is expected after this satellite is "discovered" by the ham community. Expect announcements concerning the use of the three uplinks to segregate individual operators, bulletin-board systems and packet clusters. Also expect more emphasis on Mode S operation to get on this satellite and get ready for Phase 3 D later this decade. 73

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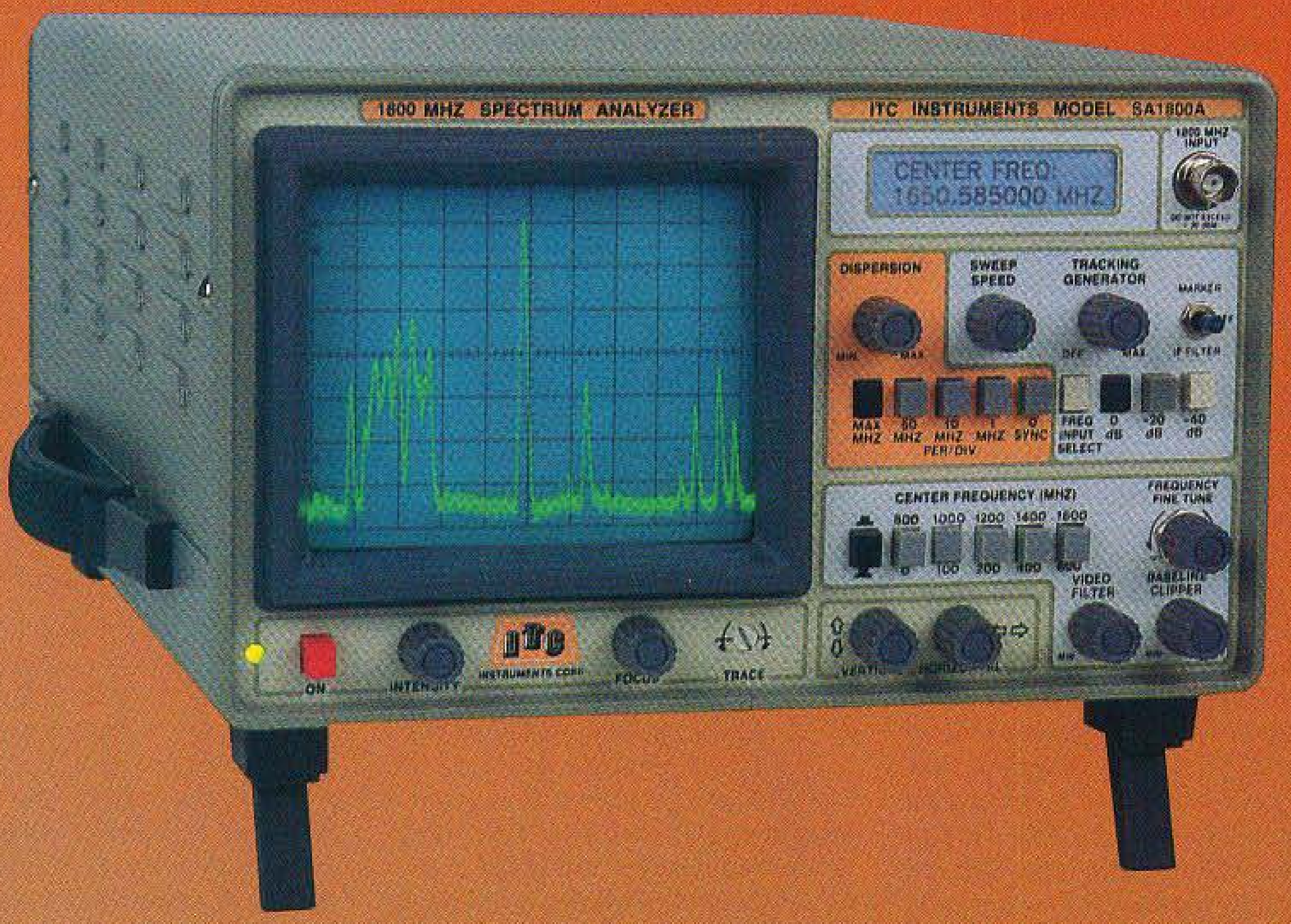

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							FINE FREQ TUNE	BASE-LINE CLIPPER	VERT. HORZ. CONTS.	SWEEP SPEED CONT.	
ITC	SA600	$1295.00	1 - 600MHZ	80dB	-110dBm	10HZ*	YES	YES	YES	YES	500MHZ**
ITC	SA1000	$1595.00	1 - 1000MHZ	80dB	-110dBm	10HZ*	YES	YES	YES	YES	500MHZ**
ITC	SA1800	$1895.00	1 - 1800MHZ	80dB	-110dBm	10HZ*	YES	YES	YES	YES	500MHZ**
B&K	*2610*	*$2895.00*	*1 - 1000MHZ*	*70dB*	*-92dBm*	*1MHZ*	*NO*	*NO*	*NO*	*NO*	*2MHZ*
PROTECK	*P-7802*	*$3500.00*	*1 - 1000MHZ*	*70dB*	*-92dBm*	*1MHZ*	*NO*	*NO*	*NO*	*NO*	*2MHZ*
AVCOM	*PS65A*	*$2895.00*	*2 - 1000MHZ*	*60dB*	*-95dBm*	*100KHZ*	*YES*	*NO*	*YES*	*YES*	*2MHZ*

Note: * add Opt. 6 for center frequency digital readout. Opt.6 is all so a 10 digit 1800MHZ stand alone Frequency Counter with 1 MV sensitivity. Note: ** For +/- 5KHZ Narrow Band Filter add Opt.3 ... All information for other manufactures have been taked form current manufactures adds and spec. sheets. ITC does not take responsibility for any incorrect information that may appear on other manufactures data sheets.

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CIRCLE 110 ON READER SERVICE CARD

QRP

Number 15 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

I had hoped to present the first part of my solar charge controller this month but, because of several circuit changes, the PC board has to be reworked and there will be a delay. This is a rather complex circuit so I'll show the charge controller in stages as we go.

The first part of the project will deal with the power supply and the voltage reference, as well as the state of the charge circuits. I'll show you the basic design for the voltage divider used for the battery sense line as well as the array detect circuits.

Power to operate the controller comes from the battery being charged. A 1N4001 diode provides reverse polarity protection for the ICs. The input to the first voltage regulator is decoupled with several low value capacitors. This keeps the IC regulator stable since the supply voltage (the battery) is located some distance from the regulator itself.

A 7812 IC regulator provides a stable +12 volts for the controller. The normal battery voltage will be around 12.6 volts so there will not be enough overhead to allow this regulator to work properly. When the battery voltage is 12.6 volts, the output of the regulator will be about 10.5 volts. When the input to the regulator is approximately 1.5 volts over the minimum needed, the regulator will work properly. When the battery is nearing full charge (14.4 volts), the regulator will have enough overhead and will output its required 12 volts.

If you have a problem with this system you may swap out the 7812 for a 7810 regulator. This is a 10-volt regulator and will work fine on a 12.6-volt battery. They are much harder to find than the 7812, though. However, all the major electronic suppliers do stock the 7810. Radio Shack does not handle this part, but it does carry the 7812.

The output of the regulator supplies VCC to all the ICs. The output also supplies the LM317L regulator. This regulator is a small TO-92 case version of the popular LM317 TO-220 case regulator. A 10-turn 1k trimmer sets the voltage at 4.5 volts. Op amp U2 is configured as a buffer. This buffer provides isolation between the logic and the 4.5-volt reference source. The output is on pin #7. This then becomes our 4.5-volt reference line. The reference line connects to several points on the PC board. If you're building this circuit on perf board, don't forget to connect all these reference lines together.

To generate our state of charge reference voltage, another op amp is used, but this time as a voltage amplifier. The 22.6k 1 percent resistor sets the gain of the amplifier in conjunction with the 0.01 capacitor. The state of charge is then set by adjusting the 470k pot. By increasing the amount of resistance in the circuit you increase the output voltage from the op amp. This then becomes our SOC reference source.

Array detect works by sampling the voltage generated from the array. A voltage comparator made up of an op amp compares the output of the array to the voltage on the battery. If the array voltage is lower than the battery voltage, then the comparator's output stays high. When the array voltage is greater than the battery voltage, meaning the array will be able to charge the battery, two things happen: First, the array ready LED is illuminated; second, the charging LED is also illuminated, indicating battery charging has begun.

Since this controller uses power MOSFETs, even when they are "off" their internal clamping diode will allow the battery to discharge at night. A Schottky barrier diode in series with the MOSFETs and the battery prevents discharge at night. It also isolates the battery from the array, allowing the array detect comparator to see only the array and not the battery voltage at the same time.

The Schottky diode is an MBR1635. This TO-220 case diode will allow current to 15 amps if the device is properly heat-sinked. You will have to de-rate the device if you don't heat-sink it properly.

Because the case of the MBR1635 is electrically hot, you must use the necessary TO-220 mounting hardware. If you don't choose this route, then insulate the heat sink from the rest of the project. Of course, you may use a different type of blocking diode for the project. I used a DO-40 stud mount diode in one of the prototypes. I mounted this diode, as well as four IRFZ40 power MOSFETs, to a 4" x 6" x 1/8" aluminum sheet. Since the case of the diode and the drain of the MOSFET are connected by the same heat sink, the entire heat sink had to be isolated from the rest of the circuitry. Although this makes it harder to mount the heat sink, it also makes it much easier to connect the blocking diode and the FETs. With the arrangement mentioned above, I have a current capacity of 45 amps!

That's about all the space I have for this project this month. Next month we'll look at a classic transmitter with a few new touches added. After I correct the final PC boards I'll pick up again with the solar charger.

Super RIT Update

I received word from Rulon Vandyke KA7BCD on a correction for the article "Super RIT for the HW-8." This modification first appeared in the April 1990 issue of the *QRP Quarterly*.

There seems to be an error in one of the resistors controlling the bias on a transistor switch. With the values shown in the original, you'll not be able to get the circuit to operate.

The transistor bias resistor R6 should be a 330k-ohm one instead of the crippling 3.3k-ohm one indicated in the schematic and parts list. Proper transmit bias voltages cannot be achieved at the collector of Q1 with such a low value of base resistance. This low resistance changes the R3/VR2 voltage divider ratio by effectively adding a low resistance in parallel with VR2.

Since this circuit appeared in many different publications, including the *HW-8 Handbook*, Rulon asked me to let the readers of the "QRP" column in on this correction. So, tell your friends and fellow HW-8 modifiers about this correction to the Super RIT for the HW-8.

Dayton '93 Hamvention

There is some good news and some bad news concerning the QRP get-together this year at Dayton. First, the bad news is that the Knights Inn is no longer in business. Hard economic times did the hotel in. The good news is that we have a block of 50 rooms at the Day's Inn South! This is the same place the QRP ARCI held their first Dayton meeting. Like the buzzards coming home to roost in Hinkely, we've come home.

The room rate is $75 per night (that's with our discount because the club has a 50-room block). There is no restriction on the number of people you can have in the room.

If you want to stay with the QRP ARCI this Dayton '93, drop a note to Mryon Koyle N8DHT at 1101 Miles Avenue, Canton OH 44710, or call him at (216) 477-5717 for more information. You'll need to send in a check for one night's stay ($75) and make the check out to Day's Inn Dayton South. Hope to see you there! 73

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HOMING IN

Number 16 on your Feedback card

Radio Direction Finding

Joe Moell, P.E., KØOV
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Fullerton CA 92633

Denver Hams "Excel" at T-Hunting

Portable computer technology is astounding, isn't it? My first, a Sinclair ZX-80, amazed me. But it seems primitive next to today's laptops and notebooks. Unless you already have one of the newest of these little marvels, I'll bet you're looking for a good excuse to acquire one.

If your ham radio activities include radio direction finding (RDF), you can put your laptop to work. My last two columns told you how WB8WFK uses one to get more accurate bearings on hidden transmitter hunts, sometimes called foxhunts or T-hunts. This month we'll move on to some new ideas in computerized triangulation.

Trigonometry Without Tears

Competitive mobile T-hunts pit individuals or teams against one another. Rules forbid collaboration between teams and assistance from base stations. Clues of any kind are a big no-no.

However, there are times when RDFers can and should work together. Search and rescue hunts go faster when the participants share information. It's much easier to pinpoint a jammer or bootlegger when several widely scattered teams compare their bearings.

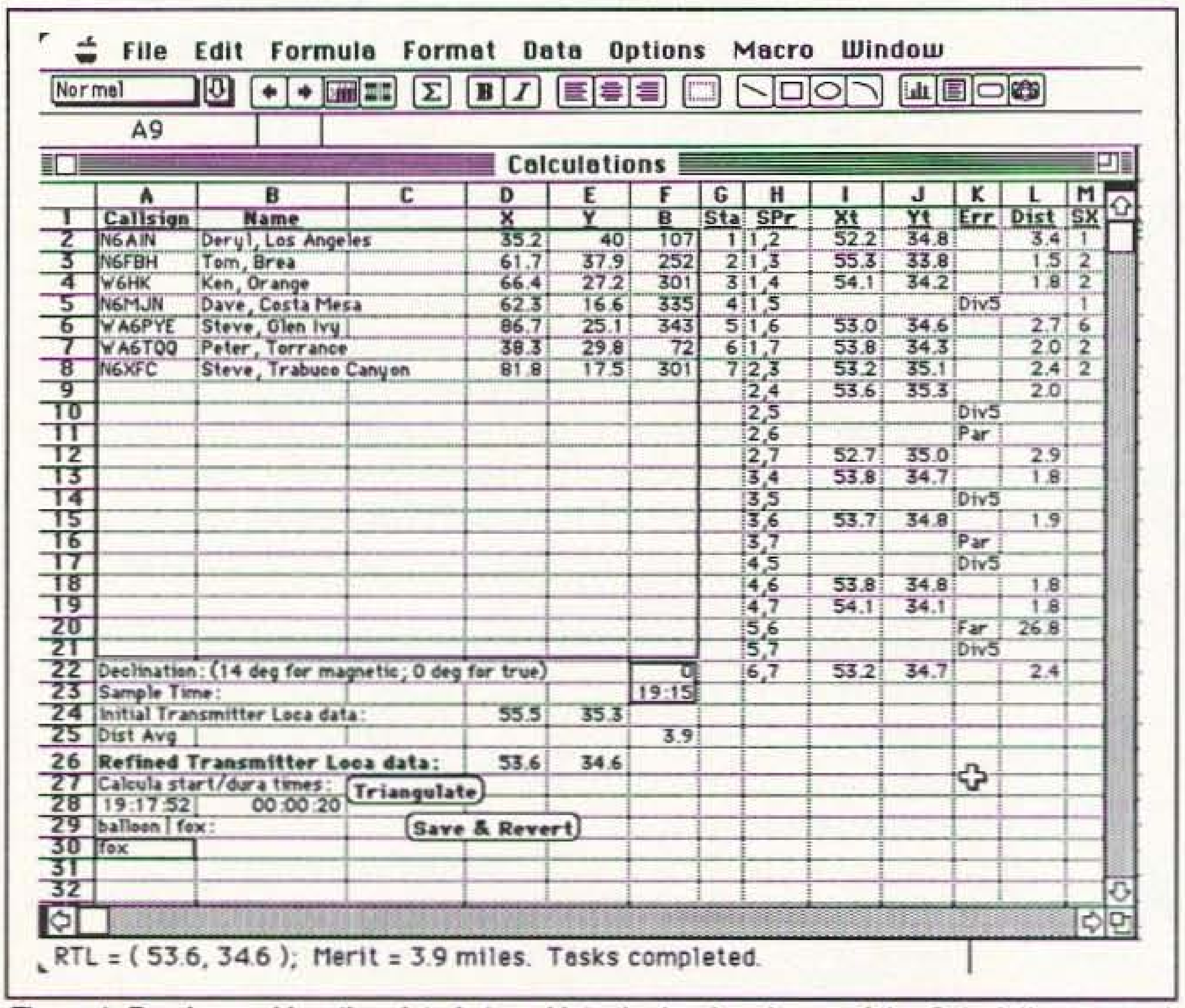
From a single location, you can determine the azimuth of an incoming signal with fair accuracy, but you can only guess the distance, based on the strength of the signal. When azimuth information is available from two or more properly-spaced locations, the intersection of the lines of bearing tells not only the direction of the T but the distance to it. The process of determining this intersection is called "triangulation." Since this term comes from the word "triangle," you might get the idea that three stations or bearing-taking locations are required. Actually, only two are needed. Two lines of bearing plus a line drawn between the stations forms a triangle. In addition, right triangles are created when you intersect the bearing lines with north-south and east-west grid lines.

If bearings are accurately taken and the signal has followed a direct path to the observer, the intersection will be the location of the signal source. Of course, conditions are seldom ideal. Buildings, hills and mountains reflect VHF signals, causing bearing inaccuracies.

The pattern of an RDF beam or quad can be skewed, due to nonsymmetrical construction. It can be affected by the vehicle or nearby objects. Your compass reading can be thrown off by a local magnetic disturbance as you sight along your antenna boom for a bearing.

To counteract these effects, it's best to take lots of bearings, perform lots of triangulations, and average the results, throwing out the wildest of the individual fixes.

Photo A. Tim Moffitt NØNXI (left) and Paul Ternlund WB3JZV use a Macintosh PowerBook computer for triangulating. They live near Denver, so they are used to T-hunting in cold weather. (Photo by Stephen Ternlund.)



File Edit Formula Format Data Options Macro Window

Normal

A9

Calculations

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Callsign	Name		X	Y	B	Sta	SPr	Xt	Yt	Err	Dist	SX
2	N6AIN	Deryl, Los Angeles		35.2	40	107	1	1,2	52.2	34.8		3.4	1
3	N6FBH	Tom, Brea		61.7	37.9	252	2	1,3	55.3	33.8		1.5	2
4	W6HK	Ken, Orange		66.4	27.2	301	3	1,4	54.1	34.2		1.8	2
5	N6MJN	Dave, Costa Mesa		62.3	16.6	335	4	1,5			Div5		1
6	WA6PYE	Steve, Glen Ivy		86.7	25.1	343	5	1,6	53.0	34.6		2.7	6
7	WA6TQQ	Peter, Torrance		38.3	29.8	72	6	1,7	53.8	34.3		2.0	2
8	N6XFC	Steve, Trabuco Canyon		81.8	17.5	301	7	2,3	53.2	35.1		2.4	2
9								2,4	53.6	35.3		2.0	
10								2,5			Div5		
11								2,6			Par		
12								2,7	52.7	35.0		2.9	
13								3,4	53.8	34.7		1.8	
14								3,5			Div5		
15								3,6	53.7	34.8		1.9	
16								3,7			Par		
17								4,5			Div5		
18								4,6	53.8	34.8		1.8	
19								4,7	54.1	34.1		1.8	
20								5,6			Far	26.8	
21								5,7			Div5		
22	Declination: (14 deg for magnetic; 0 deg for true)					0		6,7	53.2	34.7		2.4	
23	Sample Time:					19:15							
24	Initial Transmitter Loca data:			55.5	35.3								
25	Dist Avg					3.9							
26	Refined Transmitter Loca data:			53.6	34.6								
27	Calcula start/dura times:		Triangulate										
28	19:17:52	00:00:20											
29	balloon | fox:		Save & Revert										
30	fox												
31													
32													

RTL = (53.6, 34.6); Merit = 3.9 miles. Tasks completed.

Figure 1. Bearing and location data is typed into the bordered area of the Calculations spreadsheet (cells A2 through F21). The computer triangulates the bearings in pairs and displays the results in other cells.

The usual procedure for triangulation involves drawing lines on a map using a protractor and straightedge. You can cross two lines on a map quickly, but when there are many reporting stations and many bearings the map becomes a confusing jumble of points and lines. Here's where digital technology can speed things up and improve accuracy.

In recent years several hams, including WD8CBE, N6JSX, and yours truly, have written RDF programs for various computers. They feature triangulation on pairs of bearings from stations at pre-programmed locations, telling the user how far he is from the predicted T-location, plus which way and how far to drive to get there.

Listings for two such programs (DF2.BAS and DF3.BAS), along with a detailed explanation of triangulation theory and equations, are in Chapter 20 of the book *Transmitter Hunting—Radio Direction Finding Simplified* by KØOV and WB6UZZ, available from Uncle Wayne's Bookstore. The programs are in BASIC-80 and can be readily adapted to almost any computer, even my old ZX-80.

Don Lewis KF6GQ has written a special program for cooperative hunts in Southern California. It runs on PCs with VGA graphics and includes a built-in map of the Los Angeles region in the display. Send an SASE to Don (543 Bradbury Road, Monrovia CA 91016) for more information on THUNT91A.EXE.

Something New from the Mile-High City

Most RDF programs declare the hidden transmitter's location one fix at a time. What happens when there are three, four, or a dozen stations taking bearings from scattered locations at once? If you triangulate them all, two at a time, you will get many different fixes, due to inaccuracies in each bearing. Which fix is best?

In the T-hunt book, I mentioned that an advanced RDF program could average the results of multiple bearings to give a refined estimate of the T's location. It could also compare the performance of each bearing-taker, based on this result. KF6GQ's program can average up to 10 bearings at a

time, but it is limited to the Los Angeles area.

A more general program with many additional features has been developed by Paul Ternlund WB3JZV. He is an engineer and computer scientist with the Department of Defense, living in Aurora, Colorado. His favorite ham radio activities include foxhunting and tracking ATV balloons.

"I'm a nut for accurate bearings," Paul says. "I'm trying to get a practical understanding of 2 meter bearing-taking and all the phenomena that go with it. When I'm the fox on Denver's competitive hunts I ask hunters to give their bearings to me as they hunt, and I give bonus points for the best ones." A program for calculating and displaying multiple bearings must have fast math functions, sophisticated plotting routines, and a tabular user interface. Paul's T-hunt partner, Tim Moffitt NØNXI, suggested using Microsoft® Excel instead of creating a complete executable application.

Paul wrote a set of macros that accept bearing data from up to 20 RDFers, triangulate each pair, detect and throw away "wild" fixes, average the good fixes to give a best guess of the T's location, and more. The results appear in just a few seconds on a PowerBook or other Macintosh computer. (The routines should also work on the PC version of Excel, but Paul has not verified this.) WB3JZV's algorithm deduces the predicted T location using double averaging. To show how it weeds out the bad bearings, let's go through a hypothetical cooperative hunt. Assume that it's just after dinnertime and a continuous carrier has appeared on a popular packet frequency in the Los Angeles basin, blocking all message forwarding.

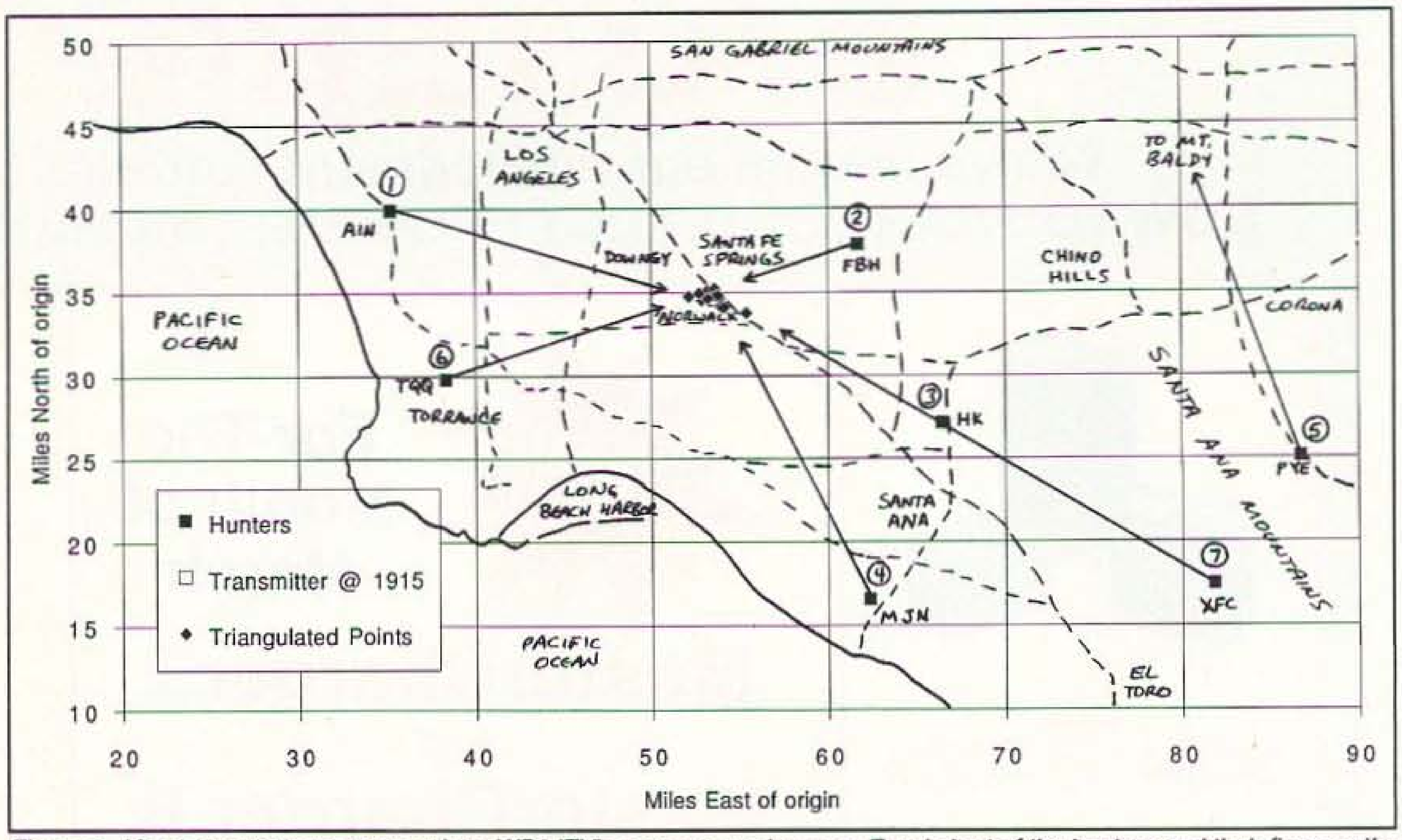


Figure 2. After triangulations are complete, WB3JZV's program produces an Excel chart of the hunters and their fixes on the fox. In this case, the final position estimate is almost buried under them. I drew in the coastline (solid) and major freeways (dashed) for reference.

Another Stuck TNC

Several T-hunters get together on a voice repeater. All have a good direct signal from the QRMing station at their homes except for WA6PYE. Steve's house is blocked from the signal source by the Chino Hills and the Santa Ana Mountains. He doesn't realize it, but the signal is getting to him by reflecting off Mount Baldy in the San Gabriel Mountains to his northwest.

Each station reports antenna heading in degrees azimuth and location, given as coordinates on an agreed-upon map. This group uses the AAA Los Angeles County and Vicinity map, marked with a grid of one-mile squares. The one-mile lines are numbered in ascending order to the north and east, beginning with zero in the lower left corner.

You are the search coordinator, so you start Excel and load FastWorkspace to begin the triangulation process. This opens the Calculations spreadsheet (Figure 1) and some other files that will be described later. You type in the callsign, name and city (optional), location coordinates (X and Y), and bearing (B) for each reporting station. A mouse-click of the Triangulate button near the bottom of the spreadsheet starts the computations.

First the program assigns each station a number, shown in the "Sta" column. Then it triangulates each pair of bearings and displays the outcomes in the "SPr," "Xt," and "Yt" columns. W6HK and N6XFC each gave a bearing of 301 degrees. Parallel bearings do not intersect, so the program puts "Par" in the error ("Err") column for station pair 2,6.

Bearings of WA6TQQ and N6FBH differ by exactly 180 degrees; thus bearing pair 3,7 cannot be triangulated and a "Par" error is displayed. WA6PYE's reflected bearing diverges from bearings of all stations except WA6TQQ. The program displays a "Div" error in these cases.

The macro averages the "Xt" and "Yt" values of all fixes to give a preliminary position estimate. Then it calculates the distances from this preliminary position to each of the fixes, displaying them in the "Dist" column. Next it scans the distances, looking for fixes that are at greater-than-average distance from the preliminary position estimate. In this case, the intersection of WA6PYE's Baldy bounce bearing with WA6TQQ's bearing was almost 27 miles away from the main cluster, so the program discards this fix and displays a "Far" error for pair 5,6.

The macro averages the surviving fixes to get a final position estimate, which it displays in line 26 and the status bar at the bottom of the window. You mark this point on the AAA map to see where it is.

Meanwhile, Excel generates a scatter chart showing the hunters, the surviving fixes, and the final position estimate (Figure 2). Excel automatically selects the area of display and scales of the X and Y axes, but you can change them manually if you wish.

GLOSSARY

Azimuth—Astronomical term for angular degrees measured in a clockwise direction from true north. For example, east is azimuth 90 degrees.

Bearing—In RDF, the compass direction of an incoming radio signal as observed by a receiving station. True bearings are taken in degrees relative to true north, while magnetic bearings are relative to the earth's magnetic North Pole.

Triangulation—RDF technique for determining the position of an unknown emitter by trigonometry, using bearings taken from two or more known locations.

Fix—The position determined by triangulation from bearings taken at two points.

Spreadsheet—A grid of cells containing numbers, formulas, and labels (see Figure 1). Spreadsheet computer programs such as Microsoft® Excel are used to enter data, calculate results, and display in tabular and graphic form.

Macro—A computer file containing a set of formulas to direct a sequence of actions, such as choosing commands, entering formulas, and performing calculations. Excel uses macros to carry out complex operations on data in spreadsheets.

Let's Roll

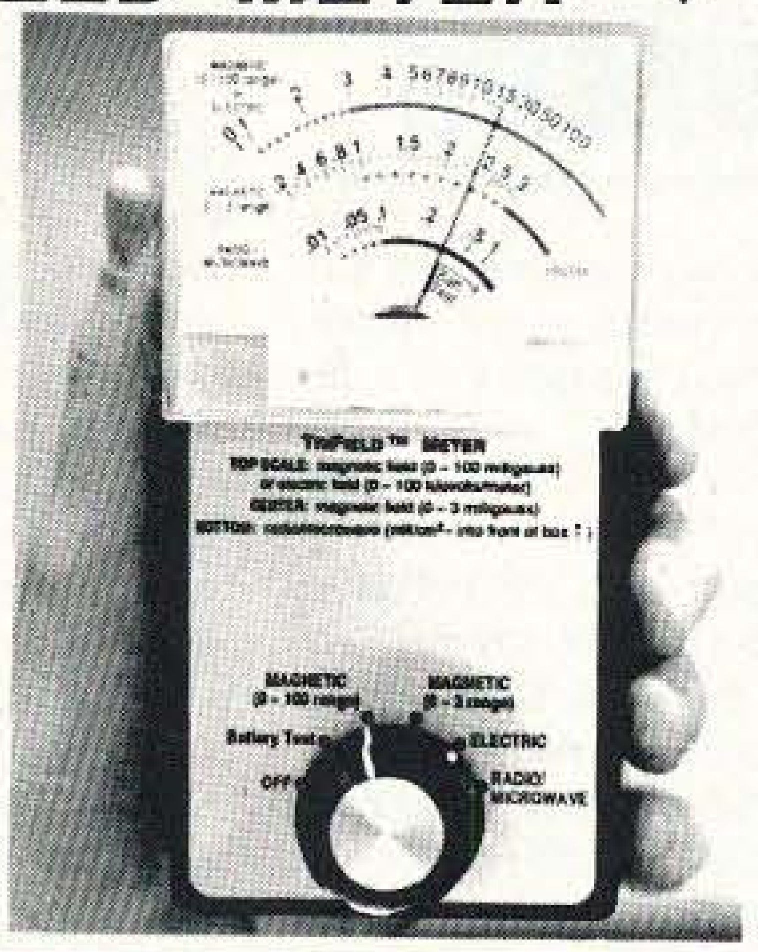
MacroFast has reduced the search zone for our hypothetical stuck carrier to a small area just northwest of the intersection of Carmenita and Rosecrans in the city of Santa Fe Springs. That's the best estimate we can expect from triangulation methods when the nearest RDFer is over eight miles away. Now it's time to send in the mobiles.

From Figure 2, it's clear that the fastest way to end the QRM will be to phone T-hunters in the connecting cities of Santa Fe Springs, Norwalk, and Downey. If none are available, and a choice must be made from stations in this RDF net, it looks like W6HK can get to the scene fastest. He is farther away than N6FBH, but he is close to a freeway that goes directly toward the target intersection.

Although not needed in this case, you can quickly update the position estimate when additional observers check in. Just add the next bearing on row 9 of the Calculations spreadsheet, click the Triangulate button again, and MacroFast will recalculate and redisplay the scatter chart. The program can crunch up to 20 bearing reports at a time.

WB3JZV's file set is excellent for coordinating the search for a stuck transmitter or jammer, but Paul designed it for a more ambitious purpose—recovering ATV balloons. Next month's "Homing In" column will show you how the system tracks moving signals, develops a figure of merit for the position estimate, and grades the performance of each hunter.

▼ ELECTROMAGNETIC FIELD METER ▼



CIRCLE 188 ON READER SERVICE CARD

CIRCLE 153 ON READER SERVICE CARD

PACKET & COMPUTERS

Jeffrey Sloman N1EWO
75 Herriott Street
Franklin IN 46131

Understanding Asynchronous Communications

It will come as no surprise that the most common roadblock to setting up a packet station is making the connections among the components. The connection between the radio and TNC (Terminal Node Controller), and from the TNC to the terminal, can have you pulling your hair out if they don't work as expected. This month we'll take a look at the TNC-to-computer link (Part 1 of 3). The series will cover both communications hardware and software. I will focus on the IBM-PC because that is the overwhelming choice for use in ham radio. If you don't use a PC, don't stop reading—the principles discussed are true of all computers/terminals, only some details will be different.

All Your Bits in a Row

The communication between your TNC and terminal is called a *serial* connection. It gets its name from the way the data is transmitted. The fundamental particle of data is called a *bit*. Bits can have one of only two values: 0 or 1. In a manner not unlike Morse code, bits are transmitted in groups, each distinct group assigned a value. For example, in the most commonly used code—called ASCII, for American Standard Code for Information Interchange—the string of bits:

1100101

stands for a lower case "e." The serial connection between the TNC and terminal sends one bit at a time—serially—and so gets its name from this behavior. The alternative to this is called parallel data transmission. This technique is faster because it uses more than one data line to transmit the information. Each bit in the code gets its own data line and the entire code can be sent in one move. The most common place to find this technique is printer connections. The Centronics parallel interface is the standard in the PC world and, because of this, on many other computers as well. Most parallel connections have eight data lines, and so are able to pass data eight bits—called a byte—at a time. This is because most communications codes use the byte as the basic character size. There are exceptions to this. For example, because of the large number of characters, Japanese codes use 16 bits (two bytes) to get more combinations.

Some programs which use the parallel port for bidirectional communications—such as file transfer programs like Lap-Link—overcome the unidirectional nature of most PC parallel ports by transmitting the data on the printer status lines. These are the connections the printer uses to say it is ready, or out of paper. Because there are only four of these, data is sent a *nybble* at a time. Yes, you guessed it, a nybble is a half-byte (4 bits).

RS-232D

The serial port on your PC follows a standard called RS-232D. This standard describes the signal lines, and to which connector pin they are assigned. Strangely, it does not specify a connector type, but the 25-pin D connector is the de facto standard. There are 25 defined pins in the RS-232 standard. Amazingly enough, you may only need three of them.

The three workhorse pins in the RS-232 connector are:

2 (TD) Transmit Data
3 (RD) Receive Data
7 (SG) Signal Ground

As you can see from the list, an RS-232 connection can be very simple: someplace to send the data, someplace to get the data, and a common ground. If this works, why bother with 25 pins?

Handshaking

In a perfect world, the receiver would be ready to receive whenever the sender was ready to send. Your own real-world experience will tell you, though, that the word "standby" is very useful. Digital communications is no different, and it is often the case that the data flow must be interrupted. This is called *flow control* or *handshaking*. The RS-232 spec defines several status lines that are variously used for "hardware" handshaking:

4 (RTS) Request to Send
5 (CTS) Clear to Send
6 (DSR) Data Set Ready
8 (DCD) Data Carrier Detect
20 (DTR) Data Terminal Ready

These handshaking lines can be used in many ways, but the most common is the RTS/CTS combination. But what about our three-wire setup?

The three-wire connection provides only enough wires to get data to and from the terminal and DCE. This means that handshaking must take the form of *software flow control*. The standard form of software flow control is called XON/XOFF protocol. To understand why, and how it works, we have to take a look at ASCII code again.

When transmitting data, it is often necessary to send some information concerning the connection itself. In the case of flow control, we want to stop and start the data stream. How can we do this? Well, we could send STOP! every time we wanted to stop it, and START! to get it going again. The trouble with this approach becomes apparent when we decide to send STOP! or START! as part of the message text itself. Well, you say, I'll probably never want to send that anyway, so I'll just "reserve" it as a command. You can't send it as part of a message, and that's that.

Well, this would work, but it would be very cumbersome. If we get a little clever we can reserve a single character, say "\." Then if "\" appears in the data stream, whatever follows should be interpreted as a command. This technique is known as an *escape* character, and is actually used, though not for flow control. While either of these techniques could get the job done, the designers of ASCII came up with a more transparent scheme. They reserved the first 31 codes as *control characters*. Yup, these are the codes that are generated when you hold down the control key and type a character. These characters need never be part of the text, and so can be immediately interpreted.

Each of the control characters has a name and function. Some of them have fallen into disuse, but there are a few of interest:

Character	ASCII	Function
CTRL+G	07	BEL (rings terminal bell)
CTRL+H	08	BS (backspace)
CTRL+I	09	HT (tab—the H is for horizontal)
CTRL+J	10	LF (line feed)
CTRL+L	12	FF (form feed—clears the screen)
CTRL+M	13	CR (carriage return)
CTRL+Q	17	XON (starts data flow —also called DC1)
CTRL+S	19	XOFF (stops data flow —also called DC3)

As you can see, most of the control characters perform familiar functions. You are probably used to hitting the backspace key to backspace, but you can experiment with CTRL+H—you'll see that it works. The last two are the flow control characters. They are generically known as DC1 and DC3—DC means Device Control. When your terminal needs to stop the data flow it sends CTRL+S to the DCE; to start it back up just takes a CTRL+Q. You can even do this manually.

Who's Who?

As you may have noticed, the RS-232 spec has a "point of view." That is, the connections are defined with one side as receiver and the other as sender. Of course, it is quite unusual to have a one-way data circuit—so what's the deal?

The individual data lines in RS-232 are not bidirectional—notice that there are separate send and receive lines. They are also complimentary—inputs must be matched to outputs. This leads to classes of equipment. Your computer or terminal is called DTE (for Data Terminal Equipment) while your TNC is known as DCE (for Data Circuit Terminating Equipment). The RS-232 spec is written from the DTE point of view.

Usually equipment to be connected to a data terminal—be it a computer or dumb terminal—such as a modem, TNC, or serial printer, is configured as DCE. This is not always the case, and is why there is such a thing as a *null modem cable*. A null modem cable flips the complimentary lines over so the two like devices (DCE-to-DCE, or DTE-to-DTE) can communicate. In the practical world of packet stations, a standard modem cable—sometimes called a Hayes modem cable, after the company that pioneered telephone modems for PCs—does the job. This cable is wired to connect DTE to DCE, the "normal" case.

Technology Marches On . . .

The IBM-PC had a 25-pin D connector for serial communications, but only used nine of the pins (maximum) to make a connection. It didn't take long for IBM to decide this was a waste of pins, so with the introduction of the IBM-AT the connector was changed to a 9-pin D connector. While this was a good idea, the implementation left something to be desired. The nine pins—as defined by the RS-232 standard—used by an IBM serial port are 2,3,4,5,6,7,8,20, and 22. Now, it would seem obvious—at least to me—that the best course would be to leave pins 2 through 8 assigned to the respective pins on the DB-9 connector. I must be missing something, or maybe that was just too simple, because here is what IBM came up with:

DB9	DB25	Designation
1	8	DCD (Data Carrier Detect)
2	2	RD (Receive Data)
3	3	TD (Transmit Data)
4	20	DTR (Data Terminal Ready)
5	7	SG (Signal Ground)
6	6	DSR (Data Set Ready)
7	4	RTS (Request To Send)
8	5	CTS (Clear To Send)
9	22	RI (Ring Indicator)

This may be confusing, but we are stuck with it. In any case, as long as you know the pinout you can make a working cable—the signals are the same.

Why Asynchronous?

You have probably heard the term before, maybe in its shortened form of "async," but what does it mean? Async refers to the fact that characters sent over the connection will not necessarily arrive at any particular time. This is important because the receive station must somehow decode the incoming signal, and to do that it needs to know when the character starts and ends. This is where the notion of start and stop bits comes from. These allow the receiving equipment to determine the front and back of the transmitted characters. When you set your communications parameters to:

8 data bits
no parity
1 stop bit

you are specifying the structure of each character sent. One stop bit will be sent—a start bit is always sent. The parity bit is used—or rather not used—for error detection. Though this is its intended purpose, it is rarely done.

I am going to stop here with Part 1. Part 2, next month, will finish this discussion—with the final installment cov-

Continued on page 50

Number 28 on your Feedback card

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PACKET & COMPUTERS

Continued from page 48

ering software following that.

Survey Results

A couple of months ago I included a survey in the column. I have gotten quite a few responses (thanks to all who took the time), but I want to see if I can get more. So, those of you waiting breathlessly for the results of the survey—take a breath. To tease a little: You guys are overwhelmingly PC users, quite a few of you with heavy-duty machines! There is a strong interest in Internet connectivity, and in improved software for packet use. After more readers respond I will publish the results here. Below are the questions once again. Paper mail and email are both fine.

1. What is you callsign?
2. What is your license class?
3. What computer(s) do you use in the shack?
4. What operating system/environment version(s) do you use?
5. Which digital modes are you *equipped* for?
6. Which digital modes are you *active* in?
7. Which of these columns (month, year) has been your favorite (if any)?
8. What has been your biggest problem with computers in ham radio?
9. What would *you* like to see in this column?
10. *Any* comments:

You don't need to copy the questions, just put the number before your answer. Answer all the questions, or just the ones you want. Make the responses wordy or brief. I really want your feedback to make this column something you look forward to each month. Thanks so much for your participation.

Electronic Addresses

Packet: N1EWO@N0ARY

(note: I'd love to hear from you on packet—but not about the survey! This survey is the business of this magazine, and we can't do that on ham radio. A personal note or test message is just fine.)

Internet: jsloman@mcimail.com
(This is my preferred address.)
MCI Mail: jsloman
(This is the same as above, but direct.)
CompuServe: 71221,1143
(This is my least favorite place to get mail, but it is OK.)

Even if you don't answer any survey questions, I am very interested in anything you have to say. I can't answer every message—though email has a *much* better chance. Many of you have written asking for help. You have not been forgotten—I am planning a "mailbag" column for the near future where I can answer the many similar questions that come in. For those of you who have written saying that you enjoy the column, thanks. For those of you who would like to see additions/changes, please write to me—it's the only way I have of knowing what you need and want. 'Til next month, 73 de N1EWO.

UPDATES

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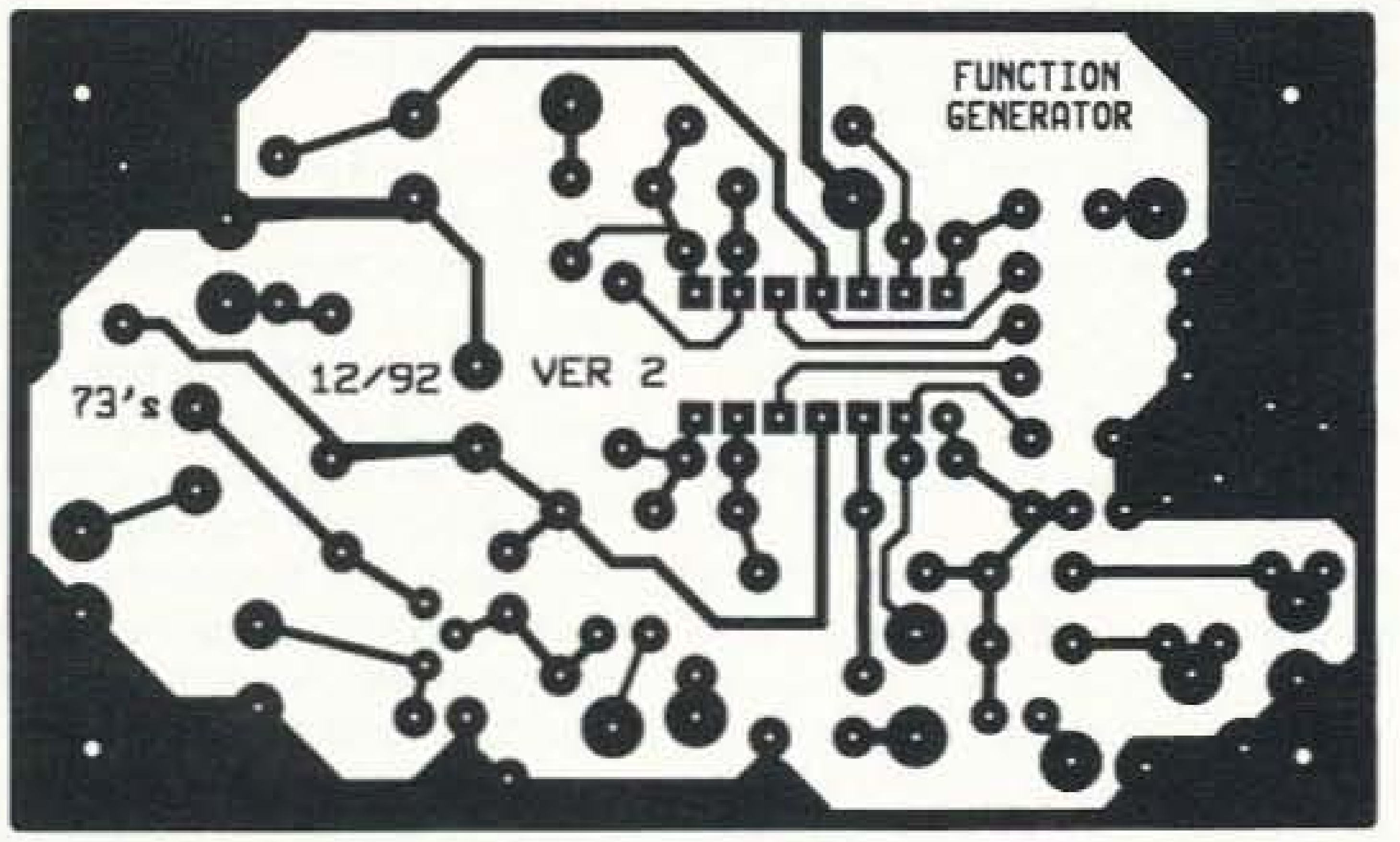

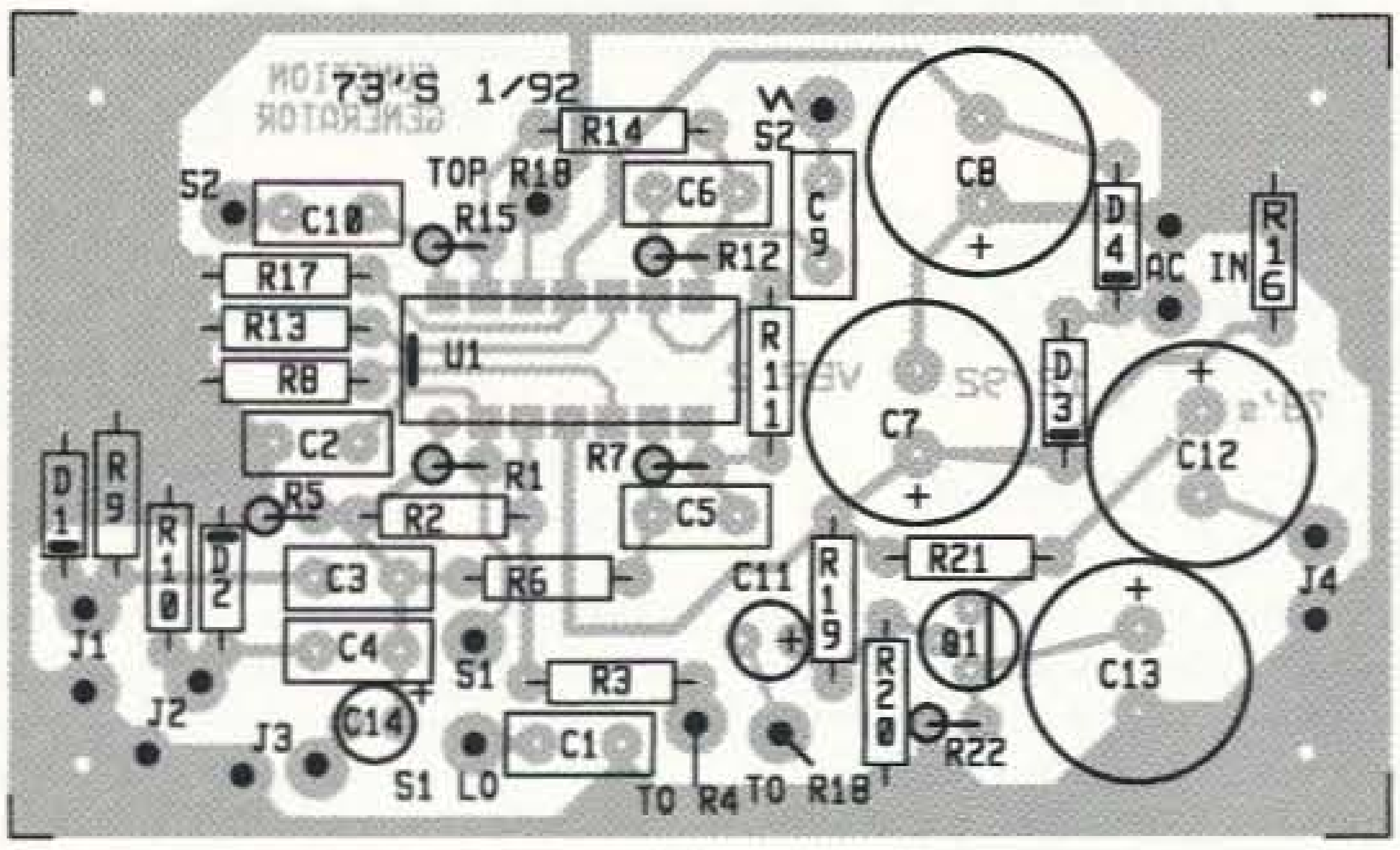

Corrected PC board foil pattern and parts placement for the Function Generator, January 1992 issue.

Build a Function Generator

Refer to the above article in the January 1992 issue, page 28. A ground lead and a component (R16) were left off the original PC board. The intersection of R18 and pin 3 of U1 should have been grounded. A new ground trace has been added to the PC board.

ABOVE & BEYOND

UHF And Above Operation

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

RF Actuated Coaxial Switching

My desire for a coaxial switching circuit that would activate on the presence of very low level RF from low power SSB HTs started me off on a new project. This is the circuit that I mentioned last month in the narrative covering mobile operation on 10 GHz. This circuit was the output of a design effort to permit our 10 GHz converters to be switched on RF detection from the transmit IF, our 2 meter SSB HTs. These HTs have a low power output of about 100 mW. The circuit can be easily modified to accommodate higher power transceivers. More on that later.

The development of this unit was predicated on a coaxial switching system that operates on RF carrier detection, eliminating the need for manual RF switching. This manual switching involved multiple switching circuits controlling converters, preamplifiers, IF switching, and other switching relays that inserted the high power TWT amp on transmit. The addition of this new control circuitry would make our microwave rigs push-to-talk, a great improvement.

This switching system is not limited to low power configurations or to microwave operation. It can be adapted as you wish (it's a basic control circuit, not just for microwave) to handle higher powers and lower microwave frequencies. As a matter of fact, you could use it to control VHF converters as easily as my microwave systems. It is well-suited to custom installations and adaptable to various switching needs.

The Circuit

First, let's get into the circuit. It's quite simple and it evolved from several designs used for transmitter-actuated switched circuits, or "tranx" switch circuits. Some of the basic tranx circuits consist of a simple diode detector rectifying a small portion of the incoming RF to produce a controlling DC signal for control use. This DC voltage is usually applied to a Darlington transistor providing high gain and amplification, allowing a relay connected in its output to be activated on detection of transmit RF. See Figure 1.

This circuit does work, but has some limitations. One limitation is that most RF detection circuits assume you have a transmitter power of a few watts or so, allowing easy brute force detection to actuate the control circuit. Delicate operation is not one of its traits. When we use a 2 meter transceiver as an IF system in our microwave converters, the higher powers are a detriment. This doesn't mean that they can't be used, but the extra power serves no purpose. If a higher power radio is used, most of the power output must be dissipated before being applied to any converter. Usually radios that provide 100 mW are desirable for converters as they will operate for long periods of time without requiring large battery packs.

In tests that I conducted, Darlington circuits proved to be very unreliable when switching multiple circuits in tests that I conducted. What was needed was a very sensitive circuit that would be reliable and not give false operations. A search through many pieces of literature produced many different approaches, but never seemed to hit the mark I wanted.

Part of the answer came from the RSGB *VHF Handbook*, fourth edition, chapter 6.3. They described just what we wanted: an op-amp-controlled, very sensitive RF-actuated detection circuit using two diodes and a 741 op amp. I built the circuit and was very impressed with its operation. It was so sensitive it would operate on key-up SSB without modulating the rig. I tried to make the circuit false (fail) but it operated very reliably. I was pleased with its high sensitivity and its ability to operate the keying circuit on SSB PTT without requiring modulation.

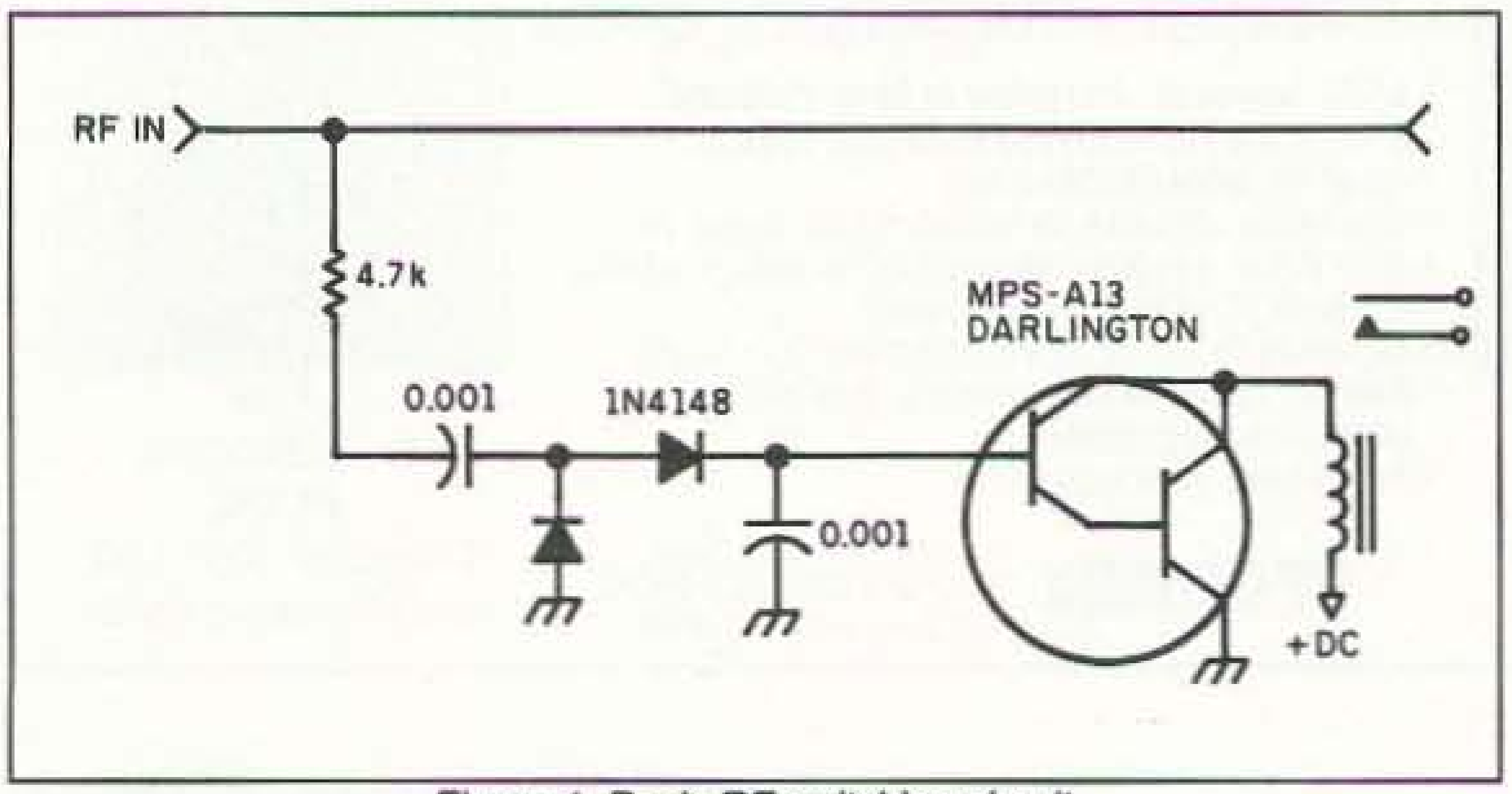

Figure 1. Basic RF switching circuit.

Improving the Circuit

The basic circuit designed by the RSGB group had one flaw: a switching transistor that is used for relay control. Up to this point I was looking at the output of the op amp for test results. This book was published in 1983 and the improvement I made was to incorporate components that were not available or were very expensive at that time.

The change or improvement is to replace the transistor with a power FET. This simple improvement made all the difference in the world in circuit operation. It speeded up switching times and made the circuit very easy to duplicate as the op amp can drive an FET easily. I used an "N" channel FET so that when the op amp did not detect RF its output would be negative, or switched towards the source of the FET, turning it hard off. When the op amp pin #3 went positive on RF detection its output would switch towards the positive rail, turning the FET's gate positive and on (see Figure 2).

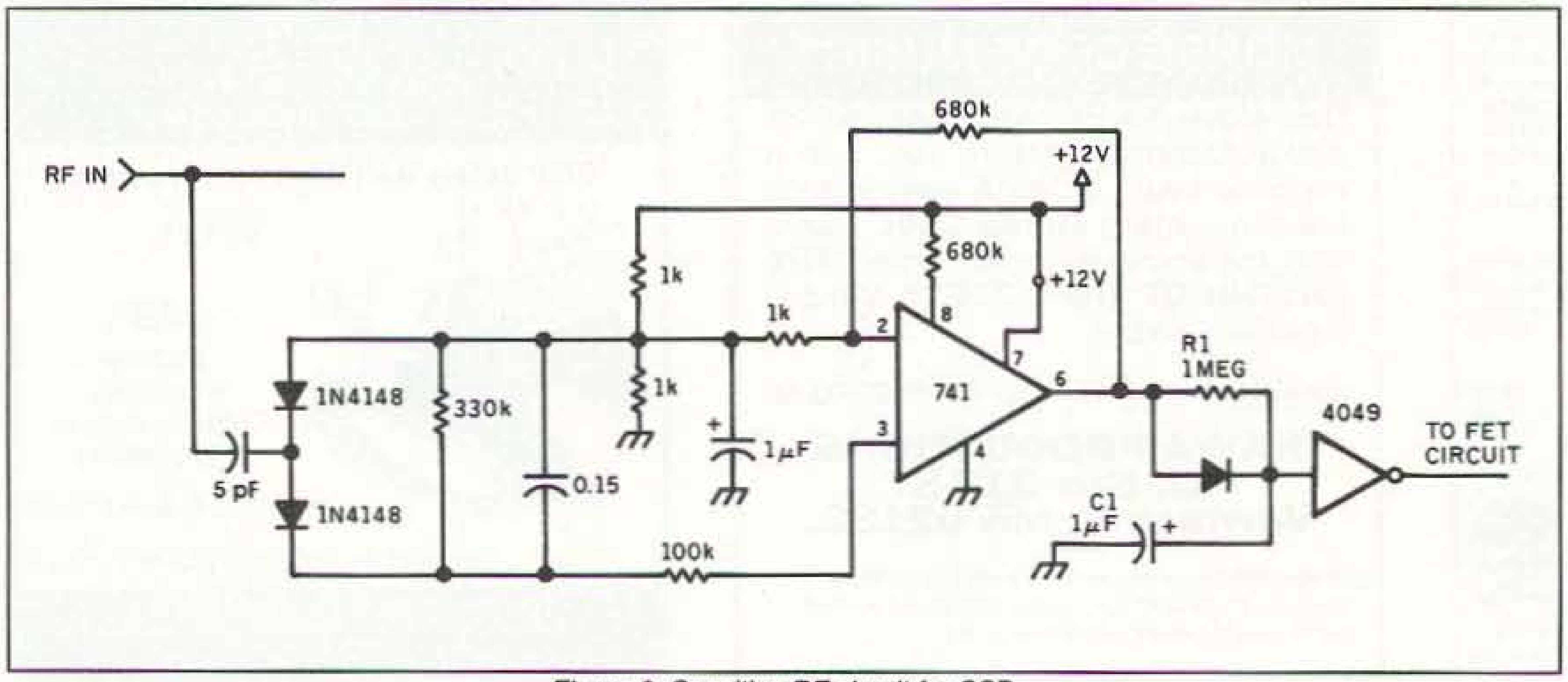

Figure 2. Sensitive RF circuit for SSB.

The difference between a transistor and an FET in switching times is like comparing a Model T Ford to a Ferrari. The FET and Ferrari are both very fast. As a matter of fact, the FET can switch in the nanoseconds, something the transistor can't accomplish.

Now the switching and RF detection circuit were functioning well. The remaining circuitry that needed to be designed was the control switching and delay for the coaxial relays. This part of the circuit would do the actual control or receive and transmit switching and timing for our microwave converters. What we desired was some time control or delay to allow the RF preamplifier switching to take place prior to the key-up of the transmitter power amplifier, a 10 watt TWT. We wanted protection during the preamplifier's switching, and to allow that to be done first. Then, in sequence, we wanted the transmit circuits to be switched into place, preparing the converter for a transmit function. This protects the receive preamp during transmit. (By the way, this same preamp is used as the transmit preamp during transmitting.)

Conversely, when we released our push-to-talk circuit (return to receive from transmit), we wanted the high level switching to de-activate first, turning off the high power amplifier and removing its coaxial from the circuit. Then, after a timing delay, we wanted the low level circuit to return to its normal receive configuration. This prevents the 10 watt TWT power amplifier from coupling any energy into receiver circuits. There is a chance of destroying the low-noise receiver's front end from transmitter coupling with switching errors.

The problem is that we wanted a complex switching circuit with minimum components. Sounds kind of unobtainable, but Kerry N6IZW came up with a very simple circuit to handle it. We used it in both our 10 GHz rigs during the last weekend of the ARRL 10 GHz contest and it worked superbly.

The time delay circuit retained the fast switching of the FET from the original op amp circuit and incorporated a simple RC time constant network with diode steering to accomplish the switching timing needed. A single 4049 hex inverter was used to interface the op amp and FET switching circuit. This portion of the circuit uses diodes for fast turn-on, providing a rapid DC charge of the timing capacitor. There's no RC time constant involved here; it's bypassed by the diode. When the control circuit (PTT) is released, the DC voltage of the op amp reverts towards negative and the charge on the capacitor, shunted by the 1 megohm resistor, forms the first timing circuit, with a delay hang oper-

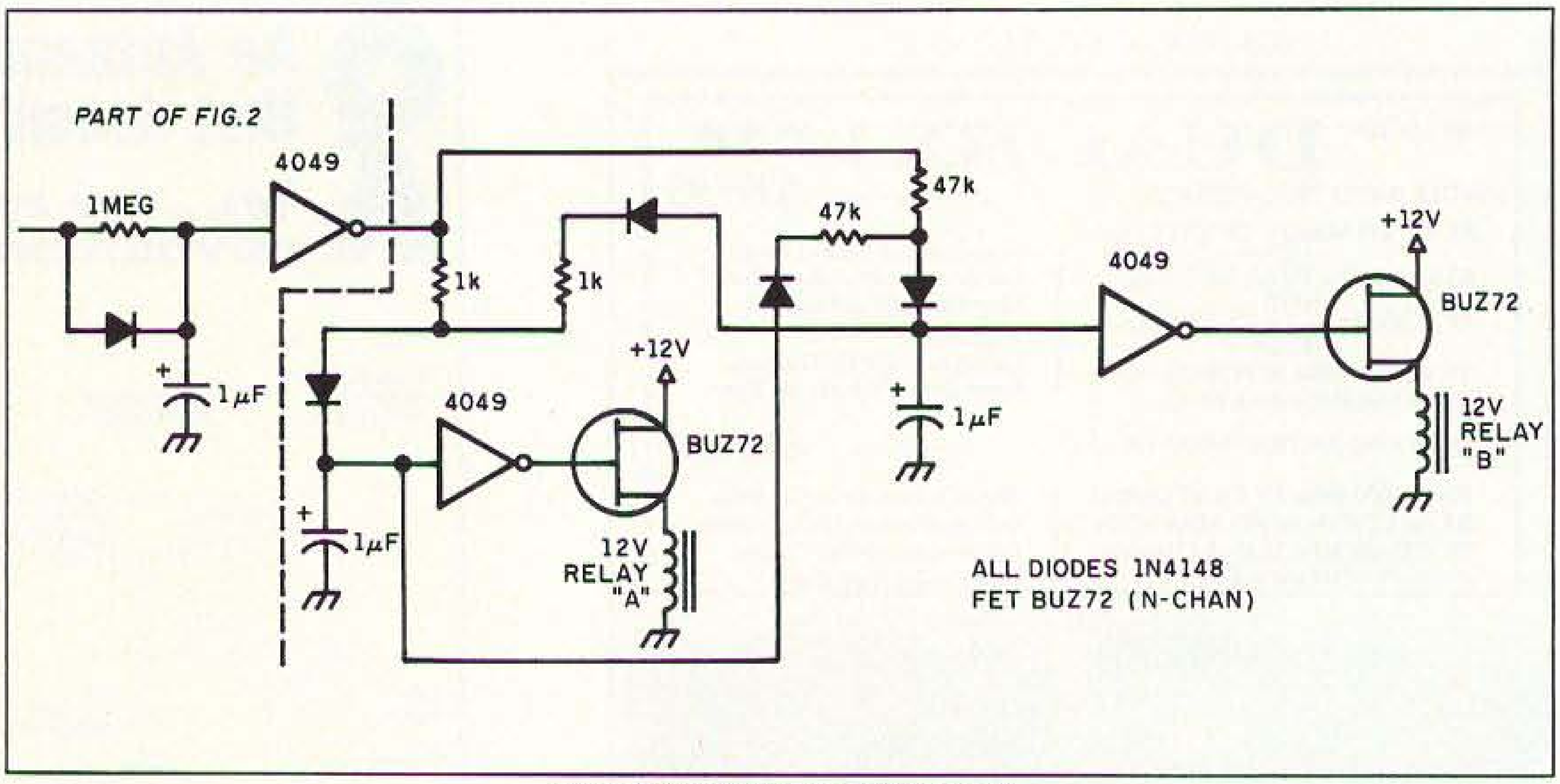

Figure 3. Timed FET switching circuit.

ation of about a second or so.

In the release cycle (receive), this circuit provides a one-second time constant. The diode is effectively out of the circuit at this time. This release time constant is sufficient to hold the circuit operational between SSB modulations, to prevent premature release of the keying relays. If you want a longer time, increase the capacitor value. Adding an additional 1 µF capacitor (now 2 µF total) gives a two-second hold time.

Two FETs were used in our circuit: one for the receive circuits and the other for the transmit circuits. The speed of operation for each circuit is determined by the R/C time constants on the FET's inputs. The hold time or hang time after releasing is controlled by diode steering of the exact opposite timing to the other FET's gate circuit, accomplished by the RC charging time constants of a 1k resistor and 1 µF capacitor vs. a 47k resistor and 1 µF capacitor. That controls the key-up time control. For the circuit to meet design constraints, the exact reverse of each circuit is needed. This was accomplished by using diode logic to take the voltage available on the opposite charged capacitor to control the other FET's gate. See Figure 3, the FET switching delay circuit.

The switching relays used for control were connected to ground in each of the two FET source leads. The drains were tied to Vcc (+12 volts). As long as the op amp is off (no RF detected), the relays are in a released condition. The relays used for control voltage are not special relays. A suitable relay for 12 volt operation can be purchased from Radio Shack (PN 275-217; $5.99 each). Any low current 12 volt multicontact relay can be substituted and should work well. I scrounged my relays off of some junk PC boards and saved a few bucks.

How do you unsolder multicontact items from PC boards? Well, get down to your local hardware store and purchase a paint-stripping heat gun. It un-solders better than it strips old paint, and it's inexpensive, less than $20.

Putting the circuit to use is the custom part of the exercise. I will describe my application, but your circuit will vary, depending on how you switch your rig's elements about. In my transceiver, I switch my preamplifier forward and in reverse, using it for receive and transmit. Additionally, in transmit I switch the now reversed preamp to drive the TWT amplifier to full power output. To accomplish this switching I use a bank of four SPDT coaxial relays. Another relay is used to switch out a direct connection from the mixer IF port to the HT and replace it with a 10 dB attenuator for transmitting. The third switch point is internal to the TWT power supply to transfer it from standby to transmit.

My sequence of events is as follows: I want the four relays to actuate first, along with the IF switching relay. Then and only then do I want the TWT relay to actuate. In this way I protect the low-noise preamplifier from the transmitter power stages by keying the power amplifier last when going to transmit. In the power down sequence this same relay must release first. This switching sequence will be similar in your situation, depending on what constitutes your elements. In any case, to set up your system's switching requirements, all you need to know is which relay is fast to operate and slow to release. See Figure 4 for the full system schematic diagram.

In actual practice, both our rigs have the circuit constructed dead bug fashion on a scrap piece of copper PC board. The FETs I used were BUZ-72 types, capable of several amps of switching capacity for relay drivers. Quite an overkill, but they should work for quite a while without problems.

I plan to make artwork for this PC board in the future and will put it in the column in another issue.

West Coast VHF/UHF Conference

The West Coast VHF/UHF conference will be held in Ventura, California, on the weekend of May 12 through 14th, at the Ventura Holiday Inn, 450 East Harbor Boulevard. Planned events include technical talks and vendor exhibits, and a Saturday banquet and Sunday breakfast, both with guest speakers. On Sunday, antenna range capabilities with pattern plots will be calculated. A color plotter will make plots, labeling each with antenna description and 3 dB beamwidth. Coverage will include 2 meters through 10 GHz. The test range, 300 feet long, will be located on top of the parking garage next to the hotel.

The noise figure measurements, a very popular test session, will also have plotting of your VHF and UHF converters and preamps. This is a tradition deep-rooted in the many conferences that have been held over the years. Hewlett Packard will provide the latest noise figure meter, which will be integrated with a computer and a graphics printer. For anyone who intends to bring preamps, standard connectors are a necessity. They should be female SMA, N, BNC or UHF to allow measurements to be made. Please provide clearly marked power terminals that can be test-clipped for the test measurement. I would add, mark the power pins clearly, least you have a 90 dB attenuator.

Registration for the conference is $15, due by May 7, for pre-registration awards. For information, contact the Venture County Amateur Radio Club, VCARC PO Box 2103, Oxnard CA 93033, or Steve Noll WA6EJO at (805) 647-4294. For exhibit space, call (805) 264-1978.

As is normal practice, the ARRL will publish the proceedings for the VHF/UHF conference and will make them available at the conference for $10. After the conference they will be available from the ARRL directly for $10 plus appropriate shipping.

Well, that's it for this month. As always, I will be glad to answer any questions related to VHF and UHF. For a prompt response please send an SASE. 73 Chuck WB6IGP.

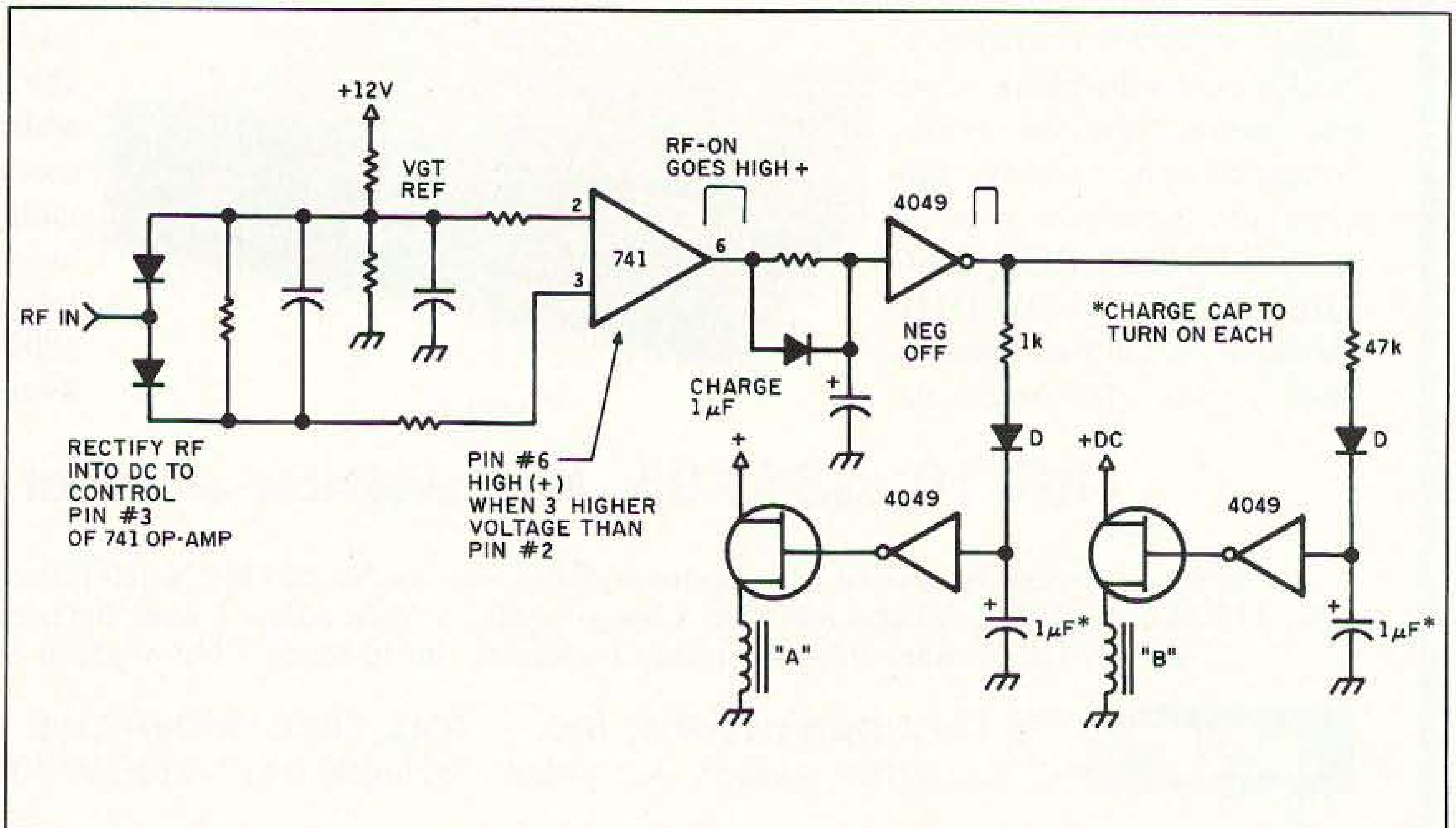

Figure 4. Full switching schematic diagram.

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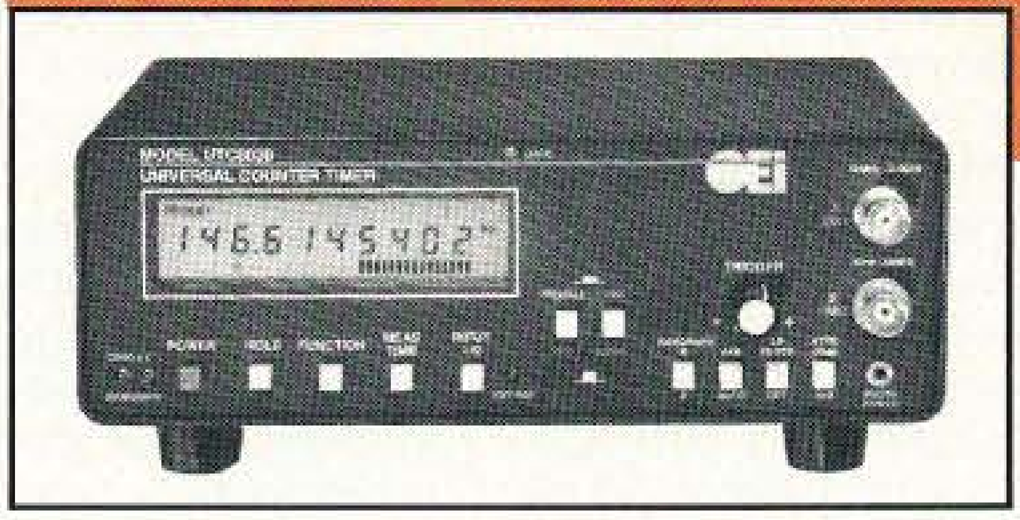

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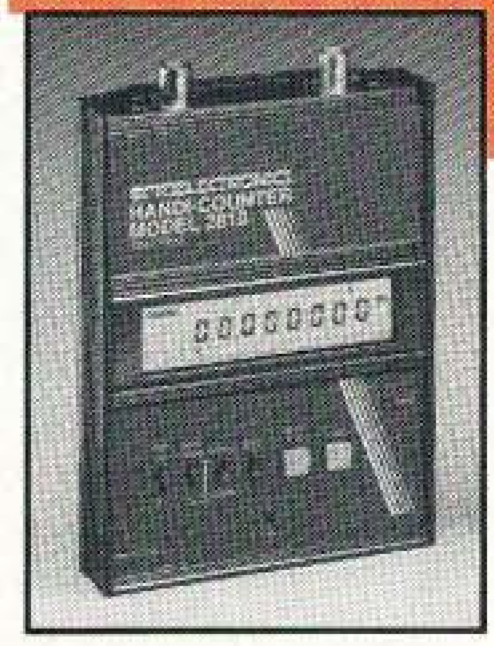

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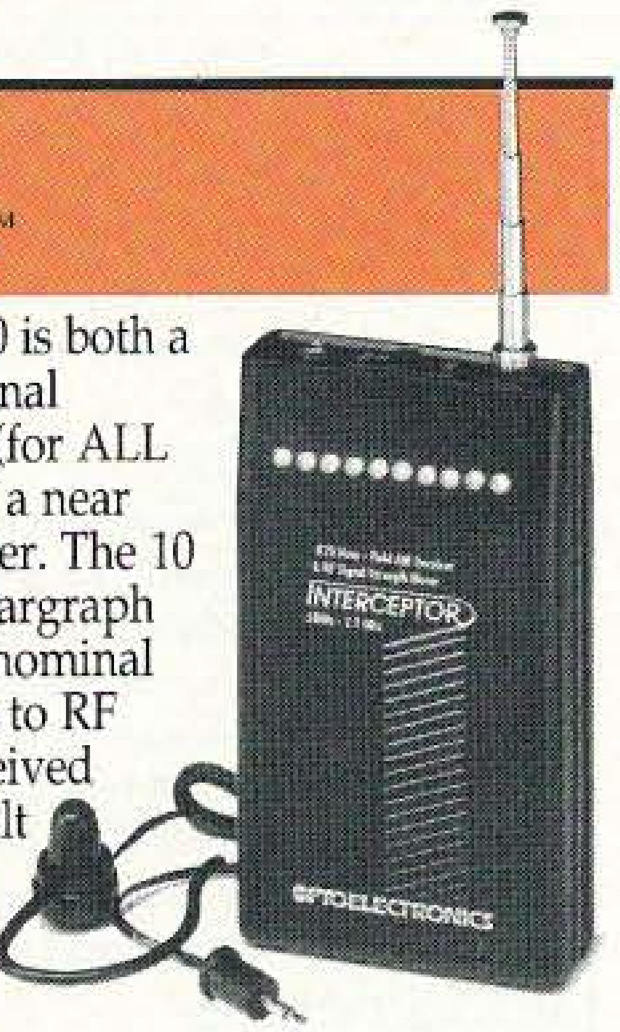

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Fixing Walkies

Probably the most common piece of ham equipment today is the 2 meter HT. Especially since the advent of the no-code Technician license, the popularity of walkies has increased. I haven't met very many hams who *don't* own walkies. So, it seems reasonable that some of those radios are going to have problems. Let's look at the kinds of problems which tend to occur and at what we can do about them.

What a Cad

Nickel-cad, that is. If you've owned your walkie for more than a year or two, chances are you either have had or soon will have trouble with the battery pack. No matter what the industry says, those darned NiCd batteries just don't last very long. By now, everybody knows that you should run the battery all the way down before you charge it up again. But, even if you do that, a year or two is about all you can ask for. I have met hams who had properly working packs more than three years old, but not very many. My own experience has been pretty dismal, despite the fact that I follow all the rules. Is it possible to actually fix a bad battery pack?

Well, sometimes. In fact, I just fixed one in my cordless drill a few weeks ago, and it's still going strong. I've described before how to zap a NiCd cell, but I'll give a brief repeat here for those who missed it.

There are two fixes which have worked for me. For shorted cells, take a DC power supply and charge up an electrolytic capacitor. The cap should be several thousand microfarads or more; a 100-microfarad cap just won't do it. Charge it to 15 volts or so, being careful to ensure that the cap is rated for more than that. Don't forget to watch the polarity. Now, again watching the polarity, connect it across the shorted cell, + to + and - to -. Don't use clip leads, because their resistance can limit the current flow. Just touch the cap's leads to those of the cell. You should get a nice little spark. Disconnect the cap and measure the cell's voltage. If you get anything much above zero, you've done it; the cell should now charge properly. If the cell is still shorted, try again. It took me 10 tries to fix that drill's cell.

For cells which aren't shorted but just won't hold a charge, I've found that a few seconds of high-current charging can sometimes do wonders. By high current, I'm talking about a couple of amps, not 20! A current-limited DC supply works fine. This fix isn't as dramatic as the other one, but it might save your ailing pack.

Neither of these fixes can be done without getting access to the terminals of the bad cell; you can't do this stuff *through* the other cells in a pack.

After you've fixed a bad cell, you must balance all the other cells before you try to recharge the pack. If you don't, the bad cell most likely will fail again very soon. To balance the pack, charge the bad cell to, say, 1 volt. Then, *discharge* all the other ones through a flashlight bulb, one cell at a time, until they all read 1 volt. Reassemble the pack and charge it normally, and it should work fine if the cells are not too far gone.

By the way, most NiCd packs have built-in thermal fuses that are designed to prevent fires in packs which inadvertently get shorted at their terminals, perhaps by keys or coins in a pocket. If the pack has in fact died immediately after experiencing such a short, a new thermal fuse may be all you need. I don't know where you can buy new ones, but perhaps one of you does. If so, please tell me and I'll pass it along. But please don't even consider simply shorting across the fuse and putting the pack back in service. Even small NiCd packs can deliver enough current into a short to cause serious injury. That's why manufacturers always warn you not to put NiCd cells into holders meant for alkalines; the holders have no fuses, because alkalines don't present nearly as much risk.

Insert Here

Sometimes, NiCd cells simply are beyond redemption. And new packs from the manufacturers are awfully expensive. Besides, my experience has been that most manufacturers use exceptionally poor cells. When a battery pack goes bad six months after you buy the rig, you sure don't want to shell out for another one just like it! Luckily, several aftermarket companies advertise inserts for walkie packs. These are pre-connected cells which fit into your original plastic shell. I tried one in the FNB-17 pack for my Yaesu FT-411 and it worked great! If you can crack the original pack open carefully enough that it can be snapped or glued back together, you would do well to try an insert. Often, soldering is required but, hey, we're hams, right? By the way, the one brand of cells I've had *good* results with has been Sanyo. I've seen, and in fact own, Sanyo cells that are five years old and have been abused, yet still work fine. I have no idea why theirs are so much better, but I strongly recommend you buy an insert made with them. You'll wind up with a better pack, at about 1/2 to 1/3 the price of a new, original-equipment pack.

Where's the Magnifying Glass?

OK, your walkie is getting power but it still doesn't work right. Walkies are basically no different than other radios, but they do have some unique characteristics which make them a bit harder to work on. The most obvious one is that they are getting awfully *small* these days. Back when the ICOM IC-2AT and Yaesu FT-208R were all the rage, you still could fit your fingers into the case. Nowadays, things have gotten to the point where surface-mounted components and ribbon cables dominate. How do you fix something like that?

Frankly, if the problem is really tough from a physical standpoint, it probably isn't worth the risk to the radio for you to hack at it. For instance, some modern walkies, such as my FT-411, use little "daughterboards" which stand up on a motherboard. Unlike the similar construction used in desktop computers, though, these daughterboards are maybe an inch square, and they're soldered in. If a tiny chip or transistor goes bad on one of them, just getting to it in order to measure the voltage or observe the signal can be a major chore. Even worse, some circuits may be spread out between what's on the daughterboard and some parts on the back side of the motherboard. Do you really want to mess with this?

Well, maybe, maybe not. If the problem is not obvious, it probably would pay to send it in for repair. Luckily, though, most problems are not due to component failure. Because walkies are so portable, they experience far more troubles caused by bad connections, broken or dirty jacks and switches, corrosion and similar environmental factors.

Open Wide

Before you can fix it, of course, you have to get inside the rig! Most of today's walkies pop apart in two halves, with just a few screws holding them together. Usually, you have to remove the plate which holds the battery contacts on the bottom. Then, remove the screws on the back and the rig should snap open. Do it carefully, though, because the two halves probably are joined by a ribbon cable, and you don't want to damage that, believe me. If there is a ribbon cable, it should have a removable connector on at least one side. Generally, these covers snap up and down. If you need to pull the radio apart farther than the cable will allow, locate the connector. Now, gently pry up (up being toward the cable) the cover, one side at a time, using your fingernail. The cable should come out easily. (Before you remove it, take note of which way it goes in; reassembling it backward can result in disaster.) If it still seems hard, don't pull! Instead, be sure you have disengaged the cover as far as it will go. When you reassemble it later, be sure to insert the cable all the way before snapping the cover closed. I've seen many cases of "failures" caused by improper reassembly of ribbon cable connectors. And, especially when the cable is one of those plastic things with the printed-on conductors, it is all too easy to rip it and ruin it. So, let the fixer beware!

Contact!

If your walkie is behaving erratically, and especially if it's cutting in and out, check the battery contacts. Dirty, bent or worn contacts can cause a bewildering array of symptoms. If the contacts look OK, check the wiring to the DC power jack, if there is one. If the jack is soldered directly to the board, look at the solder joints. Very often, the stress of plugging in and unplugging the DC plug will cause those joints to crack. If you're not sure, resolder them for good measure. Also, check that the PC board foils are not themselves broken. Just wiggle the jack a little while looking at the foils and it should be obvious if there's a problem. Now and then, the DC jack itself can go bad, especially if the radio is old. If you don't plug DC directly into the walkie, though, it is unlikely that you will have any of these problems.

Walkies usually have fuses between the DC input and the rest of the rig. These sometimes look like tiny glass resistors, while other times they look exactly like regular resistors. What they *don't* look like, of course, are fuses! With the power and battery disconnected, a simple ohmmeter check will tell you if there's any connection from one side to the other. I've seen these tiny fuses blow with no provocation. As with the battery packs, it's important that you replace the fuse, rather than just jumpering across it.

Well, we've just scratched the surface of walkie repair, so let's continue next time. Now, let's look at a letter:

Dear Kaboom,

I have a KDK model 2033 mobile rig and it won't transmit or receive. I think the problem is in the final. Where can I get one of these transistors? I've enclosed a drawing of it and the ohmmeter readings between its pins and case. I've looked in every catalog I have and can't locate the part.

Signed,
Finally Quit

Dear Finally,

First of all, that is not a transistor! It is a final amplifier *module* which contains the final transistor and a whole lot of other things. The Toshiba S-AV7 is used in various rigs, and you should be able to get one from KDK or another manufacturer. But I don't think you need one! If it were shorted, it should blow the fuse in the radio's DC line when you pressed transmit, and perhaps even in receive, depending on the radio's design. If it were open, it would kill the transmitter's output, but it shouldn't affect receive at all! Because the radio won't TX *or* RX, I'd look elsewhere. Lots of other things could be causing this general failure, which is lucky for you because those modules ain't cheap. See if you can figure out why the rig won't receive. Chances are that when you fix that, it'll transmit too. Good luck!

73, and see you all next month. 73

RTTY LOOP

Number 21 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

Commodore Interface

A few months ago, I detailed one ham's odyssey of trying to find a usable interface for an old Commodore computer. I received another response, this one from G. H. Doherty VE3BYR, of Barrie, Ontario.

He tells me that Comtech Research, of Custar, Ohio, has an excellent RTTY program for PC compatibles, which is easy to use and can be configured to work with the CP-1 interface with a minimum of trouble. A serial interface is required to use the interface. If there is not one on the unit already, he passes along this tip for adding one, with a bare minimum of parts: Plug a 75154 chip into a socket wired to a 16-pin header, according to the wiring diagram in Figure 1. The header is then plugged into the original U-13 socket in the CP-1.

He says that the CP-1 has excellent filters, and that he has used it with a Kenwood TS-830 on RTTY with no problems. On his ICOM 765, the gain to the MIC input is a little low and, according to him, AEA suggests that R116 could be reduced to a lower value, but no lower than 560 ohms. Presumably, this is to increase output.

The RTTY-PC Program

The RTTY program referred to is RTTY-PC, Version 1.07, from Comtech Research. According to the literature I have here, it will send or receive Baudot at 60, 66, 75, and 100 wpm; or ASCII at most standard speeds from 110 baud to 9600 baud. The initial display is of received data. A control menu is entered from that screen.

The display itself is a split-screen affair, with transmit and receive data displayed separately. Mode, speed, date, time, and other data are displayed as well. Twelve 1K buffers are available, accessed through the F1 through F12 keys. Even if your computer does not support all 12 function keys, they say that they have software that will allow you to use all 12 buffers.

The computer can initiate transmit/receive switching, store received material to disk, and do just about anything else you might think is important for a RTTY program to do. All in all, this sounds like a full-functioned program.

Price? According to this sheet, $29.95 for the program, $8 for a printed copy of the manual which is on the disk, and $5 extra if you want the program on a 3.5", 1.44 Mb disk. Shipping and handling adds another $3 for North American deliveries, $5.25 elsewhere.

If you're interested, drop them a line at 5220 Milton Road, Custar OH 43511, and ask for the latest pricing and availability. As always, feel free to drop the name "RTTY Loop" in your letter.

Another Model 28

Web Williams KD4CQK, of Myrtle Beach, South Carolina, says that Ralph Brown is not the only one trying to get a Model 28 up and running—he has one also. He says that his machine has a keyboard, reperf, printer, and tape reader. To clarify terminology, that would be a Model 28 ASR, standing for Automatic Send Receive. The "KSR" machine is Keyboard Send Receive, and lacks the tape equipment.

Hopefully, the material published last month was of some use to Web. He adds that it appears as though old terminal units have disappeared from the market. He has been trying, without success, to find one. With a PC compatible and MFJ-1278 in the shack, he can operate on RTTY, so it's not the mode he lacks, it's the method!

If someone in his area has a TU to spare (Web is especially looking for a Dovetronics, or HAL ST-6000 or ST-5000), I am sure he would appreciate hearing from you. Information may be sent here as well, and I will forward it down Carolina way. Thanks for the letter, Web.

CompuServe in Hong Kong

I appreciated the message on CompuServe from Ron Koyich VS6BD, whose interest in RTTY dates back to the 1960s, when he even went mobile with a Model 15. Now THAT's something my wife never let me do! In those days, Ron went under the call of VE6AJX. Hmmm, another AJ! That gets you an honorary membership in the club.

He adds that a CompuServe node is now active in Hong Kong. It will be awhile before they will be able to packet/AMTOR to us from there. There's a Hong Kong packet repeater going online sometime this year, to be installed and operated by ELARCS (English Language Amateur Radio Communications Society).

Sounds great, Ron. Keep us posted of the progress. I am sure that those of us in more mundane locales can only dream of some of the stuff you must see over there. Thanks for the note.

DSP-12 for Contesting

Another piece of Email was received from Doug Stracener KA5YSY, in Baton Rouge, Louisiana. Doug relates his experiences in the RTTY DX Worldwide contest, in which he used the DSP-12 processor.

Doug writes, "On Friday evening at 0000Z, the start of the contest, I had fired up my trusty Kenwood TS830 on 15 meters and started contesting with great vigor. Enter Mr. Murphy: At 0010Z the 830 went on strike and refused to transmit on 15 meters! This is not good when one is working single band, single op! The real problem was that the 830 has a set of International Radio crystal filters that are extremely selective on RTTY and make contesting possible.

"Enter the ICOM 735, which is my mobile radio. It has no special filtering other than the standard SSB. The selectivity for RTTY contests is at best poor, so I was wondering what kind of score would be possible, due to all the QRM and my inability to resolve the signals.

"I recently purchased one of the NIR-10 DSP filters built by JPS Communications of Raleigh, North Carolina, for the purpose of killing the white noise present on the OSCAR-13 audio when I am working satellites. In desperation, I quickly cabled the audio input of the DSP-12 to the ICOM and placed the filter in the passband medium and then narrow modes. Oh, what a difference the DSP-12 made! It is superior in all respects to the crystal filtering of the Kenwood setup and allowed me to operate in high QRM environments of the contest without any difficulty. When turning off the DSP-12 by placing it in the bypass mode, the KAM TNC I was using was unable to dècode any of the multiple RTTY signals within the receiver audio passband.

"Based on the experience I had, I can highly recommend the DSP-12 to any RTTY contester as a piece of equipment well worth the price. On the other hand, maybe you should not tell anyone about this, and let me keep the secret!"

You don't have to be in Hong Kong to drop me a note. Reach me on CompuServe at ppn 75036,2501; Delphi at username MarcWA3AJR; or America Online at screen name MarcWA3AJR.

Sure, you can write me at the above address as well. Just write, I really do want to hear from you. ■

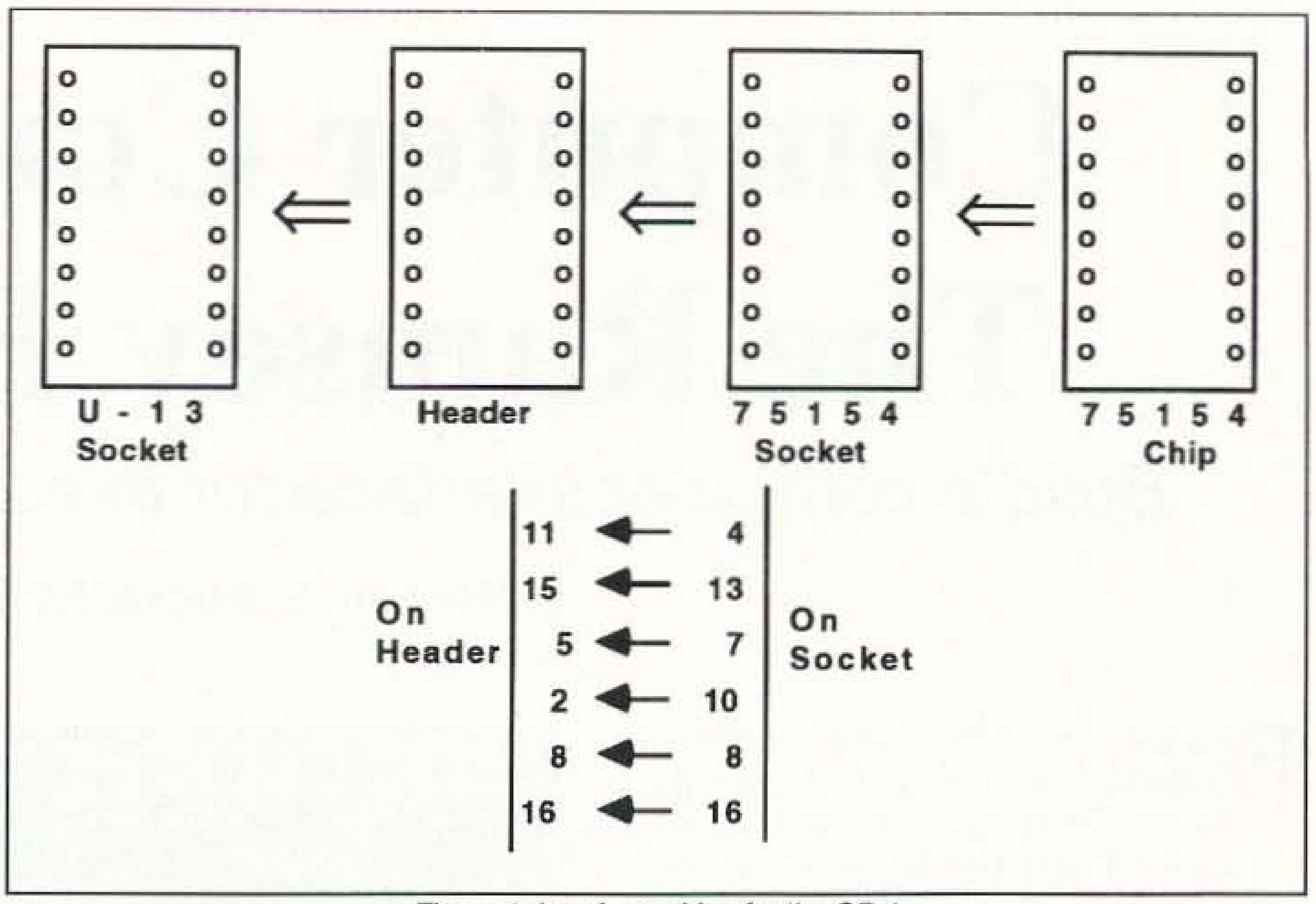


Figure 1. Interface wiring for the CP-1.

Computer Control For The Ramsey FTR-146

Build a computer interface for this 2 meter transceiver kit.

by Richard E. Lucka WD8BNR

For a long time I have wanted to use my IBM-compatible personal computer (PC) to control the frequencies of a 2 meter transceiver. I have two Kenwood rigs, but I just don't have the heart to tear these expensive rigs apart to connect them to the computer.

About a year ago, I saw an ad from Ramsey Electronics featuring their FTR-146 2 meter synthesized transceiver. What caught my eye was that the frequencies could be programmed by diodes. I immediately saw the possibility of building an interface to control the rig with my computer, so I ordered a kit.

After building the radio and studying the schematic, I came up with a programmable interface that allows me to program the frequencies using the parallel printer port from my PC. Additionally, I can select the repeater offsets (simplex, +600 and -600) and the +5 kHz channel spacing. I can also "see" the programmed binary inputs to the rig by looking at the LEDs mounted on the interface front panel. Finally, I added a new feature to the rig by tapping into the squelch output pin of the rig's FM detector chip that lets my computer detect the presence of a signal. I added an LED that lights when the rig is receiving a signal.

In this article, I will describe the interface circuit, the cable connections, and a BASIC program that selects frequencies and performs scanning operations on the Ramsey kit.

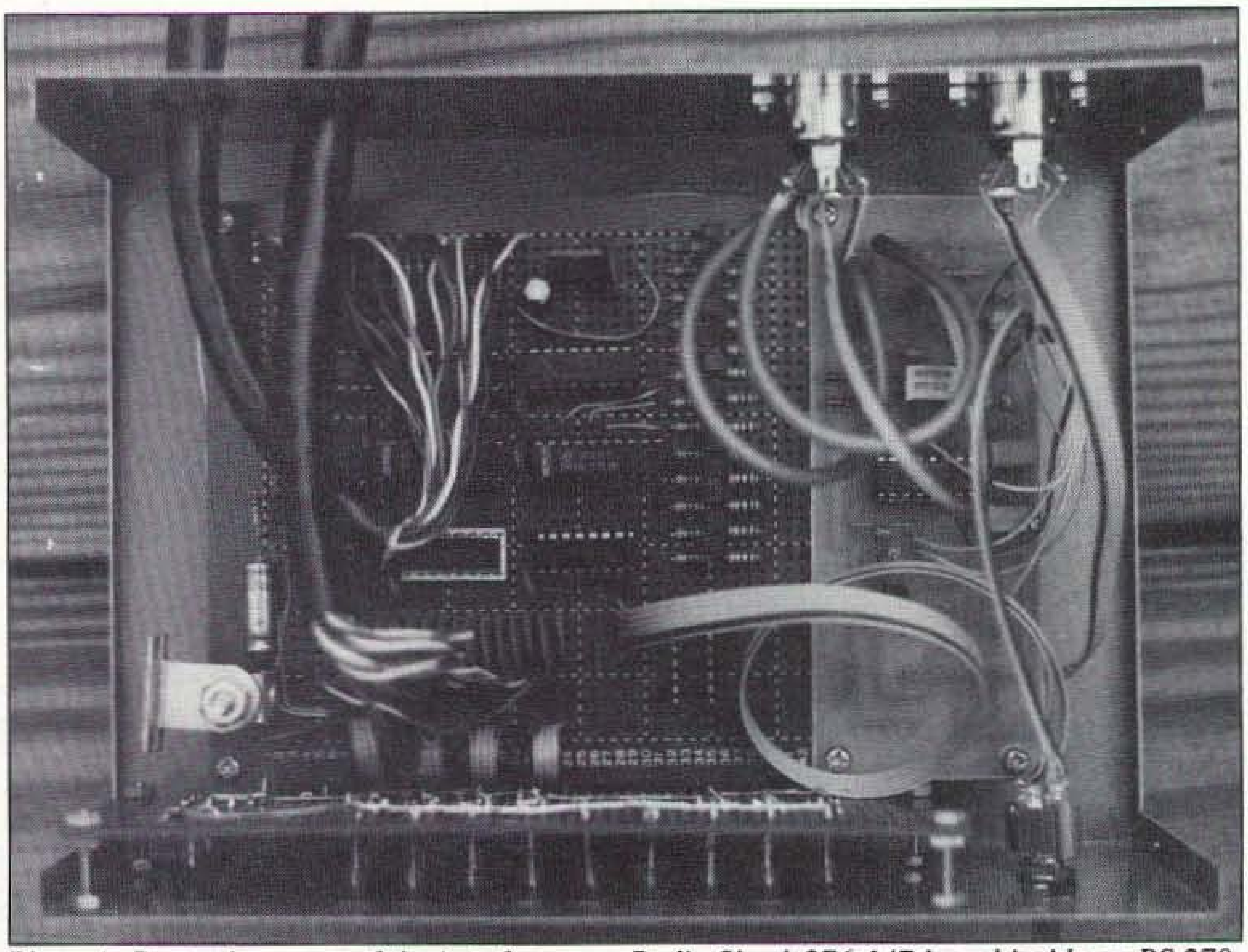


Photo A. Parts placement of the interface on a Radio Shack 276-147 board inside an RS 270-274 cabinet. The LEDs are installed on another RS 276-147 (cut in half) and mounted inside the front panel. The circuit on the right side of the board is a packet modem interface, described in "Poor Man's Packet," 73 Amateur Radio Today, *August 1991.*

The Interface

The heart of the rig's tuning capability is the MC145106 digital frequency synthesizer chip. The kit's manual contains an excellent description of how it works and how you can program selected frequencies using a diode matrix. The manual also hints at how you can use DIP switches for selecting your own synthesizer inputs. Beyond that, it's up to you to create another way of programming the frequencies.

The 5106 synthesizer contains nine input pins. Each input may be "on" (+8 volts) or "off" (0 volts). The combination of "on" and "off" inputs determines the frequency you want. The inputs coincide with digital numbers, starting with 1 and ending with 256. In other words, the pins are labeled 1, 2, 4, 8, 16, 32, 64, 128, and 256. If you add up all the numbers, you get 511 frequency possibilities.

There are a total of 400 channels in the 2 meter band, all spaced 10 kHz apart. The synthesizer can tune an additional 111 channels (511 - 400 = 111). If all the input pins are low, the synthesizer generates the lowest frequency, which is 143.00 MHz. If all the input pins are high (+8 volts), the synthesizer generates the highest frequency, which is 148.11 MHz. Consequently, the combination of the inputs produces frequencies within the 143.00 and 148.11 MHz range.

Figure 1 shows the schematic of the interface. The circuit uses all eight data output lines from the PC parallel port to program two 74LS373 D-type latches (U3 and U4) through two 4050 hex non-inverting buffers (U1 and U2).

The latches are the focal point of the interface. You program the latches to feed programming data into the transceiver. When the enable input (pin 11 of U3 or U4) is low, data is loaded from the input pins. When the enable input is high, the data is "held" at the output. The latch is a perfect device for holding programming data and driving devices such as the synthesizer.

The STROBE output line from the printer port selects latch U3 and the INIT line selects latch U4. Only one 74LS373 latch can be programmed at a time. This arrangement allows you to latch 16 bits rather than eight bits. Remember, there are nine inputs to the synthesizer, and additional inputs for the simplex, +600 and -600 repeater offsets, plus the +5 kHz channel spacing input. That comes to a total of 13 inputs with three spares. I am using the spares to drive three LEDs for displaying status information for packet radio purposes.

There is an LED connected to each of the latch outputs. They let you see how your PC is programming your rig. You'll find them to be tremendous debugging aids if you want to write your own software for your rig.

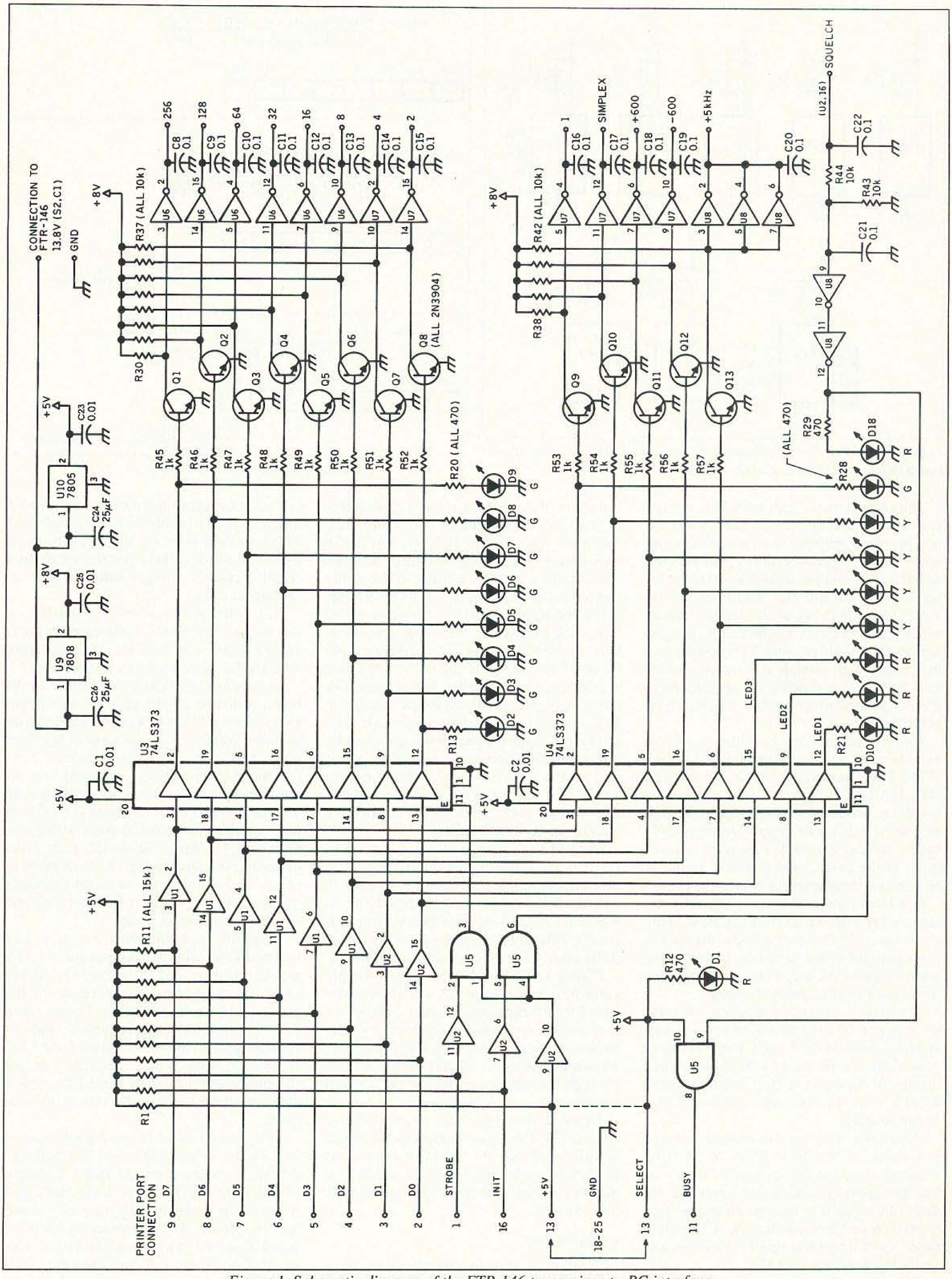


Figure 1. Schematic diagram of the FTR-146 transceiver-to-PC interface.

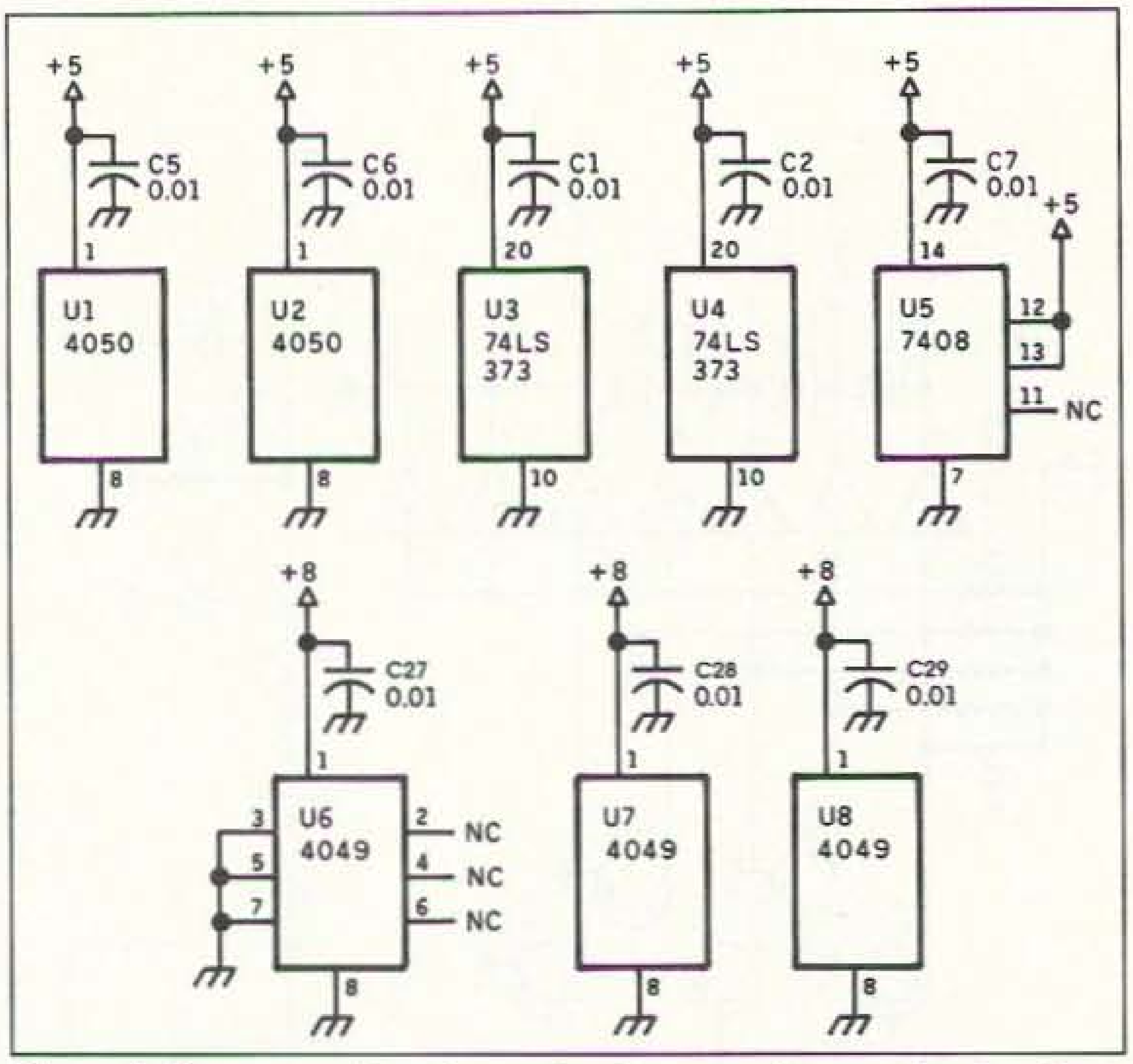


Figure 2. Power supply, voltage shunting capacitors and ordered gate connections for U1 through U8.

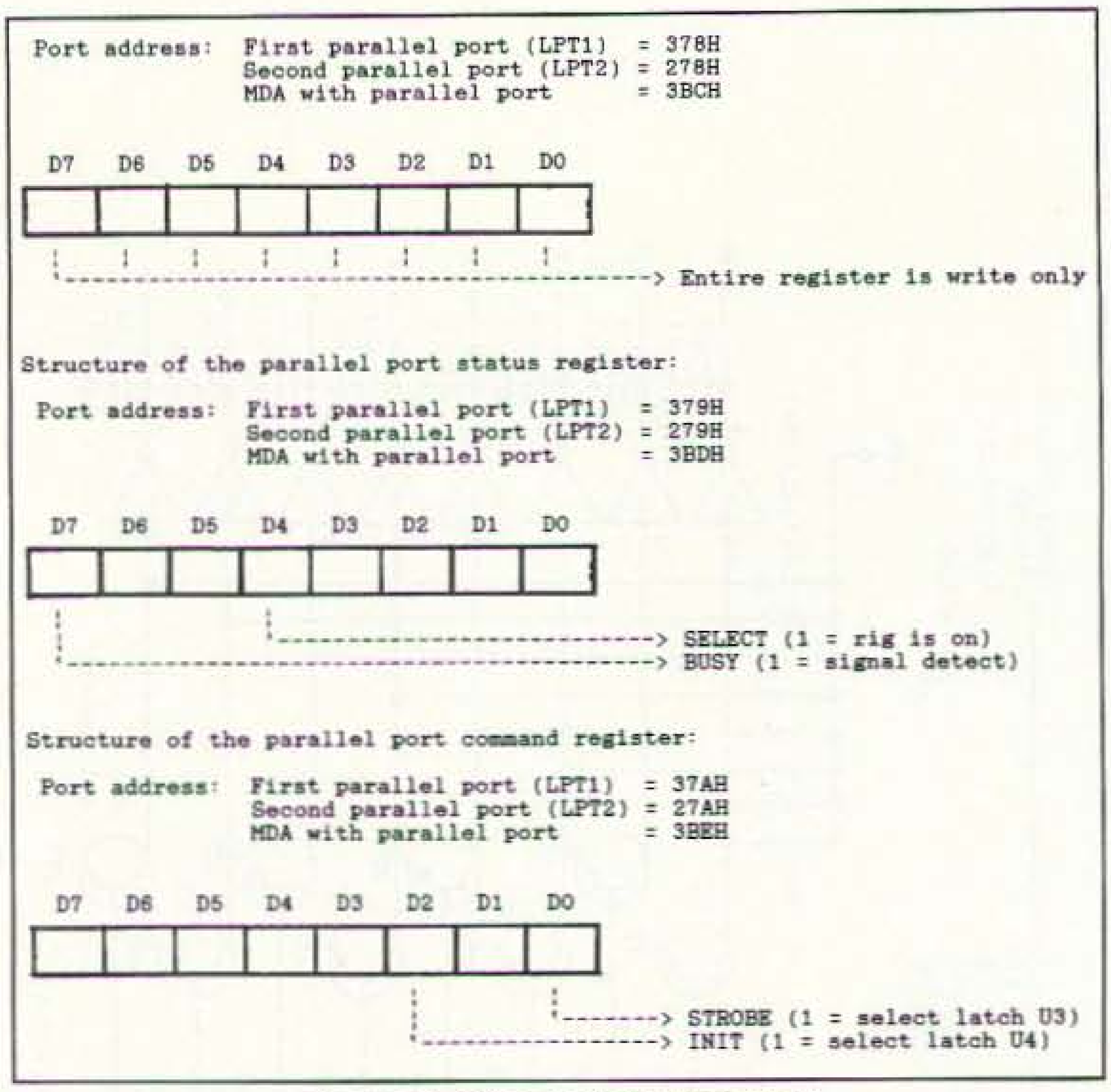


Figure 3. PC parallel port layout.

Thus far, we have dealt with TTL voltage levels (up to 5 volts) for the latches and the non-inverting buffers. The voltages coming out of the PC's parallel printer port pins are at TTL levels and are enough to drive the input buffers U1 and U2. Additionally, the voltages coming out of the latches, being slightly loaded down by the LEDs, are just high enough to drive other TTL devices, but may not be high enough to drive the synthesizer in the rig and definitely not enough to drive the repeater offsets and +5 kHz channel spacing.

I solved this problem by adding a voltage amplifier and a hex inverting buffer for each of the latch outputs (Q1-Q13, U6 through U8). If a latch output is low, it turns off a transistor, which causes the collector voltage to rise to the 8-volt supply voltage. This makes the associated hex inverter turn off (low) at the output, and therefore turns off an input to the synthesizer chip in the rig.

If a latch output is high, it saturates the transistor, causing current to flow. This drops the collector voltage below the operating threshold of the inverting buffer input, which causes its output to go high. This turns on an input to the synthesizer.

The above scenario is also the same for the repeater offsets and the +5 kHz channel spacing. However, I used three inverter gates (U8) to drive the +5 kHz channel spacing circuit. One gate is insufficient to source a full 8 volts for this input, due to the rig's circuit loading.

When you program the repeater offsets, you enable an oscillator circuit by applying a voltage (high) at the appropriate latch output. You are only supposed to select one. Be very careful as it is easy to enable or program two or three oscillators at the same time. You can control this by software and verify by observing the LEDs.

As mentioned in the introduction, another feature of the interface is the signal detect input to the BUSY line of the printer port. The 3359 FM detector (U2, pin 16) in the transceiver has a squelch output pin that connects to a cutoff transistor (Q14 in the rig) for the audio amplifier. If there is a signal in the receiver portion, a voltage at the base of Q14 enables the audio amplifier, thus disabling the squelch. I connected pin 16 of U2 (in the rig) to the BUSY input line via the remaining inverting buffer gates (U8, pin 9 in Figure 1) to reduce the voltage to TTL levels. The buffer also lights an LED (D18) to indicate a signal is being received.

The SELECT input in your printer port is tied to the +5 volt supply. This merely serves as a signal to your computer indicating whether your rig is turned on, making your computer a little smarter.

The SELECT input is also tied to pin 9 of U2. I made this connection at the printer port connector. However, you may elect to wire the SELECT or +5 volts directly to pin 9 of U2 (dotted line on schematic and PC board). This voltage enables the other half of AND gates U5 for programming the latches.

Figure 1 shows the Vcc (power supply voltage) connection to U3 and U4 shunted with 0.01 µF capacitors. Figure 2 shows the Vcc connection to all the IC chips in the interface. Note carefully that U1 through U5 are connected to the +5-volt supply and U6 through U8 are connected to the +8-volt supply.

Figure 2 also shows the unused gates of U5 and U6. The unused inputs to U5 should be tied to +5 volts to minimize current and to prevent oscillation, while the unused inputs to U6 should be tied to ground to minimize current.

Construction

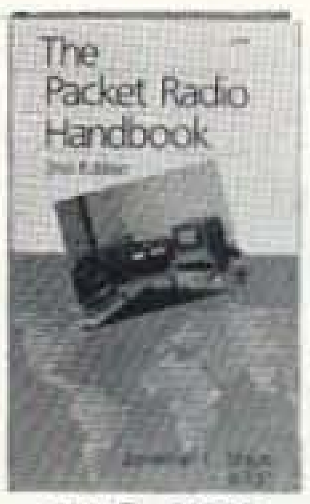
I planned to construct the circuit so that it would fit in a Radio Shack 270-274 metal cabinet. I constructed the circuit on a Radio Shack 276-147 pre-drilled board and used 24-gauge bell wire for the point-to-point wiring. I used sockets for the chips so I could measure voltages later, before installing the chips.

[Ed. Note: A PC board is available for this project from FAR Circuits (see the Parts List for order information); also see Figure 4 for the foil pattern and parts placement.]

There was more than enough space on the board to mount all the parts of the circuit, except for the LEDs (I wanted them to be on the front panel). How you want to lay them out is pretty much up to you because parts placement is not critical. I carefully laid out the chip sockets on the board, making sure that there would be room for all the resistors and capacitors and point-to-point wiring (see Photo A). I soldered the sockets only at the opposite pins, just enough to keep them in place. This allowed me to insert the wires and leads directly into the socket pins and lightly solder them in place.

I carefully laid out how I wanted to line up the LEDs, with the programming LEDs on the top row and the offset and status LEDs on the bottom row (see Photo B). Since I like multiple colors, I used green LEDs for the top row and yellow and red for the bottom row. After drawing the LED layout and using it as a template, I drilled the holes and installed the LED caps. I also drilled the holes for the mounting hardware.

I cut another 276-147 pre-drilled board in half for use as an LED board. The half-size fits nicely inside the front panel. I loosely installed the LEDs on the LED board and mounted the board on the front panel. I used spacers for the 4-40 hardware to keep the board about 3/4" away from the inside cabinet surface. Then, I manipulated the LEDs (loosely hanging between the board and the



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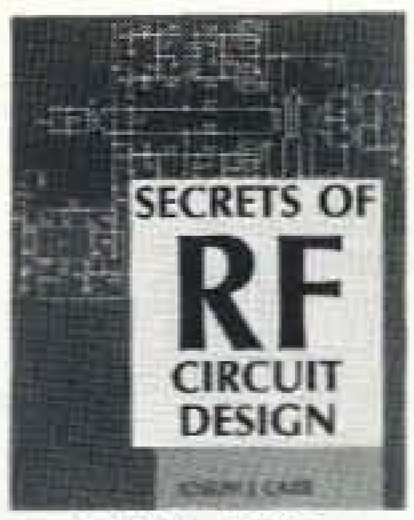

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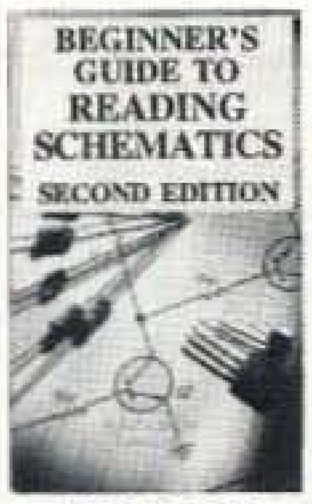

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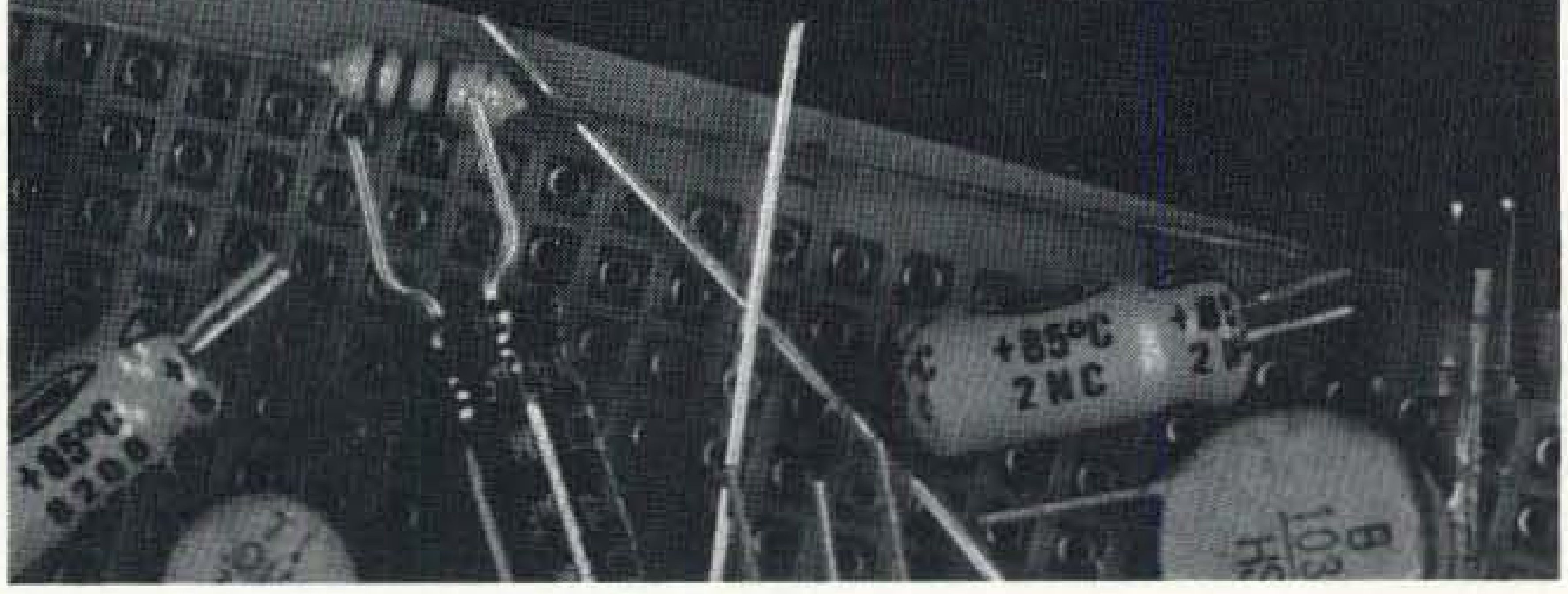

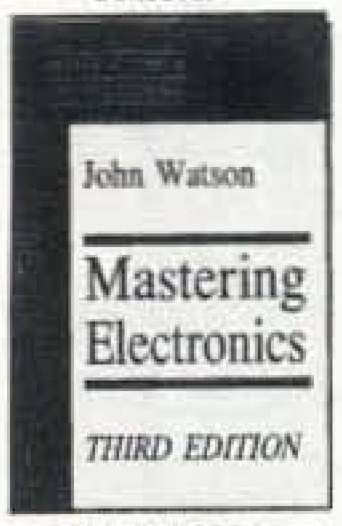

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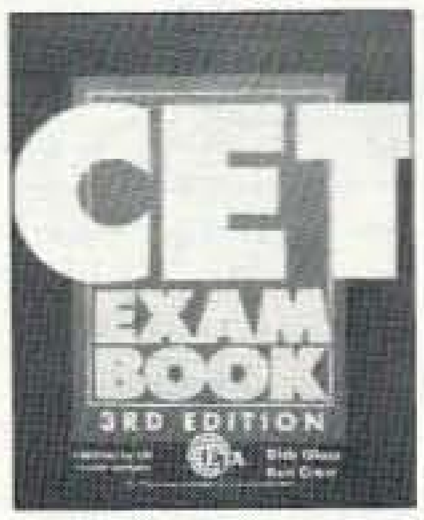

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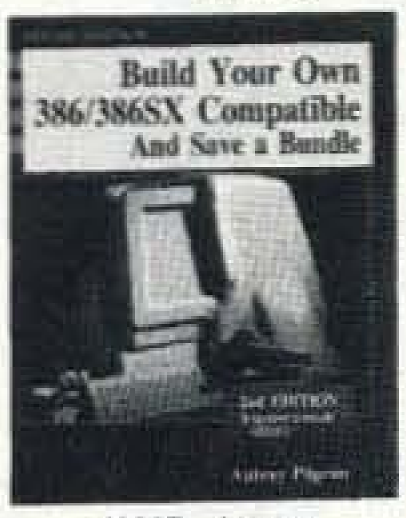

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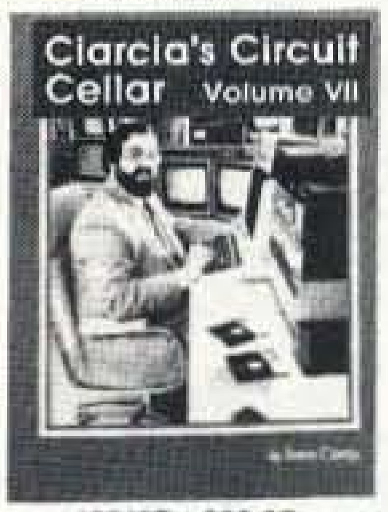

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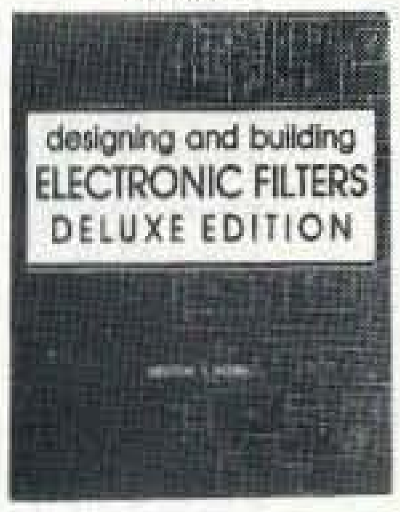

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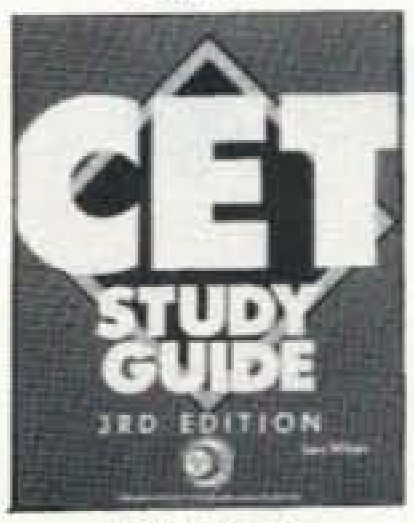

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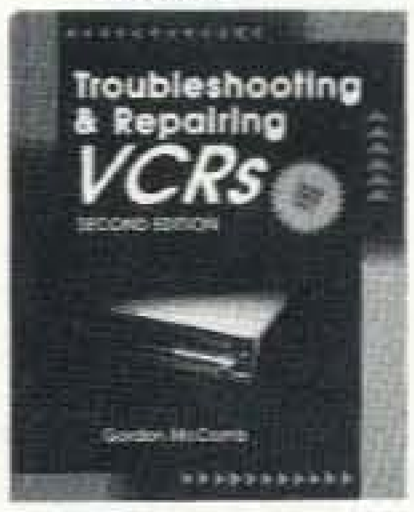
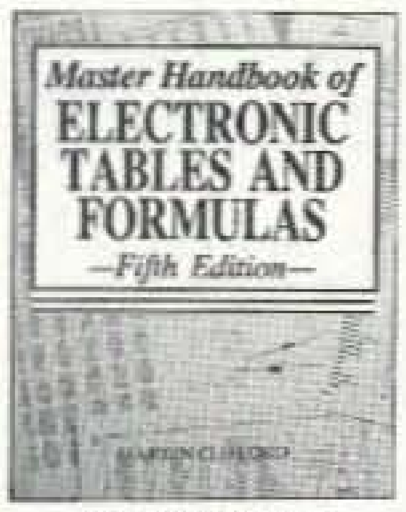
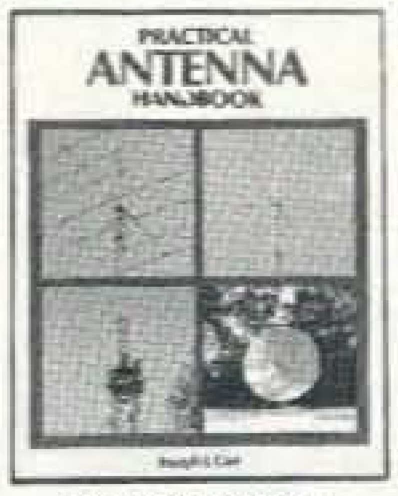


3777-XX $32.95
Counts as 2



3739-XX $39.95
Counts as 2

1367P $29.95
Softcover



3270-XX $32.95
Counts as 2

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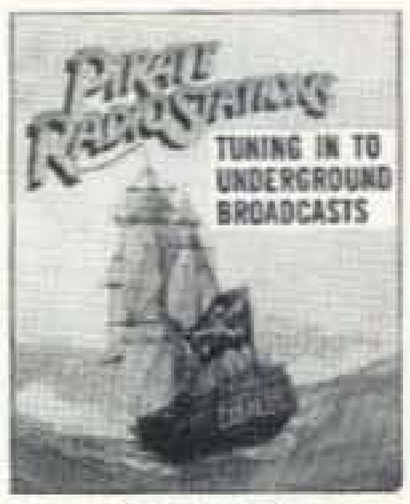

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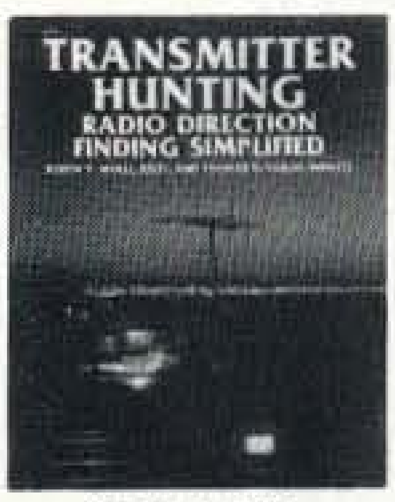

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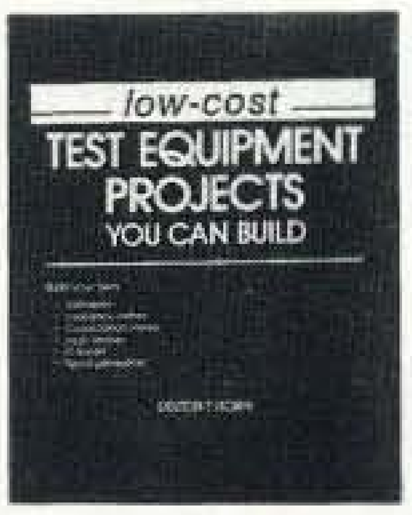

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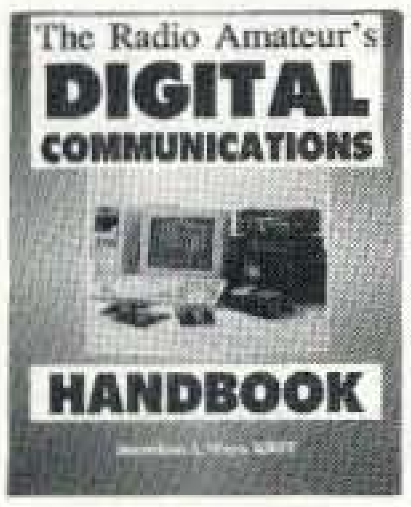

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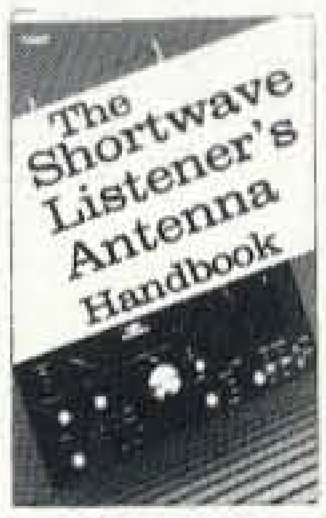
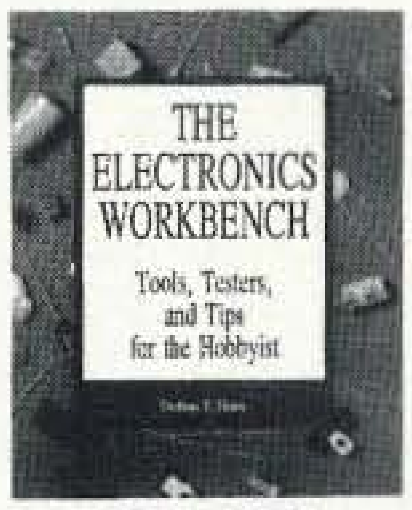


1487P $13.95
Softcover



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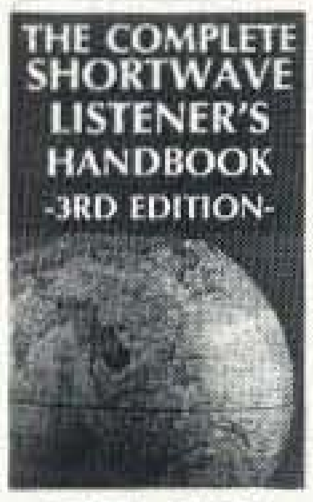
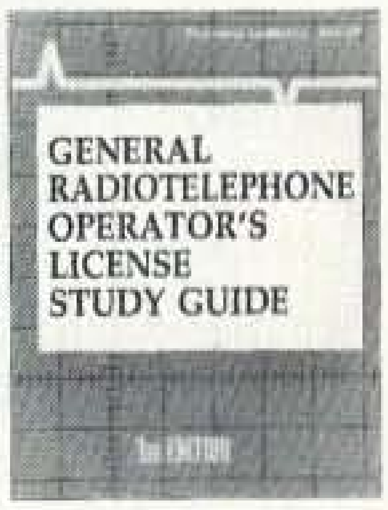


2655P $17.95
Softcover



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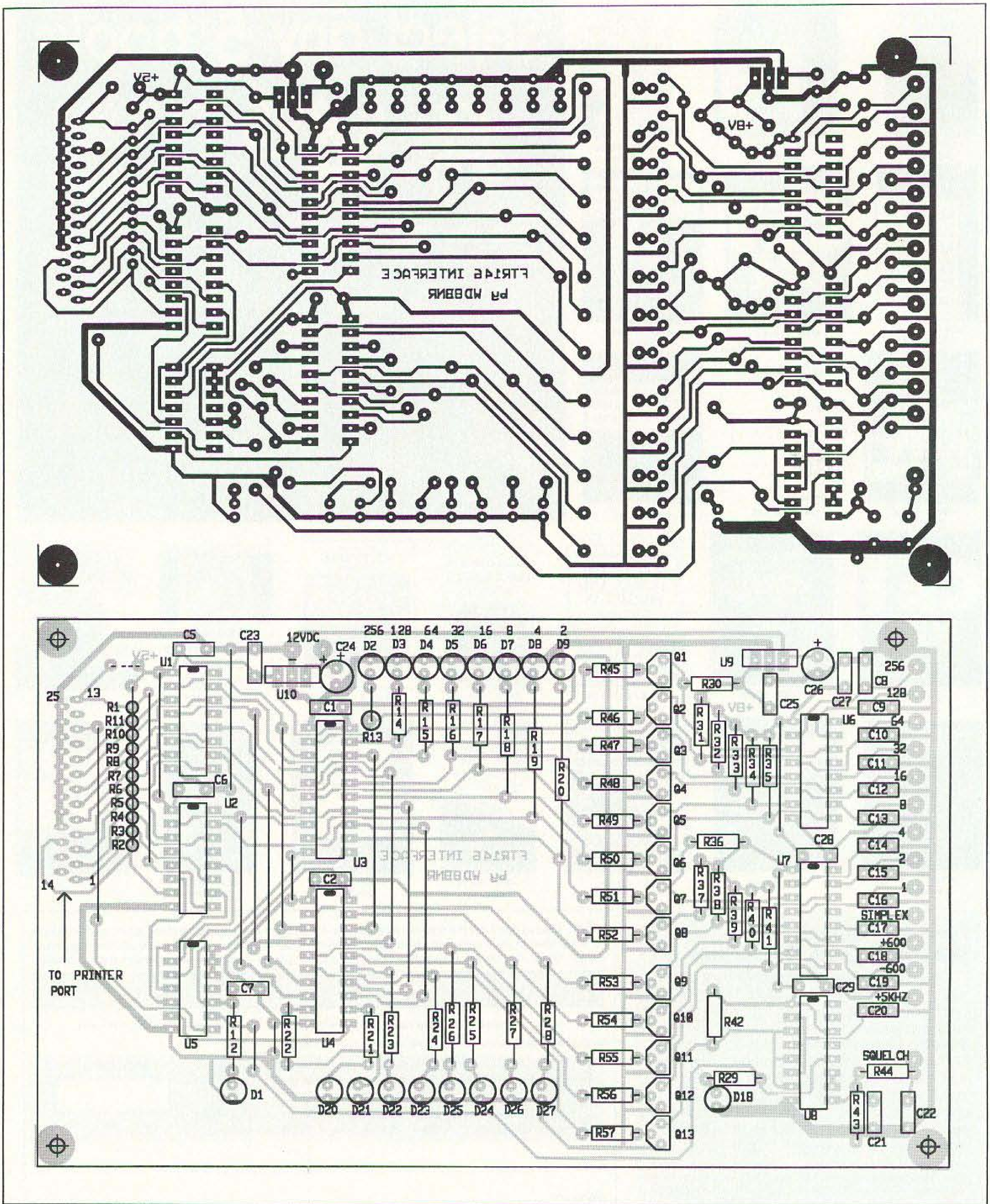

Figure 4.

inside cabinet surface) by grasping the LED leads and inserted the bulb parts into their respective caps. After making sure that the LEDs were firmly seated in the caps, I soldered the leads in place. This made it easier to remove the board, install the resistors, and re-install the board. I used ribbon cables to connect the LED board to the main board.

I used a 25-wire flat ribbon cable to make the actual connections from the transceiver to the interface cable (see Photo C). As a result, I was able to use the metal case and knob set for the rig from Ramsey because the ribbon cable fit snugly between the top and the rear panel. At the end of the ribbon

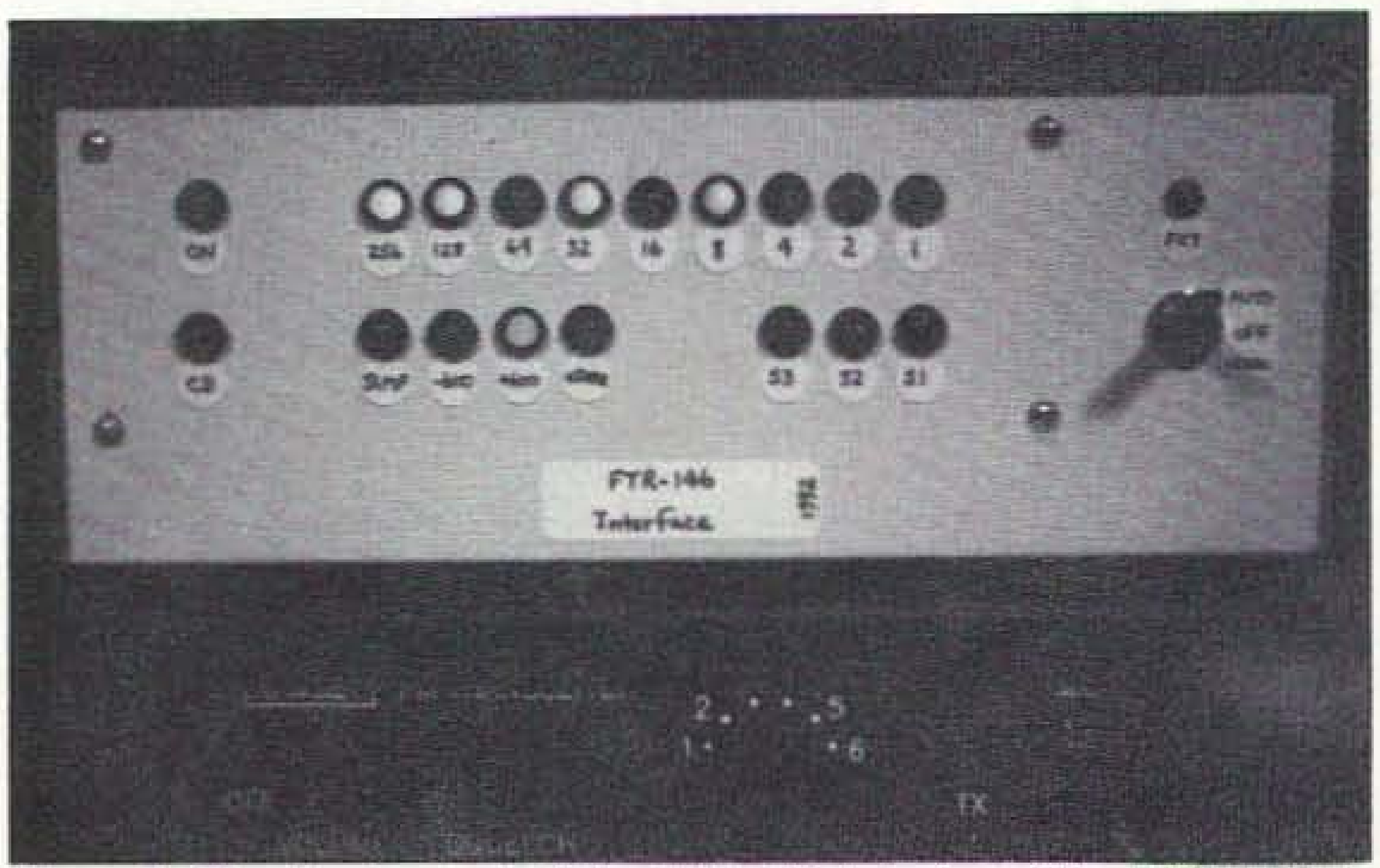

Photo B. The front panel of the FTR-146 interface. The PKT LED is connected to a modem interface circuit and is unrelated to this article. The switch on the right side of the panel is set at "AUTO," which allows latch (U4) to program the +5 kHz channel spacing. The other choices manually set the channel spacing to "off" or "on."

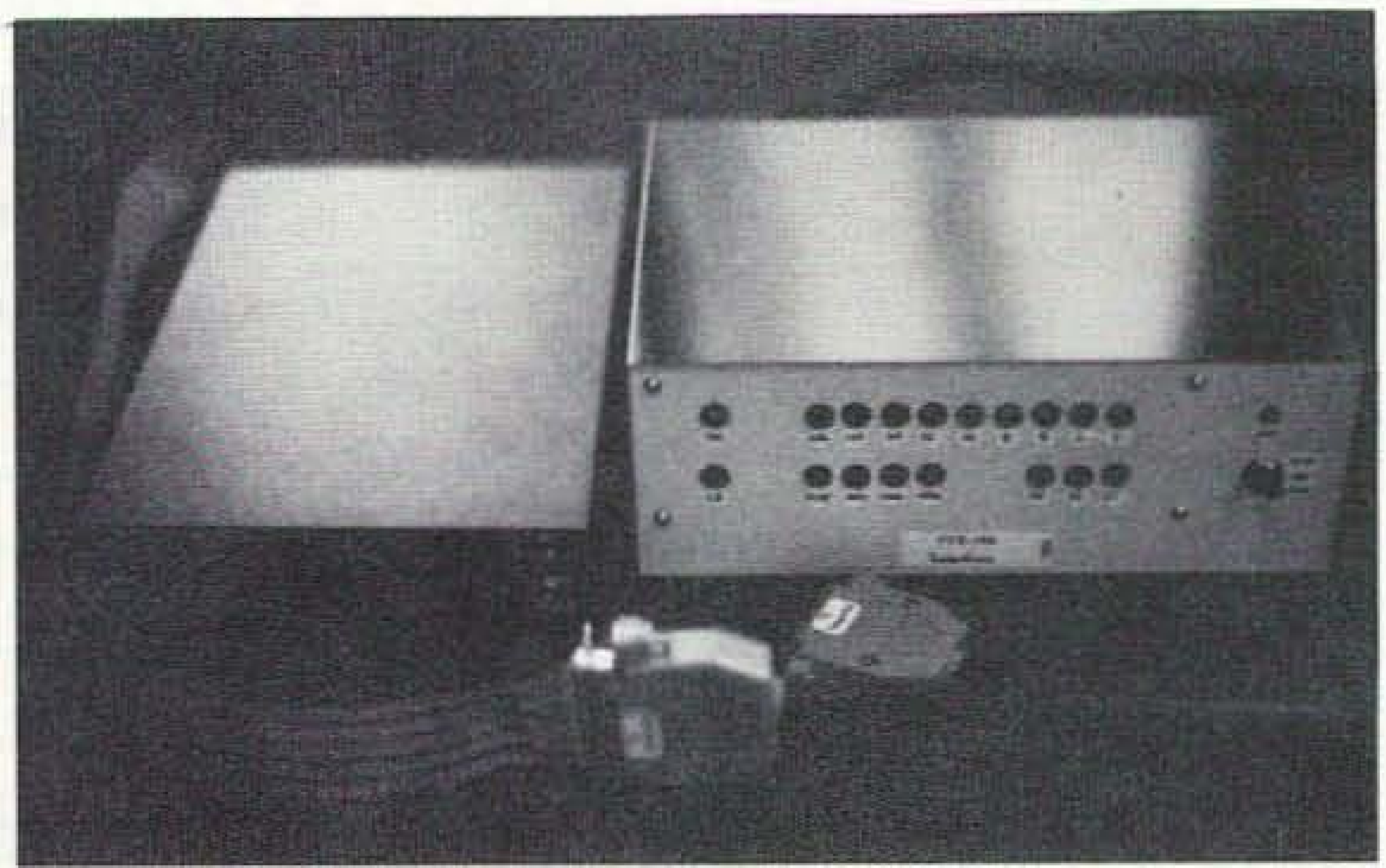

Photo C. Flat ribbon cable runs from the rear of the transceiver to the 25-pin male D-SUB cable.

cable is a male 25-pin D-SUB connector. I happened to have a length of 25-wire cable, so I attached a female D-SUB connector at one end and attached the other end to the interface.

Ramsey had the experimenter in mind when they drilled an extra set of holes in the circuit board for programming the frequency synthesizer. There are six sets of holes for building a diode matrix for six frequencies, and each are enabled by one of six positions of the 12-position rotary switch S1 (the other six positions are not used). The seventh (and extra) set of holes is where I connected the ribbon cables. These holes have inputs for the nine input pins of the synthesizer (256 through 1), the transmit repeater offsets (simplex, +600 and -600), and the +5 kHz channel spacing. The right side of Figure 1 shows all the connections to the rig via the ribbon cable.

I attached a length of 25-wire cable to the computer side of the interface and attached a male D-SUB connector for the PC parallel printer port. See the left side of Figure 1 for the wiring diagram. In reality, you can use a 15-wire cable instead.

To supply power to the interface, I connected the 13.8-volt power supply voltage from the off/on switch in the rig to the voltage regulators U9 and U10. Thus, the interface comes on only when the rig is on.

Check-Out

After thoroughly checking my wiring, I temporarily connected the interface to a 13.8-volt power supply through a 1-amp fuse. Fortunately for me, there was no

```
42000 'Send programming word (2 bytes) to radio interface via printer
42010 'parallel port.
42020 '  Entry: WORD$ = 16-bit programming data
42030 ' PORT  = base port address of parallel port
42040 FIRST=ASC(LEFT$(WORD$,1)):' FIRST = first 8-bit word
42050 CMND=0:' CMND = command to set U3 in receive
42060 OUT PORT,FIRST:' Write FIRST to data register
42070 OUT PORT+2,CMND:' Command U3 to receive data
42080 OUT PORT+2,1:' Command U3 to latch data
42090 SECOND=ASC(RIGHT$(WORD$,1)):' SECOND = second 8-bit word
42100 CMND=5:' CMND = command to set U4 in receive
42110 OUT PORT,SECOND:' Write SECOND to data register
```

Listing 1.

```
10 REM INIT146 - Initialize FTR-146 Start Frequency
20 PORT=&H378:' Base printer port address
30 FREQ$="146.43,S":' Start with your favorite frequency
40 GOSUB 42000: ' Convert FREQ$ to WORD$
50 GOSUB 40000: ' Program the radio!
60 SYSTEM:' Exit
Put 40000 and 42000 subroutines here from Listing 3
```

Listing 2.

smoke or short. After performing voltage checks, I installed the chips. I connected the interface to the computer parallel port and wrote a few BASIC programs to test it. I didn't have to test with the radio connected because I observed the results on the LEDs. After verifying proper operation, I ran the same tests while measuring the radio connections to make sure that the voltage outputs (from 6 to 8 volts) corresponded to the LED readouts.

Software

The printer parallel port contains three registers: the data register, the status register, and the command register (see Figure 3). The data and command registers are output registers and the status register is input. The base port address is hexadecimal 378 for LPT1, 278 for LPT2, or 3BC if you have a Monochrome Display Adapter. If you only have one parallel port and have a color monitor, most likely your port is configured as LPT1 (base port = hex 378).

The starting building block of any software you write is a GW-BASIC code fragment, shown in Listing 1. I chose the BASIC language for the sake of this article because everyone who owns an MS-DOS machine already has a BASIC interpreter.

Input to the code in Listing 1 is a 16-bit (2-byte) string (WORD$) containing the frequency inputs (9 bits), the repeater offsets (3 bits—only one can be 1!), the +5 kHz channel spacing (1 bit), and the three status LEDs (3 bits). This string corresponds to the outputs of the latches U3 and U4, consecutively.

To create the WORD$ string, use lines 40000 through 40470 from Listing 3. This code fragment converts FREQ$ (frequency and mode in ASCII) to WORD$. The frequency is the actual frequency you want, such as 146.52 or 146.835. Mode must follow the frequency after a comma and is a one-character transmit repeater offset character, which can be "S" (simplex), "+" (+600), or "-" (-600). If you don't specify a mode with no comma after the frequency, then simplex is assumed.

You can use this code to verify the integrity of the frequency/mode string FREQ$. The program in Listing 3, which we will discuss later, asks for a frequency and uses the code fragment to verify and convert the input to WORD$ and return a numeric status code, STAT%. IF STAT%=0, then FREQ$ passed the verification edit and the code successfully converted FREQ$ to WORD$. If STAT%=1, then FREQ$ contains a syntax error (no period in the frequency and invalid mode to name a couple of possible problems). If STAT%=2, then the frequency is outside the boundaries of the FTR146 transceiver.

The following two paragraphs describes the function of Listing 1 in detail:

Line 42040 transfers the first 8 bits of

```
10 REM FTRSCAN - FTR-146 Control Program.
20 REM Version for IBM PC clones.
30 REM Author: Richard E. Lucka  WD8BNR.
40 PORT=&H378: 'Centronics base parallel port
50 DELAY=500:  'Delay count during scan.
60 COLOR 2: CLS: PRINT "FTRSCAN Version 1.0   " DATE$: PRINT
70 PRINT "Author: Richard E. Lucka, WD8BNR"
80 GOSUB 1120: 'Get frequency list
90 REM Define function key trapping.
100 KEY(1) ON: ON KEY(1) GOSUB 600: 'Decrement frequency by 10 kHz
110 KEY(2) ON: ON KEY(2) GOSUB 700: 'Increment frequency by 10 kHz
120 KEY(3) ON: ON KEY(3) GOSUB 720: 'Decrement frequency by 5 kHz
130 KEY(4) ON: ON KEY(4) GOSUB 740: 'Increment frequency by 5 kHz
140 KEY(5) ON: ON KEY(5) GOSUB 760: 'Enter frequency and mode
150 KEY(6) ON: ON KEY(6) GOSUB 770: 'Set transmit offset to -600 kHz
160 KEY(7) ON: ON KEY(7) GOSUB 780: 'Set transmit offset to Simplex
170 KEY(8) ON: ON KEY(8) GOSUB 790: 'Set transmit offset to +600 kHz
180 KEY(9) ON: ON KEY(9) GOSUB 810: 'Scan frequency down by 10 kHz
190 KEY(10) ON: ON KEY(10) GOSUB 950: 'Scan frequency up by 10 kHz
200 KEY(11) ON: ON KEY(11) GOSUB 1460: 'Down - select previous freq.
210 KEY(14) ON: ON KEY(14) GOSUB 1510: 'Up - select next freq.
220 REM Start by asking for a st irting frequency.
230 IF FKEY=0 THEN 270
240 FOR I=1 TO 5
250 LOCATE 9+I,14: PRINT SPACE$(18);
260 NEXT I
270 LOCATE 5,1
280 LINE INPUT "Enter frequency and mode (f,m) (CR=exit): ";FREQ$
290 IF FREQ$="" THEN CLS: SYSTEM
300 GOSUB 40000: 'Convert frequency to latch programming word
310 IF STAT%=1 THEN PRINT "Syntax error!";: GOTO 410
320 IF STAT%=2 THEN PRINT "Frequency error!";: GOTO 410
330 LOCATE 5,1: PRINT SPACE$(56): PRINT SPACE$(18): TGL=0
335 REM Draw box.
340 LOCATE 10,14: PRINT CHR$(201) CHR$(205) CHR$(205);
350 PRINT " Frequency " CHR$(205) CHR$(205) CHR$(187);
360 FOR I=1 TO 3
370 LOCATE 10+I,14: PRINT CHR$(186);: LOCATE 10+I,30: PRINT CHR$(186);
380 NEXT I
390 LOCATE 14,14: PRINT CHR$(200) STRING$(15,CHR$(205)) CHR$(188);
400 GOTO 430
410 LOCATE 5,43: PRINT "          ";: LOCATE 5,1: GOTO 280
420 REM Program the freq and show on screen.
430 GOSUB 42000: GOSUB 1080
440 A=INSTR(FREQ$,",")
450 IF A=0 THEN HLDFREQ=VAL(FREQ$)<1000: MODE$="S": GOTO 480
460 HLDFREQ=VAL(LEFT$(FREQ$,A-1))<1000
470 MODE$=RIGHT$(FREQ$,1)
480 LOCATE 12,18: PRINT FREQ$ "   ";: FKEY=0
490 REM Mainstream code.  Inputs are from function keys and letters.
500 IN$=INKEY$: IF IN$< > THEN 1340: 'Select a freq
510 IF FKEY=0 THEN 500
520 IF FKEY=11 THEN 1470
530 IF FKEY=14 THEN 1520
540 IF OLNE>0 THEN LOCATE OLNE,58: PRINT " ";: OLNE=0: SUB2=0
550 IF FKEY=5 THEN 230
560 TGL=0
570 IF FKEY=9 THEN 820
580 IF FKEY=10 THEN 960
590 GOTO 480
600 REM F1=Decrement frequency by 10 kHz.
610 FKEY=1: HLDFREQ=HLDFREQ-10
620 FREQ$=STR$(HLDFREQ)
630 FREQ$=RIGHT$(FREQ$,LEN(FREQ$)-1)+","+MODE$
640 FREQ$=LEFT$(FREQ$,3)+"."+RIGHT$(FREQ$,LEN(FREQ$)-3)
650 GOSUB 40000: IF STAT%=0 THEN GOSU!3 42000: RETURN
660 IF FKEY=1 THEN HLDFREQ=148110!: GOTO 620
670 IF FKEY=2 THEN HLDFREQ=143000!: GOTO 620
680 IF FKEY=3 THEN HLDFREQ=148115!: GOTO 620
690 HLDFREQ=143000!: GOTO 620
700 REM F2=Increment frequency by 10 kHz.
710 FKEY=2: HLDFREQ=HLDFREQ+10: GOTO 620
720 REM F3=Decrement frequency by 5 kHz.
730 FKEY=3: HLDFREQ=HLDFREQ-5: GOTO 620
740 REM F4=Increment frequency by 5 kHz.
750 FKEY=4: HLDFREQ=HLDFREQ+5: GOTO 620
760 FKEY=5: RETURN: 'Enter new frequency
770 FKEY=6: MODE$="-": GOTO 620: 'Set transmit offset to -600 kHz
780 FKEY=7: MODE$="S": GOTO 620: 'Set transmit offset to Simplex
790 FKEY=8: MODE$="+": GOTO 620: 'Set transmit offset to +600 kHz
800 REM F9=Scan frequency down by 10 kHz until a signal is heard
810 FKEY=9: RETURN
820 HLDFREQ=HLDFREQ-10
830 FREQ$=STR$(HLDFREQ)
840 FREQ$=RIGHT$(FREQ$,LEN(FREQ$)-1)+","+MODE$
850 FREQ$=LEFT$(FREQ$,3)+"."+RIGHT$(FREQ$,LEN(FREQ$)-3)
860 GOSUB 40000: 'Because of delay, check if old freq came alive (line 475)
870 IF STAT%=2 THEN HLDFREQ=148110!: GOTO 830
880 IF FKEY=9 THEN FKEY=0: GOTO 900: 'Ensure start of scan over active freq
890 IF (INP(PORT+1) AND 128)=0 THEN HLDFREQ=OFREQ: GOTO 500
900 GOSUB 42000: OFREQ=HLDFREQ
910 LOCATE 12,18: PRINT FREQ$: FOR I=1 TO DELAY: NEXT
920 IF (INP(PORT+1) AND 128)=0 THEN 500
930 A$=INKEY$: IF A$="" THEN 820 ELSE 500
940 REM F10=Scan frequency up by 10 kHz until a signal is heard
950 FKEY=10: RETURN
960 HLDFREQ=HLDFREQ+10
970 FREQ$=STR$(HLDFREQ)
980 FREQ$=RIGHT$(FREQ$,LEN(FREQ$)-1)+","+MODE$
990 FREQ$=LEFT$(FREQ$,3)+"."+RIGHT$(FREQ$,LEN(FREQ$)-3)
1000 GOSUB 40000: 'Because of delay, check if old freq came alive (line 575)
1010 IF STAT%=2 THEN HLDFREQ=143000!: GOTO 970
1020 IF FKEY=10 THEN FKEY=0: GOTO 1040: 'Ensure start of scan over active freq
1030 IF (INP(PORT+1) AND 128)=0 THEN HLDFREQ=OFREQ: GOTO 500
1040 GOSUB 42000: OFREQ=HLDFREQ
1050 LOCATE 12,18: PRINT FREQ$: FOR I=1 TO DELAY: NEXT
1060 IF (INP(PORT+1) AND 128)=0 THEN 500
1070 A$=INKEY$: IF A$="" THEN 960 ELSE 500
1080 LOCATE 24,1: PRINT "F1=-10 F2=+10 F3=-5 F4=+5 F5=Freq ";
1090 PRINT "F6=- F7=S F8=+ F9=-SCAN F10=+SCAN ";
1100 PRINT "^T=Tgl " CHR$(25) " " CHR$(24);: RETURN
1110 REM Get and display frequency list.
1120 DIM RPTFREQ$(24)' Up to 24 frequencies
1130 SUB=1
1140 OPEN "I",1,"FTRSCAN.DAT"' Get frequencies and edit
1150 IF EOF(1) THEN GOTO 1230
1160 LINE INPUT #1,FREQ$
1170 GOSUB 40000
1180 IF STAT%=1 THEN 1310
1190 IF STAT%=2 THEN 1320
1200 RPTFREQ$(SUB)=FREQ$
1210 SUB=SUB+1
1220 IF SUB<25 THEN 1150
1230 IF SUB=1 THEN RETURN' Print the frequencies
1240 SUB=SUB-1
1250 FOR I=1 TO SUB
1260 LOCATE I,60
1270 PRINT CHR$(I+64) ". " RPTFREQ$(I);
1280 NEXT I
1290 OLNE=0
1300 RETURN
1310 PRINT "Frequency syntax error!": END
1320 PRINT "Invalid frequency!": END
1330 REM Select list frequency via alpha.
1340 IF IN$=CHR$(20) THEN 1560: 'CTRL-T - toggle repeater inputs
1350 IF IN$=>"A" AND IN$<="V" THEN SUB2=ASC(IN$)-64: GOTO 1380
1360 IF IN$=>"a" AND IN$<="v" THEN SUB2=ASC(IN$)-96: GOTO 1380
1370 GOTO 500
1380 IF SUB2>SUB THEN SUB2=0: GOTO 500
1390 IF OLNE>0 THEN LOCATE OLNE,58: PRINT " ";
1400 OLNE=SUB2
1410 LOCATE SUB2,58
1420 PRINT CHR$(16);
1430 FREQ$=RPTFREQ$(SUB2)
1440 GOSUB 40000: GOSUB 42000: GOTO 440
1450 REM Up arrow - select previous list freq.
1460 FKEY=11: RETURN
1470 FKEY=0: SUB2=SUB2-1
1480 IF SUB2<1 THEN SUB2=SUB
1490 GOTO 1380
1500 REM Down arrow - select next list freq.
1510 FKEY=14: RETURN
1520 FKEY=0: SUB2=SUB2+1
1530 IF SUB2>SUB THEN SUB2=1
1540 GOTO 1380
1550 REM CTRL-T - Toggle receive input for listening to repeater inputs
1560 IF MODE$="S" THEN 500
1570 IF MODE$="-" AND TGL=0 THEN 1620
1580 IF MODE$="-" AND TGL=1 THEN 1650
1590 IF MODE$="+" AND TGL=0 THEN 1670
1600 IF MODE$="+" AND TGL=1 THEN 1650
1610 GOTO 500
1620 TGL=1
1630 FREQ$=STR$(HLDFREQ-600)
1640 GOTO 1690
1650 TGL=0
1660 GOTO 1710
1670 TGL=1
1680 FREQ$=STR$(HLDFREQ+600)
1690 FREQ$=RIGHT$(FREQ$,LEN(FREQ$)-1)
1700 GOTO 1730
1710 FREQ$=STR$(HLDFREQ)
1720 FREQ$=RIGHT$(FREQ$,LEN(FREQ$)-1)+","+MODE$
1730 FREQ$=LEFT$(FREQ$,3)+"."+RIGHT$(FREQ$,LEN(FREQ$)-3)
1740 GOSUB 40000: IF STAT%>0 THEN 310
1750 GOSUB 42000: GOTO 480
40000 'Convert frequency to programming word.
40010 '  Entry: FREQ$ (f,m)
40020 '   f = frequency (146.43 or 146.235)
40030 '   m = mode (+ for +600, - for -600, S (default) for simplex)
40040 '   examples: "146.43,S"  "142.24,+"  "146.76,-"  "146.235,+"
40050 '  Exit:WORD$ (2 bytes) - corresponds to latch inputs
40055 '   byte 1 contains programming for the following:
40060 '     d7 = 256
40070 '     d6 = 128
40080 '     d5 = 64
40090 '     d4 = 32
40100 '     d3 = 16
40110 '     d2 = 8
40120 '     d1 = 4
40130 '     d0 = 2
40140 '   byte 2 contains programming for the following:
40150 '     d7 = 1
40160 '     d6 = Simplex
40170 '     d5 = +600 kHz transmit offset
40180 '     d4 = -600 kHz transmit offset
40190 '     d3 = +5 kHz
40200 '     d2 = Red LED #1
40210 '     d1 = Red LED #2
40220 '     d0 = Red LED #3
40230 ' STAT% (error return)
40240 '   0 = normal
40250 '   1 = syntax error in FREQ$
40260 '   2 = invalid frequency (outside of 143.000 and 148.115 range)
40300 STAT%=0
40310 A=INSTR(FREQ$,",")
40320 IF A=0 THEN M$="S": FREQ=VAL(FREQ$): GOTO 40360
40330 IF A < >LEN(FREQ$)-1 THEN STAT%=1: RETURN
40340 FREQ=VAL(LEFT$(FREQ$,A-1)): M$=RIGHT$(FREQ$,1)
40350 IF M$="S" OR M$="+" OR M$="-" THEN 40360 ELSE STAT%=1: RETURN
40360 IF FREQ<143! THEN STAT%=2: RETURN
40370 IF FREQ>148.115 THEN STAT%=2: RETURN
40380 FREQ=(FREQ<1000)-143000!: OFS5=0
40390 IF (FREQ MOD 10)=5 THEN FREQ=FREQ-5: OFS5=8
40400 FREQ=(FREQ/10)<128
40410 IF M$="S" THEN M=64: GOTO 40430
40420 IF M$="+" THEN M=16 ELSE M=32
40430 FREQ=FREQ+M+OFS5
40440 FREQ1=INT(FREQ/256)
40450 FREQ2=FREQ-(FREQ1<256)
40460 WORD$=CHR$(FREQ1)+CHR$(FREQ2)
40470 RETURN
42000 'Send programming word (2 bytes) to radio interface via
42010 'Centronics parallel port.
42020 '  Entry: WORD$ = programming data (direct from 40000)
42030 XD=ASC(LEFT$(WORD$,1)): XC=0
42040 OUT PORT,XD: OUT PORT+2,XC: OUT PORT+2,1
42050 XD=ASC(RIGHT$(WORD$,1)): XC=5
42060 OUT PORT,XD: OUT PORT+2,XC: OUT PORT+2,1
42070 RETURN
```

Listing 3.

"Morse Deciphered, A Meaning Behind the Code"

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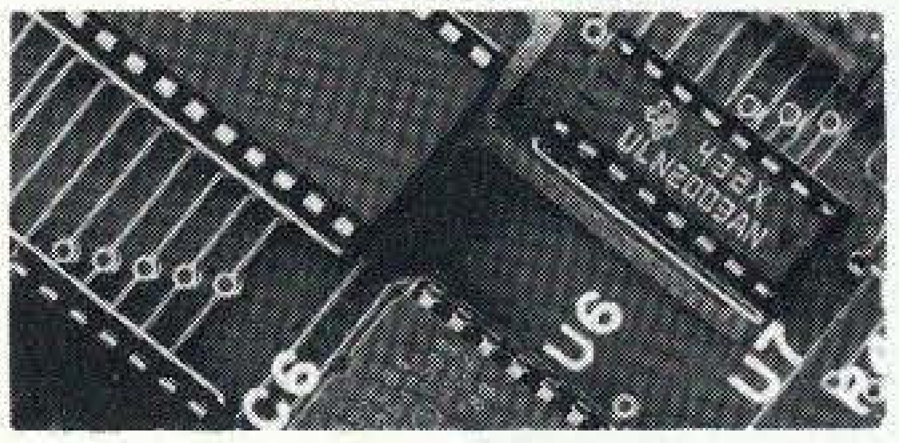

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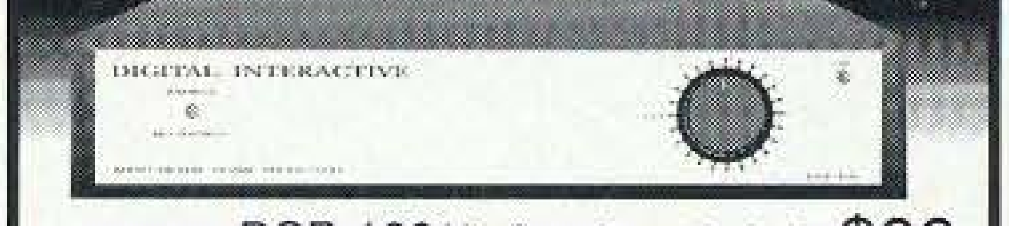

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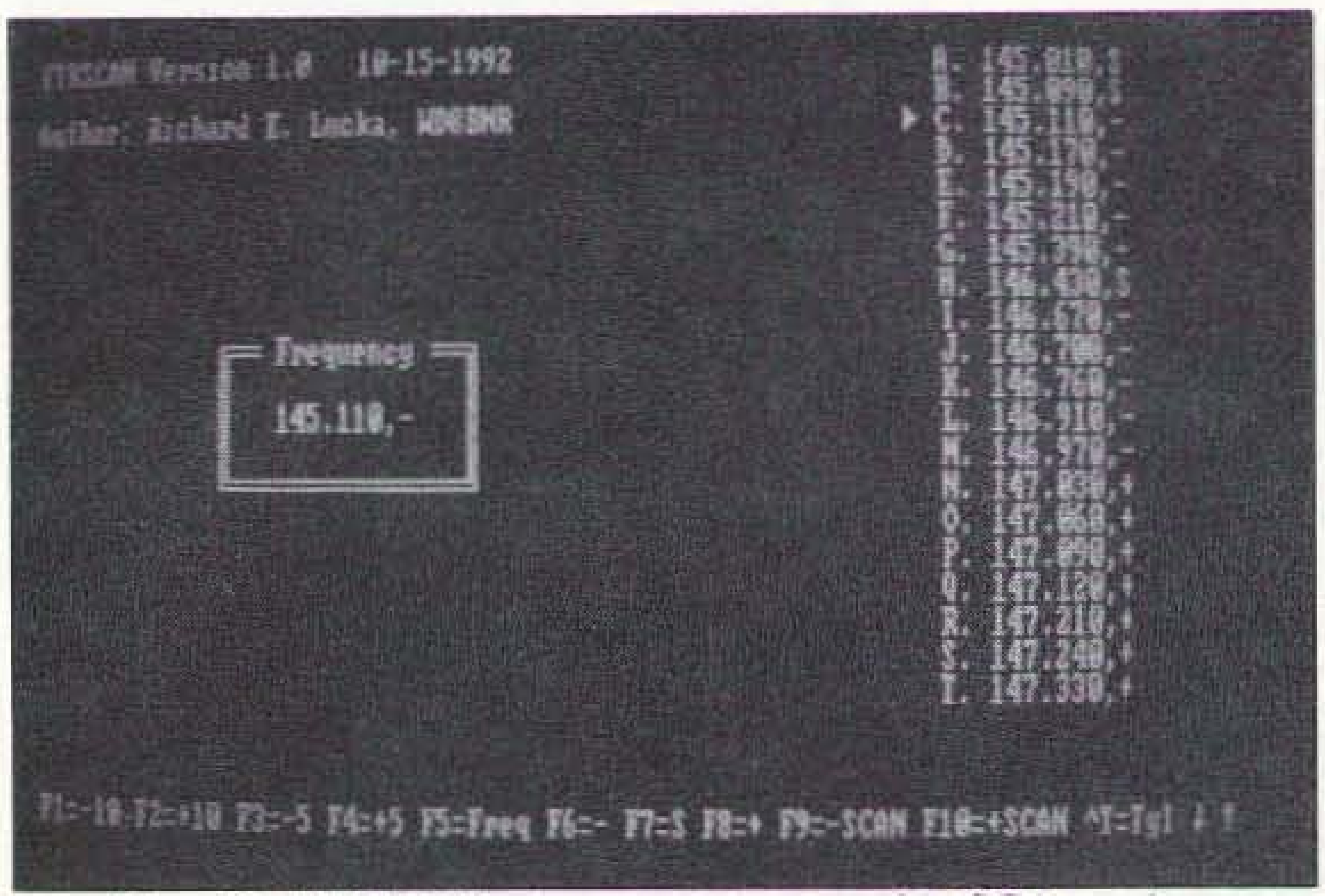

Photo D. FTRSCAN screen output on a color CGA monitor.

```
100 SECOND=ASC(RIGHT$(WORD$,1)):    ' SECOND = second 8-bit word
110 SECOND=SECOND OR 2:    ' Turn on D2
120 MID$(WORD$,2,1)=CHR$(SECOND):    ' Store change in WORD$
130 CMND=5:    ' CMND = command to set U4 in receive
140 OUT PORT,SECOND:    ' Write SECOND to data register
150 OUT PORT+2,CMND:    ' Command U4 to receive data
160 OUT PORT+2,1:    ' Command U4 to latch data
```

Listing 4.

WORD$ to the numeric variable FIRST. Line 42050 initializes a command variable (CMND) to set latch U3 in data input mode. Line 42060 sends the data to the latch through the printer port data register. Line 42070 sends a command through the command register to latch U3 to capture the data at its input (latch U4 is not yet selected and doesn't care what's in its input). Line 42080 sends another command to U3 to exit the input mode and "hold on" to the data at its output for pins 256 through two of the rig's synthesizer chips.

Line 42090 transfers the second 8 bits of WORD$ to the numeric variable SECOND. Line 42100 initializes a command variable (CMND) to set latch U4 in data input mode. Line 42110 sends the data to the latch through the printer port data register. Line 42120 sends a command through the command register to latch U4 to capture the data at its input (latch U3 is not selected and is ignoring everything). Line 42130 sends another command to U4 to exit the input mode and "hold on" to the data at its output for pin 1 of the rig's synthesizer chip, the repeater offsets, the +5 kHz channel spacing, and the three status LEDs.

At all other times, the command register should contain 1 to keep the latches disabled (not loading data). The STROBE output in the printer port is inverted, so a 1 in the STROBE bit is really a low in the STROBE output pin.

When you first turn on your computer and radio, the LEDs will randomly light up. In my computer, every other LED lights up, and one or both latches may be in data input mode. I wrote a small BASIC program to initially program the interface during boot-up (Listing 2) from your AUTOEXEC.BAT file.

Using the Status Register

If you want to check if the radio is "on" using the status register, use the following sample statements (the ... represents your statements):

100 ISITON=(INP(PORT+1) AND 16)

110 IF ISITON=16 THEN ...: ' If radio is on.

120 IF ISITON=0 THEN ...: ' If radio is off.

If you want to check if the radio is receiving a signal through the status register, use the following sample statements:

100 RECEIVING=(INP(PORT+1) AND 128)

110 IF RECEIVING=128 THEN ...: ' If there is a signal.

120 IF RECEIVING=0 THEN ...: ' If there is no signal.

Programming the Status LEDs

The lower three bits of U4 control the lighting of the status LEDs. Basically, you only need to manipulate the lower 8 bits of the string WORD$. You must maintain the first 5 bits if you want to keep the frequency and the offsets the same. The example in Listing 4 turns on status LED2.

You can use the logical operators available in BASIC to manipulate the lower three bits. The logical operators are:

OR to turn on an LED

AND to turn off an LED

XOR to toggle an LED

I encourage you to study your BASIC manual to learn more about them. They are quite easy to use once you get a handle on them. Here are some samples you can use in place of line 110 in Listing 4:

110 SECOND=SECOND OR 5: ' Turn on LED1 and LED3

110 SECOND=SECOND XOR 3: ' Toggle LED1 and LED2

110 SECOND=SECOND AND 248 ' Turn off LED1, LED2, and LED3

110 SECOND=SECOND AND 250 ' Turn off LED2 only

FTRSCAN

Listing 3 is a program called FTRSCAN. I am placing this in the public domain for your enjoyment, edification, and use. Basically, this program lets you enter a frequency, select a frequency from a list from file FTRSCAN.DAT, and scan the 2 meter band.

Initially, the program reads the FTRSCAN.DAT file (contains a list of your favorite frequencies) and lists the frequencies on the right side of the screen. The program then asks you to enter a starting frequency. After you enter a starting frequency, the program displays the frequency in the middle of the screen inside a box and lists the function keys in the bottom of the screen. Photo D shows a typical FTRSCAN display.

The following are the functions of the function keys:

F1 single steps the frequency down by 10 kHz.

F2 single steps the frequency up by 10 kHz.

F3 single steps the frequency down by 5 kHz.

F4 single steps the frequency up by 5 kHz.

F5 asks you to enter a frequency.

F6 sets the repeater offset to -600 kHz.

F7 sets the repeater offset to simplex.

F8 sets the repeater offset to +600 kHz.

F9 initiates scanning in reverse direction in 10 kHz steps.

F10 initiates scanning in forward direction in 10 kHz steps.

When you enter a frequency (function F5), enter it in this format:

freq,mode

where:

freq is the frequency (xxx.xx or xxx.xxx)

mode is the repeater offset:

= -600 kHz

S = simplex (default)

+ = +600 kHz

Examples: 146.43 147.06,+ 146.76,- 146.855,- 152.00,S

Each frequency listed on the right side of the screen corresponds to an alphabet. To select a frequency from the list, simply press a corresponding alphabet. For example, press B to select the second frequency from the list.

You can also move up and down the frequency list by pressing the up or down arrow key, respectively. The selected frequency is preceded by an arrow symbol shown on the screen.

You can use a word processor or text editor to create FTRSCAN.DAT, which is an ASCII file. Make sure that each frequency is followed by a carriage return and line feed. FTRSCAN will handle up to 24 frequencies, which is the maximum number of lines on the screen.

You can also listen in on a repeater input frequency by pressing CTRL-T (hold down the CTRL key and press the T key). The frequency box will show the input frequency. Press CTRL-T again to restore the repeater frequency. CTRL-T will have no effect on simplex frequencies.

To exit the program, press F5 and then press the RETURN key without entering a frequency. You can exit the program and still use the last selected frequency and be able to run other programs on your PC, just so long as you do not try to "print" anything to the parallel port. If you are capable of routing printer outputs through a serial port (by using DOS's MODE command) and have a printer that has a serial port, then you can print your files and still maintain the con-

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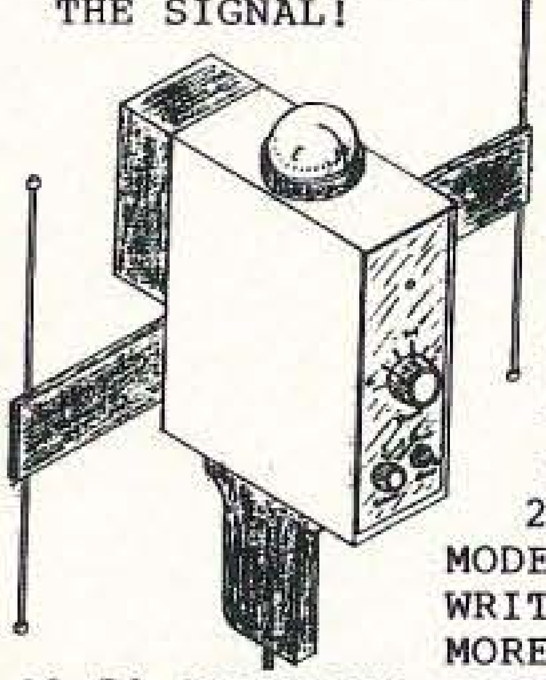

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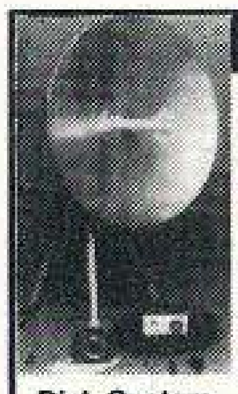

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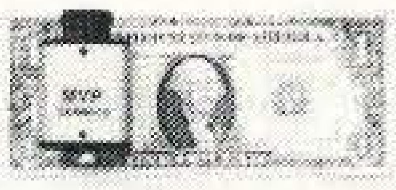

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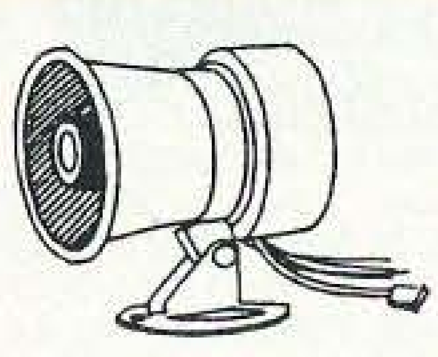

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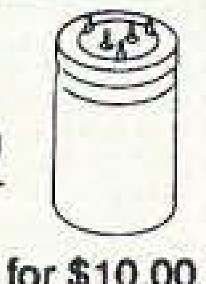

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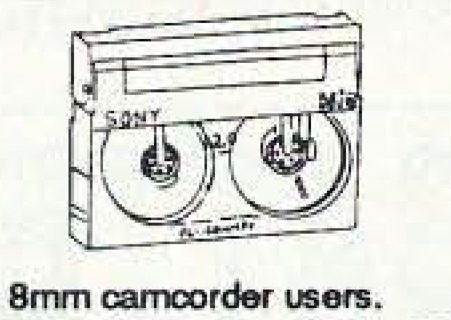

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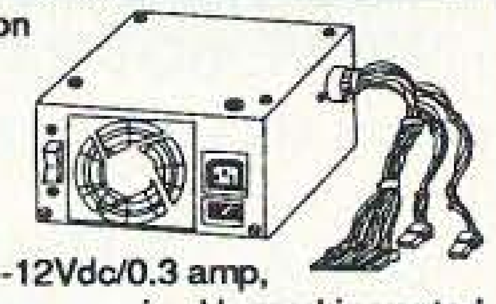

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nection of your interface to the parallel port.

The program in Listing 3 assumes you have LPT1 with a base port of 378 hexa-decimal. If you want to use LPT2 or a parallel printer port that is included in your monochrome video adapter, then change line 40 to reflect the port address. See Figure 3 for the possible port addresses.

Observations

It is very possible that stray RF will bounce around between the transceiver and your PC through the interface circuitry. All connections between the interface and the rig are shunted with 0.1 µF capacitors. In my setup, I found about 10 frequencies that are unusable because of these stray signals. Fortunately, nine of them are on unused frequencies, leaving one that sits on a packet frequency. You can block these frequencies from your scanning by creating a frequency intercept table in your program, if you so desire.

The 5106 synthesizer is slow when locking onto a new frequency. This means that you won't be able to make your radio scan quickly like today's commercial scanners. However, you can successfully scan up to five frequencies per second. The actual scanning rate can be increased or decreased, depending on the squelch setting. I found that if I turn the squelch down very near the threshold, the interface will scan faster. You can experiment with line 50 in Listing 3 to change the scanning rate. This rate works fine in my PC-XT running a 8088 CPU at 10 MHz, however you will need to significantly increase this value if you are using a much faster machine based on a 386 or a 486 processor.

Well, my dream of controlling a 2 meter rig using my PC is now a reality. One of my many projects is to develop a TSR (Terminate and Stay Resident) version of FTRSCAN so while working on another program I can use a hot-key to activate FTRSCAN, change a frequency, and return back to what I was doing. The list of software ideas is only limited by my imagination. 73

PARTS LIST FOR THE PC-TO-FTR146 INTERFACE

U1,U2	4050	Non-inverting buffer
U3,U4	74LS373	D-type latch
U5	7408	AND gates
U6,U7,U8	4049	Inverting buffer
U9	7808	8-volt regulator
U10	7805	5-volt regulator
Q1-Q13	2N3904	Switching transistor
R1-R11	15k	
R12-R29	470 ohm	
R30-R44	10k	
R45-R57	1k	
C3-C4	0.01 µF	Regulated supply
C1-C2, C5-C7, C23		
C25, C27-C29	0.01 µF	Bypass capacitors for U1 through U8
C24, C26	25 µF	
C8-C-22	0.1 µF	
D1-D18	LEDs	5 red, 4 yellow, 9 green w/snap-in holders
Boards (2)	Radio Shack 276-147 (cut second board in half for LEDs)	
Steel box	Radio Shack 270-274	
Cables	25-wire ribbon cable from transceiver to D-SUB plug (Radio Shack 278-773)	
	25-wire cable from D-SUB to interface	
	15-wire cable from interface to PC parallel printer port	
Hardware	Various 4-40 and #6 nuts, bolts and tooth washers	

Note: An etched and drilled PC board is available for $9 + $1.50 shipping per order from **FAR Circuits**, 18N640 Field Court, Dundee IL 60118.
Most parts are available from Radio Shack and JDR Microdevices.

Number 24 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area, #11. (2400 baud, 8 data bits, no parity, 1 stop bit.) Tel. (603) 924-9343. Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I want to contact Heathkit SB series owners/collectors interested in exchanging equipment, parts, manuals, or information. Contact *Bob Schlegel N7BH, 2303 286th St. East, Roy WA 98580.*

NEEDED: Manual/schematic, or a copy, for a KDK 2 meter mobile radio, Model #2033. *Rick Labrecque N1ITN, RR#1 Box 990, Dixfield ME 04224.*

I am looking for a copy of the schematic diagram for a Conar Model 452 (two meter) transceiver. This radio was supplied as a kit for a National Radio Institute correspondence course in the late 70s. I will pay all costs. *William Fritsche K0SDZ, 1512 W. California Ave., St. Paul MN 55108.*

ADVERTISERS

Bold Listings are 73's new advertisers this month.

*Advertisers who have contributed to the National Advisory Committee (NIAC).

Number 23 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

If you are anything like me (a dedicated ham), you like to receive things in the mail, such as: ham magazines, QSL cards with an SASE, letters from loved ones and friends, ham equipment catalogs, etc. I also enjoy receiving mail from other hams throughout the world, passing on important information about happenings in their area of a country or of the country itself. And what I enjoy even more is passing that information on to the thousands of readers of 73.

I have been blessed with many great Hambassadors through the three-plus years I have been putting this column together. Some have come, and some have gone. Some have become just too busy to keep it up and some just got tired (I guess). Some have become Silent Keys. Some have moved to other locations and haven't got settled in yet.

Some countries just haven't really gotten started with ham radio, either from the beginning or after changes in political status, so there are no hams to pass the information on. Some countries are in such political and economic tangles that those in power or who have the money to be involved in amateur radio are too busy with other things to pass on ham information.

I used to think that being busy leaves no time to do other things, but I think I have proved this wrong. Some of the best college students I have seen in my teaching career have been very busy in campus activities and athletics. I have learned from them that they make plans and make every minute count. Being busy doesn't mean that there is no time for fun things; to the contrary—these students just plan properly to make everything happen.

What does this discussion have to do with ham radio? What I have been leading up to is that every one of us does have time to do many things, even if we think we are too busy. All it takes is a little planning. How long does it take to gather some ham news in one's area and write a half-page or page about it? How much time does it take if it is done three or four times a year? I don't think it takes THAT much time over a one-year period. Is that any excuse to not become a Hambassador for your country? NO! What if your English is not so good? Is that any reason not to become a Hambassador for your country? NO! I think I've done a good job so far in deciphering the reports from other countries.

So, as you can see from the previous arguments, there is no reason for you not to volunteer to become a Hambassador for your country. And the rewards: You get your name in print and get a free airmail subscription to your favorite amateur radio magazine, 73 Amateur Radio Today. *And, last but certainly not least, the rest of the world gets to find out what is happening in your country. I think that is one of the most rewarding things about this job, besides working with the great people at* 73. *Even it you don't want to become a Hambassador, send me some information anyway.*

Don't put it off; write me today, either at the magazine address or at the address at the beginning of this column. Send a small sample of your writing. Better yet, send me some information about what is happening ham-wise in your area. Do it today! Get involved in this great hobby of ours!

73 for now.—Arnie, N1BAC

Roundup

IARU Region 3 It has been announced that China has decided to allow individual amateur stations to operate after December 22, 1992. The callsign prefixes will be BA, BD, and BG. The Chinese Radio Sports Association has been working on this for many years.

Philippines On behalf of the officers and members of the Benguet Amateur Radio Operators Network Society and the Texas Instruments Amateur Radio Club, we wish to express our profound gratitude for the publication of the information regarding the Special Event Station 4G2BAG commemorating the 83rd founding anniversary of Baguio City, Philippines.

As an additional note, we wish to inform all readers that Alvin 4F2AWE, one of the participating stations for the special event and the president of BARONS, Inc., became a Silent Key last 31 October 1992, at the young age of 24.

Russia/USA *Downloaded from packet:* The R&R Callsign Database containing 30,780 names and QSL addresses of stations in Russia and the independent republics is available for downloading free-of-charge from the Mountain Retreat BBS at (408) 335-4595. LLBBS SYsops can FREQ the file R&RCALLS.exe. Anyone can download the file without upload restrictions or BBS registration. The program and data are shareware. The file is almost 1 megabyte long, so call in during cheap time.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

The "A-Team" Outfoxes the Foxes Almost all summer long serious intentional QRM plagued the main Tel Aviv 2 meter repeater. All but the strongest stations were at the mercy of some QRMers who seemed to be dedicated to systematically making life miserable for anyone wanting to use the machine. The lowlifes even QRMed hams who, after being run off the R7 machine, went to other repeaters. Your faithful scribe was one of the unfortunate victims. On a few occasions the weekly Israel Amateur Radio Club net was disrupted.

There were some partisan attempts to nab the offenders, but alas, the interference persisted. Only once the trackers got organized and started to work as a team did they get successful. In this way, two offenders were tracked down and only then were legitimate contacts heard on the Tel Aviv R7 repeater.

On the weekly "Gal HaMeshudar," the IARC Newsmagazine on the Air, Tuvia 4X4GT, presiding as master of ceremonies, promised that soon the IARC would announce the name of the pirate whom the club's task force tracked down and caught. The IARC has applied to the proper authorities and filed an official complaint.

The pirate, who interrupted communications on the Tel Aviv R7 repeater and on the other machines, was caught operating a high-power transmitter in a moving vehicle. Tuvia said that the offender will be sued for damages caused by his interference, including preventing the officials of the IARC to transmit information to the membership on a weekly net.

Now that the task force has been formed, Tuvia said, once they go into operation it is just a matter of minutes before they can track down the interfering station. He asked hams to install rotatable 2 meter beams to help pinpoint the location of jammers, and promised that the next issue of "HaGal" will feature a multi-element quad that is excellent for foxhunting.

As if to take up Tuvia's challenge, an unidentified station began to interfere with the transmissions on the net and, as in days gone by, the net turned into a shambles. In the next few days the jammer grew bolder, taunting the amateurs, and even dosing out some of the vilest language. The jammer claimed that he was "untouchable" and that they'd never get him.

The "A-Team" went into operation again and tracked him down to his place of work where he was doing his vile deeds. The details will have to go unchronicled for the time being, for this is still a covert operation. The methods and identities of the live foxhunters must remain undisclosed as they must maintain their tactical advantage in keeping the repeaters clean. The bottom line says that teamwork is the only way to go when you have to out-fox the fox.

4X Delegation to AMSAT-UK 4X1AS, 4X1GP, 4X1RU, 4X4JI, and 4Z4RM were at the annual AMSAT-UK Colloquium at the University of Surrey in England. About 130 participants from around the world were present to hear and speak about developments in an amateur satellite program.

Shlomo 4X1AS announced that AMSAT-Israel shall become an affiliate organization of AMSAT-UK, drawing cheers from the participants.

Much was spoken about the Phase III-D satellite project. The bird in the works will weigh half a ton and will cost 3.8 million dollars, supported by donations from amateurs all over the world, as well as by a grant from the German government. The Spanish Amateur Radio Organization has pledged 10,000 Sterling to the project.

Many amateurs are benefiting from hamsats unknowingly. A lot of international packet radio forwarding is being done over a few of the "microsats," thus sidestepping the fickle and congested high frequencies. Thus, we would do well by offering our financial support to our nearest AMSAT organization, which shares the responsibility for the building and launching of these satellites.

Above and Beyond the Call! The Huleh Valley hams let nothing get in their way when it comes to having full participation at their meetings. When it turned out that Eddie 4X6TE of Kibbutz Kfar HaNasi had guard duty the night of their scheduled get-together, the hams moved tables, chairs, food, and drink into the guard house and held their meeting there.

National Field Day A national Field Day was held on September 19th. In the north, a station was set up in the Carmel Forests; in the center at the Silent Key's Forest at Ben Shemen; and in the south at the Yatir Forest north of Beer Sheva. Besides the operation on the HF and VHF bands, there were the traditional burnt offerings of steaks and shish kebabs.

Holy Land DX Contest 1992 Results The IARC Contest Manager, Shalom Beitcher 4Z4UT, has tabulated all the results of the past Holy Land DX Contest, which was held on April 18th, 1992. Participants from 27 countries on four continents sent in 247 logs which have been checked and the winners are hereby declared in order (1-2-3): Worldwide Hams—LY2WW, UA6JD, LY3BP; SWLs—LYR1751, ONL383, SP9-4006-KA; Israel—4Z4DX, 4X4KK, 4X4JU. A booklet of the complete re-

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73 INTERNATIONAL

Continued from page 75

sults of all participants is being compiled and will be available from the Israel Amateur Radio Club.

PEOPLES REPUBLIC OF CHINA

Rick Hunter, Chief Op. BY1QH
Room 316, Building 25
Tsinghua University
Beijing 100084
Peoples Republic of China

Four of the main members of the Tsinghua University Amateur Radio Club (TUARC), Rick, Hao, Jaro, and Mes, went to BY1PK for a friendly visit November 20. We were warmly received by Mr. Tong Xiaoyong, the president of this Number 1 station in China. We were deeply impressed by their ICOM IC-781, 2 meter repeater, SSTV rigs, and much more. We learned quite a bit about the latest developments of ham radio in China and throughout the world. Mr. Tong kindly presented us with some amateur radio related computer programs and PBBS documents. Many of these programs were written by Mr. Yan, another senior op at BY1PK.

Our ham radio class that started December 1st is going very well. Jean, Violet, Nick, and Gray (not Gary, hi!) have been taught the basics of amateur radio and the international phonetic alphabet by Rick. The four students will be practicing real-time operations on SSB shortly and are looking for voice partners to help. Please listen for them on BY1QH.

We are now receiving responses from around the world, thanks to packet and *73*. Several of the latest are Immo DK6CC and Johann ZS3AAK. We are very happy to hear that Immo is interested in learning languages also.

We have surprisingly found that the RTTY propagation is no less than perfect between the USA and Beijing at about 0000 UTC. Although we can't promise a strict schedule, we will attempt contacts on 20 meters whenever available. Don't forget to check your local DX packet cluster for spots.

BY4AA, founded on October 12, 1983, is one of the most famous stations in China and is the ARS of Shanghai Radio Sports Association, located in the biggest city in BY-land. BY4AA runs CW, SSB, SSTV, packet, and a 2 meter repeater. Many member hams participate regularly in CQWW and WPX contests. Every New Year's Day, a Shanghai-Yokohama sister-city link is established with JH1ZCT. The current president is Mr. Xu Ru and the chief op is Mr. Hu Songqing. For further information, contact BY4AA, PO Box 085-205, Shanghai.

BY1QH is currently registered at the following three BBSs: JA5TX.JPN.AS; BV5AG.#APL.TWN.CHN.AS; VE7CIZ.#VANC.BC.CAN.NA. TUARC has almost daily access to all of them. Those who can not contact these BBSs directly can pass messages through DKØMHZ and ZS5S in Europe and Africa, which will then pass those messages onward.

And lastly for this month, our thanks to Wen-Long BV3AC for his kind offer of help in our search for the 2SC2652 transistor we need; to George VE7CIZ and Werner, the Sysop of DKØMHZ, for their great jobs; to Arnie N1BAC for his frequent concern about TUARC; and to Joe ZS5S for his kind offer to put our newsletter into the ZS packet network. Finally, thanks to Mitsuo JA5TX and Katy BV5AG, without whom nothing could be achieved.

Comments and news are certainly welcome. Moreover, please don't hesitate to ask if TUARC can be of any help to you. Remember, you have quite a few friends in Beijing. 73 from Rick and the TUARC.

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*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 January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events** in message **Area #11** on our **BBS (603- 924-9343)**. for listings that were too late to get into publication.*

FEB 28

MATTAPOISET, MA An Amateur Radio Flea Market will be held at Knights of Columbus Hall starting at 9 AM. Talk-in on 146.52 MHz. Contact *Kenneth Rapoza K1NSX, 19 Golf St., Fairhaven MA 02719. Tel. (508) 993-3993.*

MAR 6

TEXARKANA, TX The Four States ARC will sponsor its 4th annual Hamfest at the YWCA Bldg. Doors open at 8 AM. VE Testing at 1 PM. Talk-in on 146.62. Contact *Travis K5AVH, FSARC Hamfest, 1260 Canadian Texarkana TX 75503. Tel. (903) 792-2080.*

MAR 12

ST. LOUIS CITY, MO The Jefferson Barracks ARC will hold their 33rd annual Radio Auction at the Concordia Turner's Hall, 6432 Gravois. Doors open at 5 PM, the auction starts at 7:30 PM. Contact *Vivian K. Scott WD0EMS, 4121 Fabian Dr., St. Louis MO 63125. Tel. (314) 631-4068.* Talk-in on 146.94 and 145.21.

MAR 13

FLEMINGTON, NJ The Cherryville Repeater Assn., II, will host its annual Flemington Hamfest from 8 AM-2 PM at the Hunterdon Central High School Field House. Talk-in on 147.375+. Contact *Keith Burt KF5FK, P.O. Box 308, Quakertown NJ 08868-0308. Tel. (908) 788-4080.*

SCOTTSDALE, AZ The A.R.C.A. Spring Hamfest will be hosted by the Scottsdale ARC from 7 AM-4 PM at Scottsdale Comm. College (East parking lots) 9000 E. Chaparral. Talk-in on 147.18 and ZIA Link. Contact *Ron Avery WB6PEB, Hamfest Chairman, 9039 N. 127 St., Scottsdale AZ 85295. Tel (602) 391-2388; FAX (602) 451-3876*, or write to *S.A.R.C. Hamfest, P.O. Box 10878, Scottsdale AZ 85271-0878.*

MAR 13-14

CHARLOTTE, NC The Mecklenburg ARS will host their 1993 Charlotte Hamfest/Computerfair, and also, the 1993 ARRL Roanoke Div. Convention, at the Charlotte Merchandise Mart, 2500 E. Independence Blvd. (US 74). There will be FCC exams by the Charlotte VEC on Sun. Contact *Charlotte Hamfest, P.O. Box 221136, Charlotte NC 28222-1136. Tel. (704) 841-HAMS.*

MIDLAND, TX Midland ARC will hold their annual St. Patrick's Day Swapfest from 9 AM-5 PM on Sat., and from 8 AM-2:30 PM on Sun., at the Midland County Exhibit Bldg. VE Exams at 12 PM Sat. Contact *N5TQU or N5UNH* at *MARC, P.O. Box 4401, Midland TX 79704.*

MAR 14

BRISTOL, CT The Insurance City Repeater Club will hold its annual Hamfest/Computer Flea Market from 9 AM-2 PM at Bristol Eastern High School, King St. (Rte 229). Talk-in on 146.88, 224.80. VE Exams by pre-registration only. Write *ICRC, P.O. Box 165, Pleasant Valley CT 06063.* SASE required.

INDIANAPOLIS, IN The Indiana Hamfest will open to the public at 8 AM at the Indiana State Fairgrounds Pavilion Bldg. Talk-in on 145.25. For reservations/info, send SASE before Feb. 22 to *Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47403. Tel. (812) 339-4446.* Sponsored by the Morgan County Repeater Assn.

YORK, PA The 6th annual York Springfest (Ham & Computer) will be held at the York Fairgrounds, starting at 8 AM. ARRL VE Exams. Talk-in on 146.37/.97 and 447.275. Contact *York Springfest, P.O. Box 526, Red Lion PA 17356. Tel. (717) 843-7864.*

MAR 20

MARSHALL, MI The 32nd annual Michigan Crossroads Hamfest, sponsored by the Southern Michigan ARS and the Marshall High Photo/Electronics Club, will be held at Marshall High School from 8 AM-3 PM. Talk-in on 146.66 or 146.52. Get details from *Wes Chaney N8BDM, (616) 979-3433.* For reservations, send SASE to *SMARS, P.O. Box 934, Battle Creek MI 49016.*

WESTBORO, MA The Minuteman Repeater Assn. Flea Market will be held at the Westboro High School. Doors open to the public at 10 AM. Talk-in on 146.61, 449.925, 223.94. Contact *A. Morrison N1BHI, (508) 481-3878.*

MARCH 20-21

FORT WALTON BEACH, FL The Playground ARC will hold their 23rd annual Ham/Swapfest at the Ft. Walton Beach Fairgrounds from 8 AM-5 PM. For tables, call *Jim Jajuga KD4NHQ, (904) 651-5362* or *Freeman Pascal KA0TGN, (904) 581-5610, or (904) 581-4699*. For RV space, call *Stan Reither WD4PEU, (904) 243-8801*. To arrange meetings or reserve commercial space, write to *P.A.R.C., P.O. Box 873, Ft. Walton Beach FL 32549*.

MARCH 21

MONROEVILLE, PA The Two Rivers ARC will hold its 21st annual Hamfest/Computer Fair at the Greater Pittsburgh EXPOMART from 6 AM-3 PM. Contact *Michael A. Kowalcheck, Jr., c/o Two Rivers ARC, P.O. Box 184, Greenock PA 15047*.

NEW CASTLE, DE The NUR Temple, 198 S. DuPont Hwy., (RT 13 near US 40 split), will be the location for the Pen-Del Hamfest, from 8:30 AM-2 PM. Talk-in on 224.220- and 147.225+. For details, please call *(215) 497-2124*. Sponsored by the Penn-Del ARC.

STERLING, IL The Sterling-Rock Falls ARS' 33rd annual Hamfest will be held at the Sterling High School Field House, 1608 4th Ave., from 7:30 AM. Talk-in on 146.25/.85 W9MEP Rptr. Contact *Lloyd Sherman KB9APW, Sterling-Rock Falls ARS, P.O. Box 521, Sterling IL 61081. Tel. (815) 336-2434.*

WEST WINDSOR, NJ The Delaware Valley Radio Assn. will sponsor HAMCOMP '93, their 21st annual Amateur Radio/Computer Flea Market, from 8 AM-2 PM, on the campus of Mercer County Comm. College, Rte. 535 (Old Trenton Rd.). Talk-in on 146.07/.67. Contact *HAMCOMP '93, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.*

YONKERS, NY WECAFEST '93, the Westchester Emergency Comm. Assn's 9th annual Radio/Electronics/Computer Fair, will be held indoors at Yonkers Raceway, intersection of I-87, Central and Yonkers Ave. Doors are open from 9 AM-2 PM. ARRL sanctioned. Talk-in on 147.060 Rptr. For vendor and Tailgate registration, call *(914) 962-9666*, or write to *Tom WB2NHC & Jeanne N2NQY Raffaelli, 544 Manhattan Ave., Thornwood NY 10594.*

MARCH 27

ELIZABETHTOWN, KY The Lincoln Trail ARC will hold their annual Hamfest at the Pritchard Comm. Center, starting at 8 AM. Walk-in VE Exams start at 9 AM. Talk-in on 146.38/.98 and 146.52. Contact *Whitey WD4GDA, P.O. Box 342, Vine Grove KY 40175. Tel. (502) 877-2234.*

MICHIGAN CITY, IN The Michigan City, IN ARC will hold their annual Spring Hamfest/Computer Flea Market at the Rogers High School, Pahs Rd., from 8 AM-2 PM, CST. Free VE Exams. Talk-in on 146.52 MHz simplex and 146.37/.97 (PL 131.8 Hz). Contact *Jack Lemley N6SYJ, 384 Hawthorne St., LaPorte IN 46350. Tel. (219) 325-0951.*

MARCH 28

BRAINTREE, MA The South Shore ARC will hold its annual indoor Flea Market at the Viking Club, 410 Quincy Ave., from 10:30 AM-3 PM. For info, call *Dave, (617) 337-5301, eves. till 11 pm.*

MADISON, OH The Madison High School at Burns and Middle Ridge Rds., will be the location for the 15th annual Hamfest/Computer Show to be hosted by the Lake County ARA. Doors open from 8 AM-3 PM. VE Exams. Talk-in on 147.210+. Contact *Roxanne, Lake County Hamfest, 5777 Fernwood Ct., Mentor on the Lake OH 44060. Phone (216) 257-2036 weekdays from 6 PM-9 PM; weekends 10 AM-4 PM; or (216) 352-6756 weekdays 10 AM-4 PM.*

APRIL 3

PERRY, GA The Central Georgia Nat'l Hamfest will be held at the Georgia Nat'l Fairgrounds. VE Exams. Talk-in on 147.3+. Contact *Central Georgia Nat'l Hamfest, 1412A Russell Pkwy., Suite 210, Warner Robins GA 31088.*

COLUMBUS, IN The Columbus ARC Hamfest will be held from 8 AM-2 PM at Bartholomew County 4-H Fairground's Women's Bldg. on State Rd. 11. Talk-in on 146.790/.190. Contact *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.*

LAWTON, OK The Lawton Ft. Sill ARC will hold their 47th annual LFSARC Hamfest from 8 AM-5 PM at the Comanche County Fairgrounds (in Lawton). ARRL approved. Talk-in on 146.91/.31. Contact *Bob Morford KA5YED, 1415 N.W. 33rd St, Lawton OK 73505. Tel. (405) 355 6120.*

UPPER SADDLE RIVER, NJ The Chestnut Ridge RC will host its annual Flea Market at the Education Bldg., Saddle River Reformed Church, East Saddle River Rd./corner Weiss Rd., from 8:30 AM-2 PM. Talk-in on 146.955 rptr. Contact *Jack Meagher W2EHD, (201) 768-8360.*

APRIL 4

LONGMONT, CO Boulder County Fairgrounds, Hover and Nelson Rds., will be the location for the annual LARCFEST sponsored by the Longmont (CO) ARC. Doors open from 8 AM-3 PM. VE Exams at 1 PM; Contact *(303) 499-1106* for Exam info. Talk-in on 147.27/.87, 146.52. For table info, SASE to *Randy Stevens N0NMD, 5280 Cypress Dr., Boulder CO 80303.*

GROSSE POINTE WOODS, MI The

South Eastern Michigan ARA will conduct its 35th annual Hamfest/Swap-N-Shop/Computer Show at Grosse Pointe North High School, 707 Vernier Rd., from 8 AM-2 PM. There will be an ARRL Forum and VE Exams. Talk-in on the SEMARA Rptr. 146.74(-.600). Contact *Rose Ann Mears NV8W, SEMARA Hamfest, P.O. Box 646, St. Clair Shores MI 48080-0646. Tel. (313) 881-3065.*

MADISON, WI The Madison Area Repeater Assn., Inc., will hold its 21st annual Madison Swapfest at the Dane County Exposition Center Forum Bldg. Doors open at 8 AM. Talk-in on M.A.R.A. Rptr. WB9AER, 147.75/.15. Contact *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890,* or call *Jim Waldorf KB9AQQ, (608) 249-7579.* Leave a message on the answering machine.

SPECIAL EVENT STATIONS

MARCH 13-14

ST. PATRICK (SHELBY COUNTY), OH The Farout ARC of Dayton OH will operate WB8SMC/8 from 1700Z Mar. 13-1700Z Mar. 14, to celebrate St. Patrick's Day. Frequencies: 80, 40, 15, 10m Novice CW; 20m General CW; 80, 40, 20, 15m General phone; 10m Novice phone, as band conditions dictate. Send a business size SASE to *Farout ARC, P.O. Box 9181, Dayton OH 45409-9181.*

MARCH 14-15

WISCONSIN QSO PARTY Sponsored by the West Allis RAC, from 1800Z Mar. 14-0100Z Mar. 15. CW and phone. Contact *WARAC, P.O. Box 1072, Milwaukee WI 53201.*

MARCH 27-28

VIRGINIA BEACH, VA The Virginia Beach ARC will operate WA4TGF from 1400Z Mar. 27-2000Z Mar. 28, to commemorate the 102nd Anniversary of the *Norwegian Lady.* CW: 10 kHz up from the bottom of the Novice subband; Phone: 3.880, 7.280, 14.280, 21.280, and 28.363. For certificate, send QSL and SASE to *VBARC, P.O. Box 62003, Virginia Beach VA 23462.*

MARCH 28

SCHOFIELD BARRACKS, HI Army MARS is sponsoring a Special Event Station to commemorate the 50th Anniversary of the 442nd Regimental Combat Team. Activities are planned for all bands, all modes, including the Novice subbands. Look for us at the lower portion of each subband, 1900Z Mar. 27-1900Z Mar. 28. For a commemorative QSL card, please send your card and an SASE to *Al Shaver, Apt. #608, 84-265 Farrington Hwy., Waianae HI 96792.*

Number 26 on your Feedback card

HAMS WITH CLASS

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

Where in the World Are We?

Many students are, to put it mildly, ambivalent about schoolwork. They labor over language arts, muddle through math, and sigh over social studies. In teachers' rooms all across the country the conversations always get around to the topic of how to improve motivation in different lessons. It's perhaps the greatest challenge of the decade to inspire and stimulate youngsters while instructing them in the basics.

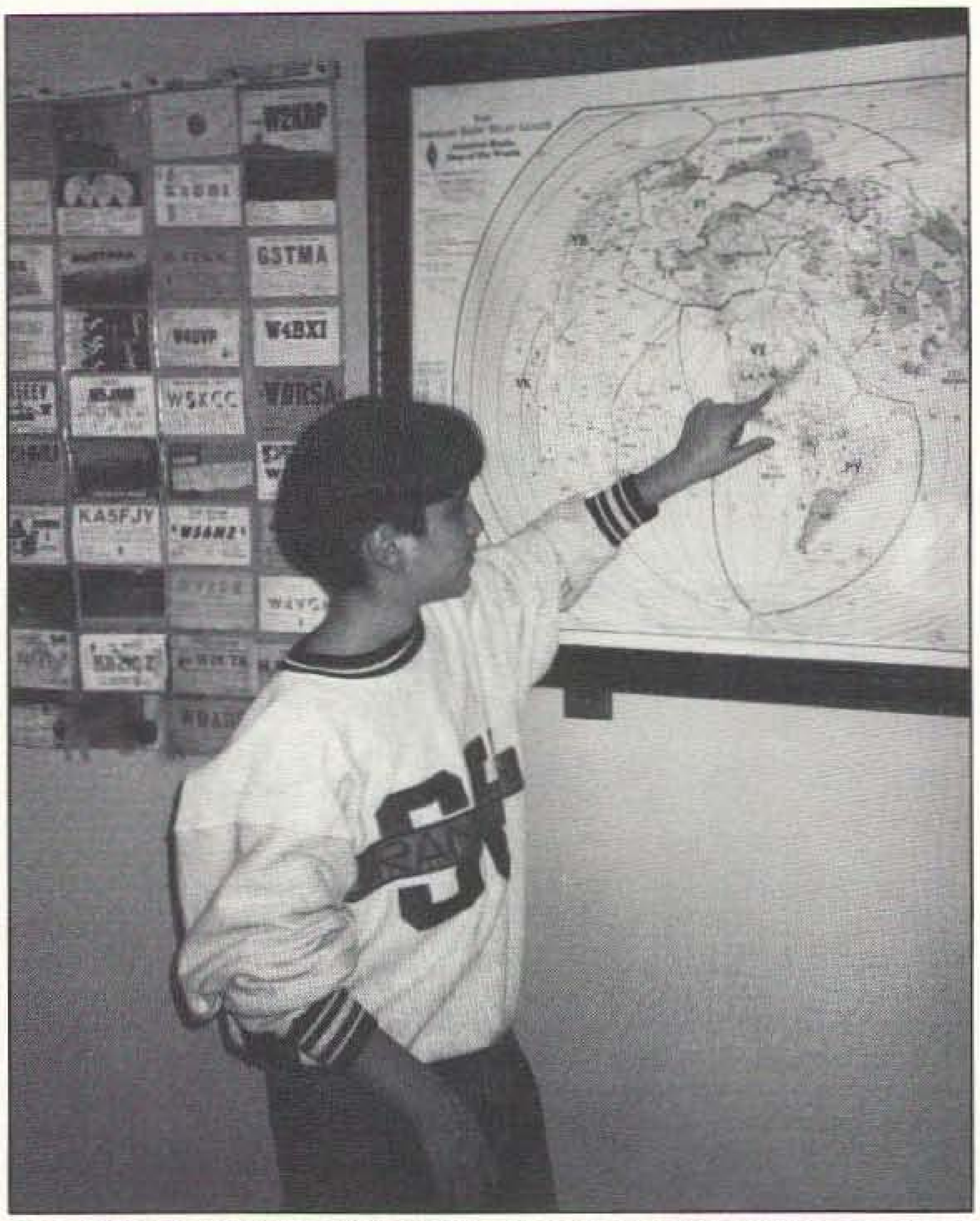
Fortunately, the teacher or instructor who uses amateur radio in the classroom has a head start on highly motivational lessons. The traditional, "Now open your books to page 456 and read about Germany" no longer can compete with the "live action" lessons a radio teacher can provide.

Aside from making contacts with citizens from different regions of the world, children can participate in many wonderful follow-up activities which can add fun and excitement to their lessons. We all know that learning is more effective when it is relevant and challenging to the student.

I'm in the enviable position of being able to teach across the curriculum lines in my 6th-, 7th-, and 8th-grade ham radio classes at Intermediate School 72 in Staten Island, New York. The most obvious correlation of curriculum, however, either before or after a radio contact, is with geography skills. I'll share some of the best and most effective geography activities I've used with my youngsters through the years. The basic premise of each lesson can be modified to fit the needs and abilities of different age groups.

Pumpkin Globes

First, I refer you to my column "What Next?" in the February 1992 issue of *Radio Fun* magazine. In it I share a really funtastic lesson where I have the kids bring in pumpkins and water-soluble markers. (This is a great project to do in the fall, right around Halloween). I divide the class into groups. Each group is provided with a globe which will be the model for their "pumpkin globes." This follows a discussion about the differences between a wall map and a globe. Surprisingly, few children could articulate the different purposes of each. For example, the globe shows only half the world at



Tom KB2NJZ points to a spot on the wall map where the class just made a contact.

one time, but it is more accurate in distance, direction, size and shape.

The children use the markers to produce a pumpkin that has North and South Poles, the equator, the prime meridian, the seven continents, and the four major oceans. Everything gets labeled, including their own location. It's advisable to initiate this project rapidly, because the pumpkins have a tendency to spoil quickly in a warm classroom.

The World Carpet

Several years ago I picked up a World Carpet at a local flea market. I spread it on the floor and let a group of students enjoy the "world at their feet." The floor map is a fun way for the kids to locate different areas that we're studying about. Each class gets to make up its own game to play on it. We now have quite a repertoire of games that have been created.

DX Activities

Sometimes when propagation is really good for us on the CQ All Schools net I let the children select their favorite DX contact of the month. I then have them plan a trip to that country or part of the world. They utilize language arts skills by writing letters to their radio contacts for more information, and to embassies and tourist bureaus for brochures. Youngsters are taught library and research skills to help them locate addresses. They must present an oral report describing the route they will take to get to their destination, the budget (an itemized account of expenses), and a scrapbook which highlights the points of interest to visit in that area.

I often work with the social studies teachers to better coordinate a stimulating introductory lesson or to follow up a geography lesson in a meaningful way. Current events takes on a whole different level of relevance when the radio can bring worldwide events into the classroom. After a radio contact with a school that had just experienced an earthquake tremor in Southern California, my classes brought in over 50 projects of every type and description that portrayed interesting facts about earthquakes.

The kids especially enjoy speaking with other young people their own age. They are always surprised to learn how much they have in common, like not liking school cafeteria food, and worrying about grades. They delight in uncovering their differences and eagerly look forward to receiving letters and pictures from children far away.

Make It Interesting and Relevant

Geography is an important part of a school's curricula and, like everything else you do in the classroom with the radio, it should be presented in a creative and meaningful way.

There are always interesting events going on all across the country that are designed to stimulate school children's awareness of geography. The following list may provide you with just the thing you're looking for to add some "zip" to your lessons. Please write to me and let me know if you have success with any of these activities and tell me how you used it in your classroom.

Nystrom is offering a *free map of the Commonwealth of Independent States*. Contact the Nystrom Map Co. (3333 Elston Ave., Chicago IL 60618-9949) to request a copy of the map. Quantities are limited.

American Express is sponsoring the *American Express Geography Competition*. It offers over $100,000 in prize money. This year students in grades 6 through 12 are eligible to participate in this exciting, challenging program. Call 1-800-395-GLOBE, Monday through Friday 10 a.m. to 7 p.m. Eastern time, for details or to obtain entry materials for the competition.

From October 6, 1992, to March 7, 1993, The Cooper-Hewitt National Museum of Design at 2 East 91st Street, New York City, will host an exhibition of more than 400 historic and contemporary maps dating from 1500 B.C. to the present. *"The Power of Maps"* examines the significance of maps as instruments of communication, persuasion, and control. It will be accompanied by lectures, seminars, workshops, and tours, as well as programs designed for schools, teachers and families. For more information, call Deborah Perlberg at (212) 860-6868.

World Map-A-Thon is a two-week program you can run anytime from October through April. It is sponsored by Save The Children, a private, non-profit, non-sectarian organization which has served impoverished children and their families since 1932. During the first week, students study the nations of the world and ask relatives and friends to pledge donations based on how many countries they will be able to identify. During the second week, students get to see what they've learned, collect their pledges, and receive their own world maps to take home. For more information, contact Linnah Madumaju, World Map-A-Thon, Save The Children, P.O. Box 990 Westport CT 06881-0990; 1-800-243-5075.

"See Me, Share My World: Understanding the Third World Through Children's Art" is a global education project of PLAN International, USA. It is a supplementary teaching unit designed for upper elementary grades. The unit is based on children's art from six developing countries that can be integrated into geography programs. Contact Meg Warren at 1-800-556-7918.

Why not make a New Year's resolution to try at least one new idea in your geography lessons?

Youth Forums

If you know of any articulate and enthusiastic young hams interested in appearing at national youth forums, have them contact me at P.O. Box 131646, Staten Island, NY 10314-0006 (718) 983-1416.

Number 27 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

STARTEK INTERNATIONAL

The new model ATH-15 from Startek International is a frequency counter/frequency finder with an instant-reading RF signal-strength bar graph in a pocket-size aluminum cabinet. The fast response time and ATH™ (automatic trigger and hold) feature on this unit offer a distinctly new and improved feel to the operation of a portable frequency counter. The ATH-15 can read frequencies from 1 MHz to 1500 MHz, and the 10-segment 2"-long LED bar graph can give an instant RF signal-strength indication from signals below 1 MHz to over 4 GHz. There are two ranges with three selectable gate times on each range; maximum resolution is 10 Hz. The new ATH feature eliminates random counting and false readings. The response time from the beginning of the input signal to a stable accurate display has been dramatically reduced.

The ATH-15 comes with factory-installed NiCd batteries. It is housed in a rugged, attractive black anodized aluminum cabinet measuring 3.5" x 4" x 1", and weighing about nine ounces. The ATH-15 is $235, the CC-90 case is $12 and the TA-90 antenna is $12. For more information, contact *Startek International, Inc., 398 N.E. 38th St., Ft. Lauderdale FL 33334; (305) 561-2211, (800) 638-8050, Fax: (305) 561-9133.* Or circle Reader Service No. 202.

AMATEUR RADIO ENGINEERING

Amateur Radio Engineering has introduced HamLink™, a telephone interface that goes between a telephone line and the computer port of your transceiver or receiver, allowing complete control of your radio. HamLink can control the frequency of a radio, mode, or band; scan memories; and operate in split mode. HamLink is even able to share a telephone line with a family answering set without problems. You can control your transceiver from a Touch-Tone phone anywhere in the world. You can monitor DX frequencies and work the rare ones from your office. If you live in a condo and can't have an HF station, you can put HamLink at a friend's home or a club station and use it by telephone.

HamLink is priced at $269 and comes with a one-year limited warranty. For more information, contact *Amateur Radio Engineering, Inc., P.O. Box 169, Redmond WA 98073; (206) 882-2837, Fax: (206) 861-5780.* Or circle Reader Service No. 201.

HART PUBLISHING

Hart Publishing has released the 1993 *Amateur Radio Mail Order Catalog and Resource Directory.* This is the fifth edition of this catalog and it has 250+ pages, nearly 200 categories, and more than 1,600 entries of mail-order products and services for hams. The catalog is categorized and alphabetized into easy-to-find headings from "Alternative Energy" to "Weather Instruments." Listings include the name, address, phone and fax number of the vendor, plus a description of products or services. And this year the catalog includes "A Library of Tips" from Bill Welsh W6DDB, columnist and author, who has for many years provided the radio newcomer with easy explanations of the jargon and theories of the hobby.

The single issue price is $14.95, plus $3 postage via priority mail. For more information, contact *Hart Publishing, 767 South Xenon Court, Suite 117, Lakewood CO 80228; (303) 987-9442.* Or circle Reader Service No. 206.

DWM ENTERPRISES

The "Pill Bottle Antenna Tuner" from DWM ENTERPRISES is equipped with just two rugged parts: the tuner's inductor, made from a pill bottle; and durable #22 wire wound and tapped at various intervals along the coil to cover the 80 through 10 meter bands. An alligator clip is used to tap the individual bands. Tuning for SWR is accomplished with a high quality Jackson Brothers 365 pF variable capacitor. The inductor and variable capacitor are mounted on cedar wood stock, giving the tuner a beautiful old fashioned look. Fahnestock clips are used for input and output connections. A variety of antenna designs can be used with this tuner, and experimentation is encouraged. It has been tested to over 150 watts output without arcs or sparks. It is great for both QRP and QRO, for portable or shack operation, for new rigs or old.

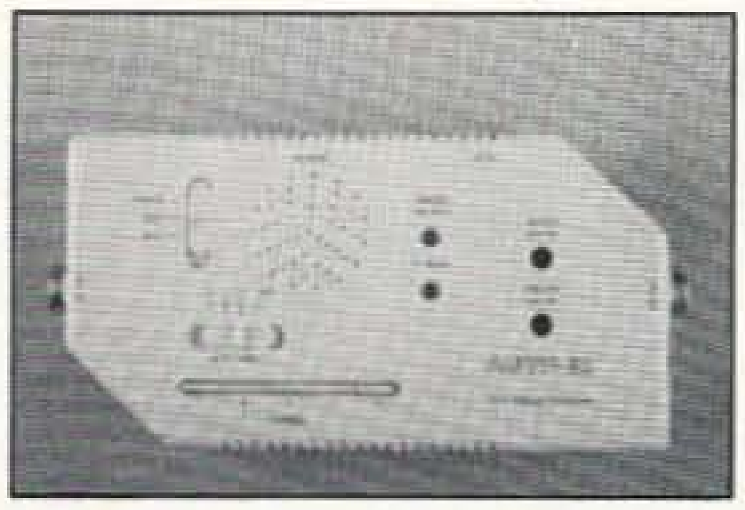
The "Pill Bottle Antenna Tuner" is priced at $27, plus $3 S & H, and comes completely assembled and bench tested. For more information, contact *DWM ENTERPRISES, 1709 N. West Avenue, Suite 103, Jackson MI 49202; (517) 563-2784*. Or circle Reader Service No. 203.

TRIPP LITE

The BC 400 from Tripp Lite is the smallest, lightest 400 VA battery backup (UPS) system anywhere. This new unit combines outstanding performance from its redesigned circuitry for powering desktops PCs, phone systems, cash registers or internet hardware such as hubs, bridges and routers. The UL-listed BC 400 features two spike-protected AC outlets, large batteries for longer battery life and a highly efficient pulse-width modulated waveform output.

The BC 40 carries Tripp Lite's Ultimate® Lifetime Insurance, which provides for the repair or replacement of connected equipment up to $25,000 if damaged by a surge, including direct lightning strikes. The suggested retail price is $219. For more information, contact *Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188; (312) 329-1777, Fax: (312) 644-6505*. Or circle Reader Service No. 204.

MING COMMUNICATIONS



The AUTO-ID automatic message broadcaster from Ming Communications is a solid-state digital voice recorder developed specially for two-way radios. It simply plugs in between the radio and its microphone. With the use of your radio microphone you can record up to five separate messages that can be played on the air by pressing one of the five message buttons. The AUTO-ID also has a built-in timer that monitors your PTT activity. Record your station identification and thereafter any time you are on the air the AUTO-ID will broadcast your message ID for you. The ID's timer can be set for intervals of three or nine minutes, or it may be set to broadcast your message every time you use PTT. With the use of the AUTO-ID's built-in speaker you can monitor the message that the AUTO-ID is broadcasting, regardless of whether the selected message was broadcast automatically or manually.

The AUTO-ID comes with plugs for an Alinco or Kenwood mobile amateur radio. There are accessories available to interface the AUTO-ID to most other types of radios. The price is $149.95. For more information, contact *Ming Communications, 2948-1/2 Honolulu Ave., La Crescenta CA 91214; (818) 249-3006, Fax: (818) 248-0840*. Or circle Reader Service No. 205.

Uncle Wayne's Bookshelf

REFERENCE

202101 **Everyday Electronics Data Book** *by Mike Tooley BA* A basic electronic "recipe" book using commonly available components. **$18.00**

20N102 **Practical Digital Electronics Handbook** *by Mike Tooley BA* Contains nine digital test gear projects. Digital circuits, logic gates, bistables and timers, microprocessors, memory and input/output devices. **$14.50**

20N103 **Electronic Power Supply Handbook** *by Ian R. Sinclair* Covers many types of supplies—batteries, simple AC supplies, switch mode supplies and inverters. **$16.25**

20N104 **Electronic Test Equipment Handbook** *by Steve Money* A guide to electronic test equipment for the engineer, technician, student and home enthusiast. **$18.00**

20N105 **Digital Logic Gates and Flip-Flops** *by Ian R. Sinclair* A firm foundation in digital electronics. Treats the topics of gates and flip-flops thoroughly and from the beginning. **$18.00**

01C80 **Master Handbook of 1001 Practical Electronic Circuits** Tried and proven solid state circuits. **$19.95**

01P68 **Pirate Radio Stations** *by Andrew Yody* Tuning in to underground broadcasts. **$12.95**

01T01 **Transmitter Hunting** *by Joseph Moell and Thomas Curlee* Radio direction finding simplified. **$19.95**

02C30 **Commodore Ham's Companion** *by Jim Grubbs* Commodore computer and the Ham. **$9.50**

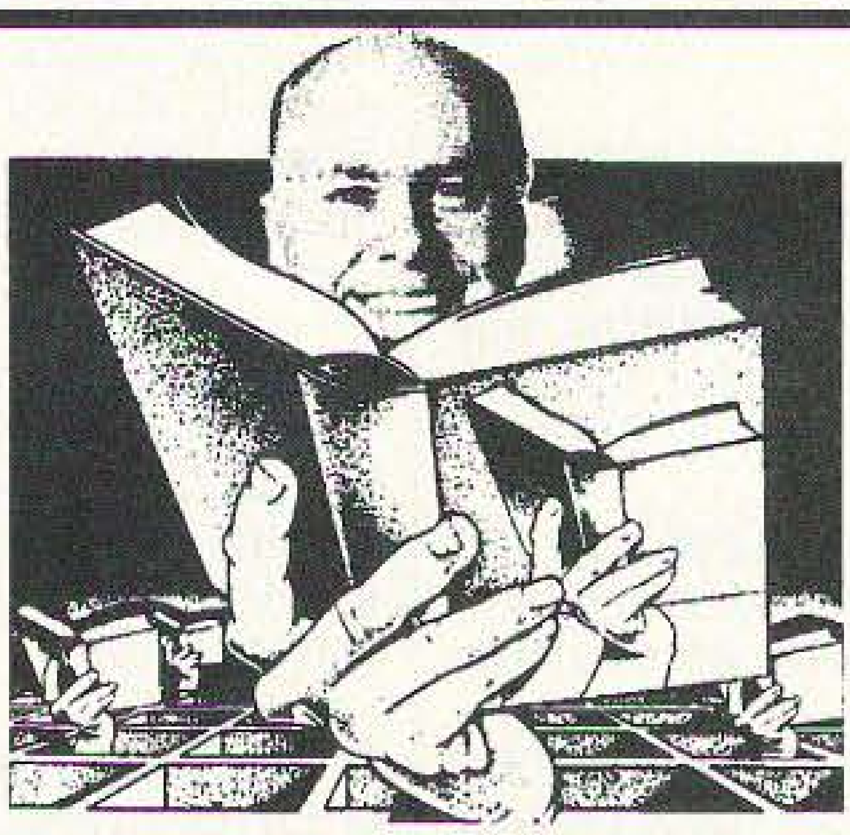
03R02 **Rtty Today** *by Dave Ingram* Modem guide to amateur radioteletype. **$8.50**

03S04 **Hidden Signals on Satellite TV** *by Thomas Harrington* The secret signals on the satellites. **$19.50**

05E01 **Basic Electricity and Electronics** The fundamentals of electronics, book 1.**$11.95**

05E02 **Basic Electricity and Electronics** The fundamentals of electronics, book 2. **$9.95**

05E03 **First Book of Modern Electronics** Unique projects that are money saving. **$12.95**



09D22 **The World Ham Net Directory** *by Mike Witkowski* New—2nd edition. Introduces the special interest ham radio networks and shows you when and where you can tune them in. **$9.50**

09P33 **Pirate Radio Directory** *by George Zeller* Where to tune in on secret entertainment stations. **$7.95**

10F093 **1993 International Callbook** The new 1993 International Callbook lists 500,000+ licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$29.95**

10D093 **1993 North American Callbook** The 1993 North American Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. **$29.95**

05H24 **Radio Handbook, 23rd Ed.** *by William I. Orr W6SAI* 840 pages of everything you wanted to know about radio communication. **$29.50**

02B10 **Heath Nostalgia** *by Terry Perdue K8TP* 124 page illustrated history of the Heath Company. Includes many fond memories contributed by long-time Heathkit employees. 02B10 **$9.50**

10DF92 **1992 Callbook Supplement** An update to the 1992 International and American callbooks. **$10.00**

12E76 **Basic Electronics** *Prepared by the Bureau of Naval Personnel* Covers the important aspects of applied electronics and electronics communications. **$10.95**

12E41 **Second Level Basic Electronics** *Prepared by the Bureau of Naval Personnel* Sequel to Basic Electronics, thorough treatment of the more advanced levels of applied electronics. **$7.50**

01D45 **The Illustrated Dictionary of Electronics, 5th Ed** *by Rufus P. Turner and Stan Gibilisco* An exhaustive list of abbreviations, and appendices packed with schematic symbols and conversion tables. **$26.95**

20N091 **Most-Often-Needed Radio Diagrams and Servicing Information, 1926-1938, Volume One** *compiled by M.N. Beitman* An invaluable reference for anyone involved in Vintage Radio restoration. **$11.95**

20N096 **How To Read Schematics (4th Ed.)** *by Donald E. Herrington* Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. **$14.95**

20N097 **Radio Operator's World Atlas** *by Walt Stinson, W0CP* This is a compact (5x7), detailed, and comprehensive world atlas designed to be a constant desk top companion for radio operators. **$17.95**

20N098 **Electromagnetic Man** *by Cyril Smith and Simon Best* Health and hazard in the electrical environment. **$29.95**

20N020 **Secrets of RF Circuit Design** *by Joseph J. Carr* Written in clear non-technical language, covers everything from antennas to transistors. **$19.50**

20N107 **Ham Stuff** A comprehensive buyer's guide and directory. **$19.95**

20N109 **73 Magazine Index 1960-1990** A complete index to every article published in *73 Magazine* through 1990. Book **$15.00** IBM software (specify type) **$20.00**

20N110 **Product Reviews Since 1945** Contains an index to 3,400 product reviews that have appeared in *QST, CQ, HR, 73* and *Radcom*. Book **$12.95** IBM Software 5.25 **$10.00**

SHORTWAVE

06S57 **1993 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$16.50**

03S11 **Shortwave Receivers Past and Present** *edited by Fred J. Osterman* Guide to 200+ shortwave receivers manufactured in the last 20 years. The Blue Book of shortwave radio value. **$8.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

03C09 **Shortwave Clandestine Confidential** *by Gerry L. Dexter* Covers all clandestine broadcasting, country-by-country: tells frequencies, other unpublished information: spy, insurgents, freedom fighters, rebel, anarchist radio, secret radio. **$8.50**

03M221 **US Military Communications (Part 1)** US Military communication channels on shortwave. Covers frequencies, background on point-to-point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. **$12.95**

03M222 **US Military Communications (Part2)** Covers US Coastguard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. **$12.95**

03M223 **US Military Communications (Part 3)** Completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. **$12.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

03S208 **Radioteletype Press Broadcasts** *by Michael Schaay* Schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. **$12.95**

11T88 **Tune in on Telephone Calls** *by Tom Kneitel K2AES* Formatted as a frequency list with detailed description of each service and its location in RF spectrum. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations** *by J. Klingenfuss* Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Meteo, PTTs, embassies, and more. **$12.95**

11AS10 **Air Scan Guide to Aeronautical Communications (5th Ed.)** *by Tom Kneitel K2AES* Most comprehensive guide to monitoring US aeronautical communications. Cover all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. **$14.95**

15A002 **Scanner and Shortwave Answer Book** *by Bob Grove* Most frequently asked questions by hobbyists. **$13.95**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

07R20 **A Radio Journal 1912-1940** *by Russ Rennaker W9CRC* Easy to read and informative, educational and entertaining. A trip down memory lane to the early days of radio. **$7.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.)** *by Tom Kneitel K2AES* This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. **$19.95**

11F52 **Ferrell's Confidential Frequency List, New Revised Edition** *compiled by A.G. Halligey* All frequencies from 4 MHz-28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more. **$19.50**

11SR97 **National Directory of Survival Radio Frequencies** *by Tom Kneitel K2AES* Handy and concise reference guide to high interest communications frequencies required by survivalists. **$8.95**

11SM11 **Scanner Modification Handbook, Vol. 1** *by Bill Creek* provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. **$17.95**

11EE06 **Guide to Embassy Espionage Communications** *by Tom Kneitel K2AES* Candid and probing examination of worldwide embassy and (alleged) espionage communications systems and networks. **$10.95**

15D93 **1993 Shortwave Directory (8th Ed.)** *by Bob Grove* Extensively revised, the new 1993 Shortwave Directory is the consummate DXer's bible for the first 30 MHz of radio spectrum, including up-to-date and accurate. **$21.95**

20N093 **Vintage Radio 1887-1929** *by Morgan E. McMahon* The authoritative reference book for historians and collectors. **$8.95**

20N094 **A Flick of the Switch, 1930-1950** *by Morgan E. McMahon* Discover the fast-growing hobby of radio collecting. **$8.95**

07R26 **World Wide Aeronautical Communications** *by Robert E. Evans* Aircraft/Air Traffic Control, Aircraft/Company Operations, Aviation Weather Broadcasts, Aeronautical Flight Tests, Worldwide Military Air Forces, Aero Search & Rescue, Aero Law Enforcement, NASA Flight Support, Aero Terms & Abbreviations and Aero Tactical Identifiers. **$6.95**

11T89 **Scanner Modification Handbook Vol. 2** *by Bill Creek* Here it is—a companion to Vol. 1. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new exciting modifications for popular scanners. **$17.95**

03R01 **World Press Services Frequencies (RTTY) New 5th Ed** A comprehensive manual covering radioteletype news monitoring—contains all information—antenna, receiving, terminal units, plus three extensive frequency lists. **$8.95**

SOFTWARE

04M54 **GGTE Morse Tutor** From beginner to Extra class in easy self-paced lessons. Code speeds from 1 to over 100 words per minute. Standard or Farnsworth mode. Adjustable tone frequency. Create your own drills, practice or actual exams. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles. **$19.50**

04M55 **Advanced Edition** **$29.95**

20N021 **No Code Ham Radio Education Package** Computer software package. Includes computer aided instruction software (IBM compatible), 200 page Ham Radio Handbook. **$28.95**

20N022 **Ham Operator Education Package** Computer software contains five IBM compatible discs with all questions for all license classes, plus "Morse Academy" code teaching software that takes you from 0-20 wpm. **$28.95**

Lanze Code Programs—(Available on 5 1/4" disk.) Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, multiple choice answers, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

IBM Part#	Commodore Part#		Price
Novice	IBM01	COM01	**$14.95**
Tech	IBM02	COM02	**$14.95**
General	IBM03	COM03	**$14.95**
Advance	IBM04	COM04	**$19.95**
Extra (New Pool)	IBM05	COM05	**$19.95**

IBM06, COM06 IBM/Commodore Tech No Code—Lanze Code Program Contains all the authorized FCC questions and answers used in testing formulas, schematic symbols, diagrams, and sample test for passing the new Technician No Code license. **$24.95**

IBM97 **Amateur Radio Part 97 Rules** Includes updated, revised Commission's Rules, September 30, 1989 5 1/4" disk IBM compatible only. **$9.95**

VIS Study Cards Compact, up-to-date Flash Cards with Key Words, Underlined, Quiz on back. Formulas worked out. Schematics at your fingertips. Used SUCCESSFULLY by ages 6 to 81!

NOVICE	VIS01	**$11.95**
TECH	VIS02	**10.95**
GENERAL	VIS03	**9.95**
ADVANCED	VIS04	**15.95**
EXTRA	VIS05	**14.45**

ARRL BOOKS

AR1993 **ARRL 1993 Handbook (69th Ed.)** 39 chapters, featuring 2,100 tables, figures and charts. Comprehensive, well organized and affordable. **$25.00**

AR1086-4 **ARRL Operating Manual (4th Ed.)** Information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF. **$17.00**

AR0194 **Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. **$10.00**

AR2545 **Antenna Compendium Vol. 2** Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. **$12.00**

AR2626 **Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **$10.00**

AR0488 **W1FB's Antenna Notebook** *by Doug DeMaw W1FB* Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$9.50**

AR0348 **QRP Notebook** *by Doug DeMaw W1FB* Presents construction projects for the QRP operator. **$9.50**

AR4141 **W1FB's Design Notebook** *by Doug DeMaw W1FB* Filled with simple practical projects that can be built using readily available components and common hand tools. **$10.00**

AR2200 **Antenna Impedance Matching** *by Wilfred N. Caron* Most comprehensive book written on using Smith Charts in solving impedance matching problems. **$15.00**

AR0402 **Solid State Design** Good basic information, circuit designs and applications: descriptions of receivers, transmitters, power supplies, and test equipment. **$12.00**

AR3193 **Weather Satellite Handbook (4th Ed.)** *by Dr. Ralph Taggart WB8DQT* Expanded and revised to reflect today's weather-fax satellite technology. **$20.00**

AR3290 **Companion Software for Weather Satellite Handbook** 5 1/4" MS-DOS Floppy. **$10.00**

AR3291 **Now You're Talking!: Discover the World of Ham Radio.** Covers everything you need to know to earn your first Amateur Radio license. More than a study quide, this book will help you select equipment for your ham radio station and explain how to set it up—everything you'll need to know to get on the air! **$19.00**

AR3292 **Your Introduction to Morse Code: Practice Cassettes** Kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. **$10.00**

AR0437 **ARRL Repeater Directory 1992-1993** 19,000+ listings with digipeaters, bandplans, CTCSS (PL(TM)) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24GHz. **$6.00**

AR1033 **The DXCC Companion** *by Jim Kearman KR1S* Spells out in simple, straightforward terms what you need to be a successful DXer. **$6.00**

AR1250 **Log Book**—Spiral **$3.50**

ARA341 **Interference Handbook** RFI sleuth's experience in solving interference problems. **$12.00**

AR2197 **ARRL Data Book** Valuable aid to the RF design engineer, technician, radio amateur, and experimenter. **$12.00**

AR2960 **Transmission Line Transformers (2nd Ed.)** *by Dr. Jerry Sevick W2FMI* Practical designs and specific information on construction techniques and sources of material. **$20.00**

AR0410 **Yagi Antenna Design** A *Ham Radio* series polished and expanded by Dr. Lawson. **$15.00**

AR2171 **Hints and Kinks** Ideas for setting up your gear for comfortable, efficient operation. **$8.00**

AR3169 **QRP Classics** Compilation of ARRL publications on building receivers, transmitters, transceivers, accessories. **$12.00**

ARRL License Manuals Complete FCC question pools with answers.

AR2375 **Technician Class**	**$6.00**
AR2383 **General Class**	**$6.00**
AR0166 **Advanced Class**	**$6.00**
AR2391 **Extra Class**	**$8.00**

AR3185 **The Satellite Experimenter's Handbook, (2nd Ed.)** *by Martin Davidoff K2UBC* Expanded and revised. Focusing on satellites built by and for the international radio amateur community. **$20.00**

AR0477 **Low Band Dxing** How to meet the challenges of the different forms of 160, 80, and 40 meter propagation with effective antennas, equipment, and operating strategies. **$10.00**

AR2456 **FCC Rule Book (8th Ed.)** A must for every active radio amateur. **$9.00**

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RANDOM OUTPUT

David Cassidy N1GPH

Consumer Complaints

We get a few letters every week from hams who are having a problem, real or imagined, with one of our advertisers. Every once in awhile we are alerted to a real scam, and we quickly take appropriate action. Most of the time, though, the problem ends up being either a misunderstanding by the customer, an honest and correctable error on the part of the business, or some factor beyond the control of either that has been blown out of all proportion by one or both parties.

Even though there is little we can do about most complaints other than pass them along to the company involved (with a staff of less than 10 people, we really can't act as consumer watchdogs for the amateur industry), we are glad that our readers inform us of when they're having problems. Every once in awhile, especially if one of us here at *73* happens to be friends with someone at the "offending" company, we'll make a phone call or two to see if we can get things straightened out.

The other day I received a six-page, photocopied newsletter that was dedicated to complaining about a longtime *73* advertiser. It appears that this guy got ticked off at the company, and then sought out and found a bunch of other people who had complaints about this company, and he put them all together in this newsletter-type arrangement and mailed it out to a bunch of hams (or maybe he just mailed it to us). The thing that is unusual about this instance is that I happen to be friends with the president of the company in question and have always found him to be one of the nicest guys in the amateur radio industry. I have used his products and have never had a problem with them. In fact, my experience has been that this particular company is one of the best when it comes to helping customers who have problems or questions.

Just last week, we got a call from a reader who was having a problem getting something shipped from a mail order company. He said his check had been cashed, but he had not received his product yet, and it had been "almost four weeks." I asked the gentleman whether or not he had written to the company, inquiring about the status of his order. He said he had called, but was connected with an answering machine (with many small mail order companies being operated part-time from people's homes, this is not that unusual). I quickly looked up the ad in a recent issue, and right there in easy-to-read type was "please allow 4-6 weeks for delivery." I pointed this out to the gentleman, who didn't seem to feel that the company should cash his check before he received his product. I tried to explain how that happens, but this guy wasn't interested. By now I knew that this ham was more concerned with bitching than he was in receiving his product. I advised him to put everything in writing and send it to the company. If he didn't hear anything in two weeks, I invited him to call me again.

While it is important that you share with us any problems you're having with our advertisers, we would all be better off if you made sure you actually *have* a problem before asking us to look into it, or before unjustifiably slandering the name of a good company.

If you think you have a complaint, the first thing to remember is to leave a paper trail. That means all of your contact with the company should be in written form, and you must keep copies of everything. When you speak with someone on the phone, get their name and make a note of it, as well as the time and date of the phone call and what was discussed. If something important was implied or promised during the phone conversation, follow up the call with a letter reiterating the main points of the understanding.

Make sure you give the company sufficient time to process your order. Unless you have paid extra for next day delivery, most companies use regular package delivery or parcel post. That can take weeks to cross the country, so don't compare the speed of the company in the next town with one halfway across the globe.

If a reasonable length of time has passed (four to six weeks is pretty standard) and you still have not received your item, make a phone call and follow it up with a letter. If you have a canceled check or credit card bill that lists the company's charge, make sure you include photocopies of them. You will usually find that any delay in shipping your product to you is caused by: a) the product *was* shipped, but has obviously been lost in transit, or b) some part or item is on back order from the company's supplier.

A company should *not* charge your credit card unless they have processed the order. If your order has been shipped, the company can put a tracer on it. This might take a day or two, but it's *not* the company's fault. Checks are deposited on a daily or weekly basis, so it is possible that you could have received the canceled check before receiving your item. Either way, you have the right to cancel your order and receive a full refund if you haven't received the item within six weeks. You don't have to be nasty about it. Simply inform the company in writing that you are canceling your order.

If you already have the product and are not pleased with it, first make sure that it is installed correctly and that you fully understand how to operate it. A friendly call to the company will usually get you all the help you need in figuring out how to install or operate some of the complex pieces of gear we use these days.

If you truly feel that something is not right with the item, it's worth a telephone call to the company before shipping the product back to them. Remember, the company wants you to be happy with the product. That's how they stay in business. They aren't out to screw you, but if you start screaming at someone on the phone about their "piece of crap that doesn't work" you probably won't make any friends. Explain the problem you're having, and give them a chance to fix it. Don't expect the person who answers the phone to know what you're talking about. Also, don't be surprised if you get transferred around a few times or if someone offers to take a message and have your call returned later. Remember, they're *trying* to help you, and they are fully aware that it is in their own best interest to solve your problem.

If you have to return the item for repair or replacement, include a brief note outlining the trouble you're having and attach it to the piece of gear. Also, include a letter (keep a photocopy) outlining what you were told on the phone and asking for what you want ("Please repair and return to me . . ." or "Please return my purchase price . . .").

Only after you have exhausted all other avenues should you bother to contact the magazines. We usually can't do much except note your complaint. If we start getting a lot of complaints about the same advertiser we *will* look into it, but a single dissatisfied customer does not mean the company is run by a bunch of crooks.

It has been my experience that, with very few exceptions, the amateur radio industry is serviced by some of the nicest people and most honest companies anywhere. As long as we all treat each other with a little respect, I'm sure that your problems will be solved. Usually all it takes is a little communication. Isn't that what this hobby is all about? 73

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Traditionally, March can be a very good month for radio propagation on the HF bands. The spring equinox on March 21 brings 12 hours of darkness and daylight, and the ionosphere has good UV excitation once again. March is also a month of wind and storms so you can look forward to some days of excellent HF conditions and good weather, as well as some days of very poor propagation and weather. The daily chart shows the *poorest* propagation conditions during the week of March 7th to 14th. "Good" propagation is expected between the 22nd and 28th, while only "Fair" propagation is anticipated for the rest of the month, when conditions may be very unsettled and the ionosphere variable from day to day. Be aware of the possibility of some extreme weather on the days surrounding the 8th and the 12th. Propagation can be very good or very poor immediately following a solar flare or some other major disturbance on the sun. Usually a "blackout" is followed by a day or two of very good conditions on the HF bands. March 30th and a day either way could be "Very Poor."

Unexpected Benefits

You may have noticed that December 1992, ordinarily expected to exhibit poor DX conditions, was unusually active and a "Good" month for DX, due to the solar flux rising to values between 140 and 160, and magnetic field indices lower than usual with a quiet field. These are the conditions that prevail as this column is being prepared and—frankly—somewhat of a surprise to this author.

On "Good" (G) days, you may expect fairly good openings on north-south paths for the 10-12 meter bands, in the afternoon, and also excellent skip to Africa and the Pacific. Openings to Europe will be fewer, but good short skip from 1300 to 2300 miles during daylight hours should occur. The 15 and 17 meter bands should provide good worldwide propagation on "Good" days during the daylight hours, and excellent trans-equatorial conditions, peaking during the afternoon hours. The 20 meter band ought to be very good from sunrise to sunset, with conditions peaking during the early morning and mid-afternoon hours. The 30 and 40 meter bands will show fine DX opportunities during the late afternoon and through the evening hours, and again in the early morning hours. Short skip between 100 and 1,000 miles during the day, and beyond 1,000 miles at night, should prevail on "Good" days. The 80 and 160 meter bands should show fairly good DX after sunset, with 160 peaking at midnight and again just before sunrise. DX on 80 meters should be good at these times, and short skip up to 1,500 miles or so should be good during nighttime hours . . . again on the "Good" days. "Fair" (F) and "Poor" (P) or "Very Poor" (VP) days will seem almost impossible . . . with the lower HF bands affected least and the higher HF bands affected the most. Even on "Poor" or "Very Poor" days, an occasional opening may occur on north-south paths across the equator. Enjoy March; it ought to be interesting. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	–	–	–	20	20	–	–	–	15
ARGENTINA	20	40	40	40	–	–	20	15	15	10	10	15
AUSTRALIA	15	20	20	–	40	40	40	–	–	20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40*	40*	–	20	15	10	15	20	20	–
HAWAII	15	20	–	–	–	–	20	20	20	10	10	15
INDIA	–	–	–	–	–	–	20	20	–	–	–	–
JAPAN	15	20	–	–	–	–	20	20	–	–	–	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	–	–	–	–	–	–	20	20	–	–	–	–
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40*	–	–	–	–	20	10	10	10	15	20
U. S. S. R.	–	–	–	–	–	–	20	15	20	20	–	–
WEST COAST	15/20	20/40	80	160	160	160	–	–	–	10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	–	–	–	–	–	–	20	–	–	–	15
ARGENTINA	20	20	20	40	40	–	20	20	15	10	15	15
AUSTRALIA	15	20	20	–	–	–	40	–	–	–	15	20
CANAL ZONE	15	20	40	40*	40*	–	20	15	10	10	10	15
ENGLAND	40	40	80	–	–	–	–	20	15	15	20	40
HAWAII	15	20	–	40	40	40*	40*	20	20	15	10	15
INDIA	–	–	–	–	–	–	–	20	–	–	–	–
JAPAN	15	–	–	–	–	–	–	20	–	–	–	15
MEXICO	15	20	40	40*	40*	–	20	15	10	10	10	15
PHILIPPINES	15	20	–	–	–	–	–	20	–	–	–	15
PUERTO RICO	15	20	40	40*	40*	–	20	15	10	10	10	15
SOUTH AFRICA	20	40	–	–	–	–	–	15	10	10	15	20
U. S. S. R.	–	–	–	–	–	–	–	20	15	20	–	–

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	–	–	–	40	40	40	–	–	20
ARGENTINA	15	20	–	40	60	–	–	20	–	10	10	15
AUSTRALIA	10	15	20	20	–	–	40*	40*	20	20	15	15
CANAL ZONE	15	20	20	–	–	–	–	20	15	10	10	10
ENGLAND	20	40	40	–	–	–	–	–	15	15	20	20
HAWAII	10	15	20	40	40	60	–	20	20	15	15	10
INDIA	–	15	20	–	–	–	–	–	20	–	–	–
JAPAN	10	15	20	–	–	–	40	40	40	–	–	20
MEXICO	15	20	20	–	–	–	–	20	15	10	10	10
PHILIPPINES	10	15/20	15/20	–	–	40	40	40	–	20	–	20
PUERTO RICO	15	20	20	–	–	–	40	40	40	–	–	20
SOUTH AFRICA	20	20	–	–	–	–	–	–	15	10	15	15
U. S. S. R.	–	–	–	–	–	–	–	–	20	20	–	–
EAST COAST	15/20	20/40	80	160	160	160	–	–	–	10	10	15

*Try 80 meters.

The bands shown represent the highest usable a these times on "Good Days."

Note that the lower frequency bands open first and close last.

MARCH 1993

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-P	2 F-P	3 F-P	4 P-F	5 F	6 F
7 F-P	8 P-VP	9 VP-P	10 P	11 P	12 V-P	13 P
14 P-F	15 F	16 F	17 F-P	18 P-F	19 F	20 F
21 F	22 F-G	23 G	24 G	25 G	26 G	27 G
28 G-F	29 F-P	30 P	31 VP			