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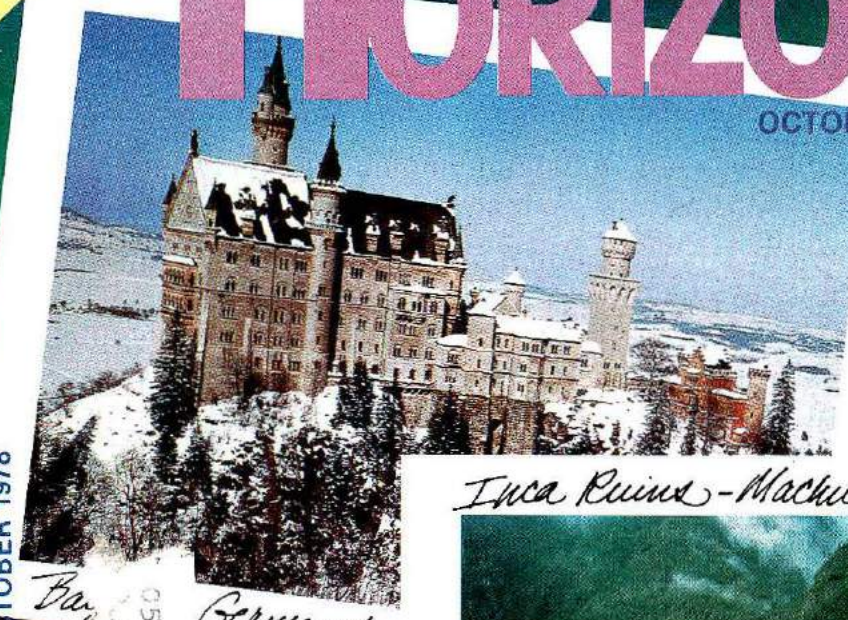
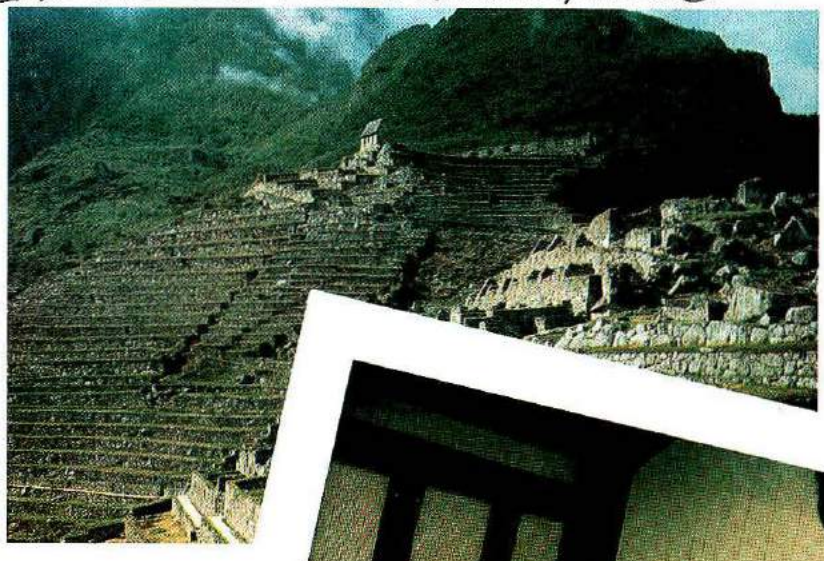
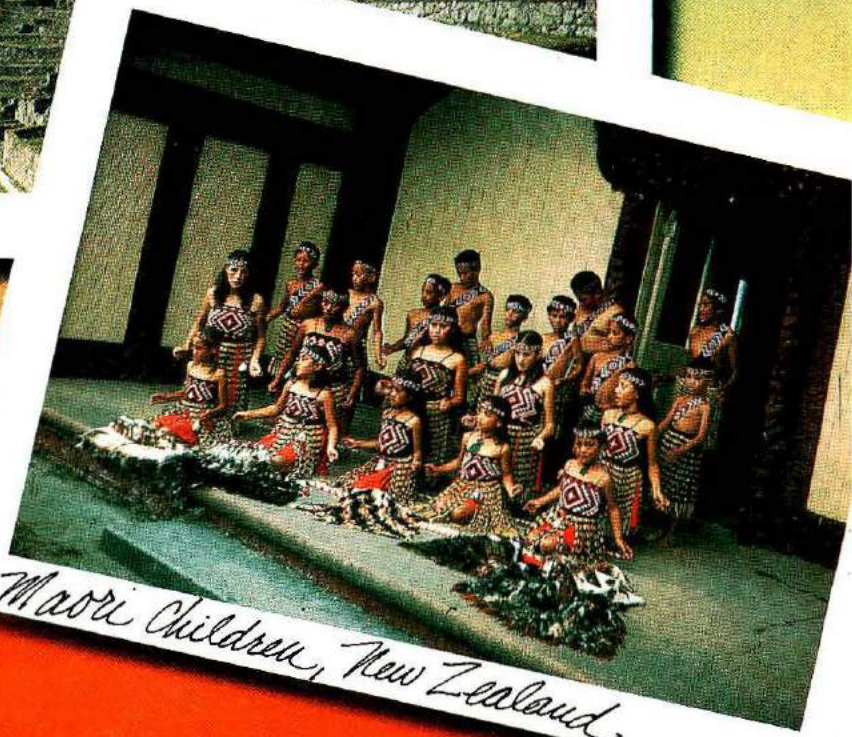


Tower of Pisa, Italy

Inca Ruins - Machu Picchu, Peru





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- Your First Construction Project

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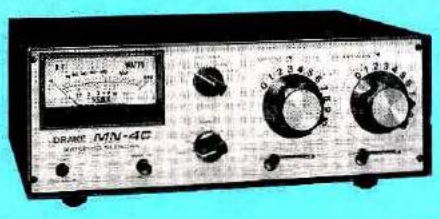

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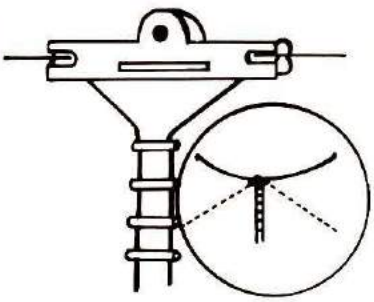

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• Has a total length of 130 feet (14 ga. stranded copper) • Center fed through 100 ft. of 470 ohm PVC covered balanced transmission line • Assembly complete • Tune 10 thru 160 with one antenna • (Requires antenna tuner).

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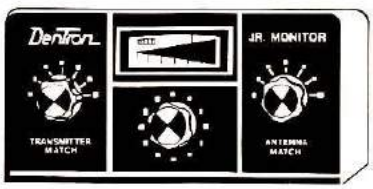

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Call it what you will — antenna tuner, transmatch, matchbox, or matching network, the Jr. Monitor has it all wrapped up in one neat, little cabinet. • Continuous tuning: 1.8 to 30 MHz • Forward reading relative output power meter • 300 watt power capability • Built-in encapsulated balun.

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More details? Ad Check page 94.

THIS MONTHS HORIZONS

Station Planning And Wiring

Like your handwriting, your station wiring and layout says a lot about you. Top performance from your equipment demands care and planning in connecting the pieces together; top performance from the operator requires that some thought be given to equipment placement. W8FX presents some ideas on how best to achieve a practical and comfortable station arrangement.

Reciprocating Ham

Some people get an amateur license and talk to the world; others obtain a passport or a visa and travel to foreign lands. If you get both a ham ticket and a reciprocal license to operate in the countries you visit, you'll never lack for friends, adventure, and activities that the tourbooks don't tell you about. K4QF relates how an amateur license made everlasting friends for him and his wife in all parts of the world.

Flying with your Feet on the Ground

Tired of fighting QRM on the low frequencies? Take heart — here's an excellent article by WB3BKJ that gives all the preliminaries of a great hobby — flying model airplanes by remote control. The equipment is easy to obtain and use.

Amateur Station — 1925 Style

Many amateurs were content with simple gear and low-powered transmitters in the early days, but some did their best to advance the art. Loren G. Windom was one of the more progressive experimenters and operators. His station, 8GZ, became known for its DX work, impressive power, excellent receiver, traffic handling, and, of course, a particular type of antenna. Windy's long-time friend and acquaintance, W7ZC, tells you what it was like to visit the 8GZ shack in those early times.

Quarter-Wave Antenna for Vhf Mobile

With simple tools and ordinary materials you can build a really efficient vertical antenna for mobile vhf work. When properly mounted on your car, it provides excellent coverage for simplex or repeater contacts. Author W1OLP provides the details.

Talk Around the World

Some young people are reluctant to learn the skills necessary to become an amateur. Others learn when given the proper encouragement. Only rarely does one decide to go it on his own, and follow up with enthusiasm and determination. Bob set his heart on the goal of obtaining a General class license, and stuck to his goal in spite of disappointments. Bob's story is told by his mother, and, mothers being the way they are, she shared the emotions of his failures and successes.

Tale Of A Beginner's First Construction Project

Remember the first time you heated up your soldering iron and tried to build some radio gear? Chances are it didn't work on the first try. Let's drop in on WB3BQO and his son, Jeff, as Jeff builds a field-strength meter.

Is Your Station Lightning-Safe?

You have a lot invested in your radio equipment and your home. An apathetic attitude to one of nature's most powerful forces — lightning — can spell instant destruction. WA5SNZ explains how he learned respect for lightning strikes and offers some advice — based on experience.

Cheapie Keyer

There are several small transmitters available for the CW enthusiast, and many are inexpensive. When it comes to the keyer to operate that transmitter, however, the dollars start to add up. WA0UZO decided that something needed to be done about this, so he did it. The result is a respectable keyer that you can put together in an evening or two. Try it — your QRP rig'll like it.

The Cover

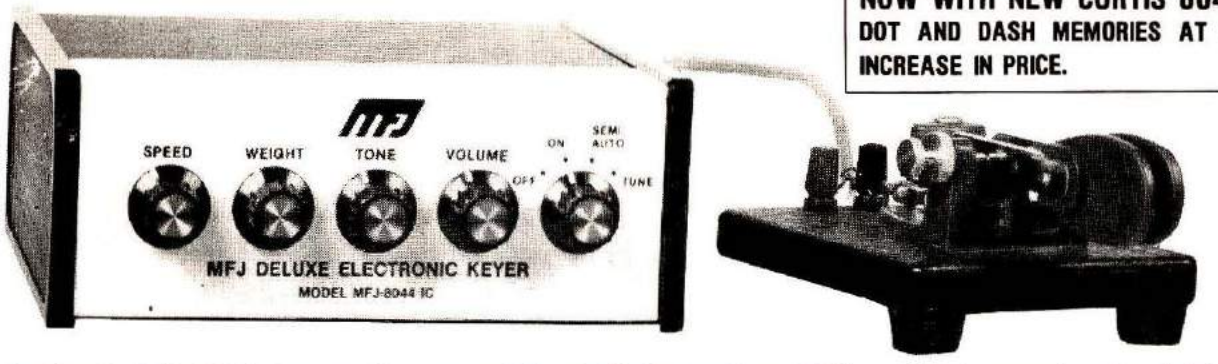
A traveling amateur can combine the thrill of seeing exotic parts of the world with the joy of meeting friends he's made over the air. If he gets a reciprocal license, he can enjoy operating from their country too; the story starts on page 22. Photographs from the Harold M. Lambert Studios, Inc., and from H. Armstrong Roberts, both of Philadelphia.

HAM RADIO HORIZONS October, 1978, Volume 2, No. 10. Published monthly by Communications Technology, Inc., Greenville, New Hampshire 03048. One-year subscription rate, $10.00; three-year subscription rate, $24.00. Second-class postage paid at Greenville, New Hampshire 03048 and additional offices.

This NEW MFJ Deluxe Keyer at

$69.95 gives you more features per dollar than any other keyer available.

NOW WITH NEW CURTIS 8044 IC. DOT AND DASH MEMORIES AT NO INCREASE IN PRICE.



Based on the Curtis 8044 IC keyer-on-a-chip, the new MFJ Deluxe Keyer gives you more features per dollar than any other keyer available.

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Totally RF proof. No problems, whatever.

Ultra-reliable solid-state keying. Keys virtually any transmitter: grid block, −300V max., 10 ma, max.; cathode and solid state transmitters +300V max., 100 ma, max.

All controls are on the front panel: speed, weight, tone, volume, function switch. Smooth linear speed control. 8 to 50 WPM.

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Tone control. Room filling volume. Built-in speaker. Ideal for classroom teaching.

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Completely portable. Take it anywhere. Operates up to a year on 4 C-cells. Miniature phone jack for external power (3 to 12 VDC).

Beautiful Ten Tec enclosure. Eggshell white, walnut sides. Compact 6x2x6 inches.

Three conductor quarter-inch phone jack for key, phono jacks for keying outputs.

Optional squeeze key. Dot and dash paddles have fully adjustable tension and spacing for the exact "feel" you like. Heavy base with non-slip rubber feet eliminates "walking". $29.95 plus $2.00 for shipping and handling. Optional AC adapter $7.95.

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To order, simply call us **toll-free 800-647-1800** and charge it on your VISA or Master Charge or mail us an order with a check or money order for $69.95 plus $2.00 shipping/handling for the MFJ-8044 keyer and/or $29.95 plus $2.00 shipping/handling for the squeeze key.

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All these MFJ Econo Keyers use the New Curtis 8044 IC.

Gives you dot-dash memories, weight control, instant start, self-completing, jamproof spacing, reliable solid state keying. Ultra compact: 2x3x4 inches.

MFJ-404 8044 ECONO KEYER HAS BUILT-IN PADDLE, SIDETONE, SPEAKER, WEIGHT, TONE, VOLUME, SPEED CONTROLS, AND MORE.

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Small enough to slip in your hip pocket!

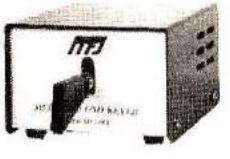
Only MFJ offers you a keyer this size with this much versatility at this price.

Paddle has adjustable contact travel.

Rear Panel: Speed control (8 to 50 WPM), 4 position switch for TUNE, OFF, ON, SIDETONE OFF. Phono jacks for external key and keying outputs.

Weight control gives distinctive signal for QRM penetration. Internal tone and volume controls.

MFJ-402 8044 ECONO KEYER HAS BUILT-IN PADDLE. WEIGHT CONTROL.



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BRAND NEW

For those with sidetone built into their rig.

The MFJ-402 gives you a quality inexpensive keyer with built-in paddle that has adjustable contact travel.

Same as MFJ-404 less sidetone and speaker, volume and tone controls, 4 position switch, jacks for external key.

Iambic operation with external squeeze key.

Reliable solid state keying: grid block, cathode, solid state transmitters (−300V, 10 ma. max. and +300V, 100 ma. max.). Uses 9 volt battery.

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Has sidetone, speaker, weight, tone, volume, speed controls. Tune switch.

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Internal weight control lets you adjust dot-dash-space ratio for a distinctive signal to penetrate QRM for solid DX contacts. Sidetone and speaker. Internal tone control.

Panel Controls: Speed (8 to 50 WPM), pull-to-tune; volume, on-off; 3 conductor, ¼ inch phone jacks for keying output and key paddle input. Uses 9 volt battery. **Optional squeeze key** (see above), $29.95 plus $2.00 shipping/handling.

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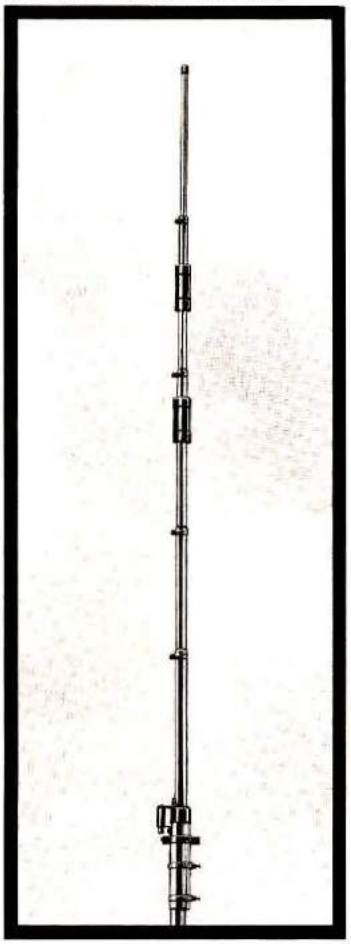
NEW

HF VERTICALS BY CUSHCRAFT

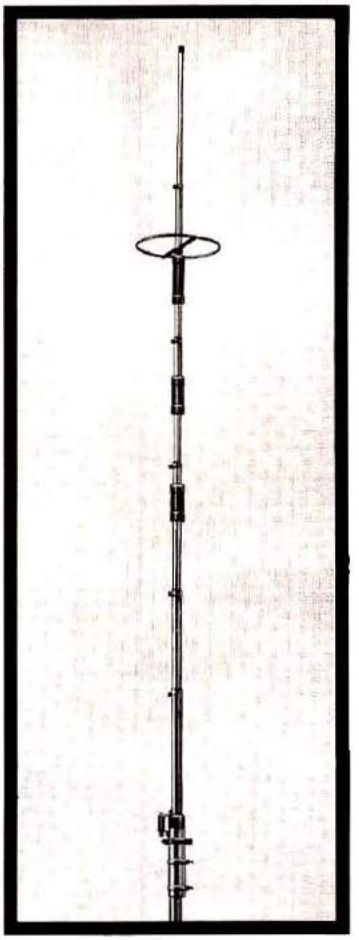
Cushcraft's new multiband vertical antenna systems have been optimized for wide operating bandwidth and provide the low angle of radiation which is essential for long-haul DX communications on the high-frequency amateur bands. The high Q traps which were designed especially for these verticals use large diameter enamelled copper wire and solid-aluminum air-dielectric capacitors; the trap forms are manufactured from filament-wound fiberglass for minimum dielectric loss and high structural strength. High strength 6063-T832 aluminum tubing with 0.058" (1.5 mm) walls is used for the vertical radiator. The massive 2 inch (50 mm) OD double-walled base section and heavy-duty phenolic base insulator ensure long life and durability. For maximum performance with limited space, choose a Cushcraft multiband vertical; all models may be roof or ground mounted on a 1¼" - 1⅞" (32 - 48 mm) mast.

10-15-20 METERS



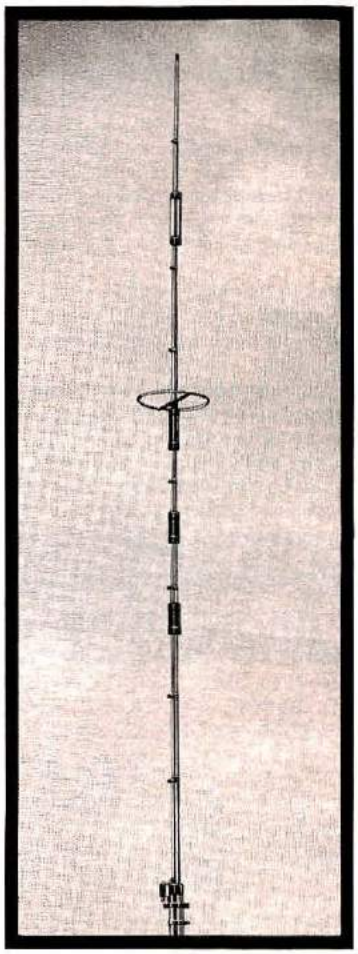
ATV-3 Cushcraft's ATV-3 multiband vertical provides low VSWR operation for both SSB and CW on 10, 15, and 20 meters. Matched to 50 ohms; built-in connector mates with standard PL-259. Stainless-steel hardware is used for all electrical connections. The ATV-3 is a compact 166 inches (4.2 meters) tall. Rated at 2000 watts PEP.

10-15-20-40 METERS

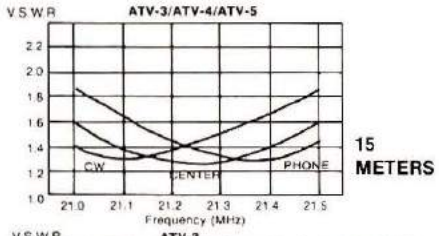


ATV-4 The Cushcraft ATV-4 four-band vertical antenna has been optimized for wide operating bandwidth on 10, 15, 20, and 40 meters. SWR is less than 2:1 over the CW and SSB segments of 10, 15, and 20. The 2:1 SWR bandwidth on 40 meters is approximately 240 kHz; may be quickly and easily adjusted to favor any part of the band. Coaxial fitting takes 50-ohm transmission line with PL-259 connector. Overall height, 233 inches (5.9 meters). Rated at 2000 watts PEP.

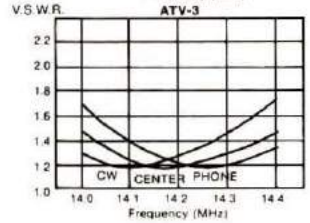
10-15-20-40-80 METERS



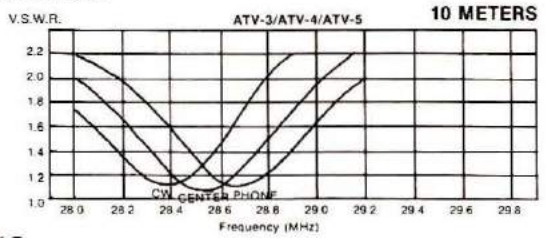
ATV-5 The ATV-5 trapped vertical antenna system has been engineered for five-band operation on 80 through 10 meters. The high Q traps are carefully optimized for wide operating bandwidth: 2:1 SWR bandwidth with 50-ohm feedline is 1 MHz on 10 meters; more than 500 kHz on 15 and 20 meters; 160 kHz on 40 meters; and 75 kHz on 80 meters. Instructions are provided for adjusting resonance to your preferred part of the band, CW or SSB. Built-in coaxial connector takes PL-259. Nominal height, 293 inches (7.4 meters). Rated at 2000 watts PEP on **all** bands.



15 METERS



20 METERS



10 METERS

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October, 1978
Volume 2, Number 10

HAM RADIO HORIZONS

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CONTENTS

Our society is a very mobile one, and when it comes to traveling long distances, most of us fly with one of the commercial airlines. It's only natural for the vhf-fm operator, with his portable fm rig, to question the possibility of using his equipment on commercial flights.

It is popularly believed that all you have to do is obtain the captain's permission to operate; surely your litle two-watt fm rig is not going to cause any interference with the high-powered radio equipment used on board the aircraft. However, this is not the case — according to the Federal Air Regulations, approval must be obtained from the air carrier (airline) and not the pilot in command. However, once approved by the air carrier, the permission of the captain in command must *also* be obtained to operate equipment aboard a particular flight.

Shortly after World War II, portable Japanese fm broadcast receivers appeared on the market, and passengers started using them aboard commercial flights. At the same time, aircraft navigation radios started doing funny things, and it didn't take long to determine that the interference was being caused by rf radiation from the portable fm receivers. The aircraft radios literally went wild, and at least two aircraft accidents have been attributed to interference of this type.

When it was determined that this interference was present, the FAA promulgated new regulations, paragraph 91.19 of the Federal Air Regulations. This paragraph states that no electronic device may be operated aboard a commercial airliner *except* heart pacemakers, voice recorders, hearing aids, calculators, electric shavers and electric watches, unless the device has been approved by the air carrier or operator. The regulation further states that *the captain of the aircraft does not have the authority to authorize such operation.*

Consider, for a moment, what might happen if such operation were allowed. Suppose you have been operating all across the country, and your plane is about to land. A passenger with a briefcase telephone sitting across from you has been watching you operate. About 10 minutes before landing, he decides to call his wife. Unfortunately, his radio telephone transmits right in the middle of the glide slope spectrum. As soon as his transmitter is keyed, the glide slope indicator cross pointer goes up or down, and the autopilot follows it. That could be disastrous.

As an airliner flies across the country, the pilot changes frequency every 5 minutes or so. If several fm operators are on the same flight, only one can talk at a time, so some may decide to switch to other frequencies. When you start to figure out all of the i-f and carrier frequencies of the aircraft radios, plus the amateur gear, plus all the possible mixing products, you can appreciate the magnitude of the problem.

A few years ago a well known vhf-fm operator prevailed upon an airline to test his Motorola HT in one of their aircraft so he could operate during a flight he planned to take. After months of correspondence and personal meetings with airline communications people (many of whom are amateurs), the airline agreed to run the necessary tests. On the appointed day the aircraft was removed from the line operation and the test began) it took three hours and four men to complete. The HT caused no interference, and the amateur received a letter authorizing the operation of *that* HT on *that* particular trip in only *that* type of aircraft. It's easy to understand why the airlines, who are trying to cut costs, are not enthusiastic about testing an individual's vhf-fm equipment.

Many fm operators continue to ask the captain's permission to operate, and he may give it, not realizing the position he is putting himself in; he could have his license suspended or he could be fined. Don't put him in that position, and don't subject yourself and other passengers to a situation which could be hazardous to all on board.

Remember, you may not cause any interference during the trip, but the ILS glide slope receiver is used only during the last few minutes of flight, and interference to these units may not be noticed until it's too late!

Jim Fisk, W1HR
editor-in-chief

IC-215 FM PORTABLE/MOBILE

- 15 channels (12 on dial/3 priority)
- Fully collapsible antenna or "rubber duck"
- Compatible mount for mobile operation
- Dual power (3 watts high/400mw low)
- External power and antenna easily accessible for mobile operation
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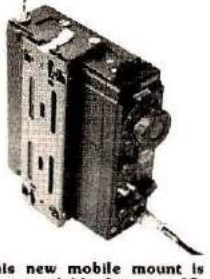
- Double-size, long-lasting internal batteries with optional Ni-Cd pack and charger available

ICOM's **IC-215** is the FM radio that puts good times on the go. Now an outstanding mobile mount and quick-change features for external power, speaker and antenna conversions make moving from base, to vehicle, to hill top fast and easy: and the **IC-215 portable/mobile** provides continuous contact for even the busiest FM enthusiast.

The **IC-215**'s three narrow filters provide quality not usually found in portable VHF equipment. With 15 channel capacity and an MOS FET RF amp with 5 tuned circuits in the front end, the **IC-215** gives optimum FM portable performance.

You'll be carrying quality, performance and versatility with your **IC-215 FM portable/mobile.**



This new mobile mount is now available for your IC-215. Fast insertion and removal is a snap, and the mount is collapsable when not in use.

Specifications: ☐ Frequency Range: 146-148 MHz ☐ Voltage: 13.8 VDC negative ground ☐ Size: 183mm(h) x 61mm(w) x 162mm(d) ☐ Weight: 1.9 kg ☐ Number of Channels: 15 total, 12 on main switch, 3 priority ☐ Power Output: 3.0 W or 0.5 W ☐ Microphone Impedance: 600 ohms ☐ Spurious Level: lower than −60 dB ☐ Receiver Sensitivity: 4 dB below 1 UV or lower ☐ Spurious Response: 60 dB or better

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FOCUS & COMMENT

There's an opportunity knocking at your shack door, and, if you'll answer it you'll do some friends, Amateur Radio, and yourself a favor.

The opportunity arises from the obsolescence of the 23-channel CB rigs which have been in use by the millions for several years. As of the 22nd of November, non-type accepted CB rigs cannot be used. Since 23-channel sets were never type-accepted, this, in effect, puts them off the air. In order to remain legal, CB operators will have to use type-accepted 40-channel sets. But, you say, that's a CB problem, what does it have to do with me?

Well, think about it a moment. Suppose that you tell some CBers you know about a type of operation where there is an infinite number of channels, where they can change their band of operation to suit the season, to talk to different parts of the world, or to avoid "skip" interference when they want to just talk around town. Or, how about a wide variety of equipment which will not be obsolete for many, many years, and which can operate at power levels from a few watts to thousands of watts.

I'm talking about getting them to upgrade to the Amateur Radio service, of course; as long as they'll have to get new (40 channel) rigs, why stop there? Go for thousands of channels for just a bit more money. If you think about dollars-per-channel, it's the only way to go.

If you think you'll meet some resistance from the guy who sells CB equipment, sell *him* on the idea of handling Amateur Radio gear as well. That way he can't lose, no matter what the customer decides.

There's another good reason for answering opportunity at this time — the vacationers are back from their summer trips, and many schools and radio clubs will be starting their code and theory classes for the fall. Get your prospective new amateur into the class without delay, and prove to him how helpful everyone is. Give him a demonstration of *real* communications through a club station, your station, or that of a friend. Hurry, before opportunity decides no one is home!

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Thomas McMullen, W1SL
Managing Editor

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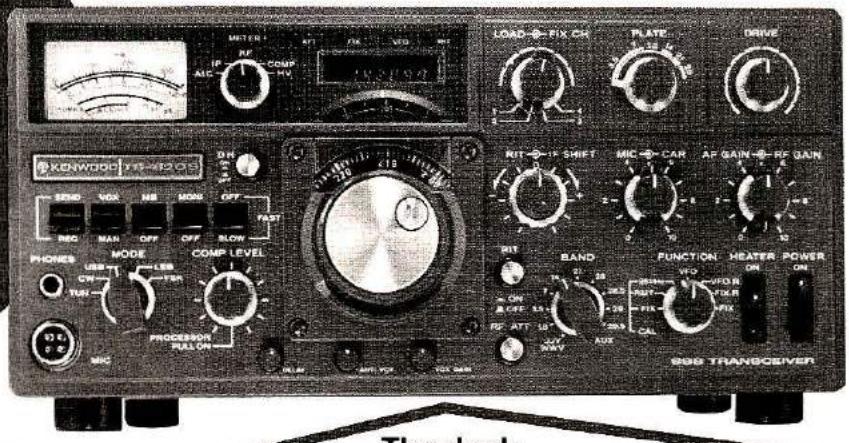

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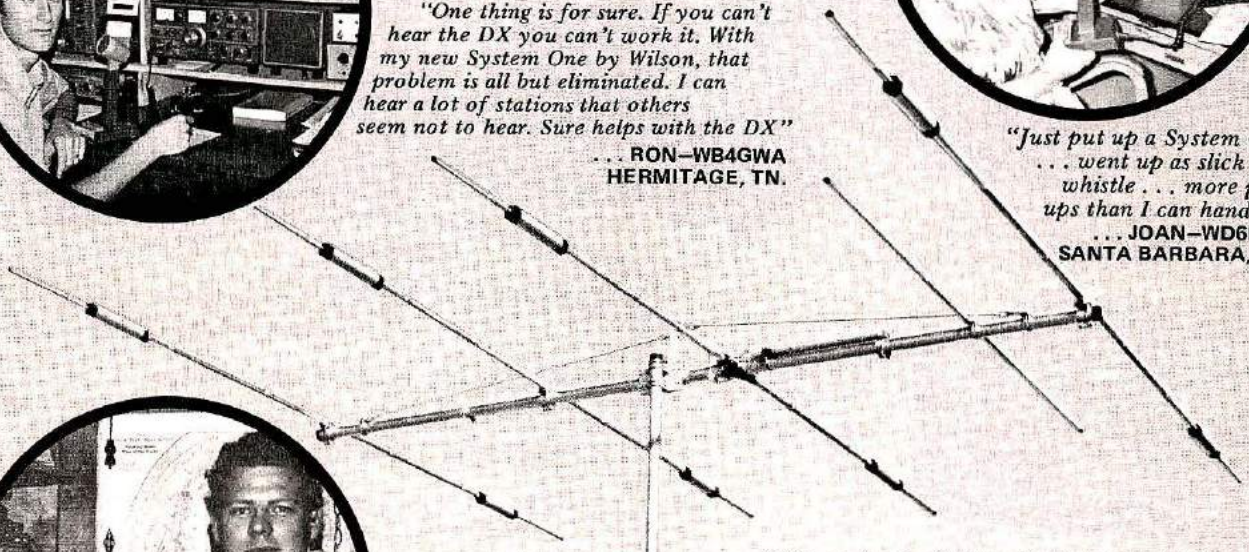

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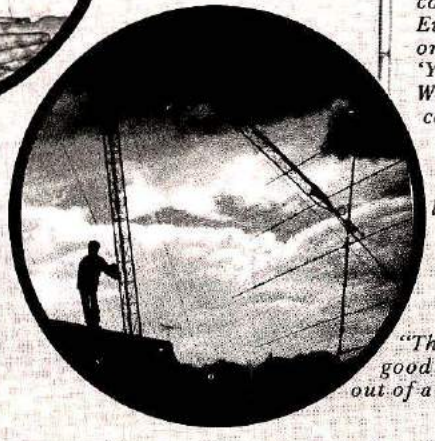

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NEWSLINE

A SIGNIFICANT ANTENNA BATTLE appears to have been won in Farmington, Michigan, a Detroit suburb. Despite strong objections from home owners, the Farmington Heights Planning Commission has come out in favor of tripling the permitted height of radio towers from the present 25 to 75 feet. In a new ordinance sent to the city council, the planning commission proposed increasing the maximum to 75 feet, but with the proviso that the tower height could be no more than half the width of the lot.

Pressure By Area Amateurs, who argued that a 25-foot-high antenna is ineffective, was a prime factor in the victory. Opponents argued that relaxing the height limit would increase radio and TV interference, lower property values, and create eyesores. The restriction is still tough, requiring a 150-foot-wide lot to go the full 75 feet, and limiting an Amateur with a 90-foot lot, for example, to 45 feet. Nonetheless, it is a significant victory in an area where the Amateur fraternity has recently been suffering defeats.

In California, N6QQ's Case has still not been settled. The scheduled July 20 hearing was postponed due to the illness of one of the attorneys. The case is considered a crucial one by the lawyers on both sides of the issue, as the ordinance N6QQ is being prosecuted under is a "model" ordinance drafted by a legal firm that represents a number of California communities.

AMATEUR "EMISSIONS DOCKET" — 20777 — was considered by the FCC Commissioners August 8, with a Notice of Inquiry and a further Notice of Proposed Rule Making the result. Noting the Amateurs' rejection of signal bandwidth as a subband determinant, the Commissioners tossed the ball back to the Amateurs by asking us to tell them just what "technical standards" we want for Amateur emissions in response to the new Notice of Inquiry.

No Extended Comment Period is expected for the Notice, though specific Comment and Reply Comment dates had not been determined by press time. However, the expected timetable is such that there will be ample time for them to be printed in the various Amateur magazines well before the deadline.

CB RULES VIOLATORS and "HF" outlaws are losing not only their CB licenses but also their right to upgrade to an Amateur license. Recent FCC releases have detailed a number of such cases in which an otherwise qualified applicant for an Amateur license was rejected because of a past history of FCC rules violations, plus several cases in which the licenses of Amateurs were revoked for operating on the "HF" frequencies just below 28 MHz.

Instructors Of Amateur Radio training courses would do well to warn their students of the risks that illegal operating poses to their future Amateur licenses.

SATELLITE TO SATELLITE RELAYED signals have been reported by WA3ZHW, who heard OSCAR 7's Mode B telemetry coming through OSCAR 8 on Mode A July 18 on 29512. Since OSCARs 7 and 8 approach each other far more often than 6 and 7 did, users will have opportunities for more satellite-satellite relayed contacts. Note that even though equatorial crossing points may be far separated, the two satellites still approach each other at the northern point of their orbits when the crossing times are close.

OSCAR 8's Delta Launch Vehicle's first stage was mistaken for OSCAR 8 by the tracking radar, leaving OSCAR 8 unnoticed above and behind the rest of the launch payload and accounting for the error in its orbital data. At present OSCAR 8 is about 1700 km behind its "imposter." Updated correction data for the OSCAR 8 orbital predictions will be provided periodically, rather than by attempting to prepare a predictions booklet this year.

CYPRUS TO RHODESIA 2-METER contact was achieved April 10 by ZE2JV and 5B4WR and has since been repeated a number of times. ZE2JV's 144.118-MHz beacon is being heard frequently in Greece as well as Cyprus, and ZS6LN has been hearing the 5B4CY beacon on 144.139 MHz.

Another Florida To Puerto Rico 2-meter opening occurred July 22, when W4GFG worked KP4EOR for about 45 minutes with signals peaking about 15° north of the great circle path.

CF AND CY PREFIXES have been authorized for VE and VO stations respectively who are present or past members of the Canadian armed services, and for Canadian Forces Amateur Radio club stations, to celebrate the 10th anniversary of the Canadian Communications and Electronics Branch and 75 years of Canadian military communications. The special prefixes may be used until December 31.

NEWEST DXCC COUNTRY IS 4U1UN, the United Nations building in New York. Any contact after February 4, 1978, when 4U1UN first went on the air, counts — but cards will not be accepted for credit until November 1.

THE QUEEN MARY SHOULD SOON BE BACK on the air waves thanks to K6OSC and the Associated Radio Amateurs of Long Beach. Nate had long ago suggested to the Long Beach officials responsible for the permanently docked liner that its radio room be equipped and operated as an Amateur station by the ARALB, and the City of Long Beach has finally agreed.

station design

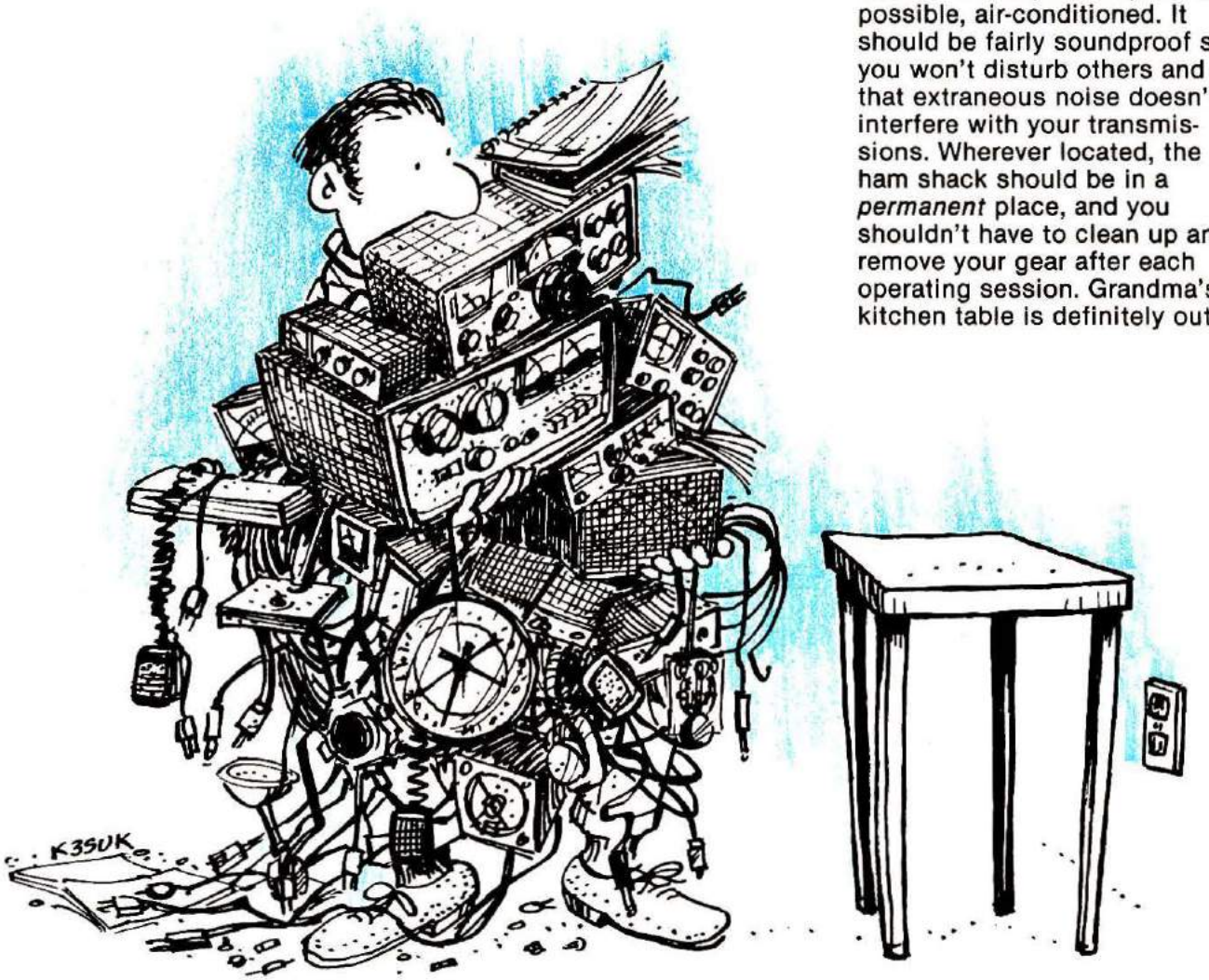
Part 2

BY KARL T. THURBER, JR., W8FX

Equipment placement and wiring tips for improved efficiency and operator comfort

Regardless of where you locate your shack, it should be designed for operating convenience, comfort, and safety. The receiver, transmitter (or transceiver), and the accessories are nothing more than so many pieces of unrelated electronic gear if they're not arranged logically with a "systems approach" in mind. A station with equipment improperly located and interconnected is difficult to operate and can result in excessive operating fatigue. It can make hamming a bore rather than the pleasure it should be. The following ideas will help you decide on your station layout. You can change them to fit your own requirements and space.

First off, the room or area of the house you select should be well ventilated, heated, and if possible, air-conditioned. It should be fairly soundproof so you won't disturb others and so that extraneous noise doesn't interfere with your transmissions. Wherever located, the ham shack should be in a *permanent* place, and you shouldn't have to clean up and remove your gear after each operating session. Grandma's kitchen table is definitely out!



You might want to separate your equipment by installing vhf gear (such as a 2-meter fm transceiver) in a location more convenient to family activities. This location might be in the family room or living room, since this type of operation is casual and more resembles ordinary conversation than does regular hamming. You might find the vhf gear to be more acceptable to the other members of the family. In any case, even if your vhf gear is located in the same room as the hf station, you might want to segregate it completely as a separate station, with its own console.

Room layout

Personal preferences, likes, and dislikes will dictate your operating-room layout. Those who have studied space planning know that one of the basic premises is the placement of the entrance door — all else depends on its location and that of the window or windows. These factors dictate the available wall space you can use for the main operating console, auxiliary tables or racks, bookcases, and worktables. The more usable wall space you have, the better off you are. In any case, first sketch out the room and locate the main console, then work in auxiliary tables and any floor-mounted equipment you will have to reach or have access to. (Don't forget storage space for spare parts). Consider the location of the door and windows, feedline entry point, availability of power outlets, and location of telephone jacks. Finally, locate furnishings such as an easy chair, couch or cot, portable refrigerator, and floor lamps.

Operating consoles and desks

Your operating surface should be as large as possible to allow room for the transmitter or transceiver, receivers, vfos, speakers, microphone, key or bug, calibrators, and other accessories you're sure to acquire eventually.

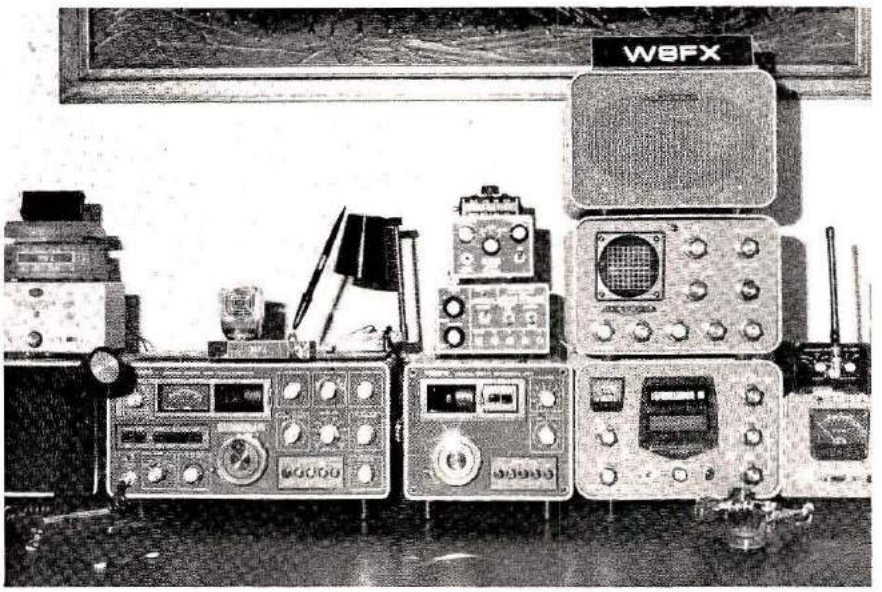
Many hams start out with a full-sized wooden door supported by a metal desk-height filing cabinet at each end. This makes an excellent, low-cost starter console. The door is usually hollow, however, so it must be supported by a vertical brace such as a 2 x 4 piece of wood if it's to hold any great weight.

Other possibilities are the large, collapsible Masonite-top tables such as used by school and church cafeterias. Oversized executive desks provide a basis for some of the best consoles; they have a lot of surface for your gear. These desks have plenty of drawer space for accessories (logs, QSLs, message blanks, call-books). Unfortunately these desks are usually quite expensive and are out of reach of most beginners. Nevertheless, they can sometimes be obtained from office-supply companies as model closeouts, or if slightly damaged, for a fraction of their usually steep list price.

Whatever console you choose, you may want to use a large piece of plate glass over the table top to allow visual aids (operating abbreviations, country lists, and beam headings) to be installed permanently under the glass surface.

One ready-made approach to the operating console problem is offered by several manufacturers who produce communications consoles. I

Radio desk manufactured by S-F Amateur Services, 4384 Keystone Avenue, Culver City, California 90230. It's a good organizer for your ham equipment and fits anywhere in your home. Assembly is required, but all hardware and instructions are provided. It's 98 × 75 × 125 cm (39 × 30 × 50 inches) width, depth, and height.



A partial view of the author's station showing equipment arrangement. When stacking pieces of equipment on top of each other, consider off-on duty cycle. If equipment runs continuously, make sure sufficient air space is available between the stacked pieces to provide ventilation.

know of two such consoles, which allow an entire medium-sized station to be contained in one unit. One is the Telco unit,* which somewhat resembles a large stereo entertainment center and has a self-contained area for all operating equipment, while doubling as an attractive piece of furniture. The unit measures 110 x 50 x 113 cm (44 x 20 x 45 inches) and has sliding doors and a front-disappearing tilt panel, which allows all equipment to be concealed and secured when not in use. It sells for about $140 directly from the manufacturer.

A similar unit, known as a "Radio Desk," is a double-decker desk with two main equipment tiers; the bottom tier is tilted back for good visibility. A continuous cubbyhole underneath the main desk surface allows for storage of logs, callbooks, pencils, and small accessories. It measures 991 x 762 x 1270 mm (39 x 30 x 50 inches) and comes in either teak or walnut finish, or unfinished in clear birch veneer. The desk costs about $130.

There are other possibilities, too, such as modular home entertainment-center consoles. While these are made primarily for component stereo systems, they can be adapted for radio use and may be attractive to the space-limited apartment dweller. The main problem with these units is the lack of leg room and a wide-enough top surface, but they make a good spot to park your accessories.

*Telco Communications Products, 44 Seacliff Avenue, Glen Cove, New York 11542.

Operating convenience

Looking for a moment at the desk-top itself, the location of the receiver or transceiver is probably the most important factor. It should be positioned for tuning convenience (depending on whether you're right or left-handed), and the rest of the equipment should be grouped around it. It's often helpful to tilt the front of the receiver or transceiver slightly upward to make it easier to see and use. When arranging accessories around the receiver or transceiver, bear in mind that the most important station controls are the tuning dials and the transmit-receive (T/R) or push-to-talk (PTT) switches. The location of other station equipment, relative to the receiver or transceiver, is determined by how frequently you use the item and by how far you must run interconnections.

For example, you don't want to run rf cabling all around the shack to get from antenna coupler to swr bridge to transceiver.

Accessories should be located near the equipment

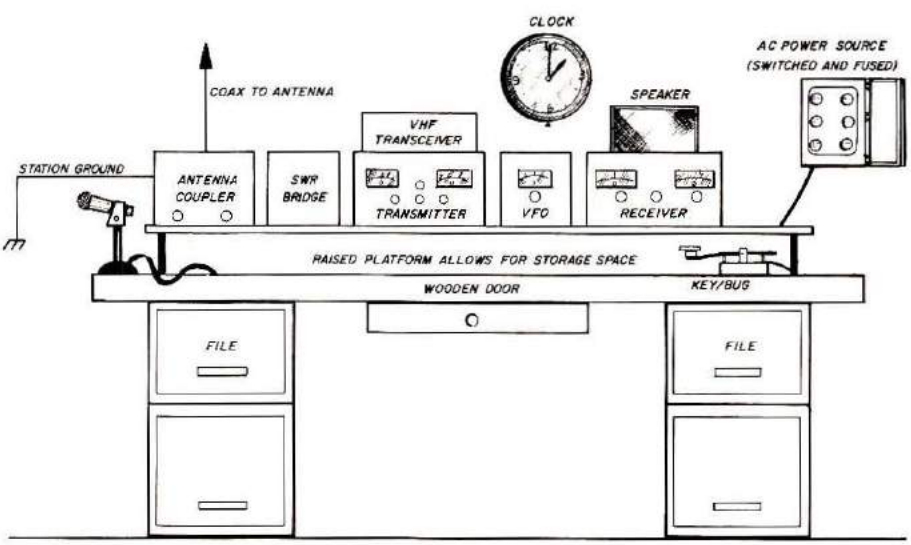


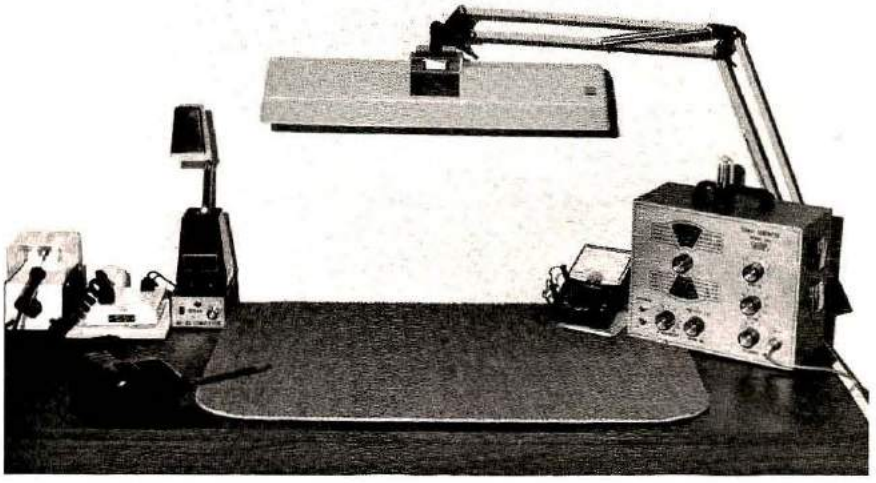
Fig. 1. Suggested beginner's station layout. A hollow wooden door mounted on two double filing cabinets makes a good operating desk with room to spare. The top should be 70 - 75 cm (28 - 30 inches) high. Normally you'll find it convenient to place major equipment items about 40 cm (16 inches) from the front of the table. The arrangement above is for right-handed persons; if you're left-handed you might want to transpose the layout so the receiver is on the left-hand side of the table.

with which they're to be used. A rotary beam antenna control, for example, should be located close to the antenna coupler; a speech compressor near the transmitter; and the swr bridge, dummy antenna load or wattmeter so that they're easily visible when transmitting. An extension telephone and phone patch, if desirable, should be located so that you don't have to leave the operating position to make a patch or answer the phone.

Peripheral equipment

Generally speaking, only the major station equipment should be arranged on the table or desk. Other equipment, such as test gear and minor accessories, should be located separately on its own table or work bench if possible — portable microwave-oven carts are excellent for test equipment!

The main operating console shouldn't be used for construction projects, otherwise you may find you're kept from operating by the latest kit that's strung out all over your equipment, which may be damaged by drilling and soldering.



Layout for a workbench for making quick fixes to your equipment. It contains the minimum of test equipment and provides plenty of space for working. Lighting is important; note the fluorescent fixture and the high-intensity lamp.

The microphone is usually located directly in front of the operator so that the transmitter audio gain doesn't have to be run up so high that you sound like Donald Duck in a barrel. This location will also position the microphone correctly for push-to-talk (PTT) operation. Some hams use a foot-switch connected to the transmit-receive (T/R) circuit rather than a PTT switch. This allows mounting the microphone on a flexible gooseneck fastened behind the equipment and keeps the microphone base from using space on the console. The hand-held microphone furnished with most transceivers is best suited for mobile work and should be replaced with a desk unit.

The hand key or keyer paddle should be heavily weighted or fastened to the table top. The key should be aligned so that it is far enough back from the table front to allow your elbow to rest on the table edge. A single combination keyer paddle and straight key, such as made by Ham-Key and Brown Brothers, is very convenient.

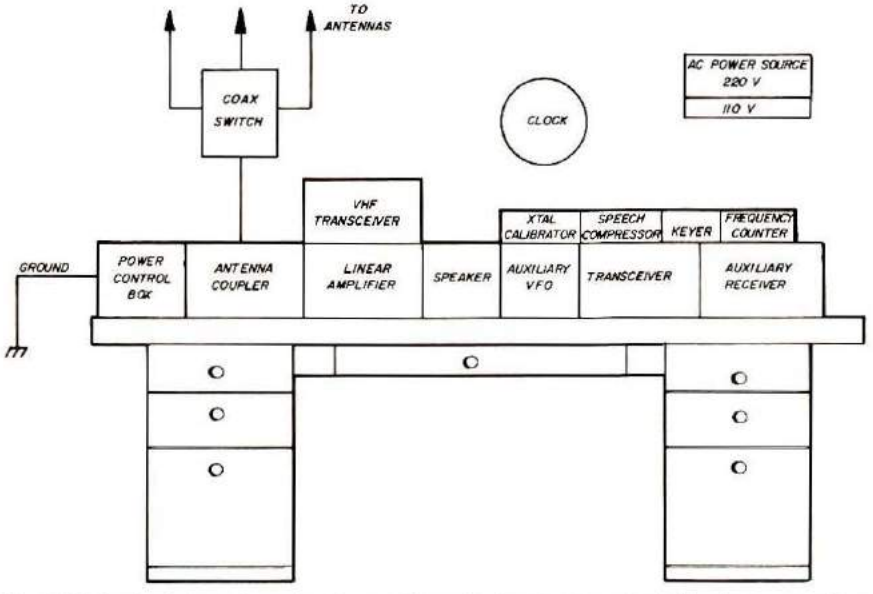


Fig. 2. Typical advanced station layout. If you're involved in specialized areas such as RTTY or SSTV, you might want an extra table or two arranged at right angles to the main console to accommodate all your gear. If your workshop is located elsewhere in your home, it's a good idea to have a small table available for fast repair work you may have to undertake.

Operating platform

As you acquire more gear you'll likely find that the desktop becomes quite cluttered so that there just isn't any room left in which to maneuver, and gear becomes stacked inconveniently, one on top of the other. An operating platform is a good way to reduce clutter, the idea being to lift the main pieces of equipment a few inches above

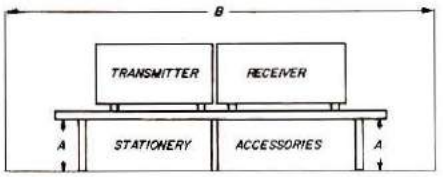


Fig. 3. An operating platform allows you to add equipment to your station without taking up additional valuable table space. The platform helps reduce clutter by lifting the main equipment items above the table top. This allows space below the equipment for stationary and small accessories. Dimension **A** should be large enough to accommodate the material you wish to place under the raised platform. Dimension **B** can be anything you like and can be the full width of the desk or console. The front of the platform can be made slightly lower than the rear, which will tilt the transmitter and receiver so you can read dials and meters more easily.

the tabletop. This allows some space beneath the gear for smaller accessories. The construction is easy, but you'll have to design the platform to meet your needs. You can use 1/2 or 3/4-inch plywood for the platform and vertical supports. You'll need at least one center support in addition to the two end pieces. These can be attached to the platform surface with wood screws and angle brackets for rigidity. It's a good idea to cut the end supports so that they protrude 50 or 100 mm (2 to 4 in) beyond the rear of the platform. This will prevent the platform from being jammed up against a wall behind your console. It also allows some space between your equipment and the wall to route cables and allow easy access to the back of your equipment. If you like, you can permanently mount small accessories under the platform or to the vertical supports using angle brackets or wood screws. **Fig. 1** and **2** illustrate some representative station arrangements. **Fig. 3** shows an operating platform that can be used to increase your effective table space.

Many ham stations look great when viewed casually. But take a look behind the equipment. Often you'll find cables, wires, and who knows what in a rat's nest of confusion — all thrown hastily together just to get the station on the air. The dedicated ham takes pride in his station, not only in first-glance appearance but in what connects it together. A little care in planning your station wiring will enhance operating efficiency, safety, and appearance. These tips will help you in planning your station wiring before you start putting it together.

Preplanning

Before you start to arrange your equipment, give some thought to planning your station wiring. Make some diagrams on how you intend to run cables and electrical wiring between your service outlets and your equipment. This preplanning will help when you decide to rebuild or add equipment; you'll save time and won't have to try to remember the original wiring layout. Wiring for even a simple station can become complex if you add a few accessories, a second or third antenna, an additional receiver, or whatever.

Keeping track of your station wiring will help if you have to move and will save time and effort when you reinstall your equipment.

Identify the termination of each cable and wire as you install it. You can do this with a Dymo Label, or you can use colored tape and keep a list of connections. Another hint: if you plan on doing a lot of experimentation with different types of gear, think about using barrier strips (insulated terminal blocks with machine-screw fasteners) mounted on the back of your desk or table. You can run all accessory cabling through the barrier strips for ease in exchanging equipment. Be sure to use *new* cable. Don't use surplus wires and cables; use only new materials for this essential part of your station.

Grouping equipment and cables

If you plan your layout so that related equipment is located close together, it's simple to keep your wiring short. For the sake of appearance, safety, and efficient performance interconnecting cables should be *grouped* according to function. They should be laced or bound together with plastic cable ties.

Although cables may be bypassed and shielded, simply running them all together is not a good idea. Why? Because doing so may introduce hum in low-level audio lines or rf in the power lines. Keep the groups apart. Coax cable should be separated from other cables and ac lines. Open-wire or TV twin lead *must* be run separately from all other cables and routed through standoff insulators, both indoors and out.

Power wiring

If it's available, and especially if you're running a high-power linear amplifier, you should have 220-volt primary power in the shack. One way to get it is to "piggyback" onto 220-volt appliance wiring if your shack is located, say, in the basement. Another way is to run a separate 220-volt line directly to your shack and/or workshop, terminating it in a separate switch-box and/or circuit-breaker panel. Be sure you know which are the 220-volt outlets! This is not

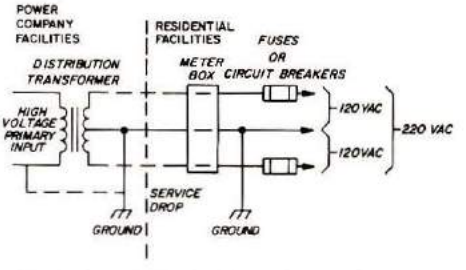


Fig. 4. Simplified schematic of a typical 220-Vac power installation for homes. Note that on the home side of the system one of the three power conductors is grounded, usually at the service entrance. The remaining three conductors carry 120 Vac to ground (center conductor), or a total of 240 volts. Branch circuits for 120-volt service are connected through the fusebox or circuit breakers to either one of the two 120-volt conductors to ground.

normally a problem in newer homes, as the 220-volt lines all use oversize 3-wire outlets and are easy to identify. Some older homes, however, use ordinary outlet boxes for the 220-volt service. In any event, be sure to use wires that will handle *more* than the maximum current you intend to use.

The low- and medium-power station usually can get by without 220-volt service, but if you're running a good deal of power or have a lot of auxiliary equipment, consider installing a 220-volt line — not only in the interest of safety, but for better voltage regulation and less "light blinking" when you depress that key at 1 kW input! Even if you don't need 220 volts in the shack, run a separate 110-volt ac line to the console so you don't end up with many ac cables, all vying for a few available wall outlets.

Preferably, all equipment should be connected to this ac line and should be controlled by a single, fused switch (hence the term "pulling the big switch"). Accessories that need power at all times, such as clocks and memory keyers, should be connected separately to wall outlets or ahead of the main switch. If you run your own power lines, whether 110 or 220 volts, be sure you know what you're doing and that you comply with local electrical codes. Alternatively, you can have the work done by a professional electrician. A simplified diagram of a typical home-power service is shown in **Fig. 4.**

The United Nations amateur radio station, K2UN, features a highly functional equipment arrangement. Completely furnished by Yaesu Electronics, the console includes dual high-frequency transceivers and a separate 2-meter station. All equipment can be reached by the operator from a single operating position (*photo courtesy Yaesu Electronics*).

Fusing

One other point on wiring: A hazard in every station is the possibility of fire through component failure. If a failure is complete, the main house fuses or circuit breakers will normally go but possibly not soon enough to prevent a fire from starting or for damage to result to your equipment. Separate circuit breakers *in your station* will help prevent these possibilities from occurring, but you should also ensure that each piece of gear connected to the ac lines is *individually fused.*

Extension cords

Be careful about using ordinary household extension cords. They're designed for low-current use, and you might push them beyond their limits if you try to use them to carry power to your equipment. Most ordinary extension cords are designed to handle no more than 5 or 6 amperes. If you need extra outlets, install heavy-duty, fused, multiple-outlet boxes mounted to the rear of your desk or table. If you must use extension cords, use the shortest ones that will do the job for you. Don't over load the cords with high-current equipment, as the cords can easily overheat and cause a fire. Remember — these cords are for *temporary* use and shouldn't be permanently stapled or taped in place.

Now consider the popular three-wire cords. Many appliances and heavy-duty radio equipment today are equipped with these three-wire power cords. The purpose of the third conductor is to provide a foolproof means of grounding the device, regardless of whether its cabinet or frame is separately grounded. Use of this type of power cord is highly recommended. Why? It prevents the potentially tragic consequences of a cabinet or handle of some appliance becoming electrically "hot" due to some internal electrical fault, with the risk of someone accidentally coming into contact with the hot circuit and receiving a severe or even fatal electrical shock. Many pieces of gear don't come with these cords.

However, consider replacing your old two-wire cords with those having the three conductors terminated in a grounding connection. Doing so will ensure that the metal cabinet or case of your equipment is safely grounded whenever the ac line is inserted into the wall outlet. (Still, it's good practice to bond the major items of station equipment together, as mentioned earlier in this article).

Be sure to check your power-supply arrangements for the

A grounded conductor is a safe conductor. Your antenna is best grounded when not in use, for lightning protection of your home and your equipment. A coaxial switch such as this Barker and Williamson Model 590G grounds all but the antenna actually in use. It's available from B&W dealers, or G. R. Whitehouse, 15 Newbury Drive, Amherst, New Hampshire 03031 (*photo courtesy B&W*).

accessories in your shack. Do any supplies represent a potential shock hazard? Most supplies are safe, but you may have some of the older ac-dc (or transformerless) supplies, in which the high-voltage supply negative side is connected to one side of the ac line. This is a definite "no-no" insofar as safety is concerned! If you use this type of power supply in any of your equipment, a) completely enclose the supply or isolate the equipment chassis from the cabinet to prevent accidental shock, or b) use a 110-Volt isolation transformer to isolate the unit with respect to the 110-volt ac line. Fortunately, this type of power supply is on the way out, but it's a good idea to check out for safety any small ac-powered accessories you may purchase.

Fig. 5 gives some suggestions on constructing a multiple power distribution panel for the console, while **Fig. 6** compares the relative merits of the various ways of connecting power cords to your equipment.

Transmit-receive switching

One of the oddities of ham radio is that operators of low-power stations frequently must flip several switches to go from transmit to receive, while the more complex high-power stations are usually controlled by a single switch. T/R (transmit/receive) switching and control wiring were real problems when hams home-brewed their transmitters and had trouble making the control circuitry match up with their store-bought receiver. Most amateurs now purchase their major items of equipment, so T/R switching is less of a problem today — although its implications for the hobby are not necessarily good.

Most manufacturers include complete rf, audio, and control switching capabilities within their equipment. They also provide extra sets of switching or relay contacts to allow you to switch other accessories you may have, and they usually give complete instructions in their service manuals for interconnecting wiring.

The problems appear when you add linear amplifiers, auxiliary receivers, antenna couplers, phone patches, and other equipment that may have to be switched when going from transmit to receive. There's no pat answer as to how to best wire up all these accessories (although the *ARRL Handbook* has some good guidance on control circuitry).

Probably the best approach when confronted with T/R and control wiring problems is to lay out the switching arrangements for each piece of gear on a piece of paper and try to plan the whole thing as an integrated system, rather than try to work at the interconnections in piecemeal fashion. You may find, in doing this, that you'll need to install an extra relay for all the switching, but so be it!

For CW work you'll find that most equipment has provisions for using a built-in CW audio sidetone to activate the VOX (voice-operated-transmit) circuitry in the transmitter or transceiver. When operating in the CW mode, actuating the key shifts the station to transmit. If you want to go

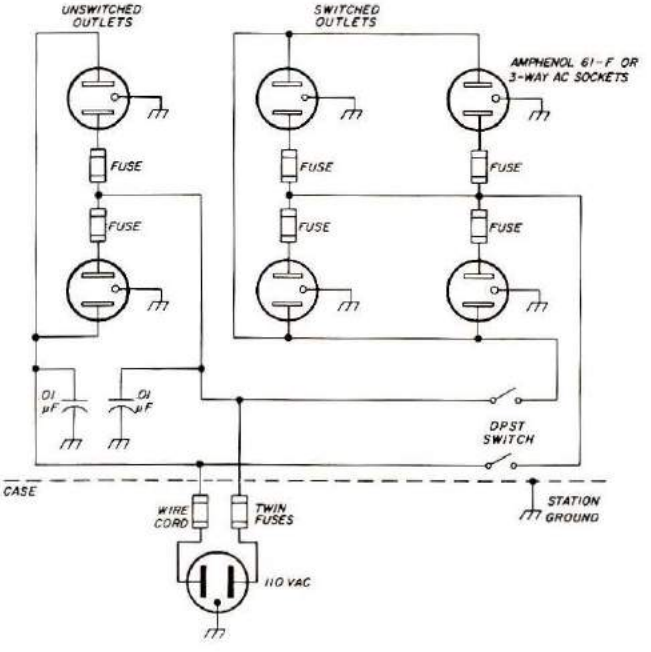


Fig. 5. A multiple-power distribution center showing how to distribute ac power for a medium-power amateur station. Any such distribution center should have fused outlets for clocks and other accessories that must have power applied at all times. The distribution center should also have an adequate number of switched and fused outlets for your station equipment.

manually from transmit to receive, you can either use the microphone PTT switch or use a foot switch (which I prefer). In any case — regardless of how many accessories you have on-line that must be switched — make sure that all are wired to be switched *automatically*. You should not have to throw more than one switch when going from transmit to receive, or vice-versa.

Antenna switching

Rf switching is usually no big problem unless you use more than one antenna and transceiver, transmitter, or receiver combination. Most stations will eventually grow to the point where several antennas will be in use, with an auxiliary receiver also being used in addition to the main receiver or transceiver. If you use coax, it's a fairly simple matter to switch rf from antenna-to-antenna, or to dummy load, or from transmitter to transceiver, or to auxiliary receiver. Multiple-position coax switches can be connected back-to-back to allow any of the antennas to be used with any item of equipment, as shown in **Fig. 7**.

For safety sake, it's best to use the type of coax switch that *automatically grounds all antenna circuits* except the one in use.

Some final thoughts on wiring: Label all your low- and high-power wiring, switches, and antenna leads with the viewpoint of a visiting ham trying to operate the station with but the simplest of instructions. Could he do it?

Furnishings

Besides the main factors of room layout and equipment arrangement, there are some smaller details that should be considered for that finishing touch.

Lighting. Probably the most desirable light sources are either ceiling-mounted pull-down lighting assemblies (which eliminate ac line cords from getting in the way) or flexible-type lamps on booms, which can be mounted at the rear of the console and swung out as needed. Fluorescent lamps give good illumination and are a great deal more efficient than incandescents — though be prepared to spend some time filtering out the rf hash most of them generate. High-intensity lamps are good for spot detail work, such as writing in the log or QSLing. Recessed ceiling fixtures should not be relied upon to give adequate illumination. Of course, lights should be independent of any master switch and may best be controlled by the on-off switch near the door. Light dimmers are effective for late-night work but, like fluorescent fixtures, they put out a lot of rf noise.

Twenty-four-hour clocks displaying Coordinated Universal Time are a great convenience for ham operating. Shown is an analog instrument that gives local time around the world.

Recording. Have a tape recorder available in the shack — it will be handy for recording unusual contacts and possibly in documenting your DX claims! Practically any recorder will do as long as it doesn't have excessive wow and flutter. Frequency response is not a factor as the recorder will be used only for communications work. You may have to debug it for radio-frequency interference (RFI), however, especially if you're running high power. You can easily tap off audio from the receiver or transceiver using a Y adapter at the speaker output jack if you want to run audio directly to the recorder input. I use a very small, highly portable (and inexpensive) cassette recorder, of the type that has a built-in capacitance microphone. This allows me to catch both sides of QSOs without intricate

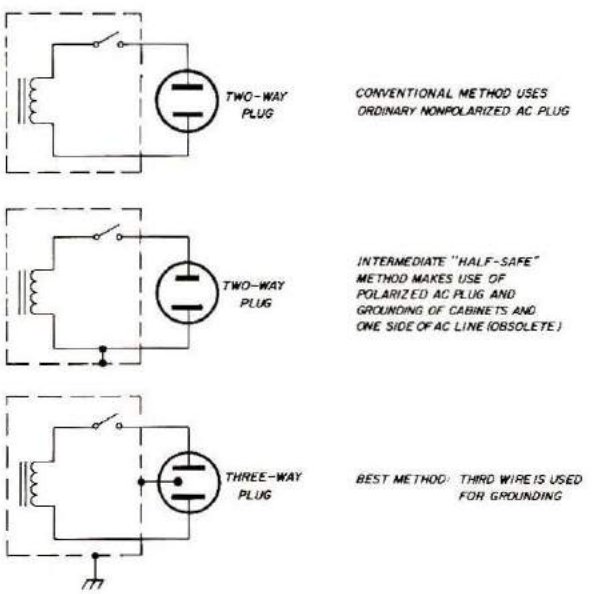


Fig. 6. Methods of connecting power cords to electrical equipment. This illustration shows the safety merits of using two- and three-wire ac cords. In **A** the conventional two-wire, nonpolarized 2-way plug is used. Either side of the ac line is connected to equipment without regard to polarity. No provision exists for grounding cabinets or chassis. **B** shows the use of a "polarized" plug, which allows the grounded side of the ac line to be connected to equipment cases and cabinets. This advantage is offset by the danger that wiring errors will make cabinets *hot* with respect to ac. The 3-way plug wiring in **C** is rapidly replacing the other two arrangements and is safest by far. Metal cases and cabinets are automatically grounded whenever the ac cord is inserted into the wall socket. Which arrangement are you using for your ac connections?

interconnections to the station equipment. I find the audio quality entirely acceptable.

Clocks. No shack is complete without clocks — at least two, one on local time and the other on Coordinated Universal Time (formerly known as Greenwich Mean Time). The choice of a digital or conventional display is up to you — digitals are certainly easier to read at a glance but are subject to RFI, which may cause the clock to dump (change its reading) whenever you go on the air. Most will also dump during momentary power failures. The accuracy of digital clocks, however, is outstanding and they can be precisely set using either a 12 or 24-hour format. If purchased as a kit, the digital clock makes an excellent construction project, though not a *first* project (integrated-circuit construction techniques are a bit tricky the first time out). A recent innovation is the dual digital clock, which is actually two electronic digital clocks mounted side-by-side in the same enclosure and powered by a common power supply. This allows one clock to be set to local time and the other to be set to Coordinated Universal Time; or you can have a 12-hour format on one clock and a 24-hour format on the other.* The same firm also offers a combination digital clock and frequency counter in one cabinet.

If you prefer the conventional time display, consider a fancy timepiece such as Yaesu's QTR-24 world time clock, which automatically shows at a glance the time in any principal city or time zone. Although it runs on a small battery, it keeps excellent time. Whichever type you prefer, locate the clock in a prominent place where you don't have to turn your head to look at it.

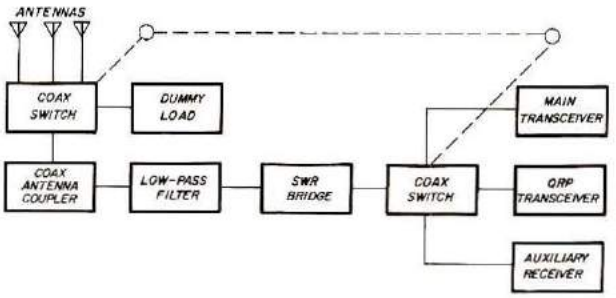


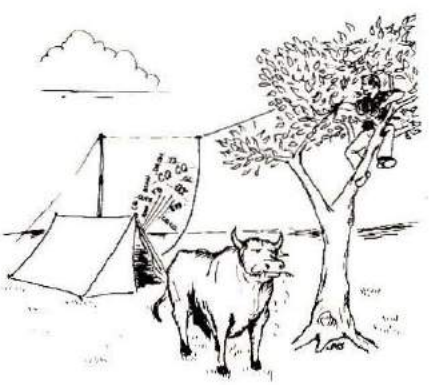
Fig. 7. Suggested rf switching arrangement. Multiple antennas and a dummy load may be connected to a variety of equipment. The common feedline between the two coax switches is a logical point to install an SWR bridge or wattmeter. The lowpass filter should be connected in the line on the coupler side of the SWR bridge, because some bridges tend to generate harmonics from an otherwise TVI-free transmitter. In the interest of safety and lightning protection for your gear, use the type of coax switch that automatically grounds the unused positions. Some CB-type coax switches don't have this feature.

Technical data files. Be sure to keep a good file on all your station equipment, including the instruction manuals, records of serial numbers, sales receipts, schematics, and equipment maintenance data. Two-drawer file cabinets are fairly inexpensive and are good repositories for this kind of thing. Also in your files you should keep your current station wiring diagram and hookups, reference materials, and product information sheets you may want to save. You might also want to maintain a file of various contest rules, FCC regulations, as well as your wife's household appliance data. You'll be miles ahead with a good technical library.

Bookshelves. Allow adequate bookshelf space to keep radio textbooks you may acquire, handbooks, manuals, and back issue of ham magazines. Maintaining back issues of radio magazines is particularly important if you have the room. When you're looking for some particular circuit or product review or whatever, there's no substitute for having the reference material available at your fingertips. Many magazines sell binders or cardboard shelf-stackers in which to store them. They're good investments if you want to hold onto your magazines.

Maps and things. Maps, globes, and other appropriate decorations add a certain "class" and a finishing touch to the shack. Plasticized wall maps are expensive but are beautiful and contribute much to the looks and "cosmopolitan appearance" of the shack. Floor- or desk-mounted globes add a regal touch. On the simpler side, you may want to specially display your first QSL received, a photo showing you completing your first contact, or even a series of photos showing the forward progress of your shack over a period of time. A little ingenuity and imagination will go a long way in dressing up the old radio room.

HRH



*Such a kit is sold by Aldelco Electronics, 2281 Babylon Turnpike, Merrick, New York 11566.

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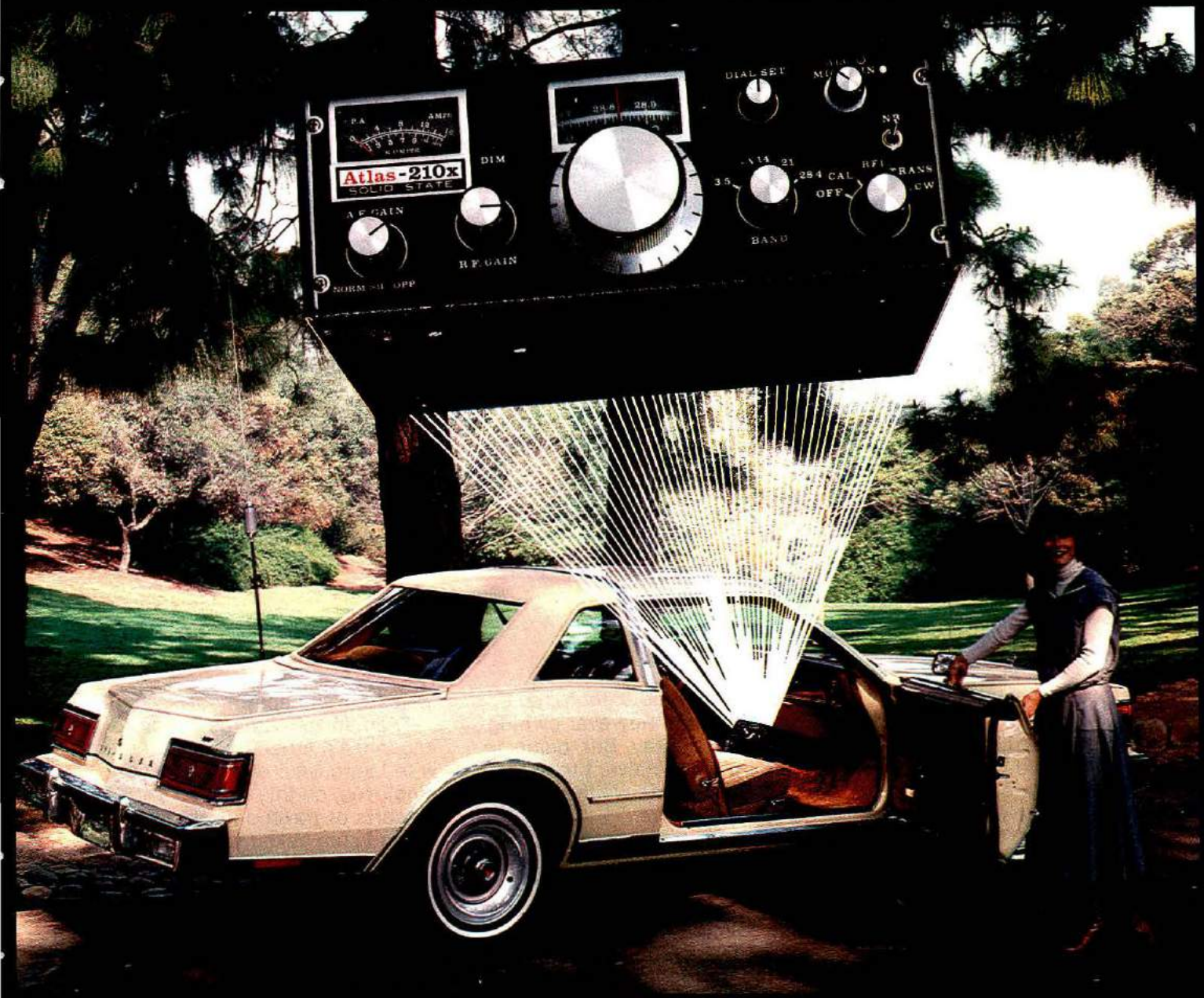

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BY BEN LOWE, K4QF/K4VOW

It has been said that sometimes we wouldn't proceed down a given road of life if we knew what awaited along the way. This, of course, works both ways — some of these roads offer rewards that aren't at all obvious when we begin the trip. Such has been the case during my journey on the path of amateur radio.

My path started on a cold winter day in 1957 when I rode my bike out to the station of W4BXP to take my novice exam. It was not an auspicious start, because my mother had already explained that "electricity" was too dangerous as a hobby. Furthermore, the high cost of radio equipment would prohibit my ever owning a station anyway. But, being 14 years old and naive, I took the test anyway and waited for the license to arrive.

As time progressed I concentrated primarily on 40-meter CW (low power) and 6-meter phone; neither of which easily lends itself to working much DX. Even these efforts were interrupted for a period of time by school, from which I emerged to live in an apartment with antenna restrictions. By 1970 my ham-radio career had been somewhat non-spectacular, and the primary mode of operation was 2-meter FM, mobile only, with minor efforts on 75 meters and 432 MHz from the apartment.

Then, in 1971 things began to happen! I married my loving wife Laura, who was an airline employee, so this opened up all sorts of travel opportunities. When Laura asked where in the world I first wanted to go, in the spirit of all adventuresome young men I answered, "Australia." Chance would have it that one of the hams I knew at work was in hot pursuit of his "Captain Cook's" award, to be issued after he worked some 50 Australian amateurs during a one year period. One of the stations whom he regularly contacted was Ray, VK3ATN, of 2-meter moonbounce fame with his stacked rhombics and 150 watts. When Ray learned I was

coming to Australia, he proceeded to arrange an itinerary for my trip even though I insisted I didn't want to impose upon anyone.

Down-Under hospitality

The trip turned out to be fantastic. When we got off the plane in Sydney on Sunday morning, we were greeted by Frank, VK2ADE, and Noel, VK2ZNS. They escorted us to the hotel to allow us a few hours rest from the long trip. Later that afternoon they returned with Olga, Frank's wife, and we proceeded with a guided tour of Sydney. We enjoyed the tour very much, and Laura quickly learned that hams all over the world are "just alike." On the following day we continued the tour, and Frank suggested that we move to the Kuala Motor Hotel since buses left directly from there for the domestic terminal at the airport. The value of having local contacts in a country was rapidly coming into focus. We offered our farewell to Frank and Olga, and told them we would see them again when we came back through Sydney.

Ray, VK3ATN, had proposed a trip schedule from then on that we never would have dreamed of making ourselves. We departed Sydney for Griffith on Ansette Airlines. Griffith is some 480 km (300 mi) west of Sydney, between the Murrumbidgee and Lachlan rivers. There we were greeted by Frank O'Donnel (VK2QC) and his wife. They met us to ensure that we could get our connecting charter flight without any problems. This next flight took us southwest over a relatively unpopulated area to Swanhill, Victoria. I had learned to fly in a part of Texas which resembled this area, so the scarcity of signs of inhabitants on the ground while flying in a single-engine plane didn't disturb me too much, although Laura seemed a little dubious of the whole affair. After landing at a small airport just outside of Swanhill the charter flight took off and left us standing there. No one was in sight, the one small building was locked, and there was no telephone. All I knew was that Ray was supposed to be there — but he wasn't. Since we were 16,000 km (10,000 miles) from home, with the temperature at 35° C (95° F), I felt that I should say something encouraging to Laura, so I told her, "I sure hope this ham radio fellowship works like I read in the magazine." You can imagine the look I got!

About that time Ray, with his wife and family, drove up and the situation immediately improved. We spent several days in Birchip with Ray and his family, and really had a ball at the parties and other get-togethers. Most of all we enjoyed meeting and talking with all the people. Later, along with Ray's father, we drove down to Balarat where we visited with John, VK3HW, and his wife. We had an enjoyable lunch and then proceeded to tour the town to see some other amateur-radio installations. Of course John's station looked most impressive; he had a full-size, 3-element, 40-meter beam, but it was so high that I thought it was a 20-meter monobander. Then he told me how most of the Australian hams home brew their own towers. Now that was impressive!

From Balarat we drove on to Melbourne, caught a flight to Sydney, and left for home the next day.

Puerto Rican VHF

Our next overseas trip, in May 1972, involving ham radio started in Sioux Falls, South Dakota, where I attended the Central States VHF/UHF Conference and met Sam Harris, KP4DJN, (Ex W1FZJ). Sam had been very instrumental in the first amateur moonbounce contacts and had eventually migrated to Arecibo, Puerto Rico to work at the 300-meter (1000-foot) diameter dish located at the observatory. During his talk at the conference he suggested that he'd be glad to give any visitors a guided tour of the installation. We had been to Puerto Rico a few times, so I wasted no time in telling Sam I'd like to visit the dish during our next trip. Later, after corresponding by mail, his wife Helen, (W1HOY/KP4) offered to let us sleep at their house during the visit. The only catch was — the house wasn't finished! We got the waterbed in the future garage, which was okay because none of the rest of the house had doors or windows yet. Of course, we were

"The Tasman sea meets the rugged coast of North Island, New Zealand, north of Wellington. I couldn't help thinking of the propagation possibilities across the water toward Australia."

The rugged alpine passes make working through vhf repeaters a great gamble. This is Arlbergpass, Austria, near Liechtenstein.

well protected by the two dogs — Moon and Bounce — and the weather was always perfect. In addition to a tour I received free lessons on how to work moonbounce from one of the masters.

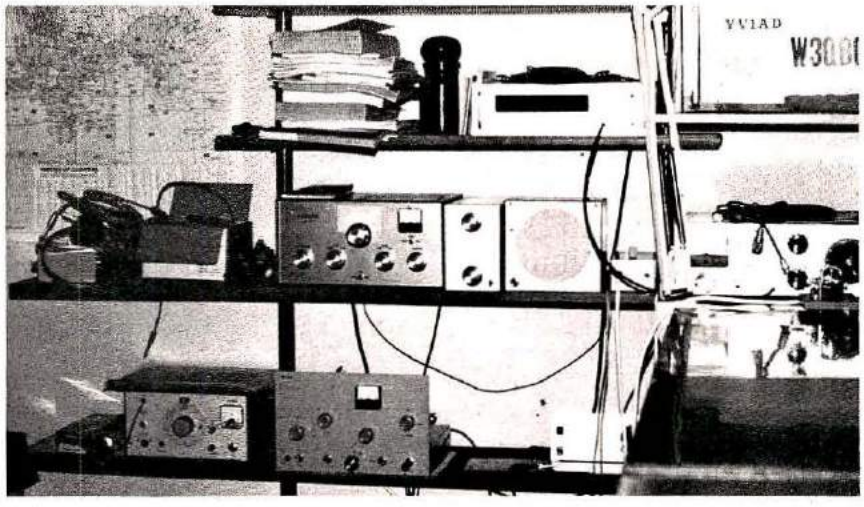
Around the globe

A year and a half later (October 1973), we took an around-the-world trip with no preplanned ham-radio contacts. Our travels took us through Europe to India, on to Bangkok, Hong Kong, Taiwan, and then home via Sydney, Australia. While there (for only one night) we telephoned Frank, VK2ADE, and arranged to meet him and Olga for dinner. By that time I had been out of contact with amateur radio for a solid month. I know Frank must have wondered why I was so anxious to operate his rig and read his *QST*.

When Laura and I arrived home there was a letter waiting for me from Hans, HB9AQZ. He had a few questions about one of my electronic designs, and I had a lot of questions about Switzerland and 2-meter fm operation there. I thought that on our next trip I'd try to obtain a reciprocal license if 2-meter fm operation were feasible. My TR-22C was convenient to transport on such a trip, and the Swiss and German authorities were very gracious in granting me reciprocal licenses; Hans supplied the necessary repeater information. When my wife and I finally arrived in Geneva, in October 1974, I was set to go. We rented a car and headed around the Lake of Geneva. I could hear the Schilthorn Repeater on the magnetic-mount antenna, but not very well. Signals picked up considerably as soon as we came out of the tunnel from Coppenstein on the northern side of the mountain; we were practically under the repeater! However, there did seem to be a problem in making contacts, even though I was able to key the repeater. What I was hearing sounded to me like a fantastic 20-meter band opening. F, I, DL, DB, and HB9 stations were all rolling in. A few days later I learned about the problem in making contacts while we were visiting Max, HB9IN, and Edi, HB9MGL. A severe winter storm had knocked out the repeater receive-crystal oven, so the receiver had drifted off frequency. Many of the Europeans had VFOs, so it was no problem for them to shift input frequencies to match the repeater receiver. Along with the repeater crystal, I had installed a simplex transmit crystal in my rig, so I managed to make contacts with a few hams, including Max and Edi. In addition, I was receiving a fine education on repeater operation outside the United States. Much to my surprise, many stations had never contacted a W or K before; I thought we were a dime a dozen!

After a brief visit with Liz, the wife of HB9AQZ (Hans was away on business), we continued on our way through the Black Forest and on to Bavaria. Since I only had the Schilthorn frequency (145.1 MHz transmit, 145.7 MHz receive), I didn't work or hear any other stations until I got

An interesting part of our visit with Hans, HB9AQZ, was the chance to see his station, which consisted of all homebuilt equipment.



back within range of that repeater a few days later. How I wished the fellows back home could have heard my CQs from Liechtenstein.

At this point I'd like to pass along a few tips I picked up along the way. While some stations spoke English, many others did not. In this situation it is very advantageous to learn a few words in the native language of the country being visited. Phrases most often used are: "My name is . . .," "My QTH is . . .," and "73 and thanks for the QSO." The international Q-signals and phonetics work wonders, but you must realize that letters are pronounced differently in other languages (for example, QTH in German is pronounced Que-Tay-Hah). These pointers will help you contact the stations with "Limited License" in foreign countries. This is a vhf license similar to our Technician license, but without high-frequency privileges and without 6 meters. These fellows aren't exposed to the barrage of English used on the high-frequency bands.

One other thing I discovered is that 145.5 MHz is the international simplex frequency in Europe, much like we use 146.52 in the United States. (The two-meter band in Europe is from 144-146 MHz.) This is a very handy frequency for Europeans, and I think we should strive to populate it here in the United States and the rest of the world. This practice would certainly enhance the capability of making contacts for those who travel to other countries. It should go without saying, of course, that is is imperative to obtain a reciprocal license for each country in which you plan to operate. Sometimes this may take 3 or 4 months, but with the WARC-79 conferences approaching, amateurs throughout the world can't afford any black marks against their fraternity.

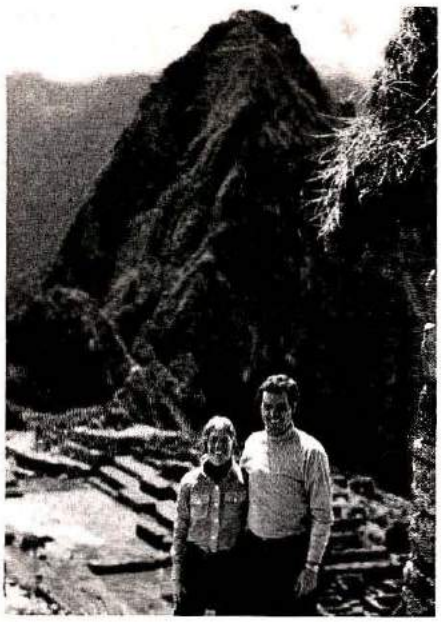
South of the border

Our next adventure, in April and May of 1975, carried us to visit our neighbors to the south, and a cousin had recommended Peru as one of the interesting countries there. With our limited time we decided this was our direction of travel. A few weeks before the trip, I was on 20 meters one night looking for some of my Australian friends when I ran across OA4AFS, Pancho, in Lima. When I told him we would be traveling through there in a few weeks he suggested we try to get together. I asked him about 2-meter, fm, and uhf operation there and wanted to find out more about the local activity. Pancho felt that vhf operation around Lima was practically nonexistent. We did exchange letters and QSL cards, and arranged for me to telephone him upon arrival in Lima. On the Sunday afternoon of our arrival we completed this call and set a date for dinner on Wednesday. Early Monday we headed for Cuzco and Machu Picchu to explore these ancient cities. Wednesday finally came, and we met with Pancho and his family. Here I discovered that Pancho's daughter, Maria Rosa, OA4TU, was married to an American who was attending school in Nashville. (Chuck, Maria Rosa's husband, has since completed his school work and moved to St. Louis. Maria Rosa operates from there as OA4AQF/W0, and Chuck is studying for an amateur-radio license.) Pancho and his family were able to explain many Peruvian customs and facts; no one can describe a country as well as the natives, and Pancho and his family are excellent ambassadors.

My wife and I enjoyed a roadside picnic stop in New Zealand. There's a two-meter whip on the roof of the rented car, allowing us to work through some of the repeaters along the way. The right-hand steering wheel in the car took some getting used to.

A few months later (September and October 1975) we were off again to Europe. Once again I was set and ready to work through the Schilthorn Repeater on 2-meter fm. After a number of contacts while mobiling, and a brief visit with Hans, HB9AQZ, and family, we were out of range and back into Bavaria. This time we were headed for Vienna through Munich. Southeast of Munich in Germany and just before we got to Salzsburg, Austria, the activity began to pick up again on the 145.1-145.7 channel. I worked several stations here, although I never did determine exactly where the repeater was located.

On the way back to Geneva for our departure, we stopped to visit 4U1ITU (the amateur station at International Telecommunications Union headquarters). There we visited the station, under the guidance



Laura and I visited Machu Picchu, the lost city of the Incas, in Peru before we met Pancho, OA4TU, and his family in Lima.

of Ted Robinson, and later met Ray Stevens, G2BVN. I sure wished I'd had the crystals necessary to work 4U1ITU on 2-meter fm! That would have been quite a QSL card to add to my collection.

It would be very difficult to say which country is best to visit and which is most beautiful. But one of the more beautiful areas of the world has to be New Zealand. Our journey there, in February 1976, began in Auckland with a chance meeting with Harry Marsh, ZL1AFX. Harry was working at an electrical supply shop where we were trying to buy an adapter for the transformer used for charging my TR-22C batteries. He fixed us up with the adapter, and, in addition, placed a phone call to the Radio Inspector's Office to check on my request for the reciprocal license. Within 3 hours we were picking up the license with the call of ZL1AQC. (This was preceded by 3 months of letter writing.)

The 2-meter band plan there is different from both America and Europe. I did observe that Channel E in New Zealand had the same output frequency as the Schilthorn Repeater (145.7 MHz) and the same input frequency as Decatur, Alabama (146.40 MHz). After a quick switch of crystals, I was ready to go on the Bay of Plenty Repeater at Whakatane. Through the repeater there I worked several stations and ended up at John's (ZL1AOF) house for dinner. Carl, ZL1TGW, came by to visit and we spent a most enjoyable evening talking mostly about ham radio and politics in various countries. As we continued on our way the next morning, David and Jill, ZL1ACN and ZL1TSA, directed us (via 2-meter fm) to their house for morning tea. There we had another nice ragchew and visit.

A couple of days later we stopped in Wellington to visit Tom Clarkston, ZL2AZ and his wife. Tom is one of those long-time hams who can hold his listener spellbound for hours talking about the QSO's he's had, the places he's been, and the changes he's seen in our hobby throughout the years. He also told us we had arrived there the first day of the new season's oyster catch. What a stroke of luck!

After eating our fill we headed up the western side of the North Island. Although I didn't make any contacts in this area, I'd have to recommend this route to anyone. Just north of Wellington the view looking west across the Tasman Sea is one of the most beautiful anywhere. The sea is aqua in color with the waves breaking on black rocks. I could just imagine how well someone would get out over that path on 432-MHz, beaming toward Australia.

The following day we continued north on our way to Auckland. Along the way there was another channel E repeater on Mt. Egmont, and I managed to make one contact here — my only ZL2 for the trip. (We never were quite within the necessary range for full quieting on that repeater.) One day later we arrived in Auckland, caught a flight to Sydney, and had another short visit with Frank, VK2ADE, and his wife, Olga. This made our third visit to Australia with Frank and Olga. Happily, our path keeps leading us back!

One final trip awaited us before our "jet-setting" days were curtailed. (I'm sure we will occasionally visit other countries, although not nearly so frequently.) Some of our German friends who had been temporarily assigned to duty here in Huntsville kept asking us to come to Cologne. While visiting these friends, I asked about a ham from Cologne I had also met in Huntsville the previous year, Dieter, DK4PZ. My friend quickly located Dieter, and we were off for another eyeball QSO. Dieter had been active on 2-meter fm in Huntsville, but was not yet on the air in Cologne.

Another who was temporarily assigned to Huntsville was Tish, I3ATE. We have never had the opportunity to visit Tish and his family in their homeland, so this is a trip we can look forward to in the future.

In conclusion I don't want to suggest, especially to you non-hams, that obtaining a ham license will guarantee world-wide travel. I do say that hams who travel overseas certainly have the edge on the non-hams as far as getting the most out of their trip. And it surely behooves those hams who visit foreign countries to get a reciprocal license, if agreements exist between the countries, and thus meet the natives of the country you are visiting. A short telephone call or note to ARRL* can get you reciprocal licensing details here in the United States. Of course this is a two-way street, so we should be watchful for hams visiting here from other countries. The resulting QSO could be one of the most rewarding you will ever make. Knowing what I know, just the fraternal aspects of ham radio would easily justify obtaining the license. **HRH**

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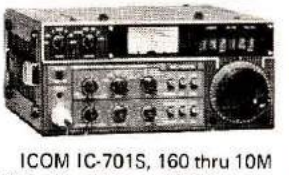

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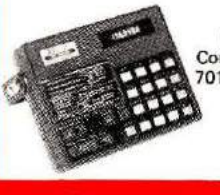

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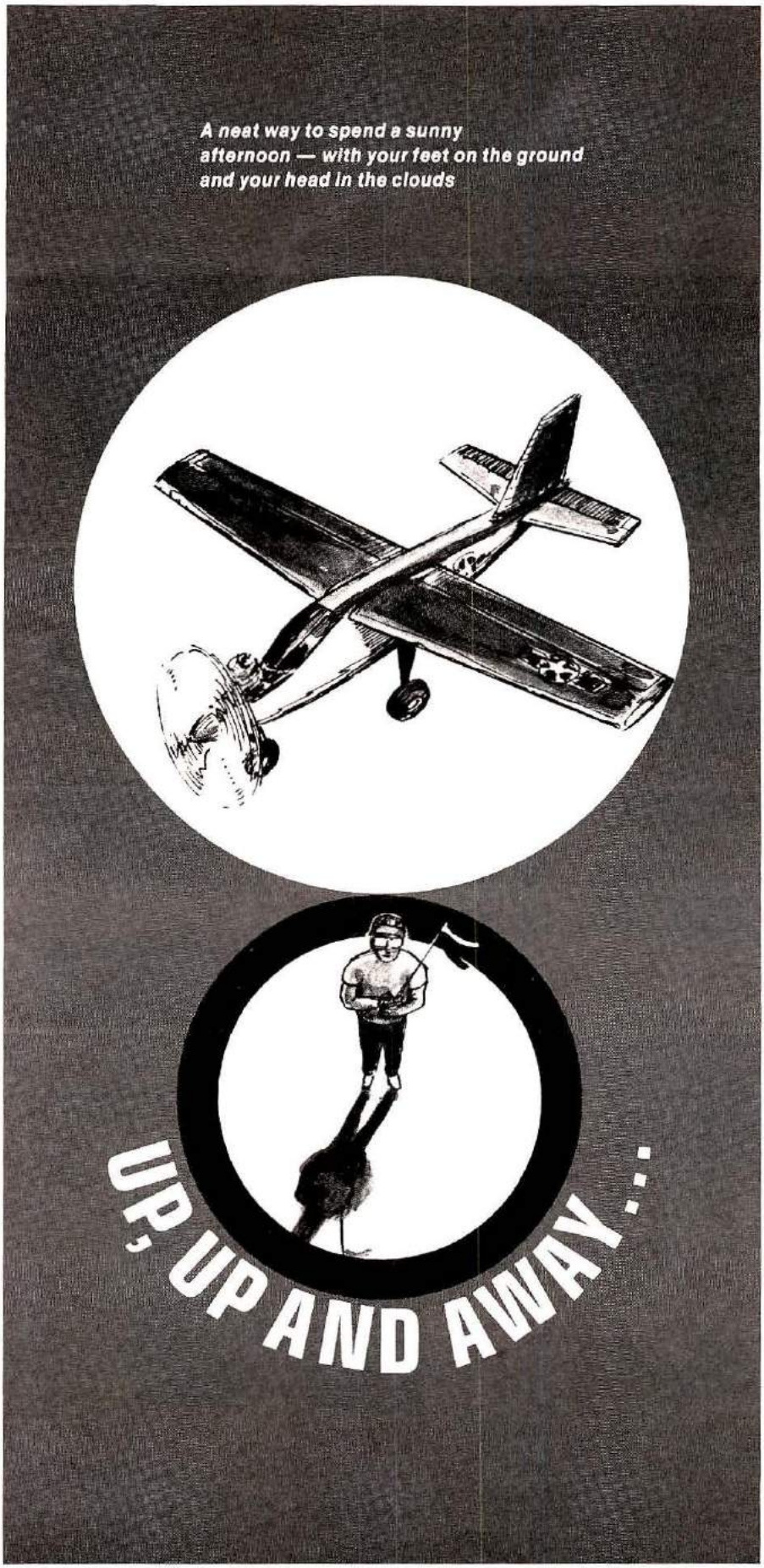


BY RON RAY, WB3BKJ

You're interested in electronics or you wouldn't be reading *Ham Radio Horizons*, right? Well, so am I — but I have an additional interest. It's one you already share with me if you're one of the hundred-thousand or so RC flyers in the United States. You've never heard of RC flying? Then you've been missing a lot of fun.

RC is the term used for radio control.[1] RC flying is the radio control of model airplanes. RC flying doesn't require an extensive knowledge of electronics. You can buy the equipment in kit form at reasonable cost and add to it as your interest expands. In this article I describe how to get started in RC flying, the licenses required (easy to obtain), and the equipment — where to obtain it and how to use it.

I find RC a fantastic sport. It combines my interests in radio and the fun of getting my head into the clouds, so to speak. It's difficult to describe the pleasure and excitement of RC flying. Try to imagine how it feels to catch a thermal (updraft of warm air) and fly a model sailplane by controlling it with a little box held in your hand. If you've never tried flying RC perhaps you should.

About the only prerequisite is a desire to try. RC flying is available to everyone, and the FCC issues free Class C licenses to anyone over 11 years old. Of course this license is only valid for certain frequencies and isn't valid on frequencies used for ham RC activities. However, with RC flying you never fly with more than a *single operator* on any one frequency. The consequence of more than one operator trying to fly on the same frequency is that, at least, one model will crash.

All right, so you're interested — great! You'll need the following to start operating: a license, the RC equipment, a model plane, and some place

Table 1. Frequencies in MHz, transmitter and receiver antenna-flag colors, and licenses required for radio-control operation of model aircraft.

Class C	Amateur Only	Class C
26.995 Brown	53.100 Black/Brown	72.080* White/Brown
27.045 Red	53.200 Black/Red	72.160 White/Blue
27.095 Orange	53.300 Black/Orange	72.240* White/Red
27.145 Yellow	53.400 Black/Yellow	72.320 White/Violet
27.195 Green	53.500 Black/Green	72.400* White/Orange
		72.960 White/Yellow
		75.640* White/Green

*Reserved for model aircraft only — observe this FCC ruling strictly.

to fly it. You can get a taste of RC flying, however, even before you receive that license from the FCC, which usually takes a long time (more about that later).

If you have a ham ticket (Technician class or higher) you can operate above 51 MHz with your RC gear as long as your transmitter doesn't exceed one watt output. Certain frequencies are used by ham RC operators (**Table 1**). You're not required to log, identify, or to give notice of remote operations. Additionally, you're not restricted to plain language as in normal communications. The relevant parts of the rules are found in the FCC regulations, *Part 97* (paragraphs 97.89-b, 97.93, and 97.99-a through d). It's well to become familiar with these rules before you begin your RC project.

Even with your ham ticket you'd be wise to obtain a Class-C Radio-Control Service license. The license is free and allows frequency privileges on 4 meters and 11 meters. If you don't have an amateur radio operator's license you must obtain a Class-C license to operate your RC gear. To obtain the license you must be at least 12 years old and submit an application to the FCC. The application form is the same as that for Class D (CB) licenses. The proper document is FCC Form 505, which can be obtained where CB sets are sold. I suggest that you use red ink when you check "item 13" for "Class-C Station License." (The FCC has been known to send Class-D licenses to those requesting Class C.) The form should be sent to the FCC, Gettysburg, Pennsylvania 17325. Remember that the Class D (CB) license is *not valid* for radio-control operation, so get that Class C; or use your ham ticket if you're flying on the ham frequencies.

RC equipment

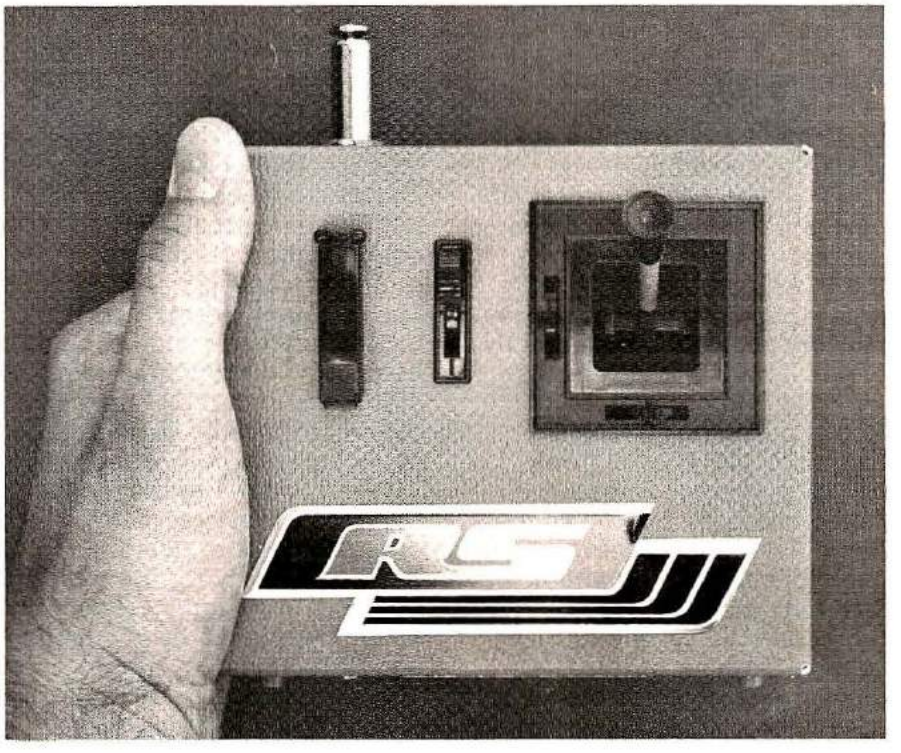
Many brands of RC equipment are available. Most will serve your RC needs reasonably well. When you're flying your plane, certain factors relating to your equipment should be of concern.

You'll want equipment built with good-quality materials. Quality materials will last longer, and fewer system failures will occur. When you do crash (and everyone does), have your equipment checked over.

Select a brand that offers speedy and reliable repair services. Occasions will occur when your plane gets further away from you than is desirable. The power output of your transmitter, combined with your receiver's sensitivity, determine how far you can control your aircraft. Make sure you'll have enough range not only to get your sailplane into a cloud but also to bring it back down, with you still in control.

Control system: The electromechanical device that moves the plane's control surfaces is called a *servo*. If the servo is performing smoothly and has enough power, you know that proper commands can produce good performance from your plane. However, if the servo doesn't

The small size of the three-channel RC transmitter is shown in this photo of an RS-3-SO controller (available from RS Systems, 5301 Holland Drive, Beltsville, Maryland 20705). A three-channel set provides controls for the Standard and Modified Standard-Class sailplane models.



The *Windfree*, by Mark Models, 220 North Tulip St., Escondido, California 92052, is one of the better sailplanes available to the radio-control enthusiast.

have what it takes then there's not much the rest of the system can do to correct it.

For every function you want to control, you need one *channel*. With a two-channel set you can control the rudder and elevator only. You want enough channels to cover your control functions, but additional channels cost more. Three channels will cover nearly anything in sailplanes, while five or six channels will cover nearly any normal flying you can think of.

Power supply: The control system will be operating on batteries. If the batteries are weak the servo power and range will suffer. Dry batteries discharge so that the voltage decreases from maximum to the dead state uniformly with time. Therefore you should use new dry cells each time you fly or you'll be flying at less than the RC system's peak potential. Rechargeable ni-cad (nickel cadmium) batteries not only can be recharged to peak voltage before each trip to the flying field but also have a very desirable discharge pattern. The voltage from ni-cads remains very near the full voltage for most of the discharge. Only after the cells have been nearly discharged do they drop below 75 per cent of their full value. What you want is the "most for the longest," which is exactly what the ni-cad provides.

Choosing RC equipment: In considering the points just mentioned it's apparent that price is not the only factor to be considered when selecting RC equipment. Compare different sets, talk to others who use the sets, and check on the service availability. Then choose a set that will make you feel secure while you're flying your planes. The last thing we want is poor equipment. This potential problem, however, is much worse for the beginner. The experienced flyer can tell the difference between equipment problems and problems caused by his flying. The beginner, however, is likely to blame himself and become needlessly discouraged over difficulties that could have been corrected by having the faulty equipment repaired.

When you get to the flying field you'll discover many different types of flying (and flyers). Some fly for the thrill of the race. In *Formula One* air racing the planes fly at speeds up to 322 km/h (200 mph). That's true speed, not scale speed! The g force on these planes at the turns is about 45. Still other flyers feel that *pattern* is the only way to go. You'll see such pattern flyers practicing their Cuban-eights, eight-point rolls, and other pattern maneuvers by the hour. Others spend months and even years building the most beautiful true-scale aircraft. Some of these modelers attend to details to the point of having functional instrument panels in a 25-mm (1-inch) wide cockpit.

I believe there's no better way for the beginner to start than with nonpowered aircraft. Using a glider, either the slope soaring or sailplane, is the best way to learn RC flying. I love flying a sailplane, and there are several reasons for starting with a glider.

First, you must learn *how* to fly, not how to be an engine expert. Second, flying is an interaction between the aircraft being controlled and the forces in the air through which the aircraft moves. Learning this interaction is best done by *using the air* rather than overcoming the air by engine power. Third, while gliders have been flown at speeds far greater than 161 km/h (100 mph), normally they are flown rather slowly. Thus, in most cases, the glider will be far more forgiving of your initial slowness in mastering the art of precise control. Finally, the potential of damage to others is much less in the event that you do make a serious error while learning to handle a plane.

An important fringe benefit of learning to fly with an unpowered plane is that, when you do start flying powered craft, you'll feel at home with your plane if the engine dies in the air. After all, under this condition the plane is just an inefficient glider.

Now to the problem of where to fly. Chances are you're not the first person in your area to ask this question. I indicated earlier that you could probably get a taste of RC rather quickly. While you're waiting for the FCC to send you the license

there are certain conditions under which you can fly. But first you'll have to find another flyer. Let's consider ways you might find other flyers and a flying site.

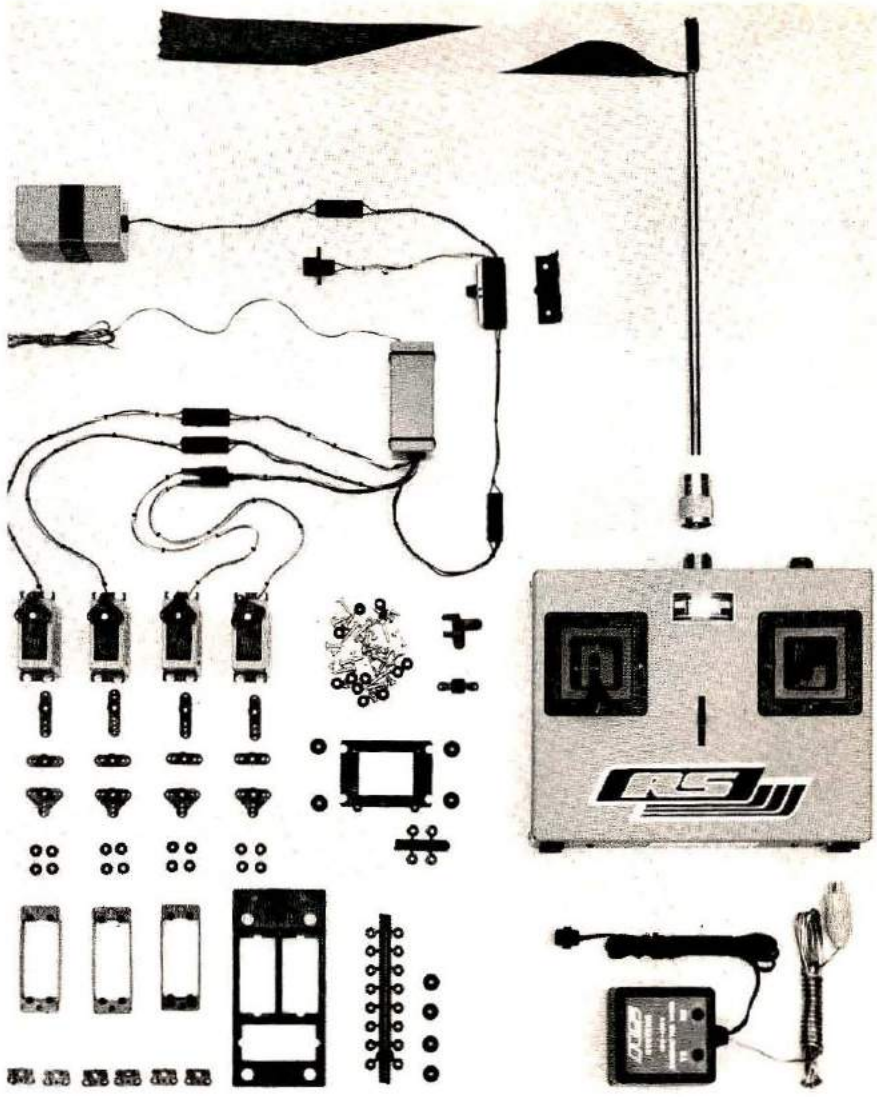
"Let your fingers do the walking" — check your Yellow Pages. Call your local hobby shop to see if they handle radio-control planes and equipment. If the answer is yes, you're well on the way to finding the flying site and the flyers. The next question is, "Where do most of the local people usually fly?" You don't have to ask when; just head out to the field on any Saturday or Sunday afternoon, unless the weather is too windy or stormy. You'll find the flyers there. Next, find out if there's a local RC club, and if so, whom you should contact about attending a meeting.

In the unlikely event you can't find a hobby shop that knows anything about RC flying in your area, write to the AMA. The AMA, or *Academy of Model Aeronautics*, 815 15th Street, N.W., Washington, D.C. 20005, had a membership of over 62,000 last year. Ask them for information. They may provide you with some local points of contact. As a matter of fact, most RC clubs require that you join the AMA for the automatic $1,000,000 flying insurance policy, which is paid for by the membership fee. Once you meet other RC enthusiasts you'll discover that most of them will bend over backwards to help you get started in flying.

Most clubs have club licenses from the FCC that will permit you to fly at the club facility if you're a member. In addition, the FCC will permit a license holder to allow you to fly his equipment under his supervision. So, you can get a taste while waiting for your own license to come in the mail.

On the technical side

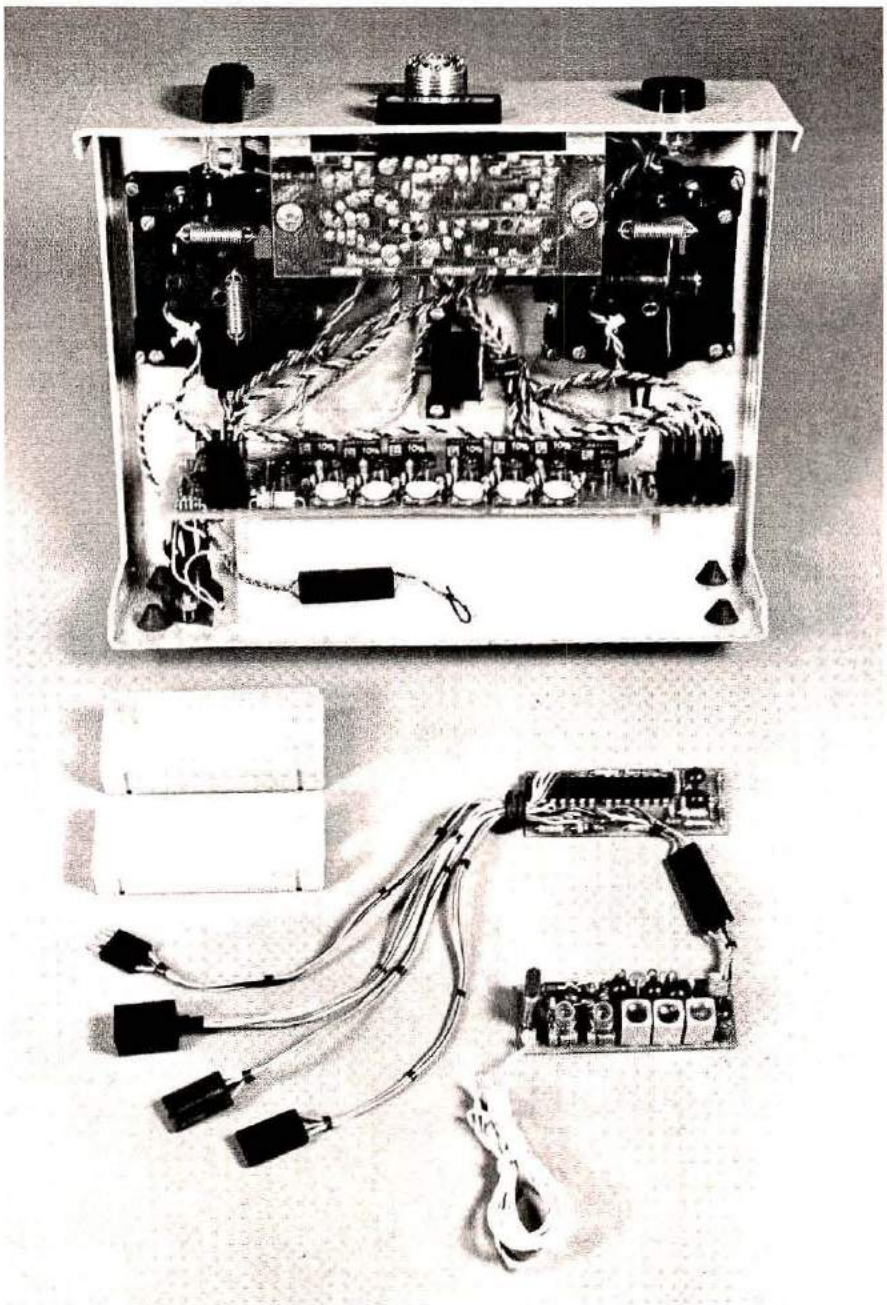
For many, the radio control equipment is simply a necessary nuisance, one which permits them to control their models. However, there are others (especially the hams) who find the gear almost as much fun as the flying.



A complete five-channel system for model radio control. The RS-5-DO by RS Systems comes with all items shown and is available for operation on any of the frequencies shown in **Table 1**.

A typical RC system: Today's radio control is considerably more advanced than the systems used several years ago. Gone are the heavy vacuum-tube systems. In their place are systems weighing a few grams (ounces) — including enough battery capacity for around two hours of flight.

A representative 5-channel system is shown in the photo. The flight battery is in the upper left of the photo and is connected through the switch harness to the airborne receiver. The receiver antenna is the length of wire at the top of the receiver. The antenna is usually unrolled and brought out to the aircraft wing or tail. The receiver is shown with four servo mechanisms plugged into it. A fifth servo could be obtained for use when needed. The total airborne part of this RC system including mounting hardware weighs 298 grams (10.5 ounces). If used as a two-channel system, the flight weight would be only 215 grams (7.8 ounces). The RS Systems transmitter in this photo is shown with the antenna collapsed and disconnected from the transmitter. It is, of course, connected and



Inside the transmitter and receiver of a typical RC system. A description is given in the text.

extended during use. The lower right of the photo shows the battery charger, which comes with such a system for recharging the ni-cad batteries used throughout the RS Systems' line of RC units.

You may be curious about the "flag" (ribbons) at the top of the transmitter antenna. The flag is called the "frequency flag" and is colored to correspond to the transmitter frequency. A list of the standard colors used on the different frequencies can be found in **Table 1**, along with other useful information relating to the RC frequencies.

How it works: The RC control systems in use today are almost exclusively of the type known as *digital proportional systems.** Don't let the name scare you. It simply means that the transmitted signal is ON or OFF (thus, "digital" in the *binary* sense of the word), and that the duration of the ON-OFF relationship is proportional to the control settings on each channel. You don't have to understand it to use it, but it's more fun if you do.

Up in the air the receiver takes the series of pulses coming from your transmitter and feeds it to the decoder, which routes the correct pulses to the individual servos. The small arms on each servo move to positions matching the location of the controls on the transmitter. Thus, when you move the control stick for any channel, the servo corresponding to that channel will move proportionately. The result is that the airplane rudder servo, for example, will move only when you tell it to move. The rudder servo is, of course, the servo that you have attached to the rudder in your plane. **Fig. 1** shows the relationship between ground and airborne hardware.

Let's fly: What RC flying amounts to is this. Pull back on the elevator control and the elevator servo lifts the elevator. This causes the plane to climb. Push forward and the elevator goes down and so does the nose of the plane. Move the rudder control to the left and the rudder servo moves the rudder to the left also. The

*An interesting form of digital proportional control for model aircraft was developed by Vic Welge, a project engineer at Consolidated Vultee Aircraft in San Diego, in 1946. The control system used the "bang-bang" principle in which each control servo was commanded by a rack of equipment about 2 meters (6 feet) high and 0.6 meter (2 feet) deep. The "flyer" sat in a full-size cockpit mockup complete with conventional aircraft controls. The system was developed to test 1/4-scale models of the famous PBY flying boats, which were used by the navy during W.W.II. The models were flown from the U.S. Coast Guard seaplane basin in San Diego harbor. The models had scaled-down Pratt & Whitney engines and were complete with retractable wing floats, also operated by the RC system. Included on the models were aerodynamic instrumentation (to obtain test data), fuel monitors, and a host of other sensors. Not really as much fun as flying today's models, but an introduction to a fascinating electronics hobby. **Editor.**

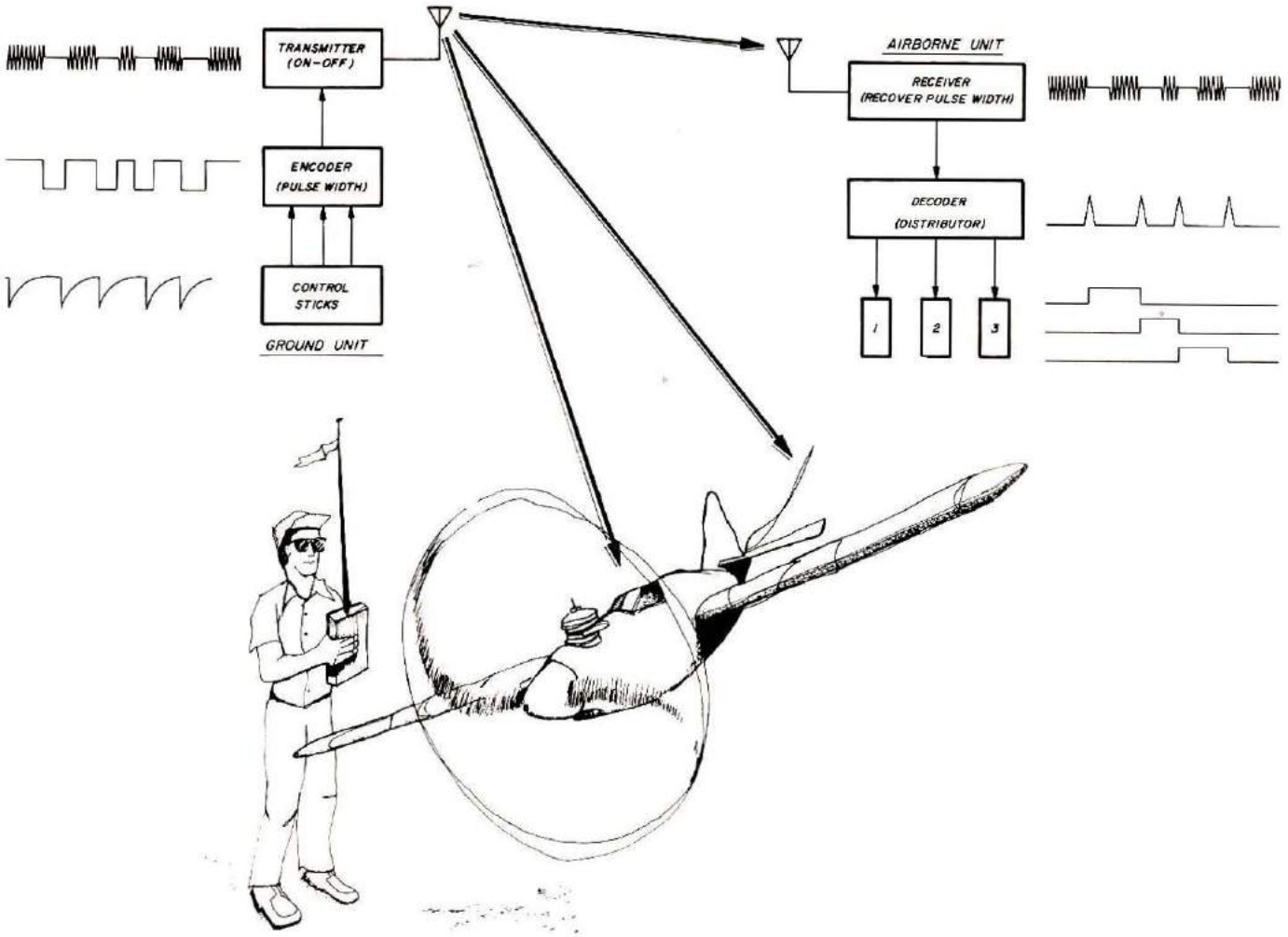


Fig. 1. The handheld ground unit transmits the control signals by ON-OFF modulation of the rf carrier to the airborne unit. In the airborne unit, the ON-OFF signals are converted into discrete pulses of appropriate length. The pulses are then applied to servo-mechanisms that control the model.

further the control is moved to the left, the further the servo moves the rudder and, as a result, the sharper the left turn the plane makes.

Inside the RC system

An idea of what the inside of the transmitter and receiver looks like is provided in the photo. (The back of the unit and the antenna have been removed.) At the top, the printed-circuit board contains the transmitter rf section. To the left, right, and centered just below the rf section, the rear of the control sticks can be seen. The printed-circuit board near the bottom is mounted atop the ni-cad batteries. This printed-circuit board contains the encoder section, which converts the control positions into pulses, which, in turn, modulate the rf section (key the transmitter ON or OFF).

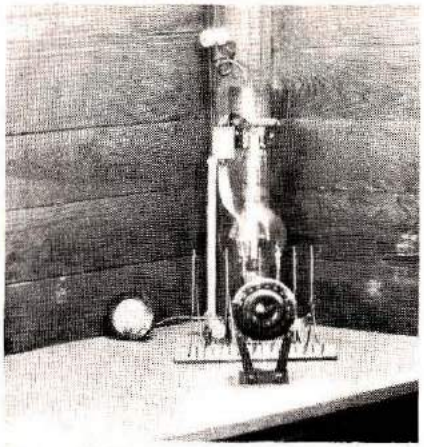
Just beneath the transmitter is the opened receiver, with its case placed next to it. The two printed-circuit boards are the *receiver* and the *decoder* (with plugs for servo connections). The total receiver case measures only 23 x 22 x 56 mm (0.9 x 0.85 x 2.2 in.).

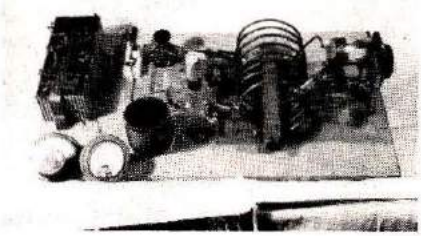
The button shown at the top right in the photo is a Buddy Box pushbutton. This feature, on two similar transmitters, allows the two units to be connected together. Only one of the two units is normally transmitting. When the Buddy Box pushbutton is operated, the second unit assumes control until the pushbutton is released. In this way, an experienced flyer can maintain control of the craft while permitting the person being trained to have control by pressing a button. The Buddy Box is an excellent method for teaching RC flying principles. It does require two interconnected RC transmitters, however, both of which require factory modifications.

Now that you've absorbed the fundamentals of RC I hope you'll pursue it further. It would take many articles of this length to do justice to such individual topics as the servos and modulation methods. I hope this brief coverage of so many areas has been helpful. Charge your batteries tonight — tomorrow we fly!

Reference

1. James H. Gray, W2EUQ, "Radio Control of Models," *Ham Radio Horizons*, July, 1977. **HRH**

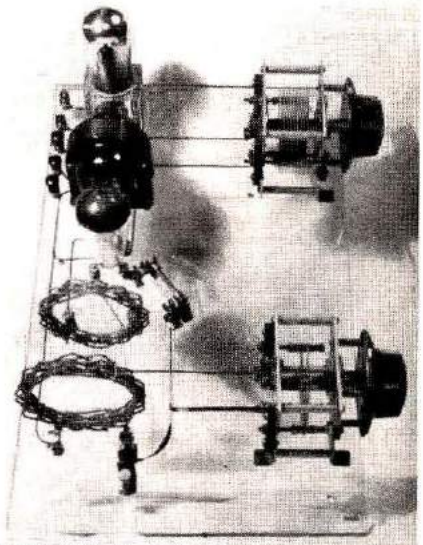


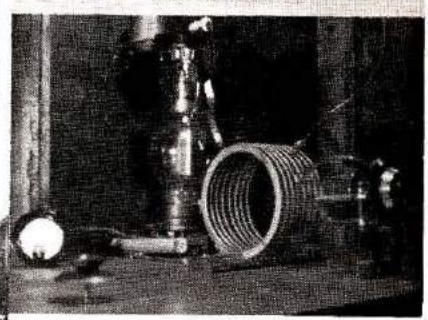


A STATION DESCRIPTION

CIRCA

1925





Receiver design, a QRP transmitter, an antenna type, and DX performance; the work of an amateur named Windom, 8GZ/8ZG

BY A. DAVID MIDDELTON, W7ZC

Historians often refer to locales where occurred some incident important to our national life or culture as "hallowed ground." Such would include Plymouth Rock, Independence Hall, Breed's Hill, and Gettysburg. Sportsmen have their hallowed grounds — Yankee Stadium, the Brick Yard at Indianapolis, Chicago's Soldiers Field, and the Rose Bowl.

Radio amateurs also have their fondly remembered historical spots. These sometimes consist of three separate items — the operator, the station equipment, and the antenna system.

Depending upon your ham-radio age, your list might include these history-making stations: Mathew's 9ZN at the Edgewater Beach Hotel in Chicago, Schnell's 1MO in Hartford, Berkner's 9AWM at Sleepy Eye, Minnesota, and Reinartz's 1QP-1XAM in Connecticut.

If you can count less than fifty ham-radio years, you would probably list W6AM's forest of rhombics at Palos Verdes, the stations of KH6UK and W6NLZ of Transpacific vhf fame, Spenceley's KV4AA at St. Thomas, and ARRL's W1AW.

Some time when twenty meters is flat, forty meters is jammed with propaganda QRM, eighty meters is too noisy, and the chatter of the repeaters on vhf is just too much — flip the OFF switch and sit back and make your own list of Hall-of-Fame type ham stations you have either visited or known about. It will be an intriguing and rewarding session.

I did this, and came up with a station from the 1920s that was both outstanding in performance and entrancing in memory. A bit of recall and some research revealed a station description that boggles the mind today. Read on and find out what it took in those days to outfit a world-wide DX station.

That is what 8GZ-8ZG of Columbus, Ohio, became in the developing days of expanding DX. Add some written and diagrammed data, a recall of many personal visits to 8GZ, and the details of that station spring to life, on paper, in these days of microprocessors, digital readout, synthesized equipment, and stacked Yagis at 150 feet.

The locale

Franklin Avenue lies in the southeastern part of Columbus. In 1925 it was a pleasant street of two-story homes and many

trees. Walking along the street and approaching number 1375, any observant person would have had his attention drawn to the slim and towering masts that reared up on the narrow city lot. A path lead around the Windom home and to the building at the rear of the lot, a two-car garage. There was an inviting door on the west section. A single-wire antenna feeder dropped down from a flat-top antenna to a glass wall-panel, thence into the shack.

Loren G. Windom, owner and operator of 8GZ-8ZG, was usually to be found in his ham station, unless he was attending law classes at Ohio State University.

A knock on the door or a whistled CQ would bring a hearty "come-in!" to visitors. Sometimes it took a couple of knocks if there were sounds of ham business from inside the shack, as there usually were.

The 1925 shack of Windy's (like so many others) had an atmosphere that was sheer magic; to be there was both exciting and challenging. To those of us who did not have these deluxe facilities, and thus had a much lower order of ham performance, 8GZ represented the ultimate.

There was no doubt about it, 8GZ-8ZG was simple, but in this simplicity it displayed an air of power and efficiency which made the station outstanding in the world.

The station

The shack was plainly furnished and without anything that did not enhance its performance. There was a long, cloth-covered operating table against the west wall. An iron Army-type cot stretched out along the other side, with a GI blanket on it. A gas space-heater and a gigantic copper-dish reflecting heater sat in a corner awaiting the cold winds and snows of the Columbus winter. Many a cozy night was spent with that parabolic heater warming the operator's back.

There were only a few decorations in sight; a station license and the U.S. flag were hung on the wooden walls of the closed-off section of the former two-car garage. There were no QSLs on the wall, although there were literally bushels of them awaiting inspection by any visitor who had time to look at them. A captain's chair sat in front of the operating table, usually occupied by either Windy or a visitor. It was seldom vacant; 8GZ was a busy station. Working a lot of DX — and handling an average of 200 pieces of traffic per month — left little peace and quiet in that shack. The station was usually filled with the clatter of relays and the whistle of fast cw coming from the Baldwin headphones cocked over the ears of the operator.

In front of the operator's position sat a fascinating device — Windy's famous "plate-glass" receiver. Beside the receiver were a straight key and a Vibroplex. At the end of the long table there was an open transmitter of strange mechanical layout that in itself said, "Here lies *real* ham power!"

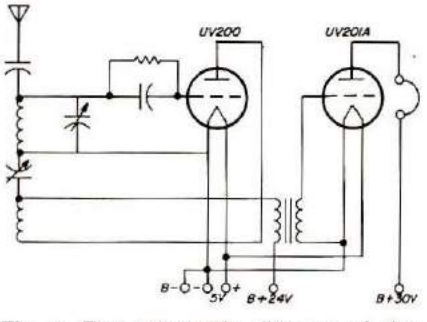


Fig. 1. The schematic diagram of the famous "plate-glass" receiver at 8GZ in 1925. It was a straight-forward regenerative detector, transformer coupled to an audio amplifier.

Plate-glass receiver

Following the classic work by Reinartz in the March, 1922, *QST*, Hassell's break-through "low-loss" article in the December, 1923, *QST*, and the Schnell design in the February, 1924, *QST*, Windom had set out to build a *zero-loss* receiver.

Laid out on a piece of plate glass which was painstakingly drilled to accept binding posts and mounting screws for the components, this receiver represented what was then the ultimate in low-loss design; it probably could not be bested today in that essential characteristic.

The receiver layout and its circuit (**Fig. 1**) was simplicity itself. Based on the well-known Schnell circuit, the unit consisted of a pair of tubes, two coils, two condensers (read capacitor if you are not an old-timer), a grid-leak and condenser, one tuning and one regeneration condenser, and an audio transformer, along with A and B batteries stowed under the table. There were also the ubiquitous Baldies (headphones — this receiver contained not one unnecessary component or frill). There was

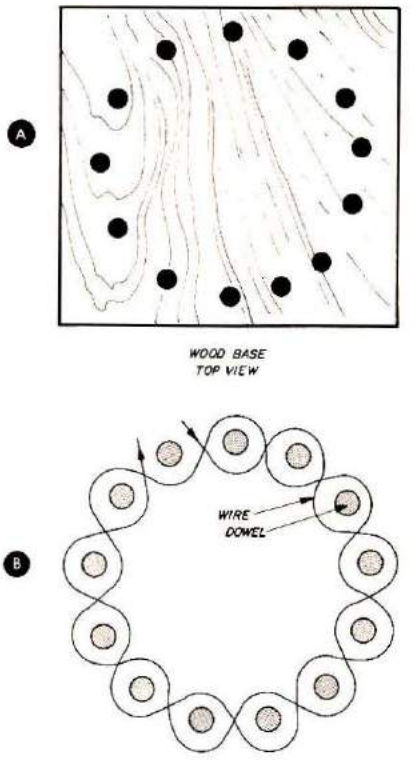


Fig. 2. The *Lorenz*-wound coils were believed by many to be the secret to good reception. Possibly the mechanical rigidity offered by the method of winding the turns had something to do with improved performance in those days of unstable detectors. The wires were wound in-and-out on a form of dowels or pegs, then the turns were tied with waxed thread in several places to keep them in place after removal from the form.

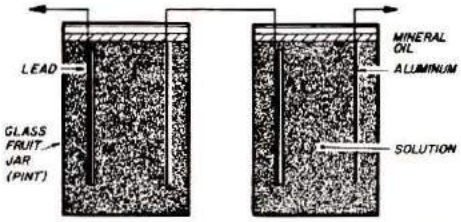


Fig. 3. The chemical rectifier was the power-supply workhorse of the era. A Borax solution served as the electrolyte, and the electrodes were lead and aluminum. The 8GZ station used 26 pint jars in each leg of a bridge rectifier. The mineral oil reduced evaporation.

no front panel (sheer heresy in 1925), and there were only the two controls: one for frequency and one to control the regeneration of the detector tube. Tuning was done by rotation of a new type of dial, a National "Velvet Vernier" (ratio 5:1) that was both smooth-running and gentle to the touch.

The receiver covered 80, 40, and 20 meters (15 was not then allotted to hams, and 10 was not exploited for several years). Grid and "tickler" coils were of the *Lorenz*-type winding, **Fig. 2**, having very low distributed capacity. Components were connected with squared-up bus or strap wiring.

The detector tube (a UV200) was operated with its base removed; its four leads ran directly to binding posts. Coils were secured by their stiff leads run through the holes in the Eby Ensign-type binding posts. The grid and plate circuits were wired with direct connections, for low-loss construction. Even the audio tube (UV201A) was mounted in a glass socket, which Windy today admits was a bit of ostentation.

The antenna was connected to a binding post attached to a bracket that made up part of the coupling condenser — two 1/2-inch-square metal plates separated by one-half inch. Calculations indicate a capacity of 0.112 pF. No wonder the receiving antenna was loose-coupled! This overcame much of the difficulty with Schnell's circuit, which was often over-coupled to the antenna. There was no ground used on the receiver. Perhaps the capacitance provided by batteries sitting on the floor furnished a sufficient ground return. Windy states that he tried a ground but it did not provide any more gain.

There was a second stage of audio amplification beneath the table. This secret weapon was not known to most of the visitors to 8GZ. After many of us had tried, unsuccessfully, to duplicate the remarkably loud signals that poured out of the Baldwin phones, I discovered this second stage. When I mentioned it, Windy calmly replied, "You never asked!"

I can give testimony as to the performance of the receiver with its 70-foot vertical antenna, having spent many happy and productive sessions either listening or pounding brass at that table during the years of 1926 through 1929. I worked plenty of DX and witnessed great accomplishments on 20 and 40 meters under a variety of conditions.

The powerhouse

At the right end of the operating table stood the self-excited cw transmitter, a three-year-old 204 in the classic Hartley circuit, running about 550 watts input. As shown in the photograph, the 204 stood upright, with its plate connection secured to a plate-glass shelf fastened to the shack wall. Another piece of glass supported the tube socket on the table. An inductor made of eight turns of flat-wound copper, 7-inches in diameter, was fitted into a slotted base of maple that had been boiled in paraffin. The radio-frequency choke (why did we make them so large?) was connected to the plate of the 204, a lead ran directly to the plate-blocking condenser, and then a copper strip ran to the tank coil. A homemade tuning condenser (with glass insulation) was clipped onto the tank coil for 80 and 40 meters. No added capacity was used on 20; I wonder how Windy tuned up on that band.

The antenna lead was directly connected to the tank coil, then through a glass panel in the wall to the 56-foot long, flat-top antenna at 70 feet. Windom states in his 1925 written comments that, while sending on 40, stations could be copied on 80 without QRM from the transmitter!

High voltage was supplied by a General Electric Company 2-kW pole-pig (service transformer), fed through a chemical rectifier consisting of 104 pint fruit jars! Details of this type of rectifier are given in **Fig. 3**. The dc filter consisted of ten 1-μF, 1750-V condensers, five on each side of a 50-henry choke in what was called a brute force filter. When desired, the condensers were cut out of the circuit by a knife switch. The high-voltage power supply components were mounted on a shelf near the ceiling of the shack. The filament transformer was a Thordarson 500-watt unit fed by a 2:1 ratio transformer from the 220-volt line. The filament voltage was adjusted by a rheostat. A time-delay relay was connected in the primary of the transformer to permit a safe warm-up time.

Antenna system

The station equipment was of superior design, good quality, and utter simplicity; it was developed after a much more complicated setup prior to 1925. The antenna system also had been given consider-

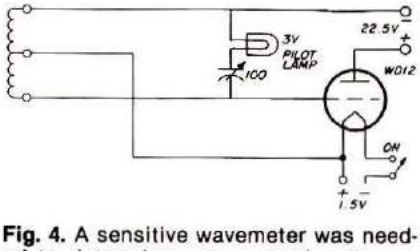


Fig. 4. A sensitive wavemeter was needed to determine your operating "wavelength" in the days before frequency became the standard term.

able thought and had been simplified through a lot of configurations. It was, like the station gear, both simple and very effective. It must be noted that the period discussed in this article was prior to the time when, at Ohio State University, experiments were conducted that resulted in the "off-center-fed, half-wave Hertz" antenna that was to become world famous.

Windom did not, at any time, refer to this or any other 8GZ antenna as a "Windom." That nomenclature first appeared in a publication of the Wireless Institute of Australia when they reprinted the substance of Windom's classic *QST* article of September, 1929, entitled "Ethereal Adornments."

The 1925 antenna was only 56 feet long (instead of the usual 67), and the feeder was connected at a slightly different place than in the now famous "Windom." Windom recalls that they were looking for an *all-band* antenna, not a *broad-band* antenna; he even tried a 1-inch copper ribbon!

The flat-top single wire was supported by two 70-foot down-spout masts. Ten-foot sections of steel down spout were soldered together after being overlapped one foot. Guy wires were broken each twenty feet with porcelain eggs. The mast near the shack was insulated from ground and served as the station *receiving* antenna. Insulation was of the highest order; at each end of the flat-top wire it was insulated from halyard by no fewer than *five* 20-inch-long x 2-inch-wide plate-glass insulators.

Windom had been a busy beaver drilling all those holes in plate glass with a twist-drill-and-turpentine rig. I wonder how much glass he broke in the process?

Windy relied upon a home-made wavemeter for proper band location. This invaluable piece of test gear is shown in **Fig. 4**. Calibrated from WWV and NKF in wavelength, it was accurate enough for those days. "Frequency" had not become part of the ham's lexicon.

The way it was

A refresher course is required to understand what was going on in 1925. The American ham bands consisted of the following:

Wavelength Meters	Frequency MHz
0.7477 - 0.7496	401 - 400
4.69 - 5.35	64 - 56
18.7 - 21.4	16 - 14
37.5 - 42.8	8 - 7
75.0 - 85.7	4 - 3.5
150 - 200.0	2 - 1.5

Radiotelephony was permitted from 3.600 to 3.500 MHz, and from 1.765 to 1.6667 MHz. Both 80- and 150-meter operation was prohibited from 8 to 10 PM local time and on Sundays during church service hours.

The classes of station licenses available in 1925 were:

Provisional — an uninspected (by radio authorities) station.

Restricted — a station within an unspecified distance from a Government station. Stations within five miles of any military or naval station [were] further restricted as to power and bands.

General — issued to a station after inspection.

Experimental — an X call was issued for special projects not possible with the use of a dummy antenna.

Special — a Z call was issued to holders of the Extra First Class license who also had a non-"Z" call.

Special — a Y call was issued to stations in educational institutions.

Amateur operator licenses were issued separate from the station privileges, and consisted of the following classes:

Amateur Second Grade — similar to the present-day Conditional.

Amateur First Grade — to operators who had passed a written examination in the presence of a Radio Inspector and passed a code-speed test of ten words per minute.

Amateur Extra First — a much more comprehensive written examination and a code speed of twenty words per minute, taken in the presence of an Inspector.

These licensing regulations are quoted from *Handy's Handbook*, First Edition, 1926. Presumably they were in force in 1925. Although no mention is made, it is my recollection that an *Amateur Extra First* was required for radiotelephony on twenty and eighty meters.

Handy also states that "interference to other services cannot be permitted, and quiet hours are prescribed when readjustments of the transmitter or alteration of a non-selective receiver will not do away with the trouble."

In 1925 there was some troublesome BCI, no TVI, and RFI pollution was all but unknown, hence the open-air transmitter at 8GZ was possible and practical.

It was then common practice to spot your transmitter on one chosen wavelength — where it remained! Seldom did an operator move about after having once established himself on a good spot. Operational procedure was to remain on

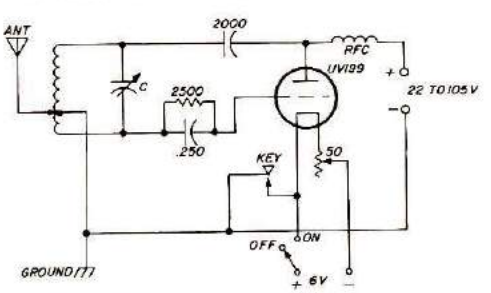


Fig. 5. The "Little Giant" low-powered transmitter was used by Windom to do some impressive DX work while using a power input of less than 1/2 watt.

that one spot and to tune the receiver over the entire band, looking for stations calling CQ or replying to your CQ. Operators looking for DX looked outside the U.S. bands for foreign stations. An operator seldom looked on his own frequency for a reply. DX stations operated for the most part outside the American bands and were thus more easily found, especially as each area chose a different segment of the spectrum outside our bands. Some areas were on the low side of the American band and others were on the high side. There was no fast rule, and DX, as now, was where you found it.

Break-in operation was a mark of a well-operated station. The straight key or a Vibroplex were standard; keyers were practically unknown. Cootie keys (side-swipers) were common; they were easy to make, hard to operate, and difficult to copy.

The "signature" of each operator (his characteristic manner of sending) made recognition easy. Often operators could be identified before they signed their call. Headphones were standard, as few hams had the new and expensive loud-speaker units. Starved-audio circuits, with low plate voltage on the output, provided some measure of audio limiting, and peaked-audio circuits were common because the use of high-ratio audio transformers usually created audio distortion.

The practice of tapping down on a coil to obtain band spread was not in common use. The now common "band-set" and "band-spread" two dial system had not come into use, although it would have been possible with the midget variables offered.

Hassell had shown in his December, 1923, *QST* article how to trim down the plates of a variable to obtain band spread. Windom had not done this. He used a standard National-type DX capacitor with plates removed, leaving only one rotor and one stator in the grid-tuning circuit.

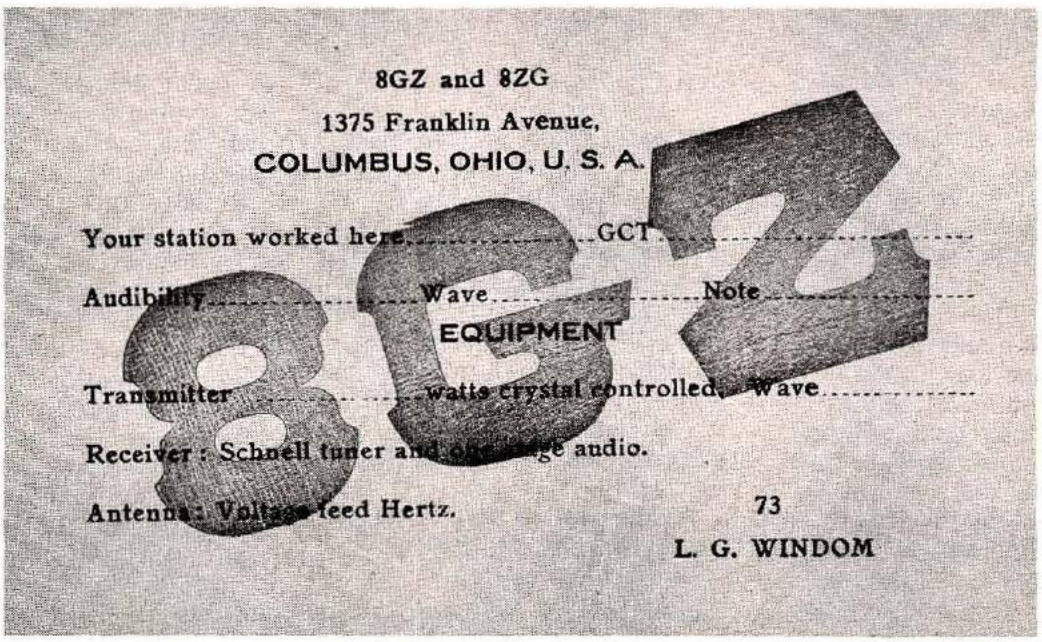
The common method of fine-tuning was to use the tip of a rubber eraser on a lead pencil. It was placed against the panel and against the round dial as a vernier. Windom chose the new and exciting National Velvet Vernier dial which was first being offered. It was a fine dial in 1925 and still is in wide use.

Low power at 8GZ

Although the 204 Hartley rig was the workhorse at 8GZ, Windom was intrigued by what is now known as QRP work. Motivated by Clayton's *QST* article of December, 1924, Windy designed and built a low-powered transmitter with the intent of breaking Canadian C9CK's low-power record.

Much of this low-power work was done in the latter part of 1925. Windy not only broke C9CK's record but also established a new record by repeatedly working DX such as Australia and New Zealand with power as low as 0.493 watts (total filament and plate input) to a receiving-type tube. Windom was awarded the Jewell Meter Company Award (a gold pocket watch) for his QRP work, an achievement detailed in the July, 1926, *QST*.

Starting in December, 1924, Windom used a 201A with 105 volts at 12 milliamps and worked much DX. A WD12 was tried, but when a borrowed



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UV199 was available it was installed with about 105 volts on the plate, and 5 volts at 60 milliamps for the filament. The UV199 was finally starved down to a 75-volt plate supply! Circuit details on the 8GZ QRP rig are shown in **Fig. 5**. A photograph shows the 1925 world's-record transmitter.

The transmitter was bread-boarded on a maple base that had been boiled in paraffin. Insulation was, as normal with Windy, plate glass. A few Burgess B batteries supplied the plate power. The regular station antennas were used on the QRP work, and the plate-glass receiver brought in the replies.

Windom recalls that the UV199 was by far the better tube tested — it gave a better signal with less input. Many T9X reports (crystal-controlled signal quality) were received.

I can attest to the potency of this flea-powered rig at 8GZ, as I had the pleasure of working many DX and domestic stations with it. By the way, such performance was not considered to be earth-shattering, at that time.

Station performance

Notes made by Windom at 8GZ in 1925 state: "During the year the station worked 464 out of a possible 514 DX stations, established a world's record of 30,000 miles per watt, and handled an average of 200 bona fide messages a month." Yes, dear reader, traffic handling was routine in 1925, and was a part of any really active ham station.

It is difficult to equate station performance then to that of today. Suffice to say that 8GZ was almost half-way to becoming a member of the DXCC, had probably made WAC, and was well on his way to a WAZ. Had there been a DX Honor Roll, Windy would have been way up on the list. It must be noted that in 1925 none of these yardsticks, by which we now measure accomplishments, had been invented.

Operations at 8GZ included much trans-Atlantic work in daylight, and many long-path QSOs. A total of *forty-one* countries was worked. A list of his DX reads like a "Who's Who of DX" for those years.

Even the then-infamous five-meter band had been tried. When no reports were received from the 8GZ efforts, Windy discarded the band. Five did not lend itself to self-excited transmitters and regenerative receivers. The Rodimon-Hull historic work on that band was still six years and a "super-regen receiver" away.

A few personal notes

I first met Windom in 1924 when we both attended the National Guard Encampment at Camp Knox, Kentucky. We were noncoms; Windom with the Headquarters Company, 74th Infantry Brigade, 37th Division, (Ohio) and I with the 38th Division Signal Company from Indianapolis.

In 1926 it was my privilege to visit 8GZ and when, in 1927, my residence was Columbus, many delightfully exciting hours were spent in the shack at 8GZ. From 1926 to 1929 a lot of hours were spent pounding brass at 8GZ or sleeping on that Army cot.

Another of the memorable aspects of visiting 8GZ was the welcome received in the shack, and in the Windom home. Loren's parents, Forrest and Bertha Windom, were not only hospitable but they were encouraging to Loren and to any visitor who was a ham. Having experienced the opposite in my own home, such warmth and respect for our hobby was very welcome. The Windoms always provided appropriate snacks or beverages, regardless of the season, and meals were served to suit the operators. Such genuine hospitality made 8GZ a pleasant place to visit. The aroma of Mrs. Windom's cooking often drew us away from the key and headphones into the kitchen.

As evidence of the reception given to ham radio by the Windoms, I recall one day when Windy was grinding quartz crystals, right on the kitchen table. That's about as tolerant an attitude as you can find! I would like to offer a long-delayed tribute to Mr. and Mrs. Windom, who played such an important part in our early lives and our great hobby, and to all the long-suffering parents of hams.

Epilogue

So much for 1925. What ever became of Loren G. Windom, 8GZ-8ZG? Well, he turned out right well! He became a brilliant lawyer (twenty-five years as a Federal District Attorney at Columbus), had a distinguished career in the military (rising from Private to Major General, with many decorations), and served as an ARRL director. Continued application of effort to ham radio brought much satisfaction to his life.

Now retired, Windy lives with his wife, Dot, on several acres near Columbus. Needless to say, the land is well covered with rhombics and other high-efficiency antennas. Although he admits that his Vibroplex is a bit neglected, his melodious voice is regularly heard on ssb, and his call, now W8GZ, is widely known on the bands. His son David (in the Military, stationed at Fort Richie, Maryland) is now W8ZG and keeps regular schedules with his OM. W8GZ has moved up into the highest brackets of DX worked, having 360 countries confirmed, and is high on the Honor Roll.

The years from 1916 to 1977 form quite a span of time. Windom filled those years with yeoman service in civilian life, the military, and in high dedication to Amateur Radio.

Ham radio has been built by the efforts of such amateurs as Loren G. Windom, who represents the best of our chosen hobby.

HRH

a quarter wave vhf mobile antenna

Inexpensive parts which are easy to assemble

BY GEORGE A. WILSON, W1OLP

Sometimes practical results make theoretical differences difficult to fathom. This is often true of simple, well-matched antennas when compared with elaborate antennas that are supposedly tuned and matched. Typically a 39.7-meter-long (130 foot) wire, end fed with a simple antenna coupler, produces startling results in comparison to rotary beam antennas. The beam may have a theoretical gain of several decibels over a simple dipole, but, at best, this is a little more than one S unit! When used on the higher frequency bands, the longwire antenna can give comparable gains in specific directions. A similar case exists when you compare a quarter-wavelength vertical antenna permanently mounted on the roof of your car to a dismountable vertical antenna on the roof or the edge of the trunk lid.

My use of the antenna described here resulted in a distinct improvement in reception and enough improvement in transmission to prompt comments from my regular two-meter fm cronies. My range through a repeater compares well with others using similar power and other types of antennas.

The following were my goals in designing the antenna:

1. Good on-the-air performance
2. Excellent weather resistance
3. Minimum damage to the car
4. Ease of fabrication
5. Ease of removal of the antenna element to protect it from theft, or for replacement

From these goals resulted the design in the photographs and in **Fig. 1**.

General description

If you want to build a similar antenna, you can reproduce the one in the drawing or you can take liberties that make it possible for you to use materials you may have on hand. Typically, 3-mm (1/8-inch) diameter brazing rod rounded on one end can be used for the quarter-wave element. Or, if you don't have a lathe handy, the adapter used between the element and the tubing fitting can be made of 6.4-mm (1/4-inch) diameter brass or steel rod, and the void between the adapter and the tubing fitting can be filled with solder (see **Fig. 1**).

The heart of the antenna is a flared-tubing fitting available from your plumbing or heating contractor and many hardware stores. The fitting adapts 6.4-mm (1/4-inch) diameter tubing to the same size pipe. The pipe-thread end of the fitting should be removed and filed (or turned) flat as shown. The modified fitting, a washer, and a length of M5 (10-32) threaded rod are sweat-soldered to form the element base. The flare nut, an adapter bushing, and a length of rod are sweat-soldered to form the removable element. The original element was made from an old automobile antenna top section. Use a good stainless steel flux if you go this route!

The antenna should be mounted in the center (or close to the center) of your car roof. The 16-mm (5/8-inch) diameter hole is easily made with a metal punch. I went through the headliner cloth at the same time the metal was cut. My car has no dome light at (or near) the roof center. If yours does,

and you can arrange the connections inside the dome-light enclosure, you can eliminate parts 17, 18, and 19 in **Fig. 1**. These parts are mostly decorative and provide protection for the connections.

The coax can be snaked under the headliner. In my car, I ran the cable down the front right corner-post and fed it under the dash to the radio. Pliobond cement was used to attach the coax to the corner-post. RG-58/U coax seems to work well in this application. The center conductor goes to the lug connected to the antenna element, and the shield goes to the ground lug.

Parts description

Refer to **Fig. 1** while reading the following descriptions.

Part 1 is from the top section of a discarded automobile antenna. Most of these are 2.5-mm (0.1-inch) diameter stainless steel. (See comments after Part 3 for cutting this part to length.)

Part 2 is a 16-mm (5/8-inch) piece of brass rod 7 mm (0.260 inch) in diameter with a 2.5-mm (0.1-inch) diameter hole drilled through its center. A 2.6 mm (no. 38) drill does the job neatly.

Part 3 is the flare nut from a flared tubing fitting; it needs no modification. Parts 1, 2, and 3 are sweat-soldered together. Trim the antenna rod to approximately the right length and assemble all the parts that go above the roof to establish the correct length before you sweat the joints. Plus or minus 3 mm (1/8 inch) should not make much difference in loading.*

Part 4 is the body of the flared tubing fitting. It is modified by removing the bottom part as shown in **Fig. 1**. This can be done with a hacksaw and a file.

Part 5 is a 19-mm (3/4-inch) brass or brass-plated steel washer with a center hole to fit an M5 (10-32) screw.

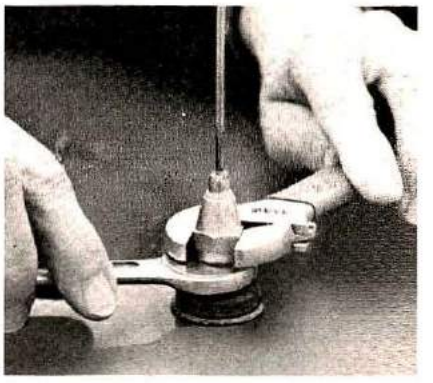
Part 6 is a length of brass or plated-steel M5 (10-32 or 10-24) threaded rod cut 41 mm (1-5/8 inches) long.

Parts 4, 5, and 6 are sweat soldered together. The overall length of this assembly should be about 51 mm (2 inches). The threaded end can be trimmed later if it's too long.

The antenna-element assembly and the base assembly just described can be plated ("bright metal" or nickel are recommended) to minimize corrosion. However, the corrosion is only a cosmetic problem — a coat of paint on the *outside* surfaces will do the trick if plating is a problem.

Part 7 is made from a good grade of electrical plastic that has good mechanical strength. Bakelite or Lucite may be used. This part, and parts 13 and 17, provide insulation between the antenna element and ground. This is a low-voltage point on the antenna and, therefore, the losses will be minimal even if you don't use fancy insulation for these pieces.

If a lathe is available, this part can be turned from a piece



Proper method of removing the antenna element is to use two wrenches. The lower wrench prevents loosening the base assembly while removing the top section.

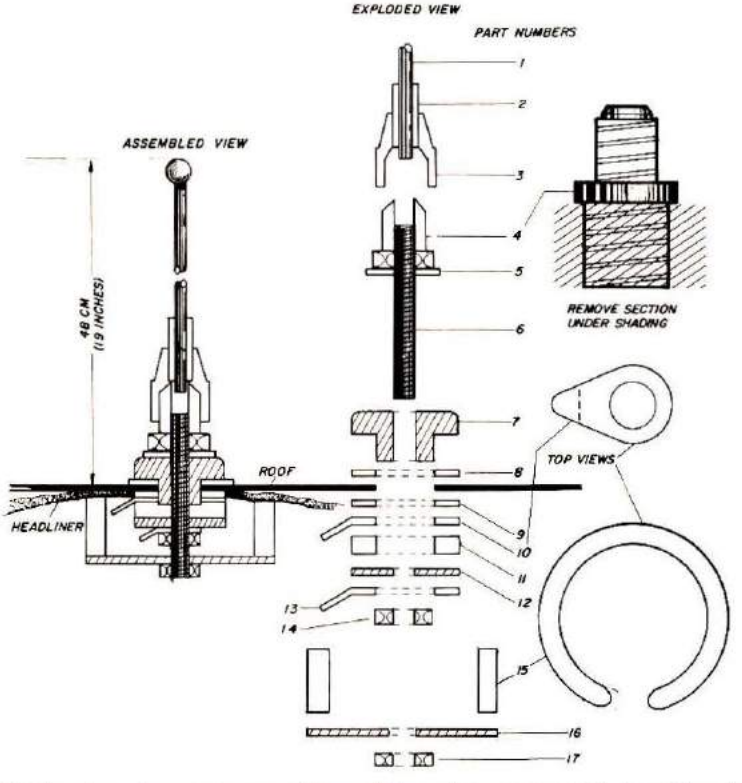


Fig. 1. The drawing shows cross sections of the antenna assembled and "exploded." Parts 3 and 4 are a flared tubing fitting. Part 4 is modified as shown before it's assembled. All parts are round except the ground lug (part 10), the bottom spacer (part 15), and the center conductor lug (part 13). Top views of parts 10 and 15 are shown; part 13 is a common shakeproof lug and, therefore, a top view is not shown. The text discusses the parts and suggests way of simplifying construction in case you have to do your building without fancy tools.

*The dimension shown should be satisfactory for the upper half o f the two-meter band. Exact resonance can be found by varying the length while examining the resonance with a grid-dip meter coupled to a one-turn coil at the far end of the coax.

of 25-mm (1-inch) rod 13 mm (1/2 inch) long. The center hole is for an M5 (10-32) thread. The lower half is turned down to 16 mm (5/8 inch) diameter to fit the hole in the car roof.

If a lathe isn't available, you can use two pieces of rod: one 25 mm (1 inch) in diameter by 6.4 mm (1/4 inch) long, and one 16 mm (5/8 inch) in diameter by 6.4 mm (1/4 inch) long. Both should have center holes to fit an M5 (10-32) thread.

If the 16-mm (5/8-inch) diameter rod isn't easily obtainable, 13-mm (1/2-inch) diameter rod may be used. In this case the hole in the car roof and parts 8, 9, 10, 11, and 12 should be changed accordingly.

Part 8 is a rubber or cork gasket with 16 mm (5/8 inch) inside diameter and about 25 mm (1 inch) outside diameter. Its purpose is to seal the roof and prevent water entrance. A similar washer can be installed between the base assembly and part 7 if the mating of these parts is not good enough to provide a good seal. A dab of silicone grease at this point is also recommended.

Part 9 is a 16-mm (5/8-inch) ID shakeproof washer. (These are used on pilot-light assemblies and electrolytic capacitors.)

Part 10 is a lug made from shim brass or tin can metal. **Fig. 1** shows how to make it. You may have one in your junk box from an old electrolytic capacitor.

Part 11 is a spacer of metal or plastic. It's 16 mm (5/8 inch) ID; about 25 mm (1 inch) OD and 4.8 mm (3/16 inch) thick. Don't use a soft material that will be crushed when you tighten up the base assembly.

Part 12 is a 25-mm (1-inch) plastic washer 1.6 mm (1/16 inch) thick with an M5 (10-32) hole. (See part 7 — use similar material.)

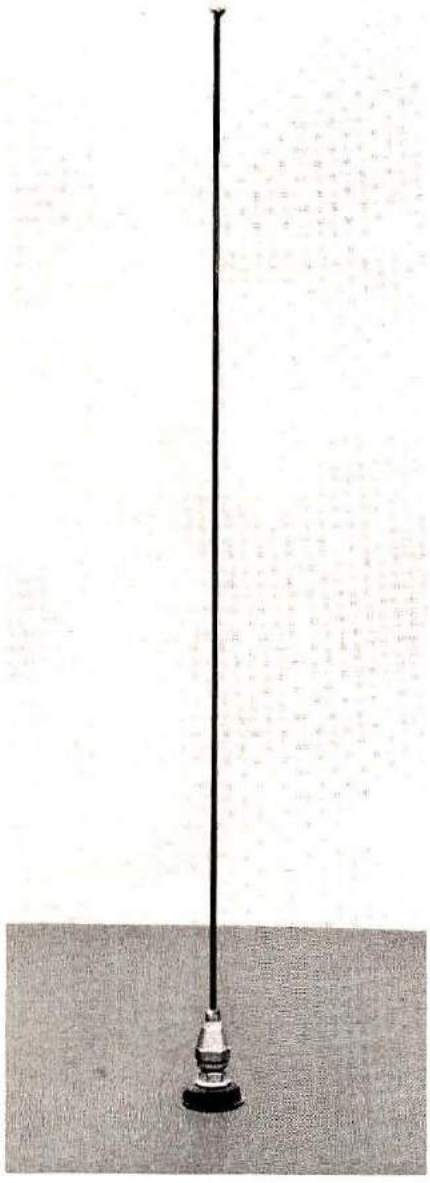
Part 13 is an M5 (10-32) shakeproof lug.

Part 14 is an M5 (10-32) nut.

Part 15 is a 51-mm (2-inch) diameter spacer 16 mm (5/8 inch) thick. It has a gap to allow passage of the coax. (See the top view in **Fig. 1**.) It can be jigsawed or turned. The original was made from plywood.

Part 16 is a 51-mm (2-inch) plastic washer 1.6 mm (1/16 inch) thick with an M5 (10-32) hole. (See part 7 — use similar material.) Part 16 is cemented (with Pliobond or epoxy) to part 15. The outside of parts 15 and 16 can be painted if appearance is important.

Part 17 is a plastic nut. A metallic nut will do, but it should be covered with insulation to prevent accidental contact.



Full-length view of the quarter-wave antenna. Working above a good ground plane, this simple antenna out performs many jury-rigged mobile installations.

Mounting and check out

Antenna assembly into the car roof is shown in **Fig. 1**. The coax-cable insulation should be trimmed carefully. Expose the braid and center conductor so that they can be soldered to the appropriate lugs and pass through the gap in part 15 without undue strain on the coax. The insulation can soften at summer car-roof temperatures and cause a short circuit if the coax is under strain.

Make sure you scrape the bottom side of the car roof down to bare metal around the access hole, which will allow the shakeproof washer to bite into the metal and make a good ground connection. This is important.

Snaking the coax under the headliner is more of a mental problem than an actual one. The snaking should be done before you put the connector on and before you solder the coax to the antenna. This leaves both ends free and makes the snaking job easier. Make loops at each end of the coax by soldering the braid to the center connector. Copper wire (about 16 mm, or no. 14 AWG) with a small hook bent in the end makes a good snake.

Resonance can be checked with a grid dipper, or loading can be checked across the band and the antenna length can be varied to put maximum loading where you want it. The original appears to cover 146-148 MHz with little change in loading. This suggests that good results over 144-148 MHz can be expected if the length is trimmed to 146 MHz.

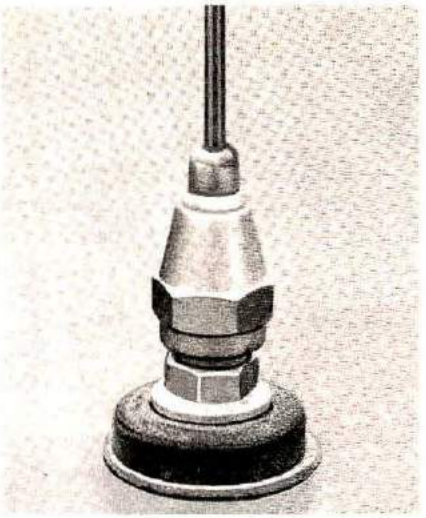
Use at higher frequencies

The same mechanical approach for the vertical antenna can be used at 220 and 450 MHz. Because of the shorter length of the antenna and consequent higher diameter-to-length ratio,

antennas at these frequencies should show good bandwidth. The car roof should be a better ground plane at higher frequencies. However, better insulation materials should be used for these frequencies. The insulation and the antenna-base termination at 450 MHz may involve an appreciable part of a quarter wavelength and, therefore, introduce some losses.

To further enhance the bandwidth at the higher frequencies, the diameter of the antenna element should be increased. With the length decreasing to about 457 mm (1.5 feet) for these higher frequency bands, the flexibility provided by the thin rod can be sacrificed. A 6-mm (1/4-inch) diameter tube (part of a discarded a-m radio broadcast antenna whip) will fit the flare nut without an adapter (part 2) and should be considered.

Results on 50 MHz should also be an improvement over



Closeup of the base for the quarter-wave mobile antenna. A flared tubing fitting is the heart of the base assembly. The antenna element may be removed easily for replacement or just to hide it from vandals.

less permanent installations. In this case, the base insulator should be larger in diameter to provide more support. A couple of sections from a discarded a-m radio broadcast antenna should do the trick neatly. The antenna length can be adjusted by telescoping. However, I suggest that the sections be soldered together to ensure the length doesn't change. Conversely, if you must reduce the height (to get the car in the garage, perhaps) you may want to maintain the telescoping feature.

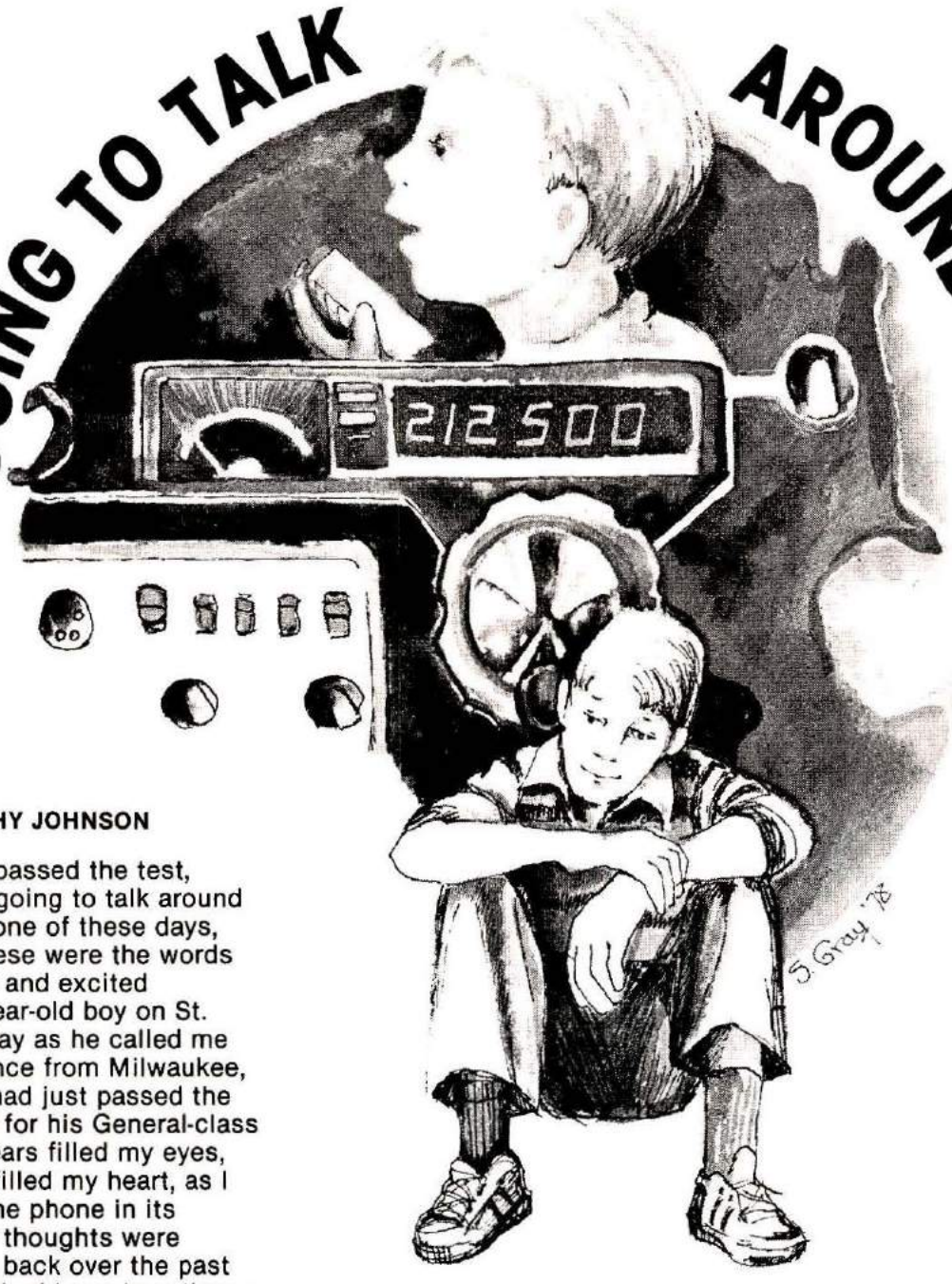
The antenna discussed here has been in use for about a year and has provided daily service that matches many other two-meter mobile antennas driven by comparable power. The presence of a relatively large, flat ground plane that's directly connected electrically appears to compensate for theoretical gains provided by less permanently installed antennas.

Bibliography

Wilson, Alf, W6NIF, "Improving the 2-meter Quarter-Wave Antenna," *Ham Radio Horizons*, April, 1978, page 54. **HRH**

More details? Ad Check page 94.

I'M GOING TO TALK AROUND THE WORLD



BY DOROTHY JOHNSON

"I did it. I passed the test, Mom! I'm going to talk around the world one of these days, Mom!" These were the words of a happy and excited fourteen-year-old boy on St. Patrick's day as he called me long distance from Milwaukee, where he had just passed the FCC exam for his General-class license. Tears filled my eyes, and pride filled my heart, as I replaced the phone in its cradle. My thoughts were wandering back over the past months. It had been less than a year since Bob first decided to become an amateur-radio operator.

How well I remember that summer afternoon when he first told me he would like to attend classes and become a ham.

"But you'll have to learn the Morse Code," I protested. "No problem," was Bob's reply. "I still have my Boy Scout manual and the code is in there. I'll be able to learn that easily." While Bob rummaged through his cabinet of outgrown toys and discards looking for the manual, I phoned the instructor to inquire about classes. "Can you teach a boy who knows no more about radio than how to turn one on and off?" I asked. He assured me that even though classes had already been in session for two weeks, with a little extra effort on his code Bob should be able to catch up by the next meeting.

And study he did! He mastered the dits and dahs of the alphabet that very afternoon, and, by evening, he was ready to go to the library for reference books on radio theory.

That evening, as I scanned the pages of the books he had brought home, I thought, "It's impossible for a boy of fourteen to understand all this. No way will he ever be able to stay with the class." It was with more than a little reluctance

and apprehension that he attended that first class, along with five other hopefuls, on a hot evening last July.

After the class, as Bob ran toward the car with his practice tapes and manuals tucked under his arm and a big grin on his face, I knew that this was to be only the first of many such evenings in Bob's future.

"I like it, Mom! Radio is fun! It isn't hard to learn at all! Ken is a great teacher and makes it interesting and simple to understand. Look at the books and tapes he gave me to study before the next class. He's going to help me build a keyer for Morse code, and I'm going to be able to talk anywhere in the world some day. Maybe I can even bounce my signal off the moon!" He chattered on and on all the way home.

Bob's eagerness to learn, together with the guidance he received from his capable instructor, kept him busy the rest of the summer. By September he was ready for the Novice test. He was one of only two who passed that test, and before long the hard-earned license with his call, WB9YXY, arrived and was slipped into a glass frame on his bedroom wall.

To reward him for having passed the Novice test, we immediately ordered the rig of his dreams, a Yaesu FT301D. Little did we know that there would be many long months ahead before delivery. To fill the anxious days while awaiting the rig, Bob worked on an electronic keyer and kept busy at his radio and school studies. Our kitchen table was frequently littered with parts and components for the keyer, and meals had to be eaten from TV trays in the living room. "After all Mom, this is more important than eating — I'll need this keyer for my new radio." I wondered how the transition from model-car kits to electronics could be made so quickly.

He was so proud of that little blue box when it was finally done. Every time visitors came to our home, the cover was slipped off the keyer to show them what he had made. Their blank stares into the maze of wires and components initiated many long conversations about amateur radio. His teacher was also impressed with his progress, and in the fall he took Bob and several other students with him to a nearby town where classes would be held for the General-class license.

More books, more code-practice tapes, more study, and finally the bleak, below-zero December morning. It was time for the ride to Milwaukee for exams.

Bob got up at dawn, packed his things into his backpack, and sleepily trudged out the door. "Is he ready for this test?" I watched the car make tracks in the fresh snow. He had studied so hard. Passing this test would mean so much to him.

Throughout the afternoon I listened patiently to the local repeater to catch the news as the hopefuls returned from Milwaukee. They would pass the news back to friends as soon as they were within range of the repeater, and, one by one, the reports drifted in. This one passed the Advanced test, another the General, and so on it went throughout the evening, but no mention was made of WB9YXY.

Finally , the word came that only one among the five in Bob's group had passed his test, and I knew from the call that Bob was not the lucky one.

I'll never forget the look on Bob's face as he came through the door that evening.

"It was hard, Mom! I tried, I really did, but I was so nervous. Some of the material hadn't been covered in class, and I couldn't understand it." The hurt and disappointment were hard on him, and I tried to explain it didn't matter, that he wasn't the first one not to pass on his first try. There would be other tests in the future, and he could always try again.

Bob matured as a result of that failure. He came to breakfast with new determination. "I'll pass it next time, Mom, I wasn't the only one. I passed the code. I'm going to talk to the world, Mom, you'll see!" My heart went out to him because I knew teachers and classmates would be inquiring about the test, and I hoped his new confidence would last through the day.

Extended weeks of classes and study followed, and the radio which we'd hoped would come by Christmas still had not arrived. At last in February the rig was delivered and turned on for the first time. Bob's interest in ham radio blossomed again as he contacted amateurs in New York and California.

In March, it was time for another trek to Milwaukee for exams. It was St. Patrick's Day, one which Bob will remember always. The exam was at 10 AM, and the telephone call to his Mom came shortly after.

"Hello, Mom? I made it, Mom! I passed! Now I can talk around the world!" **HRH**

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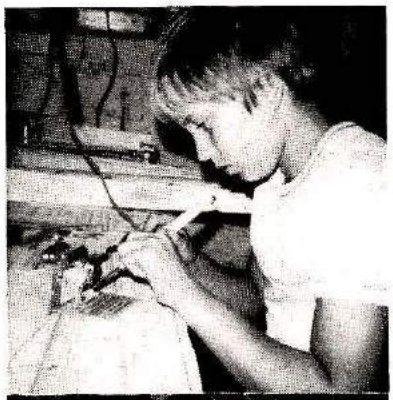

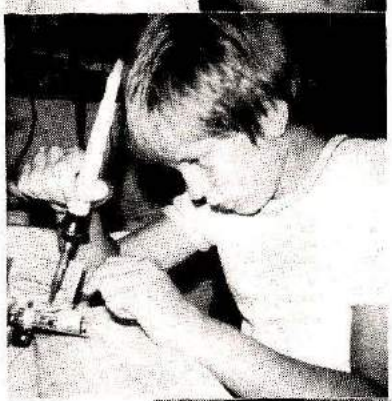

I BUILT IT MYSELF

BY PETER CARR, WB3BQO

A young Novice ham's first attempt at building electronic equipment

The Heathkit Apache Transmitter was upended on the bench for repairs and I was about to connect a new filter capacitor in the power supply when my son Jeff's head came into view around the end of the chassis. Jeff is 13 and a Novice ham.

"What happened, Dad?"

"Looks like one section of this capacitor went south. Last contact I had gave me a report of RST587, with lots of hum in the carrier."

"I see you have the new one ready to hook up. Would you let me solder the wires?"

I handed Jeff the soldering gun and short length of solder as I seated him in front of the rig and leaned over his shoulder. The capacitor was a top-mounted, can-type affair with lugs that stuck down through the chassis. About a million wires and components seemed to cover the work area. After several attempts at hitting the right connection without burning the plastic coating of the closest wires, Jeff looked up and gave me that "What am I doing here?" look.

We switched positions again. I completed the repair and set the rig back into its customary position on the operating table. Since Jeff obtained his Novice license the previous winter he'd gained quite a bit of operating experience. He now felt that he should help keep the station on the air by helping with repairs on the 18-year-old Heath. I thought that some hands-on experience would be a good thing, yet had to agree that this particular repair was less than ideal for him.

Choosing a construction project

Since many hams got into electronics construction through Heathkits, I dug out the Heath catalog. Jeff and I scanned the pages of the ham-gear and test-equipment sections, and it seemed that even the smallest of the kits was a bit much for a beginner of 13 to handle. Then, as if someone at the factory had

heard our problem, we found an ad for the Heath relative field-strength meter. At less than eleven dollars plus shipping it wouldn't dent the budget too badly, and would give the newest OM in our house a project that would be of great use in the shack.

The kit arrived. We unpacked it and found a packet of hardware and components along with two booklets. One was the assembly manual, the other a very complete guide on soldering technique. This last item is excellent reading for Novices as well as old hands.

As we read it I was amazed to find tricks I'd forgotten; and those photos of poor, cold, or generally bad connections looked like some of my recent work! Combined with the suggestions for wrapping wires around standoffs or terminals and shaping component leads for insertion on printed-circuit boards, the booklet is an excellent instructor for the new builder.

Jeff followed the manual's step-by-step construction sequence and had the field-strength meter built in under an hour's time. Space on the PC board is no problem, because the components aren't crowded together and the board has nice thick lands at the connection points. Except for the diode, none of the parts are fragile or hard to install. The diode is of the glass variety and is small. Some care is needed when soldering to keep excessive heat from traveling up the leads and burning out the insides, so a spare alligator clip was used to bleed off the heat.

After a final wiring check came the "moment of truth." It was time to fire up the station and test the new meter. I depressed the key on the Apache — the meter needle hit the left-hand peg and stayed there.

Jeff said, "Uh-oh. What happened Dad?"

Obviously the diode had been installed backward in the circuit. But I said, "Let's check the troubleshooting guide for a clue. It can't be too serious."

Sure enough, the manual indicated that such symptoms could be caused by reverse connection of the meter diode. It's easy to overlook the polarity marks on small diodes; diodes conduct in only one direction and they *must* be connected properly. You never saw a longer face than Jeff's when he found his project didn't work.

"Well, Jeff," I said, "You've learned something. Always check your work closely. Diodes can't be connected in a circuit like resistors — you have to observe polarity. Let's take the meter out of its case and fix this rascal."

The field-strength meter worked perfectly the second time around, and the smile on Jeff's face showed how pleased he was with his efforts. He placed the meter next to the Heath *Q* Multiplier atop the Hallicrafters receiver and set the sensitivity control for about half-scale deflection. Now, when changing bands and retuning the Apache, Jeff keeps one eye on the Apache grid current and the other on the field-strength meter to peak the output.

The best reward anyone could receive for his efforts is the look on Jeff's friends' faces when he takes them to see the station, shows them the meter, and says, "I built it myself."

This experience was extremely rewarding to me. It was a part of the education of a youngster interested in electronics. I'm sure Jeff realized the importance of taking nothing for granted.

Looking back, I think that Jeff probably learned more from the writing of this article than from the experience with the kit, where it all started. Jeff disliked English (he's an 8th grader) and couldn't see a useful purpose for it in his daily life. So a side benefit of Jeff's experience with building the kit is help in writing this little account. Total involvement? You bet! **HRH**

LIGHTNING apathy

Lightning can be devastating if your station is unprotected — here's how one ham learned the hard way

BY COURTNEY HALL, WA5SNZ

That lightning can be devastating, even catastrophic, is widely known. But this knowledge does not always lead to safe practices. I was guilty of "lightning apathy" and got by with it for ten years. When lightning finally did strike, I woke up fast and vowed I'd be ready for it in the future.

It's not that I hadn't seen what lightning can do. I have vivid childhood memories of a 12-meter (4 foot) cube being blasted from an upper corner of our brick school building, accompanied by a stunning clap of thunder. And a 0.9-meter (3-foot) thick tree, not 12 meters (40 feet) from our farmhouse, split down the middle with a deafening, terrifying bang. Perhaps time has a way of dulling one's perception of a lurking danger, especially when the damage is limited to others for many years.* I never grounded that vertical antenna on the roof.

Situation

Shown in **Fig. 1** is a sketch, roughly to scale, of my former antenna arrangement. The television antenna mast is properly grounded, and the utility pole has its own ground wire running along the pole tops. In between is the vertical ham antenna, complete with radials sloping down the roof top; it's fed by coax that goes down the far side of the roof, through a brick wall, and into the ham shack. Neither the radials nor the coax shield are grounded to earth.

I think I talked myself into the idea that, since the tops of the TV mast and the utility poles were grounded, my ham antenna was in a "neutral zone." If lightning should strike, it would surely hit the utility pole or the TV mast first. Much of my error was because of "eyeball" estimates of heights from the ground. Until I took measurements and made the sketch, I thought the utility pole was considerably higher than the ham antenna, and that the TV mast and ham antenna were roughly at the same height. The sketch shows clearly, however, that the ham antenna is the most attractive target for lightning.

Inside the shack, the coax is terminated at a connector mounted to a plastic wall plate. From there, another piece of coax connects to the equipment; in this case the front end of a receiver breadboard.

Occasionally, over the years, solid-state devices in the front ends of homebrew receivers mysteriously failed. And sometimes, when a storm was gathering, I could draw an arc of electric discharge between the antenna lead and the earth ground; then I'd wait a minute for the antenna charge to build back up and draw another arc. It was fun and interesting.

The strike

It was a little after 9PM, and we were in the den watching television. A sudden thunderstorm was passing overhead. It was evident from the near-simultaneous timing of lightning flashes and thunder sounds that the frequent lightning strokes were quite

*Author Hall is so right. We tend to think that "it can't happen here." In southern California lightning is rare — perhaps a severe strike occurs once in several years. So most hams in southern California don't do much about lightning protection. However the devastating winter of 1977-1978 produced tremendous lightning strikes. Several southern-California hams lost equipment to lightning and at least one home was destroyed by lightning striking an ungrounded antenna. Most of the fellows here are now true believers in lightning protection. ***Editor (W6NIF)***

near. I wasn't worried though; lightning hadn't hit my ham antenna in ten years. Besides it *was* grounded (for static charges, anyway). The center conductor of the coax was connected to the shield through a couple of turns of 0.3-mm (28 AWG) wire on the input toroid of the receiver, and a short clip-lead (about 0.5-mm, or 24 AWG wire) connected the shield to a heavy wire connected to earth ground.

From where I was seated I could see down the hall, past the darkened doorways of a bathroom and the room used for the shack. Absorbed as I was in the television program, I was severely startled when a thunder clap occurred, accompanied by a loud electric "crack" and a dazzling flash. I thought I saw a bolt of lightning flash right in front of the television screen.

Recovering from the initial shock, I saw a bright flickering glow filling the bathroom doorway down the hall. As the picture tube died, I arose and hurried to the bathroom; the light dimmed rapidly as I approached the glowing doorway. When I got there, I saw flames spewing from the unused electric outlet on the wall just above the wash basin. It quickly went out. My first thought was: is the house on fire? I was thankful that a heavy rain was falling on the wood-shingle roof.

The damage

Some of the effects were not discovered until the next morning. Two of the house-wiring circuit breakers had tripped; one was for the ceiling lights and wall outlets in one part of the house, and the other for the washing machine. The breakers wouldn't reset. They just made a loud noise and flipped back off when released. It turned out that the outlet socket in the bathroom and the socket for the washing machine had shorted internally, between the hot line (black wire) and the earth ground (third wire). Installing new outlets allowed service to be restored.

The wire portion of the ground clip-lead on the coax was literally vaporized, leaving only flash marks on the table. The antenna winding on the receiver toroid was also missing, and the receiver front-end FET was burned out. My oscilloscope had been turned off when the action occurred, but its power line fuse was wiped out. Fortunately, neither the scope nor the TV set appeared to have been damaged.

In trying to figure out how all this happened, I found that an ac line cord from a soldering-iron control box was hanging over the rear edge of the operating table and passed within 25 mm (1 inch) of the metal coax connector on the wall (see **Fig. 2**). The insulation on the line cord at that point was burned through to the copper in two places, and there were two dark spots on the plastic wall plate where vaporized insulation was deposited.

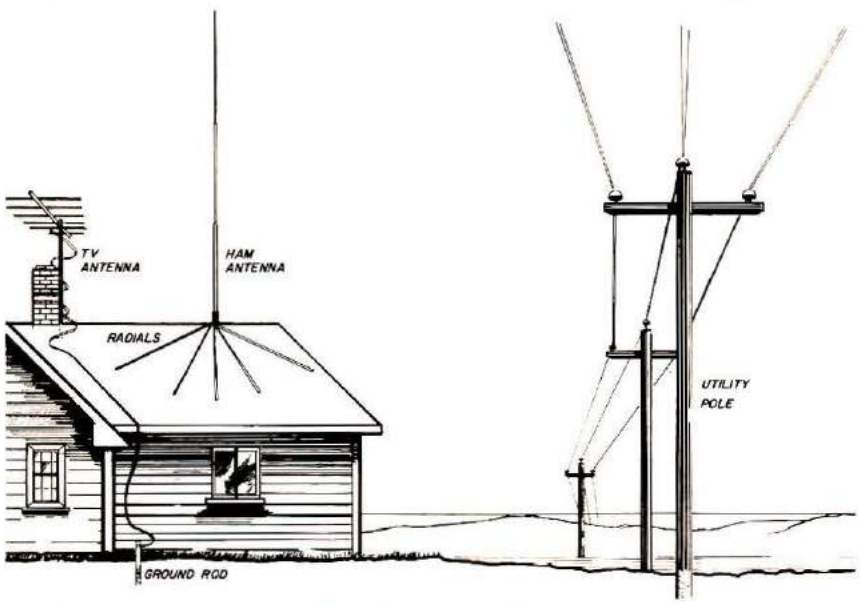

Fig. 1. Sketch of the antenna configuration that was struck by lightning. The ham antenna radials aren't grounded to earth, nor is the shield braid of the coax cable.

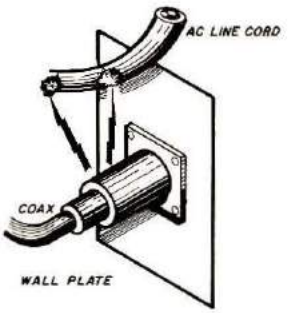

Fig. 2. Arcing from coax connector to line cord spreads lightning to house wiring. The ac line cord was about 25 mm (1 inch) from the coax connector.

I believe that when the receiver front end burned out, the lightning current jumped to the soldering-iron line cord, thus energizing all the house wiring. This brief but powerful surge on the line destroyed three ceiling light bulbs and caused arcing in the outlet sockets, which fused their metal parts. An arc must have occurred in the scope between the fuse wiring and the chassis, causing the fuse to blow.

Action

Besides replacing light bulbs and outlet sockets and cleaning up burn deposits, I've removed my antenna with its radials and coax from the roof. Until I decide on a better outside arrangement, the idea of an indoor antenna in the attic has some appeal; at least

it should be much safer than what I had. If that sounds like I'm a little scared of lightning, it's because I am.

A couple of days after this incident happened, my copy of the April, 1978, issue of *Ham Radio Horizons* arrived. Naturally, I was attracted to Jim Fisk's article entitled "Fire Prevention in the Ham Shack." One thought in the *lightning hazards* section jumped out at me: "The objective of lightning protection is to keep the effects of the lightning strike *outside* your house; don't invite it inside." So I think that any future outside antenna I might erect will connect to a heavy-duty knife switch or relay on the outside of the house, with a heavy-duty earth ground connection to the switch or relay. The antenna will be grounded except when in use.

Parting words

It was careless of me not to provide the best lightning protection available for my antenna, and I feel quite lucky to have come away with such light damage. Perhaps some reader as careless as I was will decide he won't wait for his time to run out or hope to be as fortunate. Maybe he'll wake up to his "lightning apathy." I hope so.

HRH


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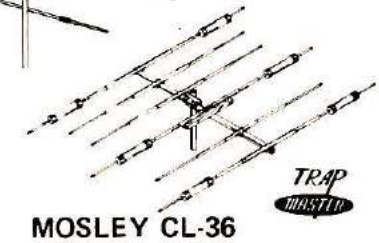

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TA-33	3 ele. 10, 15, 20 Mtr. beam	206.50	169.95
TA-36	6 ele. 10, 15, 20 Mtr. beam	335.25	279.95
TA-33 Jr.	3 ele. 10, 15, 20 Mtr. beam	151.85	129.95
TA-40KR	40 Mtr. add on	92.25	74.95
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El Cheepo KEYER

How to build a keyer that doesn't cost more than your rig

BY BOB SHRINER, WA0UZO

Several hams I know have built some of the various low-power (QRP) rigs described in the literature, and then talked about the need for a keyer to go with them. On the face of it, it does seem rather counter-productive to build a compact rig, at a cost of only a few dollars, and then hook it up to a keyer that is either huge, or costs three or four times as much as the rig. After looking at some of the available circuits and keyers, I sat down to see what could be done. Two pots of coffee and eight hours later the "El Cheepo Keyer" emerged. The operation of the keyer is extremely smooth, and on-the-air tests show that its performance equals that of some of the most expensive.

The circuit

Take a look at the schematic diagram, **Fig. 1**. Three inexpensive ICs, a few capacitors, and some resistors are all that are needed. A sardine can is used for the base. You can use other containers if you like.

I found the basic circuit in *ham radio* magazine for July, 1977. The problem was that the keyer produced only high and low voltage-levels, so I added U3 as a tone generator to drive a speaker, and Q1 to key the transmitter. Both the collector and emitter of Q1 are left open so that it can be connected to any rig. To use the keyer with most transmitters, you simply ground the emitter and connect the collector to the high side of the key jack. For lowest possible cost, the circuit can be built on Perfboard and the paddle made out of scrap PC board material. A complete kit of parts, including the printed-circuit board, components, and

parts for the paddle (sorry no sardines) has been made available.*

The first thing to do, as in all projects, is to get your hot little hands on the parts. Cut out the bottom of the can of sardines (or whatever) and either eat them or feed them to your cat (or whatever). Trim your circuit board for a nice fit on the can, then place it on top of the can to locate and drill the mounting holes. Drill a hole through which the leads for the battery may be passed, down into the can. A small grommet should be used here.

Place your battery holder, **Fig. 2**, in the can, and fasten it down with a little epoxy cement. Use some cardboard and glue to build a barrier around the holder, to keep

*Circuit boards and parts are available from Circuit Board Specialists, P.O. Box 969, Pueblo, Colorado 81002. PC board only is $5.50; a complete kit of all parts, including paddle and PC board is $15, postpaid.

The completed keyer on its sardine-can base. The printed-circuit board is mounted on spacers above the can surface. Scrap pieces of copper-clad board are used for the paddle assembly. Two screws serve as contacts for the dash and dot functions near the right end of the paddle. A 9-volt transistor-radio battery provides power for the circuit.

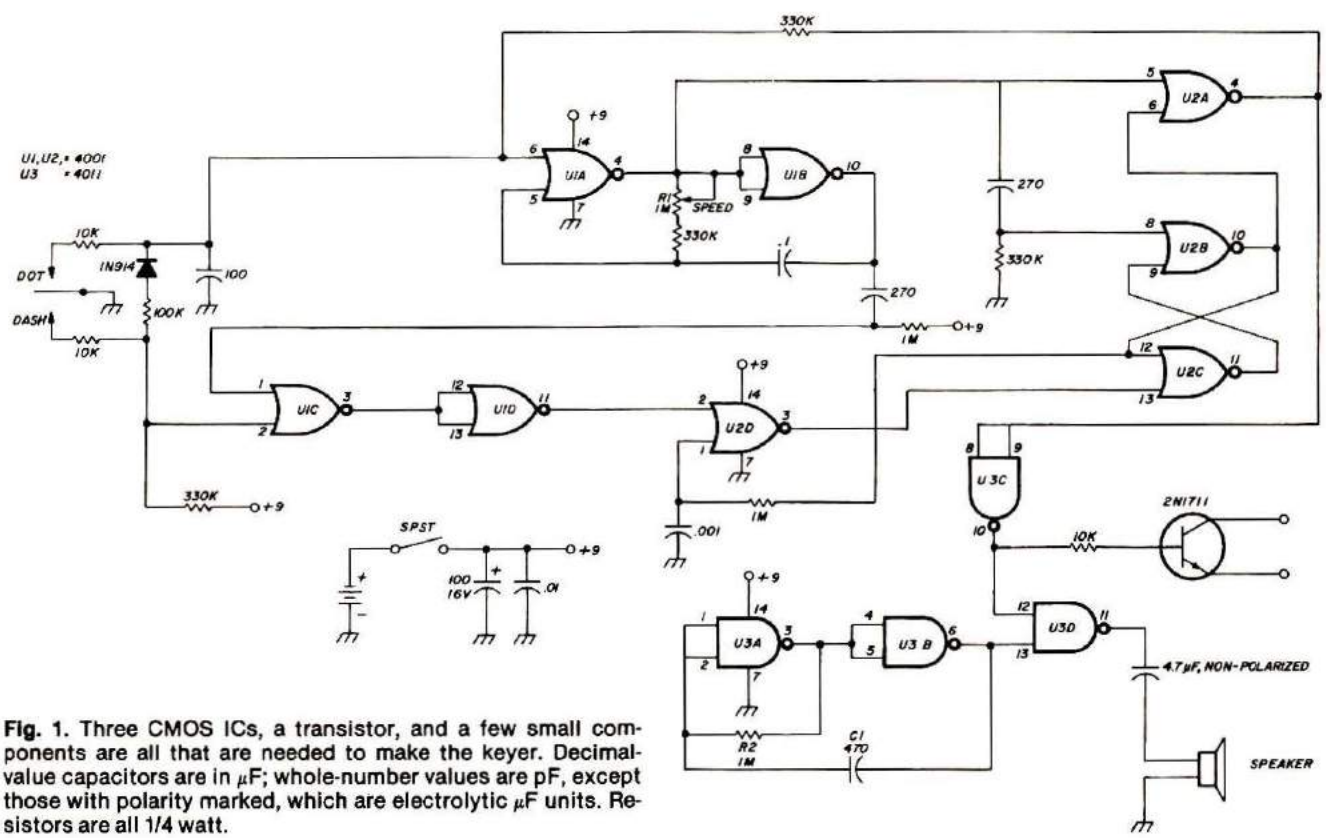

Fig. 1. Three CMOS ICs, a transistor, and a few small components are all that are needed to make the keyer. Decimal-value capacitors are in µF; whole-number values are pF, except those with polarity marked, which are electrolytic µF units. Resistors are all 1/4 watt.

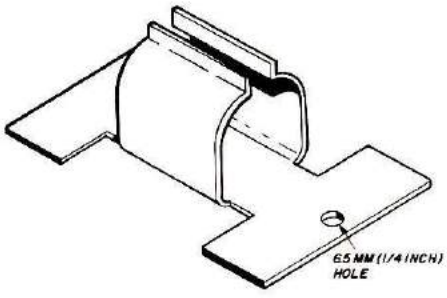

Fig. 2. A battery holder can be made from a piece of scrap metal. It is glued in place inside the can, before the epoxy-and-lead weight is added. Allow space for the battery, and provide a hole for the leads to go to the printed-circuit board on top of the can.

epoxy (to be added later) away from the battery. Assemble the circuit board, screws, nuts, and spacers on the can and put a little grease on the exposed ends of the screws (inside the can).

Now you'll need to add some weight to the assembly to keep it from walking around while you use the keyer. Lead shot, or very small fish-line sinkers will do fine. Mix up some epoxy auto-body filler, and smear a little of it around the nuts to hold them in place; coat the inside of the can, pour in the lead shot and then smooth over the surface with some more epoxy. After the epoxy is set, remove the circuit board from the top and assemble the circuit components on it.

The ICs used are CMOS, so ground yourself, your soldering iron, the work bench, and tools before you touch the ICs: they are very susceptible to static discharge. After they are installed the possibility of damage is slight. Sockets are recommended for the ICs to make trouble shooting easier.

Next, cut out the paddle and small parts as shown in **Fig. 3**. A nibbling tool, file, or tin snips will take care of this little project. Assemble all the circuit-board parts to construct the paddle. Merely locate them in the right place and solder them on. It is best to tack-solder the pieces to hold them in place until all parts are assembled and aligned. Be careful when soldering the paddle in place — it must be nicely centered. Tack it in place and solder a little on each side to keep it from pulling to one side or the other. The speaker is also soldered in place. Scrape the area to be soldered with a knife to expose clean metal.

Mount the completed circuit board and paddle assembly on the can. Three rubber feet should be used on the bottom to prevent marring your table: two in front and one in the rear. I used the stick-on (self-adhesive) type. Press the paddle to the left and a string of dahs will come rolling out of the speaker; press it to the right to produce dits. The speed is adjustable with R1. If you desire a different tone,

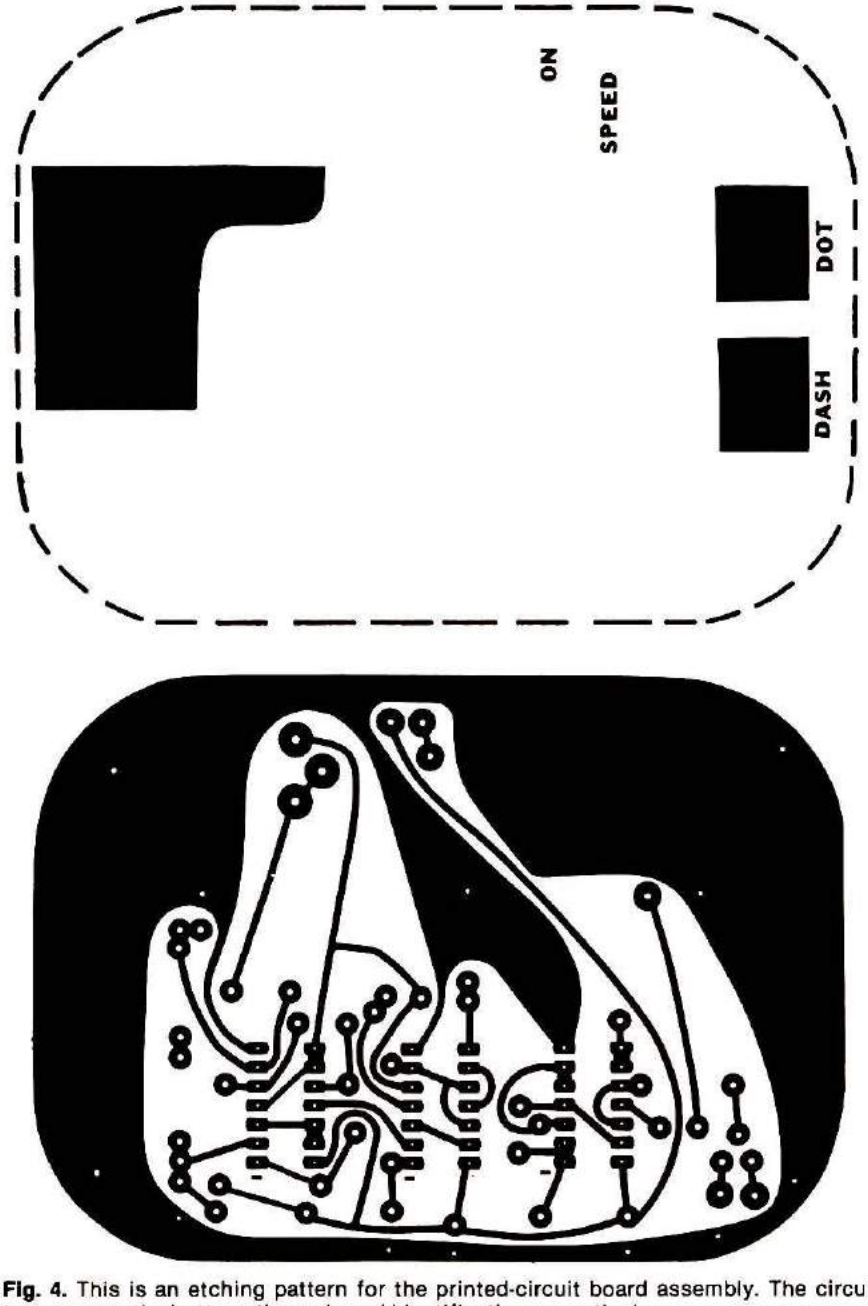

Fig. 4. This is an etching pattern for the printed-circuit board assembly. The circuit traces go on the bottom; the pads and identification go on the top.

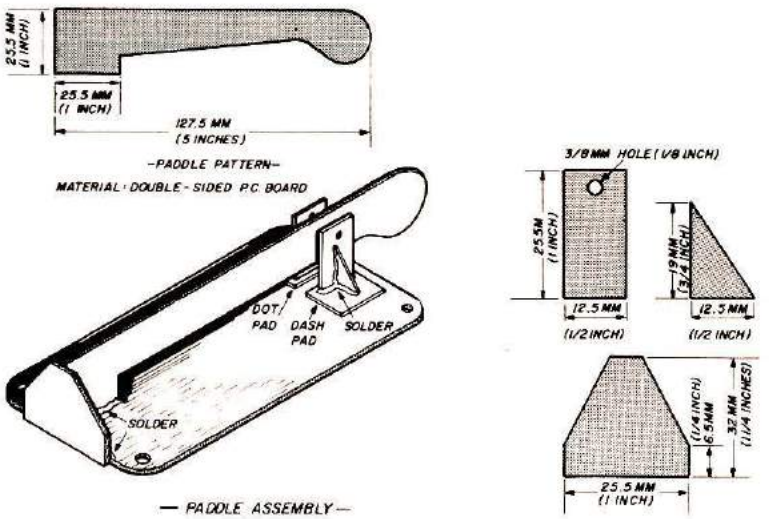

Fig. 3. The paddle assembly can be made from scrap double-sided printed-circuit board material. The pieces are cut and filed to shape, then are soldered together and to the top of the circuit board. The circuit board is double-sided, with copper pads on the top for mounting the paddle and the dit and dah contact-screws.

change R2 or C1. You can get more volume by using a small output transformer; 5000-ohm primary to 8-ohm secondary will work fine.

In the event of trouble, an oscilloscope should be used to check for an audio tone at U3, pin 4. If this is okay, then press the paddle one way or the other and check for oscillation at U1, pin 10. If this is okay, then trace the oscillation through the circuit until the fault is found and replace the defective IC.

After a little practice, you will be sending nice smooth code, and you don't have to tell anyone the humble origin of your keyer.

HRH

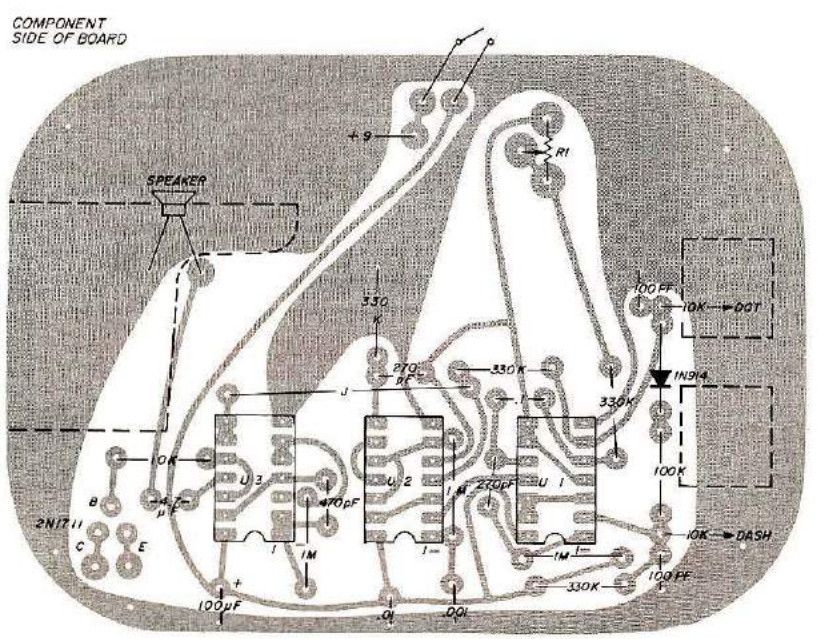

Fig. 5. This is a parts-placement guide for the printed-circuit board, as seen from the top (component) side. An etched board is available if you do not have facilities to make your own. You can also obtain a complete kit of parts; see footnote on page 59 for address and price.

EXTRA **Hamfest News** EXTRA

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HURRY! EARLY BIRD TICKETS ARE GOING FAST!

THOUSANDS in PRIZES

Biggest Show in the East

N.E. Convention Escapes to Country

Conventioneers and city dwellers alike breathed a sigh of relief when the news was released from Newington. The New England ARRL Convention, formerly held in Boston for several years was moved to the tiny hamlet of Boxborough, Massachusetts on Interstate Route 495. Free parking and easy access were given as two main reasons for the move. Home of the big show will be the Sheraton Boxborough Hotel, Exit 28, Route 495.

Prizes Awarded Both Days of Show

Through the generous cooperation of the manufacturers and exhibitors lucky conventioneers will be taking home transceivers, antennas, microphones, amplifiers . . . the list goes on endlessly.

The event is a non-profit affair and surplus funds go directly into the prize fund.

Every Manufacturer Will Attend

Virtually everybody who is anybody will be there. A partial listing at presstime included Icom, HyGain, Dentron, Tufts, 73, Spectrum International, Mosley, Drake, ARRL, Ham Radio, Yaesu, CushCraft, Robot, Atlas, Ten-Tec, Digital Group, CQ, Kenwood, Byte, Tri-Ex, Hamtronics, Harrison, Science Workshop, TPL, ETO, Newtronics, HAL, Heath, Bay State, Evans, Radio Shack, Alda, DSI, Tel-Com, Harco, etc., etc.

Big Events All Weekend

Included will be movies of the Clipperton expedition, YL fashion show, bus trip to ARRL, night club show and banquet, seminars on antennas, ATV, you name it!

There will be 2 meter fox hunts and bargains in the flea market!

Discount Coupons Mailed September 8th 23,700 Sent to New England Hams

Registration will be $4 early bird, $5 at the door. If you were in the spring 1978 callbook you were sent a flyer. You can order tickets directly from the ticket chairman: George Stewart, W1ZQQ, 17 Barnes Avenue, East Boston, Ma. 02128. Children under 16 admitted free. Hotel reservations should be made directly with the Sheraton Boxborough, Boxborough, Massachusetts 01719.

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3550W	50HZ-550MHZ	TCXO 1PPM 65° to 85°F	25MV	25MV	75MV	8	.5 inch	115VAC or 8.2-14.5VDC	2⅛"H x 8"W x 5"D
3240HH	2MHZ-250MHZ	3PPM 65° to 85°F	100MV	100MV	NA	7	.4 inch	4AA Batt.	5"H x 3"W x 2"D

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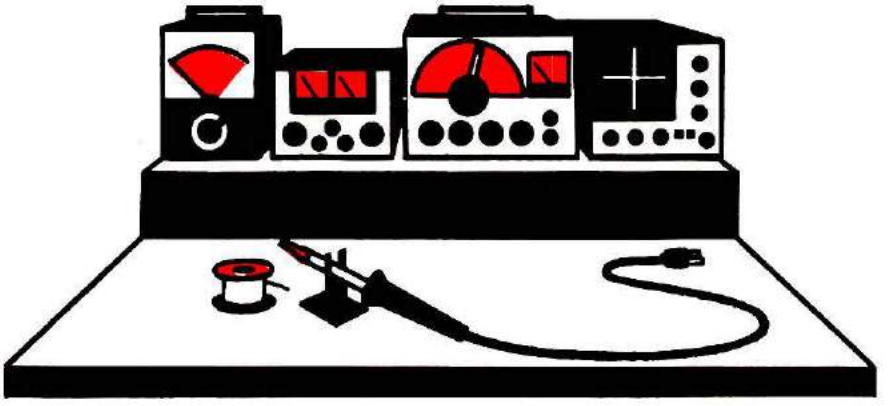


BENCHMARKS

Apartment Antenna for 7 MHz

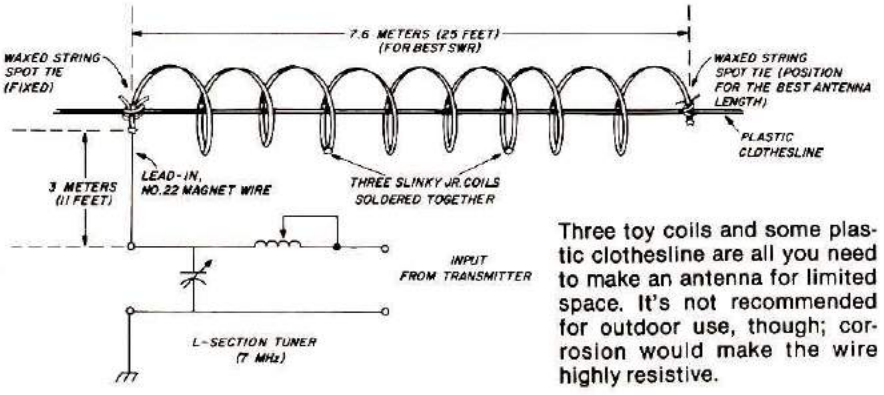
A Hertz antenna in an apartment? Well . . . at least a descendent of the Slinky family, treated as a shortened "Hertz."

Mine is located in my first floor apartment — stretched approximately twenty-six feet, with the highest point being seven feet from the floor. A kitchen-sink cold-water pipe serves as the ground system. The antenna is used with a Heathkit HW-16, loaded to 50 watts output, and covers the range 7.00 to 7.05 MHz without retuning.

Results have varied from early evening reports of 599 in San Diego (W6PLH), to 579 in Aspen, Colorado (W0NVQ), or 579 in Whitecourt, Alberta, Canada (VE6OZ). One early morning session netted a 449 from JA1ITS, Tochigi, Japan.

Original cost: 3 Slinky Jr. toy coils plus 50 cents worth of all-plastic clothesline, for a total of $2.12!

Spence Collins, N6SC



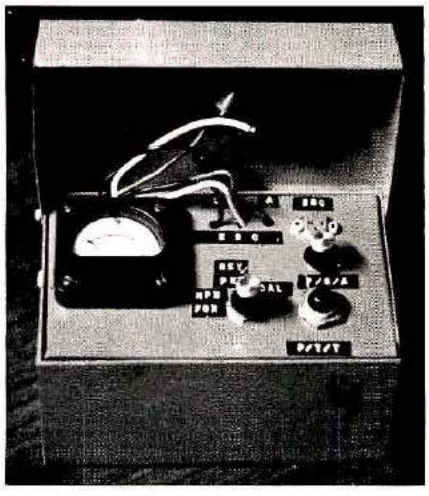
Three toy coils and some plastic clothesline are all you need to make an antenna for limited space. It's not recommended for outdoor use, though; corrosion would make the wire highly resistive.

Instant Cabinets for Home Projects

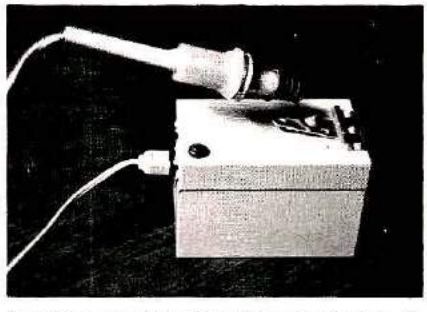
For most of us, making a cabinet for home projects is a chore, and plain alunimum boxes are not always attractive. The solution for me was a 3 x 5 index-card box. The first project that I put in this type of box was a transistor checker, which is shown in the photograph. Since that first index-box cabinet, I have made it a habit to place all my small projects in these file boxes. There is a wide assortment of colors and sizes, and two types of material are available. So far I have used the metal and plastic boxes in the 3 x 5 and the 5 x 7 sizes. One nice feature about the plastic boxes is that they have a snap-lock lid.

In most of my projects I make a panel insert which requires only two right angle bends. I have also used the surface of the index box for mounting the controls, and in this configuration the lid must be held closed in some manner. In one case I used aluminum trim-tape, which worked satisfactorily.

John A. Burton, WB9QZE



Small test instruments fit nicely into file-card boxes. Here is a transistor tester built into a 3 × 5 metal box.



Another use for the file-card boxes is this multipurpose holder. The soldering iron is in its holder on top, and inside the cover is a temperature-control circuit. A roll of solder and accessories are neatly stored in the bottom of the box. Be sure to use only metal boxes for this scheme; plastic will melt.

Put TEN-TEC At The Top Of Your Accessory List
It figures that the leader in solid-state HF technology would be the leader in solid-state HF accessories. So, when it's time to add to your operating equipment, look to the leader — TEN-TEC.

A. NEW TEN-TEC Model 247 Antenna Tuner — $69
So unique there is a patent pending, the 247 features a 47-tap toroid with silver plated 18 gauge wire, silver plated tap selector and 1kV variable capacitors in a universal Transmatch circuit. Matches 50-75 ohm outputs to a variety of load impedances, balanced and unbalanced (built-in balun). Antennas such as dipoles, inverted "V"s, long random wires, Windoms, beams, rhombics, mobile whips, Zepp, Hertz and similar types can be matched from 1.8 to 30 MHz. Power rating: 200 watts, rf, continuous duty. Attractive aluminum case with black end panels.

B. NEW TEN-TEC Model 277 Antenna Tuner/SWR Bridge — $85 Same unique features of model 247 above plus built-in SWR bridge and meter that shows ratios up to 5:1. Handsome black and gray styling. Matches Century 21.

C. TEN-TEC KR50 Ultramatic Keyer — $110 The keyer you control. Dual memories, individually defeatable, for operation as full iambic (squeeze) keyer, with single memory, or as conventional keyer. Self-completing characters. Adjustable automatic weighting (50 to 150%) determined by speed setting, paddle force (5-50 gms), speed (6-50 wpm), and 500 Hz side-tone level (to 1 v.) 117 VAC, 50-60 Hz or 6-14 VDC.

D. TEN-TEC KR20-A Electronic Keyer — $69.50
Speed 6-50 wpm. Factory adjusted paddle return force and weighting. Self-completing characters. Adjustable side-tone level. 117 VAC, 50-60 Hz or 6-14 VDC.

E. TEN-TEC KR5-A Electronic Keyer — $39.50
Same as KR20-A less side-tone and power supply. 6-14 VDC.

F. TEN-TEC KR1-A Deluxe Dual Paddle — $35
Same paddle as KR50; for iambic or conventional keyers.

G. TEN-TEC KR2-A Single Lever Paddle — $17 Same paddle as KR20-A; for "TO" or discrete character keyers.

H. TEN-TEC 206-A 25/100 kHz Crystal Calibrator — $29
Pulsed output for easy identification. 9-12 VDC.

I. TEN-TEC 208 CW Filter — $29 Four stage audio active filter provides 150 Hz bandwidth centered at 750 Hz. Two selectivity switch positions. 9-12 VDC.

J. TEN-TEC 244 Digital Readout/Frequency Counter — $197 Six digits show transmitted and received frequencies to hundreds of Hertz. LSI circuitry. 9 MHz preset information. Mode Switch selects freq. band or counter operation. 12-14 VDC.

K. NEW TEN-TEC 262M AC Power Supply with VOX — $145 Solid-state; built-in ammeter. Output: 13 VDC ±0.5V., to 18 A. Regulation better than 1%. Electronic circuit breaker. Mic. input: 2 megohms. VOX gain and delay control. Adjustable delay, 0.1 to 1 sec.

L. NEW TEN-TEC 252M AC Power Supply — $119
Same as 262M except less VOX.

M. TEN-TEC 215P Ceramic Microphone — $29.50
Use hand-held or at desk with matching stand included. Optimum articulation, smooth response free of power limiting peaks, impervious to temp. or humidity extremes. PTT switch, cable and 3-circuit plug. Black and gray.

N. TEN-TEC 210 AC Power Supply — $34 Solid-state. Output: 13 VDC, ±0.5 V, to 1.2 A. Regulation better than 1%.

O. TEN-TEC Blank Enclosures — from $7
Five sizes, finished to match 540/544.

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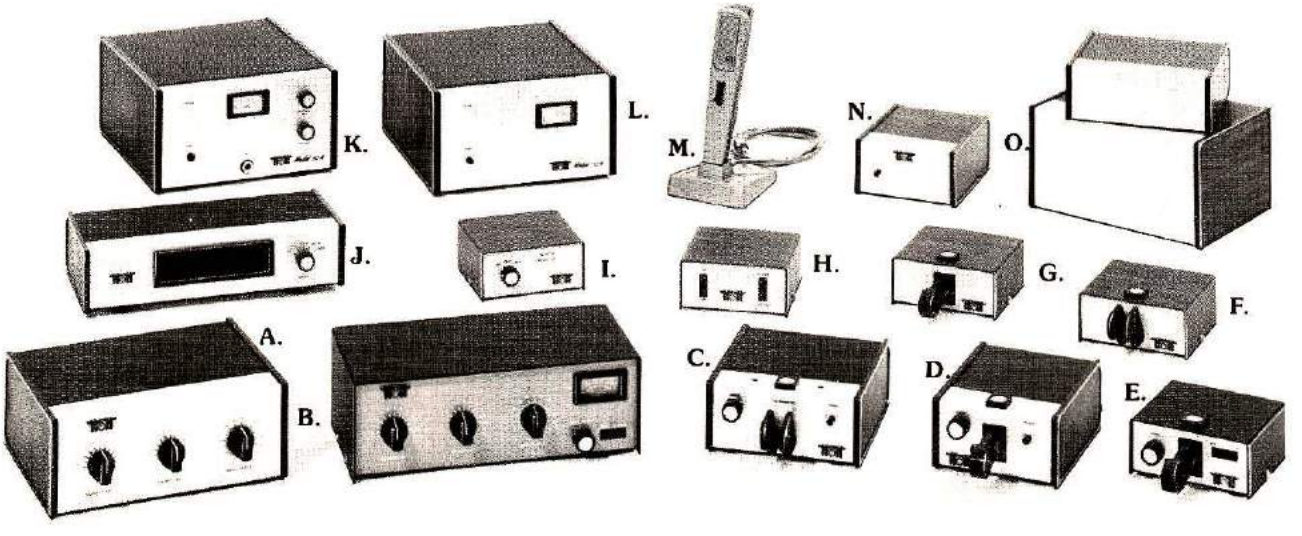

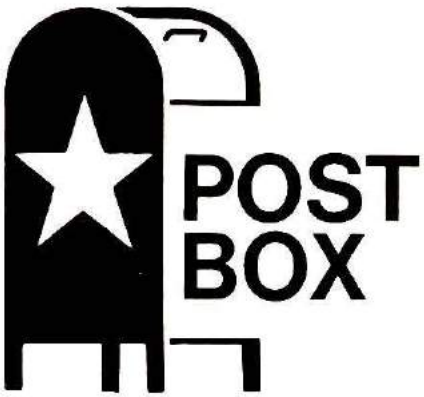

Dear Horizons:

I think your magazine is great and I have a few suggestions. You may have considered these already or for some reason they won't work, but I thought I'd tell you anyway.

1. Have a section of ham-radio-related ads in the back of the magazine; it could be similar to the way *QST* magazine does it but on a smaller scale.

2. Have a section where you review a selected piece of amateur equipment, including things like how it performed during any tests it underwent (administered by the Horizons staff if possible), how it works, etc.

3. Have a section where readers can write in with problems (such as "Dear *Ham Radio Horizons* Advisor") or give helpful hints they have discovered.

4. Divide the magazine into sections — each edition would present perhaps a different antenna in the antenna section, a different thing to build (complete with schematics and parts lists or just to give a general idea on how to build a specific project) each month.

That's all I can think of right now. If you don't like any of them, just throw them away. I hope you keep up the good work.

Derrick Kolus
Mechanicsburg, Pennsylvania

Thanks for your input, Derrick. You are right, many of these ideas have been examined to see if it would be practical to include them in Horizons. *We haven't thrown any of them out, but rather have put them on the shelf for the time being as impractical for* Horizons *in its current size. The suggestion nearest to the top of the list is the advisor section — and we're still tossing that one around to see if it'll fit. Our "Benchmarks" section is the place for helpful hints or quickie projects, so keep an eye on it from time to time.* ***Editor***

Dear Horizons:

I just read the July 1978 issue of *Ham Radio Horizons* and enjoyed the article by W8FX on lightning protection. I want to add one comment that I think your readers should be aware of. I took all of the precautions I could think of and spared no expense in protecting my antenna installation of two towers. One is 100 feet up and I figured it would get hit. The first lightning storm that came through after the installation of all of my new equipment blew the audio section out of my Yaesu. I assumed it was the power line that got it. For the next storm I unplugged the power as W8FX recommended and the audio section was blown again. This time it blew the phone patch also. A knife switch on the phone line solved the problem.

Allen Holecek, WA9MCX
Rockton, Illinois

Dear Horizons:

Thought I would drop you a note and comment about your article in February 1978 *Ham Radio Horizons*, page 12. As it happened, I was then in the process of designing some new QSL cards (my first batch was about exhausted). I wanted something original and distinctive, so I had our local printer make up a design from my sketches.

I wanted to have the necessary QSL information all on one side to make the task of the guy at the other end easier. At the same time I wished to make sure that the call was on both sides, as I understand this speeds up confirmation for a QSL manager.

The front is, of course, purely for show. I chose a maple leaf because it is a part of our flag and is generally recognized as distinctly Canadian. The call is in black and is slightly larger than the word "CANADA" to draw attention to it. I hope it will be given a prominent position on the walls of DX hams I work.

Your article was very helpful in explaining what's available and the reasons for doing (and not doing) certain things when designing a card. Your article, combined with my own experience in getting cards, made the designing of this one possible. Keep those interesting articles coming.

Glenn McMichael, VE3CGU
Goderich, Ontario

Dear Horizons:

Field Day is right! The experts in the art of QRM sure had one! I haven't heard confusion and lack of common courtesy to equal it in all the time I've been on the air. Stations with QSO's already in progress were continually stepped on by the endless "CQ field day" calls. I didn't listen in on all the bands, and I'm sure only a small percentage of participants were guilty, but it surely was disappointing to hear.

One more thing while I'm clearing the air. Please advise your readers that a station that follows his call sign with /mm (1, 2, or 3) is *not* exotic DX — just a ham who's on a boat or ship. The number identifies which ITU Region the vessel is in.

In many cases, these maritime mobiles have skeds with family and friends to keep in touch (there are no phones in the ocean). It's hard enough to make contact, much less maintain it, through the QRM of stations hot on the trail of rare DX. Listen before you call, *please*! Oh, yes, the maritime mobiles usually wait until they return home to answer QSL cards, which results in a stateside postmark!

Thanks for letting me spew a little, and thanks for a neat magazine.

D'Vonne Esbrook, WB5UTX
Mandeville, Louisiana

Dear Horizons:

Enclosed is an order for a subscription to *Ham Radio Horizons* for a good CB friend. I hope that I'll soon find him on the ham bands.

Thanks for the "down-to-basics" so many of us need. Not all of us have an "Elmer" for guidance and it is kind of tough to find a source of information that makes us feel

comfortable in the strange new world of Ham Radio.

As an XYL whose OM is still *not* a ham, I keep hoping he will soon master the code and become a novice. It's *tough* being an XYL without a ham for a husband! So many articles have been written about ladies who have succumbed to "ham fever" *after* their husbands have nagged them for a long time, but how about the gals who turn the tables? How do you convince the OM that the radio room in that closet isn't quite big enough, or that the inverted vee in the back yard needs some work done, that an antenna matcher might be of value, or that maybe if he were a ham all of it would be so basic that he wouldn't ask "why"!

Anyhow, thanks for all the help in the past.

Janice Pledger, WB7BRL
Yuma, Arizona

Dear Horizons:

Just like to say thank you for your article in *Ham Radio Horizons* on making your own QSL cards. I would not have made my original had it not been for your article. I received my ticket on 4-15-78 and I'm a novice. So far I've received about 50 QSL cards and love to read about their reaction to my cards. One nice fellow drew a picture and sent me that as his card . . . so I think original cards make ham radio that much more enjoyable. I had problems obtaining an artist, and had a little printer trouble, but it was fun. I have now inspired a couple of friends to brew their own — maybe your article will really get the ball rolling . . . thanks . . .

Dan Clark, WD6GWT
Cucamonga, California

Dear Horizons:

I am happy, excited, and just overjoyed on my good luck on being a winner of a life-time subscription to *Ham Radio Horizons* . . . it's a super magazine. The information is written so we can understand it.

I guess the Rochester Hamfest was my greatest ever — I passed my General exam out there.

Don't change this magazine — it is the best. Thanks again.

Elmer Eckerson, WB2VWD
Glens Falls, New York

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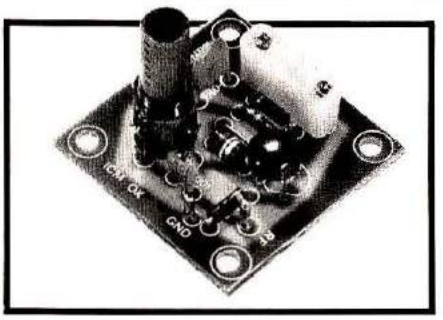

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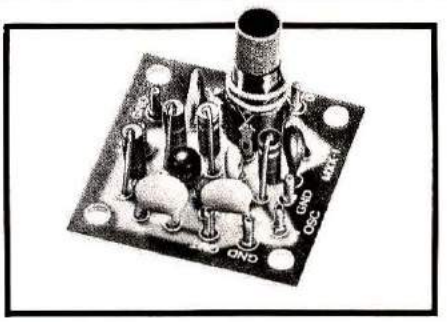

MXX-1 TRANSISTOR RF MIXER

A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106.

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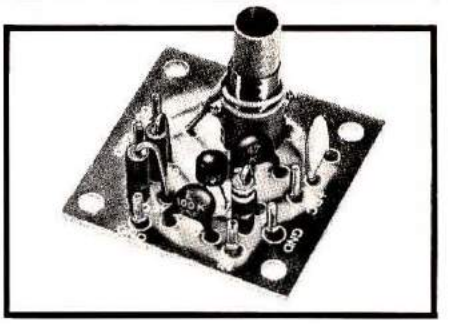

PAX-1 TRANSISTOR RF POWER AMP

A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated 3 to 30 MHz, Cat. No. 035104.

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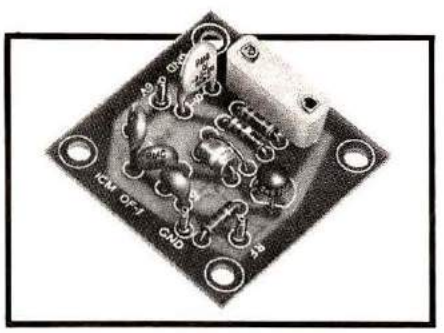

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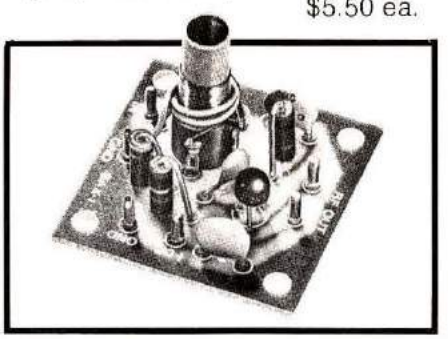

SAX-1 TRANSISTOR RF AMP

A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 035102. 20 to 170 MHz, Hi Kit, Cat. No. 035103.

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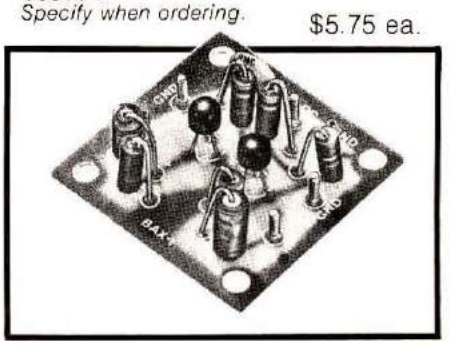

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Shipping and postage (inside U.S., Canada and Mexico only) will be prepaid by International. Prices quoted for U.S., Canada and Mexico orders only. Orders for shipment to other countries will be quoted on request. Address orders to:
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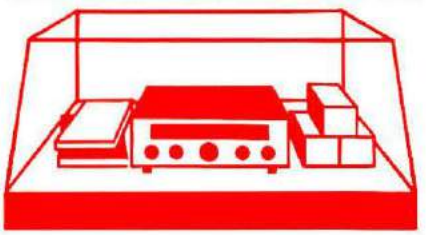


Palomar Electronics Hand-Held Transceiver

The new Palomar Mini-1 VHF-FM transceiver is about the same height as a dollar bill — yet it's a giant in performance. The transmitter output is one watt, with a total of 18 channels available in the 144-148-MHz band. The channels are obtained by using up-down split, down-up split, or simplex, all with only six crystals.

With the Auto-Patch option, the Palomar Mini-1 can access a repeater and communicate through the telephone system as well.

Dimensions of the Palomar Mini-1 are 152 mm high by 67 mm wide by 46 mm deep. Its compact size makes it exceptionally convenient as a means of portable communications.

For more information about the Palomar Mini-1 VHF transceiver, write to Palomar Electronics, 655 Opper Street, Escondido, California 92025; or use *ad check* on page 94.

New Heath Wattmeter

Heath Company, the world's largest manufacturer of electronic kits, has released a new wide-band Bi-directional Wattmeter. Called the IM-4190 (or SM-4190 in an assembled version), it is a self-contained unit that measures transmitted radio power up to 300 watts and reflected power up to 30 watts. It covers the 100-MHz to 1-GHz spectrum, and is an ideal tool for two-way radio service and repair, or for the amateur-radio enthusiast.

The IM-4190 is capable of withstanding full power overloads on its lower scales without damage to the meter movement. A single 9-volt battery powers the IM-4190, so it may be used while portable. N-type coaxial connectors are used for low insertion loss. Adaptors are included for use with UHF-type connectors.

The IM-4190 kit retails for $114.95 and the SM-4190 assembled version is $195.00 (mail order from Benton Harbor). For more information on the IM/SM-4190, write Heath Company, Department 350-630, Benton Harbor, Michigan 49022; or use *ad check* on page 94.

Nye Viking Master Key

The William M. Nye Company announces a new addition to their NYE VIKING line of products with the introduction of the MASTER KEY. Called the first major design change in telegraph keys in over 50 years, it is designed for the expert, yet is perfect for the beginner.

A prime feature of the *Master Key* is a contact assembly which is electrically isolated to keep the keying circuit separated from the base, the key arm assembly, and all exterior metallic parts. Thus, the shock hazard is greatly reduced. With its heavy die-cast body and non-skid feet, the key does not need to be secured to the operating desk, nor does it require a sub-base. As with all NYE VIKING keys, the contacts are gold-plated silver for sharp, sure sending. The base of the *Master Key* has a black wrinkle finish with nickel plated exterior hardware. The adjustable action key arm is fitted with a Navy style knob. The *Master Key* comes complete with 90 cm (3 feet) of two-conductor cord with attached plug. The list price is $19.50.

This new product joins the famous-for-quality NYE VIKING line that includes Speed-X and Super-Squeeze Keys, Iambic Keyers, Low-Pass Filters, Antenna Impedance-Matching Networks, and Phone Patches. All are manufactured by Wm. M. Nye Company, Inc., 1614 - 130th Avenue NE, Bellevue, Washington 98005, and are available at dealers nationwide. Write for more information, or use *ad check* on page 94.

Multicore Solder Products

Multicore Solders, a leading worldwide supplier to aerospace, electronic, and industrial manufacturers has introduced a line of selected professional-quality solders and soldering accessories specifically packaged for the technician, serviceman, homeowner, hobbiest, and do-it-yourself users. Included in the product line are multiple-core wire solders in a variety of alloys and/or flux formulations, solid wire solder, solder creams, and emergency solder, flux

pastes, and a line of desoldering wick.

Among the different solder alloys offered are those for electronic, general-purpose electrical, and a number of non-electrical applications including sheet metal work, plumbing, aluminum, and even a solder specifically formulated for stainless steel and silver jewelry.

The packaging for each of the products has been carefully designed to provide the user with a functional and practical choice, depending on the quantity they plan to use as well as storage requirements. All packaging is printed with complete application and instructional data, and is color coded according to alloy for quick identification. Complete information on all these products is available from Multicore Solders, Westbury, New York 11590; or use *ad check* on page 94.

Tandy Computers Catalog

A microcomputer mail-order catalog has just been issued by Tandy Computers, the newly created retail division of Tandy Corporation, parent company of the nationwide Radio Shack electronics store chain. The 52-page, 4-color catalog details a full line of popular brand microcomputers and accessories, software packages, parts, and literature currently in stock. Both kits and fully assembled microcomputer systems are listed in the catalog, at prices that range from several hundred dollars to more than $20,000.

Among the nationally known brands carried by Tandy Computers are Radio Shack's TRS-80, the IMSAI 8080, Vector 1 and 1+, Xitan, Equinox 100, Polymorphic System 8813, and many others offering beginners, hobbyists, educators, and business users a wide selection from which to choose.

In addition, the store carries a complete selection of microprocessor mainframes, peripherals, software, printed-circuit

accessories, discrete parts, and literature. The new store also offers programming assistance and on-premises computer service by skilled technicians.

Copies of the new Tandy Computers 1978 Catalog are available by telephoning toll-free 800-433-1679, by writing to Tandy Computers, Dept. R7, P.O. Box 2932, Fort Worth, Texas 76101, or use *ad check* on page 94.

Filter and Compressor for CW and SSB

Dynamic Electronics, Incorporated, of Decatur, Alabama, has recently designed a CW and ssb filter with audio compress and expand features, plus an output-level control. The fixed-tuned filters provide sharp attenuation for noise and interference from other stations. To prevent weak stations from being drowned out by extremely strong stations the COMPRESSED feature was added. This works on the amplitude of all signals whether they be code, voice, teletype, slow-scan television, or foreign-broadcast stations. This is ideal for receiving weak DX stations since a great improvement in the signal-to-noise ratio is obtained. Another advantage of the compress feature is that the output control can be set for a comfortable listening level, and strong stations will not blast through.

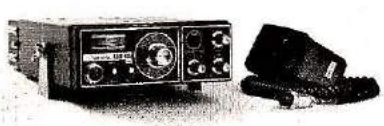
The expand feature was added to restore audio quality to signals which have been compressed by speech compressors such as Dynamic Electronics' DE-120. With this feature, a higher-than-normal level of compression can be used for superi-

or communication. An output control is included to adjust the volume for external earphones and speaker.

The DE-105 comes with a patch cord which plugs into a receiver's earphone jack. The normal speaker or earphones are then plugged into the output of the DE-105. The DE-105 comes in either an ac or a dc model. The ac model is designated as DE-105A and sells for $79.95; the dc model is designated as DE-105B and sells for $68.95. The units carry a one-year warranty and may be returned for a refund during a 15-day trial period. For more information write: Dynamic Electronics, Incorporated, P.O. Box 896, Hartselle, Alabama 35640; or use *ad check* on page 94.

Bristol Electronics 10-Meter Transceiver

Bristol Electronics of New Bedford, Massachusetts, now offers two mobile transceivers for the amateur 10-meter band. The HAM-10 is a 10-watt, 40-channel unit that covers 40 channels with 10-kHz spacing, starting at 28.965 for channel 1. The HAM-100 is a 100-watt version of the same synthesized transceiver.



Frequency control is by means of a patented Phase-Lock Loop synthesizer, and the receiver may be tuned between channels for better reception of off-frequency stations.

These transceivers are not worked-over CB units, but are, according to Bristol Electronics, designed and engineered for amateur 10-meter band use. The equipment is of the same lightweight and compact style that amateurs are accustomed to using in the vhf part of the spectrum.

Additional features include an

automatic noise-limiter, combined S- and rf-power meter, LED modulation monitor, and a jack for an external speaker. A microphone and all mounting hardware are included.

The modulation system is a-m, with a capability of 95 to 100 per cent modulation. Spurious signals are suppressed better than 60 dB, and harmonics are suppressed better than 45 dB. The HAM-100 has a selector switch for either full power or a 10-watt level for local work.

For more information, contact Bristol Electronics, Inc., 651 Orchard Street, New Bedford, Massachusetts 02774; or use *ad check* on page 94.

Prime Components Purchasing Guide

A new components catalog has just been released by Prime Components Corporation, of Hauppauge, New York.

The 36-page illustrated booklet lists many of the small parts often needed by hobbyists, experimenters, or small development laboratories.

A partial listing of items that can be purchased from Prime Components Corporation includes cleaning and servicing chemicals, test equipment, tools, integrated circuits, diodes, transistors, capacitors, resistors, LEDs and LED displays, lamps, fuses, and many other small parts. All of the parts are brand-name manufactured, and are available from stock. The catalog is free, and there is a minimum order requirement of $25.

To receive your free catalog, write to Prime Components Corporation, 65 Engineers Road, Hauppauge, New York 11787; or use *ad check* on page 94.

Etch Art Certificate

Every once in a while someone comes up with an eye-catching item for the ham shack that's truly an attention-grabber. The Etch-Art Certificate of Operation

certainly fits that description.

Although it is called a certificate, it could equally be called a plaque. The certificate is etched in copper with a black-plastic background, in the manner of the familiar printed-circuit board. The brushed-copper surface with lettering in a contrasting dense black amounts to what can only be termed a "classy" treatment of an amateur certificate.

The certificate is a standard 8 x 10 inches, ready for framing (or you could mount it on your own wood base to make a handsome plaque). The price is $14.95, postpaid. To order, PRINT your name, class of license, and your call, *exactly* as you want them to appear on the certificate, and send a check or money order to Etch Art, Post Office Box 57281, Dallas, Texas 75207. Be sure to include your return address, and add 5 per cent sales tax if you reside in Texas. No COD please.

Receiver Preamplifier

Telco Products Corporation announces two new mobile in-line receiver preamplifiers. Known as Models VHF 144 and UHF 450, they are specifically designed for amateur, police, emergency, business-band and Class A CB transceivers.

These new computer-designed preamplifiers boost receiver sensitivity. A unique rf-sniffer circuit allows the preamplifier to sense when the transceiver is keyed, and switches the preamplifier off during the transmit cycle. This feature allows the preamplifier to be connected directly into the coax line with no modification

to the existing mobile system.

The VHF 144 has 20 dB gain over a 5-MHz band in the frequency range of 140-180 MHz. Model UHF 450 features 10-12 dB gain over any 1-MHz band in the frequency range of 400-512 MHz. The VHF 144 will safely handle transmitter output of 40 watts, and UHF 450 will work with 100-watt transmitters.

Suggested retail price for the VHF 144 is $49.95; and for the UHF 450 is $59.95. For additional information, contact Telco Products Corporation, 44 Sea Cliff Avenue, Glen Cove, New York 11542; or use *ad check* on page 94.

Precision Tuning Devices

Two new series of miniature multi-turn trimmer capacitors with Teflon dielectric have been added to the *Tetfer* line manufactured in Croydon, England. Type TPC trimmers have printed-circuit tags arranged for through-board mounting; the capacitor occupies an 8.4-mm (11/32-in.) diameter hole cut in the circuit board, the tags being pushed into place from below. This minimizes protrusion above and below the board.

Type INS trimmers have the rotor insulated with a nylon extension-piece to prevent the adjusting screwdriver itself influencing the capacitance setting. *Tetfer* capacitors are cylindrical (brass-teflon-brass) with a circular ceramic base. The multi-turn screwdriver adjustment — each complete turn alters capacitance by about 1 pF — provides very fine tuning and exceptional stability. There are four models with capacitance swings of 5, 10, 15, and 20 pF. Existing versions plug into the circuit board from above, with a choice of horizontal or vertical adjustment.

New models of the Jackson Brothers TX5 vane-type transmitter-capacitors have also been announced. One version has Teflon interleaves in the air

spaces between the vanes to provide a higher voltage/capacitance ratio per unit volume. Another has the shaft mounted in roller bearings to reduce the drive torque. The capacitors are made with capacitance swings up to 1500 pF and in single-stator, split-stator, and differential versions. Working-voltage ratings vary from 2 kV to 6 kV.

10:1 Reduction Drive. The new type 6100 reduction drive introduced by Jackson Brothers is designed specifically for attachment to single-turn potentiometers. The 10:1 reduction ratio converts the component into a high-resolution multiturn potentiometer, the combination costs much less than such a potentiometer. A British potentiometer manufacturer is currently supplying such combinations in quantity for use in consumer radio and TV receivers. The drive is a friction-operated epicyclic ball-drive with automatic protection against over-adjustment.

For more information, write to Swedgal Electronics, Inc., 258 Broadway, New York, New York 10007.

Yaesu Digital Readout

Yaesu Electronics Corporation of Paramount, California, now offers an LED digital-frequency readout for the FT-221 or FT-221R two-meter all-mode transceiver. The YC-221 LED frequency-readout accessory simply plugs into the FT-221 series transceiver. A simple minor modification needs to be made to some of the early transceivers and full instructions are given in the YC-221 manual. The frequency readout is in seven digits, covering 1¼ to 148 MHz in one-half-inch LEDs. Amateur net price is $119. Contact your local Yaesu dealer or write Yaesu Electronics Corporation, 15954 Downey Avenue, P.O. Box 498, Paramount, California 90723, or use *ad check* on page 94.

More details? Ad Check page 94.

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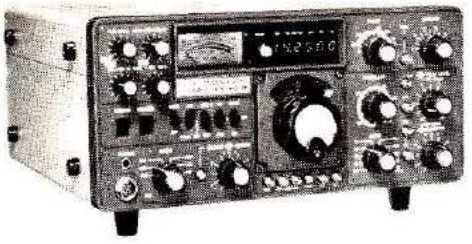

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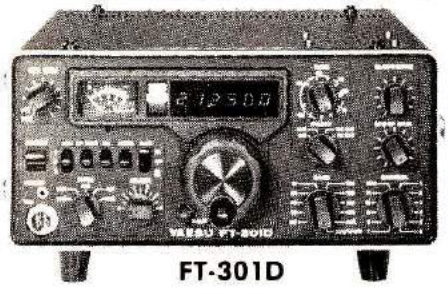

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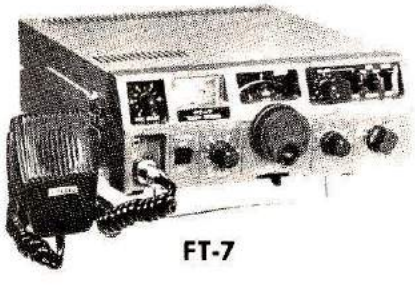

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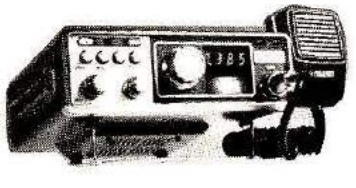

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INDIANA: Marshall County A.R.C.'s THIRD ANNUAL Swap & Shop Hamfest, October 29, 1978, at the Armory (Eleventh and West Madison Streets) Plymouth, Indiana. Doors open 7 AM to 4 PM, donations $2 for tickets. Tables can be reserved in advance, no charge, first come first served. Food, fun, and prizes. For more information, contact Melvin Mahler, P.O. Box 151, Plymouth, Indiana 46563.

MASSACHUSETTS: Annual Auction of Ham and Electronic equipment sponsored by the Hampden County Radio Association will be on Friday, October 6, at the Feeding Hills Congregational Church in Feeding Hills, Mass., west of Springfield at the intersection of Routes 57 and 187. Doors open at 7 PM and auction starts at 8. Club takes 10%, seller bids to protect items. For more information, contact Larry Soltz, WB1CJH, at (413) 567-6707.

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MT. AIRY VHF RADIO CLUB "HAMARAMA 78" at the Bucks Co. Drive-In Theater, Route 611, Warrington, Sunday, October 1, 1978, 8 AM to 4 PM. Registration $2.00, tailgating $2.00/space (own table). Talk-in via W3CCX/3 on 146.52 MHz. Advance registration to the Mid-Atlantic States VHF Conference includes admission to Hamarama 78. For information, contact WA3AXV, Ron Whitsel, Chairman, P.O. Box 353, Southampton, PA 18966. Phone (215) 355-5370.

SECOND ANNUAL MID-ATLANTIC STATES VHF CONFERENCE — Saturday, September 30, Treadway Inn on Easton Road (Route 611) Willow Grove. Advance registration contact WA3AXV, Ron Whitsel, Chairman, P.O. Box 353, Southampton, PA 18966. Phone (215) 355-5370.

TEXAS — HOUSTON/GALVESTON HAMFEST — October 8, 1978 from 0900 to 1600 CDT, Galveston County Park at League City, Texas. Prizes large and small, Flea Market, Auction, Games, Bar-B-Cue lunch. Registration — $1.00 (includes ticket for main prize). Sponsored by the Tidelands Amateur Radio Society (TARS), P.O. Box 73, Texas City, Texas 77590.

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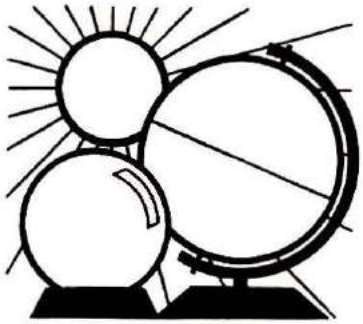

DX FORECASTER

Well, it finally happened! The DX season is off to a rip-roaring good start, with ten meters open a good share of the time, and fifteen meters wrestling twenty meters for the remainder. October begins the DX contest season, so be on the lookout for notices from *CQ* magazine about the first portion of the annual CQ Worldwide DX Contest. It begins to look as if Cycle 21 will be the biggest and best for many years — possibly rivaling Cycle 19 for top DX-favoring propagation. Peak conditions may occur in 1979 and 1980, but the decline will probably be very gradual, meaning that your DX opportunities will extend through the early 1980s.

In general, October is expected to be a rather calm month. Look for a possible minor disturbance somewhere around the 6th, 7th, or 8th. There is also the possibility of a more severe ionospheric upset between the 17th and 22nd, so be prepared. In times of high solar activity, conditions vary from extreme to extreme, passing through "normal" only on the way from one upset to another. DX could be virtually blotted out for hours or even a day or two at a time because of high absorption levels in the ionosphere. Briefly, the upper layers of atmosphere become so highly charged under the influence of solar radiation that they act like signal absorbers instead of reflectors. What is desired by hams is sort of an intermediate condition in which ionization is sufficient to promote reflection, *i.e.*, "skip," but not so great as to absorb signals entirely. You can look for DX propagation conditions between now and next March or April to be superb, with occasional lapses to rotten. In between, the conditions will be just plain good. There will be an eclipse of the moon on October second. Full moon and perigee occur October 11th. Don't forget to set your clocks *back* one hour on Saturday night, October 28th.

Band-by-band Propagation

Ten, fifteen, and *twenty* meters will provide nearly all of the DX activity this month. The chart will be your best guide as to where and when to look for DX signals. On the east coast, check for long-path openings into Central Asia from about 0900 hours local time until about five PM. Check fifteen first, followed by ten an hour or so later. With luck, ten should open up via long path for a couple of hours.

Forty and *eighty* meters have begun to come alive in the evening hours, starting as early as five PM local time. But, don't forget that in periods of increased solar activity, the absorption levels tend to increase, making life a bit more difficult on the lower bands from time to time; don't be disappointed if the DX is scarce now and then.

October is a bit early for *One Sixty* to be very active, but with the change from daylight savings to standard time, darkness will come earlier, and DX will appear sooner, if it appears at all. Static will kill your ears until December or January, so just be patient and enjoy the higher bands. **HRH**

GMT	PDT	WESTERN USA N	NE	E	SE	S	SW	W	NW	MDT	MID USA N	NE	E	SE	S	SW	W	NW	CDT	EDT	EASTERN USA N	NE	E	SE	S	SW	W	NW
0000	5:00	15	20	15	10	15	10	10	10	6:00	20	20	20	20	20	10	10	15	7:00	8:00	15	20	20	20	20	20	20*	20*
0100	6:00	15	20	15	15	15	10	10	15	7:00	15	20	20	20	20	15	15	20	8:00	9:00	20	20	20	20	20	20	20	20
0200	7:00	15	20	20	15	15	10	10	15	8:00	20	20	20	20	20	15	15	20	9:00	10:00	20	20	20	20	20	20	20	20
0300	8:00	20	20	20	20	15	10	15	15	9:00	20	20	20	20	20	20	20	—	10:00	11:00	20	20	20	20	20	20	20	20
0400	9:00	20	20	20	20	20	15	15	20	10:00	20	—	20	20	20	20	20	—	11:00	12:00	—	20	20	20	20	20	—	—
0500	10:00	—	20	—	20	20	15	15	20	11:00	20	—	20	20	20	20	20	—	12:00	1:00	—	20	20	20	20	—	—	—
0600	11:00	—	20	—	20	20	20	20	20	12:00	20	20	20	20	20	—	20	—	1:00	2:00	—	20	—	—	20	—	—	—
0700	12:00	—	20	—	20	20	20	20	20	1:00	20	20	20	20	—	—	—	—	2:00	3:00	—	20	—	—	20	—	—	—
0800	1:00	—	20	—	20	—	20	20	20	2:00	—	20	—	20	—	20	20	—	3:00	4:00	—	20	—	—	20	—	20	—
0900	2:00	20	20	—	20	—	20	20	20	3:00	—	20	—	20	—	20	20	—	4:00	5:00	—	15	—	—	20	—	20	20
1000	3:00	20	20	—	20	—	20	20	20	4:00	—	20	—	20	—	20	20	—	5:00	6:00	—	15	—	—	20	—	—	—
1100	4:00	20	20	—	20	—	20	20	20	5:00	—	15	20	20	—	20	20	—	6:00	7:00	—	15	20	20	20	—	—	—
1200	5:00	—	20	—	20	—	20	20	20	6:00	20	15	20	20	—	20	20	—	7:00	8:00	20	15	20	20	20	—	20	—
1300	6:00	—	20	20	20	—	20	20	20	7:00	20	15	15	20	—	15	20	20	8:00	9:00	20	10	15	15	15	20	20*	20
1400	7:00	20	20	20	15	—	20	20	20	8:00	15	15	15	—	—	15	20	20	9:00	10:00	—	10	15	15	15	—	15	15
1500	8:00	20	20	20	15	—	15	20*	20	9:00	15	15	15	—	—	15	20	20	10:00	11:00	—	10	15	15	15	—	15	15
1600	9:00	20	15	15	15	—	15	15	20	10:00	15	15	15	—	—	15	20	—	11:00	12:00	—	10	10	10	15	—	20	20
1700	10:00	20	15	15	15*	—	15	15	20	11:00	20	15	10	—	—	20	15	—	12:00	1:00	—	15	10	10	15	20	—	—
1800	11:00	20	15	15	10	—	15	10	20	12:00	20	15	10	10	—	20	15	20	1:00	2:00	—	15	10	10	10	15	—	—
1900	12:00	20	15	10	10	—	15	10	20	1:00	20	20	10	10	—	20	15*	20	2:00	3:00	—	15	10	10	10	15*	20	20
2000	1:00	20	20	10	10	—	15	10	15	2:00	20	20	10	10	—	15	10	15	3:00	4:00	15	20	10	10	10	10	15	15
2100	2:00	20	15	10	10	—	15*	15	15	3:00	20	20	10	10	—	15	10	15	4:00	5:00	15	20	10	10	10	10	15	15
2200	3:00	20	15	15	10	—	10	15	10	4:00	20	20	15	10	—	15	10	15*	5:00	6:00	15*	20	10	10	15	15	15	15
2300	4:00	20	20	15	10	15	10	10	10	5:00	20	20	15	15	20	10	10	15	6:00	7:00	15*	20	15	15	20*	15	15	20
	OCTOBER	CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARCTICA	NEW ZEALAND	W. AUSTRALIA OCEANIA	FAR EAST		CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARCTICA	NEW ZEALAND	AUSTRALIA	FAR EAST			FAR EAST	EUROPE	CENTRAL AFRICA	S. AFRICA	S. AMERICA	OCEANIA	W. AUSTRALIA NEW ZEALAND	AUSTRALIA

HAM CALENDAR

October 1978

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
*All international events such as contests are shown on the GMT days on which they take place even though they may actually begin on the evening of the preceding day in North America. Mt. Airy VHF RC "HAMARAMA" — Bucks Co. Drive-In Theater, Route 611 (Easton Road) Warrington, PA — WA3AXV  1	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM 2	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 3	See October 2, 5, 7, 11, 14, 16, 18, 21, 22, 28  4	West Coast Qualifyang Run — 0400Z 5	Hampden County Radio Assoc. Auction — Feeding Hills Congregational Church — Feeding Hills, MA — WB1CJH 6	Asheville Autumnfest — Asheville Civic Center — Info: Western Carolina ARS, P.O. Box 1488, Asheville, NC 28802 California QSO Party — 7-8 Ohio Area Repeater Council Meeting — Delaware County Historical Society Delaware, OH Radio Amateurs of Greater Syracuse Hamfest — New York State Fairgrounds — Syracuse, NY QRP QSO Party — 7-8 VK/ZL/Oceania DX Contest — Phone/RTTY — 1000Z 10/7 — 1000Z 1/8 7
Cedar Valley ARC Hamfest — Info: CVARC Hamfest, Box 994, Cedar Rapids, IA 52406 Tidelands ARS Hamfest — Galveston County Park — League City, TX 8	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 9	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 10	YL/AP Contest — CW — 11-12 11	Annual RSO Convention — Downtown Holiday Inn — London, Ontario Info: London Amateur Radio Club, Inc., Convention Committee, P.O. Box 82, London, Ontario N6A 4V3 — 13-15 ARRL Midwest Division Convention — Hilton Airport Plaza Inn — Kansas City, MO — 13-15 United States Air Force Military Affiliate Radio System (USAF MARS) Region One Convention — Albany, NY — 13-15 12	13	ARRL New England Division Convention — Sheraton Boxborough Hotel Exit 28, Route 495 — Boxborough, MA — 14-15 Knight Raiders VHF Club Auction/Fleamarket — St. Joseph's Church East Rutherford, NJ Manitoba QSO Party — 14-15 Mid-South Amateur Radio Association Greater Memphis Hamfest — Youth Building at the Mid-South Fairgrounds — Memphis, TN — 14-15 VK/ZL/Oceania Contest — CW — 14-15 9-Land QSO Party — 14-15 14
RSGB 21/28-MHz Contest — Phone 15	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM 16	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 17	W1AW Qualifying Run — 0200Z* 18	19	20	CARTG RTTY Sweepstakes — 21-22 RSGB 7-MHz SSB Contest — Phone — 21-22 21
Mississippi Coast ARA Gulf Coast Ham/Swapfest — International Plaza Biloxi, MS — K5YIN Repeater Assoc. of Downriver Amateur Radio Swap N Shop — Kennedy High School — Taylor, MI W1AW Qualifying Run — 2300Z 22	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 23	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 24	25	Coming up this weekend (28-29) The WEKEARNY RADIO CLUB of the Kearny Works will host the annual nationwide CQ-WE Contest. All licensed radio amateurs employed by or retired from Western Electric, Bell Labs, Teletype Corp., and AT&T, as well as their Club stations, are eligible to participate for certificates and awards. Phone — 10/28 from 1700-2200Z and 2300-0300Z * CW & RTTY — 10/29 from 1800-2200Z and 0000-0300Z * To encourage Novice & Technician participation, the first hour of each CW session on Sunday is reserved for contacting Novice & Technician stations only. Coordinators are: W2JVJ & W2IKH 26	27	CQ WW DX Contest — Phone — 28-29 Pan American Ham Exposition Jamboree — National Guard Armory on State Road 84 — Fort Lauderdale, FL — Info: Broward Amateur Radio Club, Attn: Ian Seidler, W4MRR, 10221 N.W. 36th Street, Coral Springs, FL 33065 — 28-29 28
Marshall County ARC Swap N Shop/Hamfest — Armory at 11th and West Madison Street, Plymouth, IN 29	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30 PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 30	Halloween AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 31		K2BSA Jamboree-on-the-Air will be held over the weekend of the 21st & 22nd. Suggested starting time is 0001 hours local time on the 21st and terminate 48 hours later at 2359 hours local time the 22nd. The World Scout Bureau, in conjunction with Scouts from Switzerland, France, and from the Boy Scouts of America, Trans Atlantic Council, will operate from a special international camp established at the Centre Scout de Satigny. With the cooperation of operators from the CERN ARC, it is planned to operate several stations simultaneously on all bands, including SSTV, RTTY and OSCAR. The call sign will be: HB9S/Portable.	K2BSA Jamboree-on-the-Air frequencies Phone / CW 80 Meters 3,940 kHz / 3,590 kHz 40 Meters 7,090 kHz / 7,030 kHz 20 Meters 14,290 kHz / 14,070 kHz 15 Meters 21,360 kHz / 21,140 kHz 10 Meters 28,990 kHz / 28,190 kHz 6 Meters 53,500 kHz SSTV SSTV Frequencies Info: Harry A. Harchar, W2GND/K2BSA, Boy Scouts of America, North Brunswick, NJ 08902 (201) 249-6000

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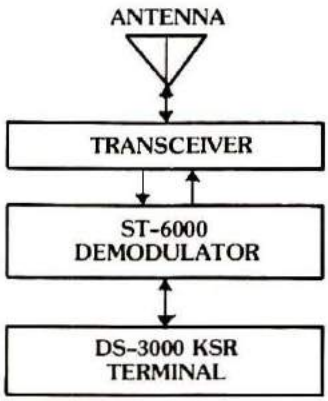

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