73 AMATEUR RADIO

International Edition

MAY 1988
ISSUE #332

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A WGE Publication

Super Satellite Issue!

Get Ready for Phase 3C

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Hamsat Awards

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Technology Update

Winnebiko's Efficient Power Supply

FLASH!

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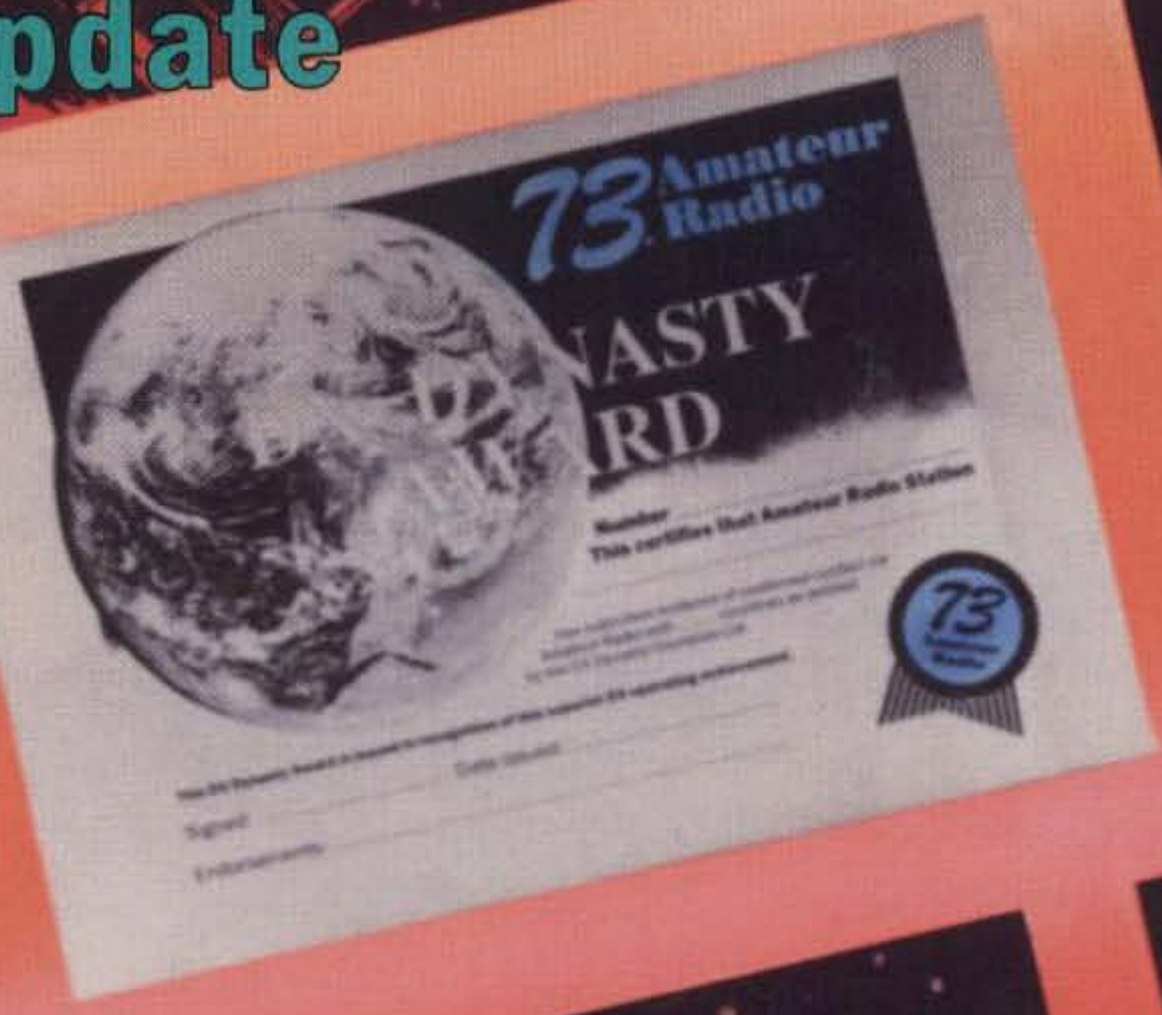

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IC-3200A
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THE ALL NEW PRIVATE PATCH IV BY CSI HAS MORE COMMUNICATIONS POWER THAN EVER BEFORE

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NEW! • Telephone initiated control . . .

- ✓ Operate your base station with complete control from any telephone
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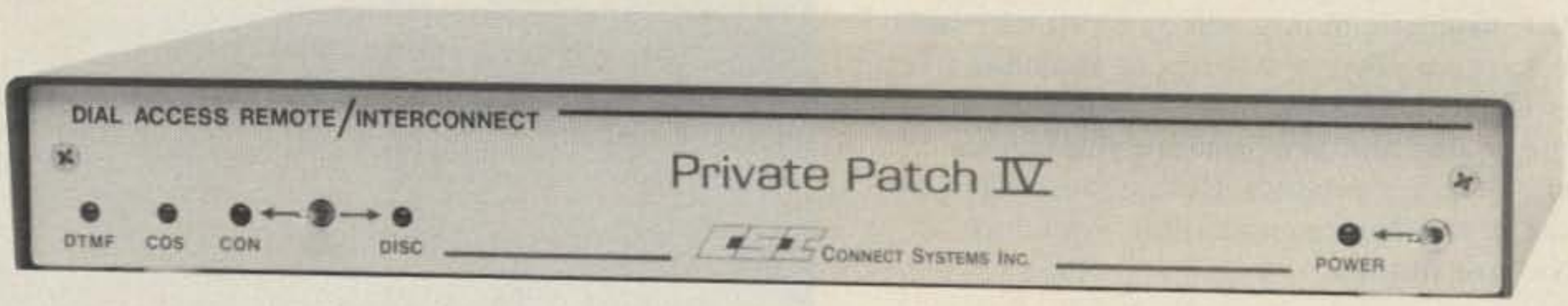
- ✓ Eavesdrop the channel from any telephone
- ✓ Use as a wire remote using ordinary dial up lines and a speaker phone as a control head.



The new telephone initiated control capabilities are awesome. Imagine having full use and full control of your base station radio operating straight simplex or through any repeater *from any telephone!* From your desk at the office, from a pay phone, from a hotel room, etc. You can even change the operating channel from the touchpad!

Our digital VOX processor flips your conversation back and forth fully automatically. There are no buttons to press as in phone remote devices. And you are in full control 100% of the time!

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The importance of telephone initiated control for emergency or disaster communications cannot be overstated. Private Patch IV gives you full use of the radio system from any telephone. And of course you have full use of the telephone system from any mobile or HT!

To get the complete story on the powerful new Private Patch IV contact your dealer or CSI to receive your free four page brochure.

Private Patch IV will be your most important investment in communications.

✓ = NEW FEATURE

- ✓ ★/# or multi-digit connect/disconnect
- ✓ Fully regenerated tone dialing
- • Pulse dialing
- • Toll protection
- • Secret toll override code
- • Busy signal disconnect
- ✓ Dialtone disconnect
- • CW identification
- • Activity timer
- • Timeout timer
- ✓ Telephone initiated control
- ✓ Regenerated DTMF selective calling
- • Ringout
- ✓ Ringout or Auto Answer on 1-8 rings
- • Busy channel ringout inhibit
- ✓ Status messages
- ✓ Internally squelched audio
- • MOV lightning protection
- ✓ Front panel status led's
- ✓ Separate CW ID level control
- ✓ 24 dip switches make all features user programmable/selectable.

- ■ Connects to MIC and ext. speaker jack on *any* radio. Or connect internally if desired.
- ■ Can be connected to any HT. (Even those with a two wire interface.)
- ■ Can be operated simplex, through a repeater from a base station or connected directly to a repeater for semi-duplex operation.
- ■ 20 minutes typical connect time
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OPTIONS

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3. CW ID chip

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- 3.4 db gain | 5/8 wave
- 200 watt rating
- 15 foot coax
  PL-259 connector installed
- Magnetic mount holds to
  100 mph

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RX SERIES (pictured lying down)

- 3.4 db gain | 5/8 wave
- 100 watt rating
- 15 foot coax
  PL-259 connector installed
- Magnetic mount holds to 75 mph

Model RX-2, 2 meter black and chrome
Model RX-220, 220 MHz, black & chrome

19.95 ea.

Also Available in Black
Model RX-2B, 2 meter
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MFJ multi-mode data controller

MFJ *shatters* the 6 mode barrier *and* the price barrier with the MFJ-1278 and gives you . . . Packet, RTTY, ASCII, CW, WEFAX, SSTV and Contest Memory Keyer

. . . 7 digital modes . . . for an affordable $249.95

Amateur radio's newest multi-mode data controller -- the MFJ-1278 -- lets you join the fun on Packet, RTTY, ASCII, CW, Weather FAX, SSTV and gives you a full featured Contest Memory Keyer mode . . . you get 7 modes . . . for an affordable $249.95.

Plus you get high performance HF/VHF/CW modems, software selectable dual radio ports, precision tuning indicator, 32K RAM, AC power supply and more.

You'll find it *the most user friendly of all multi-modes.* It's menu driven for ease of use *and* command driven for speed.

A high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

All you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

You can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions . . . everything you need to get on the air fast. Order MFJ-1282 (disk)/MFJ-1283 (tape) for the C-64/128 and VIC-20 or MFJ-1284 for the IBM or compatible, $19.95 each.

Packet

Packet gives you the fastest and most reliable error-free communications of any amateur digital mode.

With MFJ's super clone of the industry standard -- the TAPR TNC-2 -- you get **genuine TAPR** software/hardware plus more -- not a "work-a-like" imitation.

Extensive tests published in *Packet Radio Magazine* ("HF Modem Performance Comparisons") prove the TAPR designed modem used in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

Hardware DCD gives you more QSOs because you get reliable carrier detection under busy, noisy or weak conditions.

A hardware HDLC gives you full duplex operation for satellite work or for use as a full duplex digipeater. And, it makes possible speeds in excess of 56K baud with a suitable external modem.

Good news for SYSOPs! New software lets the MFJ-1278 perform flawlessly as a WORLI/WA7MBL bulletin board TNC.

Baudot RTTY

You can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. You can *copy not only amateur RTTY but also press, weather and other exciting traffic.*

A high performance modem lets you copy both mark and space for greatly improved copy under adverse conditions. It even tracks slightly drifting signals.

You can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. *This lets you operate MARS and standard VHF FM RTTY.*

You get both the American Western Union and the international CCITT character sets. Autostart for unattended reception and selectable "Diddle".

A receive Normal/Reverse software switch eliminates retuning and Unshift-On-Space reduces errors under poor receiving conditions.

ASCII

You can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode and using the same high performance modem. You also get Autostart and selectable "Diddle".

CW

You get a Super Morse Keyboard mode that lets you send perfect CW effortlessly from 5 to 99 WPM, including all prosigns -- it's tailor-made for traffic handlers.

A huge type ahead buffer lets you send smooth CW even if you "hunt and peck"

You can store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

An AFSK CW mode lets you ID in CW.

The CW receive mode lets you copy from 1 to 99 WPM. Even with sloppy fists you'll be surprised at the copy you'll get with its powerful built-in software.

You also get a random code generator that'll help you copy CW faster.

Weather FAX

***You'll** be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your printer.* Other interesting FAX pictures can also be printed -- such as some news photographs from wire services.

Any Epson compatible printer will print a wealth of interesting pictures and maps.

Automatic sync and stop lets you set it and leave it for no hassle printing.

You can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

Pictures and maps can be *printed to screen in real time or from disk* on IBM and compatibles with the MFJ-1284 Starter Pack.

You can transmit FAX pictures right off disk and have fun exchanging and collecting them.

Slow Scan TV

The MFJ-1278 lets you exchange pictures with thousands of SSTVers all-over-the-world.

You'll not only see what your ham buddies look like but *you can send your own pictures* to them, too.

You can print slow scan TV pictures on an Epson compatible printer. If you have an IBM PC or compatible you can print to screen in near real time or from disk with the MFJ-1284 Starter Pack.

You can transmit slow scan pictures right off disk -- there's no need to set up lights and a camera for a casual contact.

You can save slow scan pictures on disk from over-the-air QSOs, audio tapes and other sources if your terminal program lets you save ASCII files.

The MFJ-1278 transmits and receives 8.5, 12, 24, and 36 second black and white format SSTV pictures using two levels.

Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

You'll score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

You get iambic operation with dot-dash memories, self-completing dots and dashes and jamproof spacing.

Message memories let you store contest RST, QTH, call, rig info -- everything you used to repeat over and over. You'll save precious time and work more QSOs.

You get automatic incrementing serial numbering. In a contest it can make the difference between winning and losing.

A weight control lets you penetrate QRM with a distinctive signal or lets your transmitter send perfect sounding CW.

More Features

Turn on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

Plus . . . printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack for both radio ports, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ in. 12 VDC or 110 VAC.

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CIRCLE 24 ON READER SERVICE CARD

Welcome Newcomers!

Out Of This World, But . . .

John Q. Public is becoming more and more aware of those man-made objects orbiting the Earth hundreds of miles up. They have a growing variety of uses. They **downlink** satellite TV signals to Earth, highly detailed images of military installations, and weather pattern images over given areas of the Earth—to name a few.

Despite their growing presence, however, John may see satellites as arcane beasts. He may believe that only white lab-coated scientists, working in the rarified air of military and commercial high-tech R&D, can understand the function and behavior of these high-flying **birds**. How can the common man, without years of training in space technology, have any hands-on experience with satellites?

Answer: Through hamsats—satellites built by the Amateur Radio Service.

Well Within Your Reach!

The amateur radio service world-wide has, in the past 26 years, sent a series of hamsats into orbit, a half dozen of which are presently fully functional. Hamsats contain **transponders**, devices that receive signals from Earth, amplify them, and transmit them back towards Earth. Thus, John can—with the appropriate amateur license, or under the supervision of an amateur licensee—*communicate* through a hamsat with someone up to halfway around the world!

Although the typical ham neophyte doesn't immediately launch into satellite operation, it's not a difficult next step.

Evolution of Hamsats

The first hamsat, **OSCAR 1**, flew in 1962. This was indeed a humble craft—several hams built this 10-pound bird in their homes using less than $70 worth of parts! It "hitched" a ride into orbit in a spare compartment on a rocket carrying a payload for the Air Force. This bird and the next (OSCAR 2) carried only a **beacon** that repeatedly sent the message "Hi" in Morse code back to the Earth. OSCAR 3, the first hamsat to carry a transponder, went up in 1965, allowing nearly 100 hams in 22 countries to make contacts through it.

The amateur community was entranced by their new presence in space. The small group of hams behind the first hamsats—Project OSCAR—swelled, and new groups of hams formed to build and put hamsats into space. Hamsats rapidly became more sophisticated (see sidebar). AMSAT (The Radio Amateur Satellite Corporation), an East Coast version of Project OSCAR, formed in 1969 in Washington, DC. These two groups soon spawned associated AMSAT organizations in the US, UK, Canada, Germany, Australia, and Japan, all of whom have at least assisted in OSCAR construction and launching.

The Soviet Union also has a very successful amateur satellite program. They began launching the Radio Sputnik (RS) series in 1978. RS-10/11, a single hamsat containing two transponders, is currently very popular.

The glossary contains terms not only printed in bold in this column, but also commonly-used terms the reader will encounter in the satellite features in this issue. See you on the birds. 73

. . . de KA1HY/AE

AMSAT-OSCAR Phases

This are currently three of these. There are a few expections. Read *The History of Project OSCAR* in this issue for more details.

Phase 1 – This phase includes OSCARs 1–5. These hamsats were **low-Earth orbiters** and did not have rechargeable batteries.

Phase 2 – OSCARs 6–9, and 11 are Phase 2 birds. These birds are still low-Earth orbiters, but contain rechargeable batteries to give them long operating lives, sometimes years. Solar panels on the hamsat surface recharge the batteries.

Phase 3 – OSCAR 10 is the second and only operational Phase 3 bird. Phase 3A was destroyed when its Ariane rocket failed in flight. Phase 3C is scheduled for launch in late May. This hamsat has rechargeable batteries and a highly **elliptical** orbit. Its **apogee** can be as high as 23,000 km (14,400 mi). Earth stations can often operate for many hours through OSCAR 10 during a single **pass**.

Phase 4 – This is a dramatic step, planned for the 1990s. Phase 4 birds will be **geosynchronous,** like many current commercial satellites. Stations within their windows will always remain there, and so will have permanent access to the satellites with little or no tracking required.

GLOSSARY

AOS – Acquisition Of Signal. This is when a satellite reaches a point in its orbit when a given Earth station begins receiving signals from it. This occurs usually when the Earth station and the satellite become line-of-sight. This conventionally marks the beginning of a satellite pass.
Apogee – The most distant point from Earth in a satellite's orbit. Satellites with high-apogee orbits "view" more of the Earth's surface, thus allowing more distant stations to contact each other through it.
Azimuth – The direction measured in degrees clockwise from true north around a circular arc along the horizon.
Beacon – A transmitter aboard a satellite that sends an identification or tracking signal.
Bird – Satellite-chasers' jargon for satellite.
Doppler Effect – The variation of the frequency of a downlink signal according to the the speed of a satellite approaching (or receding from) the Earth.
Downlink – Refers to the signal traveling from the satellite to the Earth station.
Elevation – This is the angle between the horizon line and a point in the sky. A 90-degree elevation angle refers to a point directly above the observer, also called **zenith**.
Geostationary – A geostationary satellite orbits the Earth at the same rate that the Earth rotates on its axis. Because of this, the satellite appears to remain over the same point on the Earth's surface. Satellites 22,300 miles above the Earth are in geostationary or **geosynchronous** orbits.
Inclination – The angle between the plane of the satellite orbit and the Earth's equatorial plane.
Keplerian Elements – The set of six parameters needed to accurately calculate any satellite's orbit. These parameters are called right ascension at ascending node (RA), argument of perigee, eccentricity, inclination, mean anomaly, and mean motion. If the orbit is circular, only four parameters are needed for orbit predictions. All parameters must be referenced to the same epoch (time and date). These allow a satellite-chaser to calculate the azimuth bearing and elevation of a given satellite at a given time. There are many computer programs available that can perform this calculation.
LOS – Loss of Signal. This is when a satellite reaches a point in its orbit when a given Earth station loses its signal. This conventionally marks the end of a satellite pass.
Low-Earth orbiters – These satellites have a more circular orbit around the Earth than do high-apogee satellites. They orbit 200–3000 km (120–1875 mi) above the Earth. A typical direct-overhead pass for these birds lasts only 10 or 20 minutes.
OSCAR – Orbiting Satellite Carrying Amateur Radio. Refers to the AMSAT-OSCAR birds.
Parabolic antenna – Also known as a dish antenna. The concave side of the dish receives and collects signals. It is so shaped so that signals striking any part of the dish will reflect to the same point, which are collected by a feed horn and routed to the receiving station. These antennas are extremely efficient signal-gatherers for frequencies above 500 MHz.
Period – The time it takes a satellite to make one complete revolution around the Earth.
Telemetry – Radio signals originating at a satellite that convey information on the performance of onboard systems such as temperature, and whether or not the transponder(s) is/are operational.
Transponder – A device on board the satellite that receives a signal from Earth, amplifies it, and transmits back to Earth on another frequency, usually in another frequency range.
Uplink – Refers to the signal from the Earth station to the satellite.
Window – The area within which two or more Earth stations can access the same satellite, and so communicate with each other.

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 89. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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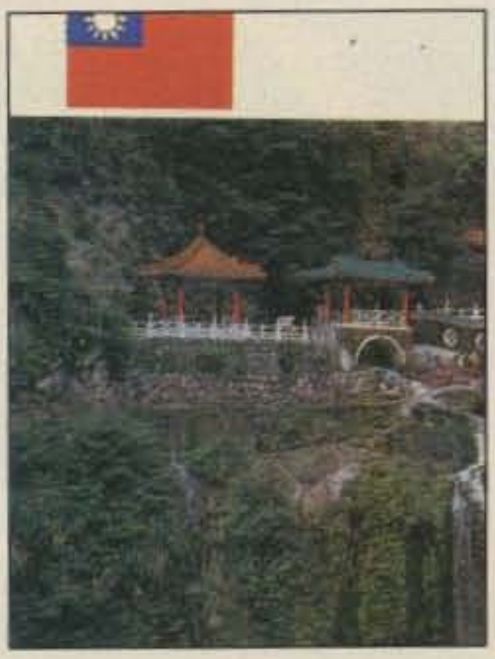

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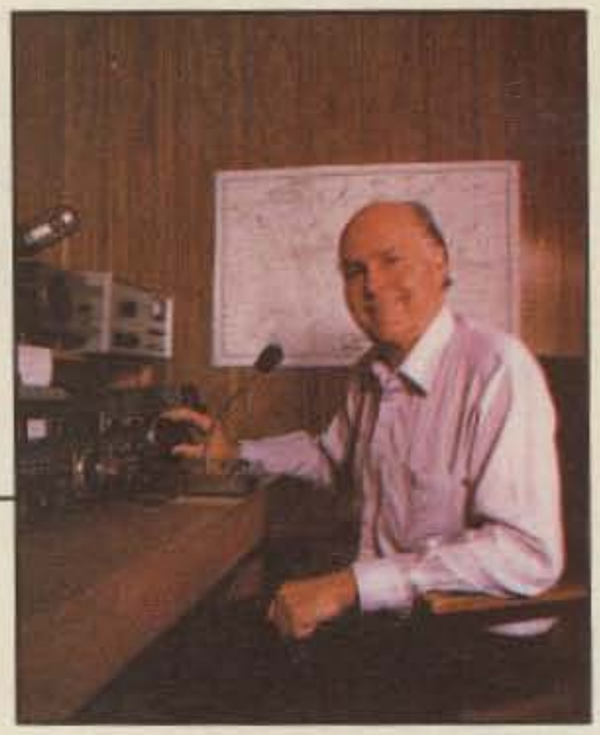

"I Don't Always Agree . . ."

That's the chorus at hamfests, "I enjoy your editorials, but I don't always agree with them." I want to know why the hell not. If you don't agree, is it because I'm wrong . . . or you are? Now, if you've done your homework and have the facts to prove I'm wrong, I want to know about it. Or am I up against your substituting conviction for information? It's a great deal easier to just believe in something than to understand it. Perhaps that's why you don't see many scientists in politics.

Speaking Of Politics . . .

You may recall my campaign for Vice President in the New Hampshire primary. Pulled 32,000 votes—more than DuPont, Kemp, Robertson, Gephardt, Jackson, Hart, Simon, and so on. Ha!

They spent zillions in TV promotion and advertising—I spent zilch, merely going around the state speaking to Lion's, Kiwanis, Rotary, Chambers of Commerce, etc., explaining the need to revamp American education and build ham and computer clubs as a way to get youngsters interested in electronics and communications.

Education

Education, I feel, is America's most serious problem. You've probably read the National Science Foundation report that the education we're providing our American kids puts us dead last in a 13-country list. There are many things which need to be done to improve the American educational system—my proposed electronics course being but one.

My proposal, which I've covered in some detail before, even gets around the lack of qualified science and math teachers—which normally would add a minimum of ten years to any teaching project.

Our teacher's groups have been fighting off technological aids to education with surprising success. As I've mentioned before, I'd encourage the development of home education and educational support systems—testing new ideas and using those that work the best. I'd sure want to encourage the development of a series of videos to help people get their high school certificates—to help functional illiterates learn to read and write, and even to pursue special interests.

Once we've teaching systems that work, we'll be ready to start selling these to other countries—in English and in the native language. This could make it possible some day for even the smallest country to provide a high quality education from the first grade right through college graduate work, and at a reasonable cost. Now that could really change the whole world!

Having visited many third world countries and talked at length with hams living in them, I'm familiar with their special problems: educational, political, social. I know of no simpler solution than education to what ails these countries.

A first class, low cost education would be far more valuable than economic and military aid, and incredibly less expensive. It wouldn't be all that popular with many dictators, who have been taking Uncle Sam for a merry ride by sending our aid dollars on to Switzerland and the Cayman Islands, or investing them in chunks of America a la Marcos.

If we can get the fundamentals of electronics into our grade schools we'll be on the road to regaining our lost consumer electronic industries. If we can get our unions to listen to quality guru Ed Deming and recognize that quality not only sells better, but also costs less, we might even start turning back the Toyotas.

Perhaps, if we can get more kids interested in the excitement of amateur radio, we can break the pattern of mediocrity that locks so many people into lives of so little value to themselves and the world. Perhaps, if we try, we can rescue kids from turning into

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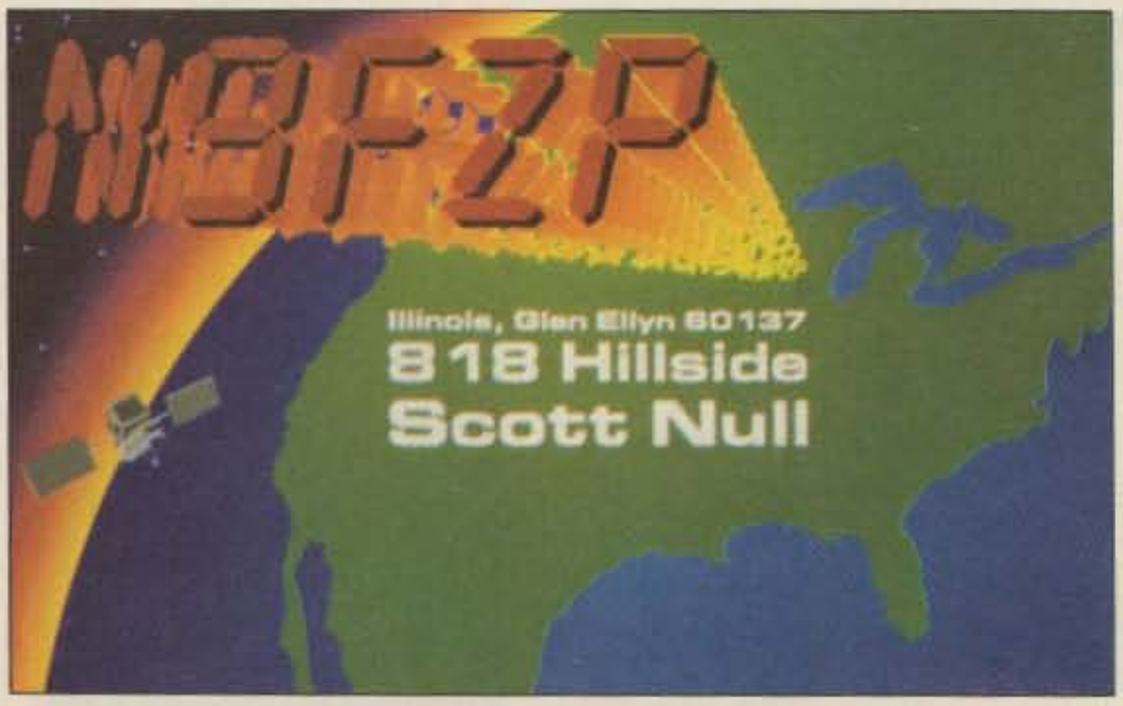

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

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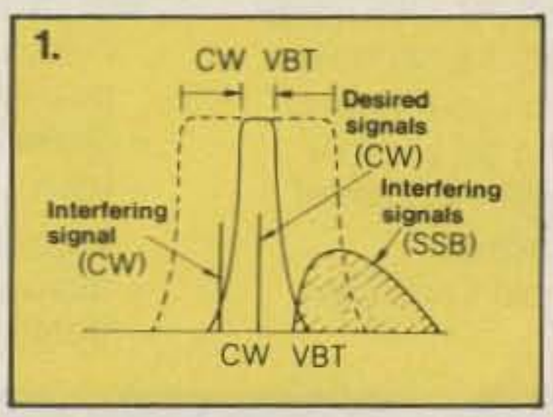

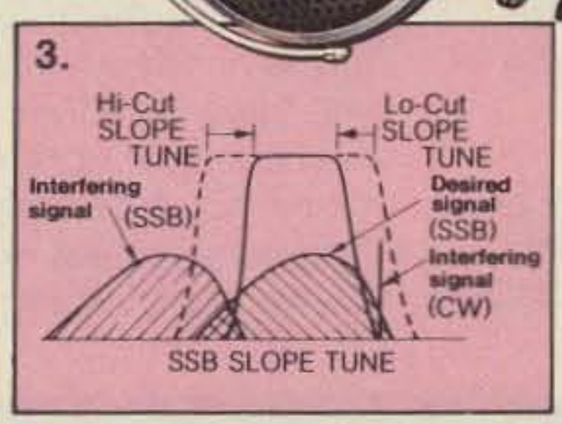

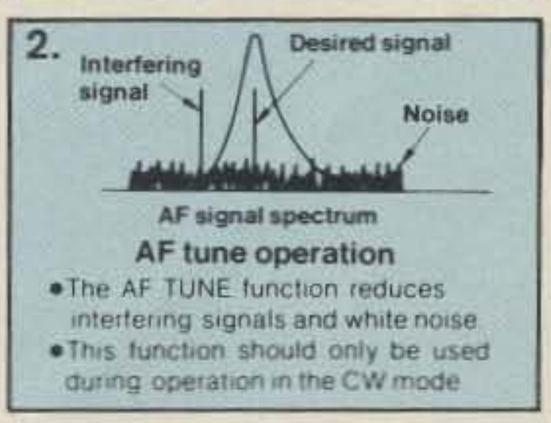

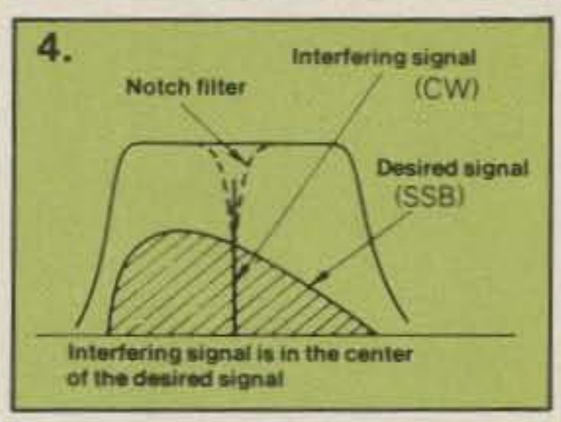

1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

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- **40 multi-function memories.**
  Stores frequency, mode, repeater offset, and CTCSS tone. Memories are backed up with a built-in lithium battery.

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- MB-430 mobile mount
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- MC-48B 16-key DTMF, MC-43S UP/DOWN mobile hand microphones
- SW-200A/B SWR/power meters:
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- SWT-1 2-m antenna tuner
- SWT-2 70-cm antenna tuner
- PG-2U DC power cable

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY/AE

Packets of Health

"Satellife" is a "Space-for-Health" project instituted by Nobel Laureate Dr. Bernard Lown of the Harvard University School of Public Health. The project invited AMSAT to participate in a meeting near Geneva 19–21 March to discuss the possible applications of the AMSAT-developed space systems and earth terminals to support communications between medicalpersonnel in remote areas. AMSAT president Vern "Rip" Riportella WA2LQQ and engineering vice-president Jan King W3GEY travelled to Annecy, France, just south of Geneva, to attend the meeting.

Rip WA2LQQ travelled to Moscow last October for an initial series of Satellife meetings. Since then, AMSAT has developed a technical proposal for a joint US-USSR project to fly a PACSAT (PACket SATellite) within 10 months. This PACSAT would not use amateur radio frequencies. An amateur radio PACSAT is also planned for construction at the same time.

Representatives from the World Health Organization (WHO) and Satellife groups from the USSR, UK, and US, attended the meetings in Annecy.

AMSAT's presentation focused on PACSAT capabilities and emphasized the possibility of very simple Earth terminals. They are to be portable and low-cost, since health workers using the Satellife PACSAT will often be working far afield in small vehicles. The PACSAT Earth terminal will be made up of two HTs, one micro TNC, a laptop computer, and will fit into an attache case fitted with an omni antenna. Radio Shack will supply the computers, Yaesu the HTs, and Tasco of Japan, the TNCs.

Canada No-Code

The Canadian Department of Communications (DOC) officially announced on 20 February that it is committed to entry-level no-code Amateur radio. The DOC is the Canadian equivalent to the FCC. This move may give impetus to the no-code license movement in the US, since the two nations often act in concert.

This move appears to be a reponse to a joint position paper that the Canadian Amateur Radio Federation (CARF) and the Canadian Radio Relay League (CRRL) submitted to the DOC. The CARF and the CRRL are Canada's two national amateur radio organizations. This proposal supported an entry-level ham ticket without a Morse code requirement.

The DOC will probably extensively revise the operator license classes. Canada currently has three amateur radio license classes—Amateur, Advanced, and Digital. The digital license is no-code, but it is un- popular, because the theory is inordinately difficult.

The CARF and the CRRL proposed a three-class restructuring, the DOC, a four-class. The proposed requirements for the entry-level no-code license for both plans are similar. Both groups also proposed for that license all modes above 30 MHz. The CARF/CRRL proposed a 100-watt limit and a lifetime license, the DOC a 250-watt limit. The DOC proposed the most interesting requirement—commercially-manufactured transmitting equipment only! They, in fact, want this requirement for three of their four proposed license levels.

Canadian amateurs will have the opportunity to comment on the government DOC proposal once the notice appears in the official government journal, the *Canada Gazette*. The restructuring will probably take place next year.

Young Ham Award

Westlink's Young Ham of the Year Award is being beefed up. Starting this year, *73 Magazine* will give a free year's subscription to the winner. In addition, Gordon West WA6NOA will furnish a complete amateur radio code and theory course to the school attended by the award winner. Falcon Communications will donate a 2-meter mobile amplifier to the person or group who wrote the nominating letter of the winner.

Yaesu USA continues to support the main prize. They supply a piece of ham gear, usually a transceiver, and cover the winner's travel and hotel expenses to and from the amateur radio convention where the award is made.

Westlink Report's Bill Pasternak WA6ITF conceived the Young Ham of the Year Award in 1986. The Award competition is open to any amateur 18 years old or younger who has performed some major public service for and/or using amateur radio. Nominating letters must be written in detail, and claims supported.

The nomination period runs until 30 June 1988. The award will be presented at the 1988 ARRL Convention in Portland, Oregon, next September.

For more info, write: Young Ham of the Year Award, *Westlink Report*, 28221 Stanley Ct., Canyon Country CA, 91352, Attn: Sanford Hicks WB6MQV

T'anks

To this month's QRX news contributors. They are: *Westlink Report*, and *W5YI Report*.

73 Magazine welcomes any and all news items and photos of interest to hams. Please send them to the magazine at WGE Center, Peterborough NH 03458-1194. Attn: QRX.

Boycott

The largest conference of Mid-western repeater coordinators may boycott the ARRL Repeater Directory if the ARRL goes ahead with plans to indiscriminately accept any submitted repeater frequency listing and coordinator names. The Mid-America Coordination Council (MACC) would conduct the boycott by refusing to furnish updated coordination to the League and by forbidding the publication of listings for their states in the book. Nebraska coordinator and former ARRL VHF repeater advisory committee chairman Joe Eisenberg WAØWRI said that a number of member states in the MACC are considering this boycott. The states that follow MACC guidelines are Missouri, Iowa, Kansas, Nebraska, South Dakota, Illinois, Oklahoma, and Wisconsin.

Trans-Ontario 2M FM Soon?

Kingston, Ontario, located at the eastern end of Lake Ontario, is the latest city to join the VE3LUR repeater chain, in official operation since 31 January 1988. Two-meter communications is now possible from London, Ontario, located 100 miles NE of Detroit, to Gananoque, 15 miles east of Kingston. The north-south link is solid from Collingwood, Ontario on the southern tip of Georgian Bay, to the US border.

HR in NY Schools

For the first time, ham radio was presented as an educational tool to teachers and administrators from across New York State at their annual middle schools convention in Rochester. Joe Fairclough WB2JKJ spoke on "Educational through Communication."

The story of the "Crew at 22" (see Aug. '87 *QRX*) came through loud and clear to an audience of non-hams concerned with the revitalization of the middle school experience for New York's students. WB2JKJ is the director of the Radio Club of Junior H.S. #22, based in Manhattan, which funds and supports classrooms in New York State and across the nation that use Amateur radio as a theme to enrich and enhance the education of young people.

Joe's ideas seem to have found favor among his colleagues. In the new officers' elections at the end of the convention, Joe won the position of New York City director for the NYC Middle Schools Association!

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220 MHz TH-315A Here Now!

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- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
- **TH-315A covers 220-225 MHz, TH-415A covers 440-449.995 MHz.**
- **5, 2.5, or 1.5 W output, depending on the power source.** Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset, in 100-kHz steps.**
- **Odd split, any frequency TX or RX, in memory channel "0."**
- **Nine types of scanning!** Including new **"seek scan" and priority alert.** Also memory channel lock-out.
- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power saver ratio selection.
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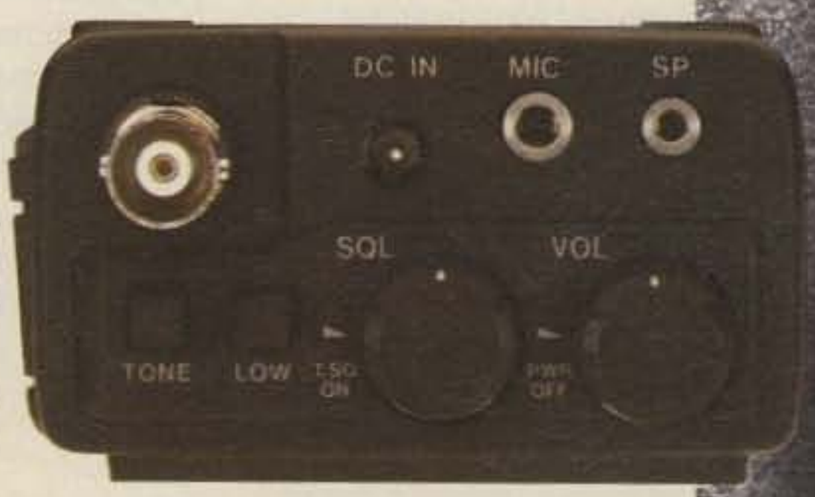

- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm keypad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, DC cable, dust caps.

Optional Accessories:

• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 compact battery charger • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier (1-4 W input) • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V extra DC cable • PG-3D cigarette lighter cord with filter

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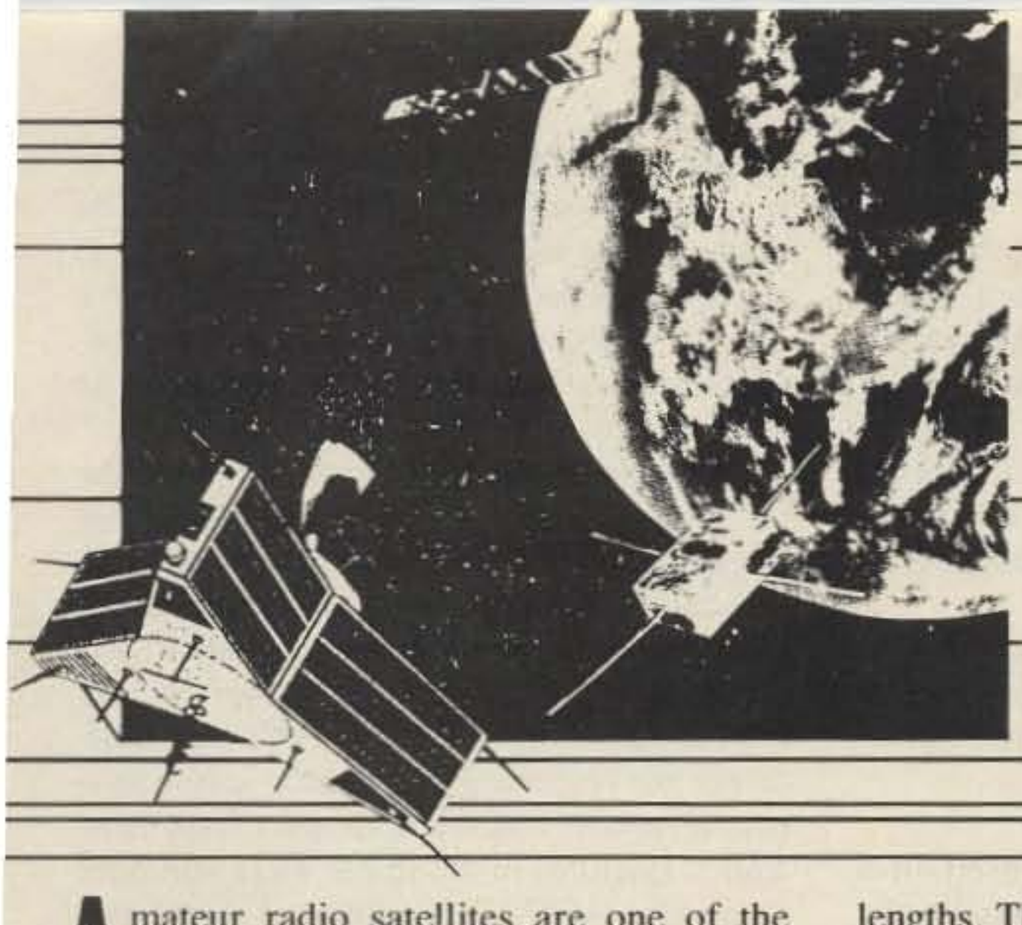

Why Do Satellites?

The future of ham radio is looking up.

Courtney Duncan N5BF

Amateur radio satellites are one of the great hopes for the future of the hobby. They represent new technologies, expanded use of the amateur spectrum, and opportunities to experiment and develop new capabilities. As the reader will see, hamsats have something to offer to everyone.

Amateur radio satellites are also known as OSCARs, an acronym for **O**rbiting **S**atellite **C**arrying **A**mateur **R**adio. The first OSCAR went up over 25 years ago. This part of the hobby has always been considered very advanced, very narrow, very technical, and very *interesting*. The current era, a period in which the Phase 3C satellite is very near its launch, is both a culmination and a conception of the technology. The role of satellites in the amateur radio service is expanding and developing in some very exciting ways.

As amateur radio moves into the future, it must continue to justify its existence in ways that an outsider can easily understand. Amateur facilities must be dependable, more precisely predictable, and high caliber, in order to approach the quality of communications service that the public has come to expect of communications carriers. Satellite-based operations easily support this standard while the ionosphere and troposphere cannot. Digital networks must be improved in quality, capacity, and coverage. Satellite-based backbones will provide a very important link in this chain as well.

The amateur satellite service is fast becoming more than just another area of the hobby in which to dabble, or even just another chapter in the Handbook which to glance through. OSCAR is becoming a ham-household word like ionosphere and troposphere are now.

Here are some examples to show that many amateur radio activities are possible on satellites.

DX

Early one Sunday morning late last November, I worked UA0ALA in Krasnoyarsk, USSR, VK7ZGK in Hobart, Australia, KE7NR in Phoenix, Arizona, JA1KX near Tokyo, Japan, VE7AIO in Clear Brook, British Columbia, and KR6B in southern California, all via OSCAR 10, and all in the space of two hours. All of the mentioned stations worked each other as well. All six contacts were more than just information exchanges—they were pleasant chats of various lengths. This is just an example of what goes on all the time on satellite DX.

The reader may say, "What's so remarkable about that? Anyone with a KW and a six-element monobander can do this." It's this very arrangement, however, that's turned many people away, myself included, from HF DX. The skip-wave DXer often clashes with his neighbors because his high power interferes with their receiving devices, and his antenna placed at an effective height is seen as an eyesore. Even if a skip-wave DXer overcomes these problems, he most often has to sit in pileups or wait his turn on lists or call-area rotations. And *then* he may wait patiently for hours, just have the band close down on him as his turn in the list comes up! HF propagation predictions still involve as much voodoo as calculating known variables.

Satellite DX contrasts heavily to its HF counterpart. My above-mentioned session didn't have pile-ups or lists—and most satellite DXing doesn't. Also openings are perfectly predictable in satellite operation—simply feed the relevant orbital elements into a satellite orbit tracking program to learn the precise duration of openings.

Power reqirements for satellite operation? Only as much as needed, and that is almost always less than 100 watts ERP. A typical satellite station uses a 10-watt output rig with a 10-dB gain antenna system.

CW

When I first made satellite contacts on OSCARs 7 and 8 several years ago, I used transverters and homebrew antennas to upgrade an HF station to satellite operations. Except during a near overhead pass of the satellite, I commonly had to use CW to hear my signal coming through clearly. Unlike many other operating modes in amateur radio today, some satellite operations still require CW for succesful operation, and most on-board beacons still transmit in CW or have CW modes that are used as part of a regular schedule. Thus, although on-board and ground-based data communications increasing use the more advanced digital modes in satellite operations, there is still an important place for CW on OSCARs.

SSB

All six of the DX contacts above were made using single sideband. With a standard satellite station and a satellite operating nominally, there is rarely a signal level requirement that precludes SSB operation. Most satellite-based contacts are made on phone. There is even an amateur satellite up now that has the ability to transmit its telemetry in spoken form through a "digitalker" chip, and it does so regularly.

Contesting

Contesters at heart will be challenged by Low Earth Orbiting (LEO) OSCAR operation. Picture this following scenario:

Fuji OSCAR 12 is about to pass over the US and the Mode J analog transponder is on. The satellite is now southwest of Hawaii, just below the horizon. Joe Sat-op's antenna is aimed in its direction, zero elevation, the 435 MHz receiver is tuned a few kHz above the beacon frequency (because the beacon will appear higher in frequency due to Doppler shift), the 145 MHz transmitter is tuned for the middle of the uplink passband, ready to go.

Suddenly, there is a faint but strengthening signal, and the CW beacon is solid, transmitting identification and telemetry at about 20 wpm. Quickly Joe tunes the receiver up into the middle of the passband. A KH6 station is calling CQ. As KH6 speaks, Joe switches between right- and left-handed circular polarization to see which results in the loudest downlink. The Hawaii op signs and Joe picks up the microphone to call but realizes that he hasn't spotted the current uplink to his current downlink frequency. Quickly Joe switches to CW for spotting and back to LSB for fine tuning. (The transponder is inverting, so LSB in the uplink is converted to USB in the downlink.) He finishes calling CQ again, "KH6...from..." Joe signs his call. He comes back, and Joe quickly exchanges the standard information with him. He comments on the view from his shack in Hawaii. It is dusk there, but night where Joe is.

After finishing, a station on the west coast calls. Signals are weaker. Joe glances at the computer elevation and azimuth printouts, and moves the antennas a little, and tries switching downlink polarization again. Both adjustments help and signals are back up strong. Tuning, Joe hear stations starting to come in from the Midwest. He moves the antennas again. Joe start a QSO with a W0. The satellite is nearing its highest elevation.

To maintain the QSO, Joe continually moves the antennas, the transmitter, and the receiver. Now stations on the east coast are showing up, and one works the KH6 just as Hawaii is losing the satellite. Joe picks up another East coast station. At this point, the Doppler rate has slowed and it is easier to stay on frequency. Joe comments about the quality of satellite signals tonight, listening to his own downlink when it takes one fade and is then gone. The downlink band is dead, and it's all over until the next orbit.

This is a typical low-orbit satellite pass, reconstructed from snatches of memories of my own satellite operations. These sometimes get so hectic that operators will tape record the session and listen later to try and figure out what happened.

This operation is not like standard contesting. The tuning, waiting, pouncing, frequency holding, and logging aspects are all there and added to that is the thrill of trying to manually keep all of the equipment on target and on frequency as the satellite flies past.

There are also technical competitions. In one, a station transmits through the satellite at lower and lower signal levels and others see how "hot" their receivers are by seeing how far down they can copy. Another contest is under development where an operator will attempt to locate a hidden transmitter by comparing its satellite relayed signals with time and frequency references and analyzing the results with a computer.

In Search of the Laid-Back QSO

Of course, contesting is not for everyone. Just as with the HF bands, there are individual operator preferences for style, mode, and frequency. Many operators came into satellite work for the wide coverage and long passes of OSCAR 10.

AMSAT has been working hard in the Phase 3 era and will continue with Phase 4 to make nominal, long duration, reliable, appliance-type operations available via satellite for those operators who prefer it or need it to support public service, emergency, experimental, and other operating styles. QSOs with meaningful and often lengthy content will be the lifeblood of amateur radio for many satellite operators as they are for many conventional operators now.

For the low-earth orbiting satellite operation, equipment is now available off the shelf that automates virtually all of the functions done manually in the LEO pass described above. The high-orbit missions like OSCAR 10 are designed to encourage and foster this very type of activity. If Phase 3C performs as advertised, it will be possible to prop modest antennas up on sawhorses on a back patio, eyeball the azimuth and elevation, and then operate for several hours with modest transmitting equipment (but a sensitive receiver, discussed below) without making any significant antenna or frequency adjustments. It is this sort of operating capability that supports long schedules, rag-chews, round tables, and nets among the traditional amateur radio activities.

Experimenters

Those who make up the amateur satellite community *need* to be experimenters. Satellite operations areat the leading edge of technology. There often is no appliance equipment available for the bands and modes of operation used with satellites. Satellite work has always been weak-signal work, too, so practitioners constantly push the state of the art to enhance the signal.

The two high-tech pursuits discussed next are just a small sampling of the many technical areas closely aligned with satellite work.

QRP is QRO

The reader should imagine himself in a raging surf trying to speak to someone on the shore. He faces in the right direction, but no matter how loud he shouts, a crashing breaker takes out half of every sentence. Seasoned operators of 20 meters should instantly see the analogy here to their DXing on that band when it is open. The only answer is to use more power. Borrow somebody's kilowatt megaphone and blast your words above the turmoil.

Now imagine a quiet meadow in the country. The pastoral wanderer sits in a clearing in the woods and the air is perfectly still. It is so quiet he can hear his analog mechanical watch ticking at his side. The person he wants to hear is on the other side of the clearing. The choice here is between the speaker speaking more loudly and the listener listening with more sensitivity. As the propogation distance increases, both are needed.

This is a typical situation at 30 MHz and above. The level of natural background noises there is several tens of dB lower below the normal HF level, particularly in the UHF frequencies and above. Indeed, the limiting factor on receiver sensitivity in amateur grade equipment is the electronic noise generated in the first RF stage of the receiver.

On a terrestrial or line-of-sight link, all else being equal, increasing transmitter power or reducing noise in the receiver front end leads to the same effect. Not so in satellite work. Power available to a satellite is limited by its power collection and storage mechanism, normally solar cells and batteries. All operators using the satellite share the available power with equipment on board the satellite. For low-earth orbiting satellites, this usually amounts to a few watts, for OSCAR 10 and Phase 3C, it is a few tens of watts. It is essential that the front end of any ground station for these satellites be "quiet" enough to hear the satellite generated or relayed signals clearly.

The satellite receivers are built to be as sensitive and quiet as possible, within practical limits. They incorporate, however, automatic gain control. The AGC in the satellite receiver operates over the transponder passband. If one station is so strong that AGC is activated, all satellite-user signals on the same transponder go down equally, and already marginal signals disappear. It's all the worse if the offending station has an inadequate receiver because he'll likely create a vicious circle by pouring out more power to hear his downlinked signal, which will be limited more and more by the AGC, and so never be satisfactory to him. This has been a chronic problem in satellite operation, because most satellite users have come up from the HF bands.

Three developments serve to reduce the problem. First, more and more OSCAR operators are understanding the nature of satellite communications, and so are investing time and energy in lower-noise preamplifiers for receivers rather than high-power amplifiers for their transmitters. Second, manufacturers are beginning to produce reasonably-priced satellite stations with quiet front ends. Third, satellites in the Phase 4 era will have "selective AGC." Using digital signal processing (DSP) or other appropriate technologies, AGC will be applied only to the louder signals in the satellite passband without suppressing other signals. Excess uplink signal will be thrown away without also hampering those users who do not have excess uplink signal.

This is a dream for QRP operators. Just how little signal does it take to achieve satellite relay? Only those with the quietest receiver front ends will know. There is elegance, simplicity, and conservation in this, all qualities of which amateur radio operators can be proud.

Especially true in satellite work, using the minimum power necessary for the intended communication is not only the law, it's also a good idea.

Digital

Since the inception of packet radio, there has been a considerable symbiosis between amateur satellite operators and digital experimenters.

At the analog end, standard modulation schemes and new, experimental ones are used, both at standard and non-standard speeds. FSK, AFSK, and PSK are all in active use. A big share of this type of experimentation is now done on the satellites and that share will increase.

The protocols used range from traditional CW to RTTY, AMTOR, and, of course, AX.25 Level 2 packet radio. The highest speed trunks, and the optimized protocols are in development for amateur satellites. Among future items are digital inter-satellite coordination. Individual users are and will be using satellites for digital communications. An AX.25 mailbox is now in orbit on Fuji OSCAR 12, and more are on the way. The Phase 3C spacecraft will have digital telemetry, bulletins, and engineering data, and an experimental digital transponder called RUDAK. The two scientific amateur satellites, UoSAT OSCARs 9 and 11, transmit most of their data to the ground digitally at 1200 bits per second.

Computers

Personal computers are becoming necessary items in most ham shacks today. Satellite-users find them especially useful. The primary use is to track the satellites, provid-

ing the numbers in real-time, or in hard-copy prepared beforehand, that tell where the antennas should be aimed from moment to moment. Other uses for the computer range from acting as a terminal with a terminal node controller (TNC) for packet operations, to full station automation and control to digital signal processing on audio signals to and from the radios.

Those who like programming are in good company in the satellite community. Most of the current leadership of AMSAT-North America have been involved in some aspect of producing satellite tracking software at some point in time and some of them even came into the program through interest in this type of programming. There are all sorts of software projects such as writing or porting software for (moving an existing program to another computer) communications, digital protocols, graphics, satellite tracking, digital signal processing, data collection, data analysis, and data archiving. There is also a need for those who can handle a personal computer in its more "traditional" role as a business machine for databasing, accounting, and word processing.

Software is available from AMSAT and from other non-profit or commercial sources to cover any of the above-listed tasks, and much more.

Hams without computers, however, can still work satellites. Those with fixed antennas (omnidirectionals, for instance), need to know only the acquisition time (when the satellite first appears on the horizon) and loss of signal time (when the satellite disappears over the horizon). These and rudimentary elevation and azimuth information are available for low earth orbit satellites from a simple graphic device called an "OSCARlocator." This device is used with information available on AMSAT HF nets and mailed publications. There is also appropriate information available via the satellites themselves, in automated CW telemetry, and in the future on nets. Phase 3C will require less actual tracking for more on-the-air time, and Phase 4 will be in geosynchronous orbit. In the last case, one needs only to obtain coordinates once, aim, peak, and lock down!

Small Lots, Country Estates

A trend these days, particularly for technical types (such as many involved in ham radio, is living in the city or the suburbs. This usually means little or no lot space, and many neighbors nearby. These constraints make it very difficult to install an adequate antenna system for HF hamming.

Not so, however, for satellite work, as my own example shows. I live on a small lot in a large city. All of my amateur transmitters (aside from hand-helds) are in the 25–30 watt output class. My very adequate antenna system is only 20 feet high and requires an eight-foot spherical turning radius. It barely clears the house. Given ten times the money and ten times the space, I could only marginally improve my receiving situation. A single, circularly polarized crossed yagi for each band, a modest transmitter, and a quiet receiver are all that is required for consistent, reliable operation.

I had made a satellite contact even before I got my satellite antennas! In my impatience, I used a magnetic mount quarter wave for one band, and the antenna from a hand-held transceiver for the other band, and completed a QSO via Fuji OSCAR 12. Other amateurs have conducted successful satellite operations from their cars using a pair of radios and mobile antennas. If Phase 3C performs as advertised, these kinds of operations will become routine.

Folks in the country can have a fully adequate satellite station that possibly has less environmental impact than the antenna system they require for terrestrial TV reception.

More room means more ambitious experiments. Using moonbounce-class antennas and quiet receiver front ends, it's possible to hear the noise floor of most if not all amateur satellite receivers being retransmitted by its associated transmitter. Information on the signal level and nature of this noise floor is useful to satellite designers and operators. Also, tests of signal level and quality at and even slightly below the horizon are of interest to the user community. Those with plenty of received signal with which to work are best equipped to pull out marginal stations. This could be critical in emergency communications.

Continued on page 76

73 Review *by Dan Kernan NX2C*

The New Ten Tec Paragon Transceiver

Ten-Tec Co.
Highway 411 East
Sevierville TN 37862
Price $2,245

For those of us that grew up in amateur radio, companies like Johnson, Hallicrafters, and National seemed as American as McDonalds or Burger King today. When the imported wave of ham gear hit America's shores in the 70s, many of these famous names disappeared from the ham shack and vocabulary. One American equipment manufacturer still around is Ten Tec from Sevierville, Tennesse. The Smokey Mountains are hardly Silicon Valley. When Al Kahn K4FW and Jack Burchfield K4JU founded the company in 1968, it quietly gathered a faithful following, and the product certainly deserved a look over. The Ten Tec Company has developed an excellent reputation for fast and thorough service at an honest cost. This was no small achievement in the highly competitive ham market.

Ten Tec's latest venture into the amateur market is the all-band HF rig the Paragon. As a satisfied Ten Tec Corsair owner, I was most interested when the dealer ads appeared in *73* for the Paragon. Ten Tec has made a radical departure from their normal no-frills approach in ham gear with new features in the Paragon, such as microprocessor frequency control, two VFOs, general coverage receiver, and a bank of memory channels.

Let me clarify the no-frills statement: It's not intended to indicate a lack of performance, but simply the lack of bells and whistles that hams have come to expect on the imported models.

In the Beginning . . .

Let's begin with a major problem with the Paragon–obtaining one. While the prototypes were around in 1986, dealers would not accept orders for the Paragon until early 1987. I placed my order around the first of March 1987, and the rig arrived the first week of September. A six-month wait. That's a little like telling a five-year-old that Christmas has been postponed until July. When checking with Ten Tec in the summer of 1987, the Company indicated a production of 100 units per month with about 250 orders back logged.

The Blessed Event

Well, the UPS man finally did show up with Model SN:057, which I hurriedly unpacked and plugged into it's outboard Model 960 power supply/speaker. I was immediately impressed with the physical size of the unit, a somewhat large 5¾" x 10¾" x 17". The control knobs were also a good size. Having large paws, the small oriental knobs can be a problem for me.

The Paragon is a synthesized transceiver. It has a general coverage, all-mode receiver (SSB, AM, CW, FSK, and optionally FM) that tunes from 100 kHz to 29.999 MHz. The Paragon comes complete with a 2.4 kHz SSB filter and 6 kHz AM filter. The AM filter makes for very comfortable listening, especially to the foreign broadcasts and the local 50's rock station. There are provisions for optional plug-in filters for 1.8 kHz SSB, .500 and .250 kHz CW and FM transceiver plug-in option, available since the end of 1987. The user can select filters regardless of operating mode. A voice synthesizer for frequency readout and an RS-232 interface for computer control will be available soon.

Receiver

How is the Paragon's receiver? In a word, quiet. Ten Tec has managed a very quiet PLL oscillator, and indeed Ten Tec indicates that much of the three-year engineering effort was invested in improving receiver performance and inherent PLL phase noise. Tuning across the bands between signals will quickly attest to Ten Tec's success in achieving the company's goal. There were only a few minor "blips" on the 10 meter band; otherwise the receiver was very quiet.

The blue flourescent display is switch selectable for 100 Hz or 10 Hz readout, and a slow–fast control for tuning. Frequency selection can be made using the main tuning knob, keyboard entry pad, or the up/down buttons that step in one megahertz increments or to the next ham band.

Ten Tec has installed a tag in the frequency display area. This tag feature shows the date or the current 12 or 24 hour time, which is displayed by repeated touches of the display key. The tag, or memo feature, may be used to write in up to a 7-digit alphanumeric message, such as net name, callsign, or ID. The function keys double as an alphanumeric keypad with which to write the electronic memos. A combination of display messages in the 62 memories and the scan feature makes the radio light up like the Fourth of July in Philadelphia! The memory channels retain mode, filter, tag, and frequency automatically.

Additional receiving functions are passband tuning, which shifts the IF +/- 1.2 kHz; a tunable audio bandpass filter, a 4-pole device with a variable center frequency of 220 to 1.7 kHz; an additional 250 to 2.2 kHz notch filter with more than 50 dB of notch depth; a variable tone control; the -20 dB attenuator; and a receiver capable of handling just about any condition the bands can dish out in terms of QRM. Completely removing the carrier of a "tuner upper" from the frequency presents no problem. The CW selectivity with any optional filters is quite good, as I discovered in the recent November sweepstakes contest on CW.

The CW sidetone SSB monitor volumes are adjustable independently of the AF gain.

Transmitter

On the transmit side of things, there is a choice of upper or lower sideband, regardless of band chosen, plus CW and FSK (FM optional). The RF output is ALC stabilized and adjustable 10 to 100 watts with the front panel control. The low impedance microphone input provides voltage to power an electret mic element. A speech processor increases the ratio of consonant to vowel sounds to increase articulation up to 10 dB. Broadcast quality reports, with and without the speech processor, were all very favorable on many contacts. The processor did give an added punch without reducing audio quality.

Internally, all circuit boards are glass epoxy and easily removed without desoldering. The front panel is hinged to provide access to all sections of the chassis. Only four screws are needed to remove either the top or bottom covers. The roomy interior can store a lunch and almost a six-pack for Field Day. The shades of gray are a little reminiscent of the older Collins "S" line.

Summary

Ten Tec has apparently aroused considerable interest with this radio, having had several visits from a number of local hams who would like to own one. The Paragon seemed to please even the demanding big gun DX types with its sensitivity and selectivity.

The improvements needed would include a panel-mount level controls for the internal monitor, and perhaps VOX gain and delay controls on the front panel instead of the rear, otherwise the Paragon was enjoyable to operate.

The Paragon is a first class amateur transceiver with an impressive list of features. It has the look, feel, performance and price of a professional piece of radio equipment. If a new HF transceiver is in your future, the Paragon warrants some serious consideration. 73

Readers interested in reviewing equipment for *73* should send us an SASE requesting a Reviewers Questionnaire.

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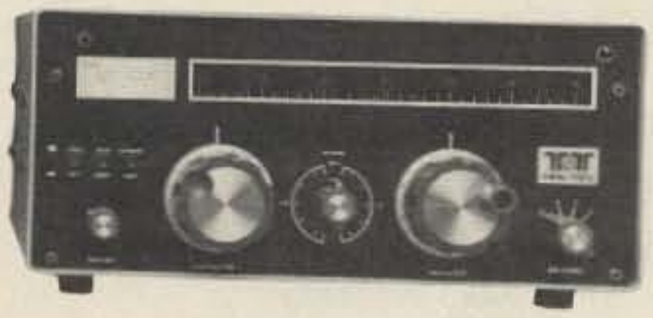

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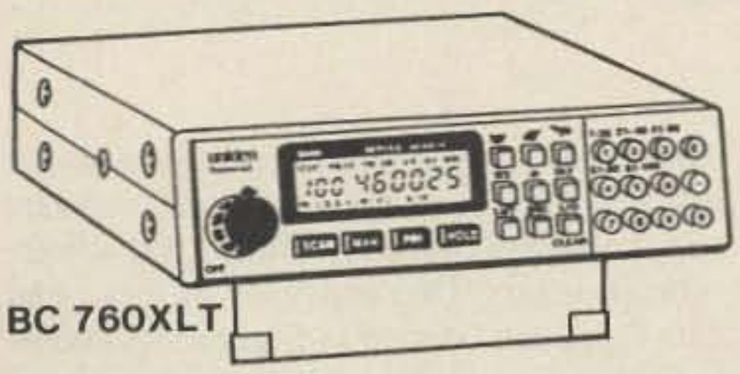

BC 760XLT

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Bearcat® 175XL-SA

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11-Band, 16 Channel • Weather Search Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512 MHz.
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FB-E-SA Frequency Directory for Eastern U.S.A..... $14.95
FB-W-SA Frequency Directory for Western U.S.A. ... $14.95
ASD-SA Air Scan Directory $14.95
SRF-SA Survival Radio Frequency Directory..... $14.95
TSG-SA "Top Secret" Registry of U.S. Govt. Freq.... $14.95
TIC-SA Techniques for Intercepting Comm..... $14.95
RRF-SA Railroad frequency directory..... $14.95
EEC-SA Embassy & Espionage Communications ... $14.95
CIE-SA Covert Intelligenct, Elect. Eavesdropping ... $14.95
MFF-SA Midwest Federal Frequency directory $14.95
A60-SA Magnet mount mobile scanner antenna... $35.95
A70-SA Base station scanner antenna..... $35.95
USAMM-SA Mag mount VHF ant. w/ 12' cable..... $39.95
USAK-SA ¾" hole mount VHF ant. w/ 17' cable.... $35.95
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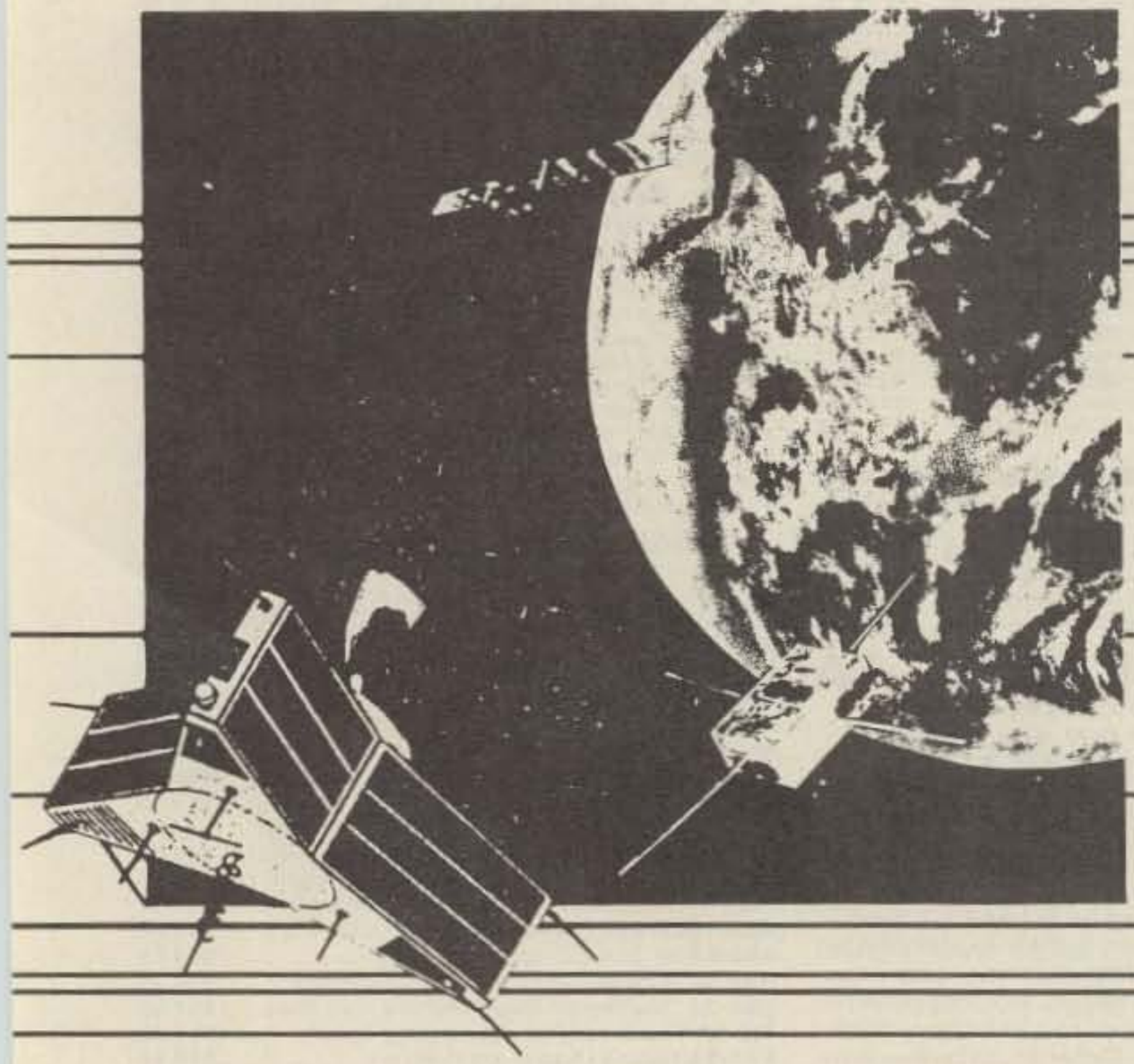


UoSATs: The British Connection Part I

University of Surrey's Contributions to Hamsats

by Robert J. Diersing, N5AHD

UoSAT-OSCAR-9 was launched in October 1981 followed by UoSAT-OSCAR-11 in March 1984. The spacecraft are frequently called UoSAT-1 and UoSAT-2, respectively. Both were designed and constructed by the Department of Electrical Engineering at the University of Surrey, England.

A Breed Apart

These spacecraft are different from other amateur radio satellites in that they carry no transponders for general communications use. Instead, they carry various scientific and spacecraft systems experiments. Some experiments are dedicated to gathering data of interest in scientific research, while other experiments serve to gather data related to the implementation of future spacecraft control systems. Of particular interest are those systems that are low in cost and yet reliable in the space environment.

One of the primary objectives for the UoSAT program has been to stimulate a greater degree of interest in space sciences among schools, colleges, and universities by enabling active participation. This goal has been realized to a greater degree in countries other than the United States. Perhaps one reason USUoSAT experimentation has been slow to develop is the apparentthe lack of publicity about the satellites.

I have followed the operation of UoSAT-1 and UoSAT-2 since they were launched. Monitoring the UoSATs is done from both my home and the Corpus Christi State University Advanced Microcomputer Laboratory. Fully automated tracking and data collection stations have been developed and are in operation at the both stations. The details of these systems have been published in a number of amateur satellite related publications.

UoSAT Data

For UoSAT-1 there are four different data types that transmitted as plain text–the onboard computer status, bulletins, standard sixty channel telemetry frames, and whole-orbit telemetry.Two examples of these four data types can be seen in Figures 1A and B. Both the sixty-channel telemetry frames and the whole-orbit telemetry will be discussed in detail later.

UoSAT-2 transmits these same four types plus one other–the Digital Communications Experiment (DCE) message headers. This experiment is very important, because it demonstrates the feasability of store-and-forward packet message systems using low-cost satellites. Samples of data captured from the UoSAT-2 downlink can be found in Figures 2A and B. During a pass with a reasonable visibility time, all of the different data types will be observed.

UoSAT-1 sometimes transmits previously stored images taken by a coupled-charge device (CCD) imager. When CCD images are transmitted, a synchronous transmission format is used on the downlink rather than the usual asynchronous format. The latter is much easier to handle on commonly available personal computer equipment.

```
UOSAT-1          8802280125320 COMPUTER GENERATED TELEMETRY
0003030101000270050300120400150565420633 8E072720083847094872
1013031106061200031337241432371519 3F164355173656183930193803
2015062123022265 9A2300672401252540122642462733052838102920 7E
3023023100023267223327723400613536213636333732273839013955 28
4014014116024273644314 9B44131345080146006447384C48373B49430A
5016025109 0D52279B530879545343553751564 49P5740065839705941 6F

UOSAT-1          8802280125324 COMPUTER GENERATED TELEMETRY
0003030101000270050300120400150565420633 8E072720083847094872
1013031105051200031337241431161518 1C164210173500183930193784
2005062124052266002300672401252540122643 9A27329D283810292090
3024053101033267223327633400613536123636443732273839013955 39
4014014116024273644314 8A44131345000146005747384C48373B49430A
5016025109 0D52279B530879545352553762564 48B5740065839705941 6F
```

Figure 1A. UoSAT-1 Standard Telemetry Frames.

```
000000301302 86C
000800137337 6B2
001000237337 6A9
001800237337 6A1
002000137337 69A
002800137337 692
003000137337 58B
003800137337 682
004000137337 67A
004800137337 672
005000137337 66A
005800137337 662
006000137337 653
007000237337 649
007800237337 641
008000337337 638
008800237337 730
009000237337 728
009800237337 720
00A000237337 718
00A800237337 710
```

Figure 1B. UoSAT-1 Whole-Orbit Telemetry.

Channel	Measurement	Calibration Equation
00	Secondary S/C Computer	1.2N mA (0.125A < I < 1A)
01	Solar Array Current +X	200 + 1.12N mA
02	Battery Half Voltage	N/100 * 1.01
03	Radiation Detector A O/P	40N * 1.04 Counts/Sec
04	Radiation Detector B O/P	40N * 1.04 Counts/Sec
05	Magnetometer Expt. HY-Coarse	INT(NYC/63.5+0.689)*8054-FY
06	Magnetometer Expt. HX-Coarse	INT(NXC/63.5+0.689)*8103-FX
07	Magnetometer Expt. HZ-Coarse	-INT(NZC/63.5+0.689)*8009+FZ
08	Battery Pack A Temperature	(474-N)/5 * 1.01 Degrees C
09	S/C Facet Temperature +X	(474-N)/5 * 1.01 Degrees C
10	CCD Experiment Current	1.2 * (N-30) mA (0.15A < I < 1A)
11	Solar Array Current -Y	200 + 1.12N mA
12	2.4 GHz Beacon Expt. Power	(N-145) * 0.45 mW
13	Radiation Expt. EHT Volts	N Volts
14	Radiation Detectors Current	(N+20)/8 * 0.983 mA
15	Magnetometer Expt. HY-Fine	FY=18.55 * (NFY-495.7)
16	Magnetometer Expt. HX-Fine	FX=18.53 * (NFX-496.45)
17	Magentometer Expt. HZ-Fine	FZ=18.34 * (NFZ-493.55)
18	Battery Pack B Tempertature	(474-N)/5 * 1.01 Degrees C
19	S/C Facet Temperature -X	(474-N)/5 * 1.01 Degrees C
20	S/C Computer Power	1.2 * (N-25) mA
21	Solar Array Current -X	200 + 1.12N mA
22	Battery/BCR 14V Bus	N/50 * 1.056 Volts
23	Sun Sensor +Z Axis	N/200 * 1.01
24	10.47 GHz Beacon Expt. Current	(N-40)/4 * 0.97 mA
25	Magnetometer Expt. Temperature	(467-N)/6.85 Degrees C
26	Magentometer Expt. Current	(N/8) * 0.9945 mA
27	Telecommand Receiver Current	(N-16)/8 * 0.952 mA
28	Radiation Expt. Temp. +X1	(474-N)/5 * 1.01 Degrees C
29	S/C Facet Temperature -Y	(474-N)/5 * 1.01 Degrees C
30	Battery Charge Current	2.9N mA
31	Solar Array Current +Y	200 + 1.12N mA
32	Power Cond. Module +10V	N/60 * 0.93 Volts
33	Telemetry System Current	(N-16)/30 * 1.084 mA
34	2.4 GHz Beacon Expt. Current	0.4*(N-11) * 1.072 mA
35	145 MHz Beacon Power O/P	(N-82) * 1.67 mW
36	145 MHz Beacon Current	(N-7)/4 * 1.014 mA
37	145 MHz Beacon Temperature	(474-N)/5 * 1.01 Degrees C
38	Primary S/C Comp. Temp. -X1	(474-N)/5 * 1.01 Degrees C
39	S/C Facet Temperature +Y	(474-N)/5 * 1.01 Degrees C
40	+14V Line Current	2.86N mA
41	+5V Line Current	1.28(N-50) mA (0.075A < I < 1A)
42	Power Cond. Module +5V	2N/300 * 1.12 mA
43	Sun Sensor -Z Axis	N/200 * 1.01
44	HF Beacons Expt. Current	(N-36)/3 * 1.038 mA
45	435 MHz Beacon Power O/P	(N-102) * 1.792 mW
46	435 MHz Beacon Current	(N-34)/3 * 1.053 mA
47	435 MHz Beacon Temperature	(474-N)/5 * 1.01 Degrees C
48	Secondary S/C Comp. Temp. -Y1	(474-N)/5 * 1.01 Degrees C
49	S/C Facet Temperature +Z	(474-N)/5 * 1.01 Degrees C
50	+10V Line Current	3N mA
51	-10V Line Current	1.3*(N-60) mA
52	Power Conditioning Module -10V	0.0158N - 0.0224n (n=Channel 32)
53	Navigation Magnetometer Y-Axis	(N-663.44)*183.486 nT
54	Navigation Magnetometer Z-Axis	-(N-336.55)*189.54 nT
55	Navigation Magnetometer X-Axis	-(N-496.5)*194.55 nT
56	Speech Synthesiser Current	(N-16)/10 * 1.009 mA
57	CCD Imager Temperature	(474-N)/5 * 1.01 Degrees C
58	Telemetry System Temp. +Y1	(474-N)/5 * 1.01 Degrees C
59	S/C Facet Temperature -Z	(474-N)/5 * 1.01 Degrees C

Table 1. UoSAT OSCAR-9 telemetry channel calibration equations.

Number	Description	0	1
01	145 MHz Beacon Power	Off	On
02	435 MHz Beacon Power	Off	On
03	2401 MHz Beacon Power	Off	On
04	Telemetry Channel Mode Select	Run	Dwell
05	Telemetry Channel Dwell Addr Load	Off	On
06	Telemetry Channel Dwell Addr Source	Ground	Computer
07	Primary Spacecraft Computer Power	Off	On
08	Primary S/C Computer Error Count	Bit-1	Bit-1
09	Primary S/C Computer Error Count	Bit-2	Bit-2
10	Primary S/C Computer Bootstrap	PROM	UART
11	Primary S/C Computer Error Count	Bit-3	Bit-3
12	Primary S/C Computer Bootstrap	A	B
13	Gravity Gradient Boom Deploy Pyros	Safe	Arm
14	Gravity Gradient Boom Deploy Pyros	Hold	Fire
15	Gravity Gardient Boom Deploy	Safe	Arm
16	Gravity Gradient Boom Deploy	Hold	Deploy
17	Gravity Gradient Boom Deploy	Extend	Retract
18	Attitude Control Magnetorquers	Safe	Arm
19	Attitude Control Magnetorquer -X	On	Off
20	Attitude Control Magnetorquer -Y	On	Off
21	Attitude Control Magnetorquer -Z	On	Off
22	Attitude Control Magnetorquer	Reverse	Forward
23	435 MHz Beacon PSK Mode	NRZI	NRZIC
24	2401 MHz Beacon PSK Mode	NRZI	NRZIC
25	Attitude Control Magnetorquers	High Power	Low Power
26	Digitalker Expt. Power	Off	On
27	CCD Camera Expt. Power	Off	On
28	CCD Camera Expt. Integration Period	Bit-0	Bit-0
29	CCD Camera Expt. Integration Period	Bit-1	Bit-1
30	CCD Camera Expt. Video Amp. Gain	Bit-0	Bit-0
31	CCD Camera Expt. Video Amp. Gain	Bit-1	Bit-1
32	DSR Power	Off	On
33	DSR Mode	Read	Write
34	DSR Mode	Run	Reset
35	Radiation Detector A EHT Power	Off	On
36	Radiation Detector B EHT Power	Off	On
37	Radiation Detector C EHT Power	Off	On
38	Electron Spectrometer EHT Power	Off	On
39	Data Commpuncations Expt. Power	Off	On
40	Data Communications Expt.	Reset	Run
41	Data Communications Expt. PROM	A	B
42	Data Communications Expt. Clock	0.9 MHz	1.8 MHz
43	Navigation Magnetometer Power	Off	On
44	Space Dust Expt. Power	Off	On
45	Status Calibrate		
46	BCR Status	0	1
47	435 MHz Beacon Modulation Select	AFSK	PSK
48	2401 MHz Beacon Modulation Select	AFSK	PSK
49	Engineering Data	Bit-1	Bit-1
50	Engineering Data	Bit-2	Bit-2
51	Engineering Data	Bit-3	Bit-3
52	Engineering Data	Bit-4	Bit-4
53	Engineering Data	Bit-5	Bit-5
54	Command Watchdog Enable	Disable	Enable
55	Command Watchdog Reset	0	1
56	145 MHz Downlink Data Select	A	
57	145 MHz Downlink Data Select	B	
58	145 MHz Downlink Data Select	C	
59	145 MHz Downlink Data Select	D	
60	145 MHz Downlink Data Select	E	
61	145 MHz Downlink Data Select	F	
62	145 Mhz Downlink Data Rate	A	
63	145 MHz Downlink Data Rate	B	
64	435 MHz Downlink Data Rate	A	
65	435 MHz Downlink Data Rate	B	
66	435 MHz Downlink Data Rate	C	
67	Particle/Wavecounter Control	Count	Reset
68	Downlink Lockout	Enable	Disable
69	Engineering Data	Bit-6	Bit-6
70	Engineering Data	Bit-7	Bit-7
71	Engineering Data	Bit-8	Bit-8
72	Engineering Data	Bit-9	Bit-9
73	P/W Channel Plate Control	Bit-0	Bit-0
74	P/W Channel Plate Control	Bit-1	Bit-1
75	P/W Channel Plate Control	Bit-2	Bit-2
76	Space Dust (MSB)	Bit-7	Bit-7
77	Space Dust	Bit-6	Bit-6
78	Space Dust	Bit-5	Bit-5
79	Space Dust	Bit-4	Bit-4
80	Space Dust	Bit-3	Bit-3
81	Space Dust	Bit-2	Bit-2
82	Space Dust	Bit-1	Bit-1
83	Space Dust (LSB)	Bit-0	Bit-0
84	DSR Write Cycle Complete		
85	1802 CWO Output		
86	1802 TLM Port (MSB)	Bit-10	Bit-10
87	1802 TLM Port	Bit-9	Bit-9
88	1802 TLM Port	Bit-8	Bit-8
89	1802 TLM Port	Bit-7	Bit-7
90	1802 TLM Port	Bit-6	Bit-6
91	1802 TLM Port	Bit-5	Bit-5
92	1802 TLM Port	Bit-4	Bit-4
93	1802 TLM Port	Bit-3	Bit-3
94	1802 TLM Port	Bit-2	Bit-2
95	1802 TLM Port	Bit-1	Bit-1
96	1802 TLM Port (LSB)	Bit-0	Bit-0

Table 2. UoSAT-OSCAR-11 spacecraft systems status points.

UoSAT-2 also transmits CCD images from time to time, and asynchronous transmission is used, but it is at 4800 bps on the 70 cm downlink rather than the usual 2m downlink. The times scheduled for CCD transmissions appear in the weekly bulletins from the spacecraft.

Equipment Required

Most of the time UoSAT-1 and UoSAT-2 transmit on 145.825 MHz FM +/− Doppler. During a pass where the elevation of the satellite in the sky is high enough with respect to the listener, the UoSATs can be heard using a two meter hand-held unit. However, for consistent results some type of outside antenna should be used. Of course the optimum situation would be some type of gain antenna which can track the satellite.

Data Capture and Analysis

For any practical analysis and use of the data transmitted by UoSAT, it must be somehow captured and processed by computer. This may sound complicated, but there are actually several alternatives. First, the audio from the two meter FM receiver may be fed to a Bell-202 modem and the modem connected to a CRT or hard-copy terminal. Second, the received audio could be tape recorded and the demodulation and processing deferred until later. Third, and probably the most desirable, the modem could be hooked to some type of personal computer where the data would be captured in memory and

```
UOSAT-2              8802173032133
00522501289202362503468904052305039F0602620705130804590903 4E
10522411321012000313058F14186A15486E16192D17551718601E19542B
20522721221222660023000124001725000726094927569F285843294935
30522631035432286D33560334110735235236291F3742753846813 94961
40653441120642641543008F44165245000146000247480F484954494 60F
50461651109C526405536462547125550000560003574 90F584845594877
60832F615FD0625FC263324064440265140666C01D6780096800 0E69000F

UOSAT-2              8802173032138
00522501293902361603434004052305039F0602620705130804590903 4E
10522411321012000313058F14191C15487F16193C17552418601E19543A
20522721219922660023000124001725000726094927569F285843294935
30522631035432286D33564734088735235236291F3742753846813 94961
40653441120642641543008F44165245000146000247480F484954494 60F
50461651109C526405536462547125550000560003574 90F584845594877
60832F615FD0625FC263324064440265140666C01D6780096800 0E69000F
```

Figure 2A. UoSAT-2 Standard Telemetry Frames.

```
DCE Message System V3.2
EDAC=61 FREE MEM=03F8 NEXT MSG=1CE CMD#=3780 ERR=00 BANK OF RAM=0091 02BB

          To K1KSY De GB2UP Re: batch of messages
          To K1KSY De: GB2UP Re:batch 09-Jan (2)

SATELL    EPOC          INCL   RAAN    ECCN   ARGP    MA      MM        DECY      REVN
UO9       88017.03827   97.63   45.50 0.0002 151.33  208.86 15.31181  6.2E-5 34944
AO10      88009.09680   27.44  343.78 0.6026 270.99   25.00  2.05883 -6.0E-7  3440
UO11      88015.22269   98.08   81.65 0.0013 147.81  212.39 14.62216  2.1E-6 20668
M2-15     88018.48193   82.47  207.34 0.0012 267.41   92.57 13.83577  6.0E-8  5230
M2-16     88018.14032   82.56  268.35 0.0012 199.33  160.74 13.83334  4.0E-7  2116
M3-1      88018.10135   82.55  240.66 0.0019 144.49  215.76 13.16925  4.3E-7 10759
N-9       88004.41281   99.08  337.04 0.0016   3.43  356.69 14.11542  9.0E-7 15770
N10       88013.22842   98.69   46.23 0.0013 324.02   36.01 14.22538  2.0E-6  6860
MIR       88018.79996   51.63  122.80 0.0016 352.04    7.91 15.74602  2.3E-4 11010
SALYUT-7  88018.79843   51.61  295.58 0.0000  43.9  316.14 15.31923  6.7E-5 32902
AJISAI    87306.47345   50.01  320.17 0.0011 277.23   82.72 12.44370 -2.5E-7  5561

          TO:K1KSY DE:GB2UP RE:MESSAGE BATCH 291087
          TO:WA9FMQ DE:GB2UP  RE:MESSAGE BATCH
          TO:NK6K DE:GB2UP RE:MESSAGE BATCH
```

Figure 2B. UoSAT-2 DCE Message Headers.

Channel	Measurement	Calibration Equation
00	Solar Array Current -Y	1.9 * (516-N) mA
01	Nav. Magnetometer X-Axis	0.1485N-68 uT
02	Nav. Magnetometer Y-Axis	0.1523N-69.3 uT
03	Nav. Magnetometer Z-Axis	0.1507N-69 uT
04	Sun Sensor No. 1	
05	Sun Sensor No. 2	
06	Sun Sensor No. 3	
07	Sun Sensor No. 4	
08	Sun Sensor No. 5	
09	Sun Sensor No. 6	
10	Solar Array Current +Y	1.9 * (516-N) mA
11	Nav. Magnetometer (wing) Temp.	(330-N)/3.45 Degrees C
12	Horizon Sensor	
13	Spare	
14	DCE Ramunit Current	(N-70.4)/6.7 mA
15	DCE CPU Current	(N-187.1)/2.0 mA
16	DCE GMBM Current	(N-121.3)/2.1 mA
17	Facet Temperature +X	(480-N)/5 Degrees C
18	Facet Temperature +Y	(480-N)/5 Degrees C
19	Facet Temperature +Z	(480-N)/5 Degrees C
20	Solar Array Current -X	1.9 * (516-N) mA
21	+10V Line Current	0.97N mA
22	PCM Voltage +10V	0.015N Volts
23	P/W Logic Current +5V	0.14N mA (N <= 500)
24	P/W Geiger Current +14V	0.21N mA
25	P/W Elec. sp. Current +10V	0.096N mA
26	P/W Elec. sp. Current -10V	0.093N mA
27	Facet Temperature -X	(480-N)/5 Degrees C
28	Facet Temperature -Y	(480-N)/5 Degrees C
29	Facet Temperature -Z	(480-N)/5 Degrees C
30	Solar Array Current +X	1.9 * (516-N) mA
31	-10V Line Current	0.48N mA
32	PCM Voltage -10V	0.036N Volts
33	1802 Computer Current +10V	0.21N mA
34	Digitalker Current +5V	0.13N mA (N <= 500)
35	145 MHz Beacon Power	(2.5N - 275) mW (N > 200)
36	145 MHz Beacon Current	0.22N mA
37	145 MHz Beacon Temperature	(480-N)/5 Degrees C
38	Command Decoder Temperature +Y	(480-N)/5 Degrees C
39	Telemetry System Temp. +X	(480-N)/5 Degrees C
40	Solar Array Voltage +30V	(0.1N-51.6) Volts
41	+5V Line Current	0.97N mA
42	PCM Voltage +5V	0.0084N Volts
43	DSR Current +5V	0.21N mA (N <= 500)
44	Command Receiver Current	0.92N mA
45	435 MHz Beacon Power	(2.5N-200) mW (N > 175)
46	435 MHz Beacon Current	0.44N mA
47	435 MHz Beacon Temperature	(480-N)/5 Degrees C
48	P/W Tempreature -X	(480-N)/5 Degrees C
49	BCR Temperature -Y	(480-N)/5 Degrees C
50	Battery Charge/Discharge Current	8.8(N-513) mA
51	+14V Line Current	5N mA
52	Battery Voltage +14V	0.21N Volts
53	Battery Cell Volts Mux	
54	Telemetry System Current +10V	0.02N mA
55	2.4 GHz Beacon Power	((N+50)**2)/480 mW
56	2.4 GHz Beacon Current	0.45N mA
57	Battery Temperature	(480-N)/5 Degrees C
58	2.4 GHz Beacon Temperature	(480-N)/5 Degrees C
59	CCD Imager Temperature	(480-N)/5 Degrees C
60	Status Points 01-12	
61	Status Points 13-24	
62	Status Points 25-36	
63	Status Points 37-48	
64	Status Points 49-60	
65	Status Points 61-72	
66	Status Points 73-84	
67	Status Points 85-96	
68	Spare	
69	Spare	

Table 3. UoSAT-OSCAR-11 telemetry channel calibration equations.

later saved on disk. Data capture programs for the IBM PC and compatibles are available from the AMSAT-NA Software Exchange and AMSAT-UK.

A little more discussion on modems is required. A Bell type 202 modem is required for demodulation of UoSAT transmissions. A Bell-212A modem will not work. Modems such as the Hayes Smartmodem 1200 are Bell-212 type modems and cannot be used for demodulating UoSAT transmissions. The differences lie in the tone frequencies and the type of modulation used.

Bell-202 modems can sometimes be found at hamfest flea markets. They can also be built from circuits that have been published in the various ham magazines. Also, typical modems used with VHF packet radio are Bell-202 compatible. This alternative is particularly attractive when there is an existing modem disconnect jack.

Another point to watch for is that the tone sense between UoSAT-1 and UoSAT-2 is reversed; that is the tones used to represent a zero bit and a one bit (mark and space) are opposite. UoSAT-1 telemetry can be demodulated with a standard Bell-202 modem, while data from UoSAT-2 must be inverted before it can be processed.

I have several UDS-202C modems are in service. I have also used the G3RUH UoSAT modem with equal success. A printed circuit board for the the G3RUH modem is available from AMSAT-UK.

Standard Telemetry Format

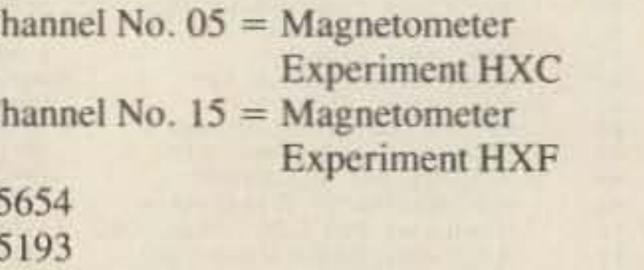
The telemetry frames shown in Figures 1A and 2A are standard sixty-channel frames for UoSAT-1 and UoSAT-2, respectively. The other frame types evolved later, and the scheme of switching among different types started with the commissioning of the Diary programs in late 1985 and early 1986.

The standard telemetry frames contain data about the status of the spacecraft systems and also contains telemetered values from the spacecraft housekeeping systems and onboard experiments. The examples shown in Figures 1A and 2A are actual telemetry frames captured while preparing this article. For both UoSAT-1 and UoSAT-2, the lines beginning with 00 through 50 contain the actual telemetry measurements. Each of these lines consists of ten sets of a two-digit channel number followed a three-digit value followed and a check digit. The check digit validation scheme is the same for both UoSAT-1 and UoSAT-2.

The header line is similar in both frames and contains the date, day of week, and UTC time of transmission. In the UoSAT-2 frame, the last line contains the status of all of the onboard systems: active and inactive systems, downlink data rate, downlink modulation type and so forth. Currently, there is no similar indication of systems status in the UoSAT-1 frame.

No matter which data format is processed, the values from the channels of interest must be converted to engineering units. This is done by substituting the value from the telemetry into a calibration equation. Some channels use the same equations while others are different. A few examples of conversions of telemetered values to engineering units for UoSAT-1 follow.

Consider one of the least complicated equations.



$I = 3 \times N$ mA = + 10V Line Current
$I = 3 \times 160 = 480$ mA

Some equations are more complicated. Channel No. 27 = I of Telecommand Receiver 27330

$I = 0.125 \times (N - 16) \times 0.952$ mA
$I = 0.125 \times (330 - 16) \times 0.952$
$= 37.369$ mA

Other equations may require values from two channels.

Channel No. 05 = Magnetometer Experiment HXC
Channel No. 15 = Magnetometer Experiment HXF

05654
15193
Bx = (129 × NXC − 64324) − 18.05 × (NXF − 511) nT
Bx = (129 × 654 − 64324) − 18.05 × (193 − 511) nT
Bx = 25781 nT

The examples shown above represent the range of complexity that will be encountered. A complete list of calibration equations for both satellites can be found in Tables 1 and 3. Note the calibration equations do change from time to time. If you are doing serious experimental work, it would be wise to check with an authoritative source.

The spacecraft systems status line is a bit more difficult to decode. The 96 systems status points are encoded in channels 60–67. Status points 1 through 12 are encoded in channel number 60. Each ASCII character is interpreted as a hex nibble. For example, 60400 means that status point 2 is set while 1 and 3 through 12 are reset. A listing of the systems status points for UoSAT-2 can be found in Table 2.

Software for capturing and decoding UoSAT telemetry is available from the AMSAT-NA Software Exchange and from AMSAT-UK. The package available from AMSAT-NA consists of three programs for IBM PCs and compatibles. One of the programs supplied will capture data from UoSAT in memory and then allow the memory buffer to be saved on disk. This has probably been the program most needed to accomplish any serious data analysis. Another program is available to edit the standard telemetry formats and save a new file consisting of only complete telemetry frames. Finally, there is a program to read the edited file and produce a decoded telemetry report.

Next month: Part II Whole Orbit Data

Number 7 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

ACE COMMUNICATIONS

ACE Communications, Inc., introduces the AR-501 Radio Telegraph Terminal, a triple-mode radio telegraph (CW) terminal for amateur radio operators and shortwave listeners.

The AR-501 is a CW decoder, trainer, and electronic keyer. Features include automatic speed follow-up and threshold control, LED tuning indicator, 32-character LCD display, random code generator, and electronic with both standard and iambic modes. Code can be routed to an internal speaker, and to a printer through the parallel printer port of the unit. The AR-501 measures 4.5" x 6.25" x 2.25". A 12-VDC source powers it. The user price is $229, including AC power adaptor and parts for hookup. For further details, contact *ACE Communications, Inc., 22511 Aspan Street, El Toro CA 92630; 714-581-4900.* Or circle Reader Service number 201.

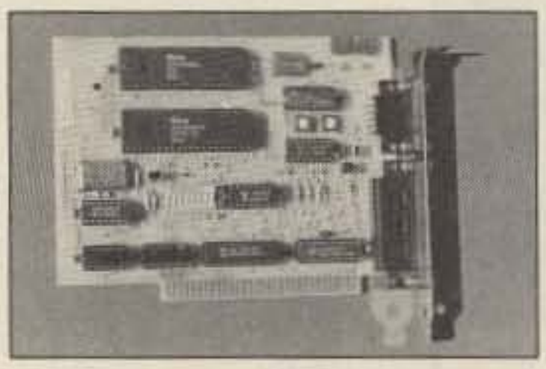
AMERICAN RELIANCE

American Reliance announces its advanced AR-80LM Logic Monitor. It is a state-of-the-art design and uses innovative custom-IC construction. The AR-80LM brings high-end performance within reach of the average user. It is designed to provide automatic detection of both power and ground pins, making instrument usage an easy, clip-on-and-view operation. Additionally, the unit automatically detects both TTL and CMOS logic levels.

The AR-80LM provides indications for logic high, low, and even pulsing inputs. The unit can be used with circuit clock rates up to 40 MHz. The AR-80LM has a suggested price of $79, which includes a storage case and operator's manual. *ARI Media, 9241 E. Valley Boulevard, Suite 201, Rosemead CA 91770; 818-287-8400.* Or circle Reader Service number 202.

MAGNAPHASE

The ALT-4 Weather-Master is Digitar's top-of-the-line handheld Micro Weather Computer, designed with data acquisition, recording, and computing abilities that make it unique. The Weather-Master gives users the opportunity to create personalized weather stations. It is engineered with dozens of superior features, including computer calibration, backlighting for easy night-time viewing, and a four-way power capability that makes it completely portable and virtually invulnerable to memory loss through power interruption. Inside/outside temperatures, time and alarm, elapsed time, date, barometric pressure, hi-low registers, autoscan, special bi-directional alarms for temp A, temp B, and altitude are just some of its functions. With the optional RG-2 Rain Gauge and AN-2 Anemometer, the functions could be extended to receive daily and accumulated rainfall, wind speed, wind chill factor, and wind direction. The ALT-4 suggested retail price is $170. For more information write to *Magnaphase Industries, Inc., 1502 Pike Street NW, Auburn WA 98001; 800-322-1502.* Or circle Reader Service number 203.



DIGITAL RADIO SYSTEMS, INC

The first DRSI PC*Packet Adapter (PCPA) is a compact, dual-port communications adapter card that plugs into an IBM or compatible. It is suitable for Packet Radio, RTTY and AMTOR applications, and has an on-board 1200 baud modem for standard VHF/UHF FM operations. This modem connects directly to the radio through a DB-9 connector. The second port may be configured for either RS-232 or TTL level outputs. It connects via RS-232 to the DRSI HF*Modem, providing a complete HF/VHF/UHF packet radio station. When configured for TTL levels, the second port can connect directly to a high-speed RF modem. Internally, the PCPA uses an 8530 Serial Communications Controller running at 4.9152 MHz. It has flexible addressing and interrupt provisions. A programmable on-board clock/timer generates a separate interrupt for protocol timing and control. *DRSI, 2065 Range Road, Clearwater FL 34625; Tel. 813-461-0204. TLX 910-250-4542 DRSI. FAX 813-447-4369.* Or circle Reader Service number 211.

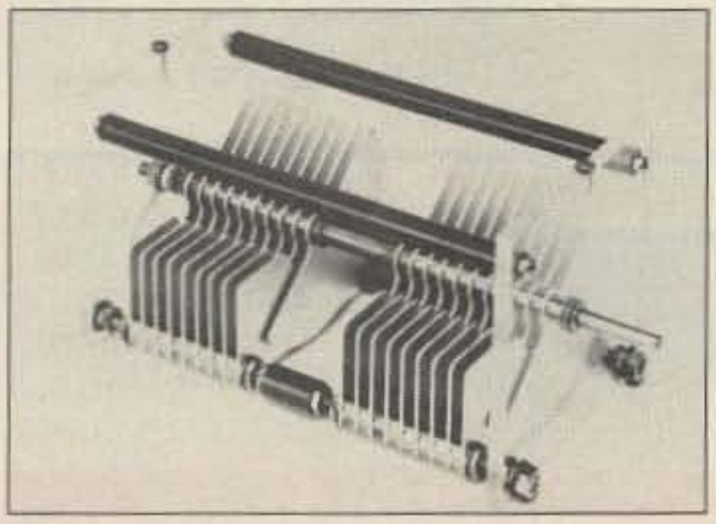
GORDON WEST'S RADIO SCHOOL

Gordon West's Radio School offers cassette theory courses for the following amateur radio license categories: Novice, Technician, General, Tech/General, Advanced, and Extra.

Each course features the latest question pool that parallels the VEC-administered examination. The cassette training courses may be used without any visual aids, if necessary, but a textbook is included. Correct answers are explained, and the radio sounds behind those answers, such as RTTY and 1200 baud packet, are played on the tape. Each cassette course with textbook is $19.95 plus $2.50 postage and handling when ordered directly from Radio School. Participating amateur radio dealers also carry these courses in stock. For more information, write or call *Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626, 714-549-5000.* Or circle Reader Service number 206.

KASARA MICROSYSTEMS

Kasara Microsystems, Inc., announces a new heavy-duty C-64 Commodore replacement power supply especially for the packet radio amateur. The amperage output now allows 24-hour continuous packet operation without voltage change or failure. This power supply also has a heavier heat sink and is an exact physical replacement for the original unit. Over 52% of Commodore 64 power failures can be directly related to the original power supply. Price is $27.95 plus $3 UPS shipping. Order from *Kasara Microsystems, Inc., 33 Murray Hill Drive, Spring Valley NY 10977, 800-248-2983 or 914-356-3131*. Or circle Reader Service number 207.

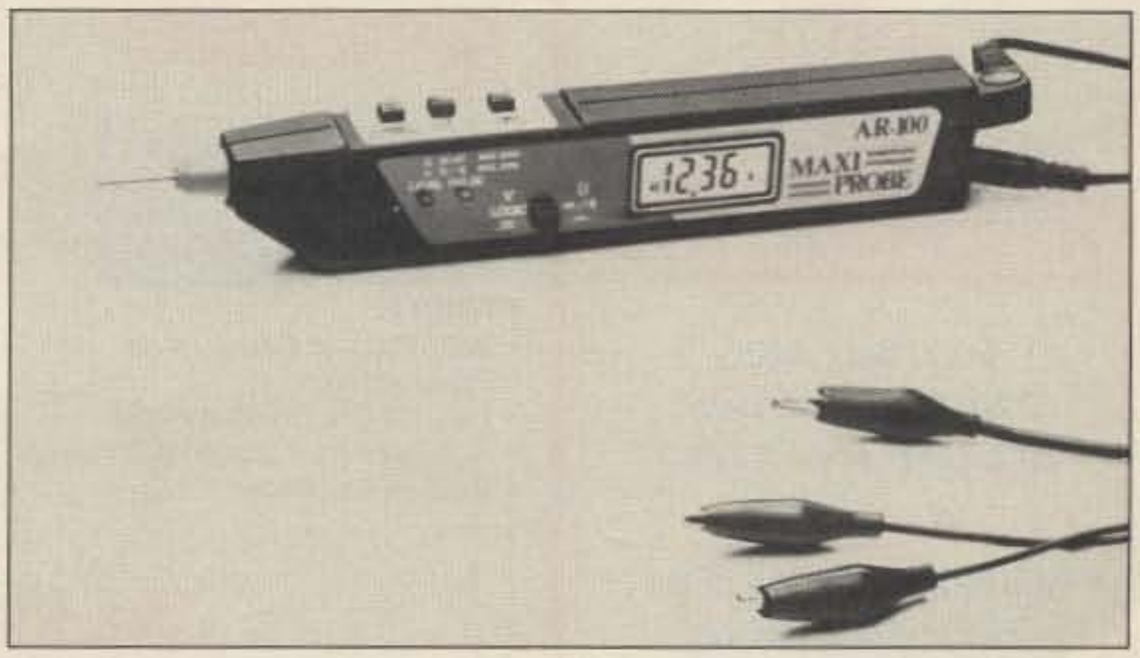


KILO-TEC

Kilo-Tec now has high quality variable capacitors rated for RF voltages up to 7.8 kV. The devices utilize heavy-duty quality brass and ultra high-grade aluminum construction with gold anodizing and high voltage acrylic. These capacitors are suitable for high-power antenna matching units, power amplifiers, and transmitters. They are presently available in two values, 500pF and 250pF. The TC-250 retails for approximately $29 and the TC-500 for approximately $40. To order or receive a quote, write or call *Kilo-Tec, PO Box 1001, Oak View CA 93022; 805-646-9645*. Or circle Reader Service number 204.

AF SYSTEMS

AF Systems describes its SEEKER Computer-Aided Communications Monitoring system as a two-part system for computer control of shortwave communications. SEEKER-LOG helps manage large databases of frequencies, and the receiver will scan the LOG for information the user wishes to record. The SEEKER radio control program will operate the receiver automatically in the user's absence, and can be programmed to record 100 weekly transmissions. SEEKER also features a menu of 26 international and other scheduled broadcasts, indicating those currently on the air. SEEKER is available for Commodore 64/128 computers and ICOM IC-R71A/E communications receivers. A demonstration package of the SEEKER system is available for $15. The suggested retail price for the complete system is $219. Free brochures. *AF Systems, P.O. Box 9145, Waukegan IL 60079; Tel. 312-623-4744. Compuserve E-Mail: 71310,3712.* Or circle Reader Service number 214.

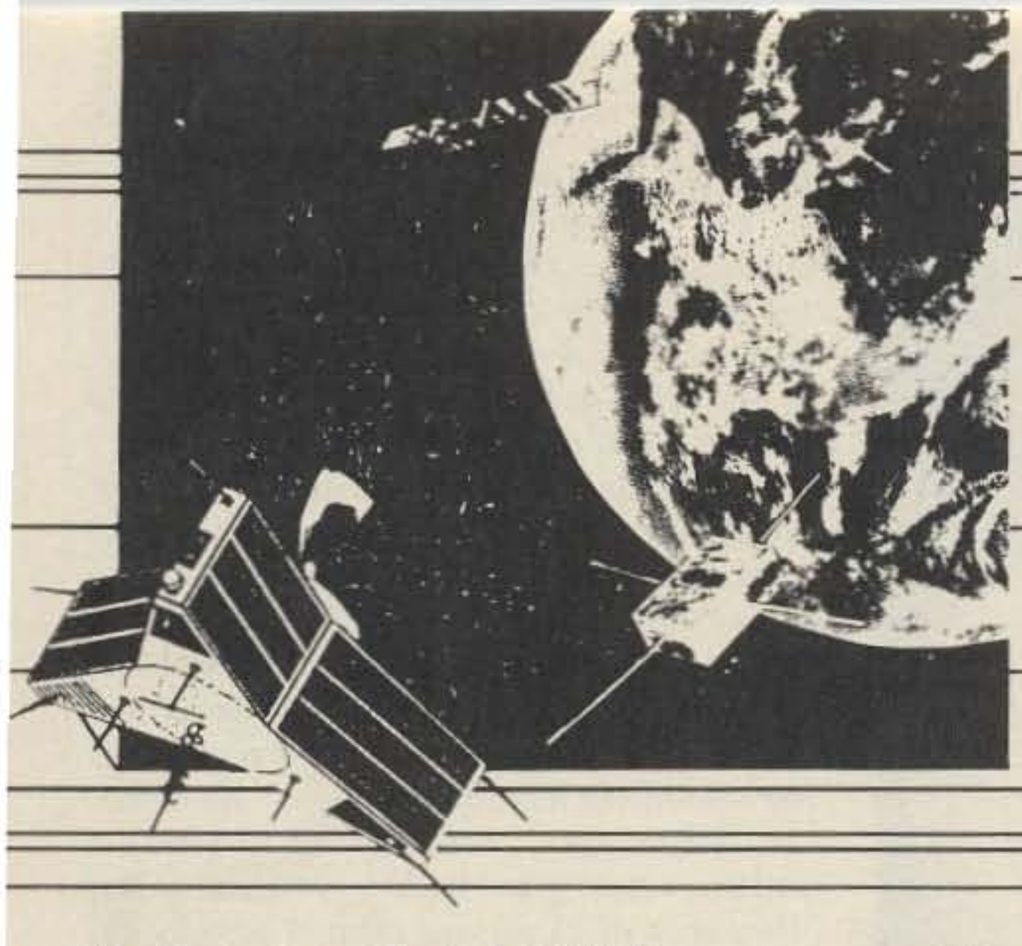


AMERICAN RELIANCE

The new AR-100 Maxi-Probe from American Reliance is three instruments in one: An autoranging DMM that measures DC or AC voltage and resistance. It is also a logic probe that works with both TTL and CMOS logic at up to 10 MHz and an audible continuity checker. The Maxi-Probe may be used with screw-on accessory tips, such as alligator and spring-hook types. The data hold feature allows users to capture and hold a voltage or resistance measurement in hard-to-reach areas. The unit also has a diode test for reading the forward voltage drop of a rectifier and a removable ground lead to further expand versatility and ease storage requirements. The Maxi-Probe comes with an alligator clip ground lead, a set of logic test leads, a carrying case, and the operator's manual. The suggested retail price is $64.95. *ARI, 9241 E. Valley Blvd., Suite 201, Rosemead CA 91770. 818-287-8400.* Or circle Reader Service number 208.

COMPUMAX

Compumax introduces its TRUFAX system, a plug-in board and software for IBM computers and compatibles, that enables the user to capture and transmit facsimile image data on either AM or FM radio facsimile. TRUFAX is compatible with the Hercules, IBM color graphics (CGA), Microsoft Paintbrush, and enhanced graphics (EGA) adapters. The TRUFAX software allows the operator to zoom and pan the entire image. Depending on the graphics adapter used, the user will actually see two colors (black and white) on a Hercules compatible graphics adapter, and up to 4 levels of gray and 4 colors on the enhanced graphics adapter. With the proper transmission equipment, the user can transmit the image at a maximum rate of 4 kHz. The TRUFAX board accepts an audio waveform in the voltage range of 0.75V to 5V peak to peak. The output level is 1V peak-to-peak. The price for the TRUFAX system, including an IBM PC compatible plug-in board and software, is $599. There is a two-year warranty on the hardware, and the software will be maintained by Compumax for 90 days, with an optional two-year maintenance agreement available for $75. For further information, contact *Mr. Robert McKenna, TRUFAX Marketing Manager, Compumax Corporation, 26 West Boylston Street, West Boylston MA 01583; 617-835-2722.* Or circle Reader Service number 209.



History of Project OSCAR

Once upon a time . . . .

by Chuck Towns K6LFH

The Beginning of Project OSCAR

Project OSCAR began in my home when Fred Hicks and his wife were visiting in the late 1950s. Fred and I, two Lockheed hams, started regular lunch meetings to discuss the topic of amateur radio in space, which soon hooked many other hams.

The name of the project came from Don Stoner when he was hamming with Fred Hicks. Don had tossed the name out in his column in *CQ* when he wrote about what hams could do if "someone had a spare (rocket) booster." Fred is the one who envisioned a Lockheed Agena ride.

The available battery power and solar cells then cost hundreds of dollars each. They were limited at best, and a call to use as a satellite ID could not have dashes and could only have a few dots. W6EE was an open call, so we did our best, and got it! We concurrently applied for W6EE/S for Space, and it was also granted. We used neither in space, however, but only on QSL cards.

Where else could a project like this go on with total acceptance besides in the San Francisco Bay area (soon to become Silicon Valley)? We addressed the feasibility of OSCAR in the OSCAR White Paper, published in March 1961. Among other things, the paper outlined a simple method to monitor the satellite's temperature—just count the time it takes to hear 10 complete HIs from the bird. The warmer the satellite, the more quickly it sent the HIs.

Down To Business

The goal was set to place an amateur satellite in space, so now we had to attend to the details. What frequency and mode to use? The group finally chose CW in the lower 2 meter band, since most countries had these allocations.

Each facet of this challenge had to be put into an international arena, and the books on frequencies and their assignments had to be tackled. We lucked out again, because one of the men on the fringe of our group specialized in frequency management. He was cornered when he wasn't looking, and we had a volunteer to certify our chosen frequency of 145 MHz.

Besides myself as Chairman and Fred Hicks W6EJU as Field Operations Manager, the following men made up the original Board of Directors: Jerre Crosier W6IGE, Club Coordinator, Harley Gabrielson W6HEK, data handling, Harry Engwicht W6HC, ARRL Coordinator, Nick Marshall W6OLO as the Engineering Manager, Stan Benson K6CBK, Planning, Don Stoner W6TNS, Project Design Manager, Bill Orr W6SAI, Publicity, Tom Lott VE2AGF/W6, Communications Manager, Milt Caston WA6MSO, Advisor, Harry Workman K6JTC, Secretary, Dick Esneault W4IJC/6, Treasurer, and Bernie Barrick W6OON, Procurement.

The men working with Nick W6OLO, the engineering manager, now had to design an oscillator to function at least at 72.5 MHz for doubling to 145 MHz. (In 1960 solid-state circuitry wasn't available!)

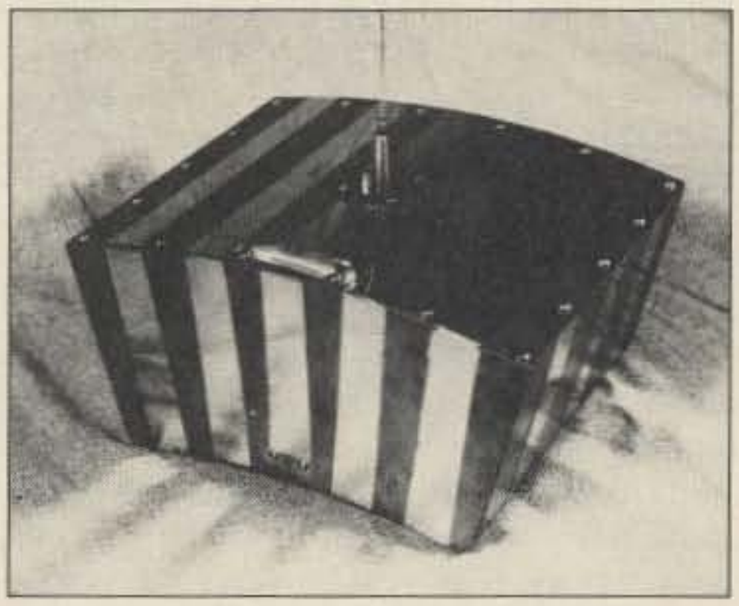


Photo A. OSCAR 1—the world's first non-governmental communications satellite.

My first task was to get Lockheed approval to study a typical Agena spacecraft to determine where our 10 pound sub-spacecraft could fit. Since Lockheed was building the rocket for the Air Force, I prepared for a trip to the Capitol. Bill Orr W6SAI and I got together to draw up a White Paper to define our needs and goals before going to Washington, DC. While Bill concentrated on the paper, I worked out a schedule with George Jacobs W3ASK of various hams in the Washington community who could promote our cause. In early fall of 1961, about a year after I'd joined Lockheed, we seemed to have all of our pieces assembled and ready to go.

My biggest task was presenting the OSCAR concept to various radio clubs and technical organizations in the area. Our group always needed volunteers to keep the ball rolling. As other technical groups became enthralled with our progress, my speaking schedule was jammed even before the launch. Our mailing list and participants grew. From September through October, hints of a Washington approval looked very good. The outer satellite housing was completed. The shake, rattle and roll tests went well, and the radio frequency study and evaluation for possible interference with the Agena vehicle were completed. In fact, in October, Bill Orr and I were requested to speak at an Air Force Radio Club in Maryland, where we planned to announce the approval for our launch. Everyone at the meeting was awaiting the good news when we were advised that the approval had been delayed. Bill and I had nothing to tell them.

Nevertheless, interest was piqued, and my speaking assignments grew almost out of reason. One question always asked at the end of these talks was, "What's down the line?" I spoke of higher frequencies, multi-frequencies, SHF beacons, and intersatellite communications. This was all blue-sky 25 years ago—but all since accomplished!

Lady Luck

OSCAR was the first nongovernmental, nonmilitary, and noncommercial satellite. It was up well before the multi-million dollar Telstar. Much of this is due to perseverance, and being in the right place at the right time.

It really seems as though there was a Guiding Spirit along with us on this venture. Whenever we needed a special part, it showed up almost as soon as the need was known. One time while riding in a hotel elevator in Washington DC, three fellows got on and start talking about the OSCAR concept. We ended up having dinner together, and I ended up with three good friends, one of whom was very helpful with OSCAR 2. Another time a nice gentleman was sitting next to me on a flight back from a few busy days in the Pentagon. I finished my notes and, as I put them away, one of my copies of the OSCAR White Paper fell on the seat between us. It was immediately spotted for what it was, and my new friend was Finley Carter K6GT, President of Stanford Research Institute. He

was an OSCAR member before we landed, and Chairman of our Board of Directors by the end of the year. Were these coincidences? That word doesn't explain such propitious events, occurring one after another.

Both the military and the State Department were involved, thoroughly investigating all of the ramifications of our project. They were especially concerned with who would pay for the damage that might occur if, on reentry, the bird crashed into an airplane or hit someone on the ground.

Up and Away!

The launch was a great shot. I have been involved with rocketry and satellites since 1945, and I will always stand in awe at a blastoff. This, of course, was a special one and I was really more excited and emotionally involved than I'd realized. I was told that I was crying with tears running off my chin. Those of us at the launch didn't get the word that our special tracking station on the South Pole had heard OSCAR thirty or so minutes after launch. We were at the airport to fly back to San Jose and our headquarters and tracking station in Sunnyvale. We got the word of the success of OSCAR from the pilot while we were flying. The tears started all over again.

I put high on this memory list the unquestioned support of every commercial concern with which we were involved. First, we got the word out to every company that had a radio club to supply volunteers from any source, before and after the launch other organizations, not just Lockheed. This move worked very well. Three or four of our active crew weren't even licensed.

Shortly after the first launch, it soon became clear that we needed new Headquarters. We no sooner started discussing this when Bob Smithwick W6JZU, Chairman of the Board of Regents of Foothill College in Los Altos, came to advise that we would be welcome on their campus and that they had an extra building on their campus that might meet our needs. Most of us knew Bob well, and he had been behind us on every step we take. We are proud to have him as an OSCAR participant. He recently sponsored an Electronic Museum on campus that will include and display the Project OSCAR archives.

OSCAR 2

The significant change for this bird was in the shape and type of temperature-control stripping on the external surface of the satellite. OSCAR 1 had a few wide stripes, 2 had more stripes with a different pattern. Whoever monitored OSCAR 2 could learn this from the temperature readings plotted from the time interval of 10 HIs.

The first two OSCARS were ejected from the parent Agena satellite with a very simple hooking device powered by a compression spring bought from Sears & Roebuck for $1.15. Lance Ginner K6GSJ conceived this. We were the first auxiliary package to eject from the parent and go our own way. This sparked other groups, such as science organizations and universities, to put up their own

Photo B. OSCAR 2. Note the difference in the external stripping from OSCAR 1. Chuch K6FLH is holding the bird.

devices. Where do you think the Air Force sent them for advice? We were more than happy to help.

OSCAR 3

A synchronous satellite was next. Our OSCAR 3, and AMSAT's OSCAR 8, were both planned for a synchronous orbit 23,000 miles above the Earth. Our launch vehicle lost its last boost rocket and the remaining orbit varied from 100 to 23,000 miles. Because OSCAR turns on at ejection from parent, enough tracking data was logged to be able to predict its new path. We then supplied this data to aid others to turn on their packages. With OSCAR 8, the booster blew up, and that was it.

OSCAR 3 was the first repeater satellite, and it was in and out on 2 meters. Lance Ginner K6GSJ, Ed Hilton W6VKP, and Don Norgaard W6VMH were the principal conceivers of this satellite configuration. It worked well and made possibly 1000 contacts in 22 countries. It only lasted 18 days, because adequate solar cells were beyond our pocketbooks. It proved, however, the practicality of Amateur Radio in two-way communication in space.

As OSCAR 3 neared completion, the West Coast crew was slowly burning out. Five years of creative, serious, and time-consuming activities were starting to take their toll, and fewer than 25 hams remained on the working crew.

TRW Into The Act

At this time, however, another very rare opportunity arose to send a bird into synchronous orbit aboard a Titan 3-C rocket. The Project OSCAR Association had contacted several technically capable ham radio groups, and one of these, the TRW Radio Club of Redondo Beach, California, felt they could meet the technical and time demands of this once-in-a-lifetime offer! OSCAR had already spent over a year developing OSCAR 3, and were not quite finished with it. We couldn't single-handedly complete 3 and create 4.

The TRW folks completed an excellent space package. During the launch, however, the last booster rocket failed, resulting in a highly elliptical orbit.

A satellite destined for a synchronous orbit about 22,000 miles above the earth requires three, serially fired, booster stages of rocket energy. The first rocket engine burn sets the satellite off the ground and into a parking orbit 100 or so miles above the earth. A third rocket booster ignites, and it turns the satellite in the direction desired around the earth to fulfill its signaling function as it accelerates the satellite to its orbital velocity. As noted, the third burn rocket failed to function and the satellite actually fell back to the altitude and dimension of its parking orbit. The velocity, however, had built up tremendously from this fall so it made a quick curve around the earth and shot out to 22,000 miles again.

OSCAR 5

Our space launching contacts said that there were many others standing by for a launch opportunity and even noted that some had duplicated our technical know-how so their satellites should qualify. We couldn't complain, they had been most fair and helpful. The OSCAR group was again approaching burn-out, but again our Guiding Light led Perry Klein W3PK and Jan King W3GEY to us. They are two of the original members of AMSAT. They visited us for two or three days, and we found a housing that could accommodate their OSCAR 5.

Project OSCAR in the Last Two Years

Our Board of Directors meeting retained John Pronko W6SN as Chairman, and elected Jim Eagleson as President, Paul Shuch as Technical Director of User Services, a new title for this year.

Jim Eagleson continued to explore the possibilities of Amplitude Compandored Sideband (ACSSB) and began looking into the possibilities of a Community Access System for future OSCARs.

Ross Forbes developed a working relationship with AMSAT-UK and AMSAT-AUSTRALIA to make software packages they developed available to users in North America. Project OSCAR also began to help organize all-day mini-conventions aimed at helping the new satellite user to get started on OSCAR.

Working with AMSAT-NA, Project OSCAR instituted a weekly VHF net to help those in Central California receive timely OSCAR information. This net is broadcast on WA6YCZ/R (147.15 MHz +600) and is held each Tuesday evening at 8 PM local time. WA6YCZ is one of the early San Francisco Bay Area repeaters, and was established by a few of the original members of Project OSCAR and the past and present licensee is Lange Ginner K6GSJ. In addition to WA6YCZ, the net is rebroadcast on K6GW3/R, 443.525 and WA6SYE/R, 443.525 (in Central Valley). At times, the Project OSCAR net is simulcast on 3.840 MHz to supplement the weekly AMSAT-NA

75 meter net. If other VHF and UHF organizations are interested in linking into the net, please contact Project OSCAR at our Post Office Box.

Quarter Century in Space

December 12, 1986 was the 25th Anniversary of the launch of OSCAR 1, a celebration was held at Foothill Community College to recognize those involved in the first program. Most of the original teams attended and many had not seen each other for many years. To honor the occasion, the OSCAR-AMSAT Archives was officially formed, and the Bud Shultz W6CG Award was created. This award was established to recognize individuals who make important contributions to the OSCAR program. The award is to be given on an annual basis at the annual meeting of the California VHF/UHF Meeting. Get complete details of this award by sending an SASE to Project OSCAR and to the attention of Paul Shuch N6TS.

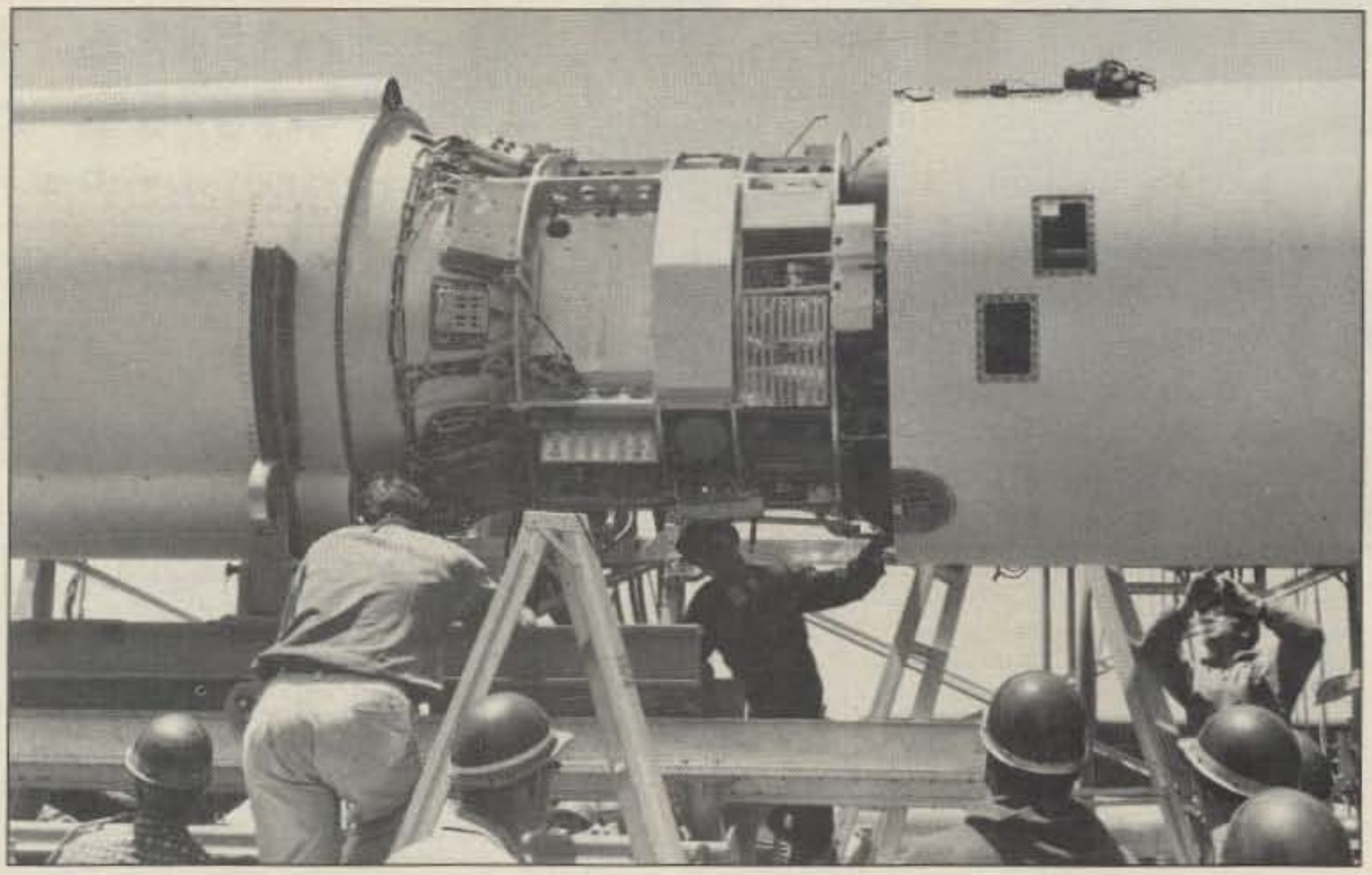


Photo C. Assembly of the launch housing on the Agena spacecraft. The top side of OSCAR 2 shows on the right side of the rack, in the exposed section of the rocket.

Project OSCAR in 1987

Dr. Robert Smithwick W6JZU returned to the board. Smitty was primarily responsible for moving Project OSCAR to the permanent home on the campus of Foothill Community College in Los Altos Hills. The annual Board of Directors meeting is held at the Electronics Museum operated by the college, and the OSCAR-AMSAT Archives are now kept by the same museum.

This year saw continued support for the VHF net, and continued sales of software. Project OSCAR continues to sell satellite tracking software written by James Miller G3RUH. This program is available for the Apple II, IBM-PC, TRS-80 (Model I/III) and the Commodore C-64/C-128. Cost is approximately $25 per disk, but those interested should send an SASE to Project OSCAR for detailed information. *Project OSCAR, PO Box 1136, Los Altos CA 94023-1136.*

Project OSCAR in 1988

At the annual Board of Directors meeting, Gary Nakayama KH6JARB and Jeffrey Pawlan WA6KBL joined the Board of Directors. Chuck Towns K6LFH and Lance Ginner K6GSJ are still very active on the Board of Directors. New officers are:

Chairman of the Board—Paul Shuch N6TX
President—Ross Forbes WB6GFJ
Secretary—Nick Marshall W6OLO
Treasurer—Gil Morris WB6KCJ
Director of User Services—Gary Nakayama KH6JRB
Technical Director—Jeffrey Pawlan WA6KBL

Recently, the board met to review and update the by-laws so we are in compliance with present regulations. This also allowed us to bring everything in line with the operation of the corporation. Most important was the establishment of an Executive Committee to oversee the daily operations. Members of the Executive Committee are N6TX, WB6GFJ, WA6KBL, W6NBI, and KH6JRB.

With the launch of Phase 3C, Project OSCAR will be adding to the software library available for sale. All funds received go toward operating the organization and for contributions to the various AMSAT organizations. New software will include SAT-SCAN for the IBM-PC developed by AMSAT-UK, and a suit of programs written by James Miller G3RUH to help the intermediate OSCAR user understand more about the elements affecting the spacecraft. Project OSCAR will also have the decoding software developed by G3RUH and Markel Bertilsson SM5REY to read the PSK telemetry and messages contained on Phase 3C. This software works with the G3RUH Oscar-10 PSK Modem.

Project OSCAR will continue to support the many worldwide AMSAT groups. With the many complex problems facing OSCAR in the future, Project OSCAR has no intention to compete with any organization. Our interest is to promote Amateur Radio Satellites and help any way we can.

Project OSCAR provides a semi-regular newsletter to anyone who makes a $10 donation and sends six SASE business-size envelopes with 2 ounces of postage or equivalent IRCs attached.

Project OSCAR will help AMSAT-NA's Field Operations with support to produce 35mm slide programs and VHS video programs. These programs will be available through the AMSAT Field team of Regional and Area Coordinators. Contact AMSAT-NA for more information. The Project's president is also working with AMSAT-NA's president to develop a closer working relationship to promote OSCAR. We make sure that Project OSCAR is represented at the annual AMSAT-NA board meeting by sending our president each year to their meeting as an observer.

OSCAR Publications

Nick Marshall W6OLO's new book, *History of Project Oscar* is now in final review and will shortly go to print. Project OSCAR is also working on a booklet aimed at the first-time user. Presently, the section of highly elliptical orbits is completed, and we are adding material for the low earth orbit satellites UoSAT, RS, and F-O-12, along with information on Phase 3C.

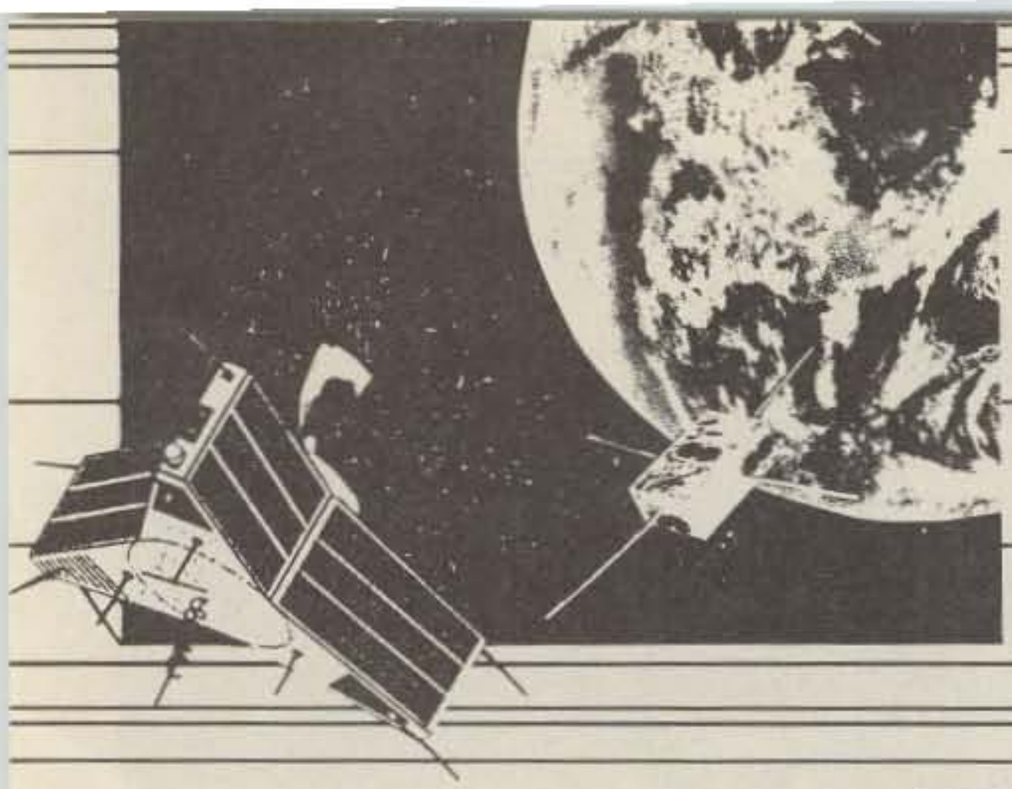
Project OSCAR also is working with AMSAT-NA Vice-President of Field Operations KO5I to produce an area coordinator's handbook. This publication will allow each AMSAT-NA area coordinator to have the necessary information to be an effective AMSAT representative in his or her area. The publication will contain details obtained from the already experienced AMSAT-NA regional and area coordinator teams.

After asking the Project OSCAR membership for their areas of expertise, we have organized a list of volunteers willing to translate OSCAR articles from various languages. Presently, we are able to translate engineering/technical Japanese, French, German, Spanish, and Hebrew into English. It is a principal goal of OSCAR to provide English translations from the foreign OSCAR users in hopes of providing better understanding among the worldwide OSCAR community.

In Closing...

Volunteer organizations need more than manpower alone. Those who can't donate time to the continuing OSCAR project may make a financial contribution to Project OSCAR and AMSAT-NA. These funds will continue to pay for technical development and postage and are tax-deductible under Section 501(c)(3) of the Internal Revenue Code. 73

Chuck K6LFH has been a ham since 1958, and has degrees in both Aerodynamics and Electrical Engineering. He worked for Lockheed Aircraft in Sunnyvale, California, until he "retired" in 1977. He has since started several computer businesses. Other hobbies include flying and travel.



Number 9 on your Feedback card

Satellite Awards

Hamsats add a new dimension to the paper chase.

by Heather MacAllister WB5RMA

As thousands of amateurs have discovered, chasing satellites can be addicting. Many a jaded ham, with walls full of rare QSLs and the familiar DXCC, WAS, and WAC awards, has renewed his enthusiasm for amateur radio by earning those awards all over again—along with new ones—through the satellites.

Just as with the low-band awards, some of the satellite certificates are more difficult to earn than others. Here's a few of the easier ones for starters.

Get Warmed Up on These

The most basic is the Satellite Communicators' Club certificate. Just report a two-way contact through any satellite to AMSAT S.C.C. Manager, PO Box 27, Washington, DC 20044. No form is necessary. Include information about the QSO along with an SASE and $1 ($2 for non-members).

A good next-step choice is the Ten American Districts Award (TAD) with satellite endorsement. This award is sponsored by Lockheed E.R.C. Amateur Radio Club. To qualify for the award, contact all ten American callsign districts from the same callsign area. Take care to not rely on the callsign, itself—check the actual district worked. The Lockheed club prefers to see a verified list over QSL cards. The list must show all pertinent information and should have the validation of an elected official of an amateur radio club or two other licensed amateurs. Enclose $1 for the list submission, $2 for submitted and returned QSLs. Send award requests to W6LS, 2814 Empire Ave., Burbank CA 91504.

When sending QSLs, make certain that each card clearly states that the contact was by satellite. State the frequency as uplink over downlink. For example, a Mode J contact on Fuji Oscar 12 is written as 145/435 MHz. Orbit number is optional.

Ready for Tougher Challenges?

The familiar WAC, WAS and DXCC awards from the American Radio Relay League are available for satellite QSOs. For the Worked All Continents (WAC) award, submit proof of contact with a station in Africa, Asia, Europe, North America, South America and Oceania. Ask for the satellite endorsement when applying.

The rules for Worked All States (WAS) are similar to the standard WAS award. Any and all satellites may be used in contacting a station in each of the fifty states. For the complete rules and an application form, send an SASE to the American Radio Relay League, 225 Main Street, Newington, CT 06111.

For Satellite DXCC, submit one hundred QSL cards from the DXCC list of countries and forms CD-164 and CD-253 to the ARRL. When requesting the forms, please include an SASE with two units of postage.

The Satellite DX Achievement Award, DX-1000, is also sponsored by the ARRL. Its rules are a bit tricky. Qualifiers must accumulate 1000 points. Each QSO with a new station is worth 10 points, each new country is 50 points and each new continent is 250 points. The very first contact nets the operator 310 points! Submit QSLs with form CD-206 to the ARRL for this award.

The ARRL charges no fees for these awards, but membership is required of all American and Canadian applicants.

Speaking of Canada, the Northern Alberta UHF Society sponsors an impressive-looking certificate called the VE Satellite Award. Stations inside North America (W/VE and KL7) must submit QSL cards confirming satellite contacts with eight different Canadian call areas: VE1, 2, 3, 4, 5, 6, 7, 8, 0, VO1, and VY1. Stations outside North America, including KH6, are required to contact just four call areas. The application fee is $1 for W/VE and KL7 stations or four IRCs (International Reply Coupons) for others. Those who wish to have their cards and award sent by registered mail must include extra postage. Send award requests to Ray J. Nadeau VE6SF, Committee Chairman, PO Box 52, Barrhead, Alberta T0G 0E0, Canada.

An award with a slightly different emphasis is the K2ZRO Memorial Station Engineering Award, honoring Kaz Desker, sponsored by the Radio Amateur Satellite Corporation. This is a test of operating skill and equipment performance. A control station sends and repeats numeric code groups at gradually reduced power levels. The operator measures the receive sensitivity of his satellite station as he monitors and records the content of the transmissions. Those who can copy the satellite's beacon can qualify for the basic award. The fun comes from pursuing endorsement stickers for the different power levels with the top award being for perfect copy at the lowest power level. AMSAT hopes to encourage stations to improve their downlink reception and thus reduce uplink excesses which are unnecessary and drain the satellites' batteries. Unfortunately, because of the deterioration of AMSAT Oscar 10, this competition is on hold until the launch of Phase 3C. For operating times and frequencies, send an SASE to AMSAT ZRO Test, PO Box 177, Warwick, NY 10990. The cost of the basic award is $3.50 for members and $5 for non-members.

AMSAT sponsors three other awards. They are the AMSAT OSCAR Award, the OSCAR Sexagesimal Award and the OSCAR Century Award. They are presented for 20, 60 and 100 qualified contacts, respectively. A qualified QSO is one in a different state, Canadian call area or DXCC country, in any combination. Endorsements for each 10 QSOs between levels are available. Again, the cost of the award is $3.50 for AMSAT members and $5 for non-members. Include QSL cards and return postage. Send to AMSAT, PO Box 27, Washington, DC 20044.

Two challenging awards are the CQ CW DX Award with OSCAR endorsement and the CQ SSB DX Award with OSCAR endorsement sponsored by *CQ Magazine*. The basic award is for confirmed contact with 100 countries specifically by CW or SSB After the basic award, *CQ* sponsors several endorsements, including one for 50 or more countries confirmed via satellite. After the basic award is issued, CQ requires only a listing of confirmed QSO's for the endorsement. To get the fee schedules, proper forms

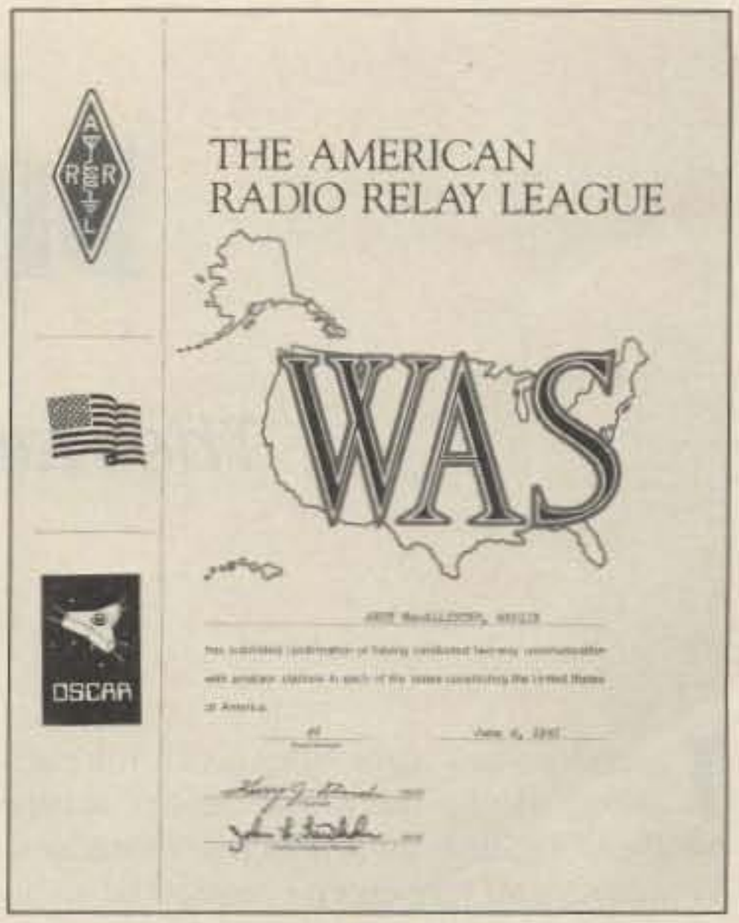
and full awards requirements, request the CQ DX rules sheet from CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

Our own *73 Magazine* offers the DX Dynasty Award. The basic award is for 100 countries worked with endorsements available in increments of fifty up to 350, then at 375 and 400. Only contacts made after 0001Z on January 1, 1987, are eligible. It isn't necessary to submit QSL cards, but it is necessary to apply on an official DXD form, available from *73 Magazine*. For the form and a countries list, send an SASE to WGE Center, Peterborough, NH 03458, Attention DXDA. Contacts should be listed in callsign order, with date, time, frequency or band, mode, and power. The fee is $6 and each endorsement is $2, with the exception of endorsements requested on the first application–they're free.

Countries besides Canada and the United States also promote some awards. South Africa AMSAT sponsors the Satellite Communication Achievement Award for making twenty-five two-way contacts through Phase 2-type satellites. Presently, these are RS 10-11 and Fuji Oscar 12. Oscar 10 contacts are not included, since it is a Phase 3 award.

The award is available from AMSAT SA, Box 13273, Northmead 1511, Republic of South Africa, but funds must be remitted in Rands. An easier way is to request it through AMSAT NA and use dollars. The certificate will still be signed by SA Awards Manager, Andre Botes, ZR2FK. Send requests to AMSAT, P.O. Box 27, Washington, DC 20044. Cost is $3.50 for members, $5 for non-members (of AMSAT NA).

From time to time, the Federation of Radiosport in the USSR sponsors a very intriguing competition via the RS satellites. Details are sporadic and aren't usually broadcast very far in advance of the actual contest. Listen to the AMSAT nets for advance warning, or try sending four IRC's to the Federation of Radiosport, Box 88, Moscow, USSR, with a request for information. In the past, the contests have lasted a few days, with the objective being to work as many different stations as possible during the period. A typical exchange consists of the contact serial number and signal report. Contest logs



should be sent to the Federation of Radiosport, Box 88, Moscow USSR. Certificates are given for first-, second- and third-place winners in each continent. They are written completely in Russian and are guaranteed eye-catchers.

These are the major awards for satellite-chasers. Earning them tests equipment and operating proficiency, as well as luck. Clear some wall space and good hunting! 73

Heather MacAllister is XYL of our hamsat columnist Andy. We welcome her contribution and look forward to more submissions in the future. She can be reached at 2310 Romayor Court, Pearland TX 77581.

Briefly Speaking:

The Hardly-Hard, Hardline Connection.

by W. Max Adams W5PFG

Tornadoes and hams often work for each other. Hams track and report severe weather, capable of producing tornadoes. Tornadoes can tear down commercial radio towers, producing short but usable sections of hard-line (rigid) coaxial cable.

Recently a Texas tornado completely lowered a 360 foot commercial two way radio and paging service tower. This produced (after the insurance company said, "Get rid of it!") a 150-foot roll of ⅞-inch hardline in my front yard. There are several kinks and abrasions, but so-what? I only need four pieces, two 20-foot and two 40-foot coax sections for my proposed fold-over tower's VHF/UHF antenna.

Now, let's see. Four sections, with two connectors per section; gotta get me eight ⅞-inch hardline connectors. Then came the eye opener; only $50 per connector times eight equals $400! Before I had a black eye closure from a usually benevolent XYL, I skillfully dodged the blemish by saying, "Ho-Kay, Ho-Kay, I gonna home-brew one and Iff-en it work, I'll home-brew seven more!"

My sharpest dull hack saw blade removed one kinked-up part and left a good six-inches of long home brewing prototype sample.

The same "150-foot roll in the front yard" remark was repeated about 6 times 400 divided by 150 (there were six 400-foot hardline runs up the same ill-fated 360-foot tower) times, by other area hams. Most were either thinking the black-eye blemish remark, or making the blemish avoidance remark, "I-gonna home-brew-em!"

Homebrewing hard line connectors is not a new project. I have seen several articles on the subject; I'm just gonna "wing-it" on my own, and see what happens.

Several "why-not" questions came to mind while cleaning-up, squaring up and smooting up the six inch hardline sample:

"Why not use commonly available material, so others can easily make their own connectors?"

"Why not simplify the procedure for use of ordinary hand tools?"

"Why not minimize soldering, yet maintain good electrical connection?"

"Why not strive for good mechanical construction, which can later be waterproofed?"

"Why not use an inexpensive mechanical arrangement, yet consider electrical requirements, such as, characteristic impedance mismatch, etc.?"

"Why not use a mechanical arrangement which will allow preventive and corrective maintenance?"

"Why not strip 1-½ inch of the sample's outer conductor plastic jacket and see what it is covering?"

"Why not remove 1.1 inches of the corrugated outer conductor and foam insulation thereby exposing the 0.3-inch tubular center conductor?"

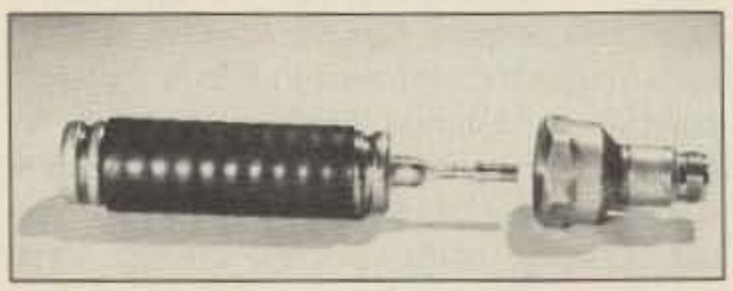


Photo A. Interior detail of the home-brewed hardline connector. At $50 each for regular connectors, it's worth the effort to roll your own.

"Why not take the stripped sample to the hardware store and search for a suitable rigid copper plumbing fitting that will reduce the ⅞-inch hardline to a female UHF barrel connector?"

Under five watchful eyes of three hardware store clerks, I fumbled through several bins of pipe fittings. I tried to prove my sanity to these same three clerks with the purchase of one, 79-cent, 1-inch male pipe thread to ½-inch rigid copper pipe adapter.

Standard water pipe threads are slightly tapered. Likewise, the copper fitting's threads are tapered. I used a ⅜-inch round burr electric drill bit, a sharp edged ½-inch mill bastard file and a pocket knife to remove the taper and some of the threads from the copper fitting. I tested the fit frequently during this surgical exercise to determine the seating of the outer conductor to the hardline adapter shell.

Notice the corrugated "lands" pressed in the hardline's outer conductor. Remove sufficient adapter shell material to allow insertion of one and one-half "high" lands; about 0.4 inches. This places the first "low" land about 0.1 inch "inside" the adapter shell.

"Why not drill and tap three, equally spaced, 6-32 thread Allen setscrew places, 0.1 inch from the adapter shells rear edge?"

This should mechanically secure the hardline to the adapter shell and provide a good electrical (although not waterproof) connection.

Assorted UHF chassis connectors, barrel connectors and adapters were scrounged from the connector junk box. I carefully examined the assembly of each: "What had to go together, can come un-together!" A lightly chrome-plated brass BNC male to UHF female adapter seemed a likely candidate for hacksaw surgery. Make a shallow cut, next to the unthreaded shoulder portion of the UHF end. Be careful, do not cut the center conductor.

"Why not remove the chrome plating from the smooth rear edge of the UHF shell?" A few strokes, with a flat file, quickly removes the not-so-tender chrome plating. Later, this allows soft soldering of the brass UHF shell to the copper adapter shell.

"Why not taper the hardline's 0.3 inch tubular center conductor to approximate the hardline adapter shell taper?" This is accomplished by sawing four ¾-inch slots in the center conductor with two hacksaw cuts spaced 90 degrees, leaving four center conductor tabs.

"Why not cut a taper to each center conductor tab, which allows them to form about the UHF adapter's center conductor?" Carefully bend each tab to provide equal reduction of the hardline center conductor. Trim the four formed tabs, setting the center conductor overall length to completely seat in the UHF shell insulator. Leave sufficient clearance for self alignment during installation of a PL-259 connector.

Notice that the center conductor's insulator is held in place by three "staked" indentations in the UHF shell.

"Why not remove the UHF insulator?" A few sharp blows to a suitable drift punch while holding the UHF shell forces the insulator from it's mounting. This prevents its distortion when the UHF connector shell is soldered to the hardline adapter shell.

Carefully assemble the hardline, adapter shell, UHF shell, insulator, and center conductor. Inspect the assembly for alignment and neatness. Carefully mark the location of the UHF shell. When it is correctly installed in the hardline adapter shell, then separate the entire assembly.

Remove the UHF insulator, as described earlier. Install the UHF shell in the hardline adapter shell at its marked location. Apply a small amount of rosin-core solder, using a 150-watt soldering gun, between the UHF

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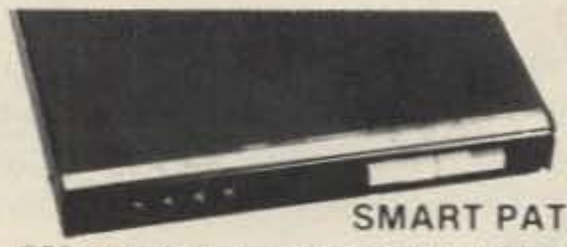

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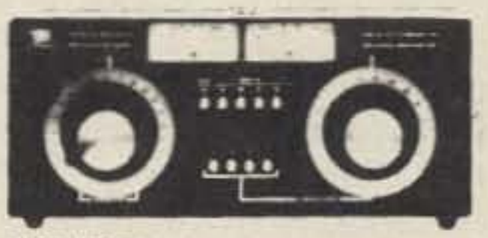

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connector and the hardline adapter shell. Heat the surfaces to soldering temperature, then flow a small bead of rosin-core solder to the joined parts. Allow the assembly to cool naturally. Do not pick it up too soon, as I did—for a very short time!

Carefully solder the UHF center conductor to the hardline center conductor tabs. Allow the solder to flow smoothly and cool naturally. Do not attempt to quench (cool) the connection, otherwise the solder may crystallize and/or distort the assembly.

"Why not place a neat amount of silicon seal around the exposed hardline outer conductor?" This may not make the joint watertight, but it can offer a little help with a potential moisture problem. Carefully install the hardline shell assembly to the center conductor assembly and snugly tighten it's three set screws. Do not puncture the hardline outer conductor.

"Why not get a cup of coffee and admire the newly completed hardly-hard, hardline connection?" It's a lot of fun to install a PL-259 on your proud home-brew accomplishment while waiting for the next cup to cool!

Somewhere near the bottom of the pot, another why-not question was found near the bottom of the cup.

"Why not repeat the procedure and make a pair of connectors, this time using a 20 foot section of hardline?"

"Why not get a cup of coffee and admire the newly completed hardly-hard, hardline

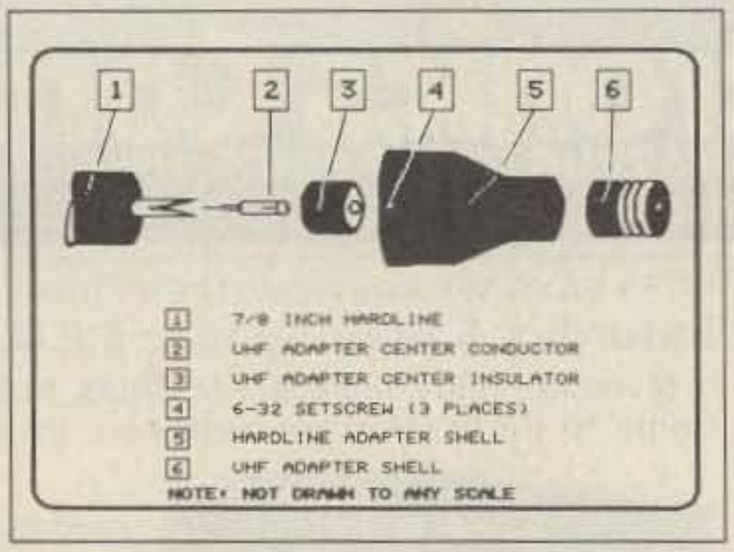

Figure 1. Hardly-Hard hardline connector assembly component parts.

connections?" It's a lot of fun to install a PL-259 on your proud home-brew accomplishment, while waiting for the next cup to cool!

Somewhere near the bottom of the second pot, another why-not question was found near the bottom of the fifteenth cup.

"Why not make some simple measurements, if for nothing else, just to "prove the books correct?" Measuring line loss in less than 100 feet of ⅞ inch hardline is not an easy task. However, some data can be obtained with a calibrated signal source, a calibrated wide bandpass radio frequency (RF) voltmeter (or wattmeter) and a dummy load of correct impedance and power dissipation.

Provided there is no system reactance, which is virtually impossible, ordinary amateur radio test equipment can be used to make good, valid measurements. If the GOESINTA nearly equals GOESOUTA and reflected power hardly lifts the needle from the peg, then all is OK. Should there be any appreciable line loss, reflected power indications, or heating of the joints, something is wrong! Incidentally, use of an antenna system, thought to be of 50Ω impedance, a 50Ω (nominal) RF source (Transceiver or transmitter), 50Ω (Nominal) hardline and 50Ω (Nominal) test equipment, will be reactive to some degree. Therefore, do not get on the local repeater and say, "Absolutely Flat!" without "for ham radio purposes" appended to the "flat" remark.

Briefly Speaking, readers may ask, "Why 20- and 40-foot sections of ⅞-inch hardline?" My main reason: to remove the unnatural kinks, skuffs and flat anomalies installed at several places in 150 feet of almost new, expensive coaxial cable, when the tower was disassembled by a Texas tornado! My second reason: to provide an ordinary flexible coaxial cable, flexible hardline "joint" on a fold over antenna "pole." After all, the price I paid for 148 feet of usable ⅞-inch hardline was far less than flea-market price of used RG-58!

Final reason: Think of the fun I have writing this stuff, taking pictures, drawing drawings and listening to an Editor laff-out-loud while saying, "Pee-eFf-Gee wants me to print this? Iff-en I do, wha-wud-ole 'NSD' say?" "Yer-fired!" thasa-wha-e-wud-sa!" Vy 73's, Max. 73

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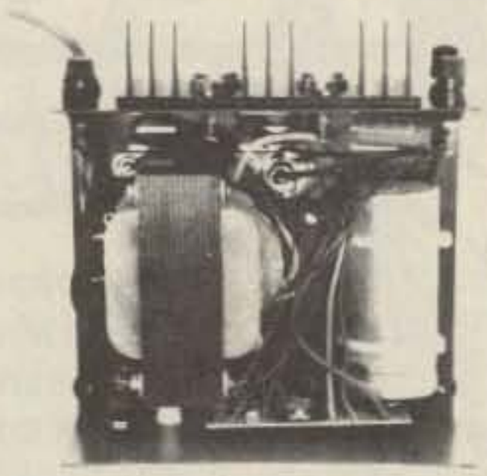
Irvine, CA 92718
(714) 458-7277



INSIDE VIEW — RS-12A

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models **except RS-3A, RS-4A, RS-5A.**
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

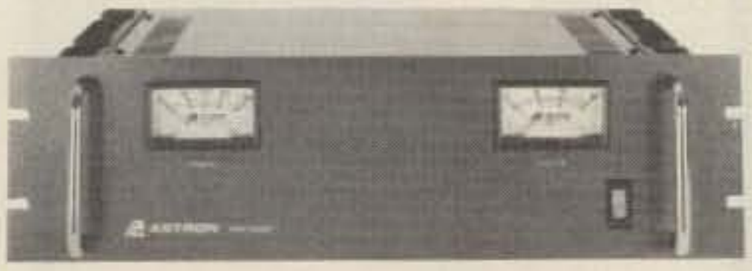
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES



MODEL RM-35M

19" × 5¼ RACK MOUNT POWER SUPPLIES

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

RS-A SERIES

MODEL RS-7A

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

RS-M SERIES

MODEL RS-35M

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

VS-M AND VRM-M SERIES

MODEL VS-35M

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

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

RS-S SERIES

MODEL RS-12S

- Built in speaker

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

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

The Winnebiko's Solar Power System

Part 4 in the tech nomad series.

by Steven K. Roberts and Glenn Glassner

From the perspective of a sandy towel on a Key West beach, there is something abstract and remote about magazine publishers and deadlines. The attitude of mañana pervades the island air like the fragrance of frangipani, rendering the daily realities of business about as substantial as stray radio waves...editors notwithstanding.

But there's nothing at all abstract about the sunlight down here in paradise—which is a good thing for both the bikini-clad spring-break beach crowd and the power-hungry Winnebiko. Free electricity, and lots of it, keeps my systems happy, unconcerned with noisy island power lines or the grim problems of dead batteries in the wilderness.

In this, the fourth article of our series, I'd like to talk about the bike's power-management circuitry. Starting with the solar panels that take it in and ending with the switching power supplies that put it out. The whole system is designed to provide maximum independence and efficiency. The resulting ideas can be applied to a wide variety of mobile, portable, and field-day systems.

Solar Panels and Batteries

The bike carries a pair of Solarex SX-10 LITE photovoltaic modules, each weighing in at less than 2 pounds and producing a steady 650–700 mA into an associated 12-volt battery when the sun shines. These rugged 12 X 17-inch units, based on semicrystalline silicon technology and lacking the traditional heavy glass cover plates and aluminum frames, have finally rendered photovoltaic use as easy as it should be: sunshine in, two wires out, no maintenance in between. The theoretical maximum power from the pair is 20 watts, but since the panels are mounted at different angles they can never both see full sun at the same time (at least in THIS solar system).

This is hardly a problem, however, since the bike's loads are supported by a pair of six amp-hour lead-acid batteries, built around SAFT Gelyte packs. These replaced the original NiCd packs of my first 10,000 miles after experience demonstrated that despite a somewhat higher power-to-weight ratio, NiCds don't like the random charge-discharge cycles of a nomadic lifestyle.

Two photovoltaic modules and two batteries... this architecture is no accident. A pair of console switches allow the former to be swapped relative to the latter—or the latter to be swapped relative to the bike's loads. The first swap option allows a low battery to get the benefit of whichever panel happens to be receiving the most light; the second allows the computer battery to serve as a backup for the "lights and radios" battery during long night rides.

This raises an interesting issue: charge management. Ideally, this would all be controlled via A-D converters and power MOSFETs by one of the bike processors—something that was, in fact, one of my original specifications for the system software. But the catch here is that the computers are not necessarily powered up when battery charge levels are changing (keeping the bicycle-control processor on all the time would impose enough overhead to offset much of the system's efficiency). Still, a future enhancement will allow many of the charge management decisions to be made in software when the bike is online, now that the use of lead-acids allows battery level to be measured with some repeatability.

At the moment, I use two tools to keep the batteries healthy. The first is a simple brute-force circuit associated with each, consisting of a series-check diode to prevent dark discharge into the panels and a power zener that warms up when the battery's terminal voltage reaches end-state levels. This seems a bit crude these days, but the approach works noticeably better than my earlier active controllers that created noise and ate about 8 mA on standby.

The second charge-management tool involves what I have come to call my "wetware infosystem," otherwise known as the human brain. A front-panel Acculex digital panel meter displays the terminal voltage of each battery, as well as the algebraic sum of all charge and load currents. After 4.5 years on the road, I have developed an intuitive sense of battery health based upon casual ongoing observation of the displayed data.

As shown in Figure 1, this information is derived by observing the voltage drop across a 0.1 ohm resistor connected in series between each battery's negative terminal and system ground. (Doing it this way keeps op amp circuitry trivial.) This measured value, which linearly reflects battery activity, is scaled to +/− 5 volts by a micropower LM10. Then it is handed off to a thumbwheel switch that feeds any

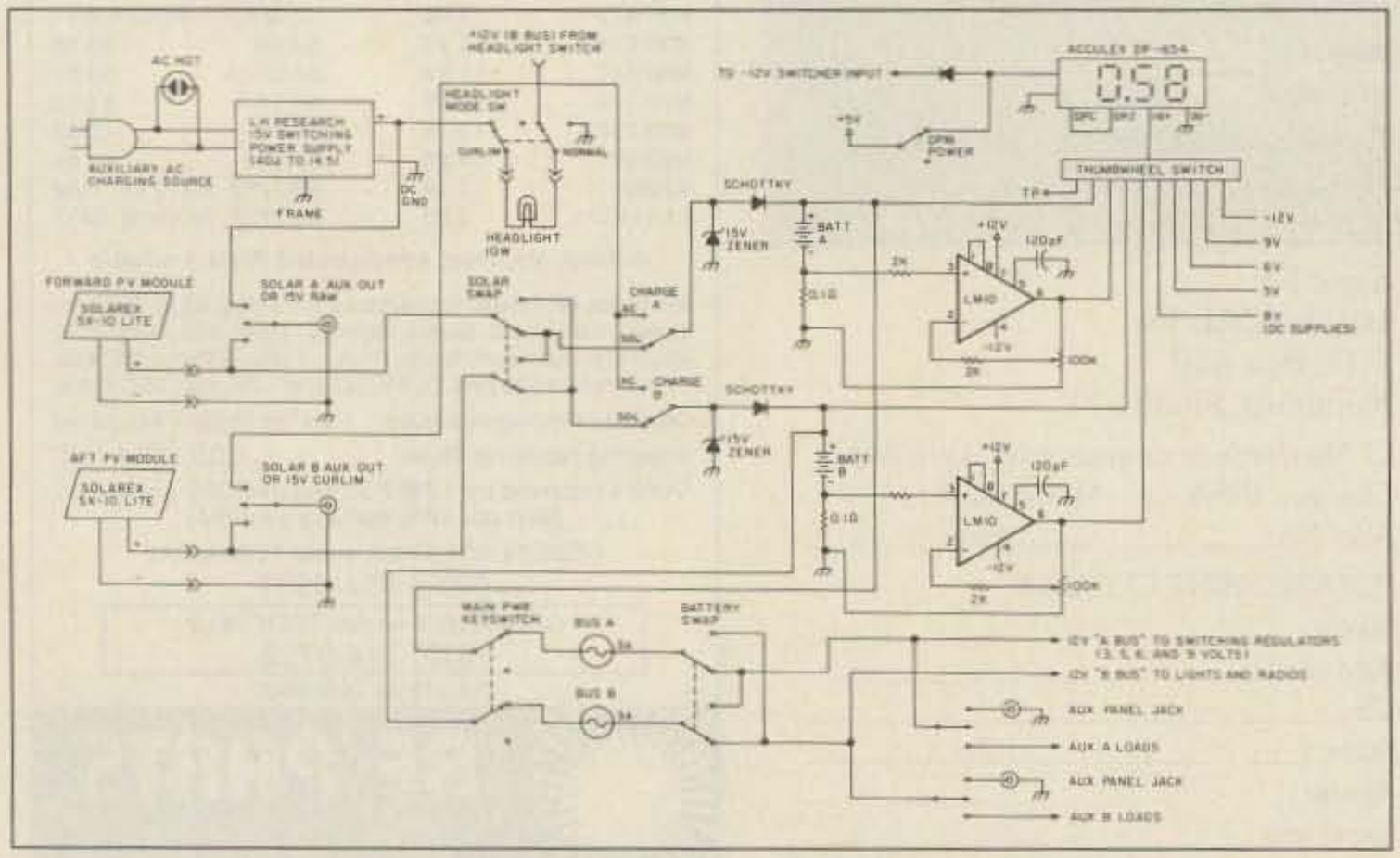


Figure 1. Winnebiko power management circuitry.

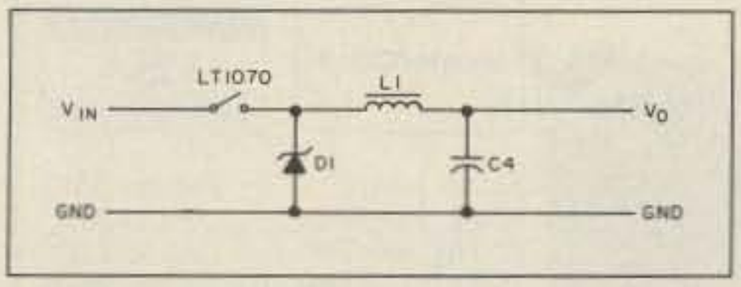


Figure 2. Positive buck converter.

of ten diagnostic voltages to the panel meter.

Let's take a quick tour of the rest of the overall circuit...

At the left of the diagram are three possible charge-current sources—the two photovoltaic modules and a 15-volt switching power supply that can let me refuel from the AC line if necessary. The latter needs a current limiter to avoid overstressing the batteries. Instead of adding a heavy resistor, I followed the old cyclist's maxim of making hardware do double duty: the headlight "mode" can be switched from normal to aseries charge-current limiter. (I'm so obsessed with light weight, you know...)

Continuing across the diagram, you can see these currents passing through the solar-swap and charge-source switches to make their way into the batteries via the diodes, yielding the voltage drop across the tenth-ohm resistors noted a moment ago. From that point, the battery power is available on two interchangeable buses, one of which feeds the array of switching supplies that provide subsidiary voltages for other bike electronics.

As this project progressed, I became increasingly concerned about efficiency. During the first 10,000 miles, I generated the lesser voltages with 3-terminal regulators—now-antiquated units that do their job by dissipating the product of load current and the difference between voltage-in and voltage-out. Such wastefulness I can no longer afford, so when the specs for power supplies began to take shape, I contacted Glenn Glassner of Precision Circuit Images in Columbus, Ohio. He knows about these things... so rather than fumble through the arcane theories of switching supply design, I now turn this article over to him for a glimpse of the radical changes that have recently come over the power-supply world. Glenn?

Miniature 5-Voltage, High-Efficiency Supply

Thank you. Steve's electronic bicycle requires 5 volts for extensive logic circuitry, and to support diagnostic equipment and future system enhancements, he specified 3-amp capacity. He also called for 3, 6, and 9 volts at one amp each, as well as a few hundred mils of -12 for op amps and RS-232 links. All of this had to live on a bicycle and be derived from a 12-volt battery, requiring that the circuitry be efficient, compact, and light weight. To make matters worse, time was at a premium, because Steve was leaving in two weeks... but then, Steve is always leaving.

One year earlier I would have said, "Impossible!" But now, thanks to Linear Technology Corporation, there is a new part on the market that does for switching power supplies, what the 3-terminal regulator did for traditional linear designs.

The finished five-voltage supply is housed in a 1.5 X 2.5 X 6.5- inch aluminum box, with all connections handled through ferrite filter pins to keep noise to a minimum. The supply is actually a collection of five separate switching regulators: four LT-1070CTs are used to provide the 3, 5, 6, and 9-volt outputs, and the -12 is derived from the +5 via an off-the-shelf DIP converter chip. Perhaps the most representative of all is the six-volt supply, and its schematic is shown in Figure 3. Before explaining the circuit, however, let me make a few comments about the LT-1070 chip itself...

LT-1070 Attributes

This device contains all the dynamic components required to build a current-mode switching power supply. For the novice, it is comforting to note that there only five pins to confuse. Other features include:

- 1.2 volt band gap reference
- 3—40 volt input range
- 40 kHz internal oscillator
- soft start
- current limit
- high peak switch current

The most important feature is the current limit, which can protect the device long enough for most people to breadboard and debug the circuit without smoking anything.

Now refer to Figure 2 for a bit of theory. The LT-1070 is a current-mode switching controller, shown in the diagram as a buck converter. The circuit controls the output voltage by varying the duty cycle of the switch: the longer the switch is on, the higher the V_O. D1 provides a return path for L1 current when the switch is off.

The most important thing about a switching regulator is that the switch is either on or off—there is no linear waste of power. The only notable items contributing to inefficiency in a well-designed switcher are the forward drop and resistance of D1, the resistance of L1, and the switch's ON resistance.

To control the duty cycle, the LT-1070 actually watches the inductor current ramp up—turning the switch off at the same current point in each cycle. Comparison of this trip point to the feedback from the error amplifier keeps the output voltage regulated. The spinoff of this is automatic limitation of the output current, making the device virtually indestructible.

The actual bike system circuit, (see Figure 3) was built directly from Linear Technology's application note #19 with my particular choice of available parts. Of the many possible circuit combinations suggested for the LT-1070, this use is perhaps the most confusing, since the device is floating on the output voltage. Because one side of the power switch inside the chip is connected to the ground pin, V_{SW} is shorted to ground when the power switch is turned on. To maintain the device supply, D3 and C3 thus store voltage while the switch is on.

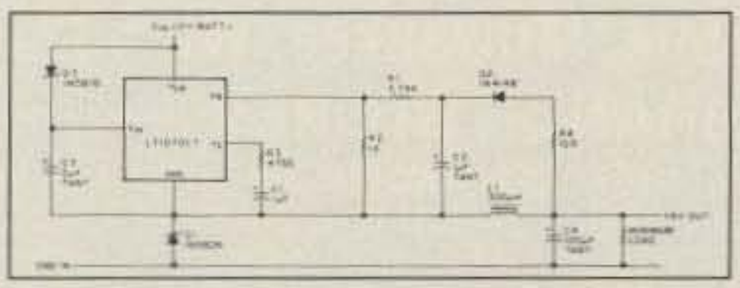


Figure 3. A six-volt supply, most typical of all. R1 and R2 are changed to adjust output voltages. 6V supply shown.

R1 and R2 take the reference output voltage and divide it to set the actual output voltage with respect to the band-gap reference. In this mode a minimum load of 100 mA is recommended for the 5-volt supply, and the others require some minimum as well. (Failing to do this results in overvoltage at the output.)

Output regulation of these supplies is actually much better than that of the batteries they replace, and I'm pleased to note there have so far, been no frantic calls for service from the road. Right, Steve?

Trouble-free

That's right, Glenn. The unit indeed came together within the two week deadline. For the last 5,000 miles it has been a trouble-free, low-overhead power source for a whole bikeload of CMOS logic, personal entertainment electronics, packet TNCs, and more. Each supply is switched on by an OR of steering diodes and front-panel toggle switches, keeping wasted power to a minimum at times of few loads. During normal bike activity, with only the 2-meter rig and the bicycle control processor on, each battery puts out about 100 mA... giving me roughly 25 hours of routine use on a full charge. (Night riding with all lights shortens this figure to 7 hours.)

And so, there it is: a self-maintaining, lightweight, efficient, solar-charged, multiple-output power supply. People often comment on the microprocessors, observing quite correctly that my high-tech nomadics never could have occurred a decade ago. But there are a host of other whiz-bang technologies as well; new devices that do not make the headlines very often, but still change the way we deal with the world. Buried in the bike, for example, is a 1-farad, 5.5-volt electrolytic capacitor about 1 inch tall. The switching supplies convert power at 85–90% efficiency. Distributed throughout the Winnebiko are the magical products of our collective technological consciousness, and I could never do it without them... even if they're NOT digital.

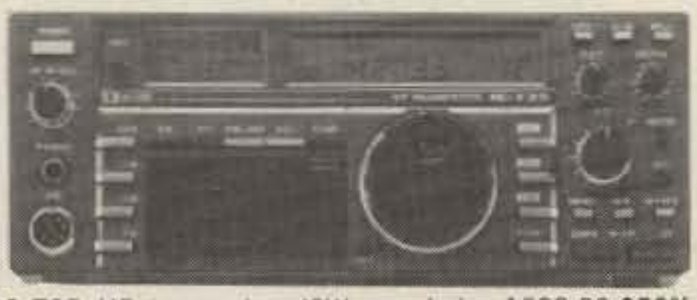
For information on acquiring lightweight, efficient solar panels from Solarex (about $145 in single quantities for the 10 watt units, contact ATG Solar at 800-826-3336 and mention this article.

To obtain two LM-1070 devices and Application Note #19, send $25.95 to Precision Circuit Images, PO Box 14026, Columbus OH 43214. Experimenters can also call 614-261-8043 for more information.

Cheers from Key West... 73

HF Equipment	Regular	SALE
IC-761 HF xcvr/SW rcvr/ps/AT	2699.00	**2369**
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter	149.00	**139.95**
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	**109.95**
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	**1449**
PS-35 Internal power supply	219.00	**199.95**
FL-32A 500 Hz CW filter (1st IF)	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	**109.95**
FL-53A 250 Hz CW filter (2nd IF)	115.00	**109.95**
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	



IC-735 HF transceiver/SW rcvr/mic	1099.00	**959.95**
PS-55 External power supply	219.00	**199.95**
AT-150 Automatic antenna tuner	445.00	**389.95**
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

Other Accessories	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	**1699**
PS-15 20A external power supply	175.00	**159.95**
PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319.95**
MB Mobile mount, 735/751A/761A	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
PP-1 Speaker/patch	179.00	**164.95**
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	**139.95**
AT-100 100W 8-band auto. antenna tuner	445.00	**389.95**
AT-500 500W 9-band auto. antenna tuner	589.00	**519.95**
AH-2 8-band tuner w/mount & whip	659.00	**589.95**
AH-2A Antenna tuner system, only	519.00	**449.95**
GC-5 World clock	91.95	**89.95**

VHF/UHF base multi-modes	Regular	SALE
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IC-275H 100W 2m FM/SSB/CW	1399.00	**1229**
IC-375A 25W 220 FM/SSB/CW	1399.00	**1229**
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	**1249**

ICOM

IC-475H 75W 440 FM/SSB/CW	1599.00	**1429**
IC-575A 25W 6 + 10m xcvr w/ps	1399.00	**1249**

IC-471A* 25W 430-450	**CLOSEOUT**	979.00	**749.95**
PS-25 Internal power supply		125.00	**114.95**
AG-1* Mast mounted preamplifier		99.50	
IC-471H* 75W 430-450	**CLOSEOUT**	1399.00	**989.95**
PS-35 Internal power supply		219.00	**199.95**
AG-35* Mast mounted preamplifier		99.75	

***Preamp $9.95 with 471A or 471H Purchase**

Accessories common to 271A/H and 471A/H		
SM-6 Desk microphone		47.95
EX-310 Voice synthesizer		59.00
TS-32 CommSpec encode/decoder		59.95
UT-15 Encoder/decoder interface		34.00
UT-15S UT-15S w/TS-32 installed		96.00

VHF/UHF mobile multi-modes		Regular	SALE
IC-290H 25W 2m SSB/FM	**Closeout**	639.00	**549.95**
IC-490A 10W 430-440	**Closeout**	699.00	**399.95**

VHF/UHF/1.2 GHz FM		Regular	SALE
IC-27A 25w 2m FM/TTP mic	**Closeout**	429.00	**349.95**
IC-27H 45w 2m FM/TTP mic	**Closeout**	459.00	**399.95**
IC-37A 25w 220 FM/TTP mic	**Closeout**	499.00	**399.95**
IC-47A 25w 440 FM/TTP mic	**Closeout**	549.00	**469.95**
PS-45 Compact 8A power supply		145.00	**134.95**
UT-16/EX-388 Voice synthesizer		34.99	
SP-10 Slim-line external speaker		35.99	
IC-28A 25W 2m FM, **TTP** mic		469.00	**409.95**
IC-28H 45W 2m FM, **TTP** mic		499.00	**439.95**
IC-38A 25W 220 FM, **TTP** mic		489.00	**429.95**
IC-48A 25W 440-450 FM, **TTP** mic		509.00	**449.95**
HM-14 Extra TTP microphone		59.00	
UT-28 Digital code squelch		39.50	
UT-29 Tone squelch decoder		46.00	
HM-16 Speaker/microphone		34.00	
IC-900A Transceiver controller		639.00	**569.95**
UX-19A 10m 10W band unit		299.00	**269.95**
UX-29A 2m 25W band unit		299.00	**269.95**
UX-29H 2m 45W band unit		349.00	**319.95**
UX-39A 220MHz 25W band unit		349.00	**319.95**
UX-49A 440MHz 25W band unit		349.00	**319.95**
UX-59A 6m 10W unit		349.00	**319.95**
UX-129A 1.2GHz 10W band unit		549.00	**499.95**
IC-3200A 25W 2m/440 FM w/TTP		695.00	**579.95**
UT-23 Voice synthesizer		34.99	
AH-32 2m/440 Dual Band antenna		39.00	
AHB-32 Trunk-lip mount		35.00	
Larsen PO-K Roof mount		20.00	
Larsen PO-TLM Trunk-lip mount		22.00	
Larsen PO-MM Magnetic mount		22.00	
IC-1200A 10W 1.2GHz FM Mobile		699.00	**629.95**
IC-1271A 10W 1.2GHz SSB/CW Base		1269.00	**1129**
AG-1200 Mast mounted preamplifier		105.00	
PS-25 Internal power supply		125.00	**114.95**
EX-310 Voice synthesizer		59.00	
TV-1200 ATV interface unit		139.00	**129.95**
UT-15S CTCSS encoder/decoder		96.00	
RP-1210 1.2GHz 10W 99 ch FM xcvr		1529.00	**1349**
RP-2210 220MHz 25W repeater		1499.00	**1329**
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Hand-helds	Regular	SALE
IC-2A 2-meters	289.00	**259.95**
IC-2AT with TTP	319.00	**279.95**
IC-3AT 220 MHz, TTP	349.00	**299.95**
IC-4AT 440 MHz, TTP	349.00	**299.95**
IC-02AT/High Power	409.00	**349.95**
IC-03AT for 220 MHz	449.00	**389.95**
IC-04AT for 440 MHz	449.00	**389.95**
IC-u2AT with TTP	329.00	**289.95**
IC-u4AT 440 MHz, TTP	369.00	**329.95**

Accessories for micros - CALL $

IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	473.00	**419.95**
A-2 5W PEP synth. aircraft HT	525.00	**479.95**
A-20 Synth. aircraft HT w/VOR	625.00	**569.95**

Accessories for all except micros	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	79.00
BP-8 800mah/8.4V Nicad Pak - use BC-35	79.00
BC-35 Drop in desk charger for all batteries	79.00
BC-16U Wall charger for BP7/BP8	21.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	49.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50
BP-4 Alkaline battery case	16.00
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00
CA-5 5/8-wave telescoping 2m antenna	19.95
FA-2 Extra 2m flexible antenna	12.00
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.65
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	24.50
MB-16D Mobile mtg. bkt for all HTs	25.99
LC-2AT Leather case for standard models	54.50
RB-1 Vinyl waterproof radio bag	35.95
HH-SS Handheld shoulder strap	16.95
HM-9 Speaker microphone	47.00
HS-10 Boom microphone/headset	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
HS-10SB PTT unit for HS-10	24.50
ML-1 2m 2.3w in/10w out amplifier	**SALE** **99.95**
SS-32M Commspec 32-tone encoder	29.95

Receivers	Regular	SALE
R-71A 100kHz to 30MHz receiver	$999.00	**869.95**
RC-11 Infrared remote controller	70.99	
FL-32A 500 Hz CW filter	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-44A SSB filter (2nd IF)	178.00	**159.95**
EX-257 FM unit	49.00	
EX-310 Voice synthesizer	59.00	
CR-64 High stability oscillator xtal	79.00	
SP-3 External speaker	65.00	
CK-70 (EX-299) 12V DC option	12.99	
MB-12 Mobile mount	25.99	
R-7000 25MHz to 2GHz scan rcvr	1199.00	**1049**
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160 Meter Contest Results

W/VE Single-Operator Category

Callsign	QTH	QSO's	States	Prov.	Country	Total Score
WB9HAD	IL	1,783	48	11	40	915,255**
KE5FI	TX	1,010	48	10	25	428,280*
W9UP	WI	919	48	10	5	289,800*
AD0O	CO	862	47	10	10	289,775*
W3GG (KA3PGL op)	MD	844	48	9	6	265,860*
VE3XN	ONT	748	48	10	11	261,510*
W4TMR	NC	788	46	9	10	255,775*
KS9O	IL	777	48	6	11	253,500*
WA1UJU	WI	850	47	7	3	242,280
K6HNZ	AZ	632	46	8	11	208,975*
N4LTA	SC	680	48	7	6	208,010*
KA1SR	RI	494	46	9	24	206,980*
WA0LRJ	WY	631	47	8	6	196,115*
K8XR	NJ	470	46	9	16	173,240*
K8HVT	CT	522	45	8	10	166,005*
K7IDX	WA	517	44	9	9	163,680*
KE7C (WB7OJV op.)	WA	510	47	8	7	162,442
W3TS	PA	483	47	9	7	153,720*
W0JLC	MO	374	48	8	19	146,625*
AA4MM	FL	357	47	7	24	143,520*
N4ICS	KY	495	46	7	2	133,650*
VE1BNN	NS	303	42	8	25	122,250*
KF4HK	NC	369	48	8	9	119,925
AG8W (K8MJZ op)	MI	455	43	7	2	118,300*
KI4UJ	KY	413	45	7	5	117,990
NE1I	NH	456	39	6	6	116,280*
NT0V	ND	350	47	6	8	108,275*
W9MQZ	WI	352	45	7	5	100,605
KE7BT	ID	346	47	7	3	99,465*
VE4WR	MAN	362	45	7	2	98,280*
N4HQT	TN	354	46	4	4	96,660*
W0EJ	IA	347	46	7	2	95,975*
W0HW	MN	268	46	7	14	93,130*
KG9D	IL	312	45	6	3	92,070
KV0I	NE	337	46	5	0	85,935*
N4FNB	TN	344	41	6	2	84,280
WD9INF	OH	321	46	5	0	81,855*
K8SVT	OH	291	44	7	3	78,570
N3II	MD	302	40	6	4	75,500*
VE2YU	QUE	230	45	7	10	73,470*
W9RE	IN	254	41	4	6	67,600*
NA2M	NY	282	39	6	2	66,270*
AA4LE	AL	263	40	6	4	65,750*
W1IS	MA	251	38	4	4	63,250*
KC7PA	UT	255	41	6	2	62,475*
K7RJ	UT	259	39	4	5	62,400
NI7T	OR	245	40	6	4	61,750*
N9DBV	IL	231	45	5	2	60,060
KA2VAZ	NJ	277	38	5	0	59,555
N5DUH	IA	266	44	2	4	56,750
K1TO	CT	216	44	6	2	56,420
KS7T	MT	233	39	8	4	51,510*
NA8W	OH	216	42	3	2	51,230
N7FMB	TX	195	41	4	5	49,000
VE2RQ	QUE	201	35	7	3	45,900
KA0QQP	IA	192	42	5	0	45,120
ND1X	CT	220	32	4	4	44,800
K4GKV	GA	198	37	4	3	43,560*
N4ARO/6	CA	181	38	4	4	43,010*
NF7E	AZ	172	43	3	2	41,520
K8KEM	OH	174	41	4	1	40,020
KT4U	VA	133	37	6	8	39,270*
KI4DC	KY	192	36	3	1	38,400
NJ0X	MO	174	38	4	1	37,410
KI6MS	CA	153	40	3	4	37,200
N0FJP	MN	154	41	3	2	35,880
KC3LV	PA	143	42	5	1	34,560
KA9ACS	IL	148	38	4	2	32,560
W3CDG	MD	140	40	5	0	31,500
N4IKX	KY	154	35	3	2	31,200
WD8MCN	MI	157	37	2	0	30,615
W8VEN	WV	134	39	4	2	30,150*
N0AKC	WI	126	42	3	1	28,980
W4WKQ	FL	136	36	1	4	28,085
N9KS	WI	131	39	3	0	27,510
KD0EE	SD	120	41	4	0	27,500*
WB5SSD	LA	116	40	2	3	26,100*
W7MCU	WA	94	41	7	5	25,175
K4ADI	SC	117	30	4	0	23,400
W4UNP	SC	112	35	3	2	22,800
W1LUG	VA	117	33	3	1	21,665
W9HOT	IL	111	37	2	0	21,645
NU8K	WV	107	31	5	3	19,795
KC3OL	MD	100	33	3	1	18,500
W4HVU	NC	102	34	1	0	17,850
KA0PPW	WI	105	32	2	0	17,850
KI3L	NM	101	29	4	2	17,675*
N5AFV	TX	98	31	2	2	17,150
N8CXX	MI	101	28	3	1	16,320
W6PFE	CA	93	23	2	3	13,630
WB9SAV	WI	79	29	3	0	12,640
WA6FGV	CA	107	16	3	3	11,880
WA8GLF	OH	79	27	1	0	10,640
W7ABX	NV	74	22	3	2	9,990
K0JVZ	CO	65	28	2	0	9,750
N8AXA	OH	71	22	2	1	8,875
N7GLT	AZ	58	25	1	1	7,830
W4UYC	GA	61	24	1	0	7,625
W2CVW	NJ	53	22	3	0	6,625
KD7RX	WY	49	21	2	0	5,635
W0IH	MN	47	21	2	0	5,405
W8AKS	CA	43	20	1	0	4,515
N9EOM	IL	37	20	2	0	4,070
KC0ES	MO	38	19	1	0	3,700
N3RC	VA	34	18	0	0	3,060
K5ZD	MA	30	19	1	0	3,000
AK7F	WA	29	17	1	0	2,610
VE3IR	ONT	28	13	1	0	1,960
AA6EE	CA	25	10	1	1	1,620

W/VE Multi-Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
WB8IFP	OH	1,494	48	10	27	653,225**
KC1U	PA	1,256	48	9	25	529,720*
KC8P	MI	1,091	48	9	18	414,000*
WB8IGY	OH	1,066	46	8	11	348,400*
WA4JXI	FL	571	48	8	33	322,180*
NT5V	TX	801	48	9	14	287,550*
N0EKK	CO	588	48	8	7	186,165*
KB8AC	IN	366	47	5	6	106,720*
NE3F	PA	402	36	6	3	90,450
KA5DLM	LA	201	39	2	5	46,230*
WB6EGE	CA	175	33	5	3	36,285*
WV2ZOW	NJ	97	23	5	3	14,290

DX Single Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
XE1L	Mexico	286	44	4	16	119,040**
G4AVO	England	189	20	3	34	74,955*
CT1AOZ	Portugal	152	23	3	32	70,470*
CO2CB	Cuba	274	43	5	3	70,125*
G3NAS	England	184	18	4	35	69,825
HP1XXO	Panama	127	36	4	19	45,725*
YU2TW	Yugoslavia	102	14	4	30	35,280*
OK1KPU	Czechoslovakia	136	1	2	36	27,450*
KL7HBK	Alaska	28	13	1	2	2,320
I0KHP	Italy	29	0	0	12	1,800
I4CSP	Italy	21	2	0	11	1,560

DX Multi-Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
ZF2JA	Cayman Is.	210	41	6	21	75,140**

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FL10/1500 FL6/1500 FL10/100 FL6/100

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FL6/1500	1000	55 MHz	63 MHz	70 db	6 meter	$49.50*
FL6/100	100	55 MHz	63 MHz	50 db	6 meter	$34.50*

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- *Radiator Snaps On and Off*
- *Competitively Priced*

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- *3 db gain*
- *No Hole*
- *Easy to Mount*
- *Rugged*
- *Superior Performance*
- *Radiator Snaps On and Off*
- *Competitively Priced*

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- *No Hole*
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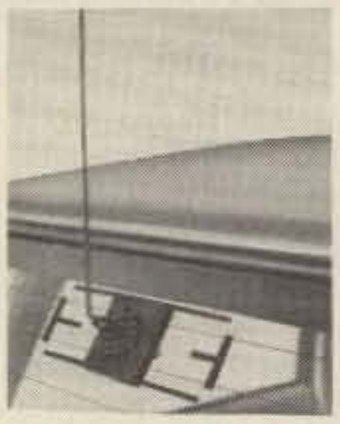

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CIRCLE 151 ON READER SERVICE CARD

40 Meter Contest Results

W/VE Single-Operator Category

Callsign	QTH	QSO's	St./Prov.	DX	Score
KE5CV	TX	1756	56	13	928,620**
KJ4CQ	NC	1196	56	18	446,960*
KS9O	IL	858	56	17	320,105*
NØCDH	MO	904	57	10	306,190*
N8CXX	MI	845	55	16	303,525*
K1KJT	MA	730	53	18	259,505*
WK4Y	VA	766	53	9	239,010*
ADØO	CO	709	51	13	229,120*
W4WKQ	FL	665	52	11	217,665*
K5UCV	TX	591	50	13	189,000*
K9JS	IN	636	52	9	189,575*
WA2HFI	MN	669	51	5	187,320*
KVØI	NE	637	53	3	178,360*
K9OSH	WI	559	51	8	165,495*
NE9O	IN	507	51	8	149,975
W9NFW	IL	511	52	5	146,490
KA7DLV	MN	500	53	4	143,640
N9BKM	IL	461	55	6	143,045
WB5SSD	LA	451	54	7	140,910*
KC9GJ	IL	393	54	13	135,675
WA6FGV	CA	472	52	5	135,090
ND1X	CT	423	48	13	132,980*
WBØBJP	MN	419	52	9	124,490
AA4LE	AL	394	50	10	123,300
KZØC	IA	409	53	8	122,915*
KE7KF	UT	387	52	5	115,640*
KI3L	NM	345	47	6	92,220*
KDØHY	AR	362	46	4	90,500*
K4GKV	GA	307	48	7	84,425*
KF4GL	VA	367	43	2	82,575
KC7PA	UT	334	47	1	80,160
N3EMD	PA	313	48	0	75,120*
WA3DNC	KY	281	47	5	73,320*
KB6ATI	CA	299	44	4	72,720
KB4RME	VA	295	45	1	68,080
K4ADI	SC	289	41	3	64,240*
KI4UJ	KY	189	46	11	56,145
KC3OL	MD	214	42	9	55,080*
K8JM	MI	204	45	4	49,980
WS4N	GA	200	42	5	47,705
KA9BQA	IL	242	38	0	45,980
WC4E	FL	190	37	7	42,460
NR4S	TN	212	38	0	40,280
W6WBY	NV	147	41	8	37,240*
K5ZD	MA	150	40	4	33,000
KB4PNQ	FL	137	40	6	32,340
KD9OY	WI	117	41	3	25,740
KAØVYM	MO	135	36	1	25,160*
NØFMT	KS	109	41	4	24,975*
KJ4TI	NC	127	37	2	24,960*
N5IET	TX	110	39	5	24,640

Callsign	QTH	QSO's	St./Prov.	DX	Score
YV6DLG	Venezuela	46	20	6	11,570
ON7WN	Belgium	51	0	21	5,670
OK1KZ	Czechoslovakia	5	0	5	175
WA5IYX	TX 102	40	4		22,660
KE7QA	UT 97	41	2		21,285
W4UYC	GA 106	37	3		21,285
K2PS	NJ 103	36	4		21,000*
WB9SAU	WI 97	35	9		20,900
KB4NAV	SC 109	38	0		20,710
KA2TWY	NY 118	34	0		20,060*
KAØPPW	WI 110	35	0		19,250
KA1NDY	RI 119	30	0		17,850*
NA8W	OH 103	32	1		17,160*
W4XT	KY 88	38	0		16,720
KF1B	CT 84	33	5		16,340
WK4F	FL 73	30	10		16,000
KD7RX	WY 91	33	0		15,015
KJ4YM	GA 84	33	2		14,700
K1TWF	MA 115	25	0		14,375
WB2TKD	NY 70	33	2		12,250
N7GLT	AZ 68	31	5		12,240
N5AFV	TX 67	34	2		12,060
KC3XD	PA 66	30	2		10,560
VE3HX	ONT 52	33	0		8,580
W9REC	IL 57	30	0		8,550
N8AXA	OH 49	24	0		5,880
N9EOM	IL 45	22	3		5,750
N6NKN	CA 47	23	1		5,640
KØJVZ	CO 46	22	0		4,950
KT2D	NJ 35	21	0		3,675
W1LUG	VA 37	19	0		3,515
KC3ZG	PA 25	19	1		2,500
KA3OGY	MD 29	16	0		2,320
N6NPZ	CA 22	11	0		1,210
KA7VMA	WY 17	12	0		1,020
K3TX	PA 17	11	0		935
KD7EO	NV 10	8	0		400

Multi-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
W2ZQ	NJ	1177	55	21	460,940**
KB4RXM	TN	1152	57	6	362,250*
NT5D	TX	847	55	20	327,375*
KS3F	PA	851	54	19	316,455*
NK7U	OR	849	56	14	301,700*
WG5J	TX	805	53	12	263,575
W7MR	UT	655	54	6	198,000*
WA7YEJ	CO	572	52	5	164,160*
W4TMR	NC	411	49	17	141,240*
WA6HRH	CA	420	48	10	103,200*
KA5DLM	LA	221	44	8	58,500*
WV2ZOW	NJ	104	35	2	19,425

DX Single-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
KP4FI	Puerto Rico	1233	53	89	1,400,830**
8P9AF	Barbados	447	40	53	329,685*
ZS5K	S.Africa	326	37	25	184,450*
HC1OT	Equador	239	40	30	161,360*
XE1L	Mexico	337	50	25	160,500*
TI2DCR	Costa Rica	243	37	28	89,050*
HK3KRU	Colombia	108	27	9	34,920*
JH7WKQ	Japan	72	10	16	15,990
AH6EK	Hawaii	64	19	6	15,750

DX Multi-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
EI1DD	Ireland	350	3	44	86,245**
JA9YBA	Japan	11	6	2	840

Check logs: W7LQU, YY1C, EA5AEN, EA3CZM

** World Champions * State, Provincial, and Country Champions

160 Meter QSO Record

WB9HAD	1987	1783
WB8IFP	1986	1522
WB8IFP	1987	1494
WB9HAD	1986	1431
WØCEM	1986	1338
KM5X	1986	1313
KC1U	1987	1256
KC1U	1986	1210
N7DF	1985	1177
WØEJ	1985	1152

World 40 Meter QSO Records

Single Operator:

KE5CV	1987	1,756
N5AU	1986	1,397
KE5CV	1986	1,261
KP4FI	1987	1,233
KE5CV	1985	1,200
KJ4CQ	1987	1,196
K4XS	1985	1,196
KE5IV	1986	1,151
W1WEF	1984	1,042
KE5CV	1984	1,020

Multi Operator:

K3TUP	1985	1,381
K3TUP	1983	1,214
K3TUP	1984	1,196
W2ZQ	1987	1,177
KB4RXM	1987	1,152
N4DDS	1985	1,151
KYØS	1985	1,139
K8ND	1983	1,129
N9NB	1982	1,098
W2ZQ	1985	1,064

73 Review *by Bill Mick K3RVN/GØEZZ*

ICOM America, Inc.
2380-116th Ave. NE
Bellevue WA 98004
Price Class: $1200

ICOM IC-R7000 Communications Receiver

The R7000 is an uncommon radio. It has an immense coverage range, nominally 25 to 1000 MHz, with a switchable preconverter that allows reception of 1025 to 2000 MHz as well. The basic design shows that Tuna was not far off in principle when he cascaded parts of his boat anchor collection. Of course, ICOM has done an elegant job of getting everything into one compact and clever box.

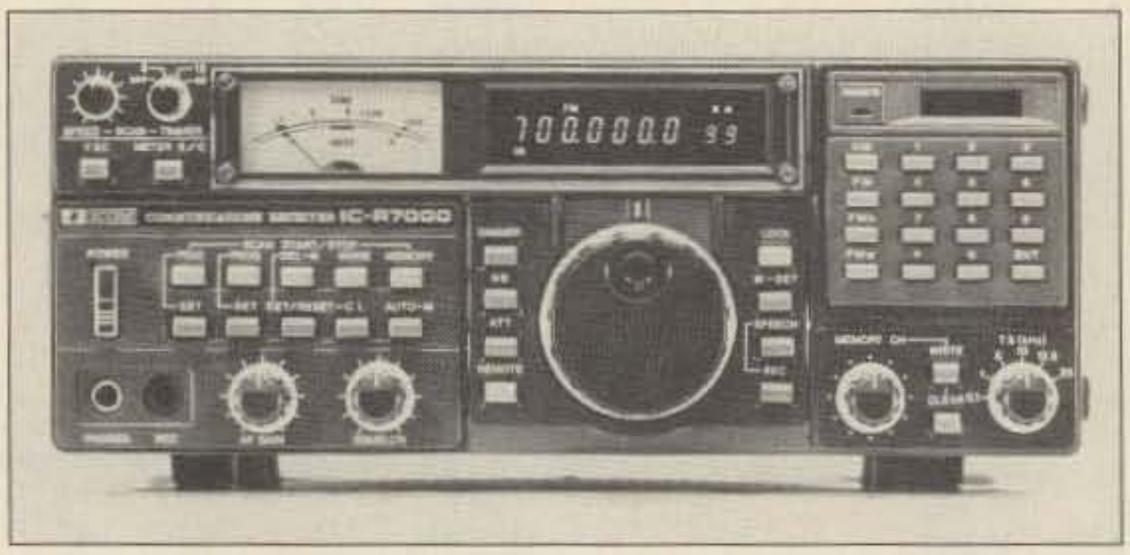
The front end is truly wideband in design, with four RF input amplifiers covering 25–90 MHz, 90–250 MHz, 250–512 MHz, and 512–1000 MHz. As the listener tunes upward through the ranges, a system of relays and switching diodes selects appropriate input bandpass filters, and the user may note a change in sound and background noise when passing from one level to another.

Below 512 MHz, the bandpass filters are varicap tuned, while stripline techniques are used from 512 to 1000 MHz. The wideband RF amplifiers are protected by tuned traps which suppress birdies from the first local oscillator. ICOM appears to have done a fairly good job shielding and partitioning the set's innards, and, with the antenna disconnected, there is little in the way of internally generated whistles. Of course, with a wideband receiver, fed by a wideband aerial in close proximity to a hamshack full of computers and micro-based radio gear, some peculiar intermod products are going to be heard sooner or later.

Occasionally, a nuisance signal could be removed by changing the channel on the shack TV set or shifting the HF receiver to another band. Getting the neighbor to change channels might not be so easy.

When tuning below 512 MHz, the R7000 uses a first IF of 778.7 MHz. In the upper half of the tuning range, the IF used is 266.7 MHz. From either of these IFs, it is a long dive to the 10.7 MHz second IF, but ICOM has installed notch filters to eliminate the images inevitable with such a conversion. A rear panel phono jack is provided for users who want to pick off the 10.7 MHz IF for use with the optional TV-R7000 television demodulator. This is also the place for a panadaptor, FM stereo adapter, or other gadget. Nine volts DC is available on the same jack, which is how the TV-R7000 is powered. The third IF is at 455 kHz, and is not used when wideband FM is selected.

Although the R7000 calls itself a communications receiver, that title is not quite accurate. It is certainly more than a garden-variety scanner, as it offers AM, NBFM, and SSB capabilities. However, hams may be disappointed that there are no narrow CW filters, not even as an option. Neither is there any selectivity adjustment by way of IF shift or passband tuning. The set has no RF gain control, although there is a 20-dB attenuator, handy when using a high gain preamplifier.



The ICOM IC-R7000. . . "everything into one compact and clever box."

I've used the R7000 as a super downconverter, hanging a general coverage HF receiver off the 10.7 MHz IF output.

R7000 Tuning

The R7000 PLL tunes in 100 Hz steps, and frequency selection can be performed via a large tuning knob, the front-panel keypad, or the optional RC-12 wireless controller. The set also has 99 memories, which can store frequency and mode. A small knob is used to select tuning step sizes for the main knob, from the basic 100 Hz, through 1 kHz, 5 kHz, 10 kHz, 12.5 kHz, or 25 kHz. The digital readout displays the frequency to 100 Hz. This step size is just adequate for readable SSB tuning, and hams who work SSB on VHF/UHF will probably find themselves wishing for 10 Hz steps. Serious VHFers usually want exactly the same features standard on HF radios, although I can't say I noticed the receiver's awkwardness in tuning SSB until I tested my Datong(UK) PC-100 HF upconverter with the R7000.

Which Antenna?

The R7000 is quite sensitive: a 3-by-1 signal on my FT-726R often becomes 5-by-1 when the antenna is switched to the R7000. The antenna, of course, ultimately determines the performance of this radio. A short whip stuck in the rear panel N connector captures FM broadcasts, strong 2 meter stations, and maybe some public service transmissions. When I tried a foot-high military surplus discone made of steel measuring tape, fed with RG-58, quite a bit more could be heard.

The R7000 came into its own when I put a 25–1300 MHz discone up on the roof and connected it with Belden 9913. This antenna was purchased in the United Kingdom for the equivalent of $60 and resembles the ICOM AH7000. Heath also sells a copy of this antenna at a competitive price. For a unity-gain omni that receives and transmits in a lot of VHF/UHF ham bands, the discone is hard to beat.

Uncanny Scanning Action

With so much spectrum to listen to, a guidebook is a must. Check with the local ham dealer, and check the ads in *73* or the *Monitoring Times*. I garnered most of my R7000 experience while living in England, where I found a ranges of interest, the R7000's six scanning modes help catch whatever's there. The user can hop between the current frequency and the local calling channel in the ham bands, using the Priority Scan. Enter Low and High frequencies bounding a Programmed Scan range, and the radio faithfully cycles stepwise through all the frequencies in between.

It's possible to perform a full Memory Scan of the 99 memories, or mark certain ones to include in a Selected Memory Scan. It is possible to restrict the memory scan to memories set with a particular mode. For people who appreciate labor-saving devices, the Auto-Write Memory Scan can search a specified range, storing the frequencies of found signals in memories 80 through 99. The R7000 can't identify signal types, so the user does have to preset the expected mode.

The operator can even vary the scanning rate! At the slowest rate, 36 unoccupied channels can be covered in about 15 seconds, while the fastest scan covers the same range in about 4 seconds.

Scan function can also be tailored with a delay control that sets the dwell time on frequencies where energy is detected. The

user can direct the set to park on a busy frequency until the activity drops, at which time the scan continues. One can also set the dwell for either five or fifteen seconds before scan resumption. There is also a setting to have scan auto-cancel on the first busy frequency.

Voice Scanning Circuit

Frequencies that break the squelch and halt the scan sometimes don't have anything intelligible to listen to. The R7000 provides a Voice Scanning Circuit which is supposed to skip dead carriers. Since this circuit is only a 1 kHz low-pass filter and detector gated with the squelch, it's easily fooled by non-voice signals, of which there are many. The VSC does work after a fashion, and provides some relief for the eardrums.

ICOM equipped the R7000 with its new CI-V serial computer interface. The connector is an ordinary phono jack at the TTL level, and the user's manual shows a simple schematic for breaking this line out via 1488 and 1489 TTL to RS-232 chips so that one can hook the radio to a computer's serial port. There is no detailed documentation on the programming of this interface in either the user's manual or the service manual, but ICOM USA readily provides supplementary data to its customers. A shack that has several late-model ICOM radios will find the CT-17 interface box the easiest way to connect them to a single RS-232 port.

Signal Recording

Those who love the idea of a radio that performs an unattended signal search will love the R7000's recording facility. The set has an independent, constant level output and a squelch output jack which can key the recorder's pause line. If the EX-310 voice synthesizer option is installed, a rear panel switch enables the dictation of the current frequency to the tape recorder along with the captured signal. I don't have the EX-310, so I don't know how well this feature works. The squelch output line can also be used to control an external alarm, perhaps to alert the operator of the presence of a beacon.

R7000 Rear Panel

Among the various rear-panel paraphernalia is a switch that selects upper or lower sideband (the front panel switch simply enables whichever sideband has been selected). Another switch sets the FM wide versus FM narrow bandwidths. In one position, narrow is 6 kHz, with wide at 15 kHz, while the other position puts narrow at 15 kHz and wide at 150 kHz. I find narrower settings more useful for my amateur work. It is also possible to set the AM filter width to 6 or to 15 kHz by means of an internal jumper.

Nit-Picks

In a radio with so many good features, there are bound to be a few negatives. I was disappointed to find that I could only set the high and low bounds of the programmed scan range via the keypad. There is no way to write these special memories using the tuning knob or from the 99 main memories. I really wanted to store useful frequency pairs in the memories, but there is no recall button to bring the values from the numbered memories to the High-Low or Priority registers. On the plus side, the R7000 lets you tune around a selected memory with the main knob, without disturbing the memory, much like the IC-751A.

Twenty-three centimeter fans in particular should bear in mind that the memories cover only 25–1000 MHz. The user needs to engage that sneaky little 1 GHz switch manually, since the memories don't know whether the downconverter is in the path. In setting up scans, I thought of numerous capabilities I would have liked, such as chaining together several separate scan ranges, but this is probably too much to expect in the basic receiver. It should be possible with the computer port to set up any oddball scanning routine, letting the external computer facilitate the programming through files of memorized frequencies.

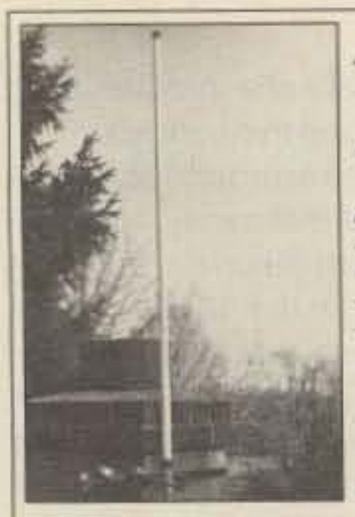
The placement of the recorder output jack on the front panel isn't all that handy, especially since the recorder pause control jack is on the back, and I really wish that ICOM had put the USB/LSB selector on the front panel instead. I also think that push-button selection of tuning step size would be slightly easier than the rotary control in the current design. A 10-Hz minimum step would have been preferable to the 100 Hz step, or a clarifier control might have been added for SSB.

One surprising omission from a so-called communications receiver is a muting jack that can be tied to a station's PTT circuit to prevent feedback on transmit. Fortunately, the rear panel has a lot of empty space for additional connectors, since the one spare phono jack provided by ICOM won't be enough for the experimenter. ICOM also sells a 12-volt DC connector option.

Despite the relatively minor shortcomings of the set, which I am sure ICOM will fix when they get around to marketing an R7000A, I love this radio. Mine is on every day, checking beacons, watching the calling channels, complementing my other VHF and UHF gear. It is sensitive, stable, and flexible, and the manual is very helpful. I regret not buying the RC-12 wireless controller, since the scan often catches a snippet of conversation that piques my interest while I'm seated across the room.

The price is high, but the R7000 is still a bargain compared to the professional surveillance receivers one usually associates with this level of coverage. When I purchased mine, the dealer told me it was the fifty-first he had sold that month. Uncle Sam bought the other fifty. 73

Bill Mick has been licensed for 25 years. His main interests include electronic construction projects and fine French food and wine. Address comments and questions to him at PO Box 565, APO New York NY 09210.



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PL258AM Amphenol female-female (barrel)	1.45
UG175/UG176 reducer for RG58/59 (specify)	.22
UG21DS N plug for RG8,213,214 Silver	3.35
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UG146A SO239 to N plug adapter, teflon	6.50
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Armed Forces Day 1988

Communications Test

contributed by Arthur R. Delperdang Chief, Navy-Marine Corps MARS

The annual Armed Forces Day Communications Test is set for Saturday 21 May 1988. This marks the 39th anniversary of this event, which emphasizes a continuing climate of mutual assistance and warm esteem between the military and amateur radio communities. The traditional military-to-amateur cross band operation and broadcast of the Secretary of Defense message are the featured highlights which include operations in CW, SSB, RTTY, and Packet radio.

These tests give both amateur radio operators and short wave listeners (SWLs) the opportunity to demonstrate their individual technical skills. Special commemorative acknowledgment QSL cards will be awarded to those amateur radio operators achieving a verified two-way radio contact with any of the participating military radio stations. Interception of these contacts by SWLs are not acknowledged by QSL cards, however, anyone who receives and accurately copies the Armed Forces Day CW and/or RTTY message from the Secretary of Defense can qualify to receive a special commemorative certificate from the Secretary.

Cross Band Contacts

The military-to-amateur cross band operations will be conducted from 21/1300 UTC (Universal Time) to 22/0245 UTC May 1988.

The military stations participating in cross band operations are:

AAE
HF/MARS Radio Facility
Fort Sam Houston TX

AAG
Army HF/MARS Radio Facility
Presidio of San Francisco CA

AIR
2045th Communications Group
Andrews Air Force Base
Washington DC

NAM
Naval Communications Area
Master Station LANT
Norfolk VA

NAV
HQ Navy-Marine Corps
MARS Radio Station
Cheltenham MD

NPG
Naval Communication Station
Stockton CA

NPL
Naval Communication Station
San Diego CA

NMH
Coast Guard Radio Station
Alexandria VA

NMN
Coast Guard Communications Station
Portsmouth VA

NZJ
Marine Corps Air Station
El Toro CA

WAR
HQ Army MARS Radio Station
Fort Meade MD

Military stations will transmit on the frequencies listed below, and announce the specific amateur band frequency being monitored.

Freq(kHz)	Emission	Station
4001.5	LSB	NPG
4010	CW	NPG
4015	CW	NMH
4018.5	LSB	WAR
4025	LSB	AIR
4028.5	LSB	AAE
4033.5	LSB	AAG
6970	CW	NPG
6988	RTTY/CW	AAG
6995.5	CW	AIR
6997.5	CW	WAR
7301.5	LSB	NPG
7315	LSB	AIR
7346.5	LSB	NMH
7358.5	LSB	AAE
7365	CW	NPG
7372.5	RTTY	NAV
7375	RTTY	NZJ
7382.5	RTTY	NPL
7393	USB/RTTY/CW	NMN
10259.5	CW	NPG
13927.5	RTTY	NPG
13975.5	CW	NPG
13986.5	RTTY	AIR
13992.5	RTTY/CW	WAR
13994.5	USB	AAE
13997.5	CW	AIR
14375	USB	NPG
14385	USB	NPL
14389.5	USB	NAV
14400	USB/RTTY/CW	NAM
14403.5	USB	WAR
14408	USB	AIR
14440	RTTY	NMH
14480	USB	NZJ
14488.5	USB	AAG
14665	RTTY/CW	AAE
20937.5	USB	NMH
20992.5	PACKET	AAE
20994.5	USB	WAR
20998.5	CW	NPG
2146.0	USB	NPG
27992.5	USB	AAE

Receiving Test

The CW and the RTTY broadcast will be special Armed Forces Day messages from the Secretary of Defense to any amateur radio operator or SWL desiring to participate. A ten-minute tuning call will precede each transmission. The CW braodcast will be transmitted at 25 wpm beginning at 22/0300 UTC May 1988. The RTTY broadcast will begin at 22/0345 UTC May 1988 and transmitted 60 wpm using 170 Hz shift. Both the CW and RTTY broadcast will be transmitted from the following stations on the listed frequencies:

Transmitting Station	Frequency (kHz)
AAE	4018.5, 6988, 9990
AAG	4021.5, 7309.5, 13994.5
AIR	6995.5, 13997.5
NAM	4005, 7393, 14400
NAV	7372.5, 14389.5
NPG	4010, 7365, 13975.5
WAR	4028.5, 6997.5, 14403.5

Submission of Test Entries

Transcriptions of the CW and/or RTTY receiving tests should be submitted "as received." No attempt should be made to correct possible transmission errors. The time, frequency, and callsign of the military station copied, as well as the name, callsign, and address of the individual submitting the entry, must be indicated on the page containing the test message. Entries must be postmarked no later than 28 May 1988 and submitted to the respective military commands as follows:

Station Copied and Address

AIR
Armed Forces Day Test
2045CG/DOJM
Andrews AFB
Washington DC 20331-6345

AAE, AAG, WAR
Armed Forces Day Test
Commander, USAISC
ATTN: AS-OPS-OA
Fort Huachuca AZ 85613-5000

NAM, NAV, NPG
Armed Forces Day Test
Naval Communication Unit
Washington DC 20397-5161

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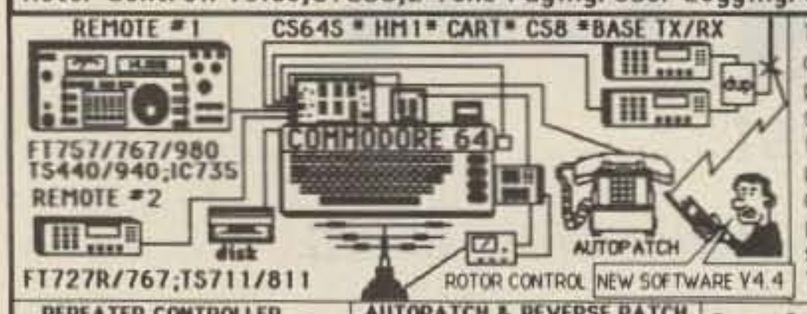

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- *Voice ack. all control commands

AUTOPATCH & REVERSE PATCH
- ***1000** (**18** digit)tel. #'s stored
- ***300** users/CTCSS & 2 tone paging
- ***50** eable/disable tel.#'s
- *Individual access privilages
- *Directed/general & reverse page
- *Full or Half duplex (level cont.)
- *Security mode/ TT readback on/off
- *Store MCI/Sprint tel. #'s
- *Reverse Patch active all modes
- *Call waiting/quick dial & reset

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- *C64 D.C. Switcher P.S. **DCPS $119.95**

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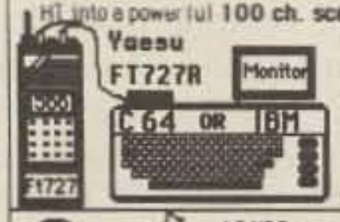

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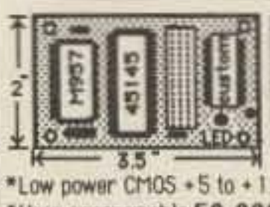

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CIRCLE 152 ON READER SERVICE CARD

FAX Program for the AEA PK232

Make the most of your PC's graphics

by Roger M. Johnson WBØGAI

Almost everyone who has had a chance to get their fingers on the new AEA PK-232 agrees that it is an amazing piece of gear. It offers many options previously requiring many separate components. I enthusiastically tried all options and worked all the modes it allows.

I ordered the upgrade kit as soon as the FAX mode was announced and within a few weeks had it up and running weather facsimile from many HF FAX stations around the country. I soon learned, however, that this used reams of paper—an afternoon's run might use over ten feet! This is also terrific wear-and-tear on the printer and ribbon.

Since I had just acquired an IBM clone and graphics display, I decided to find a way to route printer output to the screen. The result is a basic program called SCREENFAX which runs on an IBM (or clone) with either a color graphics adapter (CGA) or extended graphics adapter (EGA). Since it's written using Microsoft QuickBasic II (or III), it isn't line-number dependent. (QB is a compiled basic and, because this program needs all of the speed the computer can muster, it probably won't work very well going through an interpreter.)

How It Works

AEA wrote the FAX program with the EPSON graphics standard in mind. According to this standard, the printer prepares to receive a control command when it receives escape code CHR$(27). The next several characters command it to do a number of different things, such as enter compressed mode, double-strike, or graphics. AEA programmed the PK-232 to send the printer commands which initialize the graphics mode and set the line spacing. The PK-232 then sends characters one after another which the printer now interprets as commands to the individual pins in the printhead rather than ordinary ASCII characters.

SCREENFAX takes this same information, modifies it for the IBM graphic displays and puts it on the screen rather than the printer.

Printer Commands

Let's look at this in more detail. On the EPSON printer, there are eight vertically-placed pins that can be commanded (in graphics mode) to fire individually. If the printer receives CHR$(1), only the bottom pin fires. CHR$(2) fires the next pin up only, and CHR$(3) will fire both. Any value from zero to 255 can be sent, and its binary representation will go to the printhead. After the initialization commands are sent, the printer looks at each character, interprets it as a binary number and fires the appropriate pin combination. It then looks at the next incoming character and repeats the process.

Depending on the printer's capability, the user can tell the PK-232 to send it a prescribed number of characters before starting the next line. For example, I can send my EPSON MX-80 a graphics command (GR 1), and it will send the printer 960 dots per line or 120 dots per inch. The user can command the PK-232 with the Graphics command to send anything from 60 dots per inch (GR 0) to 240 dots per inch (GR 3) depending on the printer's capabilites. AEA may well have been thinking about the IBM graphics display when they added GR 4—this allows for 640 bits across a screen, which is the horizontal pixel length for some of the screen commands in both the EGA and CGA displays. What appears on the printer copy is the map or picture printing as wide as the GR command specifies, and eight dots high at a time. (Remember the printhead has eight vertical pins). Figure 1 shows how all this happens.

"SCREENFAX simply convinces the computer that it is a printer."

Character number one has a value of 27 and tells the printer to get ready for the rest of the control codes. Character two tells it to get ready for 960 dots across the page. Characters 3 and 4 determine the actual line length (960 dots in this case). The printer sees characters 5 through 960 as graphics characters and fires the pins in response to the binary value of the character. When the printer again sees the first four codes, it moves down eight dots and starts over. This continues until the user tells the PK-232 to do otherwise.

Enter SCREENFAX

This is all fine for those who don't mind using a lot of paper. For casual viewing, however, SCREENFAX is fine for getting a good idea of what is printing. SCREENFAX simply convinces the computer that it is a printer so it can respond to the commands from the PK-232 and print the map or picture on the screen instead of the printer. Those with an EGA card and monitor will have excellent detail, but detail with the CGA card and monitor is still very good.

The Program

SCREENFAX begins with an initialization routine to set up the appropriate screens. These are both listed as REM statements. Pick the appropriate one by eliminating the word REM. This also sets the X and Y values to zero. Next, SCREENFAX asks for the filename. Any name that DOS accepts is fine. It then asks if the user wishes to start an input display from the PK-232 (and start a file with the given name) or to "play back" a previously saved file. One choice opens the communication port, the other opens the previously saved disk file.

The next few paragraphs discuss the program routines.

OPCOM

This routine opens the communications port first by clearing things out with a CONTROL C, and then setting up the port for input from the PK-232. It then puts the PK-232 into TRANSPARENT mode, as suggested by AEA. A file with the designated name is opened for output to the disk drive. The variable "V" is set to a value of 1 so that the main portion of the program knows whether or not to save the material to this file. The screen is then cleared and, if the PK-232 is synchronized to the incoming map or picture, a line 8 pixels high appears, starting at the upper left of the screen and moving across it horizontally. Sometimes the user catches the PK-232 part way through a line and gets a partial line at the top, but it synchronizes with the next line. The map appears eight lines at a time.

OPDISC

The routine opens a previously saved file of the designated name and begins displaying it on the screen. It will appear exactly as received.

BEGIN

This is where most of the hard work in the program occurs. BEGIN begins by looking

for an input character, either from the disk or the communications port. Since CHR$(26) may be seen as an end of file marker, I added a line that changes anything with that value to a value of 24. This keeps the file from being stopped prematurely.

The program then looks for a CHR$(27). Recall that this is what tells the printer that a command (instead of another routine character) comes next. When the program finds CHR$(27), it skips to the ESCAPE subroutine.

ESCAPE

This immediately begins looking for the next character. The routine turns the character into a number with the ASC function and, after getting rid of any character with a value of 26, it looks to see if it has a value of 42. This number has special importance for setting up the screen and locating the cursor. If ESCAPE sees a CHR$(42) it prints subsequent characters on the screen as graphics characters. A glance at the graphics commands in the addendum to the PK-232 manual shows that the PK-232 code "42" is an asterisk which can be used to tell the program that a new line is starting. The X axis is set to zero and the Y axis is advanced by eight pixels. Note that ESCAPE hangs onto this character and, if it doesn't happen to be a 42, it can return with it to the main program. The PK-232 normally sends the escape code as an ordinary character. Only when it is followed by a 42 does the program see it as a command code. In all other cases it's treated as an ordinary character. When ESCAPE has done its thing, it drops into FINI, a one-line routine that routes the flow to the appropriate place in the BEGIN routine called RTRN.

RTRN

This is where the graphics work goes on. It looks at the ASCII value of each incoming character and ANDs each bit to determine its state ("1" or "0"). One turns the color value to a zero or dark (dark blue in EGA, black in CGA). Zero turns the color to white. The program compares each bit and, with the PSET command, sets the appropriate pixel to the chosen color.

After a character finishes, the X and Y values do the appropriate housekeeping. If Y is greater than 350 in EGA mode, or 200 in CGA mode, the routine sets the display back up to the upper left hand corner and the remainder of the map overwrites the earlier portion of the map. The routine recycles through BEGIN after each character is displayed.

There may be some elegant fashion to stop program execution, but hitting CTRL-BREAK works fine.

Pointers and Bugs

This program has a few quirks. It will sometimes crash when the PK-232 is sending out a stream of characters. This rarely occurs, however, and has an easy remedy—just restart the program.

The program tends to lag behind running on a 4.77-MHz clock speed PC. This is not so bad, because most of the weather services pause between pictures, which gives the program time to catch up. There's a tendency in turbo mode for the system to lock up, but I haven't yet determined if it's a hardware or software problem.

When compiling this program in QuickBASIC, use the following syntax to enter BASIC:

QB /c:32000

This creates a buffer that is 32000 characters long. This allows the program a lot of lag-time before sending a "communication buffer overflow" error message. Those using a PC in turbo mode can get by with a smaller buffer, since it's fast enough to stay well ahead of the PK-232 output. Users can also create an executable free-standing program by using the Separate Compilation Method described in the Microsoft manual.

The PK-232 needs initialization before running SCREENFAX. Use the following commands for the PK-232:

cmd:TRFLOW OFF
cmd:TXFLOW OFF
cmd:AWLEN 8
cmd:FAX
cmd:ASPECT 2
cmd:FSPEED 2
cmd:LEFTRITE ON
cmd:GRAPHICS 4
cmd:LOCK
(This command forces a display. Otherwise, there's no display until the PK-232 synchronizes with the incoming signal.)
cmd:PRCON OFF
cmd:PRFAX OFF
cmd:PROUT OFF
cmd:PRTYPE 2

The ASPECT, FAXNEG, FSPEED, and LEFTRITE commands are not critical to the display. No image at all appears without setting GRAPHICS to 4 and PRFAX to OFF.

```
R
        REM NAME OF THIS PROGRAM IS SCREENFAX
        REM BY ROGER M. JOHNSON
        REM DESIGNED TO TAKE DATA FROM THE PK232 FAX INTERFACE, SAVE IT INTO A
        REM FILE AND DISPLAY IT ON THE SCREEN OF AN IBM PC OR PC CLONE WITH
        REM CGA OR EGA.



        REM PSET INITIALIZE
        REM USE THE FOLLOWING 2 LINES FOR A SYSTEM WITH EGA. REMOVE THE REM
        REM SCREEN 9,1
        REM COLOR 14,1
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH CGA. REMOVE THE REM
        REM SCREEN 2
        X=0
        Y=Y+8
        REM SCREEN CLEAR
        CLS


        REM FILE OPEN ROUTINE
        LOCATE 3,35
        PRINT "SCREENFAX"
        LOCATE 5,25
        PRINT"BY ROGER M. JOHNSON, WB0GAI 10/87"
        LOCATE 9,20
        INPUT "PLEASE LIST THE FILENAME YOU WISH TO USE ",F$
        LOCATE 11,33
        PRINT "DO YOU WISH TO:"
        LOCATE 13,28
        PRINT "(1) DISPLAY INPUT FROM PK232"
        LOCATE 15,28
        PRINT "(2) DISPLAY PREVIOUSLY SAVED FILE "
INKBD:  I$=INKEY$
        IF I$="1" THEN GOTO OPCOM
        IF I$="2" THEN GOTO OPDISC

        GOTO INKBD
OPCOM:  OPEN "COM1:1200,N,8,1,CS0,DS0,CD0" FOR OUTPUT AS #1
        PRINT #1,CHR$(3)
        PRINT #1,"TRANS"
        CLOSE #1
        OPEN "COM1:1200,N,8,1,CS0,DS0,CD0" FOR INPUT AS #1
        OPEN F$ FOR OUTPUT AS #2
        V=1
        CLS
        GOTO BEGIN
OPDISC: OPEN F$ FOR INPUT AS #1
        V=0
        CLS
        GOTO BEGIN
        REM MAIN ROUTINE
BEGIN:
        C$=INPUT$(1,#1)
        IF C$=CHR$(26) THEN C$=CHR$(24)
        IF V=1 THEN PRINT #2, C$;

        REM EVALUATION AND DISPLAY OF EACH BYTE
        REM N IS THE NUMERIC VALUE OF THE BYTE
        N=ASC(C$)

        IF N=27 THEN GOTO ESCAPE

RTRN:
        D= N AND 1
        IF D=1 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 2
        IF D=2 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 4
        IF D=4 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 8
        IF D=8 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 16
        IF D=16 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 32
        IF D=32 THEN C=0 ELSE C=15
        PSET  (X,Y),C
        Y=Y-1

        D= N AND 64
        IF D=64 THEN C=0 ELSE C=15
        PSET  (X,Y),C
        Y=Y-1

        D= N AND 128
        IF D=128 THEN C=0 ELSE C=15
        PSET  (X,Y),C

        X=X+1 : Y=Y+7 : N=0 : D=0
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH AN EGA. REMOVE THE REM.
        REM IF Y>350 THEN Y=0
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH A CGA. REMOVE THE REM.
        REM IF Y>200 THEN Y=0
        GOTO BEGIN

ESCAPE:
        C$=INPUT$(1,#1)
        IF C$=CHR$(26) THEN C$=CHR$(24)
        IF V=1 THEN PRINT #2, C$;
        N=ASC(C$)
        IF N=65 THEN X=0
        IF N=65 THEN Y=0
        IF N=65 THEN CLS
        IF N=65 THEN GOTO FINI
        IF N=42 THEN X=0
        IF N=42 THEN Y=Y+8

FINI:   GOTO RTRN
```

Figure 2. PK-232 FAX program for the IBM PC.

Figure 1. Graph showing the binary control commands sent to the printer to initialize a line of facsimile output.

Those without QuickBASIC or the desire to type the code into their machine can buy from me the disk containing the .EXE program, source code, and a sample file, for $10 postpaid. Please send requests to 1627 36th Ave. Ct., Greeley CO 80634. I would also appreciate any comments and ideas on this program. 73

73 Book Review

Definitive DXing and Practical Antennas

The Experts Speak Out

reviewed by Arliss Thompson W7XU

Low-Band DXing
by John Devoldere ON4UN
Published by American Radio Relay League, 1987
Newington, CT
Softbound, 266 pages (illustrated)

Imagine working nearly all ARRL DXCC countries on 80 meters. Or contacting stations in 140 countries on 160 meters in just a few months. Few hams can list those among their ham radio accomplishments, but one who can is John Devoldere ON4UN. Mr. Devoldere can now add to his list of accomplishments *Low-Band DXing*, which is a compilation of the author's considerable experience on 40, 80, and 160 meters, serves as an excellent source of information for those who are interested in operating on those bands.

This 266 page book has eight chapters covering topics like propagation, equipment, operating techniques, and a literature review containing over 500 references listed by subject. In the first chapter the author covers some propagation basics, then goes into more detail regarding grey line and non-great-circle paths. Three relatively short chapters are devoted to transmitters, receivers, and transceivers, and Mr. Devoldere also provides some hints on low-band DX operating techniques elsewhere in the book.

The bulk of *Low-Band DXing*, however, is devoted to antennas. Over the space of 133 pages the author covers theoretical and practical aspects of long and short dipoles, tall and short verticals, inverted vees, sloping dipoles, vertical dipoles, loops, arrays, feed lines, and special receiving antennas. The antenna chapter includes over 170 figures and 47 tables that, in conjunction with the text, provide a wealth of information. The reader lacking a technical background may have some difficulty with the theoretical discussions in the text, but he should still find the practical hints provided by the author to be of considerable interest. While obviously geared toward the low-band operator, this section should prove fascinating reading to anyone interested in antennas in general.

Chapter 7 of the book consists of the listings for twenty-four computer programs of interest to the low-band DXer and antenna experimenter. Written in Applesoft™ Basic, it includes, among others, a design program for lumped-constant loaded-vertical antennas, L-network design, influence of element taper on resonant frequency, and radiation pattern calculation for vertical arrays. The programs, plus some others not listed in the text, are also separately available on disk from ARRL for use on many popular personal computers.

In short, *Low-Band DXing* is an excellent resource that should prove very useful not only to low-band DXers, but also to antenna enthusiasts at large. Considering what it contains, it's a steal at $10. This book is must reading for those interested in working DX on amateur MF and lower HF bands. Mr. Devoldere and the ARRL have a winner here.

W1FB's Antenna Notebook
Doug DeMaw, W1FB, author
Published by the ARRL, Newington, CT
124 pages, softback, illustrated, $8

If there is one subject that nearly all amateurs have an interest in, it is antennas. Unfortunately, if an amateur lacks a strong technical background, there aren't many good books available that describe how to build and adjust simple antennas. *The ARRL Antenna Book* is an excellent reference, but a few hams are frightened away by the mathematics, Smith charts, and theoretical discussions contained in that text. If the amateur is interested in the practical aspects of antennas, but thoughts of differential equations and building a stressed 20 foot parabolic dish leave the amateur cold, he is apt to find Doug DeMaw's latest book, *W1FB's Antenna Notebook*, to his liking.

As stated in the book's foreword, Mr. DeMaw wrote the text with the amateur, not the engineer, in mind. Using a plain-language approach, he covers a wide range of topics that will be of interest to the practical-minded ham. It is nearly impossible to discuss antennas without introducing some mathematics, but DeMaw keeps it to a minimum, only invoking simple equations when necessary to calculate antenna or feedline lengths. Likewise, the text is devoted to basic antenna types, mostly constructed from wire. When he describes "obscure antennas," he is referring to limited space and "invisible" antennas, not to Sterba arrays. Along with the text are numerous diagrams to aid in the understanding of the antennas and ideas presented.

The book is composed of nine chapters, beginning with a discussion of some fundamental antenna data. Subjects covered in that section include, among others, coaxial cable considerations, balun transformers and correct balun use, the effects of insulation on antenna wire, and "the nitty gritty of SWR."

The next three chapters are devoted to building and using simple dipole, end fed, and vertical antennas. DeMaw first provides hints on how to construct single and multiband dipoles, including the G5RV and trap dipoles. He also covers the basic in's and out's of end fed wires, then goes on to discuss how to build verticals when lack of space forces the amateur to go up, rather than out with his antennas. The vertical antenna discussion includes information on how to excite the amateur's tower, building low cost ground plane verticals, and top-loading short verticals.

The reader with lots of room to erect antennas is apt to find the chapter on high-performance wire antennas of particular interest. Large loop antennas are described, including information on their directivity and how to feed them, plus a short section on collinear arrays. The chapter closes with a description of "cloud warmers"–antennas purposely designed to emit the high angle radiation necessary for short-range communications on the MF and lower HF bands.

Limited-space antennas, including indoor types, are detailed in Chapter 6. The three subsequent chapters discuss matching techniques, special receiving antennas, and simple antenna measurements (using a field-strength meter, building a practical SWR bridge, etc.).

In summary, it's an easy to read book that covers the basics on the wire antennas that many amateurs use daily. If the amateur is looking for design information on 36-element quagis for 1296 MHz, he has come to the wrong place. On the other hand, if he is looking for the straight scoop on baluns and how to use them, *W1FB's Antenna Notebook* may be just what the doctor ordered. 73

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73

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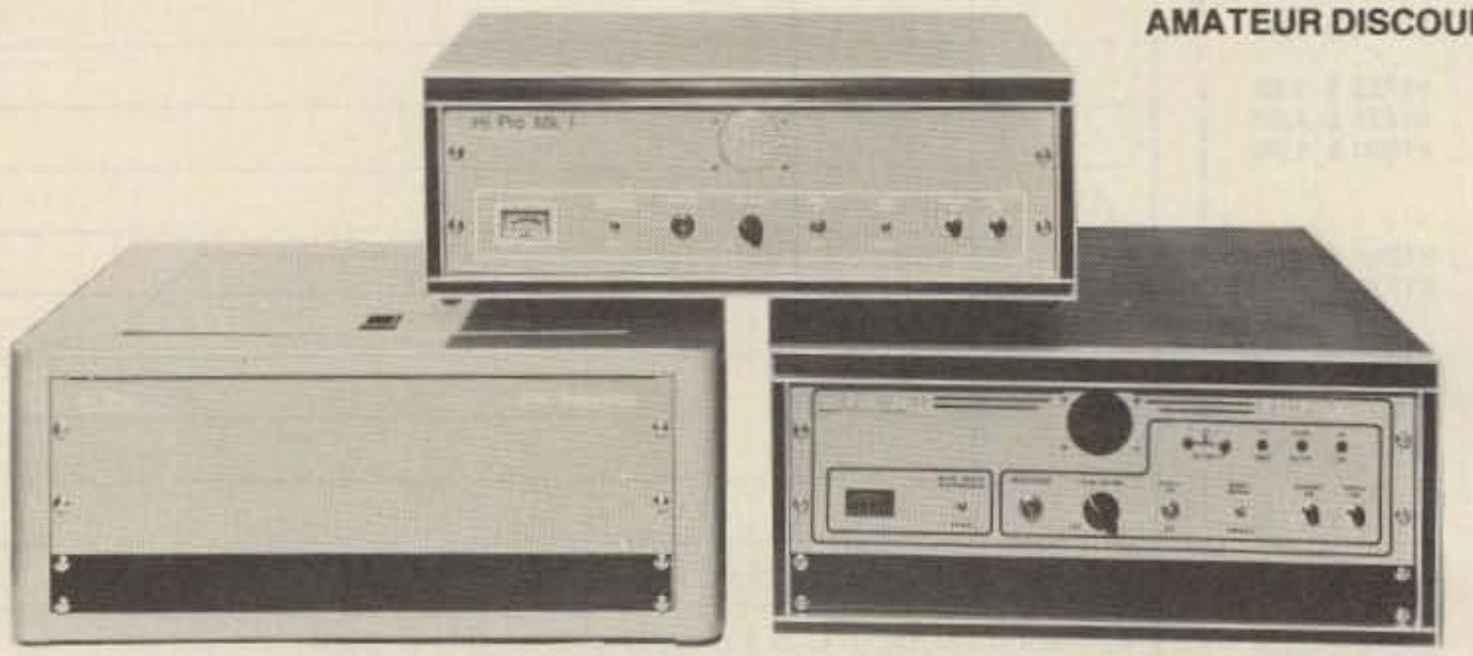

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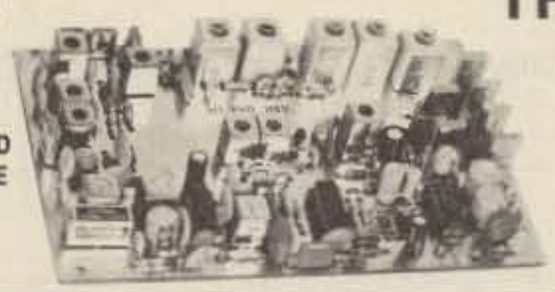

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CIRCLE 47 ON READER SERVICE CARD

Number 19 on your Feedback card

Schedule for the Dayton Hamvention 1988

April 29 thru May 1

Friday, April 29

Packet Radio, Session 1 with Bob Neben K9BL, Moderator
Antennas Tim Duffy K3LR, Moderator
Writers Conference W. Clem Small KRGA, Moderator
Packet Radio, Session 2 with Bob Neben K9BL, Moderator

Friday Activities

1200–1800 Exhibits open, prizes on display. Flea Market open. Registration and program books available at all ticket selling points.
1300–1700 Forums and scheduled activities.
Please Note: Exhibit area closes promptly at 1800.
19th Annual B*A*S*H* Friday evening at 6:30 at Hara Arena Center. Free admission. Hot dinner, sandwiches, desserts, and beverages avail. Continuous family entertainment beginning at 7:00 and many prizes. The "Conference Center" entrance will be open after the exhibits close.
DX Dinner (Third Annual) Sponsored by Southwest Ohio DX Association at Stouffer's Dayton Plaza Hotel (across from the Dayton Convention Center). Program will be "S0RASD operation by Marti Laine OH2BH." The M.C. will again be Jay Slough K4ZLE. Displays and cash bar at 6:30, dinner at 7:00. Advance reservations are required. Send check for $20 each to Jay Slough, 8183 Woodward Dr., West Chester OH 45069. Many DX hospitality suites will be open at Stouffer's on Friday and Saturday evenings. Plan to visit them after enjoying the DX Dinner.
Far-Out A.R.C. Hospitality Blitz 8 PM to midnight at the K. of C. Party Room, 267 Bainbridge St. (just 3 blocks east of Stouffer's Hotel). Free snacks and beverages. Listen 147.135 (plus offset). See 1987 or 1988 program for map.

Saturday, April 30

Antenna Tuners Ken Glanzer K7GCO, Moderator
VHF/UHF Forum Joe Burke WA8OGS, Moderator
Kent Britian WA5VJB, Speaker
Terry Price WD8ISK, Speaker
Dr. Rich Dorsch NE8Z/HC1MD, Speaker
Combined MARS Forum Art Delperdang K4KBI, Moderator and Keynote Speaker
ARES Larry Solak WD8MPV, Moderator
Geritol Net Forum Bert W. Sullivan W8EHX, Moderator
Eugene R. Mayler K8EE, Net Official
Jimmy D. Hardee KT5F, Net Official
OSSBN Harold C. Chapman WB8JGW, Moderator
ARRL Technical Talk Al Markwardt W5PXH, ARRL, Moderator and Speaker
10-10 Bill Labermeier W8PJY, Moderator
Connie Hauck K6EXQ, Speaker
John Hugentober N8FU, Speaker
NTS Forum Charles Gelm NC8Q, Moderator
Photovoltaic Power Paul J. DeNapoli WD8AHO, Moderator
Amateur Program Broadcasting Hap Holly KC9RP, Moderator
Digital Digest Dale Sinner W6IWO, Moderator
The New World of Amateur Radio Bill Pasternak WA6ITF, Moderator
Wayne Green Wayne Green W2NSD/1
Ohio Army MARS Albert W. Maddux AAA5OH/WA8CPB, Moderator
International Amateur Radio Network Glenn A. Baxter K1MAN, Moderator
Contest Forum Tim Duffy K3LR, Moderator
Slow Scan TV Dr. Don C. Miller W9NTP, Moderator
Passing the Code Loraine McCarthy N6CIO, Moderator
Firebirds Clarence "Hank" Easley WB9TUR, Moderator
Verle Winningham K8VW, Speaker
Bynum Usrey KA8GZI, Speaker
Dave Hansen N8BLX, Speaker
AMSAT Session 1 with Doug Loughmiller KO5I, Moderator
National Repeater Frequency Coordinators Forum George Waldie W8JRL, Moderator
Amateur TV Tom O'Hara W6ORG, Moderator
ARRL Len Nathanson W8RC, Moderator

Saturday Activities

0600–1700 - Flea Market Opens
0800–1700 - Exhibits open, prizes on display.
0900–1700 - Forums and scheduled activities.
1700– - Doors close for evening.
1930– - Hamvention Banquet (C.O.D. Bar open 1830).

Banquet The Hamvention Banquet will be held at the Convention Center in downtown Dayton. We are pleased to have Johnny Walker as M.C.

After a delicious filet mignon dinner, there will be entertainment and awards presentations followed by special banquet prizes. You must be present and have your banquet stub for this drawing. Seating is limited.

Sunday, May 1

ACC Owners Forum Ed Ingber WA6AXX, Moderator
SWL & Utilities Michael Harris, Moderator
WX Satellites Dave Latsch, Moderator
FCC John Johnston W3BE, Moderator
VHF/UHF Antenna Gain Measurements-Meadowdale HS Joe Burke WA8OGS, Terry Price WD8ISK, and other members of the Midwest VHF/UHF Society Measurement Team
A Weekend Novice Class Gordon West WB6NOA, Moderator
Amateur Radio and the Law James O'Connell W9WU, Moderator
Chris Imlay N3AKD, Speaker
AMSAT Session 2 with Doug Loughmiller KO5I, Moderator

Sunday Activities

0600–1600 - Flea Market open.
0800–1600 - Exhibits open, prizes on display.
0930–1445 - Forums and scheduled activities.
1500– - Drawings for major prizes.

CIRCLE 133 ON READER SERVICE CARD

Number 20 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

Welcome to the special amateur radio satellite issue! The launch of Phase 3C is scheduled for late May or early June, but the present satellites offer plenty of activity right now. Fuji-OSCAR-12 has had an excellent, predetermined operating schedule. It's a good ratio of normal analog transponder activity, PSK (phase shift keying) packet, and recharge time. RS-10/11 has been flawless and the two UoSAT spacecraft continue to transmit strong FM signals on two meters.

Transpolar Skitrek

There is an update on the Transpolar Skitrek and Project Nordski Comm since the April column. Rich Ensign N8IWJ, AMSAT's Science Education Advisor, distributed data on the Skitrek/Nordski program worldwide. His information package "Exploring the High Arctic from Your Classroom" has been sent to educators in Brazil, Venezuela, Australia, New Zealand, India, all of western Europe, and North America. Thanks to Southern Africa AMSAT President Hans van de Groenendaal ZS6AKV, more than 100 classrooms in South Africa also have materials for following the trek across the North Pole via the U-O-11 digitalker.

The expedition started on March 3rd at 0740 UTC. The initial team is composed of nine Russians and four Canadians. The Russians include group leader Dimitri Shparo UA3AJH, photographer and meal coordinator Alexander Belyayev, artist Fyodor Konyukhov, cameraman Vladimir Ledenev, physician Mikhail Malakhov, equipment organizer Anatoly Fedyakov, researcher Yuri Khmelevsky and radio operators Anatoli Melnikov and Vasili Shishkaryov. The Canadian contingent: navigator Richard Weber VE8RW, scientist Chris Holloway, cameramen Laurie Dexter VE8LD and Dr. Maxwell Buxton, M.D.

It may take as long as 100 days to make the trip from Cape Arctic at the northern tip of the Severnaya Zemlya Islands in Russia, across the polar ice cap, and on to Cape Columbia at the northern point of Ellesmere Island in the Canadian Arctic. While in Soviet jurisdiction, the official skitrek team callsign is UK0CI. The Canadian callsign is CI8UA.

Do not attempt to work the skitrek team. Battery life is limited and radio operation is reserved for communications with the designated support bases and expedition coordinators.

Each day the skiers trek for eight to ten hours, depending on travel conditions. Then, they set up the single twelve-man tent, have a meal together, and report via HF radio on the team's progress. In the mornings, a quick breakfast is followed by packing the tent and ELT (emergency locator transmitter) transmissions.

Communication Support Bases

As reported in the April column, there are three of these. They are located at Resolute Bay in Canada (callsign CI8C), Sredny Island in the Soviet Arctic (callsign EK0QCG), and the Soviet Ice Island North Pole 28 (callsign 4K0DCG). Most of these locations are active on 20 meters after 1600 UTC. When they are not communicating with the trekkers, the support base operators will be available for QSOs. Most of the operators are avid DXers.

The Resolute Bay crew includes Garth Hamilton CI8HO, Andy McLellan CI8CW, Don Whitty VO1QF, and Glen Wyant VE3ICR. Others may also be making the trip to the upper edge of the North West Territories to help out at the support base.

At Ice Island North Pole 28, Barry Garratt VE3CDX/VE8CDX is on the air with the Soviet operators using the 4K0DCG callsign. Barry is using some of the ICOM HF gear from ICOM America.

Rick Burke VO1SA also has ICOM HF gear at the Sredny Island support base. EK0QCG (the station call) and EK0CR (Leonid Labutin UA3CR) have been heard on 20 meters. In addition, listen for Moscow stations UA3HR, UK3KP and RK3KP. In Canada, VE3AUM in Ottawa and VE3CDM in Toronto are involved in support communications.

```
NUMBER 04 PRIORITY 000 DATE 7TH OF MARCH TIME
12 HOURS AND 23 MINUTES GMT YOU ARE AT 81 DEGREES
56.6 MINUTES N AND 97 DEGREES 15.1 MINUTES E 73
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Figure 1. U-O-11 Digitalker format for reporting the Skitrek team location.

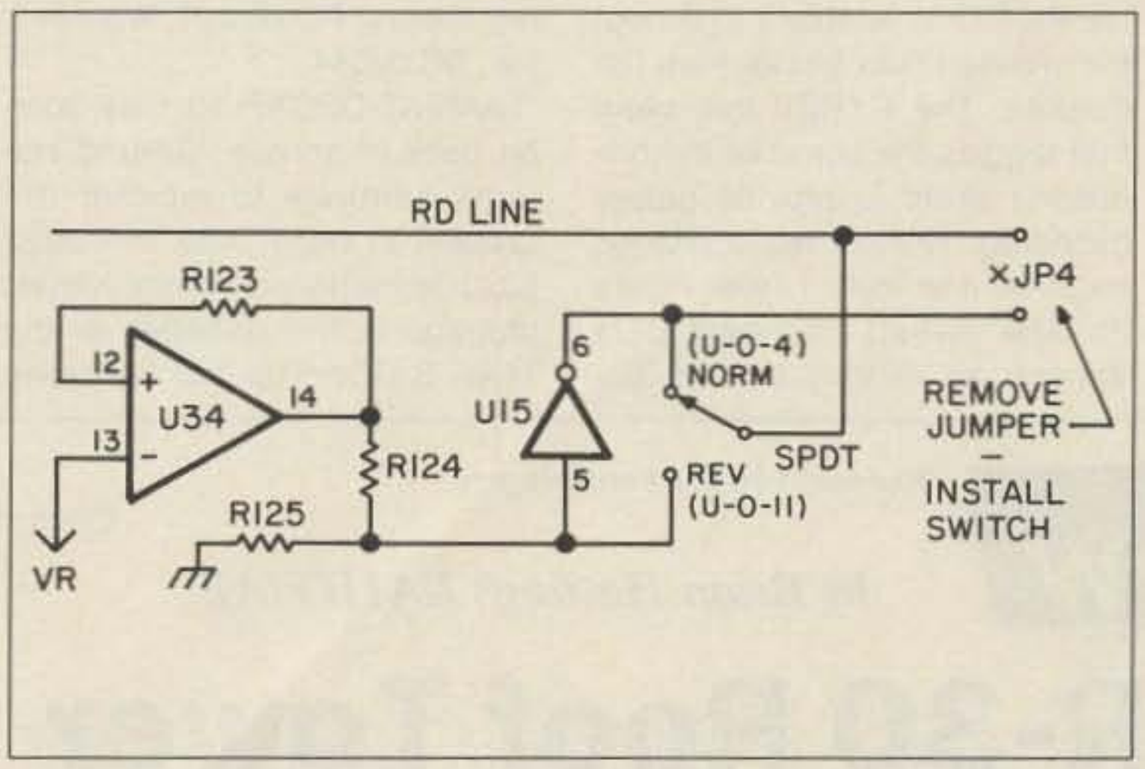

Figure 2. Hardware modification to the AEA PK-232 for U-O-9 or U-O-11 data reception.

UoSAT and Skitrek

To keep on the right track, the skiers use celestial navigation and the digitalker on board UoSAT-OSCAR-11. After a few modifications, U-O-11's voice/data format has been set. During a typical 16-minute satellite pass, a listener can hear the voice synthesizer two or three times. During the remainder of the pass, the satellite sends the usual 1200-baud AFSK telemetry.

Figure 1 shows a typical digitalker message. It is repeated several times. At the beginning of the trek, the messages included degrees and minutes in the location information. Later the format presented only decimal degrees, but the skiers preferred the degrees/minutes combination.

While the skiers are on the Soviet side of the pole, the Russian COSPAS Control Center calculates the latitude and longitude of the expedition. That information passes to the University of Surrey UoSAT Command Center in England, where operators uplink it to the U-O-11 computer. At first the information from the COSPAS center was transferred via voice, but later via telex. This hybrid communications system is the Nordski Comm part of the program.

On the Canadian side of the pole, the SARSAT (Search and Rescue SATellite) control center in Trenton, Ontario, is responsible for following the trekkers. The SARSAT center sends computed information to a coordination group in Ottawa. This group transfers the information via telex, through the facilities of Telesat Canada, to Surrey.

Check It Out!

Listeners can actually hear U-O-11 with an HT and a rubber-duck. I tried this on several occasions using an insensitive rig and a typical eight-inch-long antenna. Low-horizon passes were very noisy, but during passes with elevations over 25 degrees, there were several minutes of good-quality reception. There was no problem getting accurate copy on the skitrek team's location. From the car, using a longer trunk-mounted whip, signals on 145.825 MHz FM sounded excellent. With the HT, however, I had some control over the deep fades by moving the antenna around. This was not possible while mobile.

Once each day, the digitalker is updated to reflect the team's position at the beginning of their daily trek. Set the two-meter rig on 145.825 MHz and see what turns up in the evening hours between 7 and 11 PM. Good passes also occur in the late morning from 9 AM till after noon. The trekkers have had good copy using their ICOM μ2-AT radios at −45 degrees Celsius.

UoSAT-OSCAR-11

With all the excitement over the transpolar skitrek, it's easy to forget about one of the key ingredients to the Nordski Comm system, namely U-O-11. This satellite had its fourth anniversary in space in March. NASA launched it as a piggy-back secondary payload accompanying LANDSAT-5 into space. The orbit is polar and sun synchronous, with an altitude of 700 kilometers. This spacecraft was designed and built in six months by the UoSAT Spacecraft Research Unit at the University of Surrey, working closely with AMSAT NA and VITA members. U-O-11 has supported several different experiments, including digital store-and-forward communications, spacecraft attitude determination, stabilization and control, auroral particle-wave measurements, CCD (charge coupled device), camera imaging, and on-board computer operations. The skitrek activities show just one more possibility for the productive use of LEO (low earth orbit) spacecraft.

AFSK Data

The satellite's computer sends a wealth of information during those periods between digitalker operation. Much of this 1200 baud AFSK data is telemetry, but it also forwards bulletins and DCE (digital communications experiment) transmissions.

Starting Point - Cape Arctic:	81.25 N, 95.75 E
Ice Island North Pole 28:	87.80 N, 142.0 E
End Point - Cape Columbia:	83.10 N, 70.59 W

Table 1. Start and end points for the Skitrek team. Ice Island 28 is a communications support base.

The AEA (Advanced Electronic Applications) PK-232 offers an easy way to receive the 1200 baud data for those who don't have a Bell 202-type modem in the shack. UoSAT enthusiast Phil XE1FLF has been using his PK-232 to capture telemetry for later decoding and to keep informed on the satellite experiments at the University of Surrey via the bulletins. For UoSAT-OSCAR-9, the AEA unit is ready to go. Start by commanding the PK-232 to ASCII with WIDESHIFT on. Set ABAUD to 1200 and get ready for a pass.

For U-O-11, Phil provides the minor hardware modification to the PK-232 to enable it to accept the inverted data format from the satellite. The RXREV command that toggles the sense of the bits doesn't seem to provide proper decoding. The hardware change requires one switch (see Figure 2). The switch channels data through an existing inverter (for U-O-9) or bypasses it (U-O-11). Simply remove jumper JP4 near the external modem output and wire in the switch. Installation location is not critical.

Updates

Phase 3C is scheduled for launch on May 26th with two other spacecraft, METEOSAT and PANAMSAT. An additional mission, carrying a new Intelsat 5 communications satellite, is now in the May 11th Kourou line-up. The flights are renumbered accordingly, so the AMSAT launch is now V-23. The Amateur Satellite Report from AMSAT NA publishes many technical details of Phase 3C. Those who are not yet a member of AMSAT, or have let their membership lapse, should contact them at PO Box 27, Washington, DC 20044.

AMSAT-OSCAR-10 may soon be back in service. Ground stations continue to monitor the satellite in hopes that the latest hibernation period will end with no damage to the batteries or the Mode B (70cm up and 2m down) transponder. Check the AMSAT nets for updates and possible satellite operation in late May or early June.

Fuji-OSCAR-12 experienced a few setbacks to the ambitious two-month schedule presented by the JARL. Long periods of mode JD (2m up and 70cm down PSK packet) caused the satellite to shut down its transmitter early on several occasions. During some passes when the satellite should have been active, only a minute or two of downlink at most was heard. Recharge times have been extended to allow for good battery condition prior to each day of JD or JA (analog mode) activity. Some of the recharge cycles leave the memory on to hold the contents of the BBS system for the next active period.

The Soviet RS-10/11 combination satellite continues to give excellent Mode A (2m up and 10m down) operation. Mode K, with its 15 meter uplink, has been active with mode A most of the time. In March, however, there were some days when the 15 meter uplink was inactive. Many new stations continue to show up on RS-10/11 and signals have been great.

Be sure to catch the fine satellite articles in this issue, listen for U-O-11, and get ready for Phase 3C! 73

73 Review

Number 21 on your Feedback card

by Brian Hastings KA1HY/AE

Creative Design Co., Ltd.
Orion Hi-Tech, Exclusive U.S. Distributor
PO Box 8771
Calabasas CA 91302-8771
Price Class: $239

Create CR-30 Roof Tower

73 Magazine is in the midst of erecting a satellite antenna system. We procured Creative Design's 10-foot roof tower, the CR-30, to use for this project. This review discusses the tower assembly only.

What It Is

The CR-30 is a two-stage, pyramid-type, square tower. It is nearly 10 feet tall when fully assembled, not including the vertical mast, and has a base width of 39". The tower uses a high-strength aluminum alloy for most parts, while zinc-plated steel is used for particularly critical elements.

The CR30 weighs a mere 15 kg (33 pounds) tower and has a wind load of 70 kg in 90 mph winds. Maximum vertical load and twisting torque are 600 and 4500 kg, respectively.

Since the four rubber-padded feet merely rest on the roof without bolting to it, the tower security rests solely in the guying.

Assembly

The instructions are very thorough and graphically well-supported. They recommend three or four persons for tower assembly, but my step-brother and I spent only an hour putting the CR-30 together. Assembly is very straightforward and requires only simple hand tools. The upper and lower sections of the tower assemble separately, and the builder must leave the bolts loosely tightened until it is time to fit the two sections together.

Guying

Guy wires are the tower's only securing system, so they MUST attach to the tower as high up the tower as possible, without interfering with the mounted antenna array path. Do not attach them to the tower at any point below the top of the tower's bottom section. We chose only to secure the guys at the very top of the tower using the four stay hooks provided. The stay hooks angle downward at approximately 45° for convenient placement of the guy wires.

Rotor Mounting

The tower comes complete with rotor and thrust bearing mounting plates, which are both pre-drilled to accomodate many common rotor configurations with Kenpro, CDE, and Create products. The rotor plate mounts between the top and bottom sections, and the bearing plate serves as the tower cap.

In Closing

The antenna system is not yet complete, but the tower spent the duration of our cold New Hampshire winter outside with no visible signs of corrosion. The quality of materials is apparent. The Create CR-30 roof tower is pricey, but it is an outstanding alternative to the cost and hassle of a full-blown, ground-mounted tower. It will support any antenna array most hams care to tangle with, and it's easy to assemble. The CR-30 gets two thumbs up. 73

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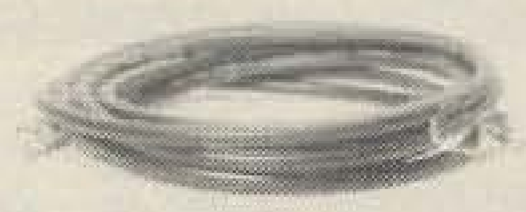

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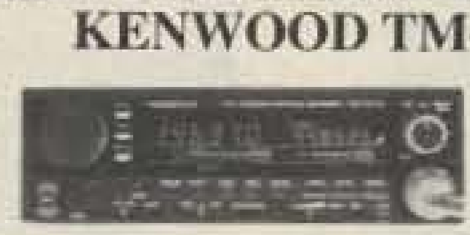

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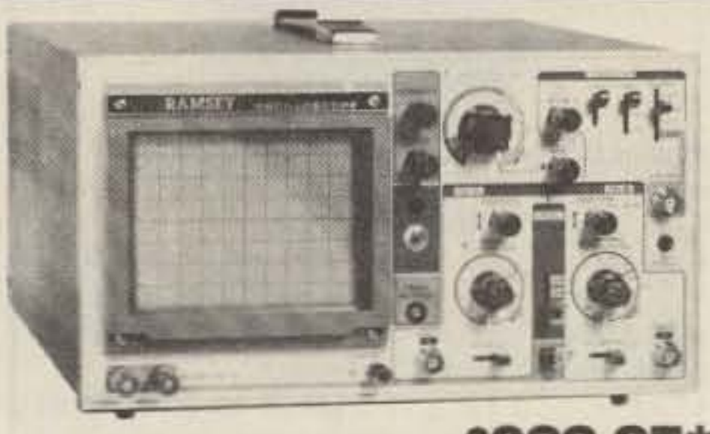

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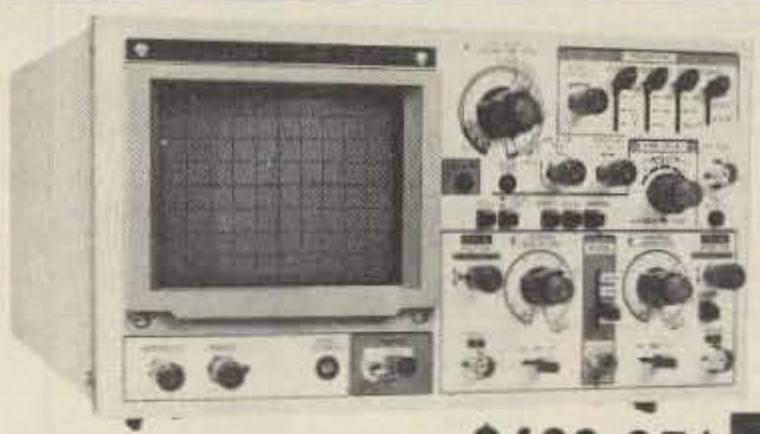

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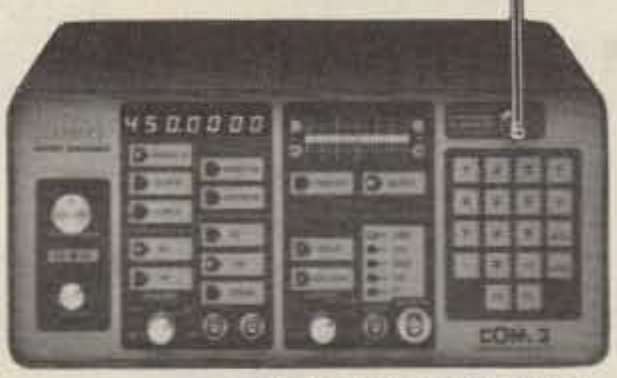

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Ol' Sol

Readers may ask, "Why should earthlings be so concerned about changes on the sun?" After all, earth is located approximately 93 million miles from the sun. What kind of influence could a body exert over that distance?

Plenty! Sunlight, which travels through space at nearly the speed of sound, takes only eight minutes to reach the earth from its point of origin. Streams of sub-atomic particles bathe the earth daily. The solarsphere, analagous to earth's atmosphere, extends all the way to earth and beyond.

Not only does the sun's gravitational pull affect the earth and keep it in orbit; its ever-changing radiation influences Earth's atmosphere. Since the sun is so far from the Earth and yet affects it in so many ways, there may well be other influences affecting the earth—and maybe even the sun!

Planetary E-M

I believe there *are* other influences, and so did my predecessor John Nelson. John Nelson pioneered the use of planetary predictions. It stands to reason the solar system is practically a "closed" system except for occasional visitors from space, namely the comets. All else is contained within the sun's gravitational pull: planets, asteroids, dust, moons, and all of the other bodies contained in this solar spaceship. Just as the moon influences earth tides, the larger planets influence solar tides, and as these change with the positions of the planets, the sun's output changes. In other words, planetary positions influence or "modulate" solar conditions . . . both gravitationally and electromagnetically.

Very often the electromagnetic (E-M) effects are likely to be more powerful and influential than gravity. While it's true that large masses "bend" light almost imperceptibly, the effects about which I speak are far more pronounced—too much so to be merely the result of gravitational pull.

> ***". . . planetary positions influence or 'modulate' solar conditions . . . both gravitationally and electro-magnetically."***

Planetary Fields

The theory holds that planets having molten cores of nickel-iron have electromagnetic fields, which act as giant magnets. A simple compass tells the user that the Earth has such a field. The Earth's molten heavy-metal core, which doesn't rotate as fast as the lighter crust, produces this field. Space probes that have closely examined other planets in the solar system indicate that some of these also have such fields. These fields can act through space on other objects, just as the field of a bar magnet acts through space to attract iron filings.

To accept the possibility of numerous heavy objects with magnetic fields whirling in orbit about the sun is to admit that the sun may well feel powerful electromagnetic effects. This supposition is the basis of my forecasting method. I have gathered enough data over a 10-year period to convince me that planetary positions definitely affect the Earth and the sun.

The magnetic field of the Earth captures solar particles and concentrates them—like the iron-filing-and-magnet analogy—in definite patterns around the Earth. The Van Allen radiation belts prove this. The Earth's magnetic field is not constant. Its magnetic flux varies daily, sometimes concentrating more densely at the poles. Sometimes the field is quiet, and sometimes it is it is disturbed, even stormy. Under magnetic storm conditions, incoming solar particles often concentrate around the earth's poles, giving rise to auroras—ionization of particles by solar energy—near areas of strongest fields intensity.

Consider also that radio waves propagate along magnetic force lines. The Earth's magnetic field will greatly affect them. Thus, when the field is upset, the propagation along north-south lines (trans-equatorial propagation) is enhanced and the propagation along the east-west directions is diminished. When the field is very disturbed, resulting in "magstorms," the ionosphere is so over-ionized that it can no longer support reflection or refraction of radio waves. Instead, it absorbs them, converting them to heat or other forms of energy.

The monthly propagation charts in this column contain what I like to think of as "general" effects (the band-by-band summary of conditions and the maximum usable frequency or MUF for the month), and the "special" effects (the daily forecast of conditions based on the earth's magnetic field whose variations we've been discussing).

Therefore, to determine where and how to propagate your radio signals around the earth, take both the general and special effects into account. First look to see in general what the MUF is likely to be between the locations on earth over which the signal will travel, and pick the time of the day and frequency bands accordingly. Then check the daily forecast, which is based on the earth's magnetic field.

The daily chart, then, tells whether propagation will be (F)air, (G)ood, or (P)oor each day—based on my estimation of the magnetic field condition of that day—made two to three *months* in advance. ■

The editors of *73* are looking for another writer for our Propagation column. W1XU, who has been with *73* since 1984, will retire soon. If anyone is interested in taking over the Propagation column, write to Larry Ledlow, Jr. NA5E, Editor in Chief, 73 Amateur Radio Magazine, WGE Center, Peterborough, NH 03458.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
1 F–P	2 P	3 P	4 P–F	5 F–G	6 G	7 G
8 G–F	9 F	10 F	11 F–G	12 G	13 G	14 G
15 G	16 G–F	17 F	18 F	19 F–P	20 P	21 P
22 F	23 F–G	24 G	25 G	26 G	27 G	28 G
29 G	30 G	31				

Propagation Forecast

Spring propagation conditions will slowly turn into summer propagation conditions on the HF bands during the month of May. May is a transition month, which means that the excellent conditions of March and April slump a bit. The rapidly-increasing Solar Flux as a result of Cycle 22's continuing upswing, however, will offset this quite a bit.

Expect good DX propagation on all of the HF bands during the day and into the early evening. Twenty meters should stay open well after dark, with 15, 12, and 10 meters staying open until at least the twilight hours. On days when the geomagnetic field is quiet and solar flux is well over 100, expect 10, 12, and 15 meters to be really up and open until dark.

The first week of the month is expected to have a disturbed magnetic field with average to poor conditions for DX. The second week will improve with a few good days. The third week looks like it may be fair to poor, but the last week will be generally good to excellent.

Four out of five weekends ought to be good. Have fun!

Number 23 on your Feedback card

ATV

Ham Television

Mike Stone WBØQCD
PO Box H
Lowden IA 52255

ATV COORDINATION SNARE

This month's column deals with a very serious subject that has been plaguing ATVers for many years: QRM resulting from poor and irresponsible frequency coordination. The time is ripe for someone from the ATV community to tell it like it is. It will certainly be the hot subject among Ham-TVers this year at Dayton!

Non-Involvement from Up Top

The problems began a number of years ago when the FCC ceased the requirement of repeater registration by clubs, groups, or individuals. This decision alone opened the door to thousands of greedy FM repeater egomaniacs across the country, who had to have, own, and control a working VHF, UHF, or above repeater system of their very own, regardless of other systems already serving the designated area. Abuse of frequency coordinator authority led to pre-approval of "under-construction" systems, as well as hundreds of outright denials to others. Most FCs are very conscientious, but it takes just a few dishonest ones—those who place their own interests above those of amateur radio—to cause a lot of misery.

Many hams have sent complaints, accusations, and documented evidence to the ARRL and the FCC in regard to hundreds of flagrant violations by volunteer FCs. Pleas for help to K1ZZ and other ARRL Board Members concerning ATV QRM and denials of frequency coordination by FCs, have to date fallen on deaf ears. The League refuses to get involved in these matters in the apparent hope that the problems will go away, yet they give national publicity and official recognition to some frequency coordinators in each year's repeater directory, and even sponsor a national FC Newsletter.

The League can no longer dodge the growing and very serious controversy caused by FC mismanagement and short-sightedness. ARRL directors are now beginning to feel the heat and now discuss this dilemma at official board meetings. The League recently petitioned the FCC to do something about it at their level.

The FCC, however, has also refused to get involved in these disputes. Last fall, a southern office of the FCC stated that not only could "any amateur or group declare themselves an Amateur Radio Frequency Coordinator" but also charge fees for the coordinating administrative work! One Southern California amateur is now selling "coordinated frequencies" for $250 each!

Is this the future of Amateur Radio on the VHF/UHF bands?

National Issue!

Callers to the nationwide "Westlink Radio Network" telephone numbers (Los Angeles (213) 462-0008, Chicago (312) 289-0423, New York (718) 353-2801, and others) were amazed at a Roy Neal K6DUE headline story during the broadcast week of February 26, which highlighted the frequency coordinator problems between Al Crites WA9ZZU of the MAAC Illinois Repeater Council, and USATVS member Henry Ruh KB9FO and his in-band 70 cm ATV repeater project in Chicago.[1] The aired story related KB9FO's year-long battle to obtain approved frequency coordination for the PEACOCK Amateur Radio Club-sponsored Chicago ATV repeater on a nationally recognized 70 cm UHF TV operating frequency.

According to the broadcast, Al Crites WA9ZZU had not only been unresponsive to Ruh's request, but had indeed coordinated dozens of FM repeater links and systems in the lower 420 MHz band where ATV repeater outputs have been agreed to for in-band ham-TV repeater systems! In January, KB9FO hosted a personal in-home visit and ATV QRM demonstration to the chief engineer of the Chicago and Minneapolis/St. Paul FCC field office, as well as to the chief mobile enforcement officer of Allegan, Michigan. After several hours listening to the plight of the KB9FO year-long effort to get proper coordination approval, and after seeing actual documented correspondence files kept by Ruh, the Chicago FCC engineer stated, "Turn the system on!"

Further Investigation

The USATVS learned that the Illinois Repeater Council reviewed the case, admitted to problems handling workloads, and stated they had been without the help of an unlisted UHF frequency coordinator for a long time. They still refused to sanction, however, the coordination requests for an in-band ATV Repeater petitioned for by Henry Ruh. In answer to a second letter recently sent to Henry Ruh from Al Crites (after the broadcast), Ruh remarks, "We are dismayed at the lack of cooperation for our 420 MHz in-band frequency requests. Be advised that, provided we are able to overcome site and frequency pollution problems, we will be operating on in-band frequencies. The nationally recognized band plan allows for ATV repeater operation on frequencies specifically set aside for this purpose. That you or other band users do not want to cooperate is of no concern to us except to the point that we would hope that all band users would be accomodated."

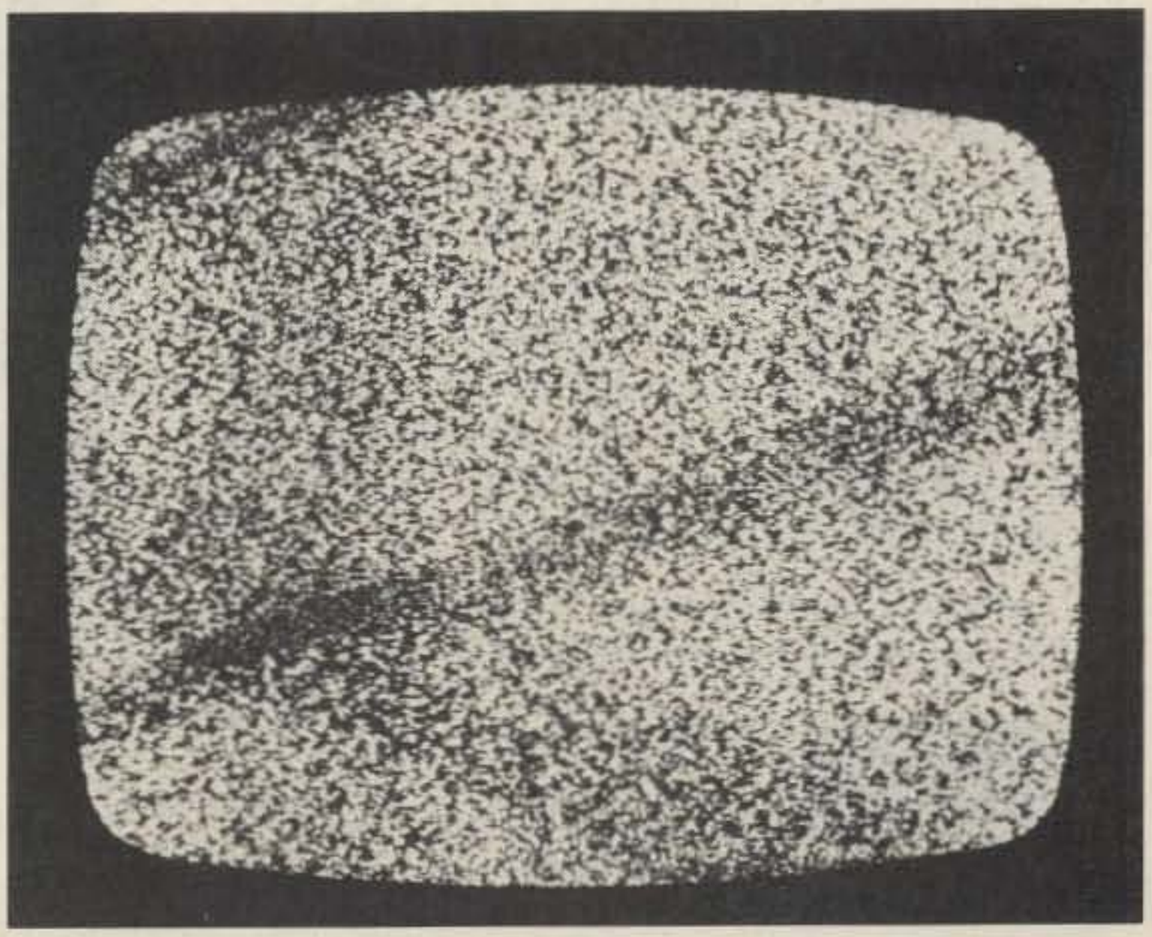
Ruh continues, "Placement of repeaters below 443.00 MHz has obliterated ATV operation for the ATVers who populate 439.25 MHz. This is nothing less than willful interference to existing band users by your coordination efforts and the operation of FM repeaters. Feel free to inform other band users that they will simply have to move to band areas set aside for links which do not interfere with nationally recognized ATV frequencies."

Ruh further cited a nearby ATV repeater under construction in Valparaiso, Indiana, on 439.250, and potential interference to the 439.25 simplex frequency.

The FCC, in an attempt to remain extricated from the matter, has also stated that anyone can declare themselves a frequency coordinator and advised the League that they must include recognition of these new FCs and any submitted system listings in any future editions of the ARRL Repeater Directory. This can help take away the abusive power of present FCs and help to defuse a potentially harmful situation. On the other hand, if out of control, it can lead to the destruction of the VHF/UHF bands as we know them today.

Pay & Play!

These problems aren't limited to the nation's northern major cities. USATVS member and Section Manager Vic Leisner W3LGV reported on February 22 about some troubles he and the Orlando ATV Repeater group have had getting proper frequency coordination from The Florida Repeater Council, Inc. Vic sent a copy of a letter dated January 1988 which announced the formation of 8 elected directors and a council of repeater owner or sponsor representatives. In the same letter, the Florida FC asks outright for donations to meet their rapidly rising $1,500 per year expenses. The tone of the strongly worded letter leaves the reader with the impression that if one does not remit a few bucks, their desired system may not get coordinated or stay coordinated. I quote from the letter, "As we have said in the past, ten dollars a year is cheap to insure an ongoing and viable repeater council that looks after your interests." The letter is signed by Thomas J. King WB4ILH, President, Florida Re-



peater Council, Inc. Further investigation by the USATVS revealed that one of the candidates running and being promoted by King for a position in control of the Florida Repeater Council is a friend of his, Gordon Williamson AB4CQ, who has a 442.75 MHz FM repeater output (against the national ARRL band plan) in Orange City, Florida. This frequency was assigned to the FM repeater output AFTER initial coordination approval was awarded to the Orlando ATV group. AB4CQ's system now wipes out all ATV pictures in central Florida! King also claims knowledge of only one ATV system in Florida. The latest USATVS ATV/R Database lists nine other operational systems!

Even more shocking is the FC's decision to create brand new FSTV repeater inputs and outputs inconsistent with others in the country. We quote from the Florida letter.

"Your letter/agreement is in reference to interference to ATV repeater operations in central Florida from AB4CQ (formerly KC4CI) operating a 70 cm FM voice repeater on 442.075 MHz in Orange City, Florida. The Council has been in contact with Mr. Williamson concerning this matter. At this time we are satisfied that AB4CQ is operating his system within accepted amateur and technical standards. The Florida Repeater Council recognizes that there is a definite interference problem between FM voice repeaters operating in the 442 MHz band and ATV repeaters with inputs in the 439 MHz band. The Council recognizes that this problem exists primarily for two reasons: 1. The occupied bandwidth of ATV (4.5 MHz) of which 3.5 MHz is above the 439.250 MHz input frequency used by most ATV systems in the United States. 2. The lack of proper frequency-use planning that came with the first ARRL 70 cm band plan.

"The Council recognizes the fact that there is only one ATV repeater pair available in the 70 cm band. Therefore, we are investigating several alternative ATV band plans. These include:

1. The inversion of ATV repeater pairs so their inputs are in the upper 420 MHz area. The impact on FM voice repeaters would be minimal, but they would totally alleviate the interference currently being felt by ATV systems.
2. The creation of two new ATV repeater channels. One pair would be 438.250 MHz in and 428.250 out, and the other would be 434.250 MHz in and 424.250 MHz out.
3. The elimination of ATV repeaters entirely from the 70 cm band There are currently 3 ATV repeater pairs in the 23 cm band with no overlapping modes of operations."

The Florida FC ends his letter in the closing paragraphs with "...the Council is compelled to deny your petition...."

This ARRL-recognized frequency coordinator is clearly woefully unsuited for his position. He did not know of eight other ATV/R systems operating in his state. He strongly implied that unless annual dues are kept up to date the coordinated frequency might indeed be lost or uninsured. He did not know the correct bandwidth of a standard NTSC TV signal. He did not know the correct offset of the riding FM audio sub-carrier. He did not know that there is more than one ATV repeater ARRL-approved operating frequency in the 70 cm band. He didn't realize that inverting ATV repeater input/output pairs would worsen matters because of intruding and improperly placed FM repeater carriers. He didn't understand that the creation of 2 new ATV repeater input/output channels at the prescribed operating frequencies would never work since Channel 1's USB falls in the 432-MHz SSB operating area. Finally, he had the gall to suggest a God-like, written policy that violates the FCC's Part 97 Rules and Regulations by *banning* ATV from the 70 cm band in Florida!

Conclusions

If other ATVers are having problems such as these in Chicago and Florida, USATVS and *73* want to hear about it! They should document as much material as possible, and write to us about the QRM or FC situation. We can't promise favorable results, but we can promise to make one hell of a fight on their behalf for a good cause. See us at Dayton and the Friday and Saturday night Ramada Inn North "ATV Workshop" sessions. 73

[1]A copy of the broadcast is available to USATVS members. Send a blank cassette tape and a return mailer. Include $1 or stamp equivalent for postage.

Number 24 on your Feedback card

LOOKING WEST

Frequency Coordination in Perspective

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

The FCC decided not long ago to permit virtually anyone—ham or not—to set up as a repeater frequency coordinator as long as that entity could show that it had support from the amateur community of a given area. The decision, penned by former Special Services Chief Ray Kowalski, used a large number of ambiguous terms—enough to wipe out two decades of work by unpaid volunteers to bring harmony to our VHF and UHF repeater subbands. Before you go off muttering about how rotten a move this was, however, please consider this insightful discussion by George Waldie W9JRL, whose article appeared in the January 1988 issue of the *ARRL Repeater Coordinator Newsletter*. He talks about the events leading to the decision, and proposes a plan to fix these ills. His excerpted article appears below.

Coordination Bedlam??

For more than three years Ray Kowalski has cautioned amateurs to do something about their coordination machinery—or else. On the eve of his departure from the FCC, Ray uncovered a part of "or else" means.

The immediate cause of this bombshell is a long-running dispute between two Southern California groups, the 220 Spectrum Management Association (220 SMA) and the 220 MHz Frequency Coordination Commission (220 MHz FCC), over who should coordinate 1-1/4 meter repeaters in their region. Material submitted by these two groups showed about 520 amateurs supporting 220 SMA and about 215 favoring 220 MHz FCC. In light of the "substantial" support for each organization, the FCC declared that it could not rule for or against either. They will have to find some way of co-existing in the same coordination area.

The notion of two competing groups issuing coordinations in the same territory boggles the mind. It is patently unworkable. If the degree of cooperation and goodwill needed to make this work existed, these Coordinators would merge. That the matter has come to this state argues against that.

The purpose of this discussion is not to dissect this particular issue. Hams must ask, "How did we ever let this get to such a point?" Amateur radio has had three full years, since Louisville '85, to figure a way to safeguard against such problems. Kowalski even *then* told us that organized groups of Coordinators could pass on the qualifications of their members and issue credentials. This same message was given as recently as last September. Writing to Steve Mendelsohn WA2DHF about the then upcoming meeting of Northeastern Coordinators, Ray said:

"During this meeting, the coordinators will recognize each other as valid coordination bodies in the Northeast. I applaud the effort, because it will provide a valuable means by which the FCC could determine the legitimacy of any particular coordinator, should the need arise. This is a completely valid approach, one contemplated in PR Docket 85-22, paragraphs 13 and 25. But it does not depend upon FCC presence for its validity, and I wish to avoid the appearance that it does. Amateur repeater groups in all parts of the country may engage in similar, regional meetings and be assured that their resulting certifications of legitimate repeater coordinators will be recognized by the FCC, regardless of whether anyone from the FCC attended the meeting."

So, amateurs have had available to them an approved method of dealing with coordination problems since April 1986, when the FCC issued Report & Order on PR Docket 85-22. What have we done about it? Well, Coordinator Conferences now cover many areas east of the Mississippi, and a substantial piece of the Midwest. Amateurs, however, need to do much more.

Ray Kowalski also writes again in the letter to WA2DHF,

"As part of the process, I would urge that some thought be given to the procedures for handling changes in circumstances. People involved in repeater coordination today may grow weary of it tomorrow, key people may relocate, a group may be lax in following standard procedures or may become controlled by corrupt individuals. The point is: There should be a way to modify the actions your meeting will take next week."

The regional Conference should be prepared to give peer review to the actions and performances of its members. It is a logical step to expect the Conference to provide mediation/arbitration to conflicts between members. Applying such measures early would reduce festering wounds that protracted combat produces.

"For more than three years Ray Kowalski has cautioned amateurs to do something about their coordination machinery."

Note that there is nothing here to suggest that Conferences should be devices for protecting members against legitimate grievances of their constituents. No Coordinator should operate except with the approval of a majority of the hams in its territory. The Conference should strive to maintain this standard. No Coordinator should ever be allowed to feel above or beyond the judgment and sanctions of its constituents and peers.

Back To California

Would this approach solve the California problem? I doubt it. Amateur radio must use this method before the problem arises.

This particular sort of conflict imposes a stern duty on Coordinators to protect the repeater operators in their area. Returning to Ray's communication to the California groups:

"The existence of two recognized frequency coordinators with overlapping responsibilities in the same geographical area creates a potential for conflicting coordinations . . . "If inconsistent coordinations lead to mutual interference between amateur stations in repeater operation, then the licensees of both stations will be held equally responsible under Section 97.85(g) of the FCC rules for resolving that interference. If interference in such a circumstance is not resolved, the result may be violation notices and/or monetary forfeitures for violation of Sections 97, 78, 97.85(g), and/or 97.125 of the FCC rules. In such a circumstance, these violation notices or monetary forfeitures could be directed against the licensees of the station in repeater operation as well as against the licensees of stations that originate transmissions that are repeated . . ."

The Coordinators feud, and the penalties land on the operators, who are the pawns in the game!

The message is clear: the FCC does not intend to referee our squabbles. Hams must stop wringing their hands and crying that "they" ought to do something. "They" is us. If this precedent of having two operating Coordinators in one territory is allowed to stand, we will see "rump" coordinators springing up wherever there is a trace of dissatisfaction, resulting in intolerable confusion.

Coordinating is indeed not a simple task. It requires large-scale organization for record-keeping, planning, and public relations. The right way to end ineffective or improper coordination practices is to vote out and replace individuals deemed at fault, and salvage the basic organization.

The Criteria Proposal

Back in 1985, Corwin Moore WB8UPM, and Steve Mendelsohn WA2DHF, wrote a set of "Proposed Criteria for Repeater Coordinating Councils" aimed at defining coordination bodies that would meet the necessary tests of representative, effective, and fair operations. Steve published the Criteria in the *Repeater Coordinators' Newsletter* and evoked a bored yawn from the coordination community. The loudest protests will flow from those same mouths, however, when they discover a rump coordinator in their back yard!

Let's face it—many folks will interpret the FCC's latest action as a license to go into business for themselves. The FCC's message is "clean up your own mess, we don't intend to." If hams fail to, they and Amateur Radio will be the losers.

Continued on p. 99

So what do we do? Why not start with the Conferences? We can go with what we presently have. Prove they can do the job and they will expand to cover the country. Each Coordinator will have to give up a smidgen of its autonomy, but they should keep bearing the alternatives in mind. This proposal at least allows territories with common problems of terrain and geography to develop their own methods of treatment.

Then look at the Criteria (I can supply a copy for an SASE). The proposal is excellent, but I propose a few additions.

—Accommodate Coordinators operating outside Council structures.

—Acknowledge that Coordinators are responsible not only to their own constituencies, but also to those territories on which their actions impact.

—Each Conference can alter the Criteria to fit its own circumstances, to arrive at a statement of operations for its members. Those who can show they conform to the adopted Criteria, are confirmed as Coordinators until a challenge arises.

". . . the FCC does not intend to referee our squabbles."

—Each Coordinator should file with its Conference a definition of its geographic coverage area. Where conflicts between Coordination areas are found, the Conference should see they are resolved.

—Each Conference should adopt methods by which dissidents within a Coordinator's territory can bring their grievances to the Conference after all of the Coordinator-supplied recourses are exhausted. This is the time for the Conference to supply mediation/arbitration services by persons from within or outside the Conference region.

Even for the initial arrangements of the Conference, the distances involved may mandate that actions be taken by correspondence, phone, or letter. Conferences need not be highly organized bodies. Most of the functions will be procedures in place to cope with eventualities, some of which will seldom or never arise. However, the Conference should be prepared to act promptly and decisively early in the development of any dispute, before irreparable damage is done.

I feel that if amateur radio above in time, the Southern California situation may well have been resolved before now. It would have been forced to a solution by the amateur community at an early time, with the weight of peer pressure to make the solution stick.

We were warned at Dayton '85 that if coordination became a problem for the FCC, we would not like the solutions they would adopt. Certainly, the Southern California 220 situation, and the FCC response to it, is not one I like. It does no good, however, to rail at the FCC. The League's well-meant effort to serve repeater users with the *Repeater Directory* has put it smack in the no-win middle of this disaster. If we are not to see more of these problems, we better take steps to treat such cases in their infancies. We fail to do so at our peril.

Epilogue

George Waldie W9JRL is in the fortunate position of being away from either coast, and better placed to view the coordinate chaos with an unprejudiced eye. The main problem is whether or not its too late to implement George's sensible advice. It has been five months since Kowalski handed down his decision, and the conflicts have grown worse. In some cases and in some places, it will be decided by a judge. That's all for now from those of us who write the late shift from Los Angeles. . . de WA6ITF 73

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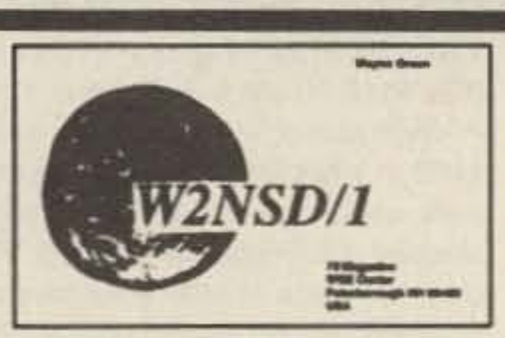

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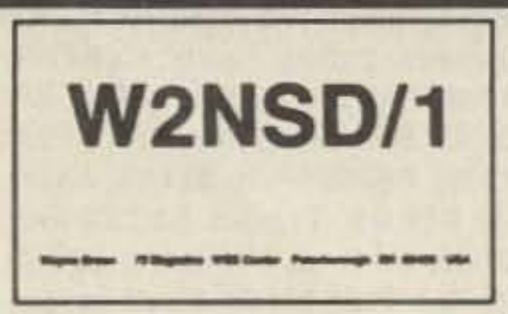

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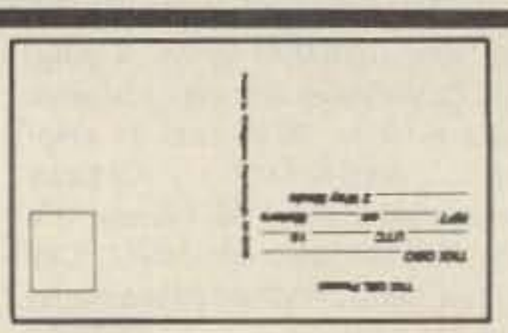
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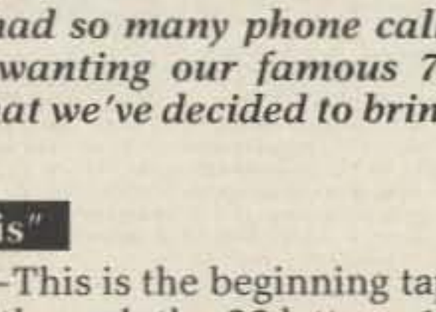

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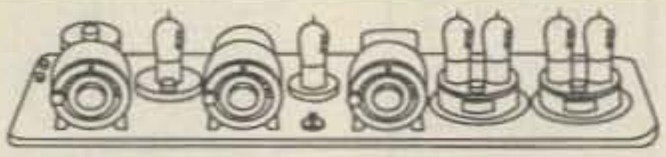

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More Letters!

Here's a letter from the bottom of the pile from Howard H. Halperin N7ETP of Phoenix, Arizona. Howard says that he has a TRS-80 Color Computer 2 connected to a Kantronics TU and a Heathkit Crossfire scope. He said that he can usually get pretty good copy on his RCA monitor, but wants to know how to transmit.

At the risk of sounding smart-alecky, Howard, a transmitter will do the trick! The Kantronics, assuming it has an audio (AFSK) output, connects to the microphone input of most any transmitter that covers the frequency desired. Just hook it up and go for it. This is an old letter, so hopefully Howard is on the air right now, but sometimes the apparently obvious eludes the best.

There is another letter from fellow Marylander Bill Thompson. His question is universal: he's looking for a CP/M based RTTY program.

Sorry to say, this columnist knows of none. The emergence of smart terminal units, such as the AEA PK-232 and Kantronics KAM, may well spell the end of many of the purely software approach to get computers onto RTTY. After all, there are a plethora of ASCII-based terminal programs for most computers. Many public domain programs are excellent. Two that come to mind immediately are QModem SST for the PCompatible crowd and MickeyTerm for the TRS-80 Color Computer. Either of these, or similar, and one of the smart terminal units, sets a user up on easy, intelligent RTTY.

If there is a public-domain CP/M-based RTTY program floating around in the readership, please send it in for the benefit of all.

Not only the CP/M crowd looks for public-domain RTTY stuff. A note form Gene Elfstrom WB2NIE says that he's interested in a public domain program for the Commodore 64.

Gene, look at the CompuServe SIG devoted to the Commodore—there's at least one such program in the database. Those who have other sources, please let RTTY Loop know!

I have a forwarded question for a RTTY program for the Commodore 128, from Lucien TR8RLA in Libreville, Gabon (Africa). Again, I have nothing in this regard. Here's one fellow I know would appreciate any help. I'll hold onto his address, and forward anything RTTYers send me. Jerry Felts NR5A/Ø issued a similar request for RTTY software for the Atari 130-XE.

Well, folks, are true RTTY software programs passé? Do only dedicated microcomputer controlled terminal units lay in the future?

A few topics covered in past columns seem always to be on someone's "wish list." There is a letter, for example, from Steve Smith WA6SOC San Francisco, CA, who is looking for low-cost demodulators to hang between a receiver and C-64 computer. These, and many more topics have been covered in the over eleven years of this column. I have prepared an index to all of these to be had only for a SASE with postage for two ounces on it. Who knows what treasures are hidden in the collection.

". . . there are a plethora of ASCII-based terminal programs for most computers."

Back to Basics

Many recent questions sent into the column, and interest in reprints of some of the early editions of this column show that there are a great many newcomers to RTTY. Likely due to the influx of computerized RTTY equipment, many of these amateurs have no idea of some of the basic elements of RTTY. Therefore, the columns over the next few months will include a little bit of review, refresher, or new material, (depending on reader orientation). Readers should send in any topics they want covered in this mini-series.

This month's column addresses the questions: "Where does one find RTTY?" and "What does one do when it's found?" On the HF bands, the two great concentrations of RTTY stations have traditionally been on 80 meters, at around 3620 kHz, and on twenty meters, at around 14.080 MHz.

This is not to say that RTTY doesn't exist on ten, but try the hot spots first. For example, as I write this column on a Sunday evening in January, there are at least ten or so RTTY signals between 3600 and 3650 kHz, and about the same number clustered around the 14.080 MHz marker on twenty. Now, not all of these stations transmit old-fashioned 60 wpm Murray (Baudot). I hear a few ASCII stations, and one or two that may well be AMTOR. The point is, here is a place to at least find something to tune in, to listen to, and to get used to the various "sounds" of RTTY.

Just for quick clarification, although the old five-level code used in Teletype machines of the Model 15, Model 19, and Model 28 vintage is commonly called Baudot code, it is really Murray code. The explanation is too much for now, but suffice it to say that common usage has prevailed over correctness.

VHF RTTY is more spread-out. Listen around on some of the local repeaters and simplex frequencies to try to get an idea of where the RTTY is in your neighborhood. Often a local club is known for its digital work, such as the BRATS club here in the Baltimore area, and they support RTTY activity on their repeater or on a specified simplex frequency.

Here's a crucial difference. Standard convention has it that on HF, the two frequencies used to represent mark and space, which form the FSK (Frequency Shifted Keying) signal are ordered such that the space is the lower frequency, and the mark the higher. The mnemonic used to remember this is LS/MFT, Low Space Means Fine Teletype. When you decode this signal, you should tune it as though it were a lower sideband signal, so the lower frequency space tone is farther away from center frequency, and thus generates a higher beat note. The lower space FSK signal generates a high space, low mark audio (AFSK) signal. Even on twenty, where upper sideband is more commonly used, tune the FSK signal on lower sideband, otherwise your resultant signal will be upside down, with mark and space reversed.

On VHF the tones used are audio already, so the convention reverses the mark/space relationship, to simulate the decoded FSK signal. Therefore, on VHF, expect to see a low mark rather than low space.

There is much more to cover in the "Back To Basics" vein. Stay tuned for future installments, and, again, let me know what you'd like to see.

Whoops!

Several readers commented on difficulties in the program listings from the January 1988 RTTY Loop, for the Super RTTY program for the Color Computer. The difficulties arise in the way that the typesetting machines handled the listing I supplied. Thanks to William Boneta, of Vero Beach, Florida, here are the errors I know about, as of now. First of all, the funny-looking raised dot in several lines should be an asterisk. The @ sign in several PRINT @ statements was omitted. PRINT A+32,"" is PRINT @A+32. Finally, in the RTTY.BAS program, line 380 reads IF C6, where it should say IF C<6; and line 390 says IF A$>CHR$(13) where it should be a statement of inequality, i.e., IF A$<>CHR$(13). May these come out correctly this time.

If all else fails, remember that the complete listing is still available on Delphi, in the Color Computer section (GROUP COCO), or I will be happy to put all of the files on a disk you send me with $2 and a stamped return mailer. Tape users may take advantage of the same deal, two bucks, a tape and mailer, and I will load the needed RTTY.BAS and MAKERTTY.BAS files to make a RTTY tape.

Some have asked how to create a TXT file for the transmit buffer to load. Use saved received text, or use any word processor or similar program to edit a text file. If there is sufficient interest, I could run a simple BASIC text editor here for those who do not have such an animal in their menagerie. 73

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
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ARE DIPOLES ONLY BIDIRECTIONAL?

Imagine sitting at home some Sunday afternoon when there is a knock at the door. A young Novice friend, Jim, has dropped by for some advice on his antennas. Jim has been doing some reading about dipoles since erecting one on 80 meters a few weeks ago, and now he has some questions.

"I managed to get my antenna up pretty high—40 feet or so—and it's running north-south. It seems to work okay, but I have been looking at some antenna patterns and discovered that a dipole gives maximum signal off the sides of the antenna. That means that most of the power is being radiated to the east and west. The problem is that I have a schedule next week with a ham friend about 200 miles to the north, which may not come off since he's off the end of the antenna. I'd like some help putting up a new antenna running east-west, or change the current one so this friend can hear me. Maybe I should put up a vertical. Advise me."

"Low antenna heights tend to reinforce high angles of radiation while producing cancellation of low-angle radiation."

What should Jim do? Does he need a second dipole? Compared to the antenna he has now, how much better would the second antenna work to the north and south, assuming they are equal in height? What if Jim doesn't have room for another dipole? Should he squeeze in an inverted vee in the space available? How about a vertical—would its omnidirectional pattern outperform Jim's dipole to the north, where he is most concerned with his signal strength? What *should* Jim do?

Many hams would advise that should Jim erect a second dipole if he had the room and can afford the coax. Those hams would probably defend their conclusions by citing diagrams of dipole radiation patterns similar to the one Jim referred to (see Figure 1). Based on what appears in Figure 1, it's easy to conclude there is no significant radiation off the ends of a dipole.

Figure 1, however, is misleading. It represents the pattern in one plane only (at zero degree wave angle in this case), and so does not tell the whole story. In fact, at certain wave angles the radiation in the direction of the wire will not be significantly different from that broadside to the antenna. Under some circumstances dipoles (and inverted vees) are essentially omnidirectional. Under those conditions, changing the orientation of a dipole has no effect on the signal strength in a given direction. Jim and many of the rest of us should then first learn under which conditions is a dipole omnidirectional.

Grab a Doughnut

One of the shortcomings with diagrams such a Figure 1 is that they seek to show on the 2-dimensional page something that actually exists in 3 dimensions. Most of us have at least some difficulty visualizing a 3-dimensional shape when given 2-dimensional views of the object, so a 3-D model is very helpful.

Before proceeding with this discussion, find a doughnut, or at least conjure up an image of one. With this model, the thicker the doughnut in any given direction, the greater the signal strength radiated in that direction.

Figure 2a shows how the wire of a dipole is related to its "doughnut" radiation pattern. Slicing the doughnut along the plane marked "1" in Figure 2a (take a horizontal cross-section), gives the pattern shown in 2b. Note that this is identical to the pattern shown in Figure 1, and, as mentioned before, is for a wave angle of zero degrees.

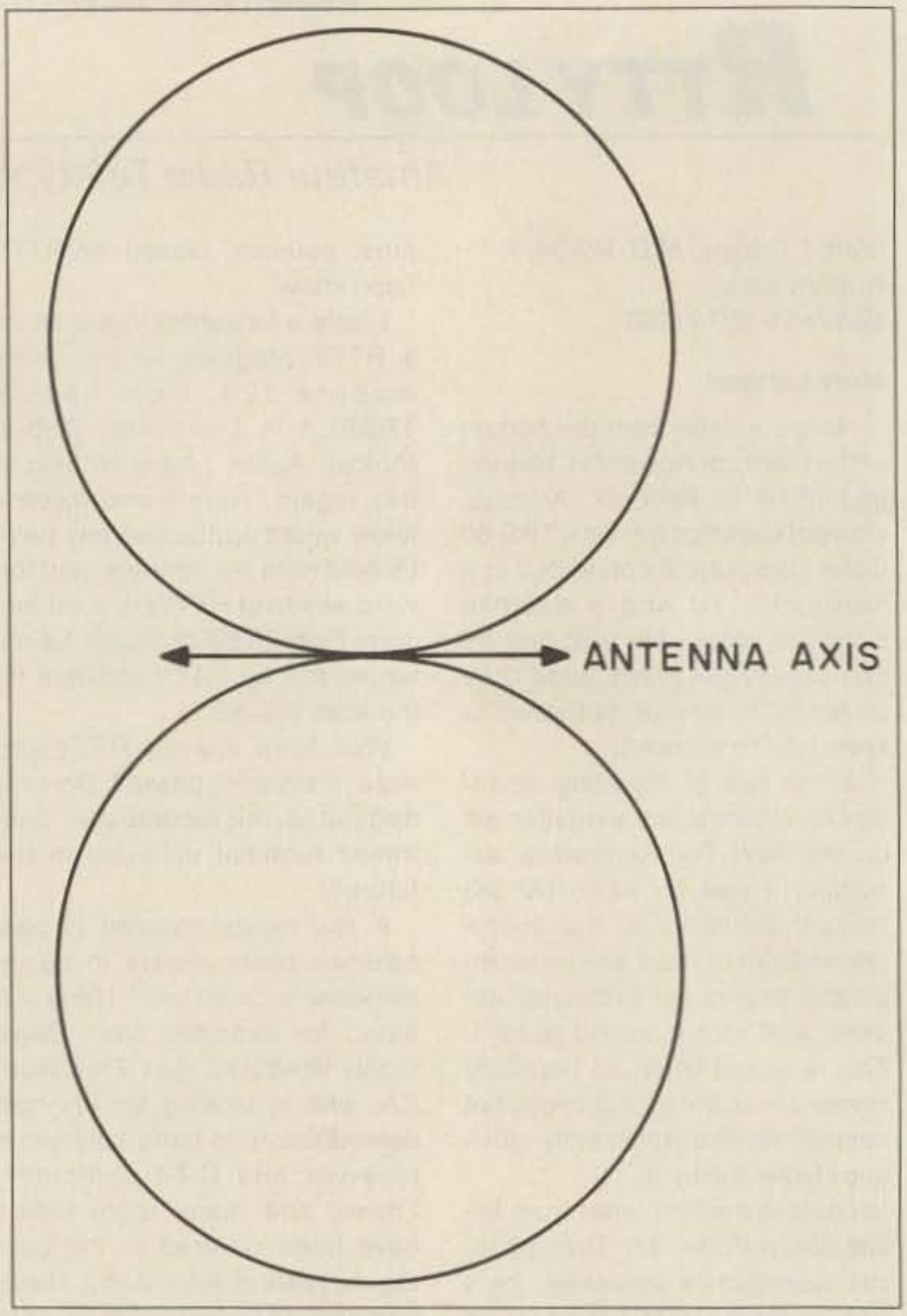

Figure 1. Horizontal directional pattern of a half-wave dipole.

Now imagine again the whole doughnut, and this time cut it along the vertical plane shown as "2" in Figure 2a. Note that with both the horizontal and vertical cross sections through the doughnut there isn't much doughnut (i.e., there is little signal radiated) along the wire axis of the dipole (line OD in Figure 2c). But look at the amount of doughnut shown at a high vertical angles of radiation (line OE) in Figure 2c. It's not much less than the maximum (line OF) being radiated from the antenna. Figures 2a–c, and the hand-held doughnut model should make it clear that while maximum radiation from a dipole occurs at right angles to the wire (including straight up), there is also significant radiation in the direction of the wire axis at high wave angles.

The reader may ask at this point, "Is that high-angle energy any use when it comes to communicating?" The answer depends on a number of variables. The two important variables are frequency and the distance between the two stations.

Frequency is important, because signals at lower frequencies are more readily returned to the earth at high angles of radiation than are higher frequencies. For example, energy radiated at an angle of seventy degrees above the horizon will almost never be returned to earth when the frequency is 28 MHz, but it commonly is at 3.8 MHz. The distance between the stations is important, because the greater the distance per hop, the lower the optimum angle of radiation. Information on the latter topic is contained in several sources, including the *ARRL Antenna Book*. In Jim's case, where the stations are 200 miles apart, the optimum wave angle will be greater than 50 degrees under average conditions.

Real Life

Keep in mind that the above-discussed dipole is in free space. Looking again at the doughnut model of Figure 2a, note that just as much energy is radiated down from the dipole as is radiated in the up direction. In real life, of course, the dipole is not in free space but is relatively close to the

The Lessons Here

1) The radiation pattern from a dipole varies with the wave angle in question.

2) There is significant radiation along the axis of a dipole at high-wave angles.

3) High vertical angles of radiation are optimum for communications over distances of less than, say, 500 miles on the lower HF bands.

4) Low dipoles radiate best at high wave angles, and are essentially omnidirectional at those wave angles. Specifically, the signal off the end of an 80-meter dipole under 60 feet high will be less than an S-unit weaker than the signal broadside to the antenna for receiving stations within 500 miles of the transmitter.

5) In an area with poor ground conductivity (desert, etc.), the amount of high-angle radiation from a low dipole can increase with ground wires parallel to the dipole. These wires should be ½ wavelength plus 5% in length. Theoretically, several such wires could be located on the ground within a radius of 60 feet or so, but whether the improvement (probably less than 3 dB) in signal strength would be worth the effort is debatable.

6) Dipoles show improved radiation at low-wave angles when erected more than ½ wavelength above ground. Those heights are easier to achieve on the higher frequency bands bands, and coincidentally, the lower wave angles are of greater importance at those frequencies. Also, dipoles are inherently more directive at low angles of radiation than at high angles. Therefore, while the orientation of an 80-meter dipole at 40 feet is irrelevant under most circumstances, a 10-meter dipole at the same height will show significant directivity at the wave angles most important for commu- nication on that band.

7) For the most part, the above statements also apply to inverted vees and beams.

ground. That means all the energy that is radiated in a "down" direction will eventually strike the earth and then be either reflected or absorbed, according to the characteristics of the ground itself. An excellent reflector such as salt water returns nearly all the RF striking it, while a ground of poor conductivity, such as desert soil, absorbs much of the incident RF. If a dipole is situated at the proper height over good ground, the energy reflected from the ground adds in phase with the energy coming directly from the antenna. Under those circumstances, the effective radiated power at certain wave angles will be increased (as much as several dB) relative to that of a dipole in free space. Those wave angles vary with the height of the antenna. There are tables, graphs, and formulas available that allow the calculation of heights that produce maximum reinforcement at a given vertical angle of radiation For now, however, it's sufficient to know that low antenna heights tend to reinforce high angles of radiation while producing cancellation of low-angle radiation.

Jim may now lament, "But my antenna is high, at least 40 feet above the ground." Forty feet does look high to someone dangling from a tree limb, but look at it in relation to operating wavelength. Forty feet on 80 meters is less than a quarter wavelength high, so Jim's antenna is actually quite close to the ground. The quality of the ground near a low dipole has a significant effect on how well the radiation is reinforced at various angles. If Jim has an average location, his dipole will have relatively little radiation at low wave angles while proving to be quite efficent at radiating high-angle signals.

My advice to someone like Jim? It would be a waste of his time and resources to erect a second dipole or inverted vee at right angles to his present antenna. His current antenna is omnidirectional under the circumstances given. Although I did not discuss the use of a vertical, such an antenna, while omnidirectional, would be a poor choice in this instance (inefficent high angle radiator). If Jim lived in an area of particularly poor ground conductivity and had an interest in experimenting with antennas, he might try placing some reflectors on or near the ground (as described earlier), but this may well not improve his antenna performance significantly.

Go ahead and eat those doughnuts now.

"Dipoles show improved radiation at low-wave angles when erected more than ½ wavelength above ground."

Other Business

Several readers contacted me with questions or comments regarding the January "Aerial View" column on parallel dipole antennas with capacitive "baluns."

First, the diagrams showing how the feedline and antenna wires are to be connected are correct. Table 1, however, does contain some errors, including calculations for the 12-meter band based on a frequency of 25.9 MHz rather than the correct 24.9 MHz. Technically, the values in Table 1 are for 52 (not the indicated 50) Ω coax, but given the tolerance of feedline construction and other variables, that error should be insignificant. The formula to calculate the necessary total capacitance (C, in pF) that should appear either side of center for a given frequency is:

$$C = \frac{1 \times 10^6}{2\pi fZ}$$

where f is the frequency in MHz and Z is the impedence of the coax. For those unable to obtain the reference I cited, more information is available on these antennas in an article by the same author in *Ham Radio*, May 1987, pp.69–78. 73

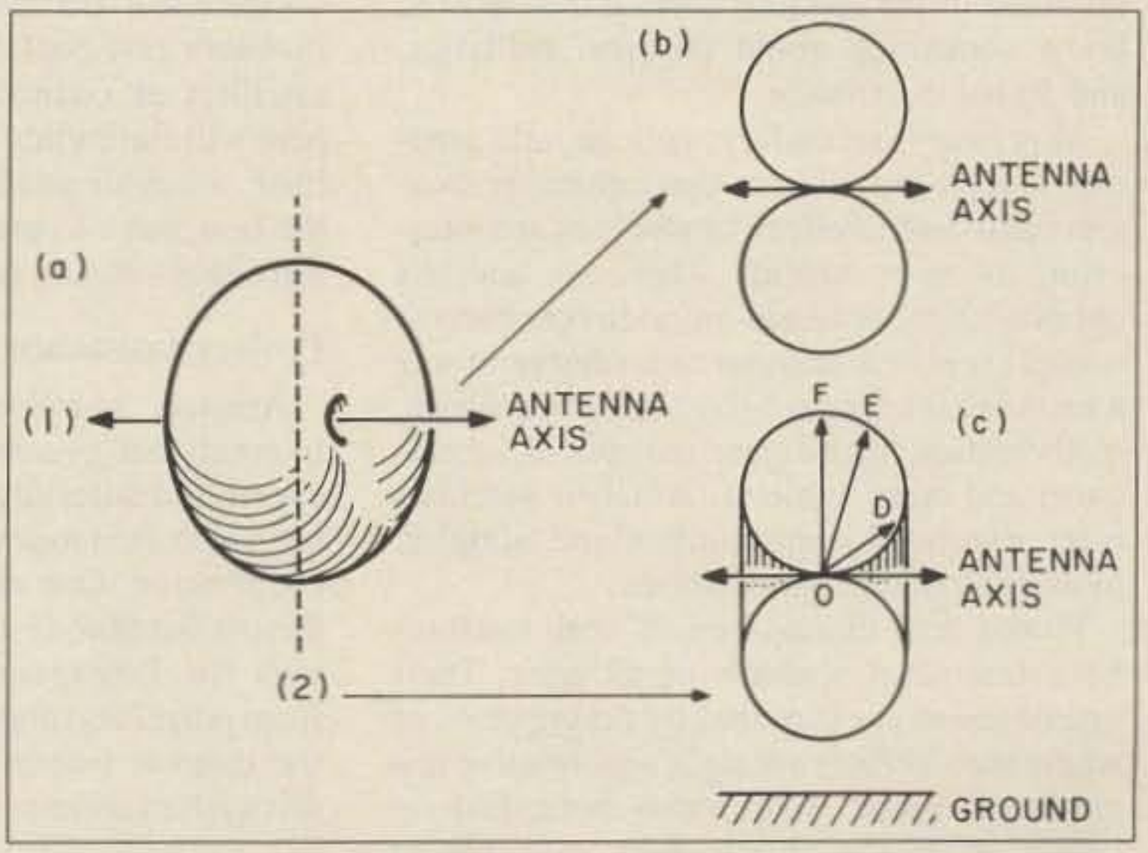

Figure 2. Representation of the 3-dimensional radiation pattern of a dipole (a). Horizontal (b) and vertical (c) cross-sections through the pattern are also shown.

Continued from page 13

Traffic

Traffic handling, whether by traditional means of nets and liaisons, or by digital and automated systems, cannot help but be greatly enhanced and streamlined by having satellites as a backbone to the network. Phase 3C promises to provide the quality and quantity of communications required of such a backbone. Phase 3 and 4 satellites added later along with low and high orbit packet forwarding systems will make possible order of magnitude improvements in current traffic systems.

Emergency Services

The same is true with emergency communications, nets, and drills. The Phase 3C satellite will not be, by itself, a 24-hour, worldwide access system, but it is a large step toward that goal. For emergency operations, high orbit satellites are like repeaters with hemisphere-wide coverage. Segments of the transponders can be dynamically allocated to emergency operations and operators at the disaster site can easily have excellent links to support stations thousands of yards to thousands of miles away in the same network.

Emergency stations already contain some combination of HF, VHF/UHF, analog, and digital modes. Addition of modest antennas and equipment for satellite capability should not be unreasonable in the Phase 3C era.

Education

Probably the most important public service of amateur radio is training and education, and OSCARs can significantly broaden the opportunities for technical education available. Society probably doesn't appreciate the amount of technical knowledge and expertise made available to it as a direct or indirect result of people's interest in amateur radio.

Amateurs, through their hobby involvement, know something about electronics and electromagnetics, legal matters including international regulations and treaties, and standard communications practices. Amateurs involved in the satellite service tend also to know something about physics, ballistics, and digital electronics.

At primary, secondary, college, and graduate levels, the subjects that constitute amateur radio and satellites of all types are interesting to many students. There are limitless opportunities for hands-on or direct observation of events via amateur radio that reinforce a knowledge of geography, culture, physics, mathematics, languages, computers, chemistry, and other subjects. Amateur satellites offer expanded opportunities and simpler, more profound demonstrations.

Photos and discussions of real satellites have fascinated students of all ages. Their imaginations are captured by descriptions of where the satellites are right now relative to a classroom globe. With a two-meter FM receiver, a class is able to hear an astronaut orbiting overhead or a scientific satellite sending telemetry. With a little more equipment, this can be expanded to pictures from a space shuttle or numbers in a telemetry chain ready for collation and interpretation. With a sideband receiver, students can hear amateur operators from around the world, and with the complimentary transmitter may even speak with them and become acquainted.

In the world of satellites, frequencies are higher so antennas and associated portable stations can be smaller. And, as I've already pointed out, the Phase 3C satellite promises to make this sort of demonstration easy and potentially commonplace. Of course, facilities and their educational uses can be extended as far as the students want to go, but this isn't necessary for meaningful introductory work.

Phase 4

Digital Signal Processing (DSP) is at the forefront of amateur radio today. Satellite operators are pioneering DSP, which will be used both by satellite users and by the satellites themselves for everything from selective gain control in the passband to specialized, dynamically adaptable modems.

Among the Phase 4 goals are transponder space for Amateur TV, direct broadcast of bulletins and appropriate announcements to entire hemispheres at a time, linking of terrestrial repeaters at continental distances at user request, experiments with digital TV and data compression techniques, and spread spectrum.

Phase 3C has one of its transponder outputs at S-Band, the 2.3-GHz amateur allocation, in anticipation of Mode-S operations for Phase 4. Since it is possible and practical to do so, amateur transponders will use higher and higher allocations to promote significant utilization of these amateur bands. Those who worry, (and with cause!) about losing valuable amateur spectrum in the future, OSCARs provide one of the best ways to stake out, and so defend, these frequencies.

Space Mobile

There have already been been two manned space missions where amateur radio was an active leisure activity. Any amateur radio station on a US manned space station will probably rely heavily on high orbit amateur satellites as communications relays. QSOs here will commonly last for more than half an hour. Amateur satellite capabilities are one of the best ways to prepare for QSOs with the astronauts, direct, or via satellites.

Project Assistance

Amateur satellites are often involved in international events, like the Skitrek polar expedition currently in progress. They have been also used to actively foster international cooperation. One example is the Search and Rescue Satellite system (SARSAT) which listens for Emergency Locator Tranmitters from polar orbit and allows timely location of the distress transmitter. OSCAR 7 proved this system concept.

How to Get Into Satellite Operation

The cost of an OSCAR 10 class station is roughly comparable to the cost of a standard HF station. The basic equipment list includes sideband and CW transceive capability at 145 and 435 MHz. Such equipment is available either as separate or combined units. Each receiver should have a low noise preamp front end, preferably but not necessarily mounted near the antenna. Single, circularly-polarized antennas with 10–15 dB gain for each band are sufficient with 25-watt range power levels. The ability to switch between right-handed and left-handed circular polarization from within the shack is as much a necessity with today's available satellites as are full elevation and azimuth antenna controls. One also needs some kind of tracking system, preferably an inexpensive computer.

Setting up a satellite station from parts is no more complex than setting up an HF station with a tower, beam, and rotator, but there are more steps and more calibrations. One should also use low-loss coax, particularly for UHF-and-above frequencies, unless the antenna-radio run is twenty feet or less.

Every part of such a standard system, and some advanced features such as computer controlled antennas, are available commercially in "ready-to-go" packages. As with any amateur station, there are many modes and routes of enhancement. These depend on the operator's personal goals and operational desires. Receivers or transmitters for other bands (15 and 10 meters, 23cm and 13cm currently) are probably the most expensive single improvements. HF-station owners should consider an additional route to get on satellites—transmitting and receiving transverters. These are available for virtually all VHF and above bands.

Those who own an FM receiver for the two-meter band can get started with satellite operations in virtually no time at all. Tune to (or buy a crystal for) 145.825 MHz wait for at most a few hours to hear several minutes of UoSAT digital data or the digitalker.

Ten-meter SSB rig owners should listen between 29.35 and 29.45 MHz. One can hear, from four to six times a day, the Soviet amateur satellite pair RS-10 and RS-11 (a pair of transponder systems on a single satellite) relaying signals from 2 and/or 15 meters.

Tune In the World

Problems have plagued the Phase 3 satellites which have been beyond the control of AMSAT or the amateur radio community. Phase 3A was lost in a launch failure in 1980. Phase 3B, OSCAR 10, did not reach its full potential after launch in 1983 following a chain of events resulting from mechanical damage after deployment from the launcher. As we know all too well, there is always the possibility of problems with any satellite launch, but the new generation of rocket builders has relearned some hard lessons and are redeveloping skills of exactness and precision in their art. There is an excellent chance that Phase 3C will be delivered into its nominal orbit in nominal (i.e. excellent) operating condition. If it is, a turning point in amateur radio and in the amateur radio satellite program will have occurred. 73

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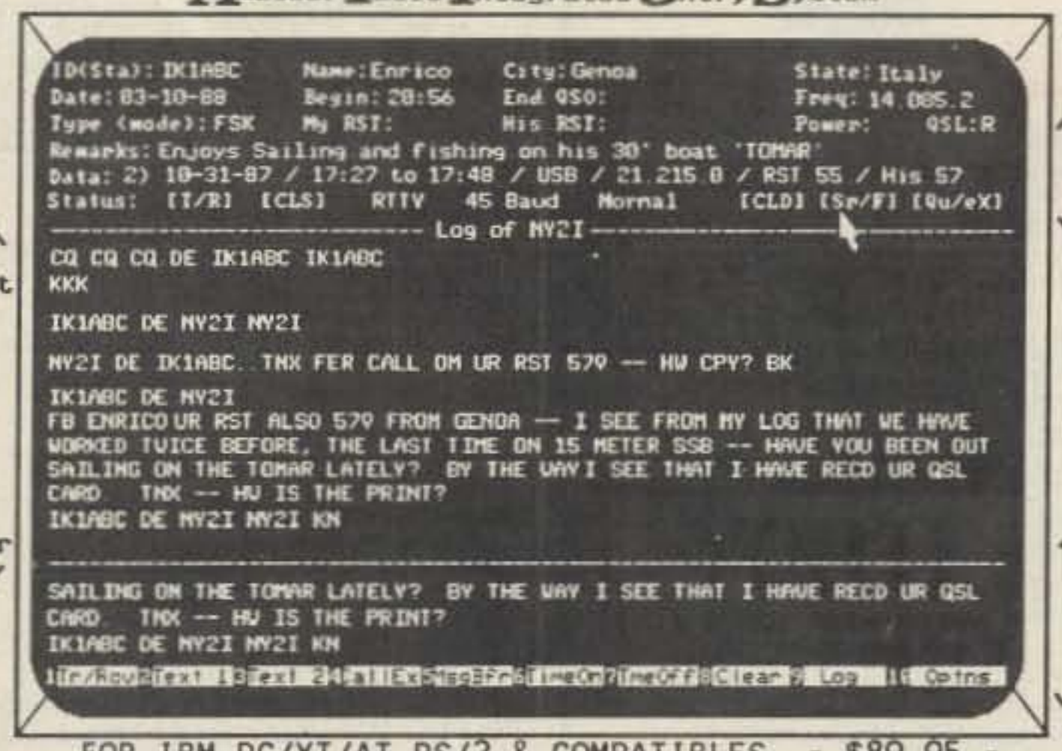

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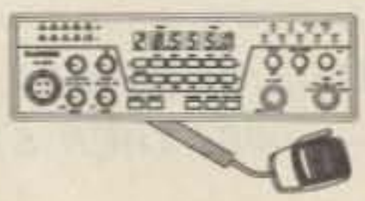

10 meter transceiver, 25 watt, can be programmed to split transceive, SSB, CW, AM, FM, programamble scanning, fully automatic noise blanker, 2½H, 7¾W, 11D.

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same features as 49SA except uses "AA" nicad batteries and comes with battery charger

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Output:13.8V DC - 3 amp constant 5 amp surge, electronic overload protection w/instant auto reset, fuse protected.

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Fully regulated, 13.8 VDC - 4 amps constant with surge protection, overload protection w/instant auto reset.

PS7 . . . . . $24.90
Fully regulated, 7 amp constant,10 amp surge capacity.

PS12 . . . . . $34.90
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PS20 . . . . . $64.90
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PS25 . . . . . $79.90
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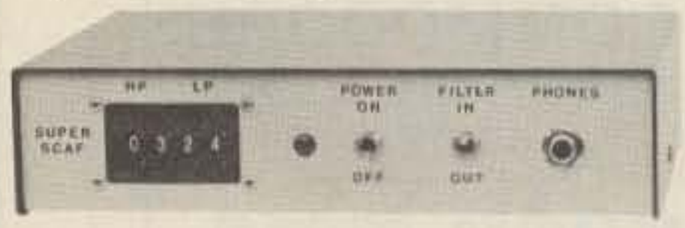

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SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 magazine free of charge on a space-available basis. Announcements must be received by the first of the month, two months prior to the month in which the event takes place (by April 1, for example, for a June or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458. ATTN: Special Events

BARTON VT
MAY 6–7

On May 6 and 7 the Boy Scouts of America, of the Green Mountain Council of Vermont, Indian Lakes District, will hold their annual Scout Show and Campboree at The Orleans County Fairgrounds in Barton. A special event will be the operation of an Amateur Radio Station on the following frequencies (signal propagation permitting): CW 3710–3740, 7110–7140, 21110–21190, 28200–28300 kHz, and on SSB 3910–3990, 7225–7390, 21325–21425, 28300–28500 kHz, and maybe 2 meters on 146.475, .940, .880, .760. Visiting Radio Amateurs with a valid license will be operating the station. A request has gone to the FCC for a special call. For more information contact *Arnold Uttin WB1DSD*.

SPRINGFIELD IL
MAY 6–8

Special event station W9DUA will be operated on May 6–8 to honor the dedication of the Vietnam War Memorial at Oak Ridge Cemetery in Springfield. Operation will be in the General Class portion of 80m–10m (up 35 kHz) to include 10 m Novice portion from 1400Z to 2000Z. For a certificate, send QSL and a large SASE to *Sangamon Valley Radio Club, Inc., Red Cross Building, 1025 South 6th Street, Springfield IL 62703.*

BEMIDJI MN
MAY 7

The Paul Bunyan Amateur Radio Club is excited to announce their annual hamfest on May 7 at the newly constructed Moose Lodge. The action-packed day will begin at 8 AM with a pancake breakfast, then move on to Skywarn retraining, Computer & Packet Radio Demos, and a presentation of a DX Expedition by George ADØS of RF Enterprises. Exams will be given. Dealers will be present. Talk-in on 146.13/.73. Write or call *Paul Bunyan Amateur Radio Club, PO Box 524, Bemidji MN 56601; 218-751-1964.*

CEDARBURG WI
MAY 7

The Ozaukee Radio Club, Inc., will sponsor its 10th annual Cedarburg Swapfest on Saturday, May 7 from 8 AM to 1 PM at the Circle B Recreation Center, in Cedarburg (20 miles north of Milwaukee). Admission is $2 in advance or $3 at the door. Four foot tables are $3 each. Door prizes, food, and refreshments. Setup at 7 AM. For admission tickets, table reservations, maps, or more information, send a business-size SASE to *1988 ORC SWAPFEST, 101 E. Clay St., Saukville WI 53080; 414-284-3271.*

DULUTH MN
MAY 7

The Arrowhead Radio Amateur Club of the Duluth/Superior area proudly presents SWAPFEST '88 which will be held on May 7 at the First United Methodist Church (the copper-domed church) in Duluth from 10 AM to 3 PM. There will be hourly prize drawings during the day in addition to the main door prize, and a meeting of the Minnesota Repeater Council during the day. Admission is $4, with 4' tables going for $5. Talk-in will be on 146.34/.94 MHz. For more information, please contact *Ron Carison KØBR, 5128 Wyoming Street, Duluth MN 55804; 218-525-6860.*

OWEGO NY
MAY 7

The 29th Annual Southern Tier Hamfest will be held at the Treadway Inn, in Owego. Talk-in on 146.16/.76 and 146.52. Gate admission $4. Under 14, free. Dinner and gate ticket combined is $15 in advance. ARRL VECC exams, League Forum, vendor displays, and all-day flea market. For more information or ticket orders, send SASE to *STARC, PO Box 7082, Endicott NY 13760.*

ST. PETERSBURG FL
MAY 8

SPARC, the St. Petersburg Amateur Radio Club will sponsor the Hamfest on May 8 from 8 AM to 3 PM at Lake Maggorie Park, Shelters 1 & 2, in St. Petersburg. Admission and swap tables are free. Talk-in will be on 147.06/.66. Contact *Hank Briese WA4RLV, 10804 84th Ave. N, Seminole FL 34642.*

BATAVIA NY
MAY 14

The Genesee Radio Amateurs (GRAM) will operate W2RCX on May 14 from 1300Z to 2200Z at the 18th century Holland Land Office Site to celebrate GRAM's 25th anniversary. Suggested frequencies are 3.913, 7.213, 14.313, 21.313, 28.313, and 147.225+. For QSL, send QSL and SASE to *G.R.A.M., PO Box 572, Batavia NY 14020.*

FAIRFIELD CT
MAY 14

The Greater Fairfield ARA, Inc., will operate WB1CQO during the 53rd annual Dogwood Festival, from 1300Z to 2200Z on May 14. Frequencies: 3.975, 7.235, 14.330, 21.420, and 28.310 MHz. Send a large SASE for certificate and QSL card to *FARA, PO Box 486, Southport CT 06490-0486.*

SCHENECTADY NY
MAY 14

SARA will operate K2AE from Saratoga Spa State Park on May 14 for Region II, Eastern Cluster, Boy Scouts of America, during their North-O-Ree III. Station hours will be 1300Z to 2000Z. Suggested frequencies are 14.330 and 28.360. For commemorative QSL, send QSL and SASE to *WB2STS, 2 Union St., Schenectady NY 12305.*

BIRMINGHAM AL
MAY 14–15

Plans are well under way for the BirmingHamfest '88 ARRL State Convention, May 14 and 15, at the Birmingham-Jefferson Civic Center. Exhibitor booths are $125 for both days, VIP tables are $20 per day, and flea market tables are $10 per day. All BirmingHamfest '88 booths and tables will be on the main floor of the Exhibition Hall in air-conditioned comfort. Your Exhibitor Booth reservation entitles you and your employees to free admission. Doors are open to the public on Saturday, May 14 from 9 AM to 5 PM and on Sunday, May 15 from 9 AM to 3 PM. Admission is $5 per adult. Featured are booths, flea market, forums, amateur license testing, awards, Birming-Hamfest banquet, and non-ham activities. For more information and a reservation form, contact *Mildred Cullen AA4XF, Chairman, BirmingHamfest '88, PO Box 26576, Birmingham AL 35226; 205-822-6130.*

OWENSBORO KY
MAY 14–15

The Owensboro ARC will operate the club station K4HY during their annual BBQ Festival starting 0200Z on May 14 to 0600Z on May 15. The frequency will be 7235, 28.350. For a certificate, send SASE to *Ray Tate N4EKG, 1615 East 23rd St., Owensboro KY 42303.*

UNIONTOWN PA
MAY 14–15

The Uniontown A.R.C. will operate W3PIE May 14–15 from 1700Z to 0300Z both days to commemorate the 50th anniversary of U.A.R.C./W3PIE. Suggested frequencies: lower portions of the 20–40–80 meter general phone bands, 28.333 Novice phone band, conditions permitting. 2 meter FM simplex on 146.55. Also 6/2 meter, 220/432 sideband. For certificate, send QSL and large SASE to *Uniontown A.R.C., c/o John Cermak, Box 433, Republic PA 15475.*

ATHENS OH
MAY 15

The Athens County Amateur Radio Association's 9th annual Hamfest will be on Sunday, May 15, from 8 AM to 3 PM, at the City Recreation Center. Admission is $4. Free paved outdoor flea market space adjacent to building for tailgaters. Talk-in on the club repeater is at 146.34/.94 MHz. Indoor space is only available by pre-registration. If interested, contact *Rod Holley KA8NDC, 15267 S. Canaan Rd., Athens OH 45701; 614-593-8177.* For general information, write *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701.* Licensing examinations will be offered at all levels, and those wishing to take them should mail a completed FCC Form 610 and a $4.55 check payable to ARRL/VECC to *John Cornwell NC8V, 101 Coventry Lane, Athens OH 45701.* (Walk-ins are accepted.)

CHICAGO IL
MAY 15

The Chicago Amateur Radio Club will hold its annual Mini-Hamfest on Sunday, May 15, from 9 AM to 3 PM at the North Park Village, in Chicago. Admission is $2. This will take place indoors in case of rain. Refreshments. For more information, call *George Sopocko WA9JEZ, Director of Special Events, at 312-545-3622.*

EVANSVILLE IN
MAY 15

The Tri-State Amateur Radio Society will hold its annual Hamfest at the 4-H Center on Hwy. 41 N, Evansville IN, on May 15, from 6 AM to 3 PM Admission is $3, tables are $5. All activities are held inside. Talk-in is on 147.75/.15 to 146.19/.79. For more information, call *C. Sartore N9DYE, 709 E. Virginia St., Evansville IN 47711.*

KANKAKEE IL
MAY 15

The annual Kankakee Hamfest sponsored by the Kankakee Area Radio Society will be at the Kankakee County Fairgrounds on May 15 from 8 AM to 3 PM. Free flea market tables (limited), ARRL booth, many exhibitors. Free parking and free shuttle to Kankakee Airport. Food and drinks will be available. Admission is $2.50 for advance tickets and $3 at the gate. Setup will be on May 14 from 6 PM to 8 PM and on May 15 from 6 AM to 8 AM. Talk-in on 146.34/.94. For more information, write *KARS, c/o Frank DalCanton KA9PWW, RR. 1 Box 361, Chebanse IL 60922; 815-932-6703 after 5 PM CST or 815-937-2452 before 5 PM CST.*

KNOXVILLE IL
MAY 15

The Knox County Radio Club, Inc., will hold its annual Knox County Hamfest on Sunday, May 15, at the Knox County Fairgrounds in Knoxville. There will be a large commercial display building and acres of outside flea market space available at no charge. The gates open at 7 AM and the commercial building at 8 AM. Talk-in will be on 147.00/146.40. As in the past, the Knox County Pork Producers will be serving their famous Butterfly pork chops and other goodies. VEC testing will be given near the Hamfest site. Walk-ins on first-come basis, or mail current FCC 610, copy of license, and $4.55 check payable to DeVry/VEC. For table reservations, pre-registration of testing, and advance tickets, write *Keith L. Watson WB9KHL, 119 South Cherry Street #3, Galesburg IL 61401-4527 or call 309-342-3885 evenings.*

WHITNEYVILLE PA
MAY 15

The Tioga Co. Amateur Radio Club is sponsoring its 10th annual Hamfest at the Tioga County Fairgrounds, in Whitneyille PA on May 15 from 8 AM to 4 PM. Admission is $3 at the gate or $2.50 in advance. Inside tables cost $3 each, outside flea market tables are free. There will be free parking on the grounds, VEC testing, plenty of good food and drink. Talk-in will be on 146.79 or 146.52 Simplex. For advance tickets (deadline May 1), send check or M.O. to *Bill Reilly, RD 4 Box 103, Wellsboro PA 16901.* For further information, contact *John Winkler WB3GPY, RD 2 Box 267, Wellsboro PA 16901.*

WRIGHTSTOWN PA
MAY 15

The Warminster Amateur Radio Club is sponsoring their 14th annual Hamfest at the Middletown Grange Fairgrounds in Wrightstown. Gates open at 7 AM (6 AM for vendors). Admission is $3 (XYLs and children free). Approximately 80 indoor spaces with 8' tables are available at $5 per space. Features new equipment vendors, large flea market. Talk-in on 146.52 Simplex and 147.69/.09 repeater. For information or preregistration, contact *Frank Charlton KA3FBP, 1479 Kingsley Drive, Warminster PA 18974; 215-675-2549.*

SO. SIOUX CITY NE
MAY 20–22

The 1988 Midwest ARRL Convention will be held at SO. Sioux City Nebraska on May 20, 21, and 22. There will be seminars on DX, Packet, computers, computer repair, handi-hams, RTTY, AMTOR, FCC, ARRL General Counsel, and more. Programming will start Friday afternoon at the Marina Inn at 2 PM. A get-acquainted dinner with entertainment will be held Friday night. Activities on Saturday begin at 8 AM. There will be programs all day Saturday and Wouff Hong Initiation Saturday night. FCC examinations will be given Saturday morning. There will be a full line of exhibitors, large flea market, free 2 meter rig testing, and ladies' programs Friday afternoon and all day Saturday. District QSL Manager, MARS. The Banquet is $10 pre-registration and the convention is $6. Flea market people contact *Al Smith WØPEX, 3529 Douglas St., Sioux City IA 51104.* For convention information, contact *Dick Pitner WØFZO, 2931 Pierce St., Sioux City IA 51104.*

ABILENE TX
MAY 21

The Key City ARC is sponsoring its annual ham radio/computer swapfest on Saturday, May 21, Armed Forces Day, at the Abilene Civic Center from 8 AM to 5 PM. Doors are open from 6 PM to 11 PM on Friday, May 20 for dealer setup. Pre-registration is $5. Admission at the door is $6. Tables are $2 each. A 6:45 AM to 7:45 AM ham breakfast and 7:30 PM BBQ dinner are planned at the Abilene Inn. Plenty of parking. Also planned: a tour of Dyess AFB and the B-7 bomber, an air show, a tour of the mall of Abilene for the ladies, and a gun and knife show. For more information, call *Bill N5DOX at 915-698-4606 after noon local time.* Send pre-registrations to *KCARC, PO Box 2722, Abilene TX 79604.*

CADILLAC MI
MAY 21

A Shop & Swap sponsored by the Wexaukee ARC on May 21, from 8:30 AM to 3 PM, will be held at the Cadillac Middle School, in Cadillac. Featuring guest speaker Doug DeMaw W1FB. Swap tables, food. Talk-in 146.97 repeater. Admission is $3. Tables are $6 each. Contact: *John Craddock KX8Z at 616-797-5491* or write *Wexaukee ARC, PO Box 163, Cadillac MI 49601.*

COLORADO SPRINGS CO
MAY 21

The Pikes Peak Radio Amateur Association will hold its 1988 Swapfest on May 21 from 8:30 AM to 4 PM at the Rustic Hills Mall at Palmer Park and Academy Blvd. Free admission. Table rental is $8 in advance and $10 at the door. Commercial dealers and VEC testing. Talk-in on 146.37/.97 (courtesy of Pikes Peak FM Association). For information or reservations, contact *Al NØCMW, 303-473-1660* or write *PPRAA Swapfest, PO Box 16521, Colorado Springs CO 80935.*

DUBUQUE IA
MAY 21

The Great River ARC of Dubuque IA will operate NSØU from 1500Z until 2200Z on May 21 at the site of the annual Dubuquefest special events and message center. Operation will be in the lower 20 kHz of the 75, 40, 20, and 15 meter general bands. Station N9FVN will simultaneously operate voice in the 10 meter novice band. For QSL card, send SASE to *NSØU, 2735 Hickory Hill, Dubuque IA 52001.*

KNOXVILLE TN
MAY 21

The Radio Amateur Club of Knoxville will have their 23rd annual Hamfest/Computer Fair on May 21 at the Kerbela Temple, one week earlier than usual, and for one day only. Admission is $5. Tables are $10 each. Talk-in will be on 147.90/.30. Advance registration is required. For more information, contact *Carol Whetstone, Hamfest Chairman, 3702 Vista Lane, Knoxville TN 37921.*

SPRINGDALE AR
MAY 21

The Northwest Arkansas Amateur Radio Club will sponsor their 1988 Annual Hamfest on Saturday, May 21 at the Rodeo Center. Setup starts at 6 AM. Doors open from 8 AM to 4 PM. Featured are indoor swap tables, commercial exhibits, snack bar, ARRL/VEC testing, forums and programs, prizes for hams and ladies. Air-conditioned facility. Table reservations are $3 each. For more information or reservation, contact *Chuck Webb KA5BML or Mary Webb KA5HEV, PO Box 338, Prairie Grove AR 72753; 501-846-2847.*

PARAMUS NJ
MAY 22

The Bergen County Amateur Radio Association is sponsoring its Spring Hamfest at Bergen Community College, in Paramus NJ. Rain or shine, 8 AM to 4 PM. Buyers free, sellers at $5 per space, tailgate only. Talk-in on 146.19/.79 and .52 direct. Amateur testing, Novice through Extra, 8 AM to 11 AM. For testing information only, contact *Pete Adely K2MHP at 201-796-6622.* For general information, contact *Jim Joyce K2ZO, 286 Ridgewood Blvd., Westwood NJ 07675; 201-664-6725.*

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Dx

Hams Around the World

Photo A. The 1987 Mt. Athos DXpeditioners: (left to right) standing Alex SV2QO, George SV2UA, Nikos SV2RE. Sitting: Paul SV2TX, Lefteris SV2UF, and Nick SV2WT.

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

MT. ATHOS AT LAST!

In September 1987 six Greek amateurs staged what many DXers around the world were starting to suspect would never occur: a legitimate operation from Mt. Athos. No Greek amateur had obtained permission to operate from the Holy Mountain since Manos SV1IW was on in 1980. In the intervening years, the Greeks have carefully scrutinized every operation from the remote peninsula, and quickly cried "foul" whenever they found problems.

For example, the Greeks bitterly fought DXCC acceptance of Frank Turek DL7FT's operation as DL7FT/SV/A, and even convinced the Greek authorities to revoke Frank's reciprocal amateur license. (The DF7FT/SV/A operation was eventually accepted for DXCC credit.) Then in 1986 the Greeks stopped several Italians from mounting a "radio propagation study" from Mt. Athos. (See "Almost Athos," in the May '87 "DX" column.) Whenever the Greek amateur community objected to hams from other countries operating from Mt. Athos, DXers around the world said, "Why don't *you* operate from Athos?" After several years, DXers were beginning to despair, and started talking about deleting Mt. Athos from the DXCC list. So it was great news when the Greeks announced that they would soon be on from the Holy Mountain.

Short Notice

The operation began on the evening of Sept. 15, when Nick Georgiadis SV2RE, President of the Radio Amateur Union of Northern Greece, received word from Apollo, a 35-year-old monk at the Dochiariou monastery, that he had finally obtained entry and transmission permission from the Holy Epistasia. Nick had been negotiating for several years with Apollo, who is studying for his own amateur license, to get this coveted permission. The permit was valid for 15 days.

Nick immediately sprang into action, and started to round up amateurs who could get away for a two-week DXpedition at a moment's notice. Many local hams had already used their yearly vacation time, and others had commitments that prevented their getting away for two weeks. But within two days Nick pulled together five other amateurs and hundreds of pounds of amateur radio gear, including the following: Yaesu FT-101, FT-102, FT-980, ICOM IC-720A, IC-740, IC-745, and Kenwood TS-520. They also brought along VHF and UHF rigs and antennas, beams, and generators.

At 5 AM on Sept. 18, the group stuffed themselves and all their gear into a small rented van and headed out of Thessaloniki for the port of Ouranoupolis, where they expected to catch the ferry that serves the roadless Athos peninsula. Unfortunately, the boat operators refused to allow their cans of gasoline for the generators. The amateurs had to settle for a single 25-liter can, enough to run the generators for a single day.

Despite the short planning period and ferry problems, the group landed at the 1000-year-old monastery of Dochiariou and quickly erected their antennas: tribanders and multi-band dipoles. The monastery loaned a two-story building to the amateurs, and provided generator power during the day, allowing the group to use their linear amplifiers. The monks even provided gasoline for the DXpeditioners' own generators for contacts at night.

Quite a Haul

Using eight HF rigs, the six operators made almost 23,000 QSOs in 13 days, using their own callsigns /SY. They tried to keep three stations on the air at all times, breaking only for meals and generator maintenance. As might be expected, nearly half of their contacts were with European hams, but they managed about 7000 contacts with North American DXers, 4000 with South America, and even 1300 Oceania QSOs. The only problem was with Asia. The Japanese amateurs couldn't hear the group, as a steep mountain blocked the path to the northeast. George SV1UA and Nick ended up hauling an entire HF station and generator to the top of a 1200-meter high mountain to make about 1000 Asian QSOs. Most of the contacts were SSB, but SV2UF/SY made about 3000 CW QSOs.

Considering that none of the operators were either experienced DXpeditioners or contesters, the group did a very fine job handing out Mt. Athos contacts.

Not True

A controversy, however, tainted this operation. After the group returned to Thessaloniki, some of the DX publications printed a false rumor that the group was demanding $5 for QSL cards, which would be a violation of DXCC rules. There was no truth to the rumor, and the Greeks have never even asked for donations, although the trip entailed considerable expense to the individual operators. The local radio club SV2SV handled the QSL chores for all six operators, and no additional donation or contribution other than return postage was required.

Goodwill

The group established excellent relations with the monks at Dochiariou, and fully expect to return for another DXpedition in the near future. Perhaps they can set up a station better suited to Asian contacts, and maybe even take along some experienced CW operators and DXpeditioners to make even more contacts next time. Meanwhile Apollo continues to study for his amateur license, between his work and religious duties, which take up to 16 hours a day. Apollo has taken the CW test once, but has not yet passed it. When he does, Mt. Athos will fall way down the list of Most Wanted countries. 73

Photo B. The Dochiariou Monastery on the southwest side of the Mt. Athos peninsula, site of the /SY operation.

QRP

Number 33 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

DIGITAL QRP

CW

People geared to QRP tend to really go in for the small and simple construction projects. CW, therefore, is QRP's principal mode since it is the most basic. It's much simpler to build a CW-only transmitter than a SSB unit.

The main goal in QRP operation is to communicate with another person using the least amount of power. The name of the game is to be understood and not to intimidate. A much slower pace helps avoid "fills" or "repeats." Average QRP CW speeds range from 10–20 wpm.

This speed goes way up when propagation is good. Operators often use terminal units (TUs), to decode CW sent faster than 40 wpm. Most operators use a terminal unit to decode the CW for a computer. These terminal units have very narrow filters, so it doesn't take much transmitter drift for the signal to fall outside the decoder bandwidth. VFO stability, therefore, is critical for the copier using a TU.

The Ten-Tec Argosy, Argonaut 509, and 515 and Heathkit HW-9 are all very stable. The VFO on the HW-8 needs work, however, and an op may as well forget about using the HW-7.

I use a computer to decode CW sent faster than 30 wpm. My computer for the task is the Radio Shack Color Computer II. A homemade decoder picks up audio from the Argosy, decodes the signal, and displays the results on the monitor. The computer also sends my CW back to the other station. Only a simple switching transistor and reed relay is required.

Ops who can copy high speed CW by ear aren't usually much bothered by slight VFO drift.

Look for high speed CW on or about 7.032 MHz.

CCW

This is "Coherent Continuous Wave." In essence, CCW allows a higher keying rate for a given bandwidth than CW by sychronizing the transmitter and receiver. Raymond Petit W6GHM describes his experiments in September 1975 *QST*. Adrian Weiss W@RSP also did some experiments on CCW in 1977. Ade wrote about these in June and July 1977 issues of *CQ*, with astonishing results.

In addition to spectrum economy, CCW gives a 20-dB signal-to-noise improvement over a typical CW signal using standard bandwidths.

I encourage those who have experimented with CCW to share their observations with me.

Photo A. Don't forget Packet radio for the QRP stations. Here's a unit running 24 hours a day on solar/wind power.

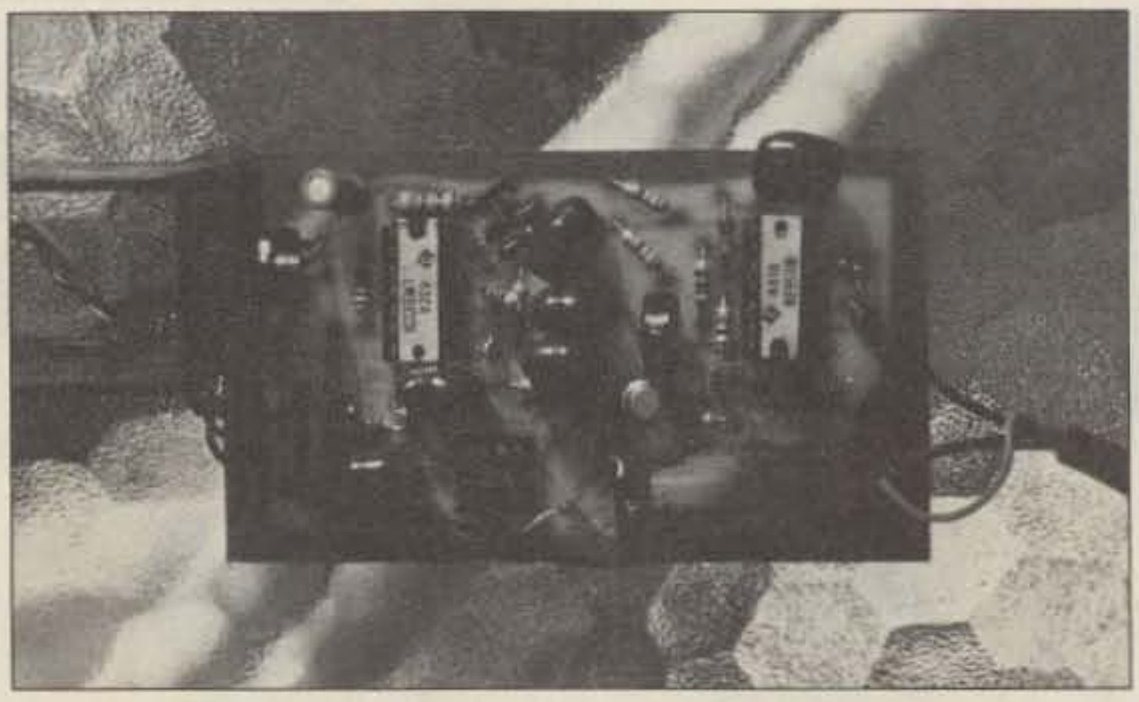

Photo B. It may not be much to look at, but my CW decoder allows high speed CW up to 100 wpm when connected to a computer.

RTTY

QRPers also dabble in radioteletype. Baudot code is used in RTTY. Common speeds are 60 wpm and 100 wpm—only a few stations operate on 75 wpm.

"Average QRP CW speeds range from10–20 wpm."

Many hams, myself included, used to use old, oily clatterers, like the Model 15 Teletype™, Model 19, and 28ASR machines to decode RTTY. These klunkers are quickly fading from the scene. There are now many computer TUs, such as my Color Color computer, which decode the Baudot code in utter silence.

The TU converts the audio tones from the receiver into a on/off voltage and routes it to the computer via the RS-232 port. The computer, with the proper software, then decodes the TU output and displays the results on the monitor. Some of the simpler phase-locked loops do a fair job decoding the audio from the radio into Baudot code, provided the bands aren't too congested.

Most QRP radios can receive RTTY. Those with a very narrow CW bandwidth don't allow enough of the RTTY signal through to let the terminal unit decode it. Again, a stable VFO is a must.

The operator needs only to shift the transmitter frequency down 170 Hz. This is called narrow shift. Wide-shift RTTY—850 Hz—is not very popular today. Direct frequency-shift keying is done by using a diode and a variable capacitor to shift the VFO down in frequency. Voltage to the diode causes it to conduct and ground the capacitor, causing the desired shift in frequency. The terminal unit/computer controls the voltage to the diode.

Have any of the readers tried to FSK the VFO of a HW-8? It looks possible on paper. The only trouble I foresee is keeping the proper 170-Hz shift on the different bands—the HW-8 has a record of moving the CW offset from band to band. Those who have dabbled with this, please send in your observations.

Audio Frequency Shift Keying (AFSK) is where the the frequency of an audio signal shifts from one frequency to another. The resting tone (MARK) frequency is 2125 Hz. The frequency shifts up to the SPACE tone of 2295 Hz. AFSK is used almost entirely on frequencies above 50 MHz.

Modern HF RTTY stations use a different approach to generate FSK: they feed AFSK tones into the microphone input of an SSB transmitter. The output, while technically J2B emission, is indistinguishable from the F1B emission when properly designed and adjusted. This method is the gateway to RTTY for Argosy and Argonaut owners. I used my Argonaut on 20-meter RTTY with excellent results.

Because of the 100% duty cycle of RTTY operation, take care to keep RF power transistors within their ratings. Power supplies are called on for extra key down-time. Many 100-watt transceivers must

operate at 50–75% power for safe operation.

QRP RTTY is not at all hard. Most of the activity is on 20 meters. Remember to use LOWER sideband. Beginners should try their luck in the middle of the day on weekdays since evenings and weekends are much too crowded for low power.

"Coherent CW gives a 20-dB signal-to-noise improvement over a typical CW signal using standard bandwidths."

Calling CQ on RTTY with two watts is unrealistic. It's best to tail-end a QSO. Listen for CQs—the RTTY CQ has a sound all its own, which an operator soon learns to pick out. Leave the main tuning dial in one spot and use the RIT to tune in the RTTY station, it prevents leap-frogging all over the band.

The budding RTTYer needs only a terminal unit, computer and SSB transceiver. I don't suggest bothering with a mechanical machine. For more words of wisdom on RTTY, check out the RTTY Loop every month in *73* by Marc Leavey, MD WA3AJR. Wonder if he'll take an interest in QRP?

Amateur Teleprinting Over Radio (AMTOR)

This mode is like RTTY with one important difference. Noise and fading easily trash RTTY signals. When the terminal unit can't decode part of the Baudot code, the data is lost. This is called "taking a hit," and can ruin copy with enough errors. AMTOR has a built-in error correction scheme.

This is the key to AMTOR's success. Time diversity allows the signal more than one opportunity to reached the desired station. In other words, the same signal sent at different times will experience different fading and noise conditions. When in QSO with someone using AMTOR, if the receiving station detects a bad code element, the transmitter is turned on and asks the sending station to repeat the code. AMTOR uses two forms of time diversity in either Mode A—Automatic Repeat Request (ARQ), and Mode B—Forward Error Correction (FEC).

AMTOR, like RTTY, requires the transmitter to be on 100% of the time. AMTOR Mode A signals are usable with some transmitters at full power because of the 210–240 ms on/off timing. Also, the receive-transmit turnaround time should be less than 20 ms. This requires full QSK in a transceiver.

AMTOR requires a special terminal unit. Some of the newer all-in-one terminals will support AMTOR as well as RTTY, CW and ASCII. Not so long ago, a ham needed a special terminal unit for each mode. Now thanks to large scale ICs, several makes of multi-mode terminals are on the market. AEA's PK-232 is a good example. The PK-232 will decode CW, RTTY (all speeds) ASCII (all speeds) AMTOR (mode A and B) Packet, and WEFAX (weather maps).

AMTOR is also found on 20 meters, just below the RTTY subbands. Right now I don't know anyone that has used QRP and AMTOR together! Let's hear from those who have!

This has been an overlook of some of the digital communications that QRPers have at their finger tips. Take a look up and down the bands. There is a lot of new and exciting things to do. Be a mover and shaker. Spread the word that QRP operation need not be a CW-only mode.

That's it for this month. Look for a discussion next time on phone operations, including SSB and AM, OSCAR satellites, and, space permitting, VHF and UHF. Look also for a small milliwatt transmitter project to build.

The reader service cards are back. Readers should take this opportunity to express their feelings about the column. I'm always looking for input on the column, and projects to share with QRPers. Don't forget to send in good photos! 73

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A convenient service for our Readers.

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FEEDBACK

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Do we really read the feedback cards? You bet! The results are tabulated each month, and Larry (our editor in chief) takes a good, hard look at what you do and don't like. To show our appreciation, we'll draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to 73. To save some money on stamps, why not fill out the the Product Report card and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

Number 35 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

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

ADAPTABLE MONOPHONIC OUTPUT

Here's one that the foreign manufacturers are starting to use on portable receivers, a plug for the same jack without an adaptor, for either a mono earphone or the popular stereo headsets. Audio is provided to both the tip and ring of the stereo plug. The mono plug receives audio even though it shorts the ring connection to the ground. Insertion of any plug disables the loudspeakers. A switch type stereo jack (of any size desired) must be used for this adaptable monophonic output.

Ron Johnson WA5RON
Austin, TX

LOW POWER INVERTER

This is a lower power inverter built cheaply and simply. It uses only 9 parts and turns 10 to 16 volt DC into 60 Hz. 115 volt square wave power to operate AC equipment up to 25 watts.

The LM556 (or NE556) integrated circuit is the dual version of the ubiquitous 555 timer. The first section of the timer chip is wired as an astable oscillator with R2 and C1 setting the frequency. The output is available at pin #5. The second section is wired as a phase inverter. That output is available at pin #9. Resistors R3 and R4 keep the output transistors, Q1 and Q2 from loading down the oscillator. The two transistors drive the transformer push-pull fashion. When one transistor is baised on the other is cut off.

The transformer is a 120V/18 V.C.T. unit from Radio Shack. Notice that it's connected backwards so that it steps the voltage up rather than down. Since it was designed to go the other way, it's not the most optimum for the purpose. However, it was available and cheap. If you can find an inverter transformer or feel like winding one, I'm sure that it would prove more efficient. Don't be afraid to experiment.

If you intend to drive much of a load it would be advisable to provide some sort of heat sinking for the transistors. With the parts shown, I found that the circuit will work down to about 6 volts input while still producing a 50 volt square wave output.

By changing capacitor C1, I found that everything worked nicely at frequencies up to 500 Hz. If you are operating from a supply with high effective series resistance or at much of a lead distance from the power source you may have to install a good sized (1000 microfarad or more) capacitor across the input.

The oscillator circuit U1, R1, R2, and C1 is a versatile circuit in itself. It operates from about 4 volts to 16 volts with a very stable output. Frequency is determined principally by R2 and C1 and can be figured by the formula: f= 1.44/ (R1 + 2 × R2) × C. Yes, with my parts that does come out to 57.6 Hz. But that's close enough for my work. If you were going to use it as the dual-phase oscillator in a descrambler you would run it up around 3.5 kHz.

Don Cantrell ND6T
Los Molinos, CA

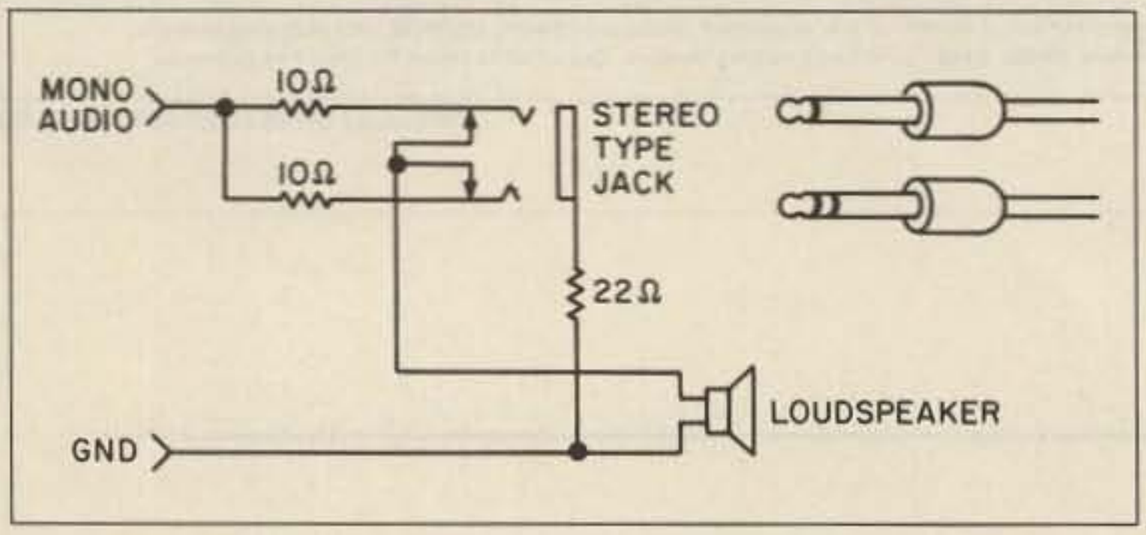

Figure 1. Adaptable monophonic output.

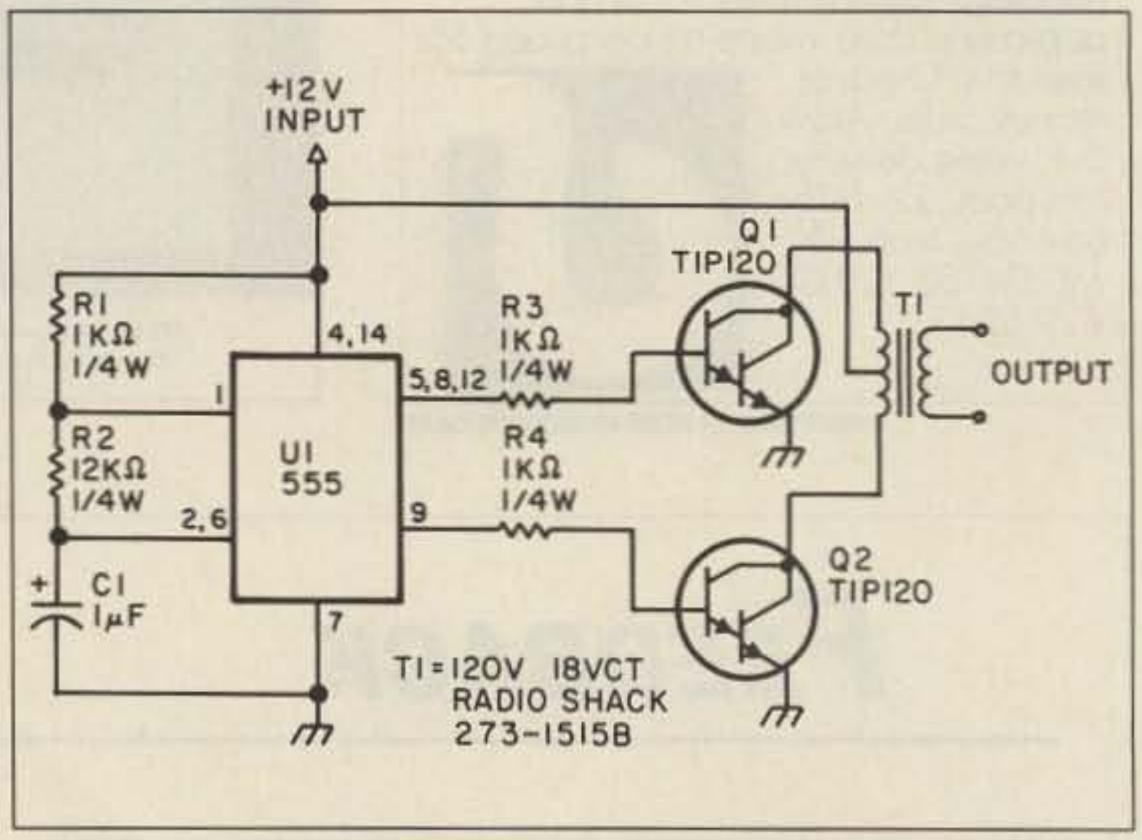

Figure 2. Low power inverter.

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All prices FOB Houston, Texas, except as noted. Prices subject to change without notice, subject to prior sale. Used gear sale price refunded if not satisfied. Call anytime to check status of your order. Texas residents add sales tax.

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Display your **name, call and hometown** on our **top quality** summer mesh cap with white seamless front and matching bill $7.95 ea
They come in **royal blue, red & brown** with matching color thread
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Send Check or Money Order, Plus $3.00 Shipping and Handling Per Order. Add 25c for each add'l cap ordered.
ALLOW 3 TO 5 WEEKS FOR DELIVERY. MD RESIDENTS ADD 5% SALES TAX
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SUPER PERFORMANCE BATTERIES

SUPER ICOM BP-7S, 13.2 volts, 900 ma, double the capacity of the Icom BP-7, 5w output.
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Both are base charge only, BP-7S or BP-8S $65.00*
Exact replacement FNB-2 Nicad pack for YAESU FT-404R/207R/208R with case. $24.00*

Inserts for:

Kenwood PB-25	**$25.00***	**Icom BP-3**	**$20.00***
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Complete line of NICAD packs for Icom, Kenwood, Tempo, Santec, Azden, Cordless Telephones, Alkaline, Nicad, Mercury and Lithium Cells. All battery packs include a 1 year guarantee. Commercial Radio Packs also available.
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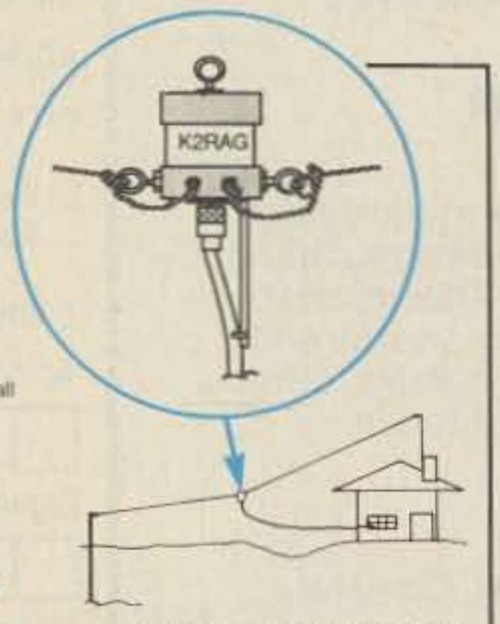
CIRCLE 68 ON READER SERVICE CARD

K2RAG Antenna Products

PERFORMANCE +©



New! Improved! K2RAG Balun $29.95

Models:
RAG-1.1A (50/75 balanced-50/75 unbalanced)
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- Broadband 0.5 to 50 MHz, one balun covers all bands
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- 2000 watt PEP rating

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New! K2RAG All Band Linear Resonating Sloper

Model: RAG-LRS

- 60 ft. long, factory assembled, easy to install
- No traps, full power
- Continuous coverage 3-30 MHz, automatic band switching
- Commercial quality

K2RAG Balun Matched Dipoles

Model	Band	Length	Price
RAG-D160	160	260'	$79.95
RAG-D80	80	133'	$59.95
RAG-D40	40	67'	$49.95
RAG-D20	20	33'	$43.95
RAG-D15	15	22'	$43.95
RAG-D10	10	16'	$43.95

"30 years experience"
Antenna Systems Inc.
14465 SW Hazelhill DR.
Tigard, OR 97224 U.S.A.
503-684-5350

CIRCLE 122 ON READER SERVICE CARD

Number 37 on your Feedback card

73 INTERNATIONAL

edited by Richard Phenix

Notes From FN42

More information about applying for permission to operate in other countries, and about the ***Universal Permit Application*** *will be found throughout this section this month. The word from Italy (I2MQP) is especially welcome—see box. We are aiming at the September issue to reprint the proposed application form using all the suggestions for improvement which have come in. Get your suggestions to us by July 1* ***at the latest!***

Delayed apologies often only recall mistakes long forgotten, but sometimes they should be made anyway. ***Taiwan*** *(the Republic of China) was supposed to be in the March column, but production problems too complicated to describe caused it to be dropped and added other mistakes; and ditto problems made April corrections impossible. Taiwan IS in this issue, and we share a BV QSL card in addition to show you some beautiful art. Sorry!*

May events: Constitution Day Japan—3rd; Norway—17th; Mother's Day Germany, Guatemala, USA—8th, Central African Republic—28th; Independence Day Israel—14th, Paraguay—15th, Jordan—25th; National Day Cameroon—20th, Tanzania—26th. On May 1—May Day, China, France, Germany, USSR. 2—King's Birthday, Lesotho. 5—Remembrance Day, Netherlands, Children's Day, Japan, Victoria de Pueblo, Mexico. 6—Bataan Day, Philippines. 7—Victory Day, France. 9—Liberation Day, Czechoslovakia. 13—Joan of Arc Day, France. 14—Unification Day, Liberia. 16—Discovery Day, Cayman Islands. 21—Armed Forces Day, USA, Navy Day, Chile. 22—National Heroes Day, Sri Lanka. 23—National Labor Day, Jamaica, Victoria Day, Canada, Spring Bank Holiday, Great Britain. 24—Bermuda Day (guess where). 25—Revolution Day, Argentina. 30—Memorial Day, USA. 31—National Holiday, South Africa.

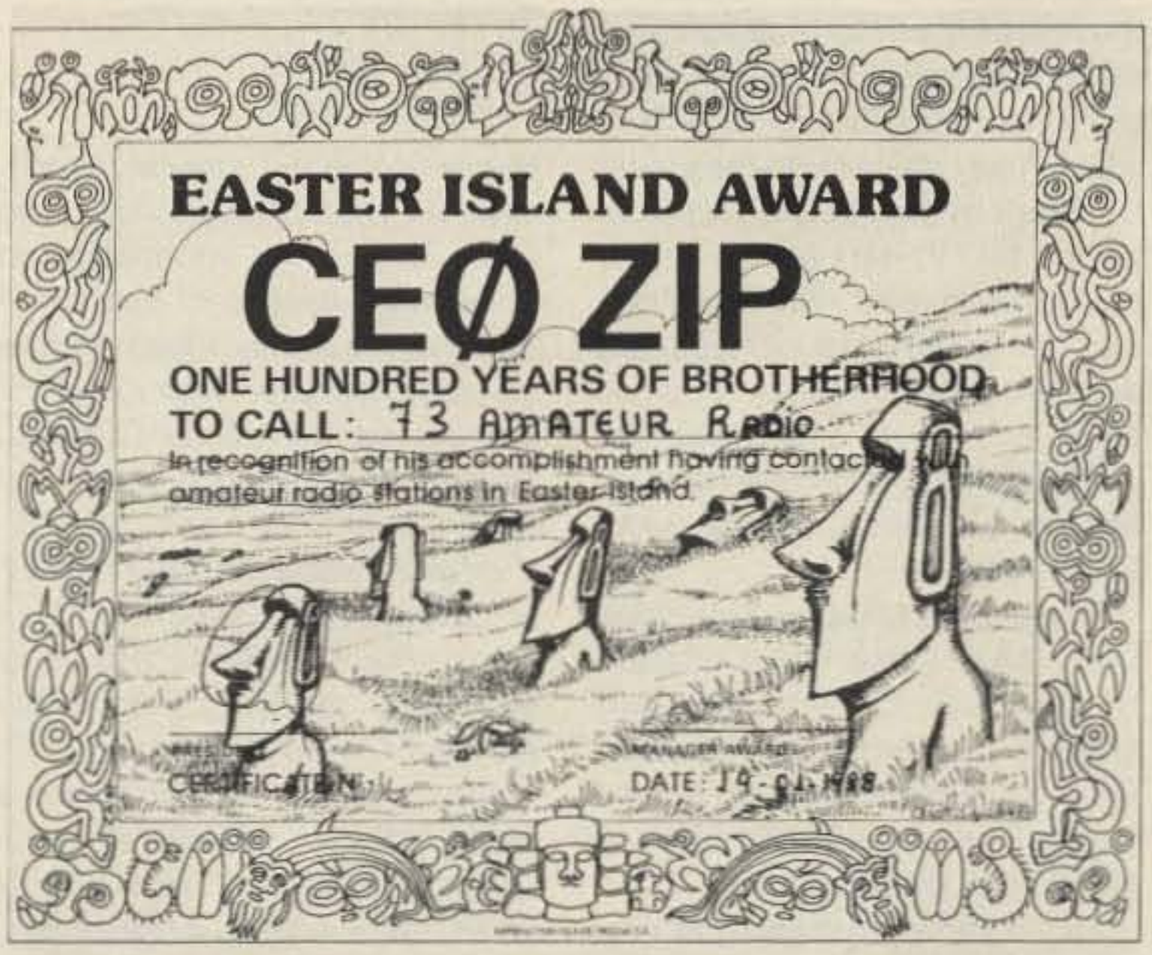
Roundup

Chile (Easter Island). One hundred years ago Easter Island became a part of Chile. The Easter Island Radio Club, Gustavo Westermeier L. CE0ZIJ, president, is making available now to licensed hams and SWLs, the "100 Years of Brotherhood" award (permanent)—the CE0ZIP Award. Required: Four contacts with Easter Island radio stations OR two contacts plus contact with CE0ZIP, any band, any mode. Send US$5 or ten IRCs with a list of the stations worked (or copy of log) to the club's secretary and Award Manager, Patricia Cisternas I. CE0 GHO, PO Box 1, Easter Island, Chile. QSLs not required.

Israel. The youngest ham in Israel is Oded Sharon 4X6NB (was Novice 4X9DDD) who recently passed his Grade B (General) exam. Son of the very proud Yossi 4X1BQ (formerly 4Z4BQ), he is ten years old.

Greece. SV1IW sent in the SV1SV instructions for applying for a permit to operate. Citizens of countries having a reciprocal agreement may receive a permit good for the length of stay in the country up to one year, not renewable. Agreement countries are Canada, Cyprus, Federal Republic of Germany, France, Sweden, and the USA. The proposed Universal form appears to be more than adequate, but have the photocopy of your license notarized, and under Special Information give "the point and manner of entry of the radio equipment into Greece." Send your application to **Ministry of Communications, General Directorate of Posts and Telecommunications, Directorate of Radio Communications Control, Section III 49 L. Syngrou, Athens, Greece.**

U.S.S.R. *73* International obtained a couple of copies of the English editions of *Moscow News* in the hope of finding some items of interest to radio amateurs. The paper has an international reputation as the "flagship of the policy of *glasnost*," according to the London *Sunday Times*. "Its small Russian print of 250,000 is sold out within hours of publication, as readers rush to learn the latest revelations . . . It is no longer foreign correspondents Soviet officials fear most [but Soviet correspondents] with their new investigative edge [who have] become the greatest threat to officials who used to run their domains as personal fiefdoms." To nobody's surprise, we found no items, but how often does ham radio make the pages of any newspaper?

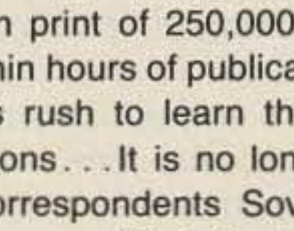


OPERATING PERMISSION IN ITALY

Mario Ambrosi I2MQP, Secretary General of the ARI (Associazione Radioamatori Italiani), has offered to help amateurs who are citizens of countries with a reciprocity agreement with Italy to obtain their license to operate when in his country.

Fill out the Universal Permit Application form in its proposed shape (p. 78, January issue), attach the documents called for, and mail with a fee equivalent to US$10.00 to **Associazione Radioamatori Italiani, Licensing Department, Via Scarlatti 31, 20124 Milano, Italy.** ARI will prepare the necessary legal document, in Italian, and will send the applicant his license to operate for three months (renewable). Complete operating information will be sent with the license (mobile not allowed on HF bands, while permitted on 2 meters and up, etc.). Upon arrival in Italy, the licensee will have to make another small payment of a tax through the post office ("only a couple of dollars," I2MQP writes).

When you submit the application, be sure to enclose a note to Mario Ambrosi expressing your appreciation. *Grazie*, I2MQP!



GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

The Radio Society of Great Britain (RSGB) this year marks its 75th anniversary. What foresight somebody had in the early pioneering days before WWI, before not just the IC and transistor, but before even the thermionic valve! The anniversary will be shared with the rest of the amateur radio world with two special stations, GB75RS and GB75HQ, which will be operating (by the time you read this) on 80 meters during midday and early evening periods (UK time). Start listening because the planned RSGB 75th Anniversary Award is bound to include contacts in its requirements! (Details when available.) As the main celebrations in July approach there will be more activity. The Department of Trade and Industry (our regulatory body) has agreed to an extension of the GB75 prefix to other stations associated with the development of amateur radio.

I have had a number of letters from readers of this column with questions about accessing the RSGB bulletin board as I've previously described it. [*See 73 International for January 1988.—Ed.*] The problems seem to hinge around transmission standards in use and may simply reflect a difference in terminology between the two sides of the Atlantic.

The RSGB system, like most in the UK, is based on the so-called Viewdata standards, defined in CCITT standard V23. There is no directly equivalent ANSI standard, so that US users will need two modems for the asymmetric speeds described below or to acquire a European modem. This is an asynchronous (i.e., character-timed) system using one start and two stop bits per character. The character code is ASCII with some control code/character combinations used which are rather simple graphics, by 1988 standards.

The most important point to note, however, is that Viewdata (also known as videotex and Prestel) uses asymmetric transmission speeds. Host (computer) to user is at 1200 baud whereas to host is at 75 baud. The most common reasons for failing to achieve a satisfactory connection are use of 1200 baud in both directions, and forgetting to accommodate the start and stop bits.

Readers interested in this may also be interested in RTTY and other data activities. Many of these are organized and/or reported on by the British Amateur Radio Teleprinter Group (BARTG), which really moves with the times. Its quarterly magazine, *Datacom* covers RTTY, data transmission, packet radio, and AMTOR. Membership is £11 (£16 per year for airmail delivery). Money orders—or IRCs for more information—to J. Beedie GW6MOK, Flynnonlas, Salem, Llandeilo, Dyfed SA19 7NP, Wales.

The British Amateur Television Club (BATC) also has a quarterly magazine, *CQ–TV*, membership £6. Contact Dave Lawson G0ANO, Greenhurst, Pinewood Road, High Wycombe, Bucks HP12 4DD, England.

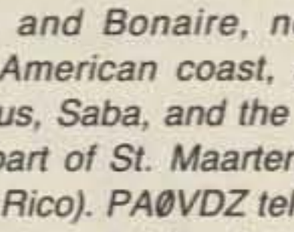
Having now given you addresses in England and Wales, here are a couple, for Scotland and Northern Ireland! Anyone who has worked GB2LNM might like to know that it promotes the LNM—the Loch Ness Monster. For a commemorative QSL and poster send your own QSL confirming a contact or logging, an A4 envelope, and IRCs [*Suggested translation: large envelope and 5 IRCs.—Ed.*] to GB2LNM, PO Box 20, Motterwell, Scotland . . . And GI0HOW collects old radio magazines and books for sale to raise money for the Radio Amateur Invalid and Belfast Club (RAIBC); all donations gratefully received by David Caldwell GI0HOW, 59 Connsbrook Avenue, Belfast BT4 1JW, Northern Ireland.

[*If you use any of these addresses, be sure to say that you got them from G4EJA's fine column in that excellent section, 73 International, of that super-splendid magazine,* 73 Amateur Radio, *Wayne Green Enterprises, Peterborough, NH 03458–1194, U.S.A.—Ed.*]

CEPT AGREEMENT AREAS

(CT, SV, and EA added soon.)

DL
F, FG, FH, FJ, FK, FM, FO, FP, FR, FT, FW
HB9, HB0
JW, JX
LA, LX
OE, ON
PA
3A, 3Y



THE NETHERLANDS

Joseph A. Stierhout PA0VDZ
PO Box 265
6950 AG Dieren
The Netherlands

[We welcome our new correspondent for The Netherlands, who starts us out with information on obtaining a license to operate in Holland. (Assume, unless he tells us otherwise later, that the same procedures will do for Curacao, Aruba, and Bonaire, near the South American coast, and St. Eustatius, Saba, and the Netherlands part of St. Maarten, SE of Puerto Rico). PA0VDZ tells us he is already receiving letters (see his report in the December, 1987, issue) and would appreciate a US$1 bill or an IRC with those requiring an answer. ***(Try to do this with all such overseas letters!)****—Ed.]*

For a guest license here, request an application from **Staatsbedrijf der PTT, Radiocontroledienst, PO Box 570, 9700 AN, Groningen, Netherlands.** [*If PA0VDZ will send us one we will work it in with our Universal Permit Application form.—Ed.*] The form should be filled in completely and signed. Send with it a certified copy of your valid license. (Note: You must be at least 16 years old.) Send Hfl.87 (by international money order is best—mark your callsign on it and also send a photocopy of it), for a one-year permit. All of this must be received by the Post headquarters at least four weeks before the starting date of the permit. [*The guilder, or florin, exchanged at two for a dollar in mid-1987.—Ed.*]

In the Netherlands we have reciprocal agreements with Finland, Great Britain, Ireland, Italy, Sweden, Botswana, Liberia, Sierra Leone, Canada, Jamaica, the U.S., Venezuela, Israel, Indonesia, Australia, and New Zealand. Even better than that, we have the CEPT license agreement (like automatic reciprocal license agreements). The Dutch Postheadquarters was one of the first to accept this agreement, which means that those with European CEPT licenses need not ask for a special license when going to another CEPT country! (See box.)

For a period of five years, March 1, 1988, until December of 1993 we get the 50-MHz band, with these conditions: Every year the permit has to be renewed; we get 50–50.450 on a non-interference basis; crossmode is permitted; CW only, 30 Watts maximum, no unmanned stations, and valid licenses are A, B, and C.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Universal Permit Application. [*See also "Special Requirements," column 2, p. 90, March, 1988, 73 International, if you try to use the Universal form.—Ed.*] Here is a recap of ZL visitor-license requirements for Northern Hemisphere radio amateurs who will be planning summer holidays about now, and for use in connection with the creating of a Universal Permit Application.

Countries with reciprocal agreements with New Zealand include most of the British Commonwealth countries, the French Republic, the Netherlands, Sweden, Switzerland, and the USA. Applications may be made to any of the 18 offices of the NZ Radio Frequency Service (a newly-named office newly under the Department of Trade and Industry, now responsible for amateur radio matters), but in most cases are made to those at the main points of entry: **Aukland** (Telecoms Office, Federal St., Private Bag), **Wellington** (Anvil House, Wakefield St., PO Box 293), and **Christchurch** (St. Elmo Courts, Hereford St., PO Box 1800). Application forms also are available from the NZART Reciprocal Licensing Bureau–ZL3AAA, Mr. R. A. Garlick, 23 Lydia St., Greymouth, New Zealand.

Send the application (in duplicate) along with (1) A valid copy of your operation license, which must indicate Morse speed qualification and grade of license, (2)Birth certificate or valid evidence of date of birth, and (3)Postal address in New Zealand where all correspondence may be sent. Callsigns are issued from the ZL0 series and are valid for 12 months. If application is received three weeks from the date of your arrival, the Visitor license should be ready for you to up-lift at the Frequency Service Office at your point of arrival.

A word about the "new" Frequency Service Office. On April first, last year, our always-amicable association with the NZ Post Office ended and a new one with the other NZ department began. We expect it to be amicable as well if for no other reason than that in many cases the personnel will be the same. One big change: The annual fee for the amateur license went up 40% to NZ$38.50 (about US$65), as part of a move to make the Service self-supporting.

NZART
"HOT SPOT CONFERENCE 88"
Friday, June 3, to June 5,
Whakatane, NZ

COMING TO NEW ZEALAND THIS SUMMER?

Plan your visit around the annual NZART Conference: plenty of technical sessions and social activities. Keynote speaker is William Orr W6SAI, prolific writer and antenna expert. Champagne Breakfast Sunday morning.

For information write me (Des Chapman ZL2VR) or the NZART Conference Committee, 233 King St., Whakatane, NZ.

PHILIPPINES

Leo M. Almazon WA6LOS/DU2
10098 Knight Drive
San Diego CA 92126

Hello everybody! Rumors abound here in DU-land regarding a DXpedition to Spratley Islands early this year. The Philippine Amateur Radio Association (PARA) and Amateur Radio League, Inc. (PARLINC) are the prime movers. It is said that Robin DU9RG and Ralph DU1RFA are planning the logistics and transportation—so stay tuned!

Confusion Department. Now that everybody is used to their callsigns, lo and behold, the National Telecommunications Commission in its infinite wisdom has told all amateurs, regardless of license class, that calls will revert back to using the DU prefix this year. (It used to be that prefixes showed license class: DU for A, DV for B, and DW for C.)

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

KIT, ONLY $675

WIRED $975

VHF OR UHF

FEATURES:

• **SENSITIVITY SECOND TO NONE! GaAsFET front end** on vhf models gives 12dB SINAD of 0.12uV (vhf), 0.15uV (220). UHF model 0.25uV std, 0.1uV with optional helical resonator preamp.

•**SELECTIVITY THAT CAN'T BE BEAT!** Both 8-pole xtal filter & ceramic filter for **>100dB at only ±12kHz.** Helical resonator front end to combat desense & intermod.

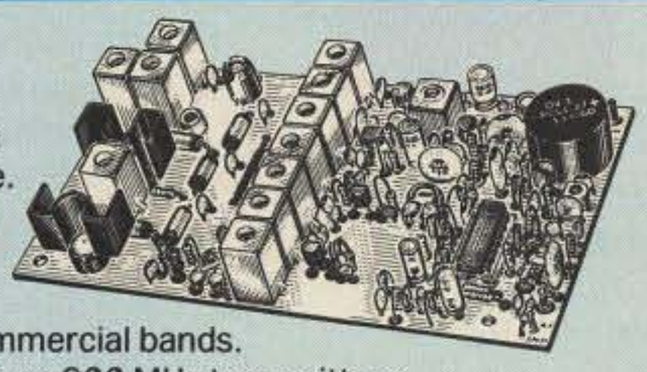
•**CLEAN, STABLE TRANSMITTER,** up to 18W output standard; 50W with accessory power amplifier.

•**FCC TYPE ACCEPTED** for commercial high band and uhf.

•**Courtesy beep,** field-programmable CWID, flutter-proof squelch, automatic frequency control to compensate for off-frequency transmitters (all standard features).

•**Full range of options** available, such as autopatch, phone line or radio remote control, sub-audible tones, duplexers.

HIGH PERFORMANCE TRANSMITTERS & RECEIVERS FOR REPEATERS AUDIO & DIGITAL LINKS, TELEMETRY, ETC.



•**FM EXCITERS:** Kits $99, W/t $179. 2W continuous duty. TCXO & xtal oven options available.

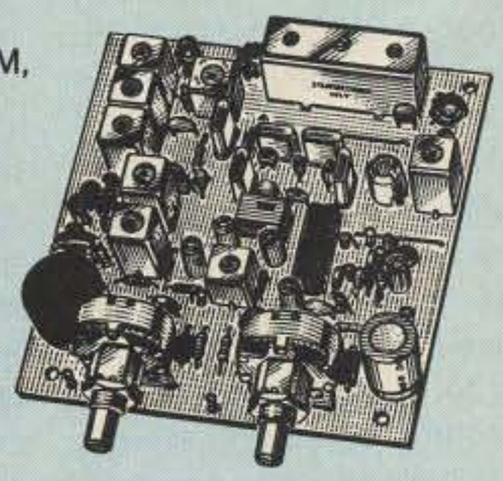
•**TA51 for 10M, 6M, 2M, 150-174, 220 MHz.**

•**TA451 for uhf.**

FCC type accepted for commercial bands.

•Call for latest information on 900 MHz transmitters.

•**VHF & UHF AMPLIFIERS.** For FM, SSB, ATV. Output from 10 to 50 Watts. Several models, kits starting at $79.



•**R144/R220 FM RECEIVERS** for 2M, 150-174, or 220 MHz. **GaAs FET** front end, 0.12uV sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere)! Flutter-proof squelch. AFC tracks drifting transmitters. Kit $149, w/t $229.

•**R451 UHF FM RCVR.** Similar to above. Tuned line front end, 0.25uV sens. (0.1uV with optional hel. res. preamp). Kit $149, w/t $229.

•**R901 FM RCVR FOR 900 MHZ.** Triple-conversion, GaAs FET front end, 0.2uV sens. Kit $169, w/t $259.

•**R76 ECONOMY VHF FM RCVR** for 10M, 6M, 2M, 220. Without hel res or afc. Kits only $129.

•**Weather satellite & AM Aircraft receivers also avail.**

FCC TYPE-ACCEPTED TRANSMITTERS & RECEIVERS AVAILABLE FOR HIGH-BAND AND UHF. CALL FOR DETAILS.

GaAs FET PREAMPS at a fraction of the cost of comparable units!

LNG -(*) GaAs FET PREAMP

ONLY $59! Wired/tested

FEATURES:

•**Very Low Noise:** 0.7dB VHF, 0.8dB UHF

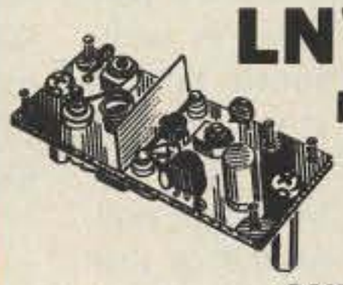
•**High Gain:** 13-20dB, depending on frequency

•**Wide Dynamic Range:** to resist overload

•**Stable:** new-type dual-gate GaAs FET

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

LNW -(*) MINIATURE GaAs FET PREAMP



ONLY $24/kit, $39 Wired/tested

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

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

LNS-(*) IN-LINE PREAMP

ONLY $79/kit, $99 Wired/tested

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

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

HELICAL RESONATOR PREAMPS

Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

MODEL HRA-(*), $49 vhf, $84 uhf.

** Specify tuning range desired: 143-150, 150-158, 158-162, 162-174, 213-233, 420-450, 450-465, or 465-475 MHz.*

NEW HIGH-SPEED DIGITAL RF LINKS

You've waited a long time for a simple, reliable, **low-cost 9600 baud PACKET NETWORKING system.** Now you've got it! Our new MO-96 MODEM and direct FSK Transmitters and Receivers for 220 or 440 MHz interface directly with most TNC's. Fast diode switched PA's output 15 or 50W. **Call for complete info on the right system for your application.**

ACCESSORIES

•**COR-3** Kit. Control ckts and audio mixers needed to make a repeater. Tail & time-out timers, local spkr ampl, courtesy beep $49

•**CWID** Kit. Field programmable, timers, the works $59

•**TD-2 DTMF DECODER/ CONTROLLER** Kit. Full 16 digits, switches 5 functions, toll call restrictor, programmable, much more. Great for selective calling too! $79

•**AP-3 AUTOPATCH** Kit. Use with above for repeater autopatch. Reverse patch and phone line remote control std. $79

•**AP-2 SIMPLEX AUTOPATCH TIMING BOARD** Kit. Use with above for simplex autopatch $39

•**MO-202 FSK DATA MODULATOR** Kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

•**DE-202 FSK DATA DEMODULATOR** Kit for rcvr end of link $39

RECEIVING CONVERTERS

VHF MODELS

Kit with Case	$59
Kit less Case	$39
Wired w/case	$89

UHF MODELS

Kit with Case	$69
Kit less Case	$49
Wired w/case	$99

Antenna Input Range	Receiver Output
28-32	144-148
50-52	28-30
50-54	144-148
136-138	28-30
144-146	28-30
145-147	28-30
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25
902-928	422-448
902-922	430-450

See catalog for full line of 2w transmitting converters for vhf & uhf. Kits only $79. Linear Amplifiers avail. up to 50 w.

• **Send $1 for 36 page catalog by return mail.**
(Send $2.00 or 4 IRC's for overseas mailing)

•**Order by phone or mail • Min $3 S & H per order**

•**Use Visa, Mastercard, Check, or UPS COD.**

Our 25th Anniversary

hamtronics, inc.

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Phone:716-392-9430 *Hamtronics® is a registered trademark*

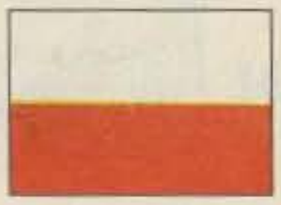
Typical PARL bull session, with Tony DU1LOG, PARL president, standing in background.

If that's not enough, district changes were made by the NTC last May. DU2s are now DU3s, part of the DU6s are now DU7s, and DU9s are now DU8s except for those who are internationally known and were allowed to keep their original prefix.

Don't try to figure it out—you'll go bananas. Come to think of it, I just worked a W1, and his QTH was Seattle, Washington, which is in W7-land!

Club Department. If you are a DX certificate-chaser, you probably are familiar with the UN-DU Award, which requires working all the member countries of the United Nations. (Submit a notarized QSL list to PARLINC headquarters, here in Metro Manila.)

PARL Inc. is a unique ham organization here in DU-land. Incorporated in 1962, prospective members are screened by a membership committee to establish their character and credibility. You must be a licensed amateur and have an interest in DX and/or state-of-the-art technologies. Most of the gatherings and eyeball QSOs are, therefore, in these subject areas. DU1RFA is the current chairman; a former airline pilot, he is an avid DXer. Meetings are every Wednesday noon in a restaurant in the Broadway Centrum shopping mall. Any DXer who would like to join should contact DU1RFA at PO Box SM159, Metro Manila 2806, Republic of the Philippines.



POLAND

Jerzy Szymczak
78–200 Bialogard
Buczka 2/3
Poland

Pieces of Information

•In January 1987 Jerzy Rutkowski SP5JR presided over a plenary session of PRRA. In addition to regular business, honors were awarded to many, including PA0LOU, president, G3FKM, secretary, LA4ND, treasurer, and the chairmen of teams of the I Region of the IARU, DF1FL and PA0QC.

•As of April reporting, the leaders [*top three reported here, only—Ed.*] of the SPDX Contest were, CW: SP6RT, SP7HT, SP2AJO; Phone: SP9VU, SP5BT, SP5EAQ; Mixed: SP7HT, SP6RT, and SP9PT.

•In May, a Presidium of PRRA Headquarters discussed preparations for Quick Telegraphy and Amateur's Radiolocation Championships, and recognition was awarded to radio stations which worked with the cities visited by Holy Father John Paul II.

•Also in May, Slupsk (Central Pomerania) was the site of the gathering of members and friends of the Radiovideography Club of PRAA to discuss new shortwave techniques, particularly in SSTV, RTTY, MSTV, FSTV, ATV, FAX, and DATA. Computer techniques in shortwave and everyday life also were discussed. The most active ham stations working RTTY are SP9BCH (60 countries confirmed), SP3CMX (54), and SP3GAX (45). On SSTV, SP2JPG had 49 countries confirmed, SP3LPM had 23, and SP3CMX had 11.

•The annual prize, "Ham of 1986," went to Ryszard Grabowski SP3CUG for his many activities in SW and USW on behalf of Leszno's District Ham Association, one of the liveliest organizations in Poland. In 1986, the number of hams in the District increased 30%, bringing the total by year's end to 90, plus 31 SWLs. Scout's clubs with most members were SP3ZAH, -ZHW, -ZFR, -ZFH, -ZSA, and -ZGI. The Club of National Defense League SP3KBW and of PRAA SP3PEI together have 27 senders.

TAIWAN

Tim S.H. Chen BV2A/BV2B
PO Box 30–547
Taipei, Taiwan, 107
Republic of China

In the wake of close cooperation with the Japan Amateur Radio League and the China Radio Association, there have been six expedition groups dispatched from Japan to BVland since 1984. Each group consisted of four to ten OMs and YLs, all enthusiastic about DXing, so they gave new opportunities to people for a new DXCC award.

Beside 7, 14, 21, and 28 MHz, they have obtained special permission to operate on 3.5, 1.8, and satellite communications, which are not allowed to domestic hams. Also, the fifth JARL mission, led by JA1UT, was especially keen about 50-MHz and 29-MHz FM experimenting. The VHF transciever, IC-551, and a six-element yagi were installed at the BV2B QTH, on top of a 13-story building, much to the appreciation of all operators. Over 1,600 QSOs were made between June 5–10, 1987, including some with Korea and Guam. Considerable contacts were made on 80 and 160 meters as well, from another suburban location; 29 MHz was not interesting due to poor propagation.

Japanese hams are tireless in this field of amateur activity. A sixth expedition is due (at this writing) to have a RTTY demonstration; it is to bring a 9000E terminal unit and an RP80 Marker 2 printer as well as a CRT. A special callsign for the unit was assigned: BV0RY, for operation on 14,070–14,100, 21,070–21,100, and 28,070–28,100 alternatively. We hope that the next demonstration will be of SSTV.

In spite of the impossibility of offering visitors permits to operate, arrangements can be made for individual visiting ops to operate. *[See March issue, page 90, column 2.—Ed]* And the DX Family Foundation of Japan (DXFF) has furnished us with special QSL cards for visitors' QSOs. *[See illustration.—Ed.]* The visitor is to fill out the cards himself. Please feel free to contact me if you plan to visit our country and to give a shout on the air. Be sure to send me a photocopy of your valid license. Do NOT bring any transceiver unless you have permission of the Ministry. Additional formalities are required as well as a fee, and it takes a month or so. In fact, however, there is no need to bring in any rig. You will find here the convenience of using our facilities, for CW and SSB on 7, 14, and 28 MHz. 73

PARL, Inc. OT DU1RFA (Ralph)) above XYL with Alex DU1AL at right.

Continued from p. 6

human plankton and turn them into scientists.

Let's imagine the text book of 1999, only eleven years from now. I see it as a monthly magazine, making it possible for the material to be up to date in a way never even imagined for text books. In the monthly text on the fundamentals of electronics is a chapter on how alternating current was invented by Nicola Tesla—the brilliance of the idea and how it solved the problems of delivering electricity over long distances. Another chapter might discuss the foundations of computer languages and chip instruction sets. Then there'd be a column on hamming—perhaps showing a QRP rig kids could build. There'd be a column on science fair projects—maybe reviewing a new superconductivity kit from Edmund Scientific. One on school computer clubs—perhaps encouraging them to network with other school clubs via ham radio or the telephone. I'll bet we could generate a generation of science hobbyists.

Of course this could unleash a lot of new hams. With about four million kids in each grade, all exposed to the ham virus via the ham column, who knows? We might have a million hamlets running around with home-made DF gear, going on fox hunts every weekend. Other kids would be doing videos of the fun to swap with other school video clubs . . . making more hams. Young hams would be expanding our satellite communications, setting new records for miles per watt on QRP, working 400 countries with under one watt using digital communications.

Could all school courses be taught with monthly magazines? Why not? Most subjects can be turned into living experiences. History can be fascinating. Ask anyone who'd read some of the Harold Lamb paperbacks. None of that crummy names and dates memorization crapola. Just think of how many great historical movies there are that could be made available on video tape as educational assists!

And at every turn, kids could be encouraged to learn more on their own; to join groups to learn. Kids could research their own city or town history and do their own video on it or put together a book. With desktop publishing so inexpensive and simple, this tool will soon be available to many school students.

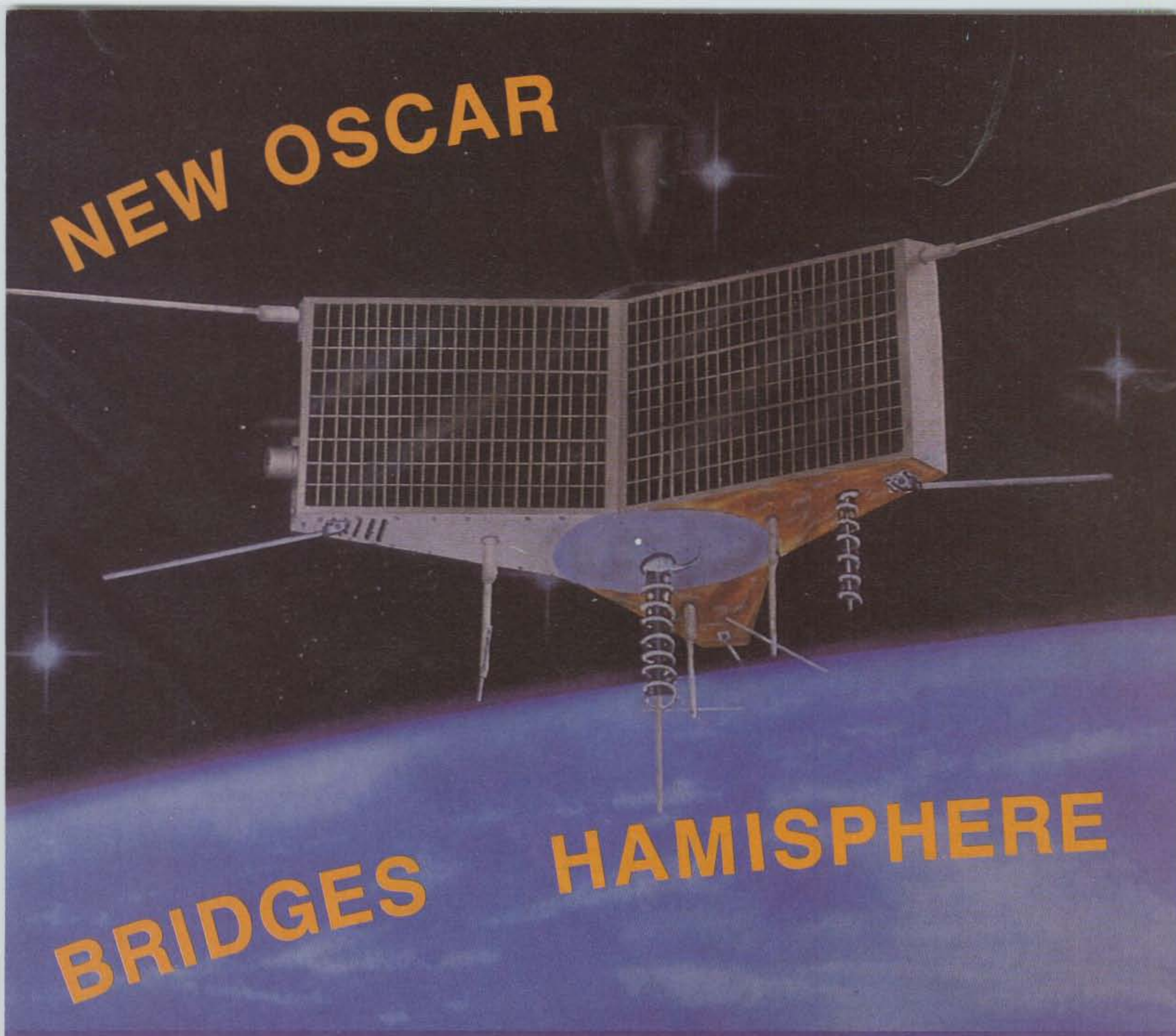
Then there's the insect world, much of which has yet to be studied in depth. Even a monthly magazine type of text would have difficulty in keeping up with the kids if they got interested in bugs. You know, in all of history, man has yet to exterminate one single species of insect? And not for having failed to try.

Math, too, can be fun. Math is a living science. Every now and then you read of a youngster who's solved some long-standing math problem. When I was in high school we had a math club where kids enjoyed the challenges of math together. A magazine would make it possible to bring the excitement of math to many more kids.

Dast we teach politics? Probably not. If the kids ever got wind of what a screwed up mess Congress is, there'd be a revolution. Not that we couldn't use one to bring that bunch to heel and get them to running the country as was originally intended instead of blowing with the breezes set up by wads of money being riffled by lobbyists and PACs. Phooey.

And if politics is off limits, imagine the howl that would go up if there was a move to start teaching about religions in school! Whoooey, what an explosion that would make! We don't want thinking when it comes to religions, we want brain washing and don't you forget it. Get those kids when they're small so we can keep up those holy wars going. Uh, oh. I've gone too far, and now you're disagreeing with me. Not logically, of course, it's just that I'm wrong somewhere there . . . right? Sure I am.

Drat, now you're not going to write me in for Veep in November. 73



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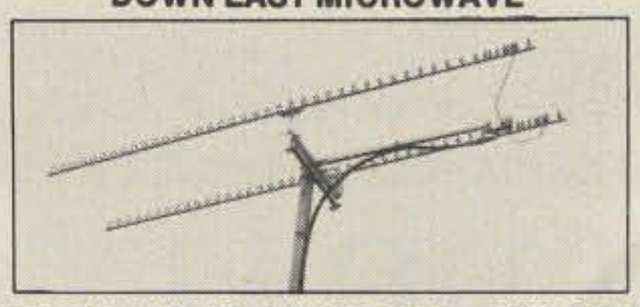

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LETTERS

From The Ham Sack

Thank you for the excellent February issue of *73*. I am an avid QRPer and found something of interest in almost every article. I appreciate the monthly space you devote to QRP and hope you will continue to cover it in more detail.

I have a suggestion. Since all of Wayne's editorials sound the same, would it be possible to simply send out a copy of one editorial to all new subscribers and use the space for more QRP articles?

Charles E. Cole
Williamsport, PA

I am following "Drifting Along the Telegraph Trail" by W6CK with great interest. Dad was a telegrapher with the Atlantic Coast Line RR for 52 years, Mother for 26 years, and for 14 years I worked on the branch line, main line, relay office, ticket office, and yard office. Back then the word "ham" was a derogatory term; literal translation: "Amateur." If you called a fellow telegrapher an "amateur," you could look forward to a fist-fight when the next train came into your station.

If I could find a job as a professional telegrapher handling trains paying one-half of what I make now, I think I would leave today. Once telegraphing gets in your blood, you are hooked for life.

Bill G. Perry, Sr., Ph.D,
President
Morse Telegraph Club,
Tampa Chapter

Earlier this year, we had a little money left in our library magazine fund, so I suggested ordering *73 Amateur Radio*.

Our school has a growing amateur radio club (we were mentioned in your September issue), and I thought this would give the kids something to read besides *Mad Magazine* during their free time.

Anyway, we waited . . . and waited . . . and waited.

No *73 Amateur Radio*.

When queried, the vendor assured our librarian that he had, indeed, ordered the magazine, but that these things take time, and we should be patient, etc., etc., etc.

Finally it came: *Amateur Radio*.

Not *73 Amateur Radio*—just *Amateur Radio*! From Australia!!

It seems that there is this Australian magazine with a very similar name to our beloved publication, except it doesn't include the numbers "73" in its name.

So listen up, librarians: When you order *73 Amateur Radio*, make sure they don't leave off the *73*.

Otherwise, you'll be reading about how they do things Down Under instead of in Peterborough.

And Wayne wouldn't like that one bit!

Craig Dible KB6LAK
Beverly Hills CA

I agree with your efforts to promote progress in hams' communication techniques. I am an "old timer" first licensed as a ham at the age of 19 in 1929. Prior to that, I was involved with crystal detectors, loose couplers, and bootleg spark transmitters. But I always pushed for progress in our hobby. I don't subscribe to the philosophy of hanging on to the old way.

Harry D. Minshew W6ZOW
Saginaw TX

KD5AE's propagation program in the January 1988 issue was most interesting. His propagation program has been embellished and adapted to the Atari ST computer. ST users can obtain the program on disk from the address below for a self-addressed, stamped disk mailer plus $3 to cover incidental expenses, and a formatted 3 ½-inch disk.

Marion D. Kitchens K4GOK
Oakton VA

Your readers should know two things about the Maxcom device (reviewed in March 1988) to better understand how to properly install the unit:

1. The Maxcom device does *not* work well with a resonant length of wire. The 128′ dipole is seen resonant in the 80 meter band, and the 70′ dipole is seen resonant in the low end of the 40 meter band. By simply lengthening both dipoles a few feet, better results would have been obtained.
2. Being a grounded, non-resonant device, height above ground

is important, just as is configuration of the radiators. A height of 25' or more above ground produces superior radiation characteristics. Because the electromagnetic field generated by the Maxcom device is parallel to the radiators, lifting the ends of the dipole up towards horizontal will eliminate a major portion of RF energy from being absorbed by ground.

A new publication entitled *Maxcom Theory of Operation and General Notes* is available free for the asking.

Sonny Irons
President of Maxcom Inc.
Ft. Lauderdale, FL

Your January 1988 issue was the first I'd read in 10 years. I thought it was excellent.

I've been away from ham radio since the late 70s. No time, no money, no interest. I've kept my license, but it wasn't until I picked up your magazine that the interest rekindled.

Seems like a lot has changed. Looks like Collins, Drake, and others are no more, lots of VHF/UHF/micro activity, no more *crystals*, and something called packet radio? Naturally, I would like to see more articles for those of us less experienced or not-yet hams, but your article mix looks pretty fair–*something for everyone*. Keep up the good work!

Thanks for sparking my interest.

Mark Unland WB9VTN/5
Jefferson LA

First of all I want to congratulate you on an excellent issue of *73 Amateur Radio*. I saw your January issue #327 at the local newsstand while looking for my favorite fishing mag.

The article on 100 countries in two days caught my eye. I, too, participated in the Golden Jubilee and I wanted to see how others fared. One item in particular needs clarification. Jay W6GO is to be congratulated for his accomplishments and his station. The #1 trophy from the DX Bulletin is surely very nice and he has every right to be very proud of that award. But this award was available only to the subscribers of the DX Bulletin, published by Chod Harris. I had completed my Golden Jubilee in only 44 hours 10 minutes, but did not qualify for the trophy because I was not a subscriber. Unfortunately, all DXers did not have the opportunity to compete for this trophy. There were a number of operators that were in the running. My Golden Jubilee Award, dated January 6, 1987, holds an important place on my wall, and it will continue to hold great memories of what fun DXing can be. Just share with your readers the whole story.

Richard Lyle KA2AJT
Oswego NY

We recently received a letter and magazine from Iran which I feel may be of interest to your readers as well as the amateur industry. This magazine purports to be a publication for the Iranian electronics enthusiast. Further examination revealed that they also claim to be the only "official sanctioned" magazine of its type in Iran. I doubt the Iranian government would encourage this publication to seek equipment sources in the USA unless motivated by a desire more serious than helping the local electronics enthusiast.

As you are no doubt aware, amateur equipment is often used in third world countries as a less expensive alternative to commercial (or military) gear. It seems that this letter may be a thinly disguised attempt by the Iranian government to acquire equipment suitable for use in their war against the "Great Satan."

I contacted the Dallas FBI office and have turned this material over to them. I also checked with the US Dept. of Commerce and was informed that there is a complete trade embargo against Iran in effect, with the exception of medical supplies.

Since I suspect that other companies in our industry may have received similiar letters, I hope that you can help spread the word that exportation of amateur gear to Iran is illegal, and that any correspondence of this type should be submitted to the proper authorities.

Tony Martin
Marketing Manager for Hustler

In the March '88 copy of *73 Magazine* I noticed that a minor error appears in the drawing for "Ultra-Convenient Mobile Antenna for Two Meters" (p.28).

The "ORG" wire goes from the "RLY" box to the #2 "GRN" wire. In the drawing, "ORG" is printed above the motor-drive housing on the MT-2 ANT assembly.

Ivan T. Lorenzen W4JC
Merritt Island FL

Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of $595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for $59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.

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OP ED

by Larry Ledlow, Jr. NA5E

DREAMING OF THE STARS

I am a child of the Space Race. To be sure, the Soviets launched Sputnik 1 just weeks before my arrival on this planet. In elementary school the teachers rolled televisions into the classrooms, and we all watched with wonder and amazement as more and more Americans entered space and eventually touched the surface of the Moon.

I focused my attention on the stars and planets. My future was "out there," I thought to myself. I dreamed of studying rocks from the Moon and Mars, living on a space station or in a lunar colony. The accomplishments of the Apollo and Skylab programs fueled my dreams like a gale fanning a forest fire. I burned with excitement and anticipation. Some day I would have my turn in space.

Poor Planning

Then came the Space Shuttle, a promised panacea more than a decade in the making; a project that literally killed off most other civilian space programs by siphoning their life-giving funds away. Most of our space eggs were in the Space Shuttle basket when *Challenger* disintegrated over the Atlantic Ocean two and a half years ago.

There are no more Saturn V-class heavy launch vehicles that took us to the Moon or put up Skylab. The rockets that do remain have had troubles of their own, and advanced communications, scientific, and national security payloads sit in moth-balls waiting for their turn in space . . . whenever that will come is anyone's guess.

The ambitious, optimistic planning that went into the Space Shuttle at the expense of other programs seriously failed to deliver the project's promises. A shuttle-based nirvana turned out to be a pipe dream, the smoke of which we saw 71 seconds after *Challenger*'s launch in January 1986.

A Different Approach

In *Aviation Week and Space Technology* the Soviets now advertise the availability of their *Proton* space booster for commercial launches. The Soviet space program was ahead of ours in 1957, and it's ahead now. The USSR launches more than 100 satellites per year into space. They have a large inventory of launch vehicles. Further, they have had an almost continuous manned presence in space for a decade!

They have achieved this position by consistently pursuing a number of technology fronts at relatively low levels over a long period of time.

Two lessons are very clear. First, any long range, high-technology program that depends on a single achievement has an inherent possibility of single-point failure. If the achievement does not occur, either the entire program will fail, or at least an alternative solution will cost a great deal more money and time.

Given the same money and expertise poured into the Shuttle program but applied to a number of different space projects, the Space Shuttle would have taken longer to develop. In light of the *Challenger* disaster, however, our technology base would have been broader and better able to cope with failure of any one element of the space program.

Hence, the second lesson: In the long run, many small technological successes are generally better than a single big one. The Soviets have proven that. They realized long ago that a sustained presence in space depends not on getting there "firstest with the mostest," but rather getting there and STAYING there. A broader technology base makes us better able to cope with changing conditions and goals, not to mention provides more spin-offs to improve our everyday lives.

In a very real sense I feel cheated by the short-sighted planning of the generations before me. Certainly the space science programs I wanted to participate in were dead long before I had a chance to get involved. Further, I will probably never visit space, much less live there.

Nevertheless, I have found a way to get involved "out there" by supporting amateur radio in space.

Amateur Radio in Space

Hence, hams have a role to play in our future "out there." Thank goodness for the insightful proposals and projects laid down by the founders of Project OSCAR—which began in 1959! The Radio Amateur Satellite Corporation (AMSAT) has evolved into an international, cooperative group to support continued technological achievements in space. Compared to the multi-billion dollar Shuttle or a $500 million surveillance satellite, an OSCAR seems like a small piece of the space pie. Recall, however, lesson #2 above.

AMSAT's achievements are significant in two ways. In the short term, they promote the advancement of amateur radio. In the long term, they promote a broader technology base with which to improve our future, not only in space, but also in other aspects of our lives as Earthlings.

Our future is "out there," alright. How lucky we hams are to have an opportunity to play a role in shaping the future for the world. Even if you don't use amateur satellites, take a stake in the future by supporting AMSAT and other organizations devoted to amateur radio in space. 73

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Work the bands quickly and easily with a wealth of microprocessor-controlled commands:

Jump between the separate VHF and UHF VFO registers. Program each of the ten memories for instant recall of repeater input and output frequencies, odd splits, and tone encode/decode.

Scan the memory channels, the entire band, or a band segment. And return to any special frequency with the priority feature.

Use link repeaters by programming TX on one band and RX on another.

Conserve power with the battery saver. It lets you monitor silently while drawing negligible current. And measure your battery level with the digital battery voltmeter. There's even a "Low Battery" LED.

Finally, your operation is rounded out with features like VOX capability. A one-touch repeater reverse switch. An LCD readout with illumination lamp. A high/low power switch. Remote computer control capability. An optional CTCSS module. And Yaesu's full line of optional accessories.

So step up your operating capability now with the logical choice in HT operation.

Yaesu's dual-band FT-727R.

YAESU

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ACTUAL SIZE FRONT PANEL

TM-721A

Deluxe FM dual bander

The Kenwood TM-721A re-defines the original Kenwood "Dual Bander" concept. The wide range of innovative features includes a dual channel watch function, selectable full duplex operation, 30 memory channels, extended frequency coverage, large multi-color dual digital LCD displays, programmable scanning, and more with 45 watts of output on VHF and 35 watts on UHF. TM-721A—Truly the finest full- featured FM Dual Band mobile transceiver!

- **Extended receiver range** (138.000-173.995 MHz) on 2 meters; 70 cm coverage is 438.000-449.995 MHz. (Specifications guaranteed on Amateur bands only. Two meter transmit range is 144-148 MHz. Modifiable for MARS/CAP. Permits required.)
- **30 multi-function memory channels.** 14 memory channels and one call channel for each band store frequency, repeater offset, CTCSS, and reverse. Channels "A" and "b" establish upper and lower limits for programmable band scan. Channels "C" and "d" store transmit and receive frequencies independently for "odd splits."
- **Separate frequency display for "main" and "sub-band."**
- **45 Watts on 2 meters, 35 watts on 70 cm.** Approx. 5 watts low power.
- **Call channel function.** A special memory channel for each band stores frequency, offset, and sub-tone of your favorite channel. Simply press the CALL key, and your favorite channel is selected!
- **Automatic Band Change (A.B.C.)** Automatically changes between main and sub-band when a signal is present.
- **Dual watch function allows VHF and UHF receive simultaneously.**
- **CTCSS encode/decode selectable from front panel** or UP/DWN keys on microphone. (Encode built-in, optional TSU-6 needed for decode.)
- **Balance control and separate squelch controls for each band.**
- **Dual antenna ports.**
- **Full duplex operation.**
- **Programmable memory and band scanning, with memory channel lock-out and priority watch function.**
- **Each function key has a unique tone for positive feedback.**
- **Illuminated front panel controls and keys.**
- **Dimmer control.**
- **16 key DTMF mic. included.**
- **Handset/remote control option (RC-10).**
- **Frequency (dial) lock.**
- **Supplied accessories:** 16-key DTMF hand mic., mounting bracket, DC cable.

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

TM-721A shown with optional RC-10

Optional Accessories:
• **RC-10** Multi-function handset/remote controller • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SW-100B** Compact SWR/power/volt meter • **SW-200B** Deluxe SWR/power meter • **SWT-1** 2m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-40** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-4000** Dual band mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

KENWOOD

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