73 Amateur Radio Today

APRIL 1992
ISSUE #379
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A WGE Publication
International Edition

Special Antenna Issue

Build These Great Antenna Projects

- Monoband Yagi
- Plumber's Delight
- Flower Pot Special
- Arrow Antenna

***73* Reviews**

- AOR AR3000
- Easy-PC Software
- Heil Microphones

0 74820 08725 1 04

6 Reasons w
build your sys

IC-725 HF Transceiver PS-55 Power Supply IC-2KL Linear Amplifier IC-475 UHF Transceiver
IC-275 VHF Transceiver

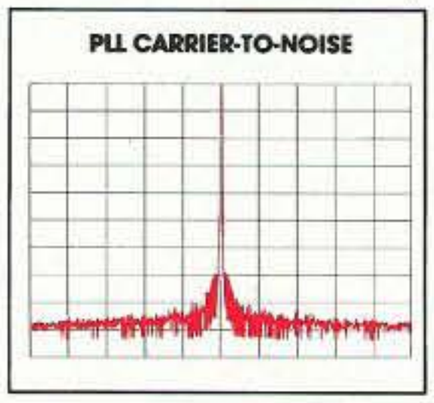
The IC-725 system above is just one example of how you can build your system.

"Don't just buy a radio. Build a system." Experienced ham operators have been giving this advice for a long time. As you build your station, you don't want "stand alone" rigs that cannot integrate with the rest of your equipment. You can avoid serious disappointments in the future by comparing compatibility, performance, reliability and service *before* you purchase each component of your system.

1 A HIGHER LEVEL OF PERFORMANCE

If you have ever made a weak signal QSO, had it fade out, then dialed the same frequency on an ICOM transceiver and found a strong, clear signal... you're already aware of ICOM's superior performance.

We have devoted three decades of research and design to ensure that our transceivers consistently meet or exceed your critical expectations. Our engineers have achieved a balance of dynamic range, selectivity and sensitivity thought unobtainable a few years ago. Their development of the ICOM DDS System, with an extremely low carrier-to-noise ratio, has resulted in loud and clear transmissions and the ultimate in HF receiver performance.



2 DESIGNED FOR COMPATIBILITY

It has been said many times, "Once you learn to operate one ICOM radio, every other ICOM is a snap to pick up." This is especially helpful as you upgrade or when you operate two or more transceivers simultaneously.

Even more important is the interchangeable, system design of ICOM equipment. This allows the integrated operation of your HF, VHF, UHF, antenna tuner, power amplifier, microphone and even your PC.

3 RELIABILITY YOU CAN COUNT ON

Ever wonder why you rarely see an ICOM radio at a swap meet? A remarkable majority of ICOM transceivers made in the last fifteen years are still making contacts in ham shacks around the world.

ICOM's outstanding reputation for reliability is a result of our integrity of construction. We use only the highest quality components and do not skimp on important details (i.e. heavy duty front panels and one-piece heat sinks).

When you compare a transceiver's value over several year's time, it is well worth buying the best.

4 CUSTOMER SERVICE THAT WILL KEEP YOU ON THE AIR

ICOM serves you regionally with four factory service centers. We provide a Customer Service Hotline for technical support and answers to your many

HF SYSTEMS

ny you should tem with Icom.

IC-970 UHF/VHF Transceiver IC-2KL Linear Amplifier IC-765 HF Transceiver

This IC-765 system is another classic combination of ICOM components.

questions. ICOM averages 7 to 10 days turnaround on radio servicing. And we still carry complete lines of parts for radios built years ago. Can other manufacturers compare to ICOM's service?

5 THE LEADING EDGE OF TECHNOLOGY

ICOM continues to be on the leading edge of technology and innovation. We pioneered digital control technology and made history by eliminating the need for manual adjustment in the transmitter final amplifier stage.

ICOM produced the FIRST all-transistorized HF amateur transceiver. We were also the FIRST to use fiber optics to create a truly modular multi-band amateur mobile radio.

6 THE MORE YOU LEARN THE MORE YOU WILL WANT AN ICOM

Ask experienced amateurs what they look for in a transceiver. Learn which features and performance characteristics are essential to quality operation and which are not. Notice which brands are winning all of the contests and DX competitions around the world. The more you learn, the more distinct advantages you will see in ICOM's quality, performance, compatibility and reliability.

At ICOM, our heritage is built on amateur radio. We are dedicated to its growth and progress. Our company is comprised of over 90% licensed amateurs and we collectively strive to make ICOM equipment the benchmark to which all others are compared.

Simply, the best.

FOR MORE INFORMATION:

See your ICOM Dealer or call the ICOM Brochure Hotline 1-800-999-9877.

ICOM America, Inc., 2380-116th Ave. N.E.
Bellevue, Washington 98004
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All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 6R292

ICOM

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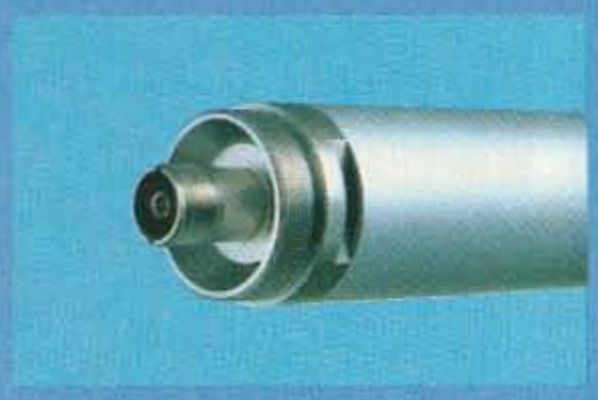
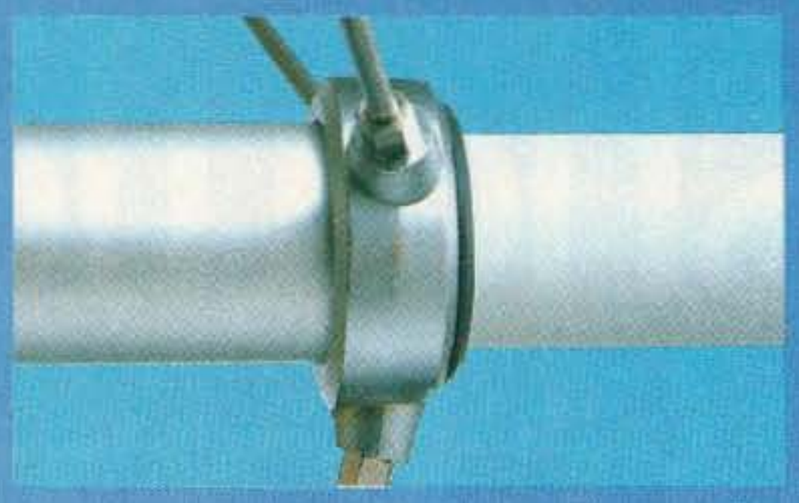
CIRCLE 179 ON READER SERVICE CARD

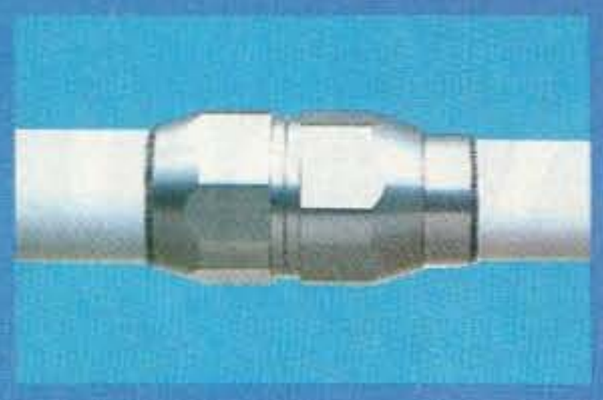
THE DIAMOND ANTENNA
THE STANDARD BY WHICH ALL OTHERS ARE JUDGED.

DIAMOND ANTENNA

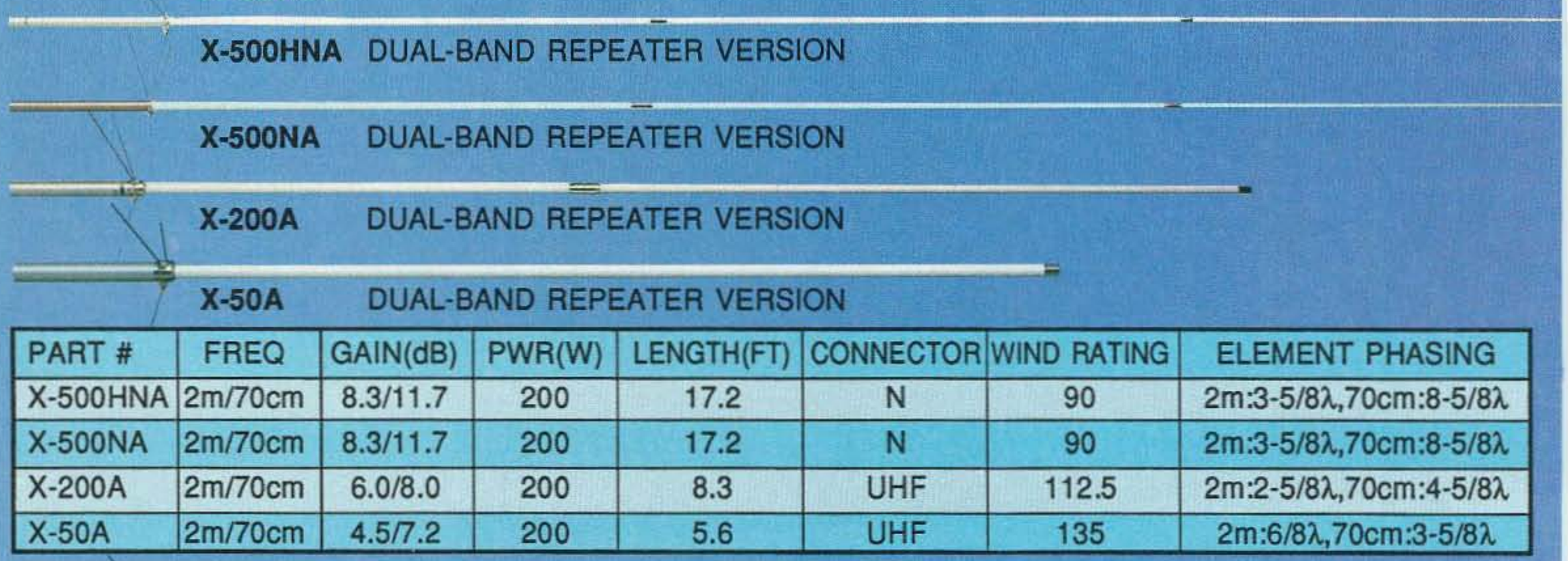
BASE/REPEATER ANTENNAS







X series



X-500HNA DUAL-BAND REPEATER VERSION

X-500NA DUAL-BAND REPEATER VERSION

X-200A DUAL-BAND REPEATER VERSION

X-50A DUAL-BAND REPEATER VERSION

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
X-500HNA	2m/70cm	8.3/11.7	200	17.2	N	90	2m:3-5/8λ,70cm:8-5/8λ
X-500NA	2m/70cm	8.3/11.7	200	17.2	N	90	2m:3-5/8λ,70cm:8-5/8λ
X-200A	2m/70cm	6.0/8.0	200	8.3	UHF	112.5	2m:2-5/8λ,70cm:4-5/8λ
X-50A	2m/70cm	4.5/7.2	200	5.6	UHF	135	2m:6/8λ,70cm:3-5/8λ

U series VHF/UHF MULTIBAND

U-5000A

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
U-300A	70cm/23cm	8.6/13.2	150	8.3	N	110	70cm:4-5/8λ, 23cm:10-5/8λ
U-5000A	2m/70cm /23cm	4.5/8.3 /11.7	150	6.0	N	135	2m:6/8λ,70cm:3-5/8λ, 23cm:7-5/8λ

F series VHF/UHF MONOBAND

F-23A

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
DP-GH62	6m	6.0	200	21.0	UHF	78	2-5/8λ
F-22A	2m	6.7	200	10.5	UHF	112	2-7/8λ
F-23A	2m	7.8	200	15.0	UHF	90	3-5/8λ
F-142A	1 1/4m	5.5	200	6.0	UHF	110	2-5/8λ
F-718A	70cm	11.5	250	15.0	N	90	18-1/2λ
F-1230A	23cm	13.5	100	10.5	N	90	25-1/2λ

*F-718L:420~430MHz,F-718J:430~440MHz

FEATURES

- WIDE-BAND performance
- VSWR 1.5:1(nom.)
- Factory adjusted, no tuning required
- Weatherproof
- Stainless steel radials & hardware
- UPS shippable
- Rugged fiberglass radome(DP-GH62 thick-wall aluminum)
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ASSOCIATE PUBLISHER
David Cassidy N1GPH

MANAGING EDITOR
Bill Brown WB8ELK

PRODUCTION EDITOR
Hope Currier

EDITORIAL ASSOCIATES
Sue Jewell
Joyce Sawtelle

CONTRIBUTING EDITORS
Mike Bryce WB8VGE
David Cowhig WA1LBP
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Jim Gray W1XU/7
Chuck Houghton WB6IGP
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Dr. Marc Leavey WA3AJR
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Joe Moell KØOV
Carole Perry WB2MGP

ADVERTISING SALES REPRESENTATIVES
Dan Harper
Louise O'Sullivan

ADVERTISING COORDINATOR
Sue Colbert

1-603-525-4201
1-800-225-5083
FAX (603) 525-4423

PRODUCTION MANAGER
Viki Van Valen

GRAPHIC DESIGN
Rachel Timper

GRAPHIC SERVICES
Ruth Benedict
Dale Williams
Theresa Verville

TYPESETTING
Linda Drew
Steve Jewett

GRAPHICS PHOTOGRAPHER
Dan Croteau

WGE PUBLISHING INC.

CHIEF FINANCIAL OFFICER
Tim Pelkey

CIRCULATION MANAGER
Harvey Chandler

To subscribe: 1-800-289-0388

Editorial Offices
WGE Center
Forest Road, Hancock NH 03449
603-525-4201, FAX (603) 525-4423

Subscription Services
1-800-289-0388

Colorado/Foreign Subscribers
call 1-303-447-9330

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Cover: "Little Hamshack on the Prairie."

The VHF/UHF contest station of Pete Sias WBØDRL in Salina, Kansas. Pete has a 28-foot dish on a 5-inch gun mount for 1296 MHz and antenna arrays for 6m–1296 MHz.

Cover photo by Pete Sias WBØDRL.

Plant your antenna. . . see page 18.

REVIEWS

DEPARTMENTS

FEEDBACK... FEEDBACK!

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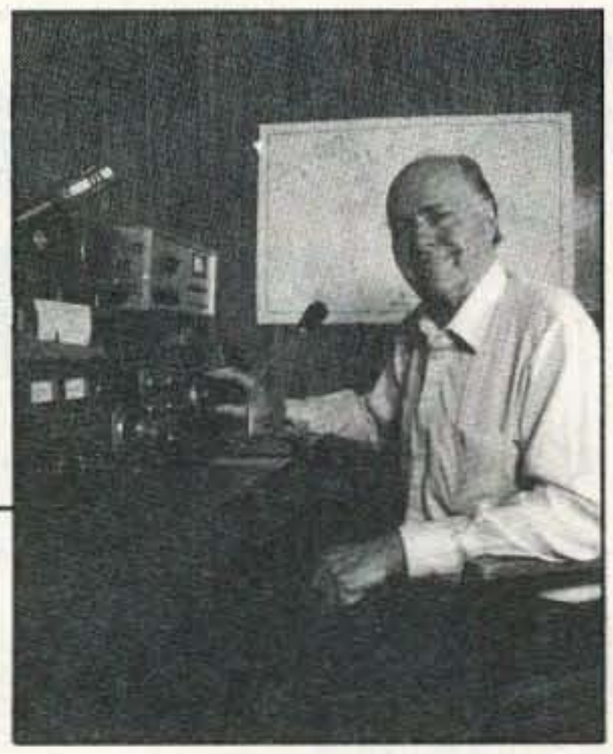
Wayne Green W2NSD/1



How About Dayton?

We hams are attracted to Dayton every spring like lemmings to a cliff. It's an urge we can't explain. It's an ultimate wallow in the latest equipment . . . in the world's largest ham flea market . . . and a yearly gathering for each of the dozens of special interests which all together go to make up this weird hobby we call ham radio.

It's a place to meet and talk about MARS, microwaves, slow-scan, packet, amateur TV, meteor bounce, DXing, contesting, certificate hunting, RTTY, AMTOR. It's a place to see old friends again. It's a time to say hello to me and tell me you've been reading my baloney since my *CQ* days 37 years ago. Or do I remember meeting you at the airport in Karachi in 1959? Or that you've got my KC4AF card from Navassa in 1958.

It's a time to see what AEA has been up to in their labs . . . to see what Bob Heil has for you this year . . . to see the faces behind the ads . . . to meet and talk with our ham entrepreneurs . . . to look over Ramsey's new kits . . . to see MFJ's latest gear . . . to shop for software bargains and computer accessories. It's a madhouse. It's a funhouse . . . and the barbecue sandwiches are fabulous. It starts April 24th . . . will I be seeing you there?

As I mentioned last month, I've been wondering what I might talk about this year. My work with the New Hampshire Economic Development Commission has not just taken a lot of my time, it's forced me to give a lot of thought to what's been going on in America, not just in amateur radio or the music business. It's gotten me to think about how things have been changing and where it looks like they're going. It's had me polishing my crystal ball.

The Commission has been meeting every three or four weeks up in the state capitol in Concord. Despite my getting to the Consumer Electronic Show in Las Vegas in January and to the 17th Annual Ham Colloquium in Aspen (where the skiing was superb as Jim Brink N4NG and I zoomed down the well-groomed intermediate trails, while Chuck KO1I and Eric KV1J tackled the double diamond trails, finally landing Chuck in the hospital after a spectacular wipe-out).

The skiing was fun, but the conferences were serious. We particularly discussed the possible future of our hobby. With the old reasons for our being allowed to use our frequencies no longer valid, we agreed that either amateur radio had to reinvent itself or it would be pushed aside by commercial interests exploiting new technologies.

Some of us old-timers remember when new technologies were pioneered by hams. I remember talking with a young Jack Babkes W2GDG in his apartment in Brooklyn in 1946 about his narrowband FM concept. I quickly built an NBFM modulator into my Meissner Signal Shifter for use on 75m and another into an SCR-274N (ARC-5) for use on 20m.

I remember building my first RTTY unit in 1949. It had over a dozen tubes and filled a 2' 19" rack panel. It had auto-start and stop, automatic acknowledgment of message receipt, and so on. The teletype was an old Model 12 I bought from John Williams W2BFD, the father of ham RTTY.

John was a tinkerer. He built one of the very first telephone answering machines, which Ma Bell hated. He used a 78 record player to answer the phone and then recorded the messages on a wire recorder. All automatic. He also upset the FBI by building tiny transmitters which the Syrians used to bug the Israeli consular limousines.

Yes, there was a time when we more than paid our dues for the frequencies we were using. This investment really paid off the best during WWII when 80% of us went into the armed forces as radio ops and electronic technicians. My *USS Drum* crew reunion is just a week after Dayton this year. Amateurs contributed very significantly to our winning the war.

But that's a far cry from today. Our hobby ground almost to a halt in 1964 and has never really recovered. We did contribute in the early '70s when we pioneered repeaters and thus made cellular telephones possible. Would that have happened if I hadn't pushed repeaters so hard in *73*, with the *Repeater Bulletin*, and with symposiums? I don't think so, but then perhaps I'm exaggerating my part in all that . . . another old man's fantasy.

We no longer contribute technically trained people for possible use in the military. Our frequencies are no longer needed as a reserve for wartime use by the military. We no longer are at the cutting edge of technology. We are no longer doing much pioneering of new communication modes. Even our vaunted emergency communications services have faded. And let's not even pretend about international goodwill.

So we need to reinvent amateur radio and make it relevant in the 1990s. We haven't got a lot to start with. Some of our bands sound worse than anything I've ever heard on CB. Many of our clubs are run by old-timers who discourage newcomers. Ninety-nine percent of our school radio clubs disappeared in the '60s, so few modern-day kids have even heard of our hobby, much less are attracted to it.

Our only real national organization is in the hands of old CW men, few with any background in business or marketing. They fought the no-code license for years until finally forced to grudgingly accept it. They've promised more wonders than George Bush, and delivered nothing. They've let our bands turn into a mess. They've done almost nothing to promote our growth. Just as Washington is the seat of our country's problems, I see Newington as the heart of our sickness.

The Reinvention

Okay, I've gloomed and doomed you . . . now let's look at some of our potential strengths. We know that if America is going to regain its strength in manufacturing we're going to have to have a better educated work force. We also know that today that means technology, not doctors of philosophy. Well, we've got one of the hottest high-tech hobbies in the world.

With a little cleaning up and some serious marketing, we can get kids by the millions interested in learning about electronics and communications. They'll do it because it's fun! Unless we lose our microwave bands through disuse, we have more than enough room for 10 million new hams.

Once we get going with digital voice and computer communications, complete with time domain systems and data compacting techniques, we'll have plenty of room for everyone. But this stuff is child's play and we've been freezing out the children. When solid state came along I tried to publish every article I could get on it. The old-timers, still fondling their tubes, hated it. My articles were almost all written by kids.

When I started publishing computer circuits in the mid-'70s, my authors were kids. When I published *Byte* in 1975, my authors were mostly kids.

By getting rid of the kids in amateur radio 30 years ago we've managed to keep ourselves in a time warp. The League is still running its old CW traffic system . . . though there is a move afoot to update their name. Where did the "Relay League" come from? Well, in the very old days spark rigs couldn't be heard very far, so when the old-timers wanted to send messages any distance they had to be painstakingly relayed from one spark station to the next. Not much has changed in that aspect of the hobby. They're still busy copying messages and rekeying them over traffic nets. I wonder if echoes of W3CUL still haunt the 80m nets. She relayed millions of messages over the years.

I think it was around 1954 that I set up a RTTY station in a store on 42nd Street to handle Christmas messages to our troops. From there we sent them on 2m to relay stations on Long Island and then to our military in Europe. I made the "Brass Pounder's League" (BPL) in *QST* for a month with our traffic . . . without ever touching brass.

If we can bring the ARRL into the 1990s and get it going as an amateur radio marketing organization, we'll be well worth whatever billions of dollars in frequencies we need. We need to get kids by the millions enthused and busy learning about electronics and communications. We need to make it fun to learn.

Of course, that's the heart of the proposals I've made to the New Hampshire Economic Development Commission. I want to re-invent the New Hampshire educational system and turn it into a way for us to generate a high-tech work force. Remember, our present educational system was designed to turn out farmers and blue-collar factory workers, not engineers, technicians and scientists.

Are you going to be a passive bystander in all this or are you going to get busy and start making things happen in your area? Are you a "Joe Six-Pack" who doesn't read books or newspapers, doesn't vote and contributes nothing much to the world or America? Are you a couch potato? You know, it's surprisingly easy to make a difference.

Of course there's a danger here too. A pathetically high percentage of our activists are emotionally driven by some cause. They make a lot of noise and get on the evening news. Then, a while later, we find that their lack of knowledge about their cause has screwed things up for us.

We've had some excessively expensive legislation forced through by acid rain fanatics . . . and now we find their "facts" were wrong. If you've been reading the science magazines you know that our worries over automobile emissions have been way off-base.

Continued on page 90

TS-450S
All This and More!

Building on a proven performer, Kenwood continues its H.F. superiority with the new TS-450S! No other compact H.F. transceiver can offer you all the features of the popular TS-440S plus an impressive new set of deluxe features designed to give you that "Kenwood Edge" in H.F. operations.

- **100 Watts on all nine Amateur bands — SSB, CW, FM, FSK modes.**
- **General coverage receiver. 150kHz-30MHz.**
- **108 dB Dynamic Range with Advanced Intercept Point (AIP).**
- **100% Duty Cycle Transmitter allows continuous transmission (Key Down) at full power output for periods up to one hour with PS-53 heavy duty power supply.**
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- **New CW REVERSE MODE and PITCH CONTROL.**
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Kenwood meets or exceeds all specifications. Contact your dealer for a complete listing of specifications and accessories. Specifications are subject to change without notice. Complete service manuals are available for all Kenwood transceivers and most accessories. One year warranty in the U.S.A. only.

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Double Header!

TH-77A

Compact 2m/70cm Dual Band HT

Here's a radio that deserves a double-take! The TH-77A is a feature-packed dual band radio compressed into an HT package. The accessories are compatible with our TH-75, TH-25, and TH-26 Series radios. Repeater and remote base users will appreciate the DTMF memory that can store *all* of the DTMF characters (*, #, A, B, C, and D) that are usually required for repeater functions!

- **Wide band receiver coverage.** 136–165 (118–165 [AM mode 118–136] MHz after modification) and 438–449.995 MHz. TX on Amateur bands only. (Two meter section is modifiable for MARS/CAP. Permits required.)
- **Dual receive/dual LCD display.** Separate volume and squelch controls for each band. Audio output can be mixed or separated by using an external speaker.
- **Cross band repeat function.**
- **Dual Tone Squelch System (DTSS).** Uses standard DTMF to open squelch.
- **CTCSS encode/decode built-in.**
- **Forty-two memory channels.** All channels odd split capable.
- **DTMF memory/autodialer.** Ten 15-digit codes can be stored.
- **Direct keyboard frequency entry.** The rotary dial can also be used to select memory, frequency, frequency step, CTCSS, and scan direction.
- **Multi-function, dual scanning.** Time or carrier operated channel or band scanning.
- **Frequency step selectable for quick QSY.** Choose from 5, 10, 12.5, 15, 20, or 25 kHz steps.
- **Two watts (1.5 W on UHF) with supplied battery pack.** Five watts output with PB-8 battery pack or 13.8 volts. Low power is 500 mW.
- **DC direct-in operation** from 6.3–16 VDC with the PG-2W.
- **T-Alert with elapsed time indicator.**
- **Automatic repeater offset on 2 m.**
- **Battery-saving features.** Auto battery saver, auto power off function, and economy power mode.
- **Supplied accessories:** Flex antenna, PB-6 battery pack (7.2 V, 600 mAH), wall charger, belt hook, wrist strap, keyboard cover.

Optional accessories:
• **BC-10:** Compact charger • **BC-11:** Rapid charger • **BH-6:** Swivel mount • **BT-6:** AAA battery case • **DC-1/PG-2V:** DC adapter • **DC-4:** Mobile charger for PB-10 • **DC-5:** Mobile charger for PB-6, 7, 9 • **PB-5:** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6:** 7.2 V, 600 mAh NiCd pack • **PB-7:** 7.2 V, 1100 mAh NiCd pack • **PB-8:** 12 V, 600 mAh NiCd for 5 W output • **PB-9:** 7.2 V, 600 mAh NiCd with built-in charger • **PB-11:** 12 V, 600 mAh OR 6 V, 1200 mAh, for 5 W OR 2 W • **HMC-2:** Headset with VOX and PTT • **PG-2W:** DC cable w/fuse • **PG-3F:** DC cable with filter and cigarette lighter plug • **SC-28, 29:** Soft case • **SMC-30/31:** Speaker mics. • **SMC-33:** Speaker mic. w/remote control • **WR-1:** Water resistant bag.

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Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and features are subject to change without notice or obligation.

QRX . . .

Mir News

On 17 March at 10:22 UTC a Soyuz module will lift off to take the next pair of Soviet replacement cosmonauts, plus a visiting German cosmonaut to *Mir*.

They should dock at 11:30 UTC on 19 March. All three have amateur radio callsigns, and the DL call will be either DP1MIR or DP2MIR. They will use 145.550 MHz simplex FM speech and packet radio as usual, plus a connected onboard digital speech system acting as a "repeater," which will listen for one minute and then replay the content back for one minute.

Sergei U5MIR, Alex U4MIR, and the visitor will return to Earth around 25/26 March, and UA3CR is suggesting to RSF that for posterity they retain their callsigns for terrestrial use, rather in the way that Ernst Krenkel UP0L2 did his. *TNX G3IOR, PA0DLO, W2RS, via Space News.*

Olympic Restrictions

The French pulled the plug on a part of the 2 meter band during the Olympic Games, and this move may possibly have a serious negative impact at the World Administrative Radio Conference and on other fronts as well.

According to DB2OS, a special bulletin from the REF (the French national radio society) states that during the 1992 Olympic Winter Games in Albertville, the 2 meter frequencies of 144.000–144.050 and 145.950–146.000 MHz were completely occupied by team members and service teams of some of the Winter Olympic Games' participating nations.

During all of February, any activity from ham stations in the French Departments of Ain, Haute-Savoie, Isere and Savoie were forbidden by order of the DRG and the amateur allocation in the sections of the 2 meter band listed above was suspended. The DRG (Direction de la Reglementation Generale) also noted that any violation of this regulation would have negative consequences between the DRG and the REF in future discussions.

According to DB2OS, this was far more than a national affair, as it was a violation by the DRG against the internationally accepted highly sensitive EME band and the equally delicate exclusive allocation for the Amateur Satellite Service, of which 145.95 MHz to 146.00 MHz are a major part. Such an action damages highly important activities internationally. DB2OS believes that this may be a reaction to criticism leveled at the French radio administration over the "SARA" amateur astronomy satellite improperly given an assignment in the Amateur Satellite Service. Nevertheless, DB2OS feels that a formal protest of this "flagrant action" by AMSAT, ARRL and the overall International Amateur Radio Union would seem to be in order. *TNX G3IOR, AMSAT-NA and Westlink Report No. 619.*

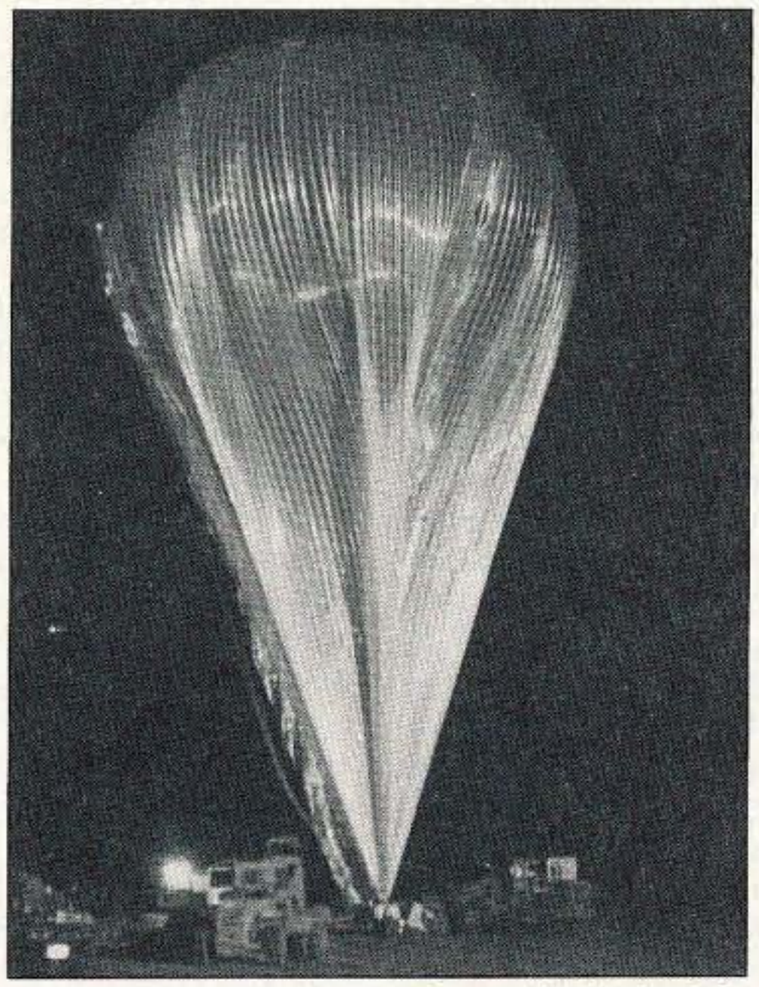


Photo. The massive 180-foot-tall Earthwinds balloon prepares for flight during the last launch attempt on February 22. Photo by Jon Pifer WM8W.

Earthwinds Delayed

The launch of the Earthwinds manned balloon flight has been delayed until next November. This flight will take three balloonists on a record-breaking non-stop journey around the world, while traveling with the jet stream at 35,000 feet in a pressurized gondola. They almost launched the massive two-balloon system early Saturday morning, February 22, from the Loral Airbase in Akron, Ohio. Unfortunately, the wind speed at ground level never became calm enough to completely assemble and launch the balloon system. The 180-foot-tall balloon is capable of lifting in excess of 20,000 pounds and contains over 300,000 cubic feet of helium.

Jet stream conditions as well as the weather around the world are not favorable for the flight after February. Therefore, the decision was made to delay the trip until next November when worldwide weather conditions give the crew their best chance at a successful circumnavigation of the globe.

The pilot of the balloon, Larry Newman KB7JGM, will activate the amateur radio experiment during the flight on a frequency of 28.303 MHz. Thanks to the efforts of Bob Rau N8IYD, Jud Nichols N8RXT, and Bill Brown WB8ELK, a voice telemetry system was designed to relay the balloon's latitude, longitude and ground speed, based on data obtained from the onboard GPS (Global Positioning Satellite) system. It will transmit the information at 15, 30, 45 and 55 minutes past each hour during the flight. Special thanks go to Mike Mouser, Jerry Knight and Loney Duncan of Rockwell International who integrated the telemetry package with the gondola's HF radio.

Antenna Patent

Ham-Pro Antennas of Sacramento, California, was recently granted patent #5,068,672 for the first major improvement in antenna matching in the past 50 years! The improved method of feeding antennas is called the balanced double gamma feed system.

The new invention feeds both sides of a grounded dipole through a non-frequency-sensitive balun which is part of the new feed loop. This balun is not obvious by examination, nor is it external. This loop is in series with the dipole. Its reactance is opposite that of the dipole, resulting in more than twice the best VSWR bandwidth found in conventional feeding methods.

Besides wider VSWR bandwidth, random radiation from the feed is eliminated, so forward gain is increased, and the front-to-side, as well as the front-to-back, ratios are greatly improved.

TVI and EMI are also reduced. Harmonic radiaton is down at least 30 dB. The very wide VSWR bandwidth makes it possible for the company to factory-tune their antennas, so no tuning of the feed is necessary. In fact, all their antennas are pre-tuned, weather-proofed, and sealed at the factory after VSWR tests.

Ham-Pro manufactures a complete line of amateur monobanders using this patented system. More information may be obtained by contacting Peter Onnigian at Ham-Pro, 6199 Warehouse Way, Sacramento CA 95826; (800) 879–7569.

The Greening of *73*

Subscribers will notice that starting with this issue, *73 Amateur Radio Today* will be arriving without the plastic wrapping (called a "polybag"). After researching the matter, we decided that the minimal protection offered by the polybag did not justify the negative environmental impact of its use. We hope our readers will support this move toward a "greener" planet.

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 525–4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 525–4438 (300–2400 bps), 8 data bits, no parity, one stop bit. You can also send news items by FAX at (603) 525–4423.

Number 3 on your Feedback card

LETTERS

From the Hamshack

Denis Catalano WD4KXB, Woodbridge VA Wayne is always saying, "go do it"—go on a DXpedition. So we did. KJ4VG and I drove 22 hours to put Zone 2 on the air during the C&WW phone contest. We made over 3,000 QSOs, and loved it.

John Wiesenmeyer NX0T, ex-WN9HFA, WA9PLV, Divernon IL All of the editorials in the December 1991 issue of *73 Amateur Radio Today* are worthy of note. Since you don't have much time to read lots of trivial fan mail, I'll get to the item of singular importance.

Your mention of the FCC establishing some sort of fee to allow the handling of requested callsigns is a SPECTACULAR IDEA!!! Sir, this callsign business, from where I view the matter, has become a deplorable situation. Who would ever have dreamed our callsign system could become such a hodge-podge mess? Dr. Green, I'd pay CONSIDERABLY MORE THAN FIFTY DOLLARS to get rid of my present idiotic callsign, in exchange for WA9HFA, (never issued, by the way), which I would have received had I upgraded from Novice (WN9HFA) before my ticket expired in 1964. If not that, ANY traditional W9 or WA9 callsign.

Any muscle you can throw at this effort would seem a great service to our hobby. I would pay PLENTY, whatever the FCC wants, to allow me to again hold a traditional ham callsign. I wouldn't bat an eye to spend several hundred dollars to unload this bogus callsign of NX0T, either up-front or as bribe money. Wouldn't matter to me one way or the other. And you would be surprised, sir: I'm far from being the Lone Ranger with this view, as you surely realize as well. 300,000 hams furnishing a $100 application for a special callsign request would net the FCC no less than THIRTY MILLION DOLLARS. If they can't issue special request callsigns with that sort of revenue, then there is something seriously wrong with the methods and the thinking of the FCC directors.

I hope you can continue to press this issue in *73*, and encourage your readers to pester the hell out of the FCC to straighten out this blithering mess.

Thank you for listening to my views.

Kenneth A. Stevens KN2A, San Jose CA For a few months there have been many comments concerning the QRM on weekends because of contest operations. Years ago I wrote to the ARRL suggesting a few procedures that might help lessen the problem. I even enclosed an SASE to get their response. The VIPs did not agree so they, as usual, did not take the time to respond. I have discussed this QRM problem over and off the air with many hams and have yet to find one who doesn't agree that the following ideas would work.

All-mode contests should not run for the full weekend. Many hams work all week and the only time they can talk to friends or family, if across the country, is on HF. Unless they have a linear, beam, etc., they cannot compete. If a contest were limited-mode, they could run phone during a CW test and CW during the phone test. On phone contests the frequencies of operation could be the bottom 50 kHz of the General class, and the top 50 kHz of the Advanced class band. This would give the non-contesters an area to enjoy other ham activities. The top edge and bottom edge of the contest frequency operation could be monitored by official observers. Any contester who was found operating outside of the assigned area would be penalized or disqualified from the contest. This would give the 00s some practice and experience. It might cut down on some of the big boys running excessive power, overmodulating and spilling outside of band edges.

I would like to hear comments from those who disagree. I feel it is time we all give others the consideration that we feel we are entitled to. I have read so many times that we should tune up on a dummy load. I must ask, how can anyone match an antenna without using a tuner and putting out a carrier to do it? Yes, we can roughly set the tuner on strong receive. Or we can invest in a noise bridge, etc. But usually the carrier is the final answer. I do feel, however, that knowing where your carrier is going to be is the best answer. There is no accepted standard by manufacturers as to where the carrier is in relation to the receive frequency. The old tube rigs would offset the carrier on tune or CW above a USB listening frequency, some below a LSB frequency. On some of the later solid-state rigs on USB or LSB, the listening frequency is also the carrier frequency. If you shift to CW, your carrier is your readout and you then are listening about 800 Hz up or down from that. The advantage is that whether you are listening to an upper or lower sideband, your carrier is zero beat and will not be heard.

For the above reasons, I say, "Do not tell a person to find a clear frequency to tune up." If you do, they will put their carrier above or below a going QSO and interfere. If they learn where their carrier is, they can put it zero beat with the QSO they intend to join and apologize later if they were a few cycles of zero.

I've heard many hams complain that they have tried to break into a lower sideband phone net with a CW signal. They claim the net control cannot read CW, should not have a license, etc. Those fellows had tube rigs that shifted to USB listening on CW. The rig transmitted 800 Hz up. So the carrier was on net controls upper sideband and not heard. The new rigs would also not be heard if they zero beat the listening frequency.

Well, I've unloaded my gripes. I know I talk too much. Hi! I enjoy *73 Magazine*. I read *73*, *CQ*, and *QST*. I find *73* the best. *CQ* has too many contests; *QST*, too much emphasis on contest and traffic self-praise. I dropped membership in the ARRL years ago because they do not represent the amateur membership. They are a money-making business. I agree with Wayne nearly 100%.

Glen A. Bizeau VE1GAB, Saint John NB Canada I keep hearing you complain about how hams are never doing anything but talking. Well, I have a surprise for you.

Six months before I got my ticket, I was over at a friend's house, Bob Meade VE1BDI, and we were talking about how Nova Scotia had such a nice linking system covering most of the province and some of Prince Edward Island. We in New Brunswick were lucky to have a decent 2 meter repeater.

After I got my ticket I decided that this one ham was going to make his new-found hobby worth the nights of studying. With the help of Bob VE1BDI, Glenn VE1GMM, Brian VE1BTC and a few other guys, we were able to make this a success. I bought the equipment and a duplexer, Glenn lent us his power supply and his time, and Brian found us a good site.

Thanks to a local radio/television station we were able to put our new-found baby on the highest hill in southern New Brunswick.

Mt. Champlain reaches up 1462′ and our antenna is up a tower at the 1500′ level. The repeater, soon to be a hub, is working pretty well. We're putting out 20 watts on 443.500 (+) and can be heard over 90 miles away. We have a few minor problems of RF sneaking into the receiver, but what do you expect from a site with a 1,000,000 + watts of RF floating around? All in all, the machine works well. Soon we will be linking a few major cities into the hub and maybe we'll even get linked into WA1KAH's Patato Head Network. Then we could talk to you through the system, Wayne. Wouldn't that be fun!

P.S. I was wondering why you never mentioned anything about the night a few fellows down here talked to WB8ELK while he was in your shack on a fine evening in the spring of '91. That was one heck of a tropo duct.

Glen, it certainly was a good opening (over 300 miles). Looking forward to our next tropo contact.—Bill WB8ELK

Russ Thomas WI9B Effingham IL A Buchanan/Green ticket in '92 has my full support.

I refuse to run. If elected, I refuse to serve.—Wayne

Alfred Holden KM4TN, Greenville SC Wayne, I have been a ham for about two years now (KM4TN) and find I have a problem. Since the first thing I read in your magazine is your editorial, I pretty well know your stand on the League. My question is: Should I just bail out and quit, or should I try to change it from the inside? I'm 29 years old, make my living as a two-way service technician and find that I play guitar more than I fool with these ham radios.

Alfred, there's no known way to change the League from inside, so all you have to do is decide whether you want to subscribe to QST *or not.—Wayne*

Eric Jorgensen KE6US, ex-K1DCK, Riverside CA I just received a renewal notice which, as usual, is more confrontational than persuasive. In the letter you mention that there has been "almost no growth in the last 10 years" and that "amateur radio has been getting by on its past glory." One of your solutions is to try "other ham modes such as RTTY, AMTOR [sic] or packet." I got news for you, Wayne. All of those came into their own in the last 10 years. Even RTTY, which has been around for a long time, really didn't advance beyond the work of a few '60s diehards (including me) until the advent of home computers.

I have enjoyed the excitement of amateur radio for 35 years. I still find it as exciting now as 25 years ago—maybe more so because of all the innovations in the last several years. I sure don't see that excitement reflected in the pages of YOUR magazine. Instead, we have a few simplistic construction articles, a couple of very good columnists, and the endless ramblings of a tired old man. This might explain why the "magazine" looks more like a pamphlet these days.

Incidentally, I worked you 25 or 30 years ago on RTTY, and our QSO consisted of you sending me an interminable brag tape about an action-packed DXpedition who-remembers-where. Now I get a form letter about the same trip. What have YOU done lately for ham radio? I'll take a live QSO complete with rig and WX info anytime to a canned travelogue from a ham personality.

Your whole magazine is about YOU, not ham radio. There is more in any given issue about how easy it is to earn money in audio CD publishing than about any single ham topic. I would bet your staff sends out resumes every time you catch a cold. In the words of Sam Goldwyn, "Count me out."

John C. Watfins N8JZH, Miamisburg OH I am a subscriber to *73* and really enjoy reading your magazine. I find that it is really informative, rather than just lists of contests and DX requests.

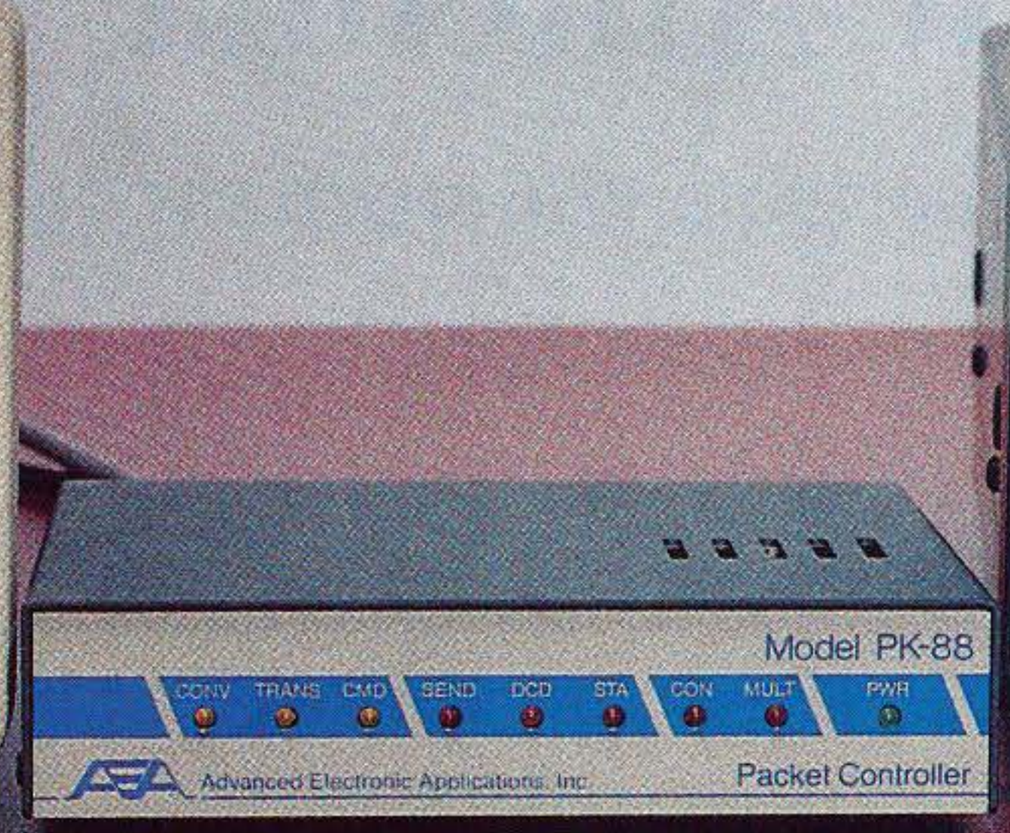
Many of your articles on radios and equipment are valuable, and the reports are useful to those of us who purchase "used" equipment. 73

Now you see it....

The PK-88 is becoming one of the most widely used packet controllers in the world. In some areas, it is outselling its closest competitor by 10 to 1!

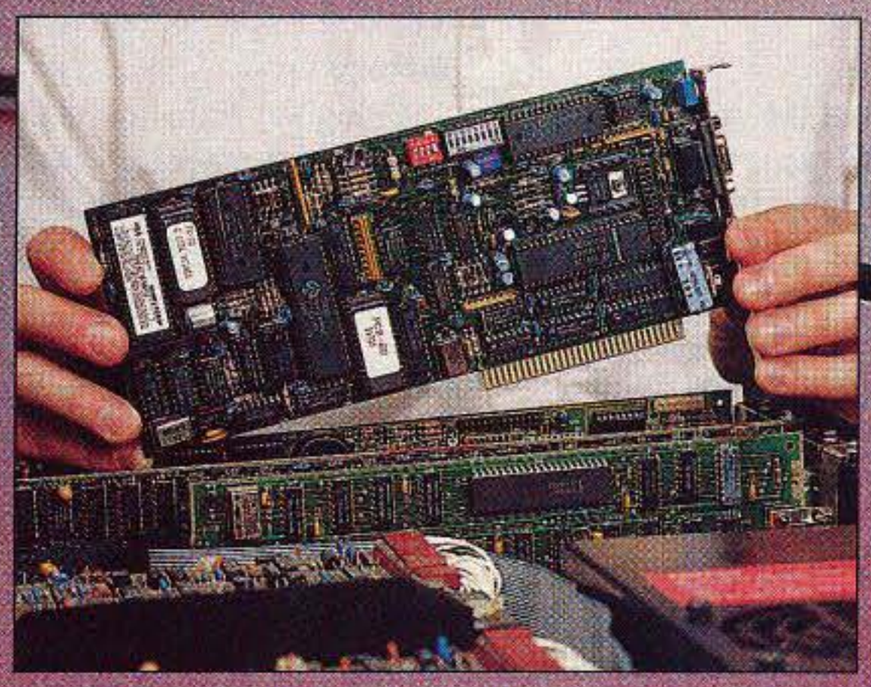
With the built-in 18k byte maildrop, you can use it as a "mini-BBS" in your area, and even automatically forward and reverse-forward traffic with your local PBBS. Or, just use it as a packet controller to help you catch that rare DX on your local DX packet cluster.

The PK-88 can be used with a dumb terminal or any computer with an RS-232 port and a communication software program (such as PC-Pakratt-88).



Now you don't.

Psst! It's in here!



The PCB-88 includes all the features of the PK-88 (above), and is easily installed in your IBM PC or compatible computer. Even if your shack is short on space, you can still have the best packet setup available.

In addition to the PK-88's features, the PCB-88 also includes TAPR's state machine DCD circuit and modem disconnect header for added performance and convenience.

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The Arrow Antenna

Hit the bull's-eye with this portable VHF sharp shooter.

by Mike Walker KA0VFF and Al Lowe N0IMW

How would you like a completely portable, 4-element 2 meter antenna that fits into its own 1" x 1" x 48" boom? Not only does it fit inside its boom, but it can be assembled in approximately two minutes. I'll just bet you are quivering with excitement! Calm down and reach for a quiver of aluminum arrows. Aluminum arrows are the secret to the versatility and exceptional gain characteristics of the Arrow Antenna.

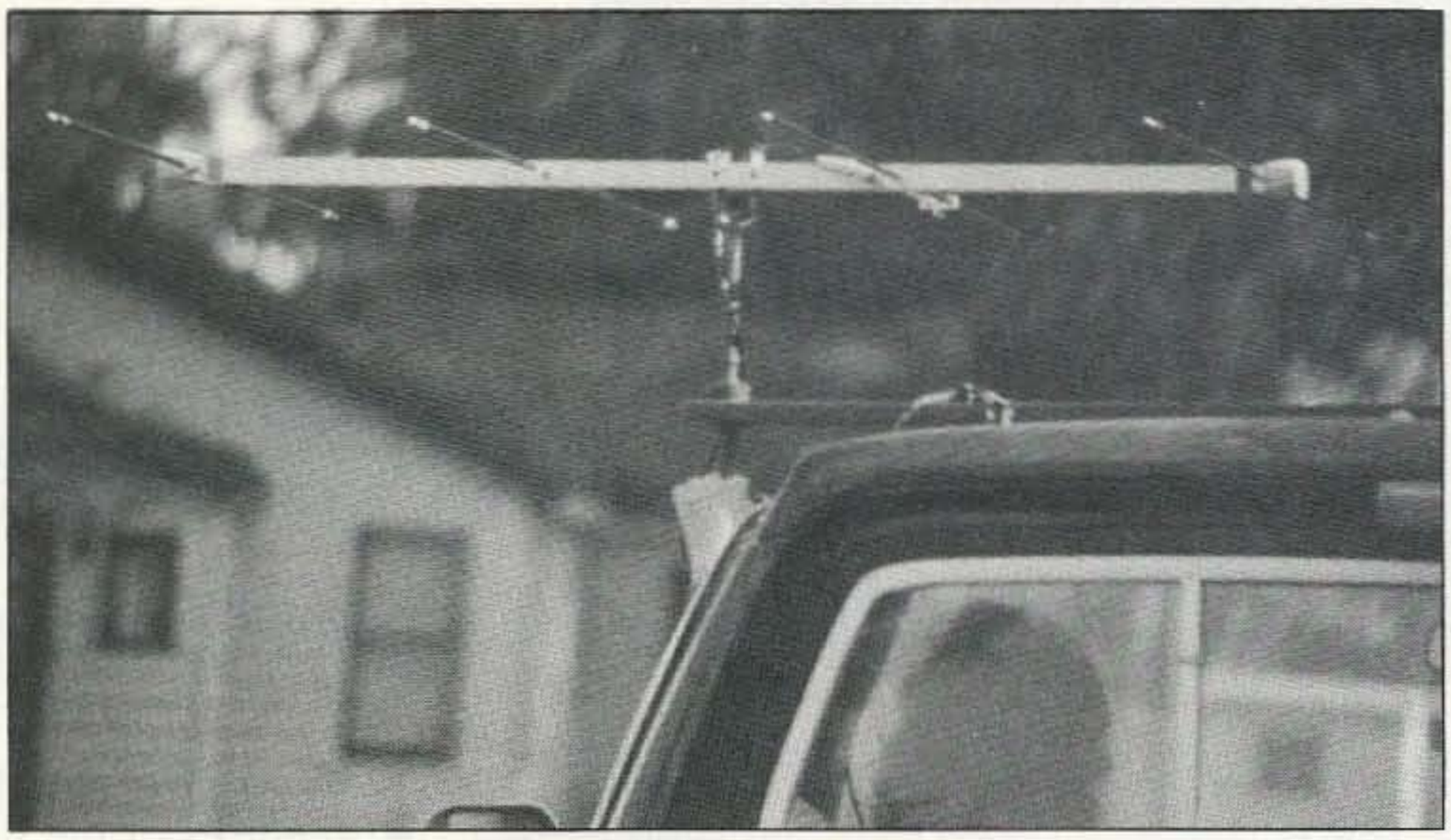

Photo A. The Arrow Antenna.

This antenna has proven to be very versatile. While hiking in the Rocky Mountain National Park, I used my antenna as a walking stick. During rest stops it was just a matter of pouring out the boom contents, taking a couple of minutes for assembly time, and I was on the air! In an emergency, this antenna is ideal. It will store easily in the trunk of your car, ready for any situation. Another advantage of the antenna is that it is not prone to damage because its contents are protected by the boom.

Foxhunting activities can be stressful to your antenna, especially during the heat of the chase. Your Arrow Antenna will be able to withstand lots of abuse, even when your partner drives under low-hanging tree limbs.

At every public service event, it seems like the check point assignments are in the worst possible locations. The Arrow Antenna will help you shoot your way out of those places where a rubber duck and an HT would not be sufficient. If you need antenna gain, portability, and a rugged antenna, then read on.

Another unique aspect of the Arrow Antenna is the gamma match. Al Lowe N0IMW is to be credited with the design of the gamma match. The gamma match makes the Arrow Antenna all the more portable. Al spent several long evenings fabricating prototypes of the gamma match before finalizing the design. When you start construction of this antenna, I am sure you will appreciate the cleverness of Al's design.

Construction

To begin construction of the Arrow Antenna you have the option of using our measurements, or to custom design your antenna for a specific frequency. Our design is not new. It is basically a copy of the standard NBS (now called the National Institute of Standards and Technology), with some variations. Our Arrow Antenna dimensions are calculated for a center frequency of 146.520 MHz. It is fairly broad-banded, having been tuned out of band for use in area search and rescue communication around 143 MHz and 149 MHz.

The materials for the antenna are readily available. If you are handy with a drill press and a hacksaw, you will have no problem building and assembling this antenna. See the Parts List for the materials needed.

Using a drill press for construction of this antenna will enhance the overall performance of your antenna. The mechanical integrity of your antenna will be a natural progression because the drill press will inherently keep all your elements parallel and perpendicular.

For our purposes, antenna performance dictated the selection of a 48" boom. Measuring from each end of the boom material, lay out the reflector element, and the second director element at 1" from the end of the boom. Mount all elements in the center of the boom width. Place the driven element 15-5/16" inches from your first mark, or 16-5/16" from the end of the boom. The spacing is slightly less than 0.2 wavelengths. In a like manner, lay out the positions for the first director. The driven element and the first director will be spaced at approximately 15-5/16" in the center of the boom. Now you have established all of your element locations (see Figure 4). At each of the element locations, drill a through-hole 11/64" in diameter for a #8-32 threaded rod.

Using the reflector as the reference for the rear of the antenna, move up to the driven element #8-32 hole location and establish the hole location for the PL259 bulkhead connector exactly 1" on center forward from the driven element, or 17-5/16" from the rear of the boom. The bulkhead connector requires a 5/8" through-hole. You should now have holes drilled for each of the elements, and the hole for gamma match and coax connections along the boom (see Figure 2). The desired polarization of your antenna will determine the location of the U-clamp. During our fabrication of the Arrow Antenna we placed the U-clamp at the balance point of the antenna. If you use the antenna in the vertical position it is imperative that the gamma match be above the boom and the coax run along the boom to the mast. If the coax is parallel, close to the driven element, antenna performance will suffer.

Each of the following measurements will be used to establish element lengths. Using a tubing cutter, scribe the outside of each element at the desired length. Grasping the element on either side of the scribe mark, you

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You'll find the perfect adjustment for your mobile whip in seconds by actually seeing the SWR as you pull the whip in and out without transmitting.

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All kinds of uses

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You'll find all kinds of uses for this totally self-contained handheld unit that'll revolutionize how SWR is measured.

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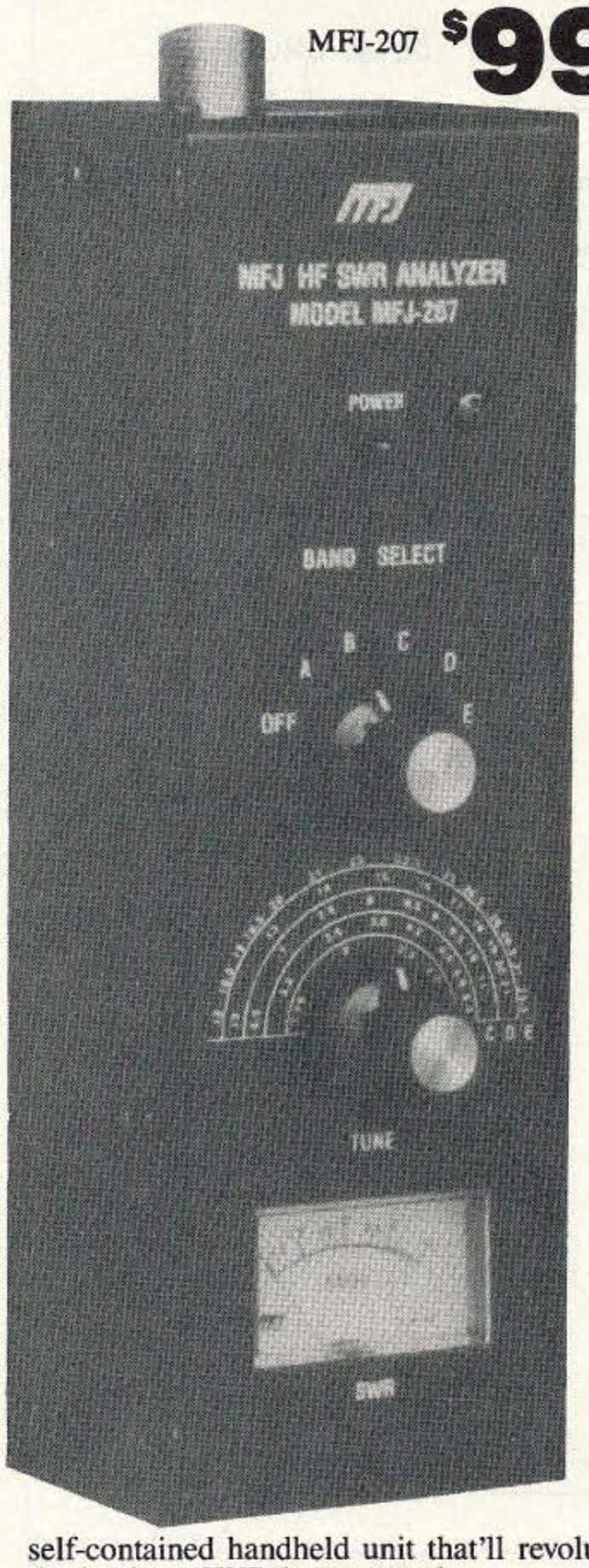

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You get a super value because several instruments are combined into a single portable handheld unit.

It has a low distortion RF generator that covers 10-160 meters, an SWR bridge that gives forward and reflected components and a computing circuit that automatically computes the SWR and displays it on the meter.

Everything is automatic. All you do is set the frequency and read SWR. It also has a frequency counter output so you can connect a frequency counter for precise digital readout.

Use 9 volt battery or 110 VAC with MFJ-1312, $12.95. 7½" x 2½" x2¼".

The best way ever to measure SWR

Here's the best way ever to measure SWR . . . so get yours today!

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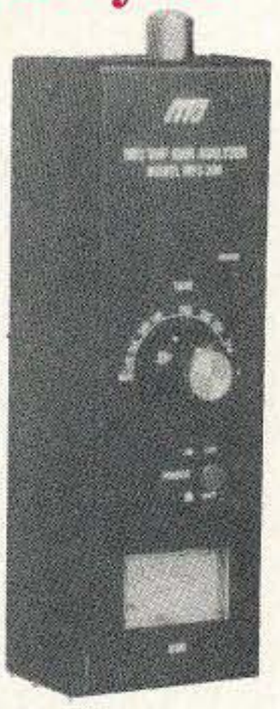

If you operate 2 meters this MFJ-208 VHF SWR Analyzer™ helps get your antennas in tip-top shape. Just plug in the coax to find the SWR of any antenna from 142-156 MHz. Use 9 volt battery or 110 VAC with MFJ-1312, $12.95.

NEW . . . Two Models for Commercial Radio!!

MFJ-217 covers 30-50 MHz; **MFJ-218** covers 150-170 MHz. These are only $149.95 each.

MFJ 600 MHz 10 Digit LCD Frequency Counter

A perfect companion for MFJ's SWR Analyzer™

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New!

Add this handy MFJ-346 frequency counter to your station and get high accuracy frequency measurements to 600 MHz with 10 digit precision. It's also compatible with the MFJ SWR Analyzers and Antenna Bridge. Large quarter-inch LCD digits make reading easy. These high contrast LCD digits don't wash out in bright sunlight like LEDs do -- they're actually easier to read the brighter the light.

Four gate times let you select the resolution you need -- selecting a 1 second gate time gives you 1 Hz resolution. Has high accuracy 1 ppm 10 MHz crystal time base with adjustable calibration.

Uses high speed ASIC and custom LCD technology. 3-7/8 x 1-3/8 x 5-1/4 inches. Uses 9 volt battery or 110 VAC with optional MFJ-1312B, $12.95.

MFJ-247 SWR Analyzer™ with LCD frequency counter

MFJ's newest SWR Analyzer™ has built-in 10 digit LCD frequency counter -- makes reading SWR easier than ever.

New!

MFJ-247

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You can use the new MFJ-247 as an SWR Analyzer™, as a sensitive high accuracy 150 MHz frequency counter and as a signal generator.

It has high contrast LCD digits that don't wash out in bright sunlight like LEDs do -- they're actually easier to read the brighter the light.

Reading SWR is automatic. All you do is plug in your antenna, set your MFJ SWR Analyzer™ to the frequency you want and read your SWR -- it couldn't be easier!

The MFJ-247 is battery operated and handheld size so you can take it right to your antenna and work on it until it's just the way you want it. Reads SWR 160-10 Meters.

You can instantly find your antenna's true resonant frequency right at your feedline -- that's something a noise bridge just can't do.

You can monitor how SWR changes as you adjust your beam or vertical -- you'll know right away which way to adjust it.

You can shorten or lengthen your dipole and see the effect immediately.

You'll find all kinds of uses for this totally self-contained handheld unit that has revolutionized how SWR is measured.

Has separate BNC input connector for use as high accuracy frequency counter. Counter has 1 ppm 10 MHz crystal time base; .01, .1, 1, 10 second gate times; .1 Hz resolution. Uses 6 AA cells or 110 VAC with MFJ-1312, $12.95. 4 x 1¾ x 7½ inches.

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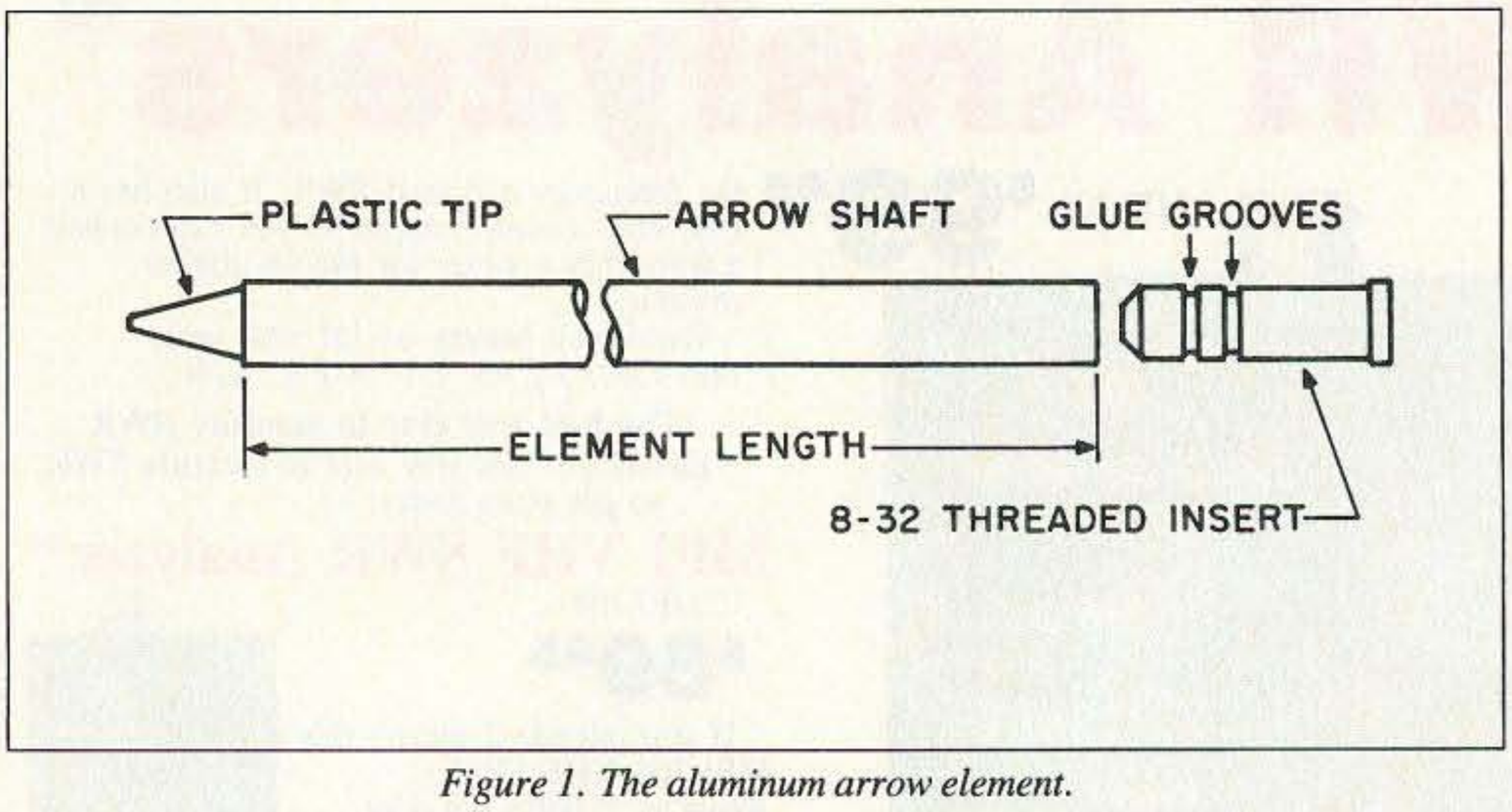

Figure 1. The aluminum arrow element.

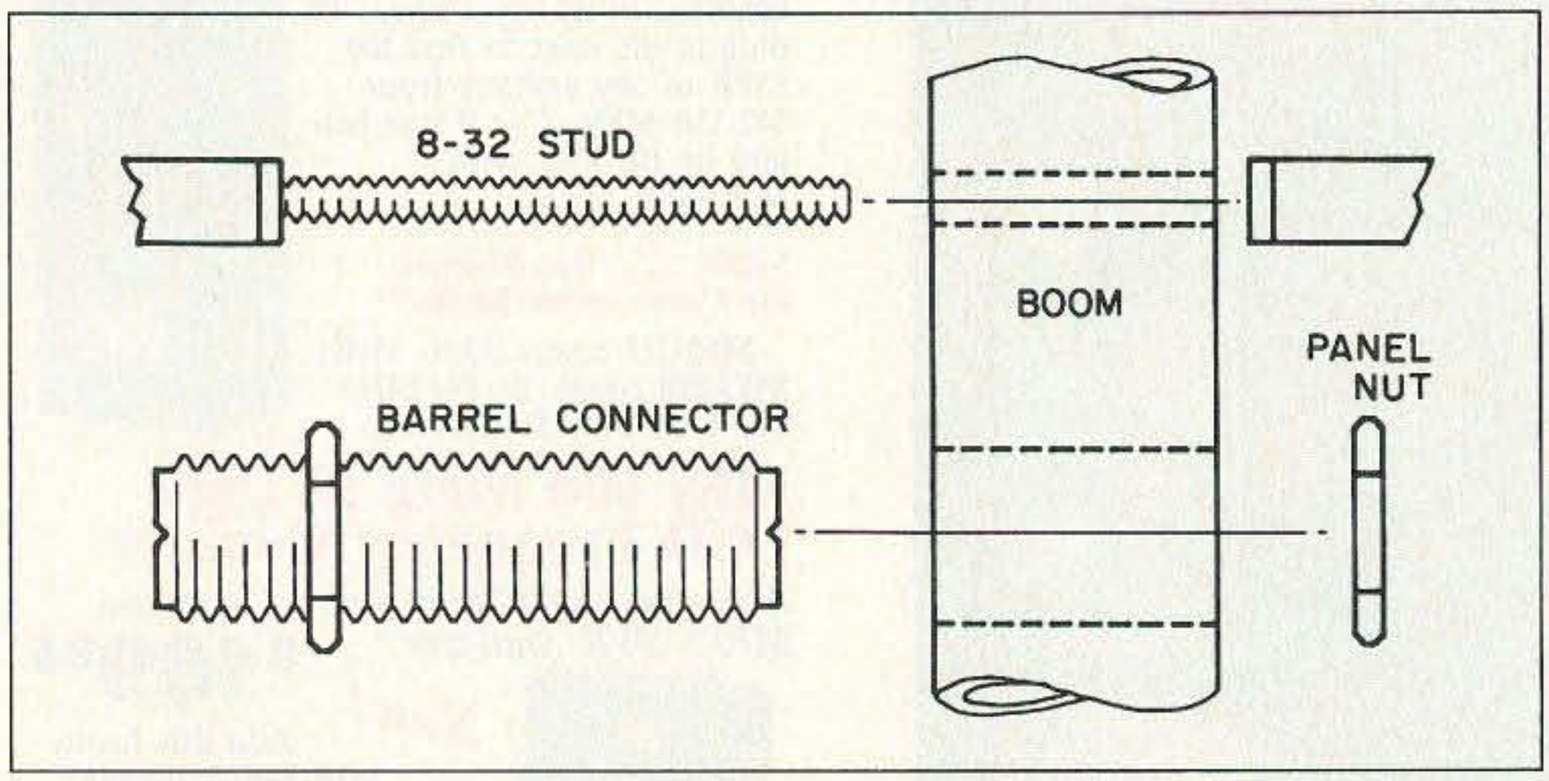

Figure 2. Attaching the elements to the boom. The feedpoint connection is also shown.

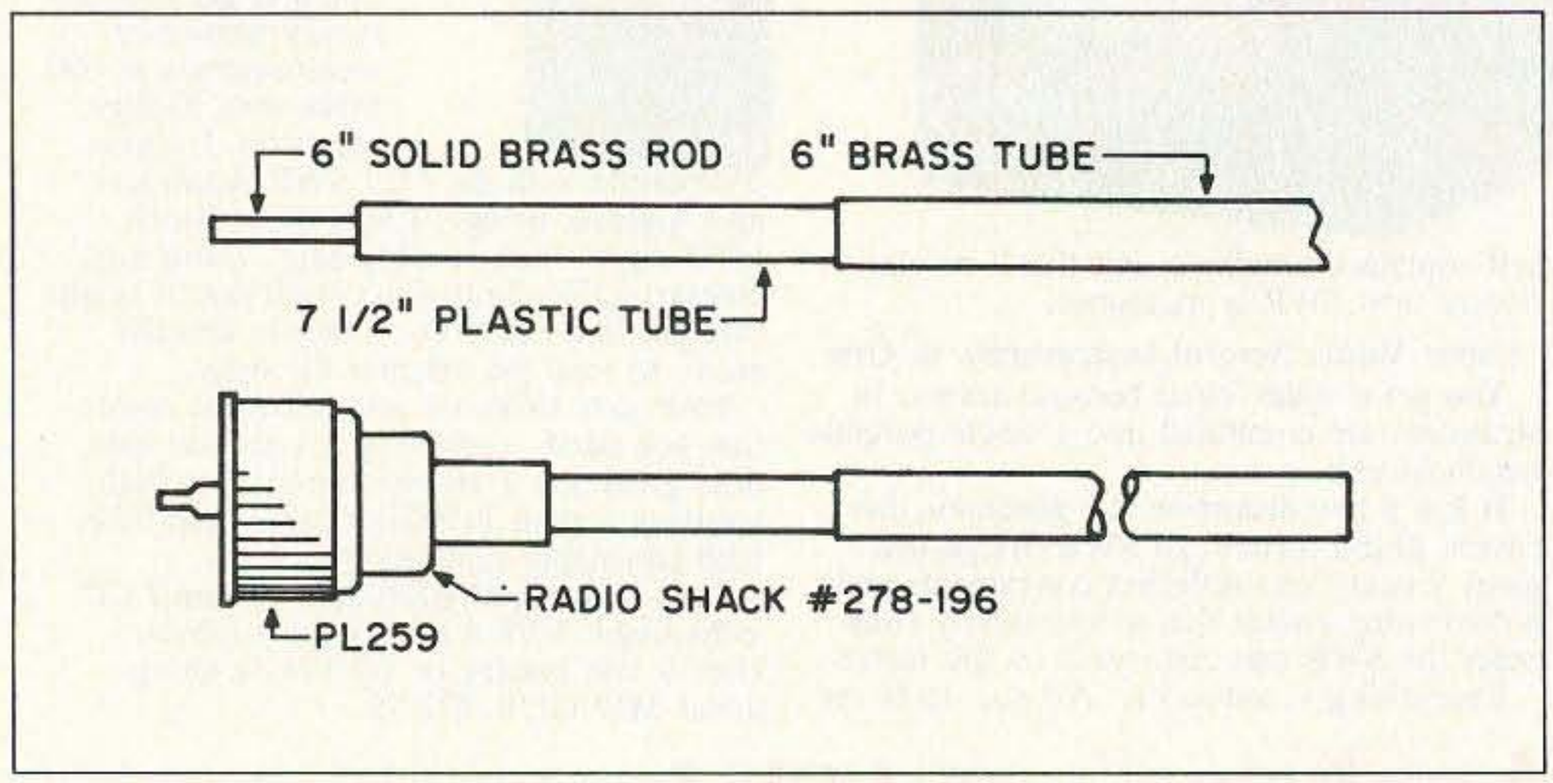

Figure 3. Preparing the gamma match.

will be able to precisely snap the element into two pieces, using the following element lengths: Scribe two arrows at 19-7/8″, two at 19-1/4″, two at 18-1/4″, and two at 17-1/8″. These pairs of elements will make up the reflector, the driven element, and the first and second directors, respectively.

The Easton EAGLE 1816™ arrow shafts that I used have conical plastic tips that are used for cementing on the nocks in normal arrow construction. The plastic tip should *not* be used when measuring the element length, but should be left intact in order to seal up the end of the element. When you purchase the arrow shafts from an archery supply store, you will be given inserts that are used for attaching the field points to the arrow shaft. These inserts will be used for attaching the elements together and to the boom. When installing the inserts, apply a small amount of epoxy.

Please note that the boom width is not included as part of the calculation for overall element length. The element diameter will have an effect on element length, and I do not recommend exceeding the element diameters by more than 0.100″. Many aluminum arrows are greater in diameter than the 1816 Easton EAGLE. The 1816 is the smallest arrow shaft that will accept the 8-32 threaded insert. Our prototype antennas both used larger diameter arrows. The change to the 1816 was only a factor of cost.

Starting with the 19-7/8″ reflector pairs, install one 8-32 threaded rod 1″ into one of the element halves. In our construction, we used LOC-TITE™ to permanently affix the 8-32 x 3″ rod into the arrow shaft. Install the remaining threaded rods into the other three element halves.

To fabricate the gamma match you will need a PL259 solderless connector, a 6″ solid brass rod 0.080″ O.D., a brass tube 0.180″ I.D. x 0.240″ O.D., and a plastic tube 0.175 O.D. x 0.080 I.D. 7-1.2″. Solder the 6″ brass rod into the center of the PL259, flush with the tip of the connector, just as you would for attaching RG-58 coax. Next, slide the 7-1/2″ plastic tubing onto the 6″ brass rod and cover the plastic tubing with the 0.180″ I.D. x 0.240″ O.D. brass tube. This assembly is now your gamma match. To complete the assembly you will need to epoxy the plastic tube into the connector. After tuning the antenna, you may want to tape the brass tube in position, and mark the position of the shorting bar for convenient setup in the future.

To make the shorting bar for the gamma match you will need a small piece of aluminum 1.5″ x 0.5″ x 0.5″ (see Figure 5). Measure and mark a place on the aluminum block 1/4″ from one end and 1/4″ from the edge of the block. This should place your mark along the center of the width of the block. Measure exactly 1″ from the previous mark and again center this mark along the width of the block. Drill a hole 7/32″ through at your first mark and drill a through hole 9/32″ at the second mark. Standing the block on end, drill a 0.201″ hole into the 0.5″ x 0.5″ block end, keeping the hole centered in relation to the block. Drill into each end of the block until the drill bit is visible through the previously-drilled 7/32″ and 9/32″ holes. Tap the two end holes for a 1/4″-20 thread. Two 1/4″-20 bolts will be used for setscrews to attach the shorting bar between the gamma match and the driven element.

Assembly

The Arrow Antenna is now ready for assembly. Place the threaded end through the 11/64″ hole in the boom and screw on the other half of the element. (See Figure 4 for the correct placement of the elements). Continue down the boom, installing the rest of the elements. Screw the bulkhead connector onto the gamma match, then screw one of the panel nuts flush to the gamma match. Now insert this assembly through the 5/8″ hole forward of the driven element, tightening it in place with the bulkhead panel nut. Attach the shorting bar over the end of the driven element that is parallel to the gamma match. Slide the bar along the element until you reach the end of the gamma match, and slide the shorting bar onto the end of the gamma match. Using the 1″ x 1/4-20 bolts, fasten the shorting bar so that it is flush with the end of the gamma match. Connect the coax to the other end of the bulkhead connector. Mast-mount your antenna and route your coax so

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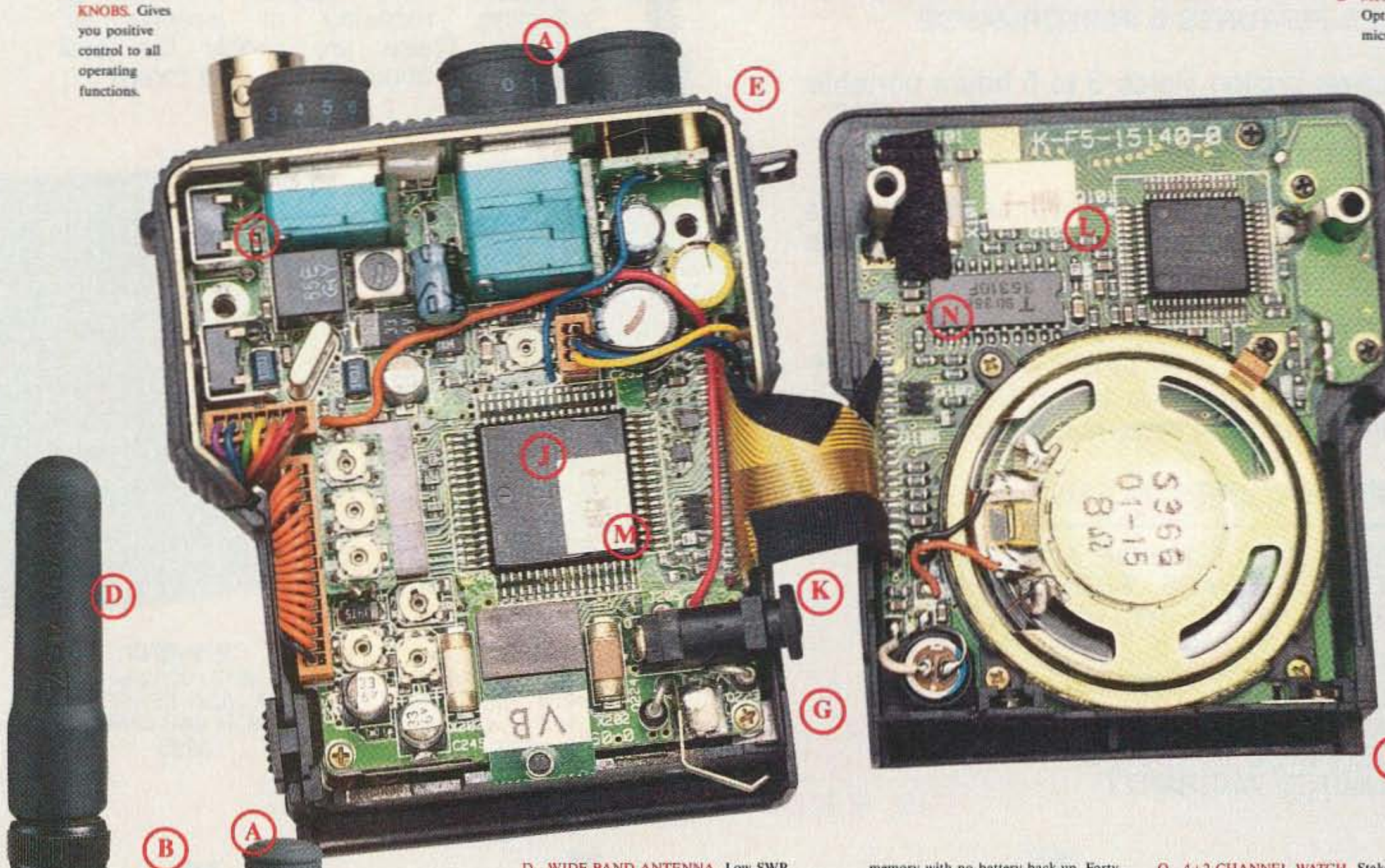

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M MEMORY LAYERS. Add as much as or as little program into any memory channel. All memory channels are protected against accidental over-write.

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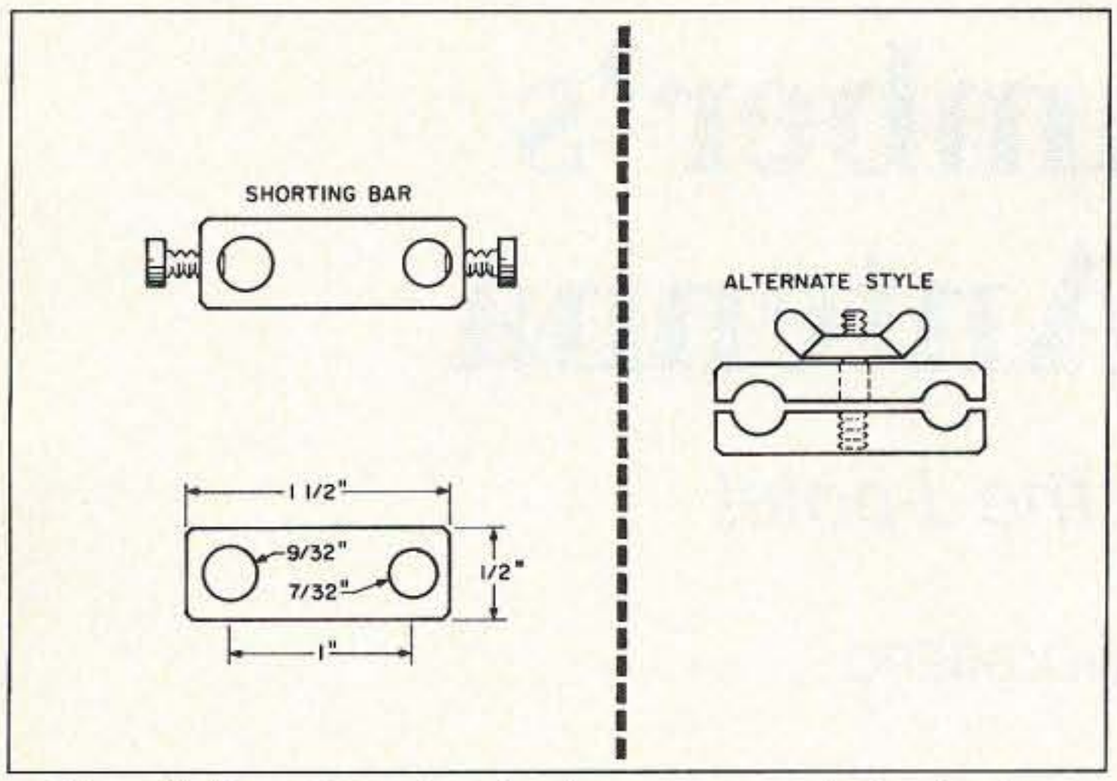

Figure 5. Two alternatives for the gamma match shorting bar.

that it is close to the boom and mast. You are now ready to test and tune your antenna.

Testing and Tuning

The antenna is tuned by sliding the outer brass tube out and moving the shorting bar along the gamma match assembly and test for the best SWR. In our experience, the antenna should be within acceptable limits of < 1.3:1, if the assembly has been constructed carefully. Our antennas have all tuned to an SWR of 1.1:1 at 146.520 MHz.

Disassemble the antenna and screw the element pairs together. Install one of the 1-1/4" crutch tips onto one end of the boom. Insert the bundle of the four element pairs into the boom. Drop in the gamma match and shorting bar. Install the second crutch tip, and you're ready to go portable.

NOTE: For permanent installation, I recommend that star washers be installed when attaching the elements to the boom. The addition of star washers should keep the elements from vibrating loose. Normal care should be taken to weatherproof your antenna. Seal the coax connection and the end of the gamma match assembly.

We Won a Respectable Second Place

I entered the antenna in the 1991 Dayton Hamvention VHF antenna competition. Al N0IMW and I both wondered how the Arrow Antenna would measure up. We were not disappointed with the results; in the homebrew category, the antenna measured 6.1 dB gain over the reference dipole used for testing.

The winning antenna was 35′ long with 19 elements and 14.3 dB gain over the reference dipole. Al and I will be looking forward to Dayton '92. We will be ready to compete again.

I was fortunate to have John Wood KC0WA as my mentor for antenna construction. Because of John's encouragement and help during our antenna experimentation, the Arrow Antenna evolved to its present form. 73

You may contact Mike Walker KA0VFF at 3816 Ash Avenue, Loveland CO 80538.

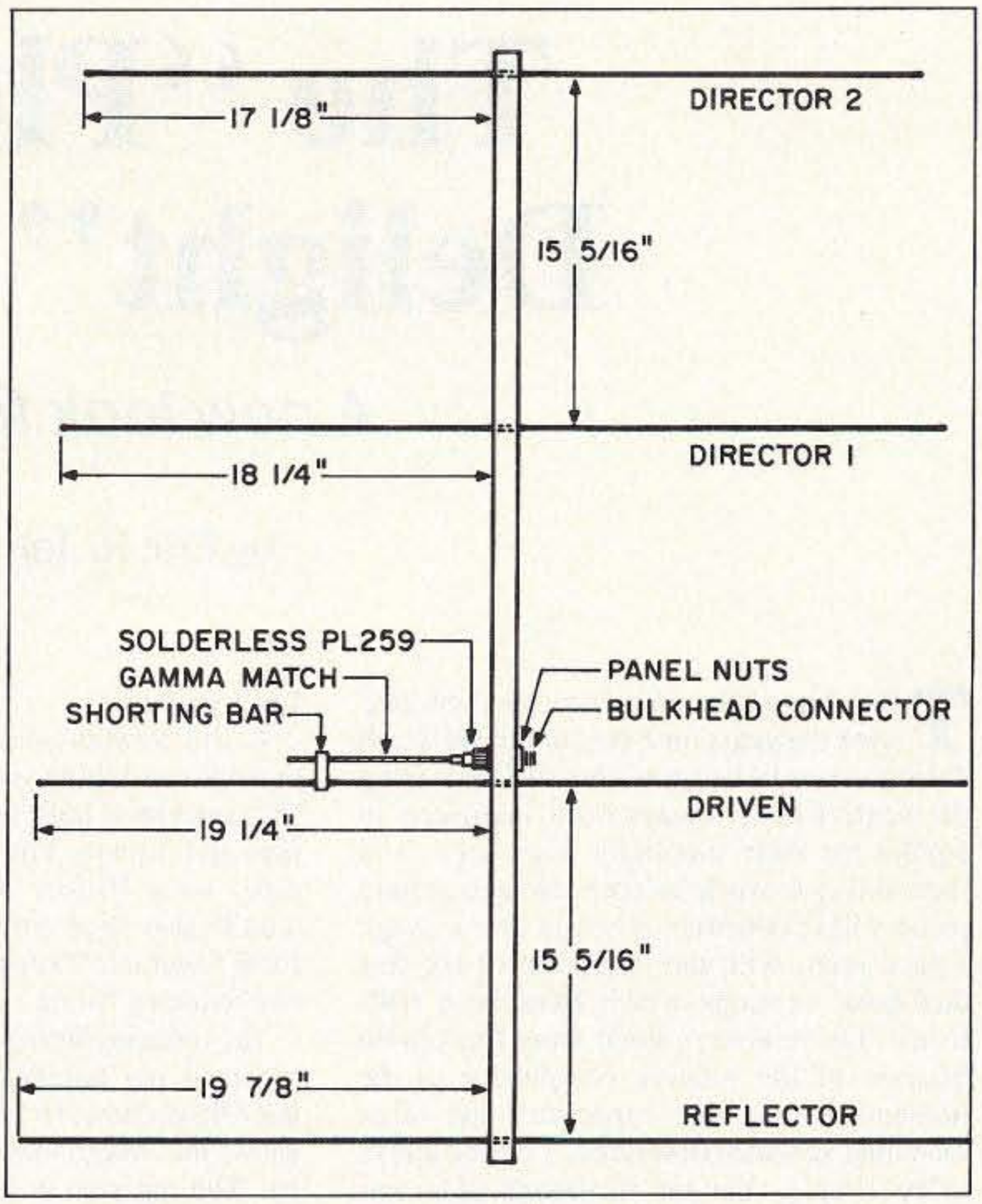

Figure 4. The overall dimensions of the completed Arrow Antenna.

The Arrow Antenna

Specifications	Configuration	Yagi
	Number of elements	4
	Matching System	Gamma
	Boom Diameter	1″ square, aluminum
	Boom Length	4′ Element Material 7075 aluminum (Arrow Shafts)
Gain	Measured (forward)	6.1 dB over reference dipole (estimated over 9 dBi)
	Measured (front-to-back)	10.1 dB

Note for direction finding: This makes the signal peak directly off the front and the deepest null directly off the back of the antenna.

Special Features	Portable	All antenna hardware fits inside the boom for storage or transport.
	Assembly time	Less than two minutes
	Weight	24 oz.
	Bandwidth	4 MHz (144–148)
	SWR over band width	< 1.5:1
	SWR at 146.52	< 1.1:1

Parts List

1	1″ x 1″ x 48″ piece of square aluminum tubing (NOTE: The wall thickness of our square tubing was 0.0625″ allowing us to pack all the antenna hardware inside the boom.)
8	Aluminum arrows > 20″ in length, and approximately 9/32″ in diameter
1	2″ PL259 bulkhead connector w/panel nuts
1	Solderless PL259 Radio Shack #278-196
1	Male PL259 90-degree connector (optional), Radio Shack #278-199
1	6″ x 0.080″ diameter brass rod
1	7-1/2″ x 0.080″ I.D. x 0.175″ O.D. plastic tube
1	6″ x 0.180″ x 0.240″ O.D. brass tube
2	1-1/8″ diameter rubber crutch tips
4	#8-32 x 2-1/2″ pieces of threaded rod
2	1/4″-20 x 1″ bolts
1	0.5″ x 0.5″ x 1.5″ aluminum bar

The Arrow Antenna is available ready-made for $65 plus $5 postage and handling. Send a check or money order to Mike Walker KA0VFF at 3816 Ash Avenue, Loveland CO 80538. Telephone: (303) 669–2697.

The "Plumber's Delight" Antenna

A new look for the J-pole!

by Eric R. Johnson KB6EPO

There have been many articles published over the years on J-pole antennas. Each design seems to be somewhat different from the next. I have always been interested in J-poles for their simplicity, their gain, and their ability to work independent of a ground plane. I have constructed nearly every design I have seen, with the exception of the few dual-band versions which have been published. I have always shied away from those because of the relative complexity of the homemade matching capacitors and other matching schemes described. I prefer things to be simple. Yet the dual-band idea was intriguing, and I thought that if two bands were possible, why not three?

I set out on a design (or more properly, tinkering) adventure to build a triband J-pole which met these requirements:

1. It must be built from cheap parts which are easily obtainable in virtually any town.
2. It must not require any special tools or test equipment to build.
3. It must be so simple in design that even the laziest of home-brewers (like me) will not hesitate to build one and get it on the air.

A Quest Fulfilled

It looks like an organ pipe cactus is growing on the roof of my shack, but I don't care because the performance-to-cost ratio is most gratifying. It exhibits a built-in triplexer effect, in that I can do any conceivable combination of simultaneous transmitting and receiving on my three rigs without having any rig interfere with the normal operation of another one. There is no transmitter power bleed-over from one feedline to any of the others.

For example, transmitting 30 watts on 440 MHz will not open the squelch on my 2 meter rig, nor interfere with the simultaneous reception of the local 2 meter repeater. While I have no real scientific means of measuring gain, I can tell you that from my QTH in Baja California, I am able to get into the repeaters on Mt. Palomar Q5 with only 100 mW of transmitter power on all three bands. These repeaters are about 90 miles from my QTH. Using a quarter-wave ground plane antenna and 1 watt transmitted power into the same group of repeaters, I received a Q3 signal report on 2 meters and was unable to access the 1.25 meter and 70cm machines.

Let's Build It

A trip to your local hardware store will provide everything you need for this project. The antenna is built from 1/2″ copper water pipe and fittings. You'll need about 8 feet of pipe, so a 10-foot length will do nicely. You'll also need three "T" fittings, three male-to-female 90 degree elbow fittings, and one reducing fitting.

The reducing fitting is the means by which I mounted my antenna. More on that topic later. Right now, let's play plumber! Figure 1 shows the overall view of the complete antenna. The top stub is for the 70cm band, the center one for the 1.25 meter band, and the bottom one for the 2 meter band. The 70cm section should be made first.

Cut the pipe so that when the pieces are assembled, as in Figure 2, the overall dimensions will be true. For the 70cm section only, it will be necessary to cut a small amount off of both the "T" and the male end of the elbow in order to obtain the small 0.375″ gap required.

Lay the assembly down on a flat surface and align the pieces, then dimple at the places marked "X" in Figure 2. I used a 16 penny nail and a large rock for this task. You may want to use a small ball peen hammer if you have one handy. Now use a propane torch to solder everything together. Be careful not to use too much solder or else you'll have the same problem I did the first time. The excess solder will get into the as-yet-unused end of the "T," and you'll have a devil of a time getting it cleaned out!

In the same manner cut, fit, dimple and solder the pipe for the 1.25 meter stub. This stub will be 180 degrees away from the 70cm stub. Now do the 2 meter section. This stub will be 180 degrees away from the 1.25 meter stub, and directly below the 70cm stub. Finally, take any pipe you have left and solder it into the unused end of the 2 meter "T." This is where you will attach the antenna to its mount.

Putting It in the Sky

I soldered a reducing fitting to the bottom of my antenna to provide a means of mounting it. The copper fitting has a 3/4″ female pipe thread on one end, and a 1/2″ female slip-fit on the other end. This fitting is depicted in Figure 1. Since 3/4″ galvanized thin-walled electrical conduit is cheaper than copper, I used a 10-foot section of that for a mounting pole.

A male-threaded fitting is available for the conduit, which allows it to screw into the bottom of my copper antenna. The conduit is clamped to the side of my shack near the roof peak. The whole conduit/copper antenna assembly stands by itself unguyed, and is quite sturdy. You may think of a different way to mount the antenna at your location, and so may not need the reducing fitting. Automotive hose clamps, to hold the antenna to the top of an existing mast, is one possibility that comes to mind.

There is no need for a ground plane or even a grounding wire. The antenna will work the same with or without them. From a safety standpoint, however, it is a good idea to ground the antenna.

To ensure a wobble-free 2 meter stub, I used a scrap of 1/4″ thick Plexiglas™ roughly 2″ square, close to the top of the stub, as a brace. I drilled holes through the Plexiglas and pipe, and used two 6-32 screws on the stub and two more on the central mast to hold the brace in place. This probably wasn't necessary, but I had the material lying around, so what the heck! The other two stubs are most definitely sturdy enough on their own.

Connecting The Feedlines

The antenna has three feedlines, one for each band. The feedlines should be a small diameter 50 ohm coaxial cable, such as RG-58, RG-223, or mini RG-8. I used RG-223, which is a double-shielded cable. Connect the feedlines to their respective elements as shown in Figure 2. Note that all shields connect to the mast, and all center conductors connect to the stubs. The distance above the bottom of the "J" to connect the coax is given by dimension "F" in the table.

Continued on page 50

	2m	1.25m	70cm
R (in) = 8370/F (MHz)	57.375	37.375	18.875
S (in) = 2787/F (MHz)	19.125	12.500	6.250
G (in) = 165/F (MHz)	1.250	.750	.375
F (in) = 345/F (MHz)	2.500	1.500	.750

R = radiator; S = stub; G = gap; F = feedpoint.

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8 Review: Heil Microphone
9 Monoband Yagi for 20 Meters
10 The SAM1 Transverter
11 Review: The EASY-PC PCB Layout Program
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15 Review: The Ace AR3000 Communications Receiver
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26 Above and Beyond
27 Ask Kaboom
28 73 International
29 Random Output
30 Propagation
31 Barter 'n' Buy

The Flower Pot Special

Plant your antenna!

by David Cassidy N1GPH

The Hidden Antenna Dilemma

People who live in apartments or condos are constantly searching for new ways to get out an HF signal. There are several ways to solve this problem, if the landlord is willing to let you string wires outside the building, but more often than not the problem is simply that no antennas are allowed. . . period.

The typical suggestions for "invisible" antennas are usually not very invisible, especially over a period of time. An HF vertical disguised as a flagpole is pretty good, if you own the space (including the space for underground radials) and are allowed to erect the flagpole. Magnet wire antennas work fairly well, but it's only a matter of time before the feedline is discovered—and then not only do you have to take the antenna down but you risk the wrath of your landlord. Indoor antennas are truly invisible to the outside world, but you're bathing yourself (and your neighbors) in potentially harmful RF radiation, not to mention the TVI problems incurred. Roll-up antennas are OK, but very few locations can accommodate them, and it's a nuisance to have to erect your antenna every time you want to check out band activity.

What we really need is a truly invisible antenna, one that can stand up to long-term scrutiny and still allow for easy operation with a decent signal.

Flower Power

With the abundance of high-quality mobile antennas available, all that is needed for a decent HF signal is a mounting arrangement. . . and a clever disguise. Enter the Flower Pot Special—the clandestine antenna mount that even the KGB would be proud of!

The solution proposed here will be of special interest to hams who have the most difficulty in getting on HF—city dwellers. Although this arrangement can be set up in the corner of a room, if you have access to a balcony (especially a balcony on a high floor), you'll be amazed at the results this invisible antenna can produce. If you're stuck on the ground floor don't worry. I've seen ground-mounted flower pots work Europe consistently when the band is open.

Take a look at the photos; the flower pot antenna mount is almost self-explanatory. The photo shows a Flower Pot Special that was put together by Don Arnold WD4FSY of Outbacker Antenna Sales. Don is the one who

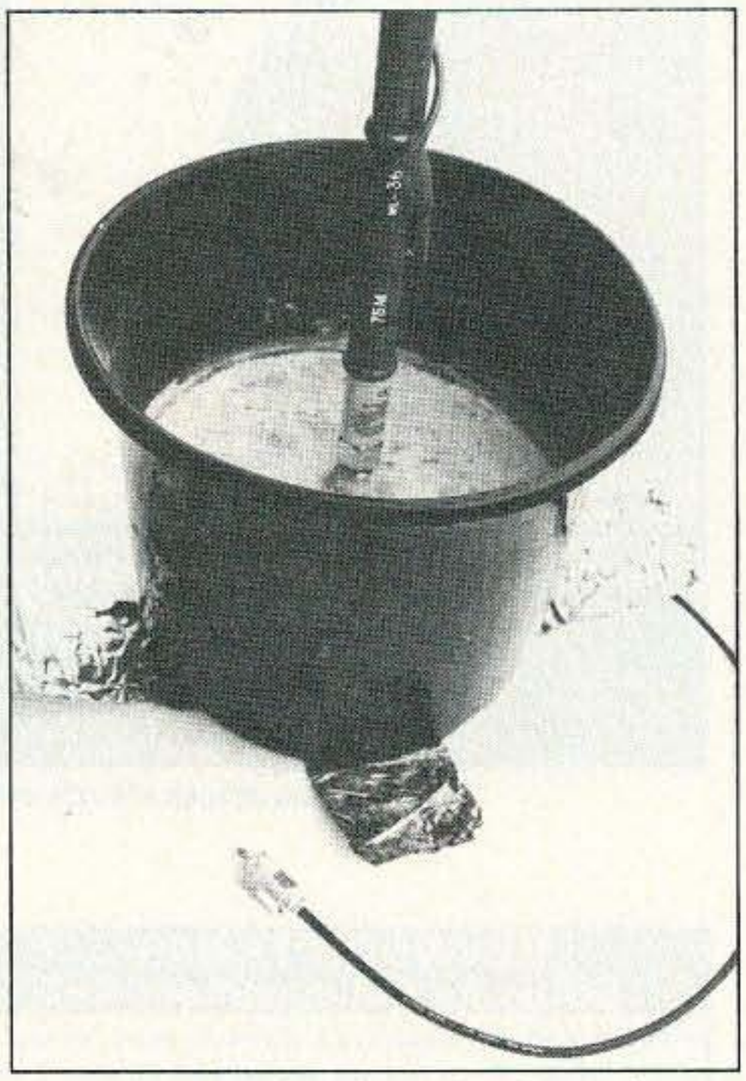

Photo A. The Flower Pot Special.

actually came up with this unique arrangement, and he uses the Flower Pot Special to demonstrate the Outbacker all-band HF antennas at hamfests. The Outbacker is especially suited for operating from an apartment or condo because it offers multiband capabilities from a single element—all you have to do to change bands is plug the wire that wraps the antenna into the appropriate plug on the antenna—but as long as you match the mount to the type of antenna you're using, the Flower Pot Special will work with any type of mobile antenna.

Construction

To build the Flower Pot Special you will need:

- 1 flower pot. The one in the photo is 9″ tall and 10″ across at the top.
- 1 metal junction box. These are used to mount AC outlets in your walls. They are usually covered with knock-out plugs for running wire through. If you can't find one that has a hole in the center, you'll have to drill a hole to accommodate your antenna mount.
- 4′ of 3″ copper foil. If you can't find this at your local hardware store, you can get it at Ham Radio Outlet. The stock number is GW0065, and you can get 50 feet for less than 30 bucks. Don't worry, you won't have too much. You'll use most of the roll for your ground plane.
- 1 roof-mount assembly. This is the kind of mount you install by drilling a hole in the roof of your car. Mine has a standard 3/8 x 24 thread mount.
- 3′ RG-58 coax, wired with appropriate connectors. One end of this will be attached directly to your mount, just as if you were installing it on your car.
- 1 bag (8–10 lbs.) of anchor cement. You can get this at a hardware store or home center. It sets up in about 10 minutes, and is less brittle than normal cement.

The first thing you want to do is cut four slits in the bottom of your pot. The slits should be long enough to allow the copper foil to pass through (about 4″), and far enough from the sides so you can totally hide the ground plane (if necessary). One to two inches should be sufficient.

Next, prepare your mount. Punch out or drill a hole in the center of your junction box. Cut your copper foil into two 2′ sections, cross them over the hole in your junction box, poke a hole in the copper foil and fasten the antenna mount to the junction box according to the manufacturer's instructions (with the crossed foil/junction box taking the place of the car roof).

Snake one end of your coax through one of the slits in your flower pot. (If ultimate disguisability is not a factor, you can drill a hole in the side of the pot at the bottom to let the coax through. Passing the coax through one of the bottom slits will allow you to hide the feedline under the carpet, behind other potted plants, etc.) Attach the coax to your mount according to the manufacturer's instructions (some mounts are hard-wired, others require a PL-259 or other connector).

Place the junction box/antenna mount inside the pot, and snake the copper foil out through the four slits cut in the bottom. Remember, the mount will be elevated 2″–3″ from the bottom of the pot, so don't pull the foil too tight. Once you're happy with the placement, tape up the holes with duct tape so the cement won't pour out.

Attach your antenna to the mount, then pour in your pre-mixed cement. Pull the mount up as you pour so that you don't cover it up with cement. Keep pouring until the pot is about half full of cement and make sure the mount is sufficiently submerged. Shake the

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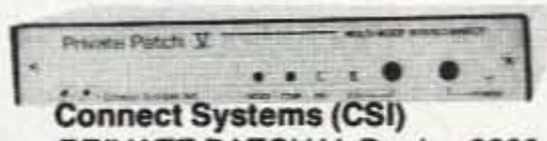

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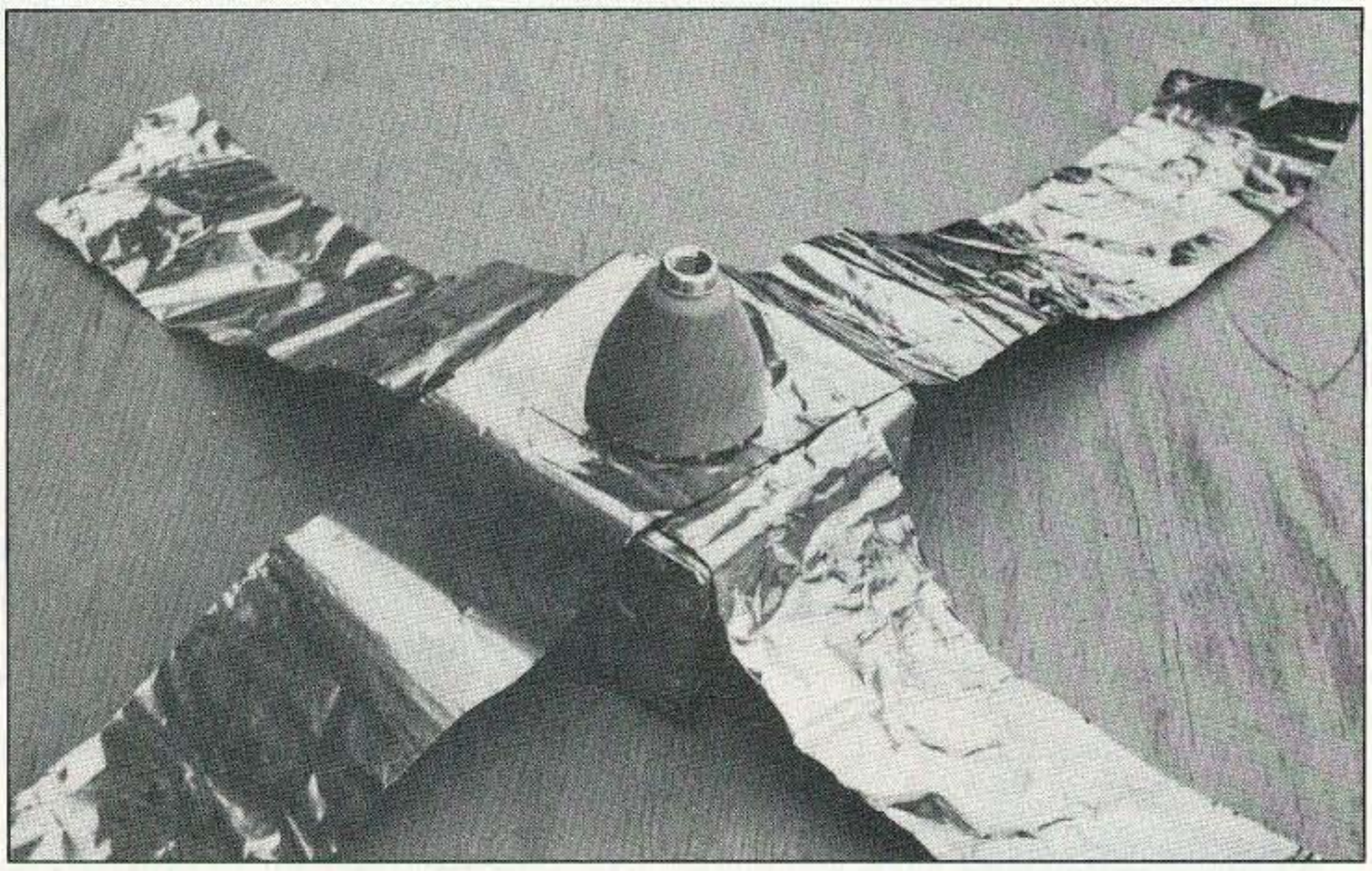


Photo B. Junction box, copper foil and antenna mount assembled and ready for "planting."

pot back and forth to make sure there are no air pockets, then hold the antenna vertical for five to 10 minutes until the anchor cement firms up.

Your Flower Pot Special is now complete. As soon as the cement thoroughly dries you are ready to hide your handiwork.

Camouflage

Once the cement is dry, you can attach your antenna to the mount and conceal it with plastic greenery. If you check out florists, home centers and craft shops, you will find a vast array of amazingly real-looking plants. The only caveat here is: Make sure that the fake plants you use to disguise your antenna are not built around a wire core. This will play havoc with your antenna's SWR and signal. You should be sure to only use non-conductive materials to disguise your antenna. While you're picking up your disguise plants, be sure to get a bag of spaghum moss or wood chips to cover and conceal the cement. With enough greenery, even your ham friends won't recognize your home decoration as an antenna.

Grounding

The reason you went through all the trouble to install that copper foil is that this antenna absolutely must have a ground plane. If you want to prove this for yourself, hold a fluorescent tube near the antenna while transmitting a carrier. With the pot resting on a ground plane, the tube will light brightly. Lift the flower pot off of the ground plane and the light will immediately go out. Remember, the antenna you're installing is designed to use a car body as a ground, so you must provide an equivalent or you won't get out any kind of a signal.

There are many possible ways to provide a ground plane for your flower pot, all of them dependent on where the antenna will be placed. If you are going to place the disguised antenna in a corner of an apartment balcony, look for a metal railing to attach to the copper ground strips. If nothing else is available, you could run a length of the copper tape around the balcony. If you are going to leave the flower pot indoors (grouped with other plants, you'll soon have to remind yourself that it's an antenna), you could run copper foil and transmission line under the carpet or behind the baseboard. With a little time and imagination, the flower pot can be installed so that it is totally undetectable.

You need a total of five to six square feet of copper foil to provide an adequate substitute for a car body. Really put some thought into how you can provide a ground plane, and it will pay off with a better signal.

With Power Comes Responsibility

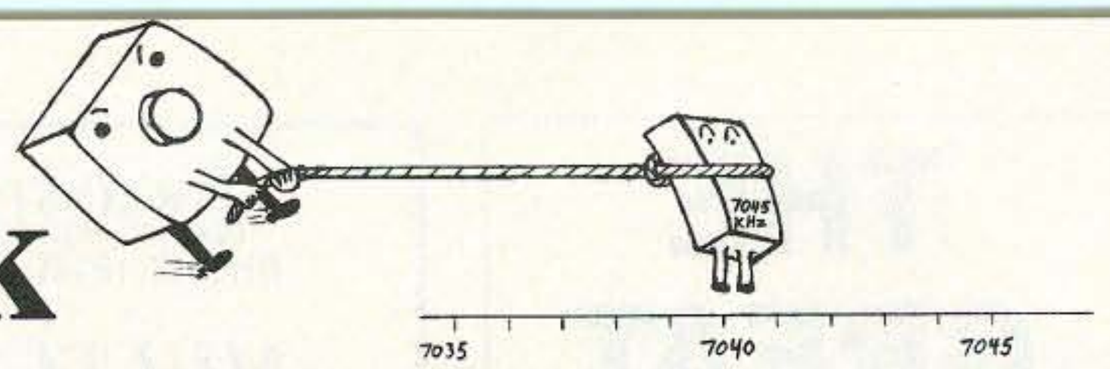
It is important for those hams who are forced to operate from apartments or condos to remember that just because they have come up with an ingenious way to conceal their antenna, it is all for naught if every telephone, stereo and television in the building makes weird noises each time you transmit. You could probably hide the fact that it is you who is causing all the interference, but sooner or later you will be discovered as the culprit. Not only will that make you very few friends, but it will give all of your neighbors a bad impression of amateur radio forever.

I'm not suggesting that you advertise that you are operating a ham station from the 14th floor, but for the sake of hams everywhere, make sure that you are acting as a responsible amateur as well as a good neighbor.

I'd appreciate hearing from anyone who decides to build a Flower Pot Special. I'm sure many of you will see other ways of putting together a similar antenna mount. I'd like to hear about your results, and any ways to improve the basic construction methods given here.

Good luck, and happy planting! 73

David Cassidy N1GPH is the associate publisher of 73 Amateur Radio Today. *He can be reached at the offices of* 73, *Forest Road, Hancock, NH. 03449-0278.*



The Rock Bender QRP Transmitter

Win QSOs and influence crystals.

by Randy Henderson WI5W

If you want a simple way to generate stable signals, a crystal oscillator will do nicely. The only problem is, you have one available frequency per crystal. This transmitter will ''bend'' the frequency of your ''rock'' (quartz crystal) to create a tunable oscillator.

The ''Rock Bender'' features two stages, an oscillator and a power amplifier. The tuning range varies with individual crystals. Various 7 MHz crystals will allow 6 to 20 kHz of tuning range. The version shown here has an output power of 3 watts into a 50 ohm load. A slight modification allows output levels of 10 watts or greater. It is extremely tolerant of mismatched loads.

Construction

The circuit board is double-sided. One side is a conventional etched pattern, shown in Figure 1. The other side is a solid copper ground plane, except where holes are drilled for component leads. All ground connections are soldered on this side. If you are making your board from the pattern, many methods can be used to form the resist paths. These include: tape, resist pen, and photo resist. See the construction chapter in recent versions of the *ARRL Handbook* to learn more about such techniques. Enamel spray paint is an easy way to cover the ground plane.

All components mount on the ground plane side (see Photo B). Only grounded leads are soldered to the ground plane. All other leads pass through the ground plane to the etched side of the board. They must not make contact with the ground plane. To prevent accidental contact, countersink the ground plane at the holes indicated as ungrounded in Figure 2. Use a substantially larger bit for countersinking than the component lead hole (1/4″ to 1/2″). Light pressure on the drill will clear away copper from the periphery of the holes (see Photo C).

Place the components as shown in Figure 2. Q2, the IRF511 output transistor, should be mounted close to the board with short leads, as well as C8. I leave conductive foam, aluminum foil, or wire, on the leads of Q2 until all of the board components are soldered in place. Shorting the leads together protects against damage from static electric charges and soldering iron leakage. Don't forget to remove the short before applying power. All other components should have reasonably short leads. Q2, L4 and the crystal socket will need larger holes and countersunk areas.

The variable capacitor C2 does not solder directly to the board. Use a short, stiff wire jumper to connect the stator plates (see Photo D). Most defunct AM broadcast receivers have small polyethylene film variable capacitors suitable for C2. To my knowledge, all use metric-sized screws. Many have internally threaded shaft ends. I find that some rubber cabinet feet make suitable knobs when the original is not available. Use care when mounting variable capacitors. Do not run the screws in far enough to damage the plates. Use washers, spacers or shorter screws. If necessary, shorten the screw and repair the threaded end.

L4 is made of 22-18 AWG solid copper wire. Enamel insulation is preferable, but not essential. Wind four turns over a 3/4-inch-long PVC pipe section. The size of pipe used for the coil form is known as ''1/2-inch.'' This is a convention used by the plumbing industry and is not the actual outside diameter. The outside diameter is approximately 0.84 inches. The length of the winding is about 1/2 inch. Do not secure or cement the turns in place at this stage of construction.

The mounting holes for the circuit board are not shown in the layout. Place mounting holes as you wish, but do not allow supports to short or ground conductors on the etched side of the board.

Although Figure 3 doesn't show a fuse, some type of

Photo A. This well-dressed Rock Bender sports a black-and-gray cabinet from Mouser Electronics (part number 4OUB101). The key jack is near the lower left corner of the front panel. The tuning knob is a black rubber cabinet foot.

Photo B. Rock Bender au naturel. The board is mounted on a clear piece of Plexiglas™. The PL-259 antenna connector is wired to the board via RG-158 miniature coax. A key jack is at lower left.

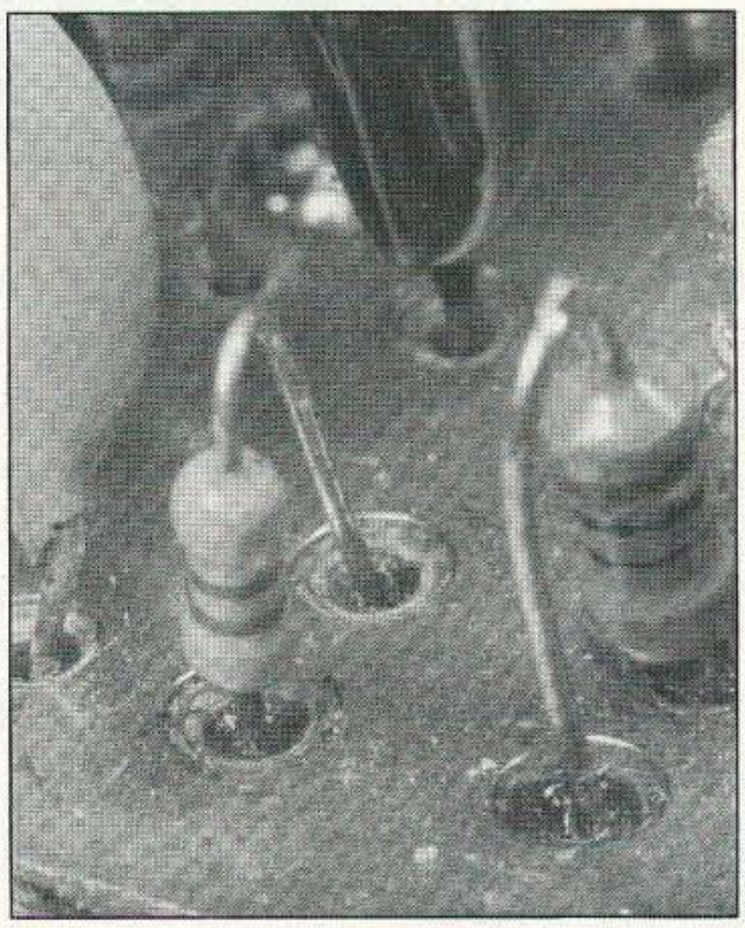


Photo C. Countersunk holes on the ground plane provide safe passage for component leads without disturbing printed circuit paths on the other side.

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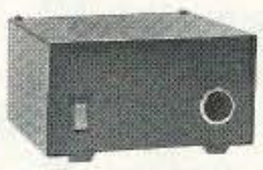

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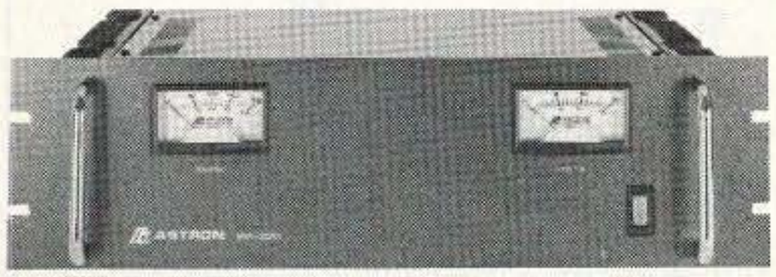
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES



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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

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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

current limiting device should be used to protect the transmitter. If your power source does not include a fuse, circuit breaker, or active current limiter, wire one into the positive supply line. A 3/4 or 1-A rating is suitable for the 3 watt output level.

The jumper shown in Figure 2 must be connected for oscillator keying. It does not connect to ground.

Connectors are needed for the antenna, the key and the power source. If you're an inexperienced builder, bring these accessories to the parts store to simplify finding the matching connector.

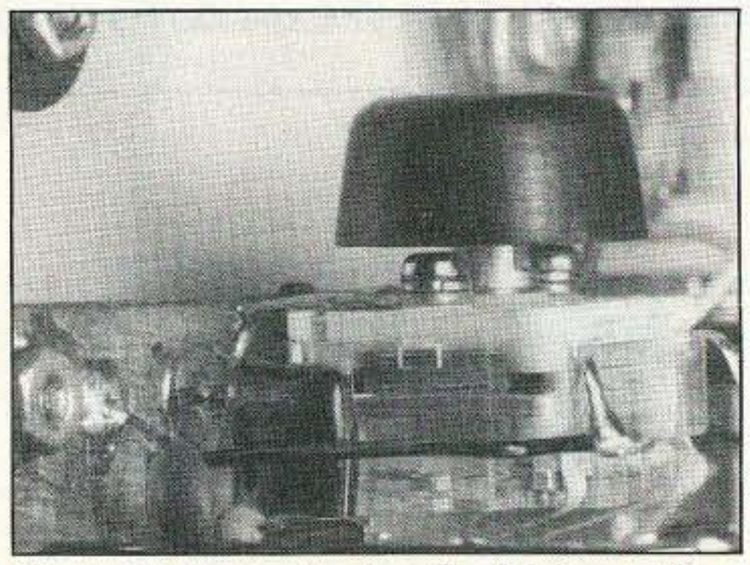

Photo D. A mounting bracket fabricated from a wire paper clip supports C2. Ground connections for C1 and C5 are visible. Hand capacity affects the frequency slightly when C2 is mounted this way.

Circuit Description

Figure 3 shows Q1 in a modified Colpitts oscillator configuration driving Q2. The output of Q2 is filtered and undergoes an impedance transformation before reaching the antenna terminal. This dual function is performed by a pi network consisting of C11, C12 and L4.

Keying is accomplished by providing a ground path for the emitter of Q1 and the source of Q2. No keying transistor is used.

You may want to experiment with operating the oscillator continuously. This often provides improved keying characteristics when you're trying to stretch the tuning range. Use a small heat sink on Q1. The oscillator keys satisfactorily with moderate tuning limits. Those of you "bent" on extending the limits may find help in reducing chirp by eliminating the jumper. Install a switch between the free end of R3 and ground.

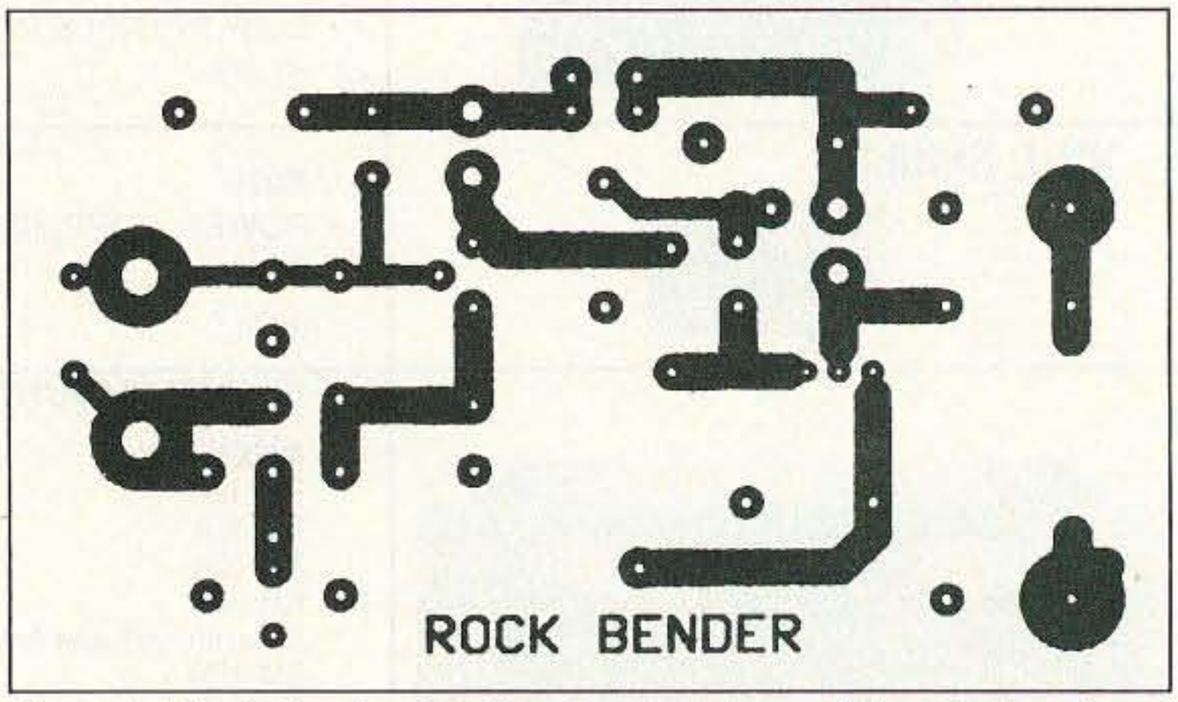

Figure 1. The isolated pads with no traces connected show the location of ground connections. These can be drilled or simply used as a visual reminder for soldering to the ground plane.

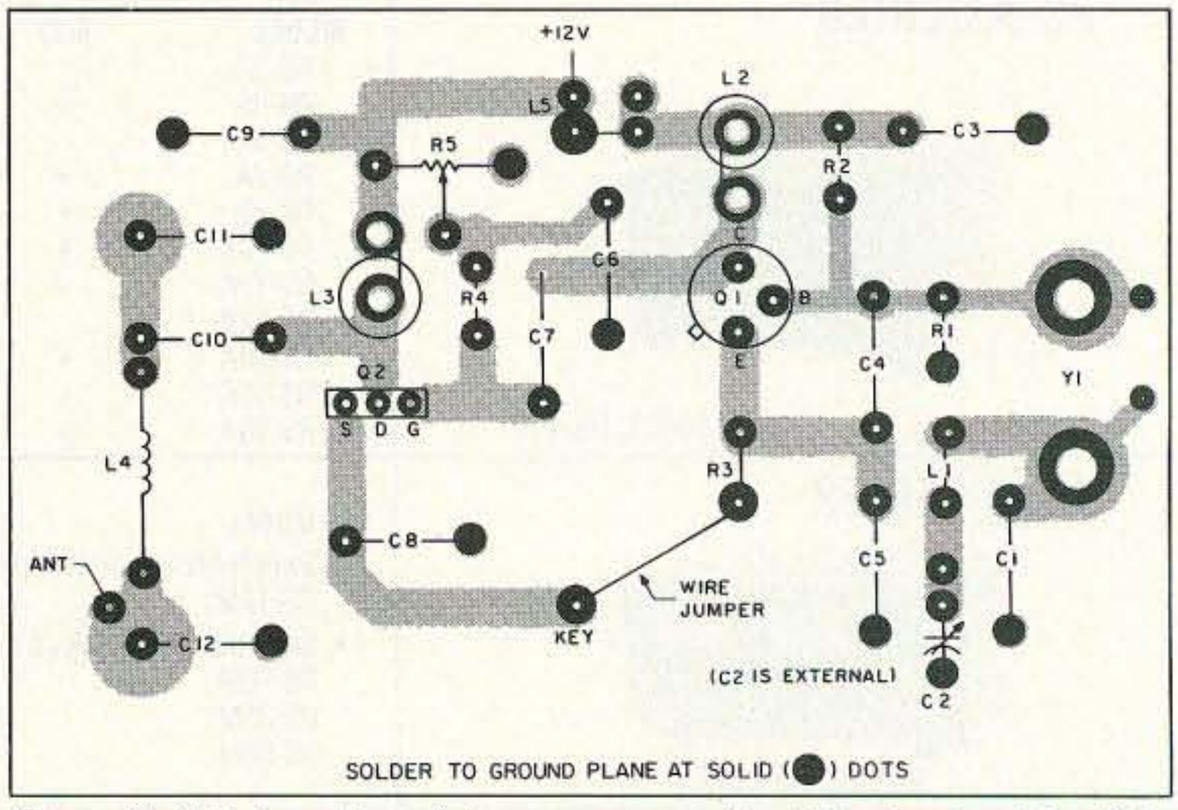

Figure 2. This is a view of the component side. It is also the side of the solid copper ground plane. The etched pattern is underneath, invisible from this side. Open circles mark component leads that pass through the ground plane to the etched side of the board. Countersink the ground plane at those locations.

What determines the tuning range for a particular crystal? L1 has, by far, the largest effect. The optimum value for L1 depends greatly on the type of crystal used. With most FT-243 crystals, 18 to 20 µH works well. HC-6 and HC-18 types seem to need more inductance. I used a total of 38 µH with one HC-6 crystal to obtain 10 kHz of tuning range. Some builders report 20 kHz of shift using old military/government surplus crystals with very large holders.

The value of L1 affects tuning in a very non-linear manner. Substituting a 15 µH inductor in place of an 18 µH inductor may reduce the available tuning range by 80 percent. If L1 is too large, the oscillator will usually malfunction in one of two ways. It may lose most or all of the tuning range. In this case, oscillation may take place at a frequency very close to the value marked on the crystal holder. Oscillation can also take place at frequencies several hundred kHz away from the marked frequency. You certainly don't want to operate the trans-

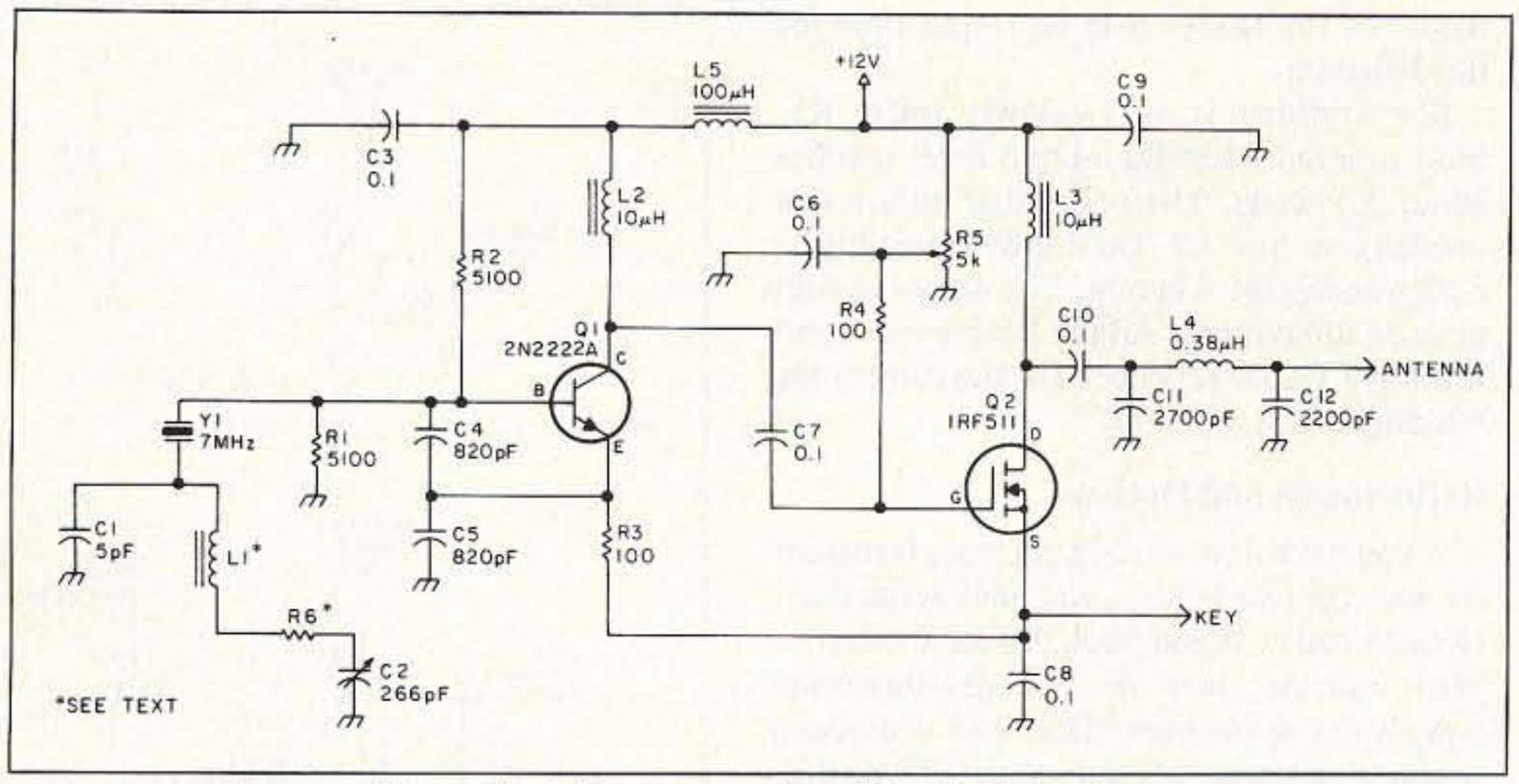

Figure 3. A 40 meter version of the Rock Bender.

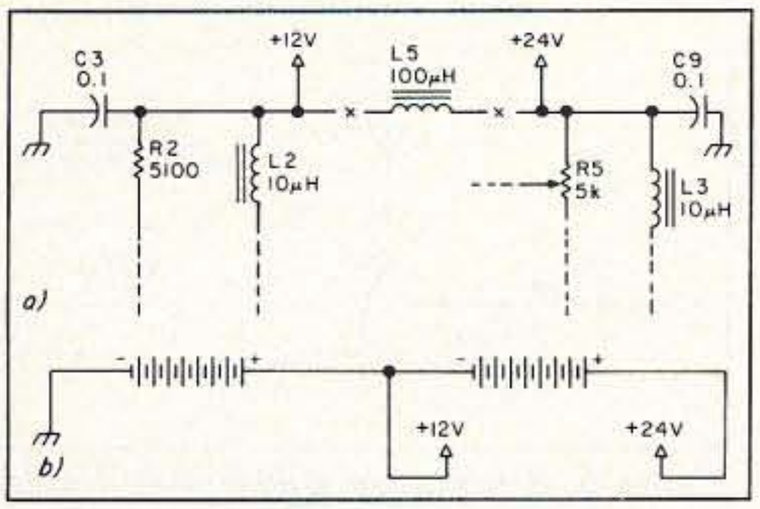

Figure 4. a) Use dissimilar power connectors for the 24 volt and 12 volt bus or one 3-pin connector keyed to plug in only one way. This will preclude accidentally swapping power sources. b) Two 12 volt batteries in series. Remember to use a fuse on both positive leads to the transmitter. About 200 mA for the 12 volt tap and 750 mA for the 24 volt lead.

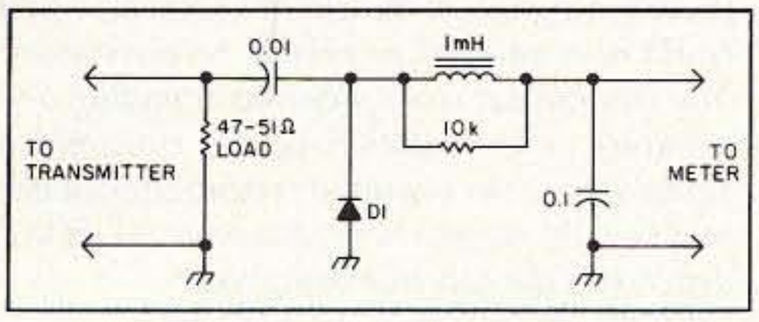

Figure 5. This circuit samples RF voltage across the load. A DC voltage appears at the meter terminals. The RMS value is approximately 0.707 x peak. If R is the load resistance and E is the voltage indicated by the DC voltmeter, then power = (0.707E²)/R. D1 is an RF or high-speed switching type of diode. A 1N34A germanium or 1N914 silicon will work. If you first subtract the characteristic voltage drop from E, the calculation is more accurate. Use 0.4 volts for germanium or hot carrier diodes and 0.7 volts for silicone. The 10k ohm resistor loads the RF choke to eliminate erroneous readings caused by parallel resonance effects.

mitter out of the band.

A low-Q inductor seems to work best at L1. High-Q toroidal inductors are often unsatisfactory. Decreasing the Q and the crystal current even more by using R6 often improves keying characteristics. The largest value I've used is 47 ohms for FT-243 crystals. The lowest value is zero ohms. Small, low-Q, low current, high DC resistance, molded chokes are a good choice for L1. The best configuration for L1 is often two or three molded chokes in series. For instance, you might use two chokes of 9.1 μH each, for a total of 18.2 μH.

C2 is the tuning control for actual on-the-air operation. Using a larger value variable capacitor may provide increased tuning range in some transmitters.

Component values for the rest of the transmitter are not so dependent on crystal Y1. Potentiometer R5 sets the gate bias voltage for output transistor Q2. R4 acts as a "swamping" resistor. In other words, it loads the gate circuit of Q2 to stabilize the output stage and prevent parasitic oscillations. It also helps establish a stable load for the oscillator.

If you need a bit more output power, here's how. The output transistor, Q2, works very well with a 24 volt DC supply. At this voltage, Q2 needs a larger heat sink with a few square inches of surface area. An aluminum chassis can be used by mounting Q2 upside down (on the etched side of the board) and thermally coupling to Q2 with a mica insulating washer covered with heat-sink compound. The gate bias voltage will need to be lower (adjust R5). At 7 MHz, 10 watts of output power is available.

Wait! Don't rush to the nearest 24 volt supply. The transmitter absolutely will not tolerate a 24 volt DC supply to Q1. The drive level (RF voltage) is so high that it punctures the gate insulation, destroying Q2 instantly. L5 is a decoupling choke for the oscillator supply. By removing L5, you can operate the oscillator at 12 to 14 volts and supply 24 volts to the IRF511 amplifier (see Figure 4a).

Crystal Y1 operates in the fundamental mode in this circuit. Overtone cut crystals also operate in the fundamental mode. At present, there are sources of very inexpensive fundamental mode 7 MHz crystals. For this reason, development of the transmitter was concentrated on the 40 meter band. This transmitter also works on 14 MHz by changing a few component values. Reduce C4 and C5 by half. Change C11 and C12 to 910 pF. Change L4 to 0.24 μH. This is for a supply voltage of 13.5, 2 watts output and a network Q of 4 (including transistor output capacitance). You can achieve initial operation (and very little tuning range) by using a jumper in

place of L1. With the optimum value for L1, the tuning range will be much greater than the 40 meter version. Output power is less. Operation on other bands should be possible. Certainly, 30 meters is a prime candidate.

Initial Checkout

Before applying power to the transmitter, you should make a thorough visual inspection. Check for solder bridges, poor solder connections, melted wire insulation and component leads touching other conductors. Double-check all connections to make sure they agree with the schematic diagram.

To adjust the transmitter, you will need a dummy antenna and some way to measure output power. A 47 ohm, 2 watt, carbon-composition resistor can be used in lieu of a standard dummy load for the 3 watt version. Just check it occasionally to make sure it's not getting too hot. If you don't have a wattmeter for this power level, see Figure 5.

The wiper of R5 should be rotated all the way toward the grounded leg. You can check this with an ohmmeter. Next, plug in a key. Make sure it can handle the current if it's an electronic keyer. Keying current is a hefty 500 to 600 mA at 13.5 volts.

The last step before key-down testing is to connect a 12 to 14 volt DC power source. With C2 at midrange, key the transmitter. The grounded wiper of R5 sets the gate bias voltage to zero and the output level will be very low. It should be less than 1/2 watt, possibly less than 100 milliwatts, depending on the supply voltage. Find the transmitter signal with your receiver. If you can't find the signal, L1 may be too large. C2 should shift the frequency over a range of at least 5 or 6 kHz. If not, L1 is too small. A very few FT-243- style crystals may refuse to oscillate if their activity is on the sluggish side. At the risk of sounding like an advocate of crystal abuse, I have found that a sharp blow from a pencil or similar object brings them to life. Once so "enlightened," they work perfectly until disturbed. I suppose the spring-loaded nature of the holder may be responsible for this behavior.

If everything is okay, slowly rotate R5. Stop rotation when the output level reaches about 2.5 watts. The only other adjustment needed is to tune L4. Do this by spreading or compressing the winding. The output should peak at some point. Adjust R5 for an output level of 3 watts. Re-check L4 and cement the winding in a few places.

Refinements and Options

If you have never used a separate transmitter and receiver before, you have some decisions to make. If you hook this transmitter to your antenna, how do you get incoming signals to the receiver? One way is to use a separate antenna. Most modern HF receivers (and transceivers) receive reasonably well with a few feet of wire strung up around the shack. Try to keep the receiving antenna away from the transmitter feedline and antenna. To use a single antenna with a manual TR (transmit/receive) switch, see Figure 6. A W7EL-style electronic antenna switch is shown in Figure 7. (See: R. Lewallen, "The Optimized QRP Transceiver," *QST*, August 1980, pp. 14–19.) Automatic antenna switching is performed by a relay in Figure 8.

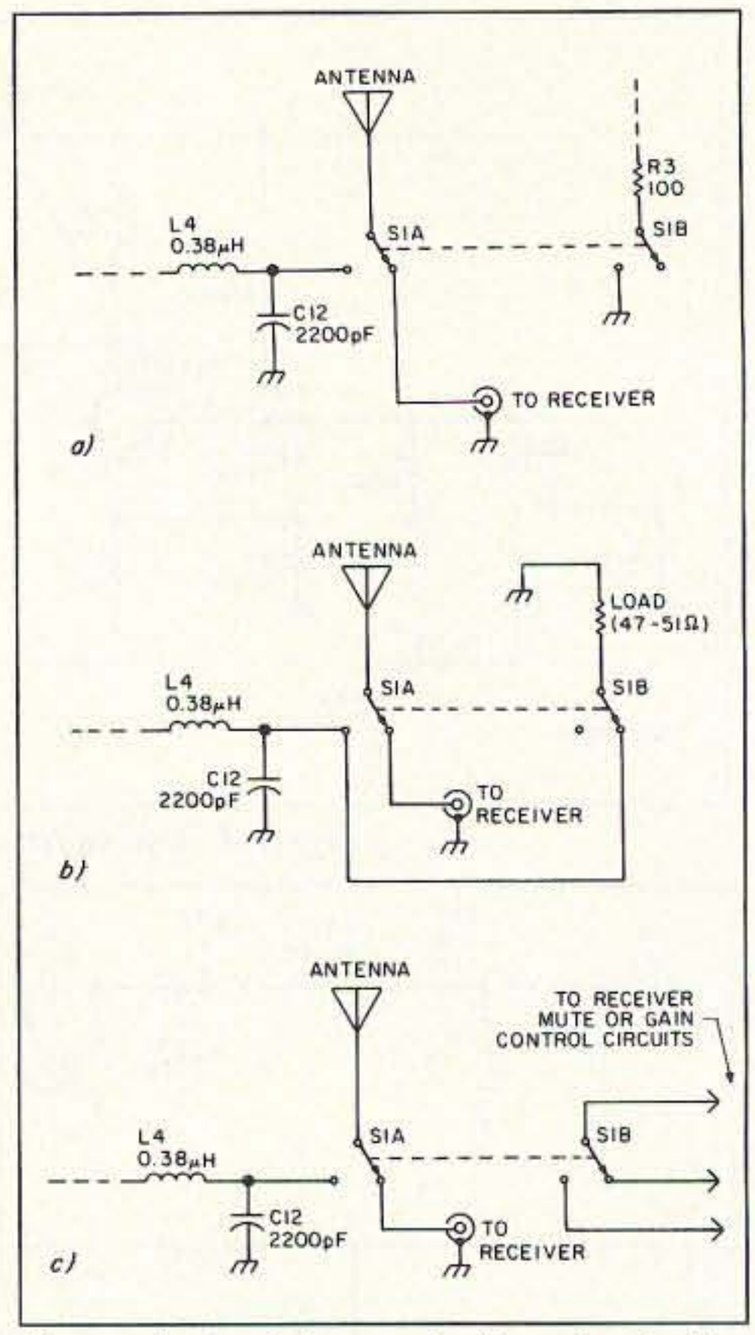

Figure 6. A miniature double-pole double-throw toggle switch can make life with a Rock Bender more pleasant. At A, antenna switching is accomplished by S1A. Amplifier keying is used. The oscillator is turned on by S1B in the transmit position. A keyed oscillator is used at B and a dummy load is automatically switched in during receive. This allows you to press the key and spot the transmitter without putting a signal on the air. C shows how S1B could also be used to reduce receiver gain. You can have a more pleasant sounding and accurate representation of the transmitted signal if receiver overload is minimized in this manner. Where and how you connect S1B will depend on the receiver being used.

Operation

The frequency marked on an FT-243 holder is the approximate upper tuning limit. The tuning range is downward from that point. Keep this in mind when ordering crystals. Smaller crystals (HC-6, HC-18) may tune up to 1 kHz higher than the marked frequency.

It's nice to move around the band and answer other stations when using low power instead of being "rock-bound." Once you find their signal, how do you get your transmitter there? Calibrating the dial helps, but only for approximate tuning. Unfortunately, the calibration becomes invalid if you plug in a different crystal. Simply press the key and turn the tuning knob, but not on the air. Use a dummy antenna and match the beat note by listening to your receiver. When the other station finishes calling CQ, switch to the antenna and reply.

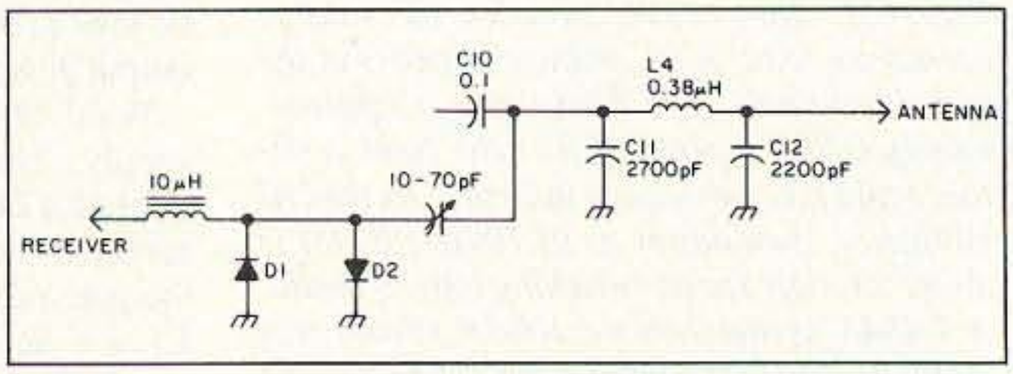

Figure 7. A simple electronic TR switch for 7 MHz. The variable capacitor is adjusted for maximum receiver sensitivity. This will be around 50 pF with a non-reactive receiver input. D1 and D2 are high-speed silicon diodes such as 1N914 types. Receiver overload is severe (not damaging). Some form of automatic or manual gain control may make the keying sound better in your station receiver.

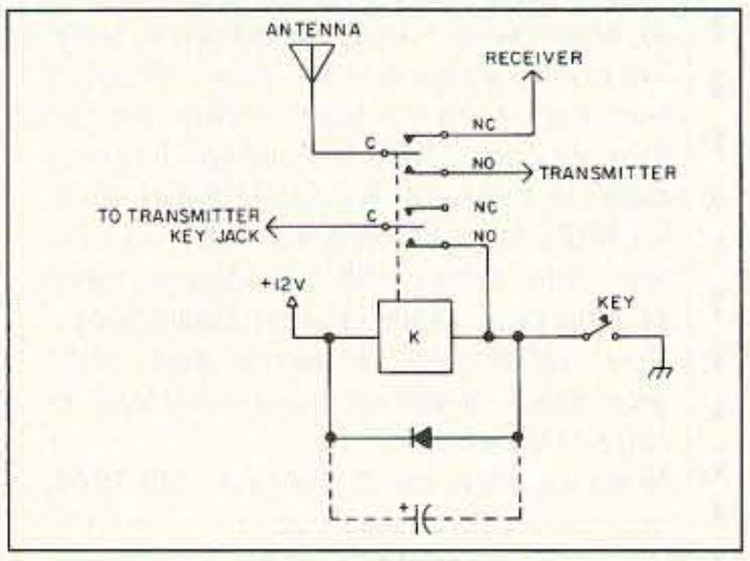

Figure 8. When you key the relay, it keys the transmitter. An optional electrolytic capacitor will provide semi break-in keying. Try 100 to 500 μF. Transmitter output occurs after relay contact is made and ceases before contact is broken. Another set of contacts or another relay can be used for gain reduction or muting at the receiver. K is a 12-volt relay to be operated from the 12-volt transmitter supply.

I have attempted to make this transmitter as useful as possible, considering the limited number of parts and the circuit simplicity. I would like to thank John Carter W5LGO for providing a great deal of assistance in the circuit design, board layout, board fabrication, testing and parts procurement. Circuit board kits and bare boards are available from John at 1620 S.E. 24, Norman OK 73071. Bare boards are $7.50. Kits with a crystal are $39. Thanks also goes to intrepid Oklahoma area amateurs who served as guinea pigs by providing feedback about construction and operation.

The pride and satisfaction of telling another operator, "Rig is home-brew," has to be experienced to be believed. Building your own equipment can open up a fascinating new dimension of amateur radio. Try it out and see! 73

Contact Randy Henderson WI5W at 10809 N.E. 17th Street, Oklahoma City OK 73141.

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CIRCLE 121 ON READER SERVICE CARD

73 Review

by David Cassidy N1GPH

Heil HM-10 Dual and BM-10 Boomset Microphones

Heil Sound
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Marissa IL 62257
Telephone: (618) 295–3000
FAX: (618) 295–2835
Price Class: HM-10 Dual $130; BM-10 Boomset $85, wired.

Anyone who is even mildly interested in home audio knows that the quickest and easiest way of altering the sound of your stereo is to change the speakers. In amateur radio, the quickest and easiest way to alter the quality of your transmitted phone signal is to use a different microphone.

While the stock mikes supplied with modern transceivers are adequate for operating, they are certainly the "weak link in the chain" of most amateur stations. Take away any remote tuning buttons and what do you have? Essentially, a plastic case, a mike element and a momentary contact switch. That's about $5 worth of parts you're using to generate an audio signal in a radio worth thousands.

Heil Sound is one of the major manufacturers of after-market microphones and accessories for the amateur radio market. Recently, I got the chance to use several of their products.

HM-10 Dual

The Heil HM-10 Dual microphone is really two mikes in one. Housed in an attractive black microphone casing that looks like the ball mikes used by performers are both an HC-4 and HC-5 mike element. Switching between the two elements is accomplished by a mini-toggle switch mounted on the mike housing (a single element HM-10, with either of the two elements installed, is also available).

When you purchase an HM-10, you must specify either a Kenwood, ICOM, Yaesu, Collins or Ten-Tec cable. The cables are high quality MIDI data transmission cables and color-coded for easy identification. You can purchase the cables separately, so the same mike is easily transferable to any modern HF transceiver by simply plugging in a different cable. The cables come wired with a 1/4" phone jack in the PTT line, so you can wire up any kind of PTT switch you choose. Heil also sells a simple, pre-wired PTT switch and a high-quality foot switch, if you'd rather not do it yourself. There is also a slide switch on the microphone body that is wired for push-to-talk operation, and the mike elements are wired straight through for VOX operation without any switching required.

Photo A. The Heil HM-10.

The heart of the microphone, and what sets it apart from your basic stock mike, is the HC-5 and HC-4 elements. The HC-5 is Heil's full-range, standard element. The element's frequency response rolls off below 300 Hz and has a 6 dB peak at 2100 Hz. This provides a nicely balanced, but slightly "punchy" sound, good for normal rag-chewing and other run-of-the-mill QSOs. Heil designed the HC-4 element with DX and contest operators in mind. The low-end roll off is 100 Hz higher at 400 Hz, and there is a 10 dB peak at 2100 Hz. The intention here is to give your voice a crisp high end, allowing it to punch through a pile-up or other interference.

The Coincidental Field Test

After hooking up the HM-10 Dual to my transceiver, I started tuning around 17 meters, looking for an informal opinion of the mike's performance. I had set up some scheds for further testing, but I was anxious to try out the new mike. I came across a couple of guys who were obviously talking about audio quality, so I started to monitor the QSO. After a few minutes of listening, it was obvious that one of the stations had just purchased the HM-10 with the HC-5 element, and was looking for observations on his audio. When he mentioned that he was using the same HF rig as me, I knew that I had to talk to this guy!

We chatted for almost an hour, switching between different mikes and different elements and comparing the results. We both came to the conclusion that the HM-10 and HC-5 combination provided a nice, pleasing audio, with just enough high-end punch to break through mild QRM. In comparison, the stock mikes sounded OK (surprisingly), but everyone who broke into the QSO affirmed that the Heil microphone provided a stronger, more pleasing audio, without the "muddiness" of the stock mikes.

Later that evening, I maintained a schedule with three friends on 80 meters. We spent most of the evening switching mikes, recording and playing back transmissions. The same results were obtained and the same opinions expressed by all: The HM-10 with the HC-5 element beat the stock mike hands-down for clear sound. We all agreed that the H-4 element had a nice, high-end punch, but would not be the element to use for normal rag-chewing. The HC-4 helped cut through the nighttime QRN better than the HC-5, but for normal conditions, the audio quality of the HC-4 is a bit too high-end for my taste. Of course, that's exactly what you want when trying to break into a DX pile-up.

BM-10 Boomset

The BM-10 Boomset has the same mike elements (either the HC-4 or HC-5, but not both) as the HM-10. In this case, the element is attached to a lightweight headset. Like the HM-10, you must order the correct version for the brand of HF gear you plan to use. You can also order a single or double earphone model, depending on your preference and intended use (I used the double earphone model). The microphone wiring arrangement is the same as for the H-10, with the 1/4 phone jack wired for PTT operation.

Since I do a lot of late-night operating, I often use headphones. The quality of the headphones on the BM-10 is excellent—as good as any I've ever used. The earphones cover your entire ear with a flat earmuff (as opposed to an earcup). I like this arrangement

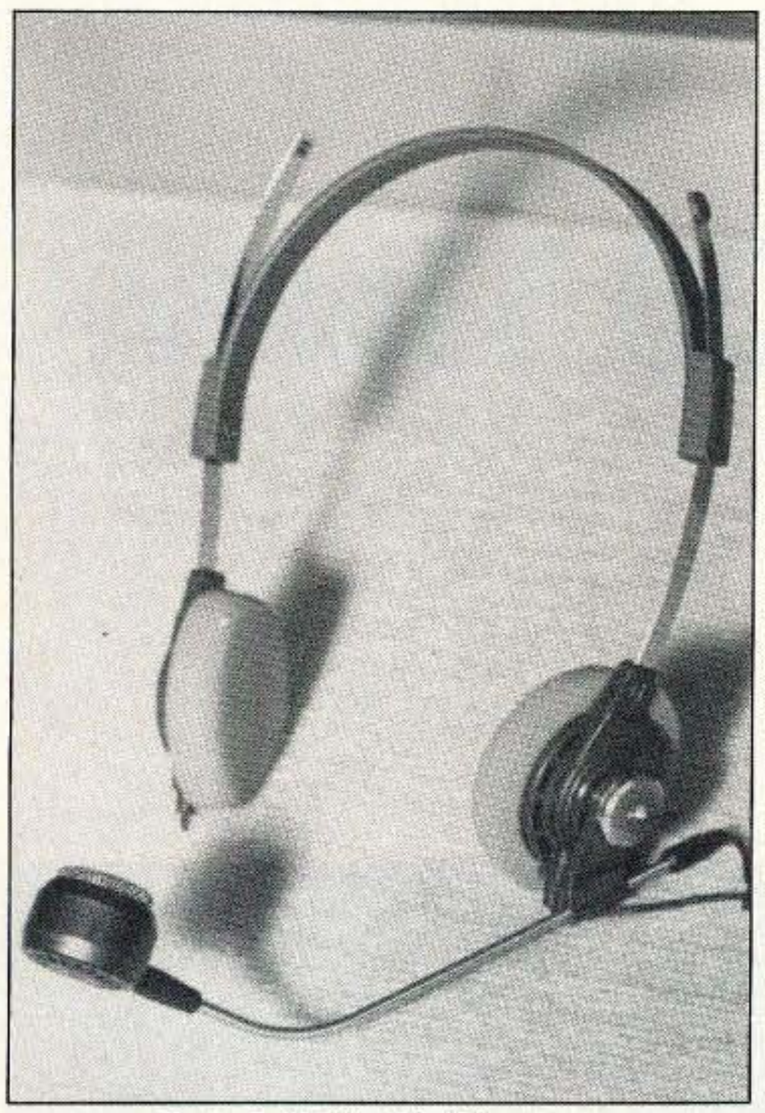

Photo B. Heil's BM-10 boomset.

best, because it allows you to slightly hear outside noise (if you've ever had someone sneak up behind you while you were wearing full-cup headphones you'll know what I mean). The best thing about these headphones (other than the superb audio quality) is their light weight. You can wear them all day without any discomfort (very important if you're a contest operator).

My only criticism of the BM-10 is in the cord arrangement. The headphone and mike cords are totally separate. The headphones have a curly cord (with a standard 1/4 plug), while the mike/boom element has a thin shielded cable. This does allow you to remove the entire boom and use the headphones separately (which, I have to admit, I've done on several occasions), but I would much rather have the mike and headphone cords be a single unit, separating into two cords with two separate plugs a couple of inches from the end. This is a purely subjective comment, since many people would probably find the removable boom a greater asset, but I found the two cords to be a minor nuisance.

On the plus side, I have to mention that Heil has gone to great lengths to make the BM-10 as modular and repairable as possible. The mike element is accessible by unscrewing the cover (Heil mike elements are available separately, so you can replace them easily). The individual earphones can be removed and/or replaced. All wiring is easily replaceable. This is the kind of touch that shows this company is run by hams (which it is).

Accessories, Accessories, Accessories

Heil Sound sells a complete line of accessories for your microphone. In addition to the extra cables, PTT switches and elements already mentioned, you'll want to check out their desk stand or boom stand for the HM-10.

I've always liked the quality of the products I've used from this American company. The HM-10 and BM-10 are fine additions to their line of audio products. 73

Monoband Yagi for 20 Meters

More dBs for the buck.

by Kenneth C. Kemski AB4GX

Like many amateurs, I live in a residential neighborhood where local sentiments do not favor large antenna arrays. Among my favorite operations, however, is hunting DX on 20 meters. This requires attempting to be heard through the pile-ups that develop around almost any semi-rare station that fires up its rig.

There would appear to be three distinct means of achieving the end of ''pile-up crashing'': blind luck; shouting your call hundreds of times, despite who is talking or listening (much to the consternation of everyone involved); or having an effective signal that allows you to ''get in-and-out'' within a few calls.

The chain between your microphone and the desired DX station's ears may include many links, and among the most important (after professional protocol) is the antenna. It is difficult to construct an antenna that affords good gain, directional performance, and usable bandwidth in a small package that won't antagonize the neighbors!

My results with semi-inconspicuous verticals, inverted vees and slopers were somewhat discouraging. It appears that one can develop an S-5 to S-6 signal anywhere in the world where propagation exists, and enjoy many a fine QSO. Unfortunately, pile-ups of any size became primarily a means of killing time until the DX station went QRT for the day.

I finally decided to attempt to design a reduced size monoband yagi that would give me a ''fighting chance'' under adverse conditions (. . . most DX contacts).

The criteria were to obtain: the smallest size possible, 10 dBi forward gain, usable front-to-back and front-to-side ratios, and the ability to withstand Florida's high winds. The result is the antenna described here.

I began to design by purchasing an antenna analysis program, based on the successful Minninec format. It is written and distributed by W7EL, and called ''ELNEC.'' This PC-based program is an absolutely fine undertaking, and is worth many times the asking price. (See the ELNEC review in the January 1991 issue of *73 Amateur Radio Today*.) A detailed description of this program would require an article in its own right. Suffice it to say that I fed my ideas for this antenna into ELNEC over a two-month period, scrutinized the results, and then assembled and tested the final design. I achieved almost total agreement between ELNEC's analyses and real-world performance; for example, the calculated element lengths were within 3/8″ of final tuning!

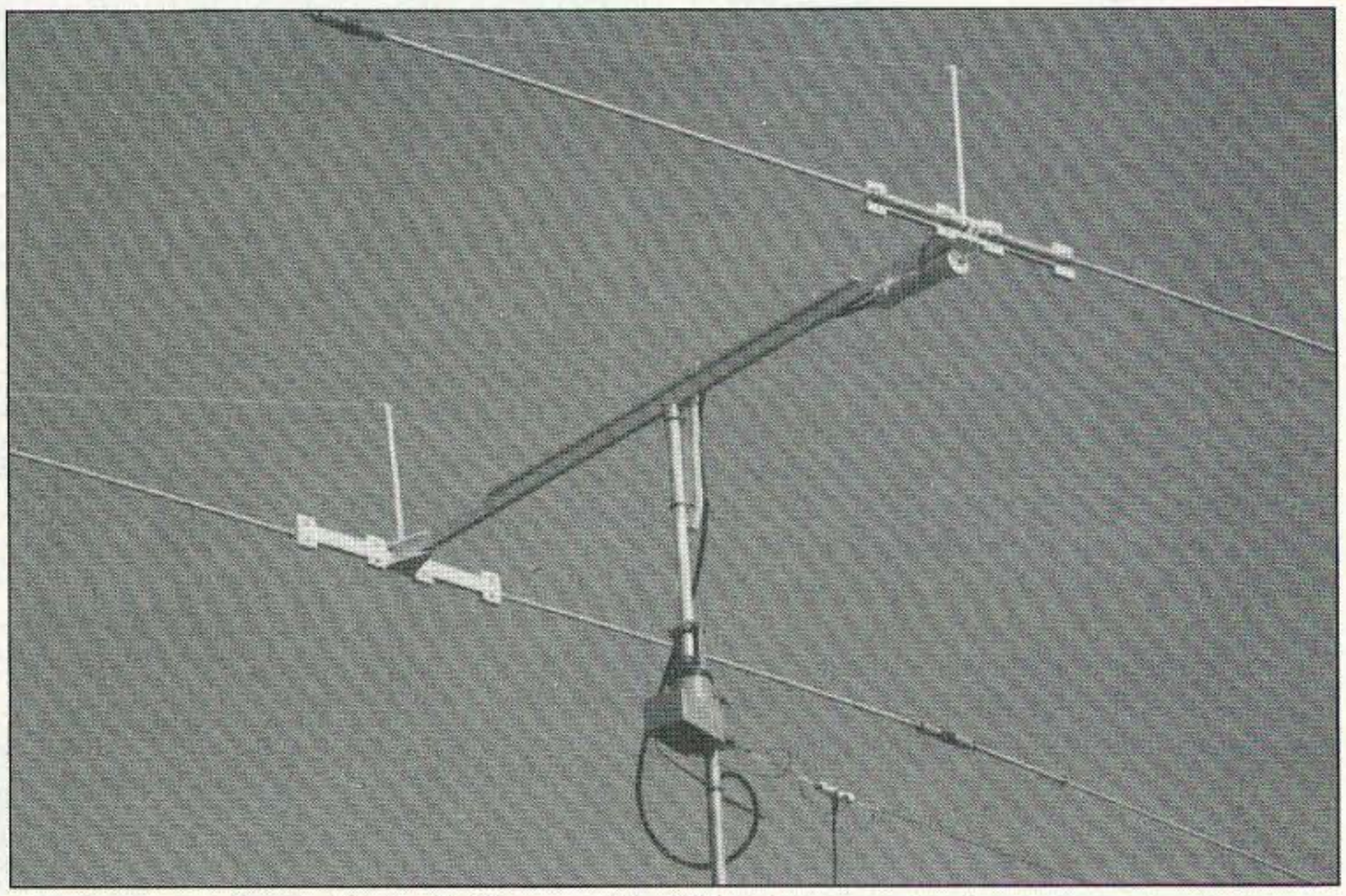

Photo A. The completed 20 meter mono-bander.

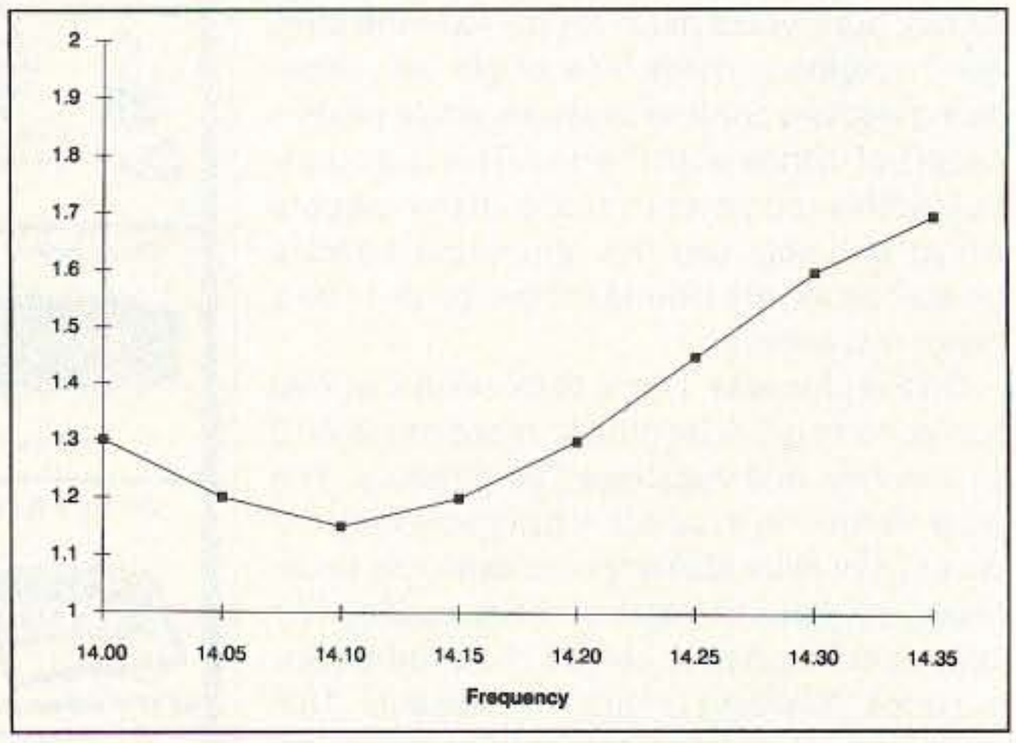

Figure 1. Measured SWR of the 20m shortened yagi.

Design Parameters

The main considerations and variables included the following important areas:

1. **Gain** This was paramount in importance, because they can't hear you if they can't hear you . . . Every available parameter was ''tweaked'' for maximum forward gain commensurate within the SWR and bandwidth constraints. The result is +10 dBi of forward gain at the frequency of interest, increasing to +11 dBi in the general portion of the band (albeit with reduced front-to-back) and decreasing to +9 dBi in the CW portion of the band. (See Figure 2.)

2. **SWR** An electrically-shortened antenna usually has low radiation resistance and requires a matching network of some type. I watched gain while decreasing the element spacing, at the same time varying reflector tuning and other parameters. I found I could match this antenna directly to 50 ohm coax using only a 1:1 wideband current balun. The balun was used to eliminate radiation from the transmission line and preserve the calculated patterns. I would have incorporated a gamma match if it would have helped, but

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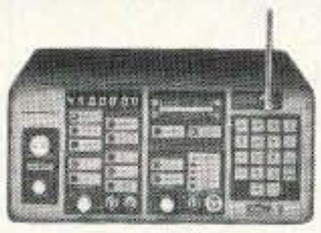

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SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above •−130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

•2 METERS
•223 MHz
•440 MHz

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Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? .....No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters) $149.95
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CFX matching case set ..... $ 24.95

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CT-90 9 DIGIT 600 MHz

CT-125 9 DIGIT 1.2 GHz

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

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Rechargeable internal battery pack, BP-4 ..... $ 8.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1 ..... 59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	<25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	<50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$249.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	<50 mV	Convert your existing counter to 1.5 GHz		$89.95

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.

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Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.

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Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.

CW-7 kit $24.95
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Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

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Matching case & knob set, CAA $12.95

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Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.

SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER

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

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Shortwave converter kit, SCI $27.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

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Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.

FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

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Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!

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AIRCRAFT RCVR

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

AR-1 kit $24.95
Matching case set, CAR $12.95

SPEED RADAR $89.95 complete kit SG-7

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

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.

PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit $29.95
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FM WIRELESS MIKE KITS

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Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to ½ mile.

FM-1, basic unit ..... $ 5.95
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A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.

Complete kit MD-3 . $19.95

MUSIC MACHINE

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Case + knob set, CMM-5 . $12.95

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Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.

KIT P-64A $59.95
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Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.

Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1 . $5.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.

VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!

PB-1 kit $14.95

NEW SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.

SP-1 ..... $29.95 Case-CSP $12.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!

TS-4 kit $9.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug."

Transmitter + receiver set, LB56 . $19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!

FR-1 kit $14.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.

BN-9 kit $5.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.

SA-7 kit $14.95

TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. •Add $3.75 for shipping, handling and insurance. •For foreign orders add 20% for surface mail. •COD (U.S. only), add $5.00. • Orders under $20, add $3.00. •NY residents add 7% sales tax. •90-day parts warranty on kit parts. •1-year parts & labor warranty on wired units.

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CIRCLE 34 ON READER SERVICE CARD

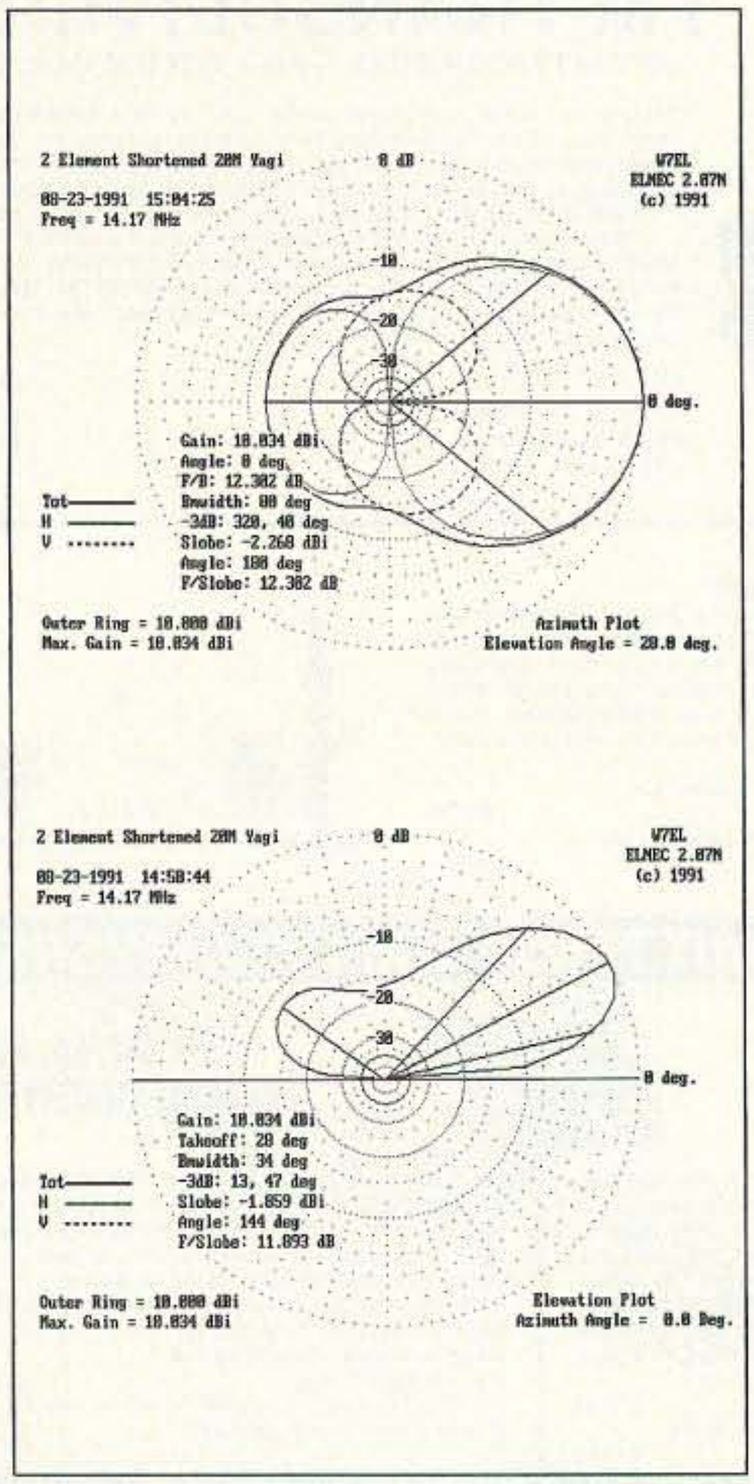


Figure 2. a) Azimuth plot of the yagi using the ELNEC program. b) The elevation plot.

believe me, this antenna is a good match to 52 ohm coax!

3. **Q (Bandwidth)** An electrically-shortened antenna also exhibits higher Q than its full-sized counterpart and this means less usable bandwidth. I wanted optimum performance, primarily within the frequency range of 14.150 to 14.225 MHz (where I hear much of the DX I'm interested in). I received an unexpected bonus when I modeled the antenna, and then constructed and tested it. Analysis showed a far better bandwidth than I had sought, and the finished antenna produced a full 350 kHz bandwidth with low SWR when measured at the transmitter end of the feedline.

Subsequent remodeling and investigation suggests that the additional bandwidth results because of two reasons: Loading coil *Q* is lower than originally modeled (fortuitous because of the "low-profile low-wind-load" form factor I had chosen); and attenuation exists in the 50 feet of RG-8 coax needed to bring the antenna into the shack. You'll find that the attenuation of a random run of coax will yield lower SWR measurements at the transmitter than that measured directly at the antenna, and this serves to "pull down the end points" of the SWR curve. Figure 1 shows the broadband nature of this reduced size antenna.

The coax losses are sufficiently low as to be negligible for two reasons: The losses occur only at the edges of the frequency band of interest; and a tuner or matching network at the antenna also would introduce losses, and they would not be confined to band edges.

4. **Pattern** We'd all like to offer a "laser beam" to the world when we transmit, but I settled for reasonable front-to-back and front-to-side ratios with this antenna because of the constraints placed upon it. The front-to-back ratio varies from 12 to 18 dB, or 2 to 3 S-units in both calculated and on-the-air tests. With the Pacific to my back when beaming Europe or Africa, and the Atlantic at the flank when beaming the South Pacific and points west, it has proven to be a good choice. For stations at a reasonable distance, a distinct "null" appears off the sides of the antenna, probably due to the horizontally polarized signals predominating. (See Figure 2.) I'll admit that I placed pattern after gain when optimizing this yagi, but I have no difficulty determining when I point at a station (or its propagation path). This is very unlike a commercial "mini" I had occasion to operate from a friend's shack a few years ago, where it seemed we were turning a vertical! This antenna does have a usable pattern.

Completed Design

Personal design constraint called for a total of 20′ element length, a spacing not to exceed 8′ (two elements), and maximum height above ground of 33′. The total antenna wind load and weight allow the use of an unobtrusive guyed push-up pole. The antenna that resulted from a few months of modeling on the computer has the following measured characteristics: element length = 20′; boom length = 6′; forward gain = 9+ dBi; F/S, F/B = >12 dB; and full band coverage with less than 1.7:1 VSWR.

Compared to its isotropic counterpart and using 1,200 watts input, this antenna provides an average of 12,000 watts ERP in the direction it is pointed. After examining the performance of many commonly used "antennas" on my computer, this, I can assure you, is a very strong signal.

Construction

Since the antenna was to be as unobtrusive as possible, I chose a wood and aluminum design for maximum structural strength commensurate with small size. I used a wooden boom (common fir) and reinforced it with fiberglass cloth and resin. This allows a good degree of flexibility, strength, and light weight for "pole" mounting.

I constructed the elements from 1/2″ and 3/8″ aluminum tubing, available at many hardware stores in 6′ lengths. These diameters are very small as common yagi elements go and have survived severe Florida winds without problem. This is probably because of the elasticity or "springiness" of the wooden boom elements. You cannot appreciate the small "willowy" nature of this antenna until you construct it.

Construction begins with the boom itself, shown in Figure 3. It is not wholly necessary to glass the joints, but you assure long-term reliability if you do. Kits for glassing are available from your local department stores (such as K-Mart) or automotive shops. These inexpensive kits contain enough fiberglass

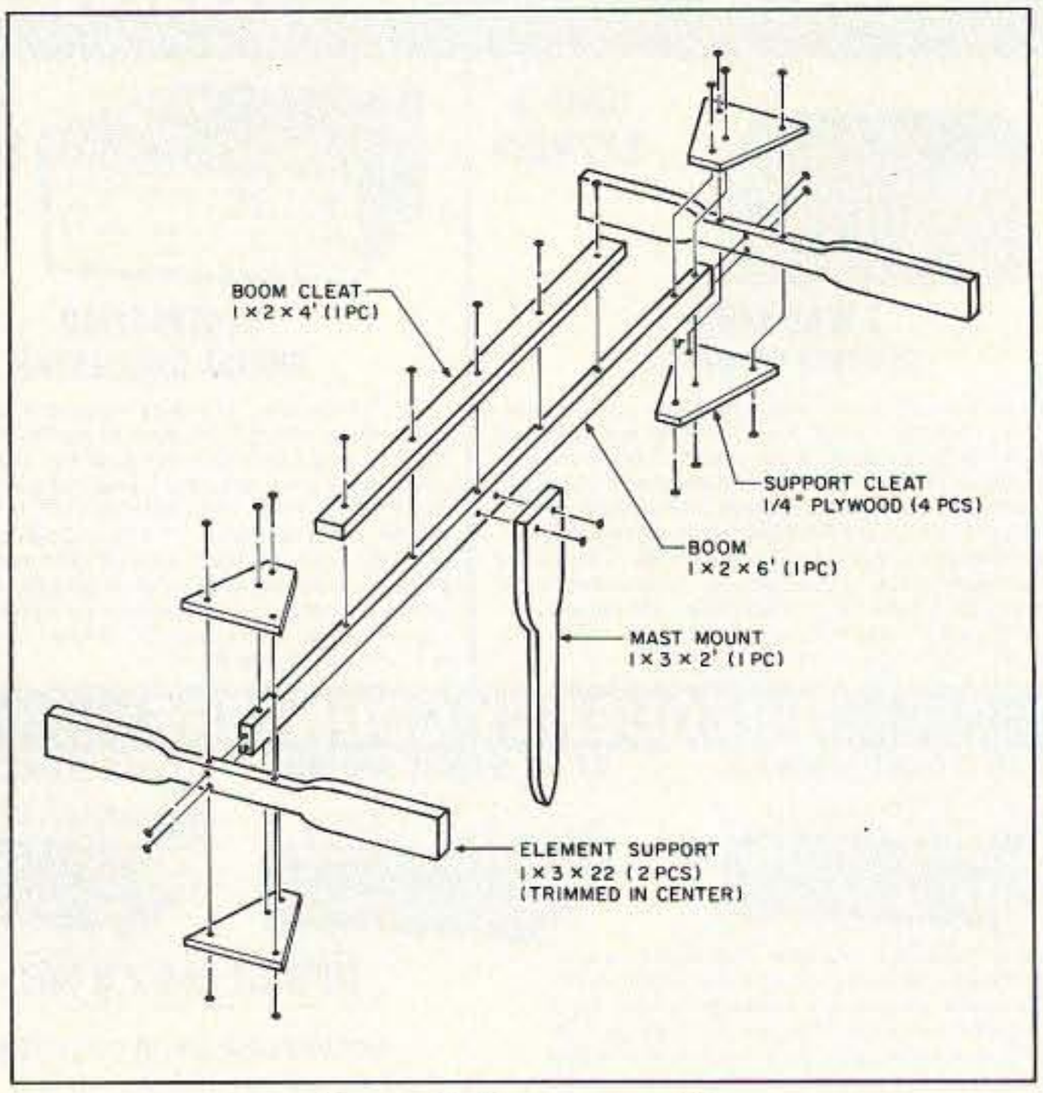


Figure 3. Boom assembly.

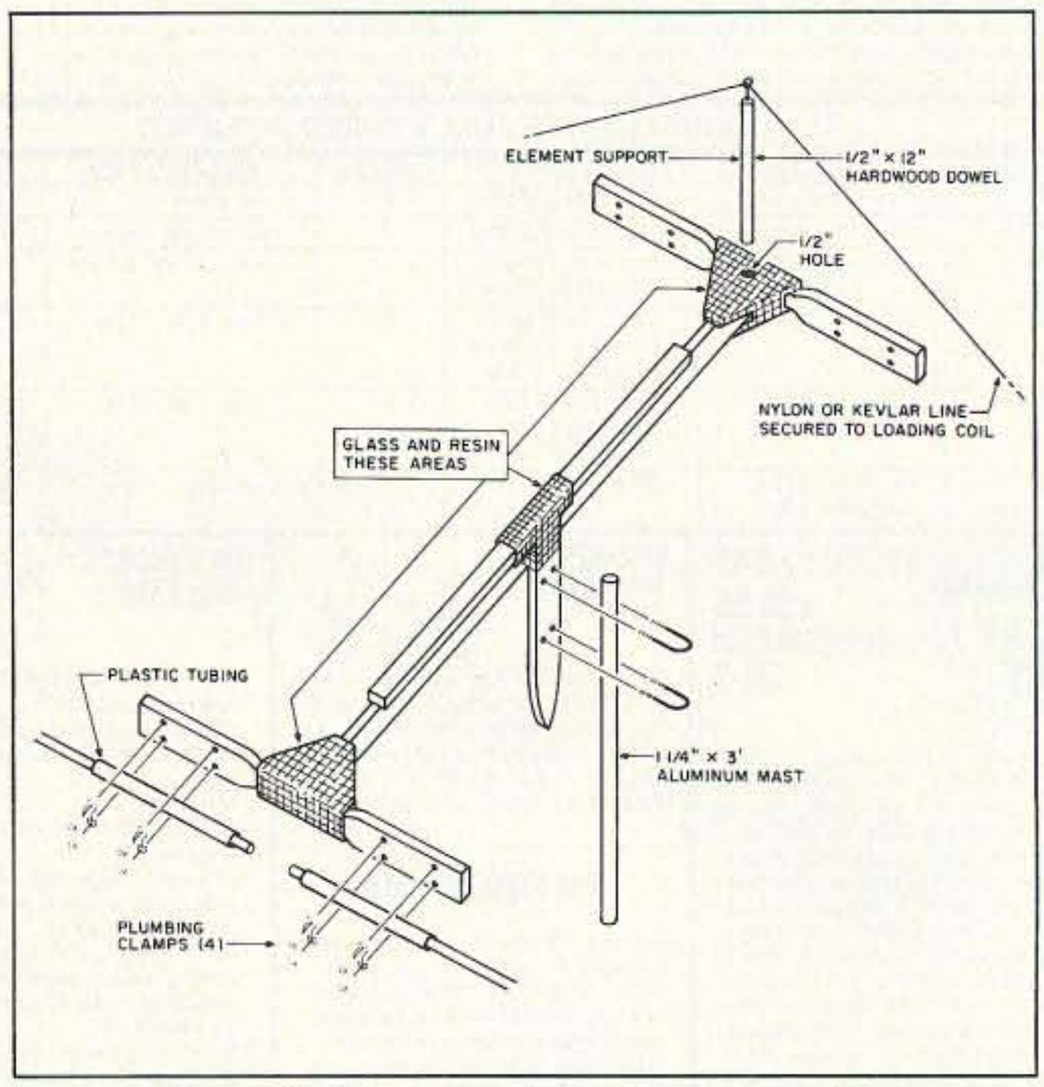


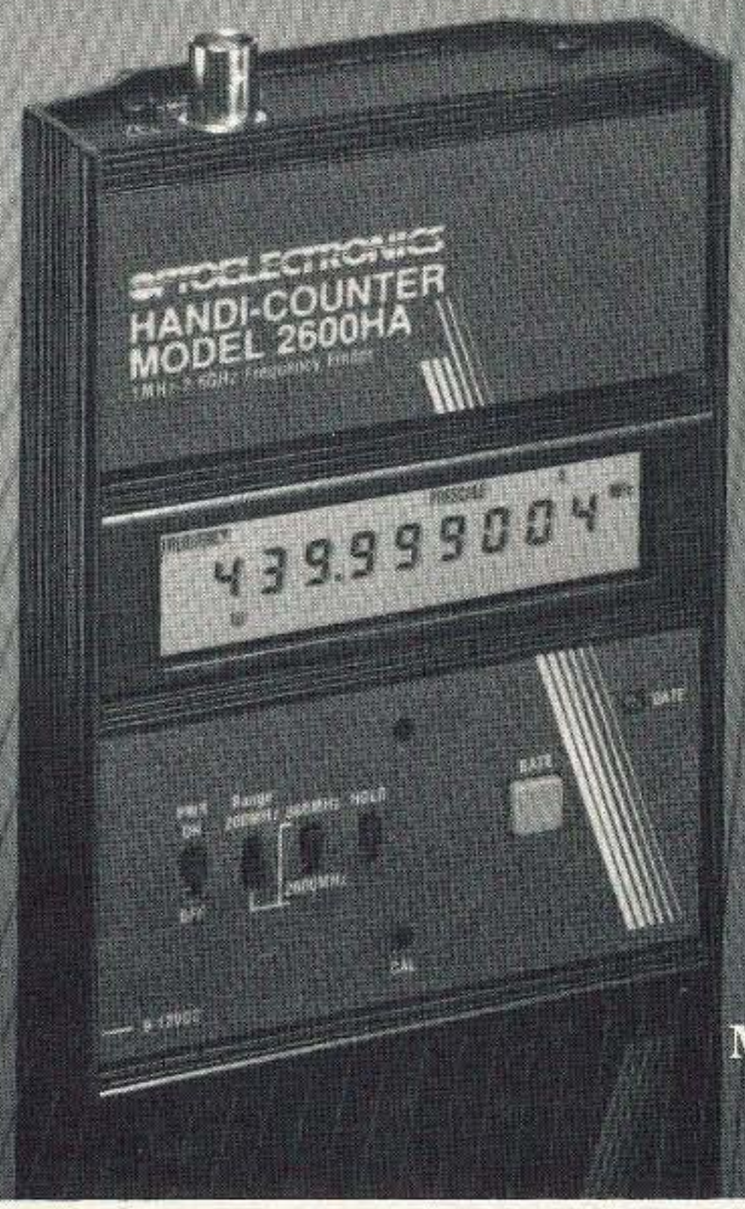
Figure 4. Glassing and final boom assembly.

OPTOELECTRONICS

"Here at Radio School classes held throughout the country, the only counters that we will use are Optoelectronics' Handi-Counters."

Gordon West

Gordon West
President
Radio School,
Inc.



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Our Name says quality, service and dependability – Our customers agree!

"The best part of the Optoelectronics LCD counters are their extreme sensitivity, their brilliant LCD readout that can be seen even in bright sunlight and the rugged construction allowing them to get banged around, but still continue to operate smack dab on frequency... Yours is the only counter which reliably gives us (at Radio School) an instant frequency readout with its rock-steady LCD digits featuring incredible 1Hz resolution."

Gordon West

"I was encouraged by one of my readers words of wisdom, and bought the Model 2300. Your service was superb! After testing this unit I personally feel that all serious radio enthusiasts should own an Optoelectronics Frequency Finder"

Ron Bruckman
Radio Monitors Newsletter
Of Maryland

Optoelectronics has satisfied its customers for over 18 years – See for yourself what countless others have already discovered!

Model	8030	3000	2600H	2810	2600HA	2210A	2300
Function	Freq, Period Ratio, Interval	Freq, Period Ratio,Interval	Frequency	Frequency	Frequency	Frequency	Frequency
Range	10Hz-3.0GHz	10Hz-3.0GHz	1MHz-3.0GHz	10Hz-3.0GHz	1MHz-3.0GHz	10Hz-2.4GHz	1MHz-2.4GHz
Display	10 Digit LCD w/Function Annunciators	10 Digit LCD w/Function Annunciators	10 Digit LCD	10 Digit LCD	10 Digit LCD	8 Digit LED	8 Digit LED
RF Signal Strength Indicator	16 Segment Adjustable Bargraph	16 Segment Adjustable Bargraph	16 Segment Adjustable Bargraph	•	•	•	•
Hold Switch	Yes	Yes	Yes	Yes	Yes	No	Yes
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cloth and resin to complete this antenna, and a few more besides! After glassing the stress points shown in Figure 4, I used automotive primer and white automotive enamel (obtained where I bought the fiberglass kit) to spray the entire assembly for weather protection and unobtrusive appearance.

After the boom has cured, drill holes for the element mounting clamps, which are common plumbing clamps. Secure the 1/2″-diameter by 5′-long aluminum tubing to the element holders, also shown in Figure 4, spacing the ends of the tubing about 1″ apart. Notice that I isolated the elements further from the boom mounts by slipping clear plastic tubing over the ends (also obtained from my local hardware store). You might wonder why I would bother to isolate elements when ''plumber's delight'' construction predominates in yagi construction, and I already had wooden insulating supports. Take nothing for granted, and KISS (keep it simple, stupid) are my mottos. I had analyzed the antenna as a set of free space conductors and that is what I wanted to build!

Connect the inside ends of the reflector with #12 wire and a pair of solder lugs screwed into the 1/2″ tubing, shown in Figure 6. Be sure to weatherize these connections as well.

You can strap the Radio Works 1:1 balun to the boom near the driven element using one or two large stainless steel hose clamps. Connect the unbalanced output of the balun to the driven element ends, again using #12 copper wire, solder lugs, and self-tapping screws affixed to the 1/2″ tubing. Be sure to weatherize these connections.

At this point, you have assembled the antenna as far as it can be and still fit in a normal garage. Subsequent assembly must be done outdoors, presumably on the day you will erect it.

Wind the loading coils on 1″ wooden dowels, a total of 23 turns of #16 enameled wire spaced over 2.5 inches, for 4.2 μH of inductance, shown in Figure 5. Start by cutting a 1″ wooden dowel into four 6.5″ lengths, and then drilling a 3/8″ hole into the ends of each dowel to a depth of two inches. Be careful to center the hole and keep the drill bit straight as it enters the dowel. A drill press and vise make the job easy.

After drilling the dowels, cut eight 5″-long pieces from a section of 3/8″ solid aluminum rod. Mix up some ''two-hour'' epoxy, and after roughing one end of the rods with sandpaper, coat the rough end of each rod and insert it into the dowel until fully seated. Continue until all four dowels have 3/8″ aluminum mountings at either end. This technique yields low profile, strong coil forms that you can easily attach to 1/2″ tubing with hose clamps.

I used stainless screws and solder lugs, shown in Figure 5, to secure an electrical connection to the aluminum rods. I drilled small pilot holes through the wooden dowels at each end, continuing until the hole progressed into the rod. Wind the coils between the solder lugs and secure by soldering each end to its respective lug. To help in producing

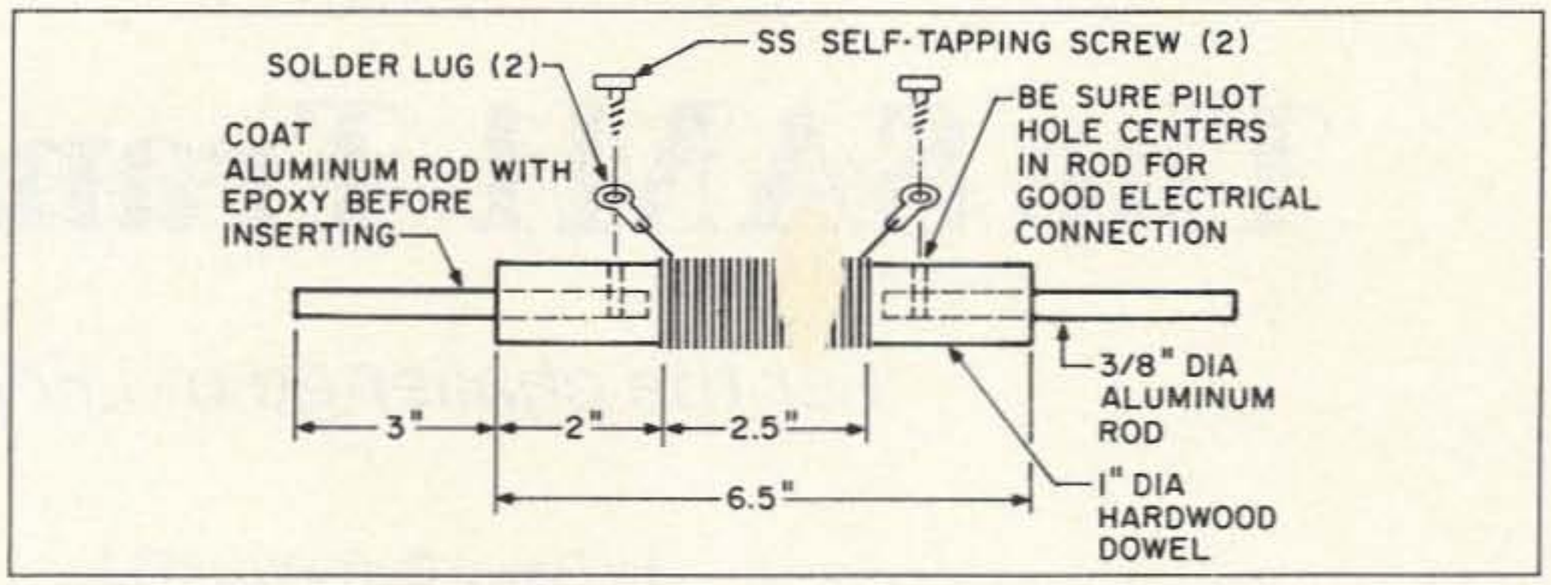


Figure 5. Loading coil assembly.

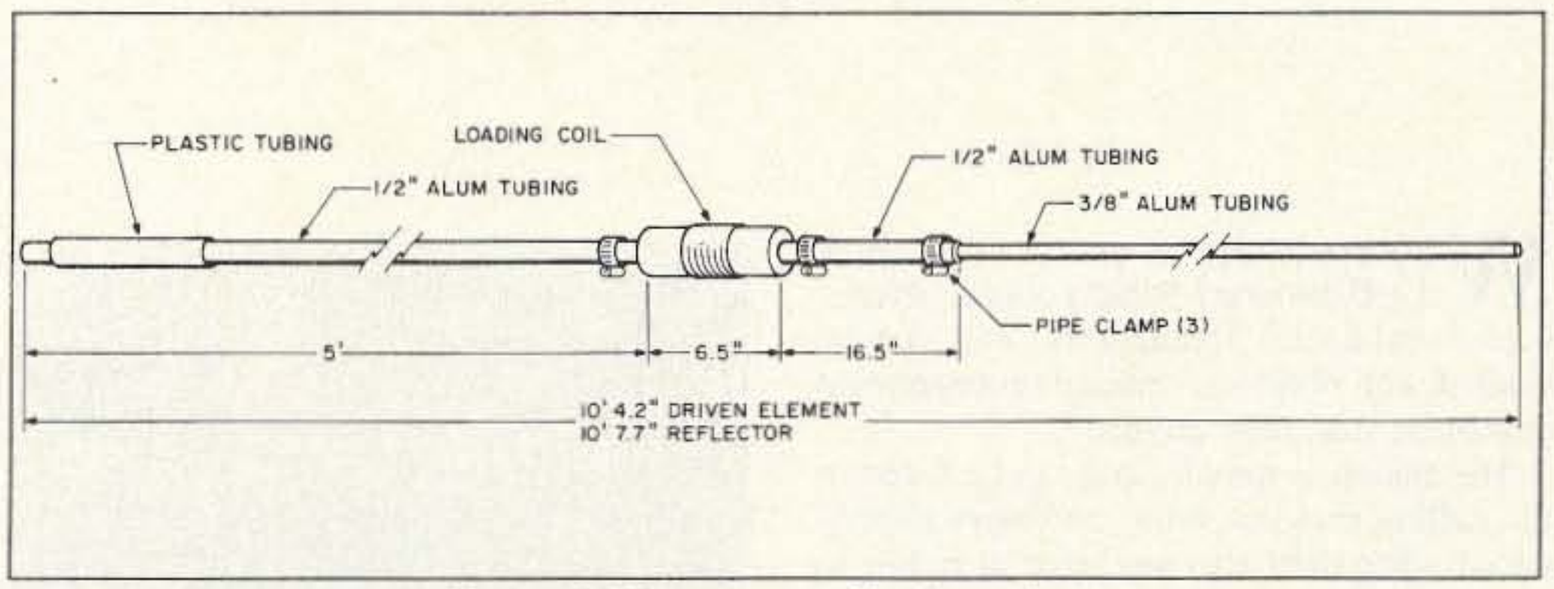


Figure 6. Element assembly (times four).

a uniformly wound coil, I used masking tape to secure the windings while I manually adjusted turns spacing with a thumbnail. This is very easy to do, and will only take a few minutes for all four coils. After the spacing looked uniform, I spread four thin beads of fast-curing epoxy down the length of each coil. I spaced the beads 90 degrees apart (the coils resembled B&W units at this point) and removed the masking tape when the epoxy cured.

The coil assembly must be weatherized, so I used 1-1/8″ Teflon™ heatshrink over the entire length of the wooden dowels, and then sealed the ends with urethane. Alternatively, you can spray or brush the weather-resistant coating of your choice over the coil assemblies, making sure to seal the lugs and screws. The result will be loading coils that should last for a very long time.

Assemble the antenna elements by following the diagram in Figure 6. I used stainless steel hose clamps, but you can screw the element segments together, being sure to leave the four 3/8″ end segments adjustable for tuning purposes.

Tuning

With the antenna lifted to the top of an 8′ to 10′ ladder, and using your rig at very low power (please don't cause QRM), simply tune the driven element to resonance at the center of your primary operating frequency. Adjust the reflector for a length that is 3.5″ greater than the driven element on each side, or 7″ longer overall. If you use the MFJ SWR

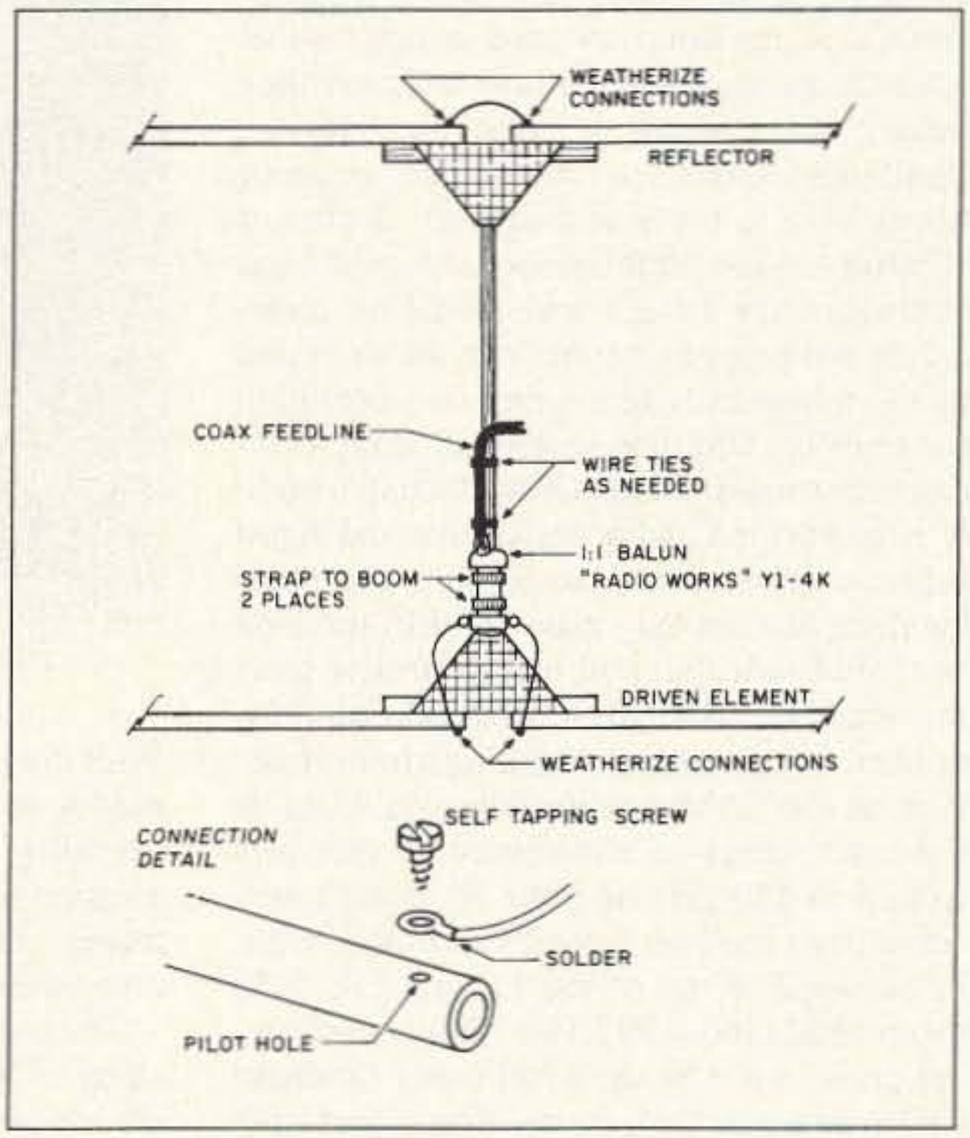


Figure 7. Final wiring.

Analyzer as I did, you can play around a bit with no fear of causing QRM. Repeat the process one more time and then recheck after raising the antenna to its final height. You can see from my SWR chart that I missed by a hint because of impatience. The antenna is usable over the entire band as tuned, and the high frequency side of the SWR chart does offer the highest forward gain . . . (excuses, excuses).

Antenna Mounting

To install the antenna, I used a 40′ four-section push-up pole, a wall-mounting bracket, and a TV antenna rotor, all obtained from

Continued on page 46

The SAM1 Transverter

For the challenge of LF/VLF.

by David Curry WD4PLI

Why would anyone ever want to work 1750 meters!? What possible excitement would such frequencies, that can be riddled with noise and strange propagational characteristics, offer anyone?

The answer is simple, and can be found in the calling that our radio ancestors experienced when they also marveled at radio, as most of us do now. 1750 meters is a band of antiquity. Electrically, long wave frequencies follow the same laws and principles that other frequencies do, but how and why they behave often seems peculiar and elusive. Challenges exist for the skilled amateur whose dive to the low frequency depths of 1750 meters to visit this once antiquated band of frequencies using a state-of-the-art transceiver and proper antenna, may be surprised by the opportunity that long wave operation has to offer. Old tube regenerative radios of that time stand in the shadow of today's highly sophisticated radio equipment and boast superior features such as IF shift and noise blanking that not only make the difference on our ham bands, but also make effective tools for amateurs who have "what it takes" for this true amateur band. Building a transverter such as the SAM 1 will allow you to enjoy top-notch reception of the entire LF spectrum from 5 to 450 kHz on your 80 meter transceiver, and transmit virtually any mode within the legal limits of the license-free 1750 meter band (160–190 KHz). This transverter design is in use by the 1750 meter Southern California net that meets every Saturday morning at 9 a.m., LSB. Stations hundreds of miles away are regularly monitored at my location under good conditions, while local stations only 30 miles distant can not be heard under poor conditions. This gives the obvious impression that this band can be one of extremes on many levels, and a challenge on all levels.

Enter the SAM1

The SAM1 transverter provides a practical way for anyone who has an 80 meter amateur transceiver to use the 1750 meter/long wave band in two-way communications. The third generation of transverters optimized by "lowfers" (anyone operating in the 1750 meter band) in the Los Angeles area, it uses only 10 transistors, one IC, and a few other parts.

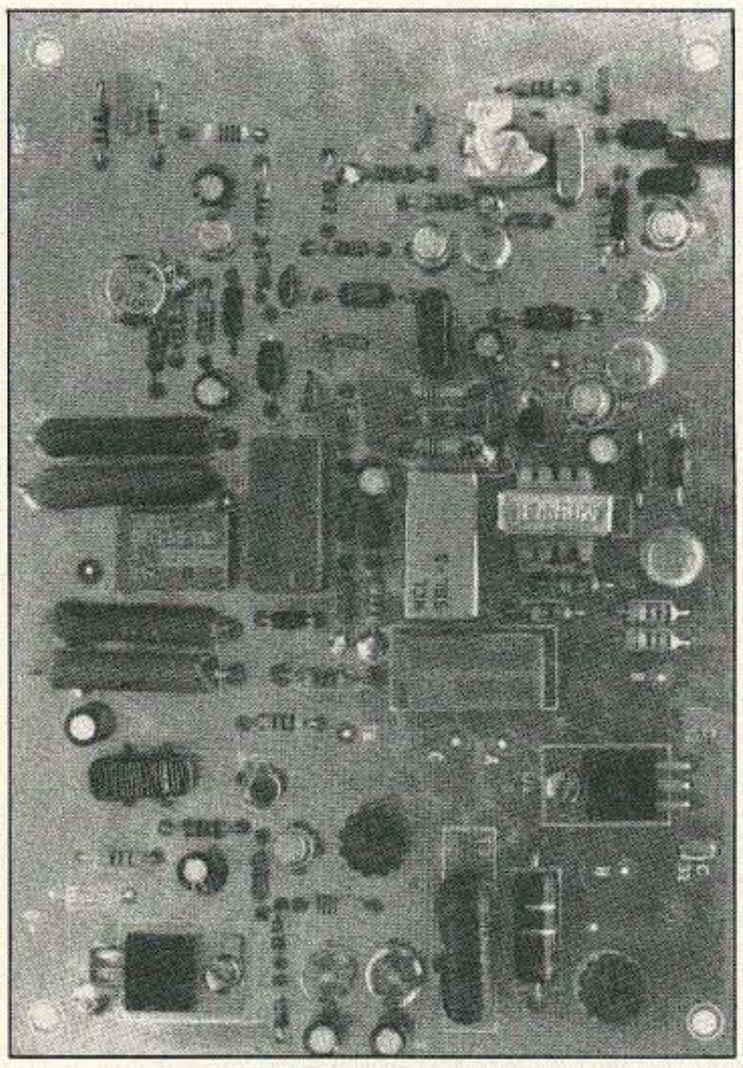


Photo A. The completed board.

With this transverter, you can operate all modes on long wave. You can also, while operating on long wave, have all the communication features, such as noise blanking, filtering, and speech processing, that are available on any HF or state of the art transceiver.

The transverter connects between any resonate 1750 meter/long wave antenna (a good choice is the "Dual-Band Vertical" in the September 1991 issue of *73*) and your transceiver, and operates on any well-filtered DC voltage supply between 12 and 24 volts (a 24 volt supply is recommended). The SAM1 has provisions for separate receive and transmit antennas and includes "phantom" power for remote active receive antennas or relays . . . or whatever! When you shut your SAM1 transverter off, automatic through-switching allows your transceiver to operate as normal, eliminating the hassle of connecting and disconnecting it.

The 1750 meter band offers a lifetime of interesting communications and challenge to appliance-weary hams looking for fresh soil, as well as to beginners and do-it-yourselfers who appreciate the art of building. Many have called it a "true amateur band." Wishing you and all the Southern California lowfers the best of luck on 1750 meters, I dedicate the SAM1 to Charles Faulkner, the father of the first practical transverter for regular SSB on 1750 meters in our area, and quite possibly in the U.S.

The SAM1 Transverter, Step by Step

See Figure 2 for parts placement, and refer to the table for parts identification, and let's go. . . . Be sure to use a good quality rosin core solder and a clean soldering iron tip.

1. Locate audio transformer T1. One side of the body is printed with the letter "P," which should match up with the "P" on the component side of the board. Insert all 6 leads and bend the transformer lugs for a tight fit.

2. Next, mount transistor Q7 (TIP31B). Bend the 3 leads near the body away from the top and insert them into the board. Line up the hole at the top of the transistor with the hole on the board and slip the small insulated gray washer in between. Clamp it tightly with a 4/40 nut and bolt (but not overly tight).

3. You can mount regulator U1 (MC7812CT) in the same way as Q7, but you don't need a washer.

4. Relays K1, K2, and K3 are next.

5. U2 is the doubly-balanced 8-pin mixer. Be sure to line up pin 1 with the dot marked on the circuit board.

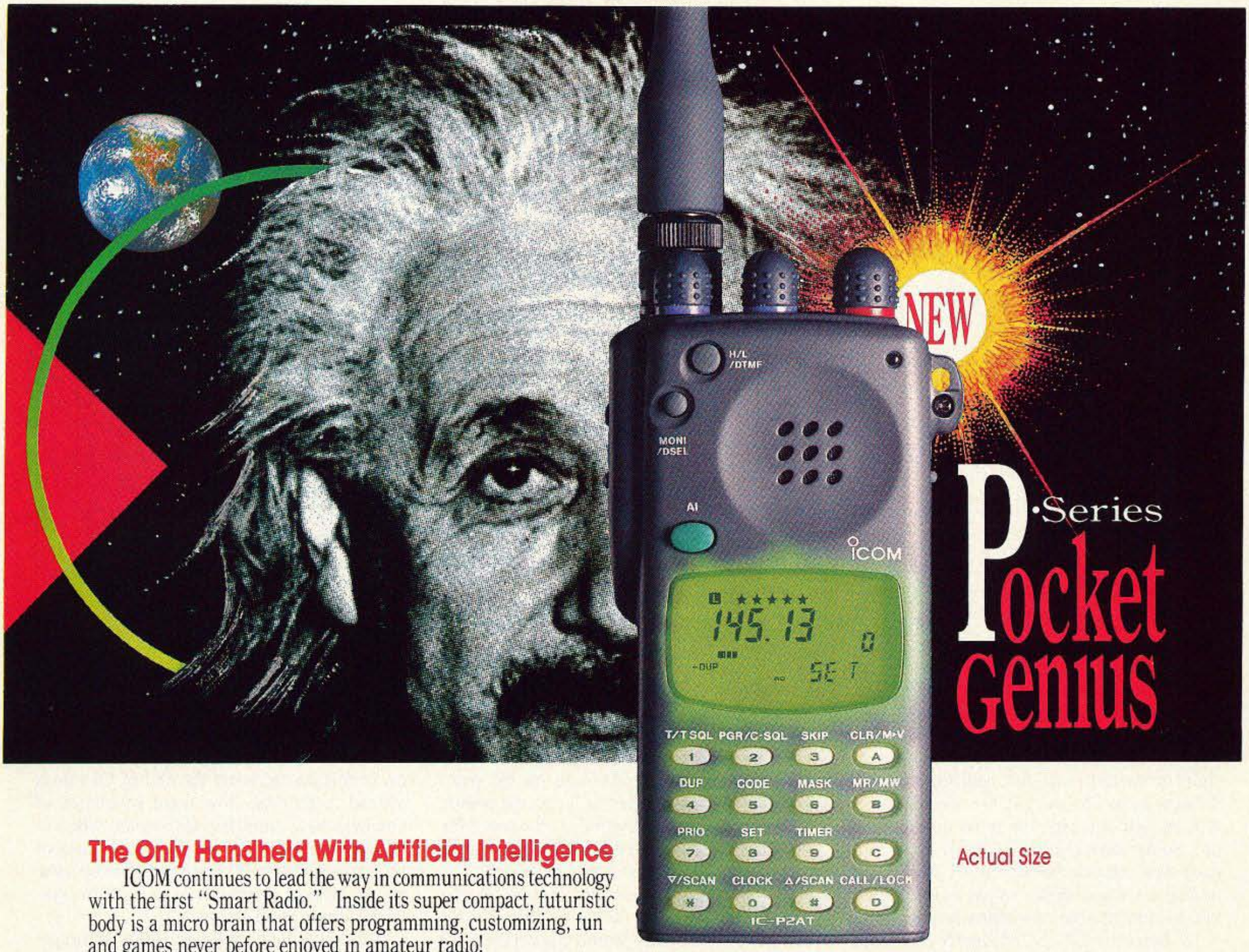
6. Insert C14, the variable capacitor, so that the capacitor plates are located away from Y1. This gives room for inserting Y1.

7. Y1 (3.4995 MHz) can be inserted next. Be sure it's snugly mounted against the board while you're soldering.

8. Insert resistors R37–R40. Bend the leads close to the body, leaving the corners slightly rounded. Make sure that the bodies of the resistors stay at least ⅛" away from the board. They can get quite hot, and the space will help dissipate the heat. Solder all component ground leads on both sides of the board marked by an "S."

9. Insert and solder R31, R35, and R41. Notice the "S" marking where component leads are soldered on the component side to insure a good ground connection. Resistors R1, 8, 9, 14, and 21 must be checked for this.

10. Next come diodes D1, 2, and 3. Notice the band marking on the diodes before inserting, making sure to match up the band on the



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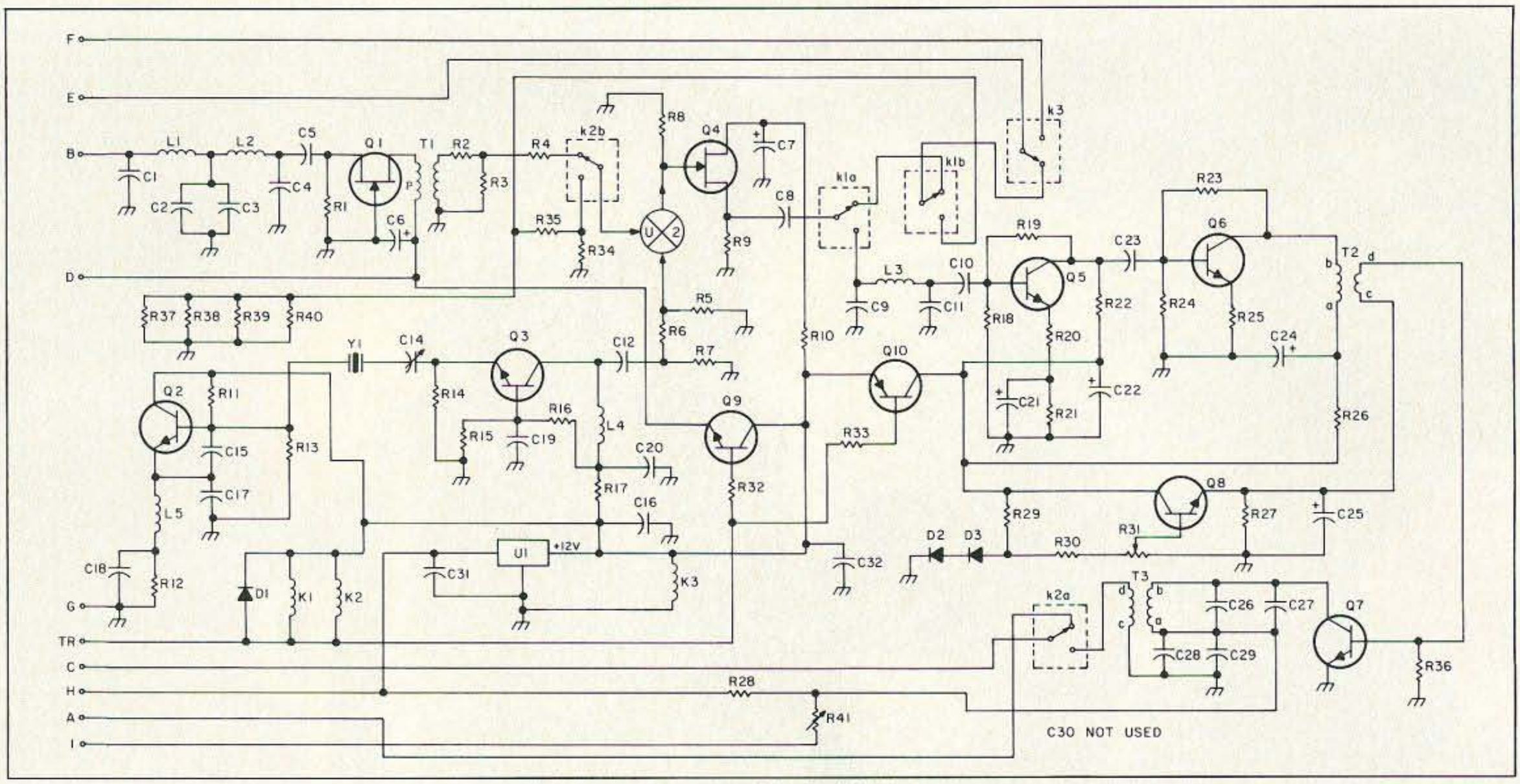

Figure 1. Schematic of the SAM1 Transverter.

part with the parts placement diagram. Diodes D2 and 3 should be directly against the board, nice and snug.

11. Insert and solder all capacitors, going right down the parts list, starting with C1 through 3, 4, 26, and 27. Do one section or type of part at a time, to avoid mixing them up. Solder and clip leads when done with each type. Notice that C5, 6, 7, 24, 25, 28, and 29 are electrolytic, so pay careful attention to polarity when installing them!

12. Inductors L1, 2, 3, 4, and 5 are mounted away from the board about ⅛" to avoid any possibility of shorting one of the fine wires. Notice the inductor part number for correct part insertion.

13. Transformers T2 and T3 are both toroid transformers (see the parts list for winding details). The smaller toroid should be inserted at the T2 location. Mount the toroid on its side, with the secondary wires going to the holes marked C and D, and the primary wires going to holes A and B. With fine sandpaper, carefully strip the enamel insulation from all four wires next to the body of the toroid, leaving the bare wires ready for soldering on the foil side. Pull each wire so that the toroid is snug against the board. Then mount transformer T3, also on its side, with the secondary wires going to holes C and D, and the primary wires going to holes A and B. Strip and pull the correct wires through the marked holes, and solder all four. Clip excess leads. Both T2 and T3 should rest snugly against the circuit board.

14. Transistors Q1 and 4 are FET devices and should be handled carefully. Notice the positioning of the part with reference to the outline on the board. The "g" marks the gate of both FETs. Insert and position the body of each FET about ¼" from the circuit board. Solder all six leads on the foil side and clip excess. Also solder the "g" of Q1 to the ground plan marked by letter "S." DO NOT use an excessive amount of heat.

15. Remaining transistors may be done next, in the above manner. Notice Q6. The base lead, or the middle lead on the part, should be bent and inserted across the board. Leave ⅓" or so from the body to the board for the part. Check that the TABS of all transistors match the TAB drawn on the board.

16. Visually inspect the bottom of the board, looking for any possible solder bridges or cold solder joints. Inspect the TOP or component side of the board against the layout diagram and parts list to ensure proper part location. The circuit board is now complete.

Operating the Circuit

The SAM1 is a basic transverter design with a few interesting tricks that greatly improve performance. On the schematic, follow the receive path from input C1.

C1, 2, 3, and 4, and L1 and 2 form a 5-element, low-pass network that greatly attenuates all frequencies above 480 kHz. This is desirable to prevent overload from local AM broadcast stations and to minimize any IMD. Below this frequency, all signals are allowed to pass with a minimum of insertion loss. The phase and filter curve is included in this manual. C5 is a DC blocking capacitor, so that operation of Q1 will be maintained. Q1 is a low-noise, 12 dB amplifier operating in the classic grounded-gate configuration for best stability. In parallel with R1, it provides a 50 ohm input at the source for the filter.

T1 transforms a load of 450 ohms for the drain of Q1 to a nominalized value of 50 ohms. A 50-ohm "T" pad consisting of R2, 3, and 4, with an attenuation value of 1 dB, provides stability and improved return loss for mixer U2. Local oscillator Q2 is the classic Colpitts circuit, with C14 adjusting the frequency of crystal Y1. Typically, the output of such an oscillator is usually taken from where L5 and the emitter of Q2 connect, and the end of C14 would go to ground. However, in this arrangement the end of C14 goes instead to the very low input resistance of common base amplifier Q3, which when in parallel with R14 has an input resistance of less than 10 ohms. This is important because any significant resistance in series with crystal Y1 would spoil Y1's *Q*.

With such high *Q* (over 1000), a simple crystal filter is formed with an extremely narrow bandwidth (less than 10 Hz). We can attenuate local oscillator harmonics by as much as 60 dB, and cut our noise floor down to −110 dB! Q3 works as a stable low-noise amplifier, taking the −2 dBm signal output of Y1/Q2 and amplifying it to an acceptable level of 9 dBm. Inductor L4 and capacitor C12 form a resonant "L" network, matching the collector impedance to the 50 pi attenuators R5, 6, and 7, at 3.5 MHz. The attenuator network provides optimum stability and good return loss for mixer U2.

While the receive amplifier Q1 is only on during receive operation, Q2 and 3 operate during both receive and transmit. U2 acts as both the receive and transmit mixer. Buffer stage Q4 simply provides optimum isolation between U2 and any other stage connected through C8. Resistor R8 is a broadband 50-ohm termination for U2 at all mixer frequencies and harmonics.

This configuration has a small loss (approximately 2 dB); however, using a true 50-ohm termination for U2, with good insulation between U2 and the next section, the advantages outweigh the disadvantages. Q4 operates as a typical source follower with a 50-ohm output across R9. C8 is simply a DC blocking capacitor.

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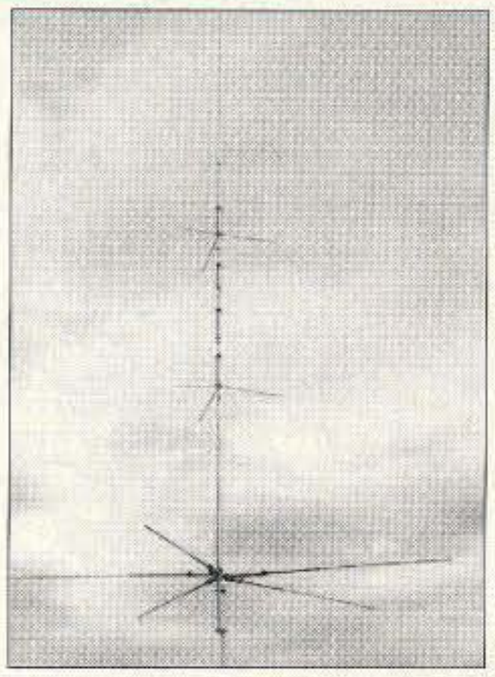

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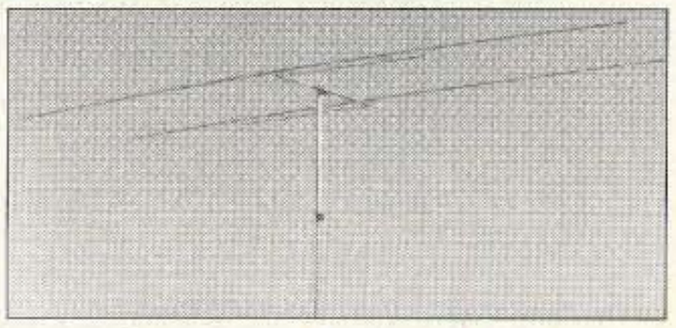

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- Boom Length: 780mm/2' 7"
- Connector: SO239 Jack

28HS2HB – 10 Meter
- Max. Input: 500W (SSB), 250W (FM)
- Gain: Better than 6.0 dB
- FBR: Better than 16 dB
- Element Length: 5,400mm/17' 8"
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- Length: 350mm/14 "
- Connector: BNC Male

HG600B

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- Gain: - U 144MHz
  1.9dB 440MHz
  3.6dB 900MHz
- Max. Input: 10W (FM)
- Length: 320mm/12.5 "
- Connector: BNC Male

HS2RB, HS70RB

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HS70RB	12.80	440MHz Whip Antenna	8 oz.

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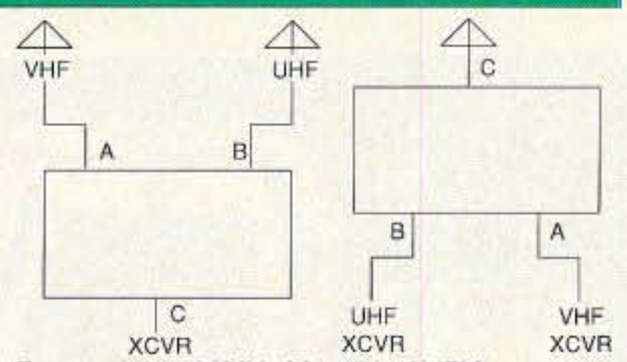

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Connectors:	A	B	C
HS790D	UHFm	UHFm	UHFf
HS790DN	UHFm	Nm	UHFf
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m=male, f= female

- **Weather Proof Model:** HS790WP comes with mounting bracket and stainless steel clamp

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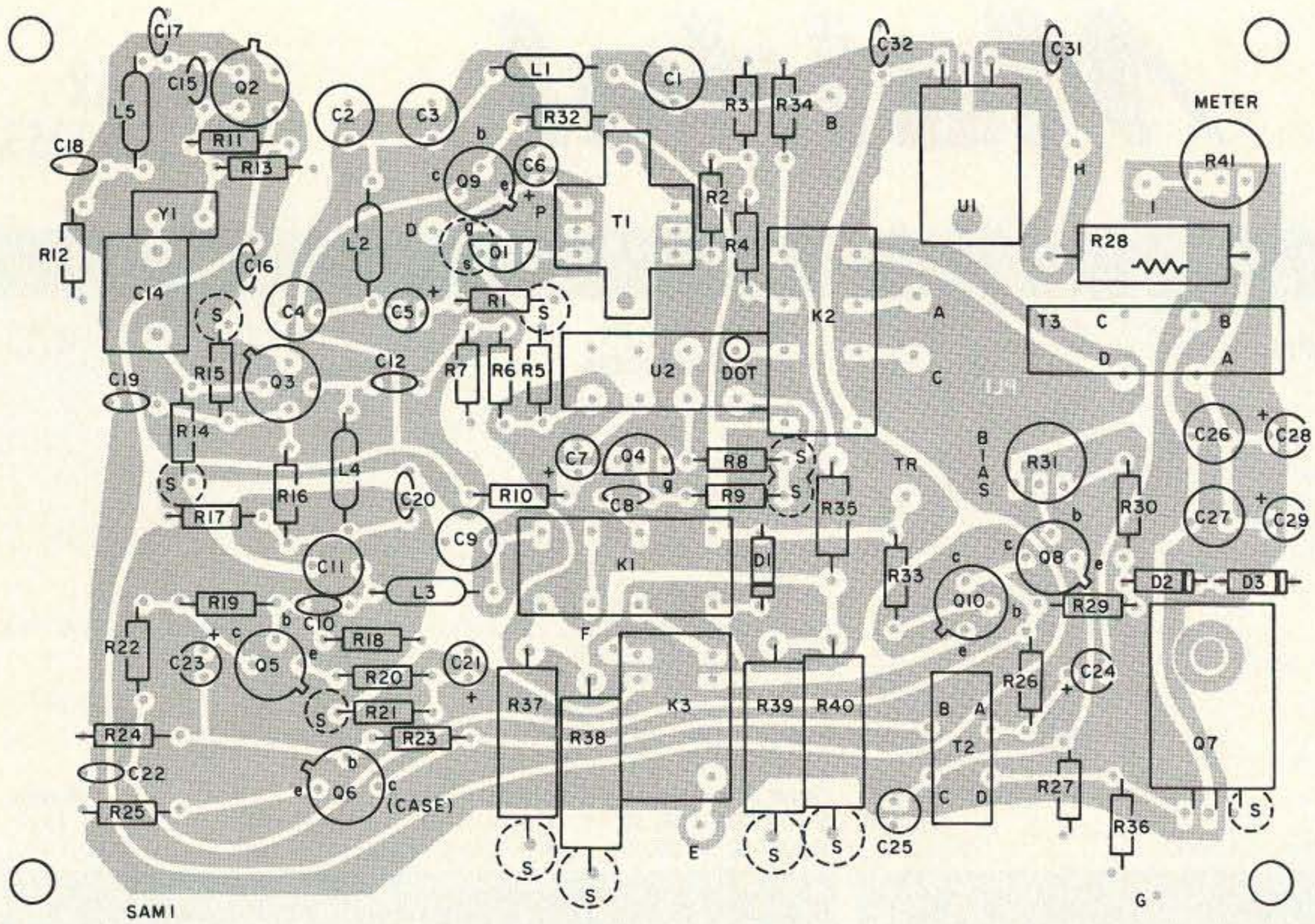

Figure 2. Parts layout and foil diagram, from the component side of the circuit board. Be sure to use a good quality rosin core solder and a clean soldering iron tip, with a wattage of 25 to 60 watts.

that transfers the output from C8 to either your receiver input through point E or to the 1740 meter amplifier and low-pass matching filter, starting with C9. The received signal is simply the *sum* of the local oscillator frequency (3.5 MHz) and the low frequency input at point B (5–450 kHz). All signals within the low frequency spectrum are mixed together with the local oscillator, providing *sum* (3.5 MHz + LF) and *difference* (3.5 MHz - LF) frequencies and their harmonics.

The *sum* frequencies are those being received on the 80 meter transceiver, while all *difference* frequencies are simply ignored. You might say that half the signal power (−3 dB) is lost because, as the signal is converted, it is split in two, one half being the *difference* and the other half being the *sum*. This is one reason that the doubly-balanced mixer, U2, has an approximate loss of 5 dB and extra amplification (Q1 and 3) is needed to overcome the loss.

The Transmitting System

The SAM1's transmitting system is a simple broadband design that uses many of the same stages of the receive circuitry to save space and, of course, money. Point TR is used to activate relays K1 and K2 that switch over the input and output ports of mixer U2. When TR is grounded, the relays close, switching the input of mixer U2 to the 40 dB attenuator transmitting pad, consisting of resistors R34, 35, and 37–40. The pad will dissipate virtually all the power from your transceiver, allowing only a very small signal of 0 dBm to reach the mixer.

The 50-ohm pad also helps minimize IMD and the return loss characteristics of U2. The low-level RF signal from your 80 meter rig (between 3.66 to 3.69 MHz) is mixed with the local oscillator output from Q3, leaving the *sum* and *difference* frequencies across R8 and the input-to-source follower circuitry provided by Q4.

Again, R8 is the optimum match for U2, with a pure 50-ohm nonreactive load for these relatively low frequencies. With relay K1 closed, the output at the source of Q4 is connected to the pi matching circuitry of inductor L3 and capacitors C9 and 11. The pi match gives good attenuation of all harmonics of the *difference* signal from the mixer and eliminates all *sum* frequencies and their harmonics. It also provides a good match from the 50-ohm source of Q4 and R9 in parallel to the 600-ohm input impedance at the base of Q5. Both Q5 and 6 operate in a broadband class A mode, simplifying system design. With the elimination of frequencies above and beyond 240 kHz by the pi match, the two-stage broadband amplifier of Q5 and 6 gives about 20 dB of gain of the *difference* frequencies that fall within the 1750 meter spectrum.

As an example, an HF transceiver that transmits a signal at 3.6 MHz mixes with LO in U2 (3.675E6/3.5E6 = 175 kHz), and presto, you have your signal right in the middle of the 1750 meter band at 175 kHz!

Q6 will run very warm because it is biased to allow good linearity of voice peaks. The output of Q6 is transformed to an impedance level of 40 ohms through the action of trans-

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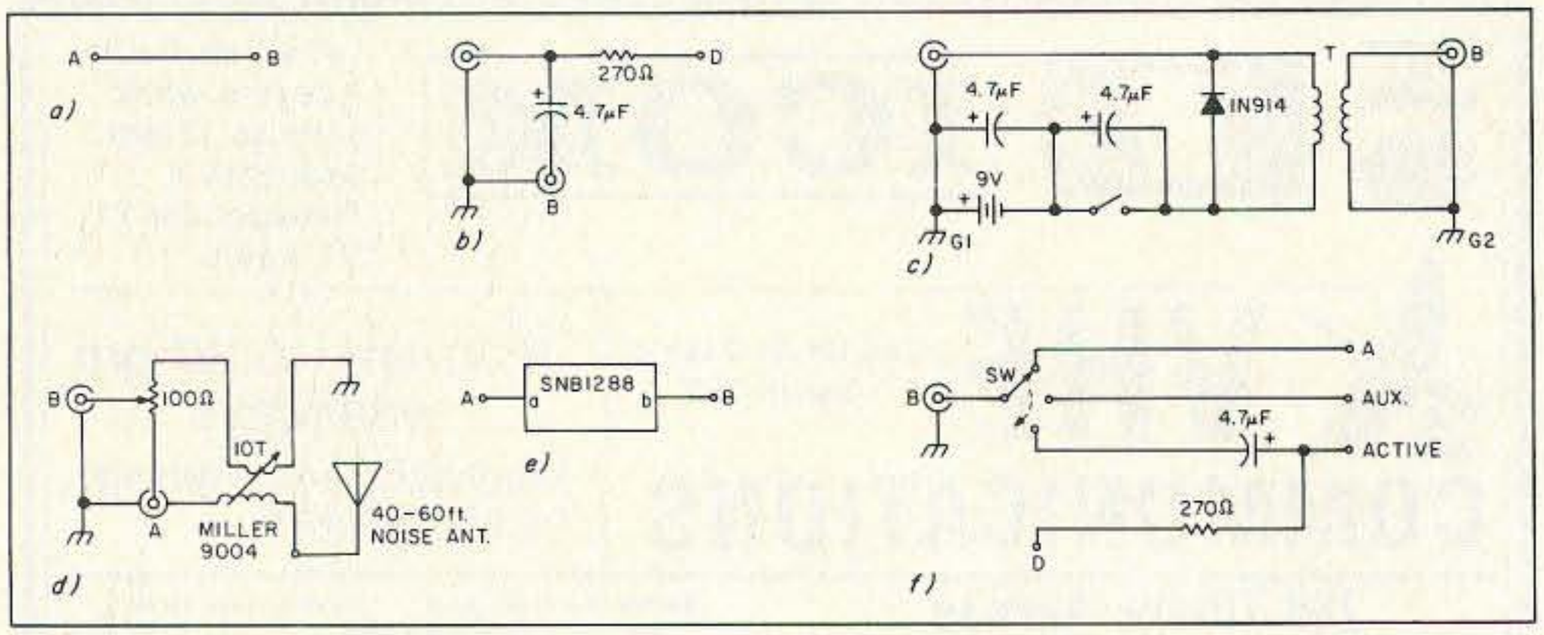

Figure 3. Noise-eliminating circuits: a) using the transmitting antenna; b) using "phantom power"; c) same as "b" but the DC supply and ground remain independent of the transverter and house ground; d) phase-canceling device; e) the SNB1288 snychronous noise blanker; and f) a switching arrangement for three antennas.

former T2, which is also operated in a broadband manner.

Transistor Q7 is a hefty 30-watt device, deliberately used here to overcompensate for mismatch conditions. Q7 is normally operating the class AB or class B mode with good gain and acceptable linearity for voice communications. Under ideal circumstances, efficiency has reached as high as 70%. Output power in the neighborhood of 10 watts is also possible, but discouraged. The heat sink for Q7 will not accomodate this; if you use the device incorrectly, you may destroy it.

You can adjust the bias potentiometer R31 for zero volts of bias to Q7 for class C operation, if you wish. The bias transistor Q8 is a simple current amplifier/voltage regulator, providing a bias potential from the emitter through the secondary of T2, where the RF signal is added to the bias voltage and over to the base of Q7.

Diodes D2 and 3 provide a steady 1.2 voltage reference for R31, which you adjust to set the idle current through Q7 to approximately 10 to 15 mA. The amplified output from the collector of Q7 is applied to tank circuitry of transformer T3 and capacitors C26 and 27. C25, 28, and 29 create a virtual short for all RF in the PA section. The output impedance of transistor Q7 and the 50-ohm load connected to the secondary (your antenna) via point C, dampen the *Q* of T3 so that full coverage and more across the 1750 meter band is possible. Excellent linearity and harmonic attenuation are found using the carbonyl HP material in this toroid.

Resistor R36 is not normally used, but if you experience any problems with oscillation of Q7 during transmission, a resistor with an approximate value of 47 ohms, or even lower, may be placed in this spot. Be careful not to use too low a value, though, since this will load down transistor Q8, which may burn out.

System Operation

All interconnections to the SAM1 are done through points on the circuit board (see the schematic). Let's look at each point and examine what each one is used for.

A: 1750/LF "thru" port. In receive mode, the transmitting antenna connected to port C will go to point A. This point can be connected to point B for using the transmitting antenna for receiving, or left unused if a separate antenna for receiving is desired.

B: 1750 meter receive input port. 50-ohm input for long wave and 1750 meters.

C: 1750 meter transmit port. Used for connection with 1750 meter transmitting antenna. You can also use it for 1750 meter receiving if you wish to use the same antenna for both.

D: "Phantom" power during receive operation. Provides 12 volts DC for accessory connections. Voltage goes off during transmit. 200 mA maximum recommended current.

E: 80 meter transceiver port. Using coax cable, connect this port to your 80 meter transceiver. Miniature coax is acceptable. Ground the braid of the coax to the ground plane on the component side of the circuit board, next to the hole where the center conductor of the coax is connected.

F: Transceiver "through" port. When the transverter is off, relay K3 will also turn off, allowing regular use of your transceiver at port F. Regular antenna connections that would normally go to your transceiver SO-239 jack should go to port F instead.

G: Ground. Use this point for a good ground connection.

H: VCC. 12–24 volts DC. Well-filtered, 24 volt supply recommended.

I: PA meter terminal. Negative connection for using a milliamp meter for monitoring input current to the PA. Positive connection should go to point H. You can use almost any type of milliamp meter, but I recommend one with a range of 1 mA. Calibrate the meter with R41. You can make PA current measurements with any VOM, VTVM, or digital meter, measuring the voltage across points H and I after adjusting R41 for minimum resistance.

TR: Transmit/Receive switch. Turns transverter from receive to transmit. By grounding this point, the transverter system will go into transmit mode. This point should go to your transceiver's auxilary relay for automatic switch over. Consult your transceiver's manual for correct connection. Connect the normally open relay terminal on your transceiver to point TR and the common relay point going to ground. This will automatically switch both systems over at the same time. For manual operation, you can switch between point TR and ground.

Optional Circuits

Once you have built your transverter, mount the board inside a suitable housing with appropriate connectors and switches. Use quality RF connectors, such as SO-239s or BNCs to simplify interconnections to other pieces of equipment. You have to decide whether you want one antenna or more than one, and whether you want to add noise-eliminating circuitry, such as the options shown in Figure 3.

Figure 3a shows a simple connection to turn the 1750 meter transmitting antenna into a receiving antenna. Just solder a wire jumper from points A and B. Figure 3b is a basic circuit for using "phantom power" to supply an active whip or other remote device, and to separate the signal to point B, the LF receive port. The unmarked port in Figure 3b should connect to RG-58AU coax or similar shielded cable, to carry both the RF and DC power to the remote device.

Another possibility is shown in Figure 3c, which is the same as circuit 3b except that the DC supply and the ground remain independent of the transverter and the house ground. This is important because a lot of the noise that plagues reception can be traced to the ground system. Frequently, many ground systems are "dirty"; they carry pow-

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SAM1 Transverter Parts List

Resistors

R1,14,21	270Ω	R10,17,20	33Ω	R22	180Ω
R2,4	3Ω	R11	82kΩ	R24,30	470Ω
R3	430Ω	R12, 33	1kΩ	R25, 26	12Ω
R5,7	910Ω	R13	22kΩ	R28	1Ω 1W
R6	6.2Ω	R15,19,23	2.7kΩ	R31	2k pot
R8,27,34	51Ω	R16	6.8kΩ	R32	2kΩ
R9,29	560Ω	R18	1.5kΩ	R35	4.3kΩ
R36	NOT USED	R37–40	200Ω 6W	R41	1k pot

All resistors are ¼W unless noted.

Capacitors

C1,3,4,26,27	0.01 µF, 50 VDC poly
C2	0.0047 µF, 50 VDC poly
C5,6,7,21,23,24,25,28,29	4.7 µF, 35 VDC, electrolytic
C8,10,16,18,19,20,31,32	0.1 µF/50 VDC monolythic chip
C9	0.022 µF/50 VDC monolythic chip
C11	0.0082 µF/50 VDC monolythic chip
C22	1 µF/50 VDC monolythic chip
C15	68 pF NPO
C17	270 pF NPO
C12	390 pF S.M.

Inductors, Transformers

L1,2	27 µH Inductor J.W. Miller #70F275AI
L3,5	120 µH Inductor J.W. Miller #70F124AI
L4	5.6 µH Inductor J.W. Miller #70F566AI
T1	200:8Ω audio transformer Mouser #42TL004
T2	FT-50-77 toroid. Primary: 45 turns #28 wire. Secondary: 6 turns #22 wound over primary.
T3	T68-3 toroid. Secondary: 61 turns #28 wire. Primary: 46 turns #28 wound on top of secondary.

Transistors and Other

Q1,4	J310	U1	MC7812CT
Q2,3	2N2857	U2	SBL-3
Q5,8,9	2N2222A	1	Q7 mica insulator
Q6	2N2102	1	4/40 nut and bolt for Q7
Q7	TIP31B	K1,2	DPDT 12 VDC relays, 8-pin Digi-Key #Z440-ND
Q10	2N2907A	K3	SPDT 12 VDC relay, 5-pin Mouser #ME431-1212
D1	1N4001	D2,3	1N914A

A kit is available from Curry Communications, 737 N. Fairview St., Burbank, CA 91505. Tel: (818) 846-0617. It includes JFETs, so be sure that your soldering iron is grounded—and your body, too! No milliamp meter is included. Options for using the SAM1 with other equipment, and articles on recommended antenna designs, come with the kit. The silk-screened component side of the circuit board is marked for parts placement. The complete kit costs $89.95. The silk-screened, double-sided, predrilled board alone is available for $19.95 postpaid.

er line hash and the remains from light dimmers (G1).

Active whip antennas, for example, have an extremely high impedance and couple easily to local structures, wires, and of course, to the braided shield of the coax delivering power to the active whip. Noise along the grounded braid is capacitively coupled to the antenna, wrecking the signal-to-noise ratio in an otherwise quiet area. For a separate (G2), "clean" ground independent of the house or system ground, put a rod or similar item directly under or near the active whip and connect it to the active whip circuitry as shown in Figure 3c.

Transformer "T" is made by winding 50 turns for both primary and secondary on an Amidon FT-82-77 coil form with #32 gauge wire. The polarized capacitors can be any value from 1 µF to 10 µF electrolytic. A battery supply is highly recommended. If you decide to use an active whip, which is quite effective as a receiving antenna, be sure to place it away from power lines and buildings. Often the best places for this type of antenna are in the front yard, on a wooden pole on the roof, or at the top of a tree.

Figures 3d and 3e are both noise-canceling devices. Figure 3d uses phase canceling, which can be highly successful for power line hash or complex noise. The noise antenna can be any length of wire from 40 to 60 feet, laid horizontally on the floor or outside on the ground. The goal, of course, is to maximize noise on the noise antenna by placing it near house wiring where it will couple to the wiring and radiate noise. You'll need to experiment with this circuit to get the best results, since noise at each location is different.

J.W. Miller coil #9004 is used to resonate the noise antenna at the frequency of interest (in this case, in the 1750 meter band). The secondary of the transformer uses a low impedance of only 10 turns; that is, 180 degrees out of phase. Antenna input at "A" contains both signal and noise, and the noise is canceled by rotating the 100-ohm potentiometer to a point where the noise is of equal and opposite current, and adjusting the resonance and phase with the Miller inductor.

Vertical resonant antennas work well at port "A". Figure 3e is the Curry Communications SNB1288 synchronous noise blanker, which can be inserted between points "A" and "B" of the SAM1 transverter as shown. This will eliminate all types of synchronous noise, such as light dimmers, and could even be added in series with the phase-canceling circuitry in Figure 3d (point "B" in 3d going to point "B" in 3e, and point "A" in 3e going to point "B" on the SAM1). Don't forget that "A" in Figure 3d goes to point "A" on the SAM1. So you can see that there really are many ways to do it.

This leads us to Figure 3f, which shows a switching arrangement capable of letting you use three different antennas, which could be quite convenient. This switch is recommended with one or both of the noise-canceling devices in Figures 3d and 3e. If you live in a suburban area, you can almost bet that light dimmers and similar devices will plague reception, and the noise blanker on your HF transceiver may not have a long enough time constant to eliminate these pulses. First check your reception to decide how elaborate you want to get with these receiving aids.

Once you have decided on the system, if any, you wish to use with the SAM1, and you've decided on how you want to mount the circuit board, remember to use ¼" spacers when you position the board inside the housing. Anything under ¼" may short the screw or bolt on Q7, which has full potential.

Connect the power supply to points G (ground) and H (positive). A 24-volt DC supply is recommended, but a 12-volt supply is adequate. When the SAM1 is properly connected, relay K3 will close.

Bias and Oscillator Adjustments

At this point, align the bias and PA meter. Rotate R31 fully counterclockwise (bias control) for minimum bias voltage on Q7. R28 is used as a current reference so you can accurately measure and monitor the PA current of Q7. A meter would be the easiest way to do this, using 1 mA across points I and H. Adjust resistor R41 to align the meter for a calibrated indication. Use a VOM or digital meter and connect leads across R28. Apply power to the SAM1. You should hear relay K3 close when you turn the power on. If you don't, your power supply potential is too low and you have to increase it.

Place the SAM1 in the transmit mode by grounding the TR point. Relays K1 and 2 should change over, and you may get a reading of 1 mA or so across R28. Remember that the VOM or digital multimeter is actually measuring the voltage across R28, but because of the resistance of R28 (1 ohm), you can interpret the reading as the actual current flowing through R28 to Q7. R31 is rotated slowly clockwise for an indication of 10 mA (or 0.01 volts measured across R28). If desired, you can use a jack or plug and simply monitor the current externally with a VOM or multimeter. Use points I and H, adjusting R41 for minimum resistance. Any meter other than a multimeter or VOM will have a

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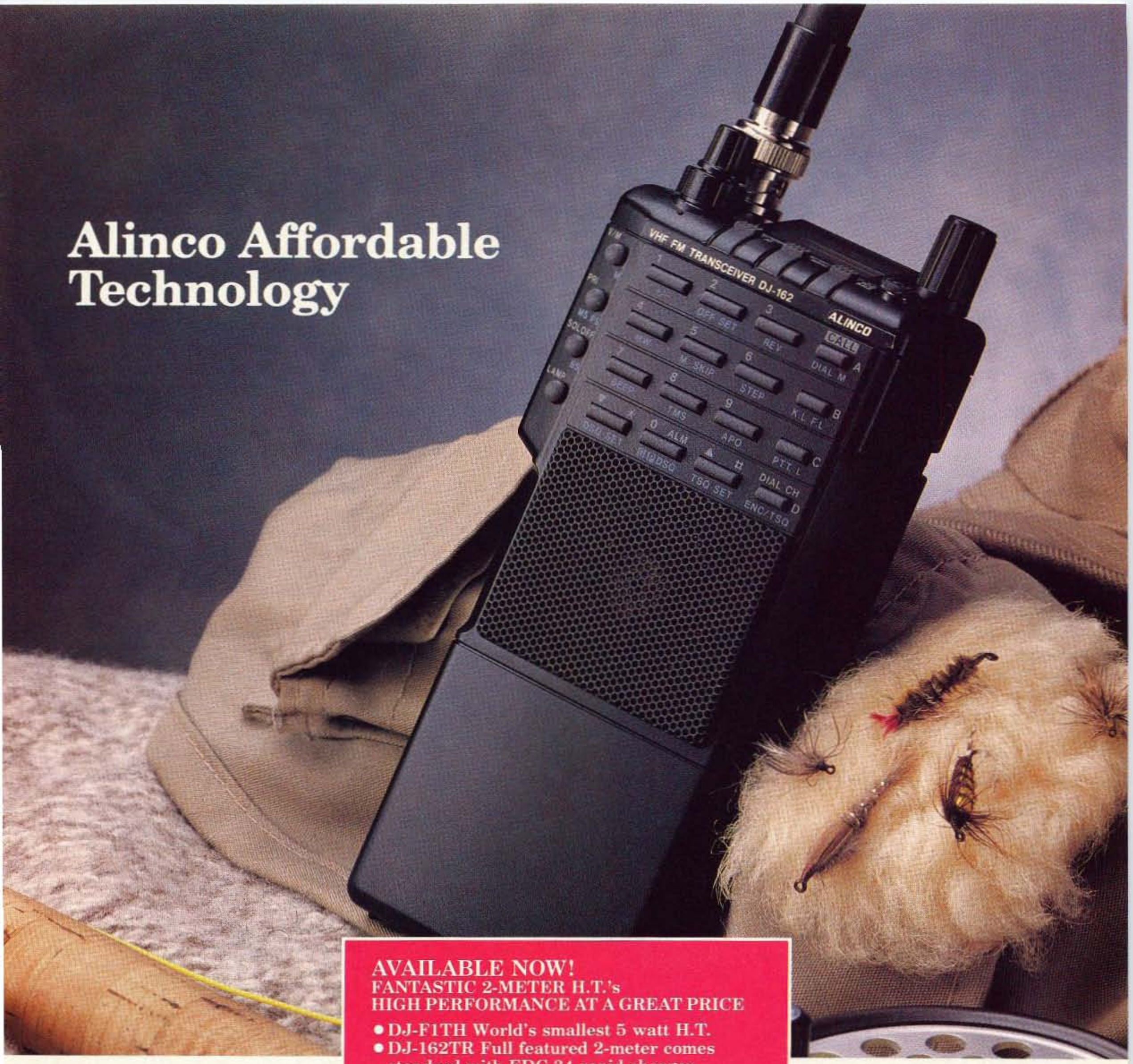

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significant amount of resistance, and R41 compensates for this.

Some meters can measure up to 300 ohms of internal resistance, and you can calibrate a meter of this type simply by monitoring the current across R28 with a VOM or digital multimeter and turning R41 so the current on the meter will be the same as the current across R28. This concludes the bias adjustment of the SAM1.

Unground point TR and connect point "E" to the RF terminal on your HF transceiver. Zero beat the local oscillator on the SAM1 by tuning your HF transceiver to 3.5 MHz and rotating C14. If you own a calibrated frequency counter, you can check the frequency of the local oscillator at the output of Q3, or across C12 or L4. Make sure your transceiver is calibrated to the internal oscillator most modern HF transceivers are equipped with. If your transceiver has one, turn the oscillator on and zero beat the two signals, listening in the AM mode.

Checking Connections

With all connections to the SAM1 completed, check to make sure the points on the SAM1 are going to their correct places on the transceiver and antenna. Apply power and again listen to make sure you heard relay K3 kick over. Your HF transceiver will operate just as it would on any amateur band, along with any controls you wish to use to improve the reception or transmission within the 1750 meter band. The readout on the analog dial or digital display is simple to read: Ignore the 3.5 MHz; read only the kHz readout.

For example, let's say you're working an SSB station on 183 kHz. What would the readout be on your transceiver? Simple: 3.683 MHz; 3.683 - 3.5 = 183 kHz! Shortly you will become accustomed to ignoring the 3.5 MHz and the fact that your HF transceiver has been transformed into a complete LF/VLF station.

Make extra sure that the TR point on the SAM1 board is connected to the external relay port on your HF transceiver so the SAM1 will automatically follow the transceiver going from receive to transmit. Check this by placing the transceiver in the send or key-down (transmit) mode, but don't let any RF leave the transceiver.

Keep all carrier and mike controls on the transceiver to a minimum! Both relays (K1 and 2) on the SAM1 should key over. If you do not hear this, your wiring on the TR line is incorrect. Point TR must be grounded during transmit mode. If all is well and the relays key over, you're ready to check the transmitter half of the SAM1. Be sure to connect a *resonant* 1750 meter antenna to point "C" on the SAM1, or a 50 ohm, 2 watt load resistor as a termination. With both the transceiver and transverter in the transmit mode, send a low-level carrier of approximately 10 watts on the transceiver anywhere between 3.66 to 3.69 MHz (160 to 190 kHz), the legal band limits of the 1750 meter band.

Check the PA current of the SAM1 as discussed previously. The legal input power for continuous duty or CW to the PA is 1 watt. Not much, but surprisingly effective! Hundreds of miles have been successfully and regularly worked on such low power, which adds to the challenge of the 1750 meter band. When operating SSB, however, 2.8 watts peak-to-peak is allowable, and the transverter can handle this easily.

The bias current to Q7 is adjusted to a class AB condition (15 mA) to accomodate SSB operation. The drive level from the HF transceiver controls the RF output of the SAM1, with only a small amount (10 watts) required for legal output on 1750 meters. With too much power or a too-high bias, transistor Q7 can go into thermal runaway. The bias will naturally increase as the temperature of Q7 increases, so don't be concerned about this. Temperature-tracking diodes D2 and 3 are help minimize this condition.

Because of their continuous duty operation, digital modes such as RTTY and AMTOR require that you keep the drive to the SAM1 low. Check the PA current to Q7 often. If desired, you may lift Q7 from the circuit board and set it down vertically, with a heat sink attached to the metal body for improved heat dissipation. The TIP31 transistor Q7 is quite rugged; because of this virtue, I chose it as the PA amplifier. 73

David Curry WD4PLI, 737 N. Fair-view St., Burbank CA 91505. (818) 846-0617.

Monoband Yagi

Continued from page 35

Radio Shack. I mounted the antenna at the top of the pole, with the sections uniformly telescoped to yield a total height of 30 feet. I obtained additional strength by telescoping the sections to this shorter length. A short mast cut from 1-1/4" aluminum tubing and mounted above the rotor brought the total antenna height to 33 feet. If you use a pole, as I did, don't attempt to extend the pole to its maximum height. Very little will be gained in radiation angle, but the structure will be weakened considerably.

I attached the pole to my eaves at a height of 10 feet using the mounting bracket. I then guyed the pole near the top using Kevlar™ line sheathed in Dacron™ (available from Radio Works). This produces a strong, inconspicuous guying system.

Performance Tests

In three months I have logged 107 countries with the new antenna, most of those on SSB and most with signal reports of 5-9 or 5-9 plus. "Big Signal, AB4GX" has commonly been heard. The power used varied between 50 and 1200 watts output, although the antenna should handle full legal power with no problems. The front-to-back-ratio agrees with the computer analysis, and I've used the existence of the null off the sides to advantage. When working East (Europe and Africa) or West (South Pacific or Asia), I can effectively null the strong South and Central American stations adjacent to my Florida QTH.

This is the first time in 27 years of hamming that I have used a yagi, and the first occurrences of QSOs interrupted by hams telling me that there must be "something wrong with your equipment because you are pinning my S-Meter and blocking my receiver." This sometimes while barefoot, and while I have ended QSOs in the interest of peace and harmony, I have also developed a new respect for the gain of this antenna. I have found I can work almost anyone I hear, most often on the first call, and power management coupled with operating courtesy are much more visible requirements. You cannot have a "Big Signal" without also having a "Big Responsibility." And all this on a push-up pole, and with shortened elements! Enjoy, and please let me know your experiences if you construct this "residential yagi." 73

Parts List

QTY	Item
2	½" x 12" hardwood dowel
4	1" x 6.5" hardwood dowel
1	1-¼" x 3' aluminum mast pipe
4	½" I.D. x 1' clear plastic tubing
4	½" diameter x 5' aluminum tubing
4	½" diamater x 16.5" aluminum tubing
4	⅜" diameter x 4' aluminum tubing (cut for proper length, as shown in Figure 6.)
8	⅜" diameter x 5" aluminum rod
2	1-¼" I.D. U-bolts for mast
8	plumbing clamps for ½" pipe
12	pipe clamps for ½" pipe
1	1" x 3" x 24" pine
1	1" x 3" x 22" pine
1	1" x 2" x 4' pine
1	1" x 3" x 6' pine
1	1' x 1' x ¼" plywood (cut up for the 4 cleats)
	#12 wire
	#16 enameled wire
1	1:1 balun - Radio Works #Y1-4K
	Kevlar support wire - Radio Works
12	self-tapping screws
12	eyelets
1	Fiberglas kit (optional) - K-Mart or equivalent

Contact Ken Kemski AB4GX at 3745 Allenwood Street, Sarasota FL 34232.

73 Review

by Thomas Gould WB6P

The EASY-PC PCB Layout Program

Easy PC PCB Layout System
Number One Systems Ltd.
Harding Way, Somersham Road
St. Ives, Huntingdon, Cambs.
PE17 4WR England
Telephone: 011 44 480 61778
Fax: 011 44 480 494072
Price Class: $200

An easy way to produce camera-ready PC board artwork.

EASY-PC, from Number One Systems Ltd., is a low-cost computerized printed circuit board layout system. With this program you can generate camera-ready PC board artwork from a dot matrix printer or plotter. That function alone makes the program worth the cost, but what really interested me was the ability to generate Gerber Data, allowing you to have your artwork plotted on a photo plotter, which provides excellent quality artwork at a very minimal cost. Also included in the package is a schematic drawing tool.

EASY-PC is a PCB artwork generation program that takes the place of the old way of using artwork tape and pads on mylar for artwork. The great advantage of the computer is that it allows you to make changes easily. Instead of having an assortment of layout templates for each part on your circuit board, you have a library of parts which you can place on your layout, move around freely and copy as much as you want.

EASY-PC will allow boards up to 17 inches square. Your board can have up to eight track layers and a top and bottom silk-screen. The monitor display shows the true track width and pad size. You can virtually set any track or pad size. There are full library construction utilities to allow the user to generate any geometrical shape needed for a part. There is a limited set of common parts supplied in the library.

The EASY-PC program can also be used for schematic drawing, but there are no utilities such as parts list output, etc. There are three utility programs for output from EASY-PC. These are: Easygerb for the gerber output; Easyplot for plotter output; and Easydrill for NC Drill output data.

Using EASY-PC

EASY-PC requires an IBM PC, PC-XT, PC-AT /PC 386 or equivalent running DOS 2.0 or later, fitted with a Graphics Adapter CGA, EGA or VGA and an appropriate monitor (preferably color if double-sided or multi-layer boards are to be designed). A minimum memory of 512K bytes is necessary. The programs work on a VGA system in the EGA mode. EASY-PC does not support Hercules Mono graphics. A mouse is not essential, but the program works better with one.

The documentation is quite complete. There is a tutorial which guides you through a

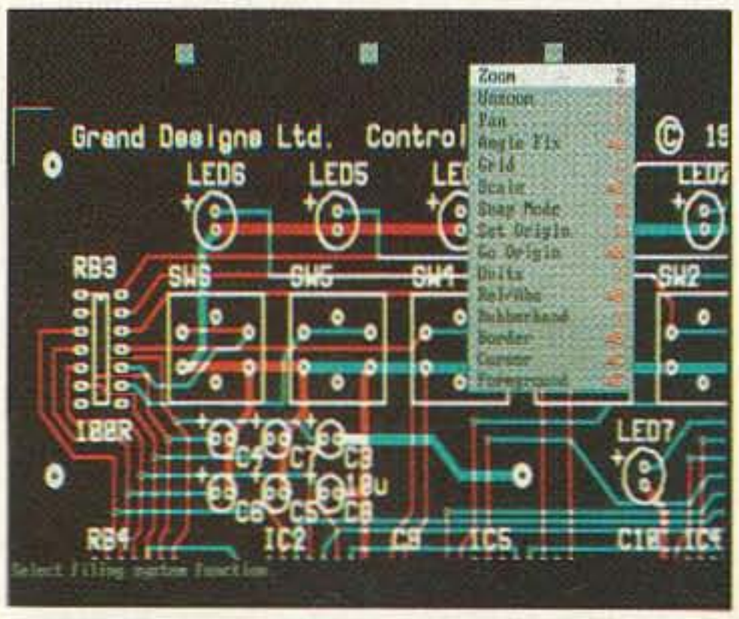

Photo A. The Easy-PC can support the design of complex multi-layer PC boards. Pull down menus along with hot keys make board design a snap.

sample circuit board to give you a flavor of the command set. For various commands you can either use the pop-down menus or use the template to enter the command sequence through the keyboard.

Zooming in and out is very fast. There are eight keyboard-selectable fixed zoom levels which allow you to quickly set the magnification you desire. The screen refresh rate time varies depending on how much information has to be drawn. With a little experience you can display only the layers of interest at that time and speed up the screen refresh rate.

The cursor x,y coordinates are displayed on the lower left of the screen display. The units can be either in thousands of inches or in millimeters. The program also supports relative or absolute coordinates. The x,y coordinate origin can be set anywhere within the 17-inch-square border.

Library symbols are easy to generate and modify. The program has a save reminder which can be programmed to warn the user to save his work at preset time intervals.

Laying down pads is very straightforward. You select the new pad command and place a pad where the cursor is. Then you can change the variation of that pad to many different types. To continue, you just move the cursor to the new pad location, click the mouse, and the pad is placed, then click the right mouse button and the pad stays. You continue in that fashion until all pads are placed. On most layouts you really do not have to place too many pads since your symbols have the pads included.

Laying down tracks is a bit of a trick to get the hang off, but with some practice it is very easy. You select the new track command and click the left mouse button, then move the cursor to the new position, click again, and repeat the process for every straight line end point until you are finished with that track. Then click the right mouse button to complete the operation. The size and layer will be the default you used on the last operation. You can edit tracks to change size, layer, or position; or delete the whole track or just a segment of it.

There is a snap-to-grid feature which can be turned on or off, and the grid can vary from 0.1- to 0.025-inch increments. Text can be placed anywhere on any layer, with variable size selection possible.

A status function allows the user to check the size of a track or pad on the layout. There are many block operations which allow you to copy, move, delete, rotate or get a mirror image of the area you draw a block around. You can also set some parameters so that you can be selective as to picking up tracks, text or pads only. The block command is used to get a copy of the layout to your dot matrix printer.

There is a file merge command which allows you to merge another layout into your current layout. This works well if you have a previous layout block, such as a regulator section, or any common layout you may use on many different circuit boards.

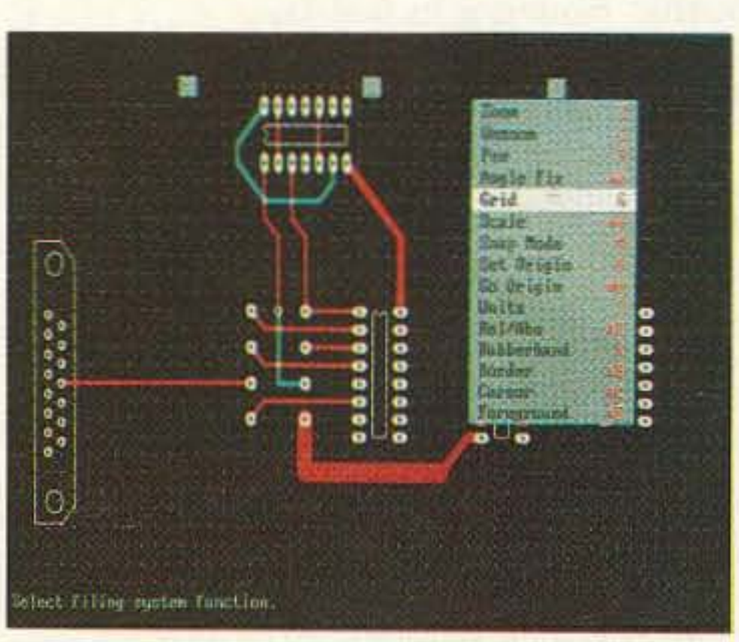

Photo B. The various layers of the PC board are represented by different colors. Here the blue layers represent the bottom layer, the red layer is the top layer and the white layer shows the silk-screened labels.

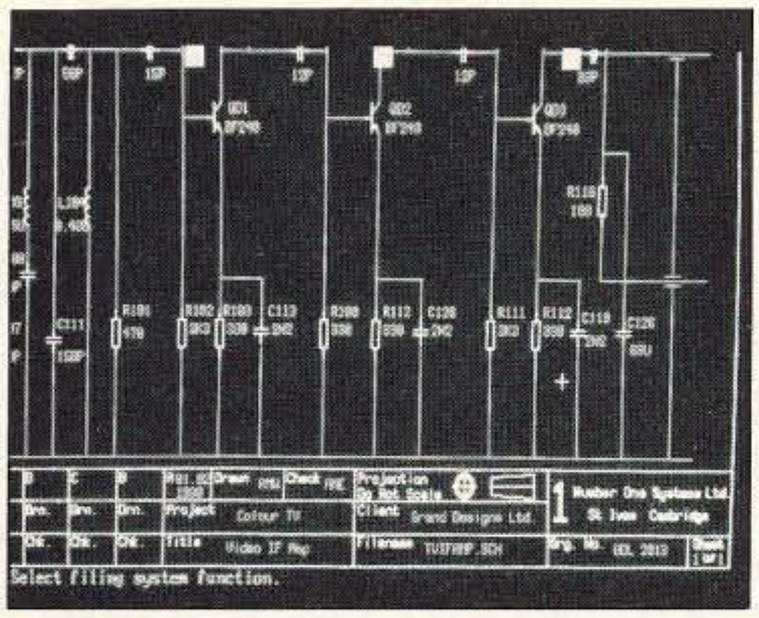

Photo C. Schematic diagrams can be drawn with Easy-PC with the built-in library of symbols.

The default colors are red and blue for track layers and white for the silk-screen layers. These colors can be changed if you want. Creating symbols is very easy. With the commands available, any geometric shape can be produced and the program even supports surface-mount technology. If you have a symbol on your layout or schematic that you have used many places and you discover you need to modify it, there is a function that allows you to change all occurrences of the symbol with one command. This is a very handy feature since everyone makes a mistake now and then.

Gerber Output

Easy PC's best feature in my opinion is the gerber output feature. This data can be plotted on a photo plotter which produces extremely accurate artwork with precise tolerance control. There are many photo plotter services available. In my location the prices are $16 dollars per layer and 24-hour turnaround time.

Another great feature is the drill file output. This file is sent to the board fabrication house, which uses the data to control a Numerical Control Drill Machine. This process allows complete automatic drilling of your circuit board, which again is another cost-saving feature.

You can also use your dot matrix printer to make layout drawings or artwork. The program supports most popular plotters.

Overall, I am very pleased with the performance of this program, especially considering the low cost. I have just received an update notice stating that the libraries have been significantly expanded to over 1,000 parts, and output to a laser printers has been added. For roughly $200, this program sure beats the old tape and mylar way of circuit board artwork. 73

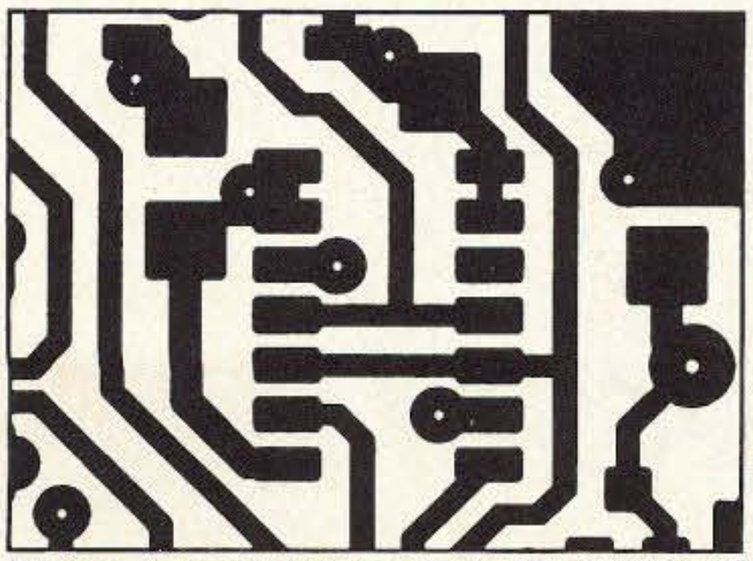

Figure. A laser printer output of one of the PC board layers.

Plumber's Delight

Continued from page 16

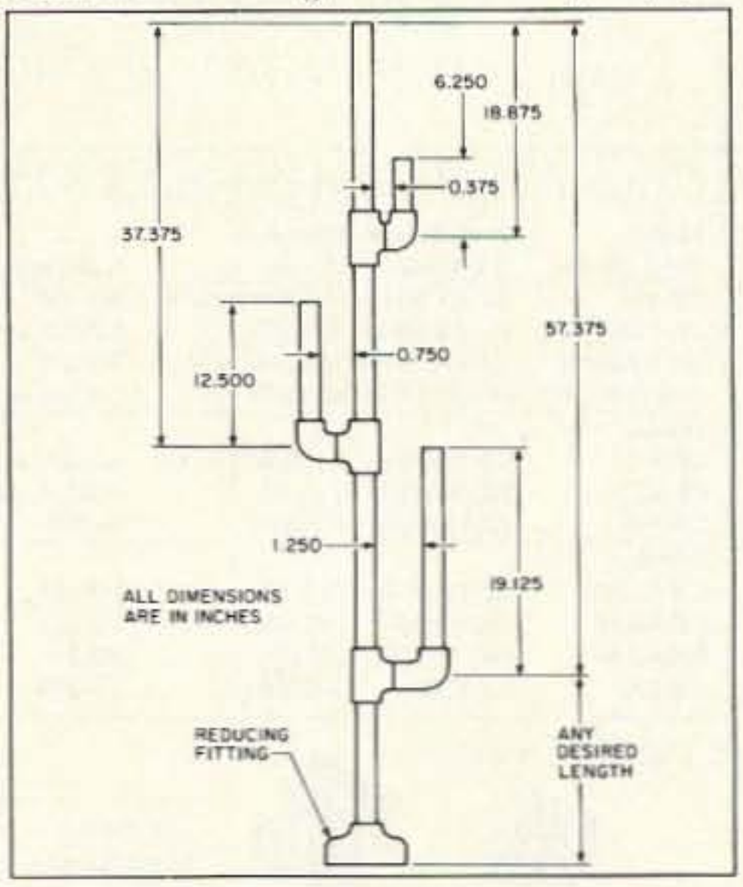

Figure 1. Tri-band J-pole antenna construction.

My finished antenna conformed very closely to the dimensions shown in Figure 1, and when I connected the feedlines I had 1.5:1 SWR or better on all three bands. The center frequencies chosen for this antenna are 146, 223, and 445 MHz. I had the antenna leaning up against a wood wall, and used a 12-foot scrap of coax to fine-tune the feedpoint. The stripped and tinned end of the cable was attached to each antenna section temporarily with Scotch tape.

I then transmitted into the antenna via a VHF/UHF SWR meter and moved the temporary connections up and down a little at a time until a 1.1:1 SWR was found. These points were marked on the pipe, and then small pilot holes were drilled. Small crimp-on eyelet terminals were first crimped, then soldered, onto the permanent feedlines.

Then I used self-tapping screws and lockwashers to attach the coax to the antenna. I cleaned everything up with a small brush and alcohol, to remove flux and dirt. Then non-corrosive RTV sealant was used to protect the connections against the weather. Non-corrosive RTV is that type which does not contain acetic acid. You can test for this by smelling of it; the proper type will NOT smell like vinegar. Route the feedlines from the two upper antennas down one side of the mast, 90 degrees from the plane of the stubs, in such a manner that the cables do not enter the space of the gaps below. You can use nylon zip ties to hold the cables in place.

I found that there was no change in SWR after I got the antenna away from the wood wall and up in the air with its permanent feedlines connected. SWR was 1.5:1 or better over the entire 2 meter and 1.25 meter bands, and over the entire 440 to 450 MHz section of the 70cm band.

No need to worry if you do not have access to a suitable SWR meter. Just connect your coax to the points indicated, and you'll have some very livable SWR values. On the other hand, if your finished antenna is not, physically, exactly the same as the measurements in Figure 1, you can use an SWR meter to adjust the feedpoints and still obtain close to 1.1:1 SWR. I found this out while helping my elmer (who is not a very good plumber) get his duplication of my model working. Formulas are provided in the table for those of you who would like to try this idea out on different center frequencies or bands.

Taking It Further

I built a version of this antenna for the 6, 2, and 1.25 meter bands out of 1.5" heavy duty steel TV antenna mast. It required two 10-foot sections of mast. The stubs were made from 3/4" galvanized pipe, and 1/5" angle iron was used to stand the stubs off from the mast. I used a MIG welder to put the thing together. Nylon guys were used.

This worked very well. Then I bought one of those Create Designs log periodic antennas that covers 50 to 1300 MHz, and started to look for a place to put it. The only place I could figure was on top of that 6 meter J-pole. So I stuck it up there along with a cheap Radio Shack TV antenna rotor.

I mounted the rotor to the top of the J-pole and used only a 1-foot section of mast above the rotor to mount the log periodic. This really messed up my SWR for those three J-poles! But by moving the feedpoints up or down a little and testing the SWR, I was able to get all three of them back to 1.1:1 SWR again.

Now I had omnidirectional vertical gain antennas for three bands plus a horizontal directional gain antenna for six bands all on one mast! Hmmmm... maybe I'll get ambitious enough one day to take the beast back down and weld on a stub for 70cm. I wonder if that would work, too?

Yes, I'm J-pole loco, and you might catch the disease too if you start playing with them. This is the perfect thing for the new rank of Technicians just starting out, to get on the air with three bands and very little cash outlay. 73

Eric R. Johnson KB6EPO, P.O. Box 996, Imperial Beach CA 91933.

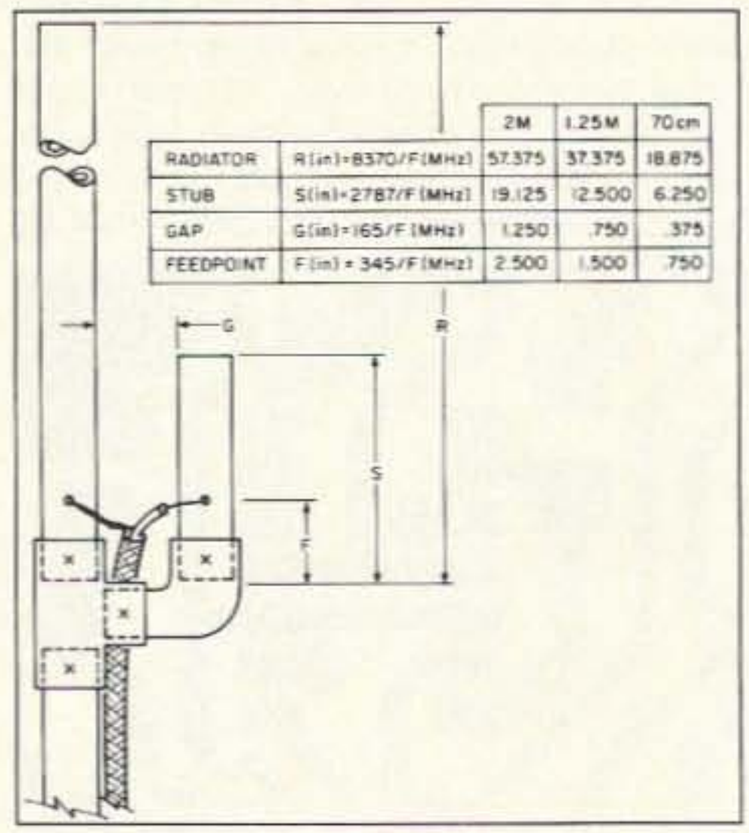

Figure 2. Individual antenna element detail.

ATV

Ham Television

Bill Brown WB8ELK
% 73 Magazine
Forest Road
Hancock NH 03449

The Flight of Eclipse 1

Every 20,000 years of so, residents of Southern California are presented with a dramatic sight: an annular eclipse of the sun just before sunset. An annular eclipse is a variation of a total solar eclipse which occurs when the diameter of the moon doesn't completely cover the solar disk. The end result is a spectacular ring of fire surrounding a dark center.

The eclipse would happen on January 4 just a couple of minutes before sunset and would be viewable along the Southern California coastline. Since the weather during January has about a 50-50 chance of being favorable, Mike Henkoski KC6CCC, Mike Collis WA6SVT and I decided to stack the odds in our favor and attempt to watch the eclipse from the stratosphere (above the clouds) with an ATV balloon.

Marathon Payload Building

We all assembled at Mike Henkoski's QTH the night before the eclipse with a large pile of parts and began a 24-hour marathon session of payload construction. We televised hourly updates via the WA6SVT ATV repeater on Santiago Peak, showing each phase of the assembly process.

Just one hour before the eclipse, we finally had transformed a pile of miscellaneous parts into a mini-spacecraft. We also succeeded in transforming KC6CCC's formerly pristine shack into an absolute junkyard! Our final configuration consisted of a Microtek micro-TV transmitter (see the July '91 issue of *73*, page 9), the companion subcarrier sound board, a PC Electronics PA-5 power amplifier, a Micro Video Products miniature B/W TV camera, a video ID board, an ICOM 2A HT, a 30 milliwatt 10 meter AM transmitter, and a voice IDer (see the November '91 issue of *73*).

The ATV antenna system was somewhat unique. Mike WA6SVT transformed a radar reflector into a quarter-wave vertical which would be suspended eight feet below the package during the flight. In addition, the shield of the ATV coax worked as half of the 10 meter dipole.

In order to keep the package pointed at the sun, Mike KC6CCC designed a solar tracking system out of a pair of photo cells and a radio control servo. This servo controlled a large fin made out of a paper file holder. Whenever the package moved away from the sun, the fin would act as a rudder and try to steer the package back towards the sun. This system worked fairly well, but the movement of the fin was uneven and didn't lock onto the sun continuously.

In order to pan the camera view, we used an idea used by Joe Mayenschein WB9SBD. In an earlier flight, Joe mounted a mirror in front of his TV camera and rotated the mirror with a small motor.

Liftoff

A large crowd assembled near the beach at a park in San Clemente as we inflated the balloon. They even stopped a nearby soccer game so the participants could watch the activities. Just 35 minutes before the eclipse, we finally had everything buttoned up and ready to go (final testing occurred on the park's picnic table!). There was absolutely no wind, so we could just reel out the balloon string and gently let go of the payload. If only all our launches were this easy! We brought along a portable TV so the spectators could see the fantastic views of the California shoreline which was transmitted down from the on-board TV camera. Gordon West WB6NOA also brought along his ATV receive station which generated a large viewing audience.

Airborne Repeater

Since we were flying with a 2 meter HT on board, we used it to listen on 146.43 MHz and retransmit the audio out on the video subcarrier as well as the 10 meter transmitter (an AM modulated computer clock oscillator on 28.322 MHz). In essence, we had an airborne dual-output crossband repeater. Every 30 seconds the voice ID/timer circuit would key up the 2 meter transmitter for a short message to aid in tracking.

Activity was brisk through the crossband repeater as stations farther and farther away could be heard through the balloon repeater as it gained altitude. The 30 milliwatt mini-AM transmitter was heard as far away as South Dakota (Paul WQ0M) and Wisconsin (Joe WB9SBD). We even had a fellow at the launch site listening in on his shortwave receiver.

Quite a View

The view from the balloon's TV camera was spectacular. The rotating mirror (two minutes for a complete revolution) gave us a continuous coverage of both horizons, the ground below, as well as the balloon straight overhead.

We gathered in KC6CCC's back yard to view the actual eclipse at sunset. John Hoot N6NHP (of Software Systems Consulting) had a telescope set up with a video camera to tape the event. Although we did see the full eclipse for a very brief time (see Photo A), it was partially covered by clouds. The Los Angeles area didn't even have a chance due to a solid overcast just to our north.

After sunset, we rushed inside to see how the balloon's TV camera was doing with the eclipse. Even though it was rapidly getting pitch dark on the ground, the balloon camera could still see the sun. At 40,000 feet, sunset would not occur for another 20 minutes! We should've used a solar filter in front of the TV camera, as the brightness of the sun was overloading the camera even during the maximum eclipse. It was still quite fascinating to see a sunset from the stratosphere!

The 6-watt ATV transmitter worked quite well. Snow-free reception of the signal was reported from most of Southern and Central California. Pat W6YEP in Fresno reported P-5 results for most of the flight (280 miles). Norm WV7K and members of the AAA5 club in Phoenix, Arizona (300 miles), had nearly P-5 reception (the IDer was in full color) with perfect subcarrier sound for over an hour.

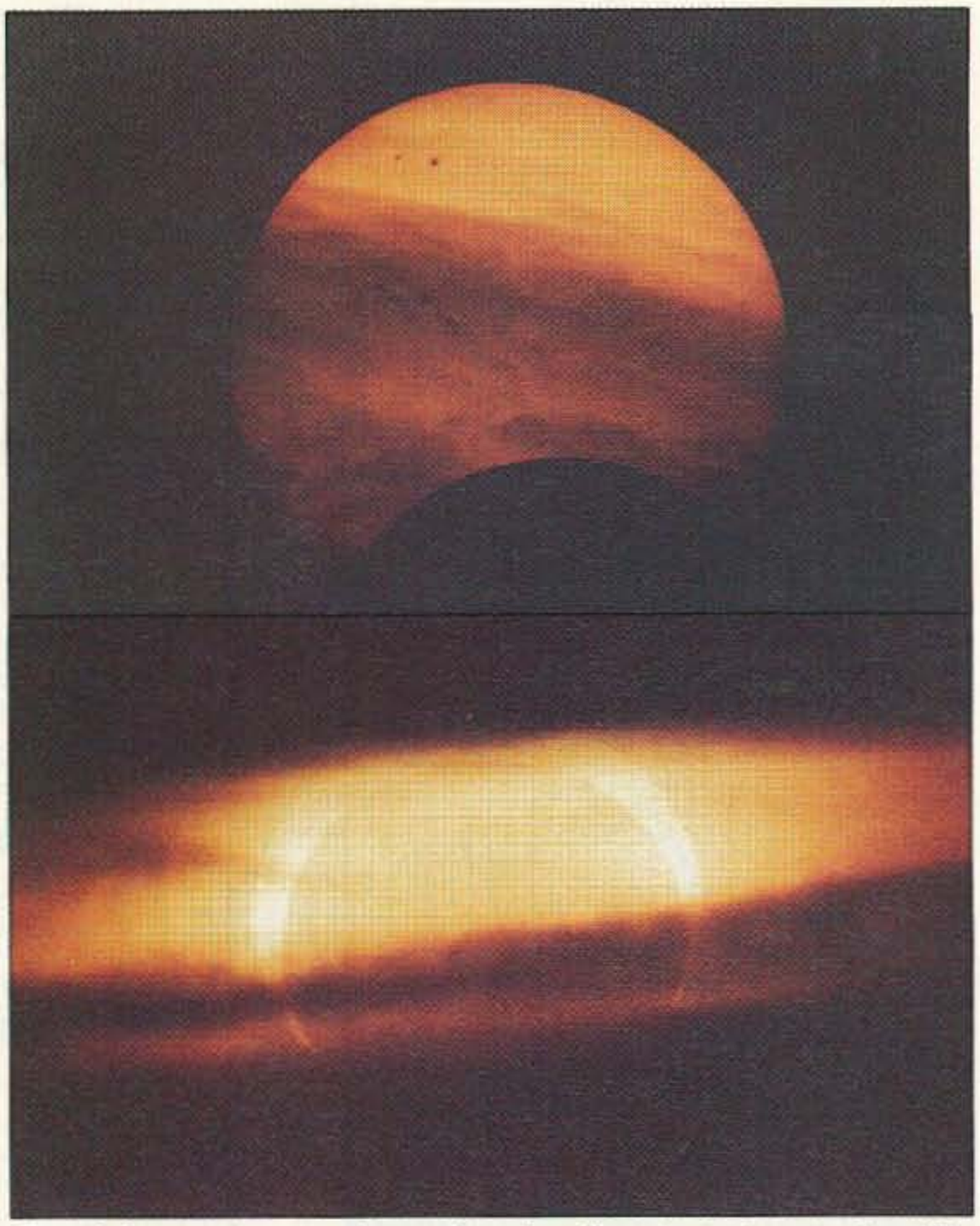

Photo A. A rare and spectacular annular solar eclipse at sunset as seen from Mike KC6CCC's yard in San Clemente, California. (Photo by John Hoot N6NHP.)

The crossband repeater worked well for the first 30 minutes of the flight, however the cold temperatures caused the timer board to malfunction resulting in a continuous loop of the voice ID. I'm sure the Southwest is a little tired of my voice by now, but it did help the T-hunters track down the payload since the 2 meter transmitter was on continuously.

The Chase

Before the flight, I contacted Scott Bovitz N6MI and Joe Moell K0OV of the Southern California T-hunt group. If anybody could track down and recover the payload, it would be this group. No matter what the circumstances, I knew they would find a way to locate the landing site of the package.

The computer prediction showed that the payload would land about 50 miles to the east-northeast. This was an area of rugged mountains with very few passable roads. To top it off, the balloon would be landing at night! A definite challenge to the T-hunters. As the balloon came down, the T-hunters had its location pegged right down to the point of touchdown. With Kuby N6JSX coordinating the mobile trackers via a repeater, they quickly converged near the top of Little Thomas Mountain (about 5,000 feet high) and re-acquired the signal in short order. Unfortunately, they couldn't get much closer than a mile

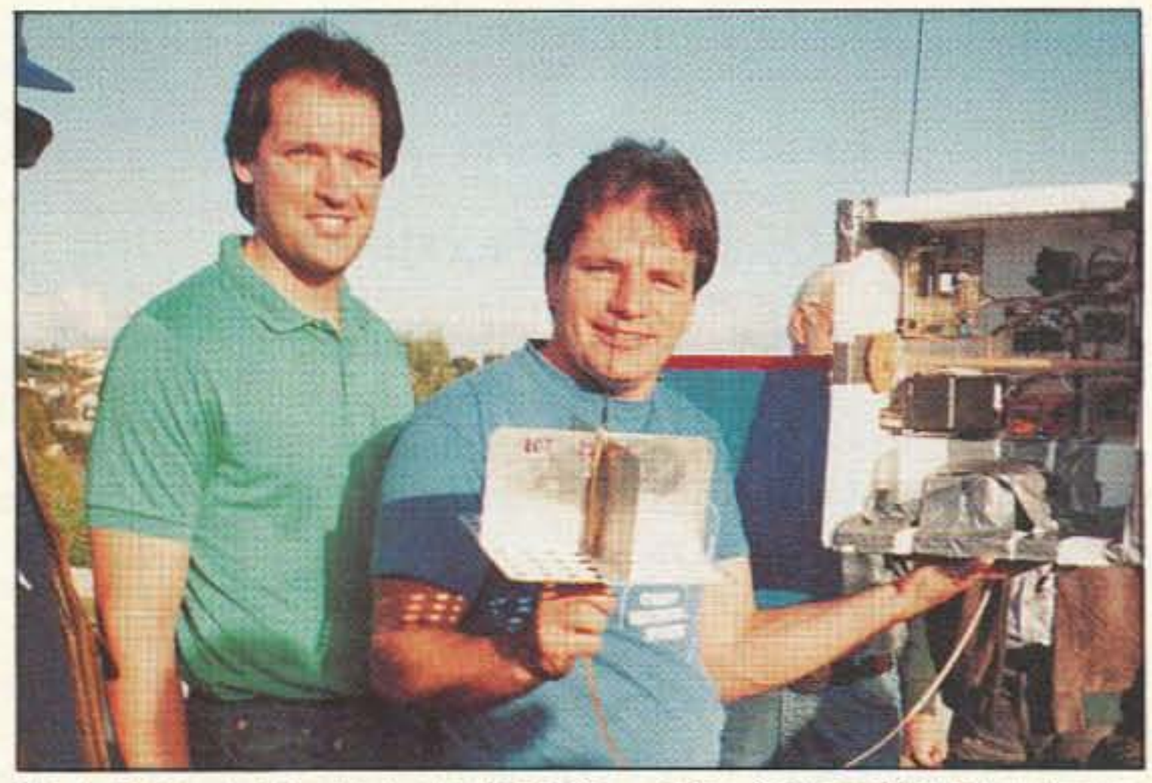

Photo B. (l to r): Mike Henkoski KC6CCC and Mike Collis WA6SVT (holding the combination radar reflector/ATV antenna) make the final tests on the balloon package.

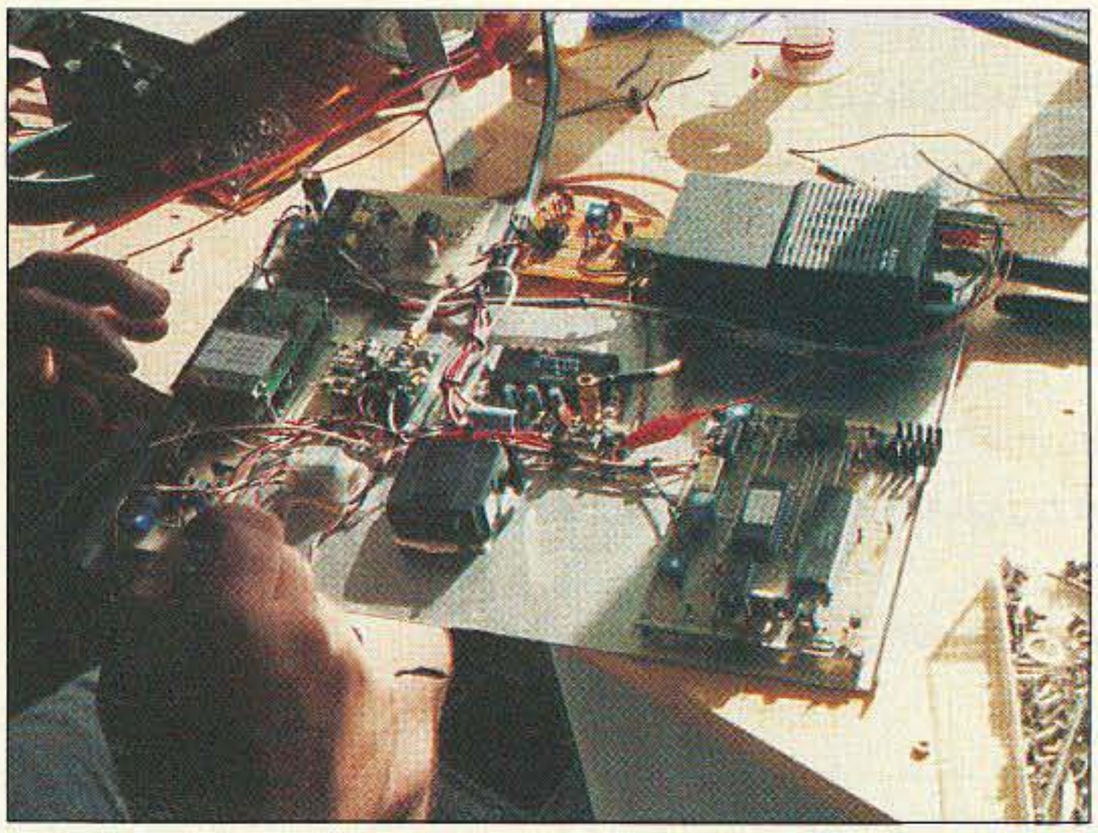

Photo C. All of the electronics were mounted on an aluminum sheet to dissipate the heat from the 6-watt ATV power amplifier.

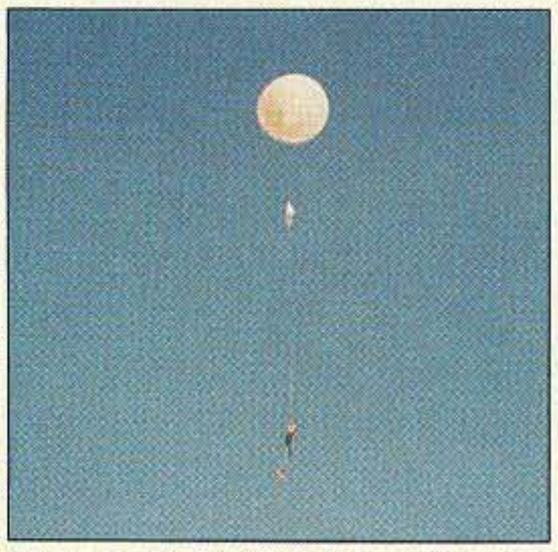

Photo E. The balloon takes off just 35 minutes before the solar eclipse.

or two on any of the roads (a lot of vehicles got stuck getting to this point).

Imagine crashing through dense Manzanita brush in the middle of the night on a freezing cold mountain while trying to track down a hidden transmitter. After the storm hit in the wee hours of the morning, they had to give up the hunt until the weather improved. It was a challenge just to find their way back to their vehicles!

Although the ATV portion of the payload died out after five hours, the 2 meter HT and the 10 meter transmitter were on a different battery system that would last several days. Fortunately, it was still transmitting two days later (the first good day after a large storm pelted the area). As the T-hunters closed in, the signal suddenly appeared to be moving. Apparently the balloon package had grown legs and was walking out on its own! A local resident had found the payload and carried it back to his cabin. The T-hunters tracked him down and rescued the package.

Back in One Piece

Even after sitting out in the snow and rain for over two days, the payload was in perfect shape. The film from the on-board 35mm film camera was rushed to the developers. The camera had taken only three pictures, however. One good sunset shot at 2,000 feet, and a couple of cloud pictures at 12,000 and 22,000 feet. It apparently froze up after that. Not much solar radiation to keep it warm during an eclipse.

This was a fun flight that hopefully stirred up activity across the Southwest. I know at least one (possibly more) of the spectators at the launch site may be joining the ranks of hamdom as a result of watching the ATV receive station at the park.

I can't say enough about the sheer determination of the Los Angeles T-hunters. Without their incredible efforts, the package may never have been found. Look at this month's "Homing In" column by Joe Moell KØOV for an excellent account of the balloon recovery effort. 73

Photo D. (l to r): Bill WB8ELK and Greg DeWit WA6JAD get ready to launch the balloon.

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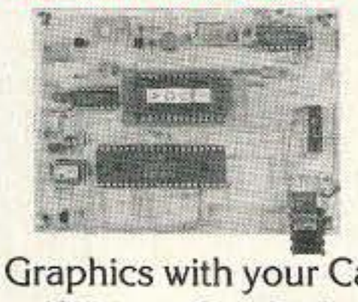

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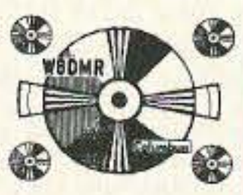

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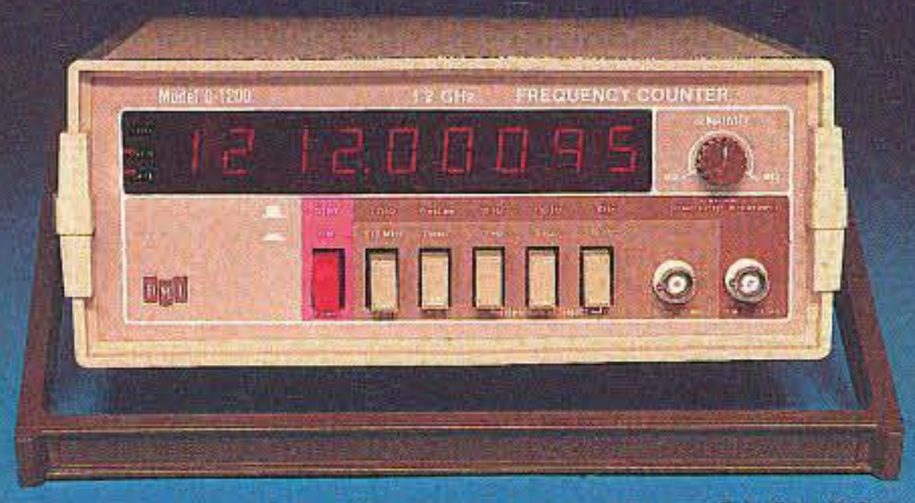

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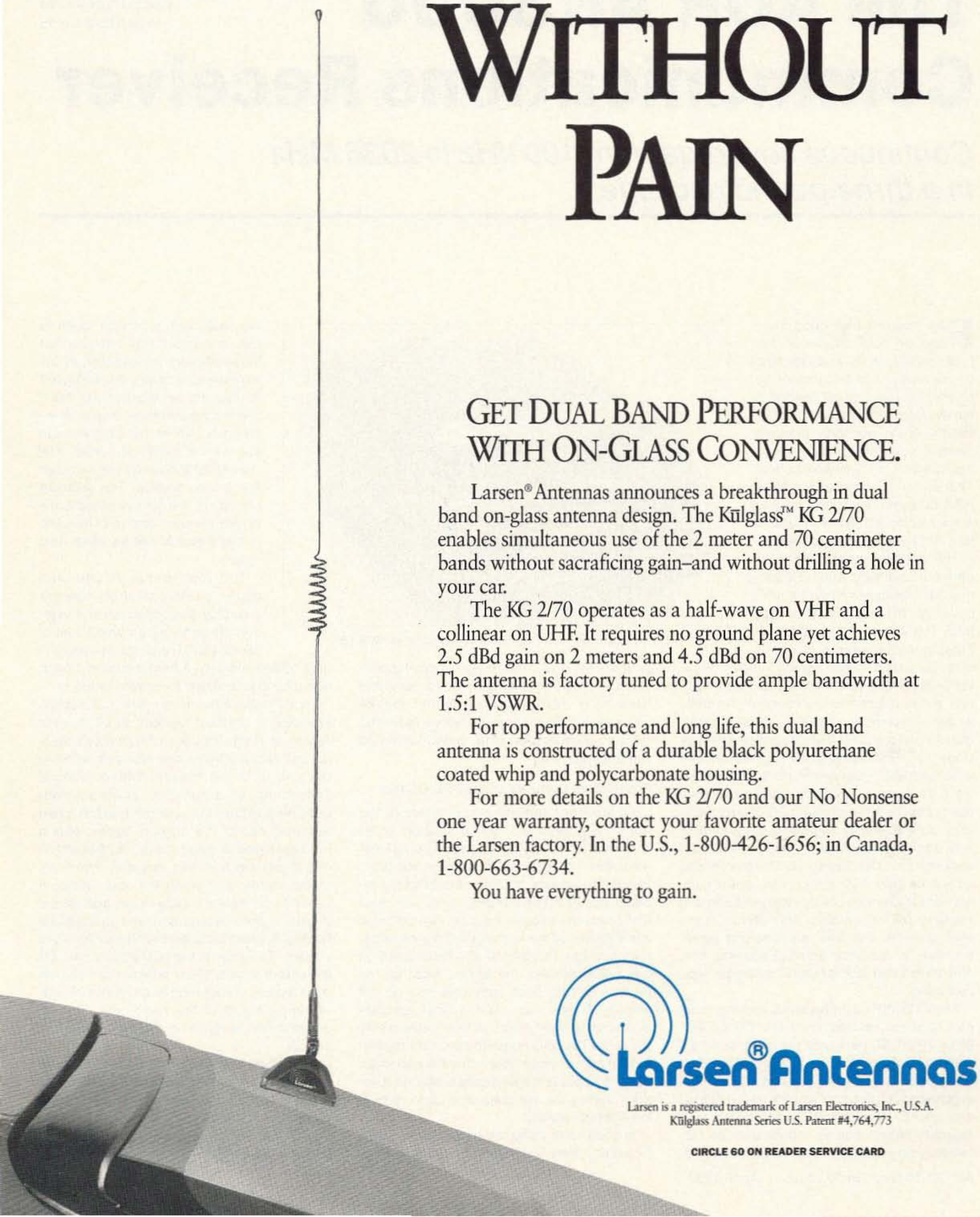

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CIRCLE 60 ON READER SERVICE CARD

73 Review

by Louis A. Smith II N3BAH

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The AOR AR3000 Communications Receiver

Continuous coverage from 100 kHz to 2036 MHz in a three-pound package.

Few receivers offer good coverage on both shortwave and public safety bands, and those that do are high priced and include sophisticated features not needed by the average hobbyist. With today's soaring costs, economy of equipment is important, particularly for the operator on a limited budget. That's why the introduction of the AR3000 communications receiver is a welcome addition to the amateur and radio hobbyist market.

The AR3000 is a combination general coverage and scanning monitor receiver, with synthesized coverage extending continuously from 100 kHz to 2.036 GHz, 400 programmable memory channels, and four independent search ranges. It's a vastly improved version of earlier AOR models, and is tailored to the needs of the radio amateur by providing more essential features, without unnecessary frills. Modes received include AM, USB, LSB, CW, and narrow and wideband FM. Programming is accomplished via a front panel keyboard augmented by a rotary dial, or by an optional PC control capability. All information regarding programming and frequency storage is displayed on the easy-to-read LCD display which also contains a bar-type LCD S/RF meter. The control complement is rounded out by rotary volume and squelch and an on/off push-button. On the rear panel are the BNC antenna and power connectors, a 3.5mm external speaker jack, and a 9-pin DIN jack for use in automatic tape recording.

Photo A. The AOR AR-3000 communications receiver.

The AR3000 is a professional-looking, compact receiver. Housed in a 3-1/7″ (H) x 5-2/5″ (W) x 7-7/8″ (D) dark gray plastic case with a sloping front panel, the unit weighs less than three pounds, yet is solidly constructed and ergonomically pleasing. Accessories included are an AC adapter, DC power cord with cigarette lighter plug for mobile use, 26-1/2″ telescoping antenna with BNC connector, instruction manual, and one-year manufacturer's warranty. Optional accessories available from AOR include an earphone, mobile mounting external speaker, mobile mounting bracket, wideband preamp, and an extended warranty program.

Front Panel Controls and the PC Option

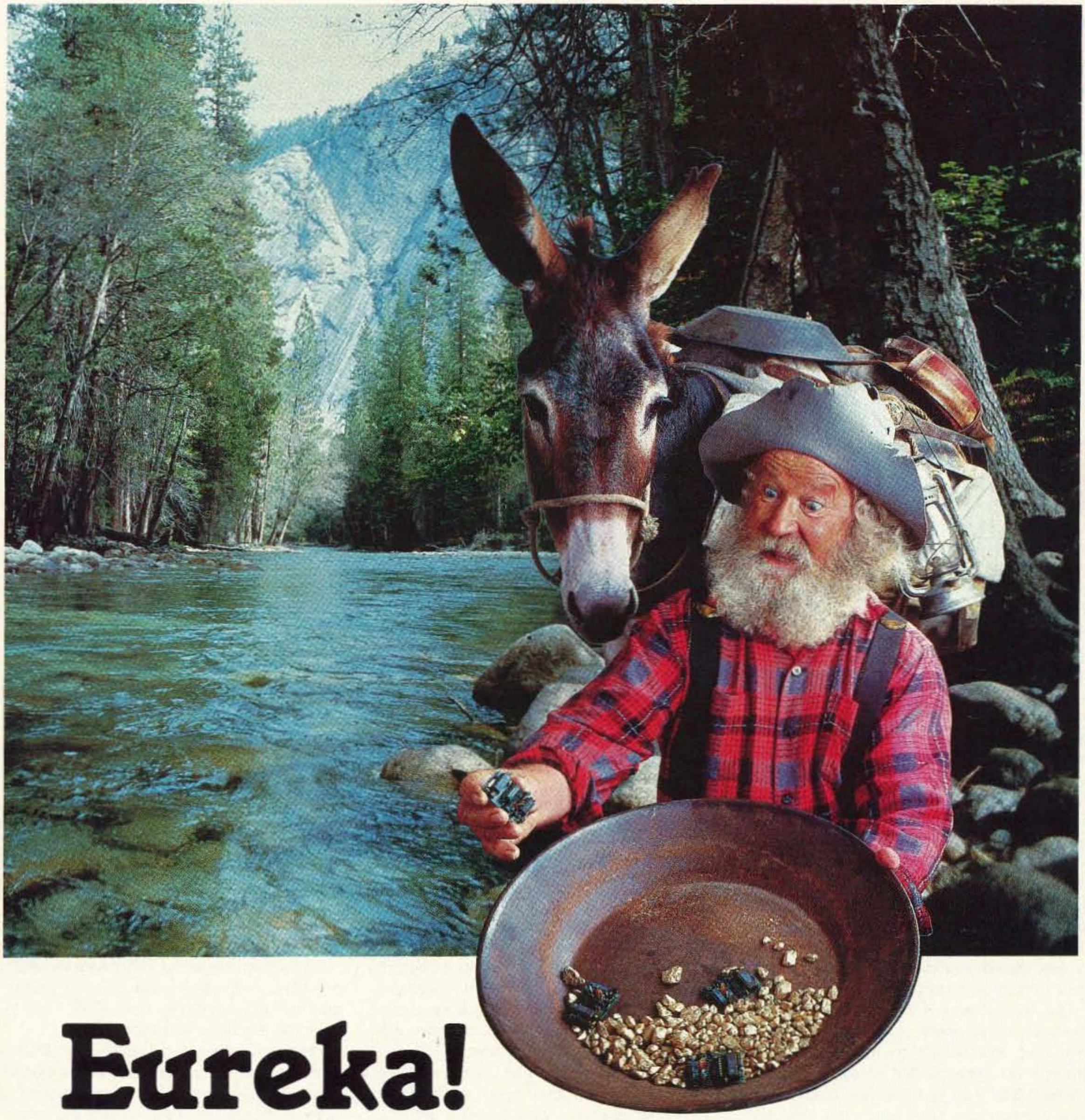
All receiver functions are controlled by the front panel keyboard, which consists of 26 individual keys, 22 of which perform dual functions such as mode and increment selection. In order to activate the alternate functions labeled above these numeric keys, you must first press the second function key, followed immediately by the key with the desired alternate function. In contrast with those used on early AOR models, the keypad used on the 3000 is sturdily built, with keys that do not wobble in their slots, and a label template surrounding them which is firmly adhered to the case. The only negative comment regarding the control ensemble is that the dark color used to indicate the keyboard's second functions makes the template difficult to read in low-light conditions.

In addition to using the keyboard for direct frequency entry, the professionally-styled tuning knob adds a familiar touch to this computerized receiver for those who are accustomed to using slide-rule tuning. It is designed so that the synthesizer will move one increment/channel up or down for each click of the knob when in the manual mode. *[Ed Note: The new AR3000A model has a smooth feel tuning control.]* The adjacent directional arrow keys operate in a similar manner, and may be used to fast forward/reverse when held down.

The front panel volume and squelch rotary controls operate smoothly throughout their range, and the push-button on/off control allows you to return to a preset volume setting instantly. A front-mounted 3.5mm headphone jack allows for private listening.

Directly above the keys is an LCD display, providing a constant readout on all receiver functions. Data included in the display's readout includes the frequency received; whether the unit is in the manual tuning, manual searching, or automatic (programmed) searching status; the channel number when scanning one of the memory banks; plus a bar-type signal strength meter. A 24-hour format digital clock is also included, which remains visible even when the radio is not in use. All information is easy to see against the display's green background, and an adequate backlight is also included to enhance low-light viewing. To the left of the LCD display are LED indicators which show which scan/search bank the unit is operating in, as well as indicating engagement of the sleep timer feature, and when the keypad is in second function key status.

In addition to the keypad, the AR3000 may also be directly controlled by a personal computer. On the rear panel of the unit is a bus connector for interfacing with any PC with an RS-232 serial port. Optional cable and software needed to interface with an IBM or



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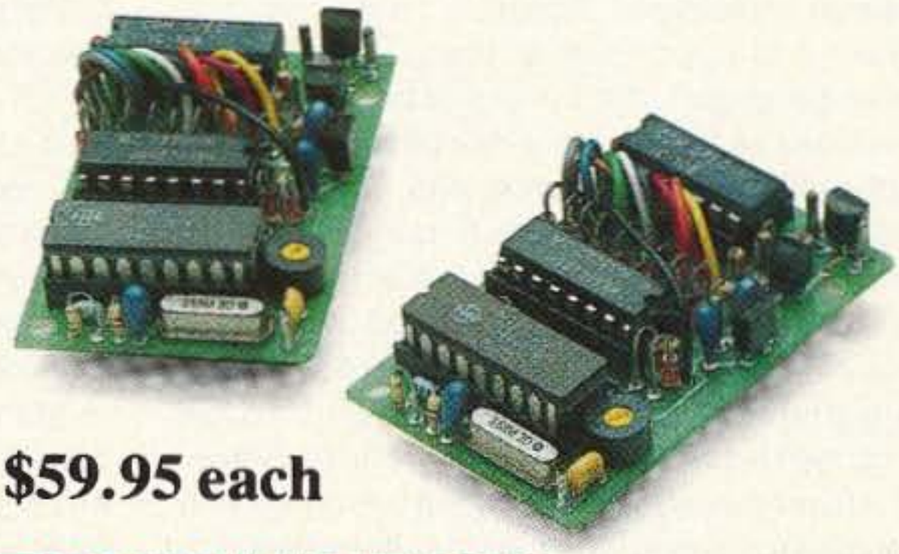

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MS-DOS type machine may be purchased as accessories. PC control also greatly expands frequency storage capability. Detailed interface instructions are provided in the instruction manual, and while I was unable to personally verify this aspect of the unit's operation, reports from other sources indicate few problems using PC control. Of course, ACE offers complete technical assistance via their toll-free information and order line.

Programming and Searching

As received from the factory, the unit contains no pre-programmed frequencies and must be loaded with the user's selections. Programming is easy, and you may want to either directly enter your favorite channels or use one of several search features to discover new ones.

Representing a true hybrid between a conventional scanning monitor and a general coverage receiver, the AR3000 allows you to select frequencies in several ways. First, direct keyboard entry of any frequency may be accomplished simply by first touching the "Dial" key, and then entering the desired frequency on the keypad. Next, you press the "Mode" key and turn the tuning knob to select between AM, CW, NFM, etc. modes as indicated in the display, and then press "Enter." Finally, you select a tuning increment, which can be any number down to 50 Hz. With these initial settings completed, each click of the tuning knob or press of the arrow keys will adjust the frequency upward or downward by one increment. To activate automatic tuning (which the instructions call "manual searching"), you hold down the appropriate directional arrow key for several seconds to start the receiver automatically advancing in the selected direction until it encounters an active frequency. Manual searching may be resumed again by using an arrow key or the tuning knob. To return to manual tuning, simply press the "Dial" key again. A separate "Dial" frequency and related data may be stored in each of the four memory banks.

The second means of locating active frequencies is automatic (or "programmed") searching. After selecting one of these banks, labeled M1 through M4, pressing of the "Search.Set" key in its second function begins prompting you to enter the intended search increment, reception mode, and the lower and upper search limits. The internal microprocessor takes over and begins moving from one search range to the other at a rate of approximately 20 increments per second. Separate automatic search ranges may be entered into each of the four memory banks, and searching must be conducted in only one bank at a time, since banks cannot be linked together. The search direction can be changed instantly by a turn of the tuning knob.

An interesting function of the tuning knob in relation to searching is that by pulling the knob out slightly, the search increment is multiplied by a factor of 10, so as to move through the range more quickly. When this feature is engaged, the word "step" appears in the display, and disappears when stepping is disengaged by pulling the knob once more.

Finally, frequencies may be loaded into the memory channels. To accomplish this, you select one of the memory banks using the second function "Bank" key to toggle among the four banks of 100 channels. Frequencies can be entered into individual channels numbered 00 through 99 within the bank, using a similar keyboard sequence as for direct keyboard entry described above. Frequencies may be entered in any combination of bands and modes, keeping in mind that channel 00 is designated as the priority channel in each bank. Active frequencies encountered when manually or automatically searching may also be directly entered into a memory bank channel.

"The unit's frequency coverage is unsurpassed by any other commercially available synthesized scanning receiver in its price class."

Each bank may be automatically scanned, or used as a bank of preset channels to manually select from. This is especially useful when monitoring shortwave broadcasts or checking your favorite net and repeater frequencies. In addition, individual memory channels may be locked-out by pressing the second function "Ch.Pass" key to engage the Channel Pass feature when stopped on the desired channel.

Once entered, all search ranges, memory channels, and related data are permanently stored in a non-volatile memory, and may be reviewed or changed at the user's discretion.

Performance

The AR3000 performed outstandingly well in all areas of its specifications, demonstrating excellent sensitivity and selectivity across the spectrum. Even in UHF and higher frequency bands, the ability to receive signals far greater than the usual "line of sight" distance was good even when using the telescoping whip antenna. This, coupled with the fact that very few birdie frequencies were encountered (e.g., only one was noted between 220–225 MHz), made monitoring a breeze. No adjacent channel interference was noted, and the 2-1/2" internal speaker's output was more than ample, though the fact that it was bottom-mounted tended to direct the sound into the surface on which it was sitting.

The unit's scan/search speed of 20 channels per second was adequate to cover a full bank of 100 channels. If using a memory bank to scan public safety frequencies, which often have spontaneous, short transmissions, it is advisable to only scan over about 40 channels, to lessen the likelihood of missed transmissions. If scanning a group of amateur repeater/simplex channels, a full 100 channel repertoire could be effectively scanned, as the transmissions would be sufficiently long to stop the scanning, and allow you to manually select a conversation of interest. To preclude the possibility of missed transmissions when scanning an entire bank, however, a scan rate of at least 40 channels per second would be more desirable.

One observation relating to the scan feature is that when frequencies from diverse parts of the spectrum are grouped in a single memory bank and scanned, the unit tends to skip over active channels unless there is a very strong signal present. A good example of this is when one attempts to group frequencies from the HF amateur bands with those in the VHF range into the same bank. The unit was observed to skip over signals whose presence was only noted by momentary flashes on the signal strength meter. A similar situation also occurred when frequencies from both FM and non-FM modes were grouped into the same bank. While ACE's instruction manual does not address this condition, the best advice is to keep channels utilizing the FM mode in a separate bank from those channels utilizing USB, AM, etc.

Most monitoring on the VHF bands and above involves FM reception. Due to its wide frequency coverage, the AR3000 includes a dual FM reception capability with narrow (NFM) and wide (WFM) modes available on any frequency. In the NFM mode the unit receives the standard 5 kHz deviation FM voice modulation common in the VHF/UHF amateur, land mobile, and cellular radio services. WFM is provided for reception of standard FM broadcast signals between 88 and 108 MHz, and the audio portion of TV broadcast signals in the VHF and UHF spectrum. Some users of the AR3000 report success in using the WFM mode in conjunction with equipment to demodulate weather and other satellite signals around 136 MHz. *[Ed Note: I've used the AR3000 to successfully track weather bureau radiosonde balloons on 1.680 GHz (wideband FM).]*

Special Features

Enhancing the unit's searching versatility are several unique features known as Frequency Pass and Free Scan, which allow for virtually hands-free operation.

Frequency Pass is a blessing for anyone who has ever used a receiver with a synthesized search feature, only to find an annoying "birdie" frequency in the midst of the search range. In such cases, even in the absence of actual signals, the internally generated birdie would halt searching, requiring operator action to resume the search. The AR3000, despite its relatively small number of birdie frequencies, compensates for this problem by allowing the user to enter up to 48 of these problem frequencies into a special memory. The user accomplishes this by touching "Freq.Pass" in the second function mode, and then entering the problem frequency. The radio permanently remembers these entries, and will eliminate them anytime the radio automatically searches over a range containing them. It will not prevent such frequencies from being monitored in either the direct keyboard entry or manual search mode. Passed frequencies can be easily displayed for verification, and deleted at will using a few simple

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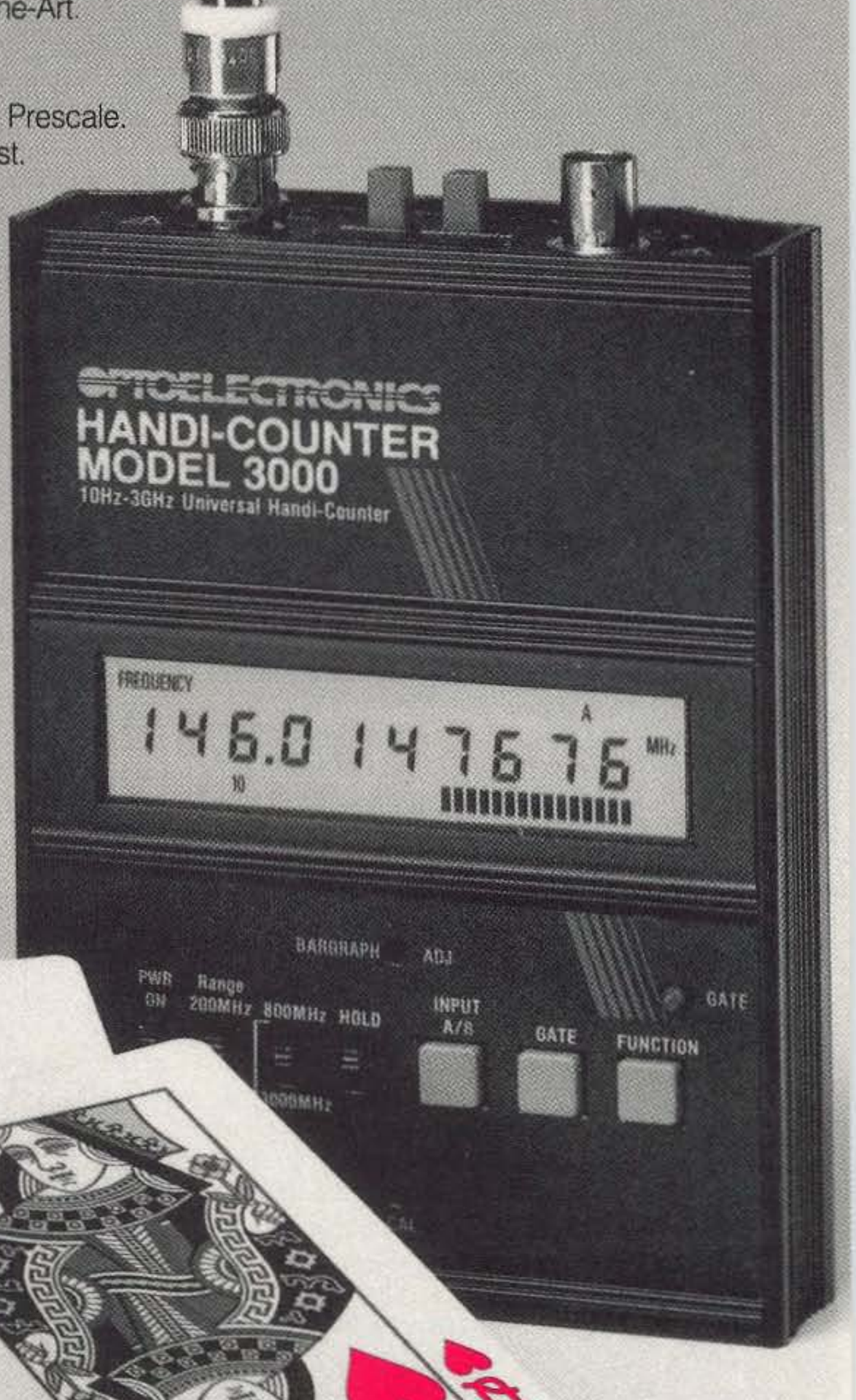

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keystrokes. This feature is useful not only for blocking out interference signals, but also when trying to locate new frequencies in a part of the spectrum populated by numerous active frequencies. In the latter case, these known active frequencies can simply be "passed," thus leaving the receiver to stop only on previously unknown active frequencies.

Another unique feature is Free Scan, which can be used either when searching or scanning in a memory bank. Free Scan causes the receiver to resume automatic searching approximately five seconds after an active frequency is located, even if the signal is still present. In this way, when searching in a band with numerous active frequencies (for example, shortwave broadcasters), the listener can briefly sample each active station without ever having to touch the receiver. This feature can also be used when scanning the channel banks. When using Free Scan, the decimal points in the LCD multi-function display alternately flash between the MHz and kHz positions.

An interesting feature which is useful for monitoring repeater traffic is Frequency Shift. After programming in the desired repeater offset (for example, +5.0 MHz for 440 MHz FM, or ±0.600 MHz for 2 meters), you may instantly monitor the signal on the repeater input by pressing "Freq.Shift," in much the same way as on synthesized transceivers.

Wrapping up the list of features is a programmable sleep timer, which allows you to set a length of time after which the radio will automatically shut itself off. The "Alarm" feature allows you to enter a desired "on" time, so that you can wake to the same frequency, search or scan bank which the radio was operating on when it was last turned off.

A voice-activated auto tape-recording capability is also provided via the DIN jack on the rear panel. General details on interfacing with a recorder are supplied in the instruction manual. This feature allows you to capture all transmissions on a cassette tape for review later.

While the unit resembles a conventional programmable scanner, hiding behind this disguise is an outstanding shortwave receiver. Expanded frequency coverage allows reception of international broadcasts in all bands below 30 MHz, with more than adequate sensitivity to receive a full spectrum of stations using the telescoping antenna, due to the GaAsFET RF amp employed. While the unit lacks several other features useful on shortwave, such as an AGC control, noise blanker, or notch filter, this does not impair the unit's functioning on these bands.

HF performance is enhanced from earlier models by the addition of a user-adjustable tuning increment. With a minimum setting of 50 Hz, tuning in the amateur and shortwave broadcast bands demonstrated that the AR3000 is a serious contender among communications receivers. It is easy to ferret out one signal from the pack with a receiver capable of such sharp tuning, due to the 15 bandpass filters the AR3000 uses to sharpen tuning. I experienced little difficulty in separating signals, even in a pile-up. In summarizing the HF tuning characteristics, I found the combination of the user-adjustable tuning increment and the frequency step feature (which allows you to multiply the increment by a factor of 10 simply with a pull of the tuning knob) worked together to make the AR3000 a pleasure for listening to either sideband, CW, or AM shortwave broadcasters.

One welcome result from the combination of shortwave and scanning receiver in the same package is the ability to search for active HF frequencies and then store them in the scan banks for future reference. With over 400 memory channels, the unit provides ample room for all the international broadcast and other frequencies of interest, while still allowing space for conventional VHF/UHF FM scanning. A similar use may be made of the unit's coverage in the VHF/UHF television bands using the WFM mode. For example, after locating the pertinent audio segments for the TV channels in your area, you may program them into a memory bank, allowing for easy listening to TV audio when you're traveling!

The unit's ability to switch from a fixed memory channel to the "Dial" status also complemented its coverage of the amateur bands. By simply touching the "Memo.Bank" key while scanning a memory bank, you may take frequencies from the memory channels and tune around using this channel's frequency as a starting point. I made use of this feature to keep track of active net frequencies, and to tune above or below them to catch off-frequency stations. Varying the frequency in this manner does not alter the memory channel contents.

Also accessible from the keyboard is a 10 dB signal attenuator, which will lessen the input signal level. While the unit handled strong signals without distortion in the regular mode, the attenuator could prove useful for VHF/UHF monitoring in urban areas where the spectrum is congested.

Performance on the VHF/UHF bands was also impressive. The unit's frequency coverage is unsurpassed by any other commercially available synthesized scanning receiver in its price class. It is important to note that, unlike some competing models, the AR3000 provides full spectrum coverage between 100 kHz and 2036 MHz with no portions locked out or eliminated. The excellent sensitivity and selectivity exhibited on VHF/UHF were virtually unequaled for monitoring narrowband FM transmissions (i.e., no noticeable difference in sensitivity was apparent in receiving frequencies as diverse as 146 MHz and 800 MHz). The capability to receive all amateur frequencies, most of which are traditionally eliminated from scanners, as well as UHF aircraft between 300–400 MHz and cellular land mobile at 800–900 MHz, provides an extra bonus. Once you become accustomed to the keyboard repertoire, entering frequencies for the police, fire, amateur, and other services occupying these bands becomes second nature. While brief, the instruction manual provides all necessary information on programming and after practicing entering search and memory information a few times, it's easy to catch on.

The large number of memory channels allows emergency service and amateur frequencies for specific geographic areas to be entered in their own bank, making it easy to change from one frequency group to another at the touch of a button. This feature is especially useful when using the AR3000 in a vehicle, since it allows you to switch to a completely programmed bank for each area through which you are traveling.

The receiver's true versatility is evident in its ability to instantly switch from scanning the banks to functioning as a tunable receiver at the touch of the "Dial" key. For example, you can switch from scanning for local police transmissions to checking your watch against a WWV time signal, all in a matter of seconds! Such changes require a minimum of keystrokes, since the frequencies or search ranges and corresponding modes can be programmed once into the unit's memory, and can then be instantly recalled anytime. The combined HF through 2 GHz capability in a single unit no larger than a conventional scanner is truly welcomed, and should serve to introduce many police/fire/EMS buffs to the intrigue of the world below 30 MHz, as well as to acquaint denizens of the amateur bands with the multitude of other radio services occupying the spectrum.

With great frequency coverage and a minimum of inconveniences, the AR3000 is a pleasure to use. It's user friendly and delivers good performance in all frequency ranges. The wide frequency coverage and multiple modes make it a great all-purpose receiver for the radio amateur, shortwave or VHF/UHF listener, and its low price tag makes it a worthwhile investment. 73

AR3000 Specifications

Frequency Coverage	100 kHz–2036 MHz	
Sensitivity	0.35 µV NFM	
	1.0 µV WFM/AM/SSB/CW	
Selectivity	Not furnished	
Scan/Search Speed	Approx. 20 channels/sec.	
IF Frequencies	1st	736.23 MHz
	2nd	352.23 MHz
	3rd	198.63 MHz
	4th	45.0275 MHz
	5th	455 kHz
Audio Output	1.2W at 4Ω	
Power Required	13.8 VDC at 500 mA	

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- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, 800-960 MHz.*

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- 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.

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LNS-(*) IN-LINE PREAMP

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- 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.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

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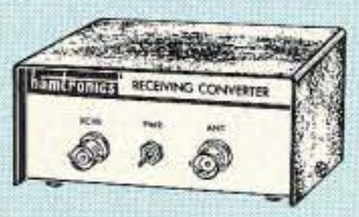

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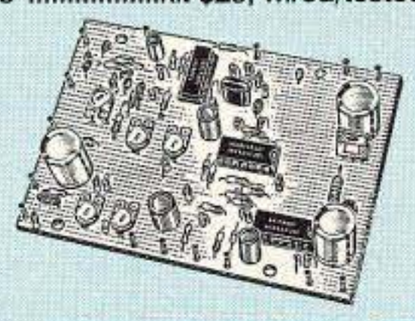

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier .....kit $49

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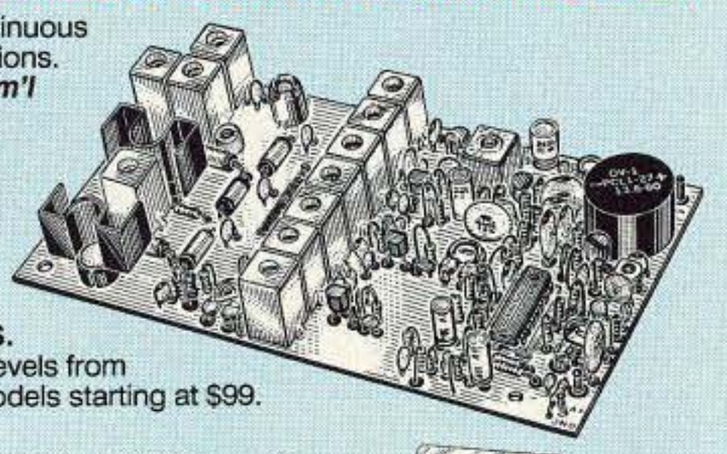

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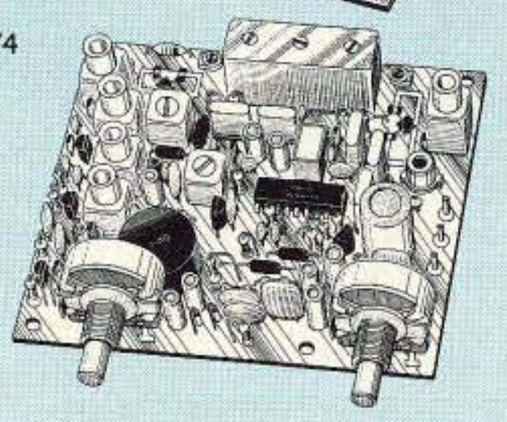

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Radios and Runners

"Why am I doing this?" I sleepily asked myself as I drove to Fort Wadsworth, Staten Island, at 4:30 a.m. on November 3, 1991—Marathon Day in New York City. Every year that I've participated in the Marathon, I've had this diatribe with myself. I'm not even a runner! I go there as a dutiful ham and because my friend and ARRL Director Steve Mendelsohn WA2DHF would yell at me if I didn't.

Photo A. 25,000 runners arrive at the crack of dawn at the starting line at the Verrazano Narrows Bridge.

Photo B. (Left to right): Gus Hahn KA2STS, Rich Balas N2KOO, George Rice Jr. NA2V, and Stan Olochwoszcz N2AYJ at Radio Headquarters at Fort Wadsworth, Staten Island, New York.

With eyelids at half-mast, I approached the fort at the foot of the Verrazano Narrows Bridge where the Marathon begins. Within minutes of arriving at the command headquarters for the amateur radio operations, I was totally caught up in the spirit and the excitement of a most incredible event. (A strong cup of coffee didn't hurt, either!) There obviously has to be a good reason why 8,000 volunteers participate in helping to support the 25,000 runners who begin to show up at the crack of dawn.

Marathon Vita

The "numbers" associated with the New York City Marathon are impressive. Nearly 3,000 New York City police officers work along the Marathon route. To date, a total of 221,898 runners have crossed the finish line of the 21 previous Marathons. Citizens of 124 countries have participated in the Marathon's first 21 years. (In contrast, just 111 countries have been represented at the 12 Olympic Games dating back to the inaugural of the Modern Games in Athens in 1896.)

The New York City Marathon is the largest Marathon in the world, with over 45,000 applications submitted. And, according to the NYC Police Department, it is the largest spectator sporting event in the world. Nearly 2 million people line the streets at various times during the race. In 1991, there were 8,000 runners from 91 countries. Over 350 linguists were recruited from United Nations volunteers and from Metro International, a group of exchange students.

Over 200 American Red Cross volunteers assisted the city's Emergency Medical Services team. Besides providing non-emergency first aid treatment, they also distributed and served 32,000 cups of coffee, 12,000 cups of hot chocolate, 6,000 cups of tea, 5,6000 sandwiches, 15,600 donuts and 8,400 rolls. Can you begin to picture the amount of work, organization and effort that goes into this event?

Who Makes It Work

The contributions of all the volunteers are vital to the smooth operations of this mammoth enterprise. Obviously, though, it is the communications aspect which is at the core of the organized efforts of the entire event that day. More than 400 ham radio volunteers representing seven states set up a network of communications that has been called the "Central Nervous System" of the Marathon.

Nets are set up to deal with the problem of downed runners, calls for doctors and medical supplies, and for the replacement of other supplies and equipment needed that day. Ham radio operators are the link to the concerned people waiting at the Family Reunion Area to inform them if their friends or family may have dropped out, and where they can meet.

In the past, I've been assigned to the supply truck at Fort Wadsworth, and to "shadow" various administrators and coordinators and offer communications capabilities wherever they are needed. This year I was assigned to "shadow" the doctor in charge of the medical area, Joe Wisenfeld. The NYC Marathon has the largest medical staff ever assembled for a sporting event. The staff includes 1,500 doctors, podiatrists, chiropractors, nurses, physical and massage therapists, emergency medical technicians, and support medical personnel. I was really impressed with the dedication and professional care I saw being administered in the medical tent.

Several former ham radio students of mine who were runners that day followed the orange hats until they found me. As a ham, I feel good being part of a team that is so vital to the safety and success of the participants. It's also gratifying when folks who know you stop by to say "thanks," and when strangers take the time to tell you how much they rely on seeing those orange Amateur Radio Emergency Communications caps along the route.

Hams on the Sweep Bus

My friends Bob Chamberlain W2HVX and Richard Sandell WK6R were doing their part on the Sweep Bus. Bob told me that he thinks that nowhere is the contribution of amateur radio communications to public welfare and safety more evident than in the Sweep Bus Operations of the NYC Marathon. This year eight buses were used on the route to pick up runners who had dropped out of the race and to transport them to the Family Reunion Area in Central Park. Every bus has a ham radio operator on board with the ability to communicate the location and condition of boarding runners, and to call for quick medical assistance if needed.

Information was immediately relayed by the hams to family members in the Central Park facility as to whether their runner had boarded the bus, whether or not there appeared to be any injury, and the expected bus arrival time. Further information was made available on the whereabouts of runners transferred by ambulance to a hospital.

Bob tells me that some runners who boarded the bus were too sick to get off by themselves. Hams were instrumental both on the buses and off in calling for ambulances or other medical assistance to help these runners. Also, if a runner fell between the mile markers, he was likely to be helped by the hams in pre-positioned buses along the route or by a ham on a Sweep Bus. The ham radio operators were in a position to observe the problems immediately and to quickly offer assistance via their radios.

The volunteer ham radio operators use their own portable radio equipment to communicate from inside their buses over the entire Marathon course from the starting point on Staten Island through all the boroughs of New York to the finish line in Central Park, a distance of 26.2 miles. Members of the Amateur Radio Emergency Service join forces with operators from the ARRL in helping to smooth the way in every aspect of Marathon operations.

The group is organized by Steve Mendelsohn WA2DHF. A responsibility of this magnitude could only be handled by a thoroughly dedicated and talented individual who knows how to motivate and to get the best out of the hundreds of hams who volunteered. Steve works with the radio clubs throughout the year, helping to get things organized for the big event.

On Staten Island, two hard-working hams, George Rice NA2V and Steve Zuvicich KA2HXU, were coordinators of the starting area communications. It's a pleasure working with these people every year. From the time the hams start their operations at Fort Wadsworth on Saturday at 11:30 p.m. to Sunday's final transmission at 7:00 p.m., they are on the air, helping keep participants and the viewing public safe.

Back in my class the next day, I was exhausted, but armed with countless ham radio stories to share with the children who love to hear these anecdotes.

So I guess I'll be griping again next year when my alarm clock rudely awakens me on Marathon morning. But I also know I'll keep on going back because I'm so very proud to be a part of the amateur radio team. 73

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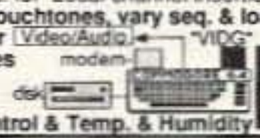

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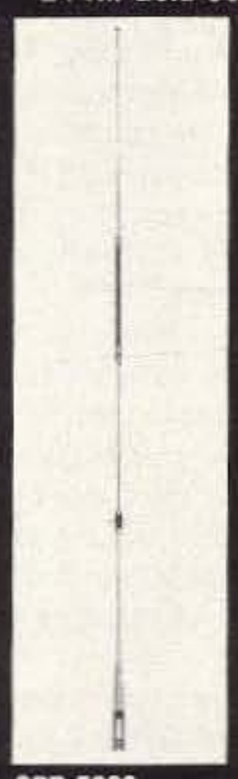

CPR-5800
Gain & Wave:
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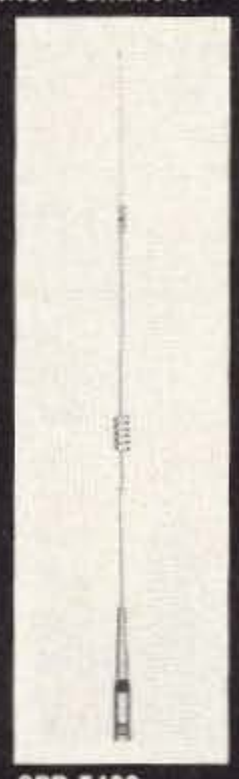

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Connector:
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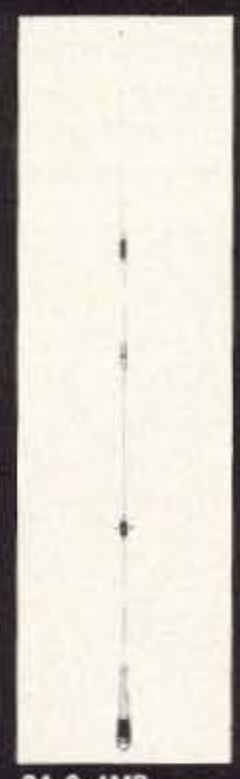

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B-10
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1/4 wave
446MHz 2.15dB
1/2 wave
Max Power: 50 watts
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HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
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Foxhunt Fame Awaits You

The gauntlet is down! If you think of yourself as a worldclass foxhunter, here's your chance to prove it. You're hereby invited to be part of one of the world's most prestigious radio direction finding (RDF) competitions.

More on that in a moment, but first some background for new readers. Hidden transmitter hunts, often called foxhunts or T-hunts, are an exciting ham radio sport. Hunters compete using various types of RDF gear, trying to locate one or more "fox" stations.

Here in the USA, most hunts involve mobiles and lots of driving. Almost everywhere else in the world it's an on-foot sporting event (see Photo A). For an in-depth look at international foxhunting, see "Homing In" for September and December 1991, plus "Showdown in Portland" in the November 1991 issue of *73 Amateur Radio Today*.

The Lvov Connection

Your invitation to foxhunt fame and glory is being passed along via John Douglas NØISL/UA4LIS, Technical Director of the Foundation for Amateur International Services. John is not a T-hunter himself. He is an ardent US DXer who has made many friends in UA-land over the years. These friendships led to an invitation to visit.

Last year, NØISL and David Larsen KK4WW went to Lvov (pronounced "luh-VOHV"), Ukraine, and Ulyanovsk, Russia, to give seminars on industrial automation. Their host, Victor Goncharsky UB5WE, arranged meetings with local hams at every stop along the way.

"We flew into Moscow and took the train to Lvov, which takes 25 hours," John explains. "During the train trip, I was introduced to Igor Shewchuk UB5SBD. He's 'Mr. Foxhunter' in the Ukraine, and runs all of the local competitions. He asked me if I would like to come out and see a hunt and maybe chase down a fox.

"That was just too good an experience to pass up. Lvov has the second largest foxhunt in the Commonwealth each year, second only to the Moscow Games. The sport is closely regulated by the Radiosports Federation.

"I got to see a training competition. They have a young persons' event for ages 15 through 19. Boys and girls are in different classes (Photo B). They also have events for adult teams and adult individuals.

"A standard foxhunt course consists of five transmitters, each beeping for one minute in sequence, on one frequency (see Photo C). A finish line transmitter operates continuously on a separate frequency. Your mission is to find all foxes in the shortest time."

"The events are stretched over two days," John says, "so you may have two hunts one day and one the next, for example."

You should be in good physical condition if you want to compete. UB5SBD writes, "Foreign foxhunters need to consider their ability to run or walk up to 10 kilometers in two hours." Of course, if your RDF skills are less than perfect, you may cover much more than 10 km!

Visiting teams from faraway countries always add excitement to a radiosports competition. The Ukrainian Open RDF Contest has hosted teams from Finland, Japan, Russia, and Czechoslovakia. Participation by a team from the USA would be a first.

Photo A. Foxhunting won't make you rich, but there are lots of medals to be won and good times to be shared at international competitions. Winners of the Ukranian hunt can compete in the IARU Regional Championships.

Photo B. Boys, girls, men, and women compete in various categories, trying to find the five fox transmitters. This Russian hunt is on the 80 meter band. There are also 2 meter events, and sometimes 10 meters is used.

"Igor would just love to have an American team compete," says NØISL. "He asked me if I could find anyone who was interested in attending the Games this year in September. He is willing to help with the invitations, picking people up in Moscow, bringing them into Lvov, loaning them equipment, and letting them practice in advance."

Tempus Fugit

I'll tell you more in future columns about Lvov, its hams, and radiosporting in the Ukraine. Meanwhile, start your training program, get your passport, and check your piggy bank. Even though athletes are given priority, it takes time for the Ukrainians to authorize your visit and to arrange for your ham privileges there.

Igor and his ham friends will host you in Lvov, but you must be responsible for your transportation to that city. Expect to spend about $1,200 per person. John has promised to help with arrangements.

NØISL is a seasoned traveler to that part of the world and can give you practical advice on what to bring, what not to bring, and what to expect. For example, you need not bring your RDF gear—there will be plenty for you to use. But be sure to pack practical items such as AA batteries to exchange as gifts.

If you are truly serious about taking part in the Ukrainian Games, write to John at 19164 - 147th Street NW, Elk River MN 55330. John is active on Internet; his address there is jrd@duke.cdc.com.

"Homing In" will be closely following the organizing of RDF Team USA. Please let me know your plans. Write to me at the address above (SASE please if you want a reply) or contact me electronically via CompuServe (75236, 2165), Internet (JoeMoell@cup.portal.com), or packet (KØOV @ WB6YMH-2.#SOCAL.CA.USA.NA).

Mother Nature Hides It Well

Repeaters in Southern California are buzzing with discussions of one of the longest and most difficult RDF efforts in anyone's memory. *73* editor Bill Brown WB8ELK and Mike Henkoski KC6CCC launched a helium balloon ATV package shortly before sunset on January 4 to get views of the annular solar eclipse from above the cloud cover.

I am sure Bill is covering the ATV part of the event in his own column. But Mike and Bill missed out on the biggest challenge—recovering their equipment package. It turned out to be the best example of cooperation in years among normally competitive me-first T-hunters.

Bill's ability to predict impact points is impressive. Twenty-four hours before launch, he said that after its fall from 100,000 feet, the package would end up 52.6 miles from the launch site on a bearing line of 87.5 degrees. He missed the actual spot by only 8.5 miles.

At the time of impact Saturday night, eight mobiles full of T-hunters (B-hunters?) were converging on the mountains north of the tiny town of Anza, following the 100 milliwatt 2 meter beacon. The roads were rough and rutted. My rotating antenna mast broke from the flexing, sending WA6OPS and me home before midnight.

Hunters soon realized that there were no accessible roads to be found for closing in. A couple of the teams in four-wheel-drive vehicles got stuck and had to be winched out. But this didn't stop the intrepid do-or-die Southern California RDFers.

N6MI, N6MJN, N6XFC, and N6XTJ set out on foot, while the remaining hunters (WB6ADC, WA6CYY, WA6FAT, KK6CU, KF6GQ, WB6JPI, N6KKN, WA6PYE and KC6TNJ) stood by to take bearings on the signal and on the hikers, to keep them from get-

GEORGE ISN'T VERY AMBITIOUS--- TWO YEARS AGO, HE STARTED TO DIG A BASE FOR AN ANTENNA TOWER

ting lost in the dark. N6JSX manned his base station, plotting bearings and keeping track of stray hunters.

It was at this point that everyone began to envy balloon hunters in other parts of the country. It must be nice to be able to DF in flat cultivated terrain with roads at least every mile on a grid, worrying only about whether a farmer will show up with a shotgun. Instead, these folks found themselves at 4,500 feet elevation, shoulder-deep in wall-to-wall manzanita bushes that made it a Herculean effort to move forward while encumbered with RDF gear.

The bearing kept indicating, "It's just over the next ridge." But by dawn Sunday the hunters had had enough. Cold and exhausted, they headed out for breakfast and some rest. It was starting to rain. Most of them had 100 miles to drive to get home.

Round Two

When we got up and heard that the package had not been found and that a storm front was due soon, WB6GCT and I headed back out to the area in his 4WD Isuzu. The beacon was still strong. We spent the morning and early afternoon driving, walking, DFing and peering through binoculars into the foggy hills. One promising road ended up in the back yard of a local resident, Chris Christensen. It turned out that Chris had "back of his hand" knowledge of the hills, where he had frequently gone horseback riding.

We inquired about roads into the area where the bearings showed the greatest promise. "You can't drive in," he said, "but I can show you the old horse trails." With that, he took off at a rapid gait and we had little choice but to hustle after him.

We followed the bearings of my TDOA RDF set, which gave clear indications from the high spots. But soon a big storm front with wind and sleet arrived, forcing us to turn back. We exchanged phone numbers and Chris hinted that he might try to find the box on his own when the weather cleared.

KC6CCC told the T-hunt crowd on the repeater Sunday night that the 2 meter beacon batteries would die within 24 hours. That motivated WB6HPW and three of the Saturday night hunters to make a last-ditch effort. They headed out to the site at dawn to find cloudy weather and six inches of snow on the ground. Would it still be on the air? Yep, still going!

It was another day of searching for roads and tramping through the snowy manzanitas. Local residents WB6MMA, W6RID, and NA6S assisted with four-wheeling and hosted the hunters' families. N6XTJ flew over the area to attempt aerial bearings.

Suddenly, at 1715 hours, the signal level began to flutter. Either the battery was dying or the package was moving. Sure enough, Chris and his brother-in-law had set out after work. With no RDF gear, following the line of bearing we had given Chris Sunday, they discovered it on a hillside less than 300 feet beyond Sunday's quitting spot. It had crashed into the manzanitas three-quarters of a mile from the nearest accessible road.

Even though some hunters expressed disappointment that a non-ham had found the equipment, they all were glad they had participated in Mother Nature's No-Holds-Barred Hunt, as it came to be called. "Bill," they're asking, "when is the next launch?" 73

Photo C. Sometimes a judge is stationed at each fox transmitter. In other hunts, there is only a flag and a special punch. Hunters must punch their cards at all five transmitters before racing to the finish line.

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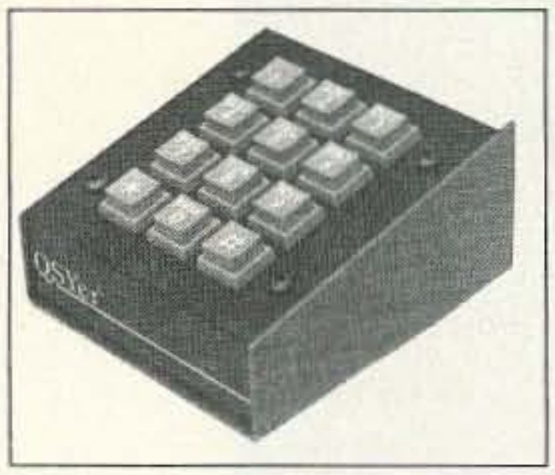
NEW PRODUCTS

Compiled by Hope Currier



INTERNATIONAL RADIO AND COMPUTER

International Radio and Computer is offering QSYer keypad frequency selectors for ICOM, Kenwood and Yaesu radios. The IC-QSYer will operate the following unmodified rigs: IC-275/375/475/575/725/726/735/736/761/765/781 and R7000/9000. It will also control the IC-751A and R-71 with ICOM UX-14 interfaces installed. The KW-QSYer will control the following transceivers: TS-450S/690S/850S/950S with no interface required; TS-940S (/AT) with IF-10B interface installed; TS-440S(/AT) and R-5000 with IC-10-chip set installed; TS-140S/680S with IF-10C interface installed; TS-711A(-E)/811A(-B, -E) with IF-10A interface installed. The Yaesu QSYer is available for FT-736R, FT-757GX, FT-757GX/II, FT-747GX, FT-767GX, FT-990, FT-1000 and Heath SB-1400.

QSYers provide high-speed frequency entry and will automatically select the proper mode (CW/LSB/USB, etc.) for the selected frequency. They install literally in seconds to the transceiver's computer interface connector on its rear panel. Automatic antenna tuners and linear amplifiers work with the QSYer attached, just as if frequencies were entered the old way. The QSYer's lightning-fast frequency selection and automatic mode selection provide a competitive edge.

For prices and more information, contact *International Radio and Computer, Inc., 3804 South U.S. 1, Fort Pierce, FL 34982; (407) 489–0956, Fax: (407) 464–6386.* Or circle Reader Service No. 201.

AUSTIN ANTENNA

Austin Antenna is offering FREE software to facilitate the design of inductors, chokes and ferrite toroids. Several capabilities are included in the software. Inductance can be calculated from turns, diameter, wire size and coil length, and vice versa. You can build inductors using wire that you have on hand. Straight wire inductors and ferrite toroid design rules are covered as well. Inductance can be determined from inductive reactance. Also included in the program is the inductance calculation for a short-loaded dipole. Finally, construction details are determined for building capacitors from double-sided printed circuit boards. Invaluable for the hobbyist and experimenter alike, this software is a worthwhile addition to every lab. (VGA required.)

Please send $5 to cover 5-1/4" floppy, copying, mailer, postage and handling, to *Austin Antenna, 10 Main Street, Gonic NH 03839; (603) 335–6339, Fax: (603) 335–1756.* Or circle Reader Service No. 205.

DANIEL A. FORT PRODUCTIONS

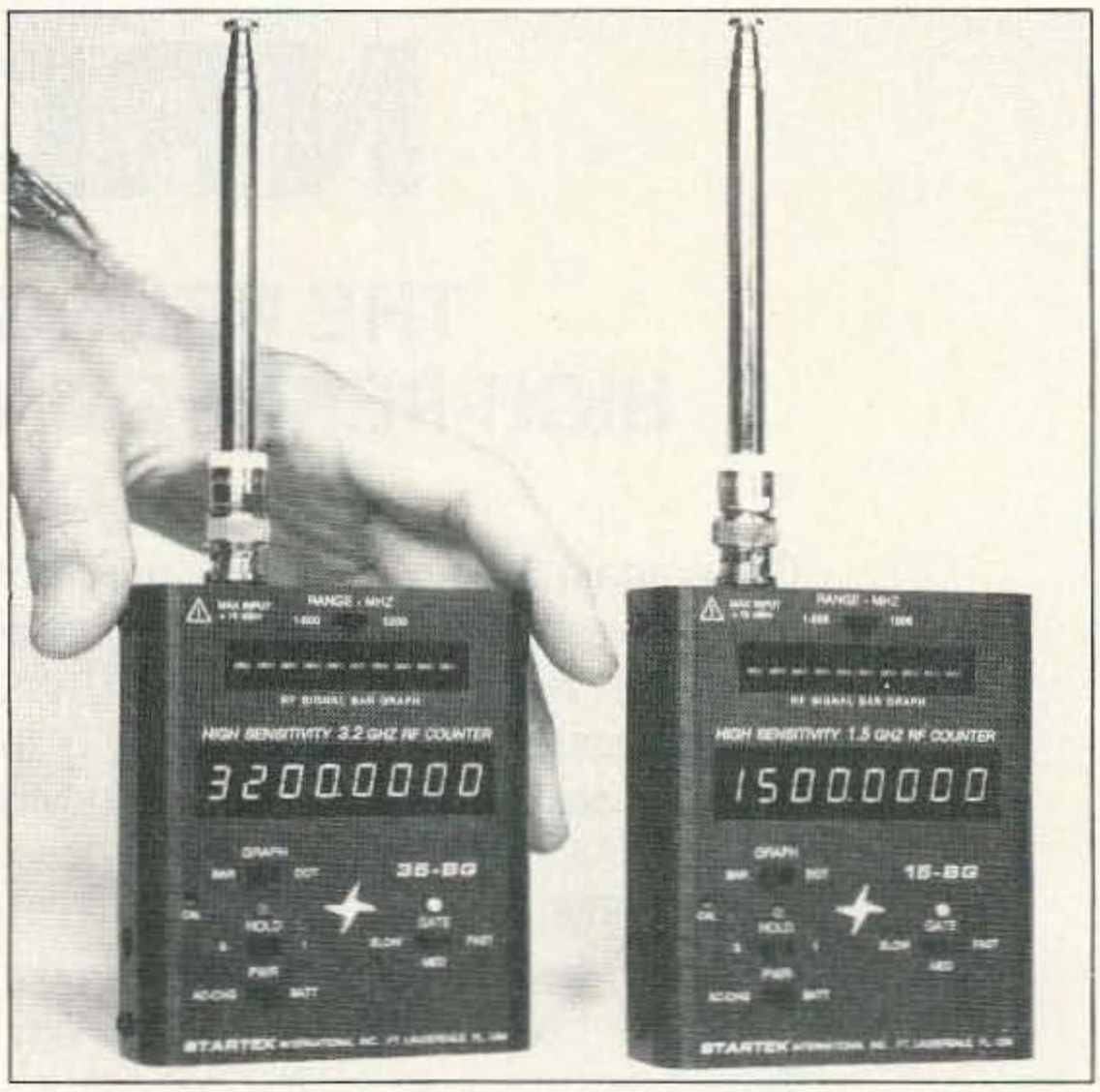
"CQ Field Day" is a new amateur radio video showing what it takes to excel on Field Day. It follows the award-winning Conejo Valley Amateur Radio Club from setup through wrap-up. This fast-paced 30 minute video brings you right up to the mountaintop site so that you can experience all the frustration and elation of a modest-sized club setting up a 22 Alpha operation, then topping the overall list by scoring an amazing 23,500 points. This documentary is valuable to anyone who participates in Field Day. It is also an impressive demonstration of amateur radio in action. It is narrated by Gordon West WB6NOA, who explains every detail in non-technical terms.

The tape is priced at $19.95, plus $3 for shipping. California residents add $1.55 sales tax. For more information, Contact *Daniel A. Fort AA6LM, P.O. Box 11324, Costa Mesa CA 92627-0324; (714) 546–5709.* Or circle Reader Service No. 208.

MFJ

MFJ Enterprises has released a new frequency counter, the MFJ-346. The MFJ-346 measures frequencies up to 600 MHz with utmost accuracy. It has a 10-digit LCD readout with large 1/4-inch digits that are visible even in direct sunlight. It is a perfect companion for MFJ's SWR Analyzer. It can also be used for exact frequency measurements of handheld FM transceivers, measuring frequencies of HF transmitters/transceivers, and even measuring unknown frequencies when placed near mystery antennas. It also measures LO signals in receivers and reads oscillation frequency of classic regenerative receivers.

The MFJ-346 uses high-speed ASIC and custom LCD technology. Four gate times let you select various frequency resolutions. It has an accuracy of 1 ppm. It is priced at $189.95. For more information, contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323–5869, (800) 647–1800, Fax: (601) 323–6551.* Or circle Reader Service No. 206.



STARTEK INTERNATIONAL

Two new Pocket Counters™ from Startek are actually ultra-high-sensitivity RF detector-counters with 2" 10-segment LED signal-strength bar graphs. The bar graph functions independently from the digital frequency counter and will indicate the relative strength of an input signal at any frequency from 500 kHz to 3.5 GHz. "Dot graph" or "bar graph" operation is switch-selectable and the sensitivity is adjustable. The bar graph is ideal for locating or adjusting an RF signal. The "digital frequency counter" has a range of 1 MHz to 1.5 GHz on model 15-BG, and 1 MHz to 3.2 GHz on model 35-BG. A 1 ppm TCXO time base is standard, with provisions for an optional ultra-high-stability TCXO. A factory-installed internal NiCd battery pack and 110 VAC adapter/charger are also standard. Although small enough to fit in a shirt pocket, these bar graph counters out-perform many larger, much more expensive models.

Model 15-BG is priced at $220, Model 35-BG is $265, and telescoping antenna TA-90 and vinyl carrying case CC-90 are $12 each. For more information, contact *Startek International Inc., 398 NE 38th Street, Ft. Lauderdale FL 33334; (305) 561–2211, (800) 638–8050, Fax: (305) 561–9133.* Or circle Reader Service No. 202.

CIRCUITS

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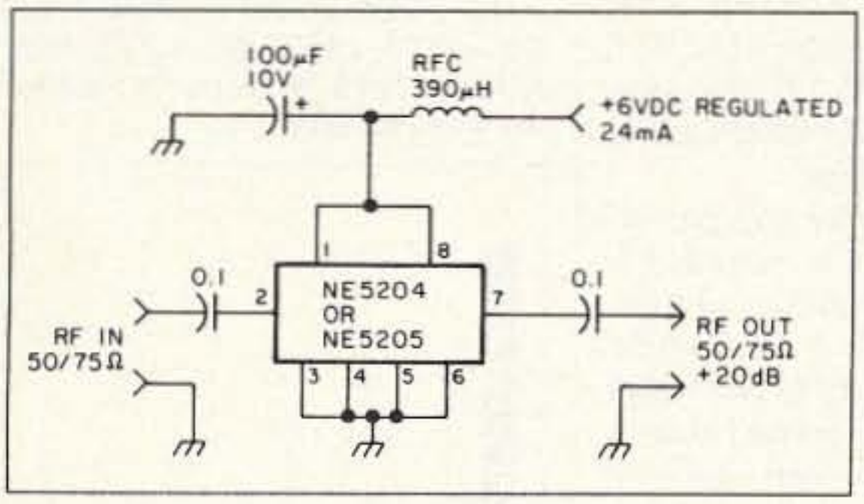
Great Ideas From Our Readers

Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to *73*! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Peterborough, NH 03458.



An AF-to-UHF Broadband Preamplifier

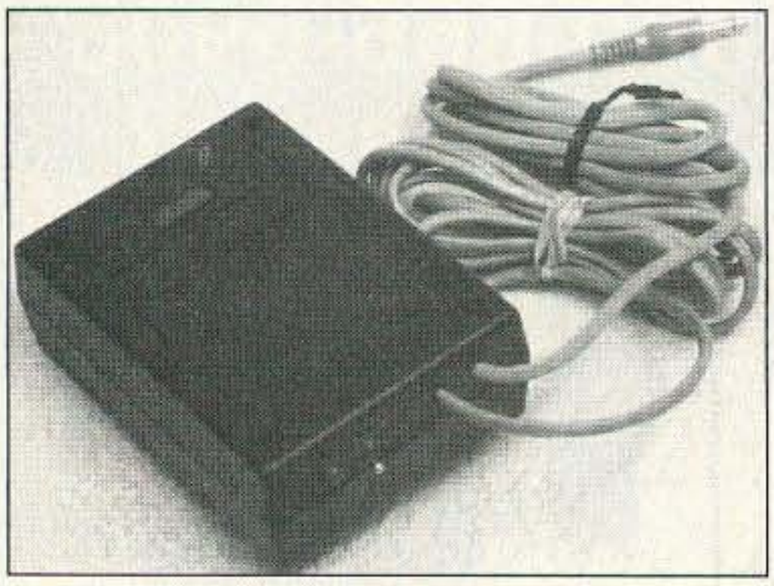
Need a simple preamp to pep up a tired old receiver? Or to amplify a weak signal so you can more easily measure it on your frequency counter or oscilloscope? Or to increase the output of your signal generator? The Signetics NE5204 or NE5205 solves this problem with a fixed gain of 20 dB and requires only four external components.

The NE5204 is flat ±0.5 dB from DC to 200 MHz, and down −3 dB at over 350 MHz. The NE5205 is flat ±0.5 dB from DC to 450 MHz, and down −3 dB at over 600 MHz. Inputs and outputs are perfectly matched to 50 or 75 ohms impedance. The noise figure is 4.8 dB at 75 ohms and 6 dB at 50 ohms. Each 8-pin IC draws 24 milliamperes at +6 VDC. Because the noise figure is higher than is usual in VHF/UHF circuits, these ICs are recommended for use from low audio frequencies to over 10 meters, or with test equipment where the noise figure is of less importance.

The circuit, shown in the figure, is simplicity itself. The +6 VDC supply voltage should be regulated. Either a 78L06 or 7806 3-terminal regulator is recommended. Nominal current drain is 24 milliamperes, 30 mA maximum. Values indicated are suitable from audio to above 10 meters, with overlaps at each end. Larger or smaller input/output capacitors, and the RFC, may be used, depending on the frequency range over which the preamp will be used. Be sure to connect all pins, as shown in the schematic.

Although these ICs are specified from DC to UHF, both input and output must be isolated from DC. Thus, they are useful only from low AC frequencies up to their high frequency limits. Although the NE5204 is cheaper than the NE5205, each chip costs several dollars, less than $5. Because of their simplicity in use, and the lack of a lot of external components to achieve the same 20 dB gain and extremely wide frequency bandpass, use of either of these ICs will be both easier and cheaper than any other approach to achieving similar results. And the physical size of the entire preamplifier is small enough to easily incorporate inside a receiver, frequency counter, etc.

J. Frank Brumbaugh KB4ZGC
Bradenton FL



ELECTRON PROCESSING

Electron Processing has introduced a means for individuals and small groups to put a repeater on the air quickly and without excessive expense. Ease of use and low cost make the Personal Repeater Interface BRI-2 ideal for HT range extension, "starter" or mobile/portable repeater operation. No internal modification of your equipment is needed as it connects to the external speaker output of your receiver and the mike jack of your transmitter. Enjoy great HT coverage into the local repeater by using the BRI-2 and your base transceiver (and scanner) to relay your HT signal to the repeater for "cordless" hamming from home!

All the basic necessities of repeater or relay operation are provided. Audio isolation and PTT transmitter keying using a VOX circuit makes connection to your equipment simple. Just wire your microphone plug! A five-second "hang" time and a three-minute "time-out" timer are both provided (and can be disabled). Powered by a 9 volt battery (12 VDC available), the BRI-2 is also ideal for emergency communications and temporary relays.

The BRI-2 sells for $50, plus $5 for shipping and handling. For more information, contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228–7020.* Or circle Reader Service No. 203.

IIX EQUIPMENT

In celebration of 10 years service to the amateur radio fraternity, IIX Equipment Ltd. has announced three additions to its ever-expanding line of tower accessories and vehicle radio mounting systems. The SO-4 is an adjustable tower stand-off bracket that mounts on tapered tower sections or masting and will adjust up to 30 degrees off the vertical. The TT-3 quadpod, a new addition to the 6- and 9-foot quadpods, will stand three feet high and will mount a vertical antenna or mast with up to 2″ o.d. The third item is a tower coax standoff, designated CA-1, which will hold multiple coax cables 14″ off the tower face. All items feature rugged IIX construction and hot dipped galvanized finish. A free 10th anniversary catalog and price list covering all IIX products is available from *IIX Equipment Ltd., 4421 W. 87th St., Hometown IL 60456; (708) 423–0605, Fax: (708) 423–1691.* Or circle Reader Service No. 209.

TELEX HY-GAIN

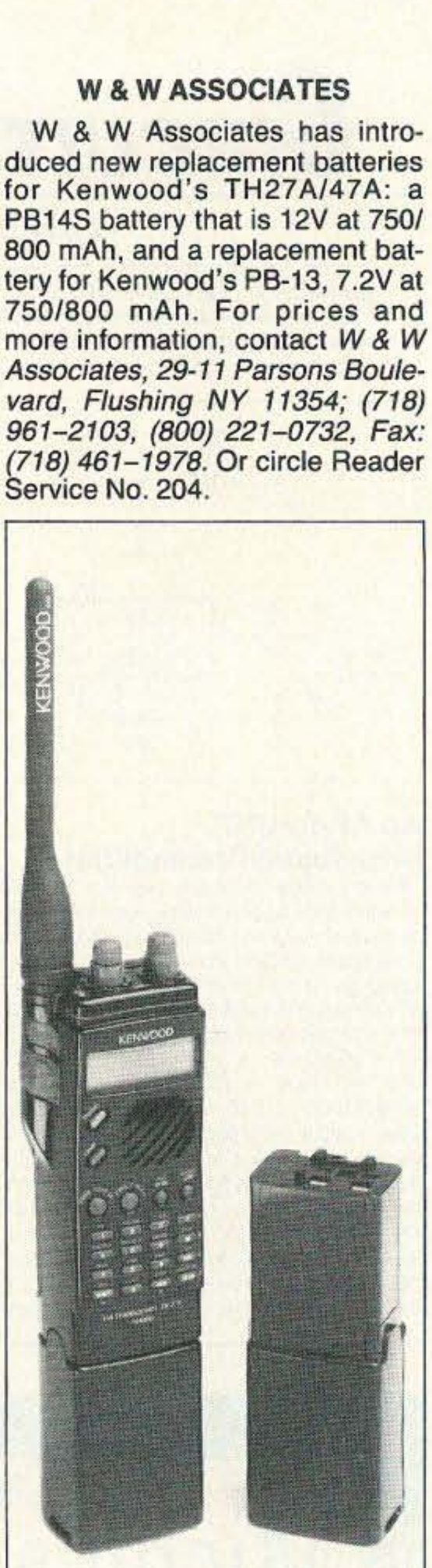
Telex Hy-Gain has introduced two new high-power current baluns for yagi and dipole antennas. Their primary function is to provide the correct current path between unbalanced coaxial cable and a balanced antenna feedpoint and prevent the shield from radiating. The new baluns match the size of the older BN86 and can be used as a direct replacement.

These baluns have an impedance of 50 ohms and a frequency range of 1.6 to 30 MHz. Insertion loss is less than 0.1 dB; SSB/CW power handling to 4,000 watts PEP, 2,000 watts average. They offer RTTY power handling to 2,000 watts continuous.

The suggested list price for the yagi balun (Model BN4000B) and the dipole version (Model BN4000D) is $107 (each). For more information, contact *Telex Hy-Gain, 9600 Aldrich Avenue South, Minneapolis MN 55420; (612) 884–4051, Fax: (612) 884–0043.* Or circle Reader Service No. 207.

W & W ASSOCIATES

W & W Associates has introduced new replacement batteries for Kenwood's TH27A/47A: a PB14S battery that is 12V at 750/800 mAh, and a replacement battery for Kenwood's PB-13, 7.2V at 750/800 mAh. For prices and more information, contact *W & W Associates, 29-11 Parsons Boulevard, Flushing NY 11354; (718) 961–2103, (800) 221–0732, Fax: (718) 461–1978.* Or circle Reader Service No. 204.



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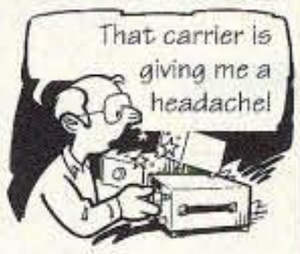

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SPECIAL EVENTS

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 /HAMFESTS on our BBS (603–525–4438) for listings that were too late to get into publication.

APR 4

ROCHESTER, MN The Rochester ARC will host their 15th annual Rochester Area Hamfest Computer/Electronic Show at John Adams Jr. High School, 1525 31st St. NW. Indoor Flea Market. Free parking. Talk-in on 146.22/146.82 MHz, W0MXW rptr. Contact ***Rochester ARC, Attn: N6VB, 6982 Indigo Ct. NW, Rochester MN 55901. (507) 280–7751*** (enter 1# and follow instructions).

COLUMBUS, IN The Columbus ARC will hold a Hamfest at Bartholomew County 4-H Fair Ground's Women's Bldg. on State Rd. 11, from 8 AM–2 PM. Set-up Fri. 6–10 PM; Sat. 6 AM. Admission $3. 8' tables, $6. Talk-in on 146.790/.190. Make reservations through ***Marion Winterberg, 11941 W. Sawmill Rd., Columbus IN 47201. (812) 342–4670.***

ALBERTVILLE, AL The First Annual Marshall County HamFest, sponsored by the Marshall County ARC, will be held at Albertville Recreation Center from 8 AM–4 PM. Easy access. Overnite security. Tailgating. Free Parking. VEC Exams. Friday night set-ups available. Admission $2; children under 12 free. Talk-in on 147.06+, alternate 145.11−. Contact ***Marshall County ARC, c/o Ann Jordan KC4UUV, 134 Bearden Rd., Albertville AL 35950. (205) 878–0880.***

APR 4–5

SPOKANE, WA The 15th Annual Inland Empire Amateur Radio Hamfest will be held at the Spokane Youth Sports Bingo Hall, East 2230 Sprague Ave. Space reserved for self-contained RVs. Admission free to dealers and their employee. 6' tables $10; 8' tables $12. Set-up Fri. from 1 PM–6 PM. Gordon West WB6NOA is the featured speaker. Contact ***Inland Empire Hamfest Committee, S. 1405 Crestline, Spokane WA 99203. (509) 534–8443.***

APR 5

SOUTHINGTON, CT The Southington ARA will hold a Computer/Ham Radio Flea Market at Southington High School on Pleasant St., from 9 AM–1 PM. Free parking. Admission $3. One vendor-aid admitted free. Reserved 6' tables $14; $18 at the door. Doors open for vendors unloading at 7 AM. Talk-in on 146.28/.88, 144.47/145.17, 222.20/224.80, 449.25/444.25. To reserve tables, send SASE to ***Southington ARA, PO Box 873, Southington CT 06489.*** Make checks payable to ***S.A.R.A.*** VE Exams, all classes, pre-registration only. Send SASE to ***PO Box 873, Attn: Exams, Southington CT 06489.***

GROSSE POINTE WOODS, MI The South Eastern Michigan ARA will conduct its 34th Annual Hamfest/Swap-N-Shop/Computer Show at Grosse Pointe North High School, 707 Vernier Rd., from 8 AM–2 PM. ARRL Forum, VEC Exams. Advance tickets/vendor passes are $2 each with 1 pass req'd for each member of your party. Talk-in on 146.74 −.600. Contact ***Thomas J. Orlicki N8HLY, PO Box 646, St. Clair Shores MI 48080-0646. (313) 527–3497.***

ST. JAMES, NY The Suffolk County RC will hold its indoor Hamfest at the St. James Lutheran School, Moriches Rd. and Woodlawn Ave., from 9 AM–3 PM. Admission is $5; children under 12 admitted free. VE Exams. Free parking. Wheelchair accessible. Talk-in on 145.210/144.610. Contact ***Jim Heacock KA2LCC, (516) 473–7529.***

LONGMONT, CO A combined Hamfest/Computer Swap, sponsored by the Longmont ARC, will be held from 0800–1500 hours at the Boulder County Fairgrounds, Nelson and Hover Rds. Free parking. Commercial exhibitors. Admission $3. Tables $7 (admission ticket required). VE Exams at 1300 hours, call ***(303) 530–2903*** for info. For table reservations remit to ***Longmont ARC, PO Box 86, Longmont CO 80502-0086;*** or call ***Jerry Schmidt N0OUW, (303) 772–6739.*** Talk-in on 147.87/.27 146.52 simplex.

APR 11

FERGUS FALLS, MN The Lake Region ARC will sponsor their 5th annual Hamfest from 8 AM–3 PM at the Otter Tail County Fairground's Hockey Arena, Hwy. 59 So. Set-up Fri. at 4 PM. Overnight security. Camping spots Fri. night only. ARRL Forum, Army MARS meeting, commercial dealers, flea market. Advance tickets $3, $4 at the door. 6' tables $4. Walk-in VE Exams begin at 9 AM, first come, first served. Call ***(218) 826–6274***, or write to ***Keith McKay N0FKF, Rt 1 Box 46, Battle Lake MN 56515.***

HUNTINGTON, WV The TARA VE Team will hold test sessions at Our Lady of Fatima church school class rooms, 545 Norway Ave., at 10 AM. Registration is at 9:15. Have your ID and Form 610 checked prior to the exam. Contact ***Jim Baker K8KVX, (304) 736–6542*** to confirm location and date.

CHESAPEAKE, VA Chesapeake ARS, Inc. will sponsor "Springfest 92" at the Indian River Recreation Community Center, 2250 Old Greenbrier Rd. and South Military Hwy. (US 13), from 9 AM–3 PM. Set-up Fri. 6–9 PM; Sat. 8–9 AM. Wheelchair accessible. VE Exams by the Chesapeake DX Assn. Advance tickets $3, $4 at the door. Dealers tables $10; Flea Market tables $6. Dealer Contact: ***Greg Hemmings N4WVE, (804) 547–1632.*** Flea Market Contact: ***Rob Holt N4SFH, (804) 485–7703.*** Please, no calls after 10 PM. Reservations must be finalized by Apr. 1.

OTTAWA, ONT., CANADA The Ottawa Valley Mobile RC will hold its annual Flea Market from 0900–1600 EST at the Canterbury High School. Talk-in on 147.30/.90. Contact ***Ken Barry VE3KJB, (613) 746–4823.***

UPPER SADDLE RIVER, NJ The Chestnut Ridge Radio Club will sponsor its annual Flea Market from 8:30 AM–2 PM, at the Education Bldg., Saddle River Reformed Church, E. Saddle River Rd., corner Weiss Rd. Donation $2. Tailgating $7. Tables $10 each. Talk-in on 146.955 rptr. Contact ***Jack Meagher W2EHD, (201) 768–8360.***

LAWTON, OK The Lawton-Fort Sill ARC will hold their 45th annual Hamfest at the County Fairgrounds, from 8 AM–5 PM. No pre-registration necessary except for table space. Admission $4. Tables $8, including admission. Talk-in on 146.91/.31. Contact ***Bob Morford, 1415 N.W. 33rd St., Lawton OK 73505.***

AUBURN, NY The Auburn ARA will hold its annual Hamfest at the Auburn High School Gymnasium from 8 AM–4 PM. Tailgating $2. Admission $4, Flea Market tables $5. Talk-in on 146.40/147.00.

APR 11–12

WEST WINDSOR, NJ The 17th Annual Trenton Computer Festival will be held at Mercer County Community College. Packet Radio Conference, VE Exams, License Study Courses, Flea Market. Call ***(609) 655–4999*** for info.

NATCHEZ, MS The Old Natchez ARC will hold a Hamfest from 8 AM–5 PM Sat. and Sun. at the Natchez Convention Center. VE Exams. Admission $3. Tables $15, contact ***K5SVC, (601) 442–0973.*** Talk-in on 146.91. 200 RV spaces available on-site $8/night. Contact ***N5YCZ, PO Box 604, Natchez MS 39121.***

APR 12

RALEIGH, NC The Raleigh ARS will hold its 20th NCS ARRL Convention, Hamfest/Computer Fair in the Jim Graham Bldg, NCS Fairgrounds, from 8AM–4 PM. Wheelchair accessible. Free parking; RVs welcome. VE Exams, pre-register with ***Vince AA4MY, (919) 847–8512.*** For Hamfest info and pre-registration, contact ***Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. (919) 269–4406.*** Advance tickets $5, $6 at the door. Talk-in on 04/64.

ROCKFORD, IL The Rockford Hamfest/Computer Fest 92 will be held at the Rockford Metro Center from 8 AM–3 PM. Talk-in on 146.610/146.010, 223.880/222.280. For table reservations call ***Joe*** at ***(815) 399–6995;*** or ***Ben, (815) 633–4122.*** For advance tickets, send SASE, and check made payable to ***RARA,*** to ***PO Box 6931, Rockford IL 61125-6931.*** Advance tickets are $4.50.

WEBSTER, MA The Eastern Connecticut ARA will sponsor a Ham Radio/Computer Flea Market from 10:30 AM–3 PM at the Point Breeze Restaurant. Admission $3. Tables $10. Talk-in on 147.225/.825. Contacts: ***Roger KA1LMN, (203) 928–4883; Gary N1BBI, (203) 974–2564; Chuck WB1AOC, (203) 774–1723.***

FRAMINGHAM, MA The Framingham ARA will hold its Spring Flea Market and Exams at Framingham High School, A Street, beginning at 10 AM (early bird buyers, 9 AM, $5 admission). General admission $2. Set-up at 8 AM. Table cost is $12 and includes one free admission. Pre-register for all tables and exams. Contact ***Jon Weiner K1VVC, (508) 877–7166.*** Send check payable to ***FARA, PO Box 3005, Framingham MA 01701.*** To register for exams, send check for $5.40, payable to ***ARRL/VEC*** to ***Dick Marshall WA1KUG, 37 Lyman Rd., Framingham MA 01701.*** Exam walk-ins will not be accepted after 10 AM.

APR 18

JOPLIN, MS The Joplin ARC will sponsor a Hamfest at the National Guard Armory, 2000 W 32nd St. VE Exams, Flea Market, Auction, unusual CW Contest. Tickets $5 or 3/$12.50. Tables (with ticket) $10. Additional tables $5 each. Send SASE and check to ***Joplin ARC, PO Box 2983, Joplin MO 64803.***

BOWLING GREEN, KY The Kentucky Colonels ARC, Inc., will sponsor a Hamfest from 8 AM–4 PM (Central Time). VE Exams. Wheelchair accessible. Camping. Tailgating. Adults $4, children under 12 free with paid adult. Tables $10 (reservations preferred). Contact ***Denver Eadens N4WWA, (502) 777–3681.*** Talk-in on 146.25/146.85

APR 19

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held at Albany and Main St. from 9 AM–2 PM, by the MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club. Admission $2. Free off-street parking. Sellers $8 per space at the gate, $5 in advance—includes 1 admission, set-up at 7 AM. For reservations and info, call ***(617) 253–3776.*** Reserve before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725–pl 2A–W1XM reptr.

APR 24

DAYTON, OH The Southwest OH Chapter of the Quarter Century Wireless Assn. will hold its 1992 annual QCWA Banquet Fri., Apr. 24, the first evening of the Dayton Hamvention. Neil's Heritage House has an outstanding meal for us. C.O.D. bar is at 6:30 PM, the banquet starts at 7:30 PM. George Wilson W4OYI, President of ARRL will be our speaker. Tickets $16 each, reservations required. QCWA membership is not a requirement to attend. For tickets/info, contact ***Bob Dingle KA4LAU, 1117 Big Hill Rd., Kettering OH 45429-1201. (513) 299–7114.*** Please make all checks payable to ***Robert L. Dingle, Treas. Chapter 9.***

APR 24–26

DAYTON, OH Dayton Hamvention 1992, sponsored by the Dayton ARA Inc., will be held at the Hara Arena Fri., Sat., and Sun. Giant 3 day Flea Market. Free bus service. License Exams Sat. and Sun., by appointment only. Send FCC form 610 (Aug. 1985 or later), with requested elements shown at the top of the form; a copy of present license, and a check for $5.40 (payable to ***ARRL/VEC*** to: ***Exam Registration, 8830 Windbluff Point, Dayton OH 45458-2855;*** before Mar. 23. No FAXes or Express Mail please! For general info contact ***Hamvention, Box 964, Dayton OH 45401-0964. (513) 454–1456.*** For lodging info, call ***(513) 223–2612*** (no reservations by phone); or write ***Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton OH 45402-2400;*** or refer to our 1991 Hamvention program for a listing of hotel/motels located in the Dayton area. For Flea Market info, call ***(513) 767–1107.***

APR 26

SOUTHWICK, MA The Hampden County Radio Assn. will sponsor a Flea Market at the Southwick Recreation Center, Powder Mill Rd., Off Rt. 57, beginning at 9 AM. Set-up at 7 AM. Admission $2, Tables $7 in advance; $10 at the door. VE Exams start at 10 AM; registration is from 9–9:30 AM. Talk-in on 449.175, 146.52. Contact ***Fred Gore KA1TBS, 40 Birchwood Rd., (413) 569–3579,*** or ***Charlie Dunlap K1II, 66 Vining Hill Rd., Southwick MA 01077. (413) 569–5988.***

MILFORD, CT The coastline ARA will sponsor All Class VE Exams at the Fowler Bldg., 145 Bridgeport Ave., at 12 noon. Contact ***Gary NB1M, (203) 933–5125; Dick WA1YQE, (203) 874–1014.*** Walk-ins welcome.

WELLESLEY, MA The Wellesley ARS will sponsor a Special Event at the Wellesley Senior High School parking lot, 50 State St., from 9 AM–2 PM. Wheelchair accessible. Admission $2. Talk-in on 147.03/.63 Wellesley rptr. Contact ***Gerry Driscoll NV1T, (617) 444–2686.***

MAY 2

CEDARBURG, WI The Ozaukee RC will sponsor its 14th Annual Cedarburg Swapfest from 8 AM–1 PM at the Circle-B Recreation Center, Highway 60 and County I (located 20 miles north of Milwaukee, west of Grafton). Admission is $2 in advance, $3 at the door. 4' tables $3. Set-up at 6:30 AM. License exams start at 9 AM. Talk-in on 146.37/.97 and 146.52. Send an SASE to ***ORC Swapfest, 11448 Laguna Dr., Mequon WI 53092. Phone (414) 242–4995.***

OWEGO, NY The Southern Tier ARC will sponsor the Southern Tier Hamfest at Marvin Park Fairgrounds, Rte. 17C and Exit 64, from 8 AM–4 PM. 33rd Annual Banquet. VE Exams. ARRL Forum. Indoor and outdoor Flea Market. Tailgating. Advance tickets $3, $4 at the gate. Tailgate $2 extra. Tables $15. Banquet (includes general admission), $18 per person in advance. Contact ***STARC, PO Box 7082, Endicott NY 13760.***

MAY 2–3

ANDERSON, SC The Blue Ridge ARS will sponsor the Greenville Hamfest/Electronic Flea Market at the Anderson County Fairgrounds on Sat. from 8 AM–5 PM; Sun. 8 AM–3 PM. Walk-in License Exams. Indoor/Outdoor Electronic/Computer Flea Market. Free Parking. Camping. Early dealer/flea market set-ups with advance registration. Advance tickets $4, $5 at the gate. To register, send SASE to ***Blue Ridge ARS, Inc., PO Box 6751, Greenville SC 29606.***

MAY 3

SANDWICH, IL The DeKALB Hamfest, sponsored by Kishwaukee ARC, will be held from 8 AM–1 PM at the Sandwich Fairgrounds, Suydam Rd., rain or shine. (Please use the main entrance.) Overnight camping without hook-ups. Free outside tailgating. Advance tickets $4 each, by Apr. 1, or $5 at the gate. Inside tables $10 each. Make checks payable to ***Kishwaukee Amateur Radio Club***. Contact ***Howard Newquist WA9TXW, Box 264, Sycamore IL 60178.*** Send SASE for info. Talk-in on 146.13/.73 and 146.52.

YONKERS, NY The Metro 70cm Network will sponsor a Giant Electronic Fleamarket, 9 AM–3 PM, rain or shine, at the Lincoln High School, Kneeland Ave., off Yonkers Ave. Set-up at 7 AM. VE Exams. Free parking. No tailgating. Admission $4, kids under 12 free. Sellers $15 1st table, $10 ea. additional table. All tables 30" x 5'; or bring your own table at $1.80 per ft.–min. $10. Full payment is due with registration. No reserved tables or spaces will be held past 9 AM. Notification of cancellation must be received 72 hours in advance for a refund. To register, contact ***Otto Supliski WB2SLQ, (914) 969–1053.*** Register early! Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 MHz; 443.350 MHz PL 156.7.

SULLIVAN, IL The Moultrie AR Klub will sponsor a Hamfest at the Moultrie County 4-H Fairgrounds, 5 miles east of Sullivan IL, on the Caldwell Rd. VE Exams 9 AM–12 noon, by pre-registration. Please send proper documents and a check or MO for $5.40 made payable to ***ARRL VEC.*** Send to ***Ralph Zancha WC9V, 502 E State St., Lovington IL 61937.*** No walk-ins. No charge for flea market set-up. Admission is $4 per person over 14 years old. Tables $8. Call ***Ralph, (217) 543–2178*** days; ***(217) 873–5287*** eves. Or write to ***M.A.R.K., PO Box 91, Lovington IL***

61937. Talk-in on 146.055/.655 and 449.275/44.275.

BEMIDJI, MN The Paul Bunyan ARC will hold its annual hamfest at the Bemidji Moose Lodge from 8 AM–3:30 pm. A pancake breakfast will be served at 8 AM. VE Exams, Flea Market. Talk-in on 146.13/.73. Contact ***Vern Skretvedt KAØKWM, (218) 751-5514,*** or ***Curt Johnson WBØHUJ, (218) 751-7920.*** To register for testing, contact ***John Simmons NIØK, (218) 243-2720.***

SPECIAL EVENT STATIONS

APR 4

BACKBONE MTN, MD MADRAS will operate a special event station Apr. 4, 0700Z (12 PM EST) to Apr. 5 0500 (10 AM EST). Counties will include Garret County, MD, and Mineral, Grant, and Preston Counties, WV. CW and SB, near the bottom 25 kHz of the General portion of the band on 80, 40, 20, 15 plus 28.325; also 2 meter SSB 17 and 12 may be available. QSL with SASE to ***MADRAS, PO Box 2468, Wheaton MD 20915-2468.***

APR 10

STRATFORD, CT The Stratford ARC will operate W1ORS 2300Z–0400Z to celebrate the 160th anniversary of the Shakespeare Hotel of Stratford CT. Operation will be on 28.360 MHz and 14.240 MHz±. For QSL, send QSL and SASE to ***Wes Quinn KD1DC, 30 Coolridge Rd., Milford CT 06460.***

APR 11–12

MYSTIC, CT The Titanic struck an iceberg and sank on the evening of Apr. 14, 1912. To commemorate the 80th anniversary of this event, Tri-City ARC will operate Station KA1BB from the Mystic Seaport Museum, from 1300Z–2100Z Sat. and Sun. On these dates, in recognition of continued Amateur Radio community service, admission to the Seaport for Amateurs and their immediate families will be free upon presentation of a valid license. Look for KA1BB in the middle of the General class phone and CW bands -10, 15, 20 and 40 meters, and the center of 10 meter Novice phone band. Send SASE and #10 envelope to ***Tri-City ARC, Box 686, Groton CT 06340.***

BAY CITY, TX The Matagorda Co. ARC will operate WA5SNL or any other Matagorda Co. ARS 0000Z–2400Z in conjunction with the Bay City Heritage Day Festival. We will operate all bands in all modes. For QSL, send SASE to ***N5QWF, 4404 Doris St., Bay City TX 77414.***

APR 18–19

HONOLULU, HI Hawaii Army MARS members will operate WH6D to commemorate the 50th anniversary of Doolittle's Raid on Tokyo. Activites are planned for all bands, all modes, including the Novice subbands. Look for us at the lower portion of each subband, 1800Z Apr. 18–1800Z Apr. 19. For QSL, please send your card and SASE to ***Joe Hao, 3251 Pakanu St., Honolulu HI 96822.***

APR 25

PINE BLUFF/FORDYCE, AR The Jefferson County ARC will operate N5RHI from 1500 UTC–2300 UTC, to celebrate "Fordyce on the Cotton Belt" in conjunction with Project 819. Operation will take place from Pine Bluff, AR and Fordyce, AR, as well as rail mobile from aboard the refurbished Cotton Belt Railroad Steam Engine #819. Frequencies: Phone–lower 25 kHz of 40, and 20 meter subband, and Novice portion of 10 meter subband. For certificate, send QSL and 9 x 12 SASE, with 2 units of postage, to ***Project 819 Special Event Station, 310 West Harding, Pine Bluff AR 71601.***

MARSHALLTOWN, IA The Progressive ARC, in conjunction with the Mid-Iowa Council, Boy Scouts of America, will operate NØJGB 14:00–21:00 UTC, to celebrate the 10th Anniversary of Black Powder and Dutch Oven Day at Camp Mitigwa near Madrid IA. Frequencies: 28.350/28.400, 21.300/21.350, 14.250/14.300, 147.420 and 446.250. For certificate, send QSL and SASE to ***David Young NØMVC, Box 907, Marshalltown IA 50158.***

MT PLEASANT, IA Station NØMQA will be in operation from 1400Z Apr. 25–0200Z Apr. 26, from the campus of Iowa Wesleyan College, to commemorate the institution's 150th Anniversary. CW operation will be in the Novice portion of 40 and 15 meters, while voice operation will be in the lower 50 kHz of the General portion of 20 meters, and also on the Mt. Pleasant 147.39 MHz rptr. For a special QSL, send your QSL and SASE to ***Roland Shook NØMQA, Iowa Wesleyan College, Mt. Pleasant, IA 52641.***

APR 25–26

ALTOONA, PA The Horseshoe ARC will operate Station W3QZF on the lower portion of General phone, on 40 through 15 meters, and Novice sub band on 10 meters. QSL to ***HARC, PO Box 225, Hollidaysburg PA 16648.***

APR 27–MAY 2

DAVIS MOUNTAINS, WEST TX Amateur astronomers/hams representing the Southwest region of the Astronomical League will operate Station K5GH (K5 Galaxy Hunters) at the 11th annual Texas Star Party, located near the Univ. of Texas's McDonald observatory in the Davis Mountains of West Texas. The Texas Star Party is a gathering of amateur and profesional astronomers from around the world. Frequencies ±QRM: 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL and SASE to ***K5GH-TSP, 721 White Dr., Garland TX 75040.***

MAY 2–3

U.S.S. OLYMPIA The Olympia RAC will operate Station WA3BAT from aboard the U.S.S. Olympia, May 2, 1400–2200 UTC May 3, to commemorate the 94th anniversary of Admiral Dewey's triumph over the Spanish fleet at the Battle of Manila Bay. CW–7.065 2200–0200 UTC; Phone: 3.895, 7.245, 14.245, 21.365, 28.365, all frequencies ±5 kHz. For certificate, send QSL with operators number and a 9 x 12 inch SASE to ***Olympia RAC, PO Box 928, Philadelphia PA 19105.***

Number 20 on your Feedback card

UPDATES

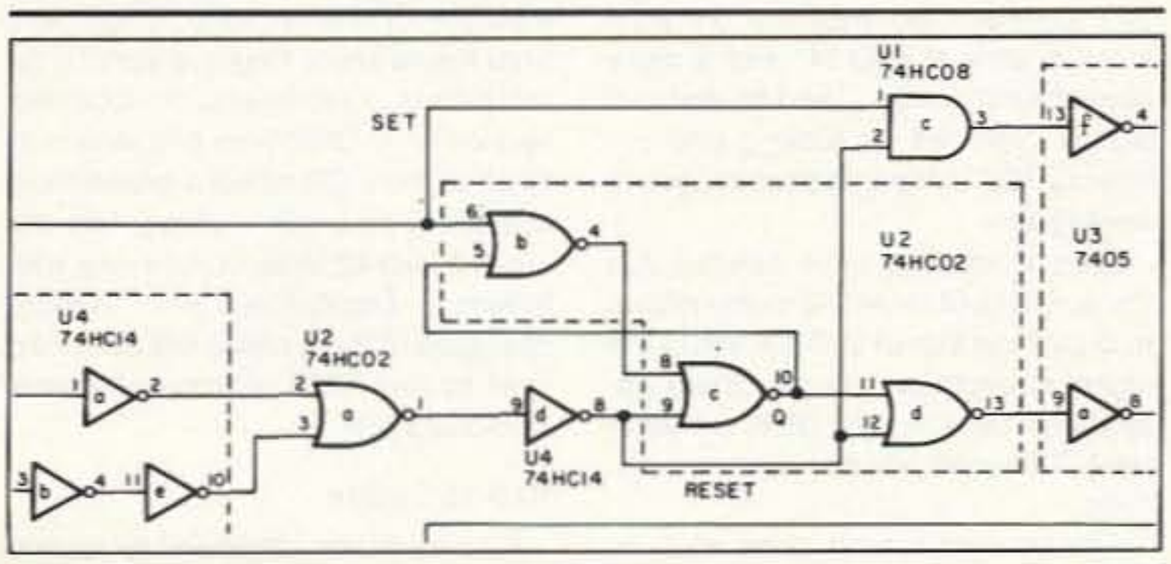

Figure. Partial schematic of the GaAsFET preamp sequencer showing new IC pin numbers corresponding to the PC board layout.

GaAsFET Preamp Sequencer

See the above article on page 8 of the March 1992 issue by Ron Klimas WZ1V. Although the schematic is correct as printed, if you build the circuit using the PC board the IC pin numbers will be different. See the Figure for a schematic that reflects the pin number changes on the PC board layout. 73

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

New Excitement

In the four months since my column on 9600 bps efforts via UoSAT-OSCAR-14 and UoSAT-OSCAR-22, there have been many changes for current and future users. Activity is up, more information is available on modems and the SBBS (satellite bulletin board system) operations have moved to U-O-22. The volume of interesting pictures, programs and news has increased dramatically. Check my December 1991 column for details on getting started with fast packets from space.

Terrestrial packet radio activity and satellite-based systems have several parallels, but also significant differences. On earth, congestion on a packet channel can usually be heard. When several stations are active on a single frequency, a user's TNC (terminal node controller) will wait to transmit when other signals are detected. For satellite work, the only station hearing collisions is the satellite itself. Hundreds of stations in the satellite's coverage area will listen for its prompt, and transmit simultaneously when the space-based system declares an available slot for interactive access or a possible opening in the broadcast queue.

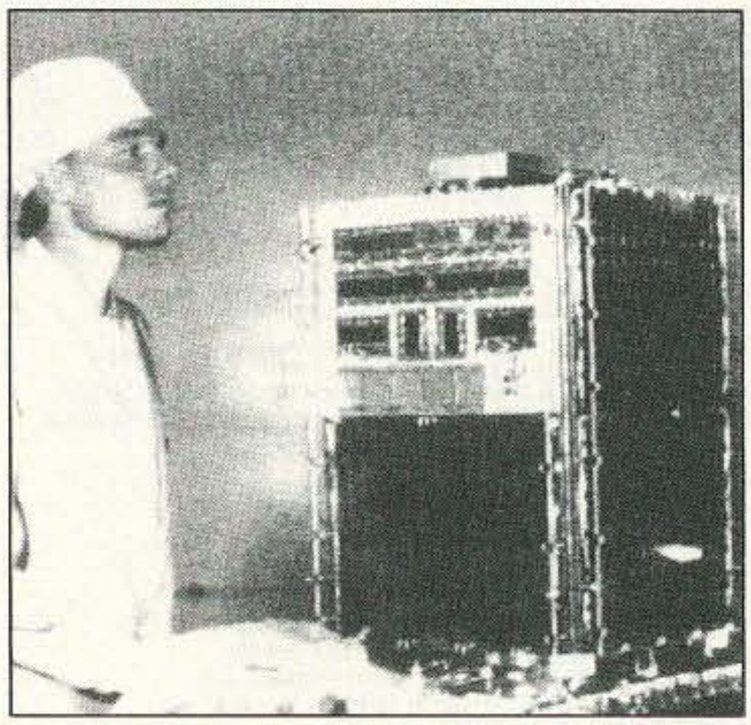

Photo A. U-O-5 (U-O-22) preparation at Kourou, French Guiana prior to launch—from NK6K via U-O-14.

Transactions between the users and the satellite are crossband and full duplex. Thanks to the program PB.EXE for PCs and clones, a station monitoring the downlink even without transmitting has an excellent chance of collecting a complete listing of the onboard directory and retrieving many complete files just by employing the "grab-all" feature while tuned to U-O-22's downlink of 435.120 MHz FM.

For those who can transmit to U-O-22 on 145.900 MHz FM, holes in files can be plugged by sending "fill" requests and directories can be updated much faster with transmitted directory requests.

In recent months changes have been made to the user software, especially PB.EXE. The new software can be downloaded from the satellite using the old software. The December version of PB.EXE had some bugs that required user intervention to correct errors. The latest edition from the University of Surrey and Jeff Ward G0/K8KA was released in mid-February and took care of many of the problems encountered with the pre-Christmas version.

Once the program PB.EXE is started, there's plenty to do keeping antennas aimed and frequencies centered, but the keyboard work to get files from the satellite has diminished. Useful additions to PB.EXE include an interactive directory that allows the user to view the contents during a pass as it receives updates, and to make changes to file status. The default is that all files be "grabbed." The user can change this to "Never" get the file, "Automatic" fill or "Priority" collection. While browsing through the list, picture files like ITAMSAT.JPG or JAS-1.JPG may look interesting, while gateway traffic and satellite data files may not. Files of interest can be tagged "A" for automatic capture or "P" for priority collection. The program will take care of the rest by requesting that the files be sent and filled as needed.

A few picture files downloaded from space are shown as photos this month. These shots of the CRT depict the wide range of images available from the SBBS. Most picture files are compressed before uploading with a compression technique called JPEG (pronounced jay-peg) which stands for "Joint Photographic Experts Group." To view these compressed images they must be converted to a form, such as GIF (Graphics Interchange Format), that can be viewed on most computers. This decompression can be done with programs like JPG2GIF (packaged with GIF2JPG) and Image Alchemy (conversions for several formats). Both are available from Handmade Software, Inc., 15951 Los Gatos Blvd., Suite 7, Los Gatos CA 95032. The shareware versions of these programs can be found on many bulletin boards and have also appeared as downloadable files on the satellite. A registered version of the JPG2GIF/GIF2JPG program set is $20, while the registered Image Alchemy package is $80.

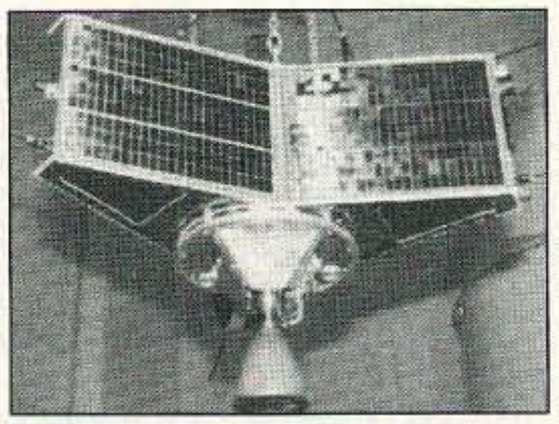

Photo B. A-O-13 ready for launch integration—picture from DB2OS via U-O-14.

JPEG files are 24-bit images that cannot be viewed directly on the typical VGA display system unless the system has a Targa board or an XGA-compatible IBM PS/2. The JPEG compression technique is also "lossy." Data is lost through the process of compression from GIF to JPG and back again. This is very noticeable if a very low Q, or quality factor, is specified when making a JPG file from a GIF image. To save space on the satellite and make uploading easier, some pictures have been over-compressed, causing loss of definition when the file is later expanded to a GIF file for viewing. A typical 150K GIF picture can be compressed to 30K without serious losses, but will become grainy with further compression.

The U-O-22 Switch

In early February Jeff Ward posted a message on U-O-14 announcing an immediate move of SBBS activity to U-O-22. The move was necessitated by difficulties with non-amateur use of the satellite by SatelLife (primary supporter of U-O-22) and other organizations. While U-O-22 worked well on amateur frequencies, the system didn't work well on the out-of-band commercial downlink.

Until further notice U-O-14 will not transmit on amateur frequencies. It will be used by SatelLife and VITA (Volunteers in Technical Assistance).

U-O-22 will be dedicated to amateur activity. The downlink will be permanently on 435.120 MHz FM. This will cause some conflict between SBBS users and CCD image enthusiasts, but this satellite has twice the program storage area of U-O-14, and a more powerful transmitter. The University of Surrey crew will be looking into onboard JPEG compression of images to save space.

Several stations have noticed that the downlink of U-O-22 is more difficult to copy than that of U-O-14. While the signal strength is stronger, there appears to be a higher BER (bit error rate). There are two possible explanations.

The primary reason some stations have problems is the design of the U-O-22 transmitter. The U-O-14 design uses a crystal-controlled modulator while U-O-22 uses a PLL (Phase-Locked Loop) modulator. The U-O-22 circuit appears to have some undesirable low-frequency cutoff characteristics. Some stations never noticed a problem, while others could not even copy the U-O-22 signals with regularity. Modifications to various systems are under study. The goal is to boost low frequency response (more bass!) in the input filtering from the receiver discriminator to the demodulator circuitry. A new 9600 bps modem from TAPR is expected soon with appropriate circuitry for full duplex and good U-O-22 receive capability.

The other reason for possible reception problems is interaction of the downlink modulator with the transputer circuitry on board the satellite. This problem is very slight, but the result is that the BER noted with U-O-14 will always be less than with U-O-22, even when the frequency response anomalies are resolved in affected ground stations. The difference is slight, but it is not correctable. In the meantime the crew at the University of Surrey are working on upgraded user software and methods to optimize amateur access of U-O-22.

Korean Hamsat

In addition to taking care of amateur operations and commercial interests,

Photo C. Italian microsat under construction—photo uploaded by I3RUF to U-O-14.

efforts are also underway in Surrey to complete another completely amateur satellite, called KITSAT, for the Korea Institute of Technology. Engineers from Korea are in England working on this project. It represents an upgraded version of U-O-22 with two lens systems on the CCD camera experiment: one for wide-angle viewing, like the current U-O-22 system, and one with telephoto capabilities. After launch, operation of the satellite will be turned over to the KARL (Korean Amateur Radio League).

STS-45 Update

Four hams are scheduled for launch with STS-45 on March 23rd. As reported previously, the ham operation will be limited to voice on 2 meters, but more casual operations are expected with the ham community on earth.

The primary callsign to be used is N5WQC, belonging to astronaut David

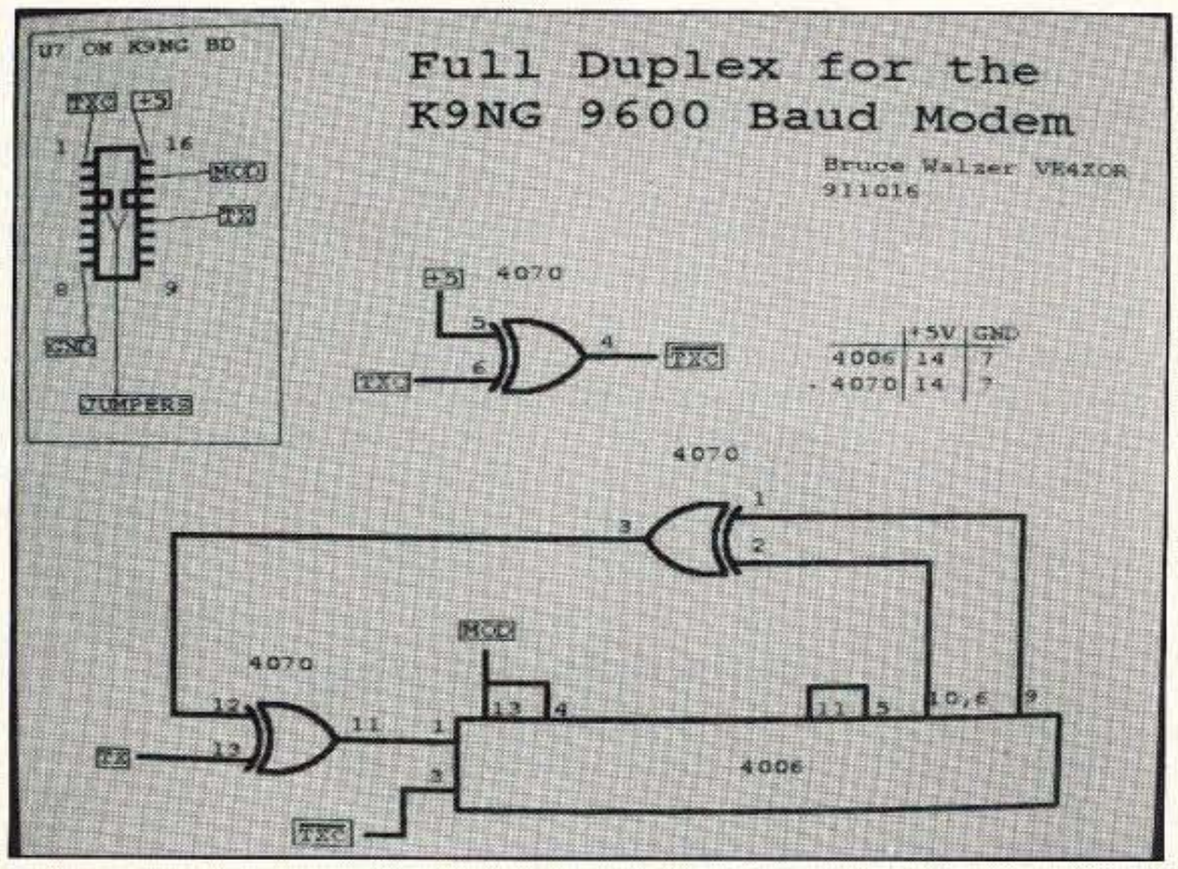

Photo D. Even schematics can be sent via satellite. This one shows modifications to a single K9NG modem to allow full-duplex operation for U-O-14 operation.

Leestma. Other hams on board include Brian Duffy N5WQW, Dr. Dirk Frimout ON1AFD, and Kathy Sullivan, who recently passed her Technician class test.

Unlike operations from the Russian Space Station *Mir*, shuttle activity is never simplex. The primary downlink is 145.55 MHz FM, but the uplinks to be used are on 144.91, 144.95 and 144.97 MHz FM. Some school activity is anticipated along with schedules over Europe, but most of the ham activity is expected to be open for random contacts. Be sure to listen on 145.55, but avoid transmitting there. 73

CIRCUITS

Number 22 on your Feedback card

Great Ideas From Our Readers

Power Supply Load Fixture

Regulated power supplies are simple to construct today, but the regulation of high-amperage supplies can be checked only with known loads. At a recent hamfest I discovered several 2-ohm 100-watt wire-wound power resistors, and immediately designed and constructed the test fixture described below and illustrated in Figure 1. With certain switches open or closed, as listed in Table 1, load resistances from 0.66 to 6 ohms are available. This table also gives the amperage drawn from the power supply for each resistive load value selected at the usual +13.8 VDC. For other voltages, Ohm's law will disclose the amperage drawn.

A hamfest, or a local ham who was licensed in the 1940s or 1950s, are about the only cheap sources of 20 ampere toggle switches, aircraft type. Open-knife switches can also be used, or you could use alligator clips on the ends of interconnecting wires in place of switches. Because maximum current in this circuit will be slightly more than 20 amperes at 13.8 VDC, use AWG 12 insulated stranded copper wire for all wiring. Keep your hands away from the resistors. They can get hot!

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Switches*					Ohms	Amps at 13.8 VDC
1	2	3	4	5		
C	O	O	O	O	6	2.34
O	C	O	O	O	4	3.45
O	C	C	O	O	3	4.60
C	O	C	O	O	2	6.90
O	C	C	C	O	1	13.80
C	O	C	O	C	0.66	20.72

*C = switch closed; O = switch open.

Table 1. Switch positions vs. load E & I.

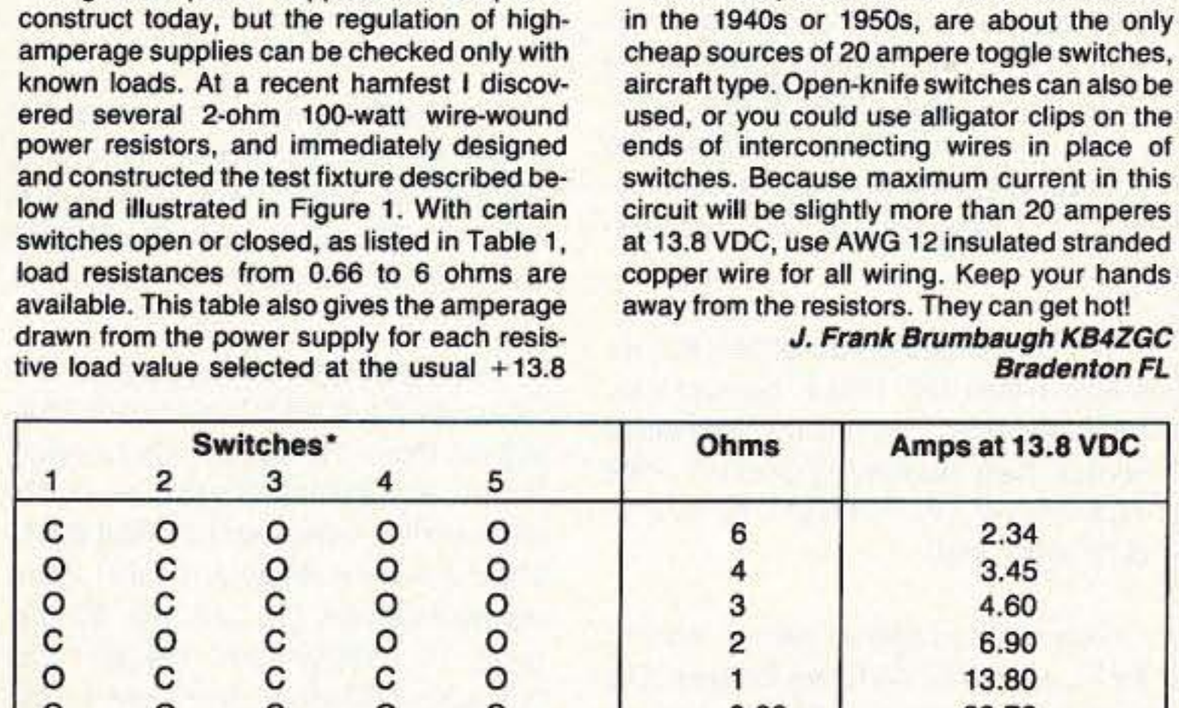

Figure 1.

Number 23 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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

The BayCom Program

For the past several months, we have been looking at various schemes to use a computer on radioteletype. From sophisticated interfaces to plug-in cartridges, there seems to be an answer for everyone. Everyone except the person on a limited budget, that is. Well, this month, I have the answer for that situation as well.

Over the past several years, a program has evolved under the hands of German hams Florian Radlherr DL8MBT and Johannes Kneip DG3RBU, with the help of Rudi Dussmann DK5RQ and Christian Lachner DL5RL, which allows a plain old PC-compatible computer to run RTTY with only a simple audio-to-TTL interface card. The BayCom terminal program has been hindered by one simple fact: The manual, prompts and help file were all written in German. Thanks to an English translation by Denis Godfrey GØKIU, the latest version of BayCom, Version 1.4, represents an exciting vehicle for getting a PC-compatible computer on packet, *without* a TNC.

From the authors of an earlier work, the widely circulated "Digicom" for the C-64, BayCom will run on an XT, AT, or 386 system, and supports all displays through VGA. It will run from either a diskette or hard disk, though the latter is clearly preferable. To dispense with one vital question quickly: No, it is not entirely interface-free. After all, you cannot just hold your mouse near the transceiver and expect to operate! No, BayCom requires a simple interface, which in essence is a simple modem board. The requirements for such a board are given in Table 1. Hardware kits for constructing a suitable modem are available from the authors (the details are given later in this column).

The program itself is modular in design, which gives it the flexibility to run on many machines. A TSR (terminate and stay resident) kernel, called L2.EXE, allows the computer to monitor the radio, even when other programs are being used. About 90K of conventional RAM is used for this program. There is no data, and I have no information regarding any testing, as to whether or not this kernel will LoadHigh with DOS 5.0 or other memory managers into high memory, or into extended or expanded memory.

Anyway, once loaded, the interface is accessed through SCC.EXE, the user interface module. Data particular to the individual station, callsign, screen parameters, and the like, is stored in an initialization file, and may be easily changed. There is even a routine, called OFF.EXE, which will unload the L2.EXE module, freeing all of the conventional RAM, provided, of course, that no other RAM resident program has been loaded after L2.EXE.

Once loaded, BayCom presents a rather typical screen for packet communication. It features about all the modes and options of TNC-based systems, all without the TNC! With many of you having expressed interest in putting PC-compatible systems on packet without investing several hundred dollars in another "box," this might be just the answer.

You can get BayCom on many local and national bulletin board systems. If you like, I will be happy to send it to you, on disk with the English manual, for the customary offer: Send a disk (either 5- or 3+-inch), a STAMPED SELF-ADDRESSED DISK MAILER, and $2 in US funds to the address at the top of this column, and I'll send you a copy by return mail.

If you'd like one of the modem kits, they are available from the BayCom authors as follows (note that prices are in deutsche marks; please check the conversion rate current for your area): program with instructions (state disk format), 20 DM; PCB only with construction manual, 12 DM; complete kit including TCM3105 modem, 89 DM; update kit for digital squelch, 10 DM; surface-mount modem kit, 94 DM. Send requests to: Rudi Dussmann, Kto 190786-859, Postgiro Office, Nuernberg, BLZ 76010085, Germany (and be sure to mention *73 Amateur Radio Today*'s "RTTY Loop"!). My thanks to Crispino Messina I5XWW, for his help in making these programs available.

Three Treats from MFJ

As long as we're talking about packet this month, and given that much of packet is on VHF, let me take a minute more to tell you about three bargains available from our friends at MFJ. How many hams operate VHF packet by plugging the TNC or computer into a hand-held unit, and operating with the limitations of the rubber ducky antenna? Well, no more! For under twenty bucks you can have a fully functional antenna for 2 meters or higher bands. UNDER TWENTY BUCKS!

The MFJ-1750 5/8-wave 2 meter ground plane handles 300 watts, with SWR under 1.5:1 over the entire band. One U-bolt mounts the weatherproofed aluminum antenna to any mast, where it should perform beautifully for years.

For traveling, the MFJ-1730 pocket roll-up "J" 2 meter antenna will roll up into your pocket, and unroll to create a classic "J" antenna. This is an omnidirectional gain antenna which does not require a ground plane, perfect for hotel rooms and camping out.

The budget-conscious ham will be interested in the MFJ-1740 quarter-wave ground plane. Tunable to the 144 MHz, 220 MHz, or 440 MHz band, this represents an affordable way to put the station on the air.

Listing at $19.95 for the MFJ-1750, $14.95 for the MFJ-1730, and only $12.95 for the MFJ-1740, these are certainly affordable alternatives to some of the more expensive skyhooks out there. I might just put one up myself! Contact MFJ at (800) 647–1800 to order, or (601) 323–5869 for information, or write them at P.O. Box 494, Mississippi State MS 39762 for details. Be sure to tell them you read about it here, in RTTY Loop.

Until next month, keep those cards and letters coming; I enjoy every one of them. Mail them to the above address, or Email me on CompuServe (ppn 75036,2501), Delphi (username Marc-WA3AJR), or America OnLine (Marc-WA3AJR). We'll uncover more goodies for you next month, and you never know where I might turn them up. But you can find them here, in "RTTY Loop." 73

Table 1. Serial Port Requirements

Signal	25-pin	9-pin	Description
DTR	20	4	Send data ±10V
RTS	4	7	PTT, high-active, −10V = RCV, +10V = TRN
CTS	5	8	Receive data
GND	7	5	Ground

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 (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525–4438, 8 data bits, 0 parity, 1 stop bit. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Manual and schematic for Hammarlund HQ-180AX general coverage receiver. I will pay for originals or copies. *Kelly Andrews KD4EWG, 8608 Timberwind Dr., Raleigh NC 27615. (919) 870–6923.*

Very tight budgeted ham is looking for FL-32 and FL-34 filters for the ICOM IC-720A transceiver. Also, a service manual for same. Please send fair price quote. Thank you. *Art Brigman, 243 Weiss St., Buffalo NY 14206.*

Disabled Army Veteran Ham (709th Ord Bn, 1958–60), living on Social Security Disability, would like to receive a donation of a complete station for HF bands, either CW or phone; preferably tube equipment in working order. Might be able to pay shipping retroactively. *Charles J. Bral N9KPL, 901 Maple Ave., Rm. 617, Evanston IL 60202.*

Wanted: Instruction book for the Micronata Dynamic Transistor Checker, catalog number 22-025. *Glenn Torres KB5AYO, Rt. 1 Box 580-B, Reserve LA 70084.*

Needed: Service manual or copy for: (1) Frequency meter 20-1000Mcs, Model FM-3 Serial No. 4035, made by Gertsch Products Inc., Los Angeles CA, USA. (2) Time Mark Generator, Model 180 A, Serial No. 010468, made by Tektronix Inc., Portland OR, USA. *Kerry Summerfield, 42 Juniper Rd., Mairangi Bay, Auckland 1310, New Zealand.* Phone and Fax *+64 (9) 479–5313.*

Needed: Schematic and manual for Conar Model 280 Signal Generator. Photocopy OK. *Dave Jorgenson N7OWT, 693 Darkwood Pl., Beavercreek OH 45430. (513) 429–3628 eves.*

The Club members of Larkana SW Listeners Club and Library are looking for those Hams, DX Clubs, Publishers, and Manufacturers, which are interested in donating technical books about Amateur Radio and QRP transceiver/receivers (10, 20, 40, 80 meters), to newcomers. We will pay postage. *AP2AHQ, President LRLC, H.No:1989/A.1 Shaikh St., Karma Bagh Larkana 77150, Sindh Pakistan.*

Wanted: Schematic diagram for Advanced Receiver Research converter Model R144VD. (144 MHz in/28 MHz out). Please let me know how many IRCs I should send you for photocopying and mailing. *Ron Gang 4X1MK, Kibbutz Urim, Negev MPO, 85530 Israel;* or via Packet *4X1MK @4Z4SV. ISR.MDLE.*

Re: KJ6DO–Did you ever work this call at Johnson Island? Any info about old QSL cards, operator's names, etc., would be greatly appreciated in my hunt for the history of my call. *Dr. Chuck Bowers KJ6DO, 837 Ridgeview Ct., Oakdale CA 95361.*

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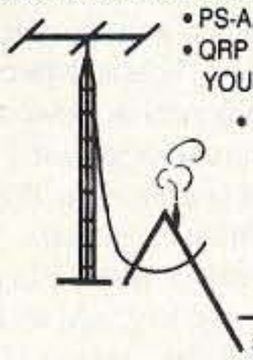

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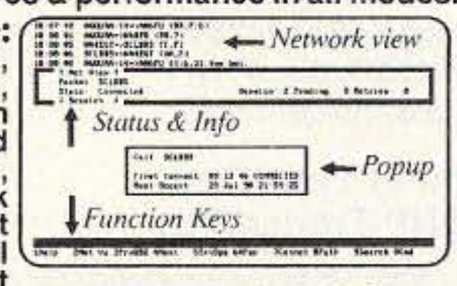

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Build Your Own QRP Transmitter

What's been your excuse for not trying QRP? Don't have the time to build a small transmitter? Can't find the parts for your project? Perhaps you've never built a QRP transmitter and don't have the test equipment to trouble-shoot the transmitter if it fails to operate.

Well, have I got a project for you this month! It's a small crystal-controlled transmitter, already built and ready to go. Add a crystal, key and power supply and you're on the air with up to 2.5 watts of RF. The power output is determined by the operating voltage of the unit. The transmitter will provide a nominal 1.75 watts at 14 volts or 1.25 watts at 12 volts.

The transmitter is the SW-1 medium/shortwave CW exciter/transmitter produced by Rayan Communications in Harmony, PA. The SW-1 is sold by Fair Radio Sales, 1016 East Eureka Street, Lima, OH 45802, a company whose 44 years in business has been largely with war surplus electronics. When someone mentions Fair Radio Sales, visions of ARC-5s and RT-77/GRC-9 transceivers come to mind. Of course, Fair Radio Sales also sells other electronic surplus aside from RT-77s.

Depending on the band, the price of the SW-1 ranges from $29.95 to $32.94. Fair Radio has a special for an order of four SW-1 exciters on four different bands. The frequency range of the SW-1 exciter ranges from 1.8–2.0 MHz, 3.5–4 MHz, 7.0–7.3 MHz, 10.1–10.5 MHz, 14.0–14.35 MHz, 18.068–18.168 MHz, 21.0–21.45 MHz and 24.89–24.99 MHz. A different SW-1 exciter is required for each different band because of the filter network used on the board. I ordered an SW-1 for the 30 meter (10.1–10.15 MHz) band.

There are three active devices in the SW-1. A single 2N3019 makes up the power amplifier. There is no high SWR protection diode in the PA circuit, so an SWR of under 2:1 would be a good idea to ensure a long life of the PA transistor. A single 2N4124 for the crystal oscillator and a 2N5089 for the buffer driver share the 4" x 2" commercial grade G-10 PC board. The entire PC board, less the crystal, weighs two ounces.

The SW-1 on 30 meters produced 1.5 watts at 13.8 volts, according to my MFJ QRP wattmeter. Hey, it's no Bird Thruline™, but it has been right on the money—most of the time. The power of the SW-1 is rated in ICAS, or Intermittent Commercial and Amateur Service. At 12 volts the SW-1 will produce 1.75 watts ICAS or 1.25 watts CCS (Continuous Commercial Service.) Key down and the SW-1 PA gets right hot to the touch. I'd keep the supply voltage down under 14 volts so the PA won't go out to lunch—permanently.

Photo A. The SW-1 QRP transmitter.

Features

Kinda strange to me, and I'm sure to a lot of other QRP builders, is the onboard fast-acting fuse. It's a 3/4 amp fuse to protect the entire SW-1. A diode on the board will conduct, blowing the fuse, if you connect the SW-1 up to the power supply backwards. It's a nice touch, especially for those shorts between the headphones when we hook something up backwards. Personally, I've never done that—really!

Frequency control for the SW-1 has provisions for fundamental mode HC6/U or HC33/U quartz crystals for non-oven, direct circuit board mounting. I have not used the popular FT-243 crystals on the SW-1. I see no trouble in using FT-243 crystals in the SW-1 as the oscillator is quite simple. Just about anything should oscillate in that circuit. It might prove interesting to rework this oscillator into a buffer/amplifier stage and add an external VXO or VFO for frequency control of the SW-1.

When I opened the box from Fair Radio containing the SW-1, I was immediately taken back by the apparent "mil spec" construction of the SW-1. Most of the resistors on the board are 1/2 watt, instead of the usual 1/4 watt resistors used by most of us. The PA transistor has a finned heat sink already attached to it. A big glob of heatsink transfer compound can be clearly seen on the PA transistor and its heat sink. All the tuned circuits are wound on toroids and the toroids are in turn mounted to the PC board with 6-32 screws and fiber washers. Flip the PC board over, and there between the crystal's socket is a surface-mount resistor.

The circuit of the SW-1 is a bit out of the ordinary, compared to many QRP transmitters you might have seen before. The oscillator's supply voltage is regulated via a 10 volt zener diode. To key the SW-1, you ground the emitter of the 2N4124. You don't see this too often. Not that it's bad, it's just different. You might have some trouble with the keying if you use a keying device utilizing a transistor. These transistor switches don't pull the key line all the way to ground because of the 0.7 volt junction of the transistor. Because the key line can carry some low-level RF, keep the wires short from the SW-1 to the keying device. For the SW-1, use a reed relay (driven by your keyer) or dig out your straight key or bug! If you built the universal T/R controller last year, that unit provides solid ground keying via its built-in reed relay.

The PA transistor has two resistors in the emitter lead. Two resistors are used to reduce the current flowing through each resistor and to reduce the overall resistance. This is different, as most QRP transmitters have the emitter lead connected directly to ground. Again, like I said before, this is different, but not necessarily bad.

So, how does it work? Great! Plug in the crystal, power and key, add an antenna, and you're off and running. I find the keying just a bit soft, but it might be my crystal. In the SW-1, you're keying the oscillator on and off. Many contacts were produced on 30 meters with the SW-1.

The Instructions

The instructions that come with the SW-1, and there are three double-sided pages, caution you not to solder any conductors to the terminal post or to the circuit board conductor traces. Doing this will void all warranties associated with the product. Trouble is, there is no mention of the warranty. I tried to call Rayan Communications, but was told the number has been disconnected.

A small plastic bag of connectors for the PC board quick-disconnect terminals are supplied so you don't need to do any soldering on the board.

If you've never done much building, the instructions may give you a fright! They read like a military manual. For example, the following caution: "Under no circumstances should an external voltage potential be applied to the exciter/transmitter keying terminals. Connections to the keying circuit originating from input/output (I/O) modules of computer devices and/or process controllers should be checked for this condition." Whoa!!

So, what's it mean? Well, just don't apply any voltage to the key line.

My favorite from the manual: "The user must supply static discharge and/or lightning protection apparatus if an antenna system is connected to the exciter/transmitter module." Simply don't hook up the SW-1 to an antenna during an electrical storm.

Besides the obvious benefits of using the SW-1 for a transmitter, you could use it as a low level driver for a transverter. How about a BFO? A beacon transmitter for 10 meters (some changes would have to be made). A plasma generator for thin film solar cell production? The list is endless.

So, now you have no excuse for not trying out QRP. The SW-1 is a fast and inexpensive way to get your feet wet in the fun of QRP. Give it a try, the results will amaze you! 73

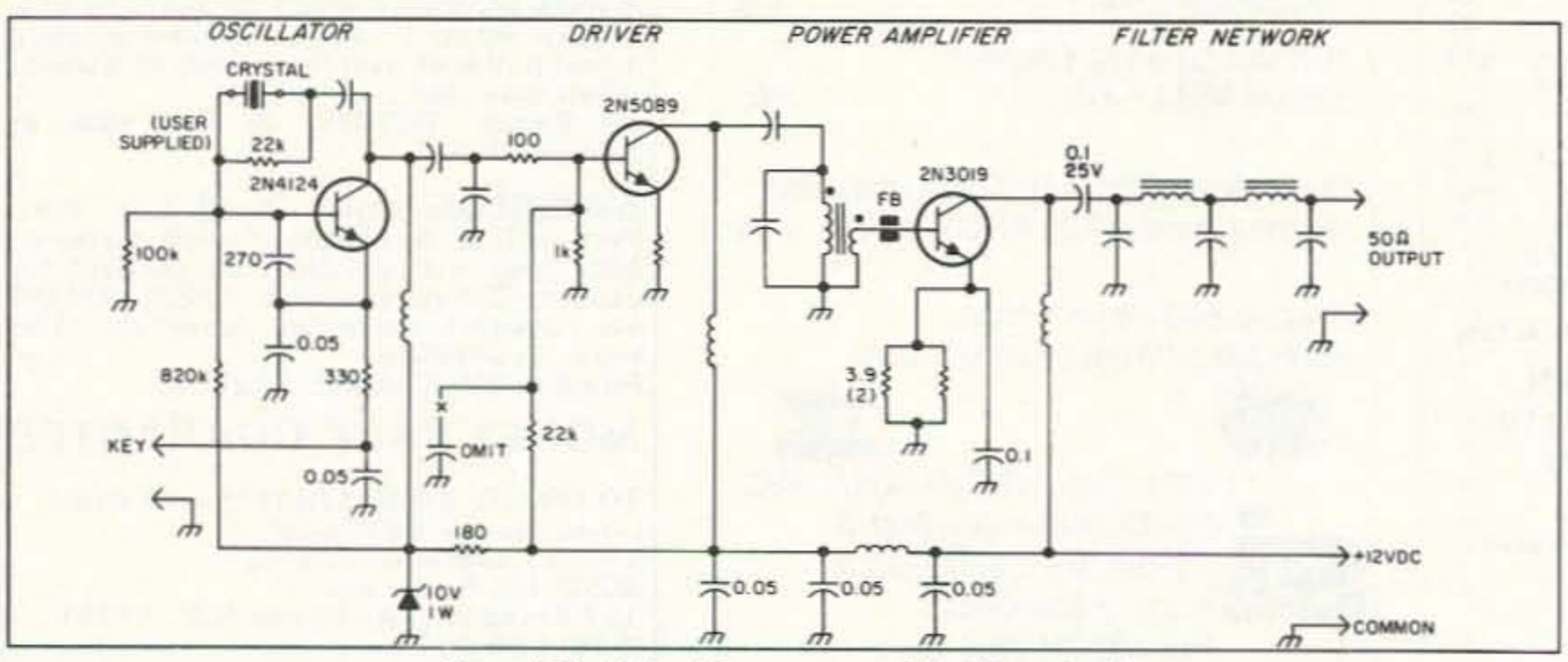

Figure 1. Oscillator driver power amplifier filter network.

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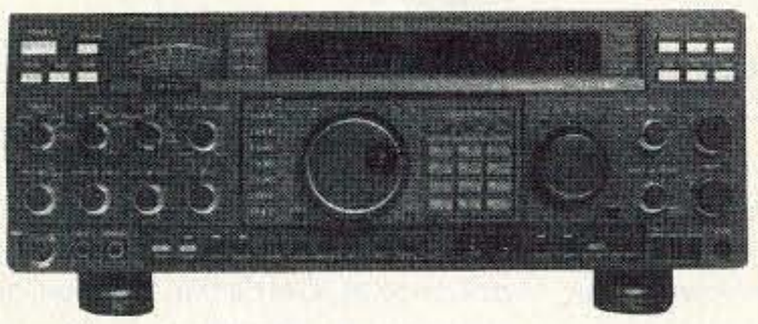

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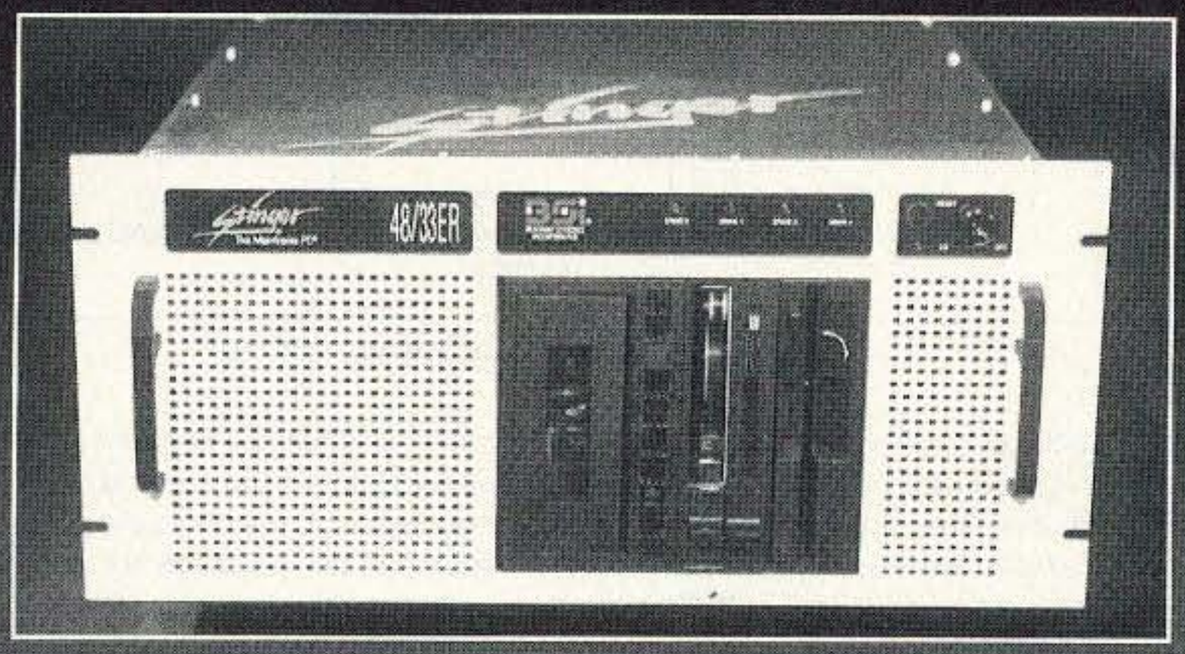

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Microwave Considerations for Resistors and Capacitors

This month, let's cover resistors and capacitors as they relate to microwave construction. This topic is in direct relationship to the PUFF microwave design program I described last month. Special components are required for microwave construction so I thought that covering some of those considerations would be a good topic for you while you wait for your PUFF program to arrive. The selection rules are general and can be used in most construction for VHF through microwave.

Selecting a proper component can not only provide proper operation at higher frequencies, but it can also prevent poor performance in a project. Components should not be selected for value, but for *type* of component. Construction and case style are important factors to consider. You must consider mechanical and electrical parameters as they affect the circuit at a rated frequency. Failure to observe proper component selection could lead to project failure.

Choose Your Components Carefully

Being a parts junkie, I collect component parts in quantity from many different surplus sources. The variety of components I see run from Mil-Spec high tolerance devices to garden variety resistors and capacitors. Using junk parts is cost effective.

In retrospect, one project comes to mind that I had difficulty with—it would not function at first. What I constructed was a 70 MHz IF amplifier, eight stages with log output for a spectrum analyzer. It was supposed to have 90 dB of gain at 70 MHz, but in testing, all stages were very numb. Total gain with full tune-up was about 25 dB. Well, to make a long story short, I traced the trouble to the high precision resistors I used—1% high quality Mil-Spec resistors. They were inductive wirewound types, and operated like RFCs (RF chokes). Replacing them with junk box carbon 1/4 watt types solved the problem.

For low frequency work the 1% resistors were spectacular, but at RF they were the pits. I should have known better. Now when I obtain surplus components I refer to catalogs to determine their suitability and mark that on the envelope that I store them in. In this case I was careless and did not heed my own advice, and it bit me. Don't get bitten. Obtain a general catalog and keep it on hand. Two very good parts suppliers are Allied Electronics and Mouser Electronics (addresses below). Both are good sources for information/catalogs, in addition to supplying components for your projects.

Resistors

Resistor lead length can also be critical. In some circuits this can be put to use in either a positive or negative way. For example, let's assume a resistor lead length of 1/2", at a frequency of 30 MHz. That equates to such a small inductance at 30 MHz that it can be totally ignored (0.006 µH or so). However, at microwave frequencies this lead length would represent quite a bit of inductance and function as an RF choke, a negative example.

The exception, where a resistor lead length forms an RF choke and is useful, is in an MMIC amplifier circuit where the long resistor lead length is coiled into a very effective RFC, and feeds DC power to the amplifier, isolating it. This DC feed resistor and lumped RFC provides good isolation to the power supply and uses one component. This provides for an inexpensive solution and circuit simplicity. This is one example of a device's long leads working for you in a positive way. It works well because the resistor and lead length RFC form a circuit in shunt with the device. If it had been in series with the device, it would have shut down the circuit operation.

Removing the leads on resistors, and changing the package style, resulted in a chip resistor. A resistor without the inductance associated with leads is suitable for very high frequency work. A chip resistor is constructed by placing a deposited carbon film on one side of a ceramic chip. Solder caps are provided for connections. These chips are well suited to strip line construction. You can buy a basic assortment of chip resistors (200 pieces) at Radio Shack for under $6, part #271-313. (See Figure 1.)

Basic Capacitors

Some of the more common types encountered are the poly, mylar, or mica and metal film types. Of these capacitor types, only the mica is suited for RF to the VHF/UHF frequency ranges. The disc ceramic and encapsulated chip types with leads (such as the CK-05) use a plated ceramic material to form the capacitor. They are quite good to 1,000 MHz. (See Figure 2.) At frequencies above 2,000 MHz, connecting leads on capacitors renders them ineffective, and other methods must be employed. The next generation of capacitor improvement at higher RF dictated a capacitor without leads. The uncased ceramic or early chip is an example of leadless capacitors. (See Figure 3.)

This leadless or chip capacitor can be a multi-layered high quality, high Q device. Values range from the small pF ranges for microwave capacitors (0.2 to 30 pF or so). Chip capacitors can be supplied even in the µF ranges. Of course, they are not suitable for microwave work—only the very low pF ranges are used at RF. The RF bypass capacitor is the exception. Other available chip type components include inductors, fuses, diodes transistors and about anything else you care to mention. Most components are made for low frequency work to reduce circuit size, and some are usable at the microwave level.

You must get into catalogs to make determinations on component suitability. I suspect that most of these components offered today, including surface-mount (chip) components obtained from scrap PC boards, are quite useful into the several hundred MHz ranges. With trial testing, this frequency generalization can be extended. On unknown components, testing through use is the only sure method to determine suitability at the microwave level.

Several manufacturers' advertisements list the cost of microwave components as several factors higher in price than their low-frequency counterparts. Unfortunately, this is very true; microwave components are costly. An example can be made for not using cheaper chip caps instead of microwave varieties. One manufacturer depicts a microwave amplifier that has blown out. The power FET blew out, due to an overrated, cheap chip capacitor. The advertiser ridicules saving a dollar by buying a cheaper capacitor when you will end up having to replace that capacitor *plus* the expensive FET, at premium dollars. Net result: No savings at all.

Their claim, a very valid one, is that the device would not have been destroyed if the circuit designer had used a capacitor rated for low dissipation, low loss, at the frequency used. Circuit losses of several dBs are possible with low frequency components used in microwave frequencies. The circuits will work with low frequency components, but do not realize their full capability. I have observed capacitors so hot from circulating RF current that they squirm in a sea of molten solder that previous-

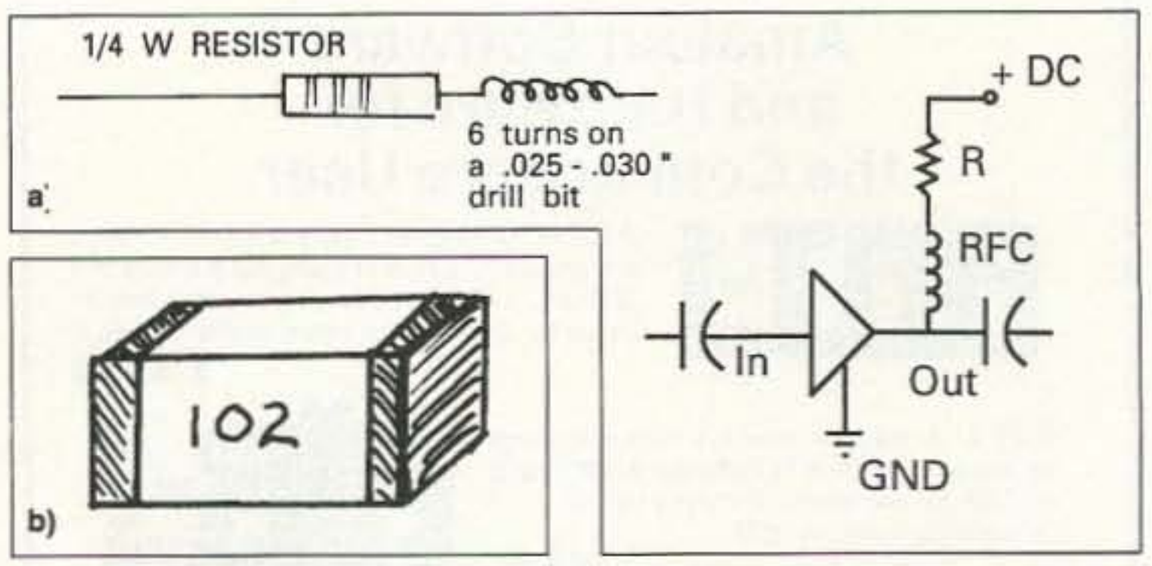

Figure 1. Standard and chip-type resistors. (a) MMIC Amplifier: You could combine the resistor and RFC by winding small RFC out of the resistor lead on one end. (b) Chip resistors are very small and are usable for microwave, within reason. Radio Shack's assortment has the value printed on the resistor. Examples: 102 = 10 + 2 zeros = 1,000Ω; 103 = 10 + 3 zeroes = 10,000Ω; 100 = 10 + 0 zeroes = 10Ω.

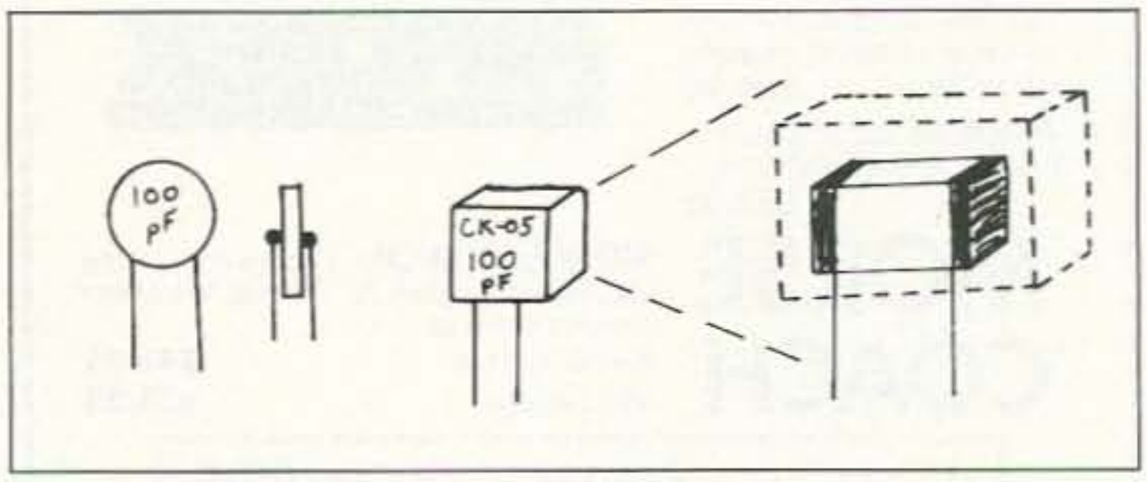

Figure 2. Ceramic capacitors. (a) Disc ceramic. The basic construction is a circular wafer with metalization on each side, forming the capacitor. Wire leads are soldered to the metalization. Sizes vary from 1/8" to larger. (b) CK-05 ceramic capacitor IS chip with packaged leads soldered to the side of the chip. The chip can be recovered by cracking the epoxy case and unsoldering the wire leads, making a lower inductance capacitor. The chip is approximately 0.15" x 0.15" square. Both the disc ceramic and CK-05 capacitors are good to 1 GHz and display lumped resistance and inductance degrading UHF operation.

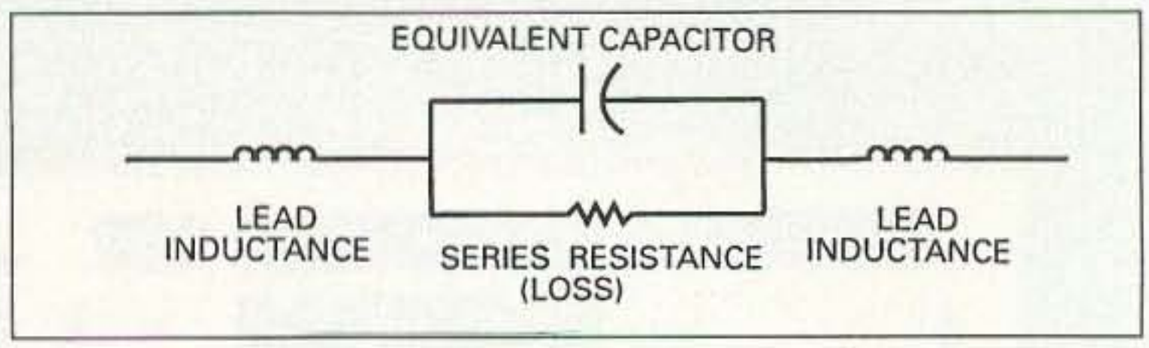

Figure 2(c). A typical capacitor at 1–2 GHz.

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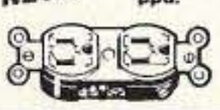

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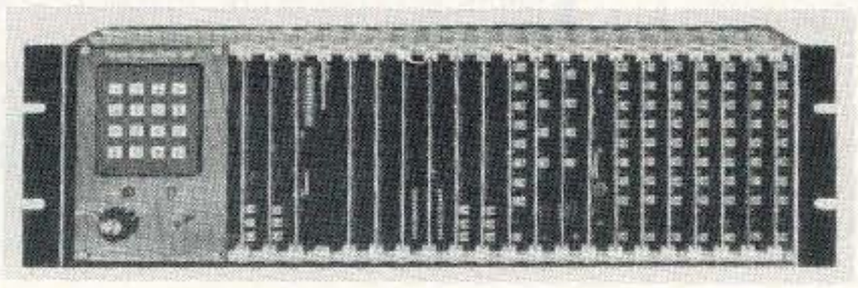

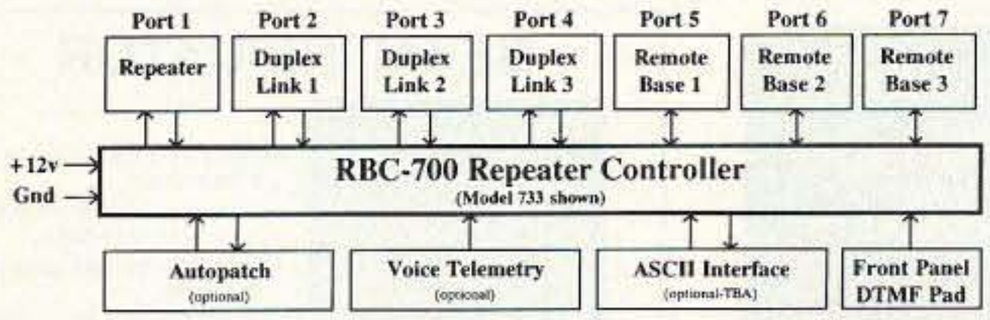

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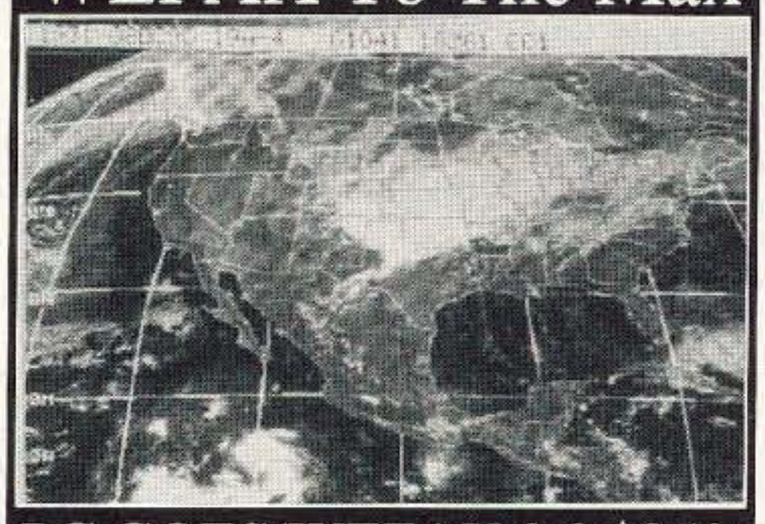

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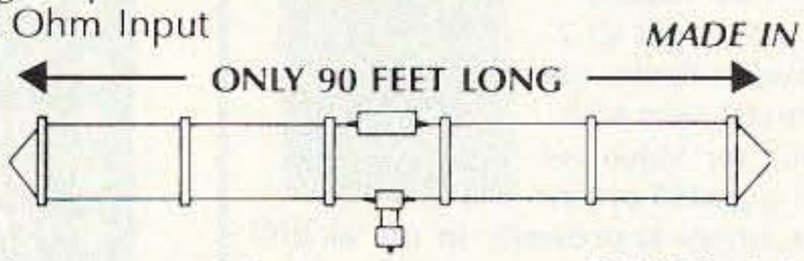

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ly attached (soldered) them to the PC board.

I don't want to appear to be really tightly postured on component use, as there is no real right answer. Lots of substitutions can be made with good results. You just have to keep in mind what is happening to the component. Is RF passing through the component, or are you trying to bypass RF?

For RF coupling, the disc ceramic is very effective for low MHz to several hundred MHz operation. At the 500 to 1,000 MHz frequency range, a capacitor's lead length becomes a limiting factor in its use. Disc ceramic types can still be used, but their connecting leads must be kept to an absolute minimum for the capacitor to be effective. With long leads, the capacitor might as well not be used as its inductance (in the leads) could render it useless.

These considerations are not important below 30 MHz, as component size is a fraction of a wavelength (100 inches equals 1/4 wavelength at 30 MHz). However, at 5 GHz a 1/4 wavelength is quite small in respect to the component, so it deserves consideration. At 10 GHz, component size is twice as critical. At 24 GHz, soldering methods used to attach components can form RF notch filters in the solder connection if the component is not fully soldered to the PC board substrate in a fully-soldered trace. The gaps or bridges in partial solder can cause real trouble.

In an amplifier we constructed with MGF-1402 for 10 GHz, we had trouble obtaining gain at 10 GHz. We solved the problem by mounting the FET upside down. This made for much shorter source leads to ground, several thousandth's of an inch made the difference. Here again minimum inductance allowed the circuit to function.

These same inductance and circuit losses make other components unsuitable for higher frequency use. Package inductance and equivalent series resistance (ESR) make higher losses to increasing frequency. If you look at the frequency ratings and Q of capacitors, you find them rated at frequencies of 1 kHz and a few MHz. Q is quite high, but when measured at higher frequencies this is another matter. The construction of the capacitor plates adds inductance; resistance is formed and the IR and dielectric losses are different at increasing frequency.

Disc capacitors are usable at very high RF frequencies and were an early VHF/UHF type. They were shipped uncased, without connecting wire leads. These uncased disc capacitors resembled a wafer with a small deposited metallic contact on either side of the device. They were attached to the circuit directly, without connecting leads.

This technique is OK to about 2 GHz; higher frequencies dictate still different methods. Remove the coating on standard disc capacitors and you can unsolder the wires and have uncased caps. Be careful—they are very fragile.

Microwave Chip Capacitors

The need for lower inductance in capacitors for microwave frequencies has led to the development of chip capacitors of superior construction. They are different from surface mount capacitors (a form of chip cap), which are not suitable for use at microwave frequencies. Non-microwave capacitors are basically rectangular, unlike their microwave counterparts.

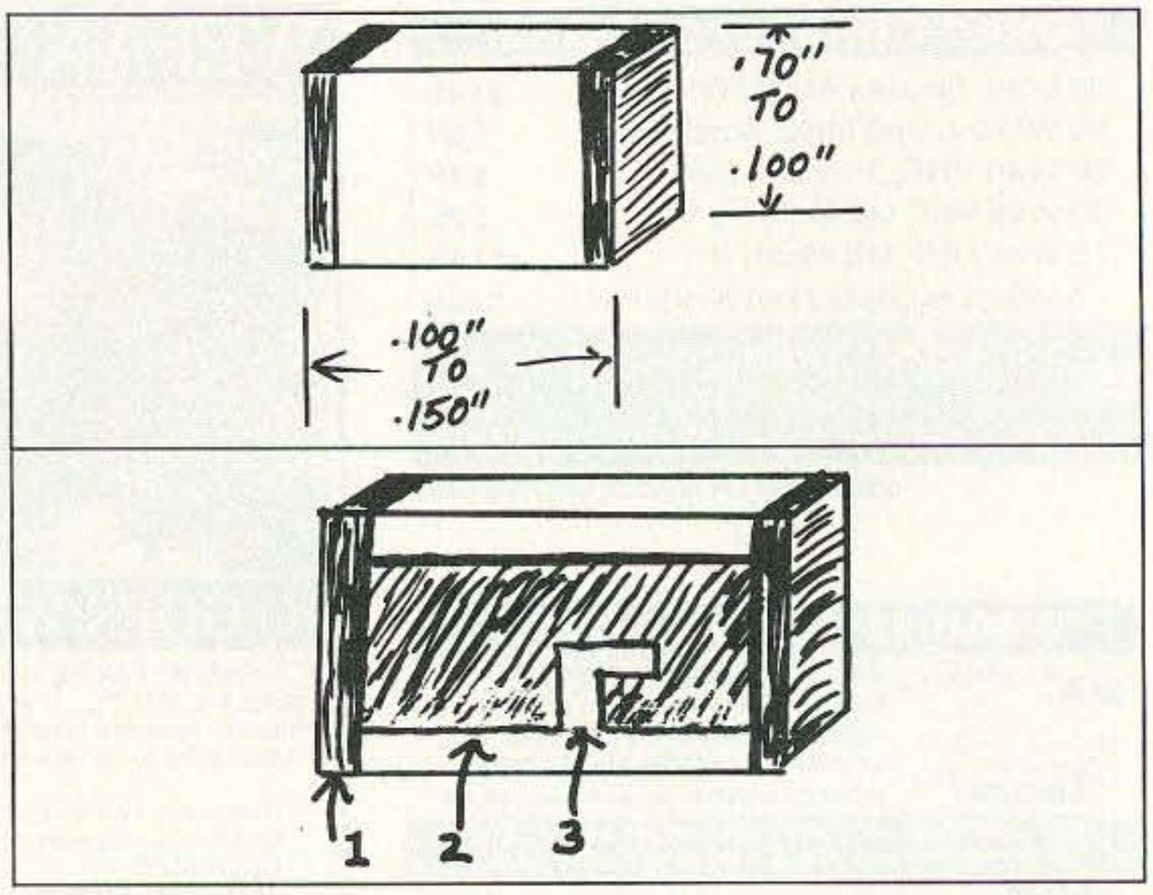

Figure 3. Surface mount device (SMD) chip capacitors and resistors. (a) Solder the capacitors on each end of the ceramic substrate. A lower Q at microwave levels produces a higher loss. This chip is usable to several GHz. The loss becomes unacceptable at 5 GHz. The normal stock value comes in large steps (2.2 pF–10 pF–47 pF, etc.) The value/size ratio is too large for most microwave projects. (b) First, solder the capacitors to each end of the ceramic substrate. Put film-deposited resistance material where indicated. Precision-trim the film, by laser cutting, to the test value. Under normal use, this model is good to 10 GHz for bias and voltage feeds in amplifiers.

The microwave chip capacitor is packaged in a 50- and 100-mil-square package to be compatible with strip line connections. It would not be acceptable to place a capacitor wider than a strip line on that strip line. It would upset the impedance of the circuit and increase loss. Most connec-

tions are made with 50 ohm strip-lines, such as amplifier input and outputs connected to coaxial connectors (50 ohm). Make the capacitors the same dimension, 0.050-inch-square, so that they match the strip line width well. Their porcelain insulation will provide lower losses to RF currents.

This porcelain substrate that forms the ceramic insulating structure is more expensive than your basic ceramic and is one of the prime reasons the capacitor will perform at microwave frequencies. ATC (American Technical Ceramics) makes the capacitors that are rated for microwave work. They are the ATC-100 style of chip caps. They have precious metal electrodes and low-loss porcelain to make microwave RF circuits work better.

A circuit tested at 500 MHz attained a 1.4 dB noise figure with a device rated at a 1.2 dB noise figure, demonstrating the capacitors' part in helping to give low loss characteristics. Any loss is directly added to the basic noise figure and degrades it. The lower losses can be put to real advantage, whether you are reaching for the ultimate or just looking for improvements in your basic system.

It has been reported that other types of chip capacitors used in amplifier circuits have not produced proper gain and noise figure measurements. Improvements of 1 to 2 dB have been attained when switching to the low loss ATC-100 type capacitors at microwave frequencies. See Figure 4 for details about ATC-100 capacitors.

Our 10 GHz amplifier ATC-100 caps of 1 to 2 pF were used to couple the coaxial connectors to the amplifier and interstage coupling. By the way, a 0.9 pF capacitor is self-resonant at 10 GHz, 2.5 pF is self-resonant at 5.6 GHz, and 20 pF is resonant at 2.3 GHz. There are two schools of thought: (1) Use a self-resonant capacitor for frequency of design; and (2) Use a 10 pF capacitor and don't worry about self-resonance. Both seem to work well.

Standard chip caps, of surface mount type, can be used for the power supply bypass connections (100 pF to 0.001 µF or so). They do not have to be the low-loss RF types as we want them to bypass RF to ground. These are what we call surface mount devices (SMD). They are very good capacitors but they're just not rated for microwave stripline work at microwave frequencies. Basic ceramic SMD capacitors, while high Q devices when used in high current applications, can fail due to greater losses and over-dissipating in RF circuits.

The dielectric constants of the materials being used for microwave capacitors give smaller capacitor size for unit value. This reduces the inductance and equivalent resistance, making a higher "Q" device with less RF loss. This drives up product cost over the basic SMD ceramic chip capacitor quite a bit, but performance is markedly improved in the microwave region.

ATC makes several lines of excellent microwave chip capacitors that are a standard of excellence in construction, if not top-of-the-line. I have used SMD capacitors up to 4 to 5 GHz, but I always question their application. If in doubt, go for the better capacitor. The bottom line is how well you want your circuit to function.

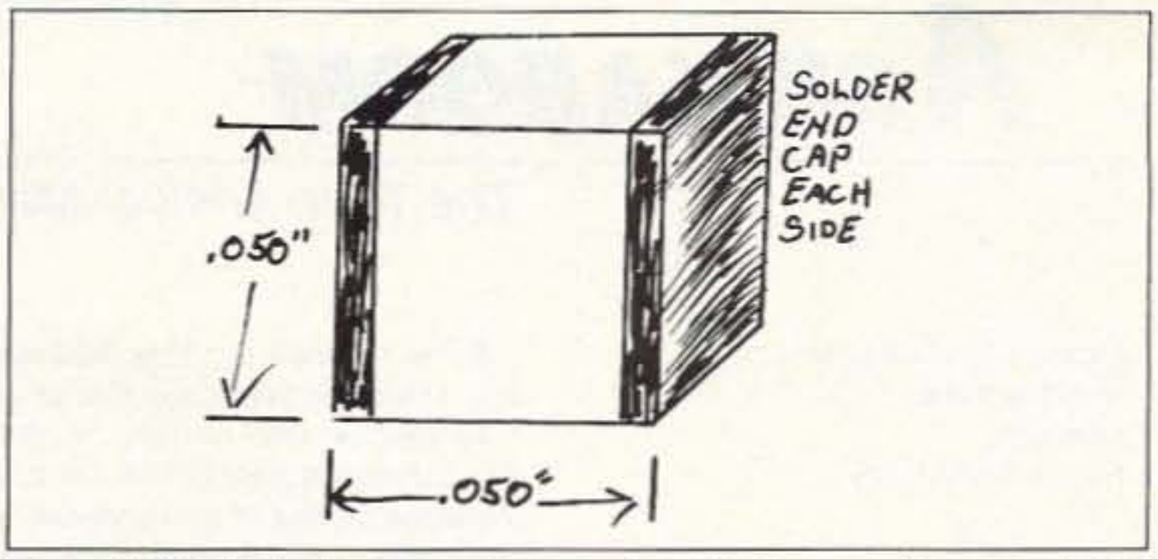

Figure 4. Standard microwave chip capacitor. This type usually comes 0.050" square for 5 and 10 GHz projects. The low loss ceramic porcelain material is rated for microwave use (low ESR—Equivalent Series Resistance. The case dimensions are well matched to microwave 50Ω strip line widths. These capacitors are supplied in very small fractional pF ranges: 0–1 pF, and higher values normally 0–30 pF. Examples: ATC-100 from American Technical Ceramics; S-910 from Johanson; and MA-18 from Murata/Erie.

The Manufacturers

Allied Electronics Administrative offices are at 4801 N Ravenswood Ave., Chicago IL 60640-4496; telephone: (312) 748–5100. They have distributors in most states, and in most provinces in Canada. Mouser Electronics is located at 11433 Woodside Ave., Santee CA 92071; telephone: (619) 449–2222. Their national number is (800) 346–6873. Mouser also offers full-line services to all of the U.S. and Canada. I have ordered from them and have had the order delivered the next day. They are very prompt. Both of these companies have catalogs available, low minimum orders, and a very good stock of components on hand.

Next month, when your copy of PUFF arrives, I will get into some considerations using PUFF. I will cover some of the problems Kerry and I ran into, and a short overview of PUFF.

Well, that's it for this month. As always, I will be glad to answer questions regarding this and other related topics. For a prompt answer, send an SASE. 73, Chuck WB6IGP. 73

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Receivers

Let's wrap up our discussion of receivers and then look at a few letters.

We've seen how a signal progresses from the antenna to the speaker in a superheterodyne receiver. The IF-based scheme gives us lots of selectivity, and we can get plenty of sensitivity at the RF input, or "front-end" stage, so we're all done, right? Well, almost.

AGC

One of the annoying things about radio signals, especially those which have traveled thousands of miles and been bent around by the ionosphere, is that they fade in and out. This fading causes unpleasant volume changes, which can range from bare audibility to receiver overload, in the recovered signal, and it is very desirable to attempt to compensate for it right in the radio. But when we are receiving AM or SSB, the amplitude of the signal is what carries the intelligence we want to recover, so how can we tell the difference between changes in amplitude caused by modulation and those caused by atmospheric distortions?

Turns out it's fairly easy. Luckily, fading happens much, much slower than modulation, so we can simply pick off some of the IF signal, rectify it and then low-pass filter it to remove the modulation. If we're really smart, we sample the signal after the ceramic filter, so that signals near our listening frequency but not within the filter's passband will not affect the AGC.

What's left will be a varying DC voltage corresponding to the average level of the incoming signal. At least it works that way for AM, which has a constant carrier. For SSB, you get a varying DC voltage corresponding to the voice level, because essentially there is no signal between syllables. Either way, the speed at which the voltage can change is governed by the low-pass filter. The bigger the filter capacitor, the slower the changes which can result. It's no different than the effect of capacitive filtering in a power supply; bigger cap, less hum. Really big cap, smooth DC, right?

OK, so now we've got this varying DC voltage. What do we do with it? We use it to control the gain of the front end or the early IF stages, that's what! If the signal gets too strong, we clamp the gain of those stages down and bring it back to a reasonable size. If it gets too weak, we open 'em up wide and build it up as much as we can.

If your rig has a fast/slow AGC control, it lets you select the size of the AGC filter, or *time constant*. A short time constant is great for CW, because unwanted signals in the passband, or static, will not clamp the gain down and cause you to miss any dits or dahs. For SSB, though, such a fast-acting AGC will make the voice sound choppy and echoey, so a slower time constant is in order. Most SSB AGC circuits are designed to respond to voice peaks, which simply means that the filter capacitor is made to charge faster than it discharges. The result is that the receiver's gain follows loud speech elements quickly, without "pumping" like a too-fast AGC. This makes for the most pleasing, natural sound. A good AGC circuit which responds properly causes the radio to reproduce quality speech. A poor one can exhibit "overshoot" by not catching voice peaks in time. (Really, they ought to call it "undershoot"!) Such a bad circuit will make the radio sound "peaky" and distorted on the louder speech sounds.

"OK, so now we've got this varying DC voltage. What do we do with it?"

Even AGC has its limits. A good one might correct an 80-decibel signal change to within 6 dB or so. To get an idea of how much better that is, try turning your AGC completely off if your rig lets you do that. I promise you, you won't be able to listen to it for more than a few seconds. AGC is vital to good receiver performance.

Spreading It Around

As with any other device, different designers have various ways of implementing the basic superhet concept. Sure, all superhets have a front end, a mixer, one or more IF chains and a detector. But consider this: Each stage contributes in some way to the overall sensitivity of the radio. Might there be some optimum way to distribute the amounts of gain? What do we have to gain (OK, a little pun intended) by worrying about this?

If we put most of our receiver's gain in one or two stages, we are asking those overworked areas to have quite a bit of dynamic range. Dynamic range is the difference in strength between the smallest signal the radio can hear and the biggest one it can handle before overload. The figure is expressed in decibels, and the bigger the number the better.

Since the objective is good overall dynamic range from antenna to speaker, it pays to spread the job around a bit. Especially in the front end RF amp, it is not practical to have barrelsful of gain *and* high resistance to overload, even with AGC. The solution is to limit the gain of the amp and make up for it in the IF stages. Even the audio amp can be used to advantage here; the more audio gain you have, the less signal you need to drive the speaker in the first place.

So why have an RF amp at all? In fact, some receivers omit it! It takes very careful mixer and IF design, though, to get enough gain without one, particularly at the higher frequencies where mixer losses and stray capacitances can wipe much of the desired signal out before it ever gets to the IF stages. In particular, passive diode mixers work poorly without an RF amp, because the voltage drop across the diodes causes you to lose small signals.

Dynamic range figures for good modern receivers can range from about 85 dB to 115 dB. Consider this: A compact disc player has about a 90 dB dynamic range. Our radios aren't doing too badly at all!

Phase It In

If you've been following the articles for the past few years, you've read about phase noise. What the heck is that?

As with any other circuit, an oscillator is not perfect. Along with its signal, it generates some noise. Some of that is in the form of amplitude noise, which can be thought of kind of like tape hiss in an audio recorder. Another type of noise is "phase" noise, which basically is random FM. In other words, the precise frequency of the oscillator wobbles just a little bit.

In a crystal oscillator, phase noise is very small, because the crystal is very steeply resonant. It forces the frequency to remain pretty constant. In an LC oscillator, the noise is still pretty small, again because of the high Q of the tank circuit.

In a synthesized design, though, the oscillator runs free with a low Q and its frequency is constantly being corrected by the synthesizer's digital circuitry. In order for it to be able to steer the oscillator, there has to be some error! The result is that the oscillator wobbles around its frequency. Careful design can reduce the wobbles to a very low level, but they are never as low as with a high-Q oscillator.

Open Wide . . .

The result of phase noise is that the receiver's passband appears wider than it actually is, because the oscillators used for mixing are moving around a little. It's almost as if you were wiggling the tuning knob around very fast. As a result, signals which shouldn't be in the passband get heard. Also, there's a "hissy" effect which garbles the audio a bit. Many of today's synthesized rigs suffer to some degree from this, but great strides are being made to eliminate the problem. The direct digital synthesis approach, in which the sine waves are digitally generated, greatly reduces phase noise, because there no longer is an analog oscillator which is constantly being corrected. I expect that we will see this system used more and more.

Well, I think that about wraps up the receiver topic. Now, let's look at those letters:

Dear Kaboom,

I need some kind of wideband power amp for RF. It doesn't have to have more than 1 watt of output, but a preamp won't do, and the commercial units cost too much. Are there any simple power amps around?

Signed,
Gettin' Stronger

Dear Stronger,

Sure! Power FETs make lovely RF power amps and will work to a few watts or more. Of course, things get tricky up at VHF, but for HF they are great. Lots of QRP rigs have been published in this magazine and others. For a simple amp which might help, take a look at my "Cassette Box Special," which appeared in the April 1990 issue of *73 Amateur Radio*. That one includes a simple driver and it might do the trick. It's cheap enough that you can try it and discard it if it doesn't work for you. Good luck!

Dear Kaboom,

Why do rigs with transistor finals have no loading controls like tube units? Seems to me the manufacturers are making lots of dough off of SWR bridges and tuners by omitting the built-in matching networks. Are we getting ripped off or what?

Signed,
Tuner Up

Dear Tuner,

No, I don't think so. The high-impedance characteristic of tubes made a pi network mandatory and, because it wasn't practical to make one which wasn't frequency sensitive, the controls had to be there. Transistors, though, are rather low impedance, so a simple wideband transformer will get you to 50 ohms without the frequency-specific problems. In fact, some early transistor units did have loading controls, and I suppose they could match a wider SWR range. But I think most of us prefer not to have to twiddle knobs every time we change frequency and the modern approach makes things simple, at least as long as you have a matched antenna. And, of course, we do have automatic matching networks today—they're called autotuners!

73 and see you all next month. 73

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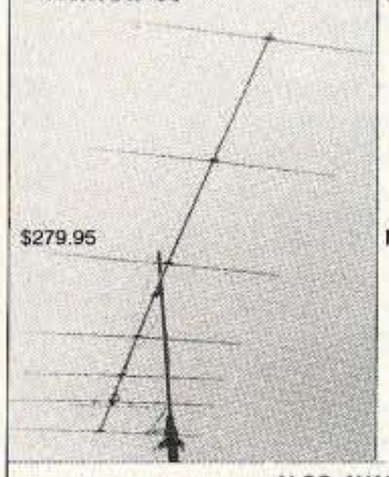

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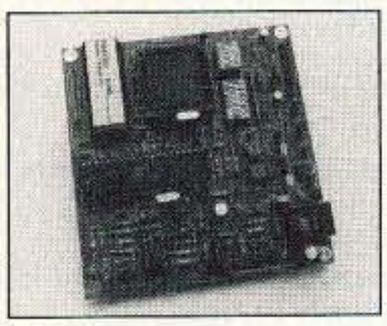

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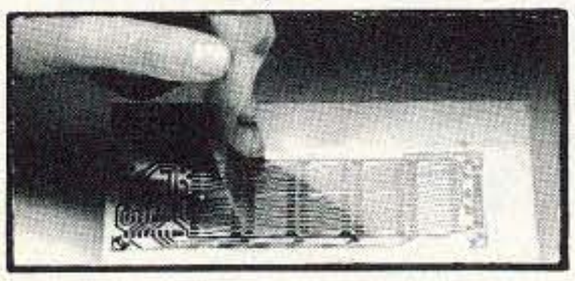

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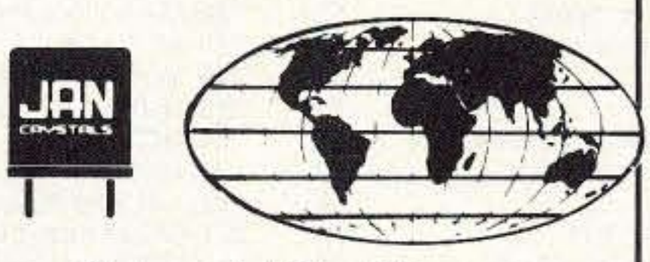

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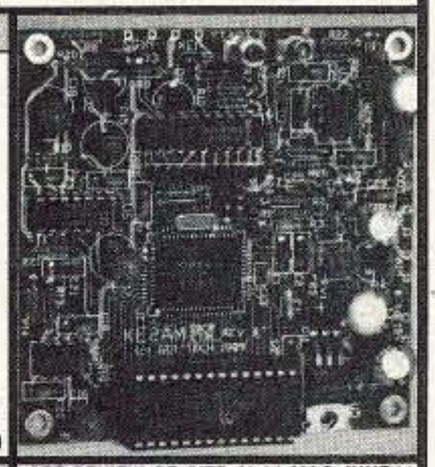

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Never Say Die

Continued from page 4

You also know that the worries over the greenhouse effect and so on are being re-evaluated. Global warming? Perhaps, but more due to sun spots than anything we're doing.

We do need activists, but we need educated activists, not religious fanatics and slogan shouters.

We know now that it isn't Japan that's causing our miseries. If you read much you know that foreigners own far less of America today than they did in 1914. You know that much of the Japan-bashing that's going on is dishonest and politically motivated. You also know that when it comes to protectionism, we have a terrible record which we'd rather not have mentioned.

In my report to the NH EDC I've outlined the major problems which have resulted in New Hampshire being the hardest hit of all the states by the recession. Then I've proposed 29 initiatives to get the state going again. The whole report is about 250 pages long. I'll eventually have it available in book form in case you'd like to read it . . . or perhaps send a copy to someone in your state government to give them some ideas on how to revive their economy. If you have any say in your local library buying, this would be a good addition.

The agricultural revolution is long past. Now the industrial revolution is fading, too, being replaced by the information revolution. Today it's what you know and what skills you have that count the most. It's not how hard you work, but how smart. Hard doesn't hurt, but without smart it's paying off less and less.

So what can you do to help generate thousands of new hams every year in your state? Are you going to wait around for a parade to get started and join it? Or are you going to start the parade? I guess it all depends on whether you are a doer or a watcher. I never was much of a watcher. I can't even sit and watch ball games.

Ignoring The Problem

Is the loss of every past reason for amateur radio to be allocated hundreds of billions of dollars in precious bands a problem we can ignore and have it go away? Is this a problem we can refuse to face? We can hide from? Can we plead ignorance? In my experience people either keep up with progress or get buried by it. Well, technology has passed us by, so we either have to start preparing ourselves for our burial or we have to come up with a valid new reason for the hobby . . . one that will hold water when we're asked if we're repaying our country for our bands.

I believe we can reinvent the hobby and that without it America (and the rest of the world, for that matter) will have a much more difficult time coping with modern technologies. Electronic, communication and computer technologies are moving ahead faster and faster, so the longer we wait to start giving our kids a head start with amateur radio, the longer it's going to take for America to catch up with Japan and Europe.

If you have any other ideas for reinventing amateur radio, we need all the arguments we can muster. You know what new communications technologies are being developed and you have a darned good idea of how much bandwidth they're going to require, so you understand the urgency.

I'm doing what I can up here in New Hampshire. What are you doing in your state? Are you kerchunking repeaters and watching basketball games on TV? What'll it take to get you into action?

Can America Do It?

How difficult would it be, if we really wanted, for us to regain our lost consumer electronics industries? Or should we even bother, considering the enormous obstacles involved? And what 'n hell has this to do with amateur radio? If "hell" offends you, please substitute "dad blamed," or take a short walk on almost any New York street and get desensitized.

"I'm doing what I can up here in New Hampshire. What are you doing in your state?"

I believe that it's not just possible for us to regain our consumer electronic industry, but that it's of critical importance. Further, as the leading hobby in the electronics field, I think we amateurs are in a far better position to do something about this than any other group.

Let's start with last things first . . . our ability as radio amateurs to do something. Since what few of the general public who have heard of amateur radio tend to view it as an enormously technical hobby which is eons beyond anything they could possible understand, why not trade on this ignorance? The altitude this gives us can be used as a platform from which to pontificate. As priests of the mysterious and unknown, they'll tend to believe us.

Sure, you know how little you actually know about radio and electronics. And I know how little you even want to know. I get your letters whining or canceling every time I publish an article requiring more than casual thought. But the general public doesn't know and if you do what I say, I won't tell them what humbugs many of us government-licensed amateurs really are. So pay attention.

Our Electronic Future

Unless you're still reading your 1938 *QST*s, you are aware on some level that high tech is the future. Heck, it's the present too, but it's only going to get higher in the future. I'm talking shirt pocket communicators with fax printout. I'm talking home theaters. I'm talking smart homes. I'm talking smart cars. I'm talking even smarter offices. I'm also talking hundreds of billions of dollars in manufacturing, sales and service.

We've not just let Japan drive away with most of our consumer electronics industries, we've helped them pack the trucks. We cut off our supply of engineers, technicians and scientists at the same time as electronic technology was exploding. We did this by discouraging kids from scientific careers and by cutting the math and science courses. We've also choked off tens of thousands of kids a year who used to pursue high-tech careers as a result of being excited by amateur radio in their teens.

As I've mentioned until the ARRL directors turn blue that before their Incentive Licensing rule change was proposed in 1963 80% of all newcomers to amateur radio were teenagers . . . and 80% of those went on to high-tech careers as a result. If this growth had continued on the same curve as from WWII we'd have well over three million more high-tech American workers available for R&D and we'd have nearly five million licensed hams instead of one-tenth that.

I hope you'll agree with me that we're going to need a high-tech educated work force if we're going to try and regain our electronics industries. That isn't all we're going to need, obviously, but a work force is basic and no matter what else we do we're helpless if we don't have it.

I hope you'll also agree with me that there's a lot we amateurs can do to prime the pump and get America started toward creating this work force. No, it isn't going to be easy. We'll be up against entrenched teacher's unions and politicians who are being bribed by these unions to prevent change. We'll be up against apathy, ignorance, and vested interests. Are you ready to give it up as hopeless? Where's your dad blamed gumption?

Opportunities

With three major new consumer electronics technologies looming on the horizon and inevitably coming, we have a unique opportunity to get the edge we need to start rebuilding our consumer electronic industry.

What are the three new technologies? Heck, you know the answer . . . or should. One is digital audio broadcasting (DAB), the second is high definition TV (HDTV), and the third is the combining of computers with the above in what we're calling multi-media (MM).

Since more and more of our electronic circuits are being handled on integrated circuit chips and less with discrete parts, the loss of our parts manufacturing plants is getting to be less and less of a problem.

I worried when our resistor, capacitor and transformer companies closed down as electronic manufacturing moved to Japan and Taiwan. Today we're doing more and more of the signal processing with chips and less with parts. We still need power supplies and power output circuits, but the parts count is far down from the past.

While we managed to lose most of our memory chip manufacturing, we're still hanging in there with microprocessors and special design chips, so we're actually in a good position to start building DAB and HDTV equipment here.

Being new technologies, there's an opportunity for small entrepreneurial companies to get into this field and grow . . . much like Apple did in the computer field.

Since these new technologies are wide open for experimentation, we amateurs have a golden opportunity to repay our country for the hundreds of billions of dollars in radio frequencies they're letting us use. If we don't start repayment there's an increasing chance the FCC will present a balloon payment bill and put us into bankruptcy. I'm talking Chapter 7, not 11, with our assets being auctioned off to the highest bidders. How much will your station be worth then?

Look, there wouldn't be cellular telephones today if we hadn't pioneered repeaters 20 years ago. So let's get busy and see what we can do with digital voice. Let's start working graphics into packet as a step toward multi-media. The next thing you know we'll be slugging full color video around in packets, complete with digital sound.

Old-timers will remember when we used to be called experimenters. These days we can build stuff with a few chips which would have taken several relay racks a few years ago. Well, if you'll build, I'll publish, and that'll inspire more people to build.

Yes, I know, I'll get lots of flak and subscription cancellations. Hey, I'm used to that. I lost tons of subscribers when I pushed repeaters 20 years ago. But I knew what I was doing was for the best interests of amateur radio, so I didn't let up.

Before that I pushed the heck out of sideband, again to the tune of a jeering crowd of AMers kvetching about Donald Duck radio. Oh, the static I got when I pushed solid-state circuits. Hams are tube people and always will be, said *QST*'s technical editor.

Well, it's time again to get our poor old brains into gear. If you'll experiment and write, I'll publish. The next thing you know we'll be seeing some new entrepreneurial companies

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Of course, without an influx of youngsters into our hobby, we're not going to have many experimenters. Worse, even if we invent two or three new consumer electronic industries, we'll lose 'em without the engineers our new manufacturers will need for their R&D.

Getting Started

The no-code license has helped our growth enormously. While the FCC's lost count of how many hams are actually licensed, we do know that we had a growth of around 7.8% last year . . . the biggest growth in decades. Oddly enough, even with the upsurge in Techs, the number of upgrades to higher licenses has dropped about two-thirds from 1990.

We know what we need to do if we want to have more growth. And we know that this will, in turn, result in more kids opting for high-tech careers. The main problem is getting into action. Well, that's the same kind of inertia we have to overcome if we're going to take off weight, get busy learning more, cut down on beer, take an interest in our own kid's education, and so on.

We need to get word of amateur radio into the local papers. We need to get kids interested in coming to our club meetings. We need to encourage them to start school clubs, even if we have to overcome objections from school authorities. We need to get our local TV reporters to do stories on our activities.

Like "Field of Dreams," if we build it, they will come. All you have to do is let kids know what fun they'll be able to have and, busy as they are, they'll be all over you wanting to know more. I'm very encouraged by the mail I've been getting. While there are still some old fogy ham clubs; more and more I'm getting letters and pictures from clubs who are bringing in kids and getting them licensed.

In some cases I'm seeing the old fogy clubs (and you know who you are) being bypassed and new clubs catering to youngsters being formed.

We have an opportunity right now to not only have a ball experimenting with some new communications technologies, we also have a golden opportunity for entrepreneurs to start some companies to supply parts and modules to help. I see a good chance for the "Apple" of the 1990s to get started.

Remember, it was just two kids that started Apple back in 1976, just a year-and-a-half after the first microcomputer was brought to the market. I still remember talking with Steve Wozniak and Steve Jobs in the garage of Jobs' home in Cupertino, watching the prototype of the Apple I perform. Two youngsters.

Photo A. W2NSD in Aspen.

Photo B. The rest of the Aspen crew (left to right): KO1I, KV1J, K9MWM, W2NSD, NØDBY.

I also remember meeting Bill Gates back in 1975 when he'd just brought a cobbled-together BASIC interpreter to MITS to use with their Altair 8800 computer. Another youngster.

No, not everyone makes it, but no one does that doesn't try. It isn't luck that wins, it's working hard and working smart. It's taking advantage of opportunities. Well, you've got one whale of an opportunity looking at you right now. You know, there isn't anything all that mysterious about digital audio . . . nothing that you couldn't learn in a few weeks, if you wanted.

Heck, I'm an old buzzard, yet I was able to cope with TV, and solid state when that came along. Then I had to get used to ICs. Next came computers and microprocessors. Now digital audio and I'm still game to learn. Bring on your compression algorithms and time domain.

Surely it must take a genius to cope with all this! Well perhaps, but only from Edison's concept of genius being 99% perspiration and 1% inspiration. It's work, but it's fun work. It's exciting work.

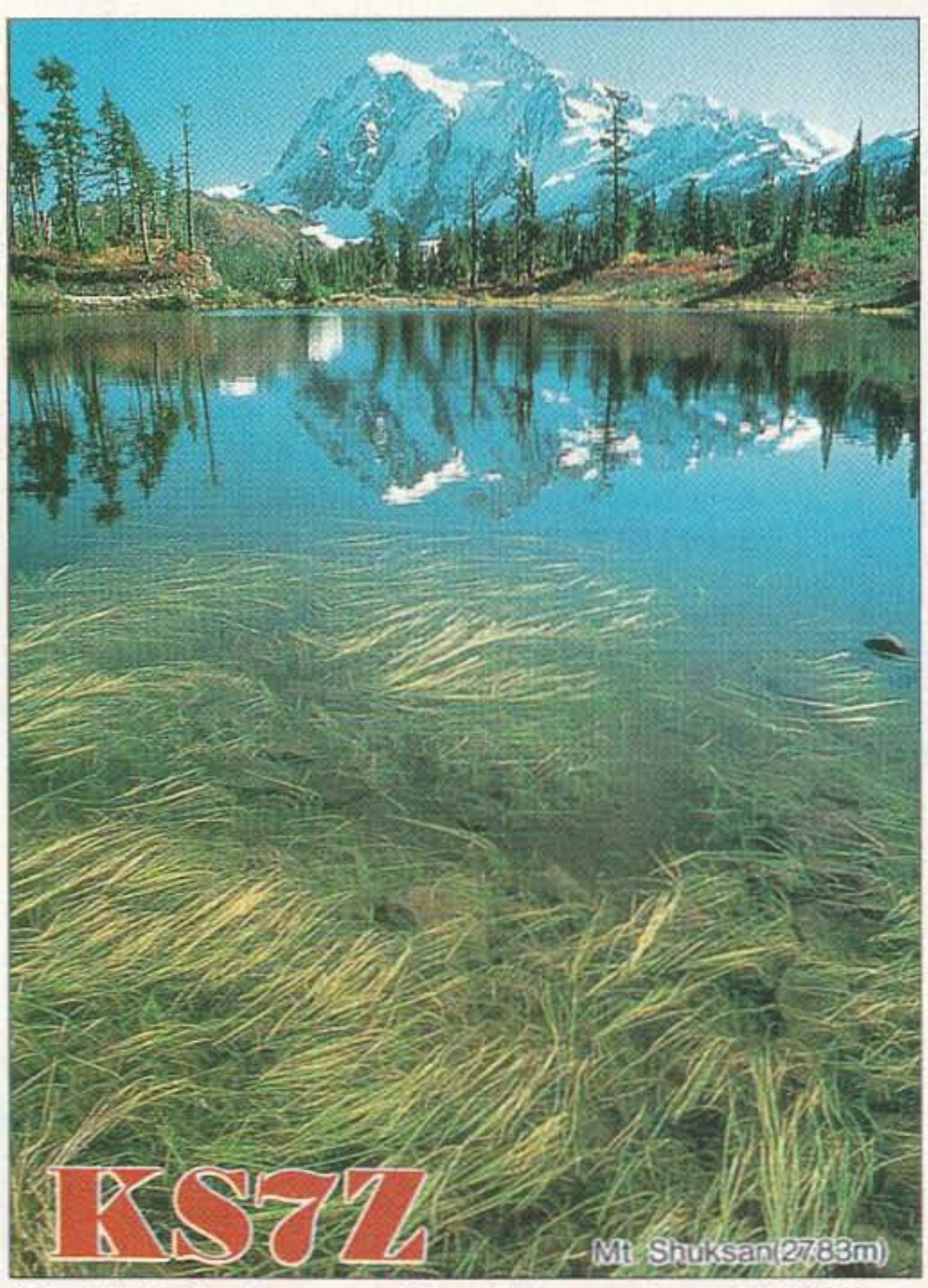
So what do you think? Can we do this or should we just resign ourselves to Chapter 7?

Raise Hell

My report to the New Hampshire Economic Development Commission with suggestions for 29 initiatives to help get the state out of the recession is now available on the *73* BBS. If you have any gumption to get your state going, some of my ideas might just work in your state too. One reader in Alaska sent copies of my report to several city mayors and has set up a group to get started with some of my initiatives.

Of course if you are tired, or just don't have the time to do anything, never mind. But do remember the incredible power one person can have.

I'm sure you are terribly busy. So am I. But in spite of managing (to some degree) 31 businesses, including 10 publications, I squeezed in the time to write a 230-page book on how to get New Hampshire going again. Now tell me how you are too busy to help your state out of the recession. 73



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Notes from FN42

I have been truly enjoying myself the past several weeks before writing this. I have been assisting with the testing of a Bulletin Board System (BBS) for packet radio.

The operator of the BBS, Scott WA1YTW, inherited another operating BBS and computer after another ham, Alan W1FYR, decided that he could not continue to operate two BBSs at the same time because if he didn't make some time for himself and his family he would be by himself. Does that sound familiar? Anyway, continuing the story, Scott decided to change to a different BBS program but wished to keep the first system running until the second one was operating without bugs, to ensure a good transition.

You might think that this would be an easy task, considering that most of the BBS programs have been around for a while and all of the bugs have been worked out, but let me assure you that these programs are very intricate and you have to get things in just the right order or the program will crash and you can lose a lot of messages and traffic. We are very lucky to have another ham, Buzz WA1NHP, volunteer the use of his computer, his computer and radio knowledge, and his time to go through the associated hair-pulling and headaches to make this project the best it can be.

There is more to it than that. To allow the BBS to be used by many other hams, not just locals within simplex distance, it has to link into some sort of packet system, especially if it is located in what might be considered an RF hole. We are very lucky that within fair radio range of our BBS there is a node of the North East Digital Association (NEDA) packet network, SWNH: KA1BBG-1 (SWNH is short for South West New Hampshire). The gurus have been very helpful, especially Linds NR1N, in assisting in the proper parameter settings to make things work efficiently and properly.

This type of help and cooperation has occurred many times before this, in many different parts of our earth, by other hams volunteering their time and resources to make something good happen. I marvel at how I can enter a packet message in my packet Terminal Node Controller (TNC), have it picked up automatically by my Home BBS, and have it delivered automatically to its addressee, such as Ron Gang 4X1MK@4X4SV.ISR.EU in Israel, David Horsfall VK2KFU@VK2RWI.NSW.AUS.OC in Australia, or Milen Postadshieff LZ2MP@HB9AK.CHE.EU or LZ2MP@DKØMTV.DEU.EU in Bulgaria. Not only that, messages get back to my TNC automatically as well. These things can only happen because of hams who care and are willing to make the effort.

One last thing before we move on: We must always remember that ham radio is involved in NON-COMMERCIAL subjects and activities. Some hams have gotten in trouble with the Federal Communications Commission (FCC) in the United States of America because they forgot or just didn't think! We must always be aware of what we are doing while using ham radio; we must make sure that we do not jeopardize our licenses. Even though I have packet capability, I have not publicized it in this column because the information I receive sent directly to me and used in this column might be construed as commercial since this magazine is in business to make money. So, if it's material related to this column, please send it to me in some other way. However, I would certainly love to make contact with other packet users around the world, if for no other reason than to demonstrate that packet works. Feel free to send a packet or two to me, but keep it non-commercial. 73, Arnie, N1BAC@WA1YTW.NH.USA.NA

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VK2KFU@VK2RWI.NSW.AUS.OC
Internet: dave@ips.oz.au

The New Year has come and gone (at the time of my writing this), and there are some special celebrations this year, but more on that later. To follow on from my previous submission, there is no further information on a possible new grade of licence, the Code-less Novice, but I will advise as to what and when. By the time you read this, many amateurs (I hate the word "ham") will have returned from the Gosford Field Day, a veritable Mecca for enthusiasts. Whilst perhaps not up to the size of Dayton, nonetheless it's a busy affair, with disposal stalls, flea markets, lectures, demonstrations, equipment displays, etc. Is it my imagination that much of the "junk" finds its way to the various club auctions, thence back to Gosford? I'm sure there must be a "Law of Conservation of Junk" that holds here.

Some interesting developments are taking place in packet radio, with gateways being set up between the packet network and Internet, a worldwide computer network. The purpose is to provide a "worm-hole" for packet traffic, enabling faster distribution of mail and bulletins. Such gateways already exist in many parts of the world, and due to the efforts of a group affectionately known as the "packet underground," Australia is finally catching up. Amateurs are also being encouraged to "wean" themselves away from 1200 bps *[baud per second]* operation, and to try faster speeds such as 2400, 4800, and 9600 bps. The current "network" of 1200 bps ROSE *[RATS (Radio Amateur Telecommunications Society) Open System Environment]* links is starting to look somewhat dated.

As previously intimated, this is a year of celebration for Sydney stations. The City of Sydney is celebrating the 150th anniversary of its incorporation as a city, and also the establishment of local government in the State of New South Wales. During this Sesquicentenary, the special callsign of VI 150 SYD is in use by various stations, clubs, and individuals in NSW. (Note that VI is a special prefix, and is reserved for special events, along with the AX prefix occasionally heard. Generally, "AX" is used by individual amateurs instead of "VK," whereas "VI" is reserved for event stations). As many frequencies and modes as practical, from DC to Daylight, will be in use. A special QSL card is available, and QSLs and SWL reports may be sent via the Bureau to VK2 QSL Bureau, PO Box 73, Teralba, NSW 2284, Australia. Those wishing to QSL direct may send a stamped self-addressed envelope (6-1/4" x 4-1/4") to: WIA (NSW Division), PO Box 1066, Parramatta, NSW 2124, Australia, for the attention of "VI 150 SYD."

Another Special Event Station is V12RC, operated by Tony VK2DEJ, to celebrate the bicentenary of the settlement of the town of Ryde in NSW, and its recent incorporation as a city. This station has been active since the start of the year, and so far Tony has worked all continents and 33 countries. VI2RC will be active for the remainder of the year, on all bands from 160m to 70cm. Prefix-chasers should certainly have something to keep them occupied!

Finally, the WIA Broadcasts recently introduced Harry Angel VK4HA. Harry turned 100 years old on 14th December last, and has been licenced since 1935. He has achieved many distinctions in his life, being an active DXer, contester, experimenter, and lecturer. It is his face that graces the cover of *Amateur Radio*, December 1991. At a hundred years old, is Harry VK4HA the oldest living amateur in the world? (I'll bet not even Wayne is that old, HI!)

Cheers for now. Dave Horsfall VK2KFU

AZORES

Portugal

Mike Lazaroff KB3RG/CU3LF
PSC 76, Box 1687
APO AE 09720

Picking up from my last contribution, here is some more background on the Azores.

The Azores were discovered and settled by the Portuguese in the 1400s

Photo A. Sr. Manuel Valadao CU3CS (left rear) and adult leaders with some of the Terceira Scouts with their home-brew 15 and 20 meter dipole during JOTA, October 1991.

April - 1992

and 1500s. As an outpost of Portuguese power, by which it could protect lines of communication and serve as a stopover for supplies to the Portuguese vessels sailing the Atlantic, the Azores have played an important part in Portugal's history.

During World War II, the Azores became very important because of their geographic position between Europe and North America. Using the islands as a refueling station enabled air transports to reduce the round-trip flying time from the USA to Africa from 70 to 40 hours. During the latter part of the war, airbases were located on Santa Maria (now CU1) and Terceira (CU3). It was the "Grand Central Station" of the Air Force, serving the American-European Theatre with as many as 900 aircraft and 13,000 crew members and passengers passing through the islands in a single month.

When the British left Terceira in 1946, the US moved its military operations from Santa Maria to Lajes Field on Terceira. Since then, the American presence has remained as a result of periodically negotiated agreements between the US and Portugal. Today, Lajes Field is rather unique—the US Army maintains boats, the Navy flies planes, and the US Air Force takes care of the base! Yes, you read it right—more on this interesting bit of "military intelligence" next time.

Hams on Terceira helped local Scout troops participate in the annual Jamboree-on-the-Air (JOTA). JOTA, an annual event since 1958, brings together Scout troops worldwide via amateur radio. The Azores Regional Office of the CTT (the local licensing authority) issued the special call CU31OS for our JOTA station. Sr. Manuel Valadao CU3CS and I provided a station for the Scouts to use and supervised the operation. The CTT temporarily waived the usual third-party restrictions so the Scouts could communicate directly with other Scouts. We made many interesting contacts, including a QSO with OM3SCT, the station located at the headquarters of the Czechoslovakian Scouts. They told us that because of the liberalization of Eastern Europe, they were now allowed to have a station and participate in JOTA—something they couldn't do before. Naturally, they were very excited. All the other stations we contacted displayed the same enthusiasm, friendly spirit, and international goodwill that many of us were afraid had disappeared from the ham bands. Too bad each day couldn't be like that (especially on 20 meters)!

Until next time, 73 de Mike KB3RG/CU3LF.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
Packet: 4X1MK@4X4SV.ISR.EU

Emergency Autopatching Allowed

For years, the Israel Amateur Radio Club has been lobbying the Ministry of Communications to allow some kind of emergency autopatches on the IARC repeater network. Finally, the efforts have paid off.

In the office of the Minister of Communications himself, Mr. Raphael Pinhasi, a ceremony of granting of authorizations to various parties was held, and those representing the Israel Amateur Radio Club were presented with a document. It permits the use of "an automatic device" on repeaters which can dial only the three-digit numbers for Police, Fire Department, and Red Star of David (the Israeli equivalent of the Red Cross) ambulance and first aid service.

No one will be able to dial home to find out how many liters of milk we were supposed to bring home, and the other three-digit numbers for services such as telephone directory assistance are also out-of-bounds. Another stipulation is that the service may be used only in emergency situations, and the Grade "C" Novice class licensees, who just over a year ago received VHF voice privileges, will not be allowed to use the autopatch.

A little background information: In the past, regular phone patching has been permitted to Grade "A" licensees (Advanced/Extra equivalent in the US) who are the only amateurs allowed to let a third party speak over their stations while the licensed ham remains physically in control of the transmitter. Grade "B" (Generals) could never legally use a phone patch, nor could they let someone else's voice go out on their transmissions. Until a number of years ago, the Grade "A"s had to pay a special license fee for a phone patch, but fortunately there has been some liberalization here. As for regular North American style autopatches, the Ministry of Communications has been adamant in their refusal to consider them.

What all this means is that soon a ham driving down the highway running into an accident will be able to ring up the authorities immediately, and this can mean the saving of lives. I don't understand why the 4Z9s (Novices) have been denied this service, as they have no enjoyment of their hobby added by this privilege, unless the Ministry believes that they can abuse the use of the emergency autopatch.

The IARC executive has already authorized the use of funds for installing the autopatches in the repeaters serving the major population centers, and it is hoped that this service will bear fruit in the further liberalization of third-party traffic in Israel.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

"Kia Ora" from ZL land again! "Have A Go (Again) 160m Activity" is again on the ZL programme for the 1992 year. Due to multiple requests to "do it again" the Hastings Branch of NZART has set up the following event for your participation and enjoyment.

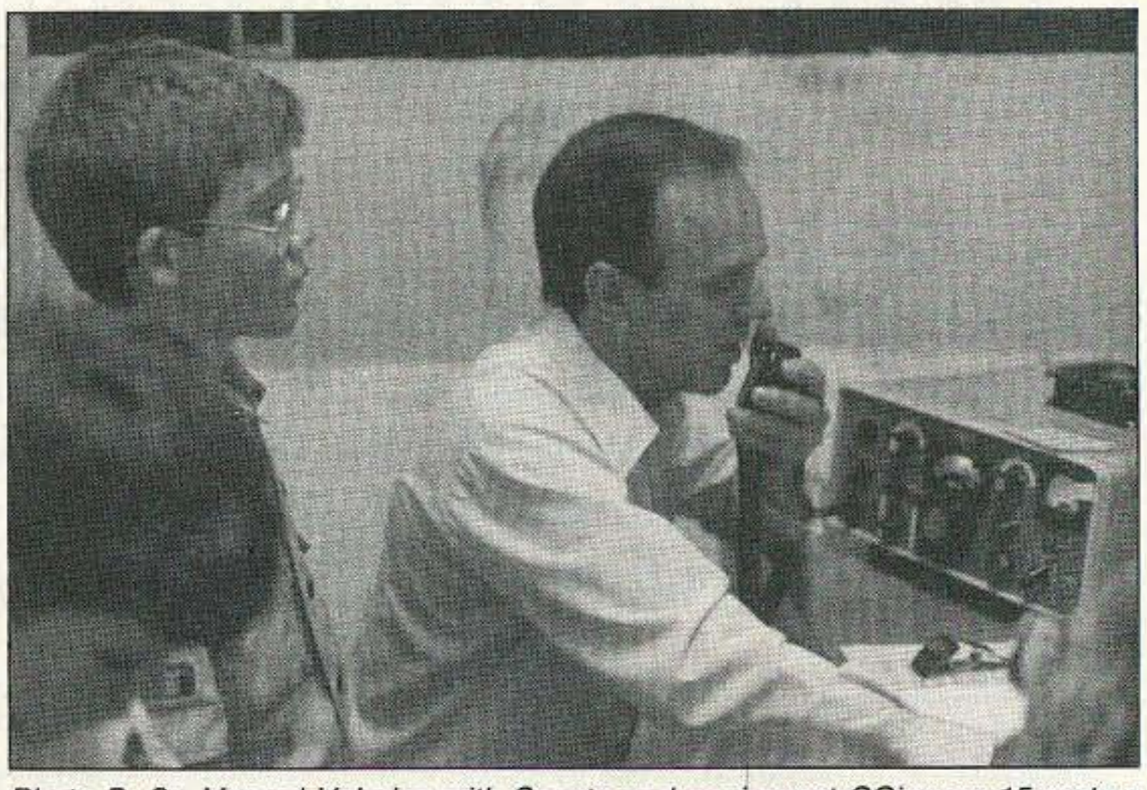

Photo B. Sr. Manuel Valadao with Scouts and equipment CQing on 15 meters during JOTA.

Get a group together and "borrow" a tower or crane or something at home (an 80m dipole works fine) and come up on 160m in March 1992—details follow: 1840 ±10KHz, 0800z–1200z, 20 and 21 March 1992. *[Hopefully some of you readers will get this copy early enough to participate. I sure plan on setting my alarm to "give it a go," even with my minuscule station—Arnie]*

Well, that's got that off. Now for 1991 in summary. We (NZART) got ourselves a new president, Trevor King ZL2AKW, from Wellington. He replaces Terry Carrell ZL3QL, who held the post for the last three years. Trevor is a keen construction man, being the "author" of many kit-set projects set up by the branch he belongs to. He is, of course, also an active ham operator.

Our Frequency Management Group, the NZART group who make recommendations on band plans, uses, etc., is investigating the use of a FAX frequency in the 2m band. There are several ZL amateurs interested in this new mode of communications.

This year saw the passing of Tom Clarkson ZL2AZ, "Mr. Amateur Radio," in ZL. Tom, known internationally through his IARU Region III associations, was one of our earliest licensed hams, and was President of NZART in 1930, very early in the association's existence. Tom was adamant on two things about amateur radio: the voluntary aspects of our hobby, for which the buzz word is currently "recreational," and secondly, the retention of a Morse code requirement to guarantee our international spectrum allocations against inroads from administrations "strapped for cash." We here in ZL respect his wishes as he was a very wise man in the international fields of amateur radio. He will be missed from amongst our ranks.

The NZART Administration Liaison Office has been attending various meetings with the Ministry of Commerce, our regulatory body, leading up to WARC-92 preparations. Fred Johnston ZL2AMJ will be our representative at the February meeting in Spain.

The recent Cyclone "Val," which devastated Western Samoa and American Samoa, again demonstrated the value of amateur radio in a civil emergency—all communications were lost with Western Samoa when the cyclone struck, with the winds up to 240km/h, and this situation continued for three days—but there were some contacts via amateur radio in those days after the cyclone's strength had abated. Even though there was no power, somehow the hams managed to "fire up" their equipment and get those vital words out about the devastation the cyclone had caused.

Television news pictures of the damage show the "flattening" of all buildings and vegetation, and an eyewitness Australian Army helicopter navigator who flew over the cyclone-ravaged islands said parts of the biggest island of Savai'i looked as if they had been hit by a nuclear blast. He said Cyclone Val had flattened houses, ripped off church roofs, snapped trees in half, and peppered the roads with debris. Some areas were still under water.

Another eyewitness said, "It is like the country has been hit by a sandblaster, and finished off by a water cannon—every building and house has been affected in some way." The damage is reported to be well in excess of NZ$300 million.

So much for the "doom and gloom" reporting. On a brighter note, in this year's CQ Worldwide DX SSB Contest there was again a Kiwi Contest Group on the air from a site close to Martinborough, New Zealand. The team consisted of ZLs 2BI, 2IQ, 2IR, 2ASD, 2BKM, 2BPL, 2BSJ, 2UDF, 2ULG, 3IX, and 4OY.

Their antenna farm consisted of two 13m lattice towers topped with a 3-element yagi for 20m and a monster 6-element 15m yagi, as well as the usual 10m beam mounted atop a telegraph pole at 11m. The 40m antenna was a 4-element vertical maypole array which gave a lot of directivity, but, unfortunately, not enough gain. The group worked 6,500 contacts in the 48-hour period.

73 from ZL-land de Des Chapman ZL2VR. 73

DAYTON Hamvention®

April 24, 25, 26, 1992

Early Reservation Information

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• Asst. General Chairman, Dave Grubb, KC8CF

• Giant 3 day flea market • Exhibits
• Free bus service • License exams
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hairman, Box 964, Dayton, OH 45401-0964.

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unday by appointment only. Send FCC form 610
ug. 1985 or later) - with requested elements shown
top of form, copy of present license and check for
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AXes or Express Mail please!

1992 Deadlines
Award Nominations: March 1
License Exams: March 23
Appointments will be mailed by April 13
Advance Registration and Banquet:
USA - April 3 Canada - March 27
Flea Market Space:
Spaces will be allocated by the Hamvention committee from all orders received prior to February 1. Express Mail *NOT* necessary! Notification of space assignment will be mailed by March 15, 1992.
Checks will not be deposited until after the selection process is complete.

Information
General Information: (513) 454-1456
FAX: (513) 890-5464 Attn: Hamvention
or, Box 964, Dayton, OH 45401-0964
Lodging Information: (513) 223-2612
(No Reservations By Phone)
Flea Market Information: (513) 767-1107

Lodging
Please write to **Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton, OH 45402-2400** or refer to our 1991 Hamvention program for a listing of hotel/motels located in the Dayton area.

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

dvance Registration Form

ayton Hamvention 1992
eservation Deadline – USA-April 3, Canada-March 27
ea Market Reservation Deadline: February 1

nclose check or money order for amount indicated
nd type or print your name and address clearly.

	How Many		
Admission (valid all 3 days)	_____	@ $10.50*	$_____
Grand Banquet	_____	@ $22.00**	$_____
Alt. Act. Luncheon			
(Saturday)	_____	@ $8.50	$_____
(Sunday)	_____	@ $8.50	$_____
Flea Market (Max. 3 spaces)	_____	$30/1 space $60/2 adjacent $150/3 adjacent	$_____
Admission ticket must be ordered with flea market tickets			
* $14.00 at door		**Total**	$ _____
** $24.00 at door, if available			

73 3

Name _____

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City _____ State ____ Zip+4 _____- ____

Make checks payable to – **Dayton HAMVENTION**

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Number 29 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Amateur Radio and the First Amendment

Much has been said and written recently about the use of what we could broadly define as "bad language" on the amateur bands. Now, let's not quibble over what exactly is meant by "bad language." We don't need the Supreme Court's definition to tell us when we've heard a dirty word. The vast majority of us have been quite conversant in the art of bad language since about the age of seven. Let's define "bad language" as any words or topics that you wouldn't use or discuss (or let anyone else use or discuss) in front of your mother.

I don't think I'm going out on any limbs by stating that bad language doesn't belong on the ham bands. I'm not talking about the occasional "hell" or "damn." I'm talking about good ol' fashioned gutter talk. I'll admit right here that what comes out of my own mouth on occasion is not fit for tender ears, but there is a time and a place for everything. (Ask me sometime why I don't use VOX when I operate mobile. It has to do with getting cut off in traffic once and letting out a string of obscenities at the offending driver, which was broadcasted via one of the most populated repeaters on the East Coast.) When I'm transmitting on the ham bands—across town or across the world—I am speaking on a public forum and, like the vast majority of you, I know that is not the time or the place for dirty words.

Many people have called for some kind of enforcement action against those who refuse to clean up their language on the ham bands. With those of us who were brought up right, it strikes a basic chord when we hear someone use foul language in such a public place. Often, the first reaction is to call for some kind of punishment.

Amateur radio is not the only place this happens, either. Whether it's books in a school library, magazines at the local 7-11, a gay rights parade or a KKK rally—take your pick—there's always someone who is going to have a problem—real or imagined—with what someone else wants to say or how they choose to say it.

Fortunately, the founders of these United States knew this was a problem. They lived in a time when you could be imprisoned or even put to death for saying the wrong thing, and they were determined to make sure the government of the United States would not have this power. After much debate, they came up with a set of amendments to the constitution they were hammering out. These amendments, known collectively as the Bill of Rights, list precisely (but not exclusively) the fundamental rights of a citizen of the United States of America. The first of these is arguably the very foundation of the liberties that so many American men and women have fought and died for over the past 200 years. This amendment expressly forbids the government from making any law that would take away a person's right to speak freely. Though tested repeatedly over the course of our nation's history, with very few notable and notorious exceptions (speech that directly threatens the life or property of others, slander, and the questionable restrictions placed by essentially every wartime president since Lincoln), it has remained the simple and straightforward declaration the founders intended.

Before we call for the immediate tar and feathering of bucket-mouthed hams, let's take a deep breath and realize exactly what we are asking for. We are saying that we want to limit someone's right to speak because we disagree with what they are saying. It's that simple. The reasons we disagree may be well-founded morally, religiously, philosophically and/or rationally. That doesn't change the fact that by calling for punishment for those whose use of language does not agree with our definition of "proper," we are expressly asking the government to make a law that will take away a person's right to free speech.

The First Amendment was not designed to protect the speech that we agree with. Its precise and direct purpose is to protect the speech that we disagree with, no matter how objectionable or offensive that speech may be. That is the trade-off this country made 200 years ago for the guarantee that no citizen would ever be gagged by a repressive government.

If you don't like the implications of this idea, just think about the alternative. If a government can stifle the speech you disagree with, what's to stop them from restricting the speech you *do* agree with? Once you place *any* restriction on *anyone's* speech, you set a precedent that could eventually shake the very foundation of American liberty. Remember, the laws that these potty-mouthed children are hiding behind to display their mental disfunction are the same laws that allow you to criticize your government, worship the way you choose, and talk about the weather on 2 meters.

By now, many of you are saying, "But what about FCC regulations? Don't they expressly forbid bad language on the amateur bands?" Yes,

Continued on page 101

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

The bands for April ought to be pretty good for some of the month, with fine DX opportunities on the best days, shown as G (Good) on the calendar. For those of you who can only operate on weekends, your chances don't seem to be as good as those who can operate during the week. The *worst* days of the month will center around the 5th, when you might hear and see some celestial fireworks, and again on the 11th through 13th and 17th through 19th. The best days for you to work those rare ones will probably occur around the 1st and 2nd, the 15th, and for the 10 days between the 20th and 30th. The remaining days will be Fair, or trending one way or the other, toward Good or Poor. Use the calendar, along with the band-time-direction chart for your best opportunities, and listen to WWV at 18 minutes after any hour for the latest summary of propagation conditions. You want the A index to be Low (below 15) and the Solar Flux index to be high (above 175).

In April, the DX bands from 20 meters and above will open early and stay open late, with the highest bands closing first . . . well after dark. You can expect weather-related QRN in the Northern Hemisphere this month, hence the bands below 20 meters (30, 40, 75–80 and 160) will suffer from thunderstorm effects, especially surrounding the days marked P (Poor) on the calendar. Effective short skip will gladden your heart as well on those days reading F(Fair) or G (Good). 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	20/15
ARGENTINA	15	15/10	20	40	40	—	—	10	—	—	20/15	20/15
AUSTRALIA	20/15	20	20	20	20	40	20/15	20	—	—	—	20/15
CANAL ZONE	15	20/15	20/15	20/15	20/15	15	15	10	10	10	20	10
ENGLAND	20	40	40/30	40/30	40	—	—	15	10	15	15	20
HAWAII	20/15	15	20	20	20/15	20/15	20	20	—	—	—	20/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	20/15
MEXICO	15	20/15	20/15	20/15	20/15	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	20/15	10	—	—	15
PUERTO RICO	15	20/15	20/15	20/15	20/15	15	15	10	10	10	20	10
SOUTH AFRICA	20/15	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	20/15	20	20	—	—	—	20/15	20/15	—	20	20
WEST COAST	20/15	20/15	20/15	40	40	—	—	20/15	20/15	20/15	20/15	20

CENTRAL UNITED STATES TO:

ALASKA	20/15	15	20	20	20	—	20	20*	—	—	—	20/15
ARGENTINA	15	15	20/15	20/15	20	—	—	10	—	—	10	20/15
AUSTRALIA	20/15	15	15	—	20	20/15	40	20*	—	—	15*	10
CANAL ZONE	20/15	20/15	20/15	20/15	20/15	—	—	20/15	20/15	10	10	10
ENGLAND	40*	40/30*	40*	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/15	40	20	—	10	10	10
INDIA	15*	10/05*	—	—	—	—	—	20/15	15*	—	—	—
JAPAN	20/15	15	20	20	20	—	20*	20*	—	—	—	20/15
MEXICO	20/15	20/15	20/15	20/15	20/15	—	—	20/15	20/15	10	10	10
PHILIPPINES	40/30	—	20*	20*	—	—	—	—	20/15	40/30	—	—
PUERTO RICO	20/15	20/15	20/15	20/15	20/15	—	—	20/15	20/15	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	20/15	20
U.S.S.R.	—	—	—	—	—	—	—	15*	15*	15*	20	20

WESTERN UNITED STATES TO:

ALASKA	40/30	20/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	40/30	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	20/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	20/15	20/15	20/15	20*	20*	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	20/15	20
HAWAII	40/30	40/30	15	20/15	20/15	20/15	40	—	15	10	—	—
INDIA	—	15*	20	—	—	—	—	—	40/30	15*	—	—
JAPAN	20/15	40/30	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	20/15	20/15	40/30	*	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	20/15	—	—
PUERTO RICO	10	15	20/15	20/15	20/15	*	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20*	—	—	20*	20*	20	20	20
EAST COAST	20/15	20/15	20/15	40	40	—	—	20/15	20/15	20/15	20/15	20

* Try next higher band on "G" days. (1) Possible opening on the band on "G" days. (2) Try 80m. Note A: Use values of 10/15 for 12m, 20 for 17m, 40 for 30m. Note B: This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

APRIL 1992

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G–F	3 F–P	4 P
5 P	6 P	7 P–F	8 P–F	9 F	10 F	11 F–P
12 P	13 P–F	14 F–G	15 G	16 G–F	17 F–P	18 P
19 P–F	20 F–G	21 G	22 G	23 G	24 G–F	25 F–G
26 G	27 G	28 G–F	29 F	30 F–G		

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Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

Deadline for the May classifieds is March 13, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. A-Z Electronic Repair, 3638 East, Indian School Rd., Phoenix AZ 85018. (602) 956–3024. BNB220

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Random Output

Continued from page 98

they do, and in a perfect world those regulatons would be adhered to and enforced. In reality, the FCC is not about to enforce that regulation for two reasons: One...the first Amendment. The FCC knows that it is very difficult to get a ruling in their favor when the infraction in question has anything to do with the First Amendment. Two...the Amateur Radio Service is at the bottom of the FCC enforcement ladder. They simply do not have the time or the staff to police the amateur bands for us. That's our job. Even if they had a full-time staff of "Amateur Radio Police," they still wouldn't be going after people for bad language. Why? Refer to reason #1.

So, with legal restrictions and reality in mind, what can we do to instill in these trash-mouths the responsibility that goes along with their rights?

First, let's not forget that we are talking about a very small minority. Except for a particular frequency or two, I can count on my hands the times I've heard what most would label as objectionable language on the ham bands. No, we cannot dismiss those who hang around certain frequencies and display their lack of maturity, but let's keep this problem in perspective.

Second, why the hell (pun intended) are you listening to these people? These adolescents are just looking for an audience, and by listening and responding to them we are giving them exactly what their repressed, underdeveloped minds are craving: attention. I don't know about you, but all of my gear came equipped with tuning controls and an on/off switch. If you don't like what you're hearing on a certain frequency, turn the dial or hit the switch. What gives you the right to tell that person how to speak or what to speak about? And don't forget, if the person who is making you so angry is transmitting illegally (no identification, intentional interference, etc.), FCC regulations forbid you from establishing or maintaining transmissions with that station. If you respond to them in any way over the air, YOU are breaking the rules too!

Let's stop calling for a revision to the Bill of Rights and start using a little common sense when it comes to the few geeks and freaks who haven't grown out of the potty stage. They are a minor eyesore in the amateur radio landscape—one that, unfortunately, we have to tolerate. It's not new advice but it's true: If you take away their audience, they will eventually go away and find some other activity to occupy their overabundant free time.

For every foul-mouthed ham I've ever heard, there have been at least three stations trying to shut him up. It seems that the bigger problem is not the few hams who use bad language, but the far greater number of hams who continue to think they can help the situation by providing an audience. 73

Uncle Wayne's BookShelf

REFERENCE

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SHORTWAVE

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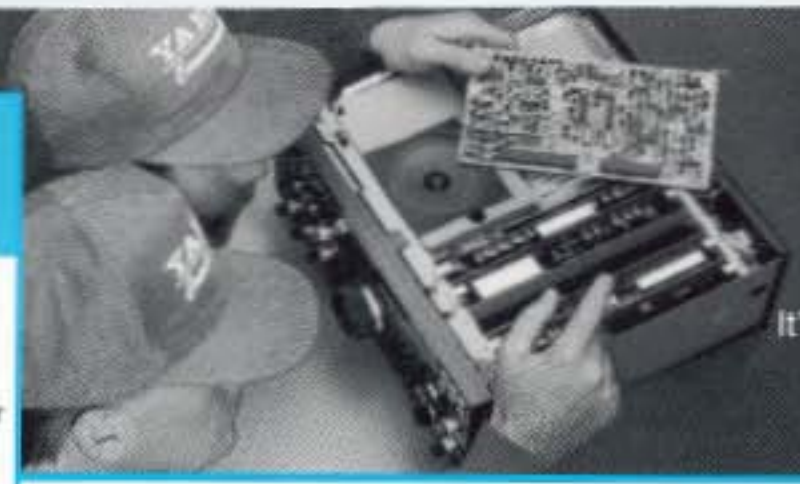

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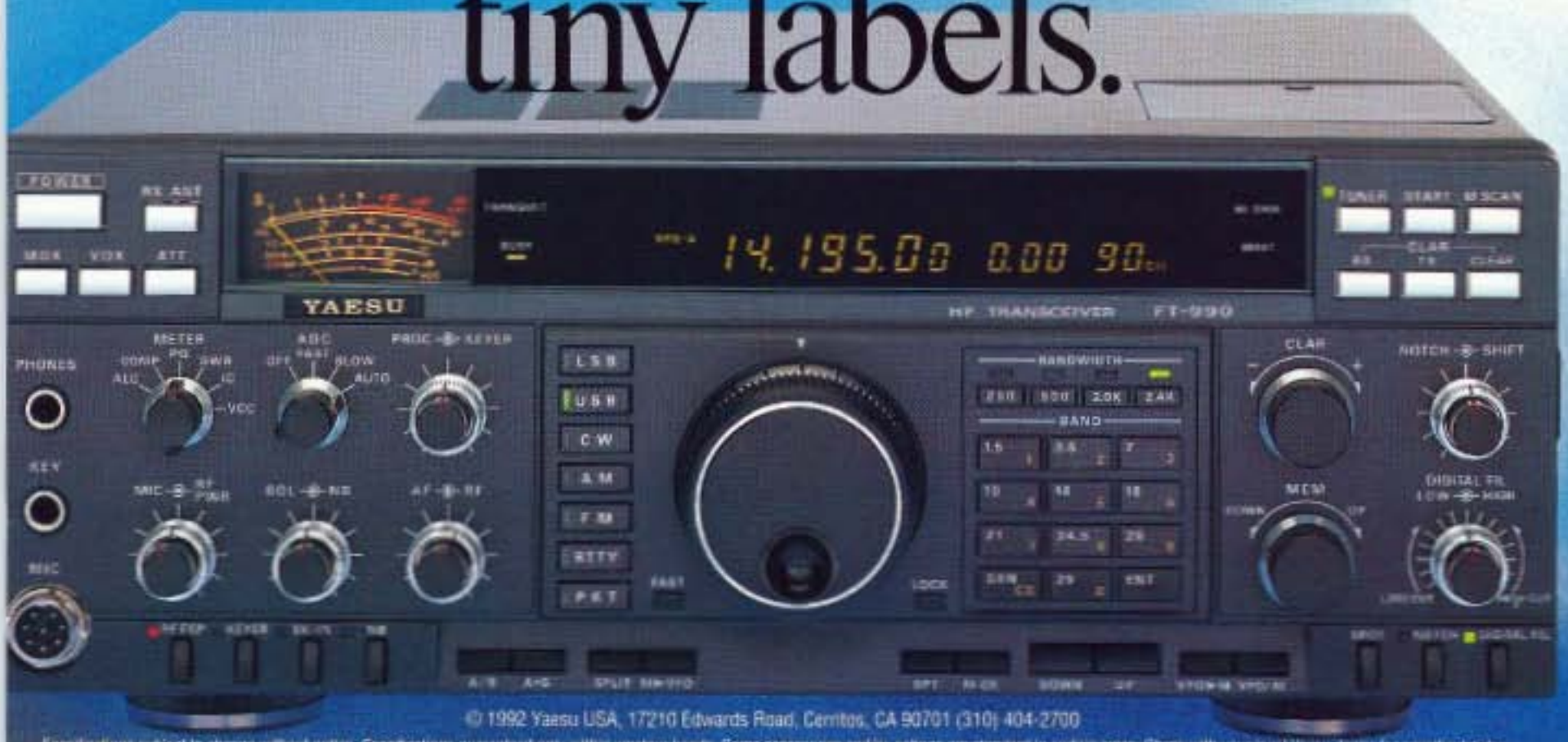

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