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Amateur Radio

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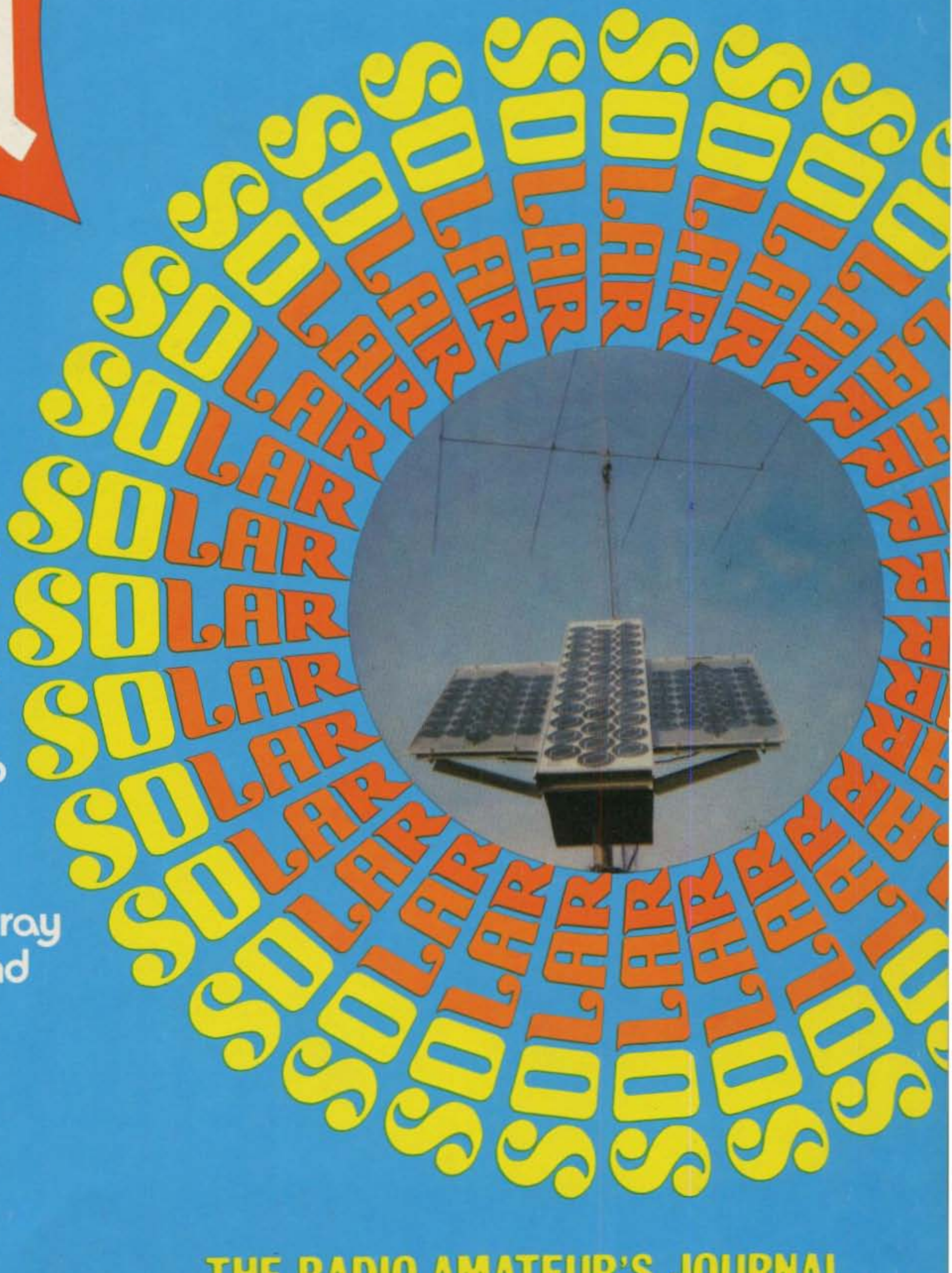

THE RADIO AMATEUR'S JOURNAL

Rack Attack from DenTron

Components are the latest in communication systems adapting to your stations' needs. The DTR-3KA and DTR-1200L are equipped with heavy-duty handles for easy rack mounting and rack brackets that can be easily removed. The DTR-1200L linear amplifier provides 1200 watts SSB and 1000 watts CW input continuous duty. It features large 3½" shadow box, back lit meters for easy reading, and tuned input for compatibility with solid state or tube transceivers. The DTR-3KA antenna tuner handles a full 3KW PEP. It features a built in 2KW dry dummy load with thermostatically controlled forced air cooling, a remote sensor box to insure meter accuracy and 50 OHM impedance. Component racks available at your DenTron Dealer.

DTR-1200L Linear Amplifier

Frequency Ranges:

80 Meter Band	3.45 - 4.6 MHz
40 Meter Band	6.00 - 9.0 MHz
20 Meter Band	10.00 - 16.00 MHz
15 Meter Band	20.95 - 23.50 MHz
10 Meter Band	Export Model

Modes: USB, LSB, CW, RTTY, SSTV
Power Input: 1200W - SSB, 1000W - CW
Power Requirements: 234/117 VAC 50/60 Hz
RF Drive Power: 150 Watts maximum and 65 watts minimum for 1 KW DC input.
DC Plate voltage: Idle + 2300V approximate
Duty Cycle: 100% SSB, CW, RTTY, SSTV
Input Impedance: 50 Ohms nominal
Input VSWR: 1.5 to 1 average
Output Impedance: 50 Ohms nominal
Antenna load VSWR: 2 to 1 maximum
ALC: negative going, adjustable from front panel
Spurious Emissions: IMD - greater than 30 db down
Harmonics - greater than 40 db down
Switchable 12VDC accessory output voltage
Multimeter:

Plate Voltage	0 - 3000VDC
Plate Current	0 - 500ma
Relative Output	Adjustable

Front Panel Plate Voltage Switching
FCC Type Accepted
Size: 5¼" H x 17" W x 13" D (19" W with rack brackets)
Weight: 46 pounds

DTR-3KA Antenna Tuner

Frequency Coverage: 1.8 - 30 MHz continuous
Built in 2 KW PEP Dummy Load - Forced Air Cooled
Input Impedance: 50 ohms (Resistive) to transmitter
Antenna Inputs
- Coax 1, 2 & 3 - unbalanced—may range from a few ohms to a high impedance
- Long wire - low to high impedance
- Balanced line - 75-660 ohms

Power Capability: 3000 watts P.E.P.
Wattmeter: 200 watts forward
2000 watts forward
200 watts reflected
Accuracy: ± 5%
Remote sensor box
3½" backlit meters
Dummy Load: with manual or automatic forced air cooling.
Integral 3KW Balun

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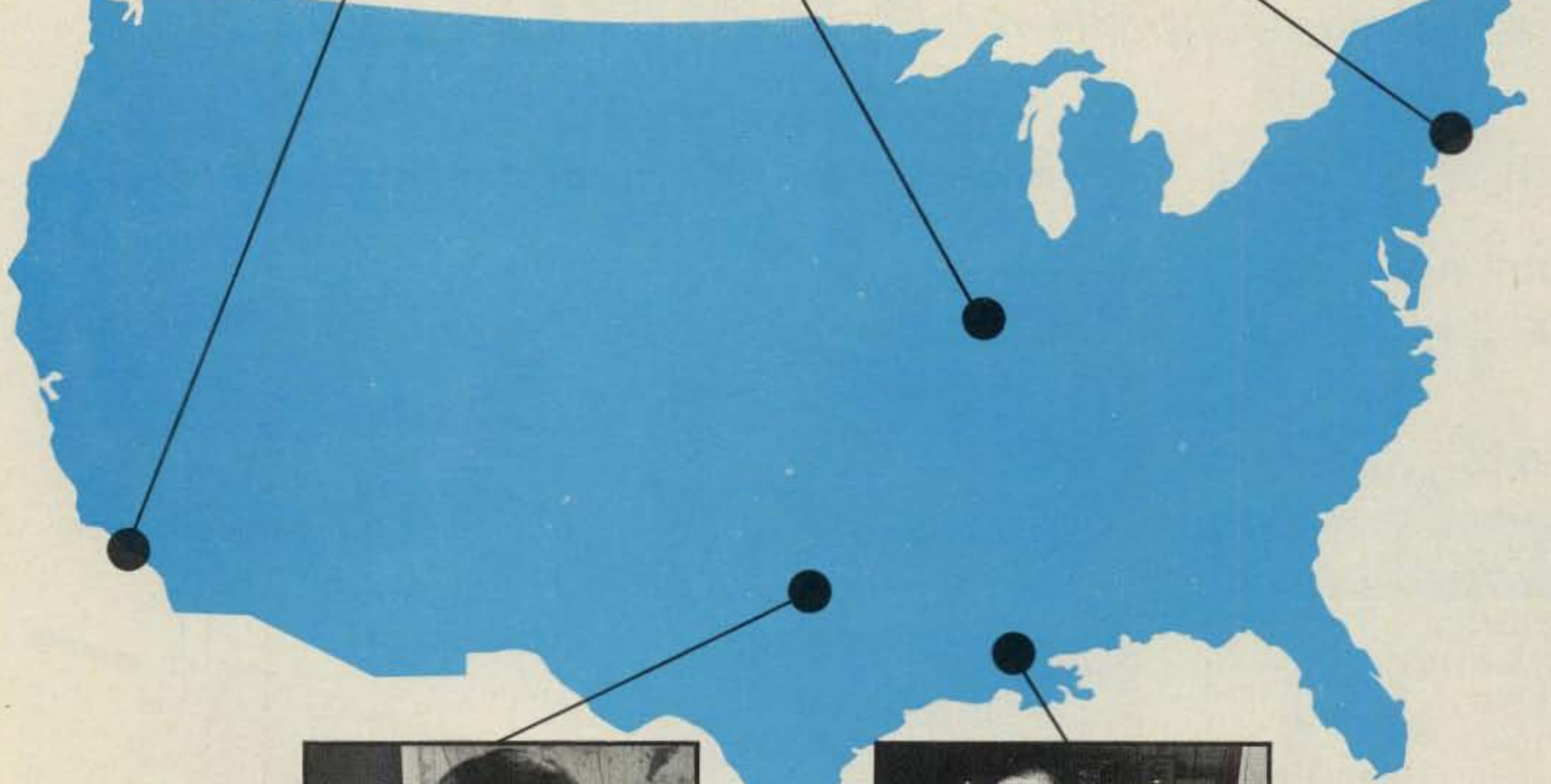

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CQ The Radio Amateur's Journal

ON THE COVER: W6PQZ, winner of *DXCC QRPp #4 All-SSB #1*, now has worked 248 with 234 confirmed. His latest efforts have been aimed at *DXCC QRPp* entirely with solar power. His rotatable solar panel can be seen here with the TB4HA tribander above it. The output from the panel is 13.5 VDC at 2.8 amps with full sunlight.

AUGUST, 1980 VOL. 36, NO. 8

FEATURES

DEPARTMENTS

Zero Bias

AN EDITORIAL

Paradox or Operating Aid

This morning my June issue of *QST* arrived and I turned as usual to the "It Seems To Us . . ." page. I like to read editorials in other publications to check on people's views and ideas. In June, in case you didn't get a chance to read it, Perry Williams, W1UED, talks about the idea of creating digital licenses for amateur radio. This digital license would be similar to the Canadian plan and incorporate amateur radio and computer technology. In general, Perry seems to be looking for feedback to this idea of creating a new licensing structure and doesn't really go into the nitty gritty of how it can be structured, administered and enforced.

Does amateur radio need such a license? I think not, especially after reading the rational behind Perry's premise. His premise is that the FCC might then consider this form of license as a beginner-class or entry-level license and therefore it would be "code free." This then would in effect give the United States a "code free" license above 30 MHz (how much above isn't certain). If the recent history of the digital-class license in Canada is any indication, we might indeed be flooded by as many as 300-500 new hams every couple of years or so. I can see that as growth of sorts, but a wonderful, exciting, captivating way of getting people past the code requirement and into amateur radio method of licensing . . . well, it's got to be one of the most convoluted pieces of irrational thinking I've seen in a long time.

Not only is this form of thinking irrational, it's down right insulting. First I think that Perry is making the classic error in logic by trying to mix apples and oranges. The apples are the digital licenses themselves. Whether this is good and desirable or bad and undesirable is a singular issue. The oranges part of the argument involves the concept of a beginner or entry-level license. There is no connection that I can see between both concepts nor do I see how one can bridge the gap. Perry sees a gap somewhere between the Novice and Technician licenses and the proposal would be a Digital Class to fill-in that gap for entry-level newcomers, code-free and populated by, as he puts it, *digital scientists* and *experimenters*. I call that insulting. I suppose that one could fill Perry's gap with a national reserve of trained, experienced digital operators in case of emergency or defense problems. Anyway, Perry does see a distinction between code speed and Baud rate, even though he doesn't understand the concept of a Novice or Technician license.

Perry goes on to justify retention of the code requirement in a laudatory manner by stating that "the present tests make each applicant demonstrate a personal commitment and invest something of *himself/herself* in acquiring an amateur license. The result has been a service with a far better reputation for discipline than others used by the public." Maybe so Perry, but what about the personal commitment and investment of time involved in winning a contest for example? On page 18 of the June issue is an article on an Electronic Voice Saver. With this device you can have programmed voice messages on your 8-track tape player in a sense operate the contest for you, therefore saving not only time but your voice as well. It circumvents the intent of the competition, which is pitting your voice (which is part of your station) against the voice of some other contester. I don't find fault with the article; it's clever and probably a good adjunct to a contest station. It does, however, remove the personal commitment and investment (in voice not cash) of the operator. This supposed personal investment and commitment has been eroding since the advent of amateur radio. All new technology and developments by definition make all subsequent use easier and in a way seem to negate the hard work previously needed to achieve the same results.

When the FCC revamps the licensing exams, a new licensing manual emanates from Newington. The manual breaks the exam down into questions very close to the actual questions and gives enough information on how to answer the questions so that the test can be passed. Does this mean that the applicant doesn't really understand the theory or fundamentals of electronics required for the license? More than likely so. Does this circumvent the personal commitment and investment in an electronic education? Definitely. It's heuristic. It's a means of getting the applicant's foot in the door where he can learn. It's useful, too, in the same manner we all used in getting our drivers' licenses. We studied a little book that had the questions and answers to the test. The person giving the driving test took us on a little spin around the block (not really in traffic), we tried to park and not hit anything and finally passed. We learned how to drive later by actually driving, not from that little book and not from the few-minute test. The League's *License Manual* or any other license manual that gets you through the door is worthwhile, and serves the same purpose.

If we take Perry's logic to the hilt, we should have had special licenses for s.s.b., SSTV, RTTY, f.m. and any other mode that came along after the audio and spark. ASCII is a mode that has its own specific technology and equipment as do all the others I mentioned, and I don't think the FCC wants to add more licensing and more regulations to amateur radio. For a relatively small group we sure go out of our way to create trouble.

I have the underlying feeling again that we are hearing another precursor to incentive licensing. WARC is over and we don't have to impress the Ik with our expertise in order to secure their support. We don't have to justify our very existence with the number of license classes we offer or hold individually. The League doesn't have to spend time thinking up these "new" ideas in order to feel important and purposeful. If there is that much free time left over after handling all of the member services, *QST*, books and the like (which I doubt), then they should use that time to improve those things. The League does have purpose and does provide its members and the fraternity with many worthwhile services. One purpose a membership organization or hobby-related organization should not have is the continual encouragement of the government for more and more restrictive legislation and regulation against its members.

I can understand to some degree the League's feeling of stewardship towards amateur radio—this all-seeing, all-knowing father who protects and nurtures his children because he knows best. But eventually that father has to realize that his children grow up and think for themselves. Stewardship can inhibit growth by overprotection. What is challenging that stewardship and therefore must be guarded against is the concept of a code-free license. The digital license is a smokescreen to encompass a mandated code-free license in a form designed not to attract many applicants. The League is threatened with the challenge to a venerated skill: code speed or code recognition. Rather than opening up the spectrum over 30 MHz to the masses via a code-free license, the League throws up a proviso in the form of a hook. The hook is the digital license requirement. You can't have one without the other. The ploy is obvious as is the perceived threat felt by the League and many of its Directors.

No one likes change, especially the League. On the other hand, c.w. is not being outlawed nor will it die out. Don't worry Newington, you survived the Novice License, Oscar, s.s.b., f.m., SSTV, RTTY, etc., and you're still going strong. Whatever happens, you'll survive a code-free v.h.f. license, too, and we'll still love you.

73, Alan, K2EEK

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Announcing

•Jacksonville Hamfest - The Jacksonville Hamfest Assn. will hold the 1980 Jacksonville Hamfest and ARRL Florida State Convention on August 2nd and 3rd at The Orange Park Kennel Club. Located at the intersection of I-295 and U.S. Highway 17, the site offers unlimited free parking, a large area for an indoor swap mart, and plenty of meeting space. Programs and forums are planned and many manufacturer and dealer exhibits will be there. Special hotel rates are available with a good selection of accommodations within walking distance. Advance registration is $3 ($3.50 at the door) and is available from Jacksonville Hamfest, 1249 Cape Charles Ave., Atlantic Beach, FL 32233. Swap tables are $5 per table per day and can be ordered from Andy Burton, WA4TUB, 5101 Younis Rd., Jacksonville, FL 32218. For more information, write JHA, 911 Rio St. Johns Dr., Jacksonville, FL 32211.

• **32nd Annual Upper Peninsula Hamfest** -Sponsored by the Delta County Amateur Radio Society (DCARS), this event will be held on August 2-3, in Escanaba, Michigan. This will be the only hamfest to take place in the Upper Peninsula of Michigan this year. Radio amateurs will gather from Michigan, Wisconsin, Minnesota, Canada, and elsewhere for this event.

• **DX-pedition to the Center of the World** – This event will be operated by the Warren Amateur Radio Association, from 1300 GMT Saturday, August 2 to 2000 GMT Sunday, August 3. Frequencies are 28.625, 21.360, 14.285, 7.235, and 3.900 MHz s.s.b. For c.w. fans, they will also monitor 21.125. QSL for a beautiful certificate with a large s.a.s.e.; DX please send 2 IRC's. Send QSL to: W8VTD, Center of the World DX-pedition, Box 809, Warren, OH 44482.

• **Kaskaskia Island** – The Saint Charles Amateur Radio Club of St. Charles, Missouri, will be operating in the upcoming 18th Annual Illinois QSO Party from 1800Z August 2 to 2300Z August 3. The call sign will be KØBM/9KI. An 8× 10 certificate will be available for all worked stations. Send a 9× 12 s.a.s.e. for the certificate. Operating frequencies will be up 60 kHz on c.w.; up 25 kHz on the Novice bands. S.s.b. operations will be on 3975, 7275, 14275, 21375, 28675. QSL to WDØGSY through the callbook address. (For more information on the Illinois QSO Party, see "Contest Calendar.")

• **Dial Radio Club Flea Market** – On August 9, The Dial Radio Club, W8BLV, will sponsor its second flea market for the purpose of raising funds for the maintenance of their repeaters. There will be door prizes hourly, refreshments, and flea market. Admission is $1. Talk-in on 146.52-52 simplex, 146.01-61 repeater. The event will be held at the Starglow Theatre in Middletown, Ohio.

• **Willow Springs, Illinois Hamfest** - The Hamfesters Amateur Radio Club will hold its 46th annual hamfest on Sunday, August 10th at Santa Fe Park, 91st and Willow Springs Road, Willow Springs, Illinois (near Chicago). Gates will open at 6 a.m. Tickets at the gate are $3 each; in advance they are $2 each. Free coffee for the early birds, games for the kids, prizes for the YL's and the world famous "shoppers row." Children under fifteen are free. For more information and advance tickets, send s.a.s.a. and check to: Hamfesters Amateur Radio Club, P.O. Box 42792, Chicago, IL 60642.

• **New Jersey** – The Ramapo Mountain Amateur Radio Club will hold its annual flea market on Saturday, August 16 at the American Legion Hall, Oak Street, Oakland, New Jersey. Indoor tables are $5 and tailgating is $3. No admission fee for buyers. Refreshments will be available on premises. Talk-in on 147.49/146.49 WR2AHD or 146.52 simplex. Call Bud Hauser, WA2JUO at 201-797-8471 or 791-0589 for advance reservations and information.

• **Fifth Annual New Delmarva Hamfest** – This event will be held Sunday, August 17 at Gloryland Park, Bear, Delaware. Admission $2 in advance, $2.50 at the gate. Tailgating $2.50. Tables under pavillion $4. Prizes, food, and drinks. Talk-in on 52 and 13/73. For more information send s.a.s.e. to Stephen Momot, K3HBP, 14 Balsam Rd., Wilmington, DE 19804. Make checks payable to Delmarva Hamfest, Inc.

• **North Carolina** – Cape Fear Amateur Radio Society's 4th Annual Hamfest will be held on August 16 and 17 at the Main Officer's Club, Ft. Bragg, NC. 9000 sq. ft. "air-conditioned" space. Prizes include a TS 120 S, Tri-band beam, Handy Talkie, Rotor, and many more. Saturday night social, and QCWA luncheon meeting Sunday. Talk-in on 146.31/91, 147.93/33, 146.52 simplex. Tickets $1 in advance, $2 at the door. Send s.a.s.e. to Marie Presler, WA4YMM, PO Box 35171, Fayetteville, NC 28303.

• **Attention County Hunters** - Antelope Valley ARC, Lancaster, California is planning a DXpedition to Alpine County August 16 and 17. All bands, modes, and county hunter nets will be used. It will be operated under K6OX. All QSL via K6GXO, s.a.s.e. or IRC's necessary.

• **Warren ARA Hamfest** - The Warren Amateur Radio Association's 23rd Hamfest will be held at the Trumbull Branch, Kent State University, on August 17. There will be 5 acres of flea market, tech forums, DX programs, dealer displays inside, XYL activities. QSL to W.A.R.A., P.O. Box 809, Warren, OH 44482 for further information.

• **Lafayette, Indiana Hamfest** - This hamfest will be held on Sunday, August 17th at the Tippecanoe County Fairgrounds in Lafayette, 18th Street at Teal Road (Indiana Highway 25). Flea market setups for this 10th annual hamfest can be made anytime after 1800 hours Saturday. Camping on the grounds Saturday night only. Forums include one on new OSCAR "9" Satellite. There will be prizes, refreshments. Tickets are $2.50 each by mail in advance or at the gate. For advance tickets send check or money order and s.a.s.e. to J.B. Van Sickle, K9KRE, RR 1, Box 63, West Point, IN 47992. Mail orders must be placed by August 10. Hamfest is sponsored by the Tippecanoe ARA, Inc. Talk-in on 146.13-73 repeater and 146.94 simplex. Call-in station W9REG.

• **LaPorte County Hamfest** - The annual LaPorte County Hamfest will be held rain or shine, Sunday, August 24 at the County Fairgrounds on Highway 2, west of LaPorte, Indiana (50 miles S.E. of Chicago). Paved flea market area outdoors. Indoor tables $1 each. Advance tickets $2 with s.a.s.e. to P.O. Box 30, LaPorte, IN 46350.

• **Gloucester County ARC Hamfest** - The Gloucester Co. ARC will hold its second annual hamfest on Sunday, August 24 from 8 a.m. to 3 p.m. at the Gloucester County College, Tanyard Road, Sewell. Tailgaters set up at 7 a.m. Indoor and outdoor spaces available. Food and prizes. Tickets $2 in advance, $2.50 at the door. Dealers and tailgaters $5. Talk-in on 52 and 78/18. For info and tickets, contact Bob Grimmer, KN2QWO, 229 William Ave., Barrington, NJ 08007.

•**Illiana Repeater System Hamfest** - The Illiana Repeater System, Inc. Amateur Radio Club will host its 11th annual Danville, Illinois hamfest, Saturday and Sunday, August 30 and 31 at the Georgetown, Illinois fairgrounds. Advance gate donations are $1.50 per adult; $2.00 at the gate; children 14 years and younger free. For more information or advance tickets, send s.a.s.e. to Illiana Repeater System, Inc., P.O. Box G, Catlin, Illinois 61817.

• **1980 Ham-A-Rama** - The Five Flags Amateur Radio Association, Inc., will hold its 1980 Ham-A-Rama on August 31 from 8:00 a.m. to 4:00 p.m. at the Pensacola Municipal Auditorium, Pensacola, Florida. Admission will be $1.00 and swap tables will be available for $5.00 each. Additional information can be obtained by writing to the FFARA, P.O. Box 17343, Pensacola, FL 32522.

LU7X operated from Staten Island (no, not the one in New York) off the coast of Tierra del Fuego in the 1979 CQ WW DX CW Contest.

DXpedition to Staten Island

BY JORGE VRSALOVICH*, LU7XP

The C.W. Argentine Group was started in June 1977 by a group of amateur radio operators. The purpose was to popularize radiotelegraphy, publish a bulletin, organize competitions, and defend the rights of all radio operators. These goals were carried out by LU1DZ with the assistance and collaboration of LU2DFX and LU6EF.

With regard to DX activities, the first move was to get things going in the southern Atlantic islands. An example was advising LU3ZX on Sandwich Island to increase his activity on c.w. Once this was achieved (to the joy of the DX world), the group turned its sights toward other islands.

In the beginning of 1979 during frequent chats between LU1DZ and myself, the idea to make a DXpedition to Staten Island began to take form. Staten Island is a chain of rocky mountains which runs from east to west; it is approximately 60 kilometers long and varies in width from 10 kilometers to 600 meters. It lies on parallel 54°55′ south between meridians 63°50′ and 64°45′ west and is separated from the island of Tierra del Fuego by the straights of Le Maire. The only safe way to get there is by seaworthy ship because the storms from the southwest are frequent and deadly.

The city of Ushuaia lies in Tierra del Fuego at 54°48′75″ latitude south by 68°17′96″ longitude west. A town of about 10,000 inhabitants with all the modern conveniences of a small city, Ushuaia sprawls on the coast of the Beagle Channel, cosily surrounded by mountains whose high, snow-covered peaks give it an amazing beauty. The cold, damp winter reaches well into spring when one would expect the weather to be more temperate, but the warm, sunny days of an all-too-brief summer seem to be enough for the comfort of the Fuegians. Thousands of tourists from all over the world visit Ushuaia every year, and the number increases constantly.

The Argentine Navy has a base in Ushuaia and moors ships at the local port. It was this factor plus the proximity to Staten Island (about 250 kilometers away) that convinced the G.A.C.W. to use someone from this area to plan the DXpedition, namely myself. I am a native of Ushuaia, and my knowledge of the place and the local authorities proved to be of great value.

A view of LU7X's campsite on Staten Island from the west.

*Box 110, Ushuaia, Tierra del Fuego Island, Argentina 9410, South America.

The LU7X group (left to right): LU6EF, LU1DZ, LU1AF, LU7XP, and LU4XS.

My first action was to contact the commander of the southern naval area in order to arrange transportation by ship and whatever support and backing would be needed. Here Captain Felipe Barrantes proved to be a priceless aid in all negotiations, a brilliant liaison officer aside from a good friend. As soon as we had confirmation that our needs and requirements would be met, we set about coordinating the flight from Buenos Aires to Ushuaia for the three radio operators who would be part of the DXpedition and the sailing date of the ship that was to take us to Staten Island. The initial date of departure was set for the 22nd of November so we could be on the island for the CQ World-Wide CW Contest. In July I began the paperwork to get my license for Staten Island; this could be either L7XP, AZ7XP, or AX7XP. The Secretaria de Comunicaciones, which is the department in charge of issuing call signs, could not give any of the prefixes I requested, but gave me LU7X instead. I insisted on having a special call because I considered that an operation of such importance deserved a special prefix, but all I could get was LU7X.

This DXpedition was to be the second in the history of Argentine amateur radio; the first was in 1955 to the Sandwich Islands. The members of the Staten Island DXpedition included Juan Carlos Giaquinta, LU1AF, a telecommunications technician in Buenos Aires; Alberto Urano Silva, LU1DZ, a communications officer in the Federal Police of Buenos Aires; Raul Marcelo Diaz, LU6EF, an economics student who lives in Buenos Aires; Martin Juan Lawrence, LU4XS, a rancher from Moat Bay on the Moat Channel; Roberto Brizuela, a government employee from Ushuaia; Hugo Fernandez, also a government employee from Ushuaia; and myself.

The next step was to get together all the equipment necessary for the DXpedition, starting with the most important item—the generators. This was not an easy task, as we needed one that would permit us to operate with a 1 kw linear amplifier. After much scouting around, the Coast Guard connected me with IFONA (the National Forest Institute), who lent us a Winco 3.5 kw generator. It weighed about 140 kilograms and later proved to be my greatest concern when boarding the ship or going ashore, not only because the success of the whole operation depended upon it, but also because I had signed a receipt for its value—about $4,000, and I was responsible for it. Another generator of 1.5 kw power output was provided by Martin Lawrence, a rancher at Moat Bay, and a descendant of the first white men to come and live in Ushuaia in the 1870's.

Raising the Argentine flag over the campsite on Staten Island.

Once we had the generator problem solved, we turned to Beto Brizuela, a Fuegian with a lot of experience in camping, who could assist in choosing camping equipment. He had been to Staten Island before and knew exactly what we would need, so it was his job to see about tents, sleeping bags, etc. In the meantime, the Naval Base provided us with food and fuel, and quite soon the backyard of my house (which sits on a hill right in the middle of town) became a maze of boxes, bags, radios, motor antennas, drums, tents, etc.

While all this was going on in Ushuaia, in Buenos Aires LU1AF, LU1DZ and LU6EF were busy preparing their sets, organizing their time off from their normal activities and jobs, and having daily QSO's with me.

On the 10th of November, Captain Barrantes informed me that the trip would be scheduled for an earlier date and that the men coming from Buenos Aires would have to be in Ushuaia by November 15th. He pulled all the necessary strings to have them brought in in an Electra Navy plane at 2 p.m. on the 15th. They arrived bursting with excitement. I took them to my place where they were to stay,

The site of the DXpedition was on the coast of Cook Bay.

and we immediately started taking care of the last-minute details. On that same day a Navy helicopter brought LU4XS from his ranch at Moat into town. We were just about set and everything was going smoothly, when the next day at about 3 p.m. the captain of our ship called to say we had to have everyone and everything aboard by 7 p.m. since we were leaving 48 hours earlier than planned. A mad rush followed as we took all our equipment and supplies (80 pieces in all) down to the pier. I've lost count of the trips we made back and forth in LU4XS's Ford F100 pickup, but there were many! We had to load all our equipment, including the generators and fuel drums, by hand because we had to cross over another ship that lay between ours and the pier. We set sail at 11 p.m.

It was zero hours on the 17th of November when the Somellera, a sea tug of the Argentine Navy, left the pier of Ushuaia heading for Staten Island. The ship had just finished two months of checking beacons and patrolling the Beagle Channel, and needless to say, the crew were all anxious to get back to their families and homes up north. As soon as we left the pier, the captain wanted us to decide on the spot where we wanted to land. The spot we had in mind (Observatory Island, where Jules Verne's lighthouse at the end of the world stands) was discarded by the Navy because it had no appropriate anchoring ground. Finally, we chose Puerto Cook, where we knew we had a good port and a beach where we could use the Zodiac inflatable boats for unloading all our gear, including the 3.5 kw generator.

LU1AF is atop the antenna setting it up for the CQ WW DX CW Contest, while LU7XP assists him from the ground.

After deciding on our final destination, we had some coffee and settled down in armchairs to try and sleep until 4 a.m. The waters were not exactly calm, so most of us were out on the deck trying to compensate for the effects of the movement with lots of fresh air. With Navarin Island always to the starboard, we crossed MacKinlay Pass leaving Gable Island to port. We then continued to the east between the coast of Tierra del Fuego and Picton and New Islands, reaching the Le Maire Straight at about 10 a.m. Some 20 nautical miles ahead we could see the chain of rocky mountains that is Staten Island. Sailing along the northern coast of the island we passed by Observatory Island were you can still see the lighthouse and a large brick house. On board we considered the difficulties that the mountains could cause with regard to our communications, but we had faith that all would go well. At 2 p.m. the

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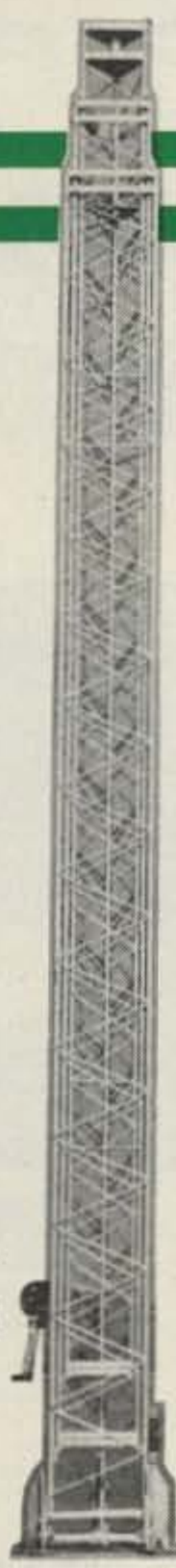

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Tents were erected on the island for the operators, with a separate tent for the generators.

Somellera reduced its speed to enter Cook Bay from the north. This bay is narrow with steep rocky slopes covered with shrubbery to the sides, and at the end of the bay is a peat-covered valley that connects with Vancouver Bay to the south. Nature here is, as in all of the Fuegian archipelago, spectacular and breathtaking in its wild beauty. After we cast anchor, two Zodiacs were let down and we proceeded to unload. After several trips all the gear was safely on shore, and we waved goodbye to the Somellera, which continued on its trip north to Puerto Belgrano in the province of Buenos Aires, about 1,000 nautical miles away.

Our first surprise was to find a large Argentine flag waving at the end of a mast. Then we saw a stone hut whose tin roof had blown away. We decided that this would be our radio shack, so we promptly made a roof from two tents. As if it had been rehearsed, the group tackled the different chores of setting up the radio station and organizing the living quarters. Thus, while LU1DZ and LU1AF put up the antennas and installed the sets and the lighting, the rest of us pitched tents, gathered firewood, brought water, and prepared something to eat. It was 9 p.m. when we sat around the fire to our first meal on Staten Island. A slight drizzle was falling, and all that could be heard were the murmurs of a couple of wild geese that eyed us with curiosity.

The tents were up, with separate ones for the generators, and it was only a question of taking care of a couple of details to get the station going. At midnight, when darkness had covered everything, including the only seven inhabitants of the island, I adjusted my old telegraphic key to send the first QSO from Staten Island to the world. The contact was with a Russian station, UA0KBC. LU1AF, LU1DZ, and LU6EF took turns on the air, a task that continued practically all day and night.

By the 18th of November everything was working normally. We had only one mishap with the 3.5 kw generator when it stopped and refused to start again. We took out the carburator, cleaned it, replaced it with much anguish and very few tools, and it started beautifully and did not give us any more trouble. It was a sunny day with a temperature of 13°C, so Martin, Beto, and Hugo decided to do some exploring. Cook Bay was the site of a prison in the early 1900's, and ruins still remain on the beach where the building once stood. Some 200 meters to the east there is a graveyard with 36 graves in it, one bearing the date January 1900. I was sitting on a rise that separates the beach from the valley writing a message to all the members of LRA10, Ushuaia's National Radio, when the three explorers returned. They had decided unanimously that I was to be the chief of the group. This implied quite a few responsibilities. In addition to watching over the food supply, I had also taken over the responsibility of checking weather conditions every three hours—temperature, pressure, humidity, winds, visibility, and clouds.

Zodiac inflatable boats were used to transport the operators and equipment from the island to the ship that took them to and from Ushuaia in Tierra del Fuego.

The group by now was working beautifully, doing all their tasks with dedication. In the shack, LU1DZ took turns with LU1AF and LU6EF in operating LU7X. Little by little we were capturing the interest of the DX world.

Beto took care of the tents and also recorded the messages we transmitted to Rio Grande's local radio station, LRA24. Through our daily contact with LU1XY of the Ushuaia Naval Base, we also spoke with the governor of Tierra del Fuego, Captain Luis Jorge Arigotti. His government gave us 400,000 pesos to help pay for the trip expenses, and he himself helped me get my license for Staten Island.

On November 21st at 3 p.m. a well-known speaker on Radio Rivadavia (Buenos Aires) interviewed us by radio, and we were able to tell him why we had come to Staten Island. This, combined with the DX contacts, allowed thousands of people all over the world to learn of the island's existence.

3,000 QSO's had been made and the date of the *CQ* WW DX CW Contest was nearing. We knew that with the prefix assigned to me we weren't going to have as great a success as we had wished for, and so it was. The contest did not improve our QSO average, but in spite of this the operators kept up an admirable pace that reached its peak on Sunday night (November 25th) when LU1AF had more than 1,000 contacts. The ship that was to take us back to Ushuaia arrived when the traffic was most intense. At about 10 a.m. there was a big pile-up on the LU7X frequency, but we had to sign off. During the 12,120 minutes that the whole operation lasted, we had 7,100 QSO's at an average of 1.7 minutes per QSO. This is not counting the time when the generator broke down or the rest periods.

That morning a strong southwest wind with rain made life somewhat difficult, but the ship had been specially sent by the Navy to look for us so there was no time to lose. We immediately set about dismantling our camp, bringing down the antennas and packing sets, equipment, etc. In an hour we had everything ready on the beach and the first Zodiac arrived with two crew members and a photographer from *Gente* magazine from Buenos Aires. The rain had stopped and the sun was breaking through the clouds. On board the Irigoyen, a sea tug slightly bigger than the Somellera, we were welcomed by Captain Pueyrredón, who offered us all the comforts available on board and our first lunch seated around a table. Later he offered us cabins as we were going to spend the night at sea. It was 3 p.m. when the order came from the bridge to lift anchor, and very slowly the Irigoyen slid out along the narrow bay. The island was gradually fading in the distance.

As we turned out of the bay I caught a last glimpse of the Argentine flag waving in the breeze next to a statue of Stella Maris, patron of our Navy. My heart filled with joy to think that we were responsible for the world getting to know about this remote and beautiful part of our country.

At about 10 a.m. on Tuesday the 27th of November our DXpedition came to an end. At the pier the TV cameras were waiting for us and Martin's family was also there to greet us. We took all the equipment back to my place in Martin's Ford pick-up, and the three operators from Buenos Aires made preparations for their journeys home.

It's certainly been worth waiting for. In May we brought you Part I of this two part construction article by the Dean of QRPp. In this concluding part Ade takes some of you brave souls through building, testing and using this handy little rig.

THE VIKING 3 × 5

A Solid State 4 Watt V.F.O. Transceiver For 20 Meters

Part II - Conclusion

BY ADRIAN WEISS*, K8EEG/WØRSP

In the first part of this article, we described the circuit of the Viking 3 × 5, a miniature transceiver with many features which make it ideal for portable operation. In this second part, we will deal with construction and adjustment of the unit. Before proceeding, certain difficulties encountered from miniaturization should be noted.

T-R Switching, Transmit Offset Problems

In order to eliminate front-panel controls in the form of a manual T-R switch, the "Simplest T-R Switch" circuit was incorporated, as it has been used successfully in numerous other transceivers by this writer. In this T-R circuit, the receiver input remains connected to the antenna during transmit periods through light capacitive coupling, and output r.f. appearing at the receiver input is clamped at about 1.4 volts by the rectifier action of the diodes, thus preventing damage to the receiver front-end device. Before mounting, the combined units and T-R switch worked properly, with very little v.f.o. "pull" detectable. However, with the receiver and transmitter sections mounted in the very small enclosure, some serious problems were encountered in the form of the r.f. field and r.f. feedback causing a serious degree of v.f.o. "pull" during transmit periods.

In an attempt to eliminate the feedback, an aluminum shield was placed around the transmitter section, reducing the "pull" from about 3 kHz to 1.2 kHz, but this was still too much for practical operation. Analysis of the situation revealed that the antenna lead to the T-R switch, carrying the full r.f. output power, was radiating the output outside the transmitter shield. In addition, the v.f.o. tuning capacitor, mounted beside the r.f. gain control, is in close proximity to the antenna lead to the r.f. gain control, and consequently was very susceptible to the field. Finally, in the original p.c. board design, the receiver antenna coupling capacitor C52 was mounted on the p.c. board, with both leads to the r.f. gain control terminating there. This version of the p.c. board is shown in Figure 1 in the event that someone wishes to use the v.f.o.-receiver design in some other application. To further eliminate "pull," the entire T-R switch circuit was removed from the p.c.b. and mounted on the r.f. gain control, and the antenna lead to the T-R switch rerouted inside the transmitter shield, with no more than about 1/2 inch length leaving the shield enclosure. Further experimentation showed that "pull" was diminished by grounding the r.f. gain control at the outside wall of the enclosure, as far from the receiver input as possible, and that a grounding of the receiver input tank circuit (L1-L2-C1) both via the p.c.b. ground foil and a buswire between the ground end of C1 and the transmitter shield further decreased "pull." Finally, it was found that the effectiveness of the shield was enhanced by ensuring positive contact through careful bending and the use of self-tapping screws to firmly bond the shield to the rear and side walls and top and bottom of the box. The use of shielded coax, such as the miniature RG-174U used in this unit, between v.f.o. and transmitter is important also. With all of the above precautions, v.f.o. "pull" during transmit periods was cut to less than 100 Hz. Unfortunately, that amount of T-R offset is too little for practical operations, and a "gimmick" capacitor—simply a piece of hook-up wire connected to the transmitter end of C52—was installed to provide a controlled amount of feedback for transmit offset. The free end of the piece of wire is jammed between C30 and the front-panel, and bent toward the plates of C30 until the desired amount of offset is achieved.

Construction

The accompanying p.c. board design and parts template, and photos, will indicate that duplication of the miniature transceiver requires previous experience in home construction. This is due primarily to miniaturization with respect to the high-density receiver/v.f.o. p.c.b. and enclosure mounting tolerances. However, other options are open to an individual with minimal experience who wishes to duplicate the unit. Obviously, a larger enclosure will eliminate the mounting problems. Beyond that, the p.c. board design could be scaled

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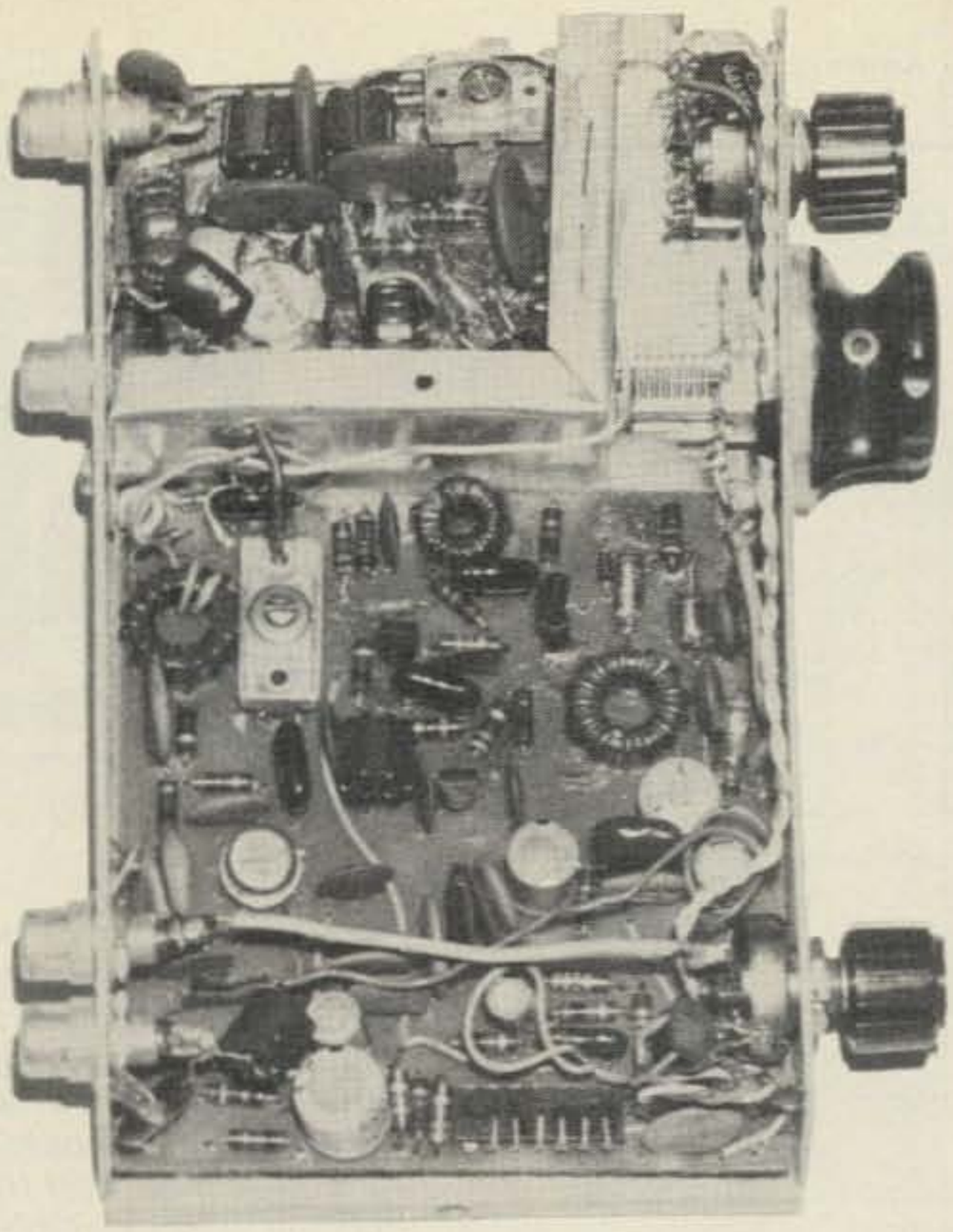


Full view of the Viking 3×5, with v.f.o.-receiver p.c.b. in lower half of enclosure, transmitter p.c.b. inside the shield, and C30, the frequency tuning capacitor, and R34, r.f. gain control at upper right, R16, a.f. gain control at bottom right. Beneath C30 and R34 appears a white area, which is cotton padding to increase thermal insulation. After completion, cotton padding is placed under and above the v.f.o. section of the p.c.b. Rear panel phono jacks, from bottom to top, are a.f. output, B+ supply input, antenna, and key. RFC5 can be seen directly to the right of the a.f. jack, with C27 connected between the jack and ground. The white wire across the lower portion of the p.c.b. carries supply B+ to the on-off switch on R16. The bottom half of the p.c.b. contains the audio section. A close examination of U2—LM3900—at the very bottom of the p.c.b. shows how the pins whose direction has not been reversed have been bent in toward the IC body. The product detector fills the upper-left one-third of the board, with U1 visible just above the B+ jack. L1-2/C1 are in the upper left corner. The buswire grounding the foil side of C2 to the transmitter shield should be noticed. The v.f.o. section fills the upper-right quarter, with L3 centered, and RFC1 at the top edge middle.

up—only the foil leads for mounting U2 need remain exactly as they are shown. Should the design be used as shown, the previously discussed method of p.c. board fabrication using self-adhesive address labels can be applied (*CQ*, March, 1978). In this approach, a piece of p.c. stock is first cut to template size, then the copper foil is covered with self-adhesive address labels, and a copy of the template (or the template cut from this magazine) is glued to the address label covering. A sharp knife or razor and straight-edge are then used to cut away the white areas of the template, leaving exposed the copper foil which is to be etched. Etching can then proceed.

The transmitter board uses double-clad p.c. stock, with isolated pads etched on one side of the board, with the other side unetched. A heatsink approximately the size of the transmitter p.c. board is cut from 3/32 aluminum stock and drilled to accept the mounting stud of the 2N5589 to coincide with the stud-mounting hole in the p.c. board itself. Another hole is positioned on the p.c. board at the bottom corner for the mounting screw, and this hole is duplicated in the heatsink. When mounting the board and sink, a spacing washer is fit between heatsink and p.c. board to duplicate spacing at the stud point. Finally, a hole must be drilled in the bottom of the chassis box to permit part of the stud to protrude. In miniaturized projects such as this, extreme care in measuring and positioning of parts in the enclosure is essential because there isn't a millimeter to spare! Shades of Swiss watchmaking! Finally, one detail about the transmitter construction may not be apparent, namely, that the MPS-U31 driver transistor uses the p.c. board as a heatsink. This is made necessary because the device is operated as a high-power Class A amplifier with considerable dissipation resulting. The tab of the MPS-U31 is bent to fit flush against the p.c.b. when the device is in position, and then the tab is soldered directly to the isolated pad provided. *Since the tab carries the collector B+ voltage, carefully avoid any contact of tab and pad with ground foil or shield.*

Assembly of the v.f.o.-receiver board requires some care with respect to preparation of some parts for insertion. R10-R14-R37 leads should be bent appropriately to account for the necessary "jamming" into position. Several tight positionings occur in the receiver audio section. Variations in parts sizes, especially with respect to electrolytics and disc ceramics, may require awkward mounting angles. The audio amplifier stage (Q6) fits directly under the a.f. gain potentiometer, and unless the leads of Q6 are cut and bent so that Q6 is mounted very near the p.c.b., it will have to be bent back to permit mounting the board in the enclosure under R16.

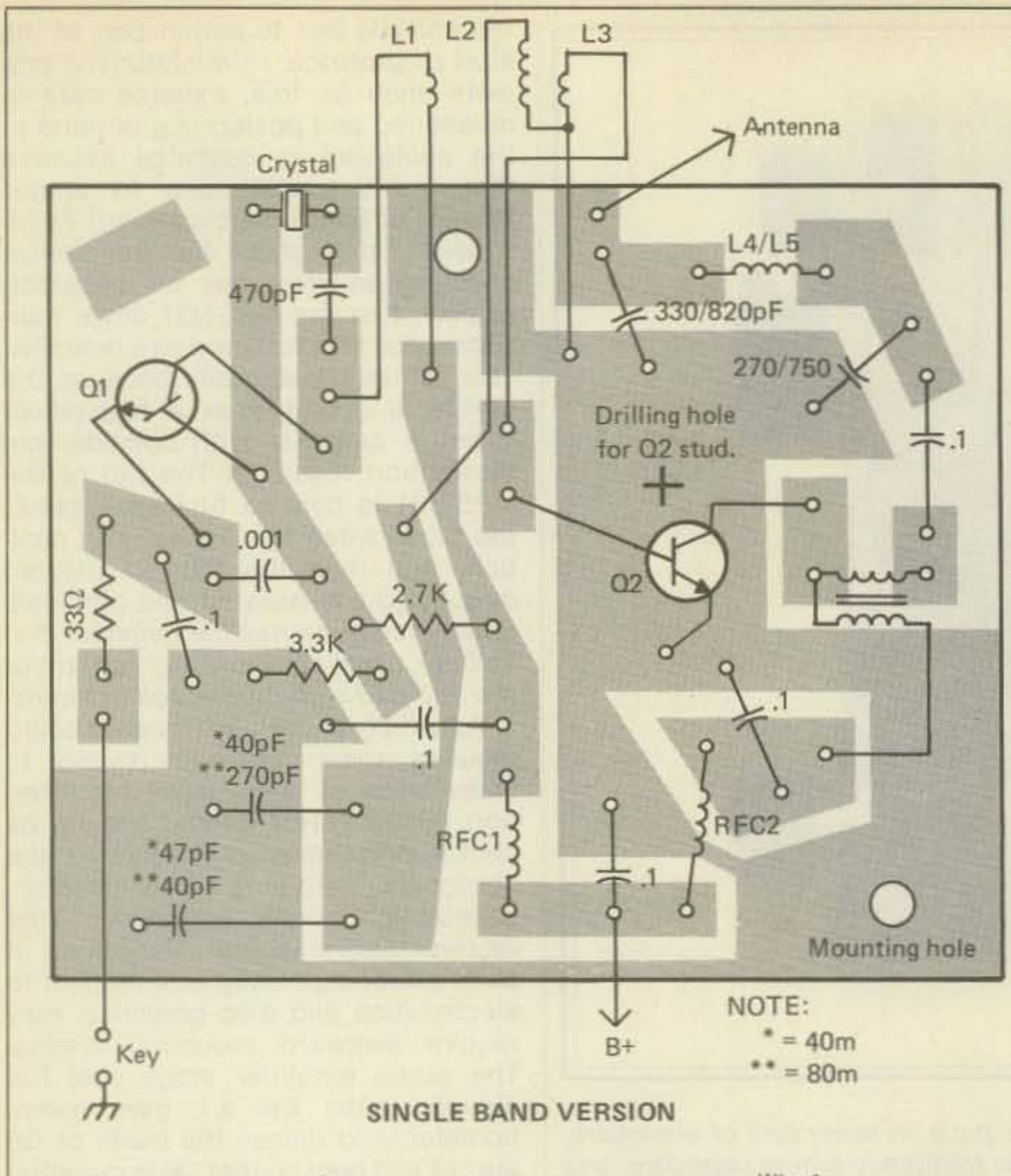
Work on the v.f.o.-receiver board logically begins with the assembly of the v.f.o. section, verification of proper operation, and preliminary adjustment. Work can then proceed on the product detector and audio filter-amplifier.

LM3900-U2 Mounting Detail

In designing the p.c. board, it was found to be necessary to mount U2 *upside down* in order to get the desired pins pointing in the right direction. Thus, *U2 is mounted upside down on the p.c. board. Pins 1-7, and 14, which are functional in the circuit, are carefully bent straight, and then upward to protrude from the top of the IC.* The IC is then flipped on its back and mounted. The best way to accomplish this task is to place pins 1-7 on a stable flat surface, and bend straight while applying pressure from a knife-blade to original bend-point. Then IC body is rotated over the knife blade until the bend is completed. Repeat with pin 14.

Testing-Adjustment

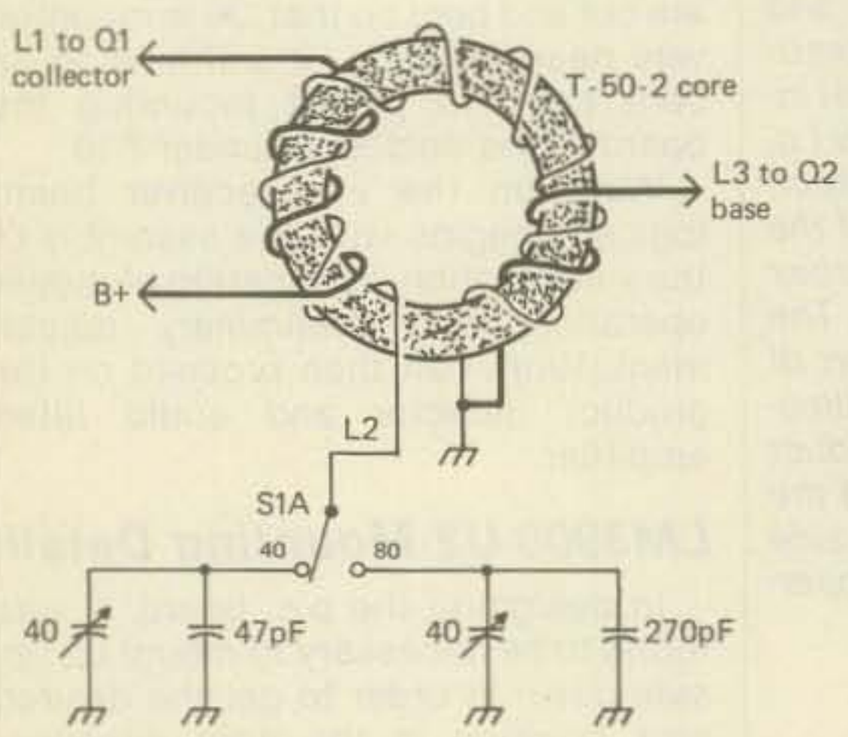
It is advisable to verify proper operation of the v.f.o. as soon as it is

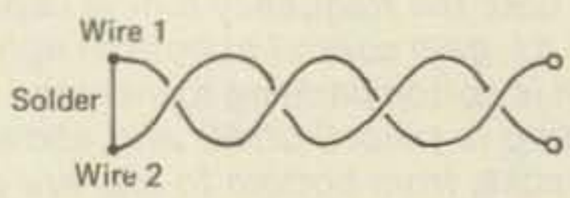


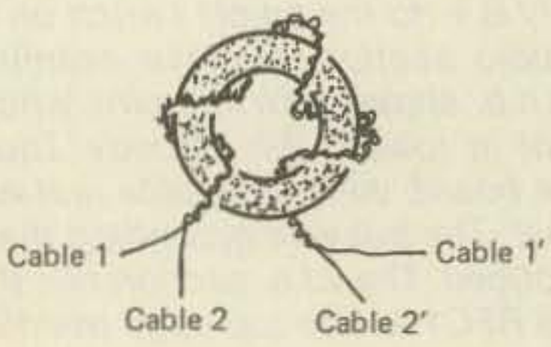
SINGLE BAND VERSION

(B)

Fig. 1- This material was first produced for the QRP Column in February, 1979. That Column and others led to this construction project. (A) is the parts placement for the original Viking 5 transmitter pc board. (B) is a full sized template for that transmitter. (C) is the coil winding data for the broadband 1:4 balun transformer, T1.







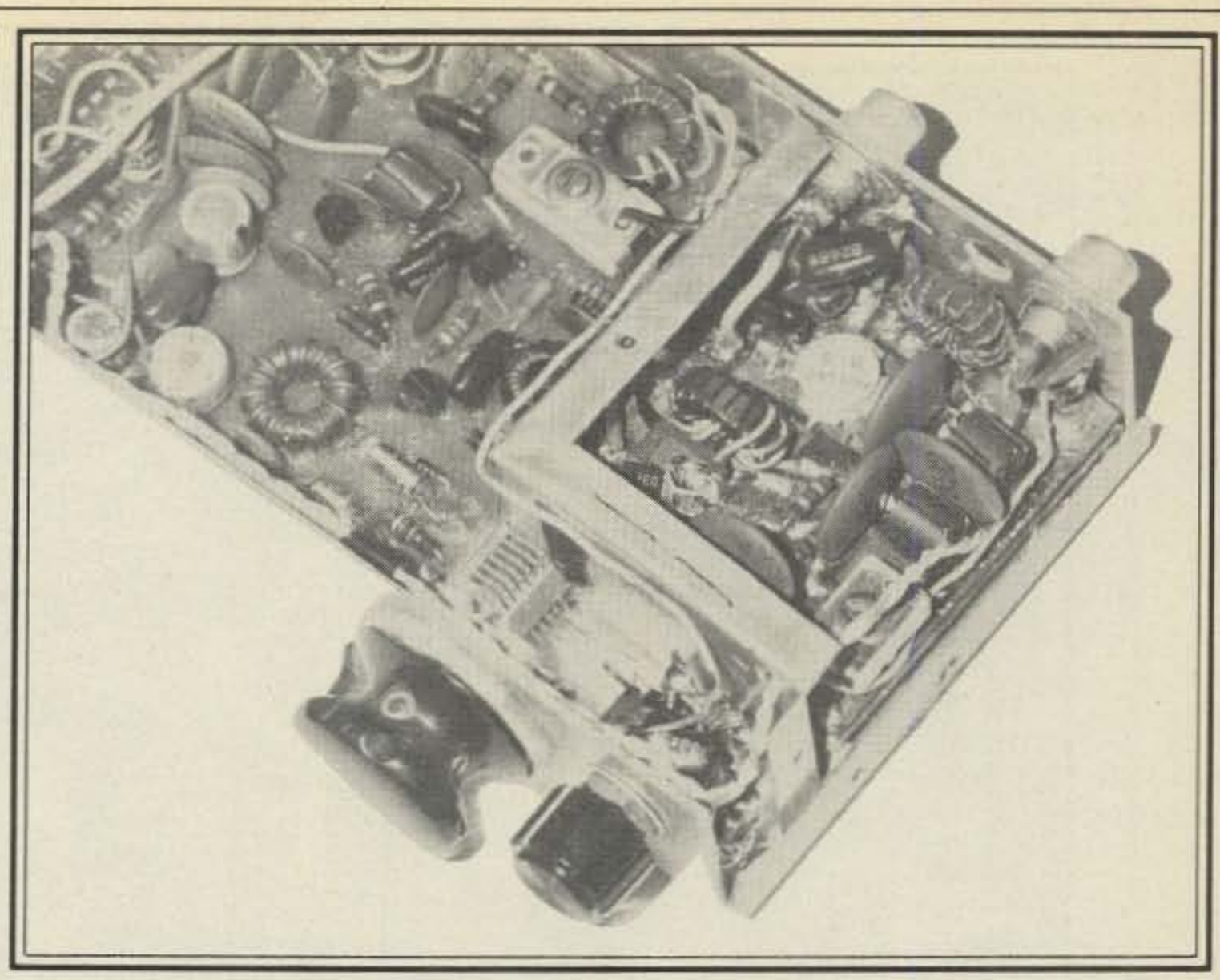
1) Form 2 wire pairs by twisting 2 wires of equal length until about 9 twists per inch is achieved.
2) Twist the two 2 wire pairs together to 10 turns per inch.
3) Wind the cable of step 2 for 16 turns on the T-50-2 core. Cut excess cable, and solder each cable end separately.
4) Cut excess cable, solder cable 2 to calbe 1. This is the lead which connects to the 2N5589 collector. Cable 1 and cable 2 attach to the B+ pad and 0.1 mf output coupling capacitor.

assembled. For this procedure, a VTVM/DVM with r.f. probe, and either general coverage receiver or frequency counter, are necessary. A hamband-only receiver can be used, but in this event, v.f.o. frequency adjustment is initially difficult unless it is tuned to the hamband by chance during assembly. In any event, after applying B+ to the v.f.o., check the d.c. drain voltage to determine that D2 is regulating the B+ properly at the specified zener rating. Next, a check of r.f. voltages at the given points will indicate that the unit is oscillating, and how it compares to the unit described. Initial frequency adjustment is performed with C32 while monitoring the signal on the receiver or frequency counter. Since C30 is not in the circuit, the lowest frequency that can be reached may be at the high end of 20 meters. If C32 does not bring the v.f.o. frequency into the 20 meter band, the turns of L3 may be compressed or spread to lower or raise oscillator frequency. The final check is for v.f.o. output level, and this is performed after connection to the receiver and transmitter sections. Once preliminary adjustment is completed, all frequency determining components associated with Q1 are secured to the p.c.b. by dripping hot wax (parafin or birthday candles, etc.) over them until they rest in a small pool of wax. Mechanical instability can thereby be eliminated. Be sure to include RFC1 and RFC6 in this procedure.

Next, the receiver and audio sections can be assembled, followed by verification of d.c. voltages at R7 and R9. Alignment of the receiver front-end C1-L2 requires a 14 MHz signal source, such as a signal generator or oscillator, which is coupled to L1. With the

headphones connected, position the signal source so that a beatnote is heard in the phones, and then adjust C1 for peak audio output. Alternately, the unit can be hooked to an antenna and tuned for initial copy of signals, then peaked. Strong signals should produce comfortable headphone volume with the a.f. gain slightly advanced. Proper operation of the audio filter can be checked by slowly tuning the signal source through zerobeat and beyond the filter cutoff, noting the center frequency audio peak, and roll-off above and below that point, and comparing results to the curve mentioned in Part I of this article. Strong on-the-air signals should produce a maximum output of about 7Vp-p into a 2200 ohm resistor load.

Transmitter assembly and adjustment can be attempted last. A complete discussion of the transmitter circuit and adjustment was provided in the initial article about the circuit (*CQ*, February, 1979), and, incidentally, the circuit and p.c.b. design were reproduced in the Vackar v.f.o. article (*CQ*, April, 1979) *with a serious circuit error in the form of the omission of C49*!! For adjustment of the transmitter, the above mentioned instruments are useful, and if possible, an oscilloscope is most helpful in monitoring signal purity. First, connect the v.f.o. to the transmitter input with a short piece of coax, and verify that the r.f. voltage appearing at the base of Q4 is roughly equivalent to the figure shown in fig. 1 of Part 1. Momentarily disconnect RFC4, removing B+ from the final, key Q4 while monitoring r.f. output at the antenna terminal and adjust C46 for maximum indication of output across a 52 ohm dummy load. This should be on the order of 0.3-0.6Vrms. If a scope is available, monitor waveform purity during this step and the next. Once C46 is adjusted, reconnect RFC4, and key the transmitter while monitoring r.f. output to the dummy load for signal purity and power level. Power output may be calculated from $Po = Vrms^2/R$, where the square of the rms voltage developed across the load is divided by the resistance of the load. Some readjustment of C46 may be necessary to peak the r.f. output. Parasitics can be detected on the receiver as "hash" or white noise on frequencies above and below the transmitter frequency. If a scope is available, some peaking of output can be accomplished by compressing or spreading the turns of L7 while monitoring waveform purity. In the several versions of this circuit constructed so far, the given values all produced very similar results with respect to power output and signal purity. R33 establishes Q4 stage gain, and with the value shown, r.f. output from the unit is on the order of 4 watts or better. R33 may be varied to produce lower output levels if desired, and up to about 5.5 watts of output have been obtained by decreasing R33 to a smaller value. Finally, a check of d.c. current to the driver and then the final will permit calculation of efficiency. Any figure below about 45% for the final indicates that some serious misadjustment exists, perhaps with regard to the L4-L6 turns ratio, or the pinet values.



A close up shot of the transmitter installation. The key jack is at the outer edge of the enclosure, and the antenna jack at the inside edge of the shield. Broadband transformer T1 is directly between the two jacks, while L7 is obscured beneath pinet capacitors C50-51. At the right edge of the p.c.b. are RFC4-C47-RFC3 and C46, the driver tank capacitor. L4-5-6 is directly to the left of the 2N5589 final, the round white object near the center. The twisted white wire entering the transmitter shield at the bottom is the B+ lead to the transmitter, and it consists of two pieces of #22 hookup wire. The white wire running from R34 alongside the bottom and left side of the shield is the antenna lead to the receiver. The hole in the rear panel is for ventilation.

Mounting

Once the above adjustments have been made and proper operation verified, the two boards can be mounted in the enclosure. After all interconnections are completed and C30 added to the circuit, final adjustment of the v.f.o. frequency set capacitor C32 puts the v.f.o. at the lower edge of 20 meters, and should result in a spread of about 110 kHz with the values shown. Some final touches to the last two turns of L3 will ensure proper frequency coverage if necessary, or the value of C34 may be increased or decreased, depending on whether the frequency must be lowered or raised. If desired, the builder may wish to temperature compensate his particular unit by measuring frequency drift vs. temperature change, and increasing or decreasing C33 accordingly, and then realigning the v.f.o. frequency. Due to the cramped nature of the enclosure used in this project, which results in high susceptibility to ambient temperature changes, changes in ambient temperature easily reach the oscillator frequency determining parts. However, with the values of C33 shown, and the addition of cotton padding between the oscillator section of the p.c.b. and enclosure and on top of the oscillator section, as well as around C30, drift was reduced to a minimum where it does not interfere with a 15 minute QSO even though ambient temperature may shift significantly. In a stable temperature situation, long-term drift is under 100 Hz. After all work is completed on the v.f.o., secure the remaining turns (if they have been broken loose during adjustment) to the p.c.b. with wax again.

With everything operating properly, monitor the frequency offset while keying the unit. This should be attempted with the top bolted firmly in place. If the offset meets with the

operator's satisfaction, the unit is ready to go. If not, then the "gimmick" mentioned earlier may be added and adjusted to produce the desired amount of offset.

Results

The unit has performed flawlessly both at the home QTH and in the field. A good antenna is important when running low power. Since the output of the unit is designed to operate into a 50 ohm load, a coax-fed antenna, such as a beam, dipole, or vertical, which presents a 50 ohm impedance is preferable, although a random wire through an L-network allows perfect matching and works quite well. However, when an antenna is fed through a tuner, such as was the case with the unit during portable operation, without a good ground, circulating r.f. currents within the enclosure cause strange effects in the audio circuitry, none of which affect the actual performance

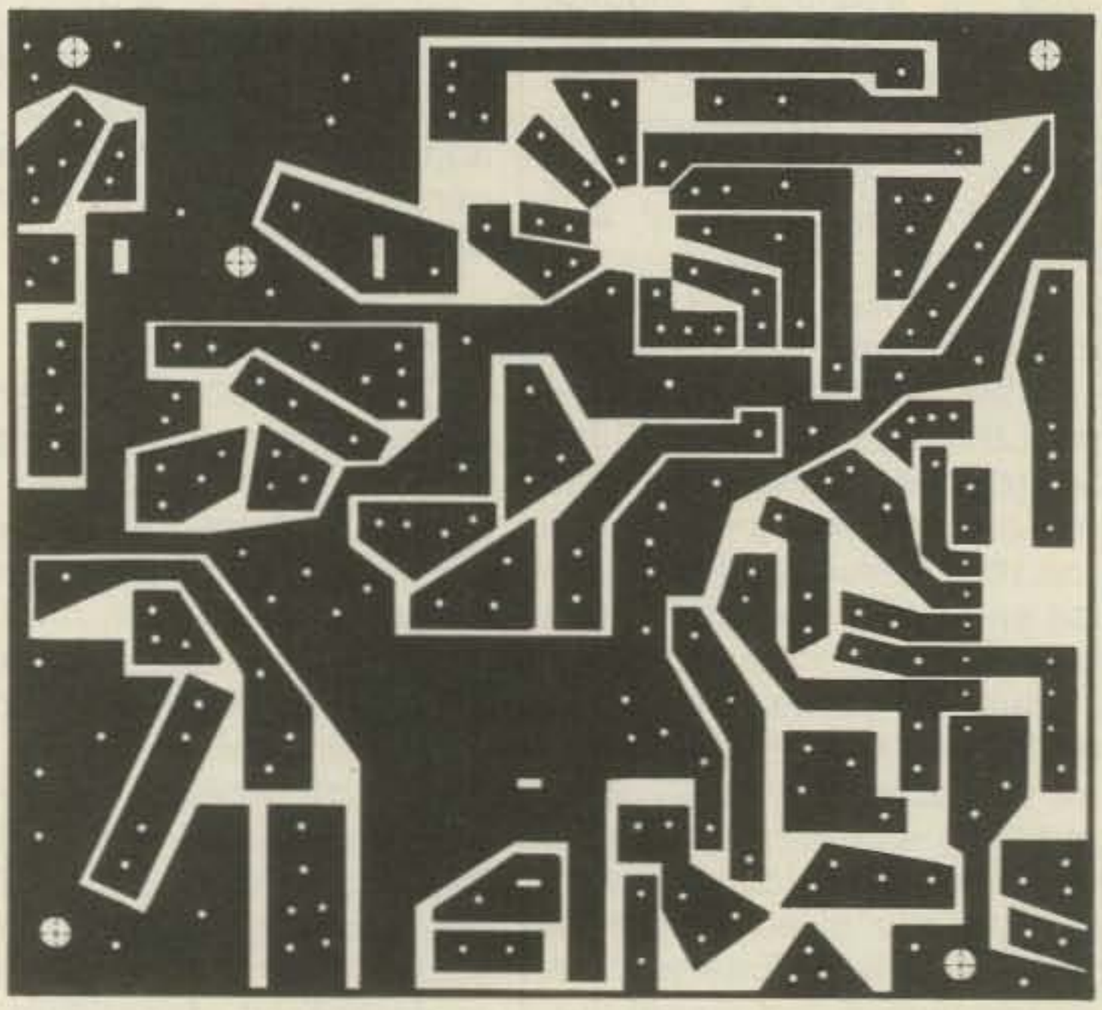
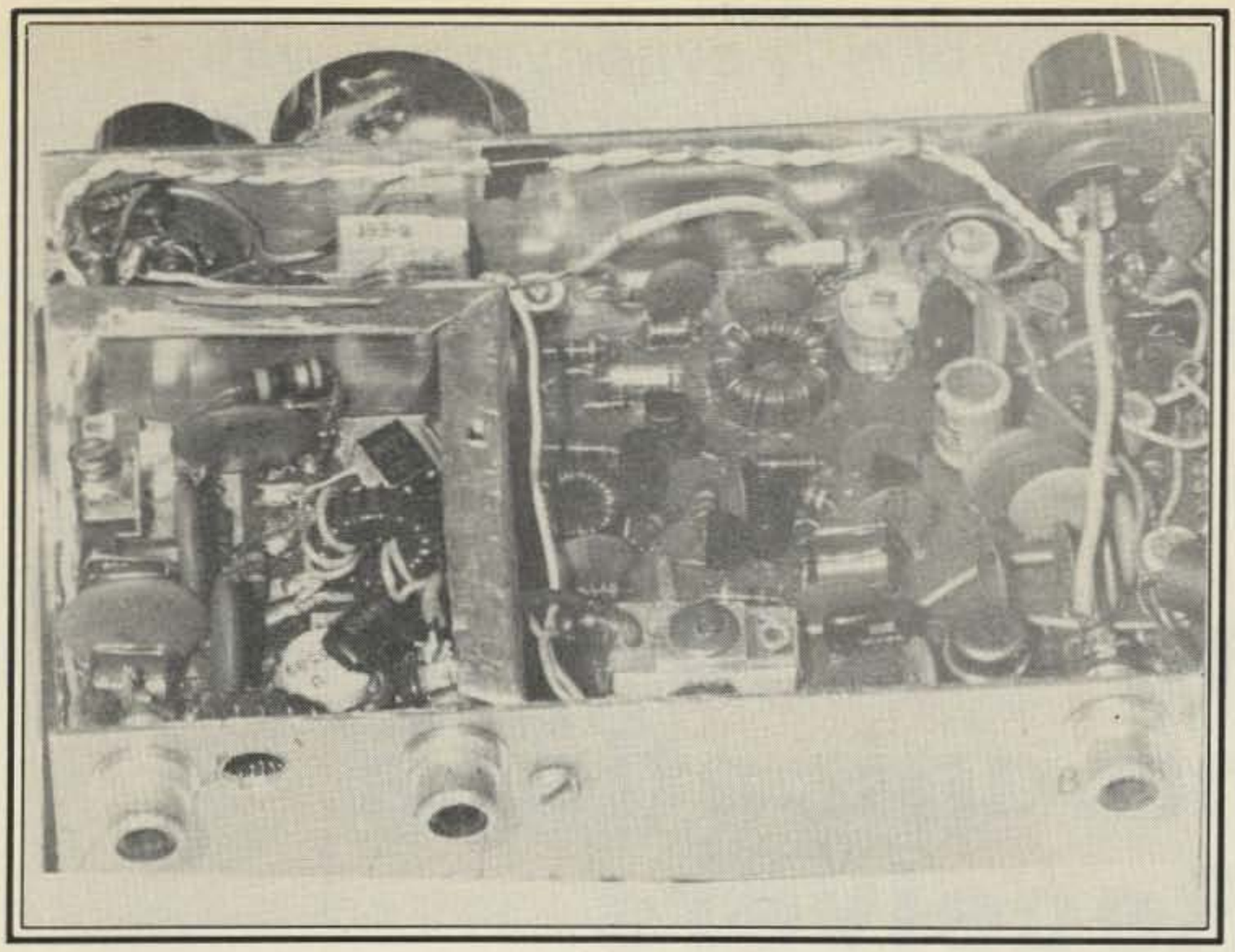


Fig. 2- Parts placement and full sized template for the Viking 3×5 20 meter transceiver.



Close-up shot of transmitter p.c.b. and R34-C30 detail. As noted in #3, the twisted pair white wire carries B+ to the transmitter. The T-R switch is mounted on R34. A dark wire can be seen snaking its way from R34 to the square white edge of C30—this is the "gimmick" wire mentioned in the text. As can be noted from the photo, the wire protrudes from the front-panel about 3/8 inch, and only a slight amount of bend toward the plates of C30 is necessary to establilsh offset feedback. Inside the transmitter shield, C46, C45-R33, and Q4 can be seen along the top edge of the board, with L4-5-6 visible just beneath Q4.

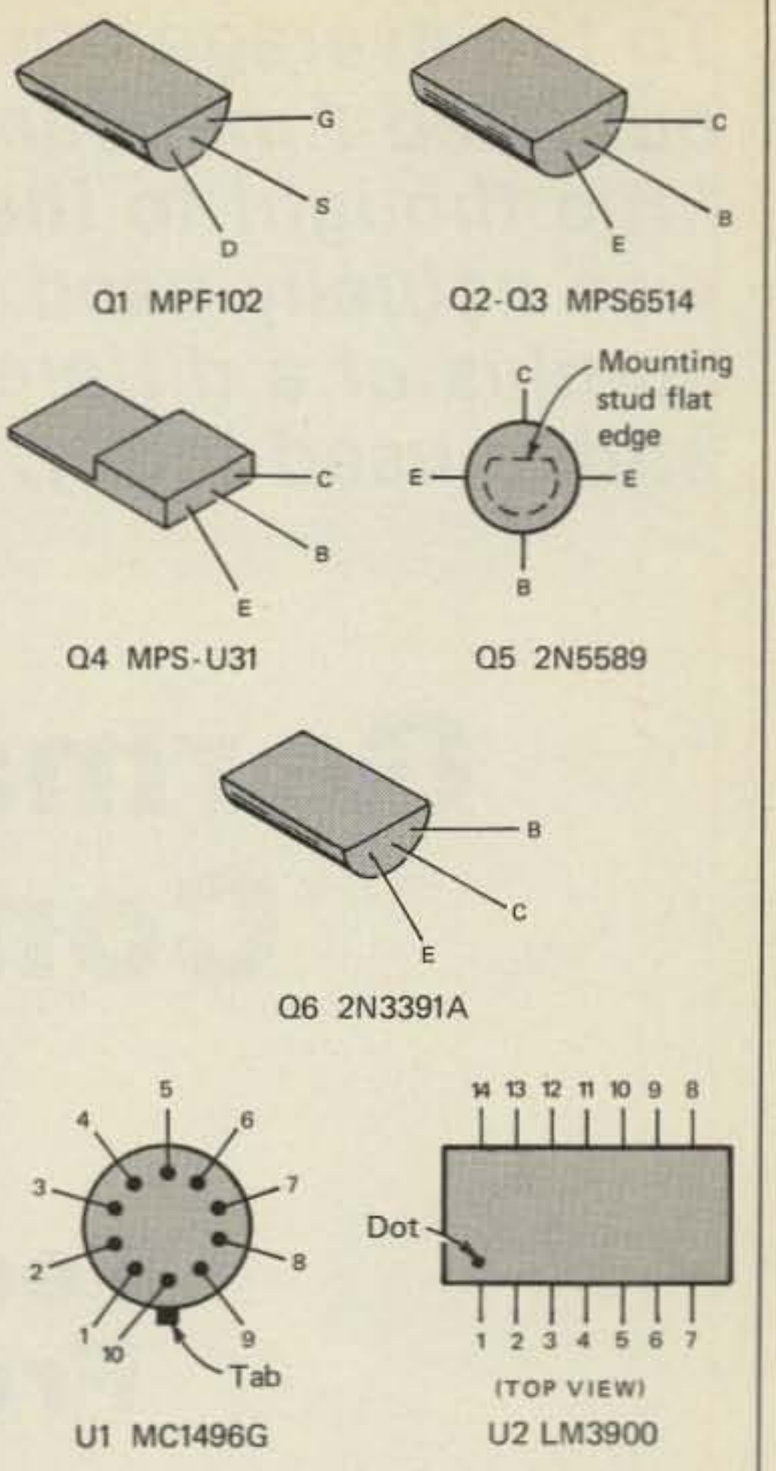


Fig. 3– Active device connections.

of the rig. Because of space restrictions, no sidetone was included, but one can monitor one's transmission by the interruption of the audio channel during key-down periods.

I've worked about 30 countries with the unit and have had a goodly number of "peaks." In addition to the QSO with the Russian station mentioned earlier, another most memorable experience was a solid 42 minute QSO with VR3AH. I was using the Viking 3×5 into my vertical, and he was using his personally designed homebrew QRPp transceiver. I felt great because everything about the QSO was "perfect QRPp" the way I see it—each of us using low power gear which we designed and built from scratch to communicate reliably across half a world! And, of course, talking about QRPp and trading design details! If they have amateur radio in heaven, I figure it'll be like that! If I was into "preaching," I suppose my standard sermon would be "get ready to meet your Maker by living virtuously and operating QRPp!" But I don't want to get into sermonizing—I get into enough trouble without it. Hopefully this discussion of the Viking 3×5 will interest others to join the QRPp flock and rediscover the excitement and adventure they once knew as new Novices.

73, Ade, K8EEG/W0RSP

To the average amateur, surplus is synonymous with outdated American military electronic equipment with little thought to the military part or what the equipment was actually used for. The following article concerns surplus of a different origin, how it works, was used, and is used today.

German World War II Communications Receivers

Technical Perfection From A Nearby Past

Part I

BY DICK W. ROLLEMA*, PAØSE

Radio communication equipment, as used by the allied forces during World War II, is well known among collectors and lovers of wireless equipment from the past.

Communication equipment that was used by the German forces during the war is much less known; that applies not only in the United States, but for Europe as well. This may look remarkable as that same Europe formed one of the main theatres of war. Why was it that so much of the allied equipment was left behind after the German forces capitulated that war surplus shops flourished for many years after, whilst at the same time German equipment has been relatively rare right from the start of the post war period?

Not because these units were manufactured or used in limited quantities. One of the main suppliers of radio equipment, the Telefunken firm, employed some 40,000 workers, spread over 350 different locations, by the end of WW II. How many sets of different categories were made is unknown to the author. But it has been put on record that of one radio used in tanks, the so called "Bogegerät", some 180,000 units were manufactured.

The reason that so little of the vast German production remained may well be that the allied forces that occupied Germany after it collapsed ordered that all radio equipment that was found was to be demolished. By the end of 1945, and the beginning of 1946 this order was changed in that equipment remaining at that time was not to be destroyed but dismantled. The components that resulted from that action formed the basis for German production of consumer radio equipment, a production that came to a faltering start at that time.

Not only thousands of radio's ended under the crash hammer, also all drawings and other documents that supported design, development and production of the equipment went the same way so that hardly a trace of it was left. What we know about the background for the wartime production of German radio equipment has been reported orally by some of the leading men who were involved. Please don't get the idea that the author condemns the decision to destroy all wartime German equipment. It was a completely understandable and justified decision. But it does explain why most of us radio amateurs, both in the USA and outside, are in general rather unfamiliar with the communication equipment that was used "on the other side." And that is certainly to be regretted as this equipment was of exceptional technical perfection and beauty.

Of course some German WW II radio equipment escaped destruction and part of what remained found its way into the hands of collectors, some of whom specialize in German radio apparatus. By sheer coincidence your scribe came into contact with one of those specializing collectors, Arthur Bauer, PA0AOB, who lives near Amsterdam. Arthur owns a most beautiful collection of German WW II radio equipment. When I met him for the first time in 1977, his collection comprised more than ninety items. By today it must have passed a hundred easily. It is certainly no simple feat to bring together so much of this rare equipment.

* *v.d. Marckstraat 5, 2352 RA LEIDERDORP, Netherlands*

Arthur scans the whole of Europe for it and he has his contacts in most of the countries of our part of the world.

PA0AOB not only *collects* the German equipment, he also *uses* it for his contacts with fellow amateurs.

Photograph 1 shows Arthur, PA0AOB, making a QSO via a powerful German transmitter of WW II vintage. The receiver at the left of the transmitter will be described later in this series. Single sideband does not exist for Arthur, of course. Only c.w. and a.m. and a system of teletyping over radio, invented in the twenties by Dr. Rudolf Hell. The machines that use this system are called "Hellschreiber" ("Schreiber" means "writer" in German). The system is different from RTTY as we know it in that the characters are transmitted in a form of simplified facsimile (FAX). The received characters are printed on a paper tape as they are received as "pictures". The charm of it is that the receiving machine does not decode the characters as in normal teletype. The decoding is done by the operator who interprets the "pictures" on the tape as characters. Interference and or fading on the radio path can never result in a wrong character being printed. The picture of the characters may become blurred or smeared by the interference. But due to the supreme capabilities of the human eye and brain a lot of interference can be accepted before the received characters become unreadable. The price for this immunity against interference is increased bandwidth. The signal is about six times as wide as a radio teletype signal of the same transmission speed in characters per second. This is partly compensated by the fact that the Hell system of teleprinting does not need FSK as modulation mode. Simple on/off keying of a c.w. transmitter gives fine results. So in the end the Hell signal occupies about the same bandwidth as a teletype signal of the same speed.

The Hell system is commercially obsolete. But it has been revived by a group of European amateurs, who possess the machines for it. Photograph 2 again shows Arthur typing on a "Hellschreiber" as they were extensively used by the German forces during WW II. Your scribe is so lucky as to have a "Hellschreiber" on loan from PA0AOB and so he meets Arthur and several other amateurs in Europe every Sunday afternoon on forty meters, using this nostalgic way of communicating. One of the members of the "Hell group" is Hans Evers, DJ0SA/PA0CX and he described the Hell system of teleprinting in *Ham Radio Magazine*, December 1979 ("Hellschreibers rediscovered").

But back to the subject of this series: German WW II communication receivers. In the next section we will describe some general characteristics of German radio equipment. One feature we will discuss in more detail: a quartz crystal intermediate frequency filter with continuously variable bandwidth. This type of filter was used in several receivers of the superheterodyne type. Following it we will discuss two receivers of the tuned radio frequency variety and two superheterodynes.

You are probably surprised that the Germans used t.r.f. sets. But they certainly knew how to make them in superior form. A great advantage of the straight set is that spurious responses are non existent, even in the presence of extremely strong signals as in shipboard use, where several transmitters may be active at the same time receivers are operated. Another advantage from a military point of view is that the t.r.f. set does not use oscillators and so

Photo 1- Arthur Bauer, PA0AOB, amidst some items of his extensive collection of German WW II radio communication equipment. He actually uses several of these sets for making QSO's on the h.f. bands.

Photo 2- Here PA0AOB is typing on a "Hellschreiber," an ingenious system of teletyping over radio. The system was extensively used by the German forces during WW II. It is now commercially obsolete. But a group of enthusiastic European amateurs have revived the system and are using it in regular skeds on the h.f. and v.h.f. bands.

the chance of location by the enemy using a direction finder on spurious radiation of the set is negligible.

This article could only be prepared thanks to the assistance of PA0AOB. Not only did he make the receivers available for photography, he also gave the author the opportunity of using some of the sets in his own shack for a considerable period of time.

The fact that PA0AOB could provide the original technical manuals, or exact replicas of them, was also of great help in the preparation of this article.

General Characteristics of German Radio Equipment

The oldest company that manufactured military radio equipment in Germany is undoubtedly Telefunken. During the first World War (1914–1918) this firm supplied radio communication equipment for the German army. Production of military equipment was forbidden in Germany under the Versailles treaty that ended WW I. But when Hitler came to the fore in the early thirties the situation changed drastically. When general conscription was announced in 1935, production of weapons and other war material came into full swing. New communication equipment was to be developed and produced. Again Telefunken was the leading firm. Also Lorenz, a German branch of the American ITT concern, started extensive activities in the field of military radio. In 1937 the German government invited tenders for a new radio for military aircraft. It came as a shock to Telefunken that Lorenz emerged as the winner with their FuG 10 set. This consisted of beautifully made separate receivers and transmitters for different frequency bands that were combined in a rack. Photograph 3 shows part of a FuG 10 installation, at the left a long wave receiver, in the center a short wave receiver and at the right a short wave transmitter. The antenna was matched by a remote controlled tuner, that is visible in photograph 1 on the shelf; it is the box with the rounded corners at the left. The superiority of Lorenz was especially evident in the mechanical engineering of their equipment. In the following years the dividing line between Telefunken and Lorenz products became less clear as equipment was manufactured under mutual licensing contracts. Also other big firms, like Siemens and companies in countries occupied by Germany took part in the production.

We will now take a look at the German radio equipment and see whether we can find some characteristics that make it so unique and different from similar gear used by the allied forces.

In the first place we observe the tendency to use a minimum number of different types of radio tubes. Most of the receivers used the same type of tube in all stages! This posed some tricky problems for the designers. We will meet an example of this later on. From a logistic and maintenance point of view it is of course a clear advantage to limit the variety of tubes to the absolute minimum. The tubes were especially developed for this military equipment. They were miniature types, certainly gauged by the standards of those days, and very robust. The tubes fitted special sockets that completely enveloped them and in which they had to be inserted top first. Nevertheless, the hope that a few types of tubes for all receivers and transmitters would suffice was not fulfilled; by the end of the war some 100 different types could be found on the lists of military tubes.

Another feature of German radio receivers and transmitters is that the designers certainly were generous as to the total number of parts used, especially if by doing so potential sources of trouble could be avoided. One finds, e.g., decoupling devices and screening liberally applied in all stages of a receiver or transmitter. Another feature is that even the simplest piece of equipment has the possibility of having its proper operation checked by the user. A built-in voltmeter with selector switch to measure voltages at different parts of the circuit is the minimum always found. Sometimes quite elaborate built-in operational checks can be encountered. Again we will meet an example of this later on in the series.

The most striking characteristic of German equipment is no doubt the mechanical part of it. The traditional chassis, so familiar to radio equipment of the past, was never used as such by the Germans. Instead they filled the space in a cabinet in three dimensions. The circuitry of a radio set was divided in a number of units, "modules" we would call them in our day, that could be easily removed and replaced. Usually such a module took the shape of a completely screened box of cast alloy

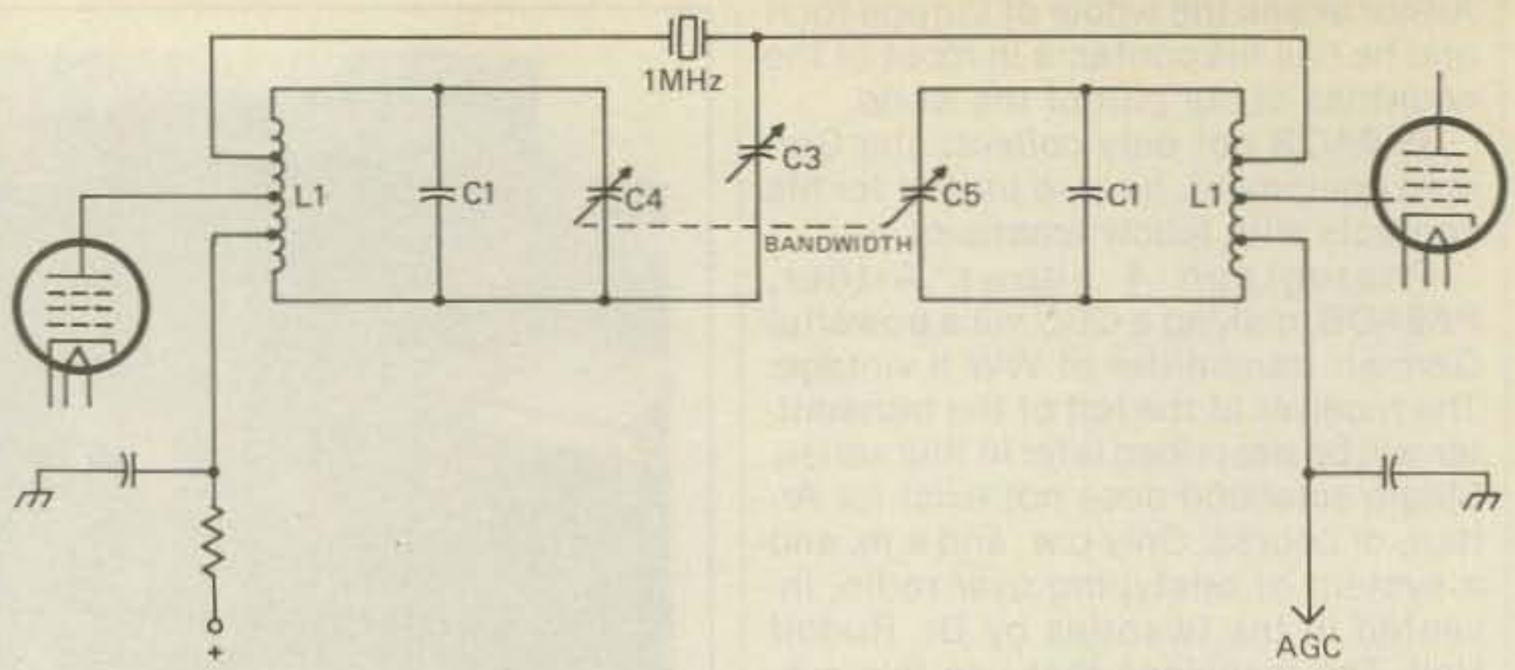


Fig. 1– Quartz crystal bandpass filter with variable bandwidth as can be found in several German World War II superheterodyne receivers.

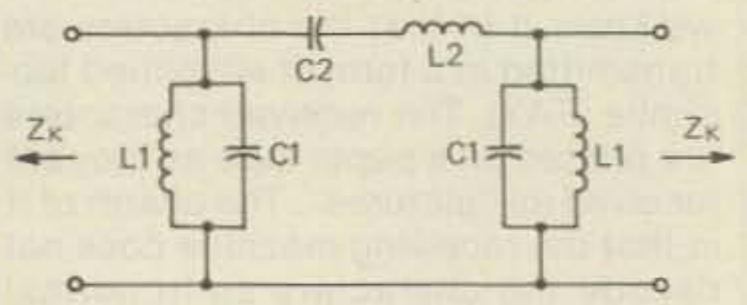


Fig. 2– Prototype bandpass filter section of the so-called constant-K type.

that made it extremely stable, both from a mechanical and an electrical point of view. Inside the box was divided in completely screened compartments that housed the different stages belonging to that unit. The units were combined to a complete set by mounting them into a frame, again made of cast alloy. The electrical connections between the units consisted of multipole connectors on the modules, mating with similar devices on the frame. The whole became an extremely strong combination with almost ideal electrical characteristics and easily accessible on all sides for servicing. The whole assembly slides from the front into a sturdy cabinet that in itself already forms a solid and stable basis.

This battleship-like construction also works out in a negative way; most of the German pieces of radio gear are extremely heavy, no doubt partly due to the fact that aluminum was not used for the boxes and frames. The exact composition of the alloy is unknown to this author, but very likely zinc formed a major component of it.

The moving parts such as gears, tuning capacitors and switches are masterpieces of mechanical engineering. Moving a coil turret from one position to another, e.g., is done by a big solid crank and it feels like opening a safe or the door of an expensive oldtime automobile. Regardless how complicated the mechanical devices, they can always be dismantled in a few seconds by loosening one or two screws. That the mechanical linkage can be complicated is evident when one realizes

that, e.g., variable capacitors or band switches that are ganged are sometimes found in different modules that can be easily taken out of the frame, in spite of the mechanical gears. Nevertheless the mechanisms operate with extreme precision. Examples that demonstrate these principles will be shown when we come to the discussion of the four receivers that will be covered in this article.

The German sense for perfection, that is reflected in even the smallest details like terminals, is also demonstrated in the instruction manuals that come with the sets. These not only provide very complete information for the operational use of the set, but also the maintenance man finds everything he needs to know for performing his job properly.

That the designers certainly had service ability of their products in mind is already clear from a simple visual inspection of a radio set. One finds, e.g., screws that are surrounded by a red ring. These have to be loosened to remove a complete unit (module). If one wants to take a unit farther apart the screws marked with a blue ring have to be removed. It is these details that make it a real joy to dissect a German WW II radio.

As announced in the previous section we will now discuss one feature in more detail: an intermediate frequency crystal filter with continuously variable bandwidth.

Such filters are found in several German communication receivers and they were made for different i.f.'s. The "Köln" receiver for instance, that we will meet later, has an intermediate frequency of 1 MHz. The bandwidth of the crystal filter working on this i.f. can be varied between 0.2 and 10 kHz!

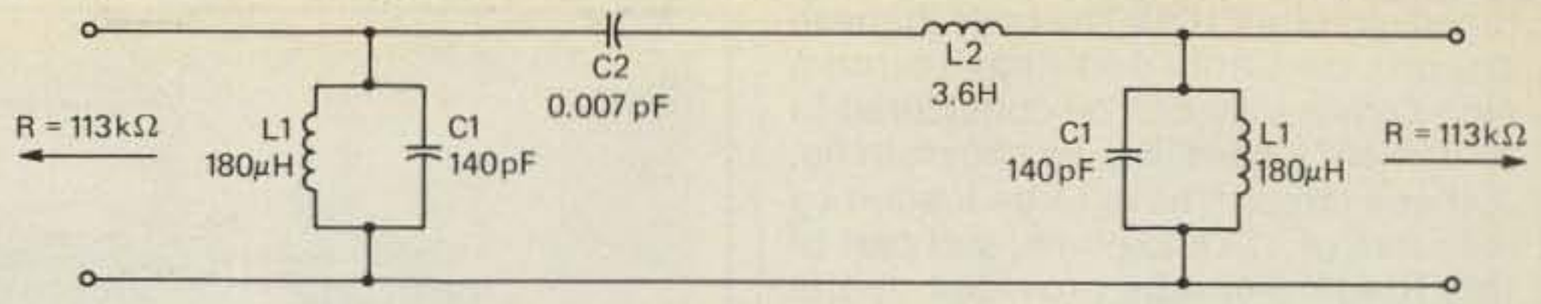


Fig. 3– Constant-K type bandpass filter with component values calculated for a passband of 10 kHz wide and a center frequency of 1 MHz. Note the "impossible" values of the capacitor and coil in the series tuned circuit.

The circuit diagram of this filter is shown in fig. 1. The filter is positioned between i.f. amplifier tubes. A second filter of the same configuration follows the tube on the right. Upon casual inspection one could easily conclude that this filter is of the familiar type to be found in many popular American communication receivers and introduced in the early thirties by James Lamb in his "Single Signal Superhet." These filters feature a sharply peaked response plus a rejection notch that can be moved up and down in frequency by means of "phasing capacitor" C3. But this conclusion would not be correct. The German filter exhibits a real bandpass response, that is to say a flat passband and symmetrical filter slopes at the transitions between pass and stopbands. How is it possible to realize such a response with just a single quartz crystal resonator?

For explanation we turn to an elementary form of bandpass filter, the so called "constant-K type," depicted in fig. 2. This filter consists of two parallel tuned circuits connected by a series tuned circuit. All three circuits are resonant at the same frequency f_o, the center frequency of the pass band. The circuits are supposed to be ideal (without losses). The filter must be fed from a source with an internal impedance Z_K and loaded by an impedance Z_K. Z_K has a different value for every frequency in the pass band and stop bands. Because this is almost impossible to realize in practice the filter is used between a source with internal resistance R and also loaded by R. R is taken as the value of Z_K at frequency f_o.

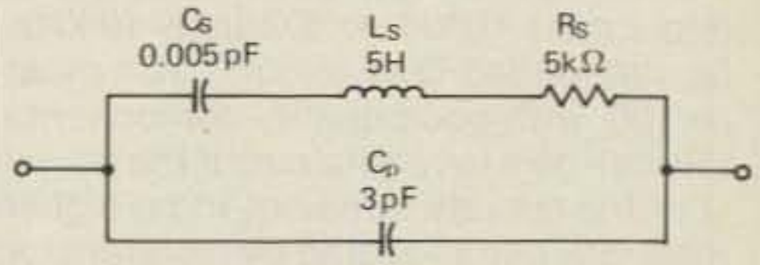


Fig. 4– Equivalent electrical circuit of a quartz crystal resonator. The element values indicated are typical for a 1 MHz crystal.

In fig. 3 a constant-K bandpass filter is shown that has been designed for a center frequency of 1 MHz and a pass band of 10 kHz wide, just as the crystal filter in the "Köln" receiver. The component values for L1 and C1 have been taken equal to L1 and C1 in fig. 1 for the "Köln" filter. Now look at the series resonant circuit L2C2; don't C2 and L2 have "impossible" values? Indeed, especially L2 could never be constructed with a self-inductance of 3.6 henry at 1 MHz. To produce a capacitor of 0.007 pF isn't simple either. But wait, let us take a look at the equivalent electrical circuit of a quartz crystal resonator, as shown in fig. 4. This consists of a series tuned circuit and a parallel capacitor that represents the capacitance of the crystal electrodes. The values for the elements of the equivalent circuit shown in fig. 4 are typical for a 1 MHz crystal. These values are very near to those of the series circuit C2L2 in fig. 3! So it looks like we could replace C2L2 by a suitable quartz crystal and so obtain a bandpass filter at 1 MHz with a 10 kHz wide pass band. But what about the earlier statement that the elements of a constant-K filter were suppose to be without losses? R_s of 5 kilo-ohms in fig. 4 certainly looks like a high loss. But be careful with that conclusion; what really matters is the *Q* of the series tuned circuit. And Q is equal to the reactance of C_s or L_s at 1 MHz, divided by R_s. And that works out to a Q of 6280. That value is so high that the crystal, acting as the series tuned circuit, can be considered lossless. And how about the losses in the parallel

Photo 3– Some units of the FuG 10 aircraft radio set, as it was developed by the German Lorenz factory, part of the ITT concern, in the year 1937. The radio was subsequently manufactured by other firms as well. The remote controlled antenna tuner of this set can be seen in photograph 1; it is the box with the rounded corners at the left on the shelf.

tuned circuits L1C1? The coils in these circuits certainly don't have such a high Q that they can be considered to be without losses. But as shown in fig. 3, these circuits have to be loaded by resistors of 113 kilo-ohms, and part of this loading can be provided by the loss of the circuits themselves. Isn't that beautiful? The loaded Q of the parallel tuned circuits has to be equal to the center frequency f_o of the filter, divided by the width of the pass band. In our case 1000 kHz divide by 10 kHz. So the loaded Q of circuit L1C1 must be 100. with good quality components this can be easily obtained. If the actual Q of the circuits turns out to be higher than 100, extra loading by resistors (or by the output impedance of the preceding tube and the input impedance of the following tube!) can be provided.

So now that we have seen how the single crystal filter can really work as a bandpass filter let us go back to fig. 1, the filter of the "Köln". We see several extra components, as compared to fig. 3. In the first place the crystal is not connected between the upper ends of the parallel tuned circuits, but between taps on the coils. This is done because it would be very difficult, if not impossible, to manufacture a quartz crystal resonator where the parameters of the electrical equivalent circuit have exactly the values required. So in practice the crystal is measured to find out what the actual values of C_s and L_s are and then the proper tap on the coil is computed.

The required value for C2 and L2 of the series tuned circuit changes with the square of the tap ratio on the coils. If for example the taps were made halfway up the coils then the value of C2 would be four times as big and of L2 four times as small as in case of connections to the top of the coils. So by selecting proper taps on the coils the actual crystal can be matched to the filter. In the "Köln" several taps are available, obviously to cater for manufacturing tolerances in the crystals.

Another new element is trimmer capacitor C3. This is a neutralizing capacitor for the parallel capacitance of the crystal and its holder. Once properly set it needs no further adjustment.

You will also note that the anode of the tube feeding the filter is connected to a tap on the coil. That is obviously done to decrease the loading of the input circuit of the filter by the output resistance of the tube. Undoubtedly the designer had selected this tap in such a way that the correct value for the loaded Q of the input circuit is obtained.

The grid of the tube following the filter is also tapped. From a loading point of view this seems unnecessary as the input impedance of a pentode at 1 MHz is very high. But the tube is controlled by the automatic gain control

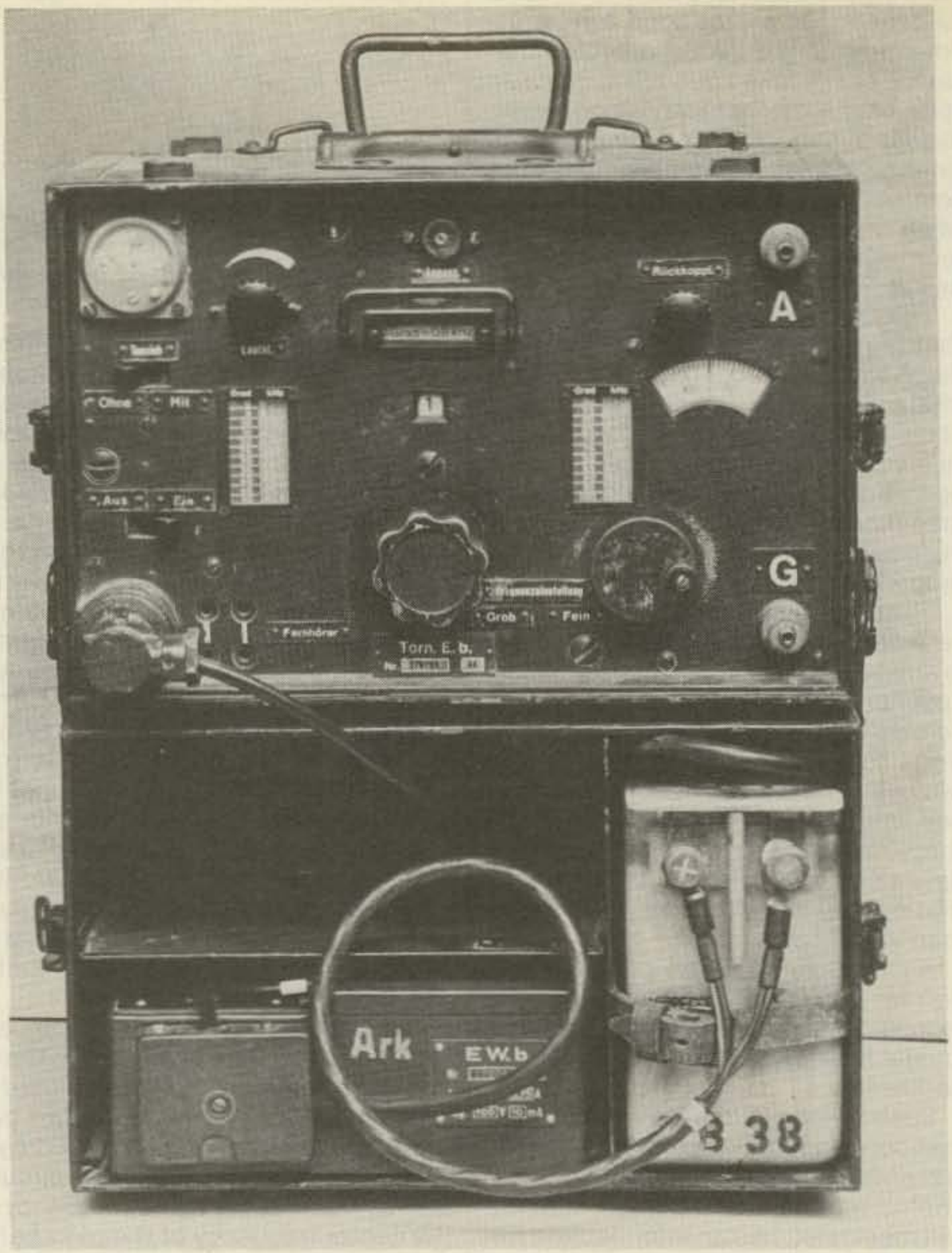


Photo 4– Tuned radio frequency receiver Torn E b. The lower cabinet houses the 2 v. filament battery and a vibrator power pack for the 90 v.h.t. The empty compartment is used to store the headphones and other accessories.

system. And under influence of the a.g.c. voltage the input *capacitance* of the tube changes slightly and this could detune the output circuit C1L1 of the filter. Hence the tap. This leaves us with the function of C4 and C5 to explain. They are sections of a two-gang variable capacitor, but a special one; the construction is such that when one section increases in capacitance, the other section decreases by the same amount. Now assume that at a certain position of the capacitor the input and output circuits of the filter have been aligned to the same frequency. The filter then acts as a bandpass filter of 10 kHz wide in our case. Now turn the capacitor, say in such a direction that C4 increases and C5 decreases. This means that the two parallel tuned circuits become detuned from 1 MHz by equal amounts and in opposite directions. Now the whole circuit is no longer a proper bandpass filter. Indeed what remains is a crystal, acting as a series tuned circuit, connected between two impedances. These impedances become lower as they are detuned farther from 1 MHz. The result is a narrowing of the passband that ultimately approaches the response of the crystal alone, which is a very narrow one. Because the input and output circuit are detuned in opposite directions, the response always remains symmetrical. There you are; a crystal filter where the passband can be smoothly varied between a few hundred cycles and 10 or more kiloHertz by simply rotating a single knob!

In the "Köln" and other receivers as well, two of these filter sections were used in cascade, separated by an i.f. amplifier tube. The sections of the capacitors for varying the bandwidth are in that case combined to a four-gang unit.

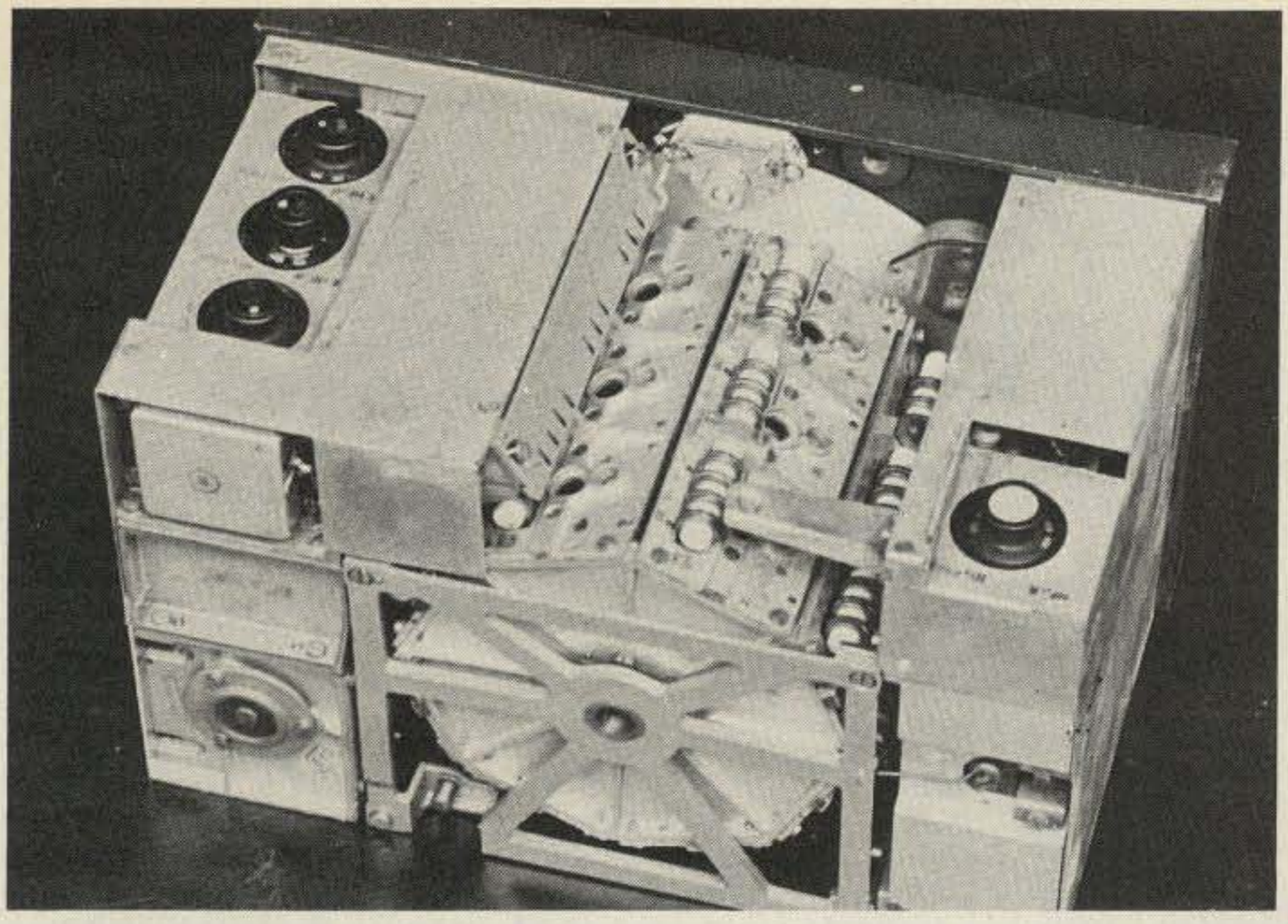
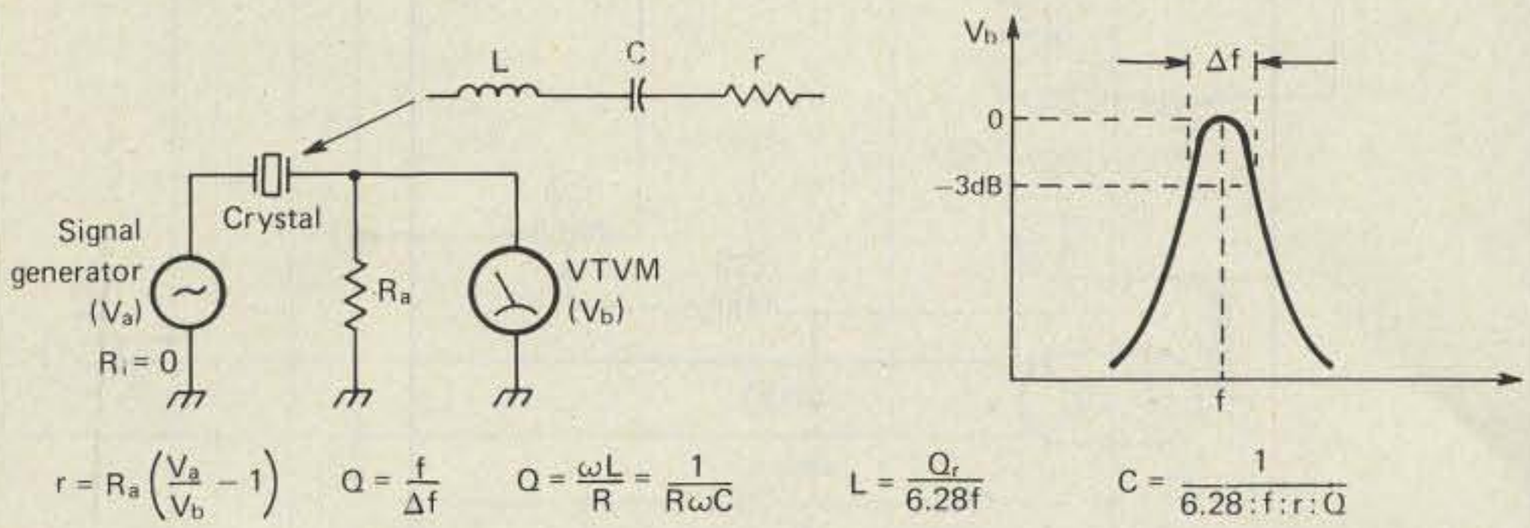


Photo 5- Receiver Torn E b with cabinet removed. Note the bases of the four tubes that disappear completely in their holders. They can be retracted by means of the knob that is part of the molded tube base.



$$r = R_a\left(\frac{V_a}{V_b} - 1\right) \qquad Q = \frac{f}{\Delta f} \qquad Q = \frac{\omega L}{R} = \frac{1}{R\omega C} \qquad L = \frac{Q_r}{6.28f} \qquad C = \frac{1}{6.28 : f : r : Q}$$

Fig. 5- The parameters of the equivalent electrical circuit of a quartz crystal resonator can be easily measured in this set-up, due to Hans Evers, PA0CX/DJ0SA.

It is a remarkable fact that this beautiful solution to the problem of obtaining a continuously variable i.f. bandwidth in a receiver seems to have been lost with the disappearance of German WW II communication receivers from the scene. The system has been used in some post war German receivers, e.g. made by Siemens, but the system in general was almost forgotten until about a year age. Credit goes to Hans Evers, PA0CX/DJ0SA, for having it revived in an article in the Dutch amateur radio magazine *Electron* of July 1979. Hans, for many years, has owned a German receiver in which a crystal filter of the type described is used with excellent results. Triggered by an article in a German magazine on the alignment of such filters, Hans finally found out how the filter really worked. The explanation given above is correct and has been proven by Cas Caspers, PA0CSC, who calculated the response of a filter according to fig. 1 with the values of C_s and L_s of the crystal inserted on an digital computer. The calculated response conforms very closely to the measured one.

It should not be difficult for the homebrewer of today to make a crystal filter according to the old German principle. One only needs to know what the parameters of the equivalent circuit are for a crystal that is to be used in the filter. These can be measured in a set-up shown in fig. 5, thanks to Hans Evers. All that one needs is a signal generator, a v.t.v.m. and a resistor. In order to read small frequency differences with sufficient accuracy an electronic frequency counter is almost a must. From the crystal parameters, the values of C1, L1 and the proper loaded Q of the input and output circuits of the filter can be computed with formulas that can be found in for instance the ARRL *Amateur Radio Handbook*. For the variable capacitor with counteracting gangs we could probably use two varicaps on which the control voltage acts in opposite ways.

It is perhaps well to explain that the success of these early crystal filters is for a large part due to the fact that the Germans knew how to produce stable high Q coils, using powdered iron cup-cores and such at a time when in other countries air coils were still used as a rule, with a simple powdered iron tuning slug used on others.

Fine coils were not found exclusively in the r.f. and i.f. parts of German receivers. In the variable frequency oscillators of transmitters coils can be found in which silver turns are burned into ceramic coil formers. As a result these oscillators show a remarkable mechanical and electrical stability. According to PA0AOB this technique reduces the temperature coefficient by a factor of 200, as compared to a conventionally wound coil. The same construction techniques were used in the manufacturing process of trimmer and fixed capacitors in tuned circuits.

Now that we know something in general about German radio equipment from WW II days it is getting time to take a closer look at some of these fine radios.

Tornister-Empfänger b

We will use the original German designation of the receiver we are going to discuss now. Photograph 4 shows a front view of the set. You see that the set consists of two units above each other. The cabinets— meant to be carried on the back of a soldier—that house the units are called "Tornister" in German. Actually in photograph 4 you see two half "Tornister", one housing the receiver and the other the power supply. "Empfänger" is the German word for receiver. And the letter "b" in the designation simply indicates which receiver. Mostly the designator was shortened to "Torn E b" and that is what we will use. The Torn E b was created around 1935/36. It was in general use with the German Signal Corps, but also at higher army staffs, police and traffic control authorities. It was a popular set, produced in great numbers and one of the few sets that found their way to amateur service in Europe in post-war stations.

It is a tuned radio frequency (t.r.f.) set with four filament type tubes that were run from a 2 volt battery at 0.2 a. each. So the whole radio consumed about 0.8 a. from the battery. The anode current came from a 90 v. dry battery at a consumption of about 12 ma. It was also possible to generate the h.t. from the 2 v. battery via a vibrator unit and that is what you see in photograph 4. The

vibrator unit is on the bottom shelf of the lower cabinet. Still another possibility was to run the whole set from a 12 volt automobile battery, also with a vibrator for the h.t.

The set covers the frequency band 100-6970 kHz in eight ranges. The actual coverage of each subband is as follows:

Band 1: 97	175 kHz
Band 2: 172	310 kHz
Band 3: 306	552 kHz
Band 4: 541	977 kHz
Band 5: 958	1720 kHz
Band 6: 1685	3030 kHz
Band 7: 2940	4760 kHz
Band 8: 4420	6970 kHz

Photograph 5 shows the inside of the set and fig. 6 the circuit diagram. This is a reproduction of the original diagram from the technical manual for the radio. The receiver has two r.f. amplifiers, a regenerative detector and an audio output stage, producing sufficient to drive two sets of headphones.

There are three tuned circuits of which the variable tuning capacitors are ganged. We also find three sets of eight coils, one set for each subband. The coils with their associated fixed and trimmer capacitors are housed in a coil turret that can be clearly seen in photograph 5. This picture shows several of the features that we mentioned in the previous section. The coil turret is of cast alloy and contains completely screened compartments for each coil. The contacts are supported on cylindrical ceramic bars. The three gang tuning capacitor is also completely screened. You see the shaft bearing on the backside of the capacitor at the lower left. You also notice the bases of the four tubes. The two r.f.s and the detector tube are at the left, the a.f. tube at the right. The tubes disappear completely in the tube holders. They can be withdrawn by means of the circular knobs that are part of the molded tube base. The two r.f. stages and the detector stage are also completely screened. The extensive screening and decoupling leads to an extremely stable set with no trace of undesired feedback between stages.

Let us again take a look at the front (photograph 4). The big knob at the lower center controls the coil turret. Immediately above it the selected subband number is shown in a little window. Left and right of center you see windows that display a table; this gives the frequency that corresponds to the reading of the fine tuning dial that revolves with the tuning capacitor, seen at the right. The table lists

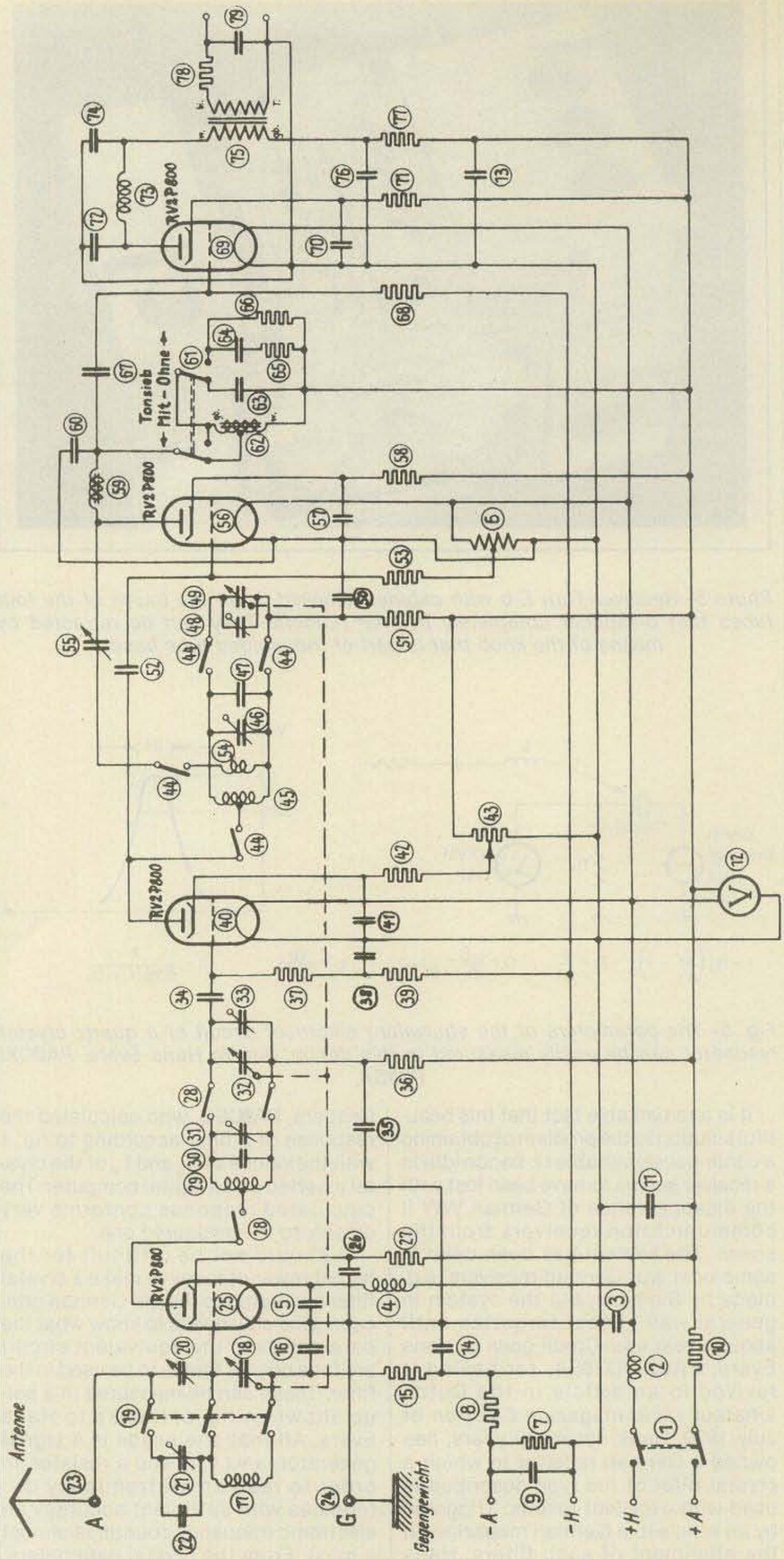


Fig. 6– Circuit diagram of the tuned radio frequency receiver Torn E b, as it appears in the instruction manual for the set.

the frequency in increments of 5 dial divisions. But for a finer reading we can extrapolate between these increments; in a fourth window, immediately above the one that shows the subband number, we read how many kiloHertz correspond to one dial division. For subband 1 this is 0.8 kHz, as you may be able to read from the photograph.

The knob called "Rückkoppl" at top right controls the regeneration of the detector stage, number 55 in the circuit diagram. Any of you who have used a t.r.f. set know that the joy or misery you derive from it is determined in a major part by the action of the regeneration control. The set should slide smoothly into oscillation, without thumb or backlash, that is to say the detector should start and stop oscillation at the same position of the control. These desirable features are dependent upon a number of factors in the circuit, as any of you oldtimers can testify. But the German designers of t.r.f. sets certainly knew the secret of making a fine regeneration control. The one on the Torn E b, or any German t.r.f. set for that matter, is a pure joy to use. Fine control is assisted even more by a slow motion drive on the regeneration capacitor!

The knob with the crank turns the tuning capacitor via a 1:19 slow motion drive. This operates with great precision and with a smooth feel. Nevertheless it was at this point that the author had some criticism on the receiver; at the high end of the frequency band covered by the set near 7 MHz, one revolution of the tuning control changes the frequency by some 200 kHz and this is too much for easy tuning of s.s.b. signals. This criticism is quite unfair, of course, as at the time the receiver was developed s.s.b. was unknown, at least for military applications. Still I found a way of fine tuning the set; as with most t.r.f. sets at high frequencies the regeneration control pulled the receiver tuning somewhat and this could be used as fine control.

The control marked "Lautst" is the gain control. It varies the screen-grid voltage of both r.f. amplifier tubes. This works very well and avoids the possibility of overloading the detector. Top center we find the antenna trimmer with screw driver adjustment. It is marked 20 in the circuit diagram.

For telegraphy an audio filter, tuned at 900 Hz, can be brought into the circuit by means of the switch "Tonsieb." The filter consists of a parallel tuned circuit with coil 62 and capacitor 63. It is very effective on c.w.

Top left on the front panel we find a voltmeter. It reads the filament voltage. Not only is the meter calibrated so that the proper voltage of 2 v. can be read, the correct voltage reading is also indicated by a red marker! By pushing the button on the meter front the instrument reads the h.t., that should be 90 v. and the correct value is again indicated by a colored marker on the meter face, this time in blue.

Finally we find on the front panel an on/off switch that controls the filament current, a plug for the power cable and sockets for two sets of headphones. And of course two big and easy to use terminals for antenna and ground.

As I already mentioned, Arthur, PA0AOB, gave me the opportunity to use the radio for considerable time in my own shack. Although the design is now over forty years old, the set still performs remarkably. As to be expected the receiver is at its best on c.w. Especially on the 500 kHz marine band it leaves nothing to be desired. But also on the long wave and medium wave broadcast band many more stations were copied than on a modern run of the mill superhet. Quality of the audio is rather limited, but then the set was certainly not meant for music. Selectivity is excellent. In fact on the long and medium wave bands the regeneration control should not be advanced too far, otherwise serious top cut is experienced.

Also on the short wave bands c.w. is received very well. S.s.b. can be resolved too, but tuning gets a bit tricky there, as already mentioned. Cross- and intermodulation forms no problem. Even in Europe's extremely crowded forty meter band, with its many intruding strong broadcast stations, amateur c.w. signals can be easily copied at night, a test that many modern superhets fail. The forty meter band is not within the range of the set according to the official specs, as it does not tune beyond 6970 kHz. Nevertheless, in practice some 30 or 40 kHz of the 7 MHz amateur band is in fact covered.

One is struck by the quiet operation of this t.r.f. set. The input noise is just noticeable on a quiet band. And the background level is steady, no doubt caused by the fact that there is no a.g.c. As wa well-known Dutch radio expert stated before WW II: "automatic gain control moves the fading from the signal to the background."

The set is rather small, 36.5 cm wide, 24.5 cm high and 22 cm deep. This is for the receiver alone. Together with the battery and accessories "Tornister" height is 46 cm. But the weight of the complete unit is surprising, 24 kg (52.9 lbs).

(To Be Continued)

a monthly feature by
A. EDWARD HOPPER, W2GT

Awards

NEWS OF CERTIFICATE AND AWARD COLLECTING

The August Story of The Month as told by Lyn is:

Evelyn Welliver, WB4RVW All Counties #254, 11-13-79

"Amateur radio interest began when traveling with friends to a Camping Club Picnic, while living in Levittown, Pennsylvania. When they turned on their mobile rig and talked with Cincinnati, Ohio, Harry and I thought, this would be great for us, as he was a truck driver and often away from home for a week (or more) at a time.

"Our friends, K3COD and K3GSV, Heddy and Roy Grant, loaned us a receiver and books and even made code tapes for us.

"In 1964 I got WA3ACJ and Harry got WA3ATZ. I became involved in Traffic Handling. I have a Bronze Medallion for that work.

"About 1966 I found the CHC Net on 75 meters and really got hooked. Got my first award from K6BX in 1968 and went on to win many more of his awards.

"In 1969 we moved to Florida and had no opportunity to operate for about five years, but then I found the MARAC bunch and got started again.

"Harry, WB4RTC, does not operate anymore, nor is he driving a truck, but he is the greatest in putting up antennas and keeping equipment in shape.

"We enjoy going mobile when we go on our camping trips which have taken us to almost every state and eastern Canada.

"Before we came to Florida we did lots of camping in the Pennsylvania mountains when we went hunting and fishing. But now I'm retired to my ham radio but Harry does get to the ocean to surf fish and to the Indian River here in Melbourne for the jumbo shrimp that come up into the river to spawn during the winter and spring.

"I am a member and Past President of the Floridoras and won the Left Footed Code Test at the Melbourne Hamfest in 1976. Other hobbies: teaching of knitting crafts and camping and traveling.

"I have been under doctors care since before last Christmans for congestive heart failure, some days are not so good.

Harry loves fishing, shrimping, gardening, camping and any outdoor activities.

We have 5 children and 9 grandchildren.

My rig is a 13 year old Swan 500C, using a mini beam up 30 feet. For mobiling we use an HW-32A and Hustler antenna."

P.O. Box 73, Rochelle Park, N.J. 07662

Lyn, WB4RVW & Harry, WB4RTC at Disney World, Florida.

Awards Issued

(WOW - Seven new All Counties Awards issued this month!!!)

Doug Hall, WA4UNS added USA-CA-3000 and All Counties, endorsed All S.S.B., to his fine collection.

Eldon Saunders, W5VDW waited until he had them All and requested USA-CA-500 through All, endorsed All S.S.B.

Ake Broman, SM4EAC got those last few QSLs (with the help of Ray, K5RPC) to get All Counties endorsed All S.S.B.

Eddie Rollings, WB9WEF also waited until he had them All before applying for USA-CA-500 through All, endorsed Mixed.

Dave Christensen, WA9WGJ added All Counties endorsed All S.S.B. to his fine collection.

Charlie Justice, W4JUJ, who received his USA-CA-500 in January 1963, got interested/active to receive USA-CA-1000 through All Counties endorsed Mixed.

Norman Heckman, K4ZT also waited until he had them All before writing for USA-CA-500 through USA-CA-2500 endorsed All S.S.B., All Mobiles, All 14; USA-CA-3000 endorsed All S.S.B., All Mobiles; and All Counties endorsed All S.S.B.

Jim Elwell, W1VJ got some more QSLs to make USA-CA-3000 endorsed Mixed.

Special Honor Roll
All Counties

#276 Douglas S. Hall, WA4UNS 4-11-80.
#277 Eldon L. Saunders, W5VDW 4-15-80.
#278 Ake Broman, SM4EAC 4-18-80.
#279 Eddie C. Rollings, WB9WEF 4-18-80.
#280 Dave Christensen, WA9WGJ 4-23-80.
#281 Charles C. Justice, W4JUJ 4-24-80.
#282 Norman M. Heckman, K4ZT 4-28-80.

Lyn, WB4RVW holding mike won in the "left footed CW contest."

Antonio Petroncari, I2PJA was sent #1 to Italy, USA-CA-2000 endorsed All 2 × S.S.B.

Dean Cowden, W0CJG added to his collection USA-CA-2000 endorsed Mixed.

Clem Lambert, WB1DQA sent for USA-CA-1000 endorsed All S.S.B., All 14, All Mobiles.

USA-CA-500 Certificates, endorsed Mixed, went to:

The Helsinki University Radio Club, OH2AC, #1 to any Finland Radio Club.
Hans Bahr, DJ2UU.
Jim Downie, WB0STR.
Stradiotto Italo, YV1AVO.

USA-CA-500 Certificates, endorsed All S.S.B., were sent to:

Alfredo Pauker, CP6EL, #1 to Bolivia.
Kim G. Windsor, SV0AE.

USA-CA-500 Certificates, endorsed All A-1, were claimed by:

Minko Lubomirov, LZ1XL #2 Award to Bulgaria.
Novicic Milomir, YU2TO.
"Jack" Jackson, SV0AA (he is ex W1DCE/6 1946, W6YYW 1947, KH6PY 1948 to 1950, W4DCE 1950 to 1952, KG6AEP 1952 to 1953, and W6GBD 1953 to now).

USA-CA Honor Roll

3000		2000		1000	
WA4UNS	303	W5VDW	420	K4ZT	597
W5VDW	304	WB9WEF	421	500	
W1VJ	305	W4JUJ	422	OH2AC	1458
WB9WEF	306	K4ZT	423	CP6EL	1459
W4JUJ	307	1500		LZ1KL	1460
K4ZT	308	W5VDW	473	W5VDW	1461
2500		WB9WEF	474	WB9WEF	1462
W5VDW	367	W4JUJ	475	YU2TO	1463
WB9WEF	368	K4ZT	476	DJ2UU	1464
W4JUJ	369	1000		K4ZT	1465
K4ZT	370	W5VDW	593	YV1AVO	1466
2000		WB9WEF	594	SV0AA	1467
I2PJA	418	W4JUJ	595	SV0AE	1468
W0CJG	419	WB1DQA	596	WB0STR	1469

Awards

The Carl Ben Eielson Award: Sponsored by Carl Eielson Historical Society and Goose River Amateur Radio Club to honor the late Carl "Ben" Eielson of Hatton, North Dakota.

He was a noted Arctic and Antartic explorer pilot for Sir Hubert Wilkins. He was killed in 1929 attempting to rescue crew members of the U.S. ship *Nanuk* which was frozen into the ice pack north and west of the Bering Straits. Eielson Air Force Base, 26 miles south of Fairbanks, Alaska is named after him. The Yukon Indians admired him so much, they named him "Moose Ptarmigan" (Brother of the Eagle).

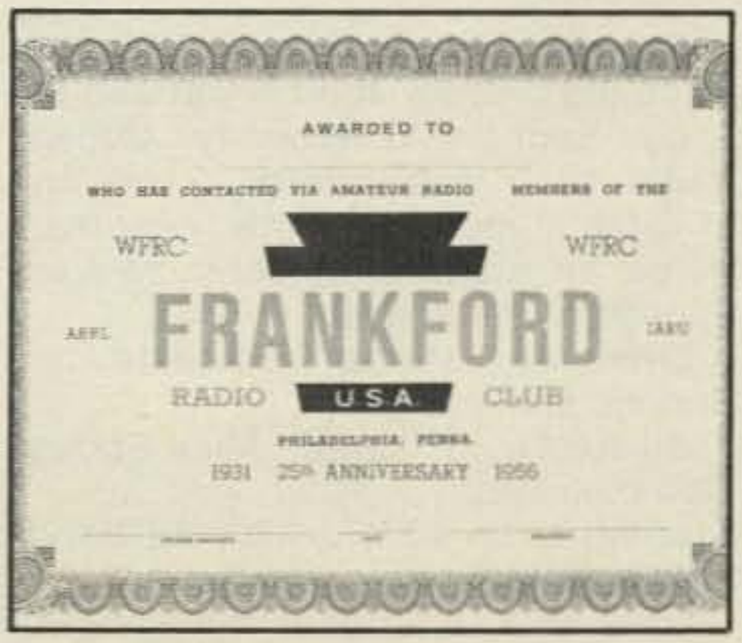
Stations (calls?) will be operating the last week of July with emphasis on the last weekend. July 25, 26 and 27 on 6 through 80 meters. QSLs from stations requesting certificates go on display at the museum. Thanks for the data from Gordon Juveli, WB0ZSA, 10925 Morris Avenue, S., Bloomington, MN 55437.

The Carl Ben Eielson Memorial Award.

Worked Frankford Radio Club Award (WFRC): DX and U.S. Possessions work 15 club members, Canada work 25 members. FRC Members work 50 members. Award is issued free. Send log information only, no QSLs needed. Send log information your QSL to: K2FL, Jack Heisey, 616 Chestnut Street, Palmyra, N.J. 08065.

Tallcorn DX Award: Sponsored by the Central Iowa Radio Amateur Club and is available for confirmed contact with three or more members. Individual QSLs are not required, but be sure to send full log information. The award is free for an s.a.s.e., however if one desires the award in an unfolded condition suitable for framing, be sure to send 50¢ to cover the postage and a large envelope. Apply to: Central Iowa Radio Amateur Club, P. O. Box 39, Marshalltown, Iowa 50158. The club membership is active on all bands on c.w., s.s.b., RTTY and SSTV. Thanks to Lynn Hansen, KA0CLQ for the data.

Talking Rails On Ten Award (T.R.O.T.): Sponsored by the TROT Chapter of the 10 X International who announces effective January 1, 1980 that a contact with any member of the Northliners Radio Club on 10 meters (any mode) qualifies any station for their certificate and the normal charge applies (I assume $1.00). Their net meets on 28.780 MHz on Thursdays at 0200Z. Apply to: Certificate manager, Cecil Vincent, W0UM, Northliners Radio Club, 176 E. 5th Street, St. Paul, Minn. 55101. Thanks to Warren Koppy for the data.



Worked Frankford Radio Club.

No-29-30

Tallcorn DX Award

Talking Rails on 10 Award

ALARA Award: Sponsored by the Australian Ladies Amateur Radio Association. Class A (Basic Award) work 10 members in VK, ZL, or P29, including at least 3 VK call areas, no more than 3 VK3 stations to be included in the 10 members. Class B (Advanced Award) work 15 members, including 4 VK call areas. No more than 4 VK3 members to be included in the 15 members for the award. Special endorsements: All Phone, All C.W., All Novices, mixed and band endorsement, e.g. all 10 meters.

Sticker for each additional 10 members. Open to both OMs and YLs. Contacts may date from June 30, 1975, which is the date of the birth of ALARA.Application may consist of log extract signed by two other amateurs. ALARA net contacts cannot be counted toward the award, however, contacts made in other nets may be used.

Cost: $1.00 or 4 IRCs. Apply to: Awards Officer, Heather Mitchell, VK3AZU, c/o ALARA, Box 110, Blackburn, Victoria 3130, Australia.

The Reverend John Flynn Memorial Award: Sponsored by the Alice Springs Community College Radio Club, in memory of the Reverend John Flynn, who was the founder of the Australian Inland Mission, the Royal Flying Doctor Service and radio communications in general, in "Outback Australia." Today, thanks largely to the efforts of John Flynn, every cattle station and settlement in the Outback has radio communications.

This year, 1980, is the 100th year since the birth of John Flynn and the Alice Springs Community College Radio Club has printed 2,000 certificates in memory of this great man.
Rules: VK stations - 3 contacts Alice Springs club members.

Overseas Stations - 2 contacts Alice Springs club members.

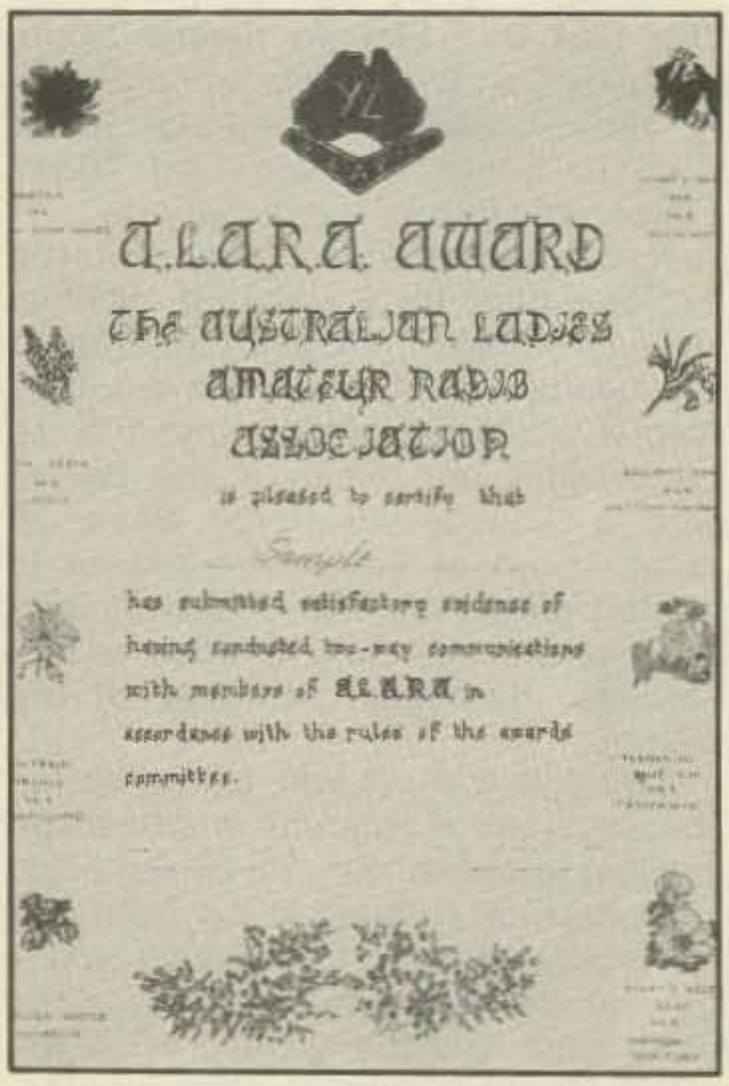
All s.w.l.s - 3 "heard" Alice Springs club members.
Starting date: 0001 1-1-80. All Bands -All Modes.
Cost is $3.00 Australian including Air Mail Postage.

Send log extracts showing Date, Time (GMT) and stations worked, signed by 2 other amateurs. Contacts 24 hours apart with same station allowed. All funds generated by this Award will be donated to charity. Apply to: Awards Manager, A.S.C.C.R.C, P. O. Box 2953, Alice Springs, Northern Territory, Australia 5750. Thanks to Danny, VK8NDN for this data—*but* note later information from VK8LD & VK8AR say the Award cost is $2.00 for VKs and $2.50 for all others.

Worked All Lynchburg Ladies: This certificate may be earned by working three YL Members of the Lynchburg Ladies (repeater contacts not acceptable). Submit log information and s.a.s.e. suitable for 8½ × 11 certificate to: N4BVP, Rachel S. Bush, 1109 Dandridge Drive, Lynchburg, Virginia 24501.

Notes

Sorry to say, we lost another County Hunter, George Vermilyea, K2PBU, All Counties #187, dated 6-6-78.



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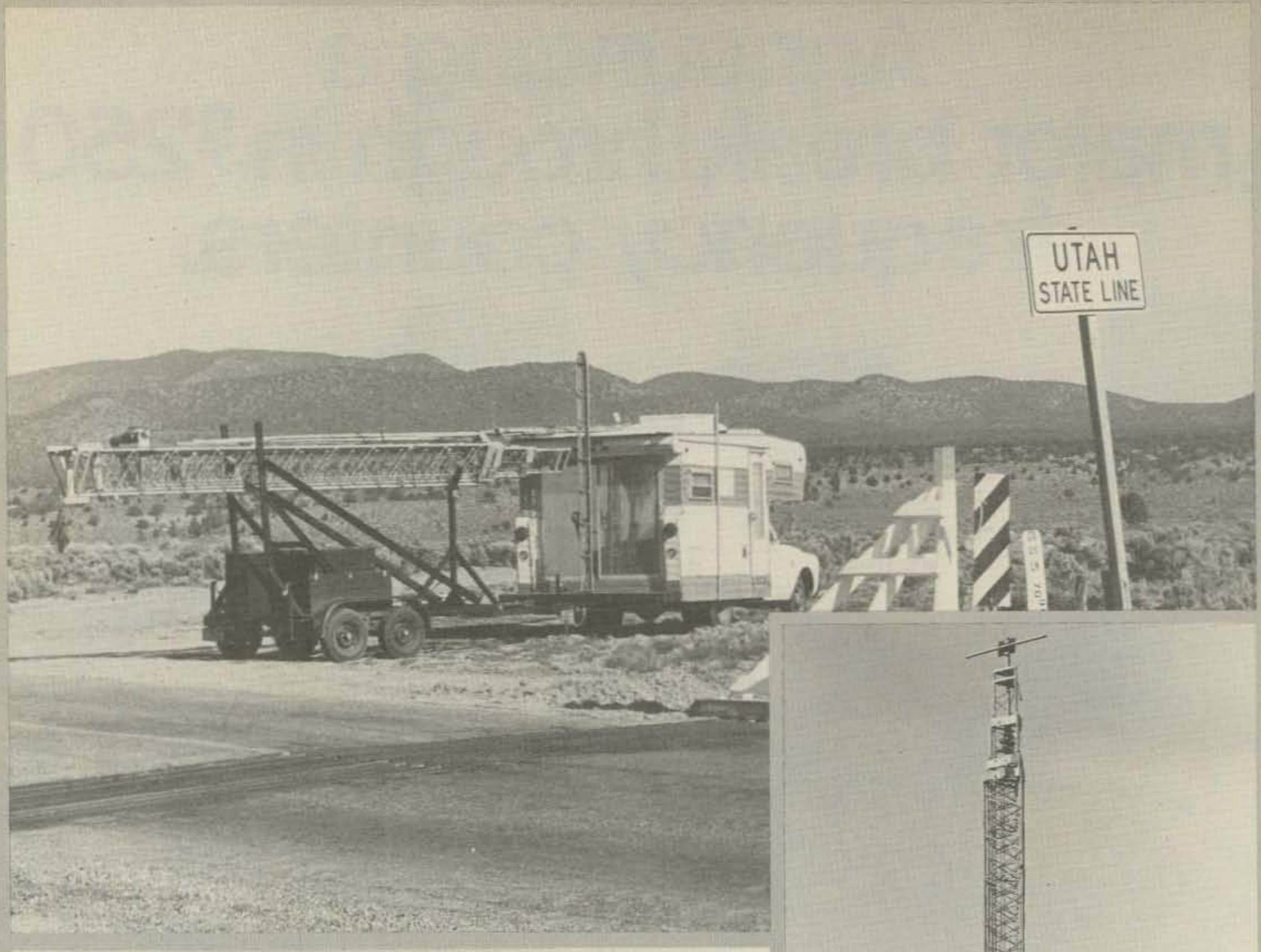


Here's "Godzilla on Wheels" arriving at the Utah-Nevada border for a 2-meter moonbounce DXpedition. The truck contains a large operating console and generator, and tows the 25-foot-long trailer easily at 55 mph.

This shows the tower halfway upright. A winch raises the tower from its traveling position, using the rear uprights as a pivot point. Note how the 12-foot outriggers are set to provide stability.

In this photo, the tower is upright, ready for antennas to be mounted at this seaside location. Since there are no guy wires in the way, it's a simple matter to assemble antennas on the ground and raise them with a block and tackle.

Most amateurs (and their neighbors) think a 70-foot tower with full-size Yagis is a bit big to have even at home—but here's a way to take one along on expeditions!

Build Your Own Tower On Wheels

BY WAYNE OVERBECK, N6NB

How would you like to have a 70-foot self-supporting tower—complete with stacked Yagis for 20, 15 and 10 meters—on top of a 10,000-foot mountaintop, far from television-watching neighbors and city noise sources? Imagine what you could do in the *CQ* World Wide DX Contest!

Or how about putting those antennas on a hillside overlooking the Pacific Ocean for the All-Asian Contest? With higher mountains immediately to the east, stateside QRM would be nearly nonexistent.

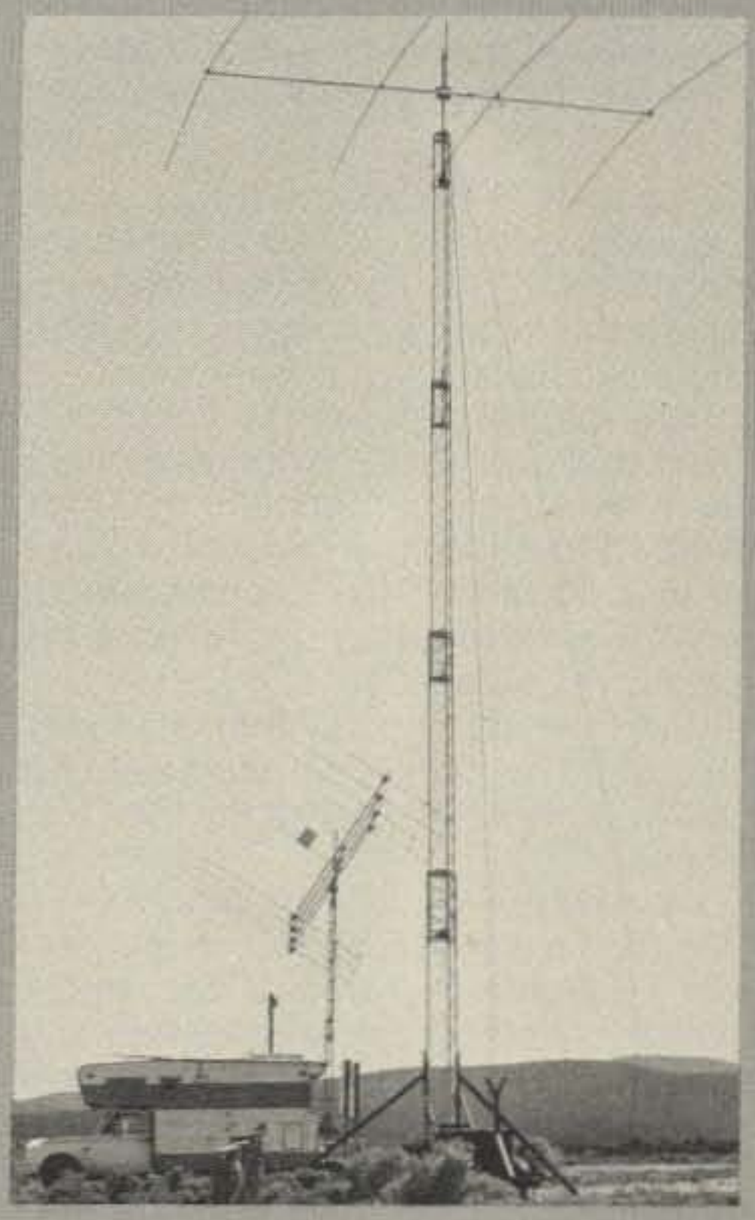
You can do all this and much more if you'll just put your tower on wheels instead of burying it in concrete!

When most amateurs go shopping for a tower, they think only in terms of what will fit in their backyards. I think that's a mistake, because the places where most of us live just aren't that great as radio locations. In the first place, most of us have neighbors who like to watch television and who get uptight about things like "property values." To an amateur, a big beam antenna may be a thing of beauty, but a lot of our neighbors have other ideas. And besides, the city or suburban neighborhoods where so many of us live are full of horrible noise sources.

Because of all this, I gave up operating seriously from my home years ago, and I think other amateurs should consider something like the tower-on-a-trailer I call "Godzilla on Wheels." It opens up an incredible number of possibilities for operating in exciting places, and it didn't cost much more to build than most amateurs spend putting up a similar tower at home.

Basically, Godzilla combines a 70-foot motorized self-supporting crankup tower (a Tri-Ex LM470D) with a homemade steel trailer that hauls the tower anywhere there's a road. Once at the destination, the trailer becomes a sturdy foundation for the tower.

Now the idea of putting a crankup tower on a trailer isn't new. Tower manufacturers have made trailers for military, commercial and government applications for years. Unfortunately, these trailers tend to be priced completely out of the amateur market. But there's no reason why a radio amateur with a little perseverance has to let a little thing like a $5000 price tag for a trailer get in the way—especially when you can build your own for a fraction of that! Now building a steel tower trailer is no one-evening project, but neither is it as difficult as it might seem. It took me about a month of evenings and weekends to do the job, working alone most of the time. It took perhaps another month to add the niceties, like storage bins and a self-contained 4000-watt electric generator. I did have help the weekend of the main structural work; there were three of us who wanted tower trailers, and we built three of them that weekend!



Here's Godzilla fully extended, supporting a 20-meter monobander at 75 feet. The smaller tower on the truck supports a moonbounce array for 2 meters, and the only purpose for having the big 20-meter beam on this particular expedition is to provide liaison for the 2-meter schedules.

For those who might like to build something like Godzilla or for those who just like to read about somebody else's fanatical pursuit of his hobby, here's a description of how it was done.

The project really began as I became dissatisfied with a 40-foot crankup tower I had mounted on a truck camper for portable expeditions. It was great for v.h.f. contests and mountaintop fun, but for a big signal on the bands below 30 MHz I needed something bigger.

I selected the 70-foot crankup as about the right size for the job, and set out to design a trailer that would support it. First I took a good look at the commercial tower trailers, but when I saw the prices I knew this whole thing was getting out of hand. So I got to know the people at a trailer component supplier and learned about axles, springs, trailer tires, hitches and such.

Ultimately, I settled on a tandem axle design with a frame made of 3-inch steel channel stock. Several other types of steel could have been used, but the channel was both readily available and inexpensive. About $250 worth of steel was required for the entire trailer.

Since highway regulations limit normal trailers to an 8-foot width, there had to be a way to gain extra width for stability with the tower fully extended. The solution was a pair of outriggers

---

* *Pepperdine University, Malibu, CA 90265.*

that swing out on each side. They are 12-foot lengths of channel, pulled tight with chains and turnbuckles at the base.

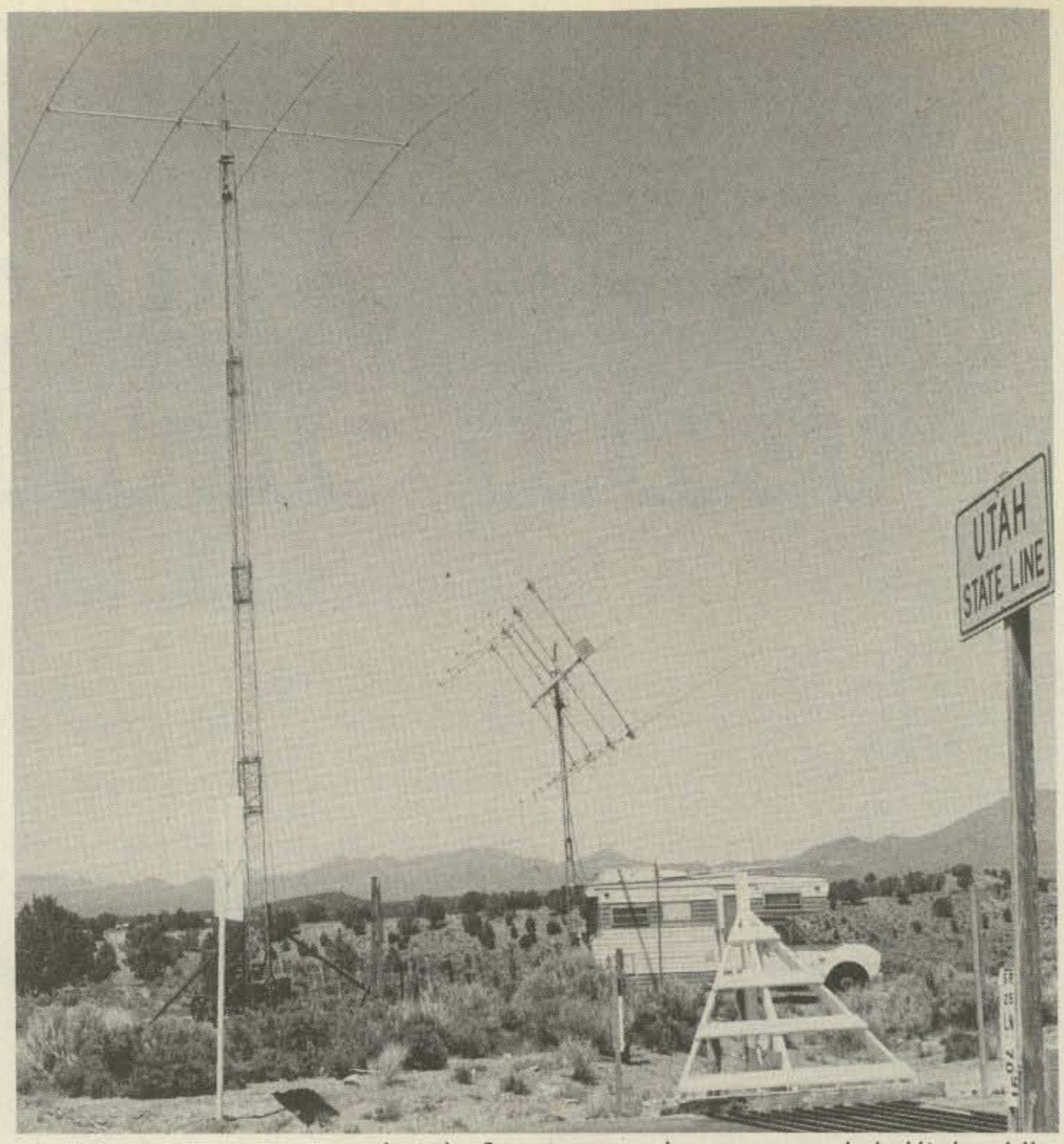
To simplify the job of raising and lowering the big tower (which weighs in at 1000 pounds), I mounted the tower 8 feet above the ground with a pivot point 8 feet from the bottom of the tower. Thus, the setup involves nothing more than pivoting the tower upright with a light-duty winch. Before the tower is extended to its full height (or climbed to mount the antennas) it is secured to the trailer frame with with 3/4-inch bolts at the base.

Since you cannot guarantee that every portable site will be exactly level, another requirement is a set of levelling jacks. I used standard trailer jacks on each side at the rear and on the tongue.

The overall length of the trailer is 25 feet, and it weighs in at 2500 pounds, including the tower, storage bins full of cables and tools, the generator and its 20-gallon gas tank, and the disassembled antennas. I carry 10 and 15 meter elements intact, while all booms and elements for 20 and 40 meters are broken down into smaller pieces.

Since the gross vehicle weight is under 3000 pounds, trailer brakers were not required. However, if I were doing the job over again I'd include a braking system, just in case.

"Godzilla" has been successfully towed by half-ton pickup trucks, vans and, most often, by my one-ton chassis-mount truck camper, which provides a comfortable indoor operating position and a second 4000-watt generator.



In this photo you can see that the 2-meter moonbounce array is in Utah, while the first three elements on the 20-meter antenna and all of the big tower are in Nevada!

How long does it take to set up the tower and antennas? Working alone, I can have a 4-element monobander for 20 up 75 feet within an hour after I pull up at a portable site. Stacking antennas for additional bands takes a bit longer, of course.

What's that? You say this is all very nice, but you think I've been welding and working with steel all my life? Not exactly.

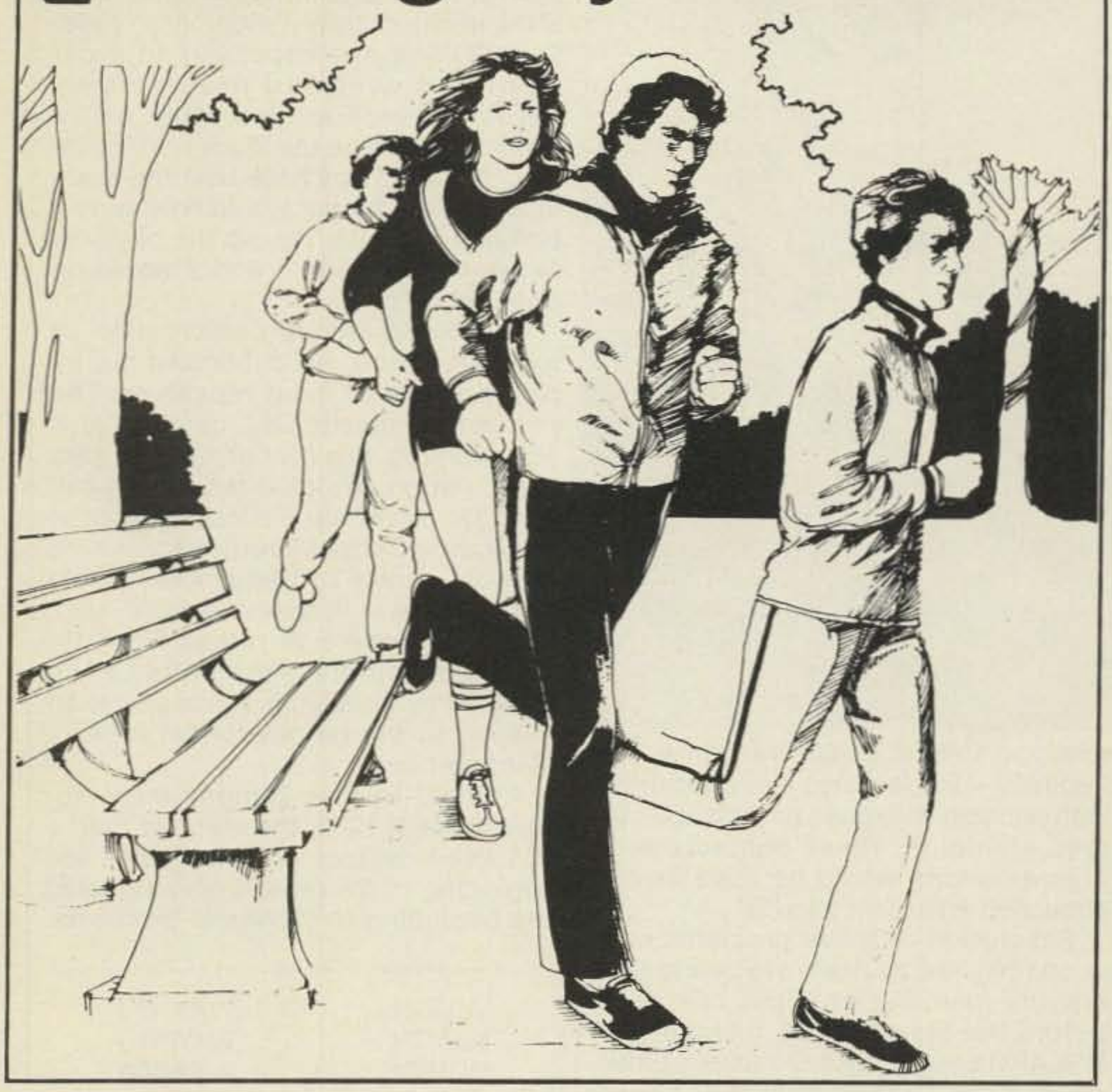
I'd never welded until WA6IKO introduced me to it just before this project. I bought a 250-amp AC arc welder (which sells new for about $125) and practiced on scrap steel for a few hours the week before our first trailer-building weekend. I'm no journeyman welder, but my work doesn't look that bad; AC "stick" welding just isn't that much harder than soldering! And if you spend a little time around welding supply houses, trailer parts jobbers, and steel warehouses, it's amazing how quickly you learn what you need to know to tackle a job like this one.

Actually, building Godzilla was easier than getting the monstrosity licensed! The people at the California Department of Motor Vehicles were absolutely convinced I'd stolen the thing from the U.S. Army or maybe Ma Bell! It was almost impossible to persuade the bureaucrats that someone would build something like this in his garage to pursue a *hobby*!

Incidentally, the motor vehicle registration people weren't the only ones to view Godzilla with disbelief. You should see the way passing motorists stare as they go by!

To those readers who remain unconvinced and still plan to dig huge holes in their yards for 10-ton concrete bases to support towers like mine, I have one question: What happens when you move? I've seen several amateurs go to all that trouble and expense, only to learn they were being transferred shortly after the big tower went up. For them, that meant starting the whole process all over again. But when I move I can tow my tower right along with me, and I can have it up at my new place the day I arrive! If I don't like the radio location there, I can move somewhere else the next day. I'll take wheels over concrete as a base for my tower any old time! CQ

The Amateur/Runner in Emergency Situations



Not only is running good for your health, but it may be a life saver for someone else. In this case, an amateur was in constant contact with portable and fixed base stations during the Marine Corps Marathon.

BY T.L. FRANCAVILLA*, WB3DGF
AND E.F. SKELTON*, N3ES

As amateur radio operators, we are all aware of the fact that emergency situations do arise and that often we can contribute a great deal to the relief of these situations. In addition, each year thousands of amateurs participate in Field Day exercises to further hone their emergency preparedness capabilities. However, we feel that an important facet of emergency assistance has been overlooked. Therefore, in this article we will relate our experiences in an exercise which utilized this mode of assistance: Namely that of a runner in constant contact with portable and fixed base stations.

The basic idea evolved slowly over several casual conversations about our two hobbies, amateur radio and running. It occurred to us that in an emergency situation roads may become impassable. Many hours could elapse before suitable all-terrain vehicles could be utilized. Moreover, possible poor weather conditions may also render helicopter assistance extremely difficult. On the other hand, the basic trained athlete is fueled and ready to go.

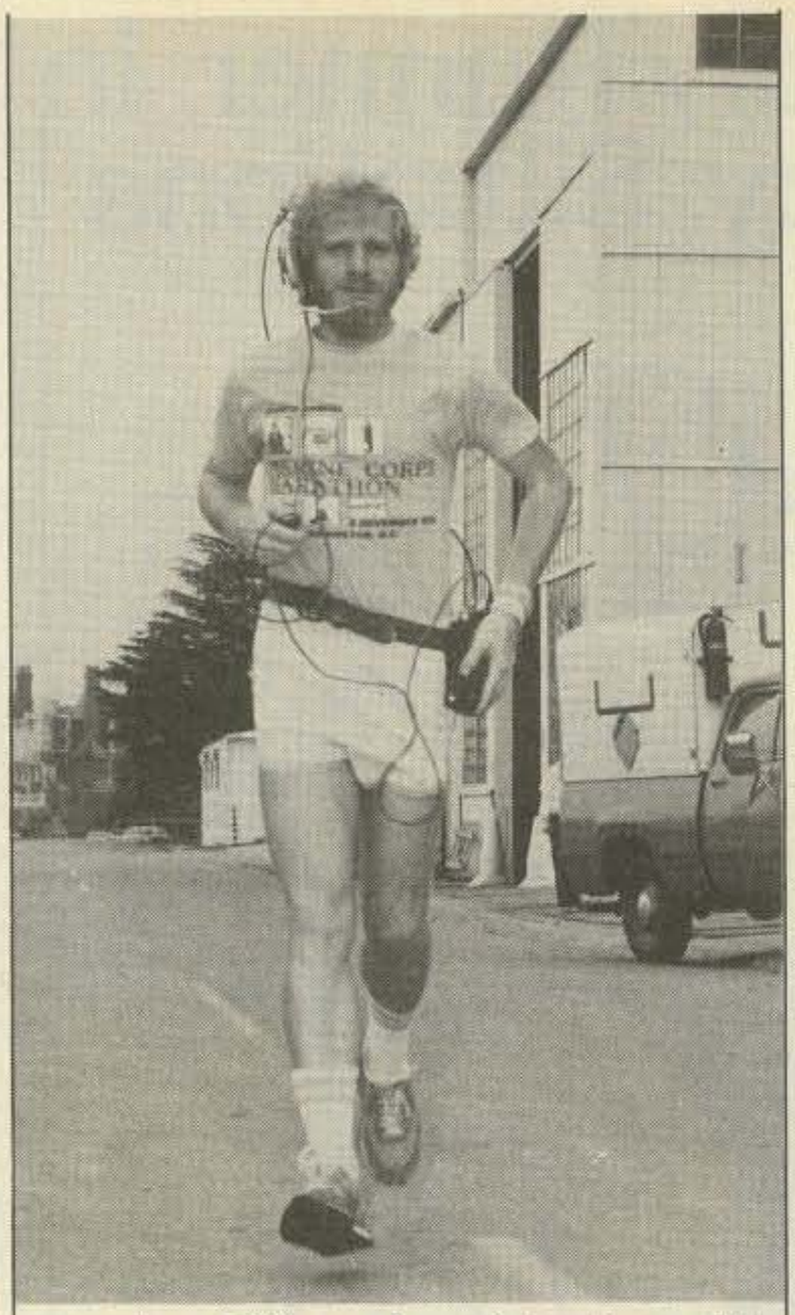
Although amateurs are aware that 2-meter f.m. is a popular mode of communication, many are unaware that the number of runners in this country has increased tremendously. One has only to pick up *Runners World* magazine and note the number of 10 km (6.2 mile), 10 mile and 26.2 mile races being held on any given weekend. (The standard marathon distance is 26.2 miles.) Not surprisingly, many of these runners are also amateur radio operators. It seemed quite reasonable that these running amateurs were in a unique position to make a special contribution in an emergency situation.

We began to consider the best way to demonstrate this capability and, therefore, selected the Marine Corps Marathon, which is run annually in Washington, DC on the first Sunday in November. This is a grueling foot race which begins and ends at the Iwo Jima Memorial near Arlington National Cemetery and winds its way through 26 miles, 385 yards of picturesque Washington streets, passing such national landmarks as the Pentagon, the Capitol, the Lincoln and Jefferson Memorials, the Kennedy Center, and the Washington Monument. We felt a runner participating in this event and in contact with a base station would be a good simulation of an urban emergency situation. Any QSOs made during the race could just as well be emergency calls reporting injured personnel, hazards, or any other emergency traffic needing immediate action.

Recognizing the need for a large support team to assist in both the actual run and the many necessary prerun technical preparations, we discussed the idea informally with key members of the Naval Research Laboratory Amateur Radio Club (NRLARC). Favorable responses led us to present our idea at the September monthly meeting, which quickly led to the formation of a nucleus of enthusiastic amateurs. We then prepared a plan which was presented to this group. After several meetings, this plan was modified in response to the various problems we encountered and their final solutions.

In our view, this exercise presented four main problem areas (which were assigned to subcommittees): I. Technical Support—Under this area we considered the operational mode, appropriate rig and antenna for the runner, power pack and rig support apparatus; II. Field Support—This considered logistic support for the runner, such as battery replacement and minor equipment repair; III. Control Station—This involved communication with the runner, field support stations and relay to local repeaters in the Washington DC, Maryland, and Virginia area. Here we also researched the appropriate FCC regulations, the keeping of accurate logs and advising the USMC Race Director and the NRL Com-

*Naval Research Laboratory, Washington, D.C. 20375



manding Officer of our intentions; IV. Publicity—The last area was concerned with publicity to ensure participation by area amateurs. These contacts with area amateurs would be used as our simulated emergency traffic.

Resolution of these problems was accomplished by many tests and several dry runs. For example, one week before the Marathon 25 members of NRLARC conducted a Simulated Emergency Test (SET) whereby a spawned tornado from a hurricane was considered to have just struck the area into which the runner was sent. Nets with local repeaters were conducted by Club station W3NKF and some test traffic was handled. In our final configuration, the runner, N3ES, was equipped with a battery powered Wilson Mark II transceiver. This was taped to a leather belt and connected to a single earphone and a battery powered ceramic mike. The mike, earphone and 1/4-wave-whip antenna were contained in a headset. This remained firmly in place throughout the run, although to relieve stress it was switched from ear to ear every 4 to 6 miles. The transmitter was keyed with a hand-held PTT-switch and was used on the low power (1 watt) mode. The frequency was 146.46 MHz simplex and crystal controlled. We planned on a 4 hour run, and based on our field tests, we concluded that a single battery change at about the halfway point would be sufficient.

All communications were routed through the NRLARC station, W3NKF. The procedure (fig. 1) was that the runner communicated with W3NKF-unit 1 on 146.46 MHz simplex. The signal was then relayed on 220 MHz to an auxiliary station at NRL (W3NKF unit 2). It was then retransmitted on one of several different local repeater frequencies, thereby linking the "mobile" running station to various amateur radio operators in the greater Washington area. The 220 link was necessary to avoid front-end overload problems by physically separating W3NKF unit 1 from unit 2. Since the Marathon, handheld 220 MHz rigs have become available, and the runner would now carry a portable 220 MHz rig, so the physical separation of units 1 and 2 would be unnecessary.

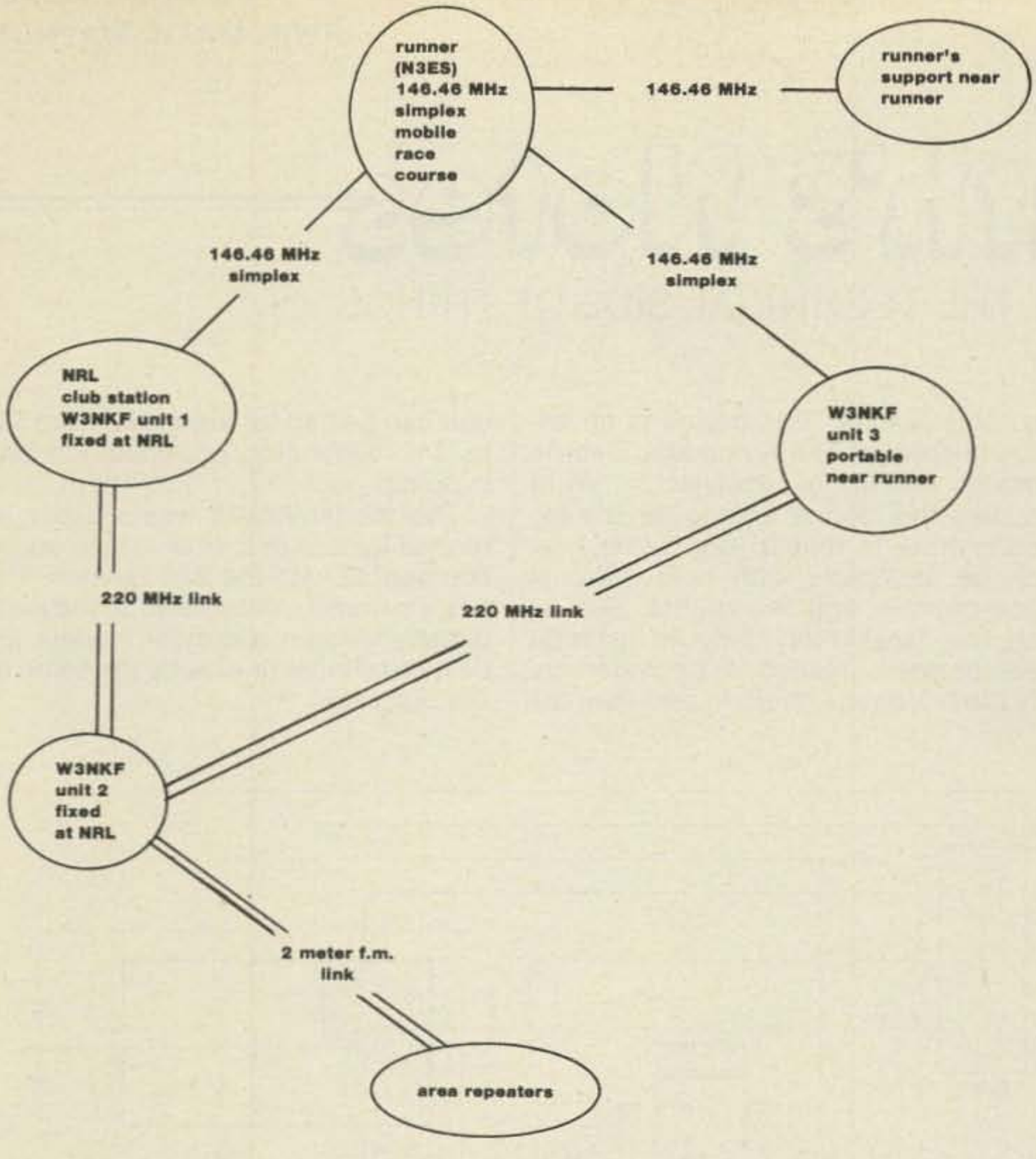
In order to ensure participation by local amateurs, we publicized our intent on several local repeaters. The promise of special QSL cards to anyone working the runner helped gain participation. We also received a call from the communications officer of the Marine Corps Marathon to be sure that our choice of frequencies would not interfere with that of a local ARC, Prince George's Wireless Society, whose members were helping the Marines by supplying communication support at the various runner refreshment stations.

At 0900 EST on Sunday morning, November 4, 1979, the Marines fired a 105 mm Howitzer which signaled the beginning of the race. It also signaled the beginning of technical problems.

W3IEZ*	WA4HYJ
K3AGR	W4WYL
W3IEZ*	WA4CGY
KA3AHI	K3AMB
W3EBK	W4XYL
WB3IRS	WB3KC
WB3KAS/4	W3CJT
W3PJM	W3EUH
WA4AKE	K4AN
K3CN	WA4SDE
W3GMI	WA4TMR
WA3PQN	KH6BIO
N4CHP	WB4LNT
W3SCD	KB3GC
W3GKK	WA4DDC
N3AWG	K1LB
K3BQZ	WA3AGD
WA4HIS	K3NCM
W3MHH	WB3BDU
AC4I	AD3R
W3CCW	W3HXF
KA3DXZ	W3KVC
WA4HIS	KB3BA
N3APH	W3FG
W4WYL	KB4LK
K4CQI	W4LBL
WB4RKN	K3FUB
KA4LIZ	

* Contact made on separate repeaters.

Table 1 - The 55 stations worked during the Marine Corps Marathon.



The various links in the chain connecting the runner with Washington, DC area amateurs.

Our aim was to have automatic electronic switching equipment to interface the runner with the repeaters. The switching units were successfully built, but it was found the night before the Marathon that the synthesized rigs available for use were controlled by transistor switching instead of relay switching. Consequently, the automatic switching units could not be used. With great speed the station crew fell back on a manual system of audio coupling. This was essentially holding the microphones of the 220 MHz rigs near the speakers of the 144 MHz rigs and vice versa. After some practice this quickly became a smooth operation and we began to log contacts. The entire race was recorded on tape and this was helpful in pointing out problem areas and in logging the contacts. We planned to sequentially access six repeaters located around the metropolitan DC area for ten-minute intervals. This provided a wide coverage and simultaneously did not tie up any one machine. Various repeaters were accessed, but because of our technical problems not exactly on the pre-set schedule. As the run progressed, it became apparent that the runner was also having equipment problems. These were rapidly diagnosed as a bad antenna cable. The man in the field, who was to link up with the runner for a battery pack change, had a spare cable and arranged to meet with him at a mutually agreeable location. Here repairs were made and the runner went on his way with a minimum of delay. The field support man immediately returned to his original battery change location and waited for the runner. The battery change was successfully made with little delay.

At one point transmission from the runner was breaking up. We deduced it was due to obstructions between the runner and W3NKF unit 1. Some members of our team at unit 1 decided to try to assemble a portable control station in the field closer to the runner with the hope of improving communications. Within 40 minutes, gear had been scrounged up and W3NKF unit 3 was in operation near the action in downtown Washington. They took over control from unit 1 and handled the link until the problem no longer existed. Control was then returned to W3NKF unit 1. In spite of all these problems a total of 55 contacts were logged.

From the runner's point of view, there were a number of additional bonuses gained from the 4-5 lbs. equipment load. Primarily, it served as a distraction from the usual discomforts associated with running distance. For example, it is virtually impossible to remember a fellow amateur's callsign and name while, at the same time, thinking about sore muscles or how many miles there are left. The presence of the gear also served to provoke queries from fellow runners: As the 2-meter rig was recognized by other amateur runners, a number of eyeball QSOs were completed. Of course, there were also a few misunderstandings. For example, some thought he was a CBer and there were more than few "10-4 Good Buddy's" shouted out; others thought him to be a member of the press; one bystander, thinking he was a professional sportscaster, called out, "Boy, that's the way to cover a marathon!" Another amusing incident occurred when the NRLARC runner passed a man and a dog, both running in the marathon and both wearing official number tags. The man explained that the dog was properly trained for the event and duly registered. When this information was passed back to W3NKF, the responding query was "Should we log him in as K9DOG?"

We found the exercise very stimulating. The inventiveness and co-operation of our team members was a fantastic thing to behold. Problems were quickly solved as they occurred by whoever happened to be free at the time. The organization was loose, but no one dropped the ball when the situation dictated action to be taken. The cooperation given was excellent, both by our team and by our fellow amateurs who worked the run ›rs. We believe the implications of this exercise are far reaching. A new vista of emergency communications is open, and the NRLARC now has a capability which others should have.

Members of the NRLARC participating in this event were: Bob Armstrong, WA4SQL, Kit Carson, W3KVC,Bob Dasenbrock, N4CHP, Mort Fischman, WA3YMO, Larry Fletcher, K3SZN,Tom Francavilla, WB3DGF, Claire Kennedy, W3MNU, Doug Kopp, WB3HLC,Roger McAlevey, WA4NYS, Dave Phillips, W3PJM, Ruth Phillips, K3AGR, John Pich, K3AKR, Earl Skelton, N3ES, Ed Westbrook, W3EW.

The 55 stations worked are listed in Table 1, and we are grateful to Dick Robinson, K4EIH of Electronic Equipment Bank, Vienna, VA for loan of a supplemental battery pack, to the U.S. Marine Corps for organizing an extremely well-run marathon, and to Lahni Blohm for typing this report.

a monthly feature by
IRWIN MATH, WA2NDM

Math's Notes

A LOOK AT THE TECHNICAL SIDE OF THINGS

Last month, you will recall, we presented a few accessories you could employ with the conventional telephone network in your home. This month, we would like to discuss an item that is beginning to appear on the surplus market. This device is an entire telephone, The Automatic Electric model AE873 (or equivalent). What makes this phone unique for the experimenter is that it is a 3 line telephone, complete with hold buttons, line buttons, and even lights. Best of all, no large relay box or external equipment is needed for operation only the telephone itself. In addition, the unit can be had for anywhere from $20 to $40 depending on condition and supplier.

The model AE873 was initially intended for use in a small office and is compatible with the Bell System. Fig. 1 is a complete schematic of the most popular version and most models will be quite similar or exactly the same as the diagram.

5 Melville Lane, Great Neck, N.Y. 11023

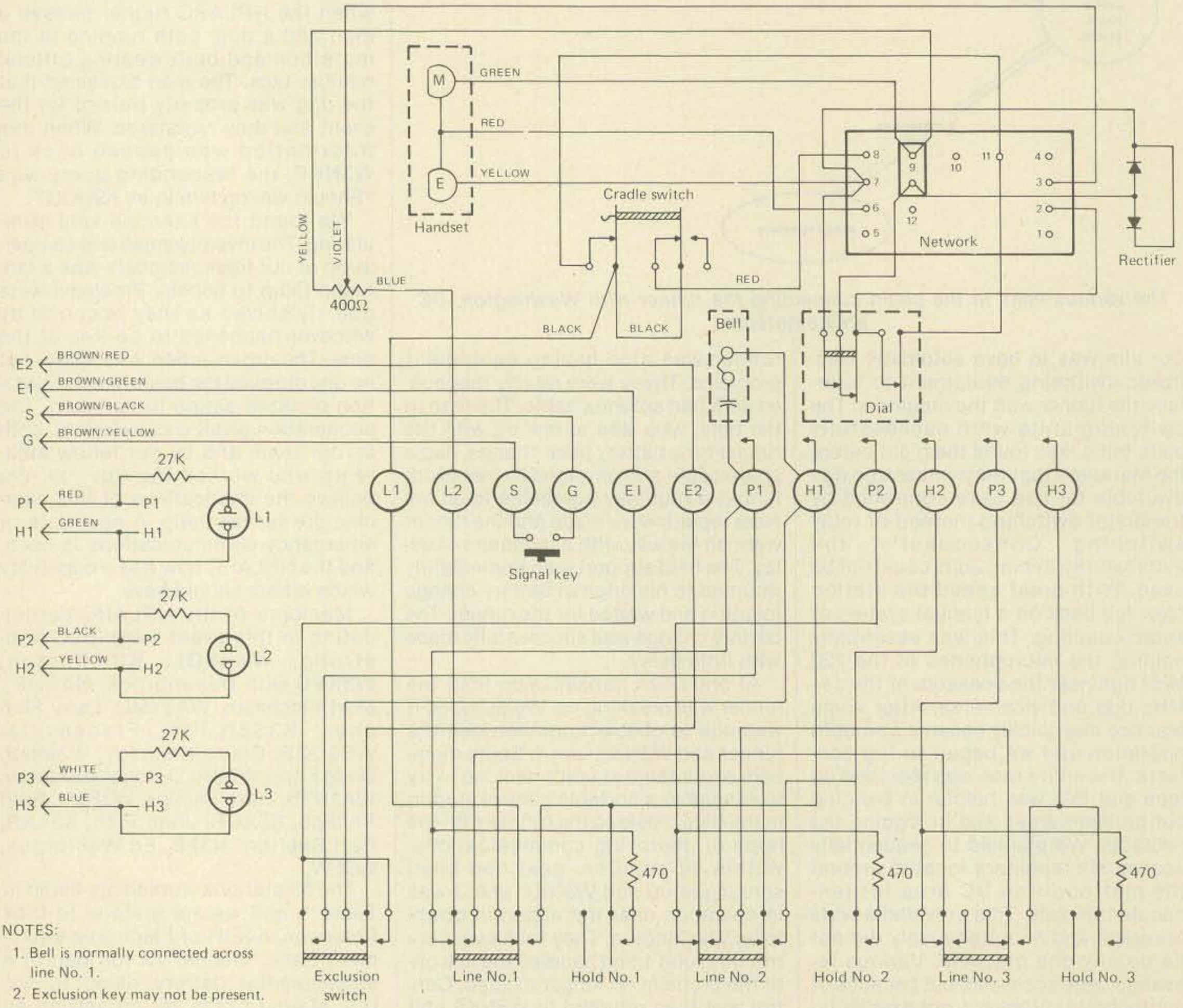


Fig. 1- Schematic diagram for the Automatic Electra model AE873 3-line telephone. Other models will be quite similar in construction.

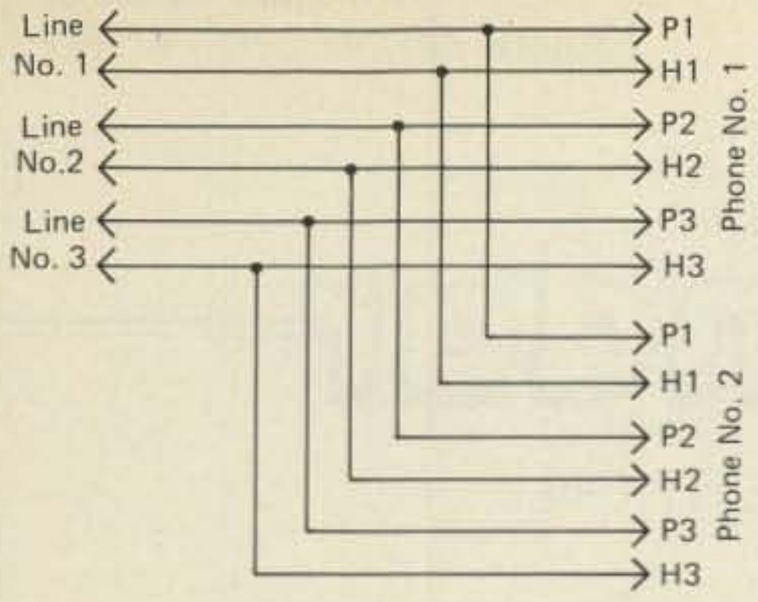


Fig. 2- Hookup connections for the AE873 telephone. All phones are in parallel.

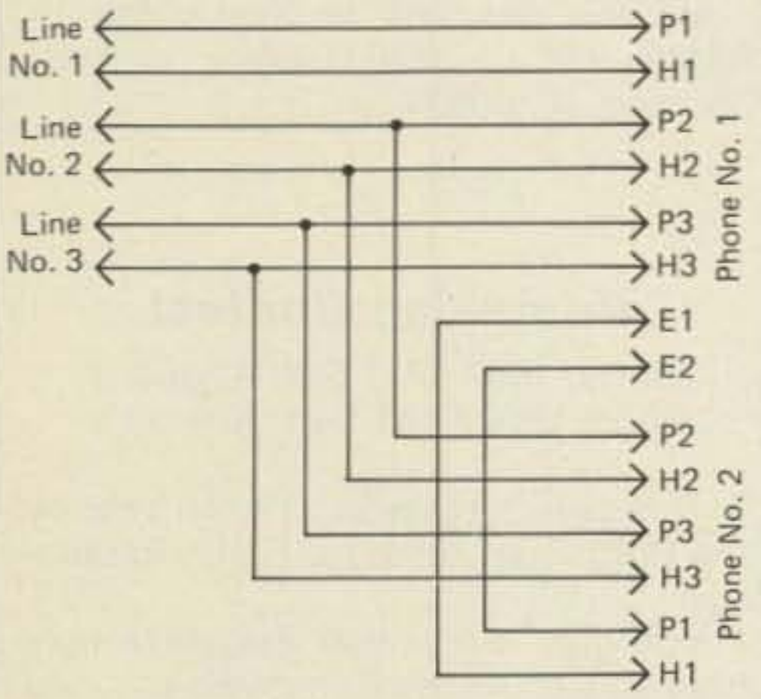


Fig. 3- Hookup connections for use with exclusion switch.

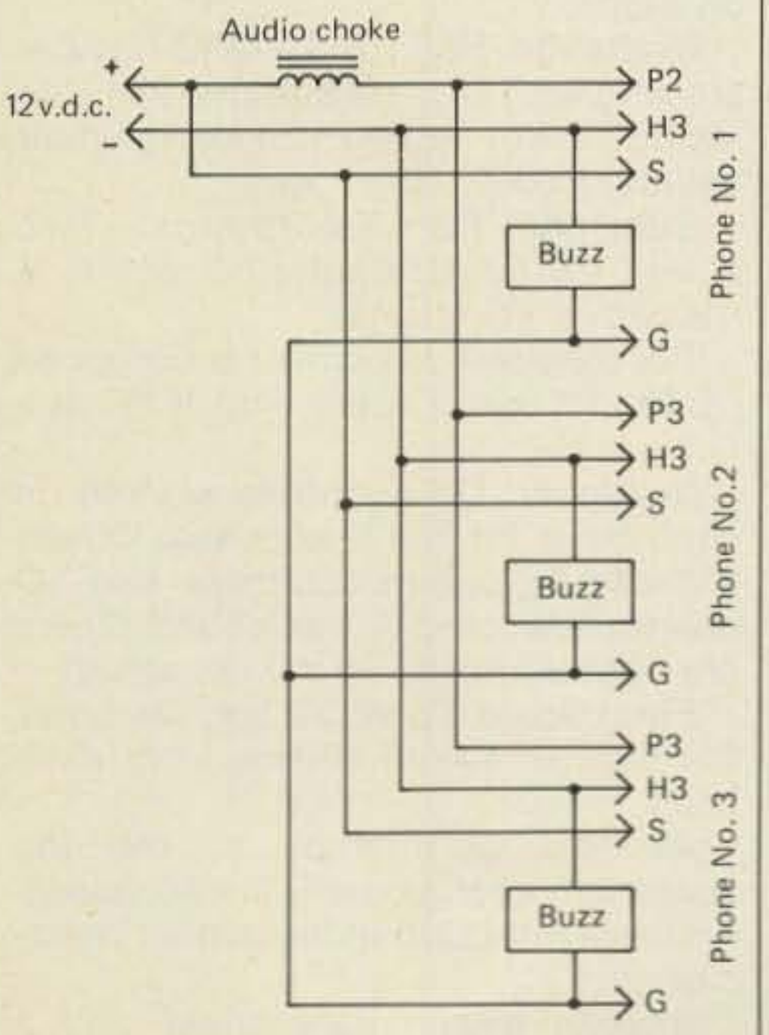


Fig. 4- Connections for use with signal button and 3rd line for intercom function.

Operation of this phone is slightly different from a normal button phone. When a call comes in, the neon lamp (L1, L2, or L3) corresponding to the proper line comes on. Answering the phone requires pushing the line button thereby connecting the proper line to the handset and network. To put the line on hold, you then push the hold button. This places a 470 ohm resistor across the line and holds it. Hanging up the phone causes a mechanical linkage to release the hold button and the line is disconnected. This means that if you put someone on hold, you must not hang up the handset. This is not too bad a price to pay to avoid a rack of external equipment.

Fig. 2 shows the normal hookup of the telephone and fig. 3 shows how to hook up the exclusion switch found on some models. The purpose of this switch is to disconnect a particular line from a second extension telephone by simply pushing the switch —sort of a privacy arrangements.

Most telephones also have a push-button switch mounted on the housing. This is a normally open switch, intended for signalling by means of an external buzzer. Fig. 4 shows a method of connecting this switch to an external buzzer network for signalling purposes. The figure also shows a method of hooking up Line 3 for intercom purposes if it is not used as a normal line. With this setup, a secretary can call her boss by pressing the buzzer (one short buzz for phone #1, two short buzzes for #2, etc.) tell him who is on the phone, and on what line.

The only drawback with these phones is that there is no provision for a continuous light to indicate that a line is in use. Other than that, the phones work well and are capable of filling the need for a system that is slightly more elaborate than a simple installation.

More information on the availability of 3 button telephones may be had from Fair Radio Sales, 1016 E. Eureka St., Lima, Ohio 45802, or from ETCO Electronics, North Country Shopping Ctr., Rt. 9, Plattsburgh, N.Y. 12901. Both of these firms have sets for sale as do many other outlets.

Just one word of caution. If you do connect these phones to the Bell System, be certain you know exactly what you are doing. The system is quite elaborate and sensitive, and a wrong connection can disrupt both your service and the service of others. In this case in particular caution is the word!!

See you next month.

73, Irwin, WA2NDM

a monthly feature by
FRANK ANZALONE, W1WY

Contest Calendar

NEWS/VIEWS OF ON-THE-AIR COMPETITION

This month's Column is being written under pressure. I'm leaving soon for a few weeks of vacation. Just can't seem to come up with anything interesting.

One thing comes to mind however—the expressive phrases that are now part of the DXers and Contesters lingo. "Slim," "Red Eye Louis," "Big Guns," and recently "Little Pistols."

I think there is no question that Hugh Cassidy originated the first two in his West Coast Bulletin. I'm going to take credit for "Big Guns," and I don't ever remember seeing "Little Pistols" until K5FUV came out with it in his new QRZ DX Bulletin.

I might be wrong. If I am, sue me. Hi!

73 for now, Frank, W1WY

Illinois QSO Party

Two Periods GMT
1800 Sat. Aug. 2 to 0500 Sun. Aug 3
1200 Sun Aug. 3 to 2300 Sun. Aug. 3

This is the 18th annual party sponsored by the Radio Amateur Megacycle Society. The same station may be worked on each band and each mode.

Exchange: QSO no., RS(T) and QTH. County for Ill. stations; state, province or country for others.

Scoring: One point per contact, 2 points if it's with a Novice or Technician.

Ill. stations multiply total QSO points by sum of states, (max. 50) VE/VO call areas, (max. 10) and no more than 5 DX countries worked. (DX may be worked for QSO points but only one multiplier.)

Out of state stations multiply total QSO points by Ill. counties worked. (max. of 102)

Ill. mobiles or portables operating away from their normal QTH may add 200 points to their final score for each county of operation from which 10 or more contacts were made.

There is a bonus for out of state stations, a multiplier of one for each group of 8 contacts with the same county.

Frequencies: C.W. - About 60 kHz. from low edge of each c.w. band. Phone - 3975, 7275, 14275, 21375, 28675. And 25 kHz from low end of each Novice band on the half hour.

Awards: Certificates to the top scorers in the following categories: single operator, multi-operator, mobile, portable, Novice and Technician. In each state, VE/VO province and country from which two or more entries have been received. And to the three top scorers in Ill. There are also Club awards.

A summary sheet is requested showing the scoring and other essential information. Include a large s.a.s.e. for copy of results.

Mailing deadline is Sept. 15th to RAMS - K9CJU, 3620 N. Oleander Ave., Chicago, Ill. 60634

**14 Sherwood Road, Stamford, CT 06905*

Calendar of Events

	Aug. 2-3	Illinois QSO Party
†	Aug. 2-3	Romanian Contest
	Aug. 9-10	European C.W. Contest
	Aug. 16-18	Rhode Island QSO Party
	Aug. 16-18	New Jersey QSO Party
*	Aug. 16-17	SEANET Phone Contest
	Aug. 16-17	SARTG RTTY Contest
**	Aug. 23-24	All Asian C.W. Contest
†	Aug. 23-24	Ohio QSO Party
	Aug. 31	RSGB WAB V.H.F.
	Sept. 13-14	Pennsylvania QSO Party
	Sept. 13-14	European Phone Contest
	Sept. 13-14	Cray Valley S.W.L.
	Sept. 14	North American Sprint
	Sept. 13-15	Wash. State QSO Party
	Sept. 20-21	Scandinavian C.W.
	Sept. 27-28	Delta QSO Party
	Sept. 27-28	Scandinavian Phone
	Oct. 4-5	VK/ZL/Oceania Phone
	Oct. 11-12	VK/ZL/Oceania C.W.
	Oct. 18-19	CLARA AC-DC Contest
	Oct. 18-19	WADM Contest
	Oct. 18-19	Scouts Jamboree
	Oct. 25-26	**CQ WW DX Phone**
	Nov. 9	Czechoslovakian Contest
	Nov. 8-9	European RTTY Contest
	Nov. 8-9	Inter. Police Contest
	Nov. 15	DARC 10 Meter Contest
	Nov. 29-30	**CQ WW DX C.W. Contest**

† Not Official
* Covered last month
** See June Calendar

Romanian Contest

Starts: 1800 GMT Sat. August 2
Ends: 1800 GMT Sun. August 3

This one is sponsored each year by the Romanian Amateur Radio Federation.

You may work other European contries as well as the Romanian stations on each band and mode, 3.5 thru 28 MHz. The same station may be worked only once per band, either on c.w. or on phone.

Classes: Both single and multi-operator, single and all band for both divisions.

Exchange: RS(T) and a QSO number starting with 001. YO stations will also include two letters denoting their county. (569001/SJ)

Scoring: For Euorpeans—Two points for DX contacts, six points if it's with a YO station.

For others: Two points for European QSOs, 10 points if it's with a YO station.

Multiplier: DX countries worked on each band for the Europeans. Others will use European countries and YO countries worked on each band. (There are approximately 40 YO countries)

Final Score: Total QSO points times the sum of the multiplier from each band.

Awards: Certificates to the top scorers in each country in each class. And a Crystal Cup to the overall champion.

Include a summary sheet and a signed declaration with your entry. (Inquire about the several YO awards. No details were given.)

Mailing deadline is September 1st

to: Romanian Amateur Radio Federation, P.O. Box 1395, 7000 Bucuresti 5, Romania.

European DX Contest

C.W.: Aug. 9-10 Phone: Sept. 13-14
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is the 25th annual contest sponsored by the DARC. The activity will be between European countries and the rest of the world.

Use all bands, 3.5 thru 28 MHz.

Classes: Single operator and multi-operator single transmitter, both all band. Multi-operator stations are allowed to change bands one time only within a 15 minute period, except for working a new multiplier.

Only 36 hours out of the 48 hour contest period may be used by single operator stations. The 12 hour off period may be taken in one but not more than three periods any time in the contest.

Exchange: RS(T) plus a QSO number starting with 001.

Scoring: One point per QSO and one point for each QTC reported.

Multiplier: For non-Europeans, number of European countries worked on each band. Europeans will use the ARRL country list and following call areas: JA, PY, VE/VO, W/K, ZL, ZS, UA9/UA0.

In addition the multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14/21/28 by 2.

Final Score: Total QSO points, plus QTC points, times the sum total multiplier from all bands.

QTC Traffic: Additional QSO points may be realized by reporting a QTC. This is a report of a QSO you made earlier in the contest and later sent it back to a European station.

The general idea is that after a number of EU stations have been worked, a list of these can be sent back to another EU station. One point is earned for each QSO reported. A QTC can only be sent from a non-European to a European station.

A QTC contains the time, call and QSO number of the station being reported, i.e., 1300/DL2DN/134. This means that at 1300 you worked DL2DN and received his number 134. It may reported only once and not back to the originating station.

A maximum of 10 QTCs to the same station are permitted, and the same station may be worked several times to complete this quota. Only the original contact however has QSO point value.

Keep a uniform list of QTC's sent. QTC 3/8 indicates that this is the 3rd series and that 8 QSO's are now being sent.

Awards: Certificates to the highest scoring stations in each country and each call area listed in the multiplier. Continental leaders and stations having at least half the score of the continental leaders will also be awarded.

Disqualification: Violation of the rules of the contest, or unsportsmanlike conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed cause for disqualification.

It is suggested that you use the official log and summary forms. A s.a.e. with sufficient IRC's to the DARC will get you a supply. Figure 40 contacts to the page; use a separate sheet for each band.

North American residents may send their requests and their logs to: Hartwin E. Weiss, W3OG, P.O. Box 440, Halifax, PA 17032.

Mailing deadline for logs is Sept. 15th for C.W. and Oct. 15th for Phone.

WAEDC Committee, P.O. Box 1328, D-895 Kaufbeuren, Fed. Rep. of GERMANY.

DARC Country List

C31 – CT1 – CT2 – DL – DM – EA – EA6 – EI – F – FC – G – GC Jer. – GC Guer. – GD – GI – GM – GM Shet. – GW – HA – HB9 – HB0 – HV – I – IS – IT – JW Bear – JW – JX – LA – LX – LZ – M1 – OE – OH – OH0 – OJ0 – OK – ON – OY – OZ – PA – SM – SP – SV – SV Crete – SV Rhodes – SV Athos – TA – TF – UA1346 – UA2 – UB5 – UC2 – UN1 – UO5 – UP2 – UQ2 – UR2 – UA Franz Josef Land – YO – YU – ZA – ZB2 – 3A – 4UI – 9H1.

Rhode Island QSO Party

Two Periods (GMT)
1700 Sat. to 0500 Sun. Aug. 16/17
1300 Sun. to 0100 Mon. Aug. 17/18

The East Bay Amateur Wireless Association is again sponsoring this one. The same station may be worked on each band and mode, and R.I. stations may work other in-state stations.

Exchange: RS(T) and QTH. County for R.I., state, province or country for others. (East Bay members add "member" or "mbr" if on c.w.)

Scoring: *For R.I.* - Two points per QSO, R.I. Novice and Techs score 5 points.

All Others - Two points for each R.I. contact, 5 points if its with a Novice or Tech. (Novice and Techs must sign /N or /T for identification.)

All stations score 5 additional points for each East Bay member worked.

Final Score: *For R.I.* - Total QSO points × (R.I. counties + states + provinces + DX countries.)

All Others - Total QSO points times R.I. counties worked. Max. of 5 (Bristol, Kent, Newport, Providence and Washington).

Frequencies: C.W. - 1810, 3550, 3710, 7050, 7110, 14050, 21050, 21110, 28050, 28110. Phone - 3900, 7260, 14300, 21360, 28600, 50.110, 144.2 simplex, no repeaters.

Awards: Certificates to top scoring stations in each R.I. county, state, province and DX country. And to Novice and Tech winners in each R.I. county and each state. There is a Club award for clubs in each state, province and DX country. (min. of 3 logs per club.)

Include a summary sheet with your entry showing the scoring, club affiliation and other information. Mailing deadline is Sept. 15th to: East Bay A.W.A, P.O. Box 392, Warren, R.I. 02885. Include a large s.a.s.e. for copy of the results.

New Jersey QSO Party

2000 Sat. to 0700 Sun. Aug. 16/17
1300 Sun. to 0200 Mon. Aug. 17/18

This is the 21st annual party sponsored by the Englewood A.R.A Phone and c.w. are part of the same band and mode, and N.J. may work in-state stations for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH.

Claimed Scores

1980 CQ 160 Meter Contest

U.S.A.			
K1PBW	183,940	W7XZ	34,944
W2YV	93,744	AA4V	34,238
W9ZR	85,008	AA4M	34,086
W2IB	74,266	W9PNE	33,176
K3SXA/mm	72,850	K4VT	32,436
K8MFO	70,656	K8OQL	32,120
K5GO	69,828	WA3WMG	31,616
K6SE	69,540	W4DHZ	31,584
N4WW	63,784	K0PP	31,320
W2FJ	59,664	KB7EJ	30,740
W0AIH/9	59,396	**DX**	
K1GQ	57,834	KV4FZ	195,624
N5JJ	56,448	GM3ZSP	137,142
K9FD	56,192	G3SZA	127,263
K8TV	53,200	GD4BEG	127,041
AA1K	52,088	YU7BCD	68,843
K8JK	48,856	G3XWZ/A	61,664
K3ZZ	44,888	YV1OB	59,415
N6VR	44,520	KH6CC	56,901
W9LT	44,464	OH6DX	50,660
W8MVN	44,308	OK2KZR	50,544
K8XR	43,732	4U1UN	48,320
W4TMR	43,206	OK1DFW/P	45,118
K5RC	42,834	SP3DOI	43,668
K4PQL	42,578	DL3LU	40,212
N6RZ	40,770	G3VRW	38,815
N4IN	38,936	OK1D1J	38,369
W0CP	38,864	OK3KFF	37,164
WB0UXI	38,796	OK2BOB	36,330
N7DF	37,968	OK1FCW	34,825
W3BUR	36,656	OK1DFF	33,360
N0BG	36,480	OK3CXF	31,424
K0GVB	36,192	JA5DQH	6,165

1979 OK Contest

U.S.A. Results

All Band			
N4YF	23,534	WA4QMQ	1,856
K2SX	19,686	W4DGX	304
W9RE	12,546	WA2SIT	90
KA1EP	11,736	W1OPJ	18
W1LQQ	8,096	14 MHz	
WA4OML	6,308	W4KMS	756
W6UA	4,305	W9QWM	578
K1KI	3,280	W0LHS	52
W3GTN	2,958	21 MHz	
W5QF	2,256	W3CBF	430
N1RI	2,074	28 MHz	
W6NNV	2,046	N4CCJ	62
WB4WHE	1,995	**Multi-op.**	
AA6EE	1,953	N4OL	111,825
K4BAI	1,944		

County for N.J., ARRL section or country for others.

Scoring: N.J. stations score 1 point for W/K and VE/VO contacts, 3 points for DX. Multiply total by ARRL sections worked. (max. of 74). KP4, KH6, KL7, etc. are 3 point contacts and also section multiplier.

Out-of-state stations multiply total N.J. QSOs by total of N.J. counties worked, (max. of 21).

Frequencies: 1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21335, 28100, 28600, 50-50.5, 144-146. Try phone on even hours, 15 on odd hours, and 160 at 0500 GMT.

Awards: Certificates to the top scorers in each N.J. county, ARRL section and DX country. Second place awards if 4 or more logs are received from that section. Also Novice and Tech awards.

Use GMT, indicate the multiplier only the first time it is worked, include a QSO check sheet and a summary sheet showing the scoring, etc. Also a large s.a.s.e. if you wish a copy of the results.

Stations planning activity in N.J. are requested to advise the E.A.R.A. by August 2nd so that coverage of all counties may be planned.

Logs must be received no later than Sept. 13th and go to: Englewood A.R.A., P.O. Box 528, Englewood, N.J. 07631.

S.A.R.T.G. RTTY Contest

Three Periods GMT
0000 - 0800 & 1600 - 2400 Sat., Aug 16
0800 - 1600 Sunday, August 17

This is the 8th annual contest sponsored by the Scandinavian Amateur Radio Teletype Group. Use all bands 3.5 thru 28 MHz. The same station may be worked on each band for QSO and multiplier credit.

Classes: Single operator, Multi-operator Single transmitter and s.w.l.

Exchange: QSO no., signal report.

Points: QSOs with own country, 5 points. With other countries on same continent, 10 points. With other continents, 15 points. The U.S., Canada and Australia call areas count as separate countries for scoring.

Multiplier: Each DXCC country and each W/K, VE/VO and VK call areas. A multiplier will not be considered unless the claimed station appears in at least 5 logs, or a log is received from that station.

Final Score: Sum of QSO points from all bands times the sum of the multiplier from each band.

S.w.l.s use same scoring but based on sum of stations and messages copied.

Awards: Certificates to the top scoring stations in each class in each country and each call area of the U.S., Canada and Australia.

Use a separate sheet for each band and include a summary sheet showing the scoring, comments and other essential information, and your name and address in Block Letters.

Logs must be received by October 10th and go to: SARTG Contest Mgr., P.O. Box 717, DK 8600, Silkeborg, Denmark.

Ohio Interstate QSO Party

Saturday, Aug. 23 and Sunday, Aug. 24
2:00 PM to 12:00 PM EDT each day.

The same station may be worked on each band and mode and Ohio stations may work other instate stations.

Exchange: RS(T), QSO no., and QTH. County for Ohio, ARRL section or country for others.

Scoring: Ohio stations multiply total QSOs by number of ARRL sections, Ohio counties and DX countries.

Others multiply their QSO total by number of Ohio counties worked (max. of 88).

Portable and mobile Ohio stations may multiply their final score by 1.5. (Except those in Butler, Clark, Cuyahoga, Franklin, Hamilton, Lake, Lorain, Lucas, Mahoning, Montgomery, Portage, Richland, Stark, Summit, or Trumbell counties.)

QRPp stations using 5 watts or less output may multiply their final score by 1.25.

Frequencies: 5 kHz up from low edge of each General class band, both s.s.b. and c.w. Try 15 meters on the hour and 10 meters on the half hour.

Awards: Certificates to the top single operator in each ARRL section, Ohio county and each DX country. Plaques for high Ohio and out-of-state single and multi-single operator winners (multi-multi not eligible). Participation certificates for each entry with 50 or more contacts.

A summary sheet showing the scoring, and the usual signed declaration are also requested. Include a large s.a.s.e. for copy of the results.

Mailing deadline is Sept. 8 to: Jeff Maass, K8ND, 4410 Norwell Drive, Columbus, Ohio 43220.

1979 All Asian Contest

Phone Results

U.S.A

All Band

* K7RI	172,650
* K6RR	144,666
N6TU	137,566
N6KT	129,210
K6HNZ	102,676
* N5JB	12,244
AF5K	10,647
* K3TW	2,754
* WA4QMQ	2,460
N4UH	1,701
N7AM	1,650
N4MM	861

28 MHz

WA6OCV	738
N6VV	490

21 MHz

* N7XX	33,580
N6RO	4,692

14 MHz

* N6AW	26,976
* K6SVL	21,677
W6BJB	8,024
WD6EKO	3,750
WB7UXK	1,140
KB8JF	912
N6AA	840
KM6FC/W1	840
* WA6VNR	375
LU1BAR/W3	322
W2CC	176
W0BK	135
AA4NC	63
W6NNV	16

Dom. Rep.

HI8LC	266

Canada

VE4SW	4,480

3.8 MHz

WB6LPK	152

* Certificate winners.

All Asian C.W. Contest

Starts: 0000 GMT Sat., August 23
Ends: 2400 GMT Sun., August 24

Detailed rules were given in the June Calendar covering the Phone section of the contest.

There are a few modifications in this year's rules. Briefly they are as follows:

The operating period has been extended to the full 48 hour weekend.

QSO point values are now as follows: Contacts on 160 have a 3 QSO point value, 2 points if on 80, and 1 point for the rest of the bands.

Awards will now be given in each U.S. call area, not only for all band competition but also on each single band. This should make it more interesting for stateside stations.

Your c.w. entries must be in the hands of the committee no later than November 30th. The phone deadline is September 30th.

They go to: J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, JAPAN.

Short-Wave Listening—Legal or Illegal?

K1VR is an attorney and president of Channel One, Inc., a dealer in home satellite TV receiving systems. In his opinion, if you really take a hard look at Section 605 of the Communications Act of 1934, you will see that it is not illegal to receive common carrier transmissions, as long as you do not divulge them.

BY FRED HOPENGARTEN*, K1VR

I've had an old (it was already old when I bought it) Hallicrafters S-38B since 1954. I paid $25 for it then. I could probably get $25 for it now. It continues to have market value because there is stuff worth listening to between the amateur bands.

In addition to amateurs, broadcasters, time signals, and other transmissions, it will cover frequencies that carry ship to shore traffic in clear voice. I was always under the impression that it was perfectly legal to tune in those transmissions, so long as I didn't divulge the contents of what I overheard. Recently though, two authors have taken the position that receiving common carriers without the permission of the sender is illegal.[1,2] A controversy swirls around the meaning of Section 605 of the Communications Act of 1934 (47 U.S.C. Section 605).

It is a prejudice common to lawyers that no one can truly read and understand the law, unless he or she is a lawyer. Frankly, I don't believe it. In my view, the biggest problems crop up when two parties argue about a law that neither has read recently. So let's take a look at Section 605.

§ 605. Unauthorized publication or use of communications

> Except as authorized by chapter 119, Title 18, no person receiving, assisting in receiving, transmitting, or assisting in transmitting, any interstate or foreign communication by wire or radio shall divulge or publish the existence, contents, substance, purport, effect, or meaning thereof, except through authorized channels of transmission or reception, (1) to any person other than the addressee, his agent, or attorney, (2) to a person employed or authorized to forward such communication to its destination, (3) to proper accounting or distributing officers of the various communicating centers over which the communication may be passed, (4) to the master of a ship under whom he is serving, (5) in response to a subpoena issued by a court of competent jurisdiction, or (6) on demand of other lawful authority. No person not being authorized by the sender shall intercept any radio communication and divulge or publish the existence, contents, substance, purport, effect, or meaning of such intercepted communication to any person. No person not being entitled thereto shall receive or assist in receiving any interstate or foreign communication by radio and use such communication (or any information therein contained) for his own benefit or for the benefit of another not entitled thereto. No person having received any intercepted radio communication or having become acquainted with the contents, substance, purport, effect, or meaning of such communication (or any part thereof) knowing that such communication was intercepted, shall divulge or publish the existence, contents, substance, purport, effect, or meaning of such communication (or any part thereof) or use such communication (or any information therein contained) for his own benefit or for the benefit of another not entitled thereto. This section shall not apply to the receiving, divulging, publishing, or utilizing the contents of any radio communication which is broadcast or transmitted by amateurs or others for the use of the general public, or which relates to ships in distress.
>
> As amended June 19, 1968, Pub.L. 90-351, Title III, § 803, 82 Stat. 223.

Now look again. In the article by Cooper[2], the conclusion is simply stated: "(P)ermission, in advance, is required before you tune in any of these s.h.f. common carrier transmissions!" I disagree. As I read through the statute, here's what came through to me:

> no person receiving . . . shall divulge or publish . . . No person not being authorized . . . shall intercept . . . and divulge or publish . . . No person . . . not being entitled thereto shall receive . . . and use . . . No person having received . . . shall divulge or publish . . .

I think that the statute says that it is illegal to receive and divulge. Mere passive reception is legal. Always has been.

I think that Congress correctly recognized that government has no business watching over amateurs and short-wave listeners as they tune the r.f. spectrum.

Obviously, common carrier transmissions are entitled to some privacy under Section 605. Yet never before has the subject attracted so much attention. The reason? Entertainment television. In the 2 GHz range you can find first-run movies being transmitted to apartment houses and cable TV operators. Similarly, in the 4 GHz range you can find a wealth of TV programming from satellites in the sky 22,300 miles over the equator beamed at North America. Satellites are owned by RCA, Western Union, the Canadian Government, and others. They serve millions of people and get paid for it. But an experimenter with a big dish and receiving equipment sensitive enough can tune it in himself.

Despite the fact that radio transmis-

* *68 Avalon Road, Newton, MA 02168*

sions at 2 and 4 GHz carry entertainment programming, those signals are still common carrier transmissions by r.f. energy. They are no different from the ship to shore transmissions in clear voice mentioned earlier. So, for example, you can find WCC transmitting from Chatham, MA on 22,571.5 MHz, with ships replying on 22,202.5 in clear voice. Similarly, on the West Coast, KPH transmits on 22,567.5 and ships reply on 22,198.5.

Any programmable low-band scanner can find mobile to base radiotelephone conversations with both sides of the conversation every 30 kHz from 152.54 to 152.84 MHz. Going even higher, every 25 kHz from 459.8 to 460 MHz you will find air to ground mobile telephone conversations.

No one I know of seriously contends that "permission, in advance, is required before you tune in any of these . . . common carrier transmissions." I see no difference in technology that should make a difference in law when I contrast the common carrier services mentioned above. If you think that a radio signal is a radio signal, regardless of mode or frequency, then s.h.f. video is covered by the same considerations that control v.h.f. f.m. and h.f. a.m. Nor would I be afraid to turn on a printer when tuning across AP r.t.t.y. transmissions.

Any lawyer can dream up a spectrum (sorry!) of situations that challenge an otherwise obvious phrase. For example, in the following circumstances which is a "use" or divulgence?

> You put the signal up on a scope.
> You play the signal through a speaker, a teleprinter, a CRT.
> You invite your spouse into the shack. Your son. Your neighbor.
> You make an audio recording. A video recording.
> You give your recording to your neighbor.
> You run an extension speaker, a remote printer, an additional TV, with baseband output, at your neighbor's home.
> You wire the whole neighborhood.

In my opinion, the line is drawn when the signal, whether live or recorded, leaves your home. But that thought alone won't solve all the problems. What if neighbors buy an antenna in common, insert power dividers, and each owns his own radio? Frankly, I haven't thought that one through yet.

It is a continuing source of fascination to me that 2 meter f.m. ragchewers claim that it is illegal to record amateur QSO's. Go back and look at the statute. Section 605 "shall not apply to the receiving, divulging, publishing, or utilizing the contents of any radio communication which is . . . transmitted by amateurs . . ." Frankly, I don't see what prevents the tape recording of jammers.

The last time I checked, the First Amendment to the Constitution of the United States read: "Congress shall make no law . . . abridging the freedom . . . of the press . . ." Yet, strangely, Section 605 reads:

> No person . . . having become acquainted with the contents . . . of such communication . . . shall publish the existence . . . of such communication . . .

Recently, when I queried a lawyer at the FCC on this subject, he replied that he thought the language rather arcane, perhaps a remnant of middle English. I tend to agree. But it's amazing what you can find in the statute books. If it were literally true, no one could write about common carriers. Short-wave listener magazines would be subject to prosecution.

In a word, will you lose your amateur license for receiving common carriers? No. In comments filed before the FCC, March 23, 1979 (Docket 78-374), the nation's prosecutor, the Department of Justice takes the position that "existing laws do not require an FCC license to use a device that simply receives radio communications."

To the best of my knowledge, the FCC has never asked the Department of Justice to prosecute a case of mere passive reception. "Should the government be cruising around the neighborhood looking for illegal receivers?" asks Elliot Maxwell, a first assistant to the FCC chairman.[3]

There is no need to feel that some frequencies are forbidden. The networks, the National Association of Broadcasters, Messrs. Cooper and Cohen, have all stated what they think Section 605 says. If you accept what they say then surely our hobby is threatened. For if listening is illegal, then receivers are the tools of the crime. But if you take the trouble to read Section 605 for yourself, and if you agree with me that there is a big difference between receiving and divulging, as opposed to mere passive reception, then you can feel comfortable, as you sit down to tune around. From 2 MHz to 20 GHz, well beyond the capabilities of my S-38B, the listening is free.

Footnotes

[1]Cohen, Theodore J., N4XX, "Dateline . . . Washington, D.C.," *CQ*, September 1979, p. 48.

[2]Cooper, Bob, Jr., W5KHT, "All Airwaves Are Not Free," *QST*, October 1979, p. 79.

[3]*Boston Globe*, October 7, 1979, p. B3.

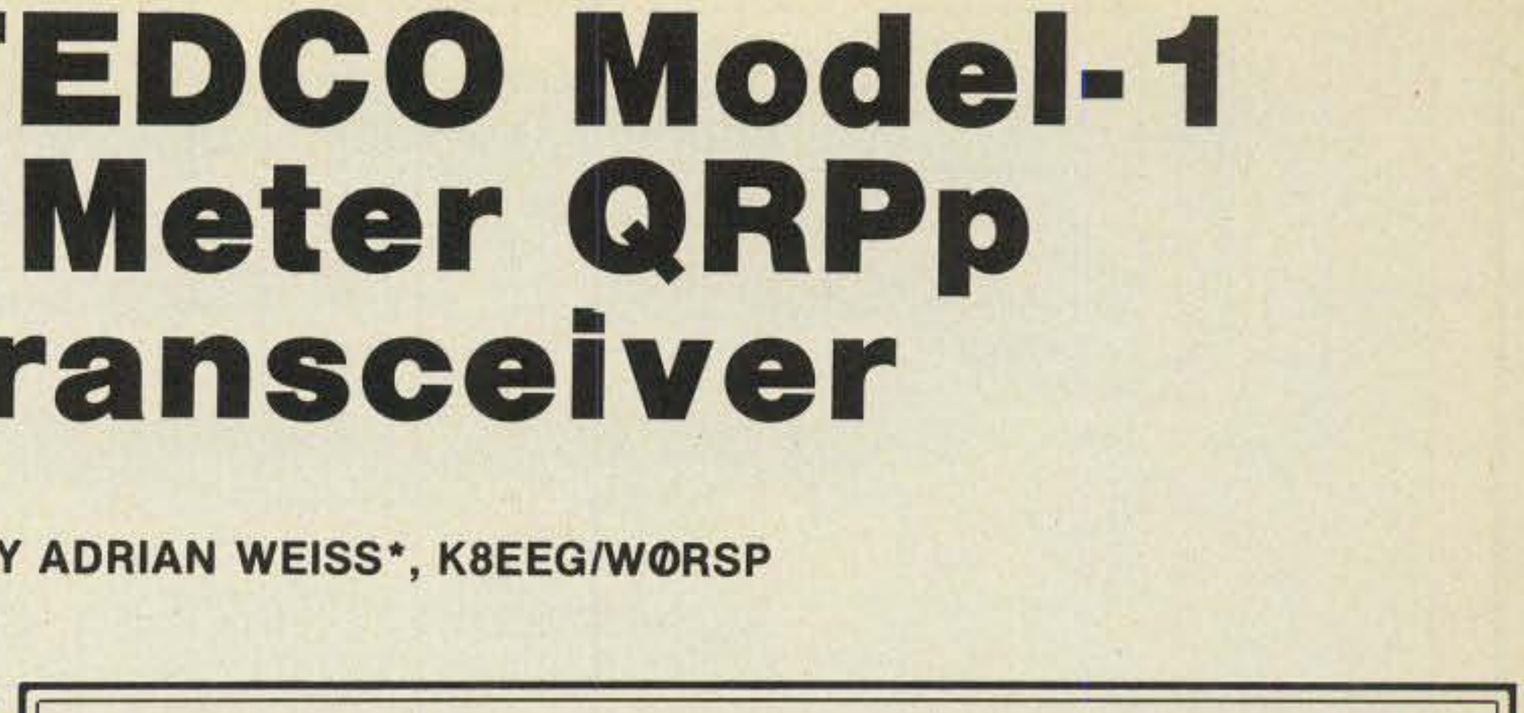
CQ REVIEWS

The TEDCO Model-1 80 Meter QRPp Transceiver

BY ADRIAN WEISS*, K8EEG/WØRSP

Quite a few of us design our own gear because our experience has provided an understanding of what is necessary for successful QRPp operation, and we find drawbacks in published designs, as well as the need for added features. When we come up with a "winner," we get a tremendous sense of satisfaction and an urge to share our design with others, figuring that a lot of amateurs would be able to enjoy QRPp if we showed them how to do it. For some, that urge quite naturally leads to a lingering occasional contemplation of the possibility of "going into production" and offering our design to the amateur market. Profit is rarely a motive underlying this urge. It is a motive more akin to that a father feels in making a toy for his son—the profit is in seeing someone enjoy himself using the design. Most of us toy with the idea, but only a few hardy individuals commit themselves to actually doing it.

Bob Turnbull, K1DDC, is one such individual who made that commitment. It is something that he has wanted to do for a long time, and finally decided that it is better to go ahead and try it, rather than wondering what it would be like to do it. The result of his dream is the TEDCO Model-1 80 meter QRPp transceiver which is remarkable in many respects. Above all, it is a high-quality product of a craftsman—designed, tested, assembled, and adjusted by one individual whose satisfaction arises from producing a unit the quality of which reflects the importance of his dream.



Front view of the Tedco Model-1 80 meter QRPp transceiver. The front panel measures 9" × 5", with a depth of 8". The color scheme is similar to the familiar TenTec cream and brown. Front-panel controls are spread out and provide comfortable manipulation. The large dial scale allows for easy frequency readout, and with factory calibration, permits an accuracy of about ±1 kHz. Both the main tuning and the Beat Select (RIT) tuning controls are solid and smooth. The enclosure box is easily removed by unthreading a set-screw at the rear panel, and pulling the chassis forward.

TEDCO Model-1 Circuit

Two versions of the TEDCO are available which differ only with respect to frequency coverage. Retail price is $79.95, including a detailed instruction manual. The Model-1 covers from 3690-3750 kHz, making it ideal for the Novice, while the Model-2 covers 3500-3600 kHz. In general, the unit employs a direct conversion receiver and a straight-through transmitter circuit. Receiver sensitivity is on the order of 1 uv with very good immunity to cross-modulation from strong signals near the operating frequency. Audio quality is exellent and the audio filter provides excellent roll-off above and below the center frequency of about 700 Hz. The transmitter section consists of a single IC which produces 500 milliwatts r.f. output which is free of harmonics and appears quite stable. The oscillator exhibits excellent short and long term stability.

Receiver

The block diagram of the TEDCO transceiver is shown in fig. 1. A first glance at the schematic provided in the instruction manual reveals a rather unfamiliar circuit configuration in terms of the usual direct conversion system. The r.f. amplifier uses a differential pair in a common-base configuration with link coupling to the antenna at T2 at the input, and a tuned transformer at the output with link coupling to the product detector. The r.f. amplifier remains in the T2 circuit during transmit periods with little loss of r.f. output power and no damage to the differential pair. A second common-base differential pair operates as a product detector, and derives the oscillator injection signal via a link on the oscillator tank inductance. Unwanted feedback during transmit periods is eliminated by a resistor in the link coupling circuit.

*83 Suburban Estates, Vermillion, SD 57069

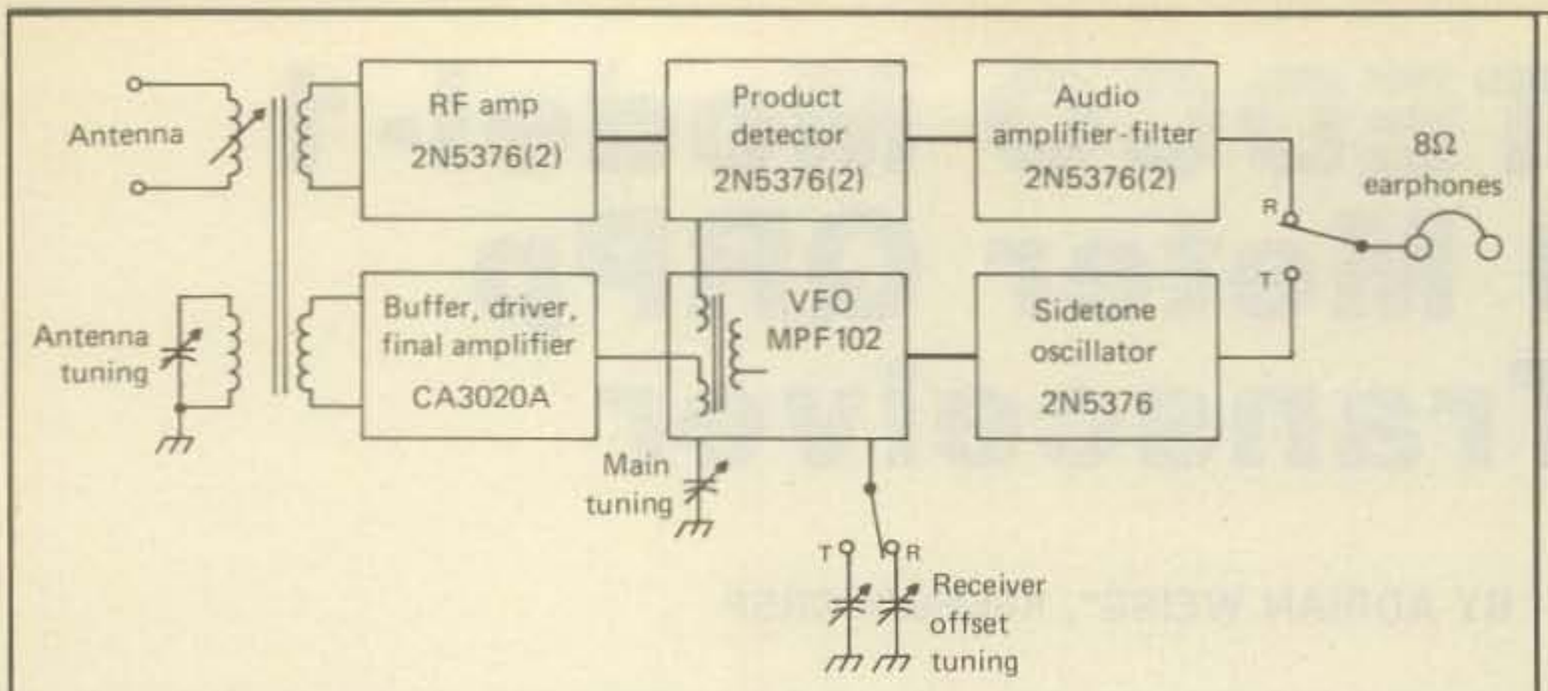


Fig. 1- Block diagram of the TEDCO Model-1 transceiver.

Audio output from the product detector is taken through a transformer that is resonated at about 750 Hz. Audio amplification is provided by a pair of 2N5376's in an emitter follower configuration.

The audio amplifier stage is an outstanding example of achieving maximum performance with a minimum number of parts. Every part performs dual service, with the feedback branch providing low-frequency roll-off with respect to the a.c. signal, as well as shunt feedback for d.c. biasing. A resistor and capacitor in the d.c. supply line provide biasing as well as high-frequency roll-off, and the output transformer is tuned to a center-frequency of about 750 Hz, providing an audio peak as well as supplying d.c. to the emitter follower. Performance of the combined amplifier-filter is remarkable with respect to selectivity and audio quality. The 6 dB bandwidth is about 150 Hz, with the 20 dB bandwidth at about 370 Hz. Performance on the air is fantastic to say the least. But it is what one can expect from the type of craftsmanship that produces the TEDCO unit. All toroid cores are individually tested for adequate permeability and about 30% of stock is the usual rejection ratio. Each toroid is then wound and the inductance measured before insertion into the circuit. The close tolerances thus achieved almost guarantee the desired performance! One drawback of the audio amplifier is its maximum power output, which is on the order of 5 mw. This output level was found adequate during testing with a very marginal antenna, but it was noticed that different 8 ohm headsets produced varying levels of output due to the variations in actual headset impedance. However, there was no problem in copying even very weak signals. Finally, the TR switch switches the headphones between the audio output during receive, and sidetone oscillator output during transmit. The sidetone is factory set at about 750 Hz and is a clear note.

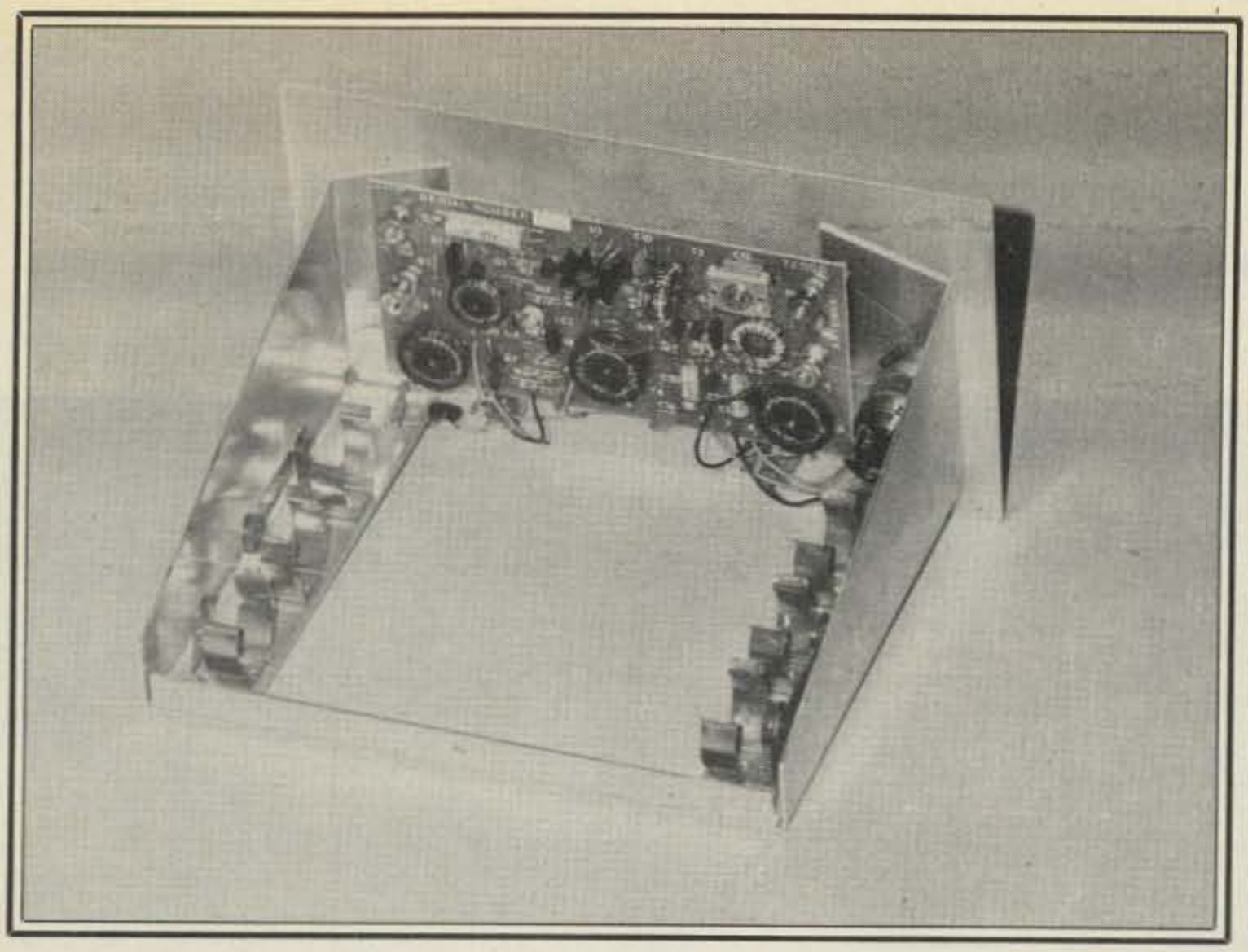
Transmitter

The v.f.o. uses an FET in a tuned-gate configuration with a tap at a very low-impedance point on the v.f.o. inductance, thus minimizing loading effects, and feedback accomplished by means of a tickler winding to the drain of the FET. V.f.o. output to the product detector and transmitter is taken through two links on the oscillator inductance. One important feature that the TEDCO unit incorporates is incremental tuning. The transmit-receive switch selects a variable capacitor located on the front-panel for offset-tuning during receive, and replaces it with a small trimmer that puts the v.f.o. back at zerobeat during transmit. Receiver frequency excursions of ± 1.2 kHz are possible with the RIT circuit. In combination with the sharp roll-off of the receiver audio filter, the RIT allows one to find a spot which pretty well eliminates interference from strong, nearby signals during receive periods, and automatically returns to zerobeat during transmit periods.

When one first glances at the TEDCO schematic, one fails to see anything that looks like a transmitter section! That is because a single IC—a CA3020A—provides a three stage transmitter consisting of buffer-driver-amplifier. The CA3020A is usable to about 8 MHz, and it performs well in the TEDCO circuit. V.f.o. buffering is provided by the differential pair within the CA3020A, with output delivered to the Class-B output transistor pair through a pair of emitter followers. Seven parts, not including the keying switch, constitute the entire transmitter! Of course, there are a lot of parts in that IC, but we won't count them. A PNP transistor functions as a keying switch in the B+ lead, permitting key leads to remain at ground potential. Keying is clean and chirpless. Output from the IC transmitter is link coupled to the antenna at T2. Two design features are noteworthy. First, the antenna link is variable, since the number of link turns can be varied to suit the impedance of the antenna being used. This allows a great deal of flexibility—one can use a dipole fed with 52 ohm coax or with 300 ohm twinlead. Second, a parallel tuned tank circuit at T2 allows for peaking the output to the antenna load. Maximum output was measured at a little over 500 milliwatts with a 13.6 v.d.c. supply. TEDCO has designed the entire unit to be powered from nine D-cells for ultimate portability, and cautions against using a supply hooked into the a.c. main lest a.c. hum appear in the audio output. This possible problem was not encountered during testing while operating the unit from three different a.c. supplies. So, I would venture to say that no problems should be encountered. If by chance you do experience a.c. hum when operating the unit from an a.c. supply, the hum possibly may be eliminated by placing a 0.1 disc ceramic capacitor across the power supply B+ terminals. Current drain during transmit is 140 ma maximum, allowing for about 20-30 hours of key-down operation from a set of D-cells. Drain during receive is only 8 ma, and ultimately, during normal operation, one can expect considerably over 150 hours with good D-cells.

Conclusions

I am quite impressed with the design, operation, and construction of



The Model-1 removed from the enclosure box. The heavy-gauge aluminum metal work results in a very sturdy unit with the feel of "battleship" construction, as we used to say in the old days. The entire circuit is mounted on a single p.c.b., which, incidentally, is the only commercially produced part in the whole unit. Everything else is handcrafted by K1DDC. Using homemade jigs and other tools, he cuts and bends and assembles all of the metal work by hand, then wires the p.c.b. after winding and accurately adjusting all the transformers. Finally, testing of the unit and final tuning adjustments are completed to within close design tolerances. Performance is outstanding. As can be seen, most of the space within the enclosure is devoted to the battery power supply, consisting of nine D-cells inserted in tubes and mounted across the width of the chassis. In looking at the unit, it immediately occurred to me that if one wishes to use this as a portable unit, the battery holders frame could be removed, resulting in a unit depth of about 2 inches maximum. The unit would then be about the size of a textbook, easily packed into a suitcase or briefcase. Whatever! The unit is a beautiful piece of workmanship.

the TEDCO Model-1 transceiver, to say the least. It is a solid mechanical unit, and a reliable, stable circuit, with the kinds of flexibility essential to QRPp operation—v.f.o. control, RIT, antenna tuning, antenna matching, portability. I am impressed with the care that goes into the assembly and adjustment of the unit. It is a fine piece of work!

Finally, someone inexperienced with QRPp operation may wonder about the results that can be had on 80 meters with 500 milliwatts output. Perhaps a brief comment will help these individuals. First off, 80 meters exhibits a fairly wide variation in propagation and noise with seasonal change. The months between mid-fall and mid-spring are the best for operating 80 meters, with the best time of day between sunset until a couple of hours after sunrise. A good antenna is of great importance. I would set the minimum height at about 35 ft. With a dipole or inverted Vee at that height, 500 milliwatts output should produce consistent results to about 750 miles, and less consistently to about 1200 miles. Of course, a higher antenna is desirable, but I have had excellent results to both coasts and 2.5 watts with a Vee at 45 ft. Stations from all over the country used to check into the Milliwatt Net back during the worst sunspot cycle period, and with good results, often using 40 meter dipoles or other non-80 meter antennas. In the well-populated areas of the country, such as the East coast, 500 milliwatts to a good antenna will produce very good results. The TEDCO manual is quite complete in that it not only describes the transceiver circuit and operation, but also includes a section about operating QRPp on 80 meters with the TEDCO unit based upon K1DDC's two year on-the-air testing of it.

In short, The TEDCO Model-1 is a fine piece of gear and I'd recommend it. I certainly enjoyed operating the test unit. It sounds good and feels good in addition to performing well.

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Antennas

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

In last month's column, we discussed the center-fed dipole, far and away the most popular antenna used on the h.f. bands. We pointed out that this antenna was simple to design and construct, and that it was also quite inexpensive. We also highlighted one of the most important features of the dipole: the fact that it works with a minimum of effort and adjustment being required.

To review, the dipole has two arms which are separated by a center insulator and connected to one another by the transmission line. Normally constructed of wire, the dipole is a resonant half-wavelength antenna. Its practical length is 5% less than one-half of the "free space" wavelength of the frequency for which it is designed. In the simple dipole, the wire is cut exactly in the middle and a transmission line is attached at the center point. We pointed out last month that the dipole can be operated efficiently and effectively at *odd harmonics* of the fundamental frequency, and that several dipoles can be joined together at the center and fed in parallel to allow operation on frequencies that are not necessarily harmonically related. We also mentioned that the *folded dipole* makes a good *broadbanded* antenna.

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In this month's column, we will follow up with a discussion of some major dipole variations. We will cover Vees and inverted Vees, vertical dipoles, slopers, "T2FDs," double bazookas, double Zepps, and extended double Zepps. We'll limit ourselves to relatively simple center-fed antennas this time, saving fancier wire antennas such as the Windom and the trap dipole for a later column.

The Vee and inverted Vee. For convenience in fitting an antenna to a particular piece of real estate, or for sharpening up a dipole's radiation pattern, the dipole can be bent into the form of a horizontal "V". Doing this will cause the directional pattern of the antenna to become sharper in both the horizontal and vertical planes. Maximum radiation will be along the line bisecting the "V." Usually, the "V" or **Vee antenna**, as it is popularly known, is made quite long with respect to wavelength, to effectively make it act as a wire beam exhibiting several dB of gain over the simple dipole. For example, a Vee about 100′ on a leg (200′ total) fed with tuned feeders as a resonant antenna will show about 7 dB gain on 10 meters, 6 dB on 15, and 4 dB on 20. The radiation pattern will be as mentioned, though it will change slightly from band to band.

Closely related to the Vee is the **inverted Vee,** named for the fact that it is strung out in the form of a nearly upside-down letter "V". Sometimes known as **drooping doublet,** the antenna is supported by a single high mast or pole, with the ends made to slope down toward the ground. There are some definite advantages to this type of antenna: it requires but *one* main structure, not two; its radiation pattern is more-or-less omnidirectional, as opposed to the figure-eight pattern of the basic dipole; and it can be used for either single-band or multi-band operation, depending on its specific construction. It's also a space saver for small city and suburban lots.

The inverted Vee is a simple anten-

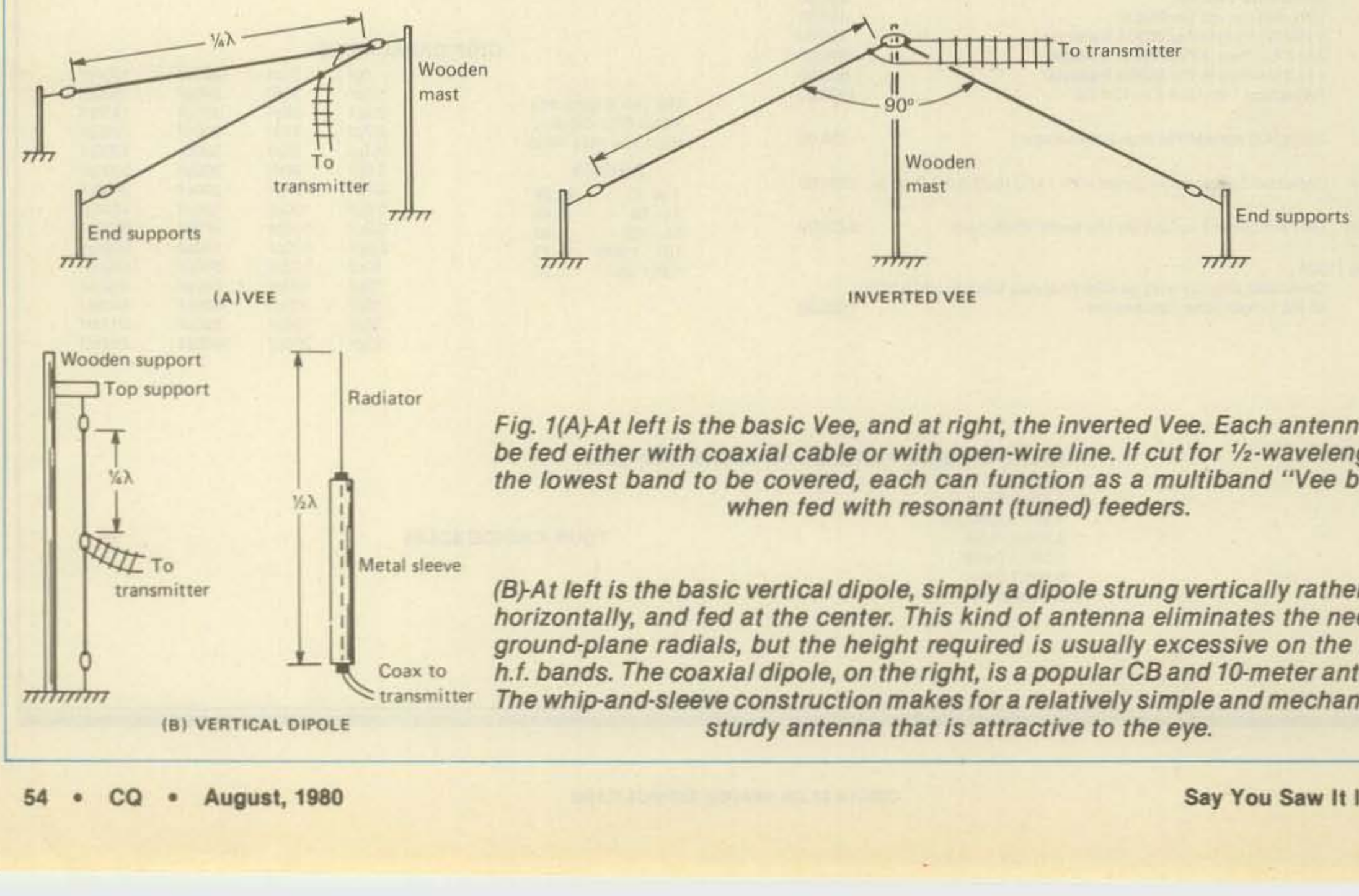

Fig. 1(A)-At left is the basic Vee, and at right, the inverted Vee. Each antenna can be fed either with coaxial cable or with open-wire line. If cut for ½-wavelength at the lowest band to be covered, each can function as a multiband "Vee beam" when fed with resonant (tuned) feeders.

(B)-At left is the basic vertical dipole, simply a dipole strung vertically rather than horizontally, and fed at the center. This kind of antenna eliminates the need for ground-plane radials, but the height required is usually excessive on the lower h.f. bands. The coaxial dipole, on the right, is a popular CB and 10-meter antenna. The whip-and-sleeve construction makes for a relatively simple and mechanically sturdy antenna that is attractive to the eye.

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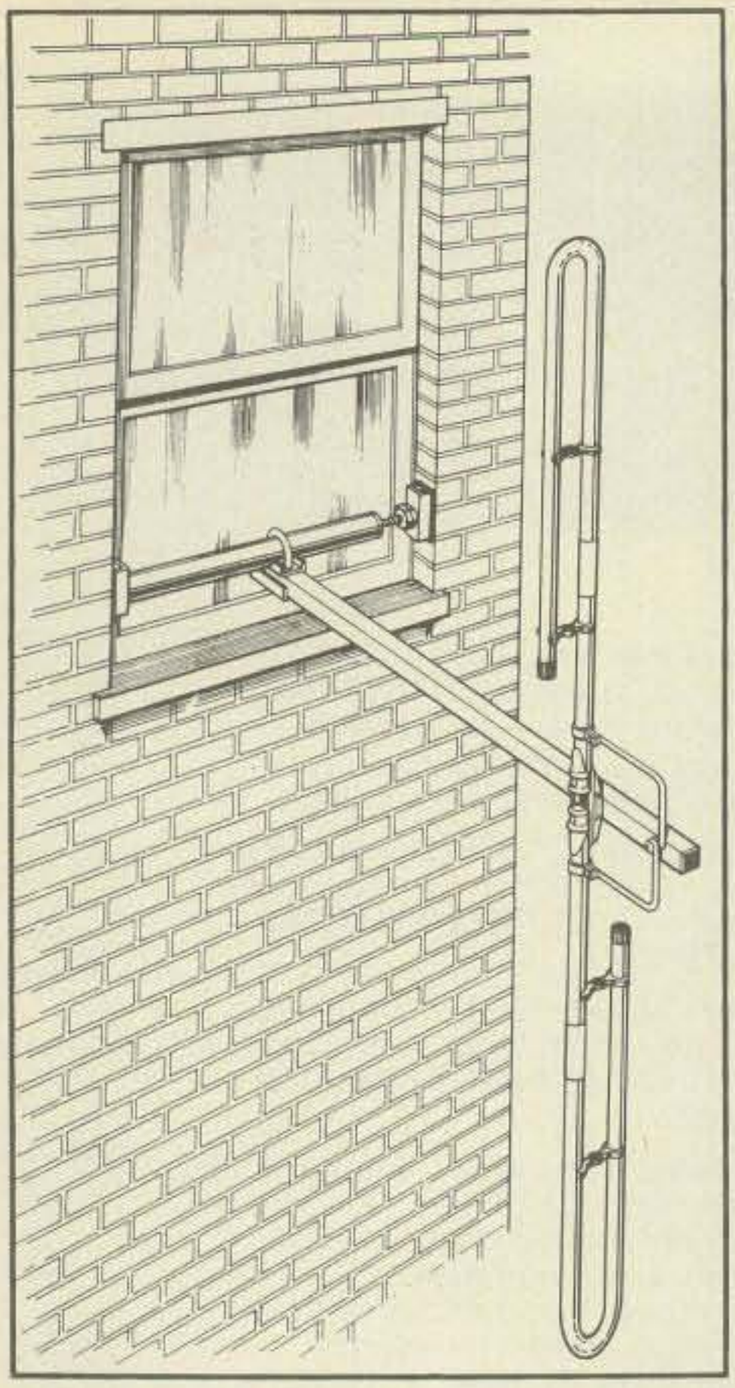
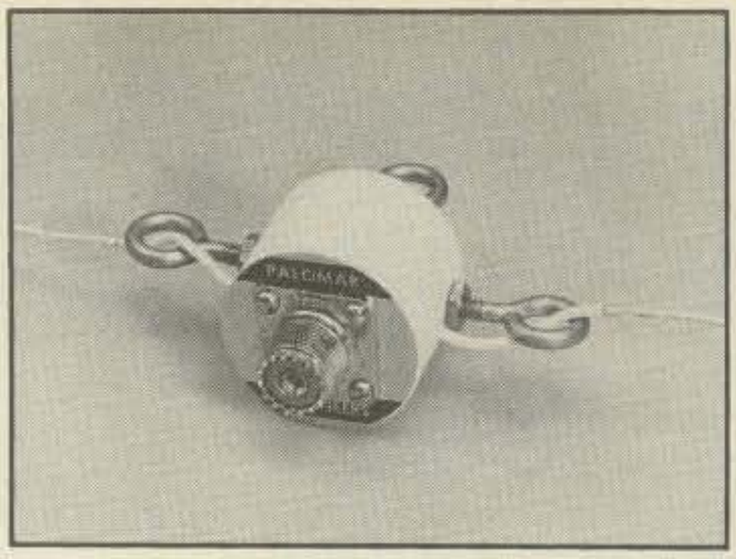


Although designed for CB use, this Finco Stinger W-40 window mount antenna is illustrative of what can be done to fit a vertical dipole to limited space. The dipole elements are bent back on themselves and fed with a Beta match to achieve good bandwidth across the entire CB range with an impedance at the center of 50 ohms. Radiator length is but 5.9 feet. Antennas of this type can easily be cut down for 10-meter use, and are particularly useful to the apartment dweller who cannot install an antenna on his building's roof. (Photo courtesy The Finney Company)

na to install and adjust. Best results are usually had when the apex angle at the "V" is between 90 and 120 degrees. A wooden support pole should be used to prevent pattern distortion, and the end supports should be at least 7′ high to prevent people from walking into the antenna. Bear in mind that its resonant frequency will be sensitive to apex angle, height, and end-effects, so tweaking for lowest s.w.r. may require some trimming. Start with the antenna length a bit longer than the theoretical length, to allow for some "slack" in tuneup.

Although the inverted Vee can be used as a multiband antenna, it is most effectively employed as a single bander. This is because as the antenna is operated on higher frequencies, radiation angle increases, to the detriment of working DX.

Fig. 1(A) shows basic Vee and inverted Vee configurations.



Palomar Engineers dipole center insulator sports a u.h.f.-type SO-239 coaxial cable connector and a handy hang-up hook, useful for stringing a Vee or inverted-Vee antenna. Stainless steel eyebolts take antenna tension and won't rust. For those who favor use of a balun transformer, a similarly-packaged unit is also available from Palomar. A 1:1 balun can be used to match 50-75 ohm coax to balanced loads (dipoles, Vees or inverted Vees), while a 4:1 balun can be used to match 50-75 ohm line to 200-300 ohm balanced loads (folded dipoles, tuned feeders). (Photo courtesy Palomar Engineers)

The vertical dipole. The dipole is the same antenna, whether installed vertically or horizontally. Mounted horizontally, it will be somewhat directional, depending on its height above ground and the band involved. Sometimes, the horizontal dipole's angle of radiation becomes too high for good results on medium- and long-haul paths.

On the other hand, the vertical dipole presents a horizontal directional pattern that is circular at any wave angle, though to a small extent the vertical-plane pattern will vary with the antenna's height above ground. For the most part, though, it can be considered to be a *low-angle* radiator—favored for DX work on the h.f. bands.

The vertical dipole can be constructed like its horizontal cousin and suspended from a mast, preferably a wooden one. Unlike the more common ¼-wavelength vertical antenna, where the ground beneath it or an artificial ground plane make up for the "missing half," the vertical dipole is full size and its efficiency isn't diminished by a poor ground/ground plane system. However, it is generally too cumbersome an antenna to be practical on the lower h.f. bands, 160 through 20 meters. . . .Still, it's a popular 15- and 10-meter antenna, since it can be made of inexpensive materials, it has a low-angle-of-radiation characteristic (for DX work), and no ground radials need be run or ground plane installed.

Perhaps the most common configuration is the **coaxial dipole,** especially popular on 10 meters and the 27 MHz CB band. In this design, the bottom section of the antenna is constructed of hollow tubing, with the coaxial cable run down the inside of the assembly. Since the r.f. energy is concentrated on the outside of the antenna, the bottom section effectively acts as a shield for the antenna's bottom half. Overall performance of this type of antenna can be outstanding; I have used an adapted Radio Shack CB coaxial dipole for several years and am pleased with the results on 10 meters, having worked into Australia, for example, using a converted s.s.b. CB transceiver running under 25 watts PEP. Too, the fact that the antenna is little more than a 17-foot fiberglass stick makes for a neat, slim-line installation that does not require any unsightly ground plane radials.

The vertical dipole's effectiveness is equivalent to that of its horizontal counterpart. Neither has any "gain" relative to the other, though they may exhibit different horizontal and vertical plane radiation patterns, and they both exhibit approximately 2.1 dB gain with respect to the so-called isotropic or point source (discussed in previous columns). In practice, one type *will* prove superior in different situations and under different conditions. Generally speaking, at practical heights on the h.f. bands, the horizontal antenna will display a higher angle of radiation than will the vertical. This will tend to make the horizontal antenna superior for short-haul work (especially evident on the lower bands, 80 and 40) and the vertical best for DX, with its lower angle of radiation.

Any vertical antenna tends to be more sensitive to man-made static pickup than the dipole, since the lower angle of radiation (and reception) favors signals coming from the antenna's horizon, that is, near the ground level. The vertical is also slightly more susceptible to situations of radio frequency interference (BCI, TVI, etc.). Keep these facts in mind when choosing an antenna.

Fig. 1(B) shows vertical dipole installation details.

Slopers and T2FDs, too. The figure-eight radiation pattern of the horizontal dipole can be varied by sloping the antenna in a semi-vertical position. The sloping dipole, or **sloper,** is popular for long-haul work since the radiation angle is lowered. (A 45-60 degree slope to the ground is typical.)

The higher the feed point is above ground level, the better, since the radiation angle will be lower. If the antenna is supported by a metal mast, maximum radiation will be off the *front* of the antenna. A slight gain in one direction results, since the mast acts as a reflector of sorts. The mast can also create a shielding effect for a

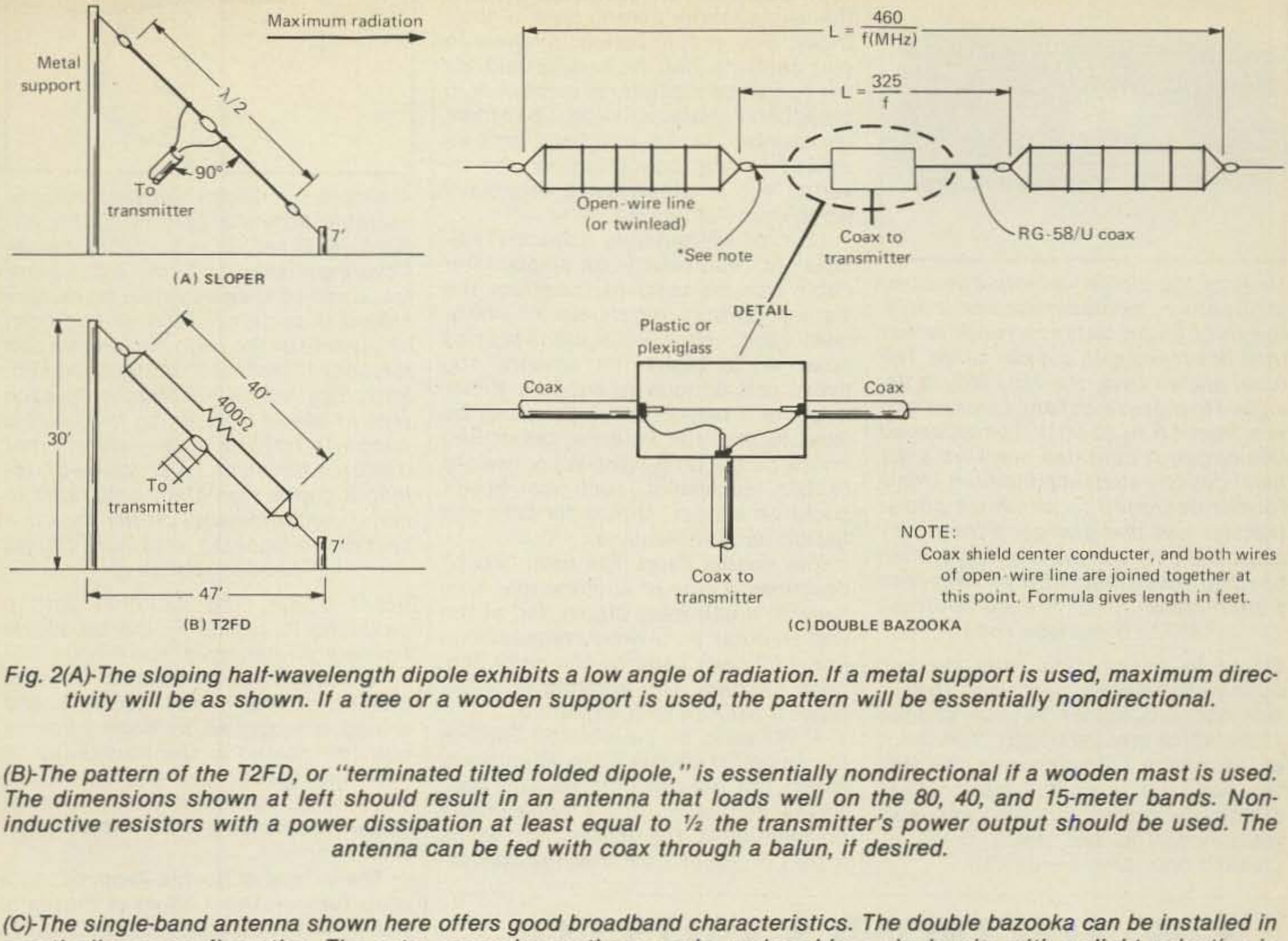


Fig. 2(A)-The sloping half-wavelength dipole exhibits a low angle of radiation. If a metal support is used, maximum directivity will be as shown. If a tree or a wooden support is used, the pattern will be essentially nondirectional.

(B)-The pattern of the T2FD, or "terminated tilted folded dipole," is essentially nondirectional if a wooden mast is used. The dimensions shown at left should result in an antenna that loads well on the 80, 40, and 15-meter bands. Non-inductive resistors with a power dissipation at least equal to ½ the transmitter's power output should be used. The antenna can be fed with coax through a balun, if desired.

(C)-The single-band antenna shown here offers good broadband characteristics. The double bazooka can be installed in practically any configuration. The outer open-wire sections can be replaced by a single wire with a slight reduction in operating bandwidth.

*NOTE: *coax shield, center conductor, and both wires of open-wire line are joined together at this point. Formula gives length in feet.*

deep null off the backside; these characteristics may or may not be desirable. If a non-metallic support is used, the pattern will be essentially nondirectional.

Some amateurs who have high towers installed for their directional arrays use several "guying slopers" spaced equally distant around the tower to take advantage of the varying directional effects possible. A feedline switching arrangement is used to select the proper antenna for the desired direction. Of course, the expected gain is small, though the slight gain improvement coupled with a lowered angle of radiation may justify the installation.

An essentially nondirectional version of the sloper is the so-called **T2FD,** or *terminated tilted folded dipole* (whew!). The T2FD was popularized by *CQ Magazine* designs in the fifties,[1] and though little known today, is still favored by many operators and is being rediscovered by others.

In one popular multi-band T2FD design, the antenna is configured as a folded dipole terminated at a point opposite the feed-point in a non-inductive resistance equal to the feedline impedance (nominally 300-400 ohms). A length of 47 feet is selected for the antenna, which is fed directly with 300-ohm twinline or 450-ohm open-wire feeders. It can also be fed with coaxial cable through a balun transformer. The accompanying illustrations (Fig. 2[A] and 2[B] show construction details for these two designs.

There are, we should point out, many strong believers in slopers and related antennas. Considering the directional possibilities and typically low angle of radiation, sloper enthusiasts rank the antenna higher than the inverted Vee and considerably higher than the conventional dipole when it comes to laying down a good signal at a distant point.

The double bazooka. Not an Army instrument of war, this is a broadband dipole especially popular for 80- and 40-meter work. Based on a radar antenna design by MIT scientists, it was popularized by author W8TV in the July 1968 *QST.*[2]

The double bazooka is constructed as shown in Fig. 2(C). It consists of a ½-wavelength section of coax opened at the center, with the coax feedline connected at that point. The end sections of the antenna are made of open-wire line. In effect, the coax's outer conductor (shield) acts as a halfwave

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[1] *Stoner, Donald S., W6TNS. Novice column,* CQ Magazine, *June 1957.*

[2] *Whysall, Charles, W8TV. "Broadside Dipole,"* QST, *July 1968. The design is also described in the ARRL* Radio Amateur's Handbook *from 1969 through 1977. (Footnote refers to a reference on following page #7). Broadband dipoles are also discussed by William Vissers, K4KI, in* 73, *August 1977, p. 36.*

Many of the dipole variants described in this month's column will work best if fed through an antenna tuner rather than direct-fed with coaxial cable. The tuner shown here, the MFJ-962, is designed to match most any antenna system from 1.8 to 30 MHz. The balanced line circuit it contains employs a 4:1 balanced-to-unbalanced (balun) transformer designed to minimize power transfer loss and give good frequency response over the tuner's range when used to feed open-wire or twin-lead transmission lines. (Photo courtesy MFJ Enterprises, Inc.)

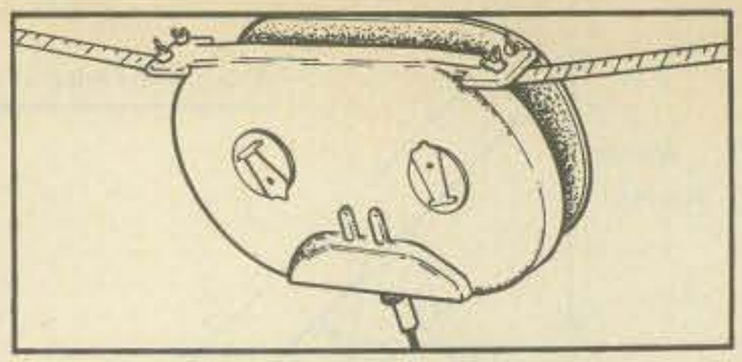
dipole in conjunction with the two open-wire antenna sections. The inside sections act as ¼-wave shorted stubs which present a high impedance at resonance. Off-resonance, the stub feedpoint reactance changes so as to effectively cancel out the antenna's reactance. The net result is an increased operating bandwidth.

The mechanical construction, like the explanation above, gets a little tricky. For simplification, single-wire end sections can be substituted for the open-wire sections at some cost in broadband characteristics. The antenna can be cut for any band and installed in any configuration; the inverted Vee is widely used, especially when space is limited.

Low power-handling capacity RG-58/U or equivalent small-diameter cable can be used to construct the flat-top portion, regardless of power level used. Using large cross-section coax would make the antenna too heavy and difficult to support. Either large- or small-diameter coax can be used to feed the antenna, depending on the power level used. A lightweight RG-8/U equivalent such as RG-8X could be a good choice for both the flattop and the feedline.

The double Zepp. The term "Zepp" describes a type of antenna that consists of a half-wave dipole, fed at the end through a ¼-wave transmission line, originally used on the early Zeppelin airships. The antenna later became a favorite with amateurs.

A variation of the end-fed Zepp is the so-called **double Zepp.** Commonly called the full-wave dipole, two half-waves in phase, or the two-element collinear array, the double Zepp yields a gain of about 2 dB over the conventional dipole. The radiation pattern produced is similar to the broadside figure-eight pattern of the dipole.



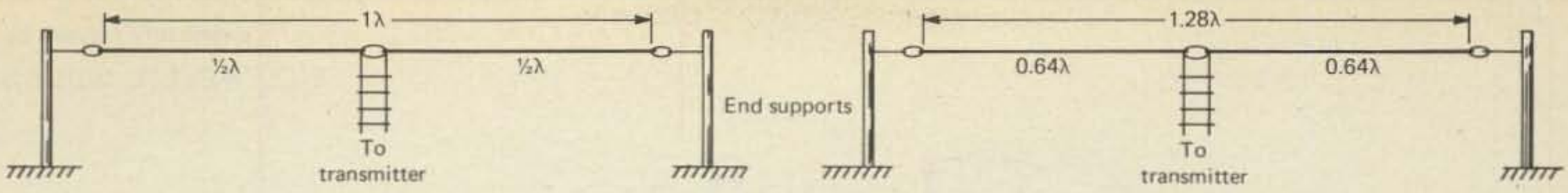
A simple, but useful high-performance portable antenna system is this Hy-Gain 18TD reel tape portable dipole. Covering 80 through 10 meters, the unit features two stainless steel tapes, calibrated in meters, which extend from either side of the main housing up to a total of 132 feet for 80-meter operation. Polypropylene rope is attached to each tape to permit installation to available supports to form a semi-permanent doublet antenna. A frequency-to-length conversion chart calibrated to meter measurements on the tape is a part of the housing assembly. (Photo courtesy Hy-Gain)

Normally, the antenna is fed with open-wire line (tuned feeders) and routed through an antenna tuner or coupler located at the transmitter. A matching section can also be used at the antenna feedpoint to allow coaxial cable to be used as the transmission line.

The extended double Zepp. Going a step further, the *1.28-wave dipole* is known as the extended double Zepp. In keeping with collinear antenna design principles, making the antenna slightly longer than a full wavelength will increase gain somewhat. The optimum length for each element is 0.64-wavelength, and results in about a 3 dB gain over the ½-wave dipole. The radiation pattern is, again, the familiar figure-eight, but directivity is considerably more pronounced. Like the full-wave dipole, the extended double Zepp is usually fed with open-wire line.

Fig. 3 shows construction details of both the double and extended double Zepp.

The dipole antennas we have discussed are particularly suitable for the beginner, as opposed to single-wire and long-wire types that are often recommended as "first antennas" due to their apparent simplicity. The resonant, balanced-to-ground characteristic of the dipole fosters easy transmitter loading and tuneup, although some designs require feeding through an antenna tuner. The single-wire's unbalanced nature and its typically nonresonant characteristics tend to combine to present loading and grounding problems that the Novice operator may not be prepared to solve. Too often, the lack of a proper ground system, required for the single-



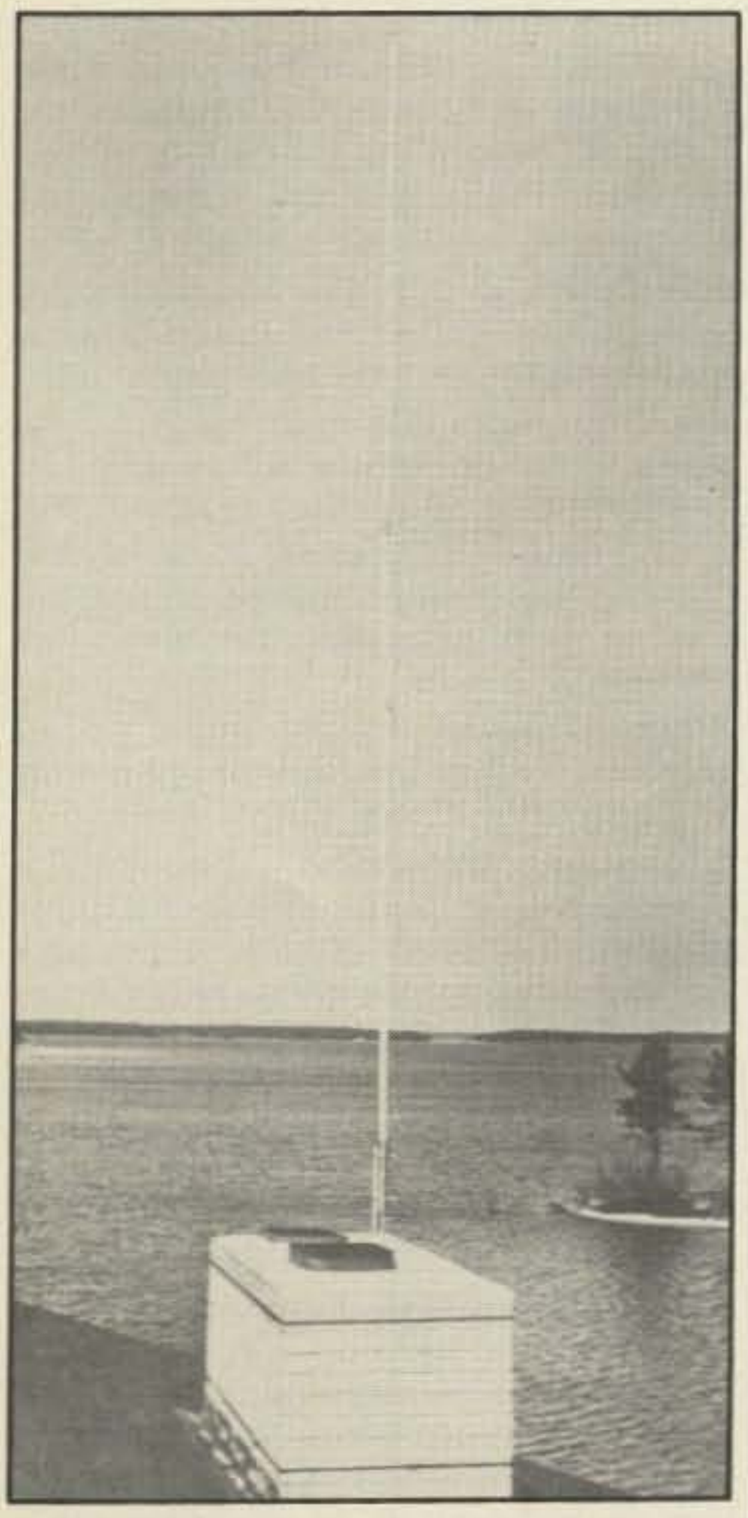
(A) DOUBLE ZEPP

(B) EXTENDED DOUBLE ZEPP

Fig. 3(A)-Shown above is the double Zepp, a full-wave dipole sometimes referred to as a "two half-waves in phase" antenna. Normally fed with open-wire line, it must be fed through an antenna tuner at the transmitter. Its advantage is about a 2 dB gain over the half-wave dipole, the penalty that it requires twice the horizontal space as the dipole. Its vertical counterpart is the ½-wave vertical, which boasts a 2 dB gain over the ¼-wave vertical.

(B)-The extended double Zepp, shown above, is 1.28-wavelengths long. It, too, is usually fed with open-wire line through an antenna coupler. It boasts slightly higher gain, about 3 dB over the standard ½-wave dipole, and it requires more than twice the space. Its vertical counterpart is the 0.64-wave vertical, which sports about 3 dB over the ¼-wave vertical.

The 1- and 1.28-wave dipoles require a great deal of space, as indicated, which is a particular drawback on the 160, 80 and 40-meter bands. When space is limited, the ends can be bent horizontally or vertically to meet the dictates of available real estate. However, there will be some loss of effectiveness and complication of the radiation pattern.



One of the most popular versions of the vertical dipole is the coaxial antenna, shown here. Configuration eliminates the need for ground-plane radials. Radiation pattern is low-angle and omnidirectional. Author has used the CB-type antenna of the kind shown here with excellent results on 10 meters.

(Photo courtesy Radio Shack)

A close cousin to the dipole is the ferrite rod directional loop, especially popular as an m.f./h.f. receiving antenna. McKay Dymek loop shown here contains a FET two-stage amplifier and it's designed to minimize interference and background noise prevalent in m.f. reception. This particular antenna is designed for broadcast band use, but higher-frequency versions are also available. Commercial quality receiving loops are also sold by Palomar Engineers. (Photo courtesy McKay Dymek)

wire, results in equipment that is hot with r.f. when touched, erratic loading conditions, r.f. feedback in station accessories, and increased probability of BCI and TVI. Working with dipole-type antennas reduces the chances for such undesirable consequences.

This concludes—at least for the moment—our two-part discussion of the dipole and related antennas. We've run the gamut, having covered the basic dipole, the odd-harmonic radiator, the folded dipole, the Vee and inverted Vee, the vertical dipole, the sloper, and T2FD, as well as the double bazooka. And, we've also touched on both double and extended double Zepps.

It's good at this point to mention the parallel relationships between the basic ½-wave dipole, the double Zepp, and the extended double Zepp, and their vertical counterparts. These are the ¼-wave, ½-wave, and 0.64-wave vertical, respectively. The basic ¼-wave vertical exhibits unity gain, whereas the latter two designs yield 2 and 3 dB gain over the ¼-wave. The long verticals, of course, derive their gain figures from an improved low-angle radiation characteristic, rather than through increased horizontal-plane directivity.

Next month, we'll shift gear. Featured will be a discussion of popular h.f. vertical antenna designs and some practical advice on their selection and use. Stay with us.

73, Karl, W8FX

P.S. — We expect, in a few months, to run columns featuring such diverse topics as SWL antennas, dummy loads, scanner radio antennas, switching arrangements and devices, antenna accessories, limited space aerials, cubical quads, portable antennas for the traveler, mobile antennas (h.f. and v.h.f./u.h.f.), longwires, and antennas for 160 meters. I invite readers to send along photos and descriptions of their installations; if the photos are of good quality and the design of broad interest, we'll try to run the photo and description sent in. The photos should be extras, since it's impractical to ensure their safe return.

a monthly feature by
BILL WELSH, W6DDB

Novice

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Guidelines for Conducting Amateur Radio Shows - Part IV of IV

This is the last of a four part article about running amateur radio shows. The first part covered people, planning and location factors. The second part detailed banquet, communications, contests, and exhibit considerations. The third part fully described publicity aspects related to conducting amateur radio shows. This final part covers prizes, technical seminars, tickets and printing, flea market, and finances of these shows.

Prizes

Responsibility. The prize coordinator is responsible for acquiring, storing, displaying and distributing all show prizes. He/she keeps an accurate listing of prizes, intended prize usage, and prize values. He/she sets aside specific items needed for such purposes as banquet, contest, hourly drawing, grand, pre-registration, and seminar prizes. This coordinator cooperates with the other show coordinators to ascertain that appropriate prizes are available when and where they are needed. A *secure* storage area is required.

Key Prizes. Certain prizes must be determined as soon as possible to allow them to be mentioned in show advertisements. The grand, pre-registration, and banquet prizes must be known since they are usually mentioned on the printed tickets. It is not necessary to strain the show budget when selecting these prizes. It is possible to select low cost items that are very popular. It has been my experience that the values of these major prizes have little effect on total attendance. Try to select the major advertised prizes from organizations that will be displaying at your show.

Paying for Prizes. Do not badger outfits for free prizes. A properly run show is able to pay its way. Many companies provide products at discounts for show prize use. Such discounts enable one to put up an improved total

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Seventeen-year-old Rob Magro, KA2EGO, who operates from Milford, New Jersey, has been licensed since February 1979. He runs an Argonaut Transceiver on 10 and 15 meters with a vertical antenna. Rob has worked all states and 26 foreign amateurs with his 5-watts input rig. He has introduced five of his high school friends to amateur radio and they are getting ready to pass the Novice examination. Rob operates about 14 hours per week and he hopes to earn the DXCC (100 foreign countries) award with his low power rig. His favorite participation sport is soccer. As you can see, he has an easy suffix to remember in his callsign.

prize value, which is good. Recognize every bit of help received from cooperating companies. Accept donated prizes but do not solicit them. Some companies donate discount certificates to allow their products to be purchased at lower prices by show attendees who win their certificates. There is no real cash value to such discount certificates and it is advisable to always use them in conjunction with some other prize.

Displaying Prizes. If prizes are to be displayed, this must be done in a *secure* manner, such as by locking them inside display cases. Be extremely protective of all prizes.

Pre-registration Prize. As previously stated, the grand prize, pre-registration prize, contest prizes, banquet prize, and other major prizes are awarded during the banquet. Draw the pre-registration prize winning stub from ticket stubs received by the pre-registration cutoff date. Draw this stub at a pre-announced time and date, selecting some event with good attendance, such as a club meeting. This stub should be drawn as soon as possible after the pre-registration cutoff date to preclude any pressure to include stubs received after the announced cutoff date. It adds some suspense to the show if no one knows who won the pre-registration prize until it is announced at the banquet. It is a simple matter to double seal this stub in two envelopes without allowing anyone to read it. The sealed envelope should be entrusted to the prize coordinator until the emcee requests it during the banquet. The pre-registration cutoff should be 7 to 14 days prior to the opening of the show.

Hourly Drawing Prizes. These prizes help maintain an air of pleasant anticipation and excitement throughout the show. Establish a minimum retail value of about $10 for each hourly prize winner. Whenever low value items are going to be used, group different ones together to at least equal the desired minimum value. Require hourly prize winners to claim their prizes in person, using their matching numbered ticket. Announce and post lists of hourly prize drawing winners throughout the show area, taking particular care to include outside display and seminar areas. Allow winners to claim prizes up to 10 minutes before the next hourly drawing is scheduled. Announce what each prize is before the winning stub is drawn. Immediately staple each prize winning stub to the associated prize record sheet, which is to be completed by each winner prior to each prize being given out. Whenever it is convenient to do so, have these hourly prize stubs drawn by exhibitors. Establish a maximum retail value for any one hourly prize draw-

ing. A limit of $30 to $50 provides reasonable separation between major prizes and suitable hourly prizes. Whether or not hourly prize winners claimed prizes, set their ticket stubs aside to be returned to the drawing barrel prior to the drawing for the grand prize. Do not return drawn ticket stubs to the barrel prior to when the grand prize is to be drawn. It is important to give as many people as possible a chance to win prizes.

Major Prizes. As previously stated, establish a maximum value for hourly prizes. Unlike hourly prize winners, the winners of major prizes do not have to be present to claim their prizes; this fact should appear on show literature. These prizes should be drawn at the show wrap-up event, which is usually a banquet.

General Considerations. Do not permit prize winners to substitute items won for other prizes not yet awarded. They win whatever has been stated to be the prize and they are welcome to use it as they wish. Mix ticket stubs very well before and between prize drawings. Advise each person to draw just one stub at a time and to draw it from beneath the visible (top) layer of stubs. If two or more stubs are inadvertently drawn at the same time, return both of them to the barrel and have a different winning stub drawn. Be sure that show announcements state that all prizes must be picked up by winners as soon as possible with none shipped or delivered and with none retained more than 3 months past the close of the show. Establish who is (and is not) eligible to win prizes. It is not advisable to exclude anyone who purchases a ticket, or is issued one for participating as a speaker, exhibitor, or show worker. Do not give more than one ticket to anyone for any purpose, but permit anyone to purchase as many tickets as they want. It is popular to have a few prizes just for women and children attending the show. Such special prizes are easily awarded by using special drawing slips filled in by attendees. Local merchants often provide items at low (or no) cost for use in major events; it is good to check with restaurants, candy stores, florists, and sports centers regarding the possible availability of such prizes. Emphasize the name and callsign (phonetically) of each prize winner. Urge attendees to notify friends about prizes they have won. State where and when each prize can be picked up by the winner. Take a few black-and-white pictures of major prize winners for use with followup stories on your show. It is the prize coordinator's responsibility to notify major prize winners to pick up their prizes, if they did not pick them up at the show. This is the best job in the show. It is better to telephone win-

Donald H. Ward, KA1BPJ, of Pownal, Maine, is a 58 year old ex-Coast Guard signalman who used to communicate via lights and semaphore flags. Donald has converted a bedroom into a shack where he runs a Health HW-101 barefoot into his homebrew 3-element, 15 meter Yagi. He built the 42 foot tower on which his Yagi is mounted. In a little over a year, he has worked 300 USA contacts and 176 foreign (DX) contacts with 60 countries. He'd like to know if there are any Novices who have been more active than he has been during the past year. If you have been more active than Donald, please submit your year-long totals to W6DDB.

ners than to notify them by mail.

Prize Uses. Prizes must be set aside for use in contests, special events, and seminars. In addition, a good prize should be reserved for use during the workers' meeting that concludes this year's show and starts the planning for the next show.

Record Sheets. Produce a prize record sheet form to help track prizes and prize winners. Number these sheets in sequence. They should show the manufacturer, model, and list price of the prize, plus the sequential prize number. They should also provide adequate space for the prize winner to fill in his/her name, callsign, and mailing address. Require every prize winner to fill in the record sheet for each prize and have the sheet completed before the prize is awarded. Use a prize record sheet with every prize, including pre-registration, grand, banquet, contest, hourly, and seminar prizes. Group prize record numbers together when you have several identical prizes. This makes it much easier to type the final prize record.

Technical Seminars

Responsibility. The seminar coordinator completes all arrangements necessary to provide a well balanced variety of presentations for the benefit of show attendees. This coordinator needs at least one assistant. During the show, they take turns introducing each speaker/program and handle heating, cooling, lighting, amplifier, microphones, projectors, screens, seating, and all other related requirements.

Requirements. Select rooms that are clean, well lit, properly cooled/heated, and are close to the main exhibit area. Use a good seating arrangement with adequate aisle space and do not permit overcrowding. When all seats are occupied, do not allow any more people to enter the room. Fire marshals are insistent about avoiding overcrowding. Make sure that emergency exits can open and that they are not blocked. Equipment such as slide projector, 16-mm sound movie projector, screen, chalk board, chalk, chalk eraser, public address system, and elephant gun (special light) must be on hand and in working order. Seminar attendees must be told about hourly prize drawing winners to preclude the possibility of not claiming a prize on time.

Tickets and Printing

Responsibility. The ticket coordinator is responsible for everything related to the printing, distribution, and sale of all show tickets, including admittance, banquet, breakfast, luncheon, and supper tickets. This person must closely coordinate his/her activities with banquet, finance, prize, and publicity coordinators. In addition to tickets, this coordinator is responsible for attendee badges, coordinator ribbons, and show workers' ribbons. In most cases, this person is also the best choice to have signs and posters prepared for use by the publicity coordinator.

Early Printing. As soon as the show planning committee has established the dates, times, prices, and prizes, get all of the tickets printed without delay. The rough draft of each show ticket should be carefully reviewed by each coordinator before it is submitted to the printer. Quantities, colors, sizes, and type styles must be determined before the ticket orders are placed. If you want the best possible tickets, tell your printer precisely what you want him to produce; do not leave anything to the printer's judgment or choice.

Simplicity. Use as few different types of tickets as is possible. Keep things simple. As an example, pre-registration and regular show tickets do not have to be separate or printed in different colors; a single ticket can show both sets of prices and serve both purposes. Similarly, the single show ticket stub can be used for drawing all prizes. Use a standard 2-5/16 by 3-7/16 inch ticket for all purposes to enable attendees to keep their tickets in the standard plastic see-through holders you provide. Tickets should be well perforated to provide easy separation of segments such as the drawing stub. Attendees should be required to have their show ticket visible at all times while they are in the exhibit area or seminar rooms. The ticket coordinator should order the 2½ by 3½ inch clear plastic display holders to be used with the main show ticket.

The pre-registration prize and price should be printed on the main show ticket along with the pre-registration cutoff date. Similarly, the grand prize and regular admission fee must also appear on this ticket. Location, dates, and show times should be included and the main show tickets must be numbered sequentially, with the same number printed on all parts of the ticket and its stubs. Each drawing stub should include adequate space for the attendee to fill in their name, callsign, mailing address, city or town, state, zip, and telephone number. Do not mention raffle on any show printed material.

Special Tickets. Seminar drawing tickets can be the common pre-printed numbered ones that are supplied in rolls. These tickets come in

This is Jim Skaife, KA9FQA, of Prairie Du Chien, Wisconsin. Jim thanks Phillip Reid, WB9CSM, and Walt Schlaught, W9SD, for helping him get started in amateur radio. He runs a Yaesu FT-101-FX with a dipole on all Novice bands. He has worked 35 states and two countries since August 1979. Jim has the Ten American Districts (TAD) award and is closing in on the Worked All States (WAS) award.

matched pairs with one marked for deposit in the drawing box and the other marked for retention by the attendee. These cheap tickets are simple to use in any drawing of this type since the winner simply has to present the matching ticket and nothing has to be written on them. If this type of ticket is used for more than one purpose in the show, use a separate color for each purpose.

Ribbons and Badges. The ticket coordinator should also obtain an adequate supply of show ribbons or badges such as banquet coordinators, chairman, contest coordinator, exhibit coordinator, exhibitor, flea market coordinator, host, hostess, prize coordinator, publicity coordinator, seminar coordinator, speaker, and ticket coordinator. Do not identify the show's financial coordinator in any way. The greatest quantities of show ribbons/badges (in declining total sequence) are for host, exhibitor, speaker, and hostess. It is advisable to pick up these show items from your own workers at the end of the show, but allow exhibitors and speakers to keep them if they want them.

Naturally, the ticket coordinator is responsible for all ticket sales and runs the registration/information booth. He/she works most closely with the banquet, finance, and publicity coordinators.

Flea Market

The flea market coordinator operates the show's flea market in accordance with the rules established by the show planning committee. This part of a show holds a lot of interest to many attendees and it merits good preparation. Businesses should not be allowed to operate out of the flea market area to avoid paying exhibit space costs. If the exhibit area is filled, businesses should be allowed to use the flea market area; they should be charged more than the amount paid by individuals but less than the regular exhibit space cost. Beware of questionable activity in your flea market area because undesirables are attracted to it.

Finances

Responsibility. The finance coordinator is responsible for all money matters related to the show. This person tracks all expenses and incomes and just makes payments for items specifically or generally approved by the show planning committee or chairman. This coordinator works in close cooperation with all other coordinators; this is particularly true of the finance coordinator's cooperation with the banquet, exhibit, flea market, prize, publicity, and ticket coordinators. Current and projected financial conditions must be presented to the show planning committee at each meeting and must be available to the chairman at any time.

Caution. The finance coordinator should not be identified by show badge or ribbon. He/she should not be known to anyone other than the show coordinators and chairman. This person requires a secure separate room with unobtrusive access and low visibility to show attendees. He/she should make arrangements with hotel/convention center officials for frequent deposits of funds in a nearby safe. Cash on hand should be minimized before, during, and after the show. Ticket income must be processed and deposited at frequent intervals during the show. Accept personal checks in payment of registration, exhibit, and similar show fees. Encourage payments by check to minimize handling of cash. I have only had three checks fail to clear in 15 years of handling show funds. Those were due to bank account shifts and they were all subsequently made good. The only people allowed in the finance control room are the finance coordinator, his/her designated runner, and the chairman. The runner's duties include picking up ticket stubs and money at regular and frequent intervals throughout the show. The runner and ticket coordinator must ascertain that the ticket stubs count and the amount of money agree exactly at each pickup. Maintain a record at the pickup point showing individual and cumulative totals as they are approved by the runner and

the ticket coordinator (or his/her authorized representative). The finance coordinator maintains a similar record of ticket stubs and funds received and the two records are compared against each other at suitable intervals during the show. Two or three comparisons per day should suffice. Advise everyone to not accept a ticket stub or payment separate from the other; troubles arise if either is accepted separately. When ticket stubs have been counted and income has been recorded, the runner should immediately have the stubs deposited in the prize drawing barrel.

Banquet Expenses. If the show is to be held at a hotel or other convention facility, advise their officials in writing that just the banquet coordinator can obligate the show to be responsible for breakfasts, luncheons, suppers, drinks, and other food. Get all charges clearly defined; these include daily exhibit space, electrical, tables, chairs, separators, curtains, ashtrays, and similar costs. Ascertain whether each quoted charge is per day or per the total event span. Each convention facility has specific storage, shipping, security, and similar service groups they recommend and prefer to work with. Determine who these groups are and use them if they appear to be suitable. Advise hotel/convention center officials in writing that, other than food and drink expenses, the only show official who can accept responsibility for expenses is the finance coordinator.

Reports. All show income and expenditures must be reported at the planning committee meetings. The chairman and the finance coordinator should both be authorized to sign checks written against the show account; however, the chairman should not sign checks except in an emergency. Each coordinator should be required to submit expenses as soon as they are known and payments should be prompt.

Track all income and expenditures by functional categories such as advertising, banquet, exhibits, postage, printing (including signs), prizes, and ticket sales. Keep show finance records simple so that they will be easily understood by everyone involved with running the show.

Receipts. Either the finance or exhibit coordinator must furnish each paying exhibitor with a signed receipt showing paid booth costs.

Incorporation. There are advantages to incorporating your show as a non-profit venture in your state. If you incorporate as a non-profit group, list the ticket price as a donation fee and instruct registration booth personnel that they must give a ticket at no cost to anyone who requests one without paying. Operate such a show on a predetermined contingency fund based on about 10 percent of the gross income and decide before the show which projects and organizations will receive any money left in the contingency fund after all show expenses have been paid. Mention these prospective beneficiaries in show literature and during the banquet. Do not disburse your contingency fund until at least six weeks after your show ends. Bills have a way of trickling in quite slowly.

If you decide to run your show as a profit-making venture, it is again advisable to incorporate under the appropriate state codes, which are normally available in public libraries. The target profit level should be determined at the first planning meeting. It can be set as a percentage of gross income or a fixed amount. In any case, excess income should be put into the show in the form of gifts to attendees, exhibitors, and speakers, plus additional prizes. If you incorporate as a profit-making venture, you must again file state and federal income tax returns at the end of the year.

Summary

General. It is primarily the exhibits, seminars, and prizes that determine the attendees enjoyment of your show. Treat your exhibitors, speakers, and attendees very well. If you can do so, meet key incoming personnel at airports, reserve their rooms at discount rates, help them resolve storage and shipping problems related to their exhibit materials, and have tools, tape, and hardware available for their use. An adequate supply of a variety of electrical adapters can eliminate a lot of setup troubles.

Costs. Do not scrimp on show items because most show attendees are willing to pay top rates for a first class show. Do not hesitate to purchase the extra items such as bumper stickers, envelope stickers, and good cumshaw. Bear in mind that (to a large extent) you are running an adult toy show. Do not become overly impressed with the importance of the event.

Records. Maintain a complete history file of the show including a sample of each ticket, announcement, invitation, program, booth agreement, layout drawing, flyer, and all other items associated with your show. It is easier to improve on your prior items than it is to start all over again the next time you are going to run a show. A summary of all show finances is an important item to include in the record file, plus lists of prize winners, speakers, and exhibitors.

It is hoped that you will read this four part article in its entirety. If your group has been running shows, you may have developed ideas and procedures that are different from those expressed in this article. Such differences are expected since objectives and conditions vary a lot. This article is just a set of guidelines intended to aid groups planning to run amateur radio shows. Constructive comments will be welcomed by the author.

Novices are urged to submit good black-and-white pictures of themselves at their operating positions. If your photograph is printed in a future Novice column, you will receive a one year subscription (or renewal) to *CQ*. A brief description of operating activities and some personal background information are needed with your picture.

Some of the stations I've recently worked on the novice bands are: Jerrold, WB1FNU, @ Mystic, CT., Don, KA2EAV, @ W. Hurley, N.Y., Joe, KA3BRO, @ Beaver Falls, Penn., Mary, KA4IKT, @ Memphis, Tenn. Jim, KA5CKR, @ Pine Bluff, Ark., Bob, KA6HJG, @ Pine Valley, Calif., Karen, KA7EJO, @ Indianapolis, Indiana, Allen, WD0BWH, @ Jefferson, S.D.

73, Bill, W6DDB

This month by

ROD LINKOUS, W7OM

DX

NEWS OF COMMUNICATIONS AROUND THE WORLD

I have missed the pileups these last few months. A new addition to the house tore out the antenna cables and my boss has me keeping United Airlines solvent with frequent trips to W3 land. Now that things are almost back to normal, my need list is out again. Those left seemed awesome a year ago, but now they are down to a manageable few, thanks to a DX repeater and a great friend in W1 land.

The Dynamic World of DX

The most extensive DX survey of most needed countries is about a year and a half old by now. Art Westneat, W1AM, surveyed the DX readers of a well-known bulletin. Over 700 DXers replied. They, on the average, had 269 countries confirmed.

I thought it might be interesting to look at what the dynamic characteristics of DXing have done. Especially since the sunspot activity has blessed us with great conditions.

The most commonly needed countries in the USA then were:

1. BY - China
2. 3Y - Bouvet
3. 8Z - Saudi Arabia/Iraq Neutral Zone
4. VS9 - Kamaran
5. XZ - Burma
6. ZA - Albania
7. VKØ - Heard
8. 1S - Spratley
9. VU - Laccadives
10. Abu Ail (Red Sea Islands)

Fortunately a group of JY DXers thought an 8Z4 operation was long overdue. To quote the QSL card:

"Neutral Zone Expedition was carried out by the Royal Jordanian Radio Amateur Society in Celebration of HM JY's 44th birthday, Nov. 14, 79. Operation was from 10-21 Nov. 79. Total QSO 40,800 on five bands s.s.b. and c.w. Special thanks to HH Prince Talal HZ1TA."

So 8Z4A satisfied many old timers and newcomers alike.

5632 47th Ave. SW, Seattle, Washington 98136

Colin Richards, 9M2CR, shown at the operating position in his QTH 70 miles from Kuala Lumpur. The shack is 50 yards from the sea. He writes... "daily temperature always 95 max, evening 75, 150 inches rain a year and the most and biggest thunderstorms in the world. That's why I keep my mono-bander down to 35 feet – surrounded by coconut palms and tropical trees." (Photo via W7AQB)

A courageous crew evaded gun boats to bring us 1S1DX from Spratley. As the story was told this one almost didn't happen. Yet, most who needed this rare Southeast Asia country logged him.

The DXpedition to Abu Ail Island, OE6XG/A was another delight of the year. A five-man crew ran up 12,700 QSOs on this trip. Another rare one fell from the list.

John Snuggerud, LA1VC, put a large dent in the demand for Bouvet. With an ICOM IC-701 and some marginal antennas, 3Y1VC came into the pileups and satisfied many.

Stories of the others aren't as rewarding. A Japanese DXer arranged for a public display of amateur radio in China and was legally on the air for a demonstration. Unfortunately for the world, a jammer came on the frequency and many do-gooders jumped in to help resulting in chaos of unparalleled proportions. The Chinese stopped the show.

Several attempts were made to activate Albania, ZA, and Burma, XZ, but to no avail. Several pirates appear now and then to excite the multitude. (*Ed.*As Cass always said, "work'em, logg'em and then worry.") George Collins VE3FXT/HS4AMI is pushing for the Burma operation and may eventually pull this one off.

China has opened its doors to trade and tourism. The exposure to many by visiting amateurs may eventually reactivate this sleeping giant. Then we may have another JA type boom to DX-ing.

The discouraging letter cited in last May's DX column forecasts a long dry spell for the Laccadives. Yet many recall the same restrictions on Navassa Island not so many years ago.

A DXpedition or year long stay of an amateur on Heard Island seems the most promising. Jim Smith, P29JS, writes from Papua New Guinea of the formation of the Heard Island DX Association. They have pursued this quest with the Australian authorities. There appears to be no problems of permission if the DXpedition is a "well planned, well founded and good intentioned amateur DXpedition." Those interested should contact Jim either by his call book address or on the air. He is very active. The subject is best handled by mail.

The activation of Albania, Burma, China, Kamaran and the Laccadives is in the fate of the political arenas. Avid DXers have overcome greater obstacles and perils to reactivate rare spots around the world; so have faith.

Of the top ten—four have fallen and one is being assaulted. So a new list is being formed by Father Time. (Jim at the *DX Bulletin* is also preparing a new survey.) It will be interesting to see if the other six of my remaining nine make the list. It seems if they are on the top ten list they are more apt to become active.

An interesting side light is the activity to keep countries out of the top ten. The many DXpeditions and the activity from DX spots slowly erodes the demand. Many that are candidates get worked while they are on the way to the top. Thus, on examination, I hope my other six never get to the top.

From the Pileups

Jan Gould, WA6YQW/KH5 is recovering from the terrible plane

The WAZ Program

10 Meter Phone

45...JH7JGG
46...WB8TLI
47...WB0RLY
48...JH6TEW
49...N8II

20 Meter Phone

292...WA0TUW
293...K4CXY
294...VE3BDE
295...WB4LIB
296...W7JAL
297...JA6CM
298...UK2BAS

15 Meter C.W.

26...N4MM
27...JH6HYC
28...JH6CAZ
29...SM5AKT
30...JR6RRD

20 Meter C.W.

103...WA4GHO
104...N6DS
105...UK2BAS
106...UA3ACI

All Band Worked All Zones

S.S.B.

1899...WD8JAB
1900...N8ACA
1901...WD4ABN
1902...W3KFQ
1903...W6KBB
1904...WA2DYN
1905...I1ZZL
1906...KQ4O
1907...WB0RLY
1908...JA8CLN
1909...WB0OQC
1910...WB7QXK
1911...K5VRX
1912...WB0LXM
1913...UA9MR
1914...UA3AH
1915...UK3DAH

C.W. and Phone

4785...ON7EJ
4786...W9XK
4787...AI3R
4788...W3NF
4789...WD8NBD
4790...JA2ODB
4791...W0RT
4792...N9ER
4793...K4TFI
4794...WB8TRW
4795...WA4SKE
4796...W2WZ
4797...K3JGJ
4798...W8AD
4799...K1VJH
4800...K7UA
4801...W4CEB
4802...WB4OPG
4803...OH1LF
4804...VE1MF
4805...W7GUR
4806...9M2FK
4807...UV3WT
4808...UA6LBO
4809...UA9AAX

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (30 cents) size 4½ × 9½ to the WAZ Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL Cards direct to the WAZ Manager or to a check point should include sufficient postage for the safe return of their QSL cards. The processing fee for all C.Q. Awards is $5.00.

Chris Pemberton, 3D6AC (left) visits with Hal Hickey, VE7BTV at a recent Frasier Valley DX Club meeting. (Photo by W7EKM)

CBA. Further to his report, we've heard that BP2A license does, in fact, exist. But we understand that it is only for listening purposes. (*Long Skip*) The 1980 Alaska DX Association officers are: Pres-KL7AF, Tony Smaker; VP-KL7RA, Richard Strand; Sec/Treasurer-AL7O; and Activities Manager-KL7PJ. (*AL7O*) BV2B, KP4AM, G3FKM, YB7AAU and JR1ZZC are among the thirty plus DXers registered as of 1 May for the Big DX Meeting in Seattle the last weekend of July. This is part of the national ARRL convention. Write N7CY or W7LFA. (*Totem Tabloid*) Mario, HH2MC was badly injured in an automobile accident. He was returning from his mountain QTH with his XYL, HH2YL, and friend HH2BM when the car went off the road. All were injured slightly, but Mario spent some time in the hospital. He is now at home recovering. (*QRZ DX*) K6LPL/KH3 produced 12,180 contacts in all *CQ* Zones and 125 countries during six days of operation. His next stop is FS7, French St Martin, for a vacation and a little operating. (*The DX Bulletin*) Have HW-101 and tribander on from Diego Garcia. Hope to have amplifier if can find loaner. Averaging over 100 QSOs a week since starting here. Our crew VQ9TT, VQ9JJ, VQ9TR, VQ9DM, VQ9WE and VQ9JP operated the club station VQ9CI for 1,105 contacts during recent contest and hope to operate others. VQ9JJ is leaving after 18 active months of operating from the single club station. (*VQ9TT*) Jerry, TU2IN, is active from the Ivory Coast most days. Usually he can be found around 28.592 MHz from 1600 to 1800 GMT. (*QRZ DX*) Another big Pacific DXpedition in the first stages but headed out soon. Hope to activate, Midway, Wake, Johnston, Palmyra, Kingman, Line Islands, and to Polynesia. (*AA6DX*) KL7IRT package of 5,000 QSL cards headed for the outgoing ARRL QSL bureau lost in the mail. Most cards headed for Europe and South America.

The WPX Program

Mixed

832...DF2RG
833...WB0YMR
834...WB4SXX
835...YU3FK
836...YU3APR
837...W5SG
838...WB3CFD

S.S.B.

1261...I1HAG
1262...KB8DB
1263...K6BMX
1264...JA6CM
1265...K5GKC
1266...WB4UBD
1267...SV1EX

C.W.

1926...OK3CFF
1927...OK2BJU
1928...WB3JRU
1929...VE1ANU
1930...IS0NZA
1931...UA1AJ
1932...UA3QEL
1933...UA3RM
1934...UA9MR
1935...UA0IAW
1936...UB5ZBF
1937...UQ2AP
1938...UQ2GEC
1939...UK5AAA
1940...DJ4ET
1941...DL7IJ
1942...OZ5KU

WPNX

181...WL7ACP

VPX

182...UA3-123-213
183...UA3-127-300
184...UA3-127-333
185...UA3-170-881
186...UA9-140-113
187...UA9-167-210

Endorsements

Mixed: 400 W0TT, WB0YMR, W5SG, WB3CFD. 500 WD0EPE, DF2RG, WB3JUK. 550 K5GOE, WB4SXX, WB8YQX. 650 YU3FK. 700 K9XJ, OK3IF, I2MQP. 750 I1HAG. 800 W9NO. 850 DK4SY. 900 OK1IQ, YU3APR. 950 K8LJG. 1000 UA3FT. 1150 N6FX. 1500 K2POA. 1600 N4MM. 1650 W2NC.

SSB: 300 K5GKC, WB4UBD. 350 WB3HPJ, KB8DB, JA6CM. 400 WB0OQV, WD0EPE, K5GOE, AG4L, UA3IJ. 450 W3GXK. 500 WB8YQX, JA3XRC. 700 W1BPM, I2MQP. 800 CX9CO. 850 N6FX.

CW: 300 WB3JRU, VE1ANU, IS0NZA, UA1AJ, K6BMX, UA3QEL, UA0IAW, UB5ZDF, UQ2AP, UQ2GEC, DJ4ET, DL7IJ, OZ5KU. 350 OK3CFF, AG5C, UA9MR, UA9AAB. 400 OK2BJU, IT9VDQ, JA7ARM. 500 UA3RM, UZ3ER, UA9YAQ. 600 OK3YCA. 650 K9UQN, N4YB. 700 OK1KDR, I3HDH. 800 F6CRT. 850 VE6CNE. 900 VE1MF. 950 N6FX. 1000 YU7SF. 1300 WA2HZR.

15 meters: DK4SY.
20 meters: DK4SY, N6FX, OK3YCA, OK1DKW, UA3RM, UA9MR, UA9YAQ.
40 meters: I2DMK, OK3IF, OK3YCA, OK1DKW, UQ2GEC.
80 meters: DK4SY, UQ3GEC, UA9YAQ.
160 meters: WB8YQX.

Asia: JA7ARM, DK4SY, OK3YCA, UA3RM, UA9MR, UA9YAQ, UW9SG.
Europe: OK2BJU, JA7ARM, I3HDH, UA1AJ, UA3RM, UA9MR, UQ2GEC, UA9YAQ.
No. America: DL1ES, YU7SF, OK3IF, DK4SY, OK3YCA, OK1DKW.
Oceania: K5GOE.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX AWARDS, 5014 Mindora Dr., Torrance, Calif. 90505. U.S.A.

crash on the recent Pacific DXpedition. Jan is very thankful to the 4,000 + amateur well wishers who came forward with cards, letters, flowers, cablegrams and calls. (*Worldradio*) DX will miss one of its most avid DXers with the passing of silent key Jim Fisk, W1HR also the editor-in-chief of *Ham Radio* and *Ham Radio Horizon*. (*HRR*) China. Word from Tommy Wong, VE7BC, is that BP2A is not for real and that he is still working on a license for himself. Also, he's still looking for electronics oriented educational material and you can save such material for him, then send it in bulk to his

(*The DX Bulletin*) VU2GO, Gopal, a famous Indian DXer, was killed in a bus accident. Gopal was one of our few chances to get permission for a VU7 Laccadives operation. (*The DX Bulletin*) Looking for KH6 on 80 meters to finish up 5BWAS. (*WB3AKI*) YV0USB, Aves Island. If you've wondered why this operation didn't come off as scheduled, there's a good reason. The fellows who planned the operation didn't know they wouldn't be going to the Aves Island they wanted to go to, and didn't realize it until everything had been packed and the boat was ready to leave. It seems

THE WPX HONOR ROLL

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ Master Prefix list. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or to confirm present total. If no up-date, file will be placed into "inactive" until next up-date. No fee required for addition to Honor Roll.

MIXED

1855 YU2DX	1536 W7LLC	1287 N4NO	1129 N6FX	902 K6DT
1814 K6JG	1525 W2NUT	1286 AA4A	1126 K5DB	873 N6JM
1814 K6XP	1525 N4MM	1283 N6JV	1109 I6SF	855 YU2CBK
1808 F9RM	1514 W9DWQ	1275 N2AC	1095 I0JX	852 SM3EVR
1805 W4WV	1512 W4BQY	1275 N6AV	1066 WA1JMP	851 K8CH
1638 W3PVZ	1462 DJ7CX	1260 I2PHN	1048 JH1VRQ	848 W6ANB
1626 W2NC	1454 K5UR	1179 YU1ODS	1015 W0SFU	782 YU4EBL
1610 ON4QX	1408 N6CW	1179 YU1AG	1010 IN3ANE	758 UA3FT
1609 VE3GCO	1401 PA0SNG	1155 W8CNL	1008 WA2AUB	700 I2MQP
1605 N4UU	1350 KE4I	1150 W0AUB	1002 PA2TMS	668 N8II
1600 K2VV	1332 W9FD	1146 DL1MD	950 PY4OD	644 DK7XX
1577 YU7BCD	1307 N9AF	1139 K6ZDL	950 K8LJG	605 I4BFY

S.S.B.

1708 F9RM	1300 K2VV	1051 WB2NYM	938 OE2EGL	839 W2NC
1684 I0AMU	1268 YU7BCD	1050 N2SS	932 W6YMV	821 CT1UA
1610 K6XP	1229 K5UR	1017 DL1MD	909 PY3BXW	804 WA2AUB
1606 I0ZV	1225 ZL3NS	992 W0YDB	908 I0MBX	760 N2AC
1600 W4UG	1207 W9DWQ	989 DJ7CX	900 JH1VRQ	759 ZP5RS
1548 K6JG	1200 I4ZSQ	967 PA2TMS	888 W4BQY	718 I6NOA
1430 I8KDB	1193 PA0SNG	962 OZ5EV	881 N4NO	706 WA2FKF
1400 I8YRK	1145 N4UU	962 YU7ODS	841 YU1AG	
1350 N4MM	1102 AA4A	957 W6RKP	854 N6FX	

C.W.

1524 W8KPL	1251 N6JV	1110 K5UR	877 I6SF	658 EA2OP
1433 W2NC	1234 W9FD	1088 I2PHN	851 KH6HC	650 K8LJG
1432 ON4QX	1188 G2GM	1067 VO1AW	833 LZ1XL	647 W9OYZ
1414 DL1QT	1165 W4BQY	1062 WA0KDI	808 I5IZ	628 W1WLW
1368 K6JG	1150 W3ARK	1013 K6ZDL	802 PY4OD	612 WA2AUB
1329 K6XP	1150 K2VV	978 N4MM	756 SM0GMG	
1327 N4UU	1124 DJ7CX	966 YU1AG	709 DL1MD	
1304 WA2HZB	1123 N4NO	925 YU1ODS	700 JH1VRQ	
1288 YU7BCD	1116 N2AC	912 N6FX	679 I1YRL	

The new Frasier Valley DX Club officers gather for a group picture. This year's officers are from both sides of the British Columbia/Washington border. (l to r) Al, W7EKM – president; Terry, VE7BFO – secretary/treasurer; Dick, N7RO — VP; and Henry, VE7WJ — club contest and awards chairman. (Photo via W7EKM)

Don and Lynette Jerome are two recent recipients of the CQ DX Awards. Don, N7ASL, prefers phone while Lynette, WB7TFT, is the c.w. operator. Between the two, the rig never cools off and the rare ones seldom get away.

One reason Ken Palmer, K2FJ, keeps going to the Caribbean: "One of the pluses" of my DXcursion to Barbuda Island is the lobsters." His operation from K2FJ/VP2A, Barbuda Island, was from the same cottage as K7SE.

there are *two* Aves Islands . . . actually, there's the one we know as YV0 which is up in the Caribbean, just west of Dominica and then there's a group of them called Islas de Aves, also in the Caribbean but just east of Bonaire. Well, the group didn't find out until it was almost too late that the transportation they'd arranged was going to the second spot . . . which was not the one they wanted. So they unpacked and went home. No plans have been made to get to the right spot, at least not yet. (*Long Skip*) The QSO grinding team of Iris and Lloyd Colvin, W6QL and W6KG ground out 10,000+ contacts from HI6XQL. Their DXpedition as J3ABV, VP2SAX, J6LOO, J7DBB, VP2KAH and HI6XQL gave out over 55,000 QSOs. Their fun was our reward. (*The Dxer*) I would like to be a QSL manager for a DX station. (*KA8AKL*) We are reporting DX info for S/TX DXers. *The Pile-up* is an American style version of the Geoff Watt *DX News Sheet.* With a lot more inputs it may become a Texas version. (*K5DB*) ZD8TC, Ascension Island with an outstanding signal on 160 meters, is regularly near 1827 kHz from about 0630 GMT. (*LIDXB*) Couldn't believe the unsportsman-like conduct during the recent VK9XT operation. (*WA7CPT*) (ed. Remember that unsportsman-like conduct is grounds for dismissal from most awards programs including DXCC. If you don't like what you hear, several notes to the DXCC desk can cause the chaos creater another kind of chaos.) Word comes from HB9DP, also 5R8TV, that he has no plans to return to Malagasy before September, 1980. (*VERON*) What was Don, W6AM, DXer extraordinare doing up a tower doing antenna work at age 81? Getting national PR for amateur radio that's what. (*HRR*) Peter is now home in Europe and S2BTF is off the air. (*Long Skip*) Mid October is the new forecast for a 7J1, Okino Torishima operation by JE6NEM and JE6NLL. These recently-licensed ops shelved the May date when they scrapped a round-the-world diving tour for a crew-berth on a Pacific fishing boat. We hope the delay will replace the intended 10 watt transceiver with something more potent. (*LIDXB*) K7RI didn't defend his WPX phone title since his antennas were down. But their replacement is up. An impressive phased pair of 40-foot-boom tribanders and a 4-element 40 meter beam. All on a single small city lot. (*Totem Tabloid*)

BV2A, Formosa is active on 15 too!! 21023 kHz. (*VERON*) VK0RM on Heard failed due to equipment and operator problems. But made 65 contacts. Have faith, P29JS is working on the solution. (*The Pile-up*) If you want Mariana Island QSL cards do not use the KG6 bureau . . . . try the Mariana KH0 QSL bureau via Box 7388, CHRB, Saipan, M.I. 96950. (*KH0AC*) DL7FT trip to Albania is off for the time being. (*HRR*) JD1ALM and JD1ALE are on Ogasawara Island. (*VERON*)

Novice WPXer

It appears that in this day of multiple call prefixes, working WPX is not limited to the most avid or to the extra class. The first WPX award was recently awarded to Bernie McClenny, WB3JRU a Novice. (*Ed.* Makes you want to unplug your linear . . . doesn't it?) Congratulations Bernie!!

CQ DX Awards Program

S.S.B.

839	WD4DZH	847	OK1JMW
840	I8HZT	848	TG9RN
841	KB6GU	849	AF2O
842	WB8TLI	850	WB3HTK
843	KB2ED	851	JH4PRU
844	K0FA	852	G4CQK
845	XE1XF	853	K4DSK
846	WA7ILC	854	K1WJ

C.W.

425	OK3CFF	427	WB4FOT
426	WB3FIY	428	WD9GSU

S.S.B. Endorsements

310	I8KDB/317	250	WA0TUW/251
310	W3GG/311	250	K1WJ/252
310	ZL1AGO/312	250	K9UAA/250
300	W0YDB/302	200	WD5CHM/219
250	WA6TOO/259	200	WA2SRM/200
250	WA4TLI/258	150	K4DSK/152

C.W. Endorsement

NONE

The total number of active countries as of deadline was 319. Complete rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope . . . self-addressed and stamped to CQ DX Awards Manager; Billy Williams, N4UF; 911 Rio St. Johns Dr., Jacksonville, Fla. 32211 USA.

Answers: April CQ DX Quiz

1. K1MM
2. W7PHO
3. Geoff Watts
4. RSGB
5. 4W2AA
6. Herb Becker, W6QD
7. W3HNK
8. UA0ALK
9. DM East Germany
10. Six
11. IY0KOW
12. T3
13. A22, HS, S8, T4, 7P
14. Canary Islands
15. WA3HUP
16. UF6 Georgia
17. 500
18. KH9
19. Mongolia, China, Siberia
20. ON4UN

Answers: July DX Quiz

1. Any of 6 of the following: Mexico, Philippines, U.S.S.R., Venezuela, Yugoslavia, Ceylon, Peru, U.N. Geneva, U.N. New York, Haiti, Yemen, Israel.
2. Mixed WPX, S.S.B. WPX, C.W. WPX, WPNX, VPX and WPX Award of Excellence.
3. Venda
4. JY1
5. TY
6. Zones 2, 18 and 19.
7. False
8. True
9. TY
10. OY
11. 31
12. False
13. Alabama, Tennessee & Kentucky
14. Red Sea
15. False
16. All are surrounded by one country.
17. Iraq and Saudi Arabia
18. a.) Only on c.w.
19. KV4AA
20. Sarawak

QSL Information

A4XFP to G4JBT
A4XIA to DK2UW
A4XIQ to K2IJL
A4XIR to DK2UW
A4XVK to G3TTC
A6XJA to PA0LP
A7XB to DJ9ZB
A7XD to WD4PYF
A7XE to DF4NW
A7XM to DJ9ZB
A22BT to DJ0FZ
A35DE to WB7OVA
A35EK to WB7OVA
A35FI to WB7OVA
A35PF to K9LSA
A35SM to WB7OVA
A35TV to WB7OVA
A35VV to WB7OVA
AH8A to WB5FBN
AP2ZR to JA6GDG
C5AAS to G3LQP
C5ABV to N4BPP
C5ACW to OZ5QU
C6ACY to K4ZGB
C31SJ to DL1HH
CN3RM to EA3OG
CN8CG to F6ETL
CT2CB to KB5GL
CT2CE to AG1K
D68AM to F2ZG
D68AR to F6ACB
DF4SU/ST2 to DF4SU
DJ1US/ST3 to DF2RG
DJ7SB/TJ1 to DL6KB
DK5BD/ST2 to DF1BP
DL7SB/TJ1 to DL6KB
DU1MRC to JG3CAE
EA6GB to WB1DQC
EA9IE to EA9GZ
EE8URE to EA8AK
EI5V/OD5 to EI5C
EL7A to DL2GA
EP2GY to JH1PLL
FB8XY to F6CIU
FB8ZO to F6EYB
FC9VN to F9VN
FG7TD to F6AZN
FH8CL to I1KFB
FK8CK to I0PQ
FK8DD to WB3JUK
FK0BW to DJ5CQ
FK0CQ to DJ5CQ
FM0FJE to F5VU
FO0DX to K1MM
FR7BP to W0AX
G5CTB to W3HNK
GB4DAA to G3FXB
H31LR to WB3KGY
HB0BEI to HB9BEI
HD0MM to K1MM
HH2PW to WD9GSO
HH2VP to N4XR
HI6XQL to YASME
HK0BKX to WB4QFH
HL9KY to W8YGA
HL9UG to N4CPR
HM5KY to W4KGH
HP1XEK to DL1HH
HP1XOJ to WB3KGY
HS4AMI to VE3FXT
HV3SJ to I0DUD
IP5ONU to I5HCH
J3ABT to W6RGG
J5AG to SM3CXS
J6LET to WB2MMV
J6LIR to WB6FCR
J6LJA to VE3GWY
J6LOU to KA4BOT
J7DBB to YASME
J28CB to I8JN
JA1PIG/PZ to JH1EDB
JD1AKE to JF1ACZ
JW1SO to LA5NM
JY2RZ to WB4RRJ
JY4MB to DJ3HJ
JY9LG to WA4DXL
K4FW/VP2K to K4FW
K5UA/KH2 to K5UA
K7SE/PJ5 to K7SE
K9EF/8R1 to K1RH
KA6DC to WD4NKZ
KC4USR to K9VFY
KH0AC to K7ZA
KP2A/J7 to K2TJ
KV4AA to K6PBT
N4HX/TT8 to ON5NT
N5RM/NH0 to N5RM
NP2AB to K8OHC
NP4A to W3HNK
NP4AU/YV5 to YV1TO
OH0AM to OH2BBM
OY5J to YASME
P29GC to VK2BSM
PJ8UC to W3HNK
PJ9GR to WD0FNK
PP0MAG to PY1MAG
PR8ZPJ to W7BUN
PY0BW to PY2JO
PY0JY to PY2JO
S2BTF to W5RU
SR50PZK to SP2FAX
T2TC to W7CL
T3AC to W5RBO
T3KC to W5RBO
TA2FM to VE1BBS
TA2KS to G3SJP
TG9AL to K8HV
TG9GI to K8HV
TG9ML to K5BDX
TG9VN to I0WDX
TG0AL to K8HV
TI5EWL to AG1K
TI9TE to TI7TE
TL8JM to W5RU
TL8SW to W5RU
TN8AJ to YZ5LO
TR8DCD to G8RVV
TR8PO to F9ON
TU2IR to VE3ECP
TZ4AQS to ON6BC
UA1PAL to UA1OSM
VE3BVD/ST2 to VE3FRA
VK2DIK/VK9 to DJ5CQ
VK9NM to DJ5CQ
VK9NS/LH to P29JS
VK9XT to VK3OT
VK0KH to VK5WV
VK0RM to VK3AKK
VP1A to WB0TNY
VP1CS to K0CS
VP1KI to JA2AAQ
VP1RLB to WB0TNY
VP1SAR to WB0ISW
VP1SWC to KA0BCW
VP1WG to W0DEL
VP2A to K4PJ
VP2AK tp K4PJ
VP2AZF to OE3ALW
VP2AZG to OE3ALW
VP2E to K8NB
VP2EES to K4VTE
VP2EEu to WA4ZSX
VP2EEV to K8ND
VP2EEW to WD8ALG
VP2KAH to YASME
VP2KAK to WB8LDH
VP2KAL to WB8LDH
VP2KAM to WB8LDH
VP2MFC to K1ZZ
VP2ML to K1RH
VP2VEC to KB0XU
VP2VFE to WB6FCR
VP2VFI to K1IJU
VP2VFT to K1IJU
VP2VFU to K1IJU
VP2VFV to K1IJU
VP2VGF to WA1GXE
VP5DX to W5KHT
VP5EE to WA4FBH
VP5JPX to N4ZS
VP5RIT to WB5EUP
VP5WRJ to WB5UEB
VP9AD to W3HNK
VQ9DM to K1ZZ
VQ9RM to WB2GTW
VQ9TT to KB5MZ
VS5MM to K1MM
VS5SS to JA4ENL
W6ENK/KH4 to WB9MFC
W7KEU/OA8 to JH8DSC
WA7JRL/SU to W8LZV
WA7JRL/4X W8LZV
WA7UWE/C6A K4ZGB
WD8QGQ/KH7 to KH5JEB
XE1RL to WD8NKT
XT2AU to WA1ZEZ
XT2AX to DJ8XF
YB9X to JA1UT
YB0ACL to W4QO
YC1BZ to WA0YJA
YJ8YS to JL1CII
YK1AN to DJ9ZB
YS9WP to K1MM
YW1AVO to YV1TO
YX1DIG to YV1TO
ZD7MG to N3ANH
ZD8HH to W4FRU
ZD8TC to N2CW
ZK1AC to G3RWU
ZK1CA to ZL2UW
ZK1CI to G3ZXD
ZS3HL to WA1ZXF
ZZ5CA to K4BAI
3B6CD to JA3DYU
3B7CF to 3B8CF
3C1HJ to EA4HJ
3D2LK to W6EDN
3D6BW to G4AVA
4S7DX to WB2VFT
4S7MX to SM3CXS
4S7OL to W0JRN
5B4IJ to OE8HFL
5B4IZ to OE2EM
5K4LRM to HK4LR
5T5AY W4LZZ
5V7GE to WB3PYA
5Z4YV to JA2AJA
5Z4YW to VE3AHV
6D2AF to XE2AFK
6W8AR to WB4LFM or
6W8AR to DJ3AS or
6W8AR to JH1ARJ
8P6J to N6TJ
8P6MI to VE3JTQ
8P6MN to N5ASE
8P6NX to W0SA
8Q7AP to N6N1
8Q7AQ to DL7EM
8Q7AR to K2TJ
9A1ONU to I4ZSQ
9G1AP to I0LCJ
9Q5GB to W7KTI
9Q5VT to K5VT
9V1UH to G3VJG
9X5LE to SM5IB
9Y4LL to WB4RRK
9Y4NP to W3HNK

CQ Award Certification

To reduce the cost of *CQ* DX Awards and to expedite the paper work, local certification of the QSL cards is authorized. Specific checkpoints have been identified to check your QSL cards. This allows avoiding the mail system and thus the risk and expense.

We would like to welcome C. La Mar Ray, W9LT to our checkpoint team. He lives in Grabil, Indiana.

From time to time we like to recap our checkpoint team for your information. For those residing outside the U.S.A., you can use a recognized *national* amateur organization (e.g.

JARL) or one of the following:

Europe	
DL3RK	Walter Gryhalter
F6MS	Claude Ronsiaux
G3FKM	Dr. E.J. Allaway
HB9DX	Etienne Heritier
I8KDB	G. "John" Nucciotti
LA5QK	Alf Almedal
OH2PQ	Kari Pekka
OK1DKR	Central Radio Club
OZ1WL	Tague Eilman
SM5DQC	Osten Magnusson
SP5BB	Polski Zwiazek Aloweow
PA0MOD	Ad Sahderse
YO2RVS	Gran Gogo
9H4H	George Gauci
Africa	
S8AAF	Mic Prinsloo
ZE2JE	Mrs. Molley Henderson
North America	
KP4AM	David Novoa
VE1RY	Stanley Parsons
VE3GMT	Jack Reed
VE7AFY	H.A. Martin
XE1AE	Juan Cedra
YS1O	Oscar Orellana
South America	
CX7BF	J. Neil Watkins
LU1DJU	Carlos Hardy
PT2VE	Remy Flores Toscano
YV5AIP	Minguel "Mickey" Delagado
Asia	
HM1AS	KARC
JR1FRD	Tac Ohshina (also JARL Awards Managers)
Oceania	
KH6DD	Pat Corrigan
VK3AMK	Geoff Wilson
VK6JS	Jack Swiney
ZL2GX	Jock White

The above checkpoints, like their U.S.A. counterparts, can provide information and forms. Should you have any questions, drop the awards chairman a note for the particular award. They are listed in the awards status boxes in this column.

73, Rod, W7OM

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Castle Marina Inc.
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Communications Center Inc.
Lincoln, **NEBRASKA**
Communications Technology Group
Oceanside, **NEW YORK**
Communications World Inc.
Hinckley, **OHIO**
Conley Radio Supply
Billings, **MONTANA**
Custom Electronics
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Doc's Communications
Lookout Mountain, **TENNESSEE**
Douglas Electronics
Corpus Christi, **TEXAS**
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Idaho Falls, **IDAHO**
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Salina, **KANSAS**
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Rock Hill, **SOUTH CAROLINA**
HI Inc.
Council Bluffs, **IOWA**
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Hamtronics Inc.
Trevose, **PENNSYLVANIA**
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Tucson, **ARIZONA**
Quad Electronics Co.
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Radio World
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Radios Unlimited
Somerset, **NEW JERSEY**
Shaver Radio
San Jose, **CALIFORNIA**
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No-71-72

You can have local and regional v.h.f./u.h.f. QSO's and maybe even an inversion DX contact or two, with this compact beam within a beam configuration.

A Three Band Array For 144, 220 and 432 MHz

BY T.E. WHITE*, K3WBH

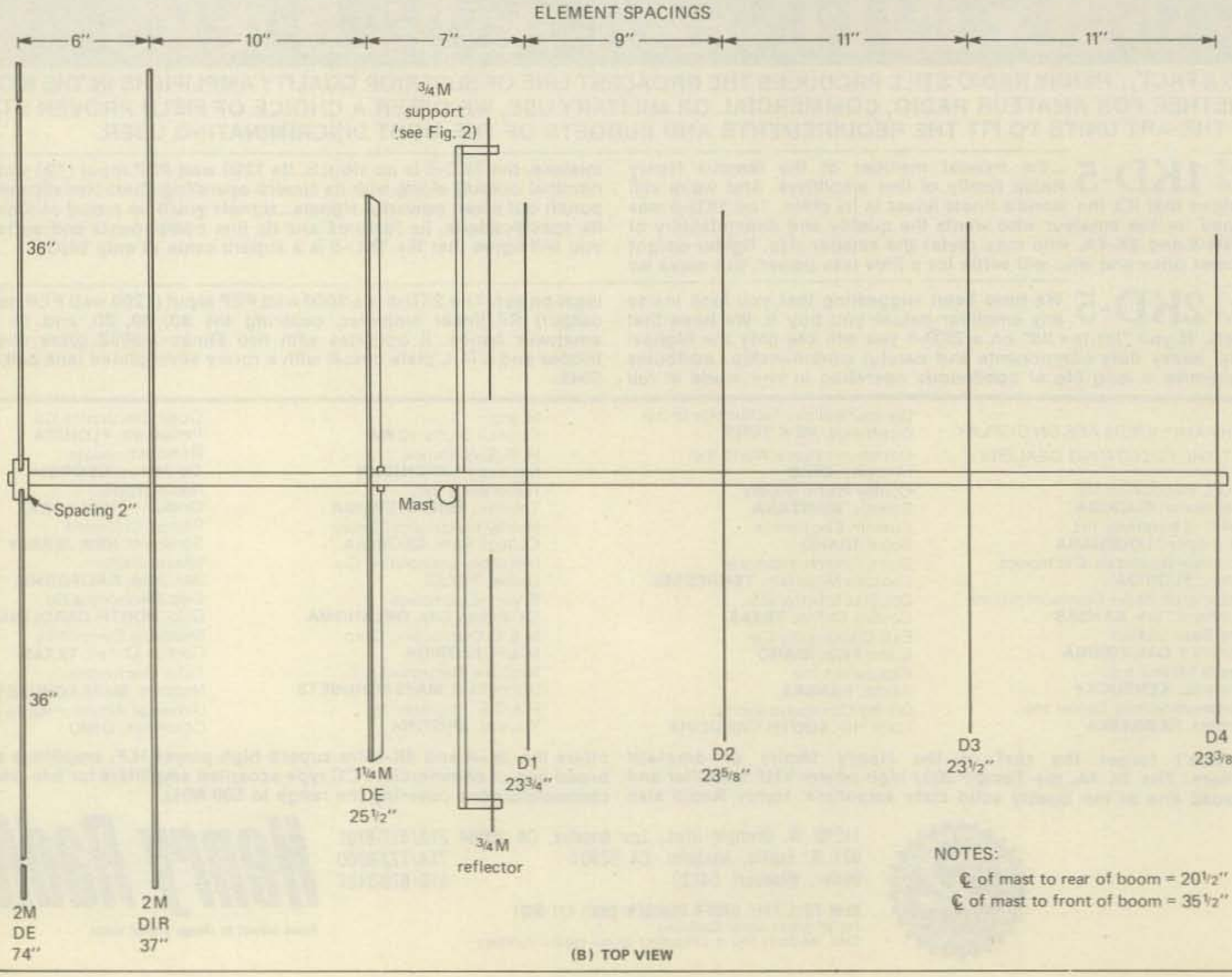
Simplicity and compactness are the criteria in this antenna design. The design parameters included something that could be mounted on a 5 to 6' length of mast, easily turned by a medium duty TV rotator and a maximum breadth of 6' or so with a depth of 4½ to 5 feet. The antenna should also try to approach 10 dB gain on 2, 12 on 1¼, and 14 dB on 3/4 meters.

The idea of putting together 2 dipoles end to end, backing them with a reflector, fronting them with a common director, then adding a similar lashup 3/4 λ apart, is nothing new or startling. You could even leave out the reflector. But it's a good way to get 10-11 dB in a compact area with a low wave angle (Fig 1).

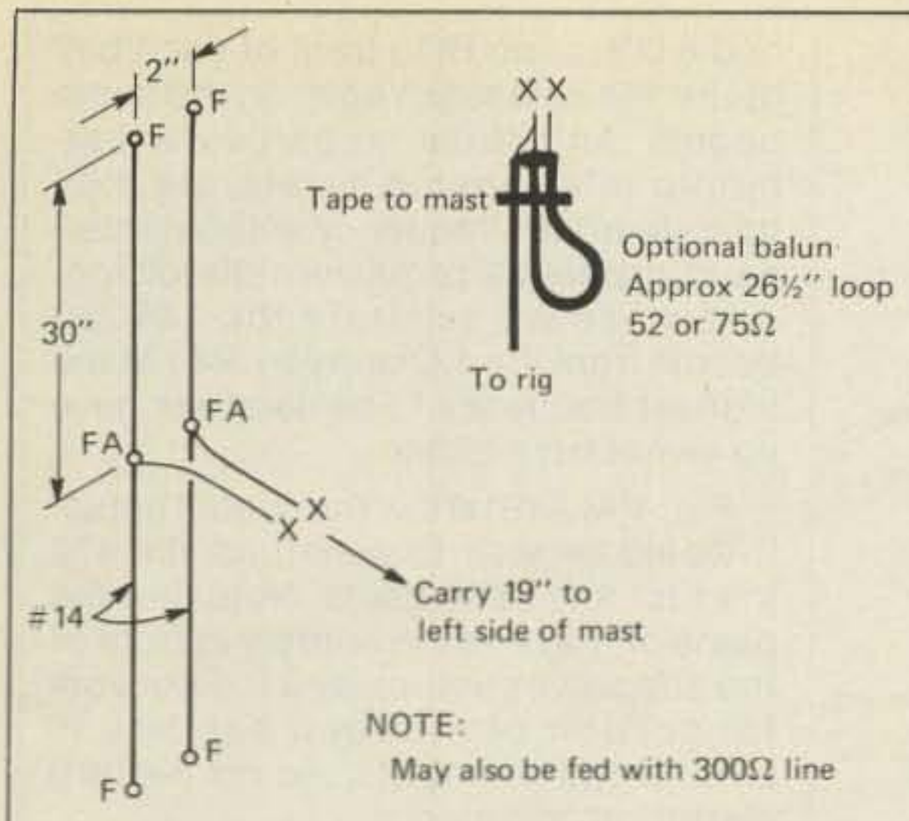
This is what we've done for 144 and 432, the latter frequency having 2 units side by side as filling in a sandwich. To save weight and material, we dispense with the reflector on 2 meters.

For 220, we mount a simple Yagi (DE

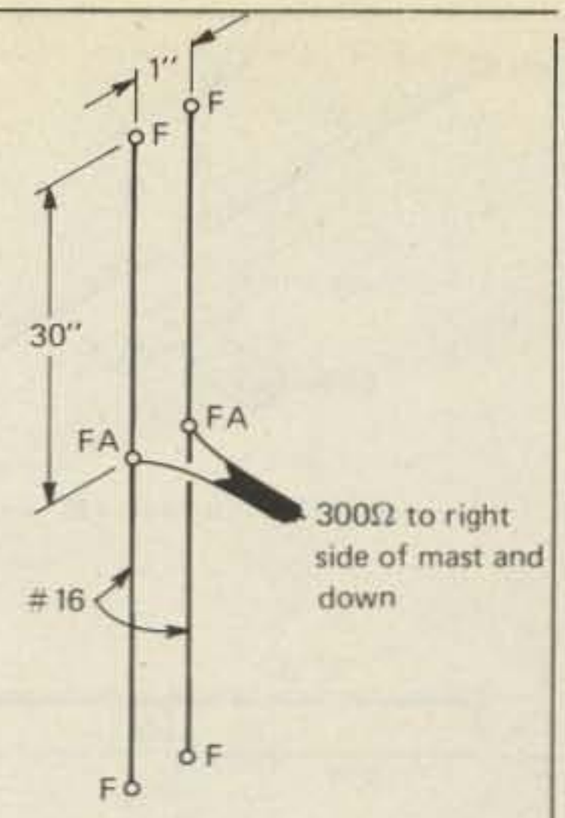
*36 Lake Ave., Fair Haven, N.J. 07701



(B) TOP VIEW

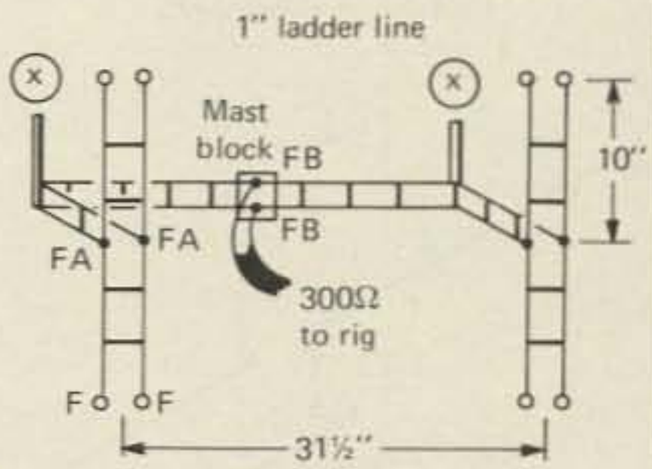


144 antenna



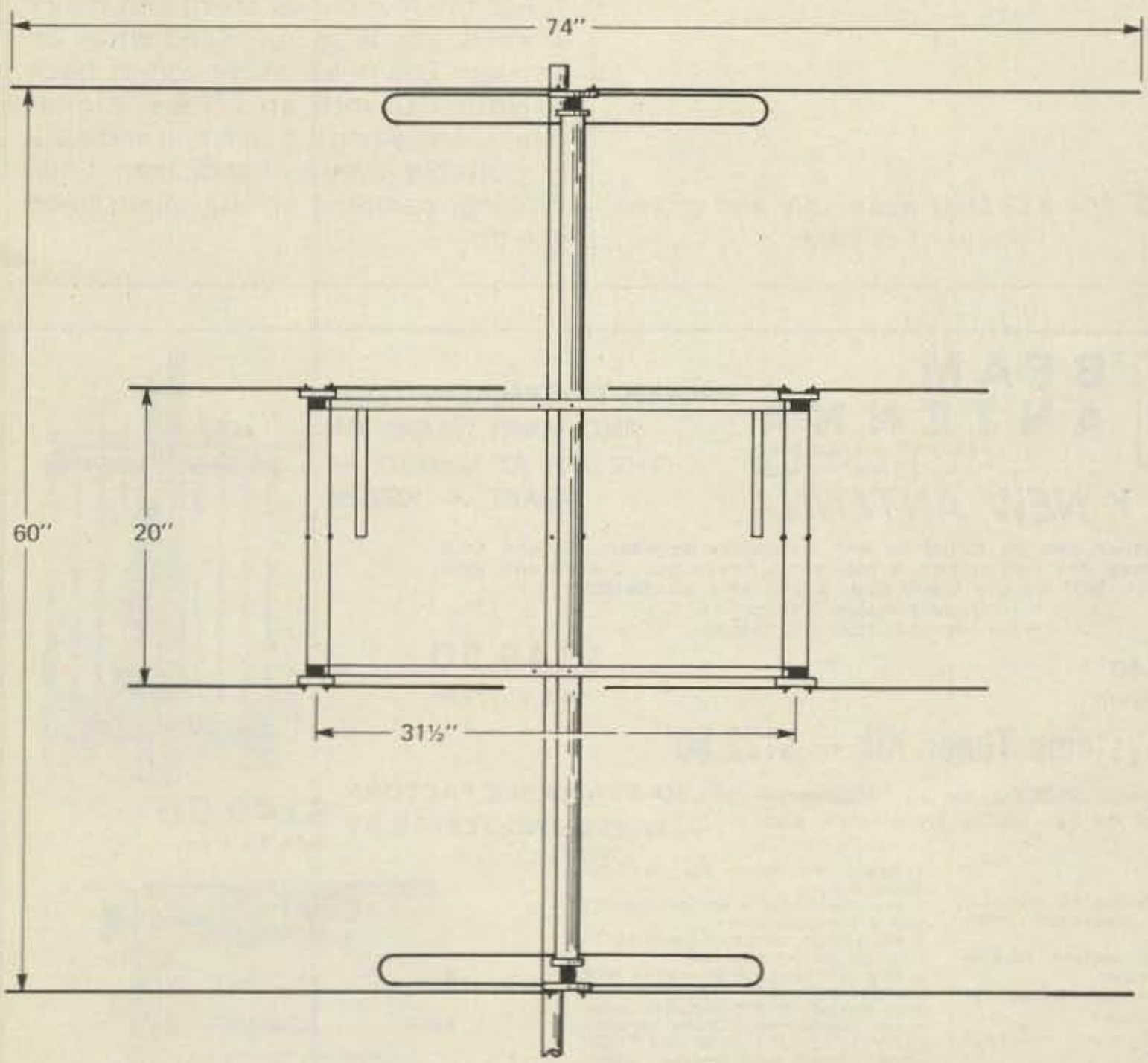
220 antenna

(X) = Harness support stick from upper crossarm.
Harness carried rearward for 6" from FA to FB.
Reactance tuning stub may be installed at FB – FB.



432 antenna

Fig. 2- Feed systems for the three band array.



(A) FRONT VIEW

Fig. 1(A) Front view of the three band array. (B) Top view of the antenna. Dimensions are in inches.

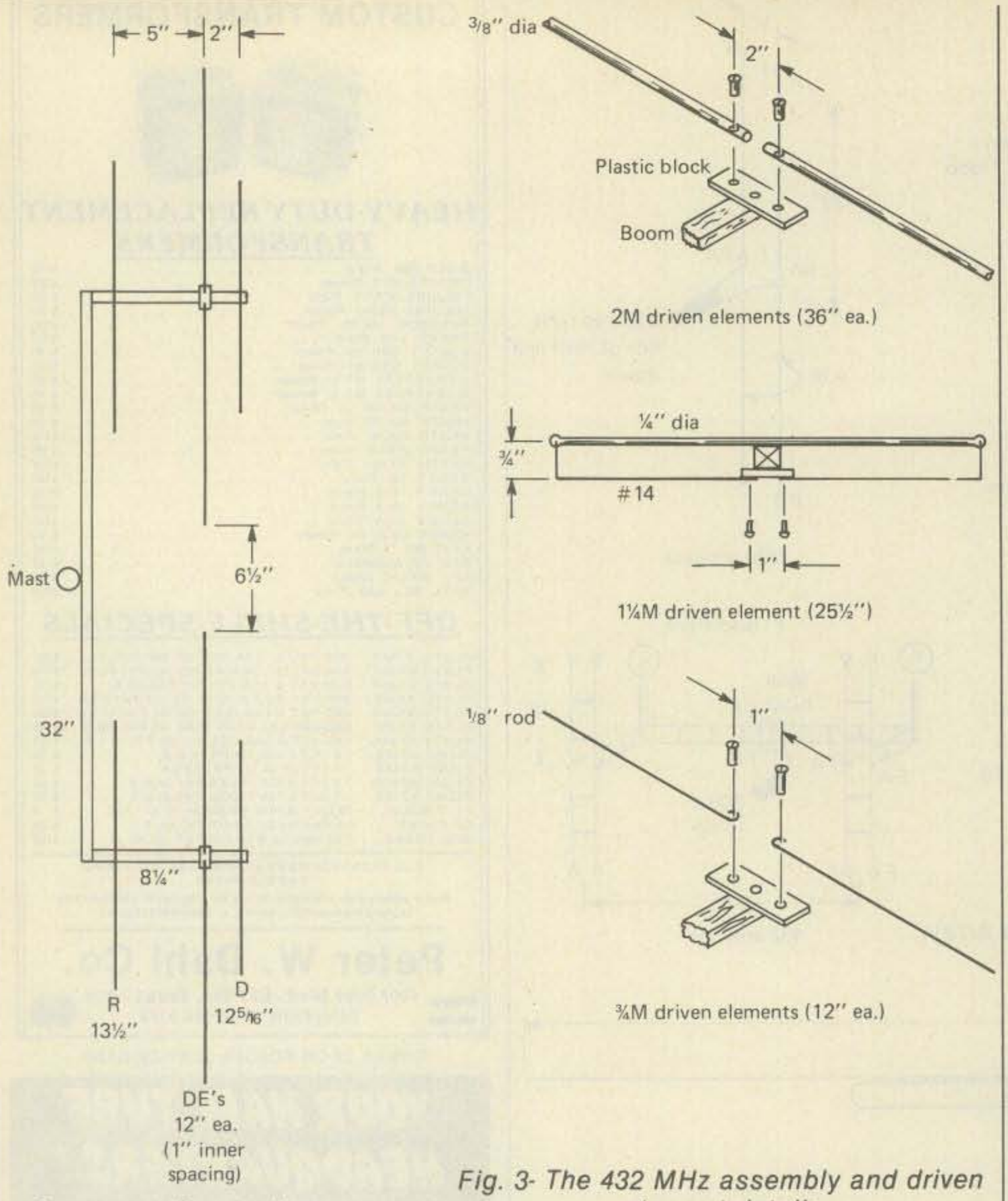


Fig. 3- The 432 MHz assembly and driven element details.

and 4 D's . . . no R) in front of each bay of the 144 collinear/Yagis, on the same booms. And since no particular harmonic relationship exists, we may operate either frequency without interband problems or pattern distortion. And since we separate the 144/220 booms from the 432 array by 3/4 λ at the highest frequency to be used, we have no sweat here either.

Fig. 1(A) & (B) show the overall setup. It would be well to construct the 432 job first and set it aside. Note that the plane of that array is entirely in front of the support structure, and the horizontal portion of the feed harness is behind the elements, so no pattern distortion occurs.

Fig. 2 details feed systems for all 3 bands. To avoid bringing 3 separate feed lines to the shack, an enclosed weatherproofed 12 v. d.c. DP relay may be installed on the mast and the 144 and 220 feeders combined. A switchable transmatch at the rig sorts things out.

Fig. 3 has driven element data and 432 assembly details. 1 × 1 wood is used for the 432 frames, and 3/4" sq. aluminum for the top and bottom booms. All 432 elements are 1/8" rod. 220 directors are ¼" tubing and 144 members are 3/8".

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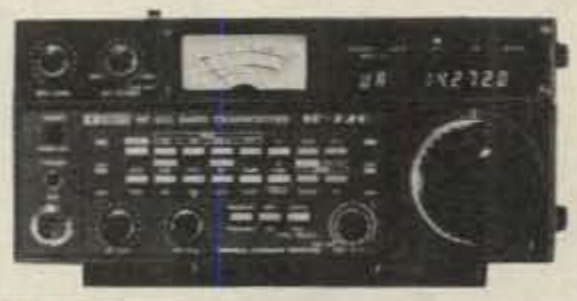

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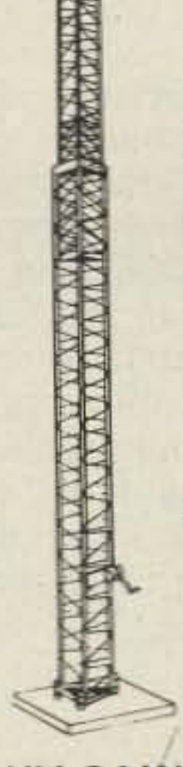

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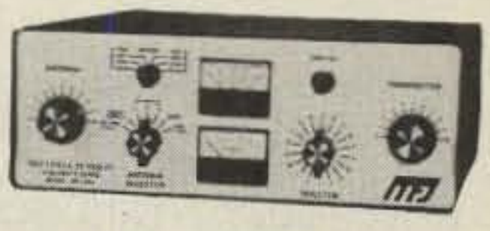

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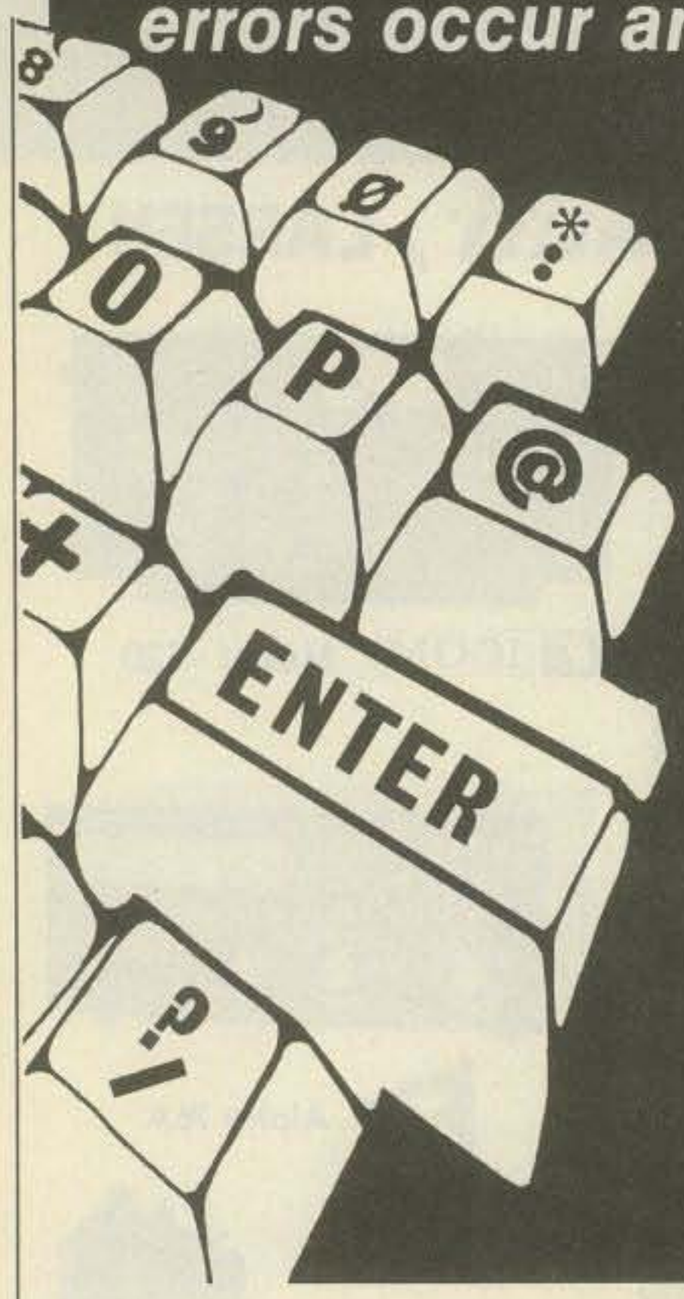
CIRCLE 121 ON READER SERVICE CARD

In Part VIII we take up the problem of problems. These problems are the ones that develop in a program and make the system go "tilt." K8BG tells us how these errors occur and how to correct them.



INTRODUCTION TO BASIC

A Computer Programming Language

Part VIII – Program Errors, Cause And Correction

BY BUZZ GORSKY*, K8BG

It would be great if every program ran and produced the desired results on the first try. Unfortunately, that rarely happens. In fact it often takes longer to debug and test a program than it does to write the program in the first place. There are some habits which you can develop while writing programs which will help in the problem solving process. Programs must be documented! That is you must describe what you are trying to accomplish in a given statement. The program line:

```
100 Z=Z+1
```

obviously increments Z by 1—but why! That line should have a remark such as REM Z IS A COUNTER FOR HOW MANY ITEMS OCCUR IN LIST. Or if you are running tight for memory space, you should list Z in your pencil and paper variable list telling what the function of Z is in the program. Documentation of a program, as a part of the program or on paper will help immensely when you are trying to figure out what is wrong with the program later. You may assume that you will always remember all of the details of a program, but if the project is long, or if you have a long delay between writing and debugging, or if you are writing several programs at one time, you will be surprised at how quickly you will forget the meaning of variables.

Another programming practice which will help debugging is to try to keep one program statement per line. When testing it is often helpful to try to narrow a problem down on a line by line basis. When each line contains several statements, the problem becomes more difficult to manage. On the other hand, each line uses memory, so when memory is tight it is often necessary to put several program statements on each line. In programs I have written in this series, I have often placed several statements per line. I have done this to show that statements can be grouped, and that lines can be complex. I did this to provide contrast to most published programs which have one statement per line.

Let's now consider what happens (usually) when you try to run a program which has just been entered into the machine. Most often there will be some error message written by the machine; such messages indicate that the machine encountered some problem as it tried to execute the program. I will go over each of the error messages which the TRS80 Level II system provides and indicate what sort of programming mistakes may be responsible for each one. Then I will discuss some special techniques for dealing with errors. The letters shown in parentheses in the following items are the error abbreviations used in the Level II system.

SYNTAX ERROR (SN) is a very common error in programs entered from the keyboard. This means that something about the program statement indicated is not in correct form. List the program line and then carefully read the line. Learn to read character by character paying especially close attention to spaces, punctuation, and parentheses. You will often find the error quickly this way. If you are not sure if a given statement requires a comma or some particular punctuation, check in the manual to be sure that your statement is indicated correctly. If you cannot find the error after several patient looks, then try retyping the line. Sometimes you will have entered a character with the shift key depressed. While this will show the same on the screen, the code will be different and in some instances will present a syntactic problem. If your program line has several statements on it and you cannot find the error, then break the line up into individual statements, so that you can isolate which section has the problem. Eventually you will find the mistake and correct it. Most

* *712 Hillside Drive, Carlisle, PA 17013.*

syntax errors are really obvious—if you look with sufficient care.

NEXT WITHOUT FOR (NF) error occurs when the machine encounters a NEXT statement without first encountering the corresponding FOR. This error can occur if you forgot to put in the FOR statement, so look through the program and make sure that the NEXT in question does indeed have a FOR. Also make sure that if you have a loop inside another loop that you have indicated the variable for the inside or second loop in the first NEXT and the variable for the outside or first loop in the second NEXT. Actually, you do not have to indicate the variables at all, but many programmers do for their own benefit. However, if you do show variables with the NEXT, then you must indicate the correct variable. If the FOR has I and the NEXT has J then there will be a problem. Sometimes you may think that you do indeed have a FOR properly indicated before a NEXT, yet you get the NF message. In that case, check for program branches and see if there was a way that the program got to a NEXT by a route that you had not anticipated. For example, in an IF statement you may have branches to a few different lines. You may think you know where the program will go first, but an error in your logic may mean that the program is actually taking a branch that you do not expect. If in that unexpected branch you encounter a NEXT before a FOR then there will be trouble. While looking through your branches make sure that you have correctly indicated statement numbers where branches occur. Sometimes as a program is edited or modified, you forget one or two places where the statement numbers should be changed, and then the program wanders into funny places.

RETURN WITHOUT GOSUB (RG) is a similar error and means that you entered a subroutine without first coming to the GOSUB statement. This often happens if you have subroutines at the end of a program and you neglect to put an END statement at the program's actual end. Then when the program gets to the end it goes right on to the next line which is actually a subroutine. At the end of that subroutine there will be a RETURN statement, but the program will not have record of a GOSUB and so it will not know where to return to, and it will instead print the error message. These are generally easy to find errors. You just have to look at the normal flow of the program and see how it got into your subroutine without a GOSUB statement.

OUT OF DATA (OD) errors occur when the program is expecting to find some information that seems to be missing. This usually occurs when the machine is executing a READ statement or is obtaining data from tape. The error message implies that the list of data anticipated was longer than the actual data list. In a READ for example there may be 10 variables listed, while the DATA statement may only have 9. If the error occurs while inputting from tape there are many potential sources for the problem. One may just be noise or whatever on the tape. However, if the PRINT # statement which recorded the tape is not exectly like the INPUT # statement which is trying to read the tape, then an OD error may occur. Compare the statements very carefully making sure that the variable lists and punctuation are identical.

The **ILLEGAL FUNCTION CALL (FC)** error implies that something is wrong with a constant or variable in a function. This may occur if you try to obtain the LOG of a negative number or the square root of a negative number or have a negative subscript for a variable. Look at the line in question to see what functions are there and what variables or constants they are associated with. Then in the command mode have the machine print the value of the variables in question. You may be surprised to see that a variable

which you thought would always be positive, now has a negative value. Look through the operations associated with the variable and see if you can find an obvious mistake. If not it is often helpful to add a statement such as:
PRINT "LINE 220--X = ";X. In line 200 if something is done to X then this line will print out the value of X in that line. If you put statements like this everywhere X occurs in the program then you will see just where X acquired the unsuspected negative value, and you can then hope to find the arithmetic statement which is in error.

OVERFLOW (OV) error is rare and simply indicates that a value outside of the computer's capability was entered or generated during computation. If there is no obvious error, then a strategy like that indicated above may be used to see how the unusually big or small value occurs.

OUT OF MEMORY (OM) error occurs when there is not sufficient memory for the program to continue. You may be surprised to find that a relatively small program seems to run out of memory. That may occur when there are large **DIMENSION** statements, since these cause large areas of memory to be set aside. When this sort of error occurs you have several choices. If possible you can *reduce* the size of **CLEAR** or **DIM** statements. You can combine lines to decrease the number of line numbers required, and you can *delete* all of the **REM** statements. When that is not sufficient then the program must be broken into smaller programs. This is usually accomplished by finding a logical break point, putting intermediate values onto tape, and then beginning the next program with a routine to read values from tape and then proceed. Such gambits can be quite cumbersome, but short of rewriting a program in machine language or buying more memory there is often little else to do.

The **UNDEFINED LINE (UL)** error occurs when the program encounters a GOTO or a line number in an IF statement which references a line which does not occur. This sort of error occurs most often when the programmer has forgotten to change a line number in a statement as a result of a change made in the program, or when there has been an error in a program entered from tape. In the first case, the mistake needs to be found; in the latter the program should be entered from tape again.

SUBSCRIPT OUT OF RANGE (BS) error indicates that a subscript for a variable is out of the range indicated in a DIM statement, or if no DIM statement was used then the subscript has gotten out of the 0-9 default range. This may occur because you underestimate the number of items in a variable list, or if the subscript is arrived at mathematically then there may be a logic or mathematical error. When the error is not obvious, then it is often helpful to sprinkle PRINT statements through the program which will show the value of the subscript each time it is changed, and in this way find where the subscript obtains its unacceptable value.

The **(DD)** error indicates that you have indicated a DIM statement for a particular variable more than once. This type of error is usually quite easy to find. It often occurs when you first DIM a variable as a single subscripted variable and then later as a double subscripted variable. The machine will not allow that to happen.

DIVISION BY ZERO (0) error means just that; a mathematical statement has resulted in an attempt to divide by zero. If the error is not obvious, then it is helpful to trace all of the variables in the offending statement by using PRINT statements in the program in order to see how the zero value is generated. Sometimes such values occur when an integer is made for a single precision number. If the single precision number has a value between zero and one then the integer equivalent will be zero. In such a case it is necessary to avoid the round-off until after the division step is accomplished.

An **ILLEGAL DIRECT (ID)** will never occur during a program. This error implies that an INPUT statement was used in the command mode as a direct command. INPUT may be used only in programs.

The **(TM)** error indicates that the program has attempted to assign a string value to a non-string variable or a non-string value to a string variable. Often such mistakes occur if the $ or other identifier has been ommitted from a variable where it was required. On other occasions this error will arise when quotes are left off. A$ = Y is not a valid statement unless Y is a variable which has been defined as a string. If A$ is to assume the value of the string constant Y then the statement must read A$ = "Y" in order to be interpreted correctly.

(OS) th **OUT OF STRING SPACE** error indicates that a string operation exceeded the space made available in a CLEAR statement. When this occurs just increase the value in the CLEAR until this error no longer occurs.

(LS) on the other hand indicates that a particular string is too large, that is more than 255 characters. This will sometimes happen when a string is repeatedly concatenated, or added to. L$ = L$ + S$ will keep adding S$ to the existing string each time the statement is encountered. If the programmer is not careful, L$ can get to be too large and this error will occur.

STRING FORMULA TOO COMPLEX (ST) is the only error which I have never encountered in BASIC programming. It implies that a given string operation has too many steps for completion in a single statement. If this error should occur, the statement needs to be broken up into smaller simpler statements.

CAN'T CONTINUE (CN) errors occur when you have broken out of a program and then type CONTINUE. A program will not continue if END has been encountered or if the program was changed through an EDIT. However, you can continue a program after the value of variables has been changed or examined.

MISSING OPERAND (MO) is essentially a syntax error. It occurs when one of the values needed for an operation has not been provided. These errors are usually very obvious.

BAD FILE DATA (FD) errors occur when data is entered from tape and an entry error occurs. This may occur because of tape related problems or because the INPUT # statement does not exactly correspond to the PRINT # statement which generated the tape. Carefully compare these two statements and then try again.

DISKBASIC ONLY (L3) indicates that a command available only in DISK BASIC was used in a non-disk system. This usually occurs by random error, in which a variable is assigned a name which happens to be a Disk Basic function. Check the list of reserved words and see if any have inadverdently crept into the program.

Once a programmer gets through the stage where each RUN results in the appearance of an error message there is a tendency to assume that the program is complete, but this may not be true. BASIC is an interpreted language. That is the machine reads each BASIC statement and then translates that statement into machine steps, carries out those steps, and then goes to the next BASIC statement. Therefore, in a program with several branches, it may be possible to have the program run without encountering an error even though there are errors in the program. It may be that the errors are in lines not encountered during that particular run. Therefore, once a program runs, try to consider which alternatives were taken on that run and then engineer another run which will enter other routines, branches, or areas of the program. One has to work through an entire program before one can be sure that there are no residual errors. How many times a program is run to accomplish this depends on the nature of the program. I would certainly devote less time to a program that prints designs than I would to one which will do my tax return. The more important the program, the more runs will be required to assure that there are no problems.

In some instances it is inconvenient to have execution stop when a program error is encountered. In other cases, it may be impossible to insure that a certain type of error will not occur with certain data. In such cases the programmer provides an error trapping routine to deal with all or a specific type of error.

The program statement **ON ERROR GO TO 1000,** placed early in a program (it must be placed before an error is encountered in order to work), will cause the program to branch to line 1000 if an error occurs rather than stopping execution to indicate the error. The programmer can then provide a routine at line 1000 to deal with the error. Early in the process of debugging a program the following routine may be helpful:

```
1000 PRINT ERR/2 + 1;"ON LINE";ERL
     1010 INPUT "OK";Z$
     1020 RESUME NEXT
```

ERR/2 + 1 will return the error code listed in the LEVEL II manual. This number can then be associated with the error abbreviation. **ERL** indicates the line number in which the error occurred. This then prints out a message very much like what the computer usually does when an error is encountered. In this case however the error type will be indicated by a number rather than a letter abbreviation and execution will continue. The input stops execution so you can look at the message. Entering any value, or nothing, will permit execution to continue. **RESUME** statements can be of several types. A plain RESUME or RESUME 0 will cause execution to continue with the statement where the error occurred. RESUME followed by another line number will cause execution to resume with that line number while RESUME NEXT causes execution to continue with the statement after the one in which the error occurred. In the little routine shown, the RESUME NEXT is used as in this way the error will not be encountered again and the program will continue. Of course, the statement in which the error occurred was never executed so the program is continuing in an incorrect manner. However, early in the process of debugging, such a strategy is helpful since the programmer has the chance to get through the program and see

where the errors are located. Incidentally, if a program encounters a RESUME before an ON ERROR GOTO then an (RW) error will occur indicating what has happened.

In some instances an error trapping routine may be specific for a particular problem which may occur in a program and may be left as a permanent part of the program. For example, suppose the programmer thinks that the string A$ may get to be too long during execution. The following might deal with that.

```
1000 A$ = LEFT$(A$,250):PRINT"A$
     TRUNCATED":RESUME
```

This will set A$ equal to the left 250 characters of A$ and print a message indicating that A$ has been shortened; then the program would resume with the statement where A$ had been too long. A specific routine could be generated for any expected error. IF statements used with the ERR/2+1 and known error codes could be used to distinguish one type of error from another.

Sometimes these techniques alone will not suffice to find the source of an error in a given program. There are, however, some other aids which can help. **TRON** is a command which turns on a **TRACE** function. After TRON has been typed in, the machine will indicate the line number of each line encountered as the line is run. The screen can quickly fill with numbers, but by carefully following the program flow with a written copy of the program, the operator can see where the program is going. In this way, a closed, infinite loop or other branching error may be discovered. **TROFF** will turn off the trace function.

When that does not work, print statements, printing out the values of variables, may be used to see what is going on. In some instances a program can be broken into sections. Artificial data may be entered via a **READ/DATA** pair rather than using real data obtained in an earlier part of the program. In this way one can see if an error was occurring because of a mistake in the first or second part of the program.

Sometimes hunting for errors can tax the patience of the most devoted programmer. When all else fails it is sometimes useful to sit down with pencil and paper and begin going through the program step by step writing down the value that each variable would assume as each statement is encountered. Follow each loop through all of the values of the index variable. In this way the programmer will sometimes discover where a logical error has occurred. On rare occassion an error cannot be found and it becomes expedient to rewrite a section of program rather than continue looking for an error.

Once all of the errors in all of the branches of a program have been found, the program is effectively debugged from the standpoint of errors which the machine can handle; but is the program doing what it is supposed to do? For example if a statement should read A=B+C but actually reads A=B−C, the computer may never find that error if A never assumes a value which is out of range for some operation. However, A will definitely not have the value it is supposed to have. How are these types of errors found? This task can be truly difficult, and again, the importance of the program will dictate just how hard the programmer should look. If the program is supposed to guide a missle to its target, you look very hard!

In most instances the best way to check for these types of errors is to have some sample data which is analyzed by hand and then by machine. If the computer answers differ from those obtained by hand then the program is suspect. For example in a satellite orbit prediction program I wrote, I entered orbital data and got answers. However, when I checked those answers graphically they were not correct, so I had to look to see why. In that case I found that a trigonometric formula had been incorrectly translated into BASIC statements so the values generated were not correct.

When searching for this type of error it is best to have several sets of trial data, each of which will cause different branches of the program to be encountered. In this way all of the program will be tested.

As you can see the testing and debugging task can be arduous, but it is as important as program writing. As experience is gained both tasks become easier.

Let's consider an example of yet another type of error. Sometimes a program will run perfectly well and do what it is supposed to do, but the task can be accomplished "better." Better may refer to with more accuracy, using less memory, or more quickly. One such error was built into a program in part five of this series. In that segment there is a program to check for contest QSO duplications. The last section of the program puts the call letters into alphabetical order. That part of the program works but it is very slow. In line 550 of the program, after two calls are switched around because they are found to be in incorrect alphabetical sequence, the program returns to line 510 to begin the I and K loops again. That return causes a number of string comparisons to be made unnecessarily.

Let's imagine that I is 1 and K is 16. That means that the first call has been found to precede the second through 15th calls alphabetically. Now the program discovers that the 16th call actually precedes the first so it swaps the first and 16th calls. However, if the first call which comes after the 16th alphabetically preceded calls 2 through 15 then the 16th call will also precede calls 2 through 15. Thus there is no need to return to line 510. The loop can continue.

In order to implement that change I removed the GOTO 510 statement. Thus after two calls were swapped the program would continue comparing the "new" first call with the 17th call. When I took out the GOTO 510, however, and tried the program on some trial data, it did not put the call letters into correct order! As I thought about the problem I realized that when the swap between the first and 16th calls is made the computer has two variables, J3 and J4, in memory. J3 refers to the number of characters in the suffix of the original first call, while J4 refers to the number in the suffix in the original 16th. When the swap is made, it is necessary to calculate a new J3 for the new first call. This can be done quite simply by stating J3=J4 after the swap is made. With that change the program runs and runs about five times faster than the original version on a sample set of data.

Although this part of the series on BASIC has been long, and perhaps a bit confusing, it has not covered all of the possibilities. Experience is the best guide in trying to find program errors. Luckily inexperienced programmers tend to write simple programs which are easy to debug, while only more seasoned individuals write complex programs which may be difficult to debug.

In the next installment of this series we'll look at the TRS-80 EDIT mode, some Command mode tricks, and a few odds and ends.

(To Be Continued)

a monthly feature by
GEORGE JACOBS, W3ASK

Propagation

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Solar data for March and April indicate very strongly that the present sunspot cycle in all likelihood peaked out during November 1979 with an index of 160, or slightly higher.

Mean solar activity during March, as reported by the Swiss Federal Observatory at Zurich, amounted to 127. Activity during April was reported to be considerably higher, reaching a level of 167.

These are mean values. They transform into smoothed sunspot numbers, upon which the solar cycle is based, of 156 centered on September 1979 and 159 for October 1979.

Solar activity is now believed to be declining slowly. A smoothed sunspot number of approximately 140 is forecast for August 1980.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for August 1980

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 6, 14, 19	A	A	B	C
High Normal: 5, 7, 10, 12-13, 15, 18, 20-21	A	B	C	C-D
Low Normal: 4, 8-9, 11, 16-17, 22-25, 29-31	A-B	B-C	C-D	D-E
Below Normal: 2-3, 26-28	B-C	C-D	D-E	E
Disturbed: 1, 27	C-E	D-E	E	E

Where expected signal quality is: A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.

B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be poor (D-E) on August 1; fair-poor (C-D) on the 2nd and 3rd; good-fair (B-C) on the 4th; good (D) on the 5th; etc.

For updated information, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD 20902.

August Propagation

August and early September is usually a transition period between summer and fall propagation conditions on the h.f. bands. On many days propagation conditions should seem much as they did during June and July. On other days, particularly during late August and early September, they will sound more typically fall-like, with somewhat higher daytime and lower nighttime usable frequencies. Since this is a period of transition, this month's *DX Propagation Charts* cover only the *one* month period from August 15th through September 15th, rather than the usual two month period. *Short-Skip Charts* for use during this period appeared in last month's column.

During the daylight hours, good DX conditions should be possible on three bands: *10, 15,* and *20* meters. Of the three, conditions should be best on *15* meters, with peak conditions expected to most areas of the world during the afternoon hours. While the *20* meter band should be open for DX throughout the daylight hours, peak signals are expected during an approximate two hour window immediately following sunrise, and again during the late afternoon. Some fairly good DX openings should also be possible on *10* meters during the hours of daylight, particularly along an arc extending across central Africa, Latin America and into the far Pacific area. Peak conditions should occur during the afternoon hours, but an increasing number of earlier openings should be possible by early September.

Between Sundown and Sunrise, *20* meters is expected to be the best DX band. Openings should be possible to almost all areas of the world, often with exceptionally strong signal levels. Until Midnight, good DX conditions should also be found on *15* meters, for openings towards Latin America, the far Pacific, and into Asia. Fairly good nighttime DX conditions are also expected on both *40* and *80* meters, despite high static levels at times. Openings should be possible before Midnight along an arc extending from Northern Europe, through Africa, and into Latin America, the far Pacific and into Asia.

By late August, it should be possible to work some DX on *160* meters during the hours of darkness. Conditions on this band, as well as on *40* and *80* meters, will tend to peak just as the sun begins to *rise* on the *light,* or eastern-most terminal of a path.

For *short-skip* openings during August and early September, try *80* meters during the day for distances less than *250* miles, with *40* meters also usable. During the hours of darkness, both *80* and *160* meters should provide excellent communications over this distance. For openings between *250* and *750* miles, use *40* meters during the day for distances up to *500* miles, and *20* meters between *500* and *750* miles. At night, *40* meters should be the best band for this distance until Midnight, with *80* meters optimum from Midnight to sunrise. *Twenty* meters should provide optimum propagation during the hours of daylight for openings between *750* and *1300* miles . Optimum conditions should continue on this band for this distance range after Sundown and until Midnight. Bet-

W3ASK generally keeps his propagation crystal ball at his Silver Spring, Maryland QTH where he is shown preparing this month's column. However, in order to meet monthly deadlines over the past thirty years, George has carried that crystal ball to twenty nine countries on five continents.

11307 Clara St., Silver Spring, MD 20902

ween Midnight and Sunrise, the best band should be *40* meters. For openings between *1300* miles and the one-hop short-skip limit of approximately *2300* miles, try *20* meters during the day, with *15* meters also usable. After Sundown, try *40* meters, with *80* meters also providing good propagation conditions for this distance range.

Frequent short-skip openings between approximately *400* and *1300* miles should also be possible on *10* meters, particularly during the daylight hours. Longer skip, up to *2300* miles, should often be possible during the late afternoon and early evening hours.

V.h.f. Ionospheric Openings

Five peak periods in meteor activity are expected during August, and these could produce considerable meteor-scatter openings on the v.h.f. bands.

At least one of these, the *Perseids*, should be a major shower with a great deal of activity. Maximum intensity should occur during the early evening of August 11th. Other peak periods, but with considerably less meteor activity, are expected on August 5, 12, 18 and 20.

Increasing daytime usable frequencies, particularly during late August and early September, along with continuing high levels of solar activity, should make possible F-2 layer DX openings on *6* meters.

The best times for such openings are shown in this month's *DX Propagation Charts*. Don't expect them to happen every day, but chances are good for some openings during the daylight hours when conditions are expected to be HIGH NORMAL, or better.

Although a seasonal decrease in the number of sporadic-E-produced short-skip openings on *6* meters is expected during August, occasional openings between approximately 1000 and 1300 miles still should be possible. When sporadic-E ionization is intense and widespread, similar openings on *2* meters may also be possible. While sporadic-E ionization can occur at any time, there is a tendency for it to peak between 8 a.m. and Noon, and again between 6 and 9 p.m., local daylight time.

Seasonal conditions should begin to improve by late August for some *6* meter trans-equatorial (TE) openings. These openings won't occur every day, and at best they will be weak, noisy and often affected with severe flutter fading. Openings favor paths between the southern tier states and deep South America. The best time to check for TE openings is during the early evening hours, shortly before and just after Sundown, although they may occur at later times as well.

V.h.f. signals can be propagated for distances up to approximately 1000 miles by reflection from ionized patches produced by auroral activity. Auroral displays are most likely to occur during August when conditions are BELOW NORMAL or DISTURBED on the h.f. bands. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be in these categories during the month.

73, George, W3ASK

George's crystal ball often finds temporary lodging in Vienna with his long-time friend Frank Friedl, OE1FF. Here George is seen recently with Frank, checking propagation conditions on the h.f. bands in Vienna.

August 15 - September 15, 1980
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	09-15 (1)	08-10 (1) 10-15 (2) 15-18 (3) 18-19 (2) 19-20 (1)	09-15 (1) 15-16 (2) 16-18 (3) 18-23 (4) 23-03 (3) 03-05 (2) 05-07 (3) 07-09 (2)	19-20 (1) 20-21 (2) 21-22 (3) 22-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 20-21 (1)* 21-22 (2)* 22-00 (3)* 00-01 (2)* 01-03 (1)*
Northern Europe & European USSR	12-15 (1)	08-10 (1) 10-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	09-14 (1) 14-16 (2) 16-19 (3) 19-20 (2) 20-22 (1) 22-01 (2) 01-06 (1) 06-09 (2)	20-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-03 (1) 21-02 (1)*
Eastern Mediterranean & Middle East	12-16 (1)	08-10 (1) 10-13 (2) 13-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	07-09 (2) 09-16 (1) 16-17 (2) 17-20 (3) 20-23 (4) 23-00 (3) 00-02 (2) 02-07 (1)	19-21 (1) 21-00 (2) 00-01 (1) 22-00 (1)*
Western Africa	12-17 (1) 17-19 (2) 19-20 (1) 11-16 (1)**	08-10 (1) 10-15 (2) 15-17 (3) 17-21 (4) 21-23 (3) 23-01 (2) 01-03 (1)	13-16 (1) 16-17 (2) 17-19 (3) 19-02 (4) 02-04 (3) 04-06 (2) 06-09 (1)	19-21 (1) 21-02 (2) 02-03 (1) 22-01 (1)*
Eastern & Central Africa	16-17 (1) 17-19 (2) 19-20 (1)	09-12 (1) 12-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	13-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-00 (3) 00-02 (2) 02-05 (1)	21-01 (1)
Southern Africa	09-11 (1) 11-15 (2) 15-17 (1) 10-15 (1)**	08-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-08 (2) 08-15 (1) 15-18 (2) 18-21 (3) 21-22 (2) 22-00 (1) 00-03 (3) 03-04 (2) 04-06 (1)	21-22 (1) 22-00 (2) 00-02 (1) 23-01 (1)*
Central & South Asia	10-12 (1) 20-22 (1)	09-10 (1) 10-12 (2) 12-13 (1) 18-20 (1) 20-22 (2) 22-23 (1)	07-08 (1) 08-10 (2) 10-12 (1) 18-20 (1) 20-22 (2) 22-02 (1)	06-08 (1) 20-22 (1)
Southeast Asia	18-21 (1)	09-12 (1) 12-16 (2) 16-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-21 (1) 21-23 (2) 23-02 (1)	06-08 (1)
Far East	18-20 (1)	09-11 (2) 16-18 (1) 18-20 (2) 20-22 (1)	17-20 (1) 20-22 (3) 22-00 (2) 00-05 (1) 05-06 (2) 06-08 (3) 08-10 (2) 10-12 (1)	05-08 (1)
South Pacific & New Zealand	09-14 (1) 14-18 (2) 18-20 (3) 20-21 (2) 21-22 (1) 15-18 (1)*	09-10 (1) 10-12 (2) 12-16 (1) 16-18 (2) 18-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-01 (1)	14-20 (1) 20-22 (2) 22-01 (3) 01-04 (4) 04-05 (3) 05-06 (2) 06-09 (3) 09-10 (2) 10-12 (1)	01-02 (1) 02-03 (2) 03-06 (3) 06-08 (2) 08-09 (1) 03-05 (1)* 05-07 (2)* 07-08 (1)*
Australasia	09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	09-10 (1) 10-11 (2) 11-12 (1) 16-18 (1) 18-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	05-08 (2) 08-10 (3) 10-12 (2) 12-17 (1) 17-19 (2) 19-22 (1) 22-01 (2) 01-05 (4)	03-04 (1) 04-07 (2) 07-08 (1) 05-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-18 (4) 18-19 (2) 19-21 (1) 11-14 (1)** 15-17 (1)**	07-08 (1) 08-09 (2) 09-12 (4) 12-14 (3) 14-21 (4) 21-22 (3) 22-23 (2) 23-01 (1)	06-07 (3) 07-10 (4) 10-11 (3) 11-15 (2) 15-17 (3) 17-03 (4) 03-05 (3) 05-06 (2)	19-20 (1) 20-21 (2) 21-23 (3) 23-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 22-23 (1)* 23-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile Argentina & Uruguay	08-10 (1) 10-12 (2) 12-14 (1) 14-16 (2) 16-17 (3) 17-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-15 (1) 15-16 (2) 16-18 (3) 18-22 (4) 22-00 (3) 00-01 (2) 01-02 (1)	10-16 (1) 16-18 (2) 18-19 (3) 19-02 (4) 02-04 (3) 04-07 (2) 07-09 (3) 09-10 (2)	20-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 22-00 (1)* 00-04 (2)* 04-06 (1)*
McMurdo Sound, Antarctica	11-14 (1)** 16-18 (1)** 17-18 (2) 18-19 (1)	12-17 (1) 17-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	16-19 (1) 19-22 (2) 22-02 (3) 02-05 (2) 05-08 (1) 07-09 (1)	01-05 (1)

Time Zones: CDT & MDT
(24-Hour Time)
CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	10-13 (1)	09-10 (1) 10-12 (2) 12-16 (3) 16-17 (2) 17-18 (1)	08-13 (1) 13-16 (2) 16-17 (3) 17-21 (4) 21-23 (2) 23-01 (1) 04-06 (1) 06-08 (2)	19-21 (1) 21-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 20-22 (1)* 22-00 (2)* 00-02 (1)*
Northern & Central Euorpe & European USSR	11-13 (1)	09-10 (1) 10-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	01-06 (1) 06-09 (2) 09-12 (1) 12-15 (2) 15-18 (3) 18-19 (2) 19-22 (1) 22-01 (2)	19-20 (1) 20-00 (2) 00-02 (1) 21-00 (1)*
Eastern Mediterranean & Middle East	11-13 (1) 15-17 (1)	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-09 (2) 09-16 (1) 16-18 (2) 18-22 (3) 22-00 (2) 00-02 (1)	20-23 (1) 21-22 (1)*
Western Africa	10-14 (1) 14-17 (2) 17-18 (1) 10-15 (1)**	07-10 (1) 10-13 (2) 13-15 (3) 15-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-00 (4) 00-02 (3) 02-04 (2) 04-06 (1)	19-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*

Eastern & Central Africa	14-16 (1) 16-18 (2) 18-19 (1)	10-14 (1) 14-15 (2) 15-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-18 (2) 18-19 (3) 19-21 (4) 21-23 (3) 23-00 (2) 00-02 (1)	20-00 (1)
Southeast Africa	09-11 (1) 11-13 (2) 13-15 (1) 11-13 (1)**	08-09 (1) 09-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-18 (1)	06-08 (2) 08-15 (1) 15-16 (2) 16-19 (3) 19-21 (2) 21-23 (1) 23-03 (2) 03-06 (1)	20-21 (1) 21-23 (2) 23-00 (1) 21-00 (1)*
Central & South Asia	09-11 (1) 19-21 (1)	08-09 (1) 09-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-23 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-11 (1) 17-19 (1) 19-22 (2) 22-02 (1)	05-08 (1) 19-21 (1)
Southeast Asia	12-14 (1) 17-19 (1)	08-09 (1) 09-12 (2) 12-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-13 (1) 18-20 (1) 20-23 (2) 23-00 (3) 00-01 (2) 01-02 (1)	05-08 (1)
Far East	16-20 (1)	08-10 (1) 13-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	19-22 (1) 22-23 (2) 23-01 (3) 01-03 (2) 03-06 (1) 06-07 (2) 06-09 (3) 09-11 (2) 11-13 (1)	03-06 (1) 06-07 (2) 07-08 (1) 06-07 (1)*
South Pacific & New Zealand	10-12 (1) 12-17 (2) 17-18 (3) 18-19 (4) 19-20 (3) 20-21 (2) 21-22 (1) 14-18 (1)**	07-11 (1) 11-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-02 (1)	07-09 (4) 09-10 (3) 10-13 (2) 13-18 (1) 18-20 (2) 20-22 (3) 22-02 (4) 02-04 (3) 04-07 (2)	23-00 (1) 00-01 (2) 01-04 (3) 04-06 (4) 06-07 (2) 07-08 (1) 23-01 (1)* 01-05 (2)* 05-06 (3)* 06-07 (1)*
Australasia	09-11 (1) 15-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1) 15-18 (1)**	09-11 (2) 14-15 (1) 15-17 (2) 17-19 (1) 19-20 (2) 20-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	07-09 (4) 09-10 (3) 10-13 (2) 13-19 (1) 19-22 (2) 22-00 (3) 00-03 (4) 03-05 (3) 05-07 (2)	02-04 (1) 04-05 (2) 05-07 (3) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07)1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1) 11-16 (1)**	07-08 (1) 08-09 (2) 09-12 (4) 12-14 (3) 14-20 (4) 20-22 (3) 22-23 (2) 23-01 (1)	07-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-01 (4) 01-03 (3) 03-05 (2) 05-07 (3)	19-20 (1) 20-21 (2) 21-23 (3) 23-02 (4) 02-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile Argentina & Urguay	07-08 (1) 08-13 (2) 13-15 (3) 15-18 (4) 18-19)2) 19-20 (1) 11-16 (1)**	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-21)4) 21-23 (3) 23-00 (2) 00-01 (1)	10-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-03 (3) 03-06 (2) 06-08 (3) 08-10 (2)	19-20 (1) 20-21 (2) 21-02 (3) 02-03 (2) 03-05 (1) 20-22 (1)* 22-02 (2)* 02-03 (1)*
McMurdo Sound, Antarctica	11-15 (1) 15-18 (2) 18-19 (1)	10-15 (1) 15-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	16-18 (1) 18-20 (2) 20-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	00-04 (1) 04-06 (2) 06-07 (1)

Time Zone: PDT (24-Hour Time) WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	11-13 (1)	08-09 (1) 09-12 (2) 12-14 (1) 14-15 (2) 15-16 (1) 22-00 (1)	00-07 (1) 07-09 (2) 09-13)1) 13-15 (2) 15-19 (3) 19-22 (2) 22-00 (3)	19-21 (1) 21-23 (2) 23-00 (1) 22-23 (1)*
Central & Northern Europe & European USSR	*Nil*	07-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-16 (1) 22-00 (1)	12-14 (1) 14-16 (2) 16-17 (3) 17-23 (2) 23-01 (1) 06-08 (2) 08-09 (1)	19-23 (1)
Eastern Mediter-ranean & Middle East	*Nil*	07-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (1) 22-00 (1)	12-15 (1) 15-17 (2) 17-19 (3) 19-23 (2) 23-01 (1) 06-08 (1)	20-22 (1)

This past fall, George carried his crystal ball to Geneva, Switzerland where he served as a senior member on the U.S. Delegation to WARC-79. George was among the handful of delegates at the Conference who were also veterans of WARC-1959.

Western & Central Africa	10-13 (1) 13-16 (2) 16-17 (1)	08-11 (1) 11-13 (2) 13-17 (3) 17-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-03 (2) 03-08 (1)	21-23 (1)
Eastern Africa	13-16 (1)	09-13 (1) 13-15 (2) 16-17 (3) 17-18 (2) 18-19 (1) 00-02 (1)	13-16 (1) 16-18 (2) 18-21 (3) 21-23 (2) 23-00 (1)	*Nil*
Southern Africa	09-11 (1) 11-13 (2) 13-15 (1)	08-10)1) 10-12 (2) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-18 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-22 (2) 22-00 (3) 00-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	19-21 (1) 21-22 (2) 22-23 (1) 21-22 (1)*
Central & South Asia	17-19 (1)	08-09 (1) 09-11 (2) 11-13 (1) 16-18 (1) 18-21 (2) 21-23 (1)	06-07 (1) 07-09 (3) 09-11 (1) 19-21 (1) 21-23 (2) 23-01 (1)	05-07 (1) 17-19 (1)
Southeast Asia	16-19 (1)	09-10 (1) 10-12 (3) 12-13 (2) 13-16 (1) 16-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	23-01 (1) 01-02 (2) 02-04 (3) 04-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	03-07 (1)
Far East	12-14 (1) 14-16 (2) 16-18 (1) 14-16 (1)**	09-10 (1) 10-12 (2) 12-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-22 (2) 22-23 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-04 (4) 04-05 (2) 05-06 (1) 06-08 (2) 08-10 (3) 10-12 (2) 12-14 (1)	01-02 (1) 02-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 03-06 (1)*
South Pacific & New Zealand	10-13 (1) 13-15 (2) 15-18 (3) 18-20 (4) 20-21 (2) 21-22 (1) 12-18 (1)**	08-10 (1) 10-12 (3) 12-15 (2) 15-18 (3) 18-22 (4) 22-00 (3) 00-02 (2) 02-03 (1)	07-09 (4) 09-11 (3) 11-13 (2) 13-17 (1) 17-19 (2) 19-21 (3) 21-03 (4) 03-05 (3) 05-07 (2)	22-23 (1) 23-00 (2) 00-03 (3) 03-06 (4) 06-07 (3) 07-08 (1) 23-01 (1)* 01-06 (2)* 06-07 (1)*
Australasia	13-15 (1) 15-18 (2) 18-20 (3) 20-21 (2) 21-22 (1) 14-18 (1)**	07-08 (1) 08-10 (2) 10-17 (1) 17-19 (2) 19-21 (3) 21-23 (4) 23-00 (3) 00-03 (1)	12-20 (1) 20-22 (2) 22-23 (3) 23-04 (4) 04-06 (3) 06-08 (2) 08-10 (3) 10-12 (2)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 01-03 (1)* 03-05 (2)* 05-06 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1) 11-14 (1)**	07-08 (1) 08-09 (2) 09-14 (3) 14-19 (4) 19-20 (3) 20-22 (2) 22-00 (1)	06-08 (4) 08-11 (3) 11-15 (2) 15-18 (3) 18-04 (4) 04-06 (3)	19-21 (1) 21-01 (3) 01-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay,, Brazil, Chile, Argentina & Uruguay	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1) 11-15 (1)**	06-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-22 (4) 22-23 (3) 23-00 (2) 00-01 (1)	09-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-02 (3) 02-06 (2) 06-08 (3) 08-09 (2)	20-21 (1) 21-00 (2) 00-02 (1) 02-04 (3) 04-05 (2) 05-06 (1) 22-01 (1)* 01-03 (2)* 03-05 (1)*
McMurdo Sound, Antarctica	13-15 (1) 15-17 (2) 17-19 (1)	12-16 (1) 16-18)2) 18-20 (3) 20-22 (2) 22-00 (1)	09-11 (1) 17-19 (1) 19-20 (2) 20-01 (3) 01-03 (2) 03-04 (1) 06-08 (2)	22-23 (1) 23-01 (2) 01-04 (1) 04-06 (2) 06-07 (1)

* Indicates best times to listen for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a propagation index of (2), or higher.

** Indicates best times to listen for F-2 layer openings on 6 Meters.

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location, The Eastern USA Chart can be used in the 1, 2, 3, 4, 8 KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. wetc. Appropriate *daylight* time is used, *not* GMT. T convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

6. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado, 80302.

a regular feature by

THEODORE J. COHEN, N4XX

dateline... Washington, D.C.

THE INS AND OUTS OF THE WASHINGTON SCENE

Amateurs Face Regulation in Use-of-Frequency Matter

As a result of interference to certain types of amateur operations, an agenda item may shortly be sent to the FCC commissioners on an amateur's right to operate on a specified frequency. Specifically, we see many examples today where an amateur station has apparently "laid claim" to a frequency or to frequencies; these include:

Net operations (e.g., WESCARS, EASCARS, etc.)
Repeater operations
W1AW code practice and bulletin operations

In the past, so-called "gentlemen's agreements" permitted such operations to continue without interference because they served the amateur's and the public's interests. Now, however, an increasing number of stations are being reported for interfering with the operations of stations which claim use of a frequency by virtue of their having operated there for a long period of time.

Based on the interference complaints being received and on the various modes of operation used today, the question has been raised within the Commission as to whether the Rules and Regulations for the amateur service fail to encompass today's manner of operation and whether more explicit "guidance" (*regulation!!!*) is necessary.

That an agenda item may even be sent to the Commissioners is another example of where they may now incur further Government control.

Illegal Radio Operations Increase in Florida

Sources in Washington (D.C.) are expressing increasing concern about the growing number of unlicensed radio operations in and around Florida. Most of these operations are occurring on frequencies in and adjacent to the amateur 20 and 40 meter bands, and are apparently related to drug traffic and political broadcasting. What is so disappointing to Federal authorities about these operations is that they follow on the heels of recent search and seizure activities by U.S. marshals which were intended to silence them.

The illegal HF operations in Florida are being monitored, and information obtained from them being passed, on request, to several Federal agencies.

Amateur Radio Lauded for Operations in the Pacific

While the subject of intentional interference and friction .between amateur operators has been much in the amateur press of late, there are many operators who can attest to the vital role our service plays in providing communications to people in remote areas. Such areas include the remote islands of the Pacific Ocean, where Lewis Strauss, AH6I (Hawaii), notes: "There is scarcely an evening that I do not hear emergency, medical, or priority traffic coming out of the Carolines, the Marshalls, and other islands to the west. In these areas, amateur radio is more than a hobby; it is a vital part of a communication system which is used by missionaries, medical personnel, and, in fact, U.S. Government personnel."

The above comments, made in a letter to Mr.Carlos Roberts, Chief of the Private Radio Bureau, FCC, concluded with the hope that the amateur service could be preserved in a healthy state so as to serve the public's interest as it was originally intended to do.

Computer RFI-Limits Deadline Extended

As a result of petitions from the computer industry, the FCC has extended to October 1981 the deadline for compliance with imposed RFI limits on computer equipment. Apparently the Commission caught most manufacturers by surprise in late 1979 when it imposed stringent limits on the radiation from computer equipment. Amateurs, in part, were responsibile for bringing the problem to the Commission's attention after home computers used for OSCAR experiments were found to interfere with radio receivers.

The RFI standards were supposed to have gone into effect on July 1, 1980. Now, however, newly-designed equipment does not have to meet the standards until October 1, 1981. Older equipment, which must be redesigned, does not have to be in compliance until October 1, 1983. The FCC standards, according to *Electronic Engineering Times,* were first thought to apply "to virtually any piece of equipment that had any computational power whatsoever—from mainframe computers to microprocessor-controlled ovens." Four classes of equipment have been temporarily exempted from the standards, however; these include on-board computers in transportation vehicles; industrial control systems; test equipment; and home appliances.

Demand for EE's up Significantly in 1980

Demand for electronic engineers has increased significantly during the first part of 1980, and in the first 10 weeks of this year, is already up over 19% as compared to the same periods last year. To attract qualified engineers, in fact, many employers are paying salaries more than 14% higher than last year's; attractive benefit packages, according to *Electronic Engineering Times,* are also important factors in the hiring process. New EE engineering graduates, it is interesting to note, now average $19,000 per year, *to start* . . . an all-time record.

Reflecting the opportunities available in the engineering fields today, it

**8603 Conover Place, Alexandria VA 22308*

is not surprising to find that enrollment in U.S. engineering schools has also reached record levels. In late 1979, 340,488 undergraduates were enrolled in this country's 286 engineering schools. Of these, 79,123 were enrolled in electrical engineering, a 9% increase over 1978.

CCIR Study Group 8E to Meet on Amateur Radio Matters

According to John (Jack) Kelleher, W4ZC, the International Consulative Committee on Radio (known as the CCIR) Study Group 8E on the amateur (terrestrial) service will meet several times during 1980 to examine technical matters of interest to the ITU. The CCIR is the technical arm of the ITU, and is responsible for advising the Union on matters of a technical nature.

Some of the issues to be discussed at Study Group 8E meetings include sharing analyses for the new amateur HF band at 10 MHz, low-frequency (LF) operations, and preferred frequency bands for the amateur service.

If you would like to participate in CCIR Study Group 8E activities, contact:

Mr. John J. Kelleher, W4ZC
Convener, U.S. Study Group 8E
3717 King Arthur Road
Annandale, VA 22003

Popular Electronics to Feature Communications in August 1980 Issue

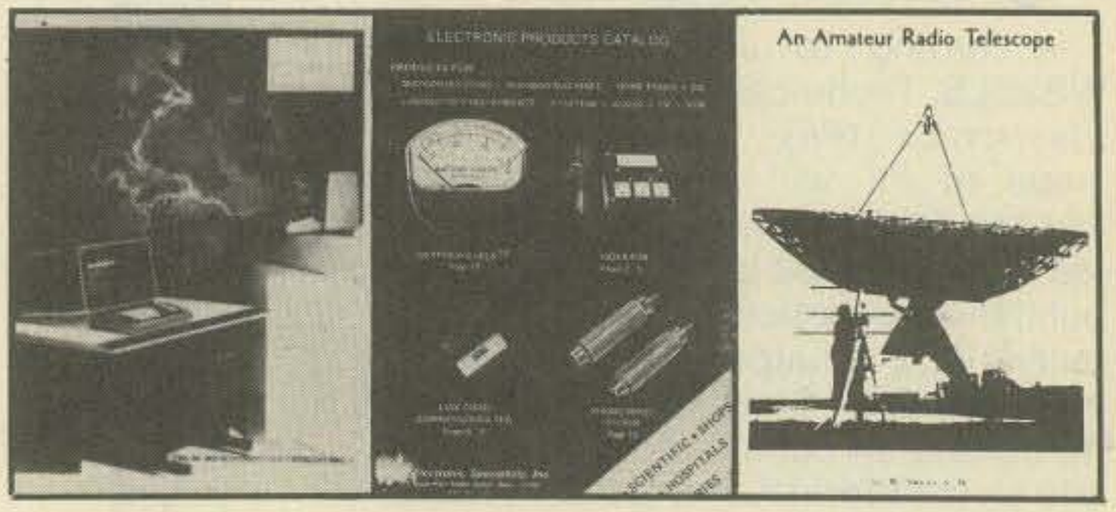
According to John J. McVeigh, WB2BLS, Technical Editor for *Popular Electronics* (*PE*), the August 1980 issue of *PE* will contain a special 16-page section dealing with communications. Included in the material to be published are articles on the new high-technology amateur and shortwave equipment; on Sunspot Cycle 21 and its effects on communications today; and on the World Administrative Radio Conference (WARC) of 1979 and its effect on amateurs, swls and CBers. The issue promises to be "must" reading for amateurs everywhere.

The Printed Word
new reading material

Microcomputer Interference Control Product Catalog. A new catalog from Electronic Specialists presents their line of microcomputer interference control products and protective devices. Descriptive sections are included which outline particular problems, and suggested solutions are given. Typical applications and uses are also outlined. For a copy of catalog 971 contact Electronic Specialists, Inc., 171 South Main St., Natick, MA 01760, or circle number 119 on the reader service card.

Solid State Replacement Guide. A 1980 edition of the RCA SK Top of the Line Solid State Replacement Guide offers 1,080 solid state replacement devices which replace more than 161,000 domestic and foreign types. The guide features a dual numbering system which shows both the SK stock number and the stock number of the numbering system used by EGC REN and TM. It contains information on RCA's line of replacement transistors, rectifiers, thyristors, integrated circuits, and high voltage triplers. The 368-page 1980 SK Guide is available for $1.50 from RCA Distributor and Special Products, P.O. Box 597, Woodbury, NJ 08096, or for more information, circle number 111 on the reader service card.

An Amateur Radio Telescope. Advances in the electronics field have made it possible to design a radio telescope which a dedicated amateur can build for a reasonable cost, and with excellent prospects for success. *An Amateur Radio Telescope* by George W. Swenson, Jr. describes such a project, a working telescope actually built by the author's students. This 58-page paperback book is available from Pachart Publishing House, P.O. Box 6721, Tucson, AZ 85733 for $6.95, or for more information circle number 114 on the reader service card.

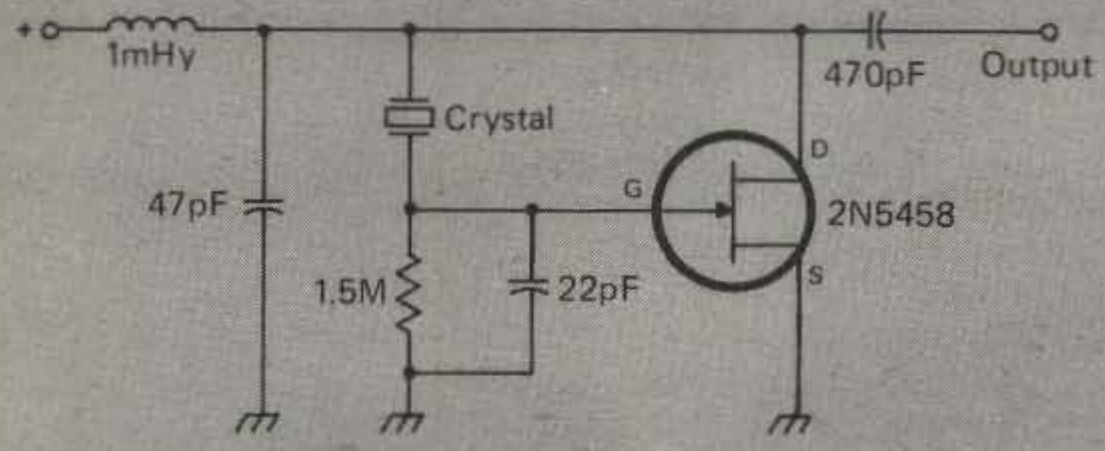


TRS-80 Microcomputer Catalog. Radio Shack has issued their TRS-80 Microcomputer Catalog RSC-3, "The Expanding World of TRS-80." The 24-page, full color catalog includes complete, up-to-date information on both Model I and Model II TRS-80 Microcomputer Systems. Also listed are peripherals and accessories such as five line printers, disk expansion units, a voice synthesizer, system desk, dust covers, carrying cases, and software including more than 50 ready-to-run programs. Detailed specs include a TRS-80 System Selection Guide, comparison charts for Level I and Level II Basic, a description of disk Basic and TRSDOS operating systems for Model I, and the Level III Basic and TRSDOS operating system for Model III. The catalog is available from Radio Shack, division Tandy Corp., 1300 One Tandy Center, Fort Worth, TX 76102, or circle number 112 on the reader service card.

CRANIUM QUERIES

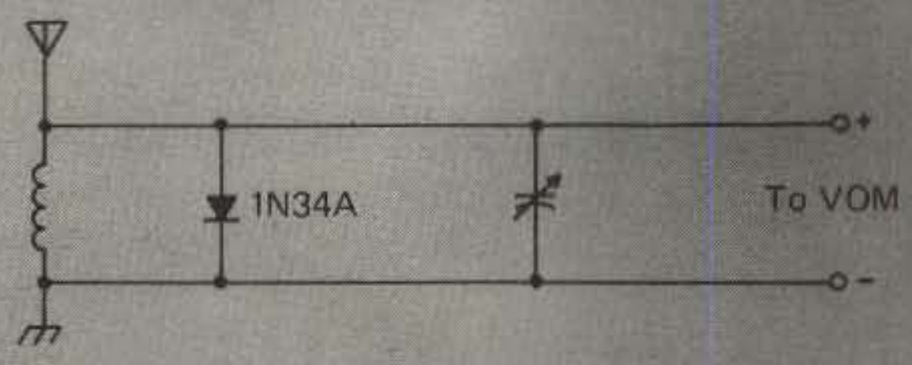
"FIND THE ERROR"

BY MARTIN BRADLEY WEINSTEIN, WB8LBV
c/o CQ



Here's What Was Wrong

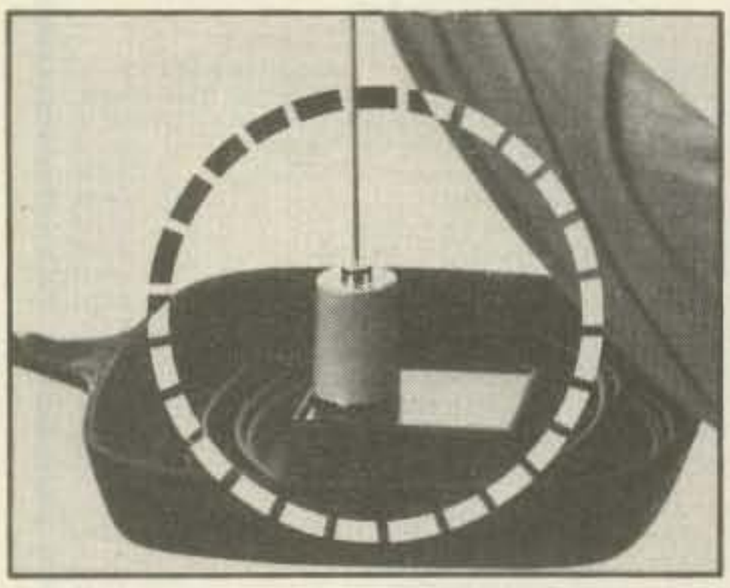
The source, of course, plus a pain in the drain. The two got reversed, for a strain on the gain. Set aright, the oscillator couldn't be greater.



What's Wrong?

A v.o.m. provides the meter for this quick, cheap field strength meter. Only this one can't seem to find a field strong enough to show on the meter. Why not?

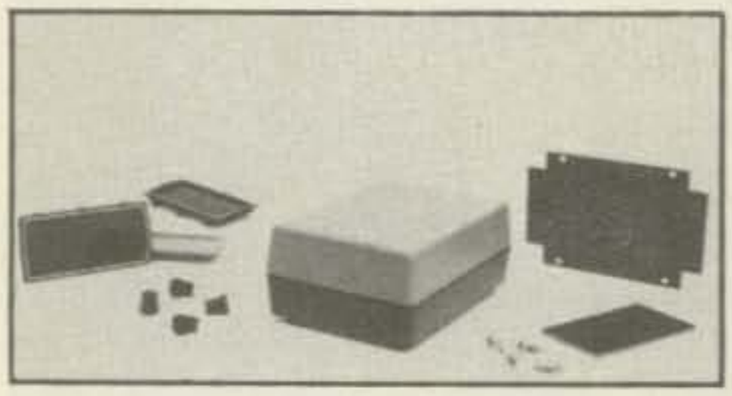
CQ SHOWCASE



Larsen Magnetic Mount

Larsen Electronics has improved their Magnetic Mount design to give it even stronger holding power and reduce even further the chance of scratching the vehicle finish. The assembly has been up-engineered to closer tolerances for more holding power per square inch.

The mount has a new boot of resilient Nordel that will not crack or harden even with long-term exposure to weather and sunlight, and that minimizes the possibility of scratching the vehicle's finish. The capacitive coupling shield on the underside of the mount has been beefed up to make it less subject to accidental puncture stress. For more information, contact Larsen Electronics, Inc., P.O. Box 1686, Vancouver, WA 98668, or circle number 101 on the reader service card.



Unibox Electronic Packaging Components

Unibox, a versatile line of packaging components, is comprised of a series of attractive enclosures and a wide selection of accessories. The components may be custom assembled to meet the user's specific requirements. Enclosures are available in six sizes and five color combinations. Manufactured from a tough engineering grade thermoplastic, the enclosures may be customized with hand tools. Enclosure sizes range from 1¼"H × 2"W × 2 ¾"L to 2"H × 4"W × 5¼"L.

Custom epoxy-glass Gridboards are available for vertical and horizontal mounting in the enclosures. Two sizes of transparent red and smoke-gray windows are available for use with LED or incandescent readouts, indicators, etc. Also available are two sizes of opaque gray panels for mounting switches, potentiometers, connectors, etc. Resilient, non-marring feet, which fit all enclosures, may be utilized for bench or desk-top applications. For more information, contact Amerex, P.O. Box 2815, Riverside, CA 92516, or circle number 102 on the reader service card.

Microprocessor-Controlled Repeater

A line of repeaters covering the 144, 220, and 450 MHz bands has been introduced by Micro Control Specialties. The Mark 3CR repeaters combine all the features of the Mark 3C repeater, plus transmitter, receiver, and power supply in a rack mount cabinet. The microprocessor-based repeater provides 39 tone accessible functions, including autopatch, autodial, redial, reverse patch, external outputs, and secure control operator commands. The repeater generates 13 different Morse messages, several of which are custom programmed to user specifications. Basic repeater functions are also directed by the microprocessor so the repeater can discriminate against noise and kerchunkers.

The repeater receiver uses dual-gate MOSFETs in both r.f. amplifier and mixer stages for high sensitivity (20 dB quieting with only 0.25 uV of input signal) and freedom from overload in the presence of ½-volt signals. Crystal filtering and double conversion are both used to obtain 65 dB rejection of off-frequency signals so the repeater is suited for use in hostile r.f. environments. Transmitter output is 2 watts but optional amplifiers are available to increase power output. For more information, contact Micro Control Specialties, 23 Elm Park, Groveland, MA 08134, or circle number 103 on the reader service card.

Curtis Keyer

An advanced design electronic keyer employing optoisolators for key isolation has been introduced by Curtis Electro Devices, Inc. Based on the 8044 single chip circuit, the EK-480M also features a direct meter readout of code speed in w.p.m. Measuring 7" × 4½" X 2½", the unit contains dot and dash memories, iambic or standard mode operation, internal 117 vac or battery supply, internal sidetone and speaker, front panel volume, pitch, weight and speed controls, plus an accessory socket for message memory and keyboard keyer add-ons. The unit will key ± 300 vdc up to 200 mA.

Supplied complete with all cables and plugs, the EK-480M is priced at $149.95. The EK-480 (excludes speedmeter) is priced at $134.95. For additional information, contact Curtis Electro Devices, Inc., Box 4090, Mountain View, CA 94040, or circle number 104 on the reader service card.

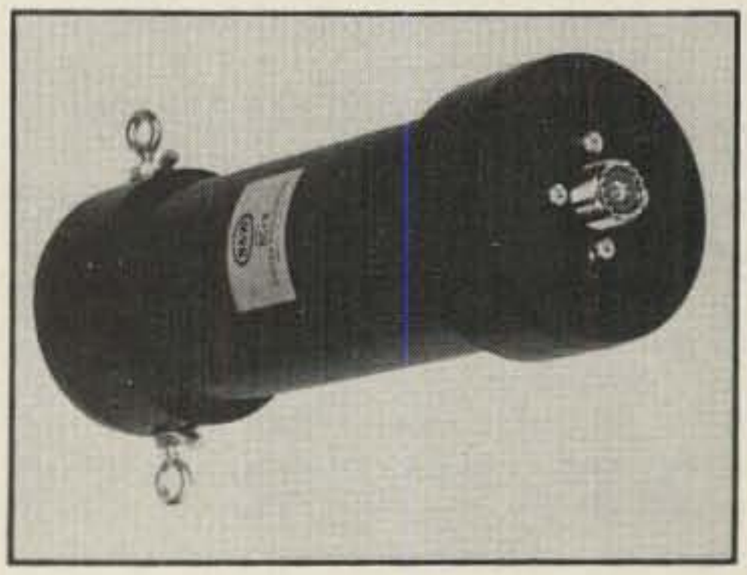
Xitex Universal Data Transceiver

The UDT-170, a Universal Data Transceiver, combines the processing power of two dedicated microprocessors plus a state-of-the-art r.t.t.y. terminal unit and c.w. converter. The resulting product is a universal converter that operates between radio and terminal. It has the capability of taking keyboard commands from a teletype, computer, or video terminal. Baudot or ASCII makes no difference, as the microcomputers can handle the size of the line printed or displayed from 64 to 80 characters per line and automatically buffer up to 32 characters. "Downshift on Command" allows the operator to tap a button to correct improperly shifted data and to mark new sections of data.

The UDT-170 is packaged in a r.f.i. protected metal enclosure measuring 12" × 7¼" × 3½", operates on either 115 or 230 vac, 50/60 Hz, and is prices at $479. For more information, contact Xitex Corporation, 9861 Chartwell Drive, Dallas, TX 75243, or circle number 105 on the reader service card.

Aluma Tower's Mobile Telescopic Towers

Aluma Tower Company manufactures five styles of mobile van-roof mounted telescopic towers. The towers will crank up on the heavier-duty model to 60 feet, if required. They are manufactured for easy mounting on a van ladder rack so they can be cranked up easily for use and cranked down for storage. The aluminum towers are tungsten inert gas welded (heli-arc) for strength, and have a safety stop for safe, trouble-free usage. For more information, contact Aluma Tower Company, 1639 Old Dixie Highway, Vero Beach, FL 32960, or circle number 107 on the reader service card.



B&W BC-1 Balun

The Model BC-1 Balun from Barker & Williamson, Inc. has impedance of 50 ohms unbalanced to 50 ohms balanced. Frequency is 1.8 to 30 MHz, and power is 2.5 kw to 5 kw p.e.p. The SO-239 connector mates with standard PL-259 plugs. Size is 2¼" in diameter and 7½" long; weight is 15 ounces. For more information, contact Barker & Williamson, Inc., 10 Canal Street, Bristol, PA 19007, or circle number 108 on the reader service card.

You can never be careful enough when working with electricity. Author Revels explains why and what you can do to increase your chances of enjoying amateur radio longer.

ELECTRICAL SAFETY

BY MARK A. REVELS*

The article by Edmund Hood, W2FEZ, ("Electrical Shock," *CQ*, Jan. 79) describing the mechanics of electrical shock was timely and welcome. Feeling that more should be said on the subject, I would like to offer the following comments.

Perhaps the single greatest risk taken by radio amateurs, hobbyists, and electronic technicians in general is working on "live" equipment. This practice is generally frowned upon, but, it is often a necessary evil. When working on live equipment remember that electrical currents flowing in the device are looking for a lower potential to flow to and seek the path of the least resistance (opposition). If your body provides this path, it is at best irritating. To avoid providing the path, avoid touching grounded objects. Water pipes, damp concrete floors, and other grounded equipment provide excellent paths for the electrical current. Don't be careless. One wrong move could be your last. The old, but none the less useful, rule is to keep one hand in your pocket at all times. This insures that if accidental contact is made with a "hot" circuit, current will only flow through the exposed hand and arm rather than across the chest and possibly through the heart. Don't work on energized equipment if you are excessively warm or are perspiring heavily. Perspiration lowers body resistance and therefore allows larger magnitudes of current to flow. Finally, it is not a good idea to work on energized equipment if you are tired and irritated. When your body is physically or mentally exhausted, mistakes occur quite easily.

When turning your equipment off, do not depend on the power switch alone, "pull the plug." Frequently, especially on "home-brew" equipment, power switches consist of a s.p.s.t. type in series with the neutral (white) conductor. This practice provides some, but far from adequate, safety. The hot (black) conductor remains energized and presents a source of electrical power that could shock or even kill the unaware technician. To illustrate this, consider an electrical device which is connected to the a.c. power line. Since the neutral is electrically tied to ground at the power station it is said to be at ground potential. The hot connector is at 120 volts (or whatever the line voltage is) above ground. If the neutral is switched off current will cease to flow in the circuit. But, when a meter is connected between the hot conductor and the grounded chassis

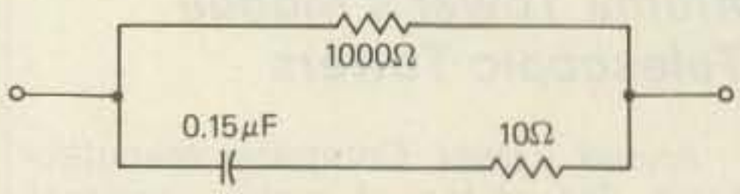


Fig. 1 - A circuit that can be used to test for excessively high leakage currents.

or other grounded equipment, it will show that a large potential is still available which could cause an electric shock. The solution to this problem is to put the s.p.s.t. switch in series with the hot conductor rather than the neutral conductor. An even better method is to use a d.p.s.t. or d.p.d.t. type switch and switch both the hot and neutral conductors.

The questions arises, "Why use an earth ground if it proves to be so hazardous?" Earth grounding would be unnecessary if electrical and electronic devices were perfect. Unfortunately, this is not the case. Take into account a step down transformer whose core is physically connected to the equipment chassis. Due to the capacitive coupling between the primary windings and the core, some current "leaks" into the core and consequently into the equipment chassis. This leakage current will flow to ground if a path is given to it. To keep the operator from providing a path, the equipment is connected to a low impedance path to ground.

Keep in mind that I am talking about current in the order of microamperes. Mr. Hood stated in his article that "Medical people estimate that a current of only 60 milliamperes or so can do you in." But, he made no reference to what medical people he was referring to. The Association for the Advancement of Medical Instrumentation (AAMI) sets the leakage current limit for electromedical apparatus at 500 microamperes from a metal enclosure to ground for non-patient connected devices (patient connected device limits are lower). Also, it has been shown that as little as 10 microamperes directly through the heart muscle can cause fibrillation (a twitching condition where the blood volume output of the heart is little or nothing). It is therefore quite clear that very small currents, such as leakage currents, can be hazardous under the proper conditions.

Another problem, which may be encountered, is non-equipotentiality of equipment and service outlets. This situation is characterized by a tingling sensation when either two grounded devices or a grounded device and ground are touched simultaneously. When current flows in a conductor, a voltage drop is developed across the conductor which is directly proportional to its resistance. Consider a ground wire running from outlet "A" to outlet "B." If device "C" injects 10 milliamperes of leakage current into the green

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ground wire and the total resistance of the wire is 2.0 ohms (not uncommon in older wiring), then the voltage measured from the ground pin of "A" to the ground pin of "B" will be 200 millivolts.

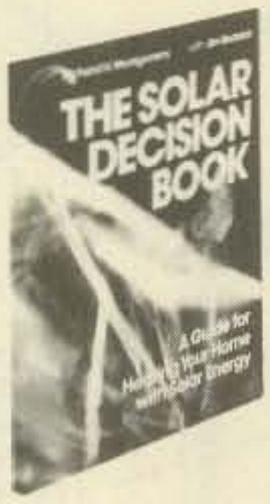
200 millivolts is not what one would call a lethal voltage but it does demonstrate the need for low impedance ground busses.

The average amateur, or hobbyist, can protect himself and his family against the woes of electrical hazards in a number of ways. Perhaps the most effective method is hard wire grounding. Simply, this consists of running a wire from each device to a common earthy ground. If the thought of a jungle of wires does not please your aesthetic views, you might consider installing three wire power cords which have the ground and power wires in the same jacket. After this is done, test each device for excessively high leakage currents. You may use the test circuit in fig. 1. It is a AAMI standard test load that assumes a body resistance of 1000 ohms. It is frequency compensated so that high frequency leakage currents are ignored (the hazard goes down as frequency goes up).

After one has protected himself sufficiently, it is only then he can sit back and enjoy his hobby.

CQ BOOK SHOP

The Solar Decision Book
by R. H. Montgomery, with J. Budnick
Through many detailed, yet easy-to-follow diagrams, illustrations, and charts, this book shows you how to narrow down solar energy options by understanding energy needs and costs. You'll also learn how to deal effectively with system contractors, how to understand the much-needed advice on solar system design and operation, component selection and sizing, job pricing and system installation, the effect the system will have on cash flow and taxes, and much more. 328 pages, paperback, $12.95. Order #M122.



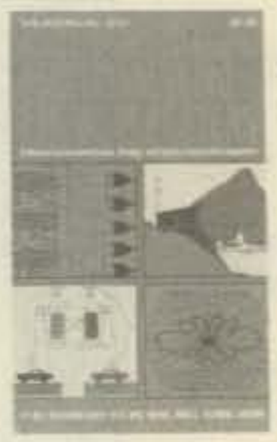
World Radio TV Handbook 1980
The world's only complete directory of international broadcasting and TV stations—the established, authoritative guide endorsed by the world's leading broadcasting organizations. A comprehensive listing of short-, medium-, and long-wave stations revised and updated to reflect actual conditions. Also includes special features on listening gear, how to adapt older receivers for use today, and DX club activities. 560 pages, paperback, $14.95. Order #B097.

OSCAR: The Ham Radio Satellites
by Dave Ingram, K4TWJ
A comprehensive guide to OSCAR satellites and earth stations, it contains all the data necessary to set up, operate, and experiment with the new OSCAR technology. Covers everything—the history of OSCAR, an armchair visit to an earth station in operation, how and where to buy equipment, how to set up an earth station, DXing, and lots more. 128 pages, paperback, $4.95. Order #I037.

RSGB Test Equipment for the Radio Amateur (2nd Ed.)
by H.L. Gibson, G2BUP
Explains the principles of measurement techniques, and gives constructional details of many items of up-to-date equipment of interest not only to the radio amateur but also to the electronics enthusiast. 151 pages, hardcover/dust jacket, $10.95. Order #G050.

RSGB Radio Data Reference Book (4th Ed.)
by Giles, G4CDY, and Jessop, G6JP
Presents a wide range of essential reference data in convenient form without needless repetition of basic theory. Chapter titles: *Units and symbols; Basic calculations; Resonant circuits and filters; Circuit design; Aerials and transmission lines; Radio and tv services; Maps and meteorological data; Materials and engineering data; Mathematical tables.* 200 pages, hardcover/dust jacket, $8.95. Order #G051.

Practical Antennas for the Radio Amateur
by Robert M. Myers, W1XT
This down-to-earth manual describes how to go about equipping a station with a suitable antenna. Included are how to build beams, quads, and wire antennas; computer-generated beam headings to every known country; charts and tables to eliminate tricky calculations; OSCAR antennas; antenna safety; a complete bibliography of magazine articles on antennas; and much more. With on-the-air operation being the goal, the book gives the reader food for thought, as well as practical data for antenna construction for both the experienced amateur and the newcomer. 192 pages, paperback, $9.95. Order #S125.



The Practical Handbook of Amateur Radio FM & Repeaters
by Bill Pasternak, WA6ITF
More than 45 chapters and appendices put all kinds of FM/Repeater topics within easy reach—technical info on FM itself, advice on planning a relay device, a description of the WA6VNV receiver, data on the ATV and RTTY repeaters, and several chapters on building your own repeater. This book shows you what job repeaters should perform and how they can be made to perform it more efficiently. You'll also learn how to handle RF interference, antenna safety, and how to boost performance. This fact-filled guide to FM repeaters, both remote-controlled and manually operated, will answer all your questions and help you get started in this phase of amateur radio. 538 pages, paperback, $9.95. Order #T127.

Design of Phase-Locked Loop Circuits
by Howard M. Berlin
An introduction to the theory, design, and implementation of PLL circuits using various TTL and CMOS devices. The basic building blocks of the PLL are discussed, and the final two chapters cover frequency synthesizers, a.m. and f.m. demodulators, fsk decoders, and other applications. Experiments demonstrate concepts presented in the text. 254 pages, paperback, $8.95. Order #S130.

Design of Active Filters
by Howard M. Berlin
An introduction to the theory, implementation, and design of active filters using the 741 operational amplifier, from a discussion of filter basics to voltage-source filters, second-order multiple-feedback filters, and the state-variable filter. Experiments are given throughout. 238 pages, paperback, $7.95. Order #S131.

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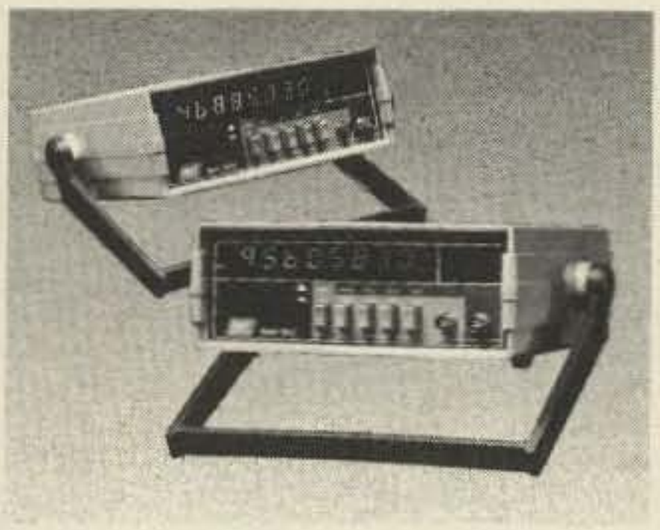


Measuring audio signals, servicing a VTR, checking a 960MHz band, troubleshooting a PLL signal or calibrating instrumentation — whatever your needs — DSI's 1.2GHz 5612 or 512MHz 5600A are sure to provide the accuracy and sensitivity required to meet the most stringent criteria. They also offer selectable resolutions to 0.1Hz at 50MHz; external 10MHz inputs/outputs; 50 ohm, 1 Meg and BNC inputs, and a choice of 95% assembled kit or completely wired versions. All this and much more are yours at the most attractive price/performance quotient available.

SPECIFICATIONS	MODEL 5600A	MODEL 5612		
Frequency Range (typ.)	50Hz-to-512MHz	50Hz-to-1.2GHz		
Accuracy Over Temperature	0.2 PPM Time-Base 10MHz Proportional Oven (10°C-40°C)			
Sensitivity: (typ.) at 100Hz-25MHz at 50MHz-250MHz at 250MHz-450MHz	10-25mV 10-15mV 15-50mV			
Number of Digits (LED)	9 (Auto. Decimal Point & Zero Blank.)			
Digit Height	0.5 inch			
Power Requirements	8.2-14.5 Vdc (NiCad Pak or 115 VAC; Opt.)			
Case Dimensions (Less Handle)	3¼'' High x 9½'' Wide x 9'' Deep			
Prices (in Single-Unit Qty.)	$169.95*	$199.95**	$199.95*	$239.95**

* 95% Factory Assembled Kit (Ready for Final Wiring).

** Completely Assembled and Wired Version.

MODEL 5510
50Hz-1.0GHz

MODEL 5500
50Hz-512MHz

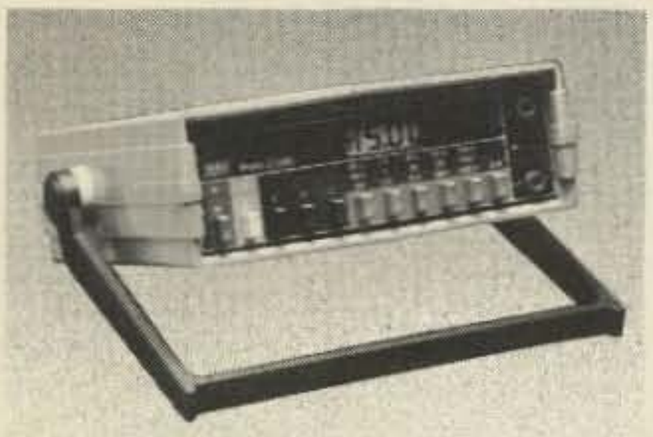
1.0 PPM TCXO (17°C-40°C)

The 1 GHz 5510 and 512MHz 5500 fill a long standing void in the frequency counter field. Now you can answer requirements to 512MHz (5500) for less than $110, or for just $30 more, you can serve the new 960MHz world with the 5510. Both models are available with a rechargeable battery pack. With sensitivities like 15mV at 250MHz, selectable resolutions of 1.0Hz at 50MHz, and a high accuracy of 1 PPM TCXO — along with their slim-silhouette housings and large 8-digit bright LED arrays — they're the best price/performance buy around.

SPECIFICATIONS	MODEL 5500	MODEL 5510
Frequency Range (typ.)	50Hz-to-512MHz	50Hz-to-1.0GHz
Accuracy Over Temperature	1.0 PPM TCXO Time-Base (17°C-40°C)	
Sensitivity: (typ.) at 100Hz-25MHz at 50MHz-250MHz at 250 MHz-450MHz	10-25mV 15-25mV 25-75mV	
Number of Digits (LED)	8 (Auto. Decimal Point & Zero Blank.)	
Digit Height	0.4 inch	
Power Requirements	8.2-14.5 Vdc (NiCad Pak or 115 VAC; Opt.)	
Case Dimensions	1½'' High x 5'' Wide x 5½'' Deep	
Prices (in Single-Unit Qty.)	$109.95*	$139.95*

* Complete Factory Assembled and Wired Units.

True RMS 3-1/2 LCD Character DMM Offers 0.1% VDC Accuracy for Under $170.



Combining true RMS readings on 5 AC voltage ranges and 5 dc voltage ranges (both from 200mV to 1000V), 5 dc current ranges (200μA to 2A) and 6 resistance ranges (200ohms to 20Meg.), with a high Vdc measurement accuracy of 0.1%, low-current drain, reading ease and dependably rugged cabinetry - DSI's LC5000 DMM will prove a truly high-performance vs. low-purchase-price value.

- ☐ True RMS Voltage Ranges 200mV, 2V, 20V, 200V, 1000V
- ☐ DC Voltage Ranges 200mV, 2V, 20V, 200V, 1000V
- ☐ DC Current Ranges 200μA, 2mA, 20mA, 200mA, 2A
- ☐ Resistance Ranges ..... 200ohms, 2K, 20K, 200K, 2 Meg, 20 Meg
- ☐ Display (Liquid Crystal - 7-Segment) ..... 3½ Digit/0.5'' Character Height
- ☐ Power . . . one 9-Volt Alkaline Battery ☐ Weight (incl. Batt.) ..... 1¼ lbs.
- ☐ Price (in Single-Unit Quantities) $169.95

Note: Prices and/or Specifications are subject to change without notice or obligation by DSI Instruments, Inc. Please add 10% to a maximum of $10.00 for shipping, handling and insurance. Orders outside of U.S.A. & Canada, please add $20.00 additional to cover air shipment. California residents add 6% sales tax.

DSI INSTRUMENTS INC

Contact our headquarters for ordering information. Corporate or personal VISA, Master Charge or American Express Charge Cards are welcomed.

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Ham Shop

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SELL: 4 KW, 120-240 Volt, Electric start, commercial duty WINCO gas generator. 1800 RPM, skid mounted, fuel pump, 14hp WISCONSIN motor. Used about 10 hours. Pick up only. T.N. Colbert, WA8MLV, 1800 Rhodes #612, Kent, OH 44240.

UNBELIEVABLE BUT TRUE: "Not $229.95, not $179.95 *but* $132.50 for a Hy-Gain triband QUAD, never used, never assembled. A. E. Hopper, 103 Whittman Street, Rochelle Park, N.J. 07662.

CANADIANS: "UNIVERSAL CROWBAR" module protects radio equipment against excessive power supply voltage. Easy installation. 20 Amp 12V, 5V models $12.95 plus $1 shipping, Ontario add 7%. CGU Radio Electronics, Box 231, Goderich, ONT.

FREE INFORMATION: On Linear Amplifiers, CB Radio Repair, and CB Radio Modification. Send to: A.P. Systems, POB 488, Dept. AR, Milford, PA 18337.

QUADS AVAILABLE in 2 and multi element tri band kits from 150.00 all components severe duty construction fiberglass spreaders 13' long use a unique internally reinforced contruction as strong as pole vaulting poles with ¼ the wind area. db+ ENTERPRISES, P.O. Box 24, Pinevalley, NY 14872.

DXERS: Get new DX Tables custom computed for your exact QTH—All Dx Prefixes, Beam Headings, Reverse Headings, Distances, Time Differences, U.S. Cities, Country/Prefix Listings, QSL Checklists. Send callsign, $3.15 to Willcomp, Inc., P.O. Box 86, South Salem, NY 10590.

MUSEUM: For radio historians and collectors now open. Free admission. Old time amateur (W2AN) and commercial station exhibits, 1925 store and telegraph displays, 15,000 items. Write for details. Antique Wireless Assn., Holcomb, NY 14469.

ROHN TOWER: Buy wholesale from worldwide distributior, - 20G $28.44 each 25G, $37.62 each, 45G, $83.60 each. 48 ft. foldover tower, $660.00 freight paid. 48 ft. BX free standing $224.02. Hill Radio, 2503 GE Road, Box 1405, Bloomington, IL 61701, 309-663-2141.

WANTED: E and F coil sets plus corresponding dial tuning strips for NATIONAL HRO-60. Don Chepurna, 41 Clinton St., Waterbury, CT 06710.

SALE-TRADE: Wyoming-Utah ranch land. 10 acres $50 down, $50 month. (Offer void in California.) FREE maps, photos, information. Trade for ham gear, home computer, test equipment, etc. Owner- Mike Gauthier, WB7QGR, 9550-Q-Gallatin, Downey, California 90240.

TRANSFORMERS: Input/Output for your linear amplifiers. ¼" to 1¼" Ferrites with from 1 to 5 turns of teflon 18ga. wire. LRI, 4035 Oceanside Bl. B-25, Oceanside, CA 92054, 714-726-8099.

SATELLITE TV RECEPTION 36-Page "How-To" Book. Complete reprint of Bob Cooper's 7-article series from *Radio-electronics* Magazine. $6.00 postpaid U.S. and Canada. All others add $3.00 postage. N.Y.S. residents add 48¢ sales tax. SATELLITE TV RECEPTION, Box E, *Radio-Electronics*, 45 East 17th Street, New York, NY 10003.

TRAVEL-PAK QSL KIT: Converts Post Cards, Photos to QSLs. Stamp brings circular. SAMCO, Box 203, Wynantskill, NY 12198.

TUBES: Octals, 7-9 pin miniatures, obsolete types, etc. List 25¢. Warnock, 45 Rothwell, Ottawa, K1J 7G7, Canada.

KENWOOD TS520S with matching speaker $630. Used only a few hours. New HUSTLER 4BTV $70. John Erwin Smith, West 405 Main, Pullman, WA 99163. 509-334-3344.

SELL: ICOM IC-245/SSB Multi-Mode 2 Meter RIG with RM-2 Microprocessor Memory, Scanning, Touch-Tone and Control Unit. Mint Condx. Works perfect $525.00. N6HI (714) 539-6555.

WANTED: Novice xmtr and receiver, need not be working. WA2PCL, 101-23 Lefferts Blvd., Jamaica, NY 11419.

I.Q. OVER 140? Radio Mensa group being formed. SASE to WA2PCL, 101-23 Lefferts Blvd., Jamaica, NY 11419.

QUALITY QSLs Printed 300/$5 /500/$9. White & colored stock! ALL PostPd.; D. Testa, PO Box 9064-CQ, Newark, NJ 07104.

SELL: Beautifully perfect late 75A4 w/rare Collins Noise Blanker, 3 fils, vern. knob, $450. Spare PTO, never used, $50. W2CVW, 343 Catherine St., S. Amboy, NJ 08879.

PRINTED CIRCUIT BOARDS from sketch or art-work. Kit projects. Free details. DANOCINTHS, INC. Dept. CQ, Box 261, Westland, MI 48185.

5 KW. GENERATOR w/ reg./autostart/loadswitch panel for standby or continuous duty. 4-cyl. water cooled. Fully shielded & rfi suppressed. $998. W2GFR, 201/838-2500 or 839-0233.

TA2TAT WRK UR DXCC. Pse callsign, adr, mode W/3 IRC or $1. I'll send to you my QRX card. QSL&QRX INF, P.O. Box 133, Ankara, Turkey.

SELL: Wilson 1405SM HT, excellent cond., auto and desk charger, fully crystaled, rubber ducky, carry case, touch tone, starting college. $300. WB3IJK, Box 243, Avis, PA 17721.

SELL: Johnson KW Matchbox with Meter, FB condx $160 FOB. Want Telrex Monobander Beams 20, 15, 10. WØAIH, Paul Bittner, 1616 South St., Eau Claire, WI 54701.

SALE: Beam 20 meter-5 element Monobander by Wilson. Brand new. Still in carton. $198. plus shipping. Plane, 42 Penn. Ave., Niantic, CT 06357.

WANTED: Factory manuals for test/amateur gear. SASE for electronic list. W7KSG, 1876 E. 2990 So., Salt Lake City, UT 84106.

WANT: Pre-1927 QST's and early ARRL/Radio Handbooks. Ken Miller, K6IR, 1904 Geo. Washington Drive, Rockville, MD 20853.

WANTED: Drake C4 Console, FS4, VHF Converters, TS820S & accessories. Or equal. K3UKW, 215-271-8898.

WANTED: External VFO for TS820 or TS520S. State condition and price. Paying to the bank. Jorma Saloranta, OH2KI, Karhutie 39, SF-00800 Helsinki 80, Finland.

NEED SPACE: No. 26 RTTY machine, excellent condition, with stand and Electrocom Frequency Shift Converter model 250, $150. Manuals included. Joseph Schwartz, K2VGV, 43-34 Union Street, Flushing, NY 11355; (212) 461-5933.

NEW: Dentron 160-10AT $95. Astron RS35-M $139. IC251A $599. IC701-AC $1085. Kenwood BS-5 $50. USED: TS180S/DFC, PS30 $875. KWM2-A (round), PM2 $895. 312B3, $50. TR4C, AC4 $525. TR3, AC3, DC3, $300. SB610 $95. Swan VHF150 $175. Bearcat 210 $100. James Craig, Box 615, Portsmouth, NH 03801, 603-436-2884.

TRADE: Rare Radio Items for Good Rcvr. C.S. Helman, 418 W. Main St., New Port Richey, FL 33552.

SELL: KWM-2 with 516F2 Wing with Rej tuning Updated and overhauled to mint condx. $650. W2UN, E.B. Snow, 716-394-1815.

FOR SALE: Heathkit HW-8 txvr $85. Will trade for Yaesu FV301 ext. VFO. N2ACZ 212-478-8310.

FOR SALE: Hammarlund Rec. HQ140XA and Johnson Viking II trans. and Johnson Viking V70 # 122, (matched set) $350. Also Hallicrafter Rec # S-40B $75. P.O. Box 427, Seaside, CA 93955.

FOR SALE: Kenwood TS-820S transceiver. Used 10 hrs and in mint condition. $700 and will ship UPS. Bob Goodman, P.O. Box 452, Alexandria, LA 71301; Ph (318) 640-1466 after 6:00 PM.

HALLICRAFTERS Service manuals. Amateur and SWL. Write for prices. Specify Model Numbers desired. Ardco Electronics, P.O. Box 95, Dept C, Berwyn, IL 60402.

GENERATE electricity with induction (washer type) motor. No modification necessary. Feed current back into utility grid, reversing meter. Instructions $3.90. E.P.S., Box 3572, Shawnee Mission, KS 66203.

HEATHKIT HW-101 with pwr supply, A-1 condition, $325. I ship. Robert Staunton, 300 Kelsey Dr., Kingston, TN 37763.

SELL: Drake 2NT transmitter, good cond. $75. Vibro-Keyer Paddle, excellent cond. $40. Tom Bailey, WD4HZK, 411 Berkshire Dr., Tallahassee, FL 32304.

FREE Ham Radio Insider Newsletter! Send large SASE: W5YI, Box # 10101-C, Dallas, Texas 75207.

RUBBER STAMPS $3.00 for 4 lines. Postpaid. "Ø" available. Print clearly. Julian Associates, Box 43121, Louisville, KY 40243.

BUY, SELL, TRADE new and used amateur radio and computer equipment. Monthly publication. Lifetime subscription $5. Send to Nuts & Volts, Box 1111-Q, Placentia, California 92670.

SELL: Frederick 1273 FSK. Modem 170 Hz with loop pwr supply. $250 or best offer. Will ship. LA5HE, Box 77, Ljan, Oslo 11, Norway.

WANTED: Swan 508 External VFO. Send postcard with condition, price & phone No. KA5GKD, 2942 Linn Rd, San Antonio, TX 78223.

RADIO-TV interference problems, 30 page book complete step by step how to identify and resolve TVI and RFI. Prepared by the FCC. Send $2.95 to High Country Electronics, P.O. Box 2284, Colorado Springs, Colorado 80901.

TR7/DR7 conversion info. Will allow transmit on new WARC HF bands and more (1.5 to 30 MHz continuous). No additional parts needed. 10 min. conversion time. $30. Edward Oros, AC3L, 715 Whitney Ave., Pittsburgh, PA 15221.

FOR SALE: HW-32A Heath 20mtr Xcvr w/HP-13 DC Sup w/manuals. Needs some work — $100. HW-22A 40mtr Xcvr w/HP-13B DC Sup w/manuals — vy clean — $150. SB-100 Xcvr w/HP-23 AC Sup, SB-600 spkr w/manuals — vy clean — $275. R-648/ARR-41 RX conv to 120VAC $200. WA6ISP (714) 645-1929.

WANTED FOR OUR LIBRARY: Old CQ's in good condition. Will swap 3-month extension on your CQ sub for each old issue that we accept. Need one each of the following: Jan. & Apr. 1952; Jan., Feb., Mar., Apr., May, June, July 1950; Jan., Feb., Mar., May, Sept., Oct., Nov. 1946. Write CQ Magazine, Att.: Joyce Mairano, 76 North Broadway, Hicksville, NY 11801. No phone calls please.

FOR SALE: Collins 75S-3B, round emblem, two filters. 312B-3 Speaker. RFE digital readout. In excellent condition with manuals and instructions. $800.00 plus shipping. A. Dorhoffer, K2EEK, CQ Magazine, 76 N. Broadway, Hicksville, N.Y. 11801.

SCANNERS, CRYSTALS: At low Wholesale Prices! Wholesale to Everybody! Prompt Service! Send stamped envelope! Alfords, Box 339-Q2, Middlesex, NC 27557.

WANTED: SB-104, good condition or fixable. Reply to Evelyn Warneboldt, 4410 Lincoln Ave., St. Joe, MI 49085. Please state approximate date of purchase and cost.

NEED HELP for your Novice or General Ticket? Recorded Audio-visual Theory Instruction. No electronic background required. Free information. Amateur License, P.O. Box 6015, Norfolk, Virginia 23508.

FOR SALE: Yaesu FT-221R multimode 2-meter transceiver with digital display unit and speaker, $465. KLM Multi-2700 2-meter all-mode transceiver with built-in OSCAR preamplifier, $565. Both are in like-new condition. Karl Thurber, W8FX, 631 N. Overbrook Drive, Fort Walton Beach, FL 32548.

VIRGINIA STATE ARRL CONVENTION: The Fifth Annual Tidewater Hamfest and ARRL Virginia State Convention will be in the great new Virginia Beach, Virginia Arts and Conference Center October 4 and 5, 1980. ARRL, Traffic, DX Forums, XYL free bingo and lounge. Admission $3.50. Advance admission ticket drawing for Kenwood FM transceiver. Flea market spaces $3.00 day. Ticket and information—TRC, P.O. Box 7101, Portsmouth, Virginia 23707, SASE.

HISTORIAN WISHES TO CONTACT owners of Browning 35, Cardwell 54, Hatry & Young HY-7, Hendricks & Harvey, Howard 490, Lincoln R-9, Norden 34, Pfanstiehl 70, Pierson KP-81, Postal 35, Postal International, Ross Jupiter, Silver 5-C and other rare communication receivers. H.L. Chadbourne, 530 Midway Street, La Jolla, CA 92037.

WANTED: Hallicrafter S-1 through S-7, DD-1, 8 HPA, SX-10, SX-12, and other early Hallicrafter gear, parts, manuals, and accessories. Any condition. For my collection, please write, even if in doubt on Model No. Chuck Dachis, WD5EDG, 4500 Russell Dr., Austin, TX 78745.

QSLs with Class! Unbeatable quality, reasonable price. Samples: 50 cents, refundable. QSLs UNLIMITED, POB 27553, Atlanta, GA 30327

FREE ELECTRONICS SURPLUS CATALOG Bargain Packed. Fascinating items. Many never before advertised. ETCO-003, Box 762, Plattsburgh, NY 12901. SURPLUS WANTED

CLUB CALL PINS 3 lines 1¼ × 3¼ $1.55 each call, first name and club. Colors blue black or red with white letters. (CATALOG) Arnold Linzner, 2041 Linden Street, Ridgewood, NY 11385.

SPLIT SCREEN RTTY Machine lang program for TRS80 (LII, 16K)/M80. $10 from B. Gorsky, 2449 Derbyshire, Cleveland, OH 44106.

SATELLITE T.V... Build your own satellite receiving station. Quick and easy to construct. For more information wirte...Robert Coleman, Rt. 3, Box 58-A, Travelers Rest, SC 29690.

MAKE YOUR CAR INVISIBLE to police radar. Complete, simple plans - Send $5.00 for manual to: Microwave Systems Engineering, Box 936 CQ, Woodside NY, 11377.

PARTS: Recycling 2 meter Transceiver sections. Front ends; include control panel, noise suppressor and memory board mounted and wired in chassis, $22. Front end w/RF section; as above plus board full of usable AF and 2m tuned RF components. Transistors, toroids, trimmers, etc. all in the chassis, $45. Final RF section (sold separately) handheld linear projects. Includes 2N6080-MRF238 RF power out. Wired board on chassis section w/heatsink and connectors. $33. These are NEW but damaged sections with 95% usable components, satisfaction guaranteed. $3 get photos & more details. ONE OAK Salvage, P.O. Box 337, Westbrook, Maine 04092.

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MFJ KW DUMMY LOAD

Lets you tune up fast into 50 ohm resistive load. Extend life of finals. Reduce QRM. Includes transformer oil. 1 KW CW, 2 KW PEP for 10 minutes. Low VSWR to 400 MHZ.

***Includes* high quality transformer oil.**
Low VSWR to 400 MHZ.
1 KW CW, 2 KW PEP.

$29.95

New MFJ-250 VERSALOAD kilowatt dummy load lets you tune up fast. Extends life of transmitter finals. Reduces on-the-air QRM.

Run 1 KW CW or 2 KW PEP for 10 minutes, ½ KW CW or 1 KW PEP for 20 minutes. Continuous duty with 200 watts CW or 400 watts PEP. Complete with derating curve.

Quality 50 ohm non-inductive resistor.

Oil cooled. Includes high quality, industrial grade transformer oil (contains NO PCB).

Low VSWR to 400 MHZ: Under 1.2:1, 0-30 MHZ. 1.5:1, 30-300 MHZ. 2:1, 300-400 MHZ.

Ideal for testing HF and VHF transmitters.

SO-239 coax connector. Vented for safety. Removable vent cap. Has carrying handle. 7-1/2 inches high, 6-5/8 inches diameter.

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	125	250	400	500	600	800	1.8	2.1	2.4	6.0	8.0
YAESU	$55 EACH										
*FT-101/F/FR-101		✓		✓	✓		✓	✓	✓	✓	
*FT-301/FT-7B/620		✓		✓			✓	✓	✓	✓	
*FT-901/101ZD/107		✓		✓			✓			✓	
FT-401/560/570		✓		✓			✓	✓			
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KENWOOD	$55 EACH										
*TS-520/R-599		✓	✓				✓	✓	• 2nd IF $125 for R-820 only		
*TS-820/R-820		✓	✓				✓	✓•			
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ALL HF		✓	✓				✓	✓			
DRAKE	FOR PRICES SEE NOTES										
R-4C	GUF-1 Broad 1st IF Superior Shape Factor/Ult Rej $65									✓	✓
BRAND NEW	GUF-2 Narrow 1st IF						✓	✓	+ pcb w sw relays $90		
	2nd IF	✓		✓	Plug in type		✓	$65			
	GUD Product Detector	pcb w relay **double balanced** type $30									
COLLINS:	SPECIAL $125 EACH										
75S-3B/C		✓	EQUALS OR EXCELS $400 COLLINS UNIT								

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BARKER & WILLIAMSON
Model 370-10

Portable Antenna for 2, 6, 10, 15, 20 and 40 meters

Weighs Less than 2 lbs.

Disassembled for packing or storage
Only 22½ inches long
VSWR: 1.1:1
Whip extends to only 57 inches
Complete with 10 ft. coax; counterpoise and all coils.

AVAILABLE AT YOUR B & W DEALER OR WRITE:

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CIRCLE 22 ON READER SERVICE CARD

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DOUBLE YOUR PLEASURE

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Work Both 2 and ¾ Meters With Yaesu's New FT-720R

The FT-720R series is a compact VHF/UHF mobile transceiver that harnesses the incredible power of the microprocessor to bring you top-operating flexibility. Start with the FT-720R Control Head, then add either the 10 watt FT-720RU 440 MHz or 25 watt FT-720RVH 2 meter RF Deck. You can clamp the Control and RF Deck together or use an optional remote cable to hide the RF Deck. The best news is still to come! By using the optional S-72 Switching Box and two remote cables, you can use a single Control Head for operation with both the 440 MHz and 2 meter decks, giving you a high-performance two band FM station for your car or home. Compare the features below, then ask your dealer for a demonstration of the fabulous FT-720R series. . . another winner from the performance leader . . . Yaesu.

- Four simplex/repeater memory channels, plus receive-only memory channel.
- Scanning controls on microphone with search for busy or clear channel.
- Optional 32 tone CTCSS module for accessing private repeaters.
- Colorful, easy-to-read LED power output/S meter.
- Built-in 1800 Hz tone generator.
- Priority channel with search-back feature.
- Pause feature that holds, then restarts scan, on busy or clear channels.
- Digital display of last four digits of operating frequency.
- Single Control Head may be used for operation on both 440 MHz and 2 meters via optional switching box and remote cables.
- Extremely compact size, light weight.

FT-720RVH	Specifications	FT-720RU
144.00-147.99 MHz	Frequency Coverage	440.00-449.975 MHz
10 kHz	Synthesizer Steps	25 kHz
25 watts	Power Output	10 watts
.32 uV for 20 dB quieting	Sensitivity	0.5 uV for 20 dB quieting
±6 kHz (—6dB) ±12 kHz (—60 dB)	Selectivity	±12 kHz (—6dB) ±24 kHz (—60 dB)

YAESU
The radio.

Price And Specifications Subject To Change Without Notice Or Obligation

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480

YAESU ELECTRONICS CORP., 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
YAESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

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You're looking at the next generation in ham radio design. The ICOM IC-720 has standard features offered elsewhere as options . . . or not offered at all:

Transmit on all 9 HF bands . . .

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Dual built-in VFO's.

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There isn't enough room to list all of the specifications and features of this exceptional radio. So, please visit an authorized ICOM dealer or write to the address below for additional information.

ICOM

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