International Edition

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Issue #282

73 T.M.

Amateur Radio's Technical Journal

A Wayne Green Publication

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23 reports

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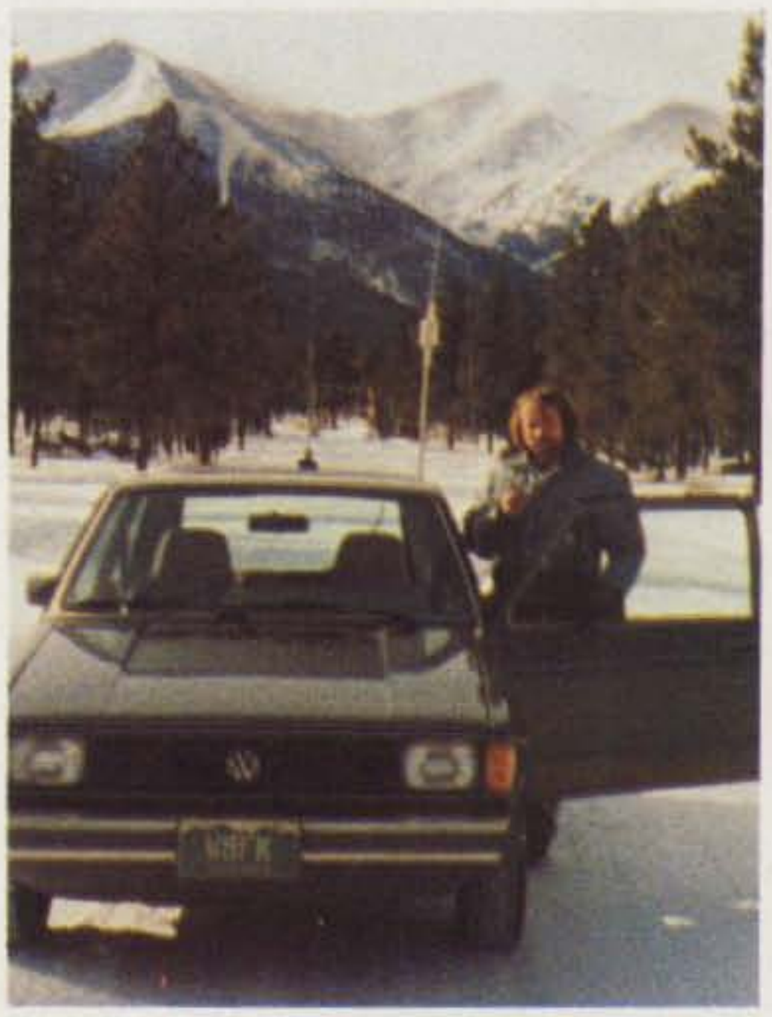
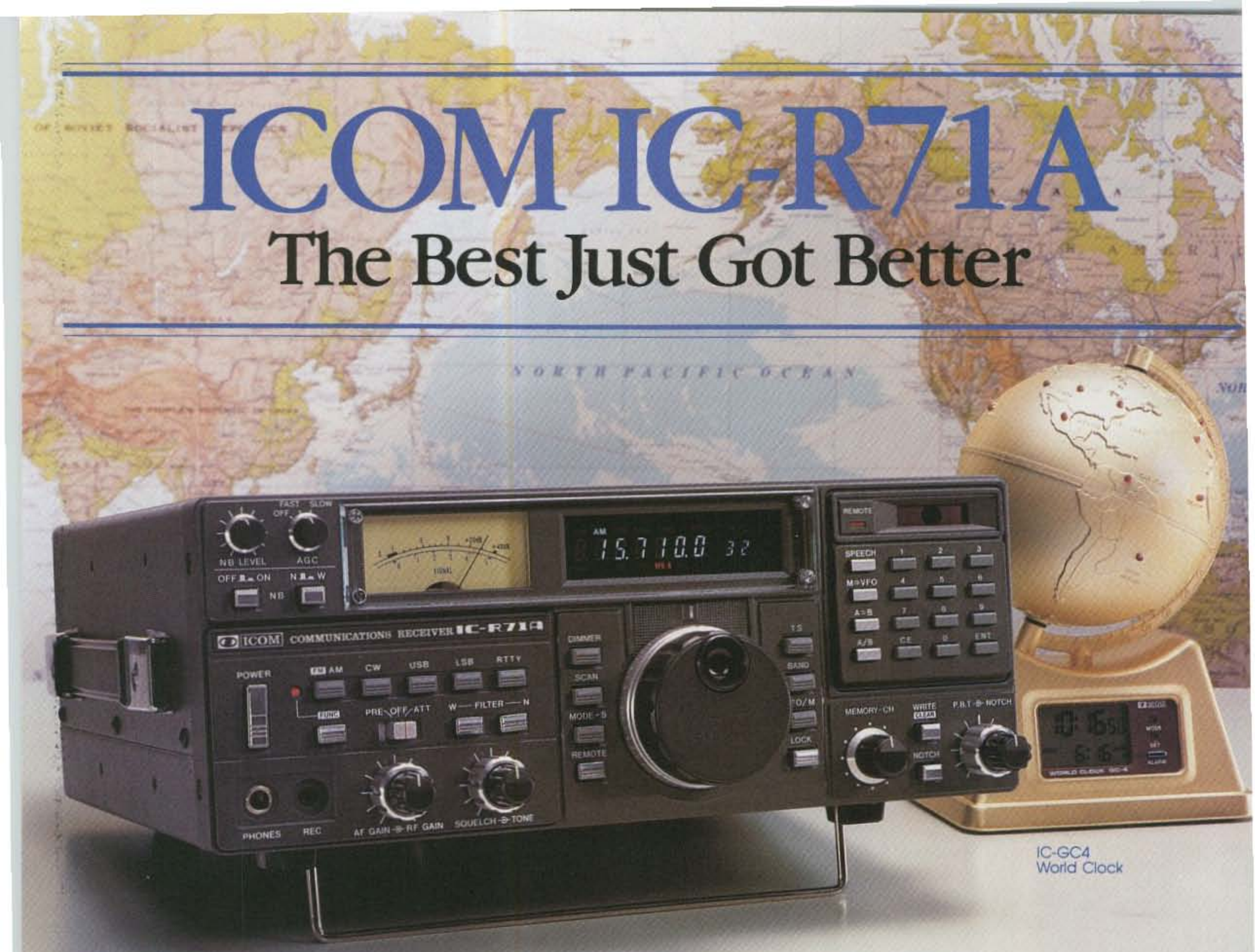


Searching—40

ICOM IC-R71A

The Best Just Got Better



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W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

VIC CLARK W4KFC

News that Vic, the president of the ARRL, had died of a heart attack reached me at Comdex. I was very sorry to hear that, for Vic was undoubtedly the best president the League has had in many, many years. Indeed, I'd been working with him on the FCC's National Industry Advisory Committee just weeks ago and he had given me a lift to the airport after the meeting, giving us a chance to talk in private. I had a lot of hopes that *73* and *QST* would be able to work more closely as a result of our talks since it was obvious that our end goals were similar. Obviously, that wasn't anything I could write about while Vic was alive, and it becomes irrelevant now that he's a silent key.

What a relief it was when the ARRL board elected a president with some brains and with more of an interest in helping amateur radio than basking in the glory of being president. Vic didn't see the presidency as an honor, but as a challenge.

He had his hands full, keeping him from being able to make fast headway. On the one hand, virtually all of the dedicated League old-timers had gotten fed up with Baldwin when he was General Manager and left HQ. And there were still far too many CW-forever old-timers on the board, fighting change at every turn. But despite these serious handicaps, Vic was making progress.

Vic, like past president Herb Hoover, Jr., was interested in what he could do for amateur radio. We've had a serious loss.

HELLO, *COLUMBIA!*

W5LFL went up while I was off at the Comdex show in Las Vegas, so I missed the first few orbits. Comdex is a computer show—about 1,400 exhibits and 5,850 booths this year. That allows about one minute per exhibit—20 seconds per booth if one does not eat, rest, or go to the bathroom during show hours. It does not allow time to whip out an HT and try for W5LFL.

Since a surprising percentage of the successful computer firms are run by hams, I had a steady stream of 'em coming to the Wayne Green booth to say hello all through the show. Many of these chaps got fired up by my editorials back in 1975 and 1976 when I pointed out that hams had an edge in computers and that microcomputers were going to turn out to be a huge business eventually.

Once back home, I checked with the managing editor of *73* to find out the *Columbia* orbit schedule. Armed with that and the frequencies to be used, I headed for my ham shack. Split frequency can be a problem, but fortunately I had the KLM OSCAR rig handy.

The repeater antenna should do the job okay. I hooked it to the KLM and started looking through the pile of microphones for the right one. I tried one after another with the four prongs.

Continued on page 130

ENCODED CODE

Congratulations to Verle D. Winningham K8VW of Fenton MI, winner of our first "Encoded Code" contest (January, pages 46-50). Other top finishers (in order) were Perry Donham KK2Y (Barneveld NY), Donald Bailey KB5BD (Nocona TX), David Rollins W7ILN (Las Vegas NV), Ron Sinclair KA1KTI (Epping NH), and Paul Gili N1CES (Brookline NH).

The solution is: "FIRST DECODING MAILED BURNETT YIELDS FIFTY DOLLARS." No, we're not going to tell you how to get it. Yes, "winning ham" sounds a little fishy to us, too.

QSL OF THE MONTH

To enter your QSL, put it in an envelope along with your choice of a book from *73*'s Radio Bookshop and mail it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries not in envelopes or without a book choice will not be accepted.

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- SP-430 external speaker.
- MB-430 mobile mounting bracket.
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- AT-130 compact antenna tuner, 80-10 m, incl. WARC.
- FM-430 FM unit.
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- YK-88SN (1.8 kHz) SSB filter.
- YK-88A (6 kHz) AM filter.
- MC-42S UP/DOWN hand mic.
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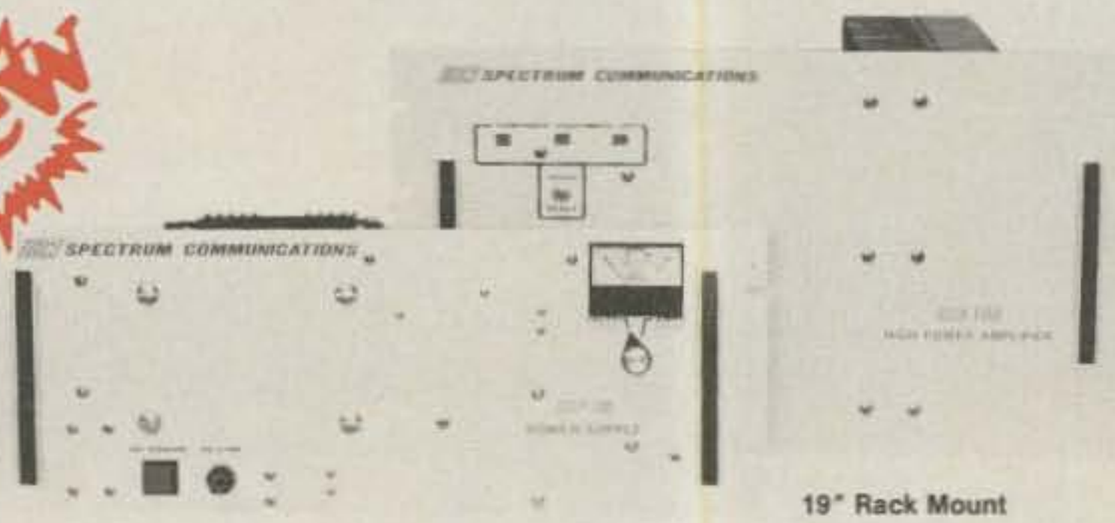

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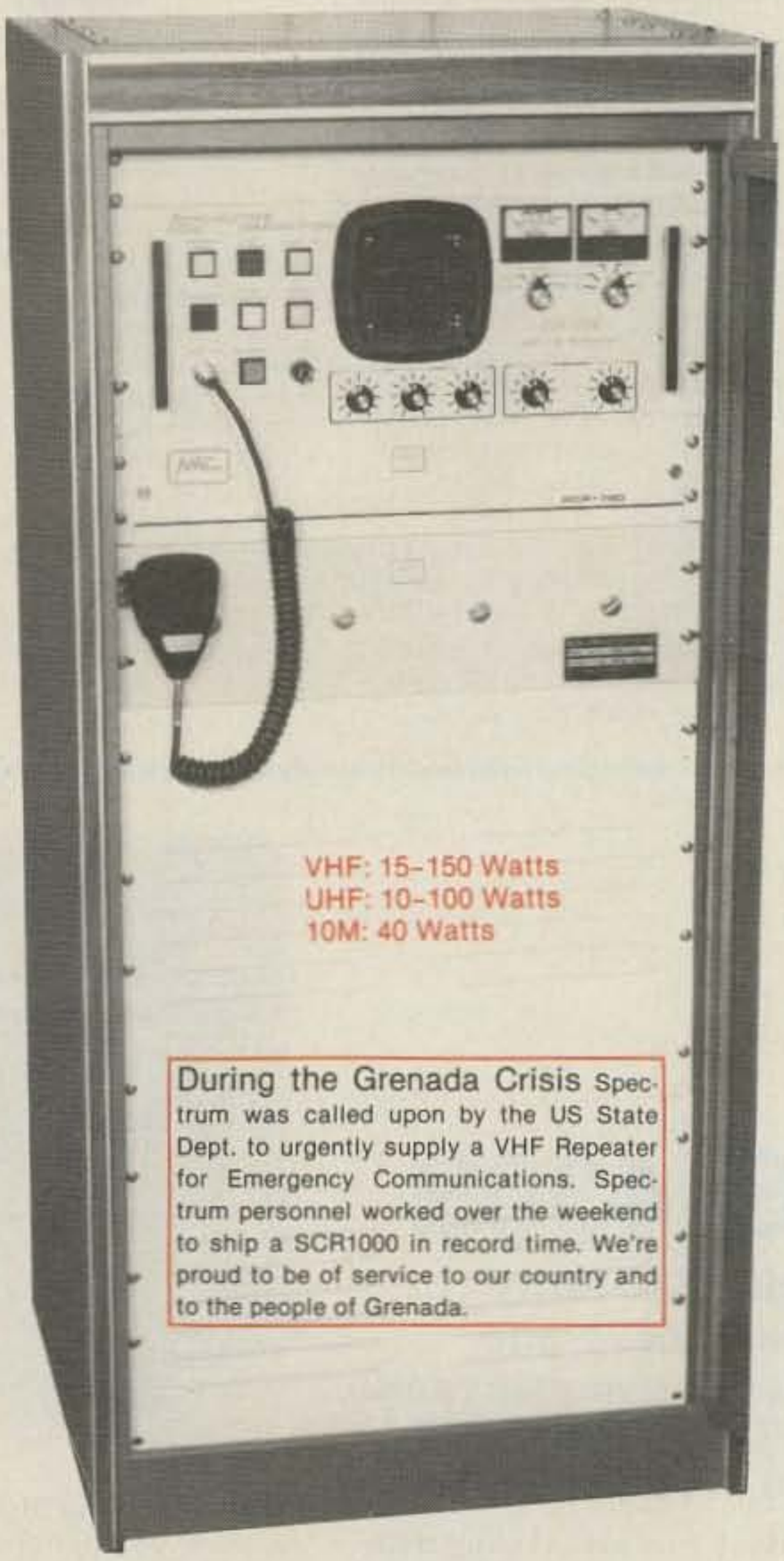

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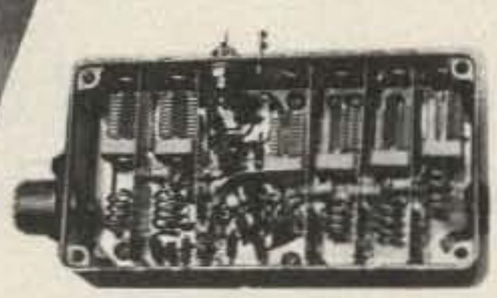

FL-6

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PRM200 Power Supply Filter Cap/Regulator/Metering Board

- As used in the SCR1000 as main part of 13.8VDC/8A Pwr. Sply.

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- 10, 30, or 75 Wt. unit.

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Fun, Frustration, Fatigue

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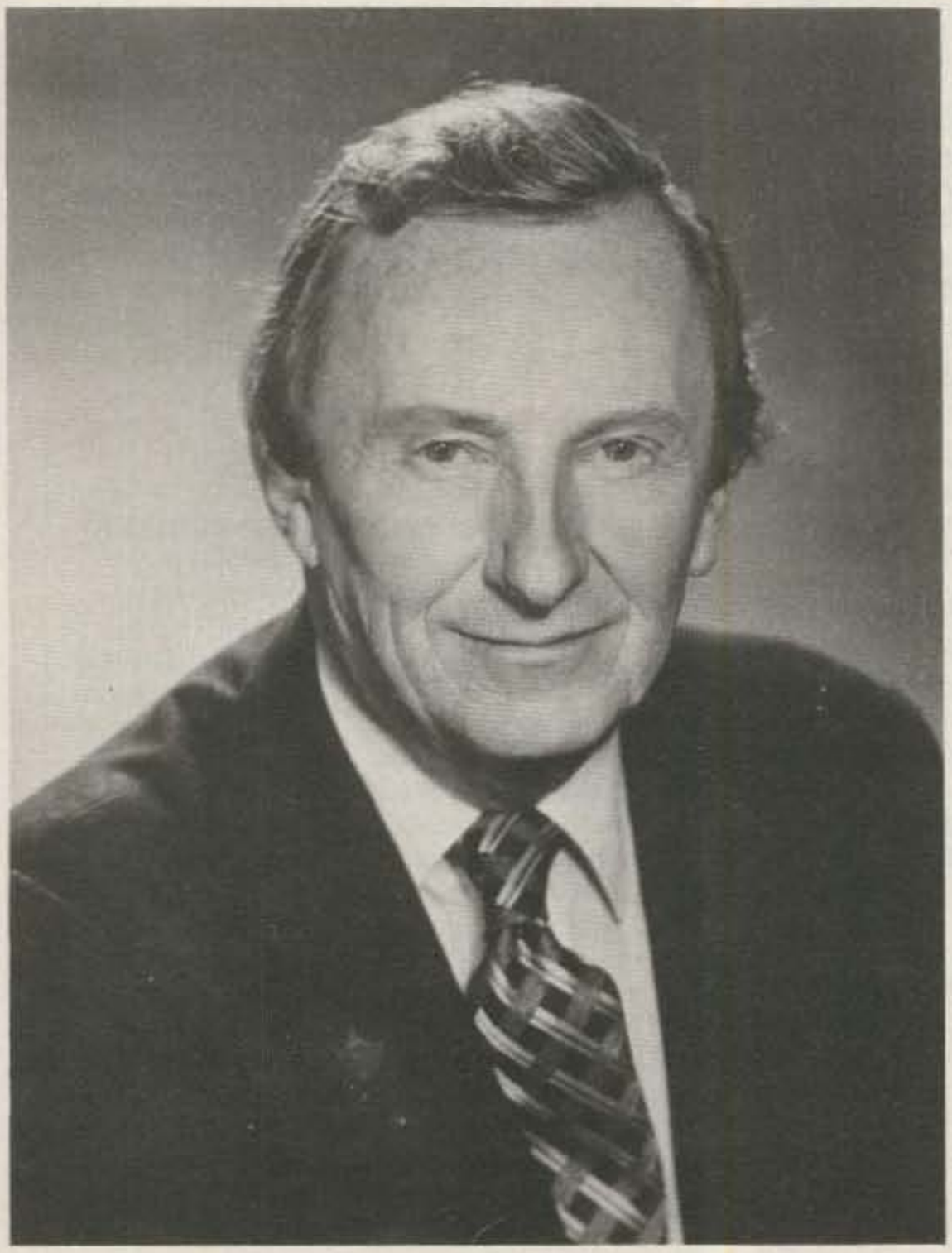
K6DUE

Roy Neal K6DUE
NBC News
3000 West Alameda Avenue
Burbank CA 91523



Roy Neal K6DUE

Owen Garriott was flying over California when I heard him. It was his first time on the air from *Columbia* and he was full quieting on a hand-held with a rubber duckie. He was over California and I was in a hotel room in Nassau Bay, Texas, fifteen hundred miles away. It was a moment of incredible elation. We had done it! After more than 20 years of trying, *WE HAD DONE IT!* A ham was operating from space and a lot of people had made it happen, each contributing according to his expertise.

In the beginning, when NASA first flew its funny little (early) satellites, we hams had a field day, listening to the signals from space and watching orbiting *Echo* balloons blinking like stars in the twilight as we bounced signals off their sides. And we amateurs suggested to the then-new Space Administration that the Amateur Radio Service could form the cadre of a ground-based tracking network for all kinds of projects. We had operators and equipment and the will to participate.

But NASA, in that era, was extremely bureaucratic. They ignored us. Shortly before Alan Shepard flew the first manned mission, Colonel John "Shorty" Powers spent an evening at my home while I worked twenty meters. Paths were open worldwide that night and he talked with stations in Australia, South Africa, Europe, and South America. Powers took notes that night and went back to Project Mercury. As its Public Affairs Officer, he had influence. He recommended formalizing arrangements through the ARRL to form an emergency or backup communications network with the Amateur Service and using beacons on board the spacecraft.

The NASA management of that time refused to listen to anyone outside the agency. That's the same management that turned down an offer of a million dollars from the television networks at the outset of the Gemini Program to be used to provide on-board video. We were told, "If you want to give a million dollars, we can find better ways to spend the money." Today, by comparison, NASA provides very fine television indeed, partly as a way of maintaining public interest in its budget.

As time went on, Doctor Owen Garriott became an astronaut and so did Tony England. What set them apart from other members of the corps was that they were licensed amateur-radio operators, W5LFL and W0ORE, respectively.

In 1972, Garriott was named to fly . . . in *Skylab,* for two months in space. He and a dedicated group of hams at what was then the Manned Spacecraft Center in Houston applied for permission to carry amateur radio into orbit. Dick Fenner W5AVI even figured out how to do it technically. After all, W5LFL would be up there for quite a while with enough free time to enjoy a little relaxation. They were turned down again. No room for an antenna, the possibility of RFI, and lack of power on *Skylab* were cited as reasons, but the fact of the matter was that no one at NASA was on a high enough administration level willing to accept the responsibility of making a decision.

As a network correspondent specializing in aerospace and a producer who managed the pool radio and TV coverage for the combined networks of the world on the Shepard flight and *Apollo 12,* the second flight to the moon, I have known most of the principals at NASA. I worked with them, covering the

space program from the day it began, but my repeated requests and suggestions concerning the possible service of amateur radio in space fell on deaf ears. While the Air Force and the European Space Agency provided launch vehicles for piggyback rides that put amateur satellites into space, no one was able to dent the consciousness of the higher powers in NASA until the space shuttle.

With the advent of the shuttle, the door began to open. Space should be all things to all people and NASA's changing management wanted to investigate ways to make that happen.

Among the key men in management of the new regime, in charge of the shuttle program for the Space Administration, was AF L/Gen James Abrahamson. "Abe," as he is known, is a man of immense imagination with great ability in the engineering world to get things accomplished. He also is one of those rare individuals . . . a public figure who is willing to expose himself frequently to the media.

And so it happened that I was doing a rather routine interview with the General last fall, during a mission. During a quiet moment, while the camera crew was changing locations, I launched into one of my favorite themes. "Abe," I asked, "has anyone ever mentioned ham radio on a space shuttle to you?"

"No," came the answer, "but I'm interested. What do you have in mind?"

And so it began. We went on with the interview; when it was finished, we went back to discussing the Amateur Radio Service. I showed him my 2-meter transceiver. We talked for perhaps ten minutes, then General Abrahamson said: "I like it, Roy. Why don't you get a formal proposal together. If it makes sense, I'll approve it."

I floated out of the office and, quite literally, ran across the campus of the Johnson Space Center to the office of Chuck Biggs KC5RG, the Chief of Public Services. We called Doug Ward WA5SFY, who is Deputy Director of Public Affairs at the center. These men had been major supporters of the move to get ham radio into space over the years, and now it was time to start moving on what could be the most exciting DXpedition of all time.

We decided that the project would require sponsorship to stand any chance of approval . . . a nice, clean, nonprofit sponsorship such as the American Radio Relay League could provide. The League and other advisors at NASA Headquarters soon added a partner, the Amateur Satellite Corporation, AMSAT, to handle technical details in discussions with NASA.

Vic Clark, that brilliant man who was President of the League for too short a time, accepted the basic concept on my first phone call and promised to do his best to steer it through League channels. We talked about a videotaped documentary to be made under ARRL auspices. Our NASA friends suggested it would help in getting the agency's final approval. For the Amateur Radio Service, it would be a way of telling everyone in Owen Garriott's own words what he was trying to do. And, if we also showed what ham radio is all about, it might even attract the public.

In November, 1982, I sent a letter to Vic which he took to the Executive Committee, where it cleared its first hurdle, then it went on to the Board of Directors where "Amateur Radio's Newest Frontier" was authorized and its financing approved. Dave Sumner K1ZZ accepted the project as the League's General Manager and almost immediately became an enthusiastic supporter. Dave was another of the key figures that guided the project and made it happen.

In California, a group of amateurs who are also thorough television professionals volunteered their services. Bill Pasternak WA6ITF, a master maintenance technician at Metromedia in Hollywood, became Technical Supervisor and Field Producer for the documentary. Alan Kaul W6RCL, NBC's Nightly News West Coast Producer,

W5LFL LOG
(Preliminary)

If you attempted to reach W5LFL and your callsign is not in the first list, look for one resembling it in the list of incomplete calls. To claim a contact, send as much information about your transmission as possible to ARRL Headquarters, Attn: W9KDR, 225 Main Street, Newington CT 06111.—Tnx W9KDR and KB1N.

AA6S
AB7C
AE7Q
AJ6L
AL7W
CE3CKE
CE3AHD
DC6SN
DC6AH
DC8AM
DF6UQ
DG6NAA
DJ1IJ
DK6RX
DL0DAA
DL1YCA
DL9GAK
DL9MH
EA3AWD
EI0RTS
EI3FI
F1FVX
F5AD
F6AVG
G4UYL
G6DEF
G6EGY
GM8NXC
GW6OJK
HH2CX
I1NRF
I5FBP
JY1
K0LIR
K0RI
K0RZ
K1IKN
K1PAD
K1PXE
K2IBP
K2OVS
K2RIW
K2TTI
K3DI
K3NV
K3PGP
K3TC
K4GFG
K4JT
K5ADQ
K5CAY
K5IH
K5OKG
K5OXE
K5QHF
K6DYD
K6GSS
K6LY
K6MYC
K6TDR
K7GIJ
K7ND
K7SMV
K7UGA
K8CS*
K8KNT
K9BI
K9HMB
KA0PGN
KA0Y
KA2BTD
KA4WJA
KA5FPV
KA6DQZ
KA7GHR
KB4CRT
KB4WM
KB6AMN
KB6TN
KB6V
KC4P
KC7EM
KC8KE
KD5JH
KD6LQ
KD7IY
KD7RF
KE5C
KE6VK
KE6XJ
KF0M
KF4SX
KF6Z
KI7L*
KN0L
KN2D
KQ5D
KQ5W
KS1S
KT1U
KX0O
KX6C
KY4Z
KY7B
N0COX
N0IS
N0LL*
N2EK
N4GAN
N4HY
N4JBK
N5BLZ
N5DDT
N5EZM
N6AVR
N6DD
N6ECL
N6JM
N6NB
N6QP
N6RJ
N7ARE*
N7BHC*
N7DOF
N7WS
N8DEJ
N9GA
NG5P
NM5I
NN6E
NR4P
NT6G
OE6WIG
OE7FRH
OF2XN
OH3XA
OK1DFG
OK1DIG
OK1KRA
OK2BDS
OK3CGX
OZ1DPR
OZ1ELF
SM2KT
SM4CLU
TI3DJT
VE1AFU
VE1BB
VE1CAW
VE1CGY
VE1OC
VE1UT
VE3BNA
VE3BNO
VE3KLW
VE3KRP
VE4OO
VE7BOQ
VE7CYB
VK1BX
VK1DF
VK1ORR
VK1RR
VK1ZAH
VK1ZIF
VK1ZQR
VK2KPG
VK2PMN
VO1BK
VO1DI
VO1FP
VO1FR
VO1GG
W0PHD*
W0PN
W1AW
W1PSG
W2EFL
W2GDV
W2JNO*
W2NQ
W2PAU
W3CWG
W4AQL
W4BE
W4KYL
W4MOP
W4ODW
W4ROA
W4WJ
W5FF
W5GEL
W5HTK
W5HUQ
W5LFG
W5LUU
W5PNY
W5RRR
W5UN
W6KH
W6LEV
W6YBL
W6YX
W7AVD
W7BGH
W7ID
W7KMF
W7RV
W7SW
W7KYN
W8AC
W8FQK
W8GUS
W8WN
W9KDR
WA0VJF
WA1BAR
WA1FCK
WA1JXN
WA1PSI
WA2BSH
WA2CHY
WA2SEF
WA2VMS
WA2WVL
WA4BEV
WA4BZJ
WA4EWA
WA4GIJ
WA4KXY
WA4LZR
WA4MMD
WA4PLR
WA4SBC*
WA4TNV/KL7
WA5AFO
WA5DBY
WA5DXR
WA5NOM
WA6CFM
WA6IUM
WA6KNR
WA6PEV
WA6RLV
WA6SGK
WA6YBT
WA7BJU
WA7DPM
WA7JUO
WA7RQS
WA7UIB
WA8KEM
WA8MTI
WA8TXT*
WB0SWD
WB0TTW
WB2ONA
WB4EMI
WB4YJC
WB4YUD
WB5AZI
WB5DSH
WB5PDW
WB5RRR
WB5VZL
WB6DEO
WB6DTR
WB6GYE
WB6IDK
WB6NOA
WB8NWY
WB8PAT
WB9MSV
WD0FOY
WD4FAB
WD4IYS
WD4KSN
WD4RJI
WD4VCS
WD5BPB
WD5IFB
WD5KBZ
WD6AUS
XE1ALQ
XE1FV
XE1TU
XE2RCP
YU7KN
YU7MAU

*Heard on CW

Incomplete Calls

Orbit 40
W5V—
KA—
—AJW

Orbit 56
WA7RV—
W7Q—

Orbit 71
W5U—Z
WA7——V
WB5—B—
—5RN
WD5CG—
WA4DN—

Orbit 97
K5A—

Orbit 111
OE7U—
DL9—
HG8—N
DH0AA—

Orbit 113
WA4N—
K2U—

Orbit 130
WA6G—
K5—V
WA6—
WA2VW—

Orbit 134
KA7—
KR8—
N8C—
W4—

Orbit 135
WB5L—J
—6E
K5D—
—1IX

Orbit 144
—XC
WD4—
KA1—
—QG
—A—A
—1DCR

Orbit 145
—ZPR
WB2JS—
—YW

Orbit 146
W7—
VE3J—

Orbit 149
VE3—
WB9C—

Orbit 150
WA7—
AD1—

produced "Amateur Radio's Newest Frontier," and Frosty Oden N6ENV, who wins awards as a top editor at CBS, turned our tapes into a highly professional package. Howard Mark WØOZC reproduced them by the thousand and Pete O'Dell KB1N took care of the distribution through the League's Board of Directors. The tapes brought amateur radio in orbit another big step forward.

But all of that was predicated on NASA approval, and the politics of the agency present a fascinating illustration of what it takes to make things fly in government circles these days.

Doug Ward forwarded a memo to Brian Duff, NASA's Director of Public Affairs at that time. Duff assigned Dick Daniels W4PUJ, Director of Management Support at Headquarters, to study the project. It was at this point that Daniels made the recommendation and AMSAT joined the project. Bill Tynan W3XO for AMSAT and Dick Fenner W5AVI for the Johnson Space Center put together a draft proposal. It was a wonderfully worded document that stressed key factors. The project, it said, would appeal to the youth of the nation. It was firmly supported by prestigious organizations and made technically practical by advances in technology such as tiny transceivers and reliable battery packs that could be space-flight qualified.

Duff gave the draft proposal an enthusiastic endorsement and forwarded it to Robert Alnutt, the Acting Associate Administrator for External Relations. Alnutt endorsed it, dependent on "the various constraints in operating the shuttle." He referred the documents to General Abrahamson and to Gerry Griffin, the Johnson Center Director. And now we had come full cycle.

Owen Garriott W5LFL was scheduled to fly on STS-9 in the fall and that, for a time, looked like a roadblock. The cargo was dedicated entirely to the European Space Agency's Spacelab and the manifest had been closed for months.

Center Director Griffin lent his enthusiastic support, clearing the hurdles of astronaut assignments and training and authorizing supervisors to permit Dick Fenner W5AVI and the many other hams at the center to go about finding, designing, and testing equipment to ensure compatibility.

When the paperwork reached Harry Kraft, the Spacelab Program Manager at the Marshall Space Flight Center, he was approached by a number of ham operators on his staff. They convinced him that the project was worthwhile.

From the outset, the experiment was earmarked Public Affairs and was to be conducted at times when it would not interfere with Owen's Spacelab duties.

Ward, in Houston, was a key figure in guiding the project through the shoals of all these politics and, more than coincidentally, keeping Owen Garriott advised as the logjams were cleared.

And finally . . . on April 16, 1983: Vic Clark and I were in Sioux City, Iowa, at a ham convention when he got a telegram. If the equipment could be made to work compatibly and if no other complications were discovered, permission was granted to fly an amateur 2-meter transceiver on the flight of STS-9, to be operated by Dr. Owen Garriott in his off-duty time. I remember Vic's enthusiasm and how quickly it spread to the hams at that convention. It was an enthusiasm we were to see repeated at many other places we traveled together that year, telling audiences what to expect.

A month later, at the instigation of Doug Ward, there was a key meeting at the Johnson Space Center and that is where the plan really came together. Peter O'Dell KB1N, the League's Public Relations Coordinator, and Bernie Glassmeyer W9KDR had been brought in to handle the intricate details of getting out information to the members.

Vic Clark was there, of course, and so was Vern Riportella WA2LQQ, President Elect of AMSAT. Vern accepted responsibility for clearing frequencies. For NASA, there was Dick Fenner to describe the Motorola transceiver that had been chosen and the battery packs that would power it. Dick described a special antenna that had been designed and built by the hams of the Johnson Center Radio Club. R. W. "Bob" Harris was there, representing the Flight Directorate. Bob was responsible for putting out the orbital tracking information that later permitted hams all over the world to know when to listen for Garriott. Charles Chassay represented the Shuttle Program Office. He was, in the final analysis, the man who approved the on-board equipment.

But the most important member of that meeting was astronaut Owen Garriott W5LFL. His background as an electrical engineer led the discussion as it wove through the intricacies of equipment planning. His communication knowledge paid off handsomely as plans were made for what would eventually be the *modus operandi* of his time on the air. We discussed the use of a tape recorder and an astronaut's lightweight headset . . . the transmit and receive cycles. An amateur-radio flight plan was built in Houston on that day in May and it worked when W5LFL finally went on the air in December.

There's a lot more to the story of Owen Garriott's major step into the newest frontier of space and there are many more people who played key roles and should be mentioned, but time and space don't permit much more.

The dedication of Doug Ward, Dick Fenner, and a couple of dozen fellow hams in Houston and another group of equally dedicated amateurs at the Kennedy Space Center who repaired the transceiver and nursed it through a siege of rf interference aboard the *Columbia* cleared the technical hurdles prior to the mission.

Pete O'Dell KB1N and Wayne Yoshida KH6WZ worked for months before the flight and then around the clock at the Johnson Space Center to get out the word of Owen's feats as he worked (King Hussein JY1, Barry Goldwater K7UGA, his mother through club station W5HTK in Enid, Oklahoma, and his sons at the Johnson Space Center station). Pete's work in particular deserves a medal. He made it all work for the League. The center club's President Dale Martin KG5U and its many members were on the air around the clock, passing the latest word on orbits as fast as they got the in-flight changes from Bob Harris and Doug Ward.

The tenth day in space, the bonus day, was the best of them all. Owen worked dozens of stations and was heard by thousands even though orbital information was sketchy.

And it was then . . . to this reporter . . . that the whole flight seemed to come into focus. This really was a big deal . . . the fraternity of ham radio had seen one of its members do something exceptional. Owen Garriott, astronaut and W5LFL, had turned in another flawless performance in space. His fellow hams, here on Earth, had begun to achieve a little maturity on that final day in the places that needed to grow up. Most of the high-powered hogs who tried to ride roughshod over their neighbors had finally realized that signals from space would come through no matter what they did to interfere and that their chances of being heard were only a little better than the little guys.

And on that day, during the several great passes over the United States, all of us had good reason to be thankful . . . to Owen for a great flight, to General Abrahamson and to NASA for opening the doors of space to amateur radio, and to Vic Clark and the ARRL for the backing and support that made it all possible.

Amateur-radio operator Roy Neal began hamming in 1934 when he was first licensed as W3GIB in the Philadelphia suburb of Wayne, Pennsylvania. From home-brew equipment he migrated into early experimental work, including aeronautical mobile transceivers on 5 meters.

Immediately following World War II, Neal went back on the air as D4ACA, in Hochst, Germany. He was Program Manager for the American Forces Network in Europe and handled phone patches by the hundred.

Post war, back in Philadelphia, W3GIB was among the early experimenters with triband antennas and two-meter relay stations (known today as repeaters).

When he went to California in 1952, Roy picked up his present call, K6DUE. Active on most amateur bands ever since, he currently operates 220 MHz, 2 meters, and the 10- through 75-meter bands with occasional forays into satellite tracking to spice a diet of DX and mobile QSOs.

He is probably best known in the amateur fraternity because of his documentaries for the ARRL, "Moving Up To Amateur Radio," "The World of Amateur Radio," and "Amateur Radio's Newest Frontier."

WA6ITF

Bill Pasternak WA6ITF
Associate Editor
28197 Robin Avenue
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I have no real story to tell. At least not this time. I was not among those lucky enough to contact Dr. Owen Garriott W5LFL as he traveled around the world on the spacecraft *Columbia*. I did hear him. In fact, I heard him make his very first QSO with Lance Collister WA1JXN in Frenchtown, Montana, about the time Owen was overhead on orbit 35, flying down the Pacific coastline. I was standing in the courtyard of Metromedia Square in Hollywood where I work, listening to 145.55 MHz on an Icom IC-2AT hand-held. The self-appointed "channel cops" were there, jumping on everyone's case if they "dared" to say a word on .55. There were even a few "touchtone jammers" playing their game, but all went away as W5LFL's booming signal from 200 km above us totally captured the channel. I listened as Owen first called CQ and a bit later began acknowledging the calls of those he was hearing. The output of the hand-held was patched to a cassette tape recorder and I to the latter through a pair of Senheisser earphones. I just stood there under one of our huge satellite antennas, leaning against a tree, knowing that Owen Garriott W5LFL's dream of becoming the first ham to operate a station from space had come true. I also knew that words penned by my friend Roy Neal K6DUE held new meaning. Many of you have probably heard them in the closing moments of the video presentation, "Amateur Radio's Newest Frontier." "Space has a future and amateur radio expects to be a vital part of it . . . the flight of Owen Garriott is only the beginning."

Indeed, W5LFL's flight on *Columbia* was "only the beginning." It was the start of a whole new era in the evolution of the Amateur Radio Service. Until now, amateurs had to be content with using objects such as the OSCAR-series satellites as "repeaters in space." Now, suddenly, a man had done what many thought would never happen. A

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man had successfully contacted others on a one-to-one basis from Earth orbit, without the aid of NASA communications channels. He did it with the most basic of equipment: a 5-Watt hand-held and battery-powered radio and a simple antenna held to the aft flight-deck window by several strips of Velcro®. Other than the radio having to meet NASA specifications to be carried on board *Columbia,* there was really nothing special about Owen Garriett's station other than its location. Its utter simplicity raised many questions, not the least of which was "will it work, and if it does, can contacts be made and QSOs held?" We all now know that the Motorola talkie and home-brew antenna performed far above expectation. Owen proved that low power and a simple antenna could provide backup communications from Earth orbit. Indirectly, he even showed the possibility of direct personal communications from space in future times when passengers are taken into orbit. What Dr. Garriott did also gave new information about our service to the non-ham populace of the world. Never before had anything like this been attempted and the world's press corps was glued to the "happening" as it unfolded. The reports in newspapers, on the radio, and on television around the world showed hams as the pioneers of communication and finally dispelled the myth that radio amateurs were eccentric tinkerers who dwelled in attics and basements surrounded by sparks and wires. For a moment, we were the center of attention; it was an opportunity well used to bring amateur radio out of the proverbial closet forever.

Knowing that there would be many stories to tell about the flight of STS-9 and attempts by ground-based stations to garner a fleeting QSO with W5LFL, *73* commissioned 21 amateurs across the nation to keep diaries of their day-to-day efforts to make a contact. Those involved were as far east as New York and New England, as far west as California, Oregon, and Hawaii, as far south as Florida, and as far north as Alaska. Each ham has his own story. Each will have something a bit different to say and by reading their combined reports, you will get a graphic idea of what most amateurs around the world experienced during 6 of the 9 days of the flight of STS-9. First, we travel to Maine to find out how K1EFZ made out in his quest to contact Owen Garriott W5LFL, the first amateur to operate from space.

K1EFZ

Robert N. Harnois K1EFZ
56 Pennell Street
Westbrook ME 04092

When this space-shuttle project was first announced, I had no idea that I would be involved to such an extent, but after the call from Jack Burnett on November 27, 1983, I suddenly was in the middle of it.

Having built the turnstile antenna described in the September *QST,* I was already prepared to listen and possibly make a call or two if the occasion arose.

On November 28, at 1100, I watched the shuttle take off and then figured out the orbit times for my location that Jack had given me. Didn't do any more until Wednesday.

In the meantime, I copied the RTTY bulletins from the ARRL and got the latest info on all the orbits. Also have been continuing receiving these bulletins every day.

The log explains my participation in monitoring the shuttle.

I was very pleased to be asked to participate in the telephone conference on Sunday, December 4, 1983. It was very interesting and informative and I wish I could have had more to report, but it seems that our location did not get the results that some of the other areas had. It was wonderful to be in such high-class company. Thanks for asking me.

SCHEDULE FOR SPACE SHUTTLE
LAUNCHED NOV.28,1983 AT 1100

LOG OF CONTACTS WITH W 5 L F L

ORBIT	DAY	HOUR	MIN	HOUR	MIN	AREA
34 A	2	1	10	1	25	CENTRAL
	NOV 30	1210		1225		
	LISTENED FROM 1130 TO 1330. NOTHING HEARD					
	COPIED LATEST ARRL BULLETINS ON RTTY					
39 D	2	9	0	9	25	CENTRAL
	NOV 30	2000		2025		
	UNABLE TO LISTEN AT THIS TIME					
49 A	2	23	27	23	47	EASTERN
	DEC 1	1027		1042		
	DURING THIS TIME W5LFL WAS BEING INTERVIEWED BY ROY NEAL ON LIVE TV. NOTHING HEARD					
70 D	4	7	5	7	25	EASTERN
	DEC 2	1805		1825		
	LISTENED FROM 1800 TO 1830. NOTHING HEARD					
71 D	4	8	35	8	50	CENTRAL
	DEC 2	1935		1950		
	NOTHING HEARD AT THIS TIME.					
96 A	5	21	25	21	45	EASTERN
	DEC 4	0825		0845		
	HEARD W5LFL LOUD AND CLEAR AT 0836.HE WAS OVER FLORIDA CALLED HIM TWICE. NO CONFIRMATION. NOT HEARD AGAIN					
97 A	5	22	55	23	23	CENTRAL
	DEC 4	0955		1023		
	NOTHING HEARD AT THIS TIME. REPORT OF SOME RECEPTION BY OTHER PEOPLE					
112 A	6	21	13	21	25	EASTERN
	DEC 5	0813		0825		
	HEARD W5LFL AT 0826, RATHER WEAK. HEARD HIM AGAIN AT 0827, LOUD AND CLEAR.CALLED HIM TWICE. NO CONFIRMATION.					
113 A	6	22	42	23	5	CENTRAL
	DEC 5	0942		1025		
	NOTHING HEARD AT THIS TIME.					
129 A	7	22	29	22	50	CENTRAL
	DEC 6	0929		0950		
	UNABLE TO LISTEN AT THIS TIME					
133 D	8	4	44	5	6	EASTERN
	DEC 6	1544		1606	**	(NEW ENGLAND)
	NOTHING HEARD AT THIS TIME					
134 D	8	6	18	6	48	CENTRAL
	DEC 6	1718		1748		
	NOTHING HEARD AT THIS TIME					
144 A						EASTERN
	DEC 7	0800				
	UNABLE TO LISTEN. HEARD REPORTS ON THE AIR THAT W5LFL LOUD AND CLEAR IN THIS AREA.NO CONFIRMATIONS.					
145 A						CENTRAL
	DEC 7	0930				
	UNABLE TO LISTEN. REPORTS FROM OTHER LOCAL HAMS THAT W5LFL WAS HEARD LOUD AND CLEAR ON THIS ORBIT ALSO.					
160 A						EASTERN
	DEC 8	0749				
	LISTENED IN CAR ON WAY TO WORK.SQUELCH WAS BROKEN SEVERAL TIMES BUT DIDN'T HEAR ANY VOICE.					
161 A						CENTRAL
	DEC 8	0920				
	UNABLE TO LISTEN AT THIS TIME.					
	DEC 8	1847				
	WATCHED THE LANDING ON TV.					

LOGGED BY ROBERT N HARNOIS, K1EFZ
56 PENNELL ST
WESTBROOK ME 04092

Robert N Harnois

Ham it up!

Maine waits for space talk

Press Herald Dec 1, 1983

✔ All eyes were on the eyes of shuttle crewman Robert Parker Wednesday. Page 15.

✔ Spacelab's astronauts created brilliant flashes of blue light.Page 2.

By DIETER BRADBURY
Staff Writer

"Ham" radio operators across Maine will have their ears glued to their receivers this morning in an effort to communicate with the orbiting space shuttle Columbia.

Astronaut Owen Garriott, a mission specialist on board the Spacelab and an amateur radio operator, is carrying a five-watt, hand-held transceiver on board the flight.

During his off-duty hours, he will be trying to communicate with some of the thousands of ham radio operators around the world. If a link is established it would be the first amateur radio communication between the earth and a manned space vehicle.

The best time for communication with the Spacelab for hams in the northeastern United States will be between 10:27 and 10:47 a.m. this morning, according to the American Radio Relay League, a national organization of radio amateurs.

The shuttle will be in its 49th orbit, making a pass across the country that takes it over parts of the eastern seaboard during that period, the ARRL said.

Dana Luke of Westbrook, a ham who edits a statewide newsletter for radio enthusiasts, said he expects many of Maine's 2,464 hams to be at their sets during the orbit.

"It's the big topic of discussion every time you tune in on your set," Luke said. "Everybody's talking about it. I'm going to have my radio on, and I've got the capability to pick him up."

Under a plan developed jointly by NASA and the ARRL, Garriott will alternately transmit and receive for one-minute periods of up to an hour.

During an even-minute period, he will identify the geographic area he will listen for and describe crew activities or views of the earth. During the odd-minute period, he will scan his receive frequency, 145.55 MHz, for call signs from the designated area.

In his next even-minute transmission period, he will then acknowledge any call signs he has received. Unless Garriott requests otherwise, hams will be limited to transmitting their call signs only.

Robert N. Harnois K1EFZ

✓See List of Advertisers on page 114

I did not hear any malicious interference, only over-anxious and possibly misinformed operation—but nothing serious.

My station consists of a KDK 2016A on two meters with a five-element vertical beam up 60 feet. The turnstile antenna was added for this project. On HF, I have a Heath SB-104A and a TRS-80 Model 4 computer with the ROM-116 interface for RTTY. Have been a ham for 26 years; am a member of QCWA. I am retired from the US Postal Service. I work a couple days a week at a direct-mail service. For other hobbies, I am an avid tennis player, playing three times a week year 'round, and am a percussionist in the Portland Community Symphony Orchestra and the S. D. Warren Band in Westbrook. Do my own house repairs and like to build furniture. Of course, this computer that I'm using for this report is also one of my hobbies.

I am 69 years old. Having lost my first wife in 1978, I was remarried in June, 1982, to a very lovely lady who was also a widow. She had eight children and I suddenly had a lovely family with five grandchildren. We have a very happy life. We usually go to Florida every year for a month or so. I have one daughter who is also a ham operator; her call is K1GSF.

Three clippings from the Portland papers are the only ones I have seen so far. Have not seen any local TV coverage, but there could have been some that I missed.

The participation by the amateurs in this area was very enthusiastic and everyone is hoping that they were heard by W5LFL's receiver. I don't know of anyone who was acknowledged.

WB1BRE

Bill Burden WB1BRE
11 Briand Drive
Nashua NH 03060

Members of the Nashua Area Radio Club prepared for the flight of the space shuttle *Columbia* for several months. Bob Wolf N1ABA and George Murphy K3RQ had been very active in working amateur satellites for several years, and the challenge of working STS-9 was a natural for them. Media interest was building up to the mission partly as a result of the Grenada situation that occurred about a month before the launch. I had not really set up anything at my home for monitoring the shuttle since I planned to go to Bob's house during the passes when W5LFL was on the air.

I was at Bob's shack during the first pass on Thursday, December 1, 1983. Present were reporters from the local papers, the *Nashua Telegraph* and the *Manchester Union Leader*. The shuttle came over, and with George at the azimuth and elevation controls and Bob at the 2m rig, the call was sent out. Unfortunately, Owen was in a news conference at the time of the pass, so all we heard was several minutes of noise punctuated by people mistakenly transmitting on the downlink. This all was slightly discouraging, but not to worry—there were many orbits to go!

The east-coast pass on Friday night (December 2) was to be a good one, but this was the night of the club annual Christmas party! We toyed with the idea of bringing a rig to the party, but rejected that as a bit of an overkill for a party. George K3RQ was coming to the party, but he delayed his departure long enough to make a try at a pass.

Again, nothing from the spacecraft, but George was undaunted. He proceeded to get ready for the Christmas party and George and Charlotte made a spectacular entrance!

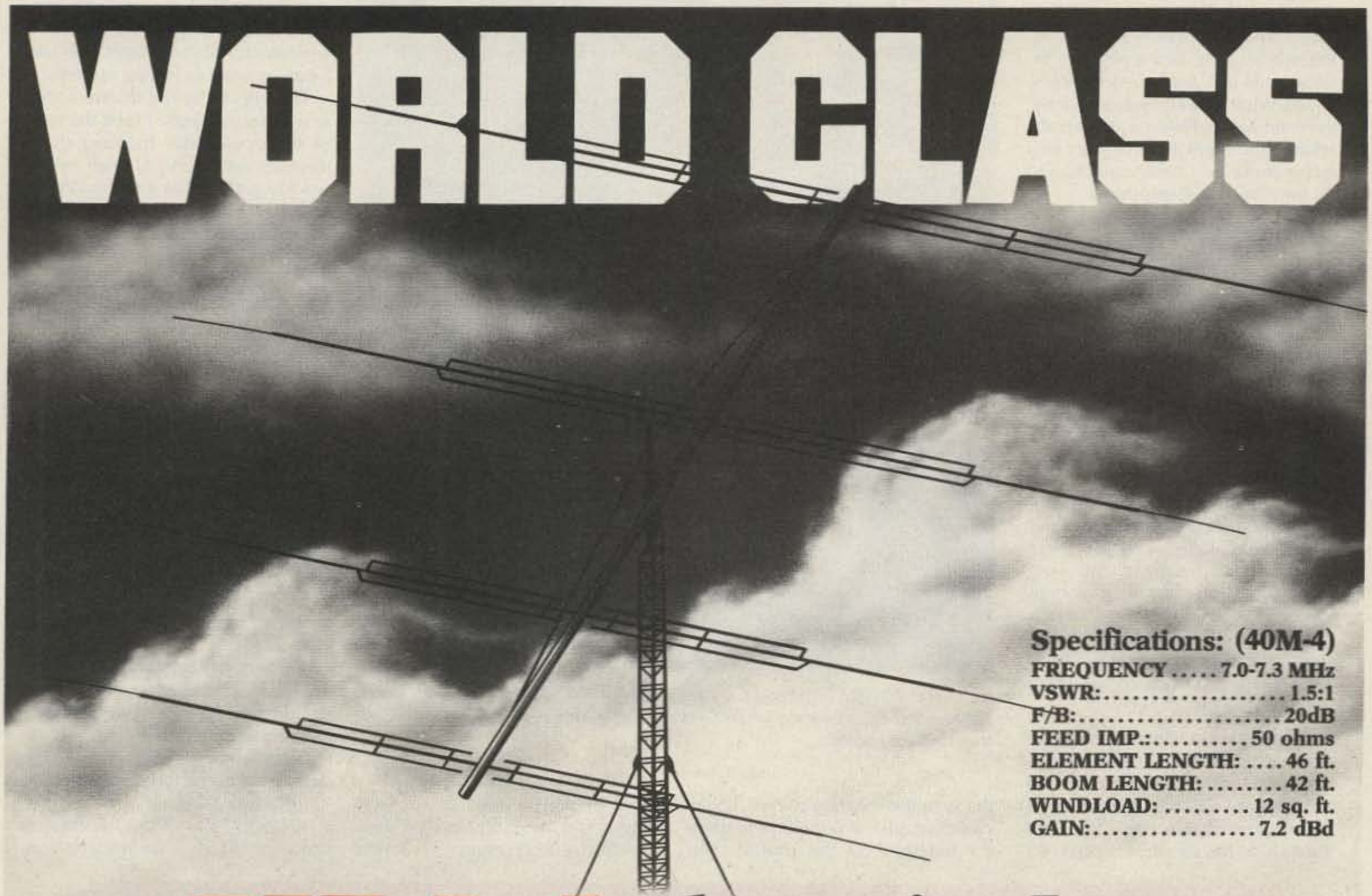
I received a call from Jack Burnett at *73* informing us that we had been selected as one of a group across the country to keep a diary of our attempts to contact the shuttle. We were astounded to be included in a select group like this. I discussed this with Bob and George and we all suddenly realized that we were into paperwork!

Sunday night (December 4), Bob and I joined in the nationwide teleconference and really enjoyed the discussions from around the country. It was exciting to hear how people in various states were making out with PR and the attempts to contact Owen.

I discussed the passes scheduled for Monday morning (December 5) with Bob and agreed to meet at his house to listen to the next attempt. Sunday night was the first snowstorm of the season and several inches were on the ground by Monday morning. Bob lives about 2 miles from me via the main highway in Nashua. Monday morning it would have been easier to reach the shuttle! Traffic was tied up all over the city and I realized that I would never make it through the city. I turned around and proceeded to Bob's house via the neighboring town of Hollis. But the delay had set me back so far that by the time I got through Hollis, I realized that I would never make it to Bob's house in time. In desperation, I turned on the old Kenwood 7400 in the car, hoping that I would hear something with the quarter-wave whip on the rear deck.

At the appointed time, I suddenly heard "This is W5LFL in the spacecraft *Columbia* calling CQ North America."

WORLD CLASS



Specifications: (40M-4)
FREQUENCY ..... 7.0-7.3 MHz
VSWR: 1.5:1
F/B: 20dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH: ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN: ..... 7.2 dBd

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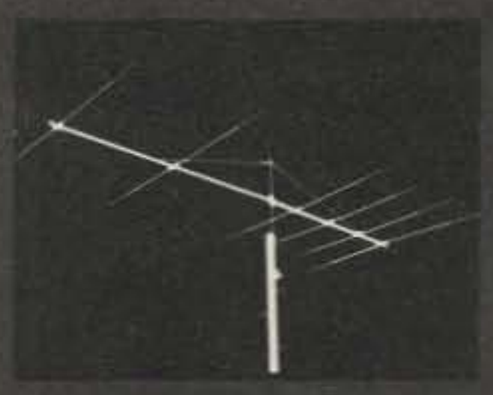
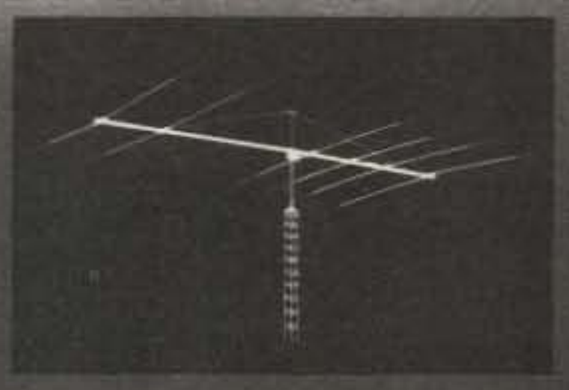
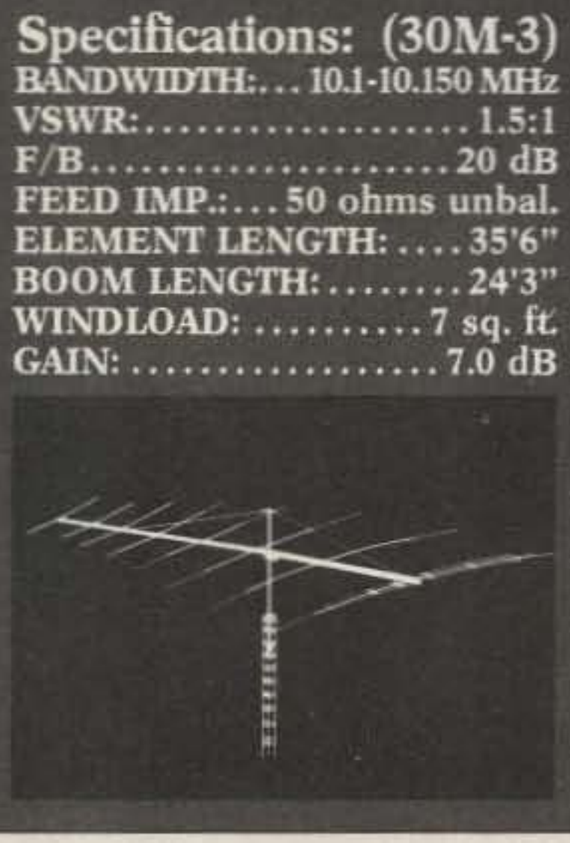


Specifications: (20M-6)
BANDWIDTH: ... 13.9-14.4 MHz
VSWR: 1.5:1
F/B ..... 35 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 37 ft.
BOOM LENGTH: ..... 57 ft.
WINDLOAD: ..... 12.8 sq. ft.
GAIN: ..... 11 dBd



Specifications: (15M-6)
BANDWIDTH: ... 21.0-21.5 MHz
VSWR: 1.5:1
F/B: ..... 30 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 25 ft.
BOOM LENGTH: ..... 36 ft.
WINDLOAD: ..... 8.5 sq. ft.
GAIN: ..... 10.5 dBd



Specifications: (30M-3)
BANDWIDTH: ... 10.1-10.150 MHz
VSWR: 1.5:1
F/B ..... 20 dB
FEED IMP.: ... 50 ohms unbal.
ELEMENT LENGTH: .... 35'6"
BOOM LENGTH: ..... 24'3"
WINDLOAD: ..... 7 sq. ft.
GAIN: ..... 7.0 dB

Specifications: (7.2/10-30-7LPA)
BANDWIDTH: ..7.2/10-30 MHz
VSWR: ..... 2:1 typical
F/B: 10/15
FEED IMP.: .... 50 ohm unbal.
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN ..... 3/7 dBd typical

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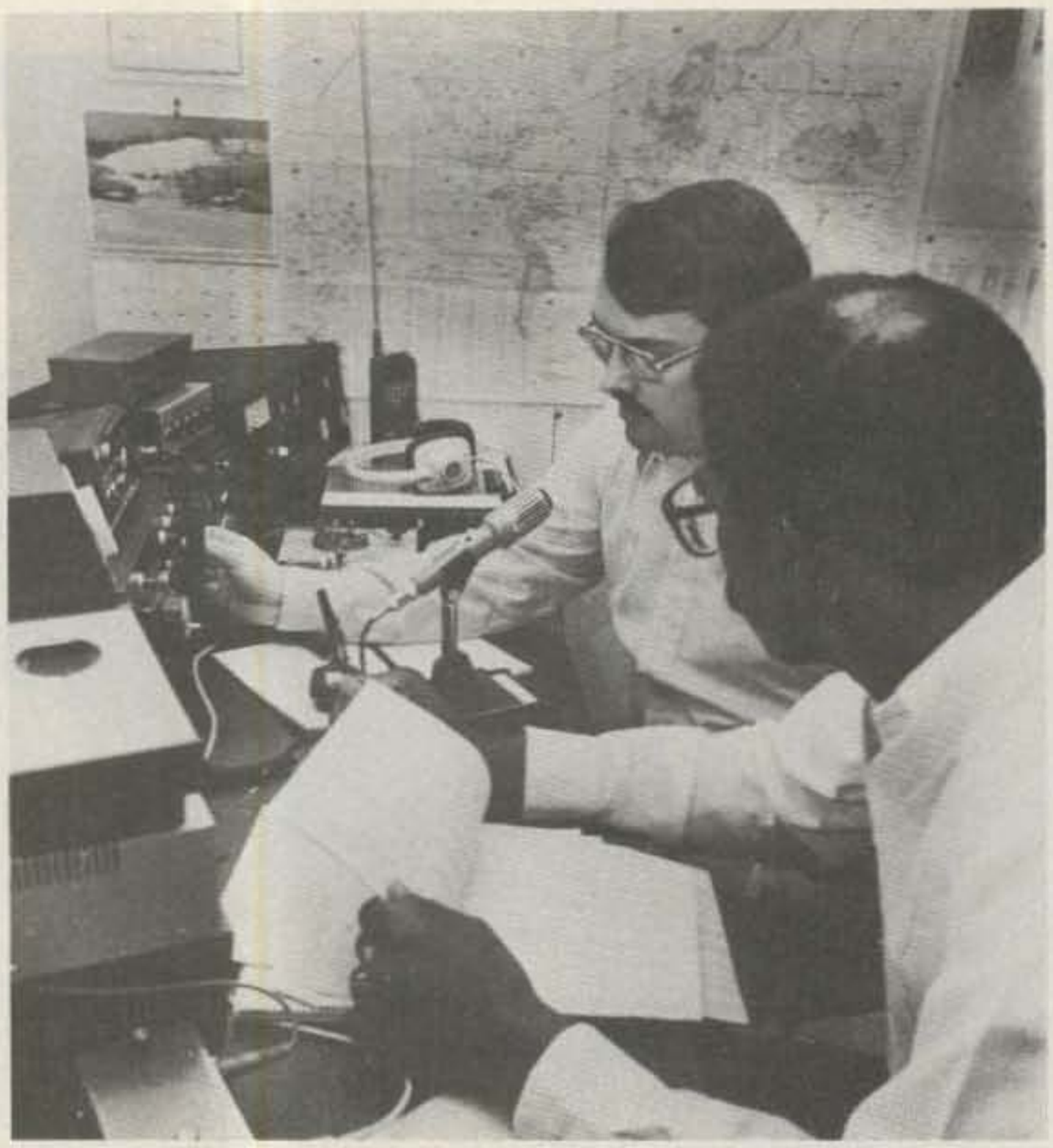
I damn near drove the car off the road! He was full quieting with no flutter and no static. I listened to the whole pass and even put in some calls as I continued to Bob's house. What a thrill! I was struck by the solid link between a spacecraft orbiting the Earth 200 miles up and a commuter on a back road in a little town in New Hampshire.

Wednesday morning (December 7), I was ready at home with my 2-meter rig tied to my 8-element yagi and a tape recorder ready to go. I pointed the antenna south to try to catch as much of the pass as possible. Right on schedule, there he came! He was loud and clear and I copied three of his transmissions. My wife and I shared the headset on the tape deck as Owen called CQ.

As I tuned around the 10 transmit frequencies listening to the local hams calling the shuttle, I was struck with a vision of the view from the spacecraft if rf energy were visible. As he passed over a given area and made a call for stations, a blanket of rf energy would rise from the surface of the Earth and envelop the spacecraft!

Monday night (December 5), the Nashua Area Radio Club had its regular monthly meeting at the local library. On the agenda was a short presentation by Bob and George on the shuttle activities. By the time the meeting started, it was clear that a lot of people were there for the info on the shuttle. The tapes of the previous passes were played and the questions flew thick and fast! The repeaters were alive with people looking for orbit info and frequencies. I kept checking the articles in the local paper to see what immortal statements Bob and I were quoted as having uttered!



Bob Wolf N1ABA (left) and George Murphy K3RQ at Bob's station. Bob is operating the 2-meter rig while George is checking orbit data and running the tracking antenna.

The interest in the shuttle activity is extremely high. I took the tape of the Wednesday morning transmissions into work. A small crowd quickly gathered to listen to W5LFL and was astounded by the clarity of the signal.

Station Equipment

- *Radio:* Kenwood TR-9130 multimode
- *Amplifier:* TE Systems 1412G, 150 Watts output with GaAsFET preamplifier
- *Antenna:* Cushcraft A144-10T, 10-element switchable left- and right-hand circular polarization. Antenna is 50 feet and is rotatable in azimuth and elevation.

Station Diary

August, 1983: Updated W3IWI (Tom Clark) Orbital Prediction Program to include STS-9 preliminary data.

September 12, 1983: Don Dillaby KA1GOZ of the *Nashua Telegraph* conducted interview with myself and George Murphy K3RQ.

September 13, 1983: Front-page article, with picture, appeared in the *Nashua Telegraph*.

October 21, 1983: Follow-up story on STS-9 ham-in-space mis-

sion was run in the *Nashua Telegraph*.

October 23, 1983: Virginia Wegener of the *Manchester Union Leader* conducted interview with myself and George Murphy K3RQ.

October 30, 1983: Article, including picture, appeared in the *New Hampshire Sunday News* (Manchester).

November 28, 1983:

1400–1420Z: Logged into the AMSAT bulletin-board system and obtained current list of potential orbits for W5LFL.

November 30, 1983:

0200–0330Z: Checked into the AMSAT net on 3850 kHz. Received the latest inputs on projected orbit numbers for STS-9 as well as element set #MH-11-29-83. Inputs from W5RRR on the net giving calculated equator crossing times and longitudes for orbits 34A and 48A were also logged.

0330–0430Z: W3IWI computer program was updated with the new element set and orbital predictions run for the time given by W5RRR. Data correlated within 10 seconds and a fraction of a degree of equator crossing to that of W5RRR.

1721–1728Z: Monitored 145.55, 145.53, and 145.57 during orbit 34. Nothing heard even though the spacecraft was in range. No transmissions were made.

1728–1900Z: Rechecked all equipment and orbital calculations. Verified with as many sources as possible including Jim Pickard WA1PSI in Derry, New Hampshire, that no transmissions were heard in the area during orbit 34. Prepared for orbit 49 which we believe to be our best chance in this area to work W5LFL.

December 1, 1983: Newspaper article appeared in the *Nashua Telegraph* describing failure to hear W5LFL on orbit 34 which had been our first opportunity in this area.

1538–1546Z: Listened for W5LFL on orbit 49. This was the first scheduled east-coast pass and was one of the best, reaching an elevation of 42 degrees. In the shack were Bob Wolf N1ABA, George Murphy K3RQ, Bill Burden WB1BRE, Dot Burden, Don Dillaby KA1GOZ from the *Nashua Telegraph*, Virginia Wegener of the *Manchester Union Leader*, Gene Balinski WA1UXA, and Randy Ward KA9GHT. Nothing was heard, but we were informed shortly after the pass that Owen Garriott was in a press conference during this time.

1546–1630Z: Short group discussion about failure to hear anything on orbit 49. Everyone was a bit disappointed, but there was also a lot of optimism among the people present, especially when we found out about the press conference.

2000–2030Z: Calculated orbital information for orbit 57, which is due to pass overhead just after sunset. There is partial cloud cover at this time, but hope to get visual sighting to confirm orbital calculations.

2150–2200Z: The *Columbia* appeared to the northwest, just as predicted, passed to the north reaching an elevation of about 30 degrees, and went over the horizon to the southeast. It was a spectacular sight, appearing as a very bright fast-moving star. It was observed for approximately five minutes. This sighting confirmed the accuracy of the computer program.

December 2, 1983: Newspaper article including picture appeared in the *Nashua Telegraph* explaining our attempt to work W5LFL on orbit 49. The article explained that Owen was in a press conference at the time of the pass and for that reason was not available. Newspaper article describing our attempt on orbit 49 also appeared in the *Manchester Union Leader*.

2230–2315Z: Prepared for orbit 70. Checked all equipment and orbit calculations. Monitored WA3NAN for shuttle transmissions and additional information.

2315–2321Z: Listened for W5LFL on orbit 70 from the car en route between Nashua and Durham. Nothing heard on any of the downlink frequencies. Did not make any transmissions. K3RQ attempted to work orbit 70 from his home in Milford, New Hampshire. Virginia Wegener of the *Manchester Union Leader* was also present. Nothing was heard by George either.

December 3, 1983: No scheduled orbits for today but monitored WA3NAN on and off for most of the day. Ran orbital calculations for orbits 85, 96, and 97. Relayed information on orbits 96 and 97 via the 13/73 repeater. Orbit 85, although not a scheduled orbit for W5LFL, was predicted to pass just after sunset, and since there was no cloud cover, this was an ideal candidate for another visual sighting. If you can't hear him, at least you can see him.

2130–2140Z: *Columbia* again appeared right on schedule from the northwest, passed to the north at about 45 degrees elevation, and disappeared over the horizon to the southeast. It was just as spectacular and exciting as Thursday's sighting. Anticipation of hearing W5LFL on the downlink for the first time is building again.

December 4, 1983:

1300–1335Z: Prepared for orbits 95 and 97 while monitoring WA3NAN.

1335–1342Z: Listened for W5LFL on orbit 96. Heard and recorded two transmissions at 1334 and 1336Z while the *Columbia* was over Florida. Called on odd minutes on 145.03 MHz. Signals peaked at 59+20 dB. Antenna polarization favored RHCP. It was a tremendous feeling to hear Owen Garriott for the first time. It was hard to believe the quality and strength of the downlink signals. Many, many signals were also heard on the uplink. It is hard to imagine what it must have sounded like in the *Columbia*.

1342–1500Z: Continued to monitor WA3NAN on 40 meters and compare notes with several other stations who had heard the downlink signals on orbit 96. Talked with WA1PSI in Derry to exchange reports and check data for orbit 97. After hearing W5LFL for the first time, everyone was anxious for a second shot at it. Many people on the 13/73 repeater had not heard him or were not listening on orbit 96 but looked forward to orbit 97 after finding out he had finally been heard in the northeast.

1505–1515Z: Listened for W5LFL on orbit 97. Heard and recorded two transmissions at 1508 and 1510Z while the shuttle was over Texas and the Great Lakes. Signals favored LHCP polarization on this pass and peaked at 59. K3RQ monitored the pass from his QTH in Milford.

December 5, 1983: Newspaper article appeared in the *Nashua Telegraph* describing the transmissions heard on orbit 96 and our continued attempts to be heard by W5LFL.

1320–1332Z: Listened for W5LFL on orbit 112. Heard and recorded four transmissions from the *Columbia* as the spacecraft traveled up the east coast. Transmissions were heard at 1324, 1326, 1328, and 1330Z peaking at 59+20 dB. Called on odd minutes on several different uplink frequencies.

1332–1430Z: While monitoring the 13/73 repeater and WA3NAN for new information, edited the tapes for orbits 96, 97, and 112 for presentation at the Nashua Area

Radio Hams Fail In First Attempt To Contact Shuttle

By VIRGINIA WEGENER
Union Leader Correspondent

NASHUA

NASHUA — The line was busy between earth and space yesterday morning as the space shuttle Columbia slashed its way across New Hampshire skies while hundreds of ham radio operators around the state tried to get a call through. But to no avail.

"NOVEMBER ONE, ALPHA BRAVO ALPHA." "NOVEMBER ONE, ALPHA BRAVO ALPHA." Nashua ham Bob Wolf kept repeating his call letters over and over during the odd numbered minutes when orbiting astronaut Dr. Owen Garriott was scheduled to be listening. (Garriott was slated to repeat the call letters on the even minutes, if he was able to receive and respond.)

Wolf continued repeating his call letters in the hope that Garriott would hear them, while fellow ham, George Murphy of Milford, manned the antenna tracking the spacecraft as it raced along.

Fellow hams Bill Burden, president of the Nashua Area Radio Club; George Balinski and Don Dillaby, all of the Nashua club, and Randy Ward of Evansville, Ind., were all in the Wolf home on Shaunee Drive in the hope of being there when Garriott broke through.

"There's only a total of eight minutes during each pass when the shuttle is in the right position to send and recieve," the various radio enthusiasts took turns explaining.

"We have 10 different frequencies we can transmit to him over and he'll respond on the even minutes on one of three frequencies."

The spaceman-ham will only be allowed to broadcast to earth during his off times and then the most earthlings will hear is "CQ CQ, this is W5FLF calling ..." whatever call letters he has received during the sending time from earth.

"Even if he can't answer us because of his NASA committments," another Nashua ham reported, "he'll try to record our calls so that when he gets back, we'll be notified that our calls were actually received in outer space."

Yesterday's unsuccessful attempt at communication didn't dampen the ham's enthusiasm, though. Tonight the shuttle sails over our area again and they'll all be at their respective stations at 6:15 p.m. for another try at reaching the shuttle.

Eavesdropping on outer space isn't restricted to those with ham radios, however. Anyone with a programmable scanner can tune in to frequency 145.55 MHZ while those with short wave radios can listen on 3.85 or 3.86 MHZ LSB.

But if O.G. doesn't call home tonight, he'll have one more chance to try Dec. 16.

Radio Club meeting. Exchanged signal reports and observations with many of the people who had monitored orbit 112. Many mobiles and several people with handie-talkies had heard W5LFL 59. Excitement was running high and *Columbia* fever was epidemic. Recorded element set #MH-12-5-83 for STS-9 from WA3NAN. Updated computer program and reran calculations for orbits 117, 128, 129, 132, and 133.

2109–2117Z: Listened for W5LFL on orbit 117. Nothing was heard. Transmitted on all uplink frequencies using both RHCP and LHCP during the pass.

December 6, 1983:

0000–0230Z: Nashua Area Radio Club meeting. Presented short update of STS-9 mission and played the recordings of downlink transmissions heard on orbits 96, 97, and 112. At least half of the 60 members present had heard one or more of the transmissions. Only a few had tried and failed to hear W5LFL. Dan X1XXX, one of the club members, was presented the "STS-9 COULD" award (Call On the Uplink Dummy). Note: The call has been changed to protect the innocent?

1311–1319Z: Listened for W5LFL on orbit 128. Nothing heard, but transmitted on all uplink frequencies during the pass.

2056–2104Z: Listened for W5LFL on orbit 133. Nothing heard, but transmitted on all frequencies during the pass.

December 7, 1983:

1130–1200Z: WA3NAN monitored while preparing for orbit 144.

1259–1307Z: Listened for W5LFL on orbit 144. Heard and recorded five transmissions at 1258:30, 1300, 1302, 1304, and 1308Z. AOS occurred at 1358:25 and LOS occurred at 1407:25. Signals peaked at 59+30 dB during the pass and favored RHCP at times and LHCP at other times. AOS occurred 30 seconds earlier than predicted.

2035–2044Z: Prepared for orbit 149. W5LFL has yet to appear on an afternoon pass, but will keep trying in hopes that the recorder is running.

2044–2052Z: Listened for W5LFL on orbit 149. Nothing heard, but transmitted on all uplink frequencies.

2100–2200Z: Ran computer calculations for orbits 160 and 161. Presented calculations for orbits 160 and 161 over the 13/73 repeater. Also discussed signals heard during orbit 144. Almost everybody was able to copy at least three of the five transmissions.

December 8, 1983:

1200–1246Z: WA3NAN monitored while preparing for orbit 160. Information received via WA3NAN indicated some problem with two of the computers, possibly associated with the maneuvering thrusters. At 1245 the scheduled landing was postponed until the problem with the computers was better understood.

1246–1300Z: Listened for W5LFL on orbit 160. Nothing was heard, and due to problems with the computers aboard the spacecraft, it was unlikely the recorder was running, so no transmissions were made.

Bill Burden is a native of Nashua, New Hampshire and has lived there most of his life. He is 47, married, and has three children. His wife Dot is waiting for her Novice ticket to arrive! Bill is a Program Manager at Sanders Associates in Nashua, where he has been employed for 28 years. He received his Novice license in 1976, his Technician in 1977, and upgraded to Extra in 1983. His primary activities include low-band CW, 2m FM, 220 FM, Field Day, and amateur radio/personal computer interfacing. Bill has been a member of the Nashua Area Radio Club for six years, serving as its president for three of those years. He has been appointed by the ARRL as Public Information Officer for NH and Assistant Director for New England for 1983, and he is a delegate to the NH Amateur Radio Association. Other activities include work on the NH March of Dimes and Nashua Red Cross Executive Boards and participation in Scottish Societies in New Hampshire and Vermont.

KO2X

Wanda G. Lovejoy KO2X
443 Jerry Smith Road
Lansing NY 14882

Interest in the space shuttle started mounting early in the spring when it became public knowledge we were about to send a *ham* into space. I never dreamed I would be fortunate enough to hear him, never mind call him. October 28 drew closer and every ham was spreading the word.

Our local club, the Tompkins County Amateur Radio Club, decided to get permission to set up a station on the Ithaca Commons, the downtown Ithaca pedestrian mall. Arrangements were completed for the October 28 lift-off. When the lift-off was postponed until November 28, our plans had to be dropped. The space was not available and we lacked ham power due to prior commitments, holiday time, and the fact that we could not arrange for a suitable location. I was ready to forget the whole project.

Monday, November 2: A few of the local hams were discussing the possibility of following through with our plans to have a station set up. We were in the middle of holding our Monday night Novice class and I had very strong feelings about the interest the project would create among the students. One of our newer younger members, Scott KA2AFN, volunteered to build a turnstile antenna. Needless to say, I grabbed at the offer. Scott met with all kinds of problems trying to get together the needed parts for our antenna.

Sunday, November 27: I was fortunate enough to have been chosen to work with other hams in the US in conjunction with Jack Burnett, Executive Editor of *73*. I was included in the first telephone conference call regarding our ham in space. My OM recorded the call on his reel to reel. It was a darn good idea, as I would have been at a complete loss without the information that was recorded. All I could think of was the fact that lift-off was tomorrow and I still lacked a circularly-polarized antenna.

Monday, November 28: The sun rose, the *Columbia* was off on schedule, and I became more frustrated by the hour. So the week progressed. By Thursday, December 1, I was completely oblivious of anything except the antenna. I called on 2 meters and the phone trying to get everything in order for this area's first chance to hear W5LFL.

Friday, December 2: This afternoon, about 5:10 EST, Scott arrived at my house, antenna in hand. We immediately went to work setting it up. At 5:45 pm, we were both out back, taking down the mast and my OM's CB antenna. It was about 25 degrees with winds about 15 mph and pitch black out there. We had a schedule to meet and we were determined to do it. We braved the elements and, finally, at 5:55 pm, into the house we ran, ignoring our frozen ears and fingers. We immediately checked the swr with a meter another club member, Lew KC2YF, had been kind enough to drop off at Scott's work QTH. Lo and behold...1:1. What a fantastic job Scott had done. Scott had another commitment and was only able to stay around for a few minutes. I felt very badly, especially after all the work he had done. After Scott left, I sat with my ear glued to my rig, an Azden 2000 mobile unit. I was sure I had a very faint copy on W5LFL, but there was barely any audio. Later that evening when I was ragchewing on the club's repeater, the guys convinced me it was other hams calling on W5LFL's frequency.

Saturday, December 3: I heard nothing. I went to bed feeling a little depressed, frustrated, and very disappointed.

Sunday, December 4: Bearing in mind what my Elmer used to preach to me—that a true ham never gives up—I turned the rig on as I was getting ready for church. W5LFL was calling "CQ North America." I was so shocked I couldn't move, and I didn't answer his call. That night, Jack Burnett arranged another conference call with the same group of hams. He gave the group all the latest and most updated information he could gather. When I finished on the call, I felt like I had been given a tremendous shot of confidence and encouragement—go get W5LFL! I spent most of the night planning my strategy.

Monday, December 5: Bright-eyed and bushy-tailed, I went into my shack, confident that not only was I going to hear W5LFL, but also that I was going to work him. I sat by my rig, tension building, excitement mounting, and completely confident of achieving my goal. Suddenly, "This is W5LFL, CQ North America." I grabbed the mike (dropped it), tried to turn the recorder on (couldn't remember how)—I was in a complete state of shock. Luckily, this mass state of confusion lasted just seconds, because I found myself calling him. In the interim, somehow I had turned the recorder on. I know it really

Wanda Lovejoy K2OX

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couldn't have been my doing—it must have been my guardian angel. Within a few minutes, W5LFL was calling "CQ" again. It seemed to me that the only ham he was really talking to was me. I went back to him again. It was too far into the game for me to start acting as if I had any common sense at all, because I didn't. The thought never entered my mind(?) to wait for the full length of the window. My OM was still asleep and I ran in the bedroom screaming. Waking him from a sound sleep, he wasn't sure whether I had completely flipped or I had come close to electrocuting myself. He calmed me down, brought me back to Earth, and attempted to explain that the astronaut was really talking to all hams on the continent, but nobody was going to burst my bubble! From here on, my rig was not turned off as long as Owen was on board the *Columbia*. We set a bed up in the shack in case any unannounced transmissions were made. Please believe me, I concentrated so hard on working Owen (you've probably noticed Owen and I are on a first-name basis now) that I never got a chance to work W5RRR. Oh well, they will be at it again many times, but nobody will ever be able to do a repeat performance of what Owen Garriott accomplished.

Tuesday and Wednesday were both fun days, as several opportunities were available to work the *Columbia* again. I worked every chance I got and will never regret one minute of it.

Thursday, December 8: The *Columbia* comes home today. I still am trying to work Owen with the same enthusiasm and pleasure I have felt all week. I feel sure that when I see the *Columbia* touch down, tears will be shed and I will have a feeling of sadness because another friend via ham radio with whom we have shared a good deal of time is back home and getting ready to get back into his normal routine.

I am sure we'll have other hams in space—we know there will be many more space shuttles. We also know that NASA will continue its efforts giving us all still another reason to be proud we are Americans. But all of this will never be able to help us relive the most exciting history-making event shared by hundreds of thousands of hams worldwide which was made possible by one of our own, Owen Garriott W5LFL. I have never been as proud of anything as I am to have had the opportunity to play my small part in this chapter of amateur-radio history.

Thank you and God Bless You, Owen Garriott.

My sincere thanks to Jack Burnett and *73* for giving me this wonderful once-in-a-lifetime opportunity.

Wanda Lovejoy lives in Lansing, New York, with her OM, Gerry, not a ham but responsible for her being one. He urged her to try for her Novice license and then kept pushing her. She was first licensed in November, 1980, upgraded to General in March, 1981, to Advanced in April, and finally to Extra in June of 1981. She is 56 years old and retired from the New York Telephone Company. During the summer she enjoys their cottage on Cayuga Lake, fishing, swimming, and keeping the company of their four children and twelve grandchildren. She is the organist at Our Lady of the Lake Church in King Ferry, about seven miles north of her home. The only real hobby she has is ham radio. She is currently president of the Tompkins County Amateur Radio Club, which just finished its first Novice class—"we have 23 new Novices in the area from a class of 26." Since the final test on December 5, after checking the results, Wanda feels twelve feet tall. "It's such a pleasure to see people work so hard to accomplish their goal for the pleasure and satisfaction we all get from our hobby—ham radio."

N4UF

Billy F. Williams, Jr. N4UF
PO Box 9673
Jacksonville FL 32208

It started here in Jacksonville, Florida, during late September when plans were made to publicize the STS-9 amateur-radio operation. Rudy Hubbard WA4PUP of Milton and I began the task with apprehension because of the lack of a precedent on which to base decisions. Rudy is Public Information Officer and I am Section Manager of the Northern Florida ARRL section which includes 44 of the state's 67 counties. Rudy has four Public Information Assistants (PIAs) who work with him.

We elected to start out "blitz" on October 1 in preparation for the proposed October 28 launch date. Packets of information were sent to the PIAs and media contacts which Rudy arranged. We were dealing with several unknowns. Would the signals from the STS-9 be audible? Would most hams brush the oppor-

Billy F. Williams, Jr. N4UF

The Florida Times-Union

Jacksonville, Monday, December 5, 1983

B

tunity off as too technical? What if we got the media excited and then found we couldn't deliver? These were among the questions which caused much concern.

In Jacksonville, interest in STS-9 was minimal but starting to develop. A few local hams were designing special antennas and a couple even ordered special arrays from commercial sources. The word was spread at our two large ham clubs and on the nets. Just as momentum was gaining, reports began surfacing that predicted certain delay of the launch. A couple of days later, these were confirmed and the earliest possible launch was set for November 28. A possibility existed that the mission would not be launched until February, 1984. Interest seemed to evaporate.

It turned out that the delay was beneficial and provided an ideal follow-up to one of the biggest amateur-radio events ever. On October 25, I heard reports of amateur radio being used by a medical student at St. Georges in Grenada to provide the only information out of a potentially explosive situation. Upon arriving at my job location, a community college with an amateur-radio station, I found KA2ORK/J3 on 20 meters. By noon, calls were coming in from local TV and radio stations. At 1:00 pm, the first camera crew arrived and began taping Mark's transmissions and asking questions about amateur radio. Grenada was instrumental in capturing attention and focusing the media's interest on amateur radio. STS-9 was to be an ideal follow-up a month later. As the reporters left with their stories and tapes, I reminded them about Dr. Garriott's STS-9 operation.

Around 4:00 am on Thanksgiving, November 24, I was tuning across the AM radio dial when I happened upon a station carrying the ABC Talkradio Network. The regular host of the program, I learned, is an amateur-radio operator. His name is Ray Briene N6FFT and he was interviewing Jay Holladay W6EJJ. The topic of discussion was amateur radio and STS-9. It was very enlightening. Many telephone calls were aired from hams around the US. Not being very familiar with satellite communications, the program helped me immensely and my interest in attempting contact with W5LFL increased.

The next day I was tuning my HF antennas for the *CQ* Worldwide CW contest and also installing a couple of VHF antennas. One was a Ringo Ranger at 70 feet and the other an 11-element Cushcraft beam at 25 feet. It would be odd to me later to discover that height means very little when communicating with a satellite. After completing the work, I began operating the 48-hour DX contest. Although band conditions on HF were atrocious, I did get several new band-countries.

On Sunday morning during the contest, I received a call from the local NBC TV affiliate seeking information on STS-9 which was to be launched the next day. The reporter seemed very interested and was slightly disappointed to learn that no communication be-

Ham operator finds lucky number is 96

By Ford Risley
Staff Writer

John Moore's lucky number yesterday turned out to be 96.

Moore, a ham radio operator from Orange Park, talked with mission specialist Owen Garriott as the space shuttle Columbia was on its 96th orbit around Earth.

"It was quite a thrill because so many ham radio operators are trying to make contact," said Moore, a radio ham for almost 30 years.

Moore said as far as he knows, he is the first ham radio operator in the Jacksonville area and one of only four in the state to make contact with Columbia.

Garriott, who is an amateur-radio enthusiast, has taken a five-watt, battery-operated radio into space as part of his personal effects.

When he has time off from his duties on the Columbia, Garriott is holding his radio to a window when the shuttle is pointed toward earth.

Garriott then scans 10 radio frequencies. When the astronaut picks up signals from earth-bound operators, he replies with his call letters — W5LFL.

Moore, whose call letters are W5HUQ, made contact with Columbia at 8:34 a.m. yesterday — on his first try.

"I was very lucky," he said.

Besides good fortune, Moore credits his success to knowing precisely where the Columbia was going in its travels.

He said he got a computer printout with the space shuttle's exact orbits from NASA.

Moore, 44, said he made contact with Garriott as Columbia was over the southwest tip of Florida at an altitude of about 135 miles.

For Moore — who has talked with radio operators as far away as Japan and Russia — the challenge was not distance, but trying to get through while hundreds of other hams were trying to do the same.

Another problem is time.

The space shuttle is over the United States for eight to 10 minutes at a time. And Garriott will only be receiving signals for five or six days of the nine-day mission.

tween the shuttle and amateur-radio operators was scheduled until at least Wednesday. He agreed to check back with me on Tuesday. At precisely 11:00 am on Monday, November 28, STS-9 was launched. At 11:04 am, CBS television mentioned Dr. Garriott's ham radio and added that he said "73" and signed his call on the main system nine minutes before lift-off. Upon arriving home at 3:00 pm, I monitored W5RRR at the Johnson Space Center in Houston. Much confusion existed about the orbit times and which ones would be best for amateur-radio contact with W5LFL. Fortunately, the night before I had gotten the latest information from Jack Burnett, Executive Editor of *73* magazine. The ARRL sent out a list of elapsed times which I got on Saturday and my conversation with Jack gave me a couple of new ones which were not on the list. On the whole, I would rate the quality of information from both sources as very good.

I converted the elapsed-time listings into local EST for the 12 most likely orbits. I had doubts about the central USA possibilities but listed them anyway. The next step was to install my cassette tape recorder into the audio line of my 2-meter transceiver which is a Kenwood TR-7800. This was easily accomplished. I had heard that the KA4GXZ repeater in Clermont was planning to rebroadcast the shuttle/ground communications, so I tuned the rig to 145.39 MHz. Since Clermont is over 100 miles from Jacksonville, I didn't expect to hear much. Surprisingly, KA4GXZ/R was putting in a strong signal and this was the case during the whole operation. I learned that KA4GXZ had the machine linked to a similar operation on the Merritt Island repeater and that the K4DPZ/R Gainesville repeater was also tied in. These repeater operators are to be commended for their initiative in providing shuttle-to-ground audio. Anyone who monitored the shuttle transmissions on KA4GXZ/R is asked to send a card or note to the *Callbook* QTH so that owners Wayne Fletcher and John Mullan W4OQF can gauge interest for future launches. Those hearing the rebroadcast on other repeaters should drop notes to those responsible as well.

On November 28, the *Jacksonville Journal*, an afternoon daily, carried a front-page article and photo about Hank Fitz WB4URU and his preparations to work W5LFL. Hank is an experimenter extraordinaire and did an excellent job of getting the information across to the reporter—a task not to be taken lightly. The same day, I received a copy of an article from a Sanford newspaper which had been carried a few days earlier. Wimpy Wimberly KB4LB was featured along with a photo of him at his station. Wimpy is one of our most energetic Public Information Assistants who covers the Greater Orlando area.

Other than listening to the shuttle audio through KA4GXZ/R, there was really little else to do except to try to gauge the interest while answering an occasional telephone call from the media. The local TV and press gave the impression that they expected a mass contact operation by W5LFL, but I had serious doubts. His signal would be audible for only eight minutes at a time which would give a total of 96 minutes of operating time if all 12 passes were perfect. I estimated he might make 500 contacts at most during the eastern and central US passes. It was decided to start impressing this point upon the media. On Tuesday, I got a call from the NBC TV affiliate again and it was agreed they would send their news team to my home for the first of the 12 possibilities which would be orbit 34. I quoted the odds at 100 to 1 against a contact and 5 to 1 against hearing W5LFL. This was to be a low orbit and would pass about 1,000 miles west of Jacksonville. In retrospect, the 100 to 1 odds seem very conservative!

On Monday night, the local ABC television affiliate had some shots of Robbie Roberts KH6FMD/W4 preparing for the chase. They stopped by Robbie's house on the way back from Cape Canaveral.

Throughout Monday and Tuesday, I monitored area two-meter repeaters to get some idea of the extent of local efforts to contact STS-9. The biggest problem was confusion as to which lists and times were correct. Quite a few hams were using outdated lists, and while about 50% of those surveyed wanted to make an effort, only a handful had the correct times. Jacksonville Public Information Assistant Mike Reublin NF4L and I participated in a discussion on the 146.16/.76 repeater in which we disseminated the correct information from the data supplied by the ARRL and *73*.

As I tuned across two meters on Tuesday, I heard quite a variety in antennas to be used. Four-bay dipoles and 11-element beams seemed to be the most popular choices. Typical power levels were in the 100- to 200-Watt range with three stations contemplating the legal limit. My own 25 Watts seemed small, but I reasoned that it was more luck involved than station capability. I was to learn a lesson in that regard, though.

My day for Wednesday, November 30, was planned. I would go to work about 8:00 am, teach my morning electronics classes, and be home for lunch by 11:15 am. The NBC TV affiliate was to arrive at 11:30 am and we would tape the orbit 34 pass from 12:10 to 12:25 pm for broadcast on the evening news. Just as I was leaving work for lunch, I got a call from another TV station. The CBS affiliate wanted to send its live remote truck to my house. I explained the odds again and informed them that one station had already asked to be present but that any station was welcome to attend. They said the truck was on the way.

Arriving home, I heard the telephone ringing. The ABC affiliate also wanted to send out a crew. After again explaining the odds of contact, I invited them to attend as well. By 11:50 am, all three TV stations had their equipment in place and checked out. One station, the CBS affiliate, would be broadcasting live during the middle segment of the noon newscast. The others would be taping for 6:00 and 11:00 pm.

I figured that W5LFL would be audible from about 12:15 to 12:23. At 12:05, I began scanning the 10 frequencies and monitoring 145.55 MHz. The live report started and I made a 20-second call which was, of course, unanswered. I then was posed a couple of questions and stated that I hoped to be the lucky one to contact W5LFL despite the long odds. A similar stance was taken with the other reporters who taped interviews after the live report was over. I was trying to develop the angle of who would be the local lucky ham to make it through to STS-9. There was little to show so far. Even a little reception of W5LFL would have been helpful. Any ideas of a DXpedition-type operation were doused and the question was now "can a local ham make good?" Any local ham would suffice. The worst thing would be to have no local get through.

Fortunately, I tuned the HF rig to 14.280 MHz where W5RRR was operational. The reporters were still listening and we heard a loud pile-up of stations calling to report that no one had heard W5LFL. There must have been 75 or 80 stations. That experience reinforced the angle of whether any local ham would be successful. If so, it should be a big news event. Later, we found out that Dr. Garriott was occupied with other duties. Incidentally, the idea of the tape recorder aboard the spacecraft was a very wise one. It took pressure off those who were involved with the media. We always could say we were confident that we would be on the tape but that no one would know until the mission was completed. This took the edge off of the unsuccessful attempts conducted in the presence of the media. The end result was a failure being turned into a selling point. As they left, the reporters gave me special numbers to call if any local station got through. I also promised to tape any interesting events.

The second of the 12 opportunities came on orbit 39 which was from 8:05 to 8:15 pm Wednesday evening. Again, this was to be a central US pass but the orbit was to be of higher altitude which would extend the communications corridor to include us on the fringes. Our weekly ARES net met at 7:30 pm on 2 meters and I read the schedule as a QNC. All 3 local affiliates carried the story on the 6:00 pm news along with pictures taken at my house that noon. Few locals had attempted on orbit 34, but interest in orbit 39 was much more intense. I decided to do most of my calls on 145.03 MHz. Some stations were using the "shotgun" approach with short calls spread over the 10 uplink channels. I spent about 30% of the time calling with the other time spent scanning the uplinks with my priority set on 145.55 MHz. I planned to make a tape of those calling to be edited and played at a future local ham club meeting.

There was no reception from W5LFL on orbit 39, so it would be the next morning (Thursday) before we would have our third shot in Jacksonville. Orbit 49 was scheduled for 10:27–10:47 am which would be a prime opportunity since it was the first east-coast pass on the list. Fortunately, I was able to get home long enough between classes to give it a shot. However, the astronauts were holding a live press conference at that exact time so our only hope was the tape recorder which might have been running. Some discouragement was being noted locally. We had been foiled on our first three attempts. Some had heard rumors of a Montana station making contact Wednesday night and other reports of very strong reception on the west coast had been noted. But locally, we were batting .000 being 0 for 3.

Friday evening provided the next opportunity. Orbit 70 was listed for 6:05–6:25 pm over the eastern USA, followed 90 minutes later by orbit 71 over central USA. Despite some frustration, more locals than ever were planning to give it a try. Both orbits passed without success. One local reported working W5LFL but I was suspicious of the claim. The source of information being second or third hand was very unreliable, and although I would have liked to get a story on the air, the potential for embarrassment was too much. I was later to find out that contact at the time stated was impossible. No one else locally had heard even a peep on either orbit.

Saturday was a breather with no scheduled orbits of operation in our area. My finances were looking up after the Thursday night televised pro football game which made me very happy. And they were to be even better still as a result of the nationally televised Florida Gator/Florida State Seminole football game. Looked like the Gators and the Raiders were having

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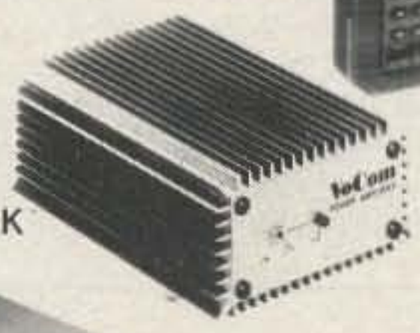

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much better luck than the local ham-radio operators.

Scattered blind calls were heard throughout Saturday evening. I even made a couple myself hoping for a break. Maybe Dr. Garriott would have a few unscheduled minutes and I would luck out. Maybe similar to a DX contest situation where thousands of stations are embroiled in a pileup and one ham moves up the band and hears an even rarer station calling CQ with no takers. At least I had plenty of local hams on tape for the meeting program. I had no way of knowing at the time, but Sunday was to be a very big day!

8:00 am Sunday arrived sooner than expected and it was time to stumble around getting ready for orbit 96. As the *Florida Times-Union* was to say in the next day's edition, 96 would be a ham's lucky number. It was tempting just to forget it and go back to sleep since we had been unsuccessful in even hearing W5LFL, but that idea didn't last long. After all, this pass was to be very close and our luck had to change.

At 8:35 am I heard W5LFL in a clear crisp signal! "I am still not able to read many of the signals in my headphones here because the background noise is just too high. We will have it all on tape and be able to sort it out when we get back on the ground. So this is W5LFL in the spacecraft *Columbia* now approaching the—let's see—we are coming across the Gulf at this time approaching the coast of Florida and then on up the east coast. W5LFL is calling CQ North America and I'll be standing by for the next 60 seconds."

A tremendous pileup ensued! A minute later we heard "W5LFL returning to Kilowatt Four Germany Foxtrot Germany. Your signals are loud and clear. Also a Kilowatt Victor Four Charlie . . ."

I looked up K4GFG in the *Callbook* and found he was licensed to Davie, Florida, near Miami. Also Dick Jansson WD4FAB of Orlando was recognized. And most important for Jax area hams, John Moore W5HUQ was logged by W5LFL! Actually, John had worked him just as he came up over the horizon. We had a local ham in contact with STS-9! A couple of minutes later, the telephone rang and John asked if I heard it. Indeed I had and the signal quality of W5LFL was sensational. Within the hour, a TV news team from the local ABC affiliate was en route to John's Orange Park QTH. They taped a very nice report which was aired on the 6:00 pm newscast. To make it even better, W5LFL had also contacted King Hussein JY1 and of course that was big news. It was a natural local tie-in!

Meanwhile, a similar scene was unfolding in Orlando where WD4FAB was also featured and gained much publicity for amateur radio. Only four Florida stations were to be logged during the regularly publicized orbits and I felt lucky to have one of them in the Jacksonville area and another in Orlando which is in the Northern Florida Section.

Orbit 96 faded away with 97 due in about 85 minutes. The next pass was to be over the central US and I doubted whether it would be heard in Jacksonville. But there was nothing else to do but give it a try. At 10:07 am, I was surprised to hear, "This is W 5 Lima Foxtrot Lima in the spacecraft *Columbia* calling CQ North America . . ." He went on to say he was over Texas. Signal quality was still excellent! A local ham, Bernie Munsey N4GBY, later reported hearing W5LFL very clearly on his mobile unit as he was heading south down Interstate 75 in southern Georgia. He was using only a 5/8-wavelength whip antenna.

At 9:07 pm that evening, I participated in a conference call with other hams who were writing reports for this article series. *73*'s Executive Editor Jack Burnett filled us in on the latest information and Bill Pasternak WA6ITF gave us insight with his observations. Each participant then gave a capsule version of activity in his or her area and a tape of a west-coast pass was played. It was a pleasure to be able to participate.

Next up was orbit 112, scheduled for 8:15–8:23 am on Monday. Again luck was with us. Although not as clear as the day before, W5LFL was heard with much the same announcement. The background noise was very high and the tape would tell the tale. W5LFL was not heard on orbit 113.

On the way back to classes, I picked up the morning paper and on the front page was a story headline: "Ham operator finds lucky number is 96." Of course, the article featured John Moore W5HUQ who did an excellent job of getting the information over to the reporters. Besides being lucky, John credited his success to knowing precisely where *Columbia* was going in its travels. He had a computer printout with the exact orbits from NASA. John's station included a pair of 7-element beams and a kilowatt. He has been very active with OSCAR and VHF, having all states worked on 6 meters along with 63 DXCC countries on 432 MHz where he operates EME. His rig is a Kenwood TS-700A.

Dick Jansson WD4FAB is also very active on VHF. He has served two terms on the ARRL VHF-UHF Advisory Committee (being the only fourth call area member). It was revealing to note that the stations

breaking through the tremendous background noise were top-notch operations while the simpler stations had great success in receiving W5LFL. I guess there is a message in that somewhere.

Orbit 129 on Tuesday was the next shot but was not heard by me or John. No dice either on 133 that afternoon. The last orbit on the regular schedule was 134 on Tuesday from 5:25–5:35 pm which was to be a central US pass. I heard two transmissions from W5LFL while he was over the Mississippi Valley carrying on a QSO with a station out that way. John Moore W5HUQ picked him up for 5 or 6 exchanges beginning with STS-9 crossing the snow line. John reported that KB4CRT in Tampa had contacted W5LFL, making him the fourth station in our state to do so.

Later Tuesday evening, I received a call from the news director of a very popular FM radio station. I played my tapes of W5LFL over the phone to him along with a sampling of the bedlam of the pileup. These were featured during morning drive time the next day. This was a good ending to a great event!

The only thing left to do was to try to work STS-9 on an unscheduled orbit during the last two days. Unfortunately, my class schedule had caught up with me and I didn't have as much time as I wanted, but scuttlebutt on the bands indicated orbits 150 and 151 on Wednesday might be a good bet. No luck here, but it was fun trying.

At this time, I cannot say which event was bigger, STS-9 or Grenada. I measure the significance of events by their long-term effect. One thing is for sure: The period of October 25–December 8, 1983, generated the most positive publicity for amateur radio that I can ever remember! I have been licensed since 1964 and have files of the 3 major ham publications going back to 1948. Nothing can match this 45-day period we just experienced! Another interesting point is that I never heard amateur radio referred to as CB once during all the publicity. At our college library are newspapers from many major cities and it is a pleasure to see big articles on amateur-radio operations in most of them.

The publicity generated by Grenada and STS-9 comes at a crucial time. We live in a political environment where the quiet get trampled. The FCC is insulting us with one proposal after another. I think they would like to drop amateur-radio licensing altogether and what we are seeing are token efforts. We must maintain high standards and become involved in promoting amateur radio or we may follow CB into complete deregulation. *73* is to be thanked for its promotion of this documentary. I have enjoyed working with Jack Burnett and the other hams involved.

Billy Williams N4UF is a professor of electronics at Florida Junior College. Now an Extra, he was first licensed in 1964. He has served as president of such organizations as the North Florida Amateur Radio Society, the Jacksonville RANGE Repeater Association, and the North Florida DX Association. He also is Section Manager of the Northern Florida Section of the ARRL and DX Awards Manager of CQ magazine.

KA4AKO

Robert C. Holley KA4AKO
PO Box 341
6184 East Ponce de Leon Avenue
Stone Mountain GA 30086

I kept a diary from Monday, November 28, through Thursday, December 8.

Monday, November 28: This station called *Columbia* W5LFL on 2 orbits. No reply was received from Owen Garriott on either try.

Tuesday, November 29: Mark Durfield KB4BPL, 15-year-old sophomore from Redan High School in DeKalb County, asked me to pick him up at his school during a study-hall period. With permission from his parents and the school, I transported him to his home amateur-radio station where he and I both made calls to *Columbia*. This was done 10:28 through 10:35 am. No reply received.

Wednesday–Saturday, November 30–December 3: Attempts were made on all eastern orbits to contact *Columbia*.

Sunday, December 4: Charles Griffin WB4UVF (Clarkston, Georgia) was monitoring 145.55 and he heard and taped W5LFL acknowledging K4GFG and another K call on orbit 96A.

Sunday, December 4: At 5:55 pm EST, Jim Truluck KB4A (Griffin, Georgia) reported to me via 2 meters that he had a good visual sighting of spacecraft *Columbia*.

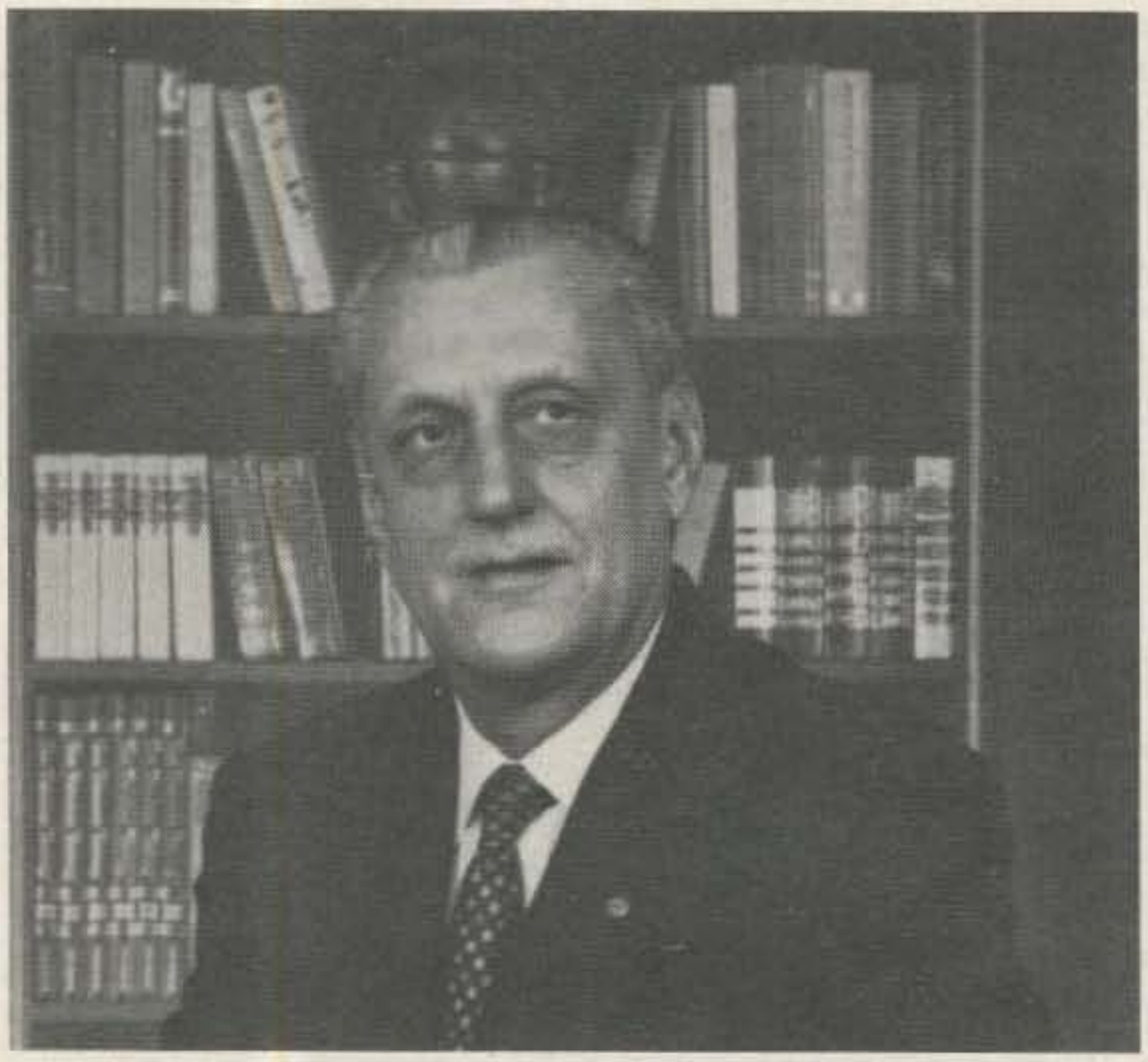
Monday, December 5: At 8:28 am, this station heard W5LFL sign on with "This is W5LFL calling CQ America. I am ready to receive calls." Signal report from my mobile rig, a Yaesu 227R, ¼-wave magnetic-mount Larsen antenna; on an rf signal meter, 0 to 10, I received a 4.

Tuesday, Wednesday, and Thursday, December 6, 7, 8: No other contacts received from *Columbia*. KA4AKO continued to place calls each time the spacecraft passed over the Atlanta-Stone Mountain area. K4LDR, Atlanta, was contacted on 145.41, the club repeater. This group carried on excellent coverage on the space-shuttle operation, and I asked Pete to furnish me with all available data that his

group collected during the period that the craft was in flight. He has been very helpful in furnishing the diary of his and other stations.

This has been a great opportunity to work a special event and I appreciate being chosen and included to participate.

Robert G. Holley KA4AKO is 59 years old. He served in the US Navy during WWII and the Korean conflict. He was Post Office Clerk 15 years and Postmaster, Stone Mountain GA 30086, for 16 years. He holds a Technician license and has been an amateur since May, 1978. A member of the ARRL, Alford Memorial Radio Club, Atlanta Radio Club, and the West Central Georgia Repeater Association, his station consists of an Icom 25A transceiver, two Yaesu 227R transceivers, an Icom 215 2-meter transceiver, and two Tempo S-1 2-meter transceivers. He has two Whamo 10 scanners with two digital frequency selectors and a Regency M-100 scanner. His fixed-station antennna is a Ringo Ranger up 40 feet above ground.



Robert G. Holley KA4AKO

K4LDR

P. J. F. Shaw K4LDR
268 Braden Drive
Tucker GA 30084

Following the launch of W5LFL aboard STS-9, the Metro Atlanta Telephone Pioneer Amateur Radio Club (MATPARC) began receiving computer-generated orbital data from Clark N5XX, Fish WA4HXE, Doug K4SWJ, and Stan WA4DYD. All data was rebroadcast via the MATPARC VHF repeater (W4PME/R 144.81/145.41) for the Atlanta area amateurs. Broadcasts were each hour, then every ten minutes during the one hour prior to the upcoming orbital communications opportunity.

Following each orbital opportunity, Pete K4LDR conducted a forum on the repeater where each participant shared his observations, thoughts, thrills, and experiences. K4LDI and WD4KYO were assistant net-control stations. WD4KYO copied ARRL teletype bulletins and passed them along. For those who did not receive signals from W5LFL on a particular obital pass, recorder tapes were played for their benefit.

As the word of our endeavors spread, the MATPARC repeater system enjoyed more than 100 different amateurs participating, with 30 to 50 per net session. Stations from Alabama (Gadsden—90 miles distant), South Carolina (Laurens—140 miles), and all over north and central Georgia checked in, either asking for or providing information. Also participating were several handicapped amateurs that our group was pleased to have join us. It was clear that our MATPARC repeater exceeded the coverage we had calculated.

AK5Q, mobiling through Atlanta, heard and joined us. When he reached his home in Tennessee, he was unable to learn orbital information locally (he was a brand-new resident). He telephoned K4LDR on successive evenings to receive the 21.00 MATPARC Bulletin which forecasted orbital data for the following day. Also checking in was NK4E/aeronautical mobile. MATPARC was pleased to make so many friends that we didn't know we had.

For orbital passes during working hours, W4QO, WD4KYO, W4PME, K4LDI, WB4LFY, K4LDR, KA4SBD, and WB4IRR, with non-licensed interested guests, ascended to the roof of the Southern Bell Corporate Headquarters building (650' AGL/1650' AMSL) in hopes of hearing W5LFL (or being heard) with handie-talkies. Early morning trips to the breezy roof found ice, 35° F, and a windchill of 15° F.

At least one non-active amateur, K4LAR, who heard W5LFL on a scanner, was re-enthused and hastily arranged for a transceiver so that he could receive better and make calls also. Dick reported into our net absolutely overjoyed that he heard W5LFL; he is back into ham radio. Though handicapped and in a wheelchair, Dick assembled a Ranger II antenna and is ready to put it in the sky, with some assistance.

Dr. Garriott acknowledged two W4-area callsigns as he traversed Atlanta during orbit 144: WA4BEV and WA4EWA. Ken W4OCW telephoned WA4BEV in Valdosta, Georgia (230 miles south), but was unable to reach WA4EWA in Birmingham. Ken played his off-the-air tape for WA4BEV. BEV was absolutely ecstatic and thanked Ken six ways to Sunday. Ken was gracious and mailed BEV a copy of the tape segment.

"Calling W5LFL, W5LFL in Columbia, *this is K4LDR, K4LDR on Earth, over." (Photo by Bob WD4KYO)*

To date (12/9/83), none of the Atlanta area amateurs knows if he is part of W5LFL's log (tapes), but we all have hopes! Over seventy local amateurs participating in MATPARC net sessions received W5LFL transmissions. Many had tape recordings; all were thrilled and excited. K4LDR remarked that he is requesting an SWL card, for sure, and that the 2-cent confirmation card would deserve an $8.00 frame. All acknowledge that "this is the best thing that has happened in amateur radio since the first functioning OSCAR satellite obtained orbit."

Thanks to W5LFL, NASA, AMSAT, the ARRL—and all the behind-the-scenes people and . . . amateur radio!

KD5JO

Bob Buchanan KD5JO
9632 Vista Oaks Drive
Dallas TX 75243

I want to start my report by saying it was an exciting experience to monitor, listen, and transmit to astronaut Owen Garriott W5LFL as the shuttle *Columbia* passed over the Dallas area. The most frustrating part of the entire experience was the amateur-radio operators who constantly called on the downlink frequency of 144.550 MHz and made it virtually impossible to hear any signals from the spacecraft. This situation improved greatly with the passage of time.

It was a "golden time" for all of amateur radio and we were well recognized by numerous newspaper articles as well as coverage on TV and radio. I was not contacted by anyone from the media; the local coverage was of a general nature.

As soon as word got around that I was doing a diary-type report for *73* magazine, I had some great support from many local ham-radio operators. I want to recognize, in particular, Al Brinkerhoff WB5PMR (Dallas), the north Texas area coordinator for AMSAT, who shared with me a great deal of data which he took off his computer and made it possible for me to have very accurate data concerning the window when the spacecraft was close to the Dallas area. I also received a great deal of valuable information from Fred Maia W5YI, publisher of the *W5YI Report*. Now I would like to pass along to you the notes I made in my diary during the flight of *Columbia*:

Wednesday, November 30, Orbit 34A: This was the first pass over the central part of the United States. The Texas window was 11:14–11:21 am local time. The *Columbia* passed over the El Paso area, and no one in the Dallas area reported

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hearing Owen Garriott. Many amateurs were transmitting on the downlink of 145.550, which made it virtually impossible to hear any calls that may have come from the spacecraft. I was operating a Yaesu 227R transceiver (10 Watts) and using a Ringo Ranger antenna up about 20 feet.

Wednesday, November 30, Orbit 39D: This was rumored to be one of the best orbits over the Dallas area, with the spacecraft reported to be just 100 miles away from us. Window time was 7:04–7:12 pm. No one in the Dallas metroplex area reported hearing the spacecraft on this orbit. We later heard that orbits 34A and 39D were scrubbed due to schedule changes that were necessary aboard the *Columbia*.

Thursday, December 1, Orbit 49A: The window time on this pass over was 9:33 to 9:41 am, and I listened to it in the car using an Icom 2AT with a 10-Watt amplifier. Did not hear any signals from the spacecraft.

Friday, December 2, Orbit 71D: This was a great day for KD5JO! I heard W5LFL for the first time at 6:48 pm. Owen was loud and clear, and he called CQ and said he would be listening for 70 seconds. He came back and started to repeat some of the calls, but QRM absolutely wiped him out! We did hear him say he would be listening for the next 90 seconds, and we transmitted again as we did during the 70-second period. No further word came from the spacecraft. My wife, Nancy, was in the ham shack with me during this orbit, and she was thrilled to hear the voice of Owen Garriott.

Sunday, December 4, Orbit 97A: The window on this orbit was 9:01 to 9:09 am and it was reported that *Columbia* was 100 miles east of Dallas. I heard W5LFL loud and clear at 9:06 CST, at which time he reported that his headset was not working well but that calls to the spacecraft were being recorded on tape and would be delivered to the ARRL as soon as *Columbia* completed the mission.

Monday, December 5, Orbit 113A: I listened for W5LFL on this orbit but did not hear him. I learned later that the *Columbia* crew was engaged in a press conference and a discussion with President Reagan at the time they were to be transmitting to the Dallas area. This was unfortunate, since this orbit was reported to be going directly over us at about 8:52 am CST. I also observed that not many stations were monitoring this morning pass; perhaps the interest and excitement level had decreased somewhat.

Tuesday, December 6, Orbit 129A: I heard W5LFL at 8:43 am CST. He said he would be monitoring the uplink frequencies for 90 seconds. His signal was 5-9±. I was in my car at the time using an Icom 2AT at 10 Watts and using a 5/8-wave antenna. Owen Garriott did not report back after his CQ call. The spacecraft was reported to be 100 miles west of Dallas.

Bob Buchanan KD5JO

Tuesday, December 6, Orbit 134D: I listened to this orbit in my car, also. I heard W5LFL at 4:31 pm loud and clear, and he passed about 100 miles to the west of Dallas. He made the comment that he could see the Texas area very clearly and was hoping he would be able to make contact with someone in his hometown. He said he would listen for 1-1/4 minutes for any calls from the area. He did not repeat any calls that he might have heard.

This concludes the entries in my diary. I was not able to monitor any more orbits that may have been scheduled. I want to close by saying I am very proud to have been a member of the team that was selected by *73* magazine to be involved in the flight of *Columbia*. I think we learned a great deal from this experience, and the information gathered should be valuable in future amateur-radio communications between Earth and space. A special thanks to Owen Garriott who took time from his busy schedule to make a great contribution to the entire amateur-radio community.

Bob Buchanan KD5JO is 52 years old, with three sons and two grandchildren. His wife, Nancy KA6ADA, has her Novice ticket which she received when the family lived in Laguna Beach, California. After 28 years of employment with Eastman Kodak, Bob took an early retirement from Sales and Marketing Management this past April. Presently, he is in management with the Primrose Oil Company of Dallas. Bob has been a ham for 25 years, and his other hobbies include fishing and photography.

WB5ASA

E. van der Smissen WB5ASA
1719 Peachtree Court
Texas City TX 77591

A book could be written about the experiences of individual hams trying to contact the spacecraft *Columbia* and Owen Garriott W5LFL. Tall tales ("How I Worked W5LFL on 2½ Watts With a Handheld") and similiar stories will be flying around hamfests until the next ham-in-space mission.

Signals from *Columbia* were strong and rode over the QRM on nearby passes and were even full quieting on some passes that were over the horizon.

W5LFL was heard in Texas on November 30 at 8:35–8:45 pm CST as the *Columbia* was passing over California on orbit 40D. The signals were full quieting in the Houston-Galveston area even though the *Columbia* was 1800 miles away over the horizon. E-skip was helpful in propagating several over-the-horizon signals. Houston-Galveston stations with good beams were able to copy W5LFL on orbit 40 with complete readability and signal strength of S5 to S9. He was also copied full quieting on several hand-helds using rubber-duckie antennas.

Roy Neal K6DUE had his hand-held on the bedside table in his room on the eleventh floor of his hotel in Nassau Bay (across the street from the Johnson Spacecraft Center), and signals from orbit 40 were strong enough to wake him up with a full-quieting signal.

Every type of receiver capable of receiving two-meter FM signals seemed to successfully hear the 5-Watt signal of W5LFL—scanners, hand-helds, and, of course, conventional base stations. During the flight of *Columbia* (STS-9), there was hardly a ham with two-meter FM capability in the Houston-Galveston area who did not at least listen for W5LFL.

If you only heard Owen Garriott on any of the orbits, send your reception report with an SASE to ARRL, STS-9, 225 Main Street, Newington CT 06111. (A reception report should include orbit number, time, your location, W5LFL's comments heard, and a description of your station.)

In spite of Murphy and his laws, hundreds of hams received contact confirmation as *Columbia* passed within range. Thousands more attempted to make contact, and several hundred will receive the WADL award (Worked All Down Links) for repeater offset mode, shifting from 600+ repeaters to the *Columbia* uplink frequencies without changing the offset-placed transmitted signals on the *Columbia* downlink frequencies, thus producing much QRM on W5LFL. More hams were heard on the uplink and downlink frequencies than had ever been heard on two meters before.

It will be interesting to see a profile of the ham stations that were actually heard, or recorded, by W5LFL. Were they all EME stations, or were some even handie-talkies? I understand the NASA club (W5RRR) is planning to develop such a profile report.

Hams tried to get every bit of performance possible from their stations, but for some this was too little, too late. I had circularly-polarized satellite antennas on hand but did not get them mounted in time, so I had only a discone and a turnstile antenna to use to try to make contact.

Rumors were wild about the types of stations used by hams. We heard that one ham in California (where else?) went out and bought ten transmitters, ten amplifiers, and ten antennas, put one on each of the ten uplink frequencies, and used them all simultaneously. I wonder if he ever made a contact.

WA5NOM, one of the first stations in the Houston area to be acknowledged by W5LFL, was operating an Icom 271 driving a 160-Watt amplifier feeding a Cushcraft 20-element twist antenna in an az-el mount as used for satellite work. It was calculated that his effective radiated power was more than 3,000 Watts.

On December 5, one of the Texas City hams (ND5D) worked W5LFL using modulated CW, with 10 Watts to a vertical antenna. The CW was believed to be acknowledged by W5LFL.

Effective radiated power (erp) used in the Houston-Galveston

area ranged from 2½ Watts to over three kilowatts. W5LFL had estimated that 40 Watts erp from a turnstile antenna would be adequate, but I believe he underestimated the QRM on each pass and the power needed to cut through. Stations heard calling W5LFL from the Houston-Galveston area included many 10-Watt stations using simple vertical antennas similar to the Ringo Ranger. Others used various types of beams: horizontally polarized, vertically polarized, or even circularly polarized. Stations used to work the OSCAR satellites seemed most effective.

The most successful antenna systems were circularly-polarized (right- and left-hand switchable) beam antennas on satellite-tracking mounts that could track the shuttle in its orbit. These satellite beams, and also horizontally-polarized beams aimed at the horizon, were able to pick up STS-9 at or slightly before (e.g., minus 3° elevation) it came over the horizon.

For passes below 20° elevation, the vertical-gain antennas (e.g., Ringo Ranger, Isopole, or similar), with their low angle of radiation, had good reception and probably good transmitted signals for most of the pass. Verticals, because of their overhead cone of silence, were not effective on direct overhead passes. However, when the pass was above 20° elevation, the turnstile and horizontal dipoles seemed to have the edge. The discone antenna and rubber duckies were not very effective, but W5LFL was heard on even these antennas.

It was amazing how many stations were actually heard. Two-meter FM simplex around 145.00 MHz, and particularly on the downlink of 145.55, appeared to have much more range than is usually considered possible on FM. (Maybe we have been missing a good many DX possibilities.)

The orbital predictions and information put out by the NASA club (W5RRR) were very helpful in following W5LFL and the *Columbia* for visual sightings as well as radio contacts. Hams all over owe the NASA club and the others involved with the ham-in-space program some very sincere thanks. Already, hams in the Houston-Galveston area are asking themselves, "What will I do different next time?" Some of the ideas that have already come up are:

- Make sure my transmitter is not in the repeater offset mode. Monitor my transmit frequency.
- Aim my beam at the point on the horizon where the shuttle (satellite) is expected to arrive, and start transmitting before it comes over the horizon. (This seems to provide an "edge effect" that enhances the signal at the horizon.)
- Have az-el antenna mounts that can track the shuttle pass.
- Set up switchable circularly-polarized antennas high enough to be above surrounding buildings and trees.
- Run more power. (This is one idea with which I do not agree. I believe we should keep our power down to avoid QRM. If all stations had kept power down to 40-100 Watts erp for STS-9, there would have been less QRM and more contacts with W5LFL.)
- Use vertical-gain antennas for passes below 20° and turnstile antennas for passes above 20°, since I cannot afford (financially or spacewise) a satellite antenna system.
- Try to transmit in clear spots (time-wise, or frequency) on the appropriate uplinks.
- Get some practice working the OSCAR satellites.

I hope you were successful in working Owen Garriott W5LFL on the *Columbia*. If you did not work him this time around, give some consideration to the comments and suggestions in this article and prepare for better luck next time.

WB8IFM

Gerd Schrick WB8IFM
4741 Harlou Drive
Dayton OH 45432

Preparation in Dayton started back in September with a short presentation at the Dayton Amateur Radio Association (DARA) about OSCAR 10 and the space shuttle. In one of the following club meetings, wave polarization was discussed and a home-brew turnstile antenna demonstrated.

I mounted my turnstile, backed by a 4' × 4' screen fixed pointing south and 45° up, and was able to copy OSCAR 10 for many days without changing the position of the antenna. A planned test with an aircraft was not necessary. I have since replaced this simple "cross dipole backed by a screen reflector" with a 2 × 6-el crossed dipole with little if any improvement.

Sunday, 27 November: Time of launch gets close; clean off operating table to make room for the various 2m FM components. A 50-W transistor amplifier is dusted off and pressed into service. We have now the KDK 2015 with 12 W driving the amplifier and the output is 45 W. Good reports are received from several local hams.

Monday, 28 November: Space shuttle got off the ground; clock is

See List of Advertisers on page 114

Gerd Schrick WB8IFM

Sat., Dec. 3, 1983 DAYTON DAILY NEWS 23

Radio operator picks up shuttle

Even though it's difficult to see the space shuttle Challenger as it passes the Dayton area, at least one local ham radio operator was able to pick up a transmission from space Friday evening.

Frank Schwab said that at 7:48 p.m. he picked up a transmission from astronaut Owen Garriott, an electronics expert who has been beaming ham radio broadcasts back to Earth.

Schwab said the astronaut repeated the call letters of several ham operators, but he was unable to hear whether his was among them.

"HE SAID HE was going to stand by for the next 90 seconds," Schwab said, as he played a tape recording of the transmission.

The astronaut then said "CQ," which meant he was calling for other operators.

The entire transmission lasted only about three minutes, until the shuttle was out of range, but Schwab said it was a "real thrill."

A ham radio operator for 37 years, Schwab said he probably picked up the transmission because he lives about seven miles north of the city — on Dog Leg Road — and doesn't have buildings or other obstructions.

Friday evening was one of the best times for local operators to receive transmissions from Garriott, who is broadcasting primarily on the frequency 145.55 MHz.

AND THE SHUTTLE will also be in range in the next few days, including Sunday around 10 a.m., Monday and Tuesday between 9:30 and 10 a.m. and Tuesday around 5:30 p.m.

Eye contact with the shuttle is a different story, however, according to a local astronomer.

Residents could get a pretty good look at the craft when it was visible for about four mihutes Thursday.

However, cloudiness interfered with sighting Friday and likely will do so again Saturday, said James Reist, curator of astronomy for the Dayton Natural History Museum. Sunday through Tuesday, the Spacelab's orbit and distance may make it difficult to see, Reist said.

REIST SAID the the Spacelab would appear as a moving light in the sky.

The Lewis Research Center reported the following orbits for today through Tuesday:

• Today, 6:03 p.m., moving northwest to south, visible for 4 minutes, 27 seconds. Difficult to see except in extreme northern part of Montgomery County — 39 degrees above the horizon, 243 miles above the earth.

• Sunday, 5:53 p.m., moving west to south, visible for 3 minutes, 51 seconds. Very difficult to see but best chance in extreme western part of the county — 24 degrees above horizon, 347 miles above the earth.

• Monday, 5:43 p.m., moving west to south, visible for 3 minutes, 7 seconds. Very difficult to see but best chance in extreme western part of county — 16 degrees above the horizon, 464 miles above the earth.

• Tuesday, 5:33 p.m. West to southwest, visible for 1 minute, 41 seconds. Very difficult to see but best chance in extreme western part of the county — 11 degrees above horizon, 588 miles above the earth.

ticking. Must not forget to synchronize station clock (electric with second hand) to WWV. Turnstile antenna is "mounted" almost on the ground in our front yard; hope for no vandalism for the next week. A decision is made to use a second radio; an IC-2 is connected and set to Owen's main frequency. Two antenna switches are employed, one to connect either one or the other receiver and one to connect any of three antennas: a vertical dipole at 70', the 2 × 6-el OSCAR antenna (8' above ground), and the turnstile directly on the ground. Now all we have to do is worry about the schedule.

Tuesday, 29 November: Listening on the bands, local repeaters, etc., lots of numbers are exchanged, but no clear picture emerges. The AMSAT Net at 9:00 pm on 3850 is great confusion: lots of decimal points and digits to feed the hungry computers. However, at the end there is some useful data! Now we see the light, getting ready for the first try which will be tomorrow noontime—will be home for lunch at 12:00.

Wednesday, 30 November: Did I mention, we have no computer; we go by orbit period and rotation of the Earth. We have pre-published data and they are very close; still, we plan to be on a few minutes early and stay a few minutes late.

Orbit 34D: No sign of W5LFL, but a lot of local stations are calling during the odd minutes. I count at least seven stations! Next I try orbit 38D—although not scheduled, there may be a chance. But Owen does not show up. Over WA3NAN on 3860 I overhear the shuttle communication and Owen is doing experiments.

Orbit 39D: Another no show of Owen. Lots of locals call, but with the ten available calling frequencies, you can still find a clear spot (locally, mind you), but there is a 2000-mile-diameter circle with lots more signals calling the shuttle. Some stations call on 145.55, Owen's frequency, and are chased off! Afterwards, some comments from the 75m band: a WØ "did not hear a thing," a K5 "had my four boomers on him, heard nothing." Oh well, there is another pass tomorrow. Later in the evening, I hear Owen had been on over California on orbit 40. So, there *is* life up there!

Thursday, 1 December: Orbit 49A: Another dud. By now everybody just calls on the odd minutes and listens in between. I keep switching my three antennas, although I had calculated that even with a simple dipole he should be putting in a signal of S9 and 9+20 when overhead. Nonetheless, every dB should help on transmit.

Friday, 2 December: Only one good pass for our area at 6:00 pm. Again we have no luck; we have a club meeting tonight and a computer presentation is scheduled. During the day we had our first few inches of snow and as usual all kinds of problems with the automobile traffic. Three of us go together to the club meeting which turns out to be cancelled because of the poor weather. I had prepared a short presentation on the space shuttle and also a handout with orbit information through Tuesday. We have some lively discussion with the few people that showed up. The late news on TV shows some Kettering hams in a shopping center parking lot with a hand-held cross yagi. A good picture with the snow and rain pouring down; of course, they had no luck! It became known that the astronauts, including Owen, are kept very busy and that they are requesting an extra day in space.

Saturday, 3 December: This is a resting day for the US hams. The shuttle will be over Europe, Africa, and Asia. I consider putting up a brand-new antenna, 2×10-el cross yagi by TET, which I picked up Thursday night from Dan WD8IDZ. But because of the cold weather and the rain, I pass that up.

Sunday, 4 December: Orbit 97A: 9:55 am. This orbit starts like all the previous ones. Everybody calls, no response from the shuttle. Then out of the blue sky, at about 10:08 EST, there was Owen, loud and clear on the IC-2AT, S9 at least. For a moment I thought some local John was impersonating him. Owen says he hears a lot of stations, and not wanting to waste any time with acknowledging, he is just going to listen for the next 80 seconds. He also says he is just now over Texas, heading for the midwest. This is the signal we have been waiting for, and for the next ten minutes, everybody in the Dayton area calls. We do not hear him again, and I do not have a recording of his transmission.

During the next orbit, which is almost out of reach for us, over in the west, we call again but do not get a response. Afterwards I talk with Leo WA8ZHE and he surprises me with a super tape recording of an earlier unscheduled pass (orbit 96, 8:34 EST) where Owen actually confirms K4GFG and another K call.

Well, at least we heard him after all these days of frustration. Some success, and there is a chance that we are on the tape.

Monday, 5 December: Orbit 113A (9:42 to 10:05 EST): Although passing several hundred miles to the west of us, this ought to be a good chance. I call a lot and listen carefully on the even minutes. But there is no response. Today there is a lot less activity locally. It is a working day and also possibly a number of hams have exhausted their patience; good for the remaining ones. We had another telephone conference last night with other

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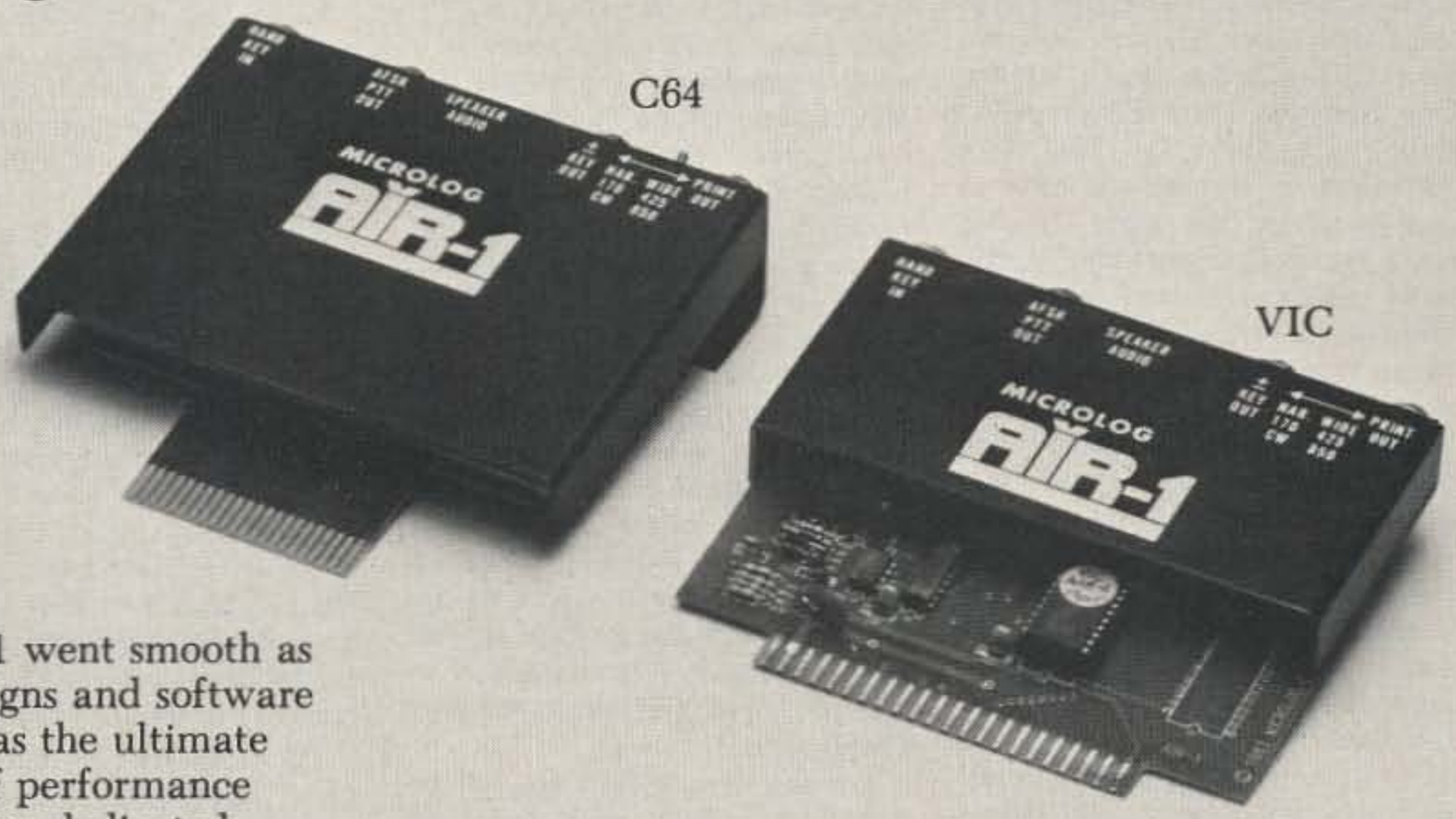

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hams from all across the US—including Alaska and Hawaii—skillfully conducted by Jack Burnett, Executive Editor of *73*. Hams from the larger metropolitan areas (LA, Chicago) complained about tremendous interference (intermod) and suggested it might be best to use a small antenna, such as a rubber duckie on a handie-talkie. No such problems were encountered in the Dayton area. By noontime we have to leave Dayton for Huntsville, Alabama, to do some receiver testing for the QRL. This is a 10-hour drive and we will have to stop over for the night. Driving south, we listen to the radio, mostly news about Lebanon, but then there is the 3-way conversation between President Reagan, West Germany's Chancellor Kohl, and the astronauts. Leaving a dreary and cloudy Ohio behind, we find some sunshine in southern Kentucky. We finally pull in for the night south of Nashville, Tennessee. Here we are in the Central time zone and with some "sharp thinking," the next 3 orbits are converted to local Central time. I brought my hand-held IC-2AT, an HB9CV portable antenna, and a tape recorder. My chances are rather slim to be heard with the low power (1 Watt), but I might get a good tape recording of Owen.

Tuesday, 6 December: Today there will be several good chances to pick up *Columbia*. Unfortunately, we will be traveling, setting up equipment, or in meetings with other engineers a lot, but I will try to break loose whenever Owen is in reach.

Orbit 129A, 8:30 am CST: We are at guardhouse no. 9 of the Redstone Arsenal, Alabama, checking in and waiting for an escort. I listen on my IC-2AT and hear nothing, but there are some locals who, after so many days, still do not have the frequencies straight. They are being chased off. Only a few stations call, so I try my luck again on this pass. Owen does not show up.

Orbit 133D, 2:45 pm CST: This orbit passes over New England, so the local stations do not even try to call the shuttle this time. However, I am at an excellent location this time and should try. I am next to NASA's Marshall Space Flight Center on top of one of the old static missile test towers, 250 feet up in the air. We can see for miles around; large areas on the ground are flooded from the recent heavy rains; I regret not having brought my binoculars. The Space Flight Center, by the way, is a complete ground-control station for the shuttle, like the primary one in Houston, Texas, and could take over operations immediately, if necessary. They have a press center set up, but there is little activity, since the scheduled teleconference with the astronauts was cancelled. The tape recorder is plugged in and 250 feet up in the penthouse we listen on the IC-2AT for the space shuttle. Unfortunately, we hear nothing. Now there is another orbit in 90 minutes; during this time we have to look for accommodations for the night. We have no reservations. Eventually we find a motel, but with the rush-hour traffic, we are a few minutes into the next orbit when we check in.

Orbit 134D, 4:18 pm CST: By the time I am in my motel room, it is 4:30. Immediately I turn the 2m radio on and after a short moment I hear some crackling noise that sounds like a voice. I grab the handie-talkie and rush outside to be in a better receiving position. There is Owen again loud and clear: "OK, here is W5LFL, over the beautiful Mississippi. I have to take a picture of that, but I also have to listen to the radio. . ." He is loud and clear on the hand-held IC-2AT with a rubber duckie. Immediately, I make frantic efforts to hook up the tape recorder for his next appearance. We cannot take the recorder, connected to an outlet, outside the room, and we do not hear Owen again.

For the next 2 days we will be very busy with an assignment, so we conclude our space-shuttle diary at this point. In hindsight, it was quite worthwhile. Although at times frustrating and no QSO resulted, we did hear W5LFL on 2 occasions, and Owen's voice from the space shuttle *Columbia* (on STS-9) will be impressed on my memory for a long time.

KC8JX

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"KC8JX, this is W5LFL." No, I never heard that. But oh, what a thrill it would have been if I had! Several in our fraternity heard it, including my good friend Jeff W7ID. It certainly wasn't for lack of trying—I was there for every orbit that could possibly be heard from southwestern Michigan.

It's amazing how such an event as this can make inactive hams active. I heard stations on 2 meters I didn't even know existed. Was there interference? Yes, a little. But after the first few days it was negligible. How did *you* prepare for this historic event? This is what I did.

First, I had to have an antenna. I had a Ringo Ranger, but I didn't think that would work very well, so I built a turnstile similar to those described in the *Handbook*. This was my first attempt at homebrewing, and it seemed to turn out very well. It certainly whets my appetite for more VHF antenna work. My boom was an old shovel handle and my elements, wire. The calculations of element lengths, phasing lines, matching sections, and reflector spacing were definitely more difficult than the 40- and 80-meter dipoles I built. I mounted the antenna, such as it was, on an unused tetherball pole and hoped for the best. This was all completed prior to the shuttle's launch.

On November 27, I participated in a teleconference call and received much valuable data which I passed on to local networks. This information was very helpful and held true throughout the mission. I tried throughout the week to get updated information through the telephone numbers which were published, but I finally gave up as the lines were always busy. All updated information was obtained nightly by listening to the AMSAT net frequency of 3850. I never was able to hear W5RRR, though I understand they were on the air.

It was now November 28, and the shuttle lift-off was perfect. Now the adventure could really begin. I had trouble figuring out the exact orbit times since they were given to me in mission elapsed time. I had never done any satellite work before, other than listening for OSCAR on 10 meters, plus I did not have a microcomputer handy to use. Today I also found that the speaker on my Yaesu FT-208R was inoperative, so I had one of the Heath technicians fashion a phone-jack patch cord. I could then use a remote speaker with the patch cord placed in the phone jack of the FT-208R. Now at least I could listen to the transmissions through a good speaker and, thus, any tape recordings would sound better. My turnstile could not be placed outside, as with the first winter storm approaching, high winds and snow could ruin my investment.

November 29 was still very cold and windy, so I still could not mount the antenna outside. It was good that no shuttle communications took place that day. I procured a VL-2280 from Dave Poplewski KC8IV at Heath Co., so my hand-held would have some punch—12 Watts. As the day ended, one final item had to be set up—my tape recorder. These last 2 days had been disasters at work, and consequently, I had to spend 3 to 4 hours each night fixing problems there. I was, therefore, late in getting everything set up. A real bright point of the day was finding the local repeater, KD8S (145.47), was broadcasting the shuttle communications. This was very convenient for us in southwestern Michigan and northern Indiana because of the current information being disseminated there.

November 30 arrived, and first communications with the shuttle were expected today. I was not able to be at home, but instead listened for the shuttle in the Heath Company Engineering Department. Owen was not active at that time. I then listened for the next flyover at 8 pm, orbit 39D. Still I didn't copy W5LFL. I am really wondering at this point whether my antenna works. By this time, the wind has really died down so I could put it up outside. I am also trying to find W5RRR on 20 and 40—no luck! At 8 pm, everyone in SW Michigan was calling W5LFL, many right on 145.55. Two meters finally sounds like 20-meter DX even with guardians of the frequency. Tonight also was the night for my weekly schedule with W7ID. After establishing contact, I found out that W5LFL had made his first contact with WA1JXN/7 in Montana at 0234Z, December 1st. These first reports indicated very strong signals from the shuttle; there were even some who heard him on hand-helds. What a thrill it must have been! Jeff W7ID forgot to turn on his tape recorder. Hope that won't happen to me. Tonight, I also listened to W1AW's bulletin and tuned in on 3850 to try to get more information.

On December 1, there were no scheduled communications orbits. I spent the day listening to the shuttle on the 145.47 repeater and tuned in to the W1AW bulletins and 3850.

Orbit 70D was deemed possible

Larry Knapp KC8JX

for December 2, so I was really ready this time. Oh, the QRM on 145.55! After this pass we really should gather on some repeater frequency and inform the multitudes, so we did. I guess because of Friday night, we really had a turnout on almost all Earth-to-shuttle frequencies. Found out −600 split on hand-held from 145.55 puts the transmit frequency on 144.95. I wonder how many of us were using this. I am trying to stay on 145.01 or 145.09. There don't seem to be many others there. No luck locally hearing 70D or 71D orbits. I'm really starting to doubt my station's capabilities. I did hear a tape made by someone in California who had good copy of W5LFL. Maybe that's the closest I'll ever come!

December 3—no flyovers scheduled. I spent the day with my family, doing some necessary Christmas shopping.

It is now Sunday, December 4, and I'm really hoping that today on orbit 96 or 97 I'll be able to hear W5LFL. I have given up most of the hope I had earlier of having my call answered, as it seems from information I have received that only those with power and good directional antennas will be answered. If I could only hear him, I'd be pleased! Then, finally, on orbit 97A, I heard him at 10:08 EST! Holy cow, was I thrilled! I was yelling for the family to come and listen. Maybe I'll even work him! (No, I didn't forget the recorder; in fact, I've got 5 minutes of my call on the recorder as I was afraid to turn it off lest I miss some of Owen's comments.) I did it! I did what I thought I could probably do—hear him. I doubt very seriously he'd ever hear my 12 Watts to a turnstile. Some of the local operators heard the earlier eastern pass, orbit 96. I didn't, but on the central pass, orbit 97, no one recorded any more than I did. I feel fortunate. I really am fired up for Monday's and Tuesday's passes.

December 5 was a disaster! Some of the locals picked up the eastern pass, but I didn't. I stayed home from work in the morning just for these flyovers. Now I'm ready for 113A. Darn news conference! He wasn't on.

December 6 was the last day I heard Owen—weak, but readable. I also found out that one of the local operators, KD8S, thought he was confirmed. I also stayed home from work this morning. Won't be able to do this much longer! The weather has turned worse as our first snowstorm appears. I took down the antenna. The spaceflight is nearly over now.

December 7. I had to be at work early. I did receive a call at work that W5LFL was heard briefly on both the eastern and central passes.

Well, I accomplished several goals just as the space shuttle did. I appreciate much more now VHF communications and the relative ease in constructing VHF antennas. It has certainly whet my appetite for OSCAR and VHF work. The entire experience has thrilled me just as much, if not more, than my first Novice contact almost 23 years ago, or the first time I heard OSCAR on 10 meters. What a thrill it must have been for Owen Garriott to hear WA1JXN/7, JY1, W7ID, and others. Would I try it again? Would Owen W5LFL? You bet!

I'd like to thank *73* magazine for its help in providing timely information and my co-writers for their support. But my special thanks go to my wife, Carol, my son, Alan, and my daughter, Amy, for their patience and their expert strong-arm motor control of my antenna. Their enthusiasm for this project for Dad is really appreciated. My co-workers, who were very interested and supportive, get special thanks as does Heath Company and fellow employees Dave Poplewski KC8IV and Jon White WAØTAQ. Without all of these people, I could not have been half-successful.

Larry Knapp KC8IX has been a licensed ham since 1961 and holds an Advanced-class license. After graduating from Illinois Wesleyan University in 1967, he went to work for Heath Company in the Credit Department. After a 4-year hitch with the Air Force at Keesler AFB, Mississippi, he returned to Heath and is currently Data Processing Manager. He is married and has two children, ages 12 and 9, and another one on the way. He has held the following calls: KØFRJ, W9HXG, W5VUF, and W8IHE. His main enjoyments other than amateur radio are writing, camping, volleyball, and golf. He is active primarily on HF in contests and DX, finally having achieved DXCC in 1983. His primary VHF activity has been 2 meters with a hand-held purchased in 1983. He is a life member of the ARRL and has been president, activities chairman, and secretary of the local Blossomland Amateur Radio Association (BARA). He writes articles for the club bulletin and also was the chairman for the club's expedition in 1981 to Mackinac Island.

W9HD

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What follows is a log/diary of the past few days. First, to introduce myself very briefly, I am a retired electronics engineer who has had a ham license for 51 years. Instead of rocking and reminiscing, I sail on deep-sea oil tankers several months per year as radio officer.

Saturday, November 26: Received a telephone call from Jack Burnett, Executive Editor of *73* magazine. He asked if I wished to participate in an effort to contact W5LFL aboard the space shuttle *Columbia* and write up the results. It certainly seemed worth a try. I happily agreed to do so, noting that my 2-meter station is not much beyond the ordinary. I have an Icom 25A and a vertically-positioned dipole made from rod stock and mounted halfway up my 50-foot TV antenna mast. It has served me well for ten years. I also have a Tempo S-15 handie-talkie with rubber duckie.

Sunday, November 27, 4:00 pm: A conference call, lasting an hour, with Jack Burnett, Randy Stimson KZ7T, Bob Harnois K1EFZ, Dave Manley KH6B (in Hilo, Hawaii), Jon Gallo KB6WT, Wanda Lovejoy KO2X, Bill Pasternak WA6ITF, and many others, including one in Alaska. Orbit times, frequencies, and procedures were given—all the help that could come over the telephone was given so that we might be successful in contacting Owen Garriott W5LFL on the *Columbia*. With my conventional gear I had little hope of making contact, but I responded to the enthusiastic spirit of "Go gettum, boys." And I looked forward to a busy week which included five evenings with a Civil Defense course in Radiation Monitoring Instruction.

Note that in subsequent entries, most times will be in UTC. Since midnight UTC comes at 1900 local time, some early-hour UTC entries are under the preceding day's date.

Monday, November 28: First order of business: organizing notes from yesterday's lengthy conference call. Then I made up a paper slide rule for computing day, hour, and minute past launch into local time and date. Not wanting the low-band station to suffer, I spent some time setting up the newly-acquired TI99-4A and interface with the Icom 720A. Made RTTY contact with W1AXL on 20 meters. Also am committed to ringing the bell for Salvation Army two afternoons. •2300 to 0145—Attending CD class with HT tuned to 145.55. Nothing heard.

Tuesday, November 29: •1530 UTC—carrier heard on 145.55 (no modulation). •1531—Called W5LFL on 144.95. No answer. •1535—Called W5LFL on 144.95. No answer. •1608—A few squelch breaks on 145.55. Nothing intelligible heard. •1631—More squelch breaks on 145.55. •1633—N9EBI calling W5LFL on 144.95 (so I joined in the calling). No reply heard. •1645 to 1820—At Rotary Club meeting. HT along. Nothing heard. •2300 to 0130—Attending CD class with HT. Nothing heard.

Wednesday, November 30: •1500—Now scanning with 25A 145.54, −.55, and −.56; also reply frequency of 144.95. No signals heard. •1710—K9UGO calling W5LFL on 144.95. •1713—Called W5LFL on 144.95 in the clear. No answer heard. However, a carrier heard (weak). Does not end at beginning of odd minute. •1750 to 1920—Ringing the bell for Salvation Army. HT along. No signals. •2300 to 0150—At CD class. HT along. No signals.

Thursday, December 1: •1220—Left Bloomfield for Indianapolis, 70 miles away, to pick up daughter at airport. Have Icom 25A with ¼-wave mag mounted on car's back deck. •About 1530—Heard WA9RDF in QSO on 145.55, not with W5LFL. When asked about his use of 145.55 simplex, he stated that he had been using that frequency regularly for several years and saw no reason for leaving it now. •About 1547—Heard several stations calling W5LFL, so joined them. No answer heard. •2300 to 0139—At CD training with HT. No signals heard. Squelch broke due to low batteries. Interrupted the instruction. •0457—Staying up late tonight. Weak carrier heard, but not cutting off on the odd minutes. Not W5LFL. And so to bed.

Friday, December 2: •1712 to 1714—Carrier but no modulation on 145.55. •1715—W9LUU calls K9OMV on 145.55. •1721—Station heard on 144.95 calling W5LFL. I joined in, except my Icom was in simplex mode, and I was so informed by others. No reply heard from W5LFL. •1914—W5LFL heard for the first time (not strong; in and out). •1915—Called W5LFL on 144.95. No answer. •2300 to 0330—Final CD session with HT along. Was issued a diploma as Radiological Monitoring Instructor.

Saturday, December 3: •1400 to 1430—Busy on low bands, Saturday morning skeds. •1456—Several stations calling W5LFL. •1457—Called W5LFL on 145.95. No answer. W5LFL not heard. Busy most of the day with errands, putting up Christmas tree and lights. Numerous "Honey do" jobs. Also monitoring 145.55. •0235 to 0250—High-altitude aeronautical mobile KXØA heard and recorded over Tennessee at 42,000 feet. He called in on 145.55, but QSYed off like a gentleman.

Sunday, December 4: •Up at 7:30 am, scanning the frequencies while reading the Sunday paper. •1334—W5LFL heard weak but readable, calling CQ. •1335—Called W5LFL (on 144.94 to avoid any possible pileup). •1336—Believe I heard my call, "W9 Hot Dog" from W5LFL. (Quite weak, barely readable.) Then his signal came up. He stated that he was flying over Florida. I felt reservedly elated. Unless others heard his transmission, I would have to wait for mail confirmation. •0200 (9:00 pm local time)—Another nationwide conference call with the same list of participants. I was happy to announce my contact with Owen Garriott. What really made it great was that one of the conferees, Bob Harnois K1EFZ, had heard Owen over Florida make that 1336 UTC transmission, and thought that W5LFL had called "W9 Hot Dog." My suggestion during the telephone conference was to not wait for the orbit times but to

call when he was heard, and to call on other than a pileup frequency if possible.

Monday, December 5: Took a holiday. Monitored occasionally. Heard a few squelch breaks. Had a CW QSO on the HF bands. Joined my comrades on the FRUPAC Net at noon local time. Monitored 145.55 on the Icom 25A, but W5LFL was not heard.

Tuesday, December 6: •1307 to 1315—Activity heard. No W5LFL signal identified. •1427—Called W5LFL on 144.94. No reply heard. (Other stations were calling him on 144.95.) •2030—Local newspaper arrived. I am featured on front page. Wow! •2230—Heard him loudest and strongest to date. •2231—Called W5LFL on 144.94. •2232—W5LFL, loud and strong, says he is over the Mississippi River Valley and it looks good down there. No callsigns were mentioned. •2233—Called W5LFL on 144.94. No reply heard. He is now QSA0.

Wednesday, December 7: •1432—Heard "CQ North America" from W5LFL. Nice, strong signal. •1433—Called W5LFL on 144.94. Nothing heard. •1555—Called W5LFL on 144.94 because others heard calling on 144.95. No answer heard. •2218—Heard W5LFL talking briefly. •2219—Called him on 144.94. No answer heard.

Thursday, December 8: •1423—Called W5LFL on 144.94. No answer heard. •1610—Suddenly remembered that this is due at *73* magazine immediately if not sooner.

I am glad to have had the opportunity of participating in this effort and to have had the good fortune to at least hear Owen Garriott aboard the *Columbia*.

Paul L. Schmidt W9HD, 68, a member of the ARRL, has been continuously licensed for 51 years. A shore-based radioman in the Navy's FRUPAC organization in WWII, he is married and has 4 children and 5 grandchildren. His employment is now on deep-sea tankers and supertankers as radio officer. In 1977, he spent six months on a Navy tanker in the Orient and made a trip around the world in the process. In 1978, he sailed on a supertanker around the Horn from New Orleans to Valdez, Alaska. In 1980, he was on a grain boat to Israel via Bermuda, and in 1982, his tanker put in for overhaul at Khalkis, Greece, and the entire crew was repatriated to the USA.

His hobbies have always included amateur radio as well as photography, writing, and traveling. ("We will ride on anything that moves," he writes.)

WD9GIG

George R. (Dick) Isely WD9GIG
736 Fellows Street
St. Charles IL 60174

Various articles about the upcoming STS-9 mission with an amateur-radio operator, Owen Garriott W5LFL, aboard appeared in early 1983 in several amateur-radio and aviation publications,

George Isely WD9GIG at the mike; the antenna which was constantly adjusted can be seen outside.

and I began to follow W5LFL's project with increasing interest.

August: The ARRL's videotape of "Amateur Radio's Newest Frontier" circulated—first midwest showing at Fox River Radio League Hamfest. Began to seriously think of trying to work W5LFL. My neighbor, Bill Smith W9LRG, and I discuss the best way to reach W5LFL while he is in orbit. We decide to construct a two-meter helical antenna based on the design work of John D. Krause W8JK.

Early September: Bill W9LRG completes work on a computer program for designing a helical antenna. I adapt his program for use on my home computer system.

Late September: Helical antenna construction started. Mathematical error results in wrong helix configuration; must rebuild helix.

October 18: STS-9 mission delayed . . helix reconstruction underway.

November 9–10: First helical antenna tests using a tapered feedline match . . antenna works, but swr too high.

November 15: Matching pi network installed and tested. Perfect match of approximate 140-Ohm feedpoint impedance to 50-Ohm coaxial cable.

November 30, Orbit 39D: First communication attempt with W5LFL. No signals heard from space shuttle *Columbia* . . heavy QRM on W5LFL's downlink frequency of 145.55 MHz by strong local station.

December 1, Orbit 49A: 2nd communication attempt . . no signals heard, but the QRM level is a little lower.

December 2, Orbit 70D: 3rd attempt . . still no signals from *Columbia*. Live CBS television coverage of this orbital pass and following pass. Disappointment for all concerned, but the coverage on TV was very good (shown during 6:00 pm news).

December 2, Orbit 71D: 4th attempt . . same as previous pass, no signals heard from *Columbia*. No signal reception reports by other hams in this area, either.

December 4, Orbit 97A, 8:55 to 9:23 am CST: 5th attempt . . finally some success. W5LFL is heard saying that he is "not transmitting callsigns back . . ." On this as on all orbital passes, transmissions are made from this station during the odd minutes of each scheduled pass. By this time we are painfully aware that our helical antenna must be carefully tracked along the predicted space-shuttle flight path if we are to hear W5LFL. Movement of as little as 5 to 8 degrees shifts incoming signal from S-9 to down in the noise level.

December 5, 8:30 pm CST: Participate in 17-point conference telephone call put together by Jack Burnett of *73* magazine to discuss the W5LFL operation and the amateur community's efforts and results to date. Except for Pacific Northwest and Florida areas, nobody is having much success. Several suggestions are exchanged within this group about what techniques and antennas may or may not work. It is apparent that "new ground" is being broken with this operation. •*113A, 8:42 to 9:05 am CST*—Another overhead pass, as were orbits 70D and 97A. More suc-

Earth to Columbia: long distance calling

By Jan Myers
The Beacon-News

ST. CHARLES — "Columbia, this is WD9GIG," Dick Isely said over and over as he shot his radio signal 150 miles up in the air, trying to talk to astronaut Owen Garriott Friday evening.

"He's coming into us, Bill, it's noisy but I can read him," Isely shouted to his fellow radio ham, Bill Smith, as Smith kept adjusting the antenna in the back yard of the Isely home in St. Charles.

The pair, along with several other members of the Fox River Radio League — and assorted media — were standing by to beam ham radio signals to Columbia-Spacelab crew member Garriott as the craft's orbit came within 150 miles over the Midwest.

Every other minute, with a format suggested by NASA, Isely would broadcast his call signal heavenward hoping that in the following minute Garriott would respond.

Isely didn't expect a long, chatty conversation with Garriott — it would have been enough if he'd just said hello.

But, that didn't happen.

For the 20-minute periods between 5:05 and 5:25 p.m. and again from 6:35 to 6:55 p.m. Isely and Smith tried to communicate with Garriott without success.

Isely would repeat his call signal for the one minute period. Then everyone on the backporch of Isely's St. Charles home would hold their breath in anticipation — waiting for the voice from on high.

There was nothing but static.

Then Isely or Smith would fiddle with the dials on the receiver, make more adjustments on the angle of the antenna, squirm under the bright television lights and then try again.

"That's the life of a ham radio operator," a club member said.

"We listen a lot."

Isely began to get impatient. "Come on, Columbia, this is WD9GIG," he said over and over managing to get in about eight calls a minute.

"Go vertical, Bill. Tip it (the antenna) to the northeast — swing it east," Isely shouted.

Then another long minute passes and Isely is again saying his call signal.

And, so it went throughout the two attempts to reach the astronaut.

Since last Wednesday and during the upcoming week, ham operators throughout the U.S. will attempt to talk to Garriott as he orbits in space.

Garriott, one of two mission specialist on the six-man Columbia-Spacelab crew, is a lifelong ham operator. He is using his own time to pursue his hobby from space.

Chances of making contact with Garriott are slim, Isely said.

"If the antenna that is on a small window of the spaceship is facing downward we'd have a better chance of receiving his signal. But, the ship may be upright and that means Garriott's radio signals are going into outer space.

"The antenna on the spacecraft is only five watts. He may have answered us and we didn't hear him," Isely said.

Other ham operators across the nation have heard Garriott's ham radio call signal W5LFL and he has acknowledged hearing some from earth.

One of the first was Garriott's fellow club member Ken Schnell, a budget analyst at the Johnson Space Center.

Isely and Smith said they have been planning for this week for about six months.

"When we heard that Garriott would be taking the ham radio equipment aboard the Columbia, we decided to build a special antenna and attempt to communicate with him during the space flight."

Columbia was originally set to lift off in October, but the flight was delayed.

That delay helped Isely and Smith ready the antenna (the same type as used by NASA) which they designed and built, using ordinary items purchased at local hardware stores.

With their radios, the pair estimate they can produce about 1,000 watts of power — enough to bounce a signal off the moon.

Although Friday's attempt to communicate with Garriott was unsuccessful, Isely and Smith said they intend to keep trying.

"We have an excellent chance of getting through about 8:55 a.m. to 9:23 a.m. Sunday morning when the craft will pass over Monterrey, Mexico, to Flint, Mich. The spacecraft's track will be over central Indiana area about 9:23 a.m. and we may be able to make contact then," Isely said.

Ham radio buffs will get other chances to beam their signals skyward between 8:42 to 9:05 a.m. Monday, and two chances on Tuesday at 8:29 to 8:50 a.m. and 4:18 to 4:35 p.m.

cess in hearing Owen Garriott on several different antennas. My partner, W9LRG, is sick with the flu and I am not able to track the helix and operate at the same time... used a 14-element yagi controlled from my permanent shack in the basement.

December 6, Orbit 129A, 8:29 to 8:50 am CST: Overhead pass again using the same antenna as used in orbit 113A... my partner still sick in bed. Heard W5LFL confirm one 5th-area and two 8th-area calls on this pass. I begin to suspect that a different propagation mode may exist than what has been predicted. Decide to work the next (western US) pass to try out my idea. •*Orbit 130A, 10:10 to 10:20 am CST*—Using yagi antenna again, W5LFL is as loud or louder than on previous overhead pass, and I hear him confirm a 6th-area and two 9th-area calls even though he is over the Colorado area. Perhaps the path is better when the space shuttle is at or near the local horizon? •*Orbit 133D, 2:44 to 3:06 pm CST*—No signals heard on this horizon pass to the northeast of my QTH. •*Orbit 134D, 4:18 to 4:48 pm CST*—Two local area hams (Jim Emma KA9HQF and Gary Senesac KC9UM) take time away from their jobs to help me operate the helical antenna for this orbital pass. I finally obtain some adjusted azimuth and elevation figures, courtesy of W9TGB, to use for this pass. We have spectacular results...we copy W5LFL for three consecutive transmissions between 4:30 and 4:33 pm CST even though *Columbia* is only 10 to 15 degrees above our horizon to the southwest. This is my last attempt to communicate with W5LFL, and it is the best of the lot if my reception of his signals can be used as a measurement.

Observations and Comments

1. Most of the QRM on Owen Garriott's transmit frequency is accidental. In most cases, the operator in error breaks off in mid-call. Some of the worst local QRM is from the "Kilocycle Cops" trying to "keep the frequency clear" rather than from the problems caused by the inadvertent offenders.

2. Our helical antenna is much sharper in bandwidth than first predicted. This is both an advantage and a problem. The helix is almost completely immune to ground-based QRM, but is very much harder to lock onto the space shuttle, which moves quite rapidly across the sky.

3. Even after the STS-9 mission was in orbit, there was still a considerable amount of confusion about frequencies, transmission protocol, and orbital parameters. I have no suggestions to make to improve this situation...some people just never get the word.

4. Lack of widely-published orbital parameters tend to favor individuals with "connections" and previous experience with tracking antenna arrays—stacked beams in EME configuration, etc. These people could construct early into the mission, using the orbital numbers to track *Columbia* through the sky reasonably, while most of the amateur community had to rely on second-hand (often inaccurate) information. The ARRL did finally put out a bulletin on December 6th listing the STS-9 orbital parameters. Perhaps this data could be released a little sooner?

5. There appears to be some type of two-meter propagation phenomenon for low Earth-orbital communications different than that predicted. I suspect that W5LFL's transmission path was somewhat different from that of stations transmitting to him in the space shuttle. Ground-to-space propagation appeared to be best when the shuttle was at or near the local horizon while space-to-ground propagation appeared to be relatively constant regardless of *Columbia*'s elevation above the horizon. This may be a function of *Columbia*'s attitude with respect to the Earth's surface at a given point in time when W5LFL was on the air. I have no way of determining this from the information available to the general public.

6. A plot of table-of-observed-propagation distances using these factors discussed in paragraph 5 above could prove to be valuable for future operations of this nature.

7. It would be a great help to have a low-power amateur-radio beacon on future space shuttles where amateur-radio operation is to be attempted. As little as one Watt output should be sufficient for this purpose and would make it much, much easier to track the vehicle through the sky.

8. If possible, future amateur-radio operations from space should be conducted using spacecraft power either directly or by means of rechargeable battery packs so that power consumption in the transmit mode does not become a limiting factor. I have been led to believe that W5LFL had this constraint particularly when the STS-9 mission was extended by one day.

9. This was my first serious attempt at any form of space communications and I am quite pleased with our results—even if we do not obtain a two-way-contact confirmation. Bill Smith and I plan to modify this helix to a two-band configuration for OSCAR use in the near future. We sincerely hope that this will not be the only amateur-radio-from-space operation...we are looking forward to future operations of this type.

George Richard (Dick) Isely WD9GIG was born in 1939 in Ironton, Missouri. A full Navy scholarship to college graduated Dick as an officer and also obligated him to several years of service, which came after his marriage to Judy Miller. He became a naval aviator assigned to active duty with an anti-submarine squadron flying P2Vs over the Atlantic off the coast of Maine. After deployments in Sicily, Spain, and Cuba, Dick resigned his commission, in August 1966, and left the navy for civilian piloting with American Airlines. For 16 years he has had an active career as an American Airlines pilot and currently flies 2nd seat (co-pilot) on the Boeing 727. Dick got into ham radio literally by accident: a bad fall resulted in a broken leg. Frustrated by enforced inactivity, he started off with CB but soon graduated to ham radio. He has been Fox River Radio League president, during which time he was active in setting up "The World's Highest Ham Shack" on the observation deck of the Sears Tower in Chicago. With permission to stay overnight (never before allowed by Sears) and transmit and receive signals from all over the world, the FRRL gained for amateur radio a healthy shot of good publicity. In St. Charles, Dick has been prominent on the city's cable TV advisory committee.

KO9G

Pete Altman KO9G
1307 E. Pershing Avenue
Wheaton IL 60187

As luck would have it, my 2-meter rig developed an untraceable intermittent on top of this event, even though I was prepared with a 2-meter turnstile antenna on the roof and good clean coax connections in between.

With no chance to borrow another rig, I wound up serving as a "clearinghouse" for flight info, frequencies, etc., for fellow hams in the neighborhood. The current data given via our conference call prior to lift-off was made available to a number of amateurs in the area via both the local repeater and land lines. It encouraged their attempts to give real tries at contacting W5LFL.

Art Lang KR9K made several attempts using a TR-9130 running barefoot into a 20-element twist antenna. (Given the pressure of work, Art has been unable to furnish a written report.) He reports hearing W5LFL loud and clear on 3 passes (no confirmed QSL though) and was able to tape Owen's transmissions. Art reports that W5LFL was within good hearing range for roughly two minutes of each pass over this (midwest) area and that Owen was able (within that 2-minute opening) to confirm two or three contacts directly. Art also reports that KA9PUC, on vacation at the time in Florida, believed he was able to make a confirmed QSO with Owen using a 2-meter handie-talkie and a rubber duck.

Eugene "Gene" McAleer N9DUW submitted the following:

"On November 30, while in Atlanta, Georgia, I secured permission to go up on the roof of the Marriot Hotel

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IC-271H 100w 2m FM/SSB/CW Xcvr	TBA	
PS-35 Internal power supply	160.00	**144.95**
IC-271A 25w 2m FM/SSB/CW Xcvr	699.00	**629.95**
AG-20 2m preamp	56.95	
IC-471A 10w 430-450 SSB/CW/FM Xcvr	799.00	**719.95**
PS-25 Internal power supply	99.00	**89.95**
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HM-12 Hand microphone	39.50	
SM-6 Desk microphone	39.00	
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(17 stories plus) and listened for STS-9 and W5LFL but to no avail. No one in the area heard a signal as I understand . . . and me with such a vantage point with my HT.

"On December 6 at 2214Z, I heard his (W5LFL's) call only very briefly and again returned the call using my Kenwood TR-7600 (10 Watts out) as I had done the previous day. My antenna was a Hy-Gain 5/8-wave ground plane approximately 20 feet above the housetop. (Gene is an airline pilot and on 12/6 was back at his home QTH.)

"Of course I recorded all this as well as a *very* clear signal from one of our club members (whom I shall leave nameless) calling W5LFL on the downlink frequency—hi.

"It was an enjoyable experience to have the signal direct and I was a great deal disappointed in the conduct of (fortunately) only a few of our fellow hams.

"My thanks to Goddard Space Center Amateur Radio Club (WA3NAN) for their very informative rebroadcast of the STS-9 communications.

"My QSL is on the way to the ARRL and I hopefully await a confirmation.

"That's it, Pete, short and direct."

The general consensus was that if you knew the orbital times (we did, thanks to Dick Isley WD9GIG, who "normalized" them to local time on his computer), you could easily hear the signals on 2 meters from the shuttle—for roughly 2 minutes out of each pass over the area—and readily with a receiver of average commercial sensitivity and almost whatever antenna you had on hand.

Making sure you're heard by an orbiting amateur, especially with crowded conditions in some parts of the country and short access times, apparently needs enough erp to "bust through."

Pete Altman KO9G is a copywriter and technical writer (and a lousy typist) who first got his ticket in 1954 (KN2MSM). He rejoined the ranks 5 years ago as N9AWF and earned KO9G two years ago—mostly because the 17-year-old next door (KA9EAT) got his Extra-class ticket (and who wants to live next door to that?).

Art Lang KR9K is an electrical engineer. He is one of the more active people in the area working satellites (contributed several contacts via Russian birds to the Field Day score) and is now even better prepared with a new tower installation. KR9K is also current president of Wheaton Community Radio Amateurs.

Gene McAleer N9DUW is a commercial airline pilot, especially active on the low bands chasing DX (his work schedule allows more time for 10- and 15-meter band openings).

THURSDAY, DECEMBER 8, 1983—CHAFFEE COUNTY TIMES—PAGE 3

Move over, Miss Piggy!

BV men await 'Hams in Space' sequel

A few years ago, the Muppets made a movie called "Pigs in Space".

But now the talk is about "Hams in Space".

Three Buena Vista ham radio operators listened in on the first ham broadcast from outer space last Friday—and the men are hoping that their broadcasts to the space shuttle Columbia were picked up by a recorder on the shuttle.

Art Ermish, whose call letters are KCOVL; Ken Eigsti, WOLSD; and Terry Huston, W8FK were among the ham operators from all over the world to hear the broadcast last Friday from the first-ever ham in space, Dr. Owen Garriot.

Garriot, a Columbia crew member and amateur radio operator, carried a small amateur radio station aboard the shuttle so he could contact hams around the world during the few off-duty hours he had away from his heavy astronaut workload.

"The unique feature of this event is that until now, no one ever had a chance to talk back to a spacecraft other than official NASA communicators," Huston said.

But, last Friday, Eigsti, Huston and Ermish were calling on their amateur radio stations as the Columbia sped over the night sky.

It took only about six minutes for the spacecraft to travel from the northwest to southwest horizon, so the timing had to be perfect, the men noted.

Ermish was able to hear the shuttle on his home base station while Eigsti was listening in on his mobile car radio and Huston heard Garriot on his portable walkie talkie.

"The signal from outer space was quite loud on all three of these stations," Huston said.

There were so many amateur radio operators calling the shuttle at one time that all the call signs were being tape recorded by the ham in space so that he could sort out the individual calls when he got back to Earth.

So perhaps other than just hearing the first-ever ham signals from outer space, one of these Buena Vista hams may have made one of the first radio contacts between civilians and astronauts in outer space.

Huston says the three men "are anxiously awaiting the return of the shuttle to Earth, carrying its precious tape recorded cargo."

Stay tuned.

SPACE HAMS—Three Buena Vista men heard the first-ever ham radio broadcast from outer space last week. Ken Elgstl, left, Art Ermish, and Terry Huston also transmitted messages to the Space Shuttle Columbia.

W8FK

Terry L. Huston W8FK
Box 1417
Buena Vista CO 81211

After all the weeks of anticipation, there he was. I mean right there on the speaker of my little handie-talkie was the first ham's voice from outer space. I was in such a state of disbelief that I almost forgot to press the push-to-talk switch of my microphone to return his call. I mean, after all, that *is* the HT that I talk to the local hams on. Can those really be signals from space coming on the very same radio? But wait, I've *got* to return the call. He won't be in there very long.

I scampered up the ladder to the loft in the A-frame where the other radio gear was. It was nothing fancy, but I was going to at least try to get my own signal back to the space shuttle. "W5LFL, this is W8FK calling, Whiskey Eight Foxtrot Kilowatt portable in the central Colorado Rocky Mountains." I don't believe this. I'm actually trying to talk to a man in outer space. I must be crazy. This is something that would be happening in those comic books I used to read as a kid. And here in my own lifetime I'm actually attempting to communicate with a spaceship?!

Hey, no time to think about that now. Even if I'm dreaming, it won't last very long. Better go for it.

I started to hear his voice even louder than before on his second transmission. "This is W5LFL aboard the space shuttle *Columbia* passing over the polar ice cap and listening for amateur-radio stations in North America. Go ahead, over." Got to start calling again. Let's see, Art and Ken are on those frequencies. Oh yes, here's my channel. The local hams were trying to spread out over 10 calling channels so we would have a better chance of one of us getting through to the shuttle. But can this really be happening? He's so far out there that maybe his signal is being received by a station in some other solar system. Got to quit thinking about that now. I've got to start calling again. "W5LFL, this is W8FK in Colorado."

I wonder if I've got a chance to get through. I mean it's only 10 Watts and a ground plane. But at least it's worth trying. I know Ken WØLSD is trying also. It's too bad about the cloud cover tonight. Skip W9GYA and I were going to try a makeshift tracking station. He was going to fire up his 160-Watt mobile installation and I was going to be the human tracking station. We figured with my 11-element beam attached to a broomstick and me standing on a stepladder pointing the antenna at the spacecraft as it went over, that Skip's 160 Watts would give us a real good erp and we might have a good chance of getting in.

But as luck would have it, our normal "banana-belt-of-Colorado" weather had turned to solid overcast this particular evening. (Is that guy's name Murphy? Who invited him anyway?) It looked like we wouldn't be able to see the shuttle tonight. We had been getting our share of the white stuff this winter and the Colorado ski areas were in their best shape for early December in many years. But unfortunately, I wasn't too impressed with it snowing this particular night (even though I had already been on those funny boards a dozen times and loved every minute of it). Just the night before, we had been outside looking for the shuttle and hoping to hear it as well. And sure enough, there went the brightest looking "star" in the sky overhead at a great rate of speed through a large hole in the clouds. It appeared right on time from the mountainous northwest horizon and sped high overhead, disappearing on the southeast horizon a mere few minutes later. That in itself was a real adrenaline rush, just watching those guys in space going over. But tonight we were actually hearing them, and even though the weather had clouded our plans to use the high-powered station with a moderately-sized tracking array (with that li'l ol' tracking facility—me), we were all bound and determined to try communicating with the first ham in spaceflight history.

So anyway, I had to overcome my rambling mind and concentrate on the task at hand. As Owen started to fade a bit on his third and final transmission of this orbit, I thought I would tune the channels that the earthbound hams were calling Owen on. Holy mackerel—every frequency was loaded with hams! Both Jack NØCDA and Art had done the same thing. We all heard some of the most exciting QRM ever to hit our eardrums. There were stations booming through on every channel.

Normally we don't hear much 2-meter activity up our way. We are located in the Upper Arkansas River Valley about 120 miles southwest of Denver and 90 miles west of Colorado Springs. There are a few hams between those front-range cities and our 8000-foot-high valley, but there are many mountains in between us to block the signals of the city hams from us. And over the Continental Divide and west to Aspen are all those 14,000-foot mountaintops of the Collegiate Peaks range, so there just doesn't seem to be any way that many signals can reach us from those population centers. But tonight we are hearing stations from all over. Several of the calls we located in the *Callbook* and tracked down later. One guy, Rod WØHON, actually was in Aurora, Colorado (a suburb

of Denver), over 100 miles away through the mountain peaks using only 10 Watts. We have trouble hearing the repeaters down there, let alone a little station. What kind of conditions are these that put so many strong signals into our area? Are all the city hams up in the high country for the weekend to increase their chances of contacting the shuttle? Is the spacecraft causing an atmospheric disturbance? Jack and Art compiled the following partial list of callsigns heard during those hectic moments of shuttle calling, with their home QTHs and approximate distances through the rugged Colorado high country from Buena Vista: NØAWD, Pueblo, 100 miles; KØILS, Littleton, 90 miles; NØBIB, Canon City, 70 miles; WA3CVC and NØERO, Florissant, 50 miles; WØSG, Englewood, 90 miles; and KAØPMT, Westcliff, 60 miles. What kind of stations were those guys using anyway?

Well, it sounds like Owen has faded from range. A look at the clock shows about 6 minutes have elapsed since I heard that first break of the squelch on the HT down in the kitchen. Wow, seems like 6 days with all that excitement packed into that short time. Better get on the local 146.745 machine and see how the others heard him. Talk about a double! This was a "quadruple!" I heard everyone on there at one time. There was NØCDA, W9GYA, KCØVL, and WØLSD almost simultaneously on the local machine. I tell you, as busy as we hams are during the week, it's seldom that all 5 of us are on at one time, but the space shuttle made it a special time. Everyone was so excited about hearing the signals. Something like this really brings out the little kid in you no matter what your age, and you should have heard the five 30- to 60-year-old little kids on the repeater now. The excitement level was running high.

"Yeah, Barb and I had to excuse ourselves from our host and hostess to go out to the car and listen to the shuttle," said Ken, who had been invited to dinner that night. Art and XYL Edith were inviting everyone over for happy hour, they were so excited. Skip and son Michael had hurried out of the local shoe store to try to make the schedule. Jack and XYL Alberta were at their home at the base of Mount Antero, and my dog Ali and I were near the repeater site at the base of another 14,000-foot peak, Mount Princeton. It sounded like a bunch of school kids who had had their first taste of ham radio all over again. What a fun time! The local frequency buzzed for quite a while. Ken and Barb had to get back to their host and hostess before they were thought to be too crazy, having rushed out into the cold Colorado night for what? To talk to a spaceship? *Right!* Edith finally understood why Art had been acting so weird earlier. I mean to say, the man had the window open all day for antenna-wire-stringing and this is wintertime in the high country. And Skip is used to talking and listening to aircraft in his job as a pilot for United Airlines, but this was a little bit higher control-tower-in-the-sky talking than usual. And where were all those stations coming from anyway that Jack and the rest of us heard on the uplink frequencies? Was that some strange propagation because the spacecraft was flying through the outer fringes of the Earth's atmosphere? We're still not sure why they were so strong in our area. We'll have to try to work those guys later for comparison.

Terry Huston, his HT, and 14,197-foot Mount Princeton in the background along with the Upper Arkansas River Valley.

After the initial shock wore off, we set about trying to talk to Owen on more of the passes. Somewhere along the line, Skip and I got the bright idea that just possibly a modulated F2 CW signal might get through over the thousands of voices calling. It was a real sight to see us holding a microphone in front of the code-practice oscillator with one hand while running the Morse-code key with the other hand. Who says CW isn't useful anymore?

Later in the week I had to ask a patient of mine if he would mind if I interrupted our eye examination to try to talk to outer space. I really expected a very strange look, but it turned out that the patient sitting in my chair was an SWL named Jerry. He had heard all the publicity about the event from the TV but didn't know where to set his scanner to receive Owen. So we hustled into the lab area of my office and grabbed the HT off the countertop and sure enough, Jerry got an earful of the astronaut as he flew across the daytime sky. We called again with the HT and telescoping 5/8-wave whip on a hope and a prayer that we would be heard. Imagine the thrill for some of the guys down on Earth as Owen repeated back a few of the callsigns that he could sort out from the thousands of hams calling him. A few lucky guys were actually hearing their own callsigns being acknowledged from outer space—right then and there. I would have had to be sitting down to take that if I had heard my own call. SWL Jerry was quite excited just to have heard the shuttle on that tiny HT.

As far as publicity for the event, our little group did alright. Ken took his HT down to the Buena Vista Middle School where Barb is a teacher and let her class hear the shuttle on one of the passes as he tried to call back to Owen. Skip recorded one of the passes and made the feature news for the rest of the day with the subsequent interview on the local KVRH radio station serving Salida and Buena Vista. He also sent a tape of one of Owen's transmissions along with his wife Kathy to the elementary school class she teaches in Salida. I wrote an article for the local newspaper and they printed it in the next issue, complete with a photograph taken by Art's XYL Edith. It was even "stop the presses" because I turned the article in as soon as I could but beyond the normal deadline for printing, but they thought it was important enough and timely enough to get in the next issue.

It was truly a remarkable event for our little group of hams. We're still trying to make schedules with some of the many stations that

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were heard on the calling frequencies to see if there was some special propagation during those days of shuttle flight, or if it could be an everyday occurrence if those antennas were pointed our way more often. Or does it have something to do with the adrenaline rush of hearing a spaceship that makes our radios get a little more excited and put out better? I'll bet it has to do with the same feeling as seeing ol' Saint Nick and his reindeer and sleigh, flying over the nighttime sky, delivering his payload to the world.

At any rate, what us "kids" experienced during those attempted QSOs is a feeling that none of us will ever forget. This was truly a pioneering event that will go down in recorded history for a long time to remember—the very first exchange of amateur-radio signals between human beings on Earth and outer space. I know for the 5 "kids" of Chaffee County, Colorado, it will be a lifelong memory and another bond in the truly fascinating world of ham radio. Amateur radio strikes our lives again!

KB6WT, KD6YG

Jon J. Gallo KB6WT
Jo Ann Gallo KD6YG
17540 Margate Street
Encino CA 91316

It all began when Bill Pasternak WA6ITF, publisher of Westlink and a *73* correspondent, telephoned to confirm that the flight of STS-9 is a go. We discuss antennas and decide to run comparisons between my OSCAR array 15 feet above the roof and an AEA Isopole at 105 feet. I'll be running 75 Watts. Bill asks whether my QTH would be available for some publicity shots for the local TV stations. I check with the XYL, KD6YG, and reply that both of us are willing to help. This is Monday, November 21, 8:00 pm.

Tuesday, November 22, 7:30 am

The morning drive to the office through the typical Los Angeles traffic jam on the San Diego Freeway. I sign on to the local 220-MHz repeater and am called by Roy Neal K6DUE of NBC. After discussing a holiday party at my QTH that Roy and his XYL will be attending, he mentions that he has talked to WA6ITF about the publicity shots and either he or Bill will be back in touch.

Saturday, November 26, 11:00 pm

KD6YG and I return from Thanksgiving vacation and find messages on the answering machine from both WA6ITF and Jack Burnett of *73*. Bill confirms that at least one local TV station wants to tape at our QTH on the first day W5LFL will be operating. Jack has left a message asking me to call him at home Sunday morning.

Sunday, November 27, 7:57 am

Jack Burnett calls to see if I would keep a diary of my experiences attempting to work Owen. KD6YG, who likes to sleep late on weekends, turns over in the waterbed and mutters something about cancelling our subscription to *73*. I go to the shack at the other end of the house and agree to take part in a conference call at 1 pm. The next step is to load Wordstar into the Apple II+ and start this diary.

Sunday, November 27, 1:00 pm

Conference call with Jack, Bill, and other hams from Indiana, Illinois, Alaska, Michigan, Hawaii, New York, Oregon, Texas, Ohio, and Georgia. WA6ITF goes over Owen's transmit and receive frequencies. Two audio tapes are played, one containing orbital information almost too fast to copy and the other an interview of W5LFL by Roy Neal.

Burnett explains that *73* wants a completely honest diary of our attempts to reach Owen and asks each of us to mail the diary to him on the evening of December 6, the last day in orbit. With Owen only having time for 400 or so QSOs, I'll have about 1 chance in 10,000 of getting through. The statistics remind me of some famous 20-meter pileups.

The call ends with a tribute by Jack Burnett to Peter O'Dell of the League for his work on the ham-in-space program and the sad news that Vic Clark W4KFC has died of a heart attack.

Monday, November 28, 7:00 am

Struggle out of bed and scan the two morning papers we have delivered daily. Both contain stories about Owen and both report the possibility that the flight will be delayed because of bad weather. I brew a cup of coffee and turn on the KA6DMY 220-MHz repeater and am reassured by the familiar "hollow" sound of the countdown being rebroadcast from the Jet Propulsion Lab repeater in Pasadena. The Apple II+ is turned on and loaded with Wordstar to continue the diary when I realize the countdown is at 10 seconds. A quick dash to the family room where I dispossess my 13-year-old son from early morning cartoons and turn to NBC where we watch the lift-off and listen to the familiar voice of Roy Neal.

Monday, November 28, 4 pm

My secretary interrupts a meeting to advise that KCOP, local channel 13, is on the phone. The person phoning doesn't seem to know much about amateur radio. We arrange to have them stop by to tape orbit 40D at 6:31 pm local time on Wednesday. They never show up or call back.

Monday, November 28, 7:45 pm

The night news producer for KTTV, local channel 11, calls. She stresses she has been reading the ARRL press releases and understands amateur radio is far different from CB. We tentatively arrange to have the crew come at 10 am on Wednesday for a live shot of orbit 35A, the first orbit over the western US.

Tuesday, November 29, all day

The phone has been ringing off the hook all day. Lenore Jenson W6NAZ, an expert in amateur-radio publicity, has given my name to a number of TV stations. KTTV calls to advise they will be out by 9 am tomorrow. CBS New York calls to tentatively schedule coverage for orbit 40D. The local ABC affiliate calls for an advance interview and will be out at 8:30 this evening.

I call Lenore to bring her up to date on the publicity schedule and spend the next hour in a round robin of calls with Lenore and Bill Pasternak attempting to determine whether Owen will be available for orbit 35A. The final decision is that it is a 50-50 tossup. KD6YG announces she is getting out of this madhouse for the evening and goes to a movie with girl friends.

I tune across two meters and find 145.550 MHz congested with catcalls and unidentified stations pretending they are the shuttle. Good grief! Is this what W5LFL is going to encounter?

Tuesday, November 29, 8:30 pm

I check into the AMSAT net for the latest orbital predictions. The crew from the local ABC affiliate arrives early and tapes for about 15 minutes. It is going to be cut to about a 45-second teaser for the late evening news. The interview ranges from the technical to personal observations on my excitement over the possibility of working the shuttle. The interviewer keeps asking what we expect to learn from operating the shuttle and I express the opinion that we are going to end up knowing more about low-power Earth-to-space communications than ever before. I wonder what they are going to leave in.

For a few minutes I check into the Southern California DX Club repeater and find nothing but discussions about the shuttle mixed with an anonymous voice using a southern accent and CB lingo pretending to talk to Owen. Anxiety over intentional interference increases.

Tuesday, November 29, 11:10 pm

ABC airs about one minute of the interview stressing my personal excitement over attempting to work Owen. A few minutes later the phone rings and the caller, in a slow and somewhat "spaced out" voice, identifies himself as Mike and asks if I was the person in the interview. When I hesitantly admit my involvement, he says he is a 32-year-old Vietnam veteran and father of a 5-year-old girl and is tired of all the negative news reports on TV and wants to thank me for doing something that brings some good news to TV. In a state of semi-shock, I tell him I never expected such a call and appreciate the nice comment. We wish each other good night and I go to bed to prepare for what is beginning to look like tomorrow's ordeal with the media.

Wednesday, November 30, 7:00 am

I check into the Southern California DX Club repeater and find discussions of orbits mixed with DX announcements. Two of the locals mention being contacted by CBS and ABC for taping at their QTHs. Maybe I'll only have to deal with the two local stations today.

Wednesday, November 30, 9:30 am

The KTTV crew arrives and sets up for live coverage of orbit 35. KD6YG handles the calling and I'm in charge of azimuth and elevation controls. We are using 145.01 as the transmit frequency and 75 Watts to the KLM 144-150-16C circularly-polarized antenna. 145.550 is a madhouse, with stations calling Owen,

Jon Gallo KB6WT

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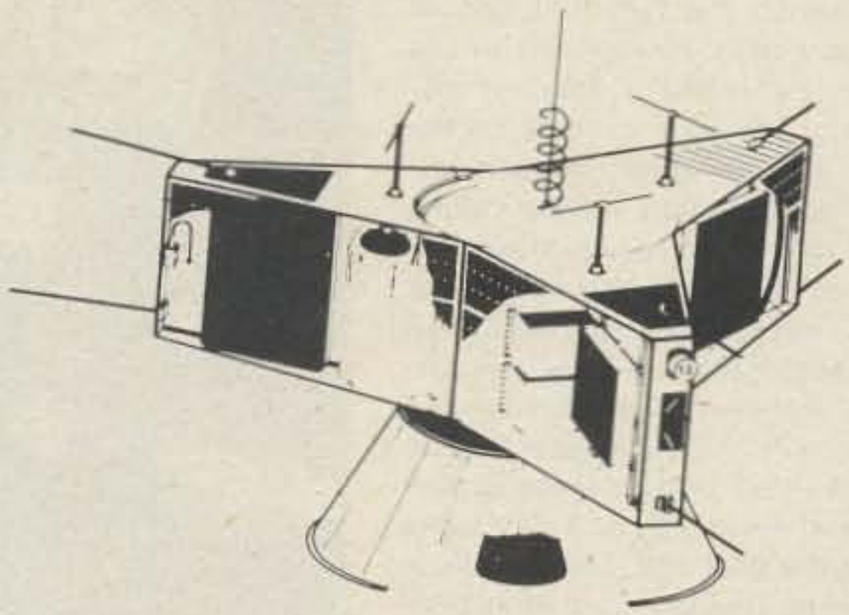

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policemen adding to the confusion by telling them to QSY, and a fair amount of deliberate interference. A great deal of the problem is attributable to the fact that one of the major daily newspapers in Los Angeles published a detailed article about W5LFL that reversed the uplink and downlink frequencies! Numerous amateurs will be calling on the uplink for several days as a result of this error. I do not hear W5LFL but am later informed on one repeater that the pass was successful and Owen was heard listing various W7s and on another that he was involved in a science experiment and never got on! KTTV tapes part of the pass and then conducts a 2-minute live interview that goes well. I pour myself a well-earned cup of coffee, put on a tie, and go to the office for a few hours.

Jo Ann Gallo KD6YG

Wednesday, November 30, 5:30 pm

The KABC crew arrives for a live feed of orbit 40. The operating plan this time is to use 145.01 at 6:35, 145.03 at 6:37, 145.05 at 6:39, 145.07 at 6:41, and back to 145.01 at 6:43. Power level will remain at 75 Watts. I spend about an hour on 145.550 simplex providing pass times and orbital data to stations needing this information. During the pass I was able to hear W5LFL quite well during three of the five minutes he was scheduled to transmit during the window. There was some intentional interference, but less than during orbit 35. However, there was a great deal of calling on the uplink and many policemen. I was unable to determine whether we got through. I deliberately use earphones so that the audio is not picked up by the TV crew. I subsequently find that other amateurs participating in live coverage provided complete audio and at least one local newspaper runs a first-page story stressing deliberate interference.

Thursday, December 1, 7:30 am

I check into the early morning AMSAT net and determine that orbit 49 will not be workable from Los Angeles. I leave for work without trying.

Thursday, December 1, 5:00 pm

Driving home from work, I monitor 145.550 MHz and listen to N6VI and WB7AJC acting as net-control stations and giving out information on orbit 56. A pattern seems to be forming. A good 95% of the amateurs on 145.550 appreciate this information. The remaining 5% are extremely negative and keep suggesting, often obscenely, that stations providing this information QSY. I am acquainted with several of the amateurs making negative comments and know them to be old-timers in their 60s or above and licensed for many decades.

Thursday, December 1, 6:24 pm

Signal acquisition on orbit 56 is loud and clear. I am operating alone this time and am using 145.01 MHz as the uplink. W5LFL is acquired during the last ten seconds of his 6:26 transmission. The 6:28 transmission is S9 with only one local policeman breaking in for a quick comment to someone he hears but I don't and about 5 seconds of interference. The 6:30 transmission starts out above S9 but can be read for only 10 seconds when a WB6 begins calling him on 145.550 and the rest of the pass is lost in the resulting exchange of insults and comments by channel cops. Comparing notes after the pass, it appears that even in QRM-free areas, loss of signal occurred in less than 2 minutes of good quality shuttle audio. My reception seemed significantly better than that obtained by many users of local repeaters and I spend much of the evening replaying the usable portions of the tape for local amateurs.

Friday, December 2, 6:00 pm

Driving home, I am informed that Owen was an S7 on orbit 71. I try on orbit 72 and W5LFL appears to be a no-show. Intentional interference on this orbit is worse than last night. I am later informed that Owen was on, but the attitude of the shuttle resulted in the antenna not being properly oriented for good reception in Los Angeles.

Saturday, December 3, 1:00 pm

Roy Neal calls from Houston to report that the shuttle mission is being extended an additional day. We compare notes about forthcoming orbits. Roy reports being able to receive Owen 5 × 9 using a handheld and rubber duckie in his hotel room in Houston. We agree that small antennas are best for receiving purposes in areas of high population density in order to minimize interference. I subsequently call Jack Burnett at his home to confirm the extra day of operation.

Sunday, December 4, 8:00 am

I check into the Southern California DX Club repeater and get orbital data for 98A. This time I decide to listen to all ten uplink frequencies before deciding on my transmit frequency. Feeling somewhat suicidal, I decide to disassemble my Icom 271A and install a newly purchased ac power supply in order to reduce the load on my 35-Amp dc power supply. More as a tribute to Icom than to my mechanical skills, the entire job is accomplished in minutes and works perfectly.

The pass begins with AOS scheduled for 1630 UTC in Los Angeles. A quick scan of the uplink frequencies shows slightly less rf on 145.03. There is less malicious interference than ever before and the number of policmen is also reduced. Unfortunately, W5LFL again appears to be a no-show. Comparing notes with local amateurs after the pass, no one heard Owen. The consensus is that the confusion is being reduced, but no one knows what to do about the channel cops.

Roy Neal calls from Houston at 9:45 am and plays the audio tape of the W5LFL/JY1 QSO. It was a pleasure to listen to a QRM-free pass. As a member of the DX Club subsequently states, a jammer in Jordan is likely to get more than his coax cut off!

Sunday, December 4, 6:00 pm

Conference call with *73* and the participating amateurs. We share our experiences, frustrations, and hopes. Parts of the country have had no success, while others, such as the northwest and south, have done very well. We go into a great deal of detail on antennas and press coverage and make final arrangements for submission of our diaries.

Sunday, December 4, 8:00 pm

My schedule suggests that I'll miss both orbits 114 and 119 tomorrow. KD6YG agrees to try to contact W5LFL. I check into the local AMSAT net to get orbital parameters and we jointly go over azimuth and elevation settings for each minute of both passes to make certain that Jo Ann is prepared.

Monday, December 5, 7:00 am

I drive off for my first meeting of the day and leave the station (and Apple II+) to KD6YG.

Monday, December 5, 8:19 am

I (KD6YG) finally get a solo chance at Owen on orbit 114. KB6WT goes to work and our 13-year-old leaves for school. Hoping the doorbell and telephone don't start ringing (I turn on the answering machine so I'll have some control over the situation), I turn on the gear and double-check the schedule. When the clock ticks to the right time, I jump in. While continuously repeating my callsign, I turn on the tape recorder, adjust the azimuth and elevation, and watch the clock. All goes well. The only sound I hear is someone saying, "He is talking to Houston." It would have been great to hear Owen. I plan my schedule for the day so I'll be at the radio to try again on the 4:08 pm pass.

Monday, December 5, 4:00 pm

Unfortunately, I (KB6WT) sneak out of the office early to be home for orbit 119. Once again W5LFL is a no-show. I heard very few calls to Owen on the uplink. Intentional interference probably amounted to no more than 30 seconds during the entire pass. Los Angeles seems to be getting its act together. (I find myself wondering whether Los Angeles has an undeserved reputation for poor operating. According to the 1983 *Callbook*, we account for 13% of all the amateurs in the country and a quarter of them live in L.A. That's about equal to the amateur population of such states as Massachusetts, New Jersey, Michigan, or Illinois!)

Tuesday, December 6, 8:00 am

KD6YG back at the Apple. The OM has to be at the office all day, so I get the shack all to myself for both orbits 130 and 135. I arrange for someone else to drive the carpool so I can be at the radio at 8:06 to try to reach Owen. It's exciting when I hear his voice acknowledging sixes "too numerous to write down." He is torn between the ham rig and the window—the view of California is fantastic, he says. Even listening to Owen Garriott call CQ from the spaceship *Columbia* is an incredible experience. Being the positive thinker that I am, I hope to hear my callsign acknowledged by Owen—what a thrill that would be.

Tuesday, December 6, 3:55 pm

My son, Don, is standing by to answer the telephone and the door if necessary so I won't be interrupted for these few precious minutes during orbit 135. This time the plan is to call for approximately 5 seconds on each uplink frequency. Now I find myself controlling azimuth and elevation, the tape recorder, 10 different transmit frequencies, and checking the clock all at the same time. I always said I

liked being able to do two things at once, but this is ridiculous! When Owen comes back after the second or third transmission, I'm pretty sure I hear Kilo Delta Six Yankee something. Did he say "Yankee Gulf"? Has he heard me? I glance at the tape recorder and realize that in all the confusion I had forgotton to turn it on. Now I have no way to double-check to be sure. I'm so frustrated! I could scream! I hope they hurry up with that official list of callsigns heard—the suspense is killing me.

Tuesday, December 6, 8:00 pm

KB6WT back at the diary. I check into the AMSAT net and obtain data for orbits 146 and 151, which are the only two likely passes over the west coast on Wednesday. If Owen is operating, the chances of getting through are likely the best yet since information on these orbits has not been given widespread publicity. Checking into the DX Club repeater, I find out that one local confirmed W5LFL using 160 Watts and a pair of KLM CP beams. That's only 6 dB more gain than I have available with 75 Watts and a single beam. Playing back the tape of today's two passes, it appears that there was no intentional interference on orbit 130 and less than 30 seconds of such interference on afternoon orbit 135. Also, the callers on the downlink and channel cops were less numerous.

Wednesday, December 7, 7:53 am

Owen shows up about two minutes later than predicted by the AMSAT net and is 60 dB over 9 while he announces he is over San Francisco. He acknowledges numerous sixes and fades out abruptly about two minutes in advance of expected LOS. The rapid fade is confirmed by several other amateurs in Los Angeles.

Wednesday, December 7, 3:41 pm

KD6YG back at the Apple. Well, here I am again, one more time, one final try to communicate with a fellow ham in space. I've gotten the system down pretty good. I'm very busy, but I sense after my first or second transmission that he isn't there and he isn't going to be there. You just know he's gone. I got a true feeling of how vast space really is. Well, Owen, it's been fun. We'll have to do it again sometime. See you in the newspapers.

Wednesday, December 7, 6:30 pm

With both the flight of STS-9 and this diary drawing to a close, some final thoughts seem to be in order.

The entire experience has been perhaps the high point of more than two decades of involvement in amateur radio. If I had to summarize it in two words, they would be "fun" and "fatigue."

In retrospect, the interference was much less than I expected and decreased dramatically with each pass.

Replaying the tapes of Owen's passes reveals that intentional interference accounted for less than 10% of the total interference I encountered. Calling Owen on the downlink accounted for another 30% or so. More than half the interference was the result of channel cops. Instead of a short transmission advising the offender that he was on the downlink, many policemen found it necessary to be both abusive and long-winded.

Attempting to work the shuttle as it approaches both AOS and LOS points is actually nothing more than a form of VHF weak-signal work. When attempting to pull a signal out of the noise level, a competing VHF signal many miles away renders the attempt impossible. If I could offer a single piece of advice based on this experience, it would be to stay off of the downlink for at least 10 minutes before and after AOS and LOS at any particular QTH. The mere fact that we have lost the shuttle in Los Angeles does not mean that we can start rag-chewing on the downlink. We will probably be interfering with another station some distance away at a better location or with better antennas.

I sure hope the ARRL releases a complete list of calls tape-recorded by Owen in the near future. The suspense is killing me!

Jon Gallo KB6WT is 41 and a partner in a large Los Angeles law firm where he specializes in estate planning and probate administration. Jo Ann Gallo KD6YG is 38 and considering re-entering the job market now that the children are teenagers. They have been married 19 years and have a son aged 13 and a daughter aged 16. Both hold Advanced-class licenses. Jon has been licensed for 21 years and Jo Ann for 2 years.

Jo Ann's hobbies include photography and needlepoint. Jon's include photography, cabinet-making, and target-shooting.

Jon has been involved in amateur-radio-related legal problems on a voluntary basis for several years and is currently the president of a large UHF-oriented radio club in Los Angeles.

For the low bands, the shack consists of a Signal One 1030 transceiver, J.W. Miller automatic antenna tuner, and Henry 2K-4 amplifier. Antennas include two elements on 40 meters at 95 feet, a KLM KT34XA tribander at 80 feet, and a coaxial dipole for 75–80 meters. VHF interests extend from 144 MHz to 450 MHz.

For the STS-9 mission, the gear consisted of an Icom 271A multi-mode transceiver, a circularly-polarized 14-element beam with azimuth and elevation controls at 30 feet, and an AEA Isopole at 105 feet. The CP beam consistently outperformed the Isopole for reception. A Mirage B108 amplifier with built-in preamplifier was used on all passes.

KZ7T

Randy Stimson KZ7T
9890 SW Inglewood
Portland OR 97225

Jimmy Hollister, a radio personality from one of the leading radio stations in Portland, KEX-AM, said on the air just now (7:00 am, July 21, 1983) that he had heard there was going to be a ham aboard the space shuttle *Columbia* and asked if anybody knew about it. I was reluctant to talk to him, but my wife, Lorna Campbell KA7RFD, called him and handed me the telephone. One of the reasons that I went ahead was that I had just returned from a ham fair in Spokane, Washington, where Roy Neal from NBC was the speaker, so I did have some knowledge about the operation of the ham-radio person on the shuttle. During our conversation he asked if I would be willing to come to the KEX station, hook up my gear, and try to contact Owen Garriott live. I agreed to do so.

August 12: Realizing that I would need help technically and otherwise, I contacted Stan Griffiths W7NI, owner of Antronics of Oregon. Stan agreed to be the second member of the team. I talked to Stan about people who could help us technically with the antennas and other related gear. He suggested Lynn Hurd WB7UNU, so I contacted him. He agreed to help out, and all three of us decided we would set up our gear at KEX Radio. We did a lot of reading and research, looking up all the information we could find on the best type of antenna, and finally agreed upon the turnstile-type antenna which produces a circularly-polarized signal.

August 22: KEX said they had an engineer who was a ham, Michael Brown N7AXC, and Mike became the fourth member of the team. He was a great asset to us as not only could we now readily obtain access to the KEX roof and studios, but he knew the correct media personnel to contact.

August 25: Telephoned Peter O'Dell of the ARRL to request press releases and U-Matic tape.

August 27: Lynn WB7UNU and I built the first antenna. We used 1 × 2s, chicken wire, 2 × 2s, and 1/8" brass brazing rod, using RG-58 and RG-59 coax and using the proper heights from the ground plane. We referred to the *ARRL Antenna Book*. We had a very difficult time as we couldn't get it tuned to where we wanted it. The swr was running at 1.8–1.9 and it didn't seem to make any difference how much we changed the 1/8 rod. We decided to enlarge the size by using 1/4" copper tubing over it so we could slide it in and out. We got some of the swr readings down as low as 1.2–1.3 and it was a lot better. We tuned the first antenna.

September 3: I built the other four antennas but did not final tune them.

October 3: We realized we would need some press releases to come from KEX and would need

↙See List of Advertisers on page 114

someone to help us write them. H. Lea T. Ball AL7W agreed to be our press-release person and the fifth member of our team. We met together on two occasions to draft and finalize the press release, but on October 24, just before we sent it out, we heard that the shuttle flight for October 28 was cancelled and everything was put on hold.

November 15: Received audio tape from the ARRL and updated press kits. Realizing that all of a sudden it was upon us again, I contacted Mike N7AXC and we put the whole operation back into motion.

November 21: I began to gather up all of the equipment necessary to make this work. The equipment consisted of two 7850 Kenwoods, one 7950 Kenwood, one Icom IC-211, and one Yaesu FT-726R. The power supplies were one KPS 12 Kenwood, two Astron RS 35As, and one Astron RS 20A. We had the two Kenwood 7850s running at 40 W each, the Kenwood 7950 had a 160-W Mirage B3016 amplifier on it, the Icom IC-211 had a 160-W Mirage B3016 amplifier, and the Yaesu FT-726R also had a Mirage B3016 160-W amplifier. We were running three stations at 160 W each and two stations at 40–45 W, whichever the 7850 Kenwoods put out. We used the Yaesu for the primary receiver and also for recording and the Kenwood 7950 as a backup recorder.

From this point on, there were a lot of meetings discussing how we would approach the transmission. We decided that on the first odd minute we would use the first five uplink frequencies, the second odd minute the second five uplink frequencies, and if time permitted, we would revert to the original five uplink frequencies, and so on. We hoped this way we might make contact. We originally thought about all five people using all five callsigns, but decided against that primarily because if W5LFL heard one call, we thought probably he would then switch channels. We decided each would use his own call.

We sent press releases to AP and UPI, all TV stations, and the local newspaper. (We did not send to the local radio stations as we were operating from a radio station.) We had some response, and TV stations did ask for a press conference which we set up for November 25.

November 24: We set up all our gear in KEX's lobby. The antennas were placed 18' apart on the roof and were tuned. We marked everything with a number. Each coax, antenna, and rig was marked with the same number so that when we re-installed the equipment we didn't have to worry about the swr. (This was necessary as we were unable to leave our gear—apart from the antennas on the roof—at the KEX station.) We used RG-11 coax cable for the feed and had trouble

Shirley Hancock of KOIN-TV interviews Randy KZ7T.

getting the longest piece, 94', below an swr of 1.8 no matter what we did, so we decided we had to live with it. The shorter pieces came down to a 1.2 level. On the 25th, we put all the equipment back up and at 10 am PST we had our first TV news conference with KATU (ABC) and KPTV (independent). At this time, KOIN-TV called and said they had not gotten the information regarding the press conference and asked if we could hold another on November 27. We finished the press conference and tore all the equipment down again. (Up it went again on the 27th for the CBS KOIN-TV conference.)

November 26: We put up the dish at Antronics of Oregon so that we could monitor NASA; we began monitoring the next day. From that point on, Pat Griffiths, wife of Stan W7NI, monitored it almost continually for us for any updates or changes. Later she also monitored W5RRR and we kept in constant telephone communication with her.

November 28: We had another meeting to figure out a better way to make contact with Owen, but we again agreed that the idea of single calls per person and on groups of five channels at a time, one channel per station, transmitting on the odd minute, was still the best way to operate. We also agreed to make only three attempts from KEX—orbits 39D and 40D on Wednesday, November 30, orbit 71D on Friday, December 2, and orbit 119D on Monday, December 5.

November 30: Our first contact. The first time we heard W5LFL we heard him acknowledge Lance Collister WA1JXN in Frenchtown, Montana, at 6:34 pm PST, orbit 40D. We had at KEX Radio all four local TV stations, KATU (ABC), KOIN-TV (CBS), KGW (NBC), and KPTV (independent). *The Oregonian* (newspaper) was there and also a reporter from KLCC who drove up from Eugene, Oregon. We were told we were on national television on NBC. Walt Morey WA7SDY, a good friend, videotaped all the events, including the coverage by the news media. Sherill Smith KA7KNG was of great help assembling and disassembling the gear on all three occasions.

December 1: Stayed home that night and heard Owen at 6:22 pm PST.

December 2: Mike N7AXC was unable to be present due to a prior commitment with jury duty, so Sherill KA7KNG became the fifth operator. Made our second contact from KEX at 4:40 pm PST. We think W5LFL may have heard W7NI who, on the last minute of our transmission, decided to change his method and switch from channel 1 to channel 2 after giving his call a few times. Owen said he had heard W7 with two other letters, switching from channel to channel, and would verify when he got back to NASA.

December 5: I had a live interview on KXL-AM radio in Portland at 2:15 pm which lasted about 10 minutes. We set up our gear for our third and final attempt for KEX. The pass was 119D. It was slated to start here at 4:07 pm PST. We started on the uplink on the same frequencies we had previously used. We tried at 4:07, heard nothing at 4:08, transmitted again at 4:09, again heard nothing, so we tried something brand new. We had two Morsematics, one an MM2, and we programmed all six operators' calls into memory. We included the call of Sherill KA7KNG as he had been our fifth operator on Friday night and was present again tonight. On the odd minute of 4:13 pm, we transmitted all calls—Morse code at 25 wpm. We did it twice. Six calls at 25 wpm took 17 seconds, then we went back to voice and we listened for the even minute. At 4:15, we did it again with CW, listened for the next minute, and then went back to straight voice. We figured if anything could have got through the QRM, it would have been Morse code. If anyone else had known about it, it wouldn't have worked at all, so we kept very quiet about our plan. This was our kicker. Unfortunately, we don't even know if Owen had his rig on. We were hoping that he would respond that he had heard Morse code. We could have tried this Friday night, but then we felt Monday would have been a disaster as everyone would have been trying. But it was a good trick and we used it as our final, desperate attempt. We had no contact with W5LFL, but we did have with us two television stations (KATU and KGW). We had excellent coverage from the news media throughout. We pulled up and separated our gear, each taking home an antenna and a large piece of coax as well as our own gear.

Special acknowledgements: Patricia Griffiths for her behind-the-scenes work; my wife, Lorna Campbell, spent endless hours helping me out, writing this report, taking telephone messages, driving around town getting things done; Sherill Smith, who did all the still photography and masses of the legwork; and, of course, KEX Radio in Portland. Without them, we wouldn't have had this coverage, and the KEX staff worked with us in a magnificent fashion.

W7NI Comments

I have been asked for an opinion as to the overall result we had here and what we might have done better. We did our part fairly well. As a matter of fact, I can't think of anything I would do differently with the exception of possibly running much higher power, since, as far as I know, the only people who got through were running considerably higher power to considerably better antennas which had the ability to track the shuttle automatically. That seems the way to get through.

As it is in virtually any other highly competitive activity, and this appears to be no exception, indeed, good sportsmanship doesn't reign. Wish it did! Sorry, but I don't think it does.

It probably would have been better if they had put the thing on a different frequency like 220 Megahertz instead of 2 meters and a different mode, CW say, instead of FM, something where there is some operator skill involved. A means, in a way, of weeding out some of the interference and some of the QRM. I really don't know what's going to happen next time they put one up. If they don't go to an odd frequency, if they remain on 2 meters, I think you'll see (you think it was chaotic this time!) a great deal more chaos next time because there will be a great deal more power on. We've sort of proven this time that high power gets through. It appears the moonbouncers were making it and there'll probably be a huge upsurge in powerful amplifiers in the next one. I think what we need is a 100-dB attenuator on the receiver.

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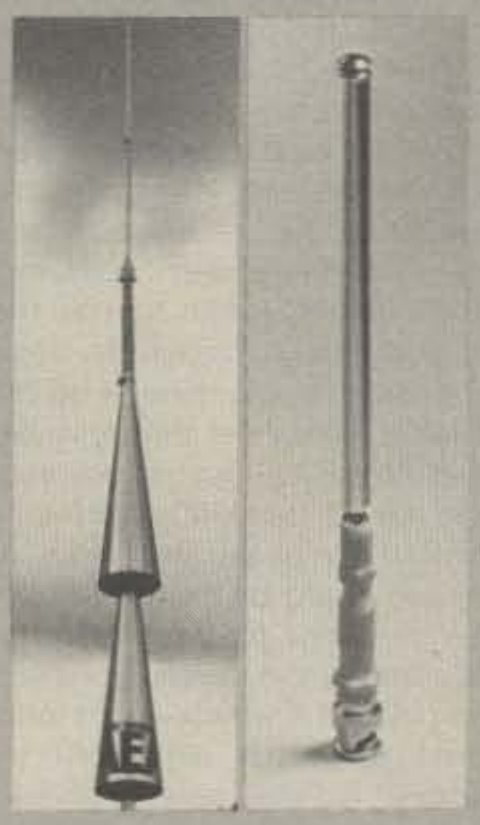

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12/07/83

AL7W Comments

My feeling on this whole experience with STS-9 is that those who made the decision to use frequency-modulated voice need to rethink the process. In a crowded band condition, which is all that could realistically be expected, all that discriminator in Owen's receiver is going to hear is a lot of noise with the exception of people who used their EME rigs and antennas. I am really disappointed in that decision. It would have meant a great deal more expense for myself to work him, but it would also have increased my chances to work him if we had used single sideband, or whatever. CW, of course, would have been the ideal mode since that is not only Owen's pet mode, but mine also. I find the idea of working him was great; I just question the wisdom of using FM and I also question, to a certain extent, the wisdom of using the 2-meter band.

WB7UNU Comments

I think that the experiment was a good one, but I hope in the future they use a frequency other than the most populated ham band so as to further the hobby by the expansion of user use on to the less used bands such as 220 or 450. People who use these frequencies are more serious about long distance. We also need better prior communication. It seemed anyone who had a radio added to the havoc, especially those people who knew nothing about it until the last minute and therefore transmitted on a downlink and on the even minute. All they knew was that there was a pass going over, and they pulled every dusty radio out of the closet and turned it on.

It would have been nice also to know those who had previously been contacted so as to remove them from the list of those attempting to contact the shuttle, such as the kilowatt moonbouncer station which was, at least in our opinion, desensitizing the receiver to the point that low-power operators were completely removed from the input of the radio. Hopefully, there will be some design changes on the next radio, whenever that may be, so that he can switch on attenuation to reduce that kind of effect.

I would like to see some way information could be exchanged between the voice link, between the shuttle and NASA, such as we see on SATCOM 1R which we are now allowed to watch and even rebroadcast. If there were some sort of key or indication that he was into that part of the activity, then we would have a little better indication what was going on.

Again, better communications. I called Westlink at 10 pm PST on Monday, December 5, and listened to a recording that gave the orbits for Friday, Saturday, and Sunday which had all passed. The indication on the tape was that it would be changed on Monday afternoon, but apparently that never occurred.

Antennas on the KEX roof.

KZ7T Comments

The hams got better and better as time went by. I did one thing on December 5, five minutes before Owen was even thinking about coming over Portland during orbit 119. I got on 5.550 on the odd minute and talked to all hams with 160-W power, reminding everyone to "check your clock, check your time, make sure you transmit on the odd minute, try not to transmit on the even minute, and remember politeness." I also said that two television stations were standing behind me with their mikes stuck into my speakers, so let's be a little careful what happens. That night was super; nothing but politeness, so we are learning how to handle this thing.

There is a lot of comment about forms other than VHF. There's talk about single sideband, 220, 440, HF, and every time you bring up one of these, it's fine if you have the gear, but a lot of people can't afford single sideband or 220 or 440, so I don't think that's the answer.

THE OREGONIAN, SATU

5 hams bone up for space

Radio operators target astronaut

Keeping their fingers crossed will be a key element in the strategy of five Portland-area amateur radio operators who hope to chat with an astronaut in space Wednesday evening.

Randy A. Stimson, H. Lea T. Ball, Michael D. Brown, Stanley A. Griffiths and Lynn C. Hurd, besides relying on the good-luck ploy, also will be using the latest equipment in a large, jointly operating base station. Their aim is to communicate with the space shuttle Columbia, scheduled for launch Monday.

Astronaut Owen Garriott, a ham radio buff, will be using a hand-held walkie-talkie to talk to Earth during his off-duty hours. He will be the first astronaut allowed to pursue his radio hobby from space through non-NASA channels.

Garriott, a mission specialist, will be working inside Spacelab, which the Columbia will be carrying it in its cargo bay.

Stimson of 9890 S.W. Inglewood St., Ball of 3945 S.E. Cora St., Brown of 3740 S.W. Comus St., Griffiths of Aloha, and Hurd of 4880 S.W. 195th Court have set up a group amateur radio operation at the KEX studios in Portland. The idea was hatched by station broadcaster Jimmy Hollister during one of his morning shows and he broadcast an appeal to ham operators in the area.

Brown is a KEX engineer with his own amateur radio station. The others also have ham stations.

"I think we have at least one chance in 25 of being heard by Garriott," Brown said. "We're hoping we have superior equipment over some of the other amateurs" who will try the same thing.

Stimson estimated that there are 4,000 to 5,000 hams within a 100-mile radius of Portland, 7,000 to 8,000 in the Seattle area and 2,000 to 3,000 in the Spokane area. As a result, the air waves likely will be busy with calls to the astronaut, Stimson said.

The best times to talk to Garriot from the Northwest will be when he is closest to overhead. Provided the Columbia is launched on schedule, it should be near, although 175 miles up, between 5 and 5:30 p.m. Wednesday, from 4:30 to 4:55 p.m. Dec. 2, from 4:07 to 4:20 p.m. Dec. 5 and from 3:45 to 4:07 p.m. Dec. 6.

Anyone with a programmable radio scanner should be able to pick up the broadcasts from space. Garriott is expected to be transmitting at 145.55 megahertz using call letters W5LFL.

Persons who do receive him and can verify it can obtain a card with his call letters by writing the American Radio Relay League-STS-9, 225 Main St., Newington, Conn., 06111.

Stimson suggested that, in sending for the card, the application should state the time, frequency and a brief outline of what the astronaut said.

Persons desiring the latest information on the frequency over which Garriot will broadcast can call 1-800-SCANNER.

Once again, persons around the world can use the telephone to listen to the astronauts and keep abreast of the flight.

Callers in the United States cna utilize Dial-A-Shuttle by dialing 900-410-8272 to hear the astronauts live when they are in touch with mission control. When the shuttle is out of range, National Space Institute personnel will update callers on the status of the flight, the next expected communication time, and educational features about the trip.

Callers from the United States will be charged 50 cents for the first minute and 35 cents per additional minute.

Dick Powers WB7ADM, in Portland, had probably one of the best answers. A lottery system where all the hams could send in their calls if they would like to contact the next ham in space and, if nothing else, arbitrarily, or by computer, pull out so many calls for an area and they would be called from the space shuttle down to Earth. If they were listening, they could acknowledge. I'm positive we would get many more contacts. If a ham tried to jam on the uplink, he would be notified he was not being accepted, because it was not working. Those who acknowledged their callsign would get a QSL card.

I cannot believe W5LFL just had batteries and wasn't plugged into a power supply with limitless power—that's hard for me to understand.

I don't feel any magazine, *73*, *QST*, or any magazine, had enough articles prior to the event to help the hams figure out what was going on. I would have liked to know a lot more about the gear Owen was using. Could he hear on 55? How long can it last? What kind of reception was he getting? We don't feel he was getting good reception or that his receiver was that good, but we don't know. Could the magazines send newsletters out? If I belonged to the ARRL, I should receive a newsletter from them. If I subscribed to *73*, I should have gotten a newsletter from them. Hams in the area were asking us questions we knew nothing about and I probably had as much information as anyone in the area as I called the ARRL and got the press releases and the U-matic tapes, and I also heard Roy Neal speak in Spokane.

It seemed to be a feeble attempt. A lot of guys spent thousands of hours, not to mention money, for a feeble attempt and I don't think that's right. I feel that 2 meters is probably as good a mode as any. Some people think CW is the answer, probably because they are good at CW, but there are many hams who don't use CW. I think this mode was a good one.

When the news media first approached us and we had the first interviews, we stressed that our only goals were to hear Owen Garriott and to further the cause of ham radio. We told them this was the first time a civilian ham had been able to listen outside of NASA. We told them ham radio was fun; we like to see how far we can talk and get a QSL card back. We tried during every interview to make it seem like fun. We had positive feedback from everyone because we did hear Owen Garriott and we did fulfill our commitment.

Randy Stimson KZ7T, aged 51, is married to Lorna Campbell. He has three children from a previous marriage, all married, with six grandchildren among them. Born in Seattle, he has spent practically all his life in the tire in-

dustry, where he started during high school busting tires for a tire shop. He spent 20 years selling equipment, but now also does service, troubleshooting, and PR work. His territory covers eastern Oregon, Washington, Idaho, and western Montana. He has been a ham for three years and prefers the community-service side to the DXing. During the past year he was part of the communications group for the Kidney Association of Oregon Keg Roll, the Portland Rose Festival, two Sports Car Association of America Rallies, and several Bike-A-Thons. He belongs to the ARRL, the Oregon Tualatin Valley Amateur Radio Club, the Portland Amateur Radio Club, the Inland Empire VHP Radio Amateurs, the American Radio Relay Group, the NW Repeater Group, the 10-10 Club, and ARES. His wife, Lorna, is very active in a non-academic sorority group which encourages friendship among women and service to those less fortunate than themselves. They like to travel and try to visit Lorna's homeland (England) about every three years, usually combining the trip with one to another European country.

N7AXC

Michael D. Brown N7AXC
3740 SW Comus St.
Portland OR 97219

The morning DJ at KEX Radio, Portland, Oregon (where I am employed as an engineer), mentioned on July 21st Owen Garriott's planned attempts at ham-radio contacts with Earth-bound hams on the next shuttle flight. Through the DJ (Jim Hollister) and News Director Jim Howe, I was forwarded a few inquiries from local hams. I first made land-line contact with Ronald W. Magnus WA7GFE, Portland, and Ron and I were in contact several times by phone and at least once in person.

It was Hollister's wish that we attempt to set up a base station in the KEX studios so that we might have the attempt to broadcast the contacts, if not live, at least on tape shortly after the contacts. It was also my feeling that the KEX studios would provide a good central location for staff and interested listeners, as well as for the media, to witness the event. Ron was very helpful in providing me with preliminary information, including orbital maps, but was of the opinion that our location hugging a hill to the west would make the KEX site less than ideal for many if not most of the orbits.

Then Randy Stimson KZ7T and I first made telephone contact. We had a comedy of errors in missing each other's phone calls up to this time. I learned that Randy, along with Stan Griffiths W7NI and Lynn Hurd WB7UNU, had already been working on the project, after talking with Jimmy Hollister. Randy was of the opinion that we would be able to make adequate contact most of the time from the KEX studio location and convinced me of its advantageous location, for the above stated reasons. Upon closer examination of the orbital maps and some rough calculations as to the effects of the hill on our potential-contact windows, I agreed to work with them in putting on a large, jointly-operated base station at the KEX studios.

My special assignment was to interface with KEX and the media. We needed a location in the building (which was not easy, since all the available accesses to the roof came to locations far from any room in the building we could potentially use). We needed ap-

NEWS RELEASE

FOR RELEASE 10 AM 11-25-83

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H. LEA T. BALL AL7W 777-1032 775-0188;
MICHAEL BROWN N7AXC 225-1190 245-4889.

For the first time in history, private citizens will have a chance to talk directly to a man in space. Astronaut Dr. Owen Garriott, callsign W5LFL, will be talking to amateur (ham)-radio operators throughout the world while on board the STS-9 space-shuttle flight. The shuttle is due to blast off next Monday, November 28. Garriott, a NASA mission specialist, will use a low-power hand-held FM transceiver to make his contacts during his off-duty hours. He will be the first astronaut allowed to communicate with Earth through non-NASA channels.

The exact time of our attempted contacts with Dr. Garriott is not confirmed at this time, but will likely be between 5 and 8 pm, Wednesday, November 30.

The idea of setting up a group amateur-radio operation was conceived by KEX Radio morning personality, Jimmy Hollister, during one of his shows. He broadcast an appeal to ham-radio operators in the area. Five area hams, including KEX engineer Michael Brown, have arranged for a large, jointly-operating base station to be run from the KEX studios. (All the equipment involved will be set up and operating for the November 25 News Conference.)

Original proposals to place an amateur-radio transceiver aboard an orbiting US spacecraft surfaced when NASA was about to launch *Skylab*, in the early 70s. The plan was rejected because it came too late in the development of the program.

Space-shuttle flights presented another opportunity. The American Radio Relay League (ARRL) and the Radio Amateur Satellite Corp. (AMSAT) jointly requested that Garriott be allowed to operate a small transceiver aboard the shuttle. NASA accepted, on the stipulation that the plan would not interfere with mission activities and that safety regulations were met. The radio will be operated from the aft flight deck of the space-shuttle orbiter, *Columbia*, which is carrying the Spacelab in its cargo bay.

The KEX team news release.

See List of Advertisers on page 114

provals from management, programming, engineering, and other parties within the station. I began working on these decisions and approvals.

Over the next few weeks, we worked out all the problems of press releases, locations, and equipment. I got clearance for, and made arrangements for us to set up in, a portion of KEX's large front lobby. Ac power for our 5 rigs and associated equipment was to be run off two isolated circuits of 20-Amp capacity each. All equipment would be set up on neatly draped tables in the lobby and would be removed, for security purposes, between each contact session. Five antennas built by Stimson and Lynn Hurd WB7UNU would be placed on the roof of the building and held down with bricks. RG-11 lead-ins would have to be brought in through an ajar front door and rolled up and stored on the roof between contact sessions.

At that time, we also planned to set up a satellite dish monitoring NASA video and audio off SATCOM 1R. The dish was to be on a trailer, in the KEX parking lot. (It was later set up elsewhere.) I would rewrite a final draft of the news release, write up a news conference notice, and mail all materials to all local television and daily newspaper outlets. I would also contact all these media by telephone to personally invite them and answer any of their questions.

On November 24, we set up all gear in the KEX lobby for a dry run and antenna tuning. All equipment and coaxes were numbered, to speed up future setups. Everything had a place and a number. The 5 antennas were set up on the flat roof. We communicated from the roof to the lobby via 2 meters, as we tuned up the antennas' active elements for lowest vswr. The best antenna tuned up to 1.2:1, while the worst was about 1.85:1. That antenna also had the longest RG-11 lead-in—some 94 feet. (Please refer to Randy Stimson's diary for a rundown of the equipment used.) In addition to what he mentioned, we wired a Sony TC-92 cassette recorder into the Yaesu FT-726R for taping all receptions.

We set up all equipment again for the 10 am news conference on November 25. In attendance was KATU-2 and KPTV-12. Randy and I had rehearsed and planned a formal statement followed by a question and answer session. All TV stations preferred to go "by the seat of their pants" with a more informal approach. Both KATU and KPTV did major stories on us on their evening newscasts. On the 27th, we re-assembled all equipment for another arranged news conference with KOIN TV-6. They ran an excellent story on us that evenng.

On November 30, we heard Owen Garriott, with readability of poor to fair and signal strength of fair. Heard him for a portion of 1834 PST, all of 1836, and part of 1838. KATU, KGW, KOIN, and KPTV, which constitutes *all local TV stations with news departments(!)*, were there to cover the event. All ran excellent stories that night. We were on live, in one case, and were the lead story in another case. (Note: TV stations usually do a *live* news story only for what they consider to be very major events.) *The Oregonian* (the only major daily in Portland), with statewide distribution, also covered the story, as did KLCC radio in Eugene (some 120 miles away). KXL and KYXI radio also had stories prior to the contact session, even though we had not mailed any materials to any other radio stations. KEX played back the tape of Garriott on the evening talk show, "Northwest at Night," and ran several news stories on the contact that evening and the next morning. The KEX switchboard received numerous phone calls on the subject, mostly for information. We pushed the 1-800-SCANNER number and gave them the downlink frequency. Jimmy Hollister and the other KEX DJs were talking about the reception of Garriott all day, December 1, and played the tape of the reception during their shows.

Stimson heard Garriott when at his home at 1822 PST, with good readability and good to very good signal strength. A tape of the reception was run on KEX that evening.

No response was ever heard to our call letters from Garriott except probably once. On December 2, Owen acknowledged W7 and "2 other designators" he was not sure of. Stan Griffiths (of our group) is W7NI. Garriott said he would check his tape later to try to identify the W7 call.

Michael Brown, 31, has been involved in broadcast radio for 9 years. He currently serves as Radio Engineer for KEX. Married with one stepchild, he's an avid backpacker, skier, Sierra Club member, and musician.

Call to shuttle goes unanswered

By TERRY CARR
Daily News reporter

From 5:15 p.m. until 5:32 p.m. Wednesday, Allen Bianco filled every odd-numbered minute with letters, numbers and pleadings.

"WSLFL, WSLFL, space shuttle Columbia, this is KL7FKO, KL7 Fox Kilo Oscar, Anchorage, Alaska, calling WSLFL, space shuttle Columbia. Come in WSLFL," he said over and over again into his ham radio handset.

Nine times he repeated the call, and nine times he got no response from the shuttle, which was somewhere 120 miles above Alaska and traveling at 10,500 mph.

"Here I've got the newspaper here and the guy doesn't want to say anything. Come on, Garriott, say something," Bianco said after one attempt.

He stared at the tiny, silent speaker that was supposed to pick up the response from Dr. Owen Garriott, an amateur radio buff and one of two mission specialists aboard the space shuttle.

Bianco, a 52-year-old retired Anchorage policeman, is one of 13 ham radio operators in the United States chosen by "73" magazine to attempt to talk to Columbia during its nine-day flight. It is the first space flight during which communication with amateur radio operators is planned.

Before the shuttle returns Tuesday, Bianco will have seven more chances or "windows" when Columbia will be positioned in the right place above Alaska to hear him calling. The windows will vary in length from 13 to 30 minutes.

The procedure calls for him to broadcast on odd-numbered minutes, and allow the even-numbered minutes for Garriott's response.

The shuttle's antennae must be pointed toward Earth and Garriott must be awake and off-duty before the link can be made.

"I don't know what happened," Bianco said after Wednesday's window closed without contact with Columbia. "I will be talking to NASA tomorrow. I want to know if he was asleep and if I'm wasting my time. But I'm not disappointed. I enjoy it very much. I'm not giving up."

United Press International reported

See Page B-2, HAM

KL7FKO

Allen Bianco KL7FKO
PO Box 10-385
Anchorage AK 99511

The following is a diary of my experiences while attempting to contact W5LFL aboard the space shuttle *Columbia*.

Orbit 56D. Started to call at 17:15 Yukon Standard Time. *Anchorage Daily News* photographer Paul Brown and reporter were present. Transmissions were made at 17:15/17/19/21/23/27/29/31. No contact.

Orbit 72D. Started to call at 17:10 YST. Channel 2 (KTUU) present with reporter Geri de Hoog and cameraman Barry. At 17:14+, heard the call of W5LF- without the L almost immediately following my call. This signal was not strong at all and was in the noise; however, I don't think that this was a reply. The receive frequency was 145.550 MHz. I logged this as a no contact—could be a ham somewhere far from Anchorage. Transmissions made at 17:11/13/15/17/19/21/23/25 YST. No contact.

On that same night, I heard comments from Australian hams complaining that the windows were wrong. A friend of mine heard the same comments on HF and reported that to me the next day.

December 2. There are no windows today. However, the receivers were constantly on and the recorder was ready. A ham reported to me that Kenai (60 miles from Anchorage) heard the word "Columbia." I think this was just interference or some other ham calling. Called Jack Burnett, Executive Editor of *73*.

Orbit 98A. Started to call at 7:30 YST. Transmissions were made at 7:31/33/35/37/39. I made a mistake and also transmitted at 7:42 (after the window). No contact.

Orbit 114A. Started to call at 7:15 YST. Transmissions were made at 7:15/17/19/21/23/25/27. Following the last transmission at 7:27, I heard and recorded on tape what appeared to be "KL7F- Anchorage, Alaska," and "AGG." The transmission was cutting off and was barely above the squelch. I got a little shook up and transmitted a few times even though the window was supposedly closed. I now have my doubts about the windows and the times. Next window is at 15:07. I then left the house and had a friend of mine listen to the tape but he could not make it out. While there I received a phone call from Jack Burnett at 13:55 YST advising me of a conference call at 17:00 YST.

Orbit 119D. Started to call at 15:07/09/11/13/15/17/19. No contact. Conference call started at 16:57 and ended at approximately 18:25.

Orbit 130A. Started to call at 7:11/13/15/17/19 YST and continued for 3 more transmissions even though window was closed. No contact.

Orbit 132D. Even though that part of Canada was not supposed to be on my schedule, I transmitted at 10:01/03/05/07/09 YST. No contact.

Orbit 134D. I experienced QRM on 145.550 MHz from a local ham and I told him to get off the frequency. Transmitted at 13:19/21/23/25/27/29/31/33/35/37/41/43/45/46/49/51/55 YST. No contact.

Orbit 135D. No-QRM transmissions made at 14:45/47/49/51/53/55/57/59. I stopped. No contact.

My transmitter was a Yaesu 221R with a 10-element beam at 63 feet. My receivers were an Icom IC-290A scanning 145.530/550/570 with a 5/8 whip at 41 feet, a Yaesu 207R scanning 145.530/550/570 with a rubber duckie, and a Tempo FMP 203 at 145.550 MHz with a 5/8 whip at 22 feet.

I transmitted and listened and transmitted and listened and I real-

Allen Bianco KL7FKO tunes his equipment to the shuttle frequency.

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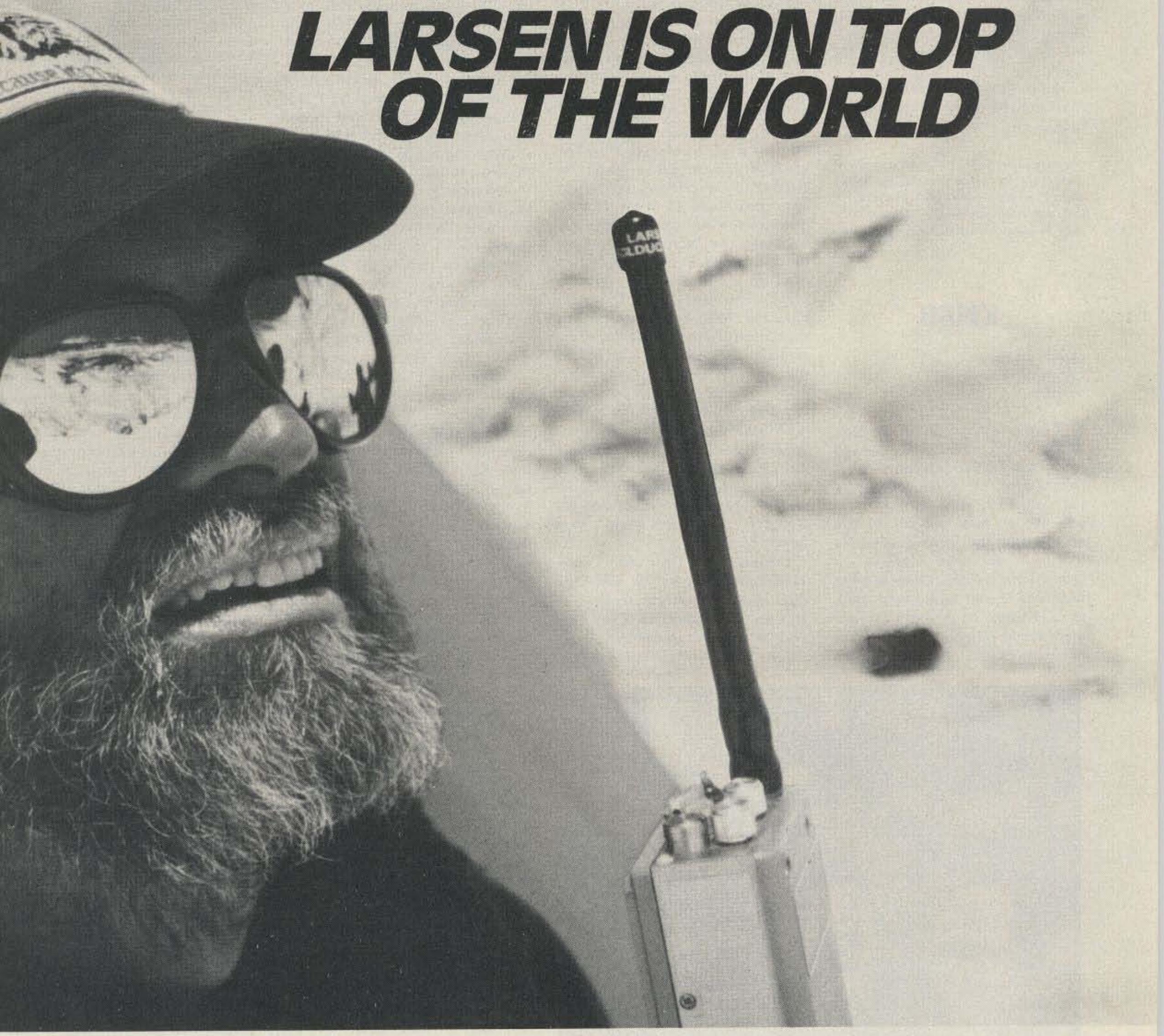

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ly don't know if he heard me or whether he acknowledged. But I did not give up. I was frustrated but I never gave up. Perhaps the next time the shuttle goes up, I will be able to tell everybody in town that I in fact did talk to it. The *Anchorage Daily News* came in and excitedly waited for Garriott to say something. KTUU (Channel 2) did the same. Radio Station KFQD was on the phone at the close of the windows. People I never knew called me and asked for the frequencies. I broadcast many a QST on two meters and read the windows. I borrowed another two-meter rig, an Icom IC-290A, so I could further monitor, and I didn't talk to Garriott. But that's OK. Perhaps he was asleep or busy or the shuttle ham antenna was facing the stars when it was passing over or near Alaska. But I will not give up. I will try again.

This is Allen Bianco KL7FKO, the Alaskan who enjoys life and his hobby.

Originally an Israeli, KL7FKO is a 52-year-old retired Anchorage policeman and the former owner of a color processing lab. In addition to ham radio, Allen and his wife, Debbie KL7GJS, enjoy traveling. Son Michael is studying for his ticket.

KH6B

Dean Manley KH6B
1262 Komohana Street
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Here is my account of the STS-9/W5LFL mission, as viewed from Hawaii. On November 27, I participated in a teleconference call with Jack Burnett of *73*. This was like an hour pep-talk to live and breathe the STS-9 mission for the next few days. However, it seemed that there was little hope to hear W5LFL, let alone work him, from Hawaii. There were no scheduled active orbital passes over or near Hawaii.

In order to get a better overview of the orbital ground tracks of *Columbia*, a sine-wave curve was drawn on one of the plastic overlays of "The DX Edge." With this device and the given active passes, it became clear that some of the daily passes would come close to Hawaii even though W5LFL would be busy at work or would be fast asleep. The following is the log of the attempts.

November 28: *Columbia* STS-9/W5LFL lift-off as scheduled at 6:00 am Hawaii time. Listened to W5RRR, Johnson Space Center, and obtained info on W5LFL operation.

November 29: Listened to media coverage to determine if W5LFL operations would begin. Some confusion on the part of some radio stations when converting UTC to local times on the mainland. And further confusion when converting times to local time in Hawaii!

November 30: Orbit 35, 8:43 am—tried listening and transmitting with a hand-held (Ten-Tec 2591). Results: negative. Orbit 36, 10:05–10:14 am, Hawaii time, again same procedure as above from a downtown Hilo parking lot. Results: negative. Numerous attempts to call Westlink to get recorded message of latest info drew a blank—line was always busy. Dialed the ARRL number and got their recorded info which was essentially the same as info before the mission started. Orbit 42, 7:35–7:46 pm, close to Hawaii, but negative results using fixed station IC-290H/Isopole antenna.

December 1: Orbit 52, 9:56–10:04 am, and orbit 59, 8:58–9:06 pm. Both negative results. Started construction of a turnstile antenna for 2 meters. Used parts from 2 yagi beams for 2 meters.

December 2: Orbit 69, 11:14–11:20 am, and orbit 75, 8:43–8:52 pm. Both negative results in Hawaii. Used both the hand-held plus fixed-station equipment.

December 3: An attempt to get additional orbital information from W5RRR failed due to poor band conditions and QRM. Westlink number was again busy. Telephoned the ARRL and got the recording of orbital passes. Was pleased to see additional passes added to the list of pre-mission info. Also learned that NASA had extended the mission one extra day. It started to look somewhat better!

Finished building turnstile antenna with tuned reflectors. Swr of 1.06 to 1 with the antenna mounted on the back-porch railing using a clamp and a bracket method of mounting.

December 4: Orbit 99, 6:23–6:32 am using IC-290H/turnstile and reflectors. Negative results. Participated in teleconference call number 2, 4:00–5:30 pm. Much valuable info was shared among all participants. Also the fact that W5LFL should be on the air much of Wednesday and Thursday. I was hoping that this meant that Hawaii would somehow be included in the activity! Orbit 106, 6:50–7:02 pm. Negative results.

December 5: Orbit 120, 3:41–3:52 pm, negative results but now keeping better records—separate log sheets for each orbital pass plus a note as to starting the magnetic recorders. Yes, I wasn't about to miss any possible activity with just one recorder! Orbit 121, 5:09–5:20 pm. Negative results. Orbit 122, 6:38–6:50 pm. Results negative.

December 6: Orbit 137, 7:28–7:36 am. Negative results. Orbit 132, 9:00–9:12 am. I didn't take part in this one. This was an active orbit scheduled for Canada. Learned via Juan KH6JJC that KH6ENC club station manned by KH6F was thought to have completed a 2-way with W5LFL. This was not confirmed as reception of *Columbia* was very marginal at best as it was practically on or beyond the horizon. Orbit 137, 4:58–5:08 pm. Negative results. Orbit 138, 6:27–6:38 pm. Also negative results. On these two attempts, used 7290 kHz as sort of an intercom (outer-com?) with Juan KH6JJC on Kauai and Larry AH6EQ on Oahu to compare and exchange notes.

December 7: Orbit 147, 7:19–7:28 am. Negative results. Orbit 148, 8:47–8:55 am. I did not monitor the orbit as it was during working hours for me. Also learned ahead of time that this pass would not be a good one for us. This info via KH6JJC and apparently coming from the NASA Tracking Station at Kokee, Kauai, Hawaii. This was the pass over Hawaii that W5LFL was heard calling KH6HA several times. According to the stations reporting the incident, it sounded like a scheduled event. This could have been confirmation of perhaps yet another 2-way in the Hawaiian Islands! Orbit 153, 4:43–4:52 pm. Negative results on perhaps the last of the good orbital passes over the islands. Orbit 154, 6:17–6:24 pm. Last chance even though the pass was very low to the horizon. I used the Isopole antenna instead of the turnstile to get the signal down towards the horizon. Again, negative results. Compared results and notes with KH6CC, KH6S, and KH6JJC on 7290 kHz. It was noted on several occasions that there was visual contact with the *Columbia* with a corresponding negative radio QSO! The experience was great, and with such experience, perhaps the next attempt will be fruitful! Aloha from the 50th state, Hawaii!

Dean Manley KH6B

Dean Manley is a 51-year-old Extra-class licensee who resides in Hilo, Hawaii, with his wife and two daughters. He is a machinist-technician, International Typographical Union, with the Hawaii Tribune-Herald, *and also is self-employed as a consultant in broadcast radio, FCC applications, etc. Dean has owned radio stations in Michigan, New Mexico, and Hawaii, and also is a published writer (his "Putting the HW-12 on 160" appeared in 73 many years ago).*

KH6HHM

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The shuttle flight is over but not forgotten. We were unsuccessful in making contact with Owen Garriott as he passed McKinley High School and the island of Oahu in the Pacific, but the excitement and anticipation of the possible QSO with W5LFL was felt by all the members of McKinley High School's Amateur Radio Club (KH6NF) and by other students on campus. For the students handling the equipment and those responsible for tracking the shuttle using the Apple computer, this was especially true. Everyone felt confident that they were doing their jobs correctly as several dry runs had been performed and it looked A-OK. As the shuttle passed by the islands time after time, it was a letdown for the students not to be successful in making contact after all of their hard work and dreams.

Back in September, at the start of the school year, when the club members heard about the shuttle and the possibility of having a QSO with W5LFL, everyone wanted to give it a try. It would be a new experience for everyone, as no one thought he would ever have a chance to talk to an astronaut.

Everyone started gathering as much information about the shuttle flight as they could find and also information about the antenna system needed to reach the shuttle. We had an Apple computer to use, so part of our research was to find a way of using it for tracking the shuttle and perhaps even controlling our antenna as the shuttle passed overhead.

Gathering the materials for the antenna system wasn't hard once

the decision was made that we would try our luck using a quad. In fact, just for luck, we would build a 2-element quad and if we needed a little more gain, a 4-element quad would be built and placed side by side. Afterwards, we could always put them to use, and building the antennas, tuning, and comparing their performance would be a learning experience for everyone.

We decided to use our old 32-foot Tri-Ex crank-up tower that a few years ago became a 16-footer during a windstorm. It was still in good shape after it made a trip to the metal shop to get a few spots welded and a new base plate made. For antenna control, we had available two light-duty rotors, one for bearing and the other mounted horizontally for vertical control.

Material for the quads would be PVC pipe and wooden dowels for spacers, with copper wire for the elements. Building the antennas went smoothly as we used plans and measurements from the *ARRL Antenna Book*. We had some problems getting the swr down to 1 to 1, and we had to unsolder the elements, replace them, and tune them one by one to keep the swr low.

Once that problem was solved, we looked at the best method of mounting them to our boom. This gave us our biggest headache because our antennas were of different size and weight. We also weren't sure if our rotor could handle the weight for our vertical control. This turned out to be our problem. Because the two antennas were of different size and weight, there existed an unbalance and our small light-weight rotor couldn't handle the difference in weight. We had control for only a few degrees and couldn't get the antenna to point directly overhead.

So it was back to the drawing board for a new design and equal distribution of weight on the rotor. After a few hours of experimenting, we solved the weight problem by making both antennas the same weight and mounting them as if they were both 4-element quads. We made the 2-element quad heavier by extending the PVC pipe behind the reflector and balancing it with an iron rod from the metal shop. Once the antennas were balanced, our problems were solved and they worked perfectly.

While the antenna problems were being solved, another group of students was in the process of getting the Apple computer to track the shuttle. This was completed at about the same time the antenna was completed and everyone felt they were ready, willing, and able for their first QSO with outer space. Our idea of using the Apple for control of the antenna had to be postponed for a later project due to time and availability of components, but it's just a matter of time and money.

It is hoped that the next flight of the shuttle will have a beacon so that at least the students will be able to hear it and know that they are doing something right. It is also hoped that Hawaii will be on the schedule of future flights where it will be possible to have a QSO with the shuttle. It's not too encouraging to know that perhaps a contact will be possible if there's any extra operating time.

The students were disappointed that no contact was made with the shuttle, but all felt the effort was worthwhile and all are looking towards the next opportunity for the Radio Club at McKinley High School (KH6NF) to have a QSO with a being in outer space.

Allan Chun WH6AVH and Dean Takamatsu make final adjustments on the shuttle/satellite antenna system located on the roof of the electronics and club station.

Chun Kit (Vincent) Lui putting the finishing touches on the tracking program using an Apple II+ computer.

SOME FINAL THOUGHTS . . .

Each of the foregoing diaries is a story in itself. On behalf of the staff and management of *73*, I wish to express to each writer our appreciation for taking on the added burden of documenting his own personal story as it unfolded. It's rare that people like this are brought together in such a way; each is well worthy of special praise.

While in the area of giving thanks, there are a number of others who must be mentioned. First, Owen Garriott W5LFL himself, the man who had the dream, worked at making it a reality, and then lived it with and for us.

Then, our good friend, NBC News Correspondent Roy Neal K6DUE. Someday the whole story of Roy's involvement will be told, but for now, it's safe to say that were it not for K6DUE, the STS-9 ham-in-space operation might never have gotten off the ground. Roy did far more than document the flight in "Amateur Radio's Newest Frontier" and file reports for NBC. For over a decade he lived Owen's dream with him and helped W5LFL become the world's first astro-ham.

To Peter O'Dell KB1N of the ARRL, there is no way to express our gratitude. Most of you are not aware that Peter regularly held teleconference meetings with every publisher in the amateur-radio field interested in reporting STS-9 ham-in-space events. Peter insisted that everyone have the same information as the ARRL was given—and have it quickly. For the past few months, KB1N *was* STS-9 at ARRL headquarters. He literally lived on a telephone 10 to 15 hours a day, flew to meetings in Houston, and spent the flight at Mission Control away from his family. Peter O'Dell is a dedicated and warm human being who deserves our collective thanks for keeping the needed information flow going at all times and keeping it as accurate and up-to-date as possible.

A word here also about NASA's Administrator, General James Abrahamson. He's not a ham . . . not yet, anyway. But General Abrahamson did recognize the value of experimenting with amateur radio from the shuttle and was the man who signed the papers welcoming amateur radio on the orbiter.

Finally, League President Victor C. Clark W4KFC. In our book, Vic was one of the best things ever to happen to the ARRL. He brought new meaning to that organization and was the person responsible for bringing the League into Owen's corner when he most needed its assistance. Vic's eyes would literally light up with pride every time he talked about STS-9, Owen Garriott W5LFL, and the ham-in-space operation. Sadly, Vic suffered a massive heart attack and died less than 2 days before STS-9 blasted into orbit from launch pad 39 at the Kennedy Space Center. He never lived to see or hear the dream of Owen Garriott—the dream he shared with Owen and countless others—become reality. Victor C. Clark W4KFC lived for and loved amateur radio. He lived and worked to better it worldwide. Vic was the "ham's ham," and it is to his loving memory that we have all dedicated this special report.—WA6ITF.■

John A. Robertsen KAØOSC
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Minnetonka MN 55343

Switch Tricks

Ever had trouble setting up switching? No more. The Minnetonka Master makes it easy.

Here are two no-nonsense approaches to switch-circuit design that anyone can use to advantage. With these methods, you will be able to draw a practical switch-circuit diagram for almost any switch-based idea you can dream up. The first is called the "Floating Circuits" method because parts of the circuit are disconnected and are floating free when they are not in use. The second is called the "Common Bus" method because in the early stages of the design process a bus (a set of connection strips or tie-points) is used.

Let's take a practical example of a switching-circuit design problem and solve it by both methods. I recently purchased a nice set of high-impedance headphones without cord or plug from a manufacturer's surplus store. To decide on what sort of plug and cord should be wired in, I looked over the various pieces of equipment where my new bargain could be put to use. It was obvious from the variety that I really needed several configurations of cord and plug, not just one.

It occurred to me then that it would be handy to be able to change the wiring of the phone cord from a stereo to a monophonic configuration without having to rewire or use an adapter. Moreover, it would be even handier to be able to transpose left and right when in the stereo mode and to change from parallel to series when in the monophonic mode. If one could just *switch* between these four functions, it would permit the use of the same pair of phones in several different applications. If all this complex switching could be done with just one switch, I'd have a foxy piece of equipment. How many times have you found yourself in this situation, but were stymied by your inability to convert your wiring concept into an electronic circuit?

This is a typical switching problem and one that lends itself well to solution by the Floating Circuits and the Common Bus approaches. With a little patience and practice, you can be designing fairly complex switching circuits simply by following a few easy steps.

1) Find a quiet spot where you can think with no interruptions. Arm yourself with a few pencils, a pad of paper, and an eraser. (There are old-timers who claim that after the brain, the eraser is the circuit designer's most important tool.)

2) So that you can have a convenient overview for reference and comparison, sketch, on a single page of paper, the circuits of each of the functions to be included in the new device. In our headphone example, there are (A) Stereo Normal, (B) Stereo Reversed, (C) Mono Parallel, and (D) Mono Series. Draw these circuits as if they were hard-wired for a single function, as in Fig. 1. Our goal will be to interconnect these four circuits with a single multi-pole, multi-throw switch.

3) Take a fresh page and, using the whole page to provide plenty of working room, sketch in the components to be worked with. In this case, the components are: the right earphone, the left earphone, the three-wire phone cord, and the phone plug. Since the switching obviously is to occur between the ends of the three-wire cord as the input terminals and the four connections to the two earphones as the output terminals, a fair amount of blank space should be left between input and output for circuit development. (See Fig. 2.)

4) Now two simple rules for adding the switching can be applied:

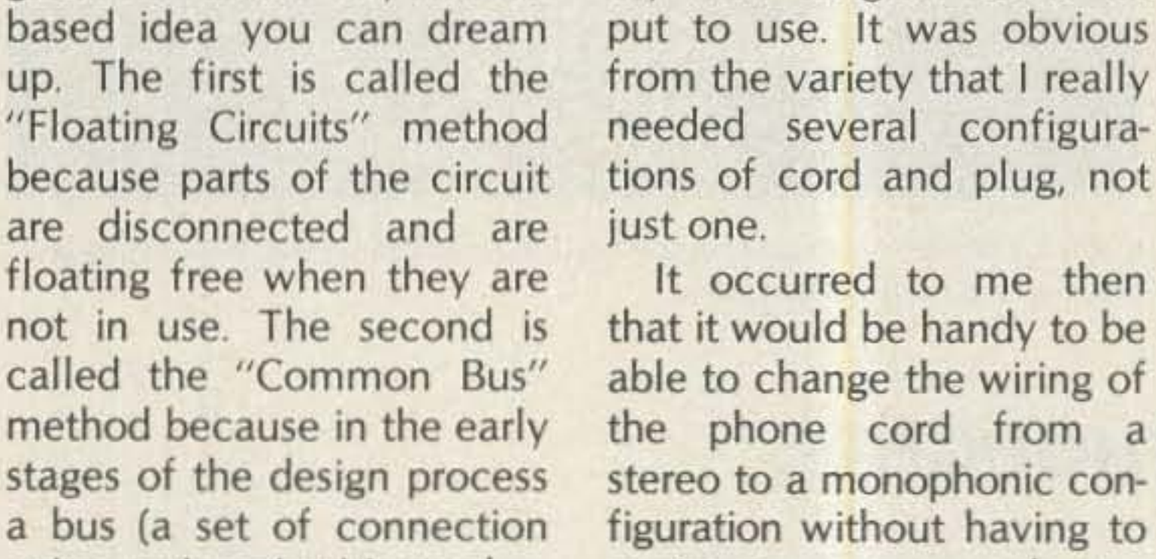

Fig. 1. Sketches of all circuits desired.

(a) Always connect each input terminal and each output terminal to the movable arm (called the wiper, blade, or pole) of a switch symbol, and give each a number for convenience of location. (The example has seven such terminals, numbered from 1 through 7.)

(b) For each switch arm, sketch in as many contacts (throws) as there are functions desired, and identify each with the letter corresponding to the function circuits you drew in your Fig. 1. Keep the same sequence from left to right in each switch set. (The example has four functions, so each switch assembly will have contacts A, B, C, and D.)

When you have gotten this far, your sketch will resemble Fig. 3 and you are ready to start drawing in the function circuits of Fig. 1. To familiarize you with the techniques, these circuits will be "wired" to the proper switch contacts first by the Floating Circuits method and then by the Common Bus method since often it is possible to gain additional advantages by evaluating both approaches.

5) In the Floating Circuit method, a single circuit and a single set of contacts are dealt with at a time until all four circuits have been connected. Begin with the circuit for function A and each switch assembly's contact A. Start with the input connections. Sketch in circuit A, connecting the input contacts 5A, 6A, and 7A to the appropriate inputs of the circuit, and then sketch in the output connections to 1A, 2A, 3A, and 4A. When this is done and checked, sketch in circuit B, making the proper connections to all seven contact Bs. Do the same for circuits C and D. With all four circuits drawn in, it will resemble Fig. 4.

Note that when all seven switch arms are swung to contact A simultaneously, circuit A alone connects input to output. When all seven switch arms are swung to contact B simultaneously, circuit B alone connects input to output, and so forth. Switches whose arms are connected mechanically so that they all may be swung simultaneously to a specific set of contacts are said to be "ganged." This is usually represented in a diagram by a dotted line. In the switching diagram you have just designed, every circuit except the one in use floats completely free of electrical connection to the working circuit. In certain rf applications (such as bandswitch

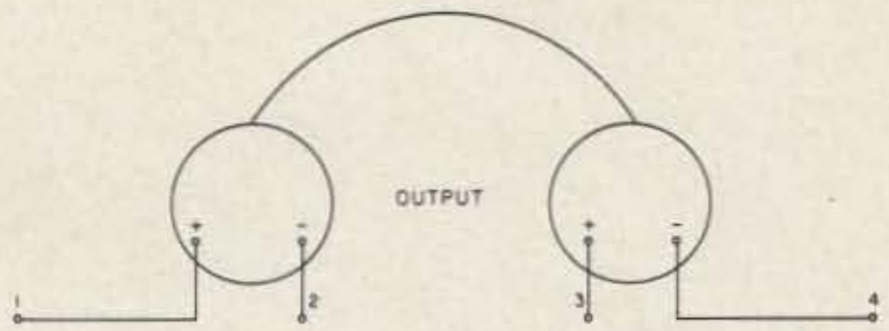

Fig. 2. Sketch of components needed for circuits.

circuits), this can be a desirable characteristic.

6) The Common Bus method will now be applied to solve the same problem in hopes of obtaining some simplification advantages. Taking a fresh page of paper, redraw Fig. 3 leaving plenty of room for circuit development. Sketch in a horizontal bus whose number of parallel elements is equal to the largest number of terminals in either the input or output. The example has a three-terminal input and a four-terminal output, so the bus will have 4 parallel elements. These are represented schematically as four parallel lines. Your sketch should look like Fig. 5.

7) Sketch function A's circuit between the contact As of all seven switch assemblies. (Such circuits are made easy to sketch by thinking of the bus elements as a convenient set of tie points.) Starting at the end of the circuit with the least terminals, in this example the input, connect each input switch contact A (5A, 6A, 7A) to a separate element of the bus. To complete the circuit, it is necessary only to connect the output contact As each to the proper bus. Check the work against A in Fig. 1 to ensure correctness.

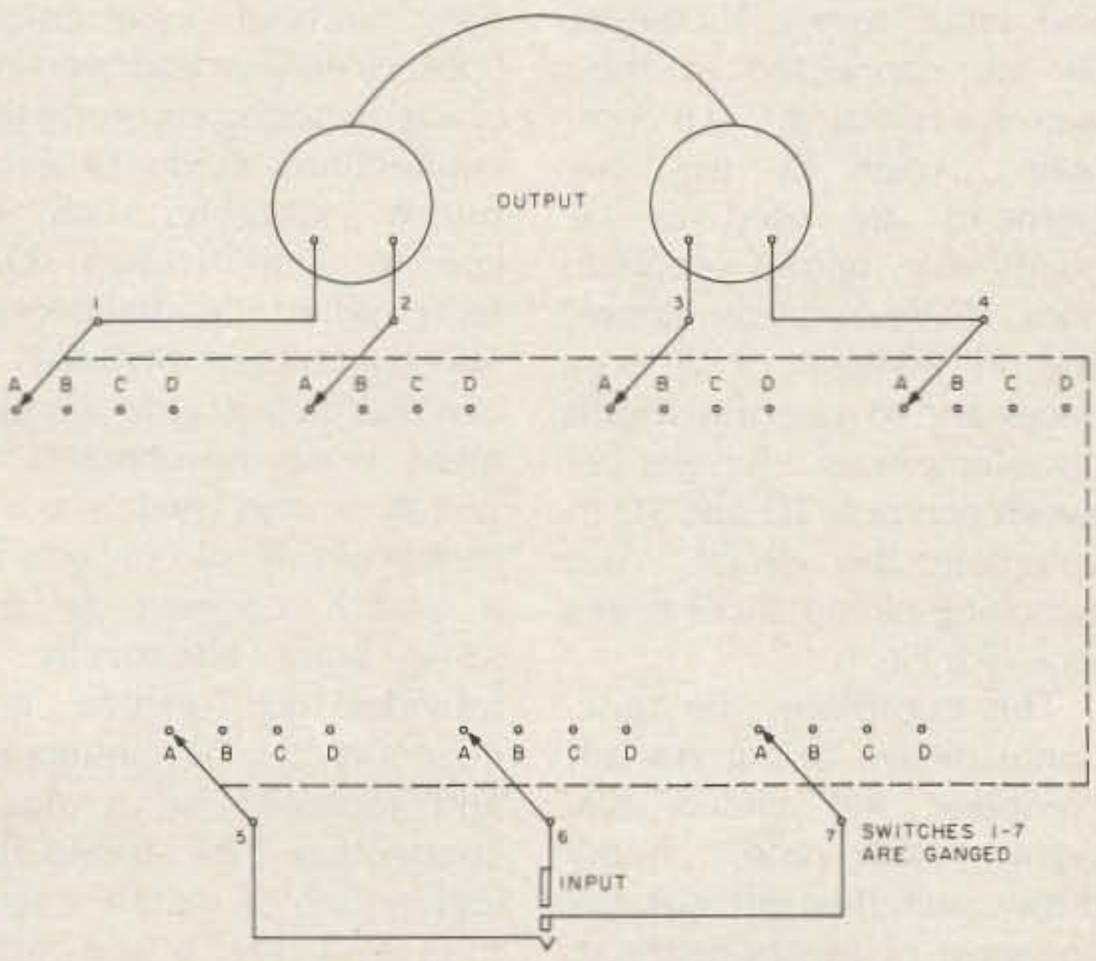

Fig. 3. Function contacts (throws) added to each of the seven terminals.

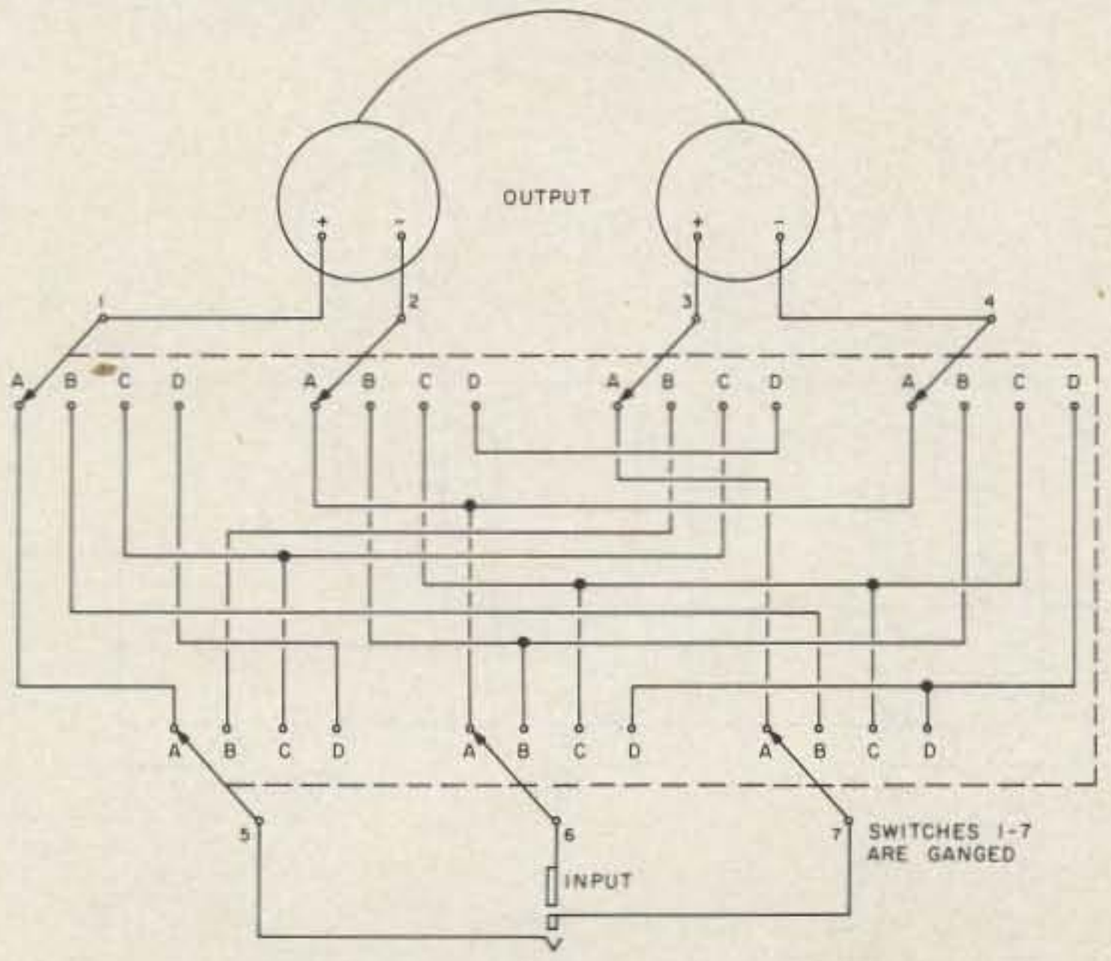

Fig. 4. All four circuits of Fig. 1 drawn in (Floating Circuits method).

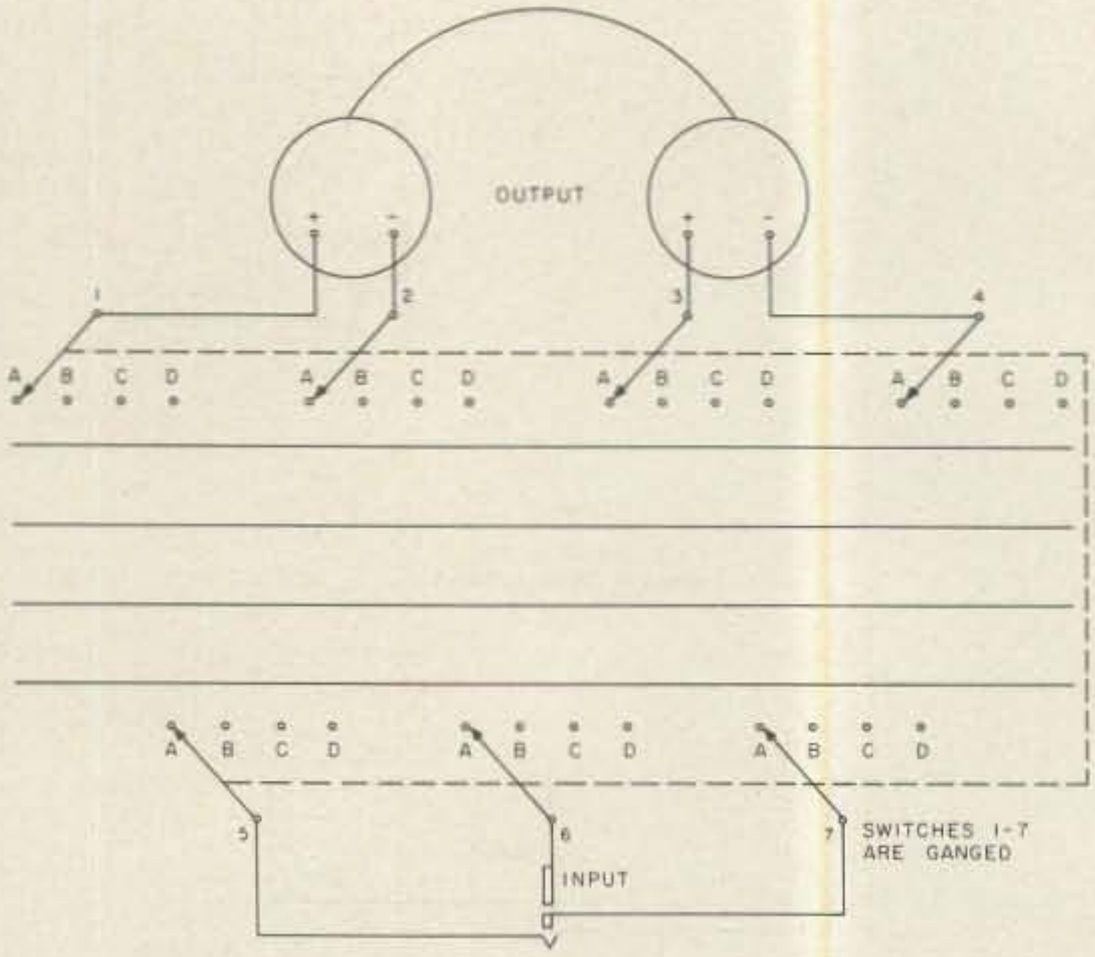

Fig. 5. Bus bars added to Fig. 3 sketch.

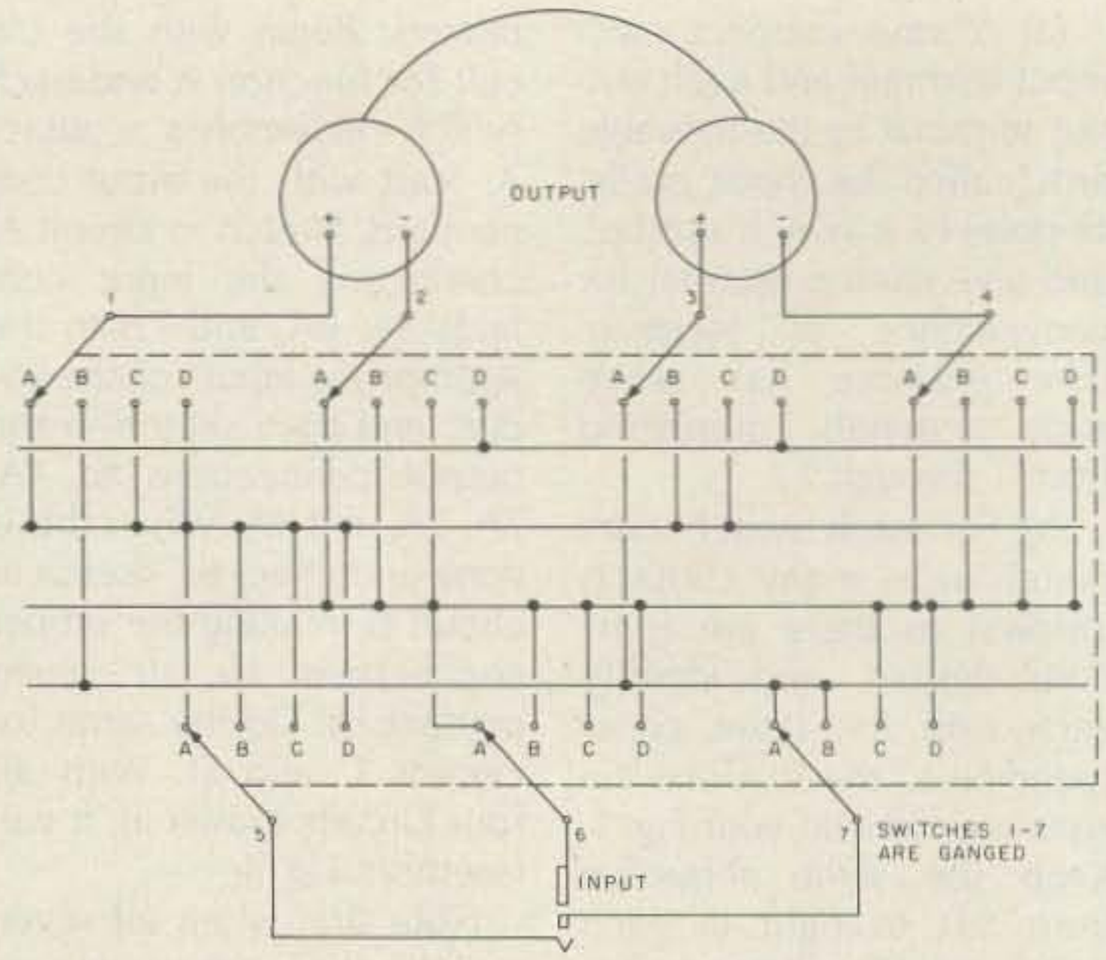

Fig. 6. All four circuits of Fig. 1 are drawn in (Common Bus method).

8) Now take your eraser and erase all seven switch arms that connect to contact A. Redraw them, this time connecting them with contact B. This may seem childish, and you may believe you'll remember that you're working with Bs instead of As, but as switching complexity builds, use every design aid that helps to keep you from getting mixed up.

9) Circuit B now can be sketched between the contact Bs of all seven switches. Looking at the input first, we see that all three input Bs can be connected to the bus elements as before. To complete circuit B, it again is necessary only to connect the output terminal contact Bs to the proper bus, using B in Fig. 1 as a guide. Both stereo functions are now designed in. Check your work carefully.

10) After erasing the switch arms on all seven switches and redrawing them all in the C position, circuit C can be sketched between the contact Cs. As usual, we start at the input end and connect the contact Cs to the bus. This time, however, it can be seen from the circuit diagram that while input terminals 5 and 6 connect to the bus as before, terminal 7 must connect with terminal 6. This is easily done using the proper bus element as the tie point. Whenever possible, all circuit connections are made via the bus elements. To complete circuit C, one now simply connects the output terminal contact Cs to the proper bus elements, according to C in Fig. 1. Checking this new addition requires care since one must be certain that no unwanted pathways are possible through parts of the circuit that are not in use.

11) Putting the eraser to good use once more, the switch arms are all transferred to contact D. Circuit D can be added now, checking it carefully against D in Fig. 1. The input terminal contact Ds are connected as they were for function C. To complete circuit D, the bus elements are used as tie points for output connections 1D and 4D as before, and in addition, it is now necessary to use the fourth bus element as a jumper between contacts 2D and 3D to complete the circuit. Your switching circuit should now look like Fig. 6.

This completes the functional design but it doesn't complete the circuit diagram. Multi-pole, multi-throw switches are not the cheapest of components, so one wants to keep them to as few sections as possible. Moreover, the more poles they have, the bigger they must be. Additionally, a good circuit becomes a better circuit if it can be simplified: There are fewer connections to be made and therefore fewer chances for mistakes; there are fewer components to fail, and there is less of a headache to treat when servicing. For these reasons, we must include two more steps in the design of our prototype switching circuit to provide analysis and simplification.

12) It's at this point that you will appreciate having chosen an area for work where you can be free to think without interruption. Look closely at your version of Fig. 6, noting carefully the connections made to each switch assembly, with an eye to simplification. Observe what has happened: The contacts of switch 4 all connect to the same bus element as do the contacts of switch 5 and switch 6 respectively. If all contacts of a switch connect to the same point electrically, it provides no function and generally can be eliminated and replaced by a single connection. This allows the elimination of switch assemblies 4, 5, and 6 and more than two dozen connections. You'll appreciate this

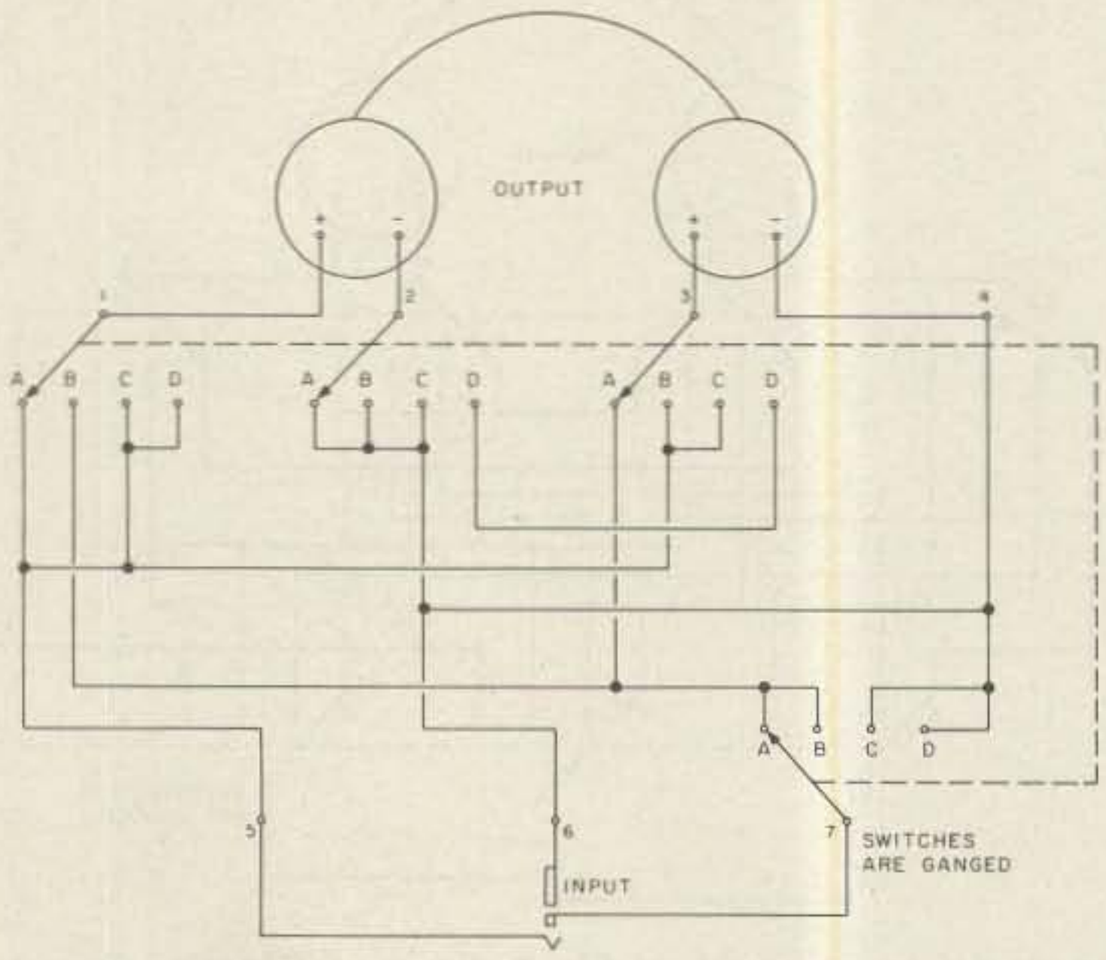

Fig. 7. The simplified system.

when the time comes for purchasing the switch and wiring it in.

13) The last step is a refinement of the previous one. Wherever the "artwork" in your circuit diagram can be simplified or clarified without sacrifice of function, do so. Replace redundant pathways with a single one; remove nonfunctional blind ends from the bus elements (the bus may disappear entirely in some designs); use short interconnections instead of long ones; minimize the number of crossovers wherever you can. When you are done, your prototype circuit will look like Fig. 7 and any of the four functions can be selected with a single 4-pole, 4-throw switch. In my prototype headphone set there was room to mount a midget 4-pole, 4-throw rotary switch in one of the phones, giving a good professional appearance.

A few words of advice: While the methods outlined above are good tools for helping the beginner solve complex switching problems, they are not the only ones and they do not substitute for good old-fashioned common sense. There may be times when the problem is solved best by a combination of methods or by one of the many other ones available. Many complex commercial design problems in switching are now solved by computer, for example. But by whatever means you derive a switching circuit, it must be checked and rechecked to ensure freedom from unwanted pathways lurking in the wiring, quite unsuspected.

When used with reasonable diligence, the methods described here provide the beginner with an excellent starting point and often the complete solution for most switching design problems. ■

↩See List of Advertisers on page 114

LEDs You've Never Seen

What are these little lights? What do they do?
This is the book.

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The light-emitting diode (LED) is indeed an amazing solid-state light. Its development, application in the electronics and electrical world, and acceptance by the consumer, housewife, student, and everyday person are as amazing as those of the transistor. In fact, the LED is a very close kin of the transistor—they both are solid-state devices, have junctions of P and N material, use very little power, and generally operate for a lifetime. In this article, we will detail the history, theory of operation, types, and functions of the LED, describe some applications, and take a look into the future of the LED.

History

As with many inventions and innovations in science and technology, the origin of the LED goes back many years. It was in 1907 that Henry J. Round, an electrical engineer, touched two wires connected to a battery to a piece of crystal of silicon carbide that had been found near Niagara Falls, New York. Using a potential of 10 volts dc, he connected the two wires across the two points on the crystal and found that the crystal gave out a yellowish light. Again, as with many great discoveries, he could not possibly have known of the terrific impact his "flashes of yellow light" would have on our daily lives some 60 years later. For additional details on the LED, consult the book *Light-Emitting Diodes* by Forrest M. Mims III (Howard W. Sams and Co., Indianapolis, Indiana).

It is interesting to note that the first light emitted by an LED was yellow, as this color was to be one of those produced later in commercial quantities, red being the only color developed cheaply enough at first to be used in great quantities. Red LEDs were followed by green LEDs and then the orange or orange-red color came along. Blue LEDs are still expensive and are not readily available to the popular experimenter.

The LED is a source of cold light, much like the fluorescent lamp which is gaining so much popularity as a means of conserving energy, as it generates little heat and is much more efficient than an incandescent lamp. If Mr. Round had kept his yellow flashes of light burning continuously all this time, there would still be about 30 years to go before he would notice his light decreasing slightly in intensity. Because the lifetime of an LED is so long—100 years—its lifetime is measured by its intensity or light output. When it is half as bright as it was, about 100 years will have gone by. Assuming linearity, when it is one-fourth as bright, 200 years will have gone by! The LED is indeed a Star Trek timing device for traveling to far galaxies. When it is completely out, 1000 years will have gone by! Contrast that to the 75-Watt incandescent light bulb which lasts an average of 750 hours (4½ weeks continuously) before it goes "poof" in a flash of no light.

Theory of Operation

Let's take a close look at the LED to see how it produces light. In Fig. 1, we see a PN junction which is the building block for all solid-state devices such as LEDs, diodes, transistors, and other current-controlled devices. Following electron theory that like charges repel and unlike charges attract, the anode of the PN junction of the diode will attract electrons, while the

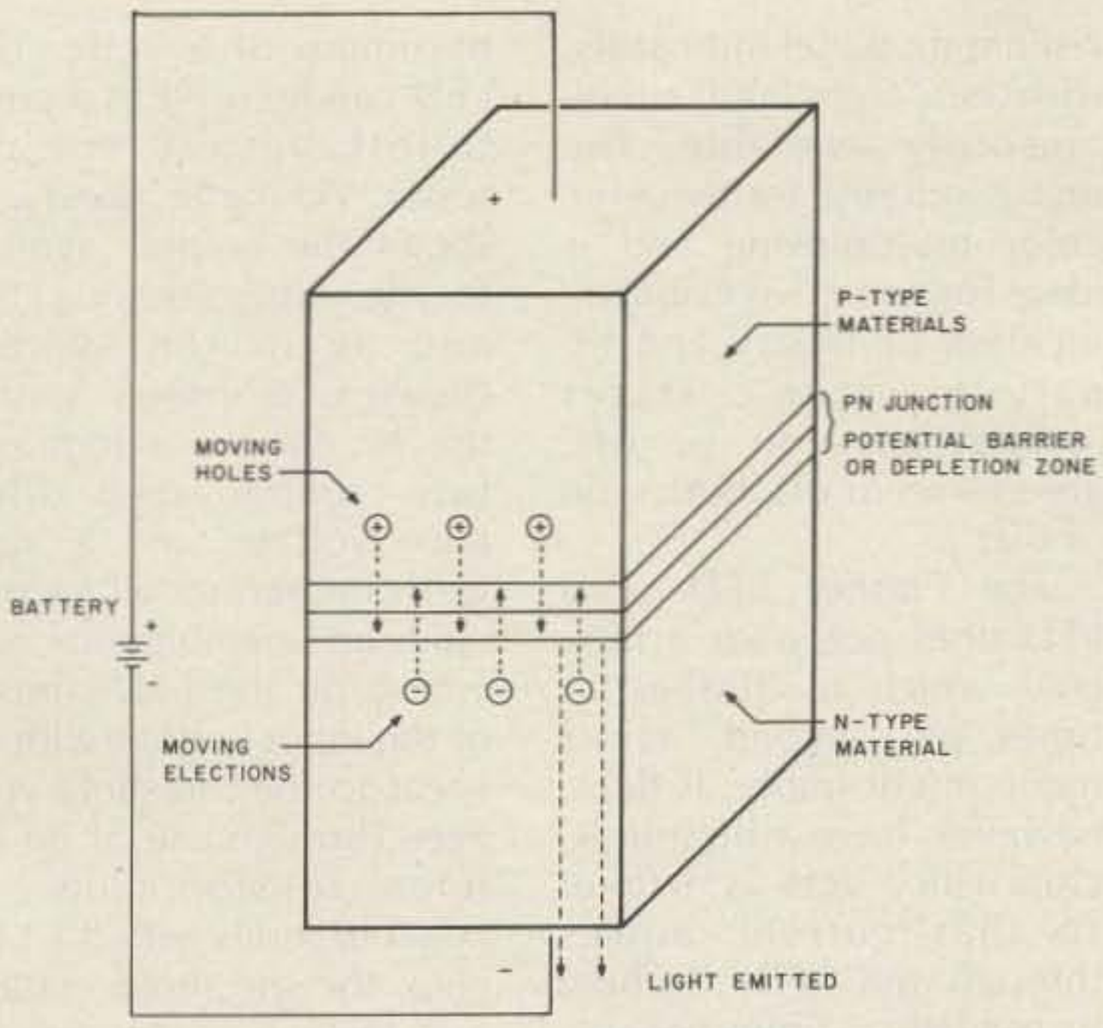


Fig. 1. Forward-biased PN junction emits light when excited electrons return to rest state.

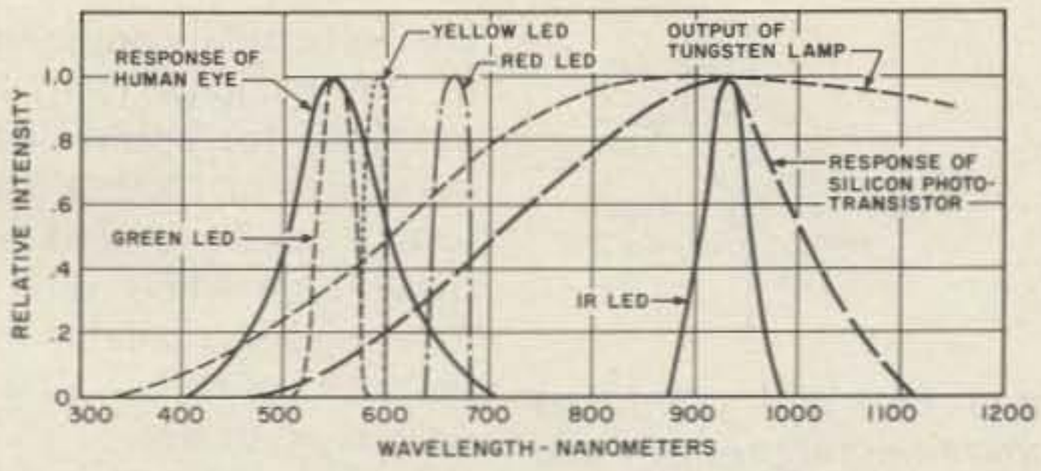


Fig. 2. Wavelength plotted against radiant energy output from green, yellow, red, and infrared LEDs.

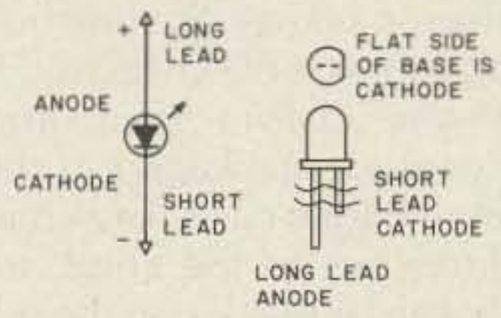


Fig. 3. Basic single-color LED.

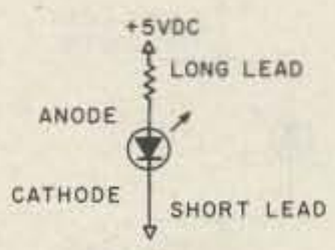


Fig. 4. LED with current-limiting resistor in same case.

cathode (negative) of the diode will attract positive "holes" (an atom missing an electron). This movement of electrons and holes constitutes a current flow and will continue as long as the voltage polarity is as shown in Fig. 1. The diode is forward-biased (anode positive) at this time and causes current (electron) flow. When the polarity is reversed (anode negative), the diode is said to be back-biased and almost no current flows. The electrons move across the PN junction to fill holes and the holes move across the junction to occupy spaces (holes) vacated by the electrons.

Light is generated when an excited electron returns to its normal state of equilibrium by combining with a hole in the valence band, its state of rest in the atomic structure. The PN junction diode is the device for raising a number of electrons into the excited state so that they can fall back into a state of equilibrium and produce light while doing it. The N side of an LED junction absorbs much less light than the P side, so the N side is usually employed as the main light-emitting region of the LED. They are usually made so the light generated at the PN junction has to travel just a short distance before being emitted into space where we see it as light. When you hold a lighted LED up close to the eye, you can see the cat's-whisker-type wire terminal connection going over to the PN junction from whence cometh the light.

Wavelength of Operation

The wavelength of operation for each of the colored LEDs is shown in Fig. 2. Note that the green LED is at a wavelength of 555 nanometers (10^{-9} meters), the maximum sensitivity of the human eye, while the red LED is at 660 nanometers where the eye "sees" only 5% to 10% of the total radiant energy from the red LED. And, of course, the infrared LED energy output is at the long wavelength of 900 nanometers which we can't see at all.

Types and Functions of LEDs

The pocket calculator and quartz crystal wristwatch really introduced LEDs to the general public. These were in the form of seven-segment numerals used for the display where each segment of the numeral was made up of one or more LED strips or a matrix of dots. There is little doubt that the pocket calculator was made possible by the development of the LED display, as all other types of displays were too large or required large amounts of electrical power. The liquid crystal display (LCD) which has become popular in wristwatches and pocket calculators was not perfected until a number of years had gone by. The original LCDs were affected by operating temperature and bright sunlight so that they had to be replaced by a jeweler every several years. In the section below, we will discuss the types of LEDs which have been developed to date and which have specific functions. We will then take a closer look at how these types may be applied to specific and general applications.

LED. The basic LED is a single-color, on-off device. Fig. 3 shows the symbol for the basic LED which can be obtained in colors of orange, green, yellow, and red. They are always used in conjunction with a current-limiting resistor. This simple LED is used as an on-off indicator, as a segment or dot matrix for numeral displays, the transmitter for optical couplers, and the like. The voltage drop across the LED itself is 1.6 V dc for red and a nominal 2 volts for green.

LED with Current-Limiting Resistor. An LED must always be operated with a current-limiting resistor in series. Fig. 4 shows a symbol for an LED with a series resistor packaged within the epoxy case. These units are designed for operation at 5 V dc TTL logic level and are available for other operating voltages.

LED with Resistor and Diode. When an LED is operated off an ac voltage, it must be provided with reverse-voltage protection as the reverse-voltage breakdown is a nominal 3 to 10 volts. This protection must be in the form of a diode or another LED in reverse polarity parallel with the LED. The average signal diode can withstand 50 to 100 volts peak inverse voltage (piv), but the average LED is limited to a nominal 3 V dc piv. Fig. 5 shows an LED complete with series dropping resistor and a reverse-protection diode, all in one package. Even though there

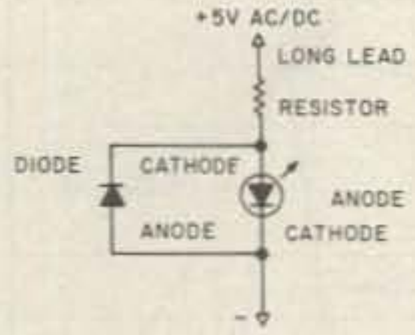


Fig. 5. LED with combined current-limiting resistor and reverse-protection diode in one package.

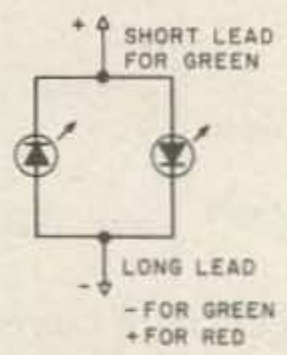


Fig. 6. Tri-color LED is achieved through reverse-parallel connection of 2-color LED chips.

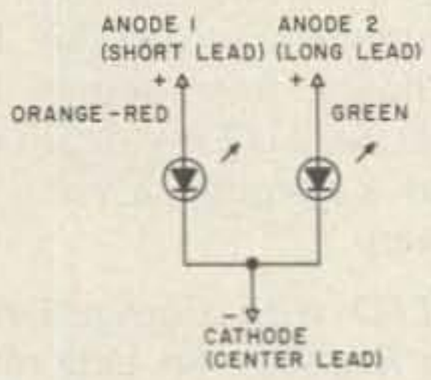


Fig. 7. The dual-color LED has 3 pins and is mounted in a single epoxy package.

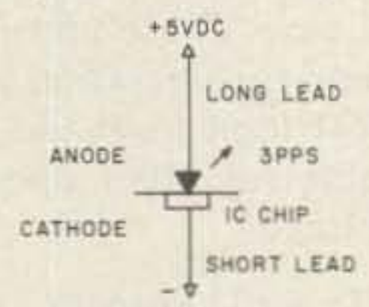


Fig. 8. Proposed graphic symbol for flasher LED. The IC chip is molded into the plastic case.

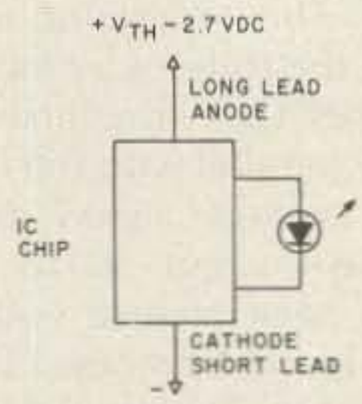


Fig. 9. Proposed graphic symbol for a voltage-sensing LED. The LED turns on within 10 mV of the threshold voltage, V_{TH}.

are 3 electrical components in the package, they are available for about 36¢ in quantities of 1000. A 5-volt source can be used to drive these type LEDs directly; they are also available to interface with a 12-volt source, ac or dc.

Tri-Color LED. The tri-color LED is really a two-color LED connected in reverse polarity paralleled in a single package as shown in Fig. 6. Two LED chips of different colors (red and green) are packaged in the same epoxy case. The characteristics of the chips are chosen so that when the red LED is on it appears as bright as the green LED when it is on. The red is at a wavelength of 697 nanometers while the green is at a wavelength of 565 nanometers, close to the maximum sensitivity of the human eye. These LEDs have a typical light output of about 2 millicandelas (2 thousandths of a candle power) at a current flow of 10 mA. As the LEDs provide reverse-polarity protection to each other, the unit can be operated on an ac voltage (with suitable dropping resistor). When operated on 60-Hz current, one LED will be on when the voltage is positive and the other LED will be on when the voltage is negative. To the eye, the LEDs will appear to be yellow or yellow-orange since the eye will integrate the discrete flashes of red and green and turn them into a yellow-orange. We will discuss the effect further under Applications of the LED.

Dual-Color LED. Once again we have two LED chips mounted in one package to simplify circuit design. However, the dual-color LED has two separate anodes and a single cathode connection as we see in Fig. 7. This LED package has 3 pins since the two anodes have separate pins while a common cathode connection is used. This type of LED is useful as it replaces 2 separate panel indicators, with the 2 color leads simultaneously available. The unit is suitable for dynamic color multiplexing and is ideal for an active visual indication of binary and trinary electronic states (orange-red—on or off, green—on or off, both—on or off).

The Flasher LED. This LED does not wear a raincoat which it "flashes" 3 times per second, as its name might imply. It does, however, have a built-in IC chip which acts as a timer so that current pulses through the LED, flashing its red light 3 times per second. As there is no standard graphic symbol for the flasher LED, the symbol shown in Fig. 8 is proposed and has appeared in several magazines.

The IC chip which is molded in with the LED in an epoxy case is usually visible through the red plastic case as a small black square dot about the size of a letter *n* of the print in this magazine. Considering the size of the chip, it is amazing to think that it is able to not only time the flash rate but also control the passage of 20 mA at 5 volts through the LED. Try doing that with discrete RC components the size of a pinhead! The red light output is 1.2 millicandelas at 5 V dc. No external parts are required, and it will operate directly off 5 V dc TTL logic level. The typical flash rate is 3 flashes per second at 5 V dc with a peak emission in the red spectrum at a wavelength of 650 nanometers.

Voltage-Sensing LED. This LED also makes use of an integrated circuit to perform its function of sensing the voltage level applied across its terminals. When the input voltage exceeds the threshold voltage, V_{TH}, the LED turns on. In fact, it "snaps on" within 10 mV of a nominal 2.7 V dc and will stay on as the voltage continues to increase up to a maximum of 5 V dc. This LED can be used as a push-to-test battery voltage tester, VU meter, etc. Fig. 9 shows the graphic symbol for the voltage-sensing LED, and again the symbol shown is proposed. Within the IC chip is a temperature-compensated reference voltage and a high-gain comparator which provides an unambiguous indication by the LED turn-on of the input voltage with respect to the threshold voltage. Through use of an external resistor, diode, or zener in series with the LED chip, the threshold voltage may be increased to any desired voltage. When a resistor is placed in parallel with the LED chip, the LED may be used as a current-sensing device. Refer to the Applications section for additional details.

Infrared LED. In appearance the infrared LED looks like any ordinary LED, whether it is housed in a red or clear epoxy case. The only thing is that the human eye cannot see the IR energy, so you can't tell whether it is on, off, good, or bad. The IR LED is used as a transmitter in intrusion devices, as the send end of a communications line (fiber optic or line-of-sight), as an object counter in conveyer belts, and for automatic flushing of urinals. Fig. 10 shows the graphic symbol for the IR LED. Note that it is identical to the visual LED except that IR has been added to the arrow light symbols. In the Applications section, we will discuss how you can easily tell if the IR LED is operating properly.

Applications of the LED

In this section we will discuss some applications of the various types of LEDs. Other applications will come to mind as you become more familiar with the capabilities of this really marvelous solid-state light.

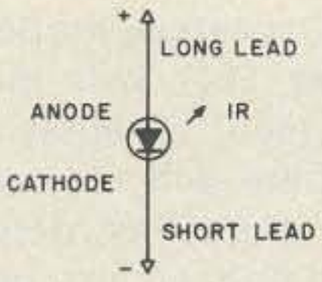


Fig. 10. The IR LED looks identical to the visible LED except its wavelength is longer and the eye cannot see its emission.

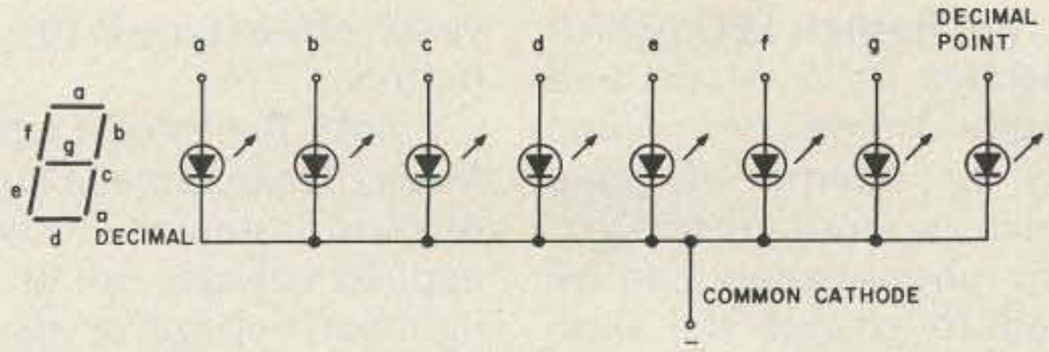
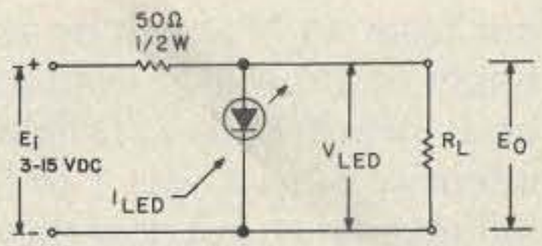
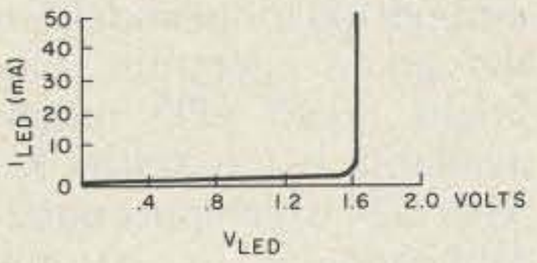


Fig. 12. Seven-segment numeral display with common cathode.





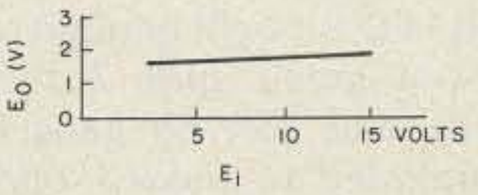


Fig. 14. The LED can serve as a voltage regulator for low current needs.

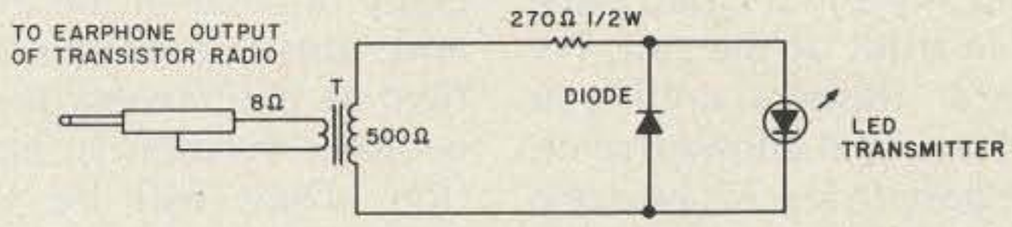


Fig. 13. An LED transmitter modulated by a transistor radio earphone output.

V	3	5	12	24	VOLTS
R	68	180	520	1200	OHMS

USE 1/2 WATT RESISTORS

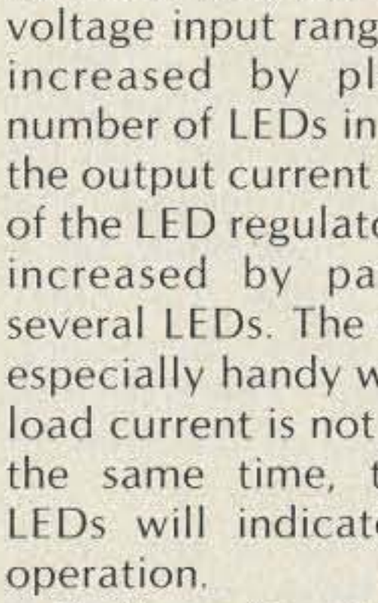
Fig. 11. Circuit for red LED drawing 20 mA at voltages shown.

Indicators. In their simplest form, the LED is used as an indicator of the presence of a voltage or current—a pilot light. But it will never burn out in your lifetime. Always use a current-limiting resistor to limit the current to 5 to 20 mA depending on the LED. Fig. 11 shows a circuit for LED operation at 20 mA for 3 V dc, 5 V dc, 12 V dc, and 24 V dc. The voltage drop across the red LED is 1.6 V dc and the green LED is a nominal 2.1 V dc.

Displays. Alphanumeric displays were the first to take advantage of the low power consumption of the LED, the first of these being the 7-segment numeral so widely used as pocket calculator displays. These numerals usually have a common cathode or anode as shown in Fig. 12. The 7 segments are lettered a through g for identification. A separate dropping resistor is used for each segment. A binary-coded-decimal (BCD) decoder and driver are used to turn on the various segments to form a numeral or digit.

Communications. When used as a source of energy for light-beam communications systems, the LED is modulated in some manner by turning it on and off by intensity modulation (which the eye cannot observe much above about 12 Hz) or pulse position modulation. In Fig. 13, we see the circuit of an LED being modulated by the audio output from a transistor radio. The audio from this intensity-modulated light beam can be recovered by connecting a silicon or selenium solar cell across the audio input of a phono amplifier or any audio amplifier. This simple transmitting and receiving system will demonstrate the basics of light-beam communications. For many interesting details and experiments on light-beam communications, including historical details on Alexander Graham Bell's Photophone communication system using a sunbeam, see *Light-Beam Communications* by Forrest M. Mims III (Howard W. Sams, 1975).

Voltage Regulator. The voltage drop across an LED is rather constant, even with greatly increasing current through the LED. In Fig. 14, we see a circuit which uses an LED as a voltage regulator. The accompanying curve of current through the LED vs. the voltage drop across the LED shows how constant the drop is at 1.6 volts for a red LED. The voltage input range can be increased by placing a number of LEDs in series or the output current capacity of the LED regulator can be increased by paralleling several LEDs. The circuit is especially handy where the load current is not great; at the same time, the light LEDs will indicate circuit operation.



EXTERNAL COMPONENT				V'TH
V'TH	+ –	VTH	SCHOTTKY DIODE	VTH+0.45V
V'TH		VTH	DIODE IN914	VTH+0.75V
V'TH		VTH	RED LED	VTH+1.6V
V'TH		VTH	ZENER DIODE	VTH+VZ

Fig. 15. The threshold turn-on voltage can be increased by using an external component with the voltage-sensing LED.

Voltage-Sensing. The nominal 2.7-V-dc threshold voltage of the voltage-sensing LED can be increased in several ways by applying in series with the LED other devices that have known fixed voltage drops. In Fig. 15, we see how these various external components such as an LED, a diode, etc., are placed in series with the sensor to increase the turn-on voltage level.

Stroboscopic Light Source. LEDs can be turned on and off in a matter of nanoseconds. Because of this capability, they can be used as a stroboscopic light source. The most common application of such a light source is the home music record turntable. They ordinarily use a neon bulb with an orange glow to indicate when the turntable is running at the desired speed. The neon bulb will flash at the rate of 120 flashes per second when operated off 60-Hz power as the neon gas ionizes on either polarity of the line voltage. A single LED, however, will flash at a 60-Hz rate when configured as in Fig. 5. Two red or green LEDs can be made to flash at 120 flashes per second when connected in reverse polarity parallel as shown in Fig. 6.

Light Flashers Light Source. The light output of LEDs has been increased over the years by manufacturers as new materials and techniques have become available. Today, the light out-

put from an LED can be as bright at 5 mA as it used to be at 50 mA. Early LED light intensity output was 1 to 5 millicandelas, but now they are available with outputs around 100 millicandelas in the green spectrum. One bright green LED readily available is the Xciton XC-5549-G24 which puts out 24 millicandelas at 10 mA. This LED is bright enough to cast a green spot 3 feet away and can be ganged (paralleled) to make a solid-state flashlighter that can be placed in series with a common dropping resistor. Remember, the green LED has a nominal operating voltage of 2.4 to 2.7 V dc depending on the type of material used in manufacture.

A circuit for flashing the LED is shown in Fig. 16. This circuit uses a 3909 LED flasher-oscillator IC chip (National LM 3909 or Radio Shack 276-1705) to pulse the current through the LED. With the circuit values shown, the LED will flash once each second for about a year using 2 C-cells. The unit can be packaged in a spray-can top and will serve as an attention-getter placed in a window to indicate to all that can see it "that the intrusion warning device is on and armed"; it also makes a great conversation piece for your desk. The 3909 IC chip is available for about $1.00 at local electronics stores.

The flasher LED which operates at 5 V dc and flashes 3 times per second has an internal IC chip which is sensitive to light. This phenomenon can be used to change the flash rate of the LED. Certain flasher LEDs can be used as sensors to tell the difference between a cloudless, sunlit sky and a cloud passing in front of the sun. Try several flashers until you find one that shows this effect best. In Fig. 17, we see a cross-section of a flasher LED by AEG-Telefunken (CQX-21); in Fig. 18, we see a block diagram of the electronics that is inside the IC chip.

In Fig. 19(a), we see a green LED placed in series with a red flasher LED, both of them across a 9-volt battery so that they flash in unison. A piezo sounder can also be placed across the green LED to pulse each time the green LED flashes. There is no current drawn from the battery during the off-duty cycle. The piezo sounder is available from Radio Shack as RS 273-060.

Fig. 19(b) shows 2 flashers placed in series with a green LED; now we find that the LEDs pulse in series so that they go "blink-blink, blink-blink," while the piezo sounder goes "beep-beep, beep-beep." The flash rate and current drawn from the 9-volt battery are also shown in Fig. 19. The circuit should flash for several years off a type-F (6-volt) battery.

Linear Indicator Display Meter. Because the LED can respond instantaneously to applied voltage, use of the light-bar voltage or signal-amplitude linear vertical or horizontal meter has become popular. These light-bar meters are especially popular in the audio and music entertainment field as the moving display is rather dynamic in operation. They will be used more and more in the future because the linear scale can be observed from a distance considerably further away than can an ordinary meter with moving needle.

Visual AND, OR, and NOR Gate Indicators. The dual-color LED can actually display 3 color conditions plus off to indicate the logic AND state (red *and* green on), OR state (red on *or* green on), and NOR state (neither red *nor* green on; both off). With the red and green on at the same time, the color will appear yellow or orange to the eye. The tri-color reverse-parallel-connected LED will indicate red, green, or yellow in color. These will indicate the logic states as described above but can also be used to ascertain a voltage polarity state such as green for a positive voltage, red for a negative voltage (or current reversed from the green or positive voltage), or yellow for an ac voltage.

Light Detector or Sensor. All semiconductor junction devices possess some degree of light sensitivity. Glass-encased diodes, LEDs, and transistors are all light-sensitive. An LED is in effect a bi-directional photovoltaic device. That is, voltage applied to the LED causes it to emit light. But shine a light on the LED and it will produce a small voltage across its terminals. Fig. 20 shows an LED being driven by a transistor radio output; a few inches away, an LED acts as a light pick-up feeding an audio amplifier. With this simple arrangement, you will be able to demonstrate this light fantastic of the LED. In-

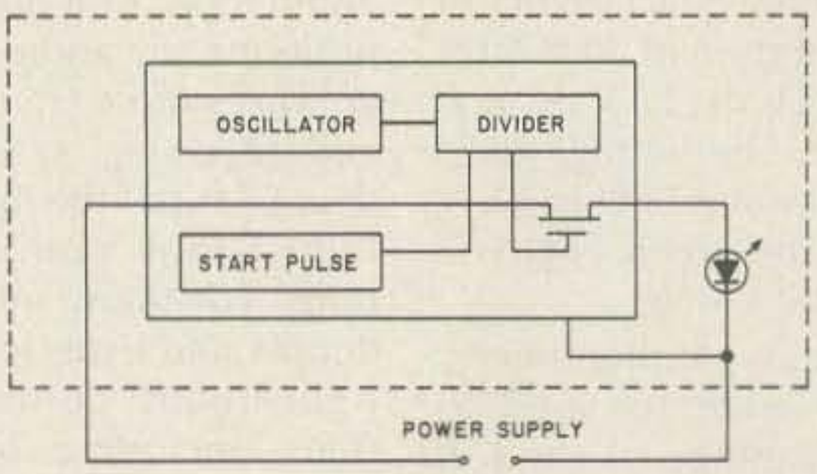


Fig. 18. Block diagram of the electronics within the IC chip of the CQX-21 Blink-LED.

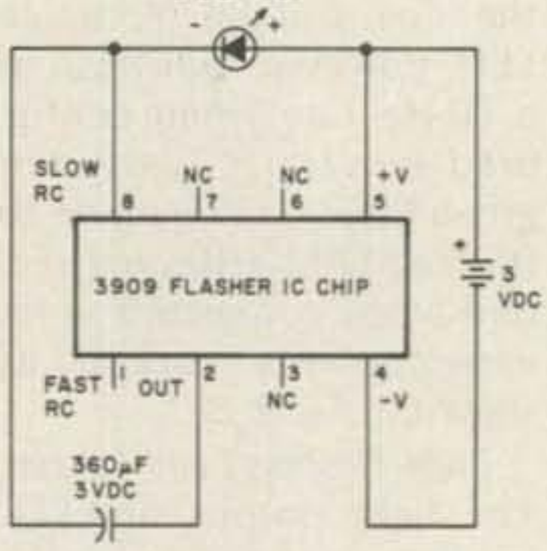


Fig. 16. This IC chip circuit will flash an LED once per second for about a year on 2 C-cells.

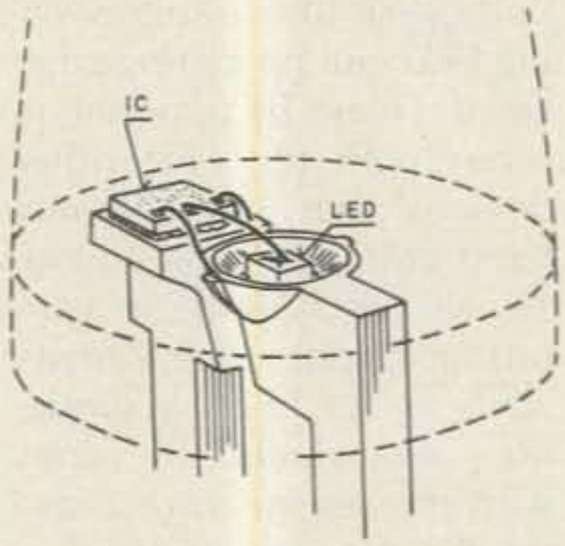
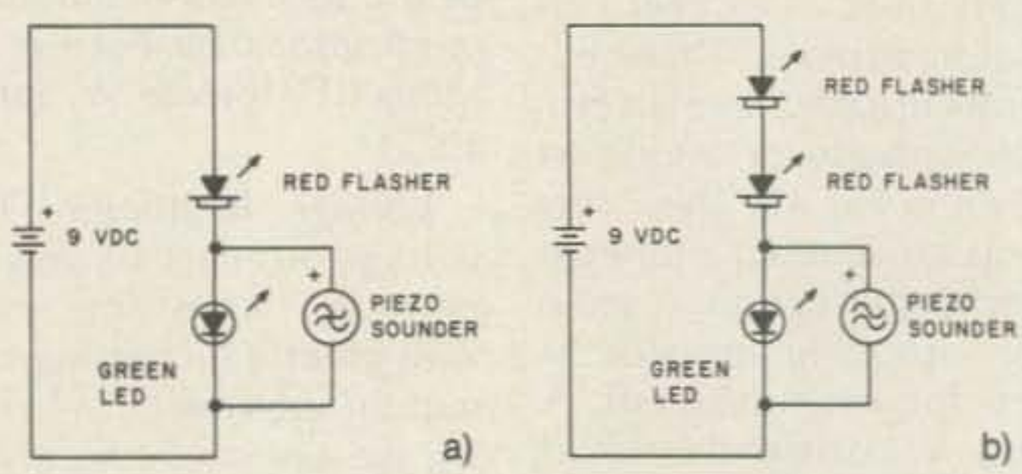


Fig. 17. Cross-section of the construction of the AEG-Telefunken CQX-21 Blink-LED.



Flashers	Flashes	Current
1	30/minute	15 mA
2	40 pair/minute	5 mA

Fig. 19.(a) Red flasher LED connected in series with a green LED. (b) Two red flashers connected in series with a green LED.

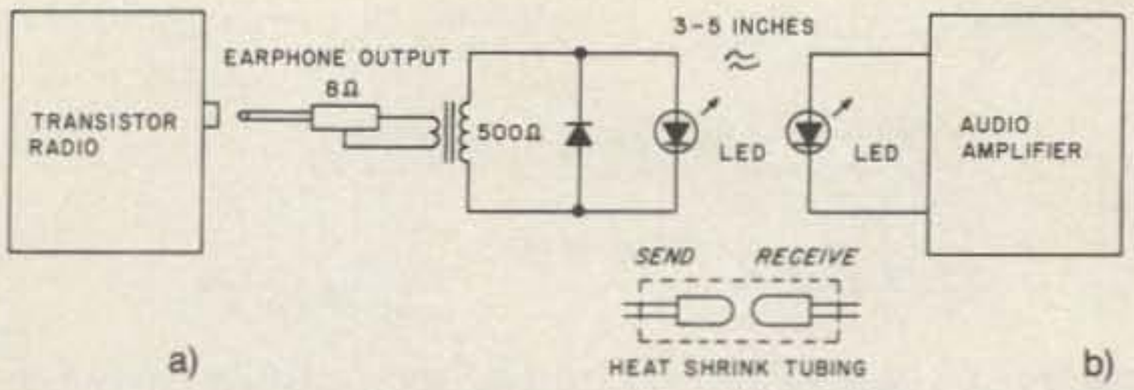


Fig. 20. The LED used as a transmitter and detector of light energy. Transmission through space is shown in (a), while (b) depicts the use of the LED as an optical coupler.

frared LEDs have greater sensitivity to light than do visual LEDs.

As a further demonstration of the light effect of a diode, take a glass-encased diode and connect it across the input to your audio amplifier. With the overhead lights on, you should be able to hear a 120-Hz hum with the audio gain turned up. Cover up the LED with your hand and the hum will go away.

You can make an LED optical coupler by using two LEDs head-to-head and held together by heat-shrink tubing which has been shrunk around the two LEDs. Either end of the coupler can be the send or receive link.

Intrusion Detector Light Source. As described earlier, the IR LED can be used as a transmitter for an intrusion device which bounces an invisible beam around a room. Through the use of mirrors, a room can be criss-crossed with the invisible beam light. When the beam is interrupted by anyone, an alarm is sounded. In the next section we'll discuss how you can tell if an IR LED is "alive and well" even though you can't see its radiation.

Continuity Tester. The LED can be used as an inexpensive continuity tester by connecting it as shown in Fig. 21. Use two AA cells to provide 3 V dc or use a 9-volt transistor battery that has been discarded as it will provide many months of additional service. You can build the unit in a discarded plastic top from a spray can or a plastic medicine pill bottle. The LED will be brightest when the probes are shorted together (zero Ohms) and really dim for a high resistance (10k to 20k).

Voltage Tester. In Fig. 22, we see the circuit diagram for a voltage tester using an LED as the indicator of voltage level. With the values shown, the tester will operate over a voltage range from 1 to about 30 volts ac or dc. The LED will be dim at 1 V and bright at 30 V. The voltage tester will operate off ac or dc because of the reverse-polarity LEDs. In addition, because either LED will light up on an ac or dc voltage, it is not necessary to observe polarity of the probes before placing them across the circuit to be tested.

Wheatstone Bridge. The direction of current flow is indicated by 2 LEDs that are connected in reverse polarity paralleled as we have discussed before. Because of this indication, the LEDs can be used to take the place of a galvanometer in a Wheatstone bridge. The circuit is shown in Fig. 22

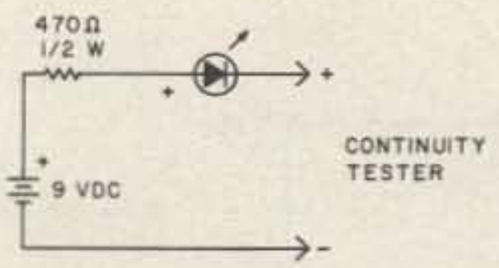


Fig. 21. The LED used as a continuity tester by adding a battery and resistor.

and the two separate LEDs or dual-color single plastic package can be used. A photocell is used to set a light level and a potentiometer is used to null the LEDs so they both go out or are equally dim. Then, as the light level is increased or decreased, by changing the light level or moving to or from the source, one or the other LEDs will become equally dim or almost out. In this manner, the same light level can be set by a room dimmer or walking toward or away from the light source.

The LED in Motion. As discussed earlier, the LED will flash on each time its anode goes positive with respect to its cathode. When an ac or pulsating dc voltage is applied to its terminals, the LED will flash on and off. If the flash rate is from about 12 to 16 flashes per second, the LED will appear to be on all the time because the human eye cannot observe the individual flashes. Most LEDs are stationary in use and we cannot observe the effect unless we can move the LED fast enough. In order to observe that a pocket calculator LED display is being turned on and off, that is, being multiplexed, move the lighted display rapidly in an arc at arms length. You will observe individual numerals or segments being multiplexed. In the section that follows, a means of flashing or pulsing the LED is described, but for additional details on the moving LED, see *One-Evening Electronic Projects* by the author (published by Howard W. Sams, 1980).

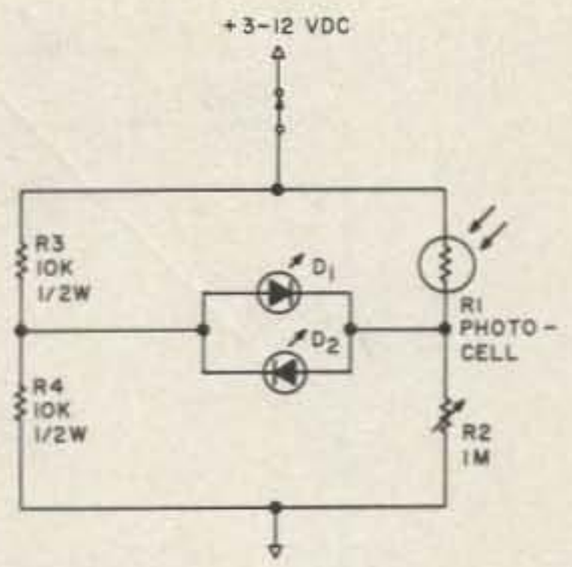


Fig. 22. A light-sensitive Wheatstone bridge which uses two LEDs to indicate when the bridge is balanced.

An LED Power Supply and Tester

A question to be asked about any LED that you are going to use in a circuit concerns the condition of the LED and its connections if it is a numeral display. Also, how do you tell if an IR LED is OK to use in a circuit you are building? Fig. 23 shows a simple circuit that you can use to test any LED, diode, or transistor. You can use it to test any LED for proper operation, identify the anode and cathode in case the leads have been cut off, and identify the segments of any of the numeral digit displays. You'll be able to tell which LED is the brightest you have and separate them out by color before you install them in a circuit.

Looking at the circuit diagram you'll see that the probes have been labeled as Plus probe and Minus probe, and that the associated LED is also labeled P and M. Use a red or bright-colored lead for plus and a black or dark

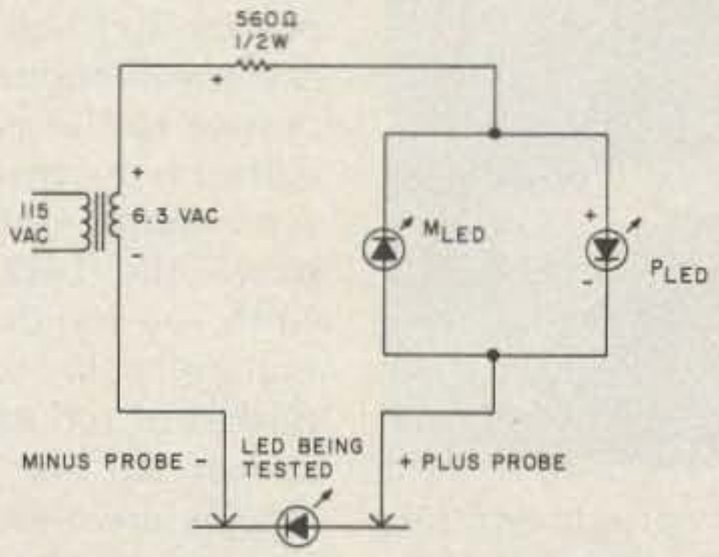


Fig. 23. This short-proof LED power supply and tester will work with any color or voltage LED.

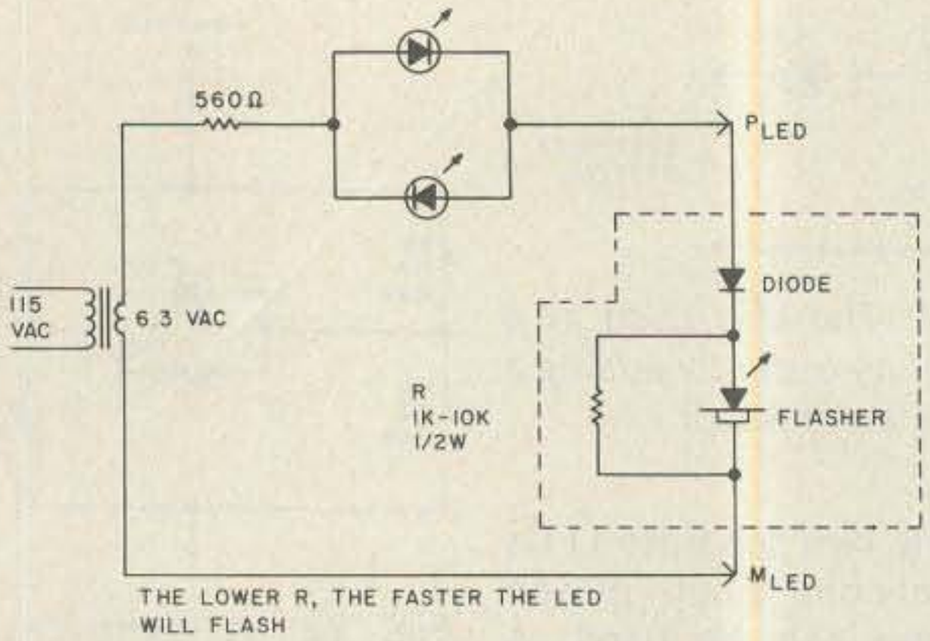


Fig. 24. By adding the components shown in the dotted lines, a flasher LED can be tested with the power supply.

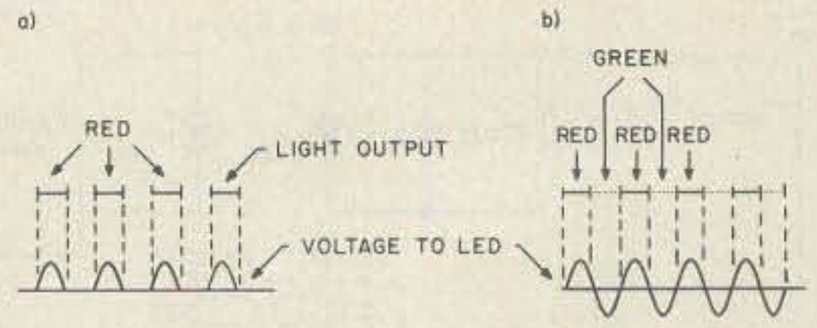


Fig. 25. A single-color LED strokes out a dashed line when moved (a), while a bi-color LED strobes out the two colors of the LED (b).

lead for minus. When you short the test probes together, both of the tester LEDs will light as current is able to blow through the circuit in both directions because of the ac voltage. When you place an LED across the test probes, one or the other tester LEDs will light as well as the LED being tested. If the P LED is lit, the red probe is connected to the anode under test (and the black probe to the cathode of the LED under test). However, if the M LED is lit, the Plus probe is connected to the cathode of the LED being tested (and the Minus probe to the anode).

An IR LED can be tested in the following manner, which is the same test for any LED or diode. Let's use the diode for reference and look at the 3 conditions of that device. When a diode is good it will conduct in one direction and not the other. So on our LED power supply and tester, one LED will be on and one LED will be off. With a diode across the probes, either LED can be lit as it doesn't make any difference as long as only one is lit. The condition for a shorted diode is that it will conduct in both directions, so both LEDs would be on, just the same as when the test probes are shorted together. The remaining test, or circuit condition, for a diode is that it is open. On the LED tester, with the probes connected across an open diode, neither of the LEDs would be lit as there is no current flow through the LEDs due to the open circuit.

So now when we place an IR LED across the tester, we can tell whether it is operating properly, is shorted or open, even though we can't observe its radiation. There is no way it can be operating properly and not provide the correct symptoms of operation. And remember—you can test the LEDs in this tester without having to use a current-limiting resistor or concerning yourself about shorting the power supply leads as the supply is short-circuit-proof.

A flasher LED can be tested using the LED power supply by using several other components connected as shown in Fig. 24. The diode will provide a pulsating dc voltage to the flasher LED while the resistor across the IC chip will cause the flash rate to vary. The lower the resistance, the faster the LED will flash.

Strobing the LED

When we connect an LED to the power supply and move the LED back and forth in a short arc, the LED will be seen to strobe out a series of lines as shown in Fig. 25(a). This is due to the fact that the LED will be on only when the anode is positive with respect to the cathode. However, when we place a tri-color LED (red and green) across the probes and hold it stationary, it will appear yellow or orange to the eye. The eye will sum the two colors and see a third color. If we now move the LED back and forth, we see that the fixed orange color changes to dashes of red and green, as shown in Fig. 25(b). The dashes are the on and off periods of each of the colors. Since we are using 60-Hz power, each of the dashes lasts for 1/120 of a second, or 1/60 of a second for a complete red-green cycle.

What the Future Holds

In the game of electronics, it is sometimes difficult to project where a certain product or process will go or how far it will go. The pocket calculator would not have been possible without the LED display and the calculator itself wouldn't have worked without the invention of the IC chip. The pocket radio would not have been possible without the transistor, but without the development of the small ferrite loopstick antenna, the whole pocket radio would not have been possible. So one development depends on another. The Dick Tracy wrist TV transmitter will one day be here, but in the meantime, more realistic developments will arrive on the scene. Some items on the scene, or almost in sight, are discussed below.

Barlights and Odd Shapes

In Fig. 26, we see a barlight available from Hewlett-Packard in colors of red, yellow, and green. These barlights are about ½ inch wide and 1 inch long and the whole surface is made to glow evenly. They can be placed end-to-end to form a long column or used in any arrangement that a designer might want in order to display numerals, play light music of different colors when operated off a stereo music amplifier, or make a large, cool-light mosaic display. In Fig. 27, we see a number of

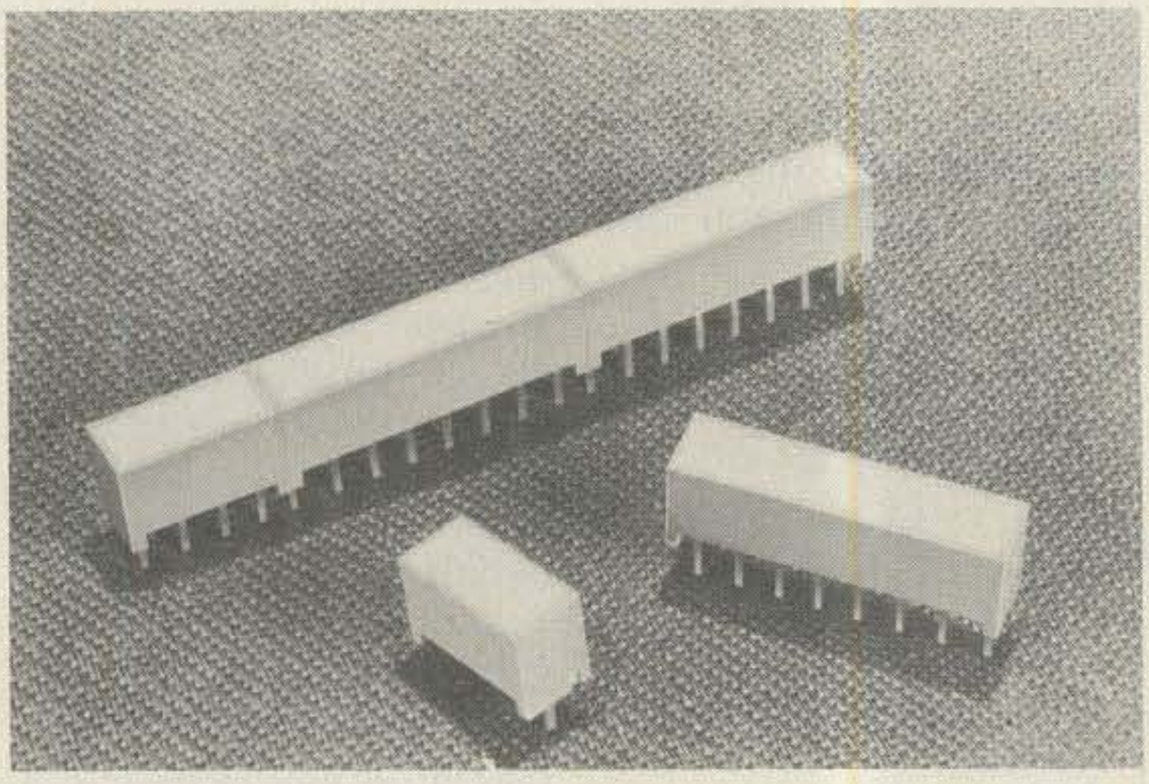


Fig. 26. A new Hewlett-Packard family of light-emitting diode light-bar modules is designed for use as back-lighting sources for display panels. (Photo courtesy of Hewlett-Packard)

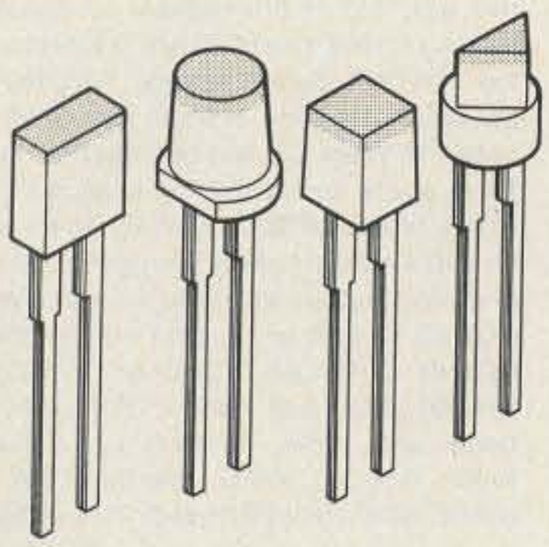


Fig. 27. Unusual LED shapes available from AEG-Telefunken.

LEDs available from AEG-Telefunken shaped as circles, squares, and triangles which can be arranged to form other figures such as arrows, rectangles, dots, dashes, and colons.

Flat-Screen Color TV. A dream of the TV industry is to make a flat-screen TV set. The CRT is also the most expensive component in the TV set and its lifetime is limited due to filament aging. So if the CRT would be replaced with a solid-state video light source such as the LED, the TV set could indeed be all solid state and would actually last a lifetime. Such a development that could lead to a flat-screen TV is an announcement by Sanyo that it has developed a multi-colored LED which emits colors from red through green, including the in-between hues. This LED is made from phosphorized gallium and will have a long lifetime. Sanyo's goal is to develop an LED that is capable of emitting the three primary colors necessary in a TV receiver—red, green, and blue.

Three-color LED. Before we get to the three magic colors of the TV set—red, green, and blue—we must be willing to take what technology has to offer us at the time. It was announced recently that Roza Luksemburg Electric Lamps Manufacturing Works of Warsaw, Poland, has developed and produced a three-color LED. Each LED has three structures, two GaAsP semiconductors which emit red and yellow light and a third structure of GaP which emits green light. These structures are all contained in a single plastic housing and are connected by a common cathode. Separate anode terminals exist for each of the 3 colors so that it is a 4-terminal LED. It is the common cathode which acts as the light color radiator. By means of symmetric spacing of the structures in a common deep reflector, uniform illumination of the light-emitting surface occurs. This type of LED can be used in a radio tuner where the 3 colors could indicate high tuning, low tuning, and on frequency. They could also be used as gauges to indicate above value, below value, and set on desired value.

Remote Reading of Utility Meters. For the past 100 years or so, electrical, natural gas, and water utility meters were read up close visually or, where possible, from a distance by means of a telescope. Various utility companies have been investigating means of doing the reading of the utility meter by some rapid and accurate method. Energy Optics, Inc., of Las Cruces, New Mexico, has installed a remote infrared meter access system to allow electric utility personnel to read meters from a moving vehicle using light-beam communications. The present installations can be read at ranges of up to 200 feet with a vehicle speed of about 15 mph. Infrared light pulses are generated by an LED or low-power laser diode. Later installations will be installed which will allow reading ranges of up to 1000 feet using a fast-moving van or low-flying aircraft. The diode laser power is extremely low but transmits the meter account number, an eight-digit meter reading, and other test data.

LED Types and Sources

Various types of LEDs have been described in this article. Most of them are readily available in small quantities of interest to an electronics experimenter or innovator. Some of the sources for some of the types of LEDs are shown in Tables 1 and 2. Consult the advertisements in this magazine for additional sources of supply and pricing information. ■

Type LED	Source
Single color Red, Yellow, Green	Hewlett-Packard, Dialight, Xciton, AEG-Telefunken, Industrial Devices, Inc., Radio Shack, Litronix, Texas Instruments, others
Single color with resistor	H-P 5082-4860 (red)
Single color with resistor and diode	H-P HLMP-3105 (red), HLMP-3680 (green)
Tri-color LED	Radio Shack RS-276-035 (red-green-yellow), IDI 4301H1/5 (red-green)
Dual-color LED	AEG-Telefunken CQ X95 (orange red-green), Opcoa LST-710 (red-green)
Flasher LED	Radio Shack 276-036 (red) Litronix FRL-4403 (red)
Voltage-sensing LED	H-P 5082-4732 (red)
IR LED	Radio Shack 276-141 (IR) TI TIL32
Rectangular LED	General Instruments CM4-65 H-P HLMP-2300 (red)

Table 1. LED types and sources.

Radio Shack	Neighborhood stores
H-P	Hewlett-Packard 1501 Page Mill Road Palo Alto CA 94304
Litronix	Litronix, Inc. 19000 Homestead Road Cupertino CA
Xciton	Xciton Corp. Shaker Park 5 Hemlock Street Latham NY 12110
IDI	Industrial Devices, Inc. Edgewater NJ 07020
Dialight	Dialight Corp. 203 Harrison Place Brooklyn NY 11237
AEG	AEG-Telefunken B. H. Frank Co. 3733 W. 139 St. Hawthorne CA 90250
Opcoa	Opcoa 330 Talmadge Road Edison NJ 08817
GI	General Instruments Corp. 4430 N. Ravenswood Ave. Chicago IL 60640
TI	Texas Instruments, Inc. PO Box 5012 Dallas TX 75222

Table 2. LED source addresses.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

JENSEN BEACH FL
FEB 25

The Martin County Amateur Radio Association will hold its annual free outdoor hamfest and swapmeet on Saturday, February 25, 1984, from 8:00 am to 4:00 pm, at Langford Park, Route 707, Jensen Beach FL. Bring your own table; swap-table and tailgate space will be available. There will be food, drinks, and desserts available throughout the day, and a playground for the kids, so bring the family. Talk-in on 147.06, down 600. For further information, write MCARA, PO Box 1901, Stuart FL 33495.

CINCINNATI OH
FEB 25-26

Cincinnati ARRL '84, the fourth annual Ohio state convention and flea market, will be held on February 25–26, 1984, at the Great Oaks Vocational Campus, 3254 East Kemper Road, Sharonville, Cincinnati OH. Registration is $5.00 and flea-market space is $4.00 for two days (ham and electronic items only). Activities will include forums, meetings, vendors, Wouff Hong, women's programs, a banquet, and a hospitality suite on Friday and Saturday nights. For more information, write Cincinnati ARRL '84, POB 11300, Cincinnati OH 45211, or telephone (513)-825-8234.

DAVENPORT IA
FEB 26

The Davenport Radio Amateur Club, Inc., will hold its 13th annual hamfest on Sunday, February 26, 1984, from 8:00 am to 4:00 pm, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA. Tickets are $2.00 in advance and $3.00 at the door. Table rentals are $7.00 each, with a $2.00 charge for an electrical hookup. Talk-in on .28/.88 (W0BXR repeater). For table reservations and advance tickets, write Dave Johannsen WB0FBP, 2131 Myrtle Street, Davenport IA 52804.

LAPORTE IN
FEB 26

The LaPorte Amateur Radio Club, Inc., will hold its Winter Hamfest on Sunday, February 26, 1984, beginning at 7:00 am (Chicago time), at the Civic Auditorium, LaPorte IN (45 miles SE of Chicago on I-80). Admission is $2.50 per person. There will be 180 8-foot tables for $2.00 each by reservation. Food and drinks will be available. Sellers will receive help unloading. Talk-in on .52 simplex. For tables, tickets, or more information, send an SASE to LPARC, PO Box 30, LaPorte IN 46350.

MORRIS PLAINS NJ
MAR 2

The Split Rock Amateur Radio Association will hold its annual auction on Friday, March 2, 1984, at the VFW Post, Mt. Tabor Road, Rt. 53 (between the train station and Warner-Lambert), Morris Plains NJ. The doors will open at 7:00 pm and the auction will begin at 8:00 pm. A cash bar will be available. Talk-in on .385/.985 and .52.

CIRCLEVILLE OH
MAR 4

The Teays ARC will hold its seventh annual King of the Pumpkin Hamfest on Sunday, March 4, 1984, from 8:00 am to 4:00 pm, at the new location, the K of C Building, 2489 N. Court Street. Tickets are $2.00 in advance and $3.00 at the door; tables are $4.00 in advance and $5.00 at the door. Food and plenty of parking will be available. For more information, write Dan Grant W8UCF, 22150 Hulse Road, Circleville OH 43113, or phone (614)-474-3026.

LIVONIA MI
MAR 4

The Livonia Amateur Radio Club will hold its 14th annual LARC Swap 'n' Shop on Sunday, March 4, 1984, from 8:00 am to 4:00 pm, at Churchill High School in Livonia MI. There will be plenty of tables, refreshments, and free parking. Talk-in on 144.75/5.35 and .52. Reserved table space with a 12-foot minimum is available. For further information, send an SASE (4 × 9) to Neil Coffin WA8GWL, c/o The Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

NORTH AMERICAN TELECONFERENCE RADIO NET
MAR 8

The Honeywell Amateur Radio Clubs will present the North American Teleconference Radio Net (TRN) at 7:30 pm CST on Thursday, March 8, 1984. Featured speakers will be attorneys Chris Imlay N3AKD, Jim O'Connell W9WU, Joe Merdler N6AHU, and Bob Benson QC VE2VW, who will be discussing the legal aspects of amateur radio. For a list of stations providing a gateway into TRN, check the Compuserve "Hamnet" X10 Database or send an SASE to net manager W0TN, 4749 Diane Drive, Minnetonka MN 55343.

EGG HARBOR CITY NJ
MAR 10

The Shore Points Amateur Radio Club, Inc., will hold the Springfest '84 on Saturday, March 10, 1984, from 9:00 am to 4:00 pm, at the Atlantic County 4-H Center, Egg Harbor City NJ (approximately 15 miles west of Atlantic City). Admission for buyers is $2.50 in advance and $3.00 at the door; sellers' space is $5.00 (bring your own table). There will be 8,000 square feet of heated indoor selling space, and covered tailgating will be available, weather permitting. For more information, write SPARC, PO Box 142, Absecon NJ 08201.

WINCHESTER IN
MAR 11

The Randolph Amateur Radio Association will hold its 5th hamfest on Sunday, March 11, 1984, from 8:00 am to 5:00 pm, in the National Guard Armory, Winchester IN. Ticket donation is $3.00 and children under 12 years old will be admitted free. Table space (by reservation only) is $5.00 with a table and $2.50 without. There will be a flea market, dealers, programs, food, and drink. Setups will be on Saturday from 6:00 pm to 8:00 pm and on Sunday from 6:00 am to 8:00 am. Talk-in on 147.90/.30, 224.90/223.30, and 146.50. For reservations and more information, contact RARA, Box 203, Winchester IN 47394, or phone Jake Life W9VJX at (317)-584-9361.

INDIANAPOLIS IN
MAR 11

The Morgan County Repeater Association Club will hold the Martinsville Hamfest on March 11, 1984, indoors at the Indiana State Fairgrounds Pavilion Building, Indianapolis IN. Admission is $4.00 at the door. Premium tables are $30.00 each, flea-market tables are $8.00 each, and flea-market space without a table is $1.00. All tables must be reserved in advance and setup will be Saturday, March 10, from 1:00 pm to 9:00 pm. Space setup will be Sunday, March 11, from 6:00 am to 8:00 am. There will be free paved parking. Talk-in on 147.21 and 146.52 simplex. For more information or table reservations, send an SASE to Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47401 before March 1.

HUDSON NH
MAR 17

The annual Interstate Repeater Society Flea Market will be held on March 17, 1984, at the Hudson Lions Club, Lions Avenue, Hudson NH. The doors will open at 8:00 am and the flea-market hours will be 9:00 am to 4:00 pm. Admission is $1.00 and tables are $7.00 each. Coffee, donuts, hot dogs, hamburgers, and drinks will be available for sale. Talk-in on 146.85 and 146.52. For more information, phone Herman Haberman WA1NYS at (603)-882-6859, or write Interstate Repeater Society, PO Box 693, Derry NH 03038.

CANTON OH
MAR 17

The Canton Amateur Radio Club will hold its annual auction on March 17, 1984, beginning at 5:00 pm, at the Nimishillen Grange, Easton Street NE. General admission is $2.00 in advance and $3.00 at the gate. An 8-foot flea-market table is $1.00 (supply is limited). Refreshments will be available. Talk-in on .72/.12. For advance tickets, send an SASE to Arthur E. Schermerhorn W8FEC, 505 E. Mohawk Drive, Malvern OH 44644, or for more information, call Scott Duncan KK8D evenings at (216)-484-6722.

MIDLAND TX
MAR 17-18

The Midland Amateur Radio Club will hold its annual St. Patrick's Swapfest on Saturday and Sunday, March 17–18, 1984, at the Midland County Exhibit Building, east of Midland TX on the north side of Highway 80. The hours on Saturday are from 10:00 am to 6:00 pm and on Sunday from 8:00 am to 2:30 pm. Registration is $5.00 in advance and $6.00 at the door; tables are $6.00 each. Refreshments will be available. Talk-in on .16/.76 and .33/.93. For further information and reservations, please contact Midland Amateur Radio Club, PO Box 4401, Midland TX 79704.

Continued on page 98

SATELLITES

Amateur Satellite Reference Orbits

	Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Mar	1	0107	110	0038	328	0147	352	0016	325	0033	323	1
	2	0111	111	0033	328	0131	349	0006	324	0030	324	2
	3	0115	112	0028	328	0116	347	0156	353	0027	325	3
	4	0120	113	0022	328	0101	345	0146	352	0024	326	4
	5	0124	114	0017	329	0045	342	0136	351	0022	327	5
	6	0128	115	0012	329	0030	340	0127	350	0019	327	6
	7	0133	116	0006	329	0014	338	0117	349	0016	328	7
	8	0137	118	0001	329	0158	5	0107	348	0013	329	8
	9	0141	119	0155	359	0142	3	0058	347	0010	330	9
	10	0002	94	0150	360	0127	1	0048	346	0007	331	10
	11	0007	95	0144	360	0111	358	0038	346	0005	331	11
	12	0011	96	0139	360	0056	356	0029	345	0002	332	12
	13	0015	97	0134	0	0041	354	0019	344	0159	3	13
	14	0020	98	0128	0	0025	351	0010	343	0156	4	14
	15	0024	100	0123	1	0010	349	0000	342	0153	5	15
	16	0028	101	0118	1	0153	16	0149	11	0150	6	16
	17	0033	102	0112	1	0138	14	0140	10	0147	6	17
	18	0037	103	0107	1	0122	12	0130	9	0145	7	18
	19	0041	104	0102	1	0107	9	0120	8	0142	8	19
	20	0046	105	0056	1	0051	7	0111	7	0139	9	20
	21	0050	106	0051	2	0036	5	0101	7	0136	10	21
	22	0054	107	0046	2	0021	2	0051	6	0133	10	22
	23	0059	109	0040	2	0005	0	0042	5	0130	11	23
	24	0103	110	0035	2	0149	27	0032	4	0128	12	24
	25	0107	111	0030	2	0133	25	0022	3	0125	13	25
	26	0112	112	0024	3	0118	23	0013	2	0122	14	26
	27	0116	113	0019	3	0102	21	0003	1	0119	15	27
	28	0120	114	0014	3	0047	18	0153	30	0116	15	28
	29	0125	115	0008	3	0032	16	0143	29	0113	16	29
	30	0129	116	0003	3	0016	14	0133	29	0111	17	30
	31	0134	117	0157	34	0001	11	0124	28	0108	18	31
Apr	1	0138	119	0152	34	0144	39	0114	27	0105	19	1
	2	0142	120	0147	34	0129	36	0104	26	0102	19	2
	3	0003	95	0141	34	0113	34	0055	25	0059	20	3
	4	0008	96	0136	34	0058	32	0045	24	0056	21	4
	5	0012	97	0130	35	0042	29	0035	23	0054	22	5
	6	0016	98	0125	35	0027	27	0026	22	0051	23	6
	7	0021	99	0120	35	0012	25	0016	21	0048	24	7
	8	0025	101	0114	35	0155	52	0006	21	0045	24	8
	9	0029	102	0109	35	0139	50	0156	50	0042	25	9
	10	0034	103	0104	35	0124	48	0146	49	0039	26	10
	11	0038	104	0058	36	0109	45	0137	48	0037	27	11
	12	0042	105	0053	36	0053	43	0127	47	0034	28	12
	13	0047	106	0048	36	0038	41	0117	46	0031	28	13
	14	0051	107	0042	36	0022	38	0108	45	0028	29	14

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77.0 XB	100.0 1Z	131.8 3B	173.8 6A
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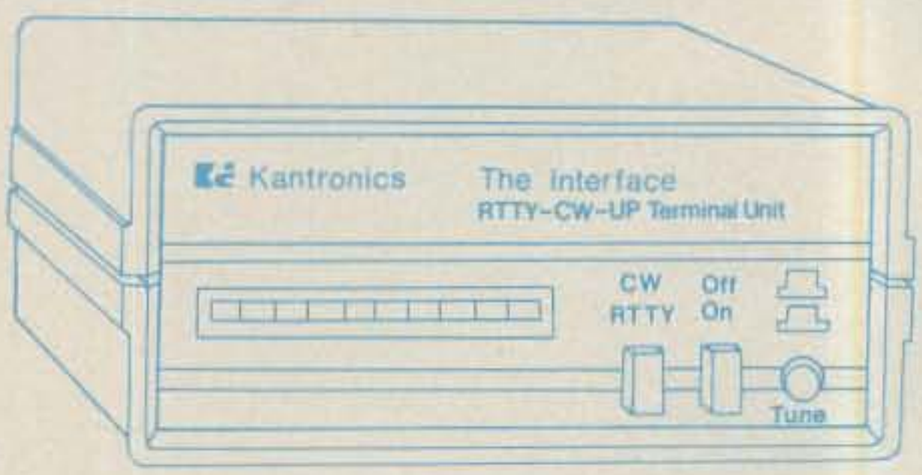
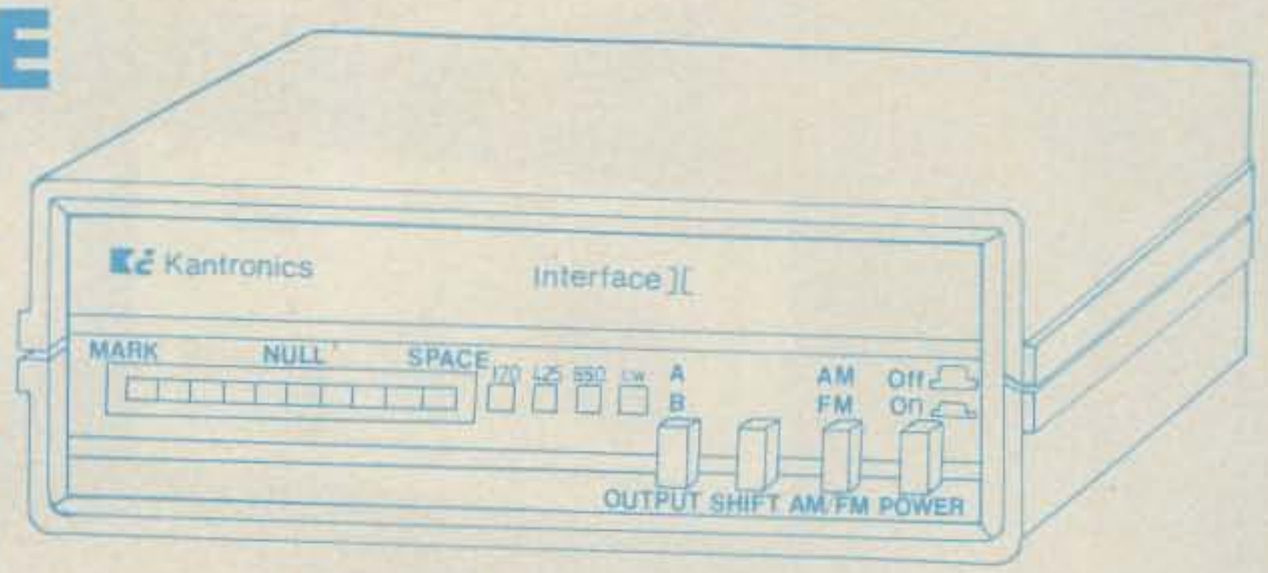
THE INTERFACE





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```
MORSE                    00:00:00
TRANSMIT SPEED   25
RECEIVE SPEED    28
-------------------------------
ENJOY YOUR MEAL AND
WE'LL TALK TO YOU
REAL SOON . . . 73'S . . .
WA5RGU
-------------------------------
WEATHER HERE IS WARM TODAY
WITH LOTS OF SUN. . .XYL SAYS
TIME FOR DINNER SO 73'S WØXI
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Kantronics has led the amateur community in software and total computer communications systems with our original program, **HAMSOFT**. With five-computer compatibility and reasonable prices **HAMSOFT** has become the industry standard. **HAMSOFT** includes split screen display, type ahead buffer, message ports, and complete keyboard control for Morse Code, Radioteletype, and ASCII communications. With THE INTERFACE or INTERFACE II, **HAMSOFT** can make any of five computers a complete amateur communications terminal. All programs are on a ROM board, except the Apple diskette.
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```
                         00:00:00
PROGRAM OPTIONS
A. RETURN TO BASIC
B. EDIT MESSAGE PORTS
C. SAVE MESSAGE PORTS
D. LOAD MESSAGE PORTS
E. SET XMIT BUFF SIZE
F. EDIT HOLDING BUFFER
G. SAVE HOLDING BUFFER
H. LOAD HOLDING BUFFER
I. SET TIME
```

```
                         00:00:00.
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CHOOSE
 S (AMTOR SLAVE)
M (AMTOR MASTER)
 L (AMTOR LISTENER)
 P (PROGRAM OPTIONS)
 T (T/R OPTIONS)
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On January 27th, 1983, AMTOR, Amateur RadioTeletype Over Radio, became a legal mode for the amateur service. AMTOR is an essentially error-free radioteletype form of communication. **AMTORSOFT,** Kantronics' newest software package, gives your computer the ability to become an AMTOR communications terminal when used with The Interface or interface II. **AMTORSOFT** is currently available for the Apple, VIC-20, and COM-64 computers. **AMTORSOFT** brings you the newest in computer-amateur communications at an affordable price.
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73 INTERNATIONAL

Each month, 73 brings you ham radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Jack Burnett.*

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

VK6—WEST AUSTRALIA

West Australia is the home of America's Cup—and with the eventual win by the West Australian syndicate and worldwide attention focused on this area of Australia, it became evident that not many people throughout the world have much idea about this vast state.

We have eight call areas on the mainland, of which VK6, with a land area of 975,101 square miles and a coastline of 7,768 miles, is the largest. It is indeed a vast area, with a very sparse population in the areas away from the major towns, with a total population for the whole state of 1,300,000, most of whom live in Perth and the larger towns scattered around the southern half of the state. The total amateur-radio population is 1,226, which means one amateur to every 795 square miles.

Albany, in the south of the state, was a port in the 1900s for those hardy whaling ships, one of which was the same *Cheynes II* that refueled there on its way down to Heard Island with the Jim Smith DXpedition. Between Albany and Perth, further north up the coast, is an area of beautiful tall forests with perhaps the best area of native Australian wild flowers in the state. Perth itself is a city very isolated from the eastern states by a large desert extending for 1,000 miles.

Perth, where the 1987 America's Cup will be contested, is located a short distance from the deep blue Indian Ocean. It has a lot of amateur activity, and with the ease of reciprocal licensing between Australia and the States, it would pay you to bring a 2-meter FM rig as it is easy to access the 2-meter repeaters with a hand-held and meet many of these friendly West Australian amateurs.

Perth also has an amateur award called The Black Swan—this bird being the state emblem. Also, if you are looking for a QSL card for VK9-Willis Island, VK6YL has all the logs for this operation; she is the QSL manager for all the Willis Island operations of latter years.

Kalgoorlie is the largest inland town, situated 350 miles east of Perth in a very dry desert area; the water for this city is piped in from near Perth. There is an interesting story appertaining to the pipeline. The engineer who built it predicted that the water, after being turned on at Perth, would arrive the next morning at 11 am. The townspeople had bands and festivities scheduled for this gala occasion, but the water had not arrived even by that night, so, in shame, the engineer shot himself. It was premature, for the water started to flow the *next* morning, 24 hours later. And it has kept flowing ever since.

There are many amateurs scattered throughout the vast desert spaces of this area. If you go visiting, take a metal detector, for the area is rich in minerals, with gold and nickel predominating. Many people have made a year's wages in a week by detecting the alluvial gold at this location. A lot, also, have found nothing.

Going east from Perth, you pass through a large grain-growing area near the coast, and then you enter sheep and cattle properties trying to survive in a harsh environment with temperatures going up to and over 120 degrees Fahrenheit. Some of these properties cover well over 1,000,000 acres, and amateur radio is a good standby in this area, not only for emergencies, where their nearest neighbor could be at least a hundred miles away, but also for those infrequent idle hours to relieve the isolation.

The northern part of the state (The Kimberleys, as it is called) is perhaps the most ruggedly beautiful area. It has large deposits of iron ore and towns fully air-conditioned by the companies extracting the mineral for export all over the world. It also is not unusual to hear a typical American voice using a VK6 callsign operating from this area, as there is a joint Australian and American communications base at a place called North West Cape.

Further inland are Australia's largest diamond deposits, located in a diamond pipe similar to the famous diamond pipes in South Africa.

One very active amateur from this remote area is Ian VK6IH, who acts as net controller for the Caribbean DX Net on 14.128 at 1000Z.

The northernmost part of the state was first discovered in the early fifteenth century by Dutch explorers, 200 years before Captain Cook first landed on the east coast of Australia and claimed the land for England. This area was, in the early 19th century, the main pearling center of Southeast Asia, with the main port being Broome, a seaport with tides that rise and fall up to 35 feet at a time. There is an active YL operator in this area, Trisha VK6KI, located in a small community offshore on Koolen Island.

Some of the early operators had to travel up to 1,000 miles just to sit for their amateur license, with no local radio club to help with their training, so if you do work one of these outback VK6 operators, you know that they have earned their right to be on the amateur bands the hard way.

If you plan to come to VK6 for the Cup Challenge, the address to write for a reciprocal license is The State Manager, Radio Frequency Management, Operators Branch, PO Box 6189, Perth 6000, West Australia.

VK2—LORD HOWE ISLAND

First discovered in 1788, Lord Howe Island is located 700 km east of the coast of New South Wales (VK2) and is part of that state.

Being so far off the coast of Australia, it is classed as a separate country for DXCC.

The first successful settlement of this island was in the 1830s by an American whaler named Nathan Thompson, who brought with him a princess whom he had saved from an arranged marriage in the Gilbert Islands. They later married, and their graves are on the island. Many of the island people are their direct descendants.

There are a couple of amateurs active on the island, with many visiting operators using portable Lord Howe. There is usually one type of DXpedition from this island each year; this year there will be approximately 10 operators on all bands, including 160 meters, from October 23rd until November 2nd. As you can see, this is not one of our rarer islands—not like the next piece of sand:

VK9—MELLISH REEF

This "country," to use the term loosely (I don't know how anybody could class Mellish Reef as a country), is only a coral sand cay 300 meters long by 60 meters wide, located at 17° 25' longitude, 155° 51' East latitude, and only 2 meters above sea level at normal high tide. With the many cyclones that go through the area each summer, however, if planning an expedition to this spot during the cyclone season, one of the main items of gear to pack would be a face mask and snorkel. This is why I question the status of "country" for places like Mellish Reef.

WIA EXTENDS MEMBERSHIPS

The Wireless Institute of Australia, which is the world's oldest radio society, has opened its membership to those living outside Australia.

Already a number of radio amateurs in the US, UK, and Oceania have joined the WIA—which celebrates its 75th anniversary in 1985 with some special events planned.

Overseas members are entitled to qualify for WIA awards, including the Australian DXCC, and have unlimited use of the free QSL bureau run by the WIA in VK3.

All members receive a copy of the WIA's monthly magazine, *Amateur Radio*, which is in its 51st year of publication.

Annual membership during 1984 is $35 (Australian), which should be sent to the Secretary, Wireless Institute of Australia, Victorian Division, 412 Brunswick Street, Fitzroy 3065, Australia.

COLOMBIA

Abelardo (Lalo) Santos V. HK3EQJ
PO Box 88937
Bogota 8
Colombia

MALPELO ISLAND, 1983 DXPEDITION

"We both feel that this was one of the best operations in the history of amateur radio. We have never heard such excellent control, rapid operating, and fine CW."—Stuart WA2MOE, Ben JA3GM.

"Congratulations on the 50th anniversary of the LCRA and the Malpelo DXpedition. I was delighted for having realized such a difficult and priceless QSO. Your QSL will be my treasure."—Ben JA3GM.

Countless congratulatory letters, messages, articles, and TV and broadcast programs' comments poured in after the Malpelo Island DXpedition took place. Meanwhile, Beto Rojas HK3DDD, on an almost round-the-clock task, helped by his XYL Luisa and two children, systematically and tirelessly keeps processing and mailing thousands and thousands of QSL cards from/to all over the amateur world.

The two voice and one CW stations manned by thirteen operators, accompanied by one TV man and three Colombian Navy sailors (for the expedition's logistic support), managed to log 20,535 voice and 8,389 CW QSOs. They worked a hundred hours from dawn well into the night, until propagation conditions were inexorably closing the bands.

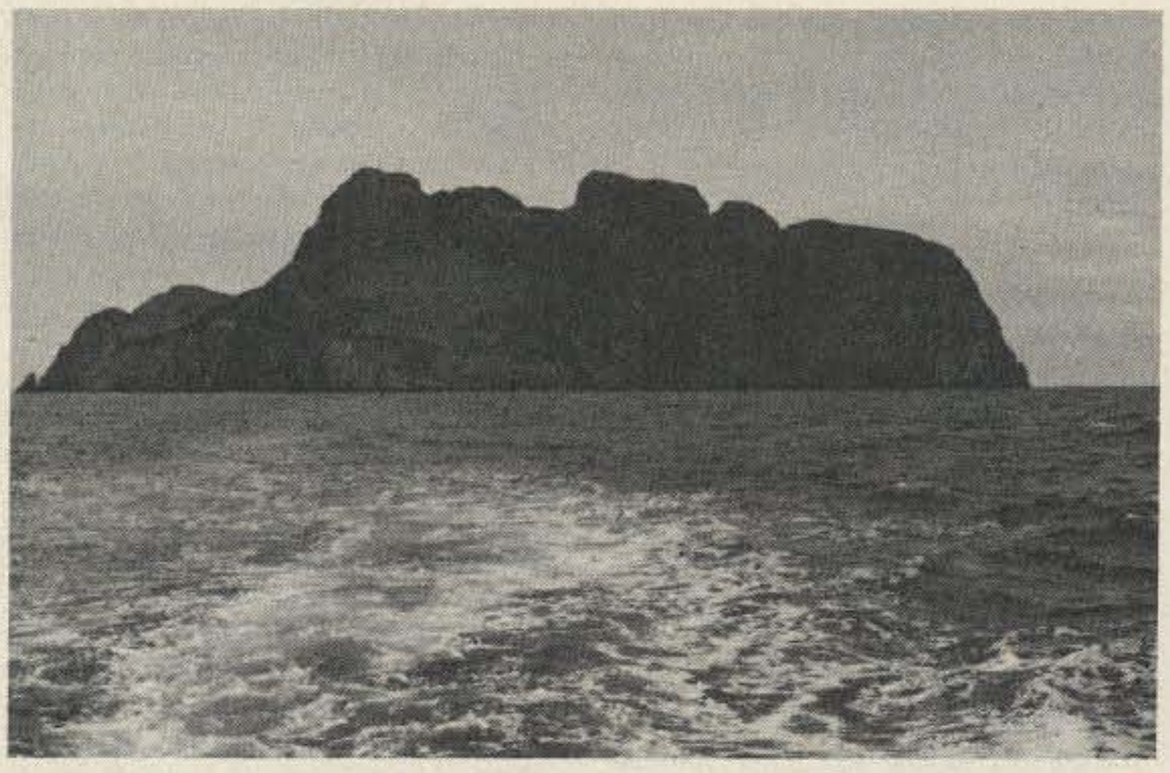
The three generators, two in operation and one on standby, worked perfectly, as did the Kenwood TS-930S transceivers (supplied free of charge for the expedition), keeping well abreast with the over-demanding operating conditions.

The camp base was installed at 160 meters above sea level on the barren volcanic surface of the island. The site was constantly swept by almost gale-force winds which frequently knocked down the tents and dangerously twisted the antennas. The expedition had rainy weather from landing till the minute it left.

As a rare coincidence with the previous Colombian Islands DXpeditions, the radio ham in charge of the health and sanitary backup arrangements, this time OM O

While some of the members of the party still were at sea, one of the lucky 13 was being hoisted to shore.

The world was listening to HK0TU.



Good-bye, Malpelo, see you again in 1990.

Campillo HK4DUM, had a fall on landing, was subsequently struck by a wave, and sustained injuries to his right leg. Fortunately, it was nothing serious, and he was taken care of by his colleagues.

The help and assistance given to the DXpedition by the Colombian Navy, with the *CNSS Providencia* from its QTN in Buenaventura Port to Malpelo Island and back, were continuous and flawless. Since there are no docking facilities at Malpelo, the 13 operators, the TV cameraman, Luis Fernando Castrillon, the three sailors, and all the equipment had to be lowered to the shore of the island by means of a crane—and picked up the same way. Since the sea was rough at both times, certainly it was not a very easy-to-forget experience for all of them.

Once the party was back in Buenaventura, a Colombian Air Force transport plane flew them back to Bogota, where the National Police Band received them with full honors.

Tired, suntanned, but deeply proud and satisfied with their accomplishment, they were warmly greeted by relatives, colleagues, and friends and started going back home full of souvenirs and unforgettable experiences. They left in a rock at Malpelo Island a commemorative plaque saying: "Republic of Colombia, Colombian Radio Amateur League, HK0TU, Commemorative DXpedition of the 50th anniversary of the League, with the cooperation of the Colombian Navy, Malpelo, October 12, 1983."

Mr. Belisario Betancourt, the Colombian President, sent the Malpelo expeditionary party a congratulatory message saying: "It is very encouraging to see a group of Colombian radio amateurs who are moved only by the wish of serving fellow men, re-

The DXpedition party had just landed. Top to bottom: O. Campillo HK4DUM, G. Cuartas HK4COK, A. Afanador HK3BED, B. Aguilar HK1AMW, Beto Rojas HK3DDD, J. Restrepo HK2YO, E. Bernal HK3BAV, E. Londono HK4BHC, A. Carrisoza HK3BAE, J. Uribe HK5LA, A. Gonzalez HK1DBO, H. Olarte HK1QQ, C. Alvarez HK8BYG.

affirming through their hard work and devotion the Colombian sovereignty over the Malpelo Island territory, thanks to the cooperation given by the Colombian Navy and the Colombian Radio Amateur League...Through investigation and radio experimentation we wish to confirm our desire to bring together our nation with itself and the rest of the world.

"I wish they will have plenty of DXs and that on their way back they will bring us all a better knowledge of the Malpelo Island, thanks to them now closer to our heart."

When the *CNSS Providencia*, bringing the Malpelo DXpedition back to the continent, was deep into Pacific Ocean waters and the island was getting smaller and more diffused, one of the excited young expeditioners loudly said: "Good-bye, Malpelo, we'll see you again in 1990."

CYPRUS

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PO Box 1723
Limassol
Cyprus

NEWS FROM CYPRUS

During the last couple of months, nothing extraordinary has happened in the sphere of ham radio in Cyprus; however, it should be noted that as far as I know, we had at least one participant in the *CQ* WW Phone Contest. He was 5B4LP, who made a total of 86 countries, 31 Zones, and 521,118 points. 5B4LP is a promising young man aged 15 years, and he is very enthusiastic and a regular operator on the 10m, 15m, 20m, 40m, 80m, and 2m bands. He can be heard also on the 10m FM mode chatting with Europeans or Americans via repeaters.

Also during the last month, elections were held for the regional committees of the Cyprus Amateur Radio Society in the districts of Limassol, Paphos, and Larnaca. The clubs in Nicosia, Larnaca, Limassol, and Paphos have been reactivated and operate one day per week.

The ZC4s are also quite active, especially from their club station in Episcopi, ZC4EPI, where they are using a couple of V-wire beams 329 feet long beaming towards Europe and the Pacific. Regular operators there are Andy ZC4HA, Steve ZC4SM, Jim ZC4JE, and Gregg ZC4GH.

On 160m, the only operator at this time is 5B4JE who is QRV most evenings on 1,835 MHz around 2100 UTC.

The Cyprus Amateur Radio Society has decided to buy a UHF repeater and members of the society will shortly make expeditions to find the most suitable location up on the mountains.

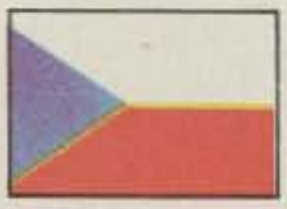
VISITORS' LICENSES

Holiday makers in Cyprus who are holding a radio amateur's license in any country of the EEC, any British Commonwealth country, or the United States of America can be issued with a temporary license free of charge if they send a photocopy of their license with a letter of application to: Chief Telecommunications Officer, Ministry of Communications and Works, Nicosia, Cyprus. It is advisable to apply at least three months before the

The 1983 DXpedition commemorative plaque.

Andreas 5B4LP operating during the CQ WW Phone Contest.

time of arrival. Visitors can use their own callsign with /5B4 at the end. A regular 5B4 license can be issued to foreign hams from the above countries if they are working or have their permanent residence in Cyprus.



CZECHOSLOVAKIA

Joachim Miroslav OK1WI
Bocni I. 23
141 00 Praha 4-Sporilov
Czechoslovakia

According to the 1983 *Radio Amateur Callbook* census, the number of amateur radio stations in Czechoslovakia is 3279. As many of the stations are collective (club) stations, the number of operators may be estimated as being at least 10,000.

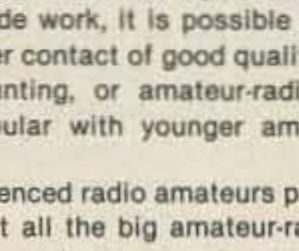
Two amateur journals are published monthly in OK-land: *Amaterske Radio*, with about 100,000 copies monthly, bringing technical and operational information on amateur radio, general electronics, and computer techniques, and *Radioamatersky Zpravodaj* (*Radio Amateur, A Messenger*), with much lower circulation, bringing technical and operational information on amateur radio. For example, the December, 1983, issue of *Amaterske Radio* brings a description of the newly-developed HF transceiver "Labe," made by Radiotechnika in Hradec Kralove (60 W, all bands, including all WARC 79 bands). On the other hand, the October, 1983, issue of *Radioamatersky Zpravodaj* brings a description of the hand-held, two-meter transceiver "Mazak," showing that even with limited possibilities of homemade work, it is possible to have a two-meter contact of good quality.

Fox-hunting, or amateur-radio DF, is very popular with younger amateurs in OK-land.

Experienced radio amateurs participate in almost all the big amateur-radio competitions and are always among high scorers. Club stations participating in world competitions often use special callsigns, the most esteemed being OK5MIR (OK5PEACE), showing the hopes of OK amateurs and the whole people of Czechoslovakia for world peace.

Czechoslovak amateurs participating in technical-cooperation missions often bring their equipment to developing countries. Some very rare prefixes are in this way made available to the whole amateur-radio community.

In daily, regular contacts, OK amateurs strive for friendly relations with all countries. The month of November was reserved for the Soviet-Czechoslovak competition during which friendly messages were exchanged between OK-land and UA-land operators.



FEDERAL REPUBLIC OF GERMANY

Ralf Beyer DJ3NW
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3300 Braunschweig
Federal Republic of Germany

RFI

Almost everyone has had his experiences with broadcast/television interference and with its reduction or complete elimination. But I suggest also looking at interference to ham radio which arises from leaking TV sets, noisy computers, insufficiently-filtered dimmers, and other sources. Recent experiences in this field got me interested in the broader aspects of RFI. Fortunately, I found that a rather systematic approach to the problem exists, at least in our country.

First, there is the German FCC, and one of its offices issues the so-called FTZ number. This number is awarded to communications equipment, domestic or imported, if it meets certain specifications regarding noise immunity against external sources, as well as low emission of signals which might cause interference with other sets. These specifications have been tightened more and more in the past, and without going into their details, I will give you an example of their real-life effects.

Having my ham-radio and TV antennas mounted on the same mast with a separation of only 2 meters, 100 Watts of transmitter output caused a complete loss of the TV picture and sound with a TV set produced around 1980 which had the (old) FTZ number Z385C. Furthermore, this TV set generated hash noise on 20 meters on the order of 25 microvolts at 50 Ohms (S8 on the meter). This was apparently caused by its switching power supply and occurred even when the TV set was in standby mode. Newer TV sets can be awarded the FTZ number 22/585/SE-VT, for example, if they meet the much tighter BCI/TVI specifications of today.

The replacement of the old TV set by a new one with a current FTZ number resulted in no or negligible TVI for the same arrangement of TV and ham-radio antennas and in a reduction of hash noise on 20 meters far below the S1 mark. Because radio and TV sets with lower-grade RFI specifications still can be sold, it is worthwhile to inform your neighbors and others about the up-to-date FTZ numbers (or similar designations in your country) before they procure a new set. In every case, it is to their advantage because our FCC, for example, does not pursue RFI cases if equipment with outdated FTZ numbers is involved.

Next, there is the RFI-filter industry. They are offering excellent antenna filters, line filters, and loudspeaker filters for the consumer products experiencing interference. Plug-in high-pass filters for TV sets with a stop-band attenuation of more than 50 dB and with an insertion loss of less than 1.5 dB are very efficient and popular. Sometimes, however, common-mode voltage problems (i.e., identical phase of the ham transmitter signal on the shield and the inner conductor of the TV coaxial cable) can render their application useless. Therefore, common-mode rejection transformers also are offered which are installed ahead of the high-pass filter so it can operate as designed.

One of my neighbors took my advice, bought two high-quality commercial high-pass filters, installed them ahead of his old VHF/UHF antenna amplifier, and cured the TVI problem completely for a total cost of 35 dollars. The FCC, by the way, investigated the case but did not pursue it because the antenna amplifier had no current FTZ number.

Information on RFI suppression products can be obtained from the Auth Company (distributor: Fritz Hoehne DJ4FT, 4630 Bochum-Hiltrop, Weg am Koetterberg 3) or from Karl E. Schertler DJ@AV, Hoehenkirchener Weg 5, 8127 Iffeldorf, Federal Republic of Germany. The latter supplies also the common-mode rejection transformer.

Furthermore, the national amateur-radio association (DARC) is providing a special service for its members. In addition to technical advice, it has procured at least one set of industrial RFI filters/transformers to be stationed in each state of Germany. Members of the DARC can borrow this set for a moderate fee in order to determine the most efficient way to eliminate RFI. This has the additional advantage that one needs to purchase afterwards only what is really required. I think this idea is applicable everywhere a larger group of hams can share a seldom-used piece of test equipment.

The next challenge, which is already with us, is from noisy computers and video games. Many of them are not state-of-the-art regarding their RFI properties. But rather than putting much effort in quieting often already-obsolete computers, I consider it more efficient to purchase new products without RFI problems. The Commodore CBM 64 personal computer is one example. Tests showed that it did not produce any RFI standing next to shortwave and 2-meter radio equipment and that it was immune to transmitter signals, too.

I am not considering the shielding and filtering at the ham transmitter site because I feel that state-of-the-art ham-radio equipment does not produce stray emissions which are significant in this context. In most cases, it is the (sometimes high-power) fundamental emission of our transmitter which causes interference in consumer products. These are designed at low cost and therefore often lack appropriate measures against RFI. Therefore, a great deal of our RFI reduction effort must be invested here.

In summary: In dealing with RFI problems, I think we are in a fortunate situation. We have a competent and respected FCC defining and upgrading RFI standards, an industry which offers a broad line of RFI-suppression products, an amateur-radio organization providing tools for the investigation of RFI cases, and an almost unlimited choice of consumer products like computers, radio/TV sets, video games, electronic organs, etc., with often similar performance but sometimes different RFI characteristics. It is up to us to make the best use of it. In the long run, it will be most efficient to promote the purchase of consumer products known to be RFI-resistant and noise-free in the private as well as in the business sphere. Nevertheless, the RFI-filter industry still will have bread and butter for years to come.

GREAT BRITAIN

Jeff Maynard G4EJA
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Widnes WA8 9RP
Cheshire
England

THE UK SCENE

The impending arrival of cable television in the UK may not cause the interference problems to radio amateurs that have been the case in the United States, with leaky cables and poor joints radiating in the 2-meter and other bands.

The guidelines for prospective CATV franchise holders published recently by the Home Office specified a number of prohibited frequencies and others with strictly limited radiation levels. The prohibitions apply only to military allocations; however, the 145-MHz (2-meter) and 430-MHz (70-cm) amateur bands are specified for a maximum emission from CATV systems of – 26 dBmV.

Systems conforming to this are unlikely to cause too many problems to amateur stations. But for once, the news is better. BICC, the multinational cable-making and construction group with extensive interests in the development of cable television, has proposed a spectrum plan that recommends no signals of any level be propagated in either the 4m, 2m, or 70-cm bands—this even though 4m (70 MHz) is not a restricted zone.

The use of the 10-meter band for local or mobile FM is to be encouraged if only as a means of keeping this band occupied during the period of minimum sunspot activity and poor propagation. For some time, activity has concentrated around the de facto simplex calling channel (there are no 28-MHz repeaters in the UK) of 29.600 MHz.

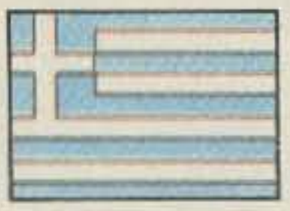
However, the situation shows signs of generating problems for other longer-established 10-meter users. CB rigs covering 27.6–28 MHz (and using the UK modulation requirement of FM) are readily available and readily convertible to cover a large portion of the 28-MHz band in 10-kHz steps (they also provide a path to 10-meter FM that is cheaper by several orders of magnitude than purchasing a custom ham kit).

The problem arises when the rigs are modified to cover 29.3–29.7 MHz, which includes the downlink for mode-A satellite working. Not only are signals from space usually quite weak, but being sideband or CW, they are difficult (usually impossible) to resolve on an FM rig. I have experienced an FM signal preventing the completion of a QSO via RS8, and with my limited power, only high overhead passes are really workable. I have tried waiting for the satellite to pass and then calling the FM station directly, but my SSB or CW signal is just regarded as interference!

An internationally-agreed recommendation for an FM subband (simplex and repeater) needs to be introduced before the situation gets out of hand.

I have mentioned previously my interest in RTTY. One aspect of RTTY listening that occupies a lot of shack time is the printing of meteorological bulletins (it really is amazing just how much information is transmitted around the world day and night). I even have a license to receive such transmissions, together with meteorological facsimile for which I am also equipped. And all for the princely sum of $7.00 *for life!*

I discovered only yesterday that the UK Meteorological Office transmitting from Bracknell includes, amongst reams of synoptic reports, some very accurate information relating to NOAA 7 and 8 orbits. I am currently seeking details for the decoding of this info which, unfortunately, is not given in the Meteorological Office "blue book," which is the basic decoding reference.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

ARDF IN GREECE

ARDF in Greece is something unknown. So you might start wondering why I picked this subject for this month's column. Well, here is why, and I hope you will enjoy the story.

See List of Advertisers on page 114

About one and a half years ago, Athens had only one VHF repeater (R1) and you can imagine how important it was for us. The repeater was working fine until the evening of August 15, 1982. The 15th and 16th of August were holidays, so everybody was out and the city was almost empty. On that evening, a steady carrier appeared on the repeater's input frequency and, of course, after three minutes the timer forced the transmitter to drop off. That was it. Athens' repeater was blocked.

It took us quite a while to understand what was going on, because on the one hand, the signal in the input wasn't that strong really, and on the other hand, such a thing had never happened before. With the darkness, there was nothing we could do.

Next morning, the repeater was still off, and after some phone calls, a group gathered at the area the signal was coming from—on the very same mountain the repeater is on. So SV1EM, SV1GH, SV1JZ, SV1OE, and SV1PH started searching for the intruder. In about one hour's time, they found it. It was a crystal-controlled oscillator on a small PC board with 8 C batteries, a stabilizing IC for the power supply, and a 1/4-wave whip for the antenna. The unit was very close to the main road leading to the repeater's site, behind a big stone.

This was the first taste of ARDF for Greek radio amateurs. Although there were many thoughts about the event, no more attention was paid to it until September 9, 1982.

On that day, R1 was in trouble again. This time the smart boys were even smarter. The carrier was on for 1/2 second every 3 seconds. R1 was on all the time. Imagine how it was to monitor the repeater waiting for a call, listening to the darned thing making like a machine gun. After our first surprise, we started turning the beams to locate the carrier, but there was nothing we could hear. The next day, a team consisting of SV1DC, SV1DS, SV1EX, SV1GH, SV1IW, and SV1KA were on top of the mountain again. If there was a place where you could hear the carrier, it was the repeater site itself. A 9-element beam was brought, and the direction of the carrier was marked on a map.

It was obvious that the signal was coming from outside Athens, but how far? We decided to cover as many areas as we could before dark. SV1AN and SV1AS were soon with us for a common effort. For three or four hours we were searching every place we could go, either driving or walking where driving was impossible.

With a big amount of luck, just a little while before dark we found the area of the beacon (within a square mile) some 10 miles outside Athens, and the next morning SV1AN, SV1DS, SV1GH, and SV1PA, along with two police officers, were in the area again. It took a little while to discover the device, which was hidden in a bush. This time the transmitter was commercial (the transmitting board of a Kenwood 2200 G portable transceiver). There was also a timer determining the on-and-off state of the unit. For the power supply, they had a truck battery with 145-Ah capacity! The whole thing except the antenna and battery was in an ice cream box.

If you think that was all, you are wrong! Although for some time there were no problems, suddenly one day we heard again something feeding into the repeater's input. But, hmmm! This time it was a moving problem!

From that day, the signal was on almost daily, one time for one hour, some other times for two or three hours. Of course, R1 was off after the first three minutes. Our beams were useless since in Athens there is nothing you can do with all the buildings and the deflections on them. We had to find something else. So, we decided that every time there was a positive indication about a particular direction, a team with as many people as possible from nearby areas would search for the car with the beacon on. We chose some channels on the UHF band as links between the people who would be searching and the officials of RAAG, just in case some directions had to be given back and forth. If immediate action was needed, then the telephone was recommended.

As the days passed by, ten times we were close to finding the car, but always at the last minute the bird had flown. We were getting nowhere, when all of a sudden one evening I received a phone call from Gus SV1DC: "Come quick to the Glyfada's police station!" (The place is near the airport of Athens.) The next minute I was on my way.

Arriving at the police station, I found Gus waiting for me, and he explained shortly the situation. Earlier the same evening, Gus had been near the area for a job when he noticed the carrier at the repeater's input. So did SV1LA, who was very close to the area, and they started searching. Quite soon they located the source of the signal, which was not on a car but . . . on a motorcycle! At a glance I saw a 50cc Honda in the yard of the police station. A closer examination revealed some more details. The antenna was a small wire, almost invisible, coming through the windshield. The radio, a KDK 2050, was in a small box behind the driver's seat, and a small cable was transferring the PPT very close to the accelerator. Now it was clear why we couldn't locate the car. There wasn't any car to locate!

Now you are probably convinced that SV radio amateurs have a lot of experience in ARDF. Who knows, maybe there will be another chance to improve our experience in the future!

INDIA

Amateur Radio Society of India
10 Box 3005
New Delhi 003
India

NEWS FROM INDIA

During the three months of January, February, and March, 1984, a station with the commemorative callsign AT0A will be operative from the Antarctic. QSL info via Dr. Ashutosh Singh VU2IF, DXCC, PO Box 4015, New Delhi 017, India. Presently, "Ashu" VU2IF is on board the ship *Fin Polaris* (callsign OIGW), operating as VU2IF/MM on SSB around 14150 kHz.

Permission to operate commemorative callsign VU7WCY during December, 1983, was granted by our authorities, applicable to any VU station. Each station was to issue his QSL info upon reaching the Laccadive Islands. (Similar permission for the Andaman Islands operation has not been received, so far.)

ITALY

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Via Bevignani, 18
00162 Rome
Italy

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milano
Italy

ITALY'S ERE RIGS

Many of us could believe that the only producers of equipment for amateur use in the world are Japan and the United States. That's not right! In Italy, a small but very technically-advanced firm, ERE (Equipaggiamenti Radio Elettronici) produces state-of-the-art radio equipment for commercial, military, and amateur use.

The first ERE jewel is a rig called HF200, an HF transceiver for amateurs which boasts design ingenuities and on-the-air performance equal to many rigs made in Japan or in the US. This lightweight (6 kg) and compact (268mm W, 117mm H, 290mm D) transceiver is suitable for mobile or base-station use, and its price is really affordable.

The HF200 is completely solid state and may be completed with options like the AL-S/200 external power supply and speaker, the VFO 200E, and a solid-state 1000-W power amplifier, LHF-100ST.

The most interesting feature of the receiver is a revolutionary tuning system developed by ERE: The main tuning knob has a limited turning range clockwise and counterclockwise, and within this range it acts as a spread-band tuning knob. At the right and left end of the ranges the knob activates two microswitches which start an up or down frequency scanning, whose speed is selected through a slow-fast on-the-panel selector. The tuning frequency is read on a big digital display. The receiver is a single-conversion superhet, and the 9-MHz i-f is equipped with two eight-pole filters. The front end boasts very good overload resistance with the use of a high-collector-current rf transistor amplifier and Schottky-diode balanced mixer. The receiver is equipped also with af filters for CW and SSB and has an optional adjustable-level noise blanker.

The transmitter is also solid state, and the power-output keydown is 100 W.

This dynamic Italian firm produces also a very updated three-band (144, 432, and 1290 MHz) transceiver, the Kontact, which will be described in a future column, and a complete line of amateur-band antennas ranging from three- and four-band yagis and dipoles to an outstanding seven-element log periodic for 10- to 30-MHz frequencies.

For more information, you may write to Equipaggiamenti Radio Elettronici, Via Garibaldi, 115, 27049 Stradella, Italy.

HAM RADIO IN SAN MARINO

The first active ham from the Republic of San Marino was the late M1A, Prof. Corrado Francini, who was followed by Mario Graziani M1B. Mario, in the post-WWII days, was active mainly on 7-MHz phone.

Following inquiries by amateurs in the United States, your columnist, who then had more hairs on his own head and held the call I1PL, together with his friend Stelio I1HR, made the first DXpedition in S. Marino and put for the first time the M1 call on the DX map. The expedition was a great success and made happy a big bunch of DXers. The number of QSOs was not astonishing, but we were in 1948 and we ran 60 Watts input into a random-wire antenna! "Never before has so much rf been pumped in one direction on one frequency in the 14-Mc band," had to remark *QST* in its 1948 October issue, reporting the great happening!

The tiny republic, 38 square miles, about 20,000 inhabitants, atop Mt. Titano in central Italy, claims to be the oldest republic in Europe, being established since 1231. Despite the fact that every stone and every mountaintop there recalls old stories of savage wars, knights, and lovely mistresses, the Republic of S. Marino has today an advanced economy with industries and commercial traffic, due to the initiative of its dynamic citizens. There is also a noticeable tourist

HF200 SPECIFICATIONS

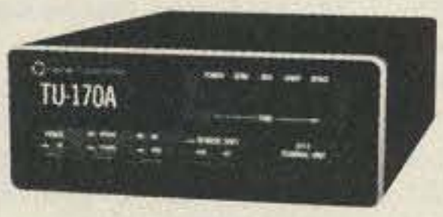
Frequency coverage	5 bands: 3.5–29 MHz (The latest models have provision for the new WARC bands.)
Receiver sensitivity	0.3 uV,10 dB S + N/N
Receiver selectivity	SSB 2.4 kHz/ – 6 dB, CW 500 Hz/ – 6 dB with CW filter
Image attenuation	100 dB
I-f attenuation	100 dB
Intercept point	+ 2 dB at max sensitivity
Transmitter input power	200 W input K.d.
Carrier suppression	50 dB
Unwanted S-band supp.	50 dB

T77C (ex-M1C) in his shack.

RTTY

TU-470
- Full featured RTTY to 300 baud plus CW terminal unit.
- 3 Shifts, active filters, remote control, xtal AFSK, FSK, plus much more.

Suggested retail price. . **$499.95**



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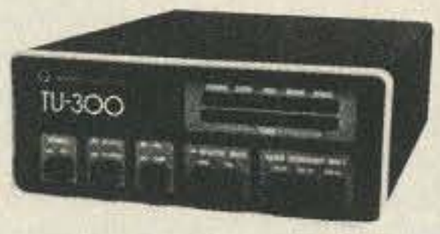

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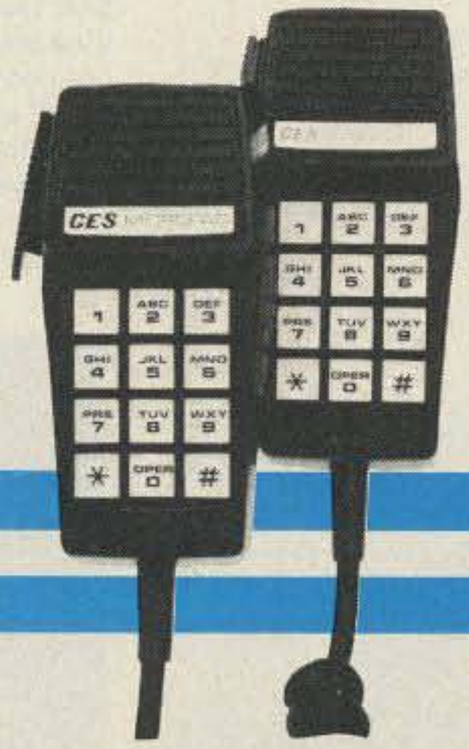

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✓462

traffic there; thousands of people come to visit the ancient monuments and to enjoy the wide vistas to the Adriatic Sea.

Amateur radio is also very active on Mt. Titano: It's ruled by the Telecommunications Department in the person of the Department Deputy himself, and by the Director of the Post Office. Just recently a proposal for official rules has been issued, which will be ratified soon.

Some years ago, the S. Marino hams founded the ARRSM (Associazione Radioamatori Repubblica S. Marino), which became a member of IARU January 30, 1981. The ARRSM president is the senior radioamateur of the group, Mario Graziani T77B (formerly M1B), and Tony Ceccoli T77C is the dynamic secretary.

(The old and unofficial prefix, M1, became the official T7 in April, 1983.)

Actually, there are 10 licensed amateurs in S. Marino, but there is also an eleventh station, the official radio club's T70A, dedicated to the memory of Corrado Francini M1A. This station will be active only once per year for some time and eventually, guest operators will be admitted only on an invitation basis.

The well known DX man Tony T77C (formerly M1C) is the most active HF operator from there. He is likely to raise tremendous pileups when his husky signal appears on the bands. Tony has been active for 10 years, and his log sports more than 82,000 QSOs, an average of 8.2K QSOs per year! That's not bad for a rare country like S. Marino!

Tony holds a 5BDXCC, a WAZ, and a WAS award; he needs only one card to be elected in that DX Olympus called Honor Roll. Everybody who has met him was delighted, finding a very friendly and modest boy. He is a real CW enthusiast, and his effort giving a new country to as many hams as possible around the world is confirmed by the fantastic number of 15,000 QSOs made in 1982!

L to R: T77B (ex-M1B), T77I (ex-M1I), T77Y (ex-M1Y), T77J (ex-M1J), and T77W (ex-M1W).

The T77C rig is a TS-820S followed by a kW home-brew amplifier, and the antenna is a rotary two-element delta loop for 10, 15, and 20 meters. He uses some dipoles for the LF bands and has started to experiment with the 160-meter band. Boys, keep your ears open for a very rare one on the top band!

Another very active ham from S. Marino is Peter T77V, who started his activity on the HF bands three years ago. He runs a TS-830S to a three-element tribander yagi and has also a 7-MHz loop and a 3.5-MHz inverted vee.

Two stations which are active on 144 MHz from Mt. Titano are T77J and T72ZR. Look for them, as their signals should have a very long span from those heights.

QSL cards for the S. Marino crew should be sent to the Radio Club S. Marino, Post Box n. 1, 47031 S. Marino Citta, Repubblica di S. Marino.

The addresses of the most active HF stations are: Antonio "Tony" Ceccoli T77C, Via Carrare, 67 Pennicciola, 47031 Repubblica di S. Marino, and Piergiovanni "Peter" Volpinari T77V, Via G. Giacomini 507/54, 47031 Repubblica di S. Marino.

Should you happen to travel in the neighborhood of Mt. Titano, please don't miss meeting the T77 boys. You will have a friendly welcome, and atop there you will enjoy ancient atmospheres, great sights, and last but not least, a great white wine together with fantastic Italian foods.

de I0XXR

BLUE TEAM DXPEDITION

It all started at the end of 1982 when the group of Italian DXers that founded the DX Blue Team under the presidency of Sergio I2JQ decided to organize a couple of expeditions: one for UHF and SHF and one for HF enthusiasts.

For the first choice, it was very easy to convince I0SNY to organize it. In fact, he went to North Africa and managed to get the world record on 1.2 GHz and on 10 GHz. On top of it, he gave to many Europeans a new one from EA9, and from CN on 432 and 1.2 GHz.

More problems were found where HF was concerned. It was difficult to find a place not too difficult, from a logistical point of view, and interesting enough for the DX community. We managed to choose three countries and started to work on getting the authorizations to work from there. The BV authorities replied to us granting permission for a 10-day operation from Taipei and offering us the assistance of the CRA.

BV represents a really good target for many DXers, and we happily started to work on it. The story of the preparation of the trip is long and not too interesting, but at the end of it we were on a plane that was landing in Taiwan.

Custom problems didn't allow us to clear the goods immediately so we left the equipment in a bonded warehouse and met for the first time Tim Chen BV2A/B at the Taipei international airport. It was Sunday afternoon, September 18, and Tim's warm welcome was a prelude to all the assistance that he was ready to give us, and he really did it.

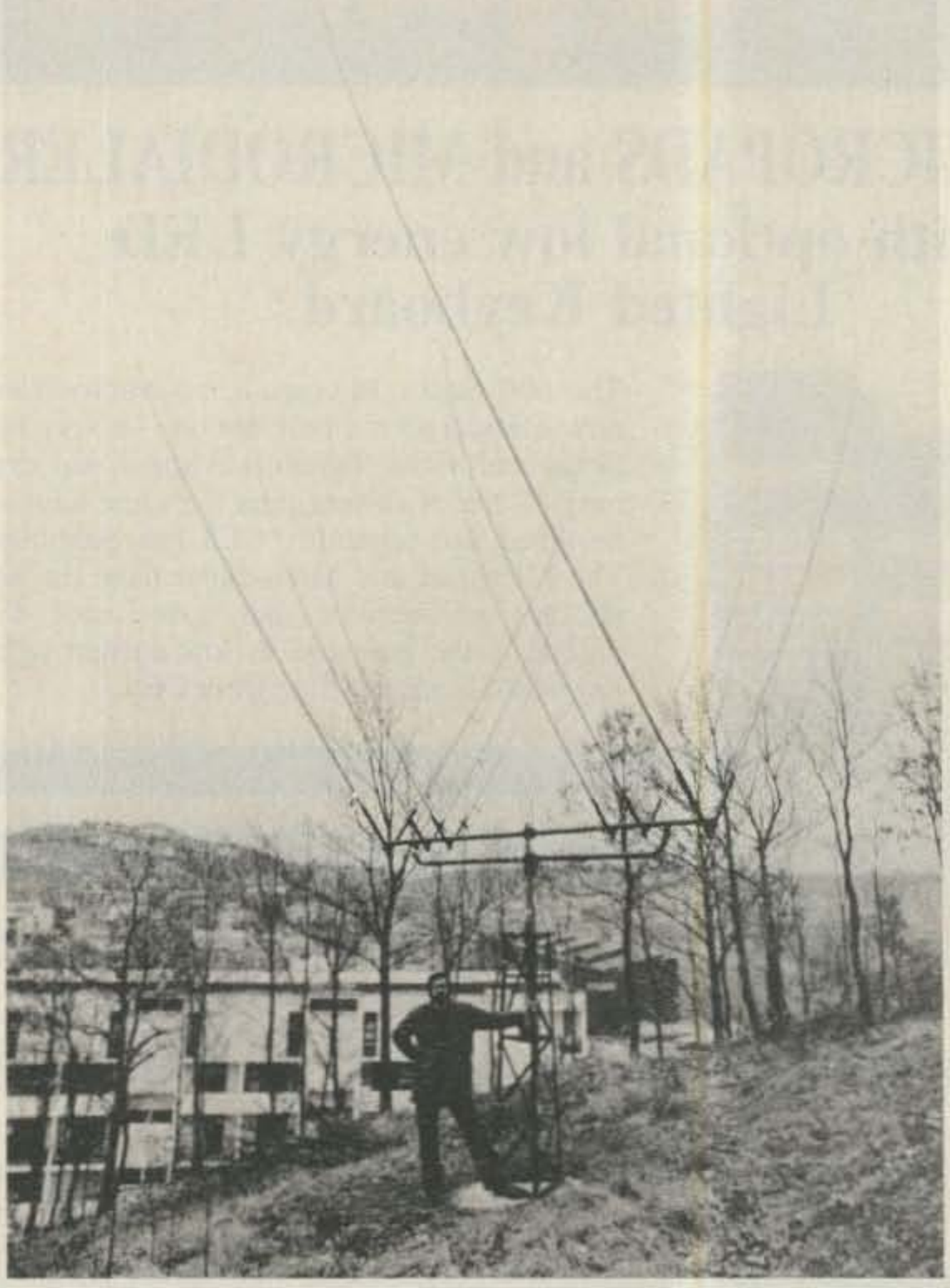
At the hotel another surprise: a group of members of the China Radio Association was waiting for us. It was our idea that Tim was the only ham in BV—not only the only active one, but also the only one interested in radio! That was not true. We had the opportunity to meet a few oldtimers and a few young fellows waiting for the local authorities to release more licenses.

On Monday, September 20, after getting all the papers to clear the rigs and be allowed to operate, we were able to put up a 12AVQ and start operations. The propagation was not too good up to midnight, local time, when the band opened to Europe, and we had the opportunity to work a few hundred stations.

On the 21st, I was in charge of the operations and, after putting up a 2-element tribander, I started to work Japan on 15. In the afternoon, the band was starting to be very good on 20. I had a good opening with VK and ZL and later on with South America. It was like being able to see the grey line moving from the South Pacific to the lowest part of the American continent and then up to the Caribbean area.

After that the first signal from the United States, Bill K1MM calling me. I worked him and a few others, but not too many Ws were on frequency. Bill called me again and told me that he was passing the message on the local repeaters, so it was just a matter of a few minutes to get a

Continued on page 132



T77C's 2-element delta loop antenna.

In the shack are BV2B, Marco I2NYN, Mario I2MQP, and Enzo I2BVS.

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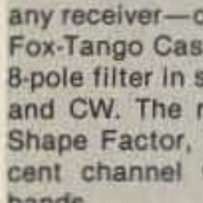

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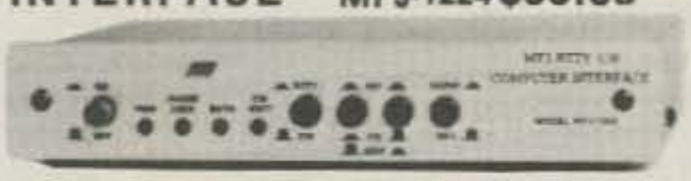
RTTY/ASCII/CW COMPUTER INTERFACE MFJ-1224 $99.95



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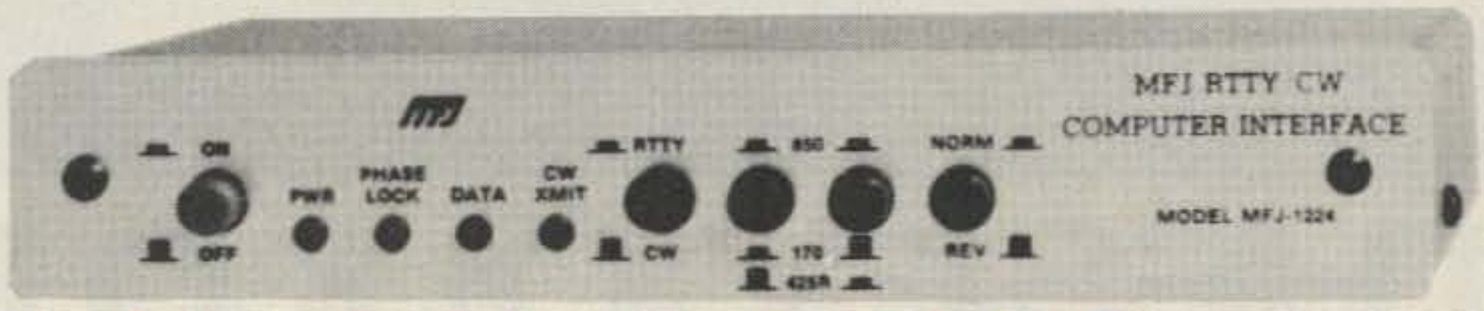

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Take the Two-Tone Challenge

Does your transmitter put out a clean signal? Build this two-tone audio generator and find out.

A "Two-Tone Test" is generally acknowledged to be the most convenient and accurate method of checking the adjustment and operation of an amateur SSB transmitter. Improper bias, nonlinearity, overload, and spurious oscillations are all revealed by this method. Two-tone testing also has the advantage of testing the whole system from microphone to antenna. If there is no frequency instability, a transmitter showing a good two-tone test is almost certain to radiate a high-quality signal.

A two-tone test signal can be produced with a single audio tone by inserting the proper amount of carrier to provide the beating frequency. This arrangement is somewhat awkward at best, and many transmitters have no convenient provision for inserting specific amounts of carrier in the SSB mode. An audio generator that will produce two audio tones and can be plugged into the microphone jack is an excellent method of setting up for this test. Such a generator is not complicated or expensive; it can be constructed in an evening or two, and every part and piece is available at your local Radio Shack store.

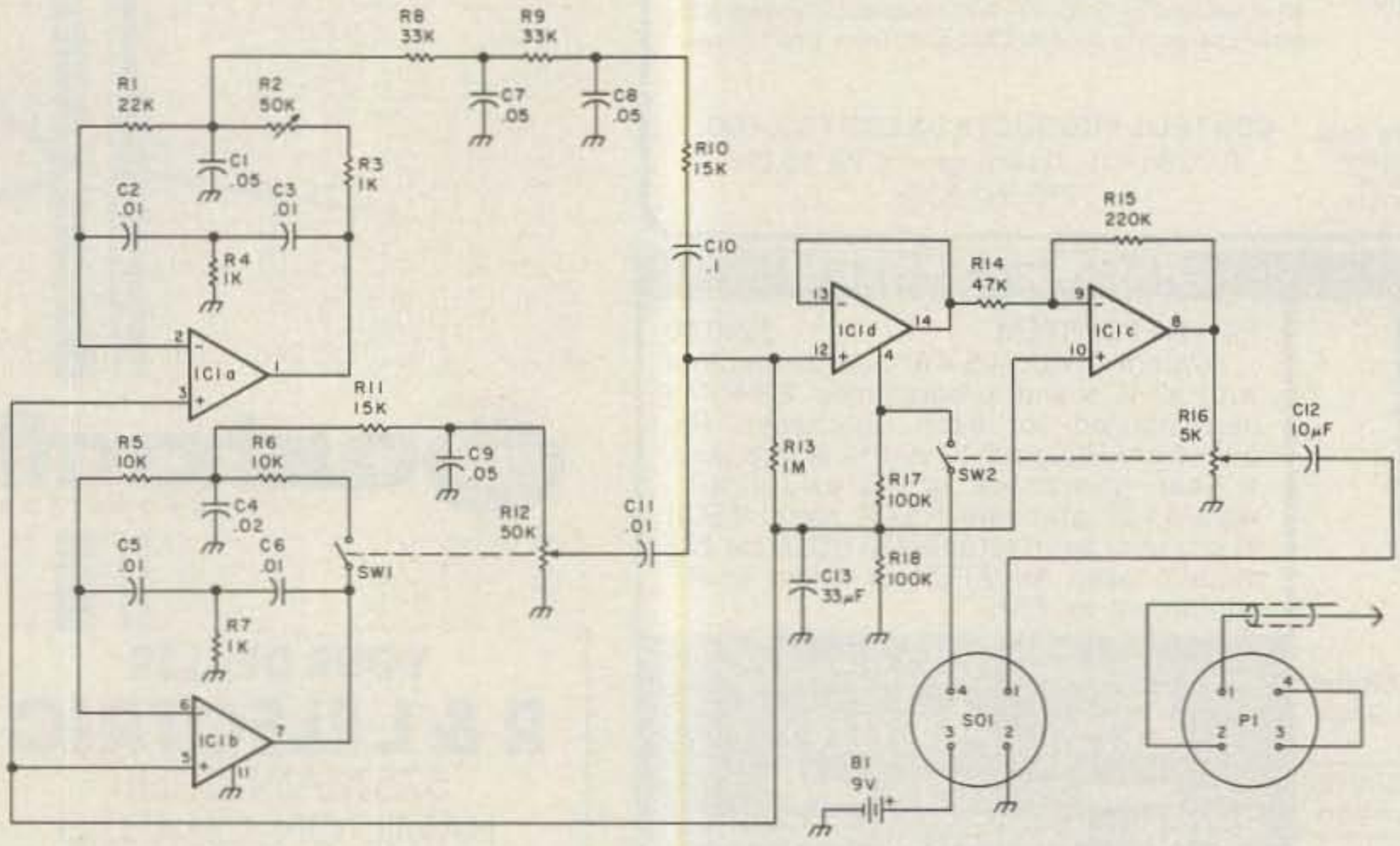


Fig. 1. A versatile two-tone generator.

Circuit Details

The only active circuit element in the generator is IC1, an LM324 quad op amp. One section of the chip (IC1A) is connected as a twin-tee audio oscillator. This is a very simple circuit, the basic oscillator consisting of the op-amp section, three capacitors, and three resistors. The 50k potentiometer, R2, is used to vary the frequency of this oscillator over the range of 440-1750 Hz. The 1k resistor, R3, places a lower limit on the effective resistance of R2. This ensures that the oscillator will run at all settings of R2.

This rudimentary method of changing the frequency of the oscillator by varying only one resistor results in the oscillator output increasing in amplitude as the frequency is increased. Ad-

vantage is taken of this characteristic in the double-section RC filter following the oscillator. The filter cleans up what distortion is present at the oscillator output, and the increasing attenuation of the filter at the higher frequencies compensates for differences in oscillator level. The result is a nice sine wave of nearly constant level at the output of the filter.

The second section of the chip (IC1B) repeats the circuit of the oscillator just described but without the variable frequency feature and with circuit values selected to give a fixed frequency of 1775 Hz. A single-section RC filter is used for this oscillator. This results in less attenuation, ensuring that the signal level on the balance potentiometer, R12, is always greater than that of the first oscillator. R12 is used to set the amplitude of the second oscillator to equal exactly that of the first oscillator.

The signal from both oscillators is now applied to the noninverting input of opamp section IC1D. This section is connected as a voltage follower. It provides no gain but has a very high-input impedance. The voltage follower is followed by an amplifier stage (IC1C) to raise the level to the output connector.

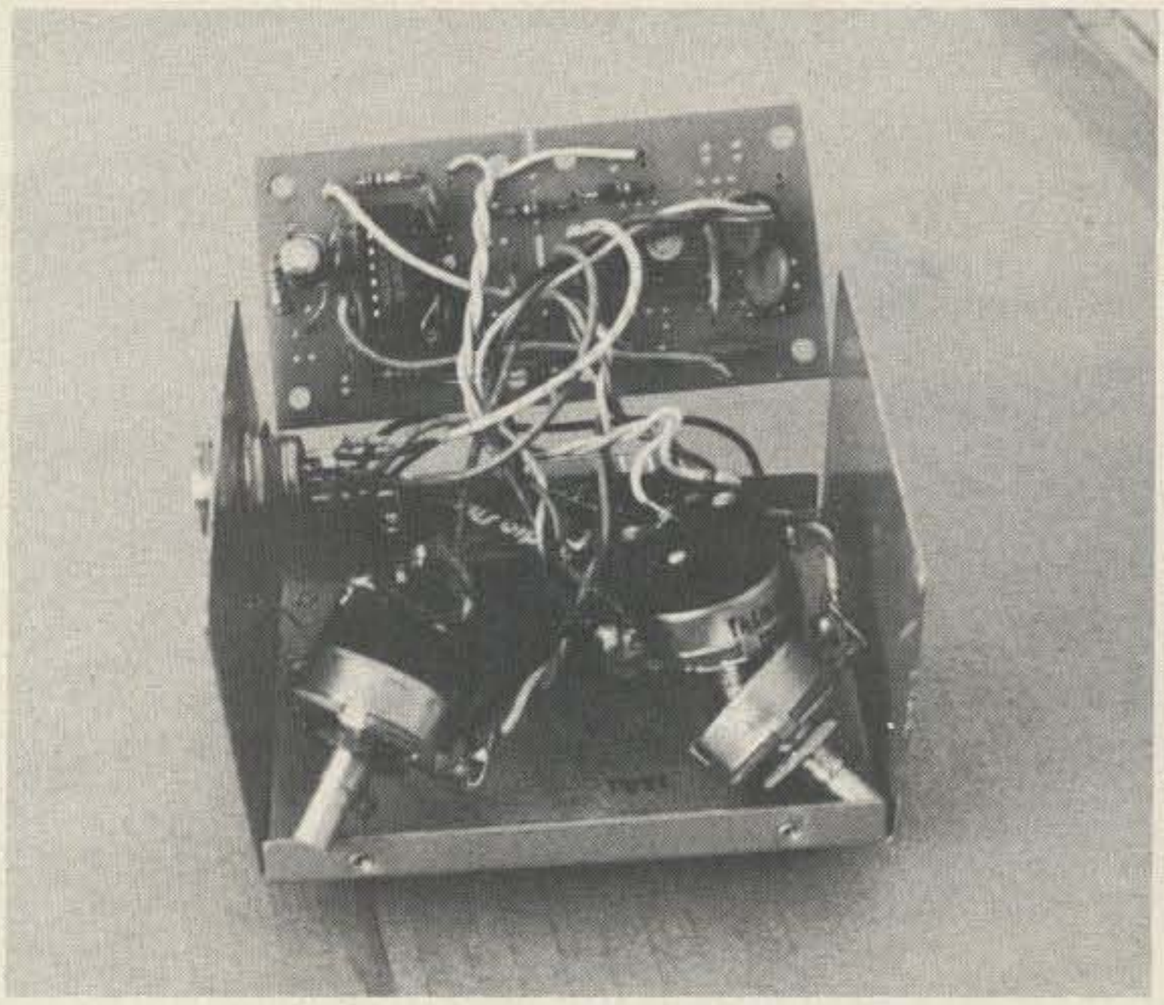
The second oscillator has a switch, SW1, ganged to the balance control. When the balance control is turned fully to the off position, opening SW1, the second oscillator is disabled while the first oscillator output is still available at the output connector. It now functions as a normal audio generator over its frequency range. This additional feature is quite useful as the waveform is good, with a maximum output level of 400 mV peak-to-peak.

Construction

The generator was constructed on a printed circuit board available at Radio Shack stores. (They list it as a "Dual IC board"; see Parts List.) Since this board is very slightly too long to fit properly in the housing specified, it is suggested that about 1/32" or so be filed from each end of the board before construction is begun and the board fitted to the housing.

At these frequencies, layout is not critical. The board has provision for two 20-pin integrated circuits. As we are using only one 14-pin chip, there are plenty of tie points to which to run component leads. I found it convenient to mount the socket and position the chip so that pins 1 through 7 were toward the center of the board. As the two oscillator sections have the greatest component density, this positioning allowed the oscillator components to spill over to the otherwise-unused section of the board. There are enough pads and holes to give each component lead a home, and with a little planning ahead, a neat layout can be achieved.

A few words for the inexperienced: In planning the layout, make an effort to have the physical components follow the layout of the schematic as well as you can. This makes troubleshooting less confusing. Although it is nice to see all resistors lying flat on the board, do not be afraid to mount them vertically if it is convenient or will improve the layout. With discretion, bare-wire jumpers may be used on the solder side of the board. For example, a wire jumper from pin 5 to pin 10 on the solder side of the board saves going all around the chip. I dedicated one of the center traces as a ground bus. Stranded wire is needed for the runs to the controls. The holes around the edge of the board are larger than the holes for components. Try to arrange to have the stranded wire to the controls go to these larger holes. Don't be ashamed of a few jumpers to get from here to there. When using an all-purpose board like this, a few jumpers are hard to avoid.



Component side of board, ready for assembly.

After all the soldering is done, there will be a considerable accumulation of rosin on the board. I scrape the heavier portions away with a small screwdriver and then spray the board with Rosin Flux Remover from Radio Shack (RS 64-2324). I use an old toothbrush to scrub away the remaining rosin and wipe the board dry with a cloth. You will be surprised at how much better the board looks. It is also much easier to spot solder bridges and poorly soldered connections when you have a nice clean board.

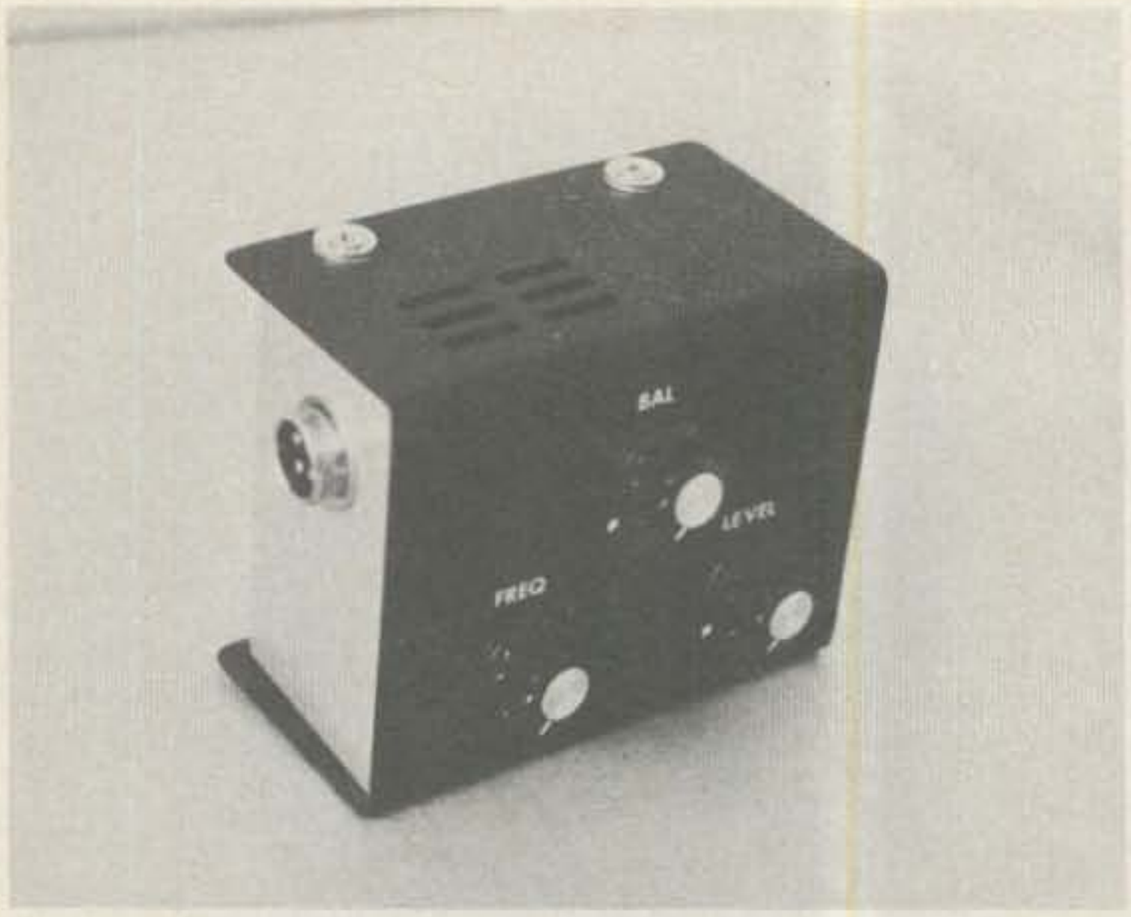
The physical construction requires little explanation. I used only two of the mounting holes on opposite corners of the board to mount it. I tapped the holes in the bottom of the housing and mounted the board on spacers, cutting the 6-32 screws to length so that they would not protrude more than a couple of threads through the bottom. If you use the potentiometers specified from Radio Shack, note that the mounting bushing is only 5/16" instead of our standard 3/8".

With the connector I used, there is no automatic grounding of the chassis. This allowed hum pickup, particularly while testing, when the chassis was separated. To alleviate this, I ran a wire ground to a lug on the screw holding the battery-clamp to ground the bottom section, and a short bare wire from the ground lug on a potentiometer, soldered to the shell of the potentiometer, to ground the top, or panel, portion.

The board specified is a very nice board. It solders well and seems quite rugged. With reasonable care, it is possible to remove and reposition components several times without any tendency for the copper to separate from the board.

Checkout

After the soldering has been completed and the board has been cleaned, the usual physical inspection for solder bridges and poor connections can be made. Before installing the battery, an ohmmeter check for a short on the supply rail is a wise precaution. With the battery installed, a voltage check on the IC socket will confirm proper supply polarity. Note that as the cir-



The finished product.

cuit is drawn, no power will be supplied to the board unless P1 is in place.

The IC can now be installed. With the level control full on and the balance control fully counterclockwise, a sine wave should appear on the output connector. If no scope is available, a pair of headphones may be used to confirm output. The tone should sound "smooth" and relatively low-pitched at one extreme of the frequency control, rising to a much higher pitch with the frequency control at the other extreme.

Advancing the balance control will cause the signal to become louder and change in character. If a scope is being used, the presence of both tones will be noted. Advancing the balance control to maximum should cause the scope pattern to more than double in height.

Should the generator fail to work, some troubleshooting is in order. The LM324 is a nice chip to troubleshoot since the output of each section is on the corner of the chip. A dc-voltage measurement should show the active pins of each amplifier section near half the supply voltage. A pair of high-impedance headphones with a capacitor of .1 μF or so in series with one of the leads makes a fine poor-man's signal tracer. There is nothing fussy about the circuit; it will work if there are no wiring errors or defective components.

Using It

A two-tone test is quite simple to set up. Use the monitor scope or service scope coupled to the output of the transmitter. Adjust the scope pattern for a convenient height while transmitting full-carrier. Now plug the generator into the microphone jack and key up the transmitter in the SSB mode. With the microphone gain at its usual setting, advance the level control on the generator to produce a scope display somewhat less than that obtained with the full carrier. With the balance control about mid-position, adjust the scope sweep or the generator-frequency control for a steady display. Adjust the balance control to achieve a sharp crossover between the individual cycles of the wave. Advancing the generator-level control will increase the height of the pattern until the tips of the waves just reach the height obtained when the carrier had been sent. Further increasing the level control should show flat-topping of the tips of the waves.

A scope will not synchronize as solidly on a two-tone test as it will on less complex waveforms. A change in level often will result in the pattern "running." As the audio generator is usually close at hand while the scope may be several

Parts List

C1	.05 μF, 50 V	RS 272-134	2/49¢	.25
C2	.01 μF, 50 V	RS 272-131	2/39¢	.20
C3	.01 μF, 50 V	RS 272-131	2/39¢	.20
C4	.02 μF, 50 V (two .01s in parallel)	RS 272-131	2/39¢	.39
C5	.01 μF, 50 V	RS 272-131	2/39¢	.20
C6	.01 μF, 50 V	RS 272-131	2/39¢	.20
C7	.05 μF, 50 V	RS 272-134	2/49¢	.25
C8	.05 μF, 50 V	RS 272-134	2/49¢	.25
C9	.05 μF, 50 V	RS 272-134	2/49¢	.25
C10	.1 μF, 50 V	RS 272-135	2/49¢	.25
C11	.01 μF, 50 V	RS 272-131	2/39¢	.20
C12	10 μF, 35 V	RS 272-1025		.59
C13	33 μF, 16 V	RS 272-1426		.69
IC1	LM324 quad op amp	RS 276-1711		1.49
P1	4-pin connector	RS 274-1		1.59
R1	22k, ¼ Watt	RS 271-1339	5/39¢	.08
R2	50k linear taper potentiometer	RS 271-1716		1.09
R3	1k, ¼ Watt	RS 271-1321	5/39¢	.08
R4	1k, ¼ Watt	RS 271-1321	5/39¢	.08
R5	10k, ¼ Watt	RS 271-1335	5/39¢	.08
R6	10k, ¼ Watt	RS 272-1335	5/39¢	.08
R7	1k, ¼ Watt	RS 272-1321	5/39¢	.08
R8	33k, ¼ Watt	RS 271-1341	5/39¢	.08
R9	33k, ¼ Watt	RS 271-1341	5/39¢	.08
R10	15k, ¼ Watt	RS 271-1337	5/39¢	.08
R11	15k, ¼ Watt	RS 271-1337	5/39¢	.08
R12	50k linear taper potentiometer	RS 271-1716		1.09
R13	1 meg, ¼ Watt	RS 271-1356	5/39¢	.08
R14	47k, ¼ Watt	RS 271-1342	5/39¢	.08
R15	220k, ¼ Watt	RS 271-1350	5/39¢	.08
R16	5k linear taper potentiometer	RS 271-1714		1.09
R17	100k, ¼ Watt	RS 721-1347	5/39¢	.08
R18	100k, ¼ Watt	RS 271-1347	5/39¢	.08
SO1	4-pin chassis socket	RS 274-2		.99
SW1	Potentiometer switch	RS 271-1740		.69
SW2	Potentiometer switch	RS 271-1740		.69
B1	9-volt battery	RS 23-583		1.19
1	14-pin DIP socket	RS 276-1999	2/89¢	.45
1	Battery connector	RS 270-325	5/99¢	.20
1	Dual IC board	RS 276-159		1.49
1	Utility cabinet	RS 270-251		2.99
3	Knobs	RS 274-415	4/1.59	1.20
				$21.36

feet away, it is convenient to adjust the frequency control on the generator to stabilize the pattern. Running the frequency control over its range will result in a number of patterns on the scope. They are all equally useful except when the two tones are harmonically related.

There is sufficient output from the generator to severely overload most microphone amplifiers. It is good practice to leave the microphone gain control set where it is normally used and to use the level control on the generator to set the level.

For those not familiar with two-tone test patterns and their interpretation, a page of pictures and a description of the test procedure is given in *The Radio Amateur's Handbook*. You should obtain a textbook pattern. Any departure from the proper display should be investigated.

As mentioned earlier, the generator can be used as a sine-wave audio source by turning the balance control fully counterclockwise. This feature can be quite useful to the ham who cannot justify the cost of an audio generator but who finds occasional need for an audio source. The frequency range, though restricted, does cover the range of frequencies most commonly used.

In Conclusion

I am quite pleased with the operation of this generator. I had gotten tired of rigging two audio oscillators to make checks on my homebrew SSB rig. Setting up for a test is now a snap! I also find that the ability to steady the scope pattern with the frequency control is very handy since my monitor scope is several feet from the rig. Add to this the economy of only 1-mA current drain and a total parts cost of under $25.00, and you have a useful gadget at a very attractive price. ■

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Build the NASA Beeper

Space-wise communicators use this device for one good reason: clarity.

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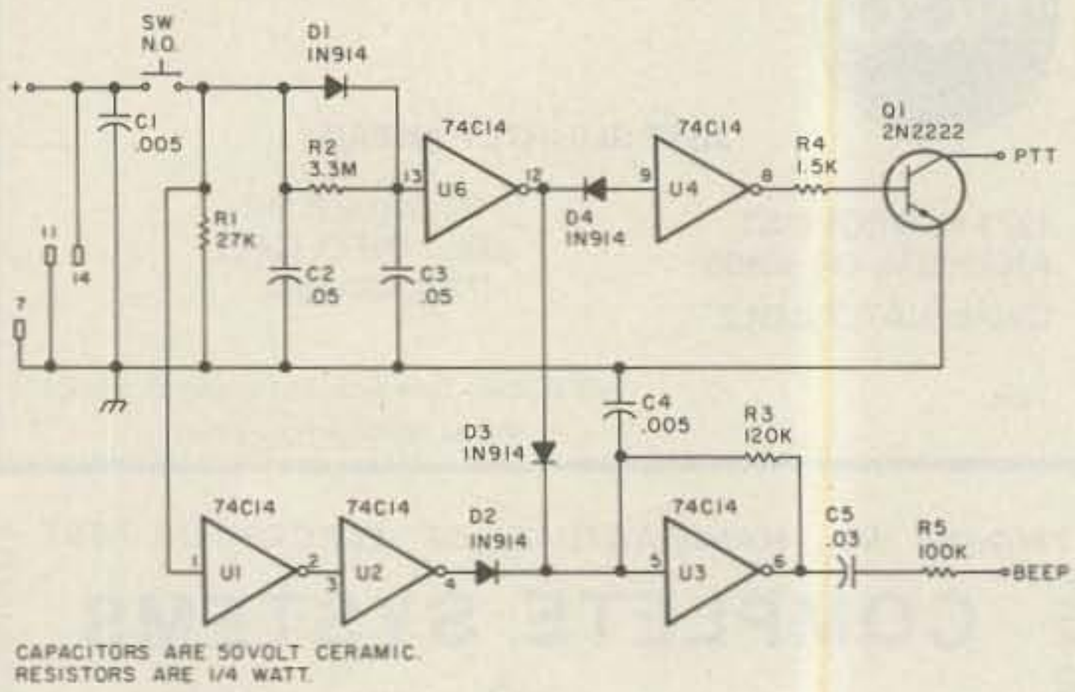


Fig. 1. Beeper schematic.

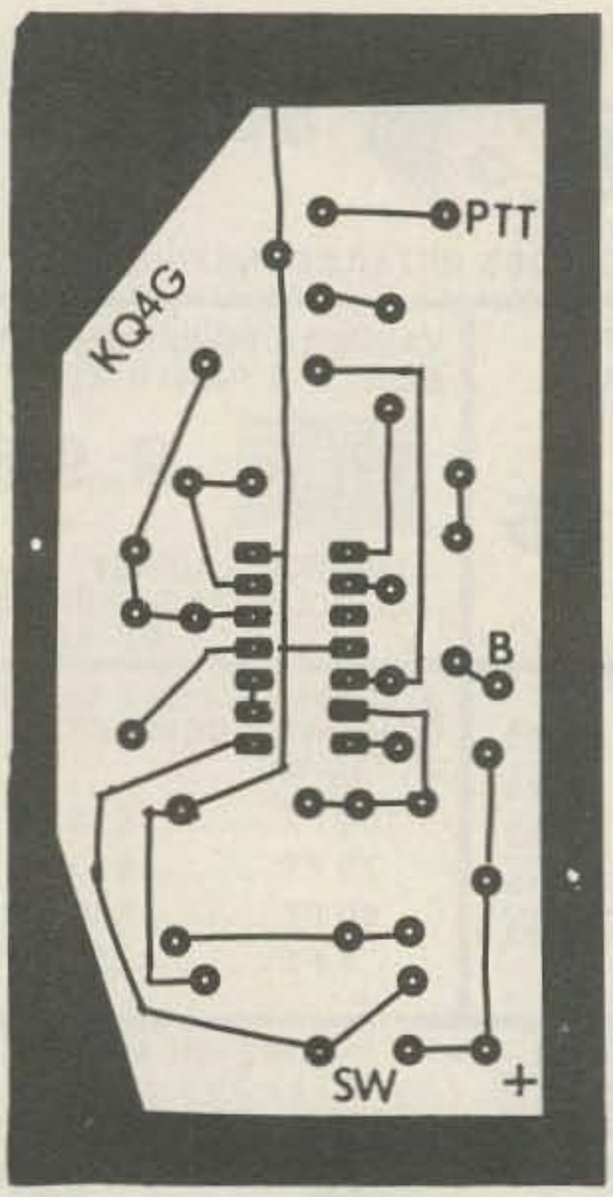


Fig. 2. Circuit board.

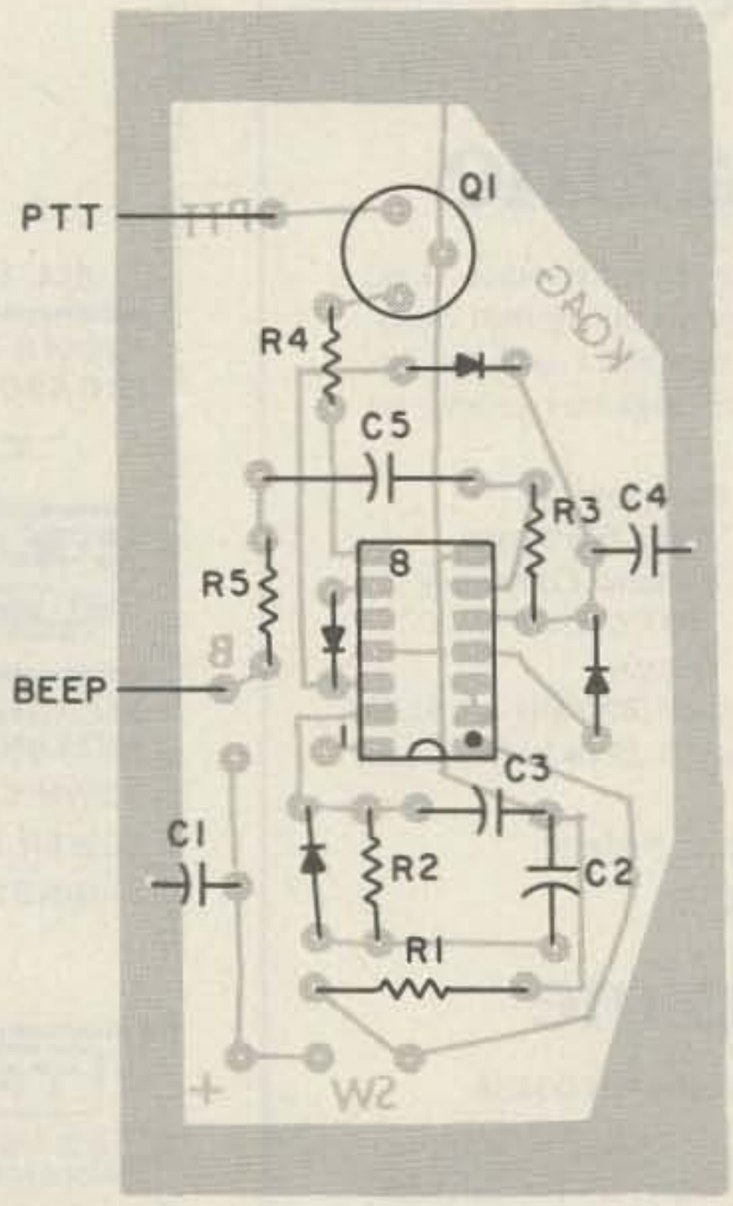


Fig. 3. Parts placement.

About three years ago, a friend sent me a circuit for a beeper that was being used in the Netherlands and by some of the ex-PA hams in the western hemisphere. It is used to insert a short tone at the end of a phone transmission, much as that used in communications with the astronauts. It was called the "Apollo Beep."

With the QRM we have on our crowded bands today, it is sometimes difficult to know when the other op has turned it over to you, and a beep can help. This beeper modulates fully, to the same level as a CW dash, and it stands out like the well-known sore thumb.

After constructing the beeper, I found that it worked quite well and accomplished its design purpose. I found this version rather cumbersome, however. It used six transistors, quite a few resistors and capacitors, plus a large capacitor across the transceiver-transfer relay to hold the carrier on until the tone had been transmitted. In some cases, a separate relay on the beeper board was used for this purpose, but the same objections still applied.

In the October, 1979, issue of *Ham Radio*, there appeared a circuit for a "K generator," designed by G8KGV. It inserted the letter K at the end of transmission. Shortly thereafter I built and installed that circuit, and it worked very well.

After some use, however, it seemed to me that this was gilding the lily. It seemed overdone. Also, several times the other op said to me, "I think there is a CW breaker in there!" Then it dawned on me that he thought my K was coming from elsewhere!

Back to the drawing board! After some head scratching and circuit-book consultation, the circuit shown here evolved. It requires only one IC (74C14), one transistor, 4 diodes, five resistors, and five capacitors.

Let's see how the circuit

works. When the switch is closed, positive voltage immediately is applied through diode D1 to U6, pin 13, and C3. U6 output goes low, U4 output high, and Q1 conducts, turning on the transmitter via the PTT line. At the same time U1 output goes low, U2 output goes high. U3, a relaxation oscillator, will not operate unless both D2 and D3 inputs are low. Therefore, at turn-on no tone will be generated.

When the switch is opened C3 discharges slowly through the 3.3-megohm resistor, R2, thus holding U6 and D3 low for a short time. Simultaneously, U2 output goes low and U3 oscillates for approximately one-half second, at which time C3 has discharged sufficiently to allow U6 output to go high and U4 output low, and Q1 shuts down and we are back in receive mode.

The use of the 74C14, a CMOS hex-inverting Schmitt trigger IC, allows the use of almost any supply voltage between 5 and 15 volts. Mine operates from a separate 10-volt supply that feeds several other auxiliary units such as an audio filter, electronic keyer, preamp, etc. The voltage can probably be taken from the transceiver. R5 may need to be changed to meet your audio-input level.

I feed the tone into the "phone patch in" on my TS-820. It can be fed into the normal mike input in parallel with your mike.

The circuit board is small and can probably be mounted in the transceiver. Bypass the switch leads with .01 capacitors to prevent rf causing erratic operation—although I have had no such problem.

This unit has worked without fail since installation and has been a pleasure to use. Questions will be answered if accompanied by an SASE. I'll be beeping you! ■

See List of Advertisers on page 114

George Brown WB4CHZ
186 E. Brooks
Memphis TN 38109

Sky Power

If you're a meteor-shower expert, don't read this. Otherwise, learn.

It's mid-August and two in the morning. With work only six hours away, the amateur radio operator creeps into the radio shack and begins flipping the switches that turn night into day inside the tiny room. Slowly the receiver is tuned to the agreed-upon frequency, the transmitter is adjusted, and the time is checked with WWV. Then the ham listens.

Nothing is heard, so he transmits during the allotted time; then he listens. Again nothing heard—but wait... out of the receiver comes a quick burst of CW: *de N4* ...The amateur carefully tunes the signal and again he hears CW: *de N4ABY/7*... With this rapid burst of radio energy, the receiving amateur springs to life; all thoughts of the time and the coming workday dissolve as he embarks on a meteor-scatter contact on two meters.

This is a typical scene at the homes of many VHF operators throughout the world during the annual Perseid meteor shower. I believe, however, that this scene should take place many more times during the year. As many of you may not be aware, there are several other opportunities each year to bounce your 50-MHz, 144-MHz, 220-MHz, and even 430-MHz signals off the trails left by meteors.

As a matter of fact, it was not even the Perseid shower that produced the very first 144-MHz meteor-scatter contact. Paul Wilson W4HHK reports that he made that very first two-way with W2UK 30 years ago. Wilson said, "In August we had a so-so contact, but it was not counted. Then in October, on one of the lesser showers, we did make a satisfactory two-way contact."

In all probability, this lesser shower that Wilson speaks of was the Orionid meteor stream.

Since meteor scatter can be a very productive form of long-distance VHF communication, you may wonder why it rarely takes place except during the Perseids. The answer to this question is quite simple: This shower is considered the best of the year in terms of the number of meteors occurring each hour and it provides the highest chance of a successful contact. However, there are a number of other showers almost up to the standards of the Perseids.

Meteor showers occur at a variety of times throughout the year. In fact, there are some 600 showers or streams known to exist. However, not all of the events are of use to radio amateurs. To be useful, the date of the shower peak should be known and the number of meteors occurring each hour should be rather high. After all, there is no point in trying to work meteor scatter when there are no meteors.

So we find that the Perseids are just one of many showers taking place each year. These showers occur when the Earth encounters chunks of nickel-iron and rock that are orbiting the sun. When one of these pieces of material (called a meteoroid while still in space) strikes the atmosphere of the Earth, friction between the meteoroid and the air causes the material to heat up and burn.

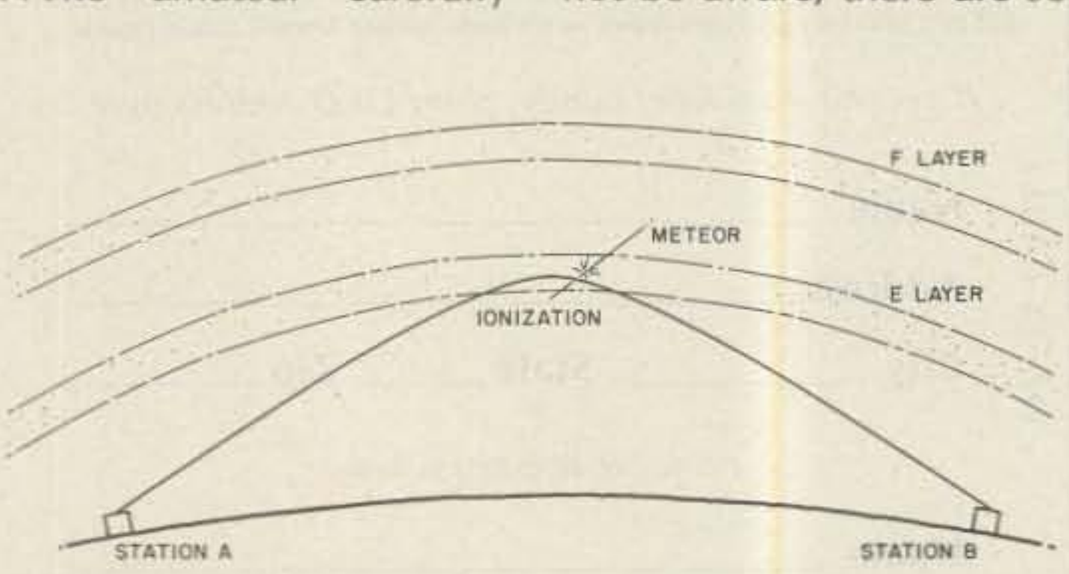


Fig. 1. Meteor-scatter diagram: As a meteoroid burns in the atmosphere of Earth, it leaves an ionized patch in its wake. If the ionization is intense enough, it may be capable of reflecting VHF signals, as shown here.

For the skywatcher, it is the tiny pieces of glowing material that are of interest since they are what produce the "falling stars" seen at night. But to the ham, it is the aftereffect of the meteor that causes the excitement.

As the meteoroid penetrates the Earth's atmosphere, it leaves behind an ionized trail that is sometimes capable of reflecting VHF radio signals. By bouncing signals off these trails, amateurs succeed in making meteor-scatter contacts. When attempting these contacts, hams should remember an important point: The frequency of the signal a trail is capable of reflecting is directly related to the density of the ionization.

Unfortunately for VHFers, it takes quite a meteor to produce enough ionization to reflect signals on 144 MHz and above. This is why attempts at meteor contacts occur during times when large numbers of meteoroids are entering the Earth's atmosphere—in other words, during a meteor shower. Fortunately, though, there are several chances each year to try to make these exotic contacts.

Of the 600 or so meteor showers that take place each year, there are seven events which may be of value to the VHF operator. While some of these showers are marginal, all should be capable of producing at least some contacts, and if you only need that "one more state," it may be worth your time to make a schedule on one of the dates mentioned.

During January of each year, the Quadrantid shower peaks on the 4th day of the month. This is a very short-lived shower, with the rise, peak, and drop-off taking less than one day. This very quick peak means you will have to be at the right place at the right time to take advantage of these meteors; however, of a more positive nature is the fact that this event produces about 40 meteor trails each hour.

The months of February, March, and April are relatively dull so far as meteor showers are concerned, but May takes a turn for the better. On the 4th of this month, the Eta Aquarid shower reaches its peak. Considered the best shower of spring, the peak varies slightly in time and the wise operator will schedule contacts for the 3rd and 4th. The point of origin of these meteors will be on the horizon at about 2:30 am, and there should be about 20 shower trails appearing each hour.

In June, there is a meteor shower that is not of much interest to astronomers but is potentially of great interest to amateur radio operators. The Beta Taurids, which peak on June 29th, produce a daytime meteor shower. This means that it is impossible to *see* the peak of the shower, but it is possible to utilize the peak for VHF communications. The best chance for catching these objects will be between 7:00 am and 12:00 pm local time. During these hours, the radiant of the shower will be rising in the east and moving to a point high in the southern sky.

After the Beta Taurids, it is almost exactly one month before the next good opportunity for meteor-scatter contacts comes along. This next chance is with the Delta Aquarid shower which peaks on July 28th. This shower should be considered seriously for meteor schedules since normally about 25 meteors occur each hour during the height of the event. In addition, contacts may be made one day before or after this shower's maximum since it is not sharply peaked.

The granddaddy of all meteor showers, the Perseids, takes place during August, and all meteor-scatter enthusiasts should be poised at their rigs ready to make contacts. The Perseids peak on the 11th, and between 50 and 60 meteors fall each hour. Like the Delta Aquarid shower but on a much grander scale, this is a rather long-lived event, and contacts should be possible one or two days before and after, maximum.

After the Perseids, nature takes a short break before it provides another really good shower. This comes in October, which offers a meteor stream that is notable for at least two reasons. First, this is the shower used initially for a two-meter meteor-scatter contact, and second, the meteors seen during this shower originate in the famous Halley's Comet. On October 20th, the night the Orionid shower peaks, VHFers can expect about 30 meteors each hour as the radiant rises in the southeastern sky.

Finally, December will provide the last big meteor shower of the year, but fortunately the year does go out with a flash. The Geminid meteor stream reaches maximum on December 14th, and it is always quite a spectacle for interested skywatchers. Since the shower produces almost 60 meteors each hour, it should also prove quite spectacular from a communications viewpoint. So, while the astronomers cool their heels watching for the meteors in the cold December weather, amateur radio operators should be able to make a few contacts in the warmth of their finals.

It is apparent, then, that there are many opportunities during the year to make a number of meteor-scatter contacts, and for the experienced operator, all that is necessary is to make schedules with other amateurs. But what if you have never made a meteor contact or don't even know what one sounds like?

The best approach is to find some ham who is making schedules and see if you can be in on some of the contacts. However, if no one in your area is active on meteor scatter, the next best bet is to find someone through one of the VHF-oriented publications or columns and make a schedule of your own. If the person you contact is an experienced operator, you should be able to get all the necessary information regarding proper procedures and techniques.

It should be apparent by now that meteor scatter can and should be a year-round activity. Those who have tried this mode of long-distance communication have found it to be quite exciting and very challenging, and for these amateurs, I hope the information provided will allow them more operating opportunities during the year.

For the beginner, I hope the knowledge that meteor scatter is not a one-time-a-year operation will provide the motivation to actually get on the air and make contacts. But remember, don't blame me for sleepless nights and rough days at work; blame Mother Nature for providing all the meteors! ■

Shower	Date	Remarks
Quadrantid	January 4	Very short-lived shower
Eta Aquarid	May 4	20 meteors each hour
Beta Taurid	June 29	Daytime shower
Delta Aquarid	July 28	Contacts possible ± 1 day
Perseid	August 11	Best shower of the year
Orionid	October 20	Originated in Halley's Comet
Geminid	December 14	Nearly as good as Perseid

Table 1. Shown here are the names of meteor showers of interest to amateur radio operators, the dates the showers peak, and comments concerning them.

H. F. (Bert) Viney VE3AZX
20 Abingdon Drive
Nepean, Ontario
Canada K2H 7M6

Wet Battery Quiz

And you thought you knew it all.

There is not much to ordinary wet batteries, is there? I mean, doesn't everyone know that all you do is charge them and discharge them? So you won't find this quiz a challenge? Right, so let's see how you do.

Here are ten statements. All refer to automotive-type storage batteries. Mostly they refer to batteries powering light loads—such as electronic equipment. Answer yes or no.

1. The best way of establishing state-of-charge of a battery is with a hydrometer.

2. An inactive battery should be kept on trickle charge.

3. A 100-Ampere-hour battery can be discharged at 10 Amperes for 10 hours.

4. You cannot tell the state-of-charge of a battery by measuring its terminal voltage.

5. Batteries stored on concrete floors will be damaged.

6. Initial voltage and open-circuit voltage are the same thing.

7. If the specific gravity of an older battery is low, add battery acid to bring it up to 1.300.

8. Only "marine" batteries should be used on boats.

9. Connecting two batteries in parallel will double the power available.

10. Impregnated felt washers on battery terminals will prevent battery corrosion.

Nothing to it, right? Want to try your answers against mine? Read on.

Batteries are interesting, even fascinating, perhaps because so little is known about them—or maybe because so much is "known." Every writer has his own rules and opinions. In a situation like this, it is wise to balance theory against practical experience. So that is what these answers are based on—a synthesis of "book larnin" and practical experience.

1. Hydrometers. Most books have this old chestnut—and it is true as long as you are talking about new batteries. However, as a battery ages, it loses its ability to raise its specific gravity, no matter how long it is charged. This does not mean that the battery will no longer serve its purpose. In addition, the hydrometer is a hazardous nuisance.

Battery acid is highly corrosive and its corrosive power lasts a long time. The better way of identifying level-of-charge is by combining battery voltage and current readings.

If either voltage or current can be regulated—that is, kept constant—then the second factor will indicate full charge when it reaches a constant value for one hour.

As a practical example, an ordinary 6-Amp unregulated charger will have fully charged the battery when terminal voltage reaches about 14½ volts.

Another indication of full charge is the amount of bubbling (gassing) you can hear from the battery. Stop the charge when bubbling becomes obvious.

2. Inactive batteries. Before the day of "dry-charged" batteries, ready-for-sale batteries in stores were kept under constant trickle charge. Some authorities today are against trickle charging on the grounds that it causes "sulphation." In other words, battery capacity will decline due to formation of inactive material on the plates.

My own experience is that as little as ½ Ampere will cause the electrolyte to boil away in a couple of months. We have to qualify this theory with the experience of North American telephone companies. The telephone companies have more batteries in service than any other user. Most of their batteries are on constant-voltage trickle charge continuously. They use two main types of batteries, low specific gravity and high:

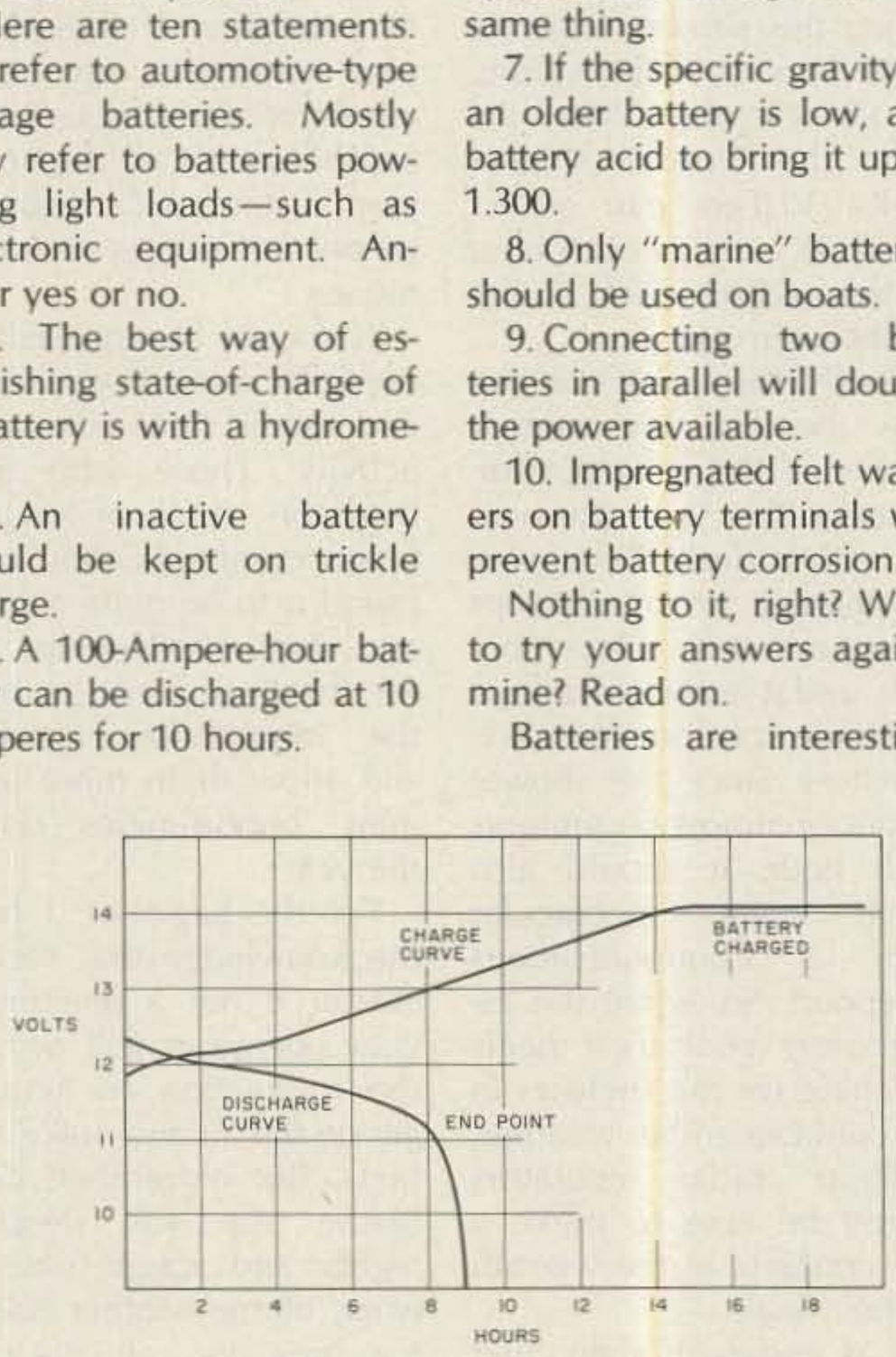


Fig. 1. Charge/discharge graph.

● Low SG type: floated at 2.17 + or − .01 volts per cell, which would be 13.02 volts for a 12-volt battery.

● High SG type: floated at 2.25 + or − .01 volts per cell, which would be 13.5 volts for 12 volts.

Batteries used in this way will last 10 to 20 years when properly maintained. Unfortunately, we cannot accept this experience as absolute because telephone batteries are commercial or industrial grade and use different alloys than are used in car batteries.

3. Ampere-hour capacity. We can be specific on this one. A 100-Ampere-hour battery will seldom, if ever, deliver 10 Amperes for 10 hours. First of all, battery output will depend on rate of discharge.

A 100-Ampere-hour battery might provide 1 Ampere for 120 hours or 25 Amperes for 2 hours. A further factor is battery age, and how it has been treated. If a car battery is discharged below 11 volts even once, its capacity will be greatly reduced. A loss of 10 to 25 percent would not be surprising.

A car battery is engineered for short, very heavy discharge followed by immediate heavy recharge. Used in this way, a good battery will last 5 years or more. In light-drain, light-recharge conditions, the battery will show serious loss of capacity in one year.

Most batteries these days are not rated in Ampere-hour capacity. Instead, they are rated in direct time and current. For example, one Gould battery was rated as follows:

Amps	Hours
2.5	41.
5.0	19.
10	8.5
15	5.3
20	3.8
25	3.0

4. Terminal Voltage: Whether this statement is true or not depends on the qualifications. If you mean open-circuit voltage, then the value of the voltage reading is doubtful. We can tell quite a bit from battery terminal voltage if the battery is placed under either charge or discharge conditions during measurement. (See graph of charge/discharge; this is the action of a car battery at about its half-life point.)

On discharge, voltage quickly drops to about 12 volts, then remains fairly constant until it reaches about 11 volts. Then it drops off quite rapidly. This is known as the "end point." Assuming that the equipment connected to the battery will still function at 11 volts, I would recommend 11 volts as the end point. Some authorities recommend 10.8 volts. Get the battery back on charge as soon as possible after reaching end-point voltage. An accurate voltmeter is essential.

Now look at the charge curve. Notice that terminal voltage rises quite rapidly at first, then levels off, and thereafter it rises quite linearly. When it reaches the flat portion of the curve, the battery is charged.

The shape of the charge curve will vary depending on the current and voltage outputs of the charger as the battery charge condition changes. Not all battery chargers are the same.

For instance, a few years ago Heathkit put out two battery chargers. One was rated at 15 Amperes and had an automatic shutoff at 14.5 volts. Its charge rate was 15 Amperes tapering to 2 Amperes.

The second charger was rated at 10 Amperes and its charge rate decline to "the leakage rate of the battery" on output voltage of 13.2 to 13.6 volts. Note that this procedure is similar to telephone company practice. (See answer to question 2.)

If you are using an ordinary charger such as the 15-Ampere model above, then we can assume that if charge current is around 2 Amperes and voltage is about 14.5 and fairly constant, then the battery is charged.

A marine battery encased in plastic.

5. Concrete floors. This one is weird, and yet appears in several books and magazine articles. Ask the question: How could the concrete floor get through the acid-impervious case? My answer—it can't. Even if concrete were a conductor, there would have to be a leak from both terminals to the concrete to provide a path. And if there is battery leakage, why wouldn't it short directly across the top of the battery?

My explanation for this one is to consider the *occasion* for which the battery is on the concrete floor. Most likely the battery is out of service. Therefore deterioration is due to idleness, not the material it rests on.

Before we leave this one, answer this for me. Battery acid is a conductor. An acid path across the top of the battery will cause current leakage. Agreed? Then how come the acid inside the case does not cause current leakage?

6. Initial voltage is the voltage at the battery terminals immediately after the load is applied. Open-circuit voltage—see answer 4.

7. Adding battery acid. All sources agree that adding battery acid will not improve battery performance. Our experiments agree with this. However, if you are buying a new battery, it's a good idea to insist on similar specific gravity in each cell. Adding acid is sometimes done locally and is subject to error. The best advice re battery acid is: Leave it alone.

8. Marine batteries. I have talked to two different companies about this. Here is the answer I was given:

A marine battery has the same construction as a car battery with these exceptions:

● An automobile battery used in a boat is guaranteed for 6 months. In a car, it may be 42 months. A marine battery is guaranteed for 12 months.

● A marine battery has a polypropylene handle to assist in lifting it out.

● A marine battery will have screw-type terminal lugs.

● A marine battery will have a picture of a boat on it.

More recently, a new type of battery has become available. These are deep cycle (or Recreational Vehicle) batteries, designed for light-discharge, periodic-recharge service. Their internal construction is quite different. If they are as good as claimed,

they are well worth the premium price.

9. Paralleling batteries. One recommendation re paralleling storage batteries: DON'T! The weaker one inevitably will discharge the stronger. If you do want the added capacity of a second battery, use a battery isolator. These are obtainable from marine and trailer supply stores. Basically, it consists of two diodes arranged so that both batteries are charged from one source. The load is split in two and each part is separately fed from its own battery.

10. Battery terminal corrosion. Usually noticed as green grass growing on the battery cables. The idea of the oil-impregnated felt washers is a good one. Unfortunately, battery acid is creepy stuff. Once it gets out of the battery case, it's almost impossible to stop it from reaching the battery holder and, worse yet, the copper cables. The classic cure is to keep the top of the battery clean, thus preventing the acid from doing any harm. Some other steps you can take are:

- Encase the battery in a plastic bag, leaving the top open. This will contain the acid if it leaks down the sides.
- In a car, it is a good idea to pull the battery out about once a year and examine the battery holder. Any white deposits should be neutralized with diluted household ammonia. Rinse well with plain water. Put on a coat of car undercoating to help prevent recurrence. Neutralize the battery cable ends as well. Grease them lightly before reconnecting.

So that is it. Batteries: our best friends most of the time; dangerous enemies if mistreated. A few precautions and a little tender loving care and your battery is a friend for life. ■

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½"×11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

Wanted: instruction sheets/manual or crystalling instructions for an E. F. Johnson Co. hi-lo band scanner, model 241-0390, 30–50 MHz and 150–174 MHz.

Mick McDaniel W6FGE
90 Temple St.
San Diego CA 92106

Can anybody help me get a schematic diagram for a Sonar Radio Corp. Model BR-2906 mobile linear amplifier? I will pay for copying and postage.

Bruce Brockway
257 S. Royal Poinciana Blvd. 106
Miami Springs FL 33166

I need the schematic or manual for a Madison Labs (Div. of Hallicrafters) FRR-71 receiver.

G. K. Barber
PO Box 31654
Aurora CO 80041

Does anyone know what improvements and updates are made by Drake when a TR7 is returned to the factory? Any information concerning mods or changes to the TR7 or TR7A would be appreciated. Are there any TR7 clubs or on-the-air nets?

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30358

I am looking for a supplier of or a circuit suitable for a linear amplifier of about 10 Watts output for the 2300-MHz band that would work for A5 ATV.

Henry R. Anderson VE6LK
2226–18 Avenue South
Lethbridge, Alberta
Canada T1K 1C8

I have been running into trouble with spikes from the 110-V-ac power line and/or my outside antenna. I am looking for information concerning protectors for 2m FM.

Robert H. Saviers WA3YCA
2101 Stackhouse Dr.
Yardley PA 19067

Help! I have a home-brew RTTY and CW TU. I have connected it to my computer's serial port but have no software to run it. Having limited funds, I cannot afford commercial software. Does anyone have an Apple-/Franklin-compatible program that he would be willing to give me a copy of? I'd be more than happy to pay for it or send a disk and pay shipping costs.

Alan Jovanovich KA7DAT
So. 1165 Grand
#86
Pullman WA 99163

I am interested in obtaining the VOX relay that plugs into the back of the Swan 700 transceiver. I would appreciate hearing from someone who may have one of these lying around that they don't have any future use for.

Augustus B. Wells
PO Box 50
Tunica LA 70782

I am looking for a copy of the instruction booklet for the Knight KG670 R/C tester made by Allied Radio. I will pay the costs for copying and mailing or for the original manual.

Lionel Roach KD5VO
3033 Teakwood
Garland TX 75042

Wanted: Collins 70E-7A PTO (permeability-tuned oscillator) for a Collins 75A1 receiver. This PTO covers 2–3 MHz and is used to tune the receiver.

Harold Smith W2GKE
26 Linden St.
Bayonne NJ 07002
(201)-436-1405

I am using the VIC-20 as a RTTY terminal with Kantronics interface and software. Can anyone help me with information on building an adapter which would let me use Atari cartridges on the VIC-20?

Robert F. Cann W4GBB
1606 Lochwood Dr.
Richmond VA 23233

I would appreciate receiving a copy of the schematic for an NCX-3 SSB/CW transceiver by National. I have the owner's manual already. I will gladly reimburse for costs.

Jeffry M. Blackmon W2YI
2107 Turnbull Road
Beavercreek OH 45431

I need the schematic for the Emergency Beacon Corporation model EBC-144 Jr. two-meter transceiver; and does anybody know where the company is located?

Bruce Stevenson WA6DUE
PO Box 7
Tecopa CA 92389

I need technical information on converting a Midland 13-863 CB to ten meters. Also, can anyone tell me the frequencies of any amateur astronomy nets I could check into?

Michael J. O'Neil KA2FIR
43 Spring Garden St.
Valley Stream NY 11580

I need a schematic and/or parts layout for a Bearcat Model BC-210. I will copy and return.

Frans F. Pauli WB6VYV
3526 North Cascade, B2
Colorado Springs CO 80907

I am looking for any information or schematics for a variable power supply (0-to-60-volt, 0-to-9-Amp), model number CH 60-9, serial number 15807-1, manufactured by NJE Corporation of Kenilworth, New Jersey. All efforts will be greatly appreciated; copying costs will be paid if requested.

Don Hanson N1AZH
RFD #2, Box 3678
Greene ME 04236

I need schematics and alignment procedures for the Icom IC-22A. I will pay mailing/copying charges.

Michael S. Greene KC7FN/VE7FSJ
Code 80412 NUWES
Keyport WA 98345

Help! The Kennehoochie Amateur Radio Club is badly in need of a relay for a KLM PA 30–150 amplifier (relay designation KY1). The relay is manufactured by GE (part number 3SAF1121). The coil is equal to 125 Ohms. The relay is no longer available from the equipment or parts manufacturer.

Carol Shrader WI4K
4065 Ophie Drive
Marietta GA 30066

I need a manual for a Swan 400 transceiver equipped with a Swan 420 vfo. I will copy and return your original or reimburse your copying and shipping costs.

Rod Robbins WA7IRY
22435 Bents Road
Aurora OR 97002

I need a schematic for an antique radio. It is a Sonora, using an 80, 47, 24-a, and 35 tube set. I would appreciate any info and will pay any expenses.

John Watzke K8OXI
9910 Shore Dr.
Pigeon MI 48755

Anyone have technical specs on the CV 278/GR RTTY TU—tube-type, scope, meter, size, etc?

H. S. Robb AF0W
Box 17
Bird Island MN 55310

I'm looking for a schematic for a Lavoie oscilloscope, model no. LA265A. I will pay for copying and mailing costs.

L. C. Hocutt WE4O
4257 Via Alta Dr.
Mobile AL 36609

See List of Advertisers on page 114

Thomas M. Hart AD1B
32 Westwood Terrace
Westwood MA 02026

Another Antenna Approach

This Timex/Sinclair program goes to great lengths.

In 1983, *Time* magazine selected the personal computer as the "Man of the Year." This is perfectly understandable since microcomputers are now priced low enough to allow virtually anyone to become involved in home-computer operations.

The least expensive computer on the market (as I write this) is the Sinclair-Timex 1000 which retails for less than $100. This is not a toy; it can be expanded to a 64K memory and has many of the features of much more expensive machines.

After purchasing a ZX-81, the predecessor of the Timex 1000, I began to look for ham-radio applications. The computer is now situated on one end of my operating bench and, as time goes on, I hope to use it for computerized CW and RTTY applications.

The program presented in this article is designed to compute the dimensions of

```
10 REM "ANTCOMP"
20 CLS
25 PRINT
30 PRINT
40 PRINT "*********************************"
50 PRINT "  ANTENNA DIMENSION PROGRAM "
60 PRINT "*********************************"
70 PRINT
80 PRINT
90 PRINT
100 PRINT "TO DETEMINE THE SIZE OF A DIPOLE"
110 PRINT "AND VERTICAL ANTENNA FOR ANY"
120 PRINT "BAND, ENTER THE CENTER FREQUENCY"
130 PRINT "IN MEGAHERTZ:"
140 INPUT F
150 PRINT
160 PRINT "  ";F;" MHZ "
170 LET L1=(INT (49200/F))/100
180 LET L2=(INT (15000/F))/100
190 LET L3=(INT (23400/F))/100
200 LET L4=(INT (7130/F))/100
210 LET L5=(INT (102.5*L3))/100
220 LET L6=(INT (102.5*L4))/100
230 LET L7=(INT (L2*50))/100
240 LET L8=(INT (L1*50))/100
250 FOR N=1 TO 70
260 NEXT N
270 CLS
280 PRINT
290 PRINT "*********************************"
300 PRINT "   ANTENNAS FOR ";F;" MHZ "
310 PRINT "*********************************"
320 PRINT
340 PRINT
350 PRINT " HALF-WAVE DIPOLE "
360 PRINT
370 PRINT " LENGTH "," EACH ARM "
380 PRINT L1;" FEET ",L8;" FEET "
390 PRINT L2;" METERS ",L7;" METERS "
395 PRINT
400 PRINT " QUARTER-WAVE VERTICAL "
410 PRINT
420 PRINT " VERTICAL "," RADIAL "
430 PRINT L3;" FEET ",L5;" FEET "
440 PRINT L4;" METERS ",L6;" METERS "
450 PRINT
460 PRINT
470 PRINT
480 PRINT "ENTER  Y/N  TO CONTINUE"
490 INPUT Y$
500 IF Y$="Y" THEN GOTO 20
520 PRINT "MEMORY USED: ";PEEK 16396+256*PEEK 16397-16509
530 STOP
```

Program listing.

```
**********************************
   ANTENNA DIMENSION PROGRAM
**********************************

TO DETEMINE THE SIZE OF A DIPOLE
AND VERTICAL ANTENNA FOR ANY
BAND, ENTER THE CENTER FREQUENCY
IN MEGAHERTZ:

      14.25 MHZ

**********************************
   ANTENNAS FOR 14.25 MHZ
**********************************

HALF-WAVE DIPOLE

LENGTH              EACH ARM
34.52 FEET          17.26 FEET
10.52 METERS        5.26 METERS

QUARTER-WAVE VERTICAL

VERTICAL            RADIAL
16.42 FEET          16.83 FEET
5 METERS            5.12 METERS

ENTER Y/N TO CONTINUE
```

Sample screens.

a dipole and a vertical antenna for a given frequency. The program requests the center frequency of the desired band and presents the data in feet and meters. The program is written in Sinclair Basic, but can easily be transposed to any other machine.

Before attempting to load the program, the program notes should be reviewed. Further, the illustrations show the computer monitor presentation of an actual run. With very little effort, the program can be modified to provide either more or less data. For example, the metric dimensions can be deleted or the decimal feet can be expressed as feet and inches through simple program changes.

In conclusion, we all can benefit from computerized operations in ham-radio applications. Computers are not just useful tools but are critical elements of everyday life. Everyone should develop some degree of computer literacy in order to cope with future demands. The Sinclair-Timex is an excellent introduction to computer logic and programming. I hope to see a flood of ZX-81 applications in the near future. ■

```
********** **********
   ANTENNAS FOR 14.25 MHZ
********** **********

HALF-WAVE DIPOLE

LENGTH              EACH ARM
34.52 FEET          17.26 FEET
10.52 METERS        5.26 METERS

QUARTER-WAVE VERTICAL

VERTICAL            RADIAL
16.42 FEET          16.83 FEET
5 METERS            5.12 METERS

ENTER Y/N TO CONTINUE
MEMORY USED: 1217
```

Sample output.

PROGRAM NOTES

1. Lines 20–160 set up the screen, provide directions, and accept the center frequency.
2. Lines 170–240 compute the variables.
3. Lines 250–260 are a timing loop. They hold the display and are only for graphic effect. They can be eliminated if desired.
4. Lines 280–470 control the output.
5. Lines 480–500 are a decision-making set. These allow input of additional frequencies.
6. The antenna calculations can be found in any ARRL handbook. They are:
   Dipole length in feet = 492/Freq. in MHz
   Dipole length in meters = 150/Freq. in MHz
   Vertical element in feet = 234/Freq. in MHz
   Vertical element in meters = 71.3/Freq. in MHz
   Radials are 2.5% longer than the vertical members
7. In order to provide results that are rounded to 2 significant decimal places, each INT function utilizes a number multiplied by 100. The result is then divided by 100 to give 2 decimal places. See lines 170–240.

↙ See List of Advertisers on page 114

SOCIAL EVENTS

from page 66

STERLING IL
MAR 18

The Sterling-Rock Falls Amateur Radio Society will hold its 24th annual hamfest on Sunday, March 18, 1984, beginning at 7:30 am, at the Sterling High School Fieldhouse, 1608 4th Avenue, Sterling IL. Tickets are $2.00 in advance and $3.00 at the door. There will be commercial distributors, dealers, a large flea market, a concession stand, and lots of free parking, including space to accommodate self-contained campers overnight. Flea-market tables requiring electricity and all commercial tables are $5.00; all other tables are $3.00. Setup hours will be Saturday from 6:00 pm to 9:00 pm and Sunday morning. Talk-in on 146.25/.85 (W9MEP). For advance tickets and tables, send a check, payable to Sterling-Rock Falls Amateur Radio Society (SRFARS), to Sue Peters KA9GNR, PO Box 521, Sterling IL 61081, or call (815)-625-9262.

MAUMEE OH
MAR 18

The Toledo Mobile Radio Association, Inc., will hold its 29th annual Ham/Computer Fest and Auction on Sunday, March 18, 1984, from 8:00 am to 5:00 pm, at the Lucas County Recreation Center, Key Street, Maumee OH. Tickets are $2.50 in advance and $3.00 at the door. The auction starts at 10:00 am. Other features will include commercial exhibitors, ladies' programs, ample free parking all day and overnight, and refreshments. Flea-market tables are available and displays are limited to electronic, ham, and computer gear only. Talk-in on .52, .01/.61, .19/.79, .34/.94, .87/.27, .975/.375, and 447/442. For further information, write Elmer Clark KR8U, 5520 Edgewater Drive, Toledo OH 43611.

MAUMEE OH
MAR 18

The annual meeting of the American Signaling Society is scheduled for March 18, 1984. The meeting will begin promptly at 0100 hours UTC. Members and guests will convene in the Main Exhibit Hall of the Lucas County Recreation Center, 2901 Key Street, Maumee OH. Activities will include the election of officers, the ever-popular forum on Modern Signaling (chaired by Mr. Alan Pike), and a Century Club confab. For additional information, please send an SASE to The American Signaling Society, 4015 Windermere Road, Columbus OH 43220.

JEFFERSON WI
MAR 18

The Tri-County Amateur Radio Club will hold its annual hamfest on March 18, 1984, from 8:00 am to 3:00 pm, at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door; tables are $3.00 in advance and $4.00 at the door. There will be plenty of food and free parking. Doors will open at 7:00 for sellers only. Talk-in on 146.52, 146.22/.82, and 144.89/145.49. For more information or advance tickets and tables, send an SASE to Bob Barker K9RIJ, 724 Burdick, Milton WI 53563.

CHELSEA MA
MAR 20

The 19/79 Amateur Radio Association will sponsor classes for the prospective Novice and Tech/General, beginning March 20, 1984, from 7:00 pm to 9:00 pm, at Chelsea High School, Clark Avenue, Chelsea MA. The only charge will be the cost of the material. For more information or to register, write 19/79 Amateur Radio Association, c/o Frank Masucci K1BPN, PO Box 171, Chelsea MA 02150.

MARSHALL MI
MAR 24

The Southern Michigan Amateur Radio Society and the Marshall High School Photo-Electronics Club will sponsor the 23rd annual Michigan Crossroads Hamfest on Saturday, March 24, 1984, from 8:00 am to 3:00 pm, at the Marshall High School, Marshall MI. Setups for sellers will be at 7:00 am with plenty of free parking and carry-in help. Tickets are $1.50 in advance and $2.00 at the door. Table space is 50¢ per foot (4-foot minimum) and it will be reserved until 8:00 am. There will be a snack bar and full food service. Talk-in on 146.52 and 146.07/.67. For reservations, send an SASE to SMARS, PO Box 934, Battle Creek MI 49016, or call Wes Chaney N8BDM at (616)-979-3433.

UPPER SADDLE RIVER NJ
MAR 24

The Chestnut Ridge Radio Club will sponsor the Ham Radio Flea Market on Saturday, March 24, 1984, at the Education Building, Saddle River Reformed Church, East Saddle River Road and Weiss Road, Upper Saddle River NJ. There is no admission fee. Tables are $10.00 for the first and $5.00 for each additional table; tailgating is $5.00. Food and soda will be available. For more information, call Jack Meagher W2EHD at (201)-768-8360 or Roger Soderman KW2U at (201)-666-2430.

MADISON OH
MAR 25

The Lake County Amateur Radio Association will present its fifth annual Lake County Hamfest and Computer Fest on Sunday, March 25, 1984, from 8:00 am to 4:00 pm, at Madison High School, Madison OH (just 40 miles east of Cleveland). Admission is $3.00 in advance and $3.50 at the door; table and display space is $5.00 for a 6-foot table and $6.50 for an 8-foot table. All display space is indoors and doors will open at 5:30 am for exhibitors. Plenty of free parking will be available. Talk-in on 147.81/.21. For reservations or more information, send an SASE to Lake County Hamfest Committee, PO Box 150, Mentor OH 44061, or phone (216)-953-9784.

GRAYSLAKE IL
MAR 25

The Libertyville and Mundelein Amateur Radio Society will hold LAMARSFEST 1984 on Sunday, March 25, 1984, starting at 8:00 am, at the Lake County Fairgrounds, Routes 45 and 120, Grayslake IL. Tickets are $2.00 in advance and $3.00 at the door. There are plenty of 8-foot swapfest-area tables available at $5.00 each. Commercial exhibitors should contact LAMARS for more information and reservations. Setups begin at 6:00 am. Food and free parking will be available. Talk-in on 147.63/.03 and 146.94 simplex. For advance tickets and table reservations, send an SASE to LAMARS, PO Box 751, Libertyville IL 60048.

OMRO WI
MAR 25

The Oshkosh Amateur Radio Club will sponsor the 4th annual OARC Auction on March 25, 1984, from 11:00 am to 4:00 pm, at a new, larger location (no stairs), Winro Hall, Omro WI. Auction items must have a $15 minimum value and OARC will charge a 10% commission on all sales. Setup starts at 9:00 am. Tickets are $2.00 in advance and $3.00 at the door. There will be a professional auctioneer and food, drink, and free parking will be available. Talk-in on 147.945/.345. For advance tickets, send an SASE and $2.00 per ticket to Tickets, K9WWW, 1646 Michigan, Oshkosh WI 54901. Deadline is March 11, 1984, and orders without SASEs will be held at the door at the buyer's risk.

GRAND JUNCTION CO
MAR 31

The Grand Mesa Repeater Society will hold the fifth annual Western Slope Hamfest on Saturday, March 31, 1984, from 10:00 am to 4:00 pm, at the Plumbers and Steamfitters Union Hall, 2384 Highway 6 & 50, Grand Junction CO. Admission is free and swap tables are $5.00 each. Features will include an indoor swapfest, Novice exams, an auction, a talk by Lys Carey K0PGM, Director of the ARRL Rocky Mountain Division, and a session on repeaters and remote bases with Ted Wetzel WB0PDU. There will be refreshments. Talk-in on 146.82 and 449.20. For further information or to reserve a swap table, send an SASE to Larry Brooks WB0ECV, 3185 Bunting Avenue, Grand Junction CO 81504, or call (303)-434-5603.

FRAMINGHAM MA
APR 1

The Framingham ARA, Inc., will hold its annual spring flea market on Sunday, April 1, 1984, beginning at 10:00 am at the Framingham Civic League Building, 214 Concord Street (Rte. 126), downtown Framingham. Admission is $2.00 and tables are $10.00 (pre-registration required). Sellers may begin setups at 8:30 am. There will be radio equipment, computer gear, and food in-house. Talk-in on 147.75/.15 and .52. For more information, contact Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701, or phone (617)-877-7166.

TRENTON NJ
APR 1

The Delaware Valley Radio Association will hold its 12th annual flea market and computer show on Sunday, April 1, 1984, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township, Trenton NJ. There will be an indoor and outdoor flea-market area, commercial dealers, and refreshments. Sellers are asked to bring their own tables. Talk-in on 146.52 and 146.07/.67. For advance tickets and space reservations, please send an SASE to Walter L. Sharpe KB2ZY, 140 Susan Drive, Trenton NJ 08638.

SAN ANTONIO TX
APR 7

The San Antonio Area Radio Club will hold its first annual Swapfest and Bar-B-Q on April 7, 1984, from 7:00 am to 5:00 pm, at Comanche Park. Talk-in on 147.36 MHz. For more details, write Melvin Anderson, 8932 Saddle Trail, San Antonio TX 78255.

ROCHESTER MN
APR 7

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the 7th annual Rochester Area Hamfest on Saturday, April 7, 1984, beginning at 8:30 am, at John Adams Junior High School, 2535 NW 31 Street, Rochester MN. There will be a large indoor flea market for radio and electronic items, refreshments, and plenty of free parking. Talk-in on 146.22/.82 MHz. For further information, contact RARC, c/o W. C. McGurk WB0YEE, 2253 Nordic Court NW, Rochester MN 55901.

FLEMINGTON NJ
APR 7

The Cherryville Repeater Association will sponsor the annual Flemington NJ Hamfest on Saturday, April 7, 1984, from 8:00 am to 3:00 pm, at the Hunterdon County High School Field House on Route 31. General admission is $3.00. For early birds, breakfast will be available on site from 6:30 am. Talk-in on 147.375, 147.015, 146.52, 224.12, and 444.85. For additional information or table reservations, write Bill Inkrote K2NJ, RD 10, Box 294, Quakertown-Croton Road, Flemington NJ 08822, or call (201)-788-4080.

GREENCASTLE IN
APR 7

The Putnam County Amateur Radio Club will hold its second Amateur Radio and Electronics Auction on April 7, 1984, at the Putnam County Fairgrounds, US 231, north of Greencastle IN. Admission is $1.00, sales commission is 5%, and there will be a $1.00 service charge on buybacks. Doors will open at 8:00 am and the auction will start at 10:00 am. Bring your equipment to be sold on consignment. All activities will be inside and food will be available. Talk-in on 147.93/.33. For more information or a flyer, contact John Underwood K9IIB, RFD 1, Box 10, Fillmore IN 46128.

KANSAS CITY MO
APR 7-8

The PHD Amateur Radio Association, Inc., will sponsor the 1984 Missouri State ARRL Convention on Saturday and Sunday, April 7–8, 1984, from 10:00 am to 5:30 pm (both days), at the Trade Mart Building, at the downtown Kansas City MO airport. For both days, registration is $4.00 and swap tables are $10.00, which includes one registration with each table. Commercial exhibitors may set up from 7:00 pm to 9:00 pm on Friday or 7:00 am to 10:00 am on Saturday; swappers may set up at 9:00 on Saturday. The Saturday-night banquet at the world-famous Gold Buffet is $10.50. Those desiring banquet tickets and swap tables are urged to order in advance. Other features will be a complete program of forums, commercial booths, a large flea market, a home-brew contest, Missouri-Kansas Amateur-of-the-Year and CW Contest awards, and on Sunday, a Missouri-Kansas Repeater Council meeting, as well as QCWA and YL luncheons. Unlimited free parking, including RV space (no hookups), will be available.

Talk-in on 146.34/.94. For more information and registrations, write PHD Amateur Radio Association, Inc., Liberty MO 64068-0011, or call (816)-781-7313 or 452-9321. All pre-registrations will be held at the door.

AMBOY IL
APR 8

The 19th annual Rock River ARC Hamfest will be held on Sunday, April 8, 1984, beginning at 8:00 am, at the Lee County 4-H Center, one mile east of the junction of 52 and 30. Ticket donations are $2.00 each in advance and $3.00 at the gate; 8-foot tables are $5.00 each. Camping space will be available for a nominal charge and breakfast and lunch will be served. There will be an auction of amateur-related gear. Talk-in on .37/.97 repeater. For more information or advance tickets (available until April 1, 1984) and tables, write to Shirley Webb KA9HGZ, 618 Orchard Street, Dixon IL 61021, or phone (815)-284-3811.

MADISON WI
APR 8

The Madison Area Repeater Association, Inc. (MARA), will hold its 12th annual Madison Swapfest on Sunday, April 8, 1984, at the Dane County Exposition Center Forum Building in Madison WI. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under will be admitted free. Flea-market tables are $4.00 each in advance and $5.00 at the door. Doors will open at 5:00 am for commercial exhibitors, 8:00 am for flea-market sellers, and 9:00 am for the general public. Features will include commercial exhibitors, a flea market, an all-you-can-eat pancake breakfast, and a barbecue lunch. Plenty of parking space and nearby hotel accommodations are available. Talk-in on 146.16/.76 (WB9AER/R). For reservations (early ones are advised) or more information, write to MARA, PO Box 3403, Madison WI 53704.

MUSKEGON MI
APR 14

The Muskegon Area Amateur Radio Council will hold the ARRL Michigan State Convention and Muskegon Hamfest on April 14, 1984, at the L. C. Walker Arena, 4th at Western, Muskegon MI. Features will include Friday-evening hospitality rooms, programs covering areas of amateur radio interest, ladies' activities, and Saturday-evening convention dinner program. Setups for manufacturers and dealers will begin at 2:00 pm on April 13th. For more information, write Muskegon Area Amateur Radio Council, PO Box 691, Muskegon MI 49443.

JACKSON MS
APR 14-15

The Jackson Amateur Radio Club will host the Capital City Hamfest and 1984 ARRL Mississippi State Convention on Saturday and Sunday, April 14-15, 1984, at the Communications Workers of America Building, I-220 at Country Club Drive. Hours on Saturday are 9:00 am to 5:00 pm and on Sunday, 8:00 am to 1:30 pm. Admission is free and flea-market tables are $3.00 each. Attractions include commercial dealer exhibits, a large indoor flea market, concessions, forums, and free parking (including self-contained RVs). For special hamfest rates, contact the Holiday Inn Southwest directly. Talk-in on 146.16/.76. For further information, contact Carol Kemp NA5Y, 3581 Beaumont Drive, Pearl MS 39208, or phone (601)-939-7612.

RALEIGH NC
APR 15

The Raleigh Amateur Radio Society will hold its 12th annual hamfest and flea market (all under cover) on Sunday, April 15, 1984, beginning at 8:00 am, at the Crabtree Valley Shopping Mall, located at the intersection of US 70 west and US 1 and 64. Admission is $4.00 at the gate, with no extra charge for tailgaters. Tables will be available for rent. Features will include a CW contest, a home-brew contest, and special-interest meetings. Talk-in will be on 146.04/146.64 (W4DW) and 146.28/146.88 (K4ITL). For more information, contact Pete Thacher N4HQZ at (919)-876-4073 or Jim Bradley WA4AOO at (919)-851-2437 from 6:00 pm to 8:00 pm weekdays or on weekends, or write RARS, PO 19127, Raleigh NC 27619.

DAYTON OH
APR 27-29

The Dayton Amateur Radio Association, Inc., will sponsor the Dayton Hamvention on April 27-29, 1984, at the Hara Arena and Exhibition Center, Dayton OH. Admission, valid for all three days, is $7.50 in advance and $10.00 at the door. The Saturday evening Grand Banquet and Entertainment is $14.00 in advance and $16.00 at the door. Harry Dannals W2HD, past president of the ARRL, will be the featured speaker. Because seating is limited, early reservations are requested. There will be a giant flea market starting at noon on Friday and continuing all day Saturday and Sunday. Flea-market space is $15.00 for all three days and will be sold in advance only. Entrance for setups will be available starting Wednesday and the special flea-market telephone is (513)-223-0923. Other features will include forums, awards, and exhibits. For special motel rates and reservations, write Hamvention Housing, Box 1288, Dayton OH 45402; no telephone reservations will be accepted. Address all other inquiries to Box 44, Dayton OH 45401, or phone (513)-433-7720. Please send advance registration checks to Dayton Hamvention, Box 2205, Dayton OH 45401.

DAYTON OH
APR 27

The 15th annual B*A*S*H will be held on Friday night, April 27, 1984, at the Dayton Hamvention at the Convention Center, Main and Fifth Streets, Dayton OH. Admission is free and parking is available in the adjacent city garage. There will be sandwiches, snacks, and a COD bar, as well as live entertainment. For further information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

DAYTON OH
APR 27-29

The 1984 Dayton Hamvention's International VHF/UHF Conference will be held concurrently with the Hamvention from Friday through Sunday, April 27-29, 1984, at the Hara Arena and Exhibition Center, Dayton OH. There will be technical forums by acknowledged experts; noise-figure, dynamic-range, and antenna-range measurement contests; and a hospitality suite with refreshments. Technical papers and presentations on VHF/UHF topics of interest are being solicited for consideration. Potential speakers should submit their requests immediately. For further information, contact Jim Stitt WA8ONQ, VHF/UHF Conference Moderator, 4126 Crest Manor, Hamilton OH 45011.

BRAINTREE MA
APR 29

The South Shore Amateur Radio Club of Braintree MA will celebrate its 53rd year in amateur radio by holding an indoor flea market on Sunday, April 29, 1984, rain or shine, from 11:00 am to 4:00 pm, at the Viking Club, 410 Quincy Avenue, Braintree MA. The entrance fee is $1.00 and 8-foot tables are $10.00 (which includes 1 free admission per table). Vendors will be admitted at 9:30 am and plenty of parking will be available. For advance table reservations, send a check payable to the South Shore Amateur Radio Club to Ed Doherty W1MPT, 236 Wildwood Avenue, Braintree MA 02184. A confirmation of check receipt will be sent and there will be no cancellation refunds after April 25. For more information, call Ed at (617)-843-4431, evenings.

ST. DAVID AZ
MAY 4-6

The Cochise Amateur Radio Association, Inc., will hold a hamfest (upgraded from a swapmeet) on May 4-6, 1984, in St. David AZ. There will be a flea market and all tailgaters are welcome. Tours planned to Tombstone, the Bisbee Lavender Pit, and other places of interest. Talk-in on .16/.76 and .52 simplex. For more details, contact CARA, Attention: Bob Clay KB7HB, PO Box 1855, Sierra Vista AZ 85636.

COLUMBIA MO
MAY 5-6

The Central Missouri Radio Association will hold Columbia Hamfest '84 on May 5-6, 1984, at the Hilton Inn, I-70 and Stadium Boulevard, Columbia MO. Features will include forums, a hospitality room, a Saturday-night banquet, a hard-surfaced flea market, display tables, and shuttle-bus service to parking areas and shopping centers. Talk-in on .16/.76 or 220.42/.02. For banquet tickets, reservations for hotels, flea-market spaces, or dealer tables, and more information, contact Ben Smith KØPCK, Route 1, Prairie Home MO 65068, or phone (816)-427-5319.

GREENVILLE SC
MAY 5-6

The Blue Ridge Amateur Radio Society will sponsor the Greenville SC Hamfest on Saturday and Sunday, May 5-6, 1984, at the American Legion Fairgrounds, White Horse Road, ½ mile north of I-85, Greenville SC. Admission is $3.00 in advance and $4.00 at the door. Talk-in on 146.01/.61. For advance tickets, write Mrs. Sue Chism N4ENX, Rte. 6, 203 Lanewood Drive, Greenville SC 29607. For further information, write Phil Mullins WD4KTG, Hamfest Chairman, PO Box 99, Simpsonville SC 29681.

CEDARBURG WI
MAY 5

The Ozaukee Radio Club will sponsor its 6th annual swapfest on Saturday, May 5, 1984, from 8:00 am to 1:00 pm, at the Circle B Recreation Center, Highway 60, Cedarburg WI (located 20 miles north of Milwaukee). Admission is $2.00 in advance and $3.00 at the door. Six-foot tables are $2.00 and eight-foot tables are $3.00. Food and refreshments will be available. Sellers will be admitted at 7:00 am for table setups. For tickets, tables, maps, or more information, send a business-size SASE to 1984 Ozaukee Radio Club Swapfest, PO Box 13, Port Washington WI 53074.

CENTRALIA IL
MAY 6

The Centralia Wireless Association, Inc., will hold its annual hamfest on Sunday, May 6, 1984, at the Kaskaskia College Gymnasium, 3 miles northwest of Centralia IL. Admission to the hamfest is free and there will be no charge for the flea-market and exhibit space (a limited number of tables will be issued on a first-come, first-serve basis). Doors will open at 7:00 am for flea-market and exhibit setups. Food and refreshments will be available, as well as plenty of free parking. Talk-in on 147.27/.87 and 146.52. For further information, contact Bud King WB9QEG at (618)-532-6606 or Lou Hodges W9IL at (618)-533-4724, or write to CWA, Inc., PO Box 1166, Centralia IL 62801.

PARAMUS NJ
MAY 6

The Bergen ARA will hold a Ham Swap 'n' Sell on May 6, 1984, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. There will be tailgating only and admission for sellers is $4.00 (bring your own table). Buyers will be admitted free. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

DURHAM NC
MAY 12

The Durham FM Association will hold the Durham Hamfest on May 12, 1984, at the South Square Mall, Durham NC. Talk-in on 147.225. For more information, write Milan R. Burger, President, DFMA, 5711 Spruce Drive, Durham NC 27712.

See List of Advertisers on page 114

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

IARS/CHC INTERNATIONAL CONTEST
CW—0000 GMT March 10 to 2400 GMT March 11
SSB—0000 GMT March 17 to 2400 GMT March 18

This is a semiannual contest sponsored by the International Amateur Radio Society and Certificate Hunters Club. Work stations once per band, no repeaters or crossmode contacts allowed. Look for stations calling "CQ CHC."

EXCHANGE:

RS(T), IARS and/or CHC number, and state, province, or country.

FREQUENCIES:

CW—70 kHz from the bottom of the band.

SSB—3960, 7260, 14300, 21360, 28600.

SCORING:

Multiply QSOs times the number of countries worked, times the number of IARS/CHC members worked. Any member of both divisions counts as two multipliers!

AWARDS:

Engraved plaque to the highest overall score. Certificates to the highest score per band and top 10 runners-up.

ENTRIES:

Logs must show date and time in GMT, station worked, exchanges sent and received, QSO points claimed, and final claimed score. All entries with 100 or more QSOs must also include a check sheet. Entries must be mailed by June 1st to Ted Melinosky K1BV, 525 Foster Street, South Windsor CT 06074. Include a large SASE for a copy of the results.

VIRGINIA QSO PARTY
Starts: 1800 GMT March 10
Ends: 0200 GMT March 12

The 1984 QSO party is again sponsored by the Sterling Park Amateur Radio Club of Sterling Park, Virginia. The same station may be worked on each band, on both CW and SSB modes. Virginia stations may contact in-state stations for QSO and multiplier credit. Virginia mobile stations may be worked in each new county they operate from for new QSO and multiplier credit regardless whether or not previously worked on the same band and mode in another county. Stations on county borders count for only one QSO. QRP stations must run 5 Watts or less for their entire operating time.

EXCHANGE:

QSO number starting with 001 and QTH consisting of state, province, DX country, or Virginia county. Viriginia stations note that the reference for valid counties is the *CQ* magazine *Counties Award Record Book* which lists a total of 95 counties.

FREQUENCIES:

Phone—3930, 7230, 14285, 21375, 28575, and anywhere on 160-meter band except in DX windows.

CW—60 kHz up from the low end of each HF band and anywhere in 10- and 160-meter bands or Novice subbands.

SCORING:

Count one point per SSB QSO, two points per CW QSO. Virginia stations multiply total QSOs by the sum of states, Canadian provinces, DX countries, and Virginia counties worked. Others multiply QSOs by the number of Virginia counties worked.

AWARDS:

Engraved plaques to the top-scoring stations in the following categories: High Virginia single operator (fixed location); High Virginia CW-only station; High Virginia mobile; High out-of-state (including DX) station; High Virginia QRP station (if 5 or more QRP entries are received). Certificates awarded winners of Virginia counties, states, provinces, and DX countries.

ENTRIES:

Follow ARRL standard contest guidelines for logs. Indicate each new multiplier as worked. Include a summary sheet with your log and an SASE for a copy of the results. Indicate on summary sheet if mobile or QRP. Entries are due April 15th and should be addressed to: Virginia QSO Party, c/o Ken Harrigan KB2LT, 2 Darus Court, Sterling Park VA 22170.

WISCONSIN QSO PARTY
Starts: 1800 GMT March 11
Ends: 0100 GMT March 12

Use both CW and phone, stations may be worked once per mode on each band. Mobiles may be worked again when changing counties. No repeater QSOs!

EXCHANGE:

RS(T) and state, province, or Wisconsin county.

FREQUENCIES:

Phone—3990, 7290, 14290.

CW—3560, 7050, 14060.

SCORING:

Phone contacts count 1 QSO point while CW contacts count 2 QSO points. Wisconsin stations multiply QSO points by total number of states, provinces, and Wisconsin counties. DX countries count for QSO points but not mutlipliers. Non-Wisconsin stations multiply QSO points by number of Wisconsin counties (72 max.). As a bonus, Wisconsin mobiles add 500 points for each county contacted from outside your home county with a minimum of 15 QSOs per county to qualify.

AWARDS:

Awards will be presented to the highest scores in each state and province, and to the highest aggregate club score.

ENTRIES:

All entries must contain a log consisting of: time in GMT, call, RS(T), state, Wisconsin county, mode, and a score summary. Logs containing more than 100 QSOs must be accompanied by a dupe sheet. Entries must be postmarked by April 15th and sent to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, PO Box 1072, Milwaukee WI 53201.

BERMUDA AMATEUR RADIO CONTEST
Starts: 0001 GMT March 17
Ends: 2400 GMT March 18

The 26th Bermuda Amateur Radio Contest is again sponsored by the Radio Society of Bermuda. The contest is open to all licensed amateurs in Canada, USA, United Kingdom, and the Federal Republic of Germany. Of the 48-hour contest period, your total operating time cannot exceed 36 hours; off periods must be clearly logged. Each off period must not be less than three consecutive hours. All stations must be single operator only and must operate from their own private residence of property. Use all bands, 80 through 10 meters. No crossband or crossmode contacts are permitted. Additionally, no phone contacts are allowed between W and G or West Germany on 40 meters.

EXCHANGE:

All stations will send RS(T) reports and give the following: Canadians add province, UK stations add county, US stations add state, West German stations add DOK#, Bermuda stations add parish. US and Canadian stations may exchange reports with West German, UK, and Bermuda stations only. UK and West German stations may exchange reports with US, Canadian, and Bermuda stations only.

SCORING:

Each completed contact on each band counts 5 points. A phone and a CW contact with the same station on the same band will count if they are made at least 30 minutes apart. For all stations outside Bermuda the multiplier is the total number of VP9s worked on each band. For Bermuda stations the multiplier is the total number of states, provinces, counties, and DOK#s worked on each band.

AWARDS:

Printed awards to the top score in each state, province, county, and DOK area. The top score in Canada, US, UK, and West Germany shall receive a trophy to be awarded at the society's annual dinner held in October of each year. Round-trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards. Top winners for the 1979 through 1983 contest shall be eligible for the area awards only.

ENTRIES:

Logs must show all dates and times in GMT. A separate sheet must be used for each band. All contestants to compute their own scores and check for duplicate contacts. Dupe sheets must be submitted with logs to cover each band where more than 200 contacts are logged. For every duplicate contact for which points are claimed, a penalty of three contacts will be deducted by the contest committee. An excess of claimed duplicates may mean disqualification. No penalty will be exacted against duplicates for which no points are claimed. Each page must be clearly numbered and marked with contestant's call, year, and band to which it refers. All contestants must sign a statement that they have complied with the

CALENDAR

Mar 3-4	ARRL DX Contest—Phone
Mar 10-11	IARS/CHC International Contest—CW
Mar 10-12	Virginia State QSO Party
Mar 11-12	Wisconsin QSO Party
Mar 17-18	YL-ISSB Commo System QSO Party—CW
Mar 17-18	Bermuda Contest
Mar 17-18	Spring QRP CW Activity Weekend
Mar 17-18	IARS/CHC International Contest—SSB
Mar 17-18	Kentucky QSO Party
Mar 17-18	Tennessee QSO Party
Mar 31-Apr 2	Connecticut QSO Party
Apr 21-22	QRP Amateur Radio Club April QSO Party
May 5-6	Late Spring QRP SSB Activity Weekend
Jul 13-15	*A5* International SSTV-DX Contest
Aug 11-12	New Jersey QSO Party
Aug 24-27	*A5* North American UHF FSTV-DX Contest
Sep 15-17	Washington State QSO Party
Sep 22-23	Late Summer QRP CW Activity Weekend
Dec 26-Jan 1	QRP Winter Sports—CW

Ham Rag

NEWSLETTER OF THE MONTH

The Rockford Amateur Radio Association's *Ham Rag* really does the job. Their December issue, for example, featured President's Log, Micro/Digital Corner, Secretary's Log, Tech Topics, Elmer Patrol (Novice class news), New Product Review, Potpourri, and Ham Mart. And this is all in a slick little package which includes photos! Congratulations to Editor Sharon Harlan WB9SFT, Circulation Manager Alice Davidson, and the whole crew.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

rules and terms of their license. All logs must be received by the Contest Committee, Radio Society of Bermuda, Box 275, Hamilton 5, Bermuda, no later than May 31st. Overseas contestants are recommended to forward their logs via air mail. All decisions of the contest committee are final.

Bermuda parish abbreviations are as follows: SAN—Sandys, PEM—Pembroke, SOU—Southampton, HAM—Hamilton, STG—St. George, DEV—Devonshire, WAR—Warwick, SMI—Smiths, PAG—Paget.

TENNESSEE QSO PARTY
2100 GMT March 17 to 0500 GMT March 18 and 1400 to 2200 GMT March 18

This is the 14th annual QSO party sponsored by the Tennessee Council of Amateur Radio Clubs. You may work the same station on different bands, modes, or counties. Repeater contacts are not allowed. Mobiles compete against mobiles, portables against portables. Single-transmitter entries only. No county-line operations allowed for multiple contacts. Portable stations must set up per Field Day rules. No "list" operations are allowed. No CW contacts in phone bands.

EXCHANGE:

Signal report and state, province, country, or Tennessee county.

SCORING:

Score one point per phone QSO; 1.5 points per CW QSO. Combine phone and CW score as one contest, unless you wish to compete for phone-only or CW-only awards. Tennessee stations multiply QSO points by sum of number of different states (50), Tennessee counties (95), and VO and VE1-7 (7). DX stations count only for points, not as multipliers. Each portable or mobile station working outside their home Tennessee county scores 500 bonus points for each county outside of home county with a minimum of 10 QSOs. All others multiply QSO points by the number of different Tennessee counties worked (95 max.).

FREQUENCIES:

Phone—1860, 3980, 7280, 14280, 21380, 28580.

Novice—3725, 7125, 21125, 28125.

CW—1815 and approximately 50 kHz up from bottom of each band.

Note, you must log a minimum operating time of 10 minutes for each change of band or mode.

AWARDS:

Plaque to highest-scoring Tennessee fixed, mobile, and portable, plus out of state. First-place certificates to highest-scoring station in each state, Canada, DX country, Tennessee Novice/Technician, out-of-state Novice/Technician, Tennessee phone only, and Tennessee CW only. Participation certificates to every station sending in logs with at least 25 contacts.

ENTRIES:

Logs must show date/time in GMT, station worked, band, mode, exchange, and score. Submit a cross-check sheet similar to ARRL CD77 for each band and mode with 100 or more contacts. Logs must be legible to avoid disqualification. Logs must be postmarked by May 1st and sent to: Oak Ridge ARC, Attn: Mel Wardell K4PJ, Oak Ridge TN 37830. Please include a business-sized SASE with your logs for complete results, any certificates earned, or for return of logs (if desired).

KENTUCKY QSO PARTY
2100 March 17 to 0700 March 18
1400 to 2200 March 18

This is the second annual Kentucky QSO Party sponsored by the Western Kentucky DX Association. Stations may work the same station on different bands, modes, or counties. Mobiles compete against mobiles, portables against portables, and fixed against fixed. No county-line operation for the purpose of multiple contacts. Portable stations must set up per Field Day rules. Single-transmitter entries only, but single or multi-operators OK. Repeater contacts not allowed. No list operations permitted.

EXCHANGE:

RS(T) and state, province, country, or Kentucky county.

FREQUENCIES:

Phone—1840, 3985, 7285, 14285, 21385, 28585.

Novice—3725, 7125, 21125, 28125.

CW—1815 and approximately 60 kHz from bottom of each band.

Kentucky stations must operate a minimum of 10 minutes for each change of band or mode.

SCORING:

Count 2 points for each 160-meter QSO, phone or CW; 2 points per CW QSO on all other bands; 1 point per phone QSO on 80 and 40 meters; 1.5 points per phone QSO on 10, 15, and 20 meters. Combine phone and CW score as one contest.

Kentucky stations multiply QSO points by the sum of the number of states (50), Kentucky counties (120), plus VO, VE1-7, and VY1/VE8 (9). DX stations count only in point totals, not as multipliers. Non-Kentucky stations multiply QSO points by the total number of Kentucky counties worked (120 max.).

Portable and mobile Kentucky stations add to total score a bonus of 1000 points for each county operated outside of home county. A minimum of 25 contacts must be made in each county to qualify for the bonus.

AWARDS:

Plaques to the highest-scoring Kentucky fixed, Kentucky mobile, Kentucky portable, and out-of-state station. First-place certificates to highest score for each state, Novice, Canadian, DX station, all phone, all CW. Participation certificates to all stations submitting logs with at least 25 contacts.

ENTRIES:

Logs should show date/time in GMT, station worked, band, mode, exchange, and score. A sample log sheet is available if you send an SASE. Logs must be legible and neat to avoid disqualification. Submit a cross-check sheet (similar to ARRL form CD77) for each band and mode with over 50 contacts. Kentucky stations must show counties they worked from as part of their log entry. Logs must be postmarked no later than May 5th to be eligible for award consideration. Send a large (9" by 12") SASE with $.35 postage to ensure receiving complete contest results plus any awards you may win. No logs will be returned.

CONNECTICUT QSO PARTY
Starts: 2000 GMT March 31
Ends: 0200 GMT April 2

Sponsored by the Candlewood Amateur Radio Association (CARA). There is a rest period from 0500 to 1200 GMT. This contest is normally run in December and will reappear back in its regular slot, the first weekend in December.

EXCHANGE:

Send RS(T), serial QSO number, and ARRL section or Connecticut county.

SCORING:

Club station W1QI counts 5 points per band/mode. Novice QSOs count 2 points, OSCAR QSOs 3 points. Out-of-state stations multiply QSO points by the number

RESULTS

1983 WASHINGTON STATE QSO PARTY
CERTIFICATE WINNERS

Callsign	QSOs	Multipliers	Total
Alaska			
NL7D	42	19	1,653
Arizona			
W7RIR	63	22	3,256
Arkansas			
WB5RYB	67	20	3,080
California			
W6NNV	35	19	1,995
AA6EE	35	18	1,782
Colorado			
WB8ZRL	46	18	2,106
Connecticut			
W1NG	79	24	4,488
Florida			
W4WIJ	71	21	3,360
K4DDB	66	19	3,078
Georgia			
KE4XW	112	29	6,786
Idaho			
KA7PMP	23	11	759
Illinois			
W9QWM	95	28	6,832
Indiana			
WD8QBB	107	27	5,778
Iowa			
KØHQE	34	16	1,616
Kansas			
WDØCCW	39	18	2,070
Kentucky			
WA4EBN	39	18	2,106
Maine			
W1DLC	66	22	3,608
Maryland			
W3HQU	72	21	4,536
W3FG	67	20	3,520
Massachusetts			
KA1CLV	60	20	3,100
Michigan			
KA8IIN	79	21	3,948
KS8Q	64	19	3,173
Minnesota			
WAØQIT	20	9	432
Missouri			
KMØA	25	14	924
New Jersey			
KC2ME	29	11	759
New Mexico			
W7LHO	37	15	1,350
New York			
WA2PHA	63	20	2,620
North Carolina			
K4JEX	59	19	2,793
North Dakota			
KCØUM	14	8	224
Ohio			
WB8LZR	14	9	252
Oklahoma			
KD6YR	39	12	936
Oregon			
WA7RQS	154	36	11,124
Pennsylvania			
WA3HAE	113	26	7,358
Rhode Island			
WB2NDE	98	26	6,084
South Carolina			
KE4VP	23	9	414
South Dakota			
WAØBZD	1	1	2
Tennessee			
K4UVH	38	14	1,064
Texas			
W5PWG	79	22	4,532
W5SOD	63	19	2,812
Utah			
W7LN	26	11	759
Virginia			
W4KMS	36	15	1,560
West Virginia			
W8VEN	23	10	460
Wisconsin			
WB9PYE	24	11	682
K9GTQ	23	12	552
Canada			
Ontario			
VE3EQF	24	14	952
Brazil			
PY1NEZ	16	6	192
Japan			
JA9YBA	35	14	1,106
(oprs. JA9LNJ, JA9NFO)			
JH3DPB	32	14	896
KA2KS(KV7J)	25	11	704
New Zealand			
ZM2RY	3	3	24
Washington			
Asotin County			
KN7L	275	50	38,750
Benton County			
N7EPN	239	50	23,900
Chelan County			
K7GAH	106	34	10,812
Clallam County			
W7MPD	52	28	4,284
Cowlitz County			
KJ7N	84	32	8,064
KO7W	83	30	6,990
Ferry County			
KD7H/7	66	31	5,983
Grant County			
W7WMO	443	59	64,192
Grays Harbor County			
KW7R	282	50	34,050
Island County			
N7AYF	1,048	100	209,600
King County			
K7NWS	688	53	77,592
(oprs. AK7S, KS7F, KS7Z, KA7COD)			
KA7DJR	637	55	70,070
KU7F	447	69	61,686
N7AOP	246	53	27,454
K7UU	167	40	15,240
Kitsap County			
KC7GQ	218	46	20,056
W7IIT	110	34	11,220
Kittitas County			
WA7STA	49	23	2,254
Mason County			
W7DFO	109	33	8,778
Okanagon County			
KD7H	230	41	25,420
Pacific County			
K7NPS	254	44	28,204
Pierce County			
WA7RWK	376	52	39,104
N7EPD	181	46	24,978
W7DK	147	39	14,820
(oprs. KG7V, W5PBL, KL7UR, KA7CXU, K7QLC, N7DRT, K1DPO)			
Skagit County			
K7EQ	167	43	19,092
Snohomish County			
W7IEU	217	44	28,644
W7TSQ	202	46	18,584
Whatcom County			
WB7CAO	201	42	16,884
Whitman County			
W7YH	4	4	48

of Connecticut counties worked (8 max.). Connecticut stations multiply QSO points by the sum of ARRL sections worked. Additional DX contacts count for QSO points but only one DX multiplier overall is allowed.

FREQUENCIES:

CW—40 kHz up from the bottom of each band.

SSB—3927, 7250, 14295, 21370, 28540.

Novice—3725, 7125, 21125, 28125.

ENTRIES AND AWARDS:

Logs must show category, date/time (GMT), stations, numbers, bands, QSO points, and claimed scores. Enclose a large SASE for results. Logs must be postmarked by April 30th and sent to: CARA, c/o R. Dillon N2EFA, Box 954, Danbury CT 06810.

QRP ACTIVITY WEEKENDS

The various QRP Activity Weekends throughout the year are sponsored by the G-QRP-Club in England. They are intended to promote QRP activity on the times and frequencies suggested. Members from other QRP clubs throughout the world and all amateurs interested in QRP are invited to join in. QRP clubs are requested to publicize the activity periods in their club magazines.

The following times and frequencies will be used for the Spring QRP CW Activity Weekend on March 17–18, the Late Summer QRP CW Activity Weekend on September 22–23, and the QRP Winter Sports on CW, December 26 through January 1st:

0900–1000 GMT	14060
1000–1100	21060/28060
1100–1200	7030
1200–1300	3560
1300–1400	10106
1400–1500	3560
1500–1730	21060/28060
1730–2000	14060
2000–2100	7030/10106
2100–2200	3560
2200–2300	14060

In addition to the above events, members of the G-QRP-Club have weekly activity periods on Sundays between 1100 and 1230 and again from 1400 to 1530 on the International QRP frequencies (mentioned above) and on Wednesdays on 3560 from 2000 local time (for amateurs in the UK and Western Europe).

Full details of membership of G-QRP-Club from the Membership Secretary, Fred Garratt G4HOM, 47 Tilshed Close, Druids Heath, Birmingham, B14 5LT, England.

REVIEW

REVIEW OF A GLUE

Do you sometimes have the need for a good, strong, easy-to-use plastic glue—something a little better than model-airplane cement and more versatile than "super glue"? If so, you should give "Plast-i-Pair" a try.

"Plast-i-Pair" is a two-part "repair kit," mainly for plastics, but also excellent for bonding most anything to anything else.

"Plast-i-Pair" is just dandy for fixing up most of the non-electronic computer things that tend to break, crack, snap, and otherwise fall apart. It can be used to repair computer cases, broken key tops, cracked circuit card guides, broken switches, and joysticks. If you've ever broken an impossible-to-replace knob on a television or other piece of electronic gear, you will certainly appreciate this glue's ability to repair knobs!

In addition to the usual "glue" application of sticking broken things back together, "Plast-i-Pair" can be used to mold things . . . plugs and sockets, for example. (Ever break a weird computer or radio plug and have the metal parts still intact but the plastic all disintegrated?) It's just fine when you need to custom-build a special plug for some project, too. With just a little care, you can mold and repair fairly large sections of a broken cabinet. This works well, for example, in filling a gaping hole in the case of a $10 used video monitor!

The glue is easy to use. It does, however, require a couple of exotic materials . . . a mixing container and a mixing stick. For most small jobs, a baby-food-jar lid is just right for the mixing container. A tongue depressor (or Popsicle stick!) makes an excellent mixing device.

One component of "Plast-i-Pair" is a white powder, the other is a clear liquid. To use the material, merely dump a small amount of the white powder into the mixing container and add a few drops of the clear liquid. Stir until the components are well mixed. If the mixture looks grainy, you need a little more liquid. When you have it mixed (without grains), you're all set . . . unless, that is, you want the glue to be thicker. In that case, you just sit back and wait a few more seconds (maybe even a minute or so) until the mixture is the desired consistency. Then, apply it. Clamping is rarely needed . . . and even in the cases when clamping is necessary, it doesn't have to be done for very long.

For some plastic-to-plastic repairs, the liquid solvent can be used by itself as a glue. It works at least as well as most regular plastic-solvent-type adhesives.

Lest you think that this material is all fun and games, however, we should mention one tiny drawback that could get you to run out of the house: "Plast-i-Pair" smells absolutely terrible! Imagine a skunk's odor combined with a little alcohol and some acetone and you will have a rough idea of how this material smells. If you must use it indoors, an open window or an exhaust fan will be extremely useful!

In addition to its obvious computer and electronics applications, "Plast-i-Pair" is very handy for repairing kids' toys and eyeglass frames. My most recent use, incidentally, was in repairing a bird feeder. "Plast-i-Pair" was used to glue two leather straps to a piece of transparent plastic. And it held!

The smallest size kit of "Plast-i-Pair" consists of 90 cc of liquid and 3 ounces of powder. It's sold as "No. 175" and costs $5.50 plus shipping.

While you're waiting for the "Plast-i-Pair" to arrive, start saving up (or scrounging) baby-food-jar lids and Popsicle sticks!

For more information, contact the *Rawn Company, Inc., PO Box 9, Spooner WI 54801*. Reader Service number 477.

Dennis G. Brewer K8DIU/4
Greenville NC

B & W MODEL AC 1.8–30 CONTINUOUS-COVERAGE ANTENNA

Surely there are many of us who would like to operate on some band(s) in the 1.8-to-30-MHz region but who cannot, for some reason, erect a full-sized, high-efficiency antenna for same. To abandon the band(s) altogether is foolish and unnecessary, especially in light of some of the recent market offerings of multipurpose antenna systems which cover all seven popular HF bands without the requirement of external tuners or sprawling rural lots.

The Barker & Williamson model AC 1.8–30 is such a multipurpose antenna system. There is no question that the efficiency of such a system is relatively low when compared with well-elevated single-band resonant arrays. I do not believe the AC 1.8–30, or any other multiband nonresonant antenna system will work as well as individually-tuned half-wave dipoles installed the requisite half wave above ground; however, this is no reason to avoid these multipurpose systems, especially if you simply do not have unlimited space. Even an antenna with −20 dB gain (i.e., 20 dB loss compared with a half-wave dipole) can be used to make many enjoyable contacts. After all, 20 dB below a 40/S9 signal is still pretty strong.

The B & W model AC 1.8–30 is advertised as a "continuous-coverage antenna," offering some degree of efficient radiation from 1.8 through 30 MHz with a single feedline and no adjustments. Both because I wanted an antenna for 160 meters and to prove or disprove B & W's rather fantastic claims for this product, I ordered one from a franchised distributor and received it about a week later.

Inspection

Inspecting the AC 1.8–30, I found a completely pre-assembled antenna consisting of two bulky weatherproofed assemblies and 110' of stranded copperweld wire, a coil of about 100' of similar stranded copperweld wire to use as an optional counterpoise, and three heavy-duty antenna insulators. The quality of all component parts appears to be excellent. The antenna feedline, not supplied, connects to what B & W calls an rf transformer having an appearance and bulk similar to a heavy-duty wideband balun. At the opposite end of the antenna radiating wire is another bulky component which B & W calls a balancing network: This is similar in size and weight to the rf transformer and is a two-terminal device which connects between the radiating wire and ground. The balancing network is a potted assembly which appears very weatherproof and strong.

The instruction sheet supplied with the antenna is a simple two-sided photocopy which does not attempt to describe the theory of the antenna (see Theory section later in this review). It does state that the antenna will exhibit a maximum swr of 2:1 from 1.8 through 30 MHz (referenced to 50 Ohms), that the power rating of the product is 1.5 kW ICAS (intermittent commercial/amateur service), and that the antenna should be installed as an inverted "V" with the center twenty-five to thirty feet higher than the ends, making the overall antenna length about eighty feet end to end at the base. The instructions also recommend connecting the two ground terminals, one each on the rf transformer and the balancing network, directly to ground rods. Assuming this meant that I should install the antenna with the two ends nearly on the ground and the center elevated about thirty feet above the ends, I proceeded to install the AC 1.8–30 exactly in that manner.

Installation

My property measures 140' deep by 250' wide, slightly over three-quarters of an acre, and is probably typical of a suburban lot. While my lot is wide enough to accommodate a full-sized half-wave dipole for 160 meters, the trees are not in the right places to support a dipole at a sufficient height to make it work well. A half-wave dipole really should be installed a half wave above ground to work like an ideal dipole, and at 1.8 MHz this is over 200' high. If I lived in a redwood forest with 400' trees all around, I could probably work this out, but I don't, and I really couldn't see installing two 250' towers to support a $10 dipole. So, I decided to try a compromise (short, and less than 200' high) antenna for 160; thus, the AC 1.8–30.

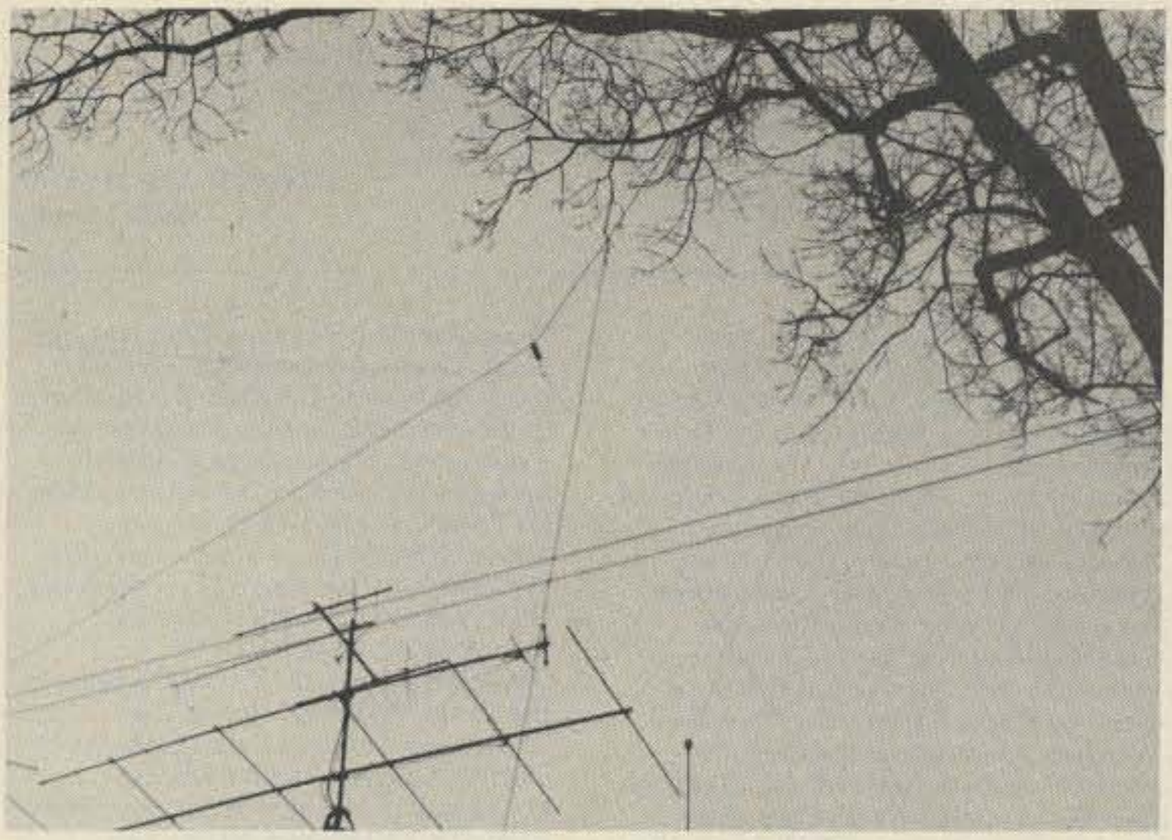
To install the B & W antenna, I first ran a rope from a limb of an oak tree in my backyard to the top of a mast strapped to my chimney on the roof of my house. This made the rope about sixty feet long, with each end support about forty feet above ground. This rope was to be used to support the center of the B & W AC 1.8–30 at a height of about thirty feet. I figured, correctly, that the rope would stretch and sag a bit with the weight of the antenna hanging from it.

Next, with the help of my friend KT2B, I installed the antenna so that the dimensional center of the antenna wire is supported by the rope and the two ends of the antenna wire come down to the ground about eighty feet apart, just like the sketch in the B & W instruction sheet. At each end of the antenna, we drove a four foot ground rod into the earth, and then we stretched the antenna straight and connected the ground wire supplied at each end of the antenna assembly (this is pre-wired) to the two ground rods, making the ground wires quite short. This means the rf transformer and the balancing network are supported in midair by the radiating antenna and ground wires, only about a foot above ground at each end.

We were sure to install the antenna so that it makes a perfect inverted "V" and the entire antenna is in line; that is, viewed from directly above or below the antenna, it would look like a straight line. B & W doesn't mention if this is important

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.



The AC 1.8-30 shown near its center, which is hanging from a horizontal support rope. The vertical rope to the right of the antenna is used for positioning the support rope.

The feedpoint rf transformer against a backdrop of New Jersey chestnut leaves. The transformer hangs between the antenna wire and a ground stake just above ground level.

but I guessed it might be, and it wasn't any extra effort to do it this way.

Measurements and Tests

We then connected a 50-Ohm feedline (at first, random lengths of RG-8/U and RG-11/U in series; later, a single length of RG-8/X), ran the cable in the house, and started making measurements. I should state that the very first band we tried out was 160 meters and I was pleasantly surprised to find that the antenna loaded well, with a measured vswr of 1.5:1 *across the whole band*. This made me kind of suspicious. The only thing I owned which was flat across any whole band was a dummy load, and I began to suspect that maybe the B & W antenna is a big dummy load. Tuning across the band, I found that the antenna is certainly no dummy, because it was receiving loud signals all across 160 meters at about 4 o'clock in the afternoon. I immediately made a few quick contacts, using my Kenwood TS-520S at about 100 Watts PEP, to determine that the contraption actually works!

Pete KT2B and I next proceeded to measure the antenna impedance using an old GE rf impedance bridge with an internal tunable oscillator; we found the impedance to be about 70 Ohms all across 160 meters and about the same all across 40 meters, but much higher on the other HF ham bands. On 80, 20, 15, and 10 meters, the impedance measured between 100 and 200 Ohms, which would have produced swr readings of 2:1 to 4:1. However, the test was premature because I had spliced together a quick feedline of RG-8/U in series with RG-11/U (75-Ohm cable), random lengths of each, and this probably had some detrimental effect on the antenna's impedance/frequency relationship.

The next day I disconnected the RG-8/U to RG-11/U system and ran an RG-8/X 50-Ohm "minifoam" coax feedline, about sixty feet long, from the antenna rf transformer to my Kenwood. Using my Bird model 43 directional coupler/wattmeter and a 100-Watt HF band element, I measured vswr vs. frequency over the six ham bands covered by my Kenwood, and this information is shown in Table 1.

The eighteen readings of Table 1 are all that are really required because it is obvious that the antenna is quite broadband and the swr within any given band doesn't change much. The "100" readings indicate immeasurably low reflected power using my most sensitive Bird element. The swr is probably never quite 1.00:1, but when I cannot detect any reflected power at all, I round the swr value to 1. When the swr is relatively high, as on 20 meters, the impedance of the antenna is higher than 50 Ohms, not lower; e.g., at 14.2 MHz, the complex impedance is about 120 Ohms.

Based on my measurements, the B & W antenna doesn't quite make the "less than 2:1 swr across 1.8-30 MHz" they claim, but it comes impressively close. Note that I did *not* install the counterpoise wire which B & W states might improve performance in some installations.

Performance

Of course, what good is a low swr if you can't get out? Not much. So I spent the entire contest weekend (November Sweepstakes) following my installation of the AC 1.8-30 antenna switching back and forth between the B & W antenna and some standards for my station: On 80 meters, I normally use a half-wave double-bazooka coaxial dipole installed as an inverted "V" with the center up sixty feet; on 40 meters, I normally use a conventional half-wave dipole at forty feet; on 20-15-10 meters, I use either a 4-element trap triband yagi (Cushcraft ATB-34, 18' boom, 8-9 dB gain/band) or a half-wave vertical (Cushcraft R-3). The triband yagi is tower-mounted at about twenty-five feet, and it should be noted that I have a hilltop location with rocky (and probably not very conductive) soil. With a total of five antennas to switch from, and I do have all the feedlines brought to a coaxial switch, I could easily compare the B & W antenna to the others listed.

Frequency, MHz	Vswr, measured
1.80	1.65:1
1.85	1.50
1.90	1.50
3.50	1.80
3.75	2.00
4.00	1.85
7.00	1.05
7.15	1.00
7.30	1.00
14.00	2.20
14.20	2.40
14.35	2.30
21.00	1.80
21.20	1.70
21.45	1.70
28.00	2.10
28.50	2.20
29.00	2.00

Table 1.

Basically, the B & W continuous-coverage antenna works fairly well. It does not compare with my beam on 14, 21, or 28 MHz, but I didn't expect that it would. It also does not compare with the R-3 half-wave vertical on those three bands. But it does hear pretty well, and it does get out. On twenty meters, I switched to the B & W antenna in the middle of a few contacts and the contacts were completed with no trouble. One of these contacts was with Hawaii, some 5500 miles distant. I guess this proves that 20 dB down from an S9 signal is still easily readable!

On forty meters, the B & W antenna really shines and performed almost as well as my half-wave monoband dipole at forty feet under most conditions. On 80 meters, the antenna works, but it is no match for my inverted "V" double bazooka, typically producing signals about three "S" units down from the bazooka standard. On 160 meters, I do not have a standard antenna with which to compare the B & W; however, I can say that the AC 1.8-30 has produced many enjoyable 160-meter QSOs at various distances from a few miles to a few thousand miles. I am running only 100 Watts PEP output on 160 and have received several complimentary reports from lots of stations who seem to "live" on that band. Clearly, the antenna works.

Theory

Intrigued by the AC 1.8-30, I made some measurements on both component parts and the completed, installed assembly to reason why or how this antenna works. The balancing network is really just a 600-Ohm dummy load (resistive termination) of rather significant proportions; I assume this is probably rated at a few hundred Watts in free air. The rf transformer is exactly that and has an impedance ratio which varies somewhat with frequency and power but averages about 12:1 (secondary:primary). I checked this by removing the transformer from the antenna circuit and performing bench tests using a Bird 43 wattmeter installed in the 50-Ohm primary side and connecting various terminating resistances across the secondary. The vswr dropped to a very low value when the transformer was terminated with 500 to 600 Ohms, yielding my estimated design ratio of about 12:1.

Based on the above findings, I surmise that the AC 1.8-30 is a "traveling-wave" antenna which need not be resonant to perform with reasonable efficiency. The antenna system looks like a terminated wire of high impedance (600 Ohms), and the rf transformer is used to match this load to its low-impedance unbalanced transmission line (50-Ohm coax). Although I didn't try it, I believe that if the antenna radiating wire were replaced with 600-Ohm open-wire transmission line hung in free space, the entire system would then become one big 600-Ohm dummy load which would hardly radiate at all; however, because in actual practice the conductor from line to load is neither shielded nor balanced, it radiates, rather

The balancing network hangs between the antenna wire and a ground stake just above the lightly snow-covered lawn.

than conducts, most of the power applied to it.

Conclusion

I guess the summary results of my tests thus far indicate that the AC 1.8–30 is ideal for anyone who only has room for or can afford just one antenna to cover all the popular HF bands. I regret I could not try it out on 30 meters, but I don't have anything on this new band (yet). On 160 meters, it is one of the few antennas which actually works and fits on a suburban lot; on the bands above 160, the B & W antenna appears to work, but not as well as single-band dedicated dipoles. For less than $150, it's not a bad deal; I'll use it just on 160 for that price and be happy about it.

For more information, contact *Barker & Williamson, 10 Canal Street, Bristol PA 19007, (215)-788-5581.* Reader Service number 476.

Steven D. Katz WB2WIK
Budd Lake NJ

FCC

47 CFR Part 97

[PR Docket No. 83-28; FCC 83-584]

Establishment of a Class of Amateur Operator License Not Requiring a Demonstration of Proficiency in the International Morse Code; Withdrawal of Proposed Rule

AGENCY: Federal Communications Commission.

ACTION: Withdrawal of proposed rules; Report and Order.

SUMMARY: This document withdraws two alternative sets of proposed rules set forth in a *Notice of Proposed Rule Making*, 48 FR 4855 (February 3, 1983). These rules would have established an amateur radio operator license class which an individual could have obtained without first demonstrating a proficiency in the international Morse code. These rules are being withdrawn because: (1) The requirement for Morse code proficiency is not a significant barrier for those who want to get an amateur operator license; and (2) it is in the public interest to maintain a skilled pool of amateur operators for the safety of life and property and public emergencies and for the national defense.

FOR FURTHER INFORMATION CONTACT: John Borkowski, Private Radio Bureau, Washington, D.C. 20554 (202) 632-4964.

Report and Order

In the matter of establishment of a class of amateur Operator License not requiring a demonstration of proficiency in the International Morse Code; PR Docket No. 83-28.

Adopted: December 14, 1983.
Released: December 23, 1983.
By the Commission.

Introduction

1. In the *Notice of Proposed Rule Making*, 48 FR 4855 (February 3, 1983) in this proceeding, we proposed to establish an amateur radio operator license which an individual could obtain without first demonstrating a proficiency in the international Morse code. The proposal was intended to attract intelligent, disciplined persons to the Amateur Radio Service who could make a valuable contribution to the service without such a proficiency. It sought to remove any barrier the code requirement might place in the path of computer-oriented or handicapped individuals otherwise qualified to be amateur operators but for the code requirement.

2. The *Notice* proposed establishment of one of two kinds of "codeless" operator license classes. One proposal was to eliminate the five word-per-minute Morse code examination element [Element 1(A)] from the existing Technician class operator licensing requirements, with all authorized amateur privileges above 50 MHz. The alternative proposal involved creation of an entirely new license class with qualifications akin to those for the Canadian Digital Amateur Class Certificate.

Background

3. The issue of a codeless amateur operator license has been addressed in past Commission proceedings. In a *Notice of Proposed Rule Making* in Docket No. 20282, 39 FR 44042 (December 20, 1974), we noted that the Morse code requirement might be a significant barrier to Amateur Radio Service (ARS) entry. In a *Notice of Inquiry* in General Docket No. 78-250, 43 FR 37729 (August 24, 1978), we considered, among other possible improvements in administering Morse code examinations to handicapped applicants, creating a new class of amateur operator license without a Morse code proficiency requirement and with eligibility restricted to handicapped applicants. In the *Third Report and Order* in Docket No. 20282, 44 FR 16460 (March 19, 1979), we stated we would like to get fresh comments on the issue and would initiate a new proceeding to do so. The *Report and Order* terminating General Docket No. 78-250, 47 FR 14197 (April 2, 1982), also discussed the possibility of a class of amateur radio operator license without telegraphy requirements.

Comments

4. Almost 5,000 comments and reply comments were received.[1] The comments were overwhelmingly opposed to the establishment of any class of amateur operator license not requiring a demonstration of proficiency in the international Morse code. There were approximately twenty comments opposed to a codeless operator class for every comment in favor of such a class.[2]

5. Comments and reply comments in favor of some form of amateur license not requiring proficiency in the international Morse code included those of the Amateur Radio Research and Development Corporation (AMRAD), the Amecom Amateur Radio Club, the Capitol Hill Amateur Radio Society (CHARS), the Centralia Wireless Association, the Emerson Electric Amateur Radio Club (Emerson), the Garden State Amateur Radio Association, the Northern Illinois DX Association, the Okaw Valley Amateur Radio Club, the Southern Michigan Amateur Radio Team, the Sterling Park Amateur Radio Club, the Tennessee Council of Amateur Radio Clubs and the Willamette Valley DX Club.

6. Comments and reply comments opposed to any form of amateur license not requiring proficiency in the international Morse code included those of the Amateur Radio Association of the Tonawandas, Amateur Radio Post 380 (American Legion, Department of California), the Amateur Radio Transmitting Society of Louisville, the American Radio Relay League, Inc. (ARRL), the Athens Amateur Radio Club, the Bay Area Two-Twenty Group, the Bell Amateur Radio Club, the Beloit Amateur Radio Club, Inc., the Bemidji Amateur Radio Club, the Black Diamond Amateur Radio Club, the Brandon Amateur Radio Society, the Buffalo Amateur Radio Repeater Association, the Butte Amateur Radio Club, the Capeway Amateur Radio Club of Massachusetts, the Central Carolina Amateur Radio Society, the Cleveland Wireless Association, the Concord Brasspounders Amateur Radio Club, the East Bay Amateur Radio Club, the Eastern Shore Amateur Radio Club, the Elmore County Amateur Radio Club, the Emporia Amateur Radio Society, the Estero Amateur Radio Club, the Everglades Chapter of the Quarter Century Wireless Association (QCWA), the Fairfield Amateur Radio Association, the Falmouth Amateur Radio Association, Inc., the Findlay Radio Club, the Flathead Valley Amateur Radio Club, the Grande Ronde Radio Amateurs, the Great Circle Shortwave Society, the Greater Milwaukee DX Association, the Greater Toledo Amateur Radio Association, the Green Fox Amateur Radio Club, the Grumman Amateur Radio Club, Hancock Emergency Amateur Radio Services, Inc., the Hendricks County Ham Club, the Hoodview Amateur Radio Club, the Houston Echo Society, the Idaho Society of Radio Amateurs (Magic Valley Chapter), the Inter-City Amateur Radio Club, the Irwin Area Amateur Radio Association, the ITT Gilfillan Amateur Radio Club, the Jackson Amateur Radio Club, Inc., the Jefferson Amateur Radio Club, the Kettle Moraine Radio Amateur Club, the Lac Qui Parle Amateur Radio Club, the Lebanon Valley Society of Amateur Radio Club, the Liverpool Amateur Repeater Club, the McHenry County Wireless Association, the McMinnville Amateur Radio Club, the Madison Amateur Radio Club, the Metropolitan Amateur Radio Club, the Metuchen Amateur Radio Club, the Mid-Oklahoma Repeator, Inc., the Mike and Key Radio Club, the Milton Academy Amateur Radio Club, the Milwaukee Radio Amateur's Club, Inc., the Milwaukee School of Engineering Amateur Radio Club, the Monongalia Wireless Association, the Murray State University Amateur Radio Club, the Nashua Area Radio Club, Inc., NBS-Brass, the North Alta Loma Repeater Club, the Northrup Radio Club, the Old Post Amateur Society, Inc., the Old Pueblo Radio Club, Inc., the Ole Virginia Ham Amateur Radio Club, the Owensboro Amateur Radio Club, the Pentagon Amateur Radio Club, the Pentucket Radio Association, Inc., Pike Amateur Radio Emergency Services, the Port City Amateur Radio Club, the Portage Amateur Radio Club, the Potomac Valley Radio Club, QCWA, the Radio Amateur Teletypists Society of Minneapolis, the Radio Club of Tacoma, Inc., the Rock River Radio Club, the St. Barnabas Amateur Radio Club, the St. Cloud Amateur Radio Club, the St. Lawrence Valley Repeater Association, the San Antonio Repeater Organization, the Santa Rosa Amateur Radio Association, the Schenectady Amateur Radio Association, Inc., the Sharon Amateur Radio Association, the Shiawassee Amateur Radio Association, the Sierra Nevada Amateur Radio Society, Inc., the Sioux Falls Amateur Radio Club, Inc., Sonoma County Radio Amateurs, Inc., the South Georgia Amateur Radio Club, the South Texas Amateur Radio Society, Inc., the South Texas Amateur Repeater Club, Inc., the South Towns Amateur Radio Society, the Southeastern DX Club, the Southern California 220 Spectrum Management Association, the Southern California Repeater and Remote Base Association (SCRRBA), the Southern Oregon Amateur Radio Club, the Steubenville-Weirton Amateur Radio Club, the Story County Amateur Radio Club, the Suburban Amateur Repeater Association, Inc., the Texas DX Society, the Texas VHF-FM Society, the Thibodaux Amateur Radio Club, the Thumb Amateur Radio Club, the University of Minnesota Amateur Radio Club, the Valley Amateur Radio Association, the Valley of the Moon Amateur Radio Club, the Viking Amateur Radio Society, the West Valley Amateur Radio Association, the Western Piedmont Amateur Radio Club, the Wood County Amateur Radio Club, the Worthington Amateur Radio Club and the York Radio Club.[3]

Summary of Decision

7. For the reasons set forth in the discussion below, we have determined that it would not be in the public interest, convenience or necessity for the Commission to establish a class of amateur operator license not requiring a demonstration of proficiency in the international Morse code.[4] We reach this determination on the basis that: (1) A five word-per-minute (wpm) code requirement does not constitute a significant ARS entry barrier; (2) knowledge of the Morse code continues to be relevant to everyday usage in the ARS; and (3) a Morse code requirement for every license class is important to maintaining the traditional public service role of the ARS in emergencies involving public safety and the national defense.

Discussion

I. Morse code as an entry barrier.

A. *The general public.* 8. We received many comments from persons who indicated that the Morse code was a barrier for them in joining the ARS. For instance:

> I am not a licensed amateur radio operator. I have a technicians degree from the Cleveland Institute of Electronics and a Batchelor of Science degree in Electrical Engineering from the University of Tennessee. I know that I can pass the technical exams for amateur licensing. At this time the Morse code is the major obstacle between me and my amateur license. Comments of John D. Triplett.

Some commenters alleged personal learning barriers. Others indicated that they cannot find the time to learn the code.

9. To the extent a "code barrier" exists, it appears to be an attitudinal one. M. Hoshiko, faculty advisor and trustee of the Southern Illinois University Amateur Radio Club, said that very few electronics students are willing to study the code to become hams. The unwillingness to study Morse code may reflect a perception that it is an outmoded form of communication. Edward Novak commented that most individuals who will not study the code

[1] The motion of the Capitol Hill Amateur Radio Society (CHARS) to accept its late-filed (August 1, 1983) reply comments is granted. The motion of the American Radio Relay League, Inc. (ARRL) for leave to submit supplemental reply comments on CHARS' late-filed reply comments is also granted.

[2] Many comments, such as those of Donald L. Stoner, which included "a proposal for the creation of a computer hobbyist license class," were alternative suggestions for the type of codeless license to be adopted should we decide to proceed with some sort of codeless license. We are treating these as comments on the proposal rather than as separate petitions for rule making. In view of the result reached herein, we would entertain future proposals for allocating spectrum separate and apart from amateur radio frequencies for a new computer hobbyist radio service.

[3] Donald B. Nowakoski's Petition to Cancel or, in the alternative, Amend is denied as an invalid petition under § 1.773 of the Commission's Rules (this is not a petition for suspension or rejection of a new tariff filing). However, this petition will be treated as a comment in opposition to the proposed rule making.

[4] As a result of this determination, we do not reach the question of which type of "codeless" license would be most appropriate.

are refusing to submit to what they perceive as an obsolete "ritual" requirement that they feel will have no application for them beyond gaining them their ham licenses. (See paragraphs 24–28, *infra*.)

10. Sometimes, a lack of willingness to study Morse code appears to be related to fear of its difficulty. One Morse code instructor stated that he has ". . . observed an initial apprehension of learing the international Morse code which usually accompanies the thought of learning something like an abstract foreign language." Comments of Gary L. Crown.

11. Those who do study Morse code appear to have few problems with the five wpm requirement. Instructors of code and theory commenting in this proceeding agreed that anyone can, with study, establish Morse code 5 wpm proficiency. Several instructors told us that no successful electronics students in their classes who really wanted an amateur license had failed to learn and pass the code test.

12. Significantly, instructors of code and theory also agreed that younger students have little or no difficulty in mastering Morse code. John B. Mollan stated that younger students have difficulty with the "theory" rather than the code requirements. John C. Hallyburton, Sr. indicated that he has experienced no difficulty in training both Cub and Boy Scouts in Morse code. And Francis J. D'Auria said that his average student learns the code with fifteen hours of study and practice, and some youngsters learn the code in eight to ten hours.[5] Melvin C. Vye, an associate professor of electronic technology at the University of Akron, indicated that young people with an interest in computers—one of the groups targeted as a basis for the *Notice* in this proceeding—have the least problem of any group in mastering Morse code.

13. Many commenters hastened to point out that a Morse code requirement cannot be much of a barrier to ARS entry, because ". . . (s)everal hundred thousand licensed Amateurs have learned Morse code and successfully passed code examinations in order to achieve a license." Comments of Richard A. Stiern. Martin D. Shapiro correctly pointed out in his comments that over the past 50 years the number of licensed amateur operators has increased from 30,000 to in excess of 400,000, or roughly 1300%.

14. In disputing the *Notice's* reliance upon a 1971 study referred to in Docket No. 20282, the Pentucket Radio Association, Inc. stated that from 1976 to 1980 the number of ARS licensees grew by 35%, adding over 100,000 persons to the Service. The Radio Operators Association of New Bedford pointed to the growth in numbers of Licensed Amateurs between 1973 and 1980 of nearly 200% Novice, 27% Technician, 30% General, 38% Advanced and 100% Amateur Extra Class licensees as evidence that Morse code requirements are not deterring ARS expansion.

15. The most recent Commission statistics showed continued increase in the number of amateur operators in fiscal year (FY) 1983. In FY 1983, the total number of amateur operators grew to 410,767 for a net gain of 4,339 operators (20,940 new operators balanced against a loss of 16,601 operators). We conclude that the Amateur Radio Service is a healthy, growing service which has attracted large numbers of new licensees over the past decade. Its growth is continuing. The Morse code requirement does not appear to have critically affected the entry of new licensees into the Amateur Radio Service.

16. We conclude that a five wpm requirement for proficiency in the international Morse code is not an unreasonable burden upon license applicants. Members of the general public, particularly younger students with developing interests in electronic technology, radio and computers, are capable of learning the international Morse code at a proficiency of five wpm without undue difficulty. We conclude that to the extent a Morse code requirement acts as a bar to ARS entry for some, it is a necessary trade-off for the present nature of the Amateur Radio Service.

B. *Computer interests and the ARS.*

17. Bash Educational Services, Inc. (Bash) expressed the view that the implementation of a codeless Technician Class license would not greatly increase the ranks of amateur radio operators but would enhance the Service with the input from the more technically oriented youth in the United States. On the other hand, the Emerson Electric Amateur Radio Club (Emerson) acknowledged the affinity between home or personal (hobby) computing and amateur radio, as evidenced by packet radio, AMTOR, microprocessor RTTY, keyboard keyers, and code readers. But Emerson stated that the development of a body of pseudo-communicators who are little more than "appliance operators" would not be a sigificant step in merging the two interests.

18. Some commenters, such as William M. Pasternak (Pasternak), executive producer of Westlink Radio News, felt that while amateur radio and computer interests may overlap, most young computer users have no interest in amateur radio. Instead they pursue information retrieval and exchange through the use of modems interconnected with the public switched telephone network to access commercial computer networking organizations such as "The Source" and "Compunet."

19. After reviewing the comments, we conclude, as the ARRL stated, that:

> there is no evidence that younger, school-aged individuals whose primary interest is in computer technology will be attracted to amateur radio through the medium of such a license . . . . an interest in computer operation by no means connotes an interest in radio communications.

C. *Handicapped applicants.* 20. The vast majority of comments opposed implementation of a codeless license on the basis of a need to accommodate handicapped applicants. The only comments favoring any sort of special codeless license for the handicapped were the comments of some who, while generally opposed to a codeless license, acknowledged that they did not want to bar entry to the ARS on the basis of a person's handicap.

21. Comments from handicapped people themselves and from people who assist them in learning code and theory in order to successfully complete amateur operator examinations strongly opposed a codeless license for the handicapped. The Pentucket Radio Association, Inc. pointed out that in responding to PR Docket No. 78-250, handicapped Amateurs were not asking for a special license or elimination of requirements but instead sought acknowledgement of an individual's handicap and permission to use special techniques so that they may take the same examination as everyone else. Reo DePew expressed the view of a majority of handicapped amateurs when he stated that a "no-code" license would be unfair to them and rob them of some of their pride of accomplishment.

22. Perhaps the most telling and persuasive comments of all on this subject are those of the Courage HANDI-HAM System, an international non-profit service organization which provides amateur radio educational services, equipment and fraternity to people with physical, sight, speech and/or hearing handicaps. They stated:

> We must strenuously object to the argument that people with physical handicaps are prevented from being able to successfully complete a Morse code examination. Extensive experience in training over 5,000 severely handicapped people proves otherwise. In only six cases over the past 16 years have we encountered a situation where a *physical* (as opposed to mental) disability has absolutely prevented an individual from learning the code at the prescribed speeds! The Courage HANDI-HAM System has developed learning methods and transcription techniques which bring the International Morse code well within the abilities of severely handicaped persons.
>
> Of perhaps even greater significance is the reason WHY so many severely handicapped Radio Amateurs put forth tremendous effort to learn the code at speeds which permit fast and reliable on-the-air communications: for many, the Morse code is the ONLY means of communications available to them. You must realize that the very person who is so severely handicapped that he has a great deal of difficulty transcribing the code is precisely the person who, by reason of severe speech involvement with his physical handicap, NEEDS the code to communicate. Comments of the Courage HANDI-HAN System.

23. We conclude that physical disability, in other than extremely rare and exceptional circumstances, does not prevent handicapped persons from learning the Morse code and successfully completing Morse code examinations. We have made every effort to accommodate the handicapped in commission—administered amateur operator examinations. We have promulgated rules to assure that the handicapped will be similarly accommodated under the new amateur volunteer examiner program. *See e.g.* 47 CFR 97.26(g). Generally, the handicapped go to extraordinary lengths and are extremely resourceful in designing methods to achieve code proficiency. Handicapped applicants are justifiably proud when they master the Morse code. They wish to be treated as co-equals in the Amateur Radio Service: not as a special group needing a special license. Thus, considerations for handicapped applicants do not appear to warrant creation of a codeless license.

II. Relevance of Morse Code

24. Comments supporting the proposals in the *Notice* claimed that knowledge of the international Morse code is irrelevant in today's ARS. In its Reply Comments, CHARS stated that it is not even necessary to have any Morse code skills to utilize the code because inexpensive home computers interconnected with radio transmitters and receivers are generally capable of transmitting and receiving Morse code at speeds between 1 and 99 words per minute. Harold A. Wilson commented that with current technology almost all communication above 50 MHz on the amateur bands is FM. David A. Miller stated that at the Technician level "99% of UHF and VHF communication is voice communication."

25. The comments on this subject are conflicting, with a large preponderance of comments of the opposite view. Alfred G. Conte, Jr., stated that the proposal for a codeless license equates with a proposal to do away with the instruction of arithmetic in elementary schools due to the prevalence of inexpensive pocket calculators. Many commenters, like Charles E. Daum, pointed to the survey conducted by Florida State University's Institute for Social Research, cited in the *Notice*, in which 83% of the amateur operators responding said that a Morse code requirement is either essential or important for operator privileges below 30 MHz, and 64% said that such a requirement is essential or important for operator privileges above 30 MHz.

26. Emil Pocock commented that Morse code has many applications today above 50 MHz. He said that it is used for weak-signal communications, which is an important and widely pursued art in the VHF and UHF bands. Edgar Herbert Callaway, Jr., further explained that such weak signal work included:

> the use of low-noise transistors, power amplifiers, high gain antennas, stable narrow-band receivers, etc. . . . The first amateur EME (moonbounce) contact was made using Morse code. Also the first meteor-scatter contacts on 144, 220, and 432 MHz. The pioneering California-to-Hawaii 144 and 220 MHz contacts by W6NLZ and KH6UK (2540 miles, discovering truly long-hanl tropospheric ducting in the tropics) were made via Morse code. . . . Most of these contributions to the amateur radio service and the radio art in general were made by operators with ability, yes, state-of-the-art equipment, yes, but they all *required* Morse code. The contemporary equipment did not allow for the extra 3- to 10-dB of signal strength needed for another mode. There would have been no breakthroughs without Morse. Comments of Edgar Herbert Callaway, Jr.

27. There is also much evidence that Morse code is used frequently above 144 MHz. Matthew V. Ellsworth commented that it is often used in the two-meter and 440 MHz bands for communications with earth-orbiting satellites. He also stated that most automatic repeating stations identify by using a code generating device. Geoffrey H. Krauss said that even recent VHF contests reflect substantial Morse code usage. Richard A. Stiern commented that the Morse Code is still used extensively by the Armed Forces and the Merchant Marine because of its reliability under any circumstances. Joseph M. Rice stated in his comment that 99% of the present OSCAR satellite work is done using Morse code.

28. We conclude that Morse code still occupies a significant place in day-to-day amateur operation, particularly in the HF bands. The Morse code is used normally on VHF and UHF frequencies in conjunction with weak signal communications. The Morse code is relied upon heavily for experimentation and the development of new technological advances. The Morse code, rather than being irrelevant or obsolete, continues to be an integral part of amateur radio.

III. Use of Morse Code in Civil Emergencies and for National Defense

29. In extensive comments, Donald Godward set forth the basic philosophy of those commenters who believe that Morse code is no longer needed for amateur responsiveness in civil or military emergencies. He stated that the advent of all solid state SSB transceivers, VHF-FM gear, and RTTY equipment has essentially eliminated the need for CW in emergency operations. He said that modern SSB/FM/RTTY equipment is so small and light that it is highly portable and its power requirements are so compatible with modern batteries and portable power generators that there is no longer any real advantage to CW in emergency operations, even in terms of being able to "get through." The Mississippi Emergency Management Agency said that modern digital techniques are preferable to code for getting a message through. CHARS stated that most emergency communications in fact utilize voice, either sideband or FM.

30. However, most individuals and groups involved in amateur emergency communications urged retention of a code requirement for all amateur operator licenses. Many amateur operators brought our attention to specific instances of emergency communications that were possible only with the use of Morse code, such as this year's tornado and floods in Southeast Missouri, life threatening emergencies at sea handled by the Maritime Mobile Service Net, the rescue of the crew of the *Jala Morari*, and the rescue of the crew of a sinking ship in the Straits of Juan de Fuca. Al Uvietta, Communications Support Group Coordinator for the City of San Antonio, Office of Emergency Management, and

[5] Daniel and Claire Rosenbaum referred to the Department of the Army Technical Manual TM 11-459 and the Department of the Air Force Technical Order TO 31-3-16, entitled *International Morse Code (Instructions)*. According to this joint publication an average person can learn to send and receive Morse code with 15–22 hours of study, based on sending and receiving proficiencies tested at one continuous mistake-free minute.

Hancock Emergency Amateur Radio Services, Inc., a group of about twenty-five amateur operators banded together by the need for emergency communications during tornadoes, floods and other disasters, commented that Morse code is more effective in getting through when communications are affected by weather, poor propagation and interference. Most commenters still view Morse code as the communications mode of last resort for the worst conditions. See, e.g., Comments of Ralph V. Anderson; Comments of James W. Partin.

31. Many commenters, including the Southern California Repeater and Remote Base Association (SCRRBA), were concerned that the anticipated growth of the ARS if we adopt a codeless license would adversely impact already-crowded repeater operation in large urban areas, with resultant detrimental effect upon emergency communications capability. The Story County Amateur Radio Club pointed out that a Morse code requirement for every amateur operator license assures maintenance of a pool of skilled amateur operators available to provide communications for the public in emergencies.

32. Several years ago, the U.S. military services "de-emphasized" the use of Morse code as a modern communications tool. Now there is a major push in the U.S. military services to re-train their radio operators in the proficient use of Morse code. In the Air Force, for example, all ground radio operators must be proficient at five words per minute before March 1, 1984. They have two years to reach ten words per minute and three years to reach 15 wpm. See the Comments of Gen. Kremin. Henry M. Wymbs, an Army Signal School graduate and former member of the Second Signal Service Battalion in World War II commented that amateurs having a knowledge of the international Morse code have always formed a trained cadre of communicators upon which the military has always depended.

33. A letter to the ARRL from Mr. Oscar A. Goldfarb, acting Deputy Assistant Secretary for Logistics and Communications, U.S. Air Force, stated that "(s)hould the Commission adopt the 'No-Code' proposal, we would establish a requirement for Morse code proficiency as a condition for becoming an Air Force MARS member." See the Reply Comments of the American Radio Relay League. The Central Intelligence Agency (CIA), in a full-page advertisement for Electronic Technicians, Communicators and Radio Operators published in the June 1983 issue of Signal Magazine and appended to the comments of Philip B. Petersen stated that "Morse code ability at 12 gpm [wpm] is preferred; other applicants will be tested for Morse aptitude."

34. We conclude that a proficiency in the International Morse code is still very useful for amateur responsiveness in civil and military emergencies. In such emergencies, it is the principal communications mode of last resort in the face of uncertain propagation characteristics or severe interference. Due to international language barriers, it is sometimes the only effective communications mode. It is in the public interest, convenience and necessity to maintain a pool of skilled amateur operators available to provide emergency communications for the public during disasters and for the national defense. Continuance of a requirement for proficiency in the international Morse code will contribute to continued maintenance of such a pool. Clearly, Morse code is a fundamental communications skill critical to the nature of the ARS.[6]

35. *Foreign Codeless Experience.* Many commenters, including Edward C. Simmons, stated that Canada has very few codeless class licensees because of a much more difficult examination than we proposed for either alternative U.S. codeless class license. On the other hand, a large number of commenters attributed the substantial growth of Japan's amateur radio service (from 70,000 licensees in 1965 to over 1,000,000 licenses in 1982) directly to Japan's easy-to-get codeless class license.[7] Our proposals fell somewhere between Canada's and Japan's codeless licenses. Neither country's experience appears directly applicable.

36. *Impact of a Codeless License Upon ARS Compliance.* Many comments opposing the proposal feared that a codeless amateur operator license would really be no more than another Citizens Band Radio Service, with what they perceived to be all its attendant problems. The Ozaukee Radio Club and the Inter-County Amateur Radio Club expressed concern that the amateur radio spectrum not be abused, as in Citizens Band. Pasternak commented that investigations by him and his news service reveal that such a license will initially be looked upon as an extension of Citizens Band Radio, to be mass marketed to the general public in a way similar to the way Citizens Band Radio was in the 1970's.

37. Coupled with this fear is a belief held by many commenters that rule compliance and dedication to public service in the ARS is a function of the time and effort a person must expend in obtaining a license. See, e.g., Comments of H. T. Hunt; Comments of the American Radio Relay League, Inc. The Honorable Lee H. Hamilton, U.S. House of Representatives, stated that the praiseworthy performance of ham operators during emergencies and their dedication to radio demonstrates a level of discipline which may be damaged by any relaxation of standards.

38. A contrary minority view, expressed in the comments of Frederick J. Glenn, is that the present written examination requires a sufficient demonstrated effort at learning. Corwin D. Moore expressed sentiments similar to those of Charles E. Cohn, who stated:

> Code lovers threaten us with CB-type chaos and insanity if the code requirement is dropped or loosened. The flaw in that argument can be readily seen if you note that a good many of the hams that have been disciplined for malicious interference have been Extra Class licensees, and thus have demonstrated code mastery, not just at 13 wpm, but at 20 wpm! Comments of Charles E. Cohn.

39. Nonetheless, the majority of commenters anticipated a large influx of undisciplined licensees as a result of either proposal in the *Notice*. The Pentagon Amateur Radio Club and others said that "weak signal" experimenters, such as those engaged in experimenting with extended range terrestrial modes of VHF/UHF communications and those involved in earth-moon-earth (EME) or "moonbounce" modes, and amateurs using satellites as relay platforms are justifiably concerned that a larger and potentially less well disciplined population of amateurs may not respect the up-to-now voluntarily imposed frequency management procedures necessary for these experiments to be conducted.

40. We are not persuaded that there is a relationship between the time and effort expended to successfully complete Element 1(A) (the Morse code 5 wpm examination) and the rule compliance or dedication to public service of a particular applicant. We believe it is not possible to predict reliably the behavior of prospective codeless licensees. Accordingly, we do not find this issue significant to our resolution of this proceeding.

Conclusion

41. The five word-per-minute slow speed Morse code requirement for the present entry-level Novice and Technician class licenses in the ARS does not appear to constitute a significant function barrier to potential applicants. The amateur ranks are growing by thousands of licensees every year with the code requirement in effect. To the extent the Morse code requirement poses a barrier for a few, we are willing to accept that "trade-off" in light of the very substantial benefits it produces both for licensees and the public.

42. The five word-per-minute Morse code requirement poses no unacceptable burden for handicapped applicants. Ingenious devices, alternative methods of examination administration, and the laudable dedication and perseverance of handicapped applicants in combination usually result in successfully completion of the Morse code examination. Licensees in the ARS who are handicapped are proud of their achievement in mastering Morse code, and generally do not seek special treatment.

43. There is still substantial everyday use of the Morse code in the ARS. The international Morse code is essential to many aspects of technical advance and experimentation in the ARS today. It is a fundamental communications skill critical to the nature of the ARS.

44. A requirement for proficiency in the international Morse code is necessary in order to insure maintenance of a trained pool of amateur operators for emergencies involving the safety of life or property or for the national defense. Dropping this requirement for an entry-level license would adversely affect amateur emergency communications capabilities, which would adversely affect the public.

45. It is unusual to receive the volume of comments we have received in this proceeding. Almost five thousand people and organizations responded to the *Notice*. They were mostly people licensed in the ARS who use their privileges on a regular basis. They were people who, by a margin of roughly twenty to one, expressed an overwhelming sentiment to maintain the current nature and makeup of the service. They felt that Morse code is an integral feature of the ARS. These commenters are the people who have made the ARS what it is today—a service that is a model of public responsiveness in times of emergency and distress, and a service that is a model of self-enforcement and volunteerism. The strong sentiment they expressed in this docket about the nature of such a service is a critical factor in weighing the proposals.

46. For all the above reasons, we have decided to reject each of the proposals set forth in the *Notice* and to retain the present licensing structure of the Amateur Radio Service.

Procedural Matters

47. In the *Notice of Proposed Rule Making, supra*, in this proceeding, we previously determined that Sections 603 and 604 of the Regulatory Flexibility Act of 1980 (Pub. L. 96-354) do not apply to this rule making proceeding since this proposal would only have amended the operator license class structure of the Amateur Radio Service. There would have been no significant impact on small businesses, small organizations or small governmental jurisdictions. Of course, since we are terminating this proceeding without action, there is no impact at all.

48. It is further ordered that the Petition to Cancel or, in the alternative, Amend filed by Donald B. Nowakoski is denied.

49. It is further ordered that the Motion for Leave to File Reply Comments filed by the Capitol Hill Amateur Radio Society is granted.

50. It is further ordered that the Motion for Leave to Submit Supplemental Reply Comments filed by the American Radio Relay League, Inc., is granted.

51. It is further ordered that this proceeding is terminated.

52. It is further ordered that the Secretary shall cause a copy of this *Report and Order* to be served upon the Chief Counsel for Advocacy of the Small Business Administration and that the Secretary shall also cause a copy of this *Report and Order* to be published in the Federal Register.

53. For further information on this proceeding, contact John J. Borkowski, Federal Communications Commission, Private Radio Bureau, Washington, D.C. 20554, (202) 632-4964.

Federal Communications Commission.
William J. Tricarico,
Secretary.

[6] In the Marine Radio Service we have granted an exemption from radiotelegraph requirements to large cargo vessels operating on U.S. coastwise voyages where such vessels carry an array of alternative communications equipment including a satellite ship earth station. *Report and Order*, PR Docket No. 79-336 (FCC 82-75), February 14, 1982.

[7] Emerson commented that 95% of the Japanese amateur operators hold Telephony class (codeless) licenses. They also commented that one-third of England's amateur operators and 40% of Germany's amateur operators hold codeless licenses.

HAM HELP

I need a schematic or any other available documentation on the JFD Model 600 B and W TV camera. I'll pay any reasonable charges.

Tom Workman K9TW
Rt. 9, Box 688
Tucson AZ 85743

Manual needed for a Solar Capacitor Analyzer Model CE 1-60. Lacking a manual, it would help to talk to someone who has operated one of these testers.

Homer Lawrence W8DIH
16 So. Garden St.
Norwalk OH 44857

I need the broadband couplers for 10 and 15 meters for the Central Electronics 200V or information on how to fabricate them.

Maj. Howard M. Mills
HHC 440 SIG BN
APO NY 09175

I am interested in books about switcher-type electronic power supplies: push-pull, PWM, and regulated. I would like to know their titles, authors, copyright dates, number of pages, and prices.

S. Hachikian
637 N. 64 St.
Philadelphia PA 19151

I would like the schematics, operation manual, and any pertinent information concerning the Lafayette Priva-Com 3C.

Calvin Smith, Jr.
PO Box 238
Wenonah NJ 08090

I am looking for a service manual or power-transformer output voltages for a Tennelec MPC-1 scanner. I would also like a service manual for a Tennelec MS-2.

Peter J. St. Arnaud
PO Box 8066
Lowell MA 01853

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Send to Advertising Department, *73*, Elm Street, Peterborough NH 03458.

ON MARCH 11, 1984, the Morgan County Repeater Association Club will sponsor the Martinsville Hamfest at the Indiana Fairgrounds Pavilion Building in Indianapolis. Dealers, vendors, forums, and free paved parking. Doors open to the public at 8:00 am. Table reservations: Aileen Scales, 3142 Market Place, Bloomington IN 47401. BNB039

DEALERS IN SURPLUS TEST INSTRUMENTS, microwave equipment, and components. Wanted: Late test equipment H.P., Tek, G.R., Narda, etc.), waveguide/coax components. Immediate needs: H.P. K382A, R382A, S382C, 432A, 6522A, 415E, G.R. 874- and 900-series coax items, G.R. 1633, 1863, 1864. Request want list. Lectronics, 1423 Ferry Ave., Camden NJ 08104; (609)-541-4200. BNB050

WANTED—your unused Teletype™ repair parts. High prices paid! Send SASE for list of Teletypewriter parts and supplies. TYPETRONICS, Box 8873, Fort Lauderdale FL 33310; (305)-583-1340 after 9:00 pm. N4TT. BNB052

COLLINS: 325-3, 755-3B, 30L-1, more. Also Hy-Gain TH65DXX, rotator, tower. Make offer. WA7WOC, (602)-867-2378, evenings. BNB054.

APPLE add-on keyboard. Has various functions. Shortens keying and programming time. "AMKEY PRO-100." SASE for specs. Ralph Jannini KA1FAA, 16 Hanom Road, Andover MA 01810; (617)-457-8831. BNB055

COLLINS 75A-4 with two mechanical filters, original manual, $225, perfect condition. Also looking for schematic of Yaesu FT127RA, copy okay. AA6SC, 248 San Gabriel Court, Sierra Madre CA 91024. BNB056

FOR SALE! Hammarlund HQ 110A receiver, $75.00. Tempo One transceiver with power supply/speaker, $275. Motorola H23DEN VHF HT, $50. John Singler WA5BJC, 4815 Patrick Place, Liverpool NY 13088; (315)-451-5204. BNB057

HG-830S with YK88C/YG455C filters and HP230 speaker, $600.00. Heathkit SB-200, $600.00. Heathkit SB-634 station monitor console, $50.00. Heathkit SB-614 monitor scope, $75.00. Yaesu FT-7, $275.00. Robot 400 with Sanyo video monitor and camera, $600.00. Radio Shack TRS-80 Model I with Macrotronics M800 RTTY program and Flesher TU170, $400.00. DenTron Super Tuner, $50.00. James F. Kraus, 1100 Westover Ln., Schaumburg IL 60193; (312)-894-6398. BNB058

CLEANUPS of your drawings or schematics. $5.00 minimum on all drawings. Call after 6:00 pm for more info. (816)-483-7823. Craig Schley, 1221 Monroe, Kansas City MO 64127. BNB059

TEN-TEC ARGOSY with power supply, including 500-Hz CW filter, AF filter, and calibrator, $400. Realistic DX-302 SWL receiver, $125. Joseph P. Kononchik, 29 Village Drive, Ledyard CT 06339. BNB060

RADIO BUFFS—1927 RCA signal generator in working condition, $50. WA0PLZ, 1516 McAfee St., St. Paul MN 55106. BNB061

WYOMING-UTAH RANCH LAND. 10 acres, $60 down, $60/month. FREE information, maps, photographs. Trade equity for ham gear, home computer, test equipment, etc. Owner—Mike Gauthier K6ICS, 9550-B—Gallatin Rd., Downey CA 90240. BNB001

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

COMPUTER OWNERS! Super new MFJ 1224 CW/RTTY/ASCII terminal units. Send/receive CW/RTTY/VIC-20 and Commodore 64 software. Full-featured, disk or cassette. Kantronics, too. Low prices, speedy delivery. Hundreds sold internationally. SASE for details and catalog of Commodore, Atari, PET, ZX-81, TI, TRS-80 software and accessories. Amateur Accessories, 6 Harvest Court, RD 7, Dept. BB, Flemington NJ 08822. Telephone (201)-782-1551, 6:30–10:30 Eastern time. BNB019

COLOR COMPUTER owners—call (212)-441-2807 for FREE color computer hardware and software catalog or write to Spectrum Projects, 93-15 86 Drive, Woodhaven NY 11421. BNB023

RTTY FDM DEMODULATORS. FDM RTTY exists on satellites, FM SCA broadcast subcarriers (e.g., Commodity News Service), and HF radio. Four solid-state synthesized models, NSA surplus, new-used, $50 to $350. Call/write for brochure. Electrovalue Industrial, Inc., Box 376-WF, Morris Plains NJ 07950; (201)-267-1117. BNB032

ON MARCH 11, 1984, the Morgan County Repeater Association Club will sponsor the Martinsville Hamfest at the Indiana Fairgrounds Pavilion Building in Indianapolis. Dealers, vendors, forums, and free paved parking. Doors open to the public at 8:00 am. Table reservations: Aileen Scales, 3142 Market Place, Bloomington IN 47401. BNB040

PRINTERS: LA36 Decwriter II with keyboard, variable-width paper, etc., $325. CDI 1030 with keyboard, built-in modem, $125. W9QH, 11209 Hwy. U, Wausau WI 54401. BNB043

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

DX HIDDEN ASSET LOOP ANTENNA. Get on the air, comply with no-visible-antenna rules, from most indoor locations. Inexpensive, easy-to-build antenna couples directly to 50-Ohm coax; no antenna matcher required. Omnidirectional with vertical, bi-directional with horizontal polarization. Vswr typically 1.2:1 at resonance; useful bandwidth 3 to 5 percent of resonant frequency. Plans and instructions, $12.50 postpaid. H. Stewart Designs, PO Box 643, Oregon City OR 97045. BNB047

DRESS UP YOUR CLUB! Jackets, teeshirts, hats, sportshirts, etc., with your logo or we'll custom design. Wavelength Productions, 20-22 120th St., College Point NY 11356. BNB048

UHF/VHF Spectrum Analyzer Kit, $54.95! Send stamped envelope for details. Science Workshop, PO Box 393, Bethpage NY 11714. BNB062

WANTED: Old keys for my telegraph and radiotelegraph key collection. Need pre-1950 bugs. All models of Vibroplex, Martin, Boulter, Abernathy, McElroy, etc. Also need Spark keys, Boston keys, large or unusual radiotelegraph keys, sideswipers, cooties, homebrew, and foreign keys. Neal McEwen K5RW, 1128 Midway, Richardson TX 75081. BNB063

BECOME ALARMINGLY SUCCESSFUL. Radio amateurs quickly grasp the relatively simple hookups of burglar alarm systems. We can help you get started in this exciting, rewarding business. Our Buyer's Guide lists over 300 manufacturers and wholesale suppliers and we have loads of information on how to get started in this rapidly growing field. Information, $2.00 (redeemable). Plenty of employment-business opportunities. Security Electronics International, POB 1456, Grand Rapids MI 49501. BNB064

WE ENJOY creating ham plaques, trophies, awards. Pse QSO. Prices, shipping—low. Care—free. J & J Trophy, Grove Street, Peterborough NH 03458; (603)-924-7804. BNB065

WANTED: Pre-1950 TV sets and old *TV GUIDE* magazines. W3CRH, Box 20-S, Macomb IL 61455; (309)-833-1809. BNB066

RETIRING? Consider a business of your own. Security alarm systems are easily learned. Installation in businesses and residences is easy, enjoyable, fascinating, profitable work. Information that could change, improve your future: $2.00 (redeemable). Security Electronics International, PO Box 1456-V, Grand Rapids MI 49501. BNB067

AM IS ALIVE! Monthly newsletter chronicles renewed amateur interest. Sample, $1; subscriptions, $9/year. AM Press/Exchange, Route 1 Box 281, Woodlawn TN 37191. BNB068

HELP! Cleaning garage—test eqpt., 6m and 2m FM gear, tubes, 1000s of service manuals for all makes and models of commercial FM xceivers 1975 and older. Reasonable prices. Send SASE for list. Tom McLaughlin WB4NEX, PO Box 411, Mango FL 33550, (813)-681-9709. BNB069

ICOM AT-500, cover, $280. Tempo S-15T, HM-15, case, $240. Panasonic RF-2600, $140. New Yaesu FC-700, $90. Interact Computer CW system, $40. FOB Lanny Aldrich K1LEC, Box 73, N. Springfield VT 05150; (802)-886-8121. BNB070

WANTED: Military surplus radios. We need Collins 618T, ARC-72, ARC-94, ARC-102, RT-712/ARC-105, ARC-114, ARC-115, ARC-116, RT-823/ARC-131 or FM622, RT-857/ARC-134 or Wilcox 807A, ARC-159, RT-1167 or RT-1168/ARC-164, RT-1299/ARC-186, RT-859/APX-72, APX-76, ARN-82, ARN-84, ARN-89, RT-804/APN-171, RT-829/APN-171, MRC-95, 718F-1/2, HF-105, Collins antenna couplers, 490T-1, 490T-2, 490T-9, CU-1658A/ARC, CU-1669/GRC, 490B-1, CU-1239/ARC-105, 490D-1. Top dollar paid or trade for new amateur gear. Write or phone Bill Slep, (704)-524-7519, Slep Electronics Company, Highway 441, Otto NC 28763. BNB071

WANTED: SB-201 with 10 meters, good condition, mech. and elec. Steve Pesany, 2840 Gerritsen Ave., Brooklyn NY 11229. BNB072

1984 WIRE & CABLE prices cut!!! Call or write for latest listings. Certified Communications, "The CB to 10 Meter People," 4138 So. Ferris, Fremont MI 49412; (616)-924-4561. BNB073

RTTY FOR THE TI99/4a. Mini-memory required. Mark and space tones are computer-generated in send mode. TU is needed for receive-only. $17.95. Mark Schmidt, 4661 Lark Dr., Beale AFB CA 95903. BNB074

PLASTIC CARTON SHIPPING TAPE. Four standard 165' rolls, tan or clear: 2"—$6; 1¾"—$5; 1½"—$4. Add $1 shipping. Three or more orders shipped free. TR-22—$60; 186E—$25; HP 417A, 20-500 MHz, FM detector—$15; 4.4-W Motorola audio chip, 10.7-MHz filters, mix or match—3/$5; tape switch—$10; SP-600 oscillator and crystal deck, new—$7.50. All, plus shipping. J. Lisaius, 116 Orton Road, W. Caldwell NJ 07006; (201)-226-7943. BNB075

KQ6P NOVICE EXAM KIT.™ FCC no longer supplies written test! The Novice Exam Kit provides everything you need to give the Novice exam including . . . 3 multiple-choice written exams . . . 6 code tests on cassette (3 tests using 5-wpm characters and 3 tests using 13-wpm characters) . . . all FCC forms (610 and PR1035A) . . . plus "Instructions and Helps for the Examiner." Only $5.95 (plus $1.00 shipping) from Spirit Publications, 2200 El Camino Real Suite 107, Redwood City CA 94063. Discount to clubs! BNB076

NEW PRODUCTS

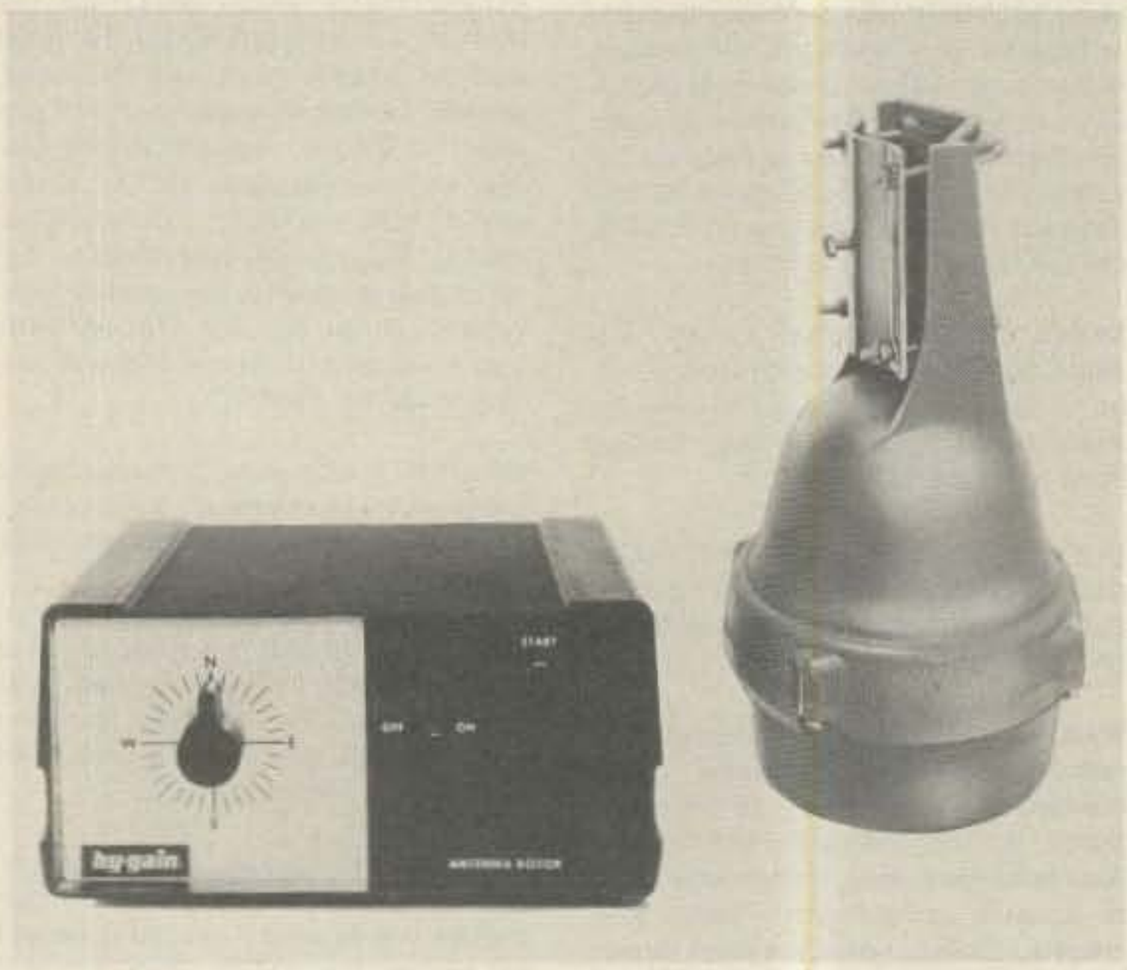
NEW ANTENNA ROTATOR FOR BLIND HAMS

Telex/Hy-Gain has introduced the HAM-SP rotator designed for visually-impaired amateur-radio operators.

The control unit functions are marked in both braille and conventional lettering. The unit also emits a high-frequency tone to indicate rotator action. Since the brake release as well as delayed brake engagement is automatic, operation of the rotator is a simple one-hand, one-touch operation to aid the blind.

When mounted inside a tower, the new HAM-SP rotator is designed to operate large antenna arrays up to 15 square feet (1.4m^2) wind-load area. The HAM-SP (Catalog No. 307) is available at amateur-radio dealers.

For more information, contact *Telex Communications, Inc., 9600 Aldrich Ave. So., Minneapolis MN 55420, (612)-884-4051.*



HAM-SP antenna rotator for the visually handicapped.

FT-757GX LINE COMPUTER-AIDED TRANSCEIVER

Yaesu Electronics Corporation has introduced the FT-757GX Line, the latest generation of CAT (computer-aided transceiver) technology from the engineers at Yaesu Musen Company, Ltd.

Controlled by three 8-bit microprocessors, the FT-757GX is a full QSK synthesized transceiver offering general coverage on receive and ham-band transmit capability, with expanded coverage available for MARS operators. The transmitter section is specified for up to thirty minutes of continuous operation at a nominal output of 100 Watts. For maximum operating flexibility, the FT-757GX performance package includes dual vfo's, eight memories, all-mode squelch, and a variety of scanning features. A 600-Hz CW filter, electronic keyer module, af speech processor, and FM capability are all included in the purchase price.

The Yaesu FT-757GX CAT.

Among the high-performance options for the FT-757GX Line are the FC-757AT automatic antenna tuner with band/antenna memory, the FP-757GX compact switching regulator power supply, the FP-757HD heavy-duty power supply (for continuous duty applications), the FP-700 standard power supply, and the FTV-700 transverter.

For further information on the FT-757GX Line or other Yaesu transceivers designed for computer interface, contact *Yaesu Electronics Corporation, PO Box 49, Paramount CA 90723.* Reader Service number 482.

EQ300 MICROPHONE EQUALIZER FROM HEIL

The new EQ300 from Heil, Ltd., is an improved version of its EQ200. The EQ300 has an output-level control on the front panel so that one model can be used to drive either mike-level inputs (Kenwood, Yaesu, etc.) or line-level inputs used with the new Icom series transceivers.

The EQ300 uses an internal mike gain trimpot for initial setting with your mike. The front-panel Output control provides a variable level up to +2.0 volts out, sufficient to drive any transceiver microphone input, including the new Icom series. Simply adjust to .10 V out (11 o'clock) for Kenwood, Yaesu, etc., and 1.5 V (3 o'clock) for Icom.

Just two models are offered, The EQ300-4 and the EQ300-8. Both use two active filters, the low centered at 490 Hz and the high at 2200 Hz, with plus or minus 18 dB of boost and cut. The only difference in the two models is the connectors. Order either 4 or 8 pins to match your rig. A two-tone generator used for tuning linear amplifiers with an oscilloscope is also available for either model.

The new EQ300 has a power adapter circuit built in so it can be operated from a 9-volt battery or from a good 12-volt dc supply, and excellent RFI suppression has been installed for use in heavy rf environments.

The EQ300, as all of the 1984 Heil products, will be housed in their new beige and chocolate enclosures. All Heil products now feature the same two-color control knobs and switches used on their famous recording studio equipment.

For more information, contact *Heil Ltd., Box 68, Marissa IL 62257, (618)-295-3000.* Reader Service number 484.

NEW PRODUCTS FROM ICOM

Icom has introduced the IC-HS10 Headset and IC-HS10SB PTT Switch Box which can be used with all Icom hand-held transceivers: the IC-2A and 2AT; IC-3A and 3AT; IC-4A and 4AT; IC-02A and 02AT; and IC-04A and 04AT. The easy-to-use system has the following features:

IC-HS10 Headset

- Crystal-clear reception
- Pivoting microphone
- Light weight
- Adjustable boom
- Folds up for safe and compact storage

EQ300 microphone equalizer from Heil.

New headset and switch box from Icom.

- Adjustable for comfortable fit

IC-HS10SB PTT Switch Box

- Compact size: 3″ H × 1.5″ W × .75″ D
- Belt clip
- Provides transmit-receive switching control
- Mike gain control
- Molded plastic connector for speaker/mike connection to hand-held

The IC-HS10 Headset and IC-HS10SB PTT Switch Box may be purchased separately.

For more information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004, (206)-454-8155.*

MORSE-CODE TUTOR

Tutorcode is an instructional software release which can establish your Morse-code proficiency from 3 to 25 words per minute in an exciting, enjoyable game-type atmosphere. Tutorcode is written in machine language for any TRS-80 16K or larger Color Computer system. Extended Basic is not required. Sound flash cards are easily accessible from the menu-driven program. A string of up to 255 characters may be input from the keyboard and the equivalent Morse code will be output at any selected code speed on command.

Tutorcode is available on cassette only from *Rabbitt Ware, Inc., Rt. 1 Bascomb Road, Jackson TN 38305, (901)-668-8816.* Reader Service number 478.

ICM ALIGNMENT OSCILLATORS

International Crystal Manufacturing Company has introduced the FOT-12 and FOT-12 LOW alignment oscillators. They provide a convenient stationary or portable signal source for alignment purposes, convenient for alignment of first i-f frequencies in pagers and other receivers.

Six crystal positions permit the user to choose any one of six frequencies. The FOT-12 LOW covers the frequency range 250 kHz to 4.0 MHz, and the FOT-12 covers the range 4.0 MHz to 24.0 MHz.

Front-panel controls include a six-position switch for selecting the frequency, a BNC-type connector for rf output, and a power switch with an indicator lamp for internal or external power.

The internal battery permits operation away from the test bench. Jacks are provided on the rear panel for an external dc power source.

Following is a list of specifications.

- Rf output—1 V across 470 Ohms
- Power requirements— 9 to 15 V dc @ 30 mA maximum
- Frequency adjustment—trimmer provided at each crystal socket for adjustment to nominal frequency
- Operating temperature— −10° C to +60° C
- Stability—maximum change of ±25 ppm (−10° C to +60° C, referenced to 25° C)
- Dimensions—5″ W × 2⅜″ H × 6″ D overall

These units are available direct from the manufacturer. For more information, contact *International Crystal Manufacturing Company, Inc., PO Box 26330, Oklahoma City OK 73126, (405)-236-3741.* Reader Service number 480.

BREAK CONSOLES

Break Communications Systems has introduced 4'-, 6'-, and 8'-wide wood/mica communications consoles. The replaceable front panel is bolted in with steel clamps for easy low-cost station updates over the years. Front-panel holes are precisely cut by computerized X-Y wood-cutting table, and hole/equipment gaps are less than 1/32"!

The purchase price includes: front panel cut for your station, hidden accessory shelf for power supplies (dummy loads, etc.), pre-assembled rear equipment support system (rigging), teak mica, casters, multiple tap station ground bus, one set of puppets of your equipment, and ½-scale front-panel grids for station layout and design assistance. Corner units are available to integrate standard width consoles into "L" and "U" circular configurations.

Options include: 1000 different micas to match your decor, drawer/bookshelf combination, pencil drawer in desk's front edge, keyboard cut-out in desk top, shelf under desk, desk-top extension into the front panel, dolly for floor-standing amplifiers, temperature-controlled fan cooling system, wire duct, labels, ties, etc. Custom work makes the basic console just right for your station.

For additional information, contact Larry Kushner WA6BKC/4 at *Break Communications Systems, Inc., 5817 SW 21st Street, Hollywood FL 33023, (305)-989-2371.* Reader Service number 479.

SOLID-STATE DIP METER FROM CAYWOOD

A solid-state dip meter for testing radio frequencies, antennas, oscillators, rf chokes, and similar devices, formerly manufactured by Millen, is available from Caywood Electronics, Inc., of Malden, Massachusetts.

The Millen Solid-State Dipper is a portable oscillating frequency meter that determines the resonant frequency of de-energized resonant circuits with an accuracy of ±2%. Covering a range from 1.65 to 310 MHz with 7 plug-in coils, it also features an absorption-type wavemeter with the oscillating circuit acting as a Q multiplier amplifier to enhance tuning response and dip sensitivity.

Wood/mica communications console from Break.

Weighing only 2½ pounds, the 7¼″ D × 3½″ W × 3¾″ H Millen Solid-State Dipper provides a calibrated 205° drum dial with 7 direct reading scales and a universal scale. The rugged copper-plated steel unit and coils store in a handy 11⅜″ D × 5¼″ W × 4″ H carrying case. An optional tube-type dipper with 5 additional coils for frequencies down to 165 kHz is also offered.

For more information, contact Wade Caywood KA1UP, *Caywood Electronics, Inc., PO Drawer U, Malden MA 02148.* Reader Service number 481.

MFJ-1423 ENHANCER/STABILIZER

Enhancement and stabilization are basic necessities for even the beginning videophile. That's just what the MFJ-1423 offers: all the controlled, detailed sharpness and picture clarity of an enhancer combined with a stabilizer to remove picture roll and override copyguard.

The enhancer allows you to control the picture by defining, clarifying, and sharpening the fine details of the picture to the desired degree. The enhancer features an exclusive new light-enhancer mode that enhances light areas only, which yields reduced snow in the dark areas of the picture. The enhancer has 2 adjustment features that let you control the picture: (1) The Enhancement control lets you decide the degree of sharpness and clarity you want, and (2) the Noise Cancel control helps eliminate snow which is sometimes brought on by increased enhancement. An Enhancer Bypass switch also gives you the added convenience of being able to make a quick, clean, definite comparison between the unenhanced and the enhanced picture just by the touch of a button.

The stabilizer removes picture roll

The FOT-12 alignment oscillator from ICM.

Caywood's solid-state dipper.

caused by copyguard. It features a Stabilizer Bypass switch, including an LED for on-off identification at a glance, and a stabilizer control knob that is non-critical to adjust. Just turn the knob until the picture locks in, then sit back and enjoy the picture.

The enhancer/stabilizer features a Power On-Off Bypass switch so you won't be bothered with reconnecting at times when the enhancer/stabilizer is not needed. The front panel has an LED Power On-Off indicator and is operated by high-quality aluminum knobs and switches to make tuning and adjusting feel as smooth as silk.

The back-panel controls include the following:

(1) a Channel 3/4 Selection Switch corresponds to channel 3 or 4 on the television.

(2) The RF Out consists of a built-in rf modulator which allows listening and viewing on any standard television. It outputs a signal that connects directly to the VHF of the television.

(3) An Audio In jack connects the audio signal from the source (VCR, video disk, camera, etc.).

(4) Two Video Out and one Video Out/Bypass jacks output the enhanced/stabilized video signal. The Video Out/Bypass allows you to bypass the MFJ-1423 when in the Off position. A built-in distribution amplifier allows three copies to be made or viewed simultaneously.

(5) The Video In is where the video signal from the source is connected.

(6) The PWR jack is where the ac adapter is connected. The MFJ-1423 operates on 110 V ac or on 112 V dc as a portable (possibly for camera use). All connections on the back panel are RCA jacks. Three cables for hook-up are included.

The unit is housed in a rugged black aluminum cabinet with an attractive brushed aluminum front and measures 7″ × 2″ × 6″ overall.

MFJ offers a 30-day money-back trial period on all direct purchases. If you are not satisfied, return the unit and get a full refund (less shipping). MFJ also offers a one-year unconditional guarantee on all MFJ products.

For more information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762*. Reader Service number 483.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

INTERNATIONAL DX CONVENTION

The 1984 International DX Convention is coming to Visalia, California, April 13–15. Will you be there? This top-notch convention attracts DXers and DX operators from around the world and includes seminars featuring many of the DXpeditioners of the past year.

Sponsorship alternates between the Northern and Southern California DX Clubs. 1984 is a Southern Cal year. The convention location remains the same—the Holiday Inn in Visalia. Pre-registration, including the banquet and Sunday breakfast, costs $38 ($42 after March 15, 1984). Send your check to Westcoast DX Convention 1984, c/o Treasurer Nick Winter WB6DXU, 1426 North Avon St., Burbank CA 91505.

4U1VIC—THE VIENNA INTERNATIONAL AMATEUR-RADIO CLUB

When is a country not a country? When it is the Vienna International Amateur Radio Club! This station, the third one to use the United Nations 4U1 prefix, counts as a separate country for the DARC-sponsored Worked All Europe award, but not for the ARRL-run DXCC program.

The original 4U1 station was set up in Geneva, Switzerland, at the headquarters of the International Telecommunications Union (ITU). Back in the days when DXing was a gentlemanly activity, the amateur-radio club at the ITU headquarters asked for and received separate-country status, based on the fact that the station was located on United Nations property, and not in Switzerland proper. For years 4U1 meant 4U1ITU. The station has been a gathering point for numerous international visitors and the showcase amateur station for telecommunications officials attending conferences in Geneva. Amateur radio greatly benefitted from the existence of 4U1ITU.

Then, in the 1970s, some enterprising amateurs in New York City convinced United Nations authorities to permit a similar station in a UN building (on UN land; the US gave the land to the UN years ago) in downtown Manhattan. K2UN operated quietly for a while, until it dropped its bombshell: the station applied for separate-country status under the then-current DXCC rules. The ARRL's DX organization was faced with a nasty dilemma: either authorize a new "country" in the middle of downtown New York City or throw out the well respected and very useful 4U1ITU.

Since the League was facing the upcoming World Administrative Radio Conference (WARC), throwing out 4U1ITU was not even considered, and 4U1UN gained status as a separate country. This obvious absurdity, along with the approval of such nonsense "countries" as St. Paul Island and Sable Island off Nova Scotia and Desecheo off Puerto Rico, led to the League's throwing out the "separate-administration" provision for a new country.

Which brings us back to 4U1VIC. In 1979 all United Nations organizations in the Vienna, Austria, area were consolidated into a single-building complex on the banks of the Danube River. As with the United Nations complexes in Geneva and New York, the adjacent land becomes part of the UN, not Austria. The region is now known as Vienna International Centre (VIC) or UNO City.

Among the many amateur-radio operators on the staff of the various UN organizations in Vienna were Tom Gabbert K3TG/OE1ZGA and Horst Eisenlohr DL9OL/OE3OLW. They paved the way for the formation of the Vienna International Amateur Radio Club and convinced UN Headquarters to grant them the callsign 4U1VIC. The station began operation last fall.

The operators of the station include hams from many different countries, since membership in the VIARC is restricted to staff and accredited diplomatic staff. The club members loan equipment to the station and feed a triband vertical on the roof of the 350-foot-high UN building. During contest operation, the club members string temporary dipoles for the lower bands.

The combination of antenna restrictions and the time limitations of the operators makes 4U1VIC a challenge for the DXer. The best times to watch for the station are local lunchtime, early evenings, and weekends, especially during contests. The station was on the air during most of the *CQ* WW SSB test last fall. Try 1130–1300 UTC and after 1630 UTC, around 14030 or 21030 CW and 14200 or 21300 SSB.

As with other club stations, the QSL chores fall on the operator making the contacts. Your best bet for a confirmation is to include the name of the operator on the card. The QSL address is VIARC, Box 200, A-1000 Vienna, Austria. Two IRCs with your self-addressed envelope will bring a direct response with UN stamps. Or you can send the card via the well-run Austrian QSL bureau, which handles the cards as a courtesy for the VIARC.

Why is 4U1VIC considered a country at all, if DXCC rules don't permit separate-country status? The DXCC is not the only game in the DX community, although it is the most respected award program. The German national amateur-radio organization, the DARC, also sponsors a prestigious award for working all the countries of Europe, and their country list is slightly different from the League's DXCC country list. Specifically, the Shetland Islands off the Scottish coast and the island of Sicily (IT9) are "separate countries" for the DARC award program.

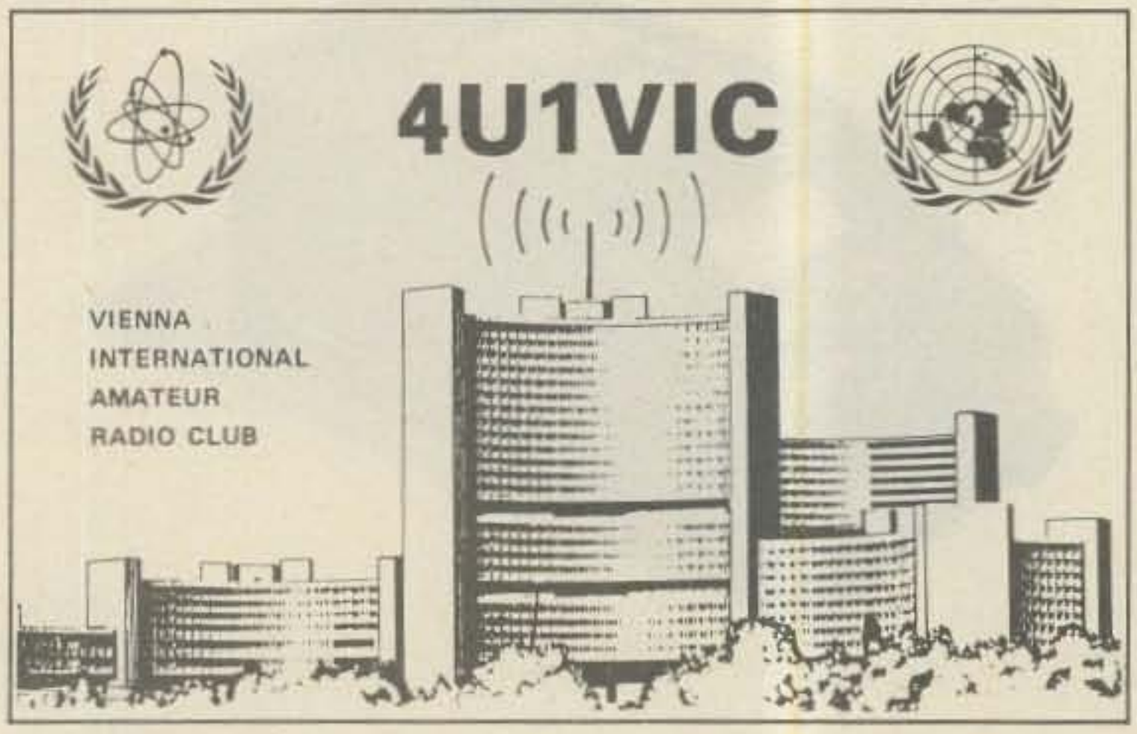
This is of interest to radio contesters, because both the DARC-sponsored Worked All Europe contest in the fall and the *CQ* WW test use the DARC country list for multipliers. This means that the Shetland Islands, Sicily, and now 4U1VIC count as separate multipliers for these contests, but not for the ARRL DX test in the spring, which uses the DXCC list.

DX FOLLOW-UP

Several members of the International DX Foundation traveled to the tiny country of St. Kitts in the Caribbean last summer to hand out DX contacts on all bands from 160 meters through 2. The four amateurs (see Photo A) hauled a Yaesu FT-901ZD, a Kenwood TS-130S, and VHF gear to the island, which is about 200 miles east of Puerto Rico. Antennas included a triband beam, a long six-meter yagi, dipoles, and a vertical (see Photo B).

The group made several thousand contacts in more than 100 different countries during the stay, including 10 countries on 6 meters! If you worked any of the four different callsigns used (VP2KBH–KBK), send your QSL card to Andy Anderson K8EFS, 4300 South Cochran, Charlotte MI 48813.

As promised (see this column, October, 1983), the Colombian amateur-radio organization mounted an impressive DXpedition to Malpelo this past fall. Thirteen



The Vienna International Amateur Radio Club operates from the top of the highest building in the United Nations complex on the Danube.

Photo A. The St. Kitts DXpedition crew relaxes in front of their operating position: (left to right) Kaye VP2KBI/N8AKY, Don VP2KBH/WB8BKC, Donna VP2KBJ/KA8LDO, and Andy VP2KBK/K8EFS.

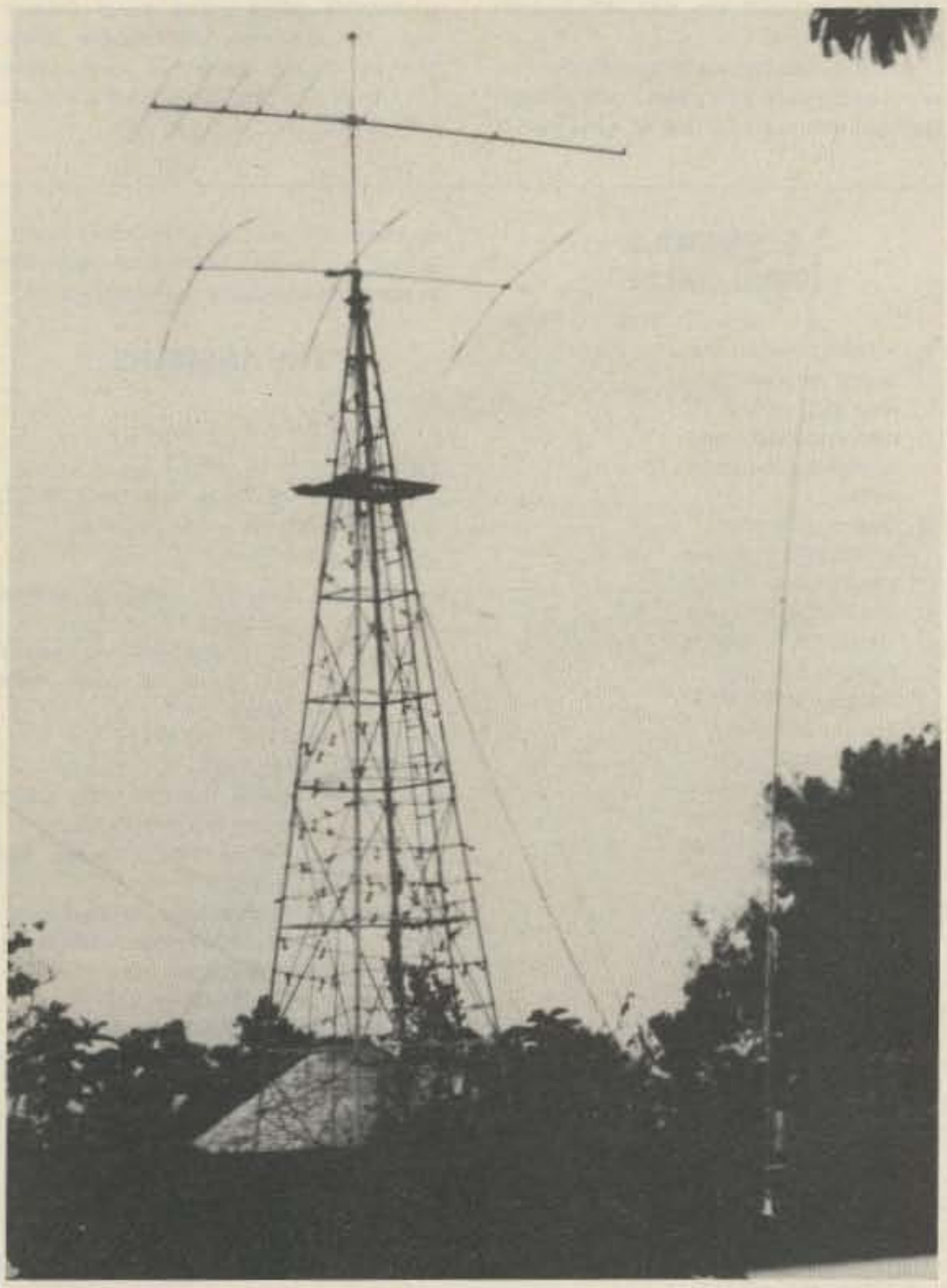


Photo B. The St. Kitts antenna farm included an 8-element 6-meter beam, tribander, dipoles, and a vertical.

Photo C. The CW operating team at HKØTU in front of the "Malpelo Hilton." From left: HK1DBO, HK1QQ, HK1AMW, and HK3BAE.

Colombian amateurs formed the operating team at HKØTU, which finally landed on Malpelo on October 12 for a four-day stay. The group set up four stations, 3 on SSB and one on CW. The CW team of HK1DBO, HK1QQ, HK1AMW, and HK3BAE (see Photo C) made about 7600 contacts of the 20,000-plus total of the DXpedition. The CW operating position (a tarp thrown over some poles) prominently displayed a sign which read, "Malpelo Hilton. VIPs only. No phonepatchers allowed!"

The composite photograph taken from the top of the 1000-foot cliff overlooking the landing site gives some idea of the rugged nature of the island. Lacking the assistance of military helicopters, the operators were forced to set up all their stations on the eastern side of the island, so the US West Coast and Japanese amateurs once again found Malpelo a difficult contact. The Colombian hams scouted out the rest of the island during breaks in their operating schedule; they located a possible site on the western side of the island for a future DXpedition, which should please W6 hams. Don't hold your breath, however; the next Malpelo trip is tentatively scheduled for 1990!

That's it for now. Coming up: the wondrous WWV!

ARGENTINA INVADES ANTARCTICA

No, not another Falklands/Malvinas shooting-type war. DX contacts are the major weapon in this battle of international diplomacy. Specifically, AZ5ZA fired a shot in favor of the Argentine's claim to the polar regions by operating during the month of January (middle of summer) from the South Orkney Islands group, between South America and Antarctica.

With the kind assistance of the Argentine Navy, two amateurs traveled to Laurie Island to activate AZ5ZA (which is a legitimate Argentine callsign). Carlos Poffo LU9EIE and Art Gargarella LU6ETB braved the elements and the prospect of Christmas in one of the worst climates in the world to put this island on the air.

While the action might not be quite as exciting (nor as deadly) as the ill-fated attack on the Falklands, this DXpedition is really another skirmish in the long-standing disagreement between the United Kingdom and Argentina over the ownership of vast amounts of Antarctic real estate and (more importantly) ocean-fishing and mining rights.

At stake in such apparently innocent DXpeditions is the 200-mile limit which most countries recognize as "territorial waters." Argentina has always taken its claim to the nearby islands and a slice of the Antarctic continent very seriously. Maps of the country printed in Argentina always show a huge slice of Antarctica and the surrounding islands as part of Argentina. If Argentina can win international support for its claim to these disputed regions, the country stands to gain fishing, drilling, and undersea-mining rights to an enormous area, potentially worth many billions of dollars.

The Argentines have pursued their claims to this region through international courts as well as on the battlefield and have never acknowledged the United Kingdom's claims to the same territory. Since one of the bases for international recognition of the territorial claims is inhabitation and development, the Argentine Navy "shows the flag" in this region as often as the nasty weather permits. This year it's South Orkney. Meanwhile, a small community of British subjects stays on the next island to the south, Signy Island, also part of the South Orkney group. Listen for VP8s AOD, AOH, and ALD.

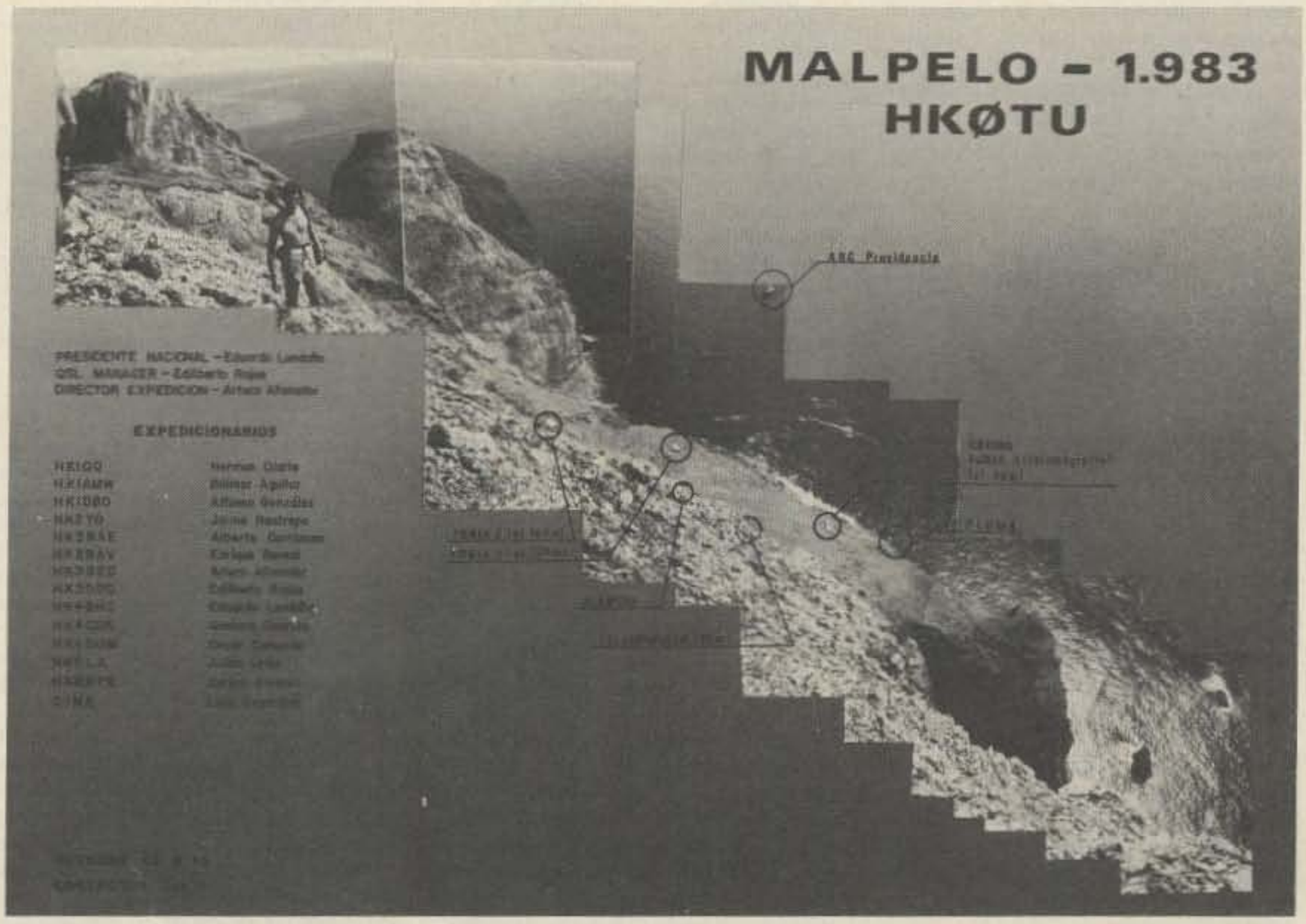


Photo D. The HKØTU operation as seen from the top of the cliff high above the stations. "Fonia" indicates a phone station, while "telegrafia" indicates a CW position.

Fortunately for DXers, the international ramifications of these disputes do not (yet) affect the DX status of the "country." South Orkney is a new one for hams, regardless of whether the contact is with a VP8 or LU (AZ) operation. But don't try to confirm your AZ5ZA contact through the United Kingdom! The Radio Club of Argentina, one of the sponsors of the DXpedition, advises that the QSL route for AZ5ZA is via LU2A, Box 100, 1428 Buenos Aires, Argentina.

While it is unfortunate that amateur radio is being used as a pawn in the difficult game of international law, at least the DX community gains some major DXpeditions to otherwise inaccessible spots, financed by the respective governments. Let's hope that all shots fired are in the form of "CQ DX."

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

DXING AND DXPEDITIONS

I have many wonderful dreams and desires. Most of them I can't describe in a magazine that caters to readers of all ages, but one great dream I can write about is my wish to travel on a real, honest-to-goodness, 100-percent-genuine DXpedition.

During my youth, while other kids were drooling over pictures of Corvettes and ten-speeds, I used to fantasize about packing up my station (a Heathkit Sixer and a Trick Stick) and setting off on a journey to the highest peaks of the Swiss Alps, there to work the world on 50-MHz AM. Okay, I know six meters isn't legal in HB-land, but remember, this was a dream.

Today, my goals aren't quite so lofty. I no longer dream of giving a new country to tens of thousands of eager amateurs. Instead, I would happily settle for a journey to any reasonably remote destination. All I ask is that this place be warm, have relatively decent propagation characteristics, and feature a hospitable populace (no gunfire, please).

Will I ever achieve this goal? Who knows? So far, my total DX operating experience consists of an Icom IC-2A that I secretly slipped into 4U1-land (4U1-block?). Unbeknownst to the dozens of surrounding security guards, I actually kerchunked K2KLN/RPT from foreign territory. (Well, the ARRL says it's a foreign country. I call it East 42nd Street.)

So there you have it—a ham and his dreams. I'm open to offers.

ELEMENT 1
MULTIPLE CHOICE

1) On 160 meters, the DX window is:
   1) 1975–2000 kHz
   2) 1100–1560 kHz
   3) 1875–1900 kHz
   4) 1825–1830 kHz
2) Soldiers of which nationality fired at DXers during the recent Spratly Island fiasco?
   1) North Korean
   2) Vietnamese
   3) Cambodian
   4) Laotian
3) Which of the following groups *does not* sponsor DXpeditions:
   1) Yasme Foundation
   2) Private individuals and radio clubs
   3) Northern California DX Foundation
   4) ARRL Foundation
4) Back in the 1950s, FCC Form 405A was used for:
   1) Amateur-license renewals
   2) TVI complaints
   3) Amateur-license revocations
   4) CB-license applications
5) Which of the following *is not* a time and frequency station:
   1) CHU
   2) JJY
   3) ZUO
   4) IBE

ELEMENT 2
MATCHING

Match the renowned DX operators in Column A with their calls in Column B.

Column A	Column B
1) Father Michael Moran	A) XY1W
2) Martti Laine	B) 4S7PB
3) Tim Chen	C) W6AM
4) Paddy Gunasekera	D) VP2ML
5) K. Venkataramanan "Venkat"	E) BV2A
6) Don Wallace	F) OH2BH
7) Tom Christian	G) ON4UN
8) Johan "John" Devoldere	H) VU2KV
9) Chod Harris	I) 9N1MM
10) Lloyd Colvin	J) VR6TC
	K) W6KG

ELEMENT 3
TRUE-FALSE

		True	False
1)	A 1-land station that works Western Europe with an antenna pointed east is working the short path.	____	____
2)	Over-driving your transmitter is called flat-topping.	____	____
3)	The 75-meter phone allocation for USSR amateurs ranges from 3.9 to 4.0 MHz.	____	____
4)	The first two-way, transatlantic QSO took place in 1912.	____	____
5)	Most RTTY DX is found around 14.090 to 14.100 MHz.	____	____
6)	The highest altitude DXpedition was one that took place on top of California's Mt. Whitney (14,495 feet).	____	____
7)	The Worked All Continents award is sponsored by the ARRL.	____	____
8)	The Africana Net meets on 10 meters.	____	____
9)	If a DX station on CW sends "U5," it means "stand by for five minutes."	____	____
10)	As of 1978, DXpeditioners Lloyd and Iris Colvin had traveled to over 133 countries and worked over half of the active amateurs in the world.	____	____

ELEMENT 4
FILL IN THE BLANK

1) To _____ is to call a DX station at the same time another operator is signing off.
2) Very long distance DX is often called _____ operation.
3) The ham who relays a list of station calls to the DX operator is often called the _____.
4) An _____ is a document that may be converted into postage in another country.
5) To _____ is to adjust your transmitter to the same frequency as the DX station.

THE ANSWERS

Element 1:
1—4, 2—2, 3—4, 4—1, 5—4.

Element 2:
1—I, 2—F, 3—E, 4—B, 5—H, 6—C, 7—J, 8—G, 9—D, 10—K.

Element 3:

1—False	Only if using a broken compass.
2—True	Of course, only contesters are guilty of this—never DXers.
3—False	3.6 to 3.65 MHz.
4—False	No, 1923.
5—True	When the CW guys aren't trying to kill the signals.
6—False	I think W5LFL broke that record.
7—False	Technically, it's an International Amateur Radio Union certificate.
8—False	On 15 meters.
9—False	You should go up five kHz.
10—True	That adds up to a half-million QSOs.

Element 4:
1—tail-end
2—long-haul
3—master of ceremonies (MC)
4—international reply coupon (IRC)
5—zero beat

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct match.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each word correctly filled in.

Are you a ham of the world?
1–20 points—Repeater fan
21–40 points—Armchair DXpeditioner
41–60 points—Half-way through the DXCC ranks
61–80 points—Honor Roll material
81–100 points—DXCC in countries visited

RTTY LOOP

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

March blows in like a lion, and so did a letter I received this month from John Gist KD6LP/Ø in Hazelwood, Missouri. John's letter takes the "tell-it-like-it-is" award, for taking me to task on the selection of the VIC-20 as the computer end of Microlog's AIR-1 RTTY system.

Without reprinting John's four-page letter, I will relate that he is totally satisfied with his VIC-AIR combo and feels that he is missing nothing with the setup. He notes that large letters are not a decrement if your vision is poor. As an aside, the earlier Microlog equipment featured such large type for those with poor acuity or to allow the screen to be read across the room. The price is right, the features appear to be good, and the users are happy; what more can I say?

Now, the flip side of it is the wish that, since the VIC uses the same 6502 that several other "low-end" computers use, Microlog would consider producing versions for those systems as well. Also, since the stand-alone Microlog units have always used 6800-series microprocessors, why not cross-assemble one for the CoCo? The 16K cassette-based bottom line CoCo is quite a bargain, and when you upgrade it . . . but more about that later.

Thanks for the note, John; I think we have given this one enough AIR, don't you?

A close runner-up for the "t-i-i-i" award is a card I received from Eark Morris from Midland, Michigan, regarding the RCA offer to sell ASR-33s for $300. He states, "These machines are selling around here for $50 to $75. Why spend $300 for an old Teletype when for $400 you can buy a new dot matrix printer? Most people who purchased 33s for computer use are now trying to sell them since they have purchased a real printer. Now, Model 1 Teletypes are a different story. Those yo can't even give away anymore! Everyon has been buying VIC-20s." I wonder if Ear has been talking to John? Oh, well . . .

Hams on the frontier of technology co tinue to fill us all in on the techniques an nuances of some of the newer RTT modes. With AMTOR, particularly, indivi ual observations tend to provide a lot of i formation. For instance, Carty Ellis KA2 writes of his and his son's (KS2Z) activi on both RTTY and AMTOR for the past fe months. Their station includes a VIC-2 with the Kantronics HAMTEXT and AM TORSOFT programs, and AEA CP-1 inte face, and a barefoot eighty- through te meter transceiver.

"Let me share some observations equipment, documentation, assistanc and on-the-air experiences. We original

wanted to try using our Atari 400 computer on the air. A local amateur was kind enough to loan us his Kantronics interface unit and the HAMSOFT program for the Atari. We were pleasantly surprised at how easy it was to get on RTTY. One comment we had heard on the Kantronics interface was somewhat negative, (that) the received signal had to be S9 or better for reliable copy. We did find this to be true in our case. For that reason, as well as a desire to be able to hook up an oscilloscope to aid in tuning. . .(we ordered) the CP-1. I can do nothing but rave about the CP-1! It is very selective, far easier to tune without a scope. . .and it will copy signals that I can barely hear through the speaker. I can really be proud of that selection.

"As far as the Kantronics software—I have to give them a solid A on that. The only rap on the knuckles for the software is two documentation problems. On both HAMTEXT and AMTORSOFT they do not explain why you need to affirm that you are using their software with their interface or with someone else's. This 'game' results in your RTTY or AMTOR signal being 'upside-down' if you didn't make the right choice. This is your *transmitted* signal, not the one you are receiving—(I haven't discovered if the situation is an inverter in the Kantronics AFSK generator or actual program logic; however, I suspect the prior—so watch it on your first RTTY and AMTOR QSOs (or lack of QSOs). And for those of you who say, 'Why didn't he try the reverse switch on the interface?'—a) that only affects the received signal, which is OK, and b) properly written software does not require user experimentation for proper use.

"The problem with AMTORSOFT is more one of interpretation; AMTOR is a new mode—procedural protocol is still changing, some of the techniques are really exotic (very impressive is a better phrase)—and it all takes a lot of learning. The technique of establishing a raw, unscheduled contact on AMTOR is not real life—it would work, just nobody does it that way. And there is a feature of AMTOR which makes it a bit like QSK CW—you can actually break into the other station while he is sending to you—try that on RTTY. And last but not least—one 'lid' thing can happen to you—you can be trying to find the SELCAL being used, and if you forget to tell the computer NOT to respond—you may find yourself actually screwing up the link between two stations who are in QSO—that really gets embarrassing for the new ham doing it and frustrating for the two stations who are otherwise in 100% perfect copy situations."

My sincere thanks to Carty for a meaty letter, which I am sure many hams toying with the idea of getting on AMTOR appreciate.

Now, a short tale of two computers. Many of you have dropped me notes telling me of your use of the VIC, Atari, or other personal computers on RTTY. I noted in these pages some months back of my acquisition of an Atari 400, with the hopes of putting it on RTTY. Well, now you may note that I am talking about a TRS-80C Color Computer® with the same lines. My computer history goes back to the 6800 school, as faithful readers of this column know, and it is from that school that the 6809 used in the CoCo comes. After looking at several systems and spending quite a bit of money, not all of it wisely, I have come to the conclusion, at least for now, that the 6809 is the way to go. Points in its favor include ease of programming, a wide range of system software, and a wide range of hardware which retains compatibility. There are at least three or four disk operating systems, each of which fills a different niche, and hardware systems which range in complexity from Color Basic CoCos, selling for a little over one hundred dollars, to GIMIX OS9 systems and Cheftains, selling for thousands. This is no toy, the 6809, but that does not mean you can't play games. For a three-year-old version of CoCo RTTY, look at Clay Abrams' article on page 58 of the September, 1983, issue of *73*. We will present more here, as it develops!

As I reread the above paragraph, I see I mentioned one thing that, if not explained, leaves unsaid why I feel the 6809 is so powerful. Those of you who read any of the computer magazines have read about the "big" system operating systems, like Unix or Xenix. These multi-user operating systems allow several users to share a central CPU and disk, with only a remote terminal. Except for certain high-use times, such users are typically unaware of other users' existence. That is what OS9 is, a multi-user, multi-tasking operating system for the 6809 CPU. Two users can run my CoCo with a "background task," say printing out a listing, all going at the same time. Because of hardware design, there is a bottleneck with simultaneous input and output, but other tasks can run at the same time. The bottleneck is caused by the use of a parallel port PIA as a serial port, through use of a software UART. This was used in early 6800 systems and has been used here as one way to interface RTTY with a computer. It does tie down the CPU, though, and when a true serial port, ACIA, is implemented, it will help. But in the meantime, a CoCo running OS9 runs rings around other systems. Check it out.

You are a vocal lot, RTTYers. I enjoy reading your comments, views, and opinions, and so do your cohorts. Let me hear from you, and I'll pass along what I can, filter some more, and add what's needed. The product? Next month's RTTY Loop.

FCC

ssuance of Ten Year Amateur Radio icenses

GENCY: Federal Communications ommission.

CTION: Issuance of licenses.

UMMARY: The Commission has ommenced issuing new, modified and enewal amateur radio station and perator licenses for ten year terms. The nger-term licenses were authorized in le amendments previously adopted in is proceeding. Issuance of ten year censes was delayed so that necessary anges could be made in licensing ograms. The Public Notice is ecessary so that licensees will know at we are now issuing ten year censes. The effect of this Public Notice the creation of an informed public and reduction in the number of telephone quiries concerning license terms.

DDRESS: Federal Communications ommission, Washington, D.C. 20554.

OR FURTHER INFORMATION CONTACT: aurice J. DePont, Private Radio ureau, Special Services Division (202) 2–4964.

IPPLEMENTARY INFORMATION: The eport and Order in this matter was blished on October 28, 1983 at 48 FR 861.

The Commission has commenced uing new, modified and renewal ateur radio station and operator enses for ten year terms. The longer- m licenses were authorized in rule endments adopted by the mmission on October 6, 1983. Before rules were changed, an amateur ense was issued for a five year period. uance of ten year licenses was layed so that necessary changes could made in licensing programs. (PR Dkt. -337).

There will be a two year grace period expired ten year station and operator enses.

The Commission emphasizes that the ten year license term is not a blanket extension of existing station and operator licenses. An amateur license that specifies less than a ten year term will show a ten year term on the face of the license when it is either modified or renewed.

William J. Tricarico
Secretary, Federal Communications Commission.

Amendment of the Commission's Rules To Make Additional Frequencies Available for Repeater Operation

AGENCY: Federal Communications Commission.

ACTION: Withdrawal of proposed rule.

SUMMARY: This document withdraws an earlier proposal which sought to make additional frequencies in the 10 meter band available for repeater operation. Making such frequencies available to users would have an adverse impact on amateur satellite communcations in that band. Further, it was determined that there is no compelling need for repeater subband expansion in the 10 meter band at this time.

ADDRESS: Federal Communication Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Maurice J. DePont, Private Radio Bureau, Washington, D.C. 20554, (202) 632–4964.

Order; Proceeding Terminated

In the Matter of Amendment of the Amateur Radio Service Rules, Part 97, to make additional frequencies available for repeater operation, PR Docket No. 83–485; RM–4231.

Adopted: October 31, 1983.
Released: November 2, 1983.

By the Commission.

1. On May 12, 1983, the Commission adopted a Notice of Proposed Rule Making (48 FR 24954; June 3, 1983) proposing to amend the Amateur Radio Service Rules to authorize the frequencies between 29.0 and 29.5 MHz for repeater operation. Current frequencies available for repeater operation in the 10 meter band are between 29.5 and 29.7 MHz. Comments in the proceeding were due July 25, 1983, and reply comments were due August 24, 1983.

2. The Commission's proposal stemmed from a petition for rule making (RM–4231), filed October 13, 1982, by Beryl Gosney of Oak Harbor, Washington. Mr. Gosney requested that frequencies in the 10 meter band now available for repeater operation be expanded to include frequencies between 29.0 and 29.5 MHz. In his petition, Mr. Gosney said that the present number of 10 meter band frequencies was inadequate and that severe frequency congestion was taking place. He attributed the congestion to the recent increase in FM communications that has taken place on 10 meters, but offered no data to support his claim. In our proposal, we noted that there might be merit in the petitioner's request and invited comments on the need for additional repeater frequencies. We also asked for comments on the impact that additional 10 meter frequencies would have on present and future repeater and non-repeater operations.

3. Commentors in favor of the proposal said there was a great need for the additional repeater frequencies. For example, the Southern California Repeater and Remote Base Association (SCRRBA) said that it was unable to coordinate additional repeaters, even though there are operators in that area who want to construct and operate new stations. SCRRBA acknowledged that there are satellite operations in the 29.3–29.5 MHz portion of the 10 meter band, but anticipated that sharing arrangements with Amateur-Satellite Service users could be worked out within the amateur community. Carl E. Bollinger stated that there is a great need for these additional frequency allocations on FM. According to Mr. Bollinger, under favorable propagation conditions, there is extreme crowding and interference on both the repeater and simplex frequencies.

4. Commentors opposed to the proposal mentioned the disruption that would occur to amateur satellite communications if repeaters were permitted between 29.3 MHz and 29.5 MHz. The Radio Amateur Satellite Corporation (AMSAT) said that FM repeater operation in that frequency segment would worsen an already difficult situation. The American Radio Relay League, Inc. (ARRL) concurred. In addition, the ARRL said it had no evidence of overcrowding in the existing 10-meter repeater subband. The ARRL noted that its latest Repeater Directory listed only 43 repeaters in the 10 meter band for the entire United States, and only one repeater in the State of Washington, where the petitioner resides.

5. After considering the comments on both sides of the issue of additional 10 meter repeater frequencies, we are persuaded, for two reasons, that we should terminate this proceeding without adopting the proposed rules. First, providing additional repeater frequencies in the 10 meter band would have an adverse effect on amateur satellite communications, including beacon transmissions, robot operations, telemetry signals and transponder downlinks. Second, we conclude that there is no compelling need for repeater subband expansion in the 10 meter band at this time. Comments referring to congestion on repeater frequencies appear to represent local conditions. Amateur satellite communications, on the other hand, transcend local areas. Hence, the adverse impact on amateur satellite communications that would occur if the subband were expanded, outweighs any frequency congestion that local repeaters may be experiencing.

6. In view of the foregoing, it is ordered, That the petition of Beryl Gosney, RM–4231, is denied.

7. It is further ordered, That this proceeding IS TERMINATED.

8. Information in this matter may be obtained by contacting Maurice J. DePont (202) 632–4964, Private Radio Bureau, Federal Communications Commission, Washington, D.C. 20554.

Federal Communications Commission.
William J. Tricarico,
Secretary.

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QX0500	QSL CARDS – STYLE X – 500	$13.95
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DR. DIGITAL

Robert Swirsky AF2M
PO Box 122
Cedarhurst NY 11516

I have a tendency to get carried away. When someone asks me what is thought to be a simple question, that person is usually sorry he asked; I tend to give lengthy replies. This was the case the other day when a friend asked me about a certain programming technique.

My friend was working on a net-control management program and wanted to know how to have a "first-in-first-out" sequence for the data. Obviously, after the check-ins are noted, the net control must respond to them in the order that they checked in. One solution is to store the check-ins in an array. This, however, presents a number of problems. One must know the maximum number of check-ins that can "pile up" before the net control can get to them. Also, there is the problem of how to handle the situation where a new station checks in before all the previous check-ins have been taken care of—if the first check-in of the initial group is in array element #1, the only way would be to move all the other elements up one space. Clearly this is a waste of time; on a microcomputer with a slow Basic, this can take a few seconds.

Since we were discussing programming languages last month, I'll use this problem to show how a programming problem that is hard to code in Basic is almost trivial in a different language.

Programming Language

A number of years ago, a committee from IBM decided to invent a new programming language (well, maybe the decision was made and then the committee was formed, but let's not pick nits). After a long period of heated debates, they came up with PL/I. This language took the best features of FORTRAN, COBOL, and ALGOL as well as a bunch of other stuff never before seen in a programming language and integrated them into one huge language. In its present form (PL/I-F), it includes practically every feature one can imagine: concurrent subroutines, exception processing, modular programming, and the ability to communicate with other languages. There are even forms of the language that will try to correct syntax errors.

The problem with PL/I was that is was *too* big. In order to deal with this, another committee (ANSI) sat down and removed all the redundant and seldom-used features of the language and produced PL/I subset G. This was done primarily to meet the needs of minicomputer users. When subset G was designed, memory pieces were still high and minicomputers didn't have much more memory than some of today's microcomputers.

It wasn't long before some other committee decided to trim some more fat off PL/I and make it fit on microcomputers. This was done by Digital Research (the company that markets CP/M) in 1980. Their product was called PL/I-80 (the 80 refers to the fact that it runs on an 8080 or Z-80 based computer). Because I am a PL/I fanatic, I obtained a copy of PL/I-80 as soon as it came out and have had a love/hate relationship with it ever since.

The "love" is because I feel it is one of the best microcomputer languages around. The "hate" is because of the subtle differences between PL/I-80 and "real" PL/I. I have a great deal of difficulty transferring programs between PL/I-80 and DEC PL/I, even though both are called "subset G." Still, I have no reservations recommending PL/I-80. It is available for any system that can run CP/M-80 (even Apple computers with a Z-80 card).

Queues

The way to handle the "first-in-first-out" net-control problem is with the data structure know as a "queue." A queue simply means a line, and this provides a useful analogy. When one goes to see a movie, one generally waits in a line. New people can only enter the line from the rear (we'll assume we live in a perfect world and nobody cuts), and a person can only get off the line from the front. This is exactly the type of organization we need for the net-control program—new check-ins get on the rear of the line while the net control handles the people on the front of the line.

Listing 1 shows the PL/I program to handle this. It allocates blocks of memory, called "nodes," for each person who checks in. Associated with each node is a pointer called "next" which points to the next person on line. There are also two other pointers called "front" and "rear" which point to the front and rear of the queue. Subroutines are provided to add a new node at the rear of the queue, to remove a node from the front of the queue, and to see if the queue is empty. Following is a line-by-line description of the program.

Line 1 is the standard way to begin a PL/I program. This identifies the program name as QUEUE and tells the computer that this is the main program, as opposed to a subprogram.

The form of each node is specified with lines 6 through 9. The DCL stands for "declare." Each node is to consist of an 8-character callsign field and a pointer to the next node. Note that this declaration does not actually reserve any memory for the node. It simply serves as a template to indicate the structure of each node. Line 7 says "BASED (Q)." This specifies that the variable Q will be used to hold the memory address of the queue's location.

Other variables that will be used in the program are specified in lines 12 through 16. Line 12 means that Q is a "pointer" variable; it is used to hold a memory address. The declaration in line 13 tells the computer to reserve 8 memory locations for character data and reference this location by the name "INFO." A "fixed" variable (line 14) can contain integer data between the values of −32768 to +32767. Finally, the variables that will hold the addresses for the front and rear of the queue are specified in line 16.

PL/I programs are generally divided into smaller units called "procedures." These are similar to Basic subroutines. The procedures or subroutines for this program start at line 18. The first one is called INIT-QUEUE. All this does is initialize the queue; the pointers to either end of the queue are set equal to NULL, which is a built-in system variable used to indicate an invalid memory location. The queue can be checked to see if it is empty by determining if the pointer is equal to this null value.

We start to get to the more interesting part of the program at line 23. This procedure, called ADD-REAR, is used to add a new callsign to the end of the queue. The ALLOCATE statement (line 26) reserves enough memory for one node and sets the variable Q equal to the address of this

Listing 1. This program demonstrates the use of a queue for a net-control management problem.

```
 1: QUEUE:PROC OPTIONS (MAIN);
 2:
 3:
 4:
 5:
 6:    DCL
 7:        1 NODE BASED (Q),
 8:          2 CALLSIGN CHAR (8),
 9:          2 NEXT POINTER;
10:
11:
12:    DCL Q POINTER;
13:    DCL INFO CHAR (8);
14:    DCL I FIXED;
15:
16:    DCL (FRONT,REAR) POINTER;
17:
18:  INIT_QUEUE:PROC;
19:       FRONT=NULL();
20:       REAR=NULL();
21:  END;
22:
23:  ADD_REAR:PROC(INFO);
24:   DCL INFO CHAR (8);
25:
26:   ALLOCATE NODE SET (Q);
27:   Q->CALLSIGN=INFO;
28:   Q->NEXT=NULL();
29:   IF REAR=NULL() THEN
30:      FRONT=Q;
31:   ELSE
32:      REAR->NEXT=Q;
33:   REAR=Q;
34: END ADD_REAR;
35:
36:  REMOVE_FRONT:PROC RETURNS (CHAR(8));
37:  IF EMPTY() THEN DO;
38:     PUT SKIP LIST ('QUEUE ACCESS ERROR');
39:     RETURN ('-ERROR--');
40:     END;
41:
42:   DCL TEMP POINTER;
43:   TEMP=FRONT;
44:   INFO=TEMP->CALLSIGN;
45:   FRONT=TEMP->NEXT;
46:   IF FRONT=NULL() THEN REAR=NULL();
47:  FREE TEMP->NODE;
48:  RETURN (INFO);
49: END;
50:
51:
52:  EMPTY:PROC RETURNS (BIT(1));
53:   RETURN (FRONT=NULL());
54:  END EMPTY;
55:
56:  CALL INIT_QUEUE;
57:
58:  MAINLP:DO WHILE ('1'B);
59:    PUT SKIP LIST ('1. ADD CALL TO LIST');
60:    PUT SKIP LIST ('2. REMOVE CALL FROM LIST');
61:    PUT SKIP;
62:    GET LIST (I);
63:
64:    IF I = 1 THEN DO;
65:     PUT SKIP LIST ('CALL -->');
66:     GET LIST (INFO);
67:     CALL ADD_REAR(INFO);
68:    END;
69:
70:    IF I = 2 THEN DO;
71:     IF EMPTY() THEN
72:      PUT SKIP LIST ('LIST IS EMPTY');
73:     ELSE DO;
74:      INFO = REMOVE_FRONT();
75:      PUT SKIP LIST (INFO);
76:     END;
77:    END;
78:   END MAINLP;
79:  END QUEUE;
```

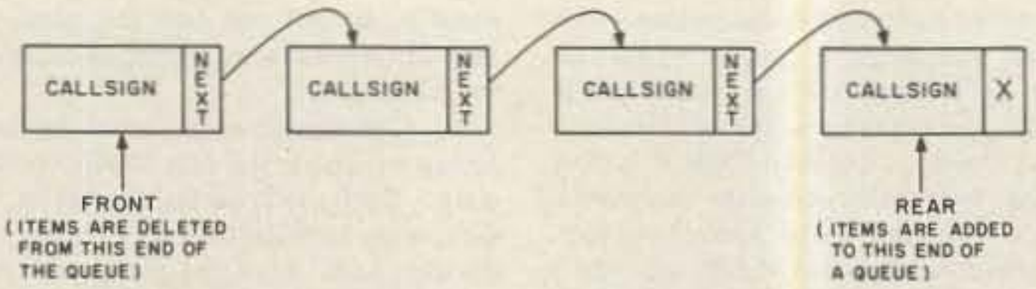

Fig. 1. What a queue looks like. Each rectangle represents a node.

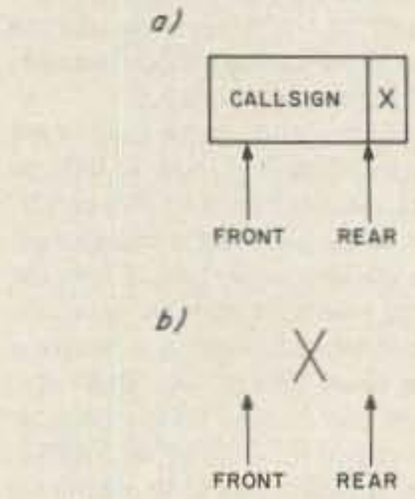

Fig. 2. (a) A queue containing only one node. (b) A queue containing no nodes and both front and rear point to NULL, represented here with an X.

memory. It then takes the callsign field of the node and inserts the proper information into it. The node is then linked to the rest of the chain of nodes by taking the "next" field of the existing rear node and setting it equal to the address of the new rear node. The value of the REAR variable is then updated to reflect this change. (See Fig. 1 for a diagram of what queue looks like.)

The other operation we need, that of removing a callsign from the front of the queue, starts at line 36. If the queue is empty, this subroutine prints an error message. If not, it removes the front element of the queue and saves the callsign information. The FRONT variable is then updated to point to the next element on the list (line 45), and the old FRONT node is discarded (line 47). The statement on line 47 frees the memory that was used for the node so that it can be used again. It would be helpful to think of memory as being a pool of nodes; the ALLOCATE statement takes a node from the pool, and the FREE statement dumps a node back into the pool.

In order to see if the queue is empty, the procedure starting at line 52 checks to see if the FRONT pointer is equal to the null value. An empty queue is shown in Fig. 2(b). Both the front and rear pointers point to the null value, represented by an "X". Also, note that a queue can have one element—Fig. 2(a). In this case, the front and rear pointers both point to the same element.

The main program starts at line 56. After the queue is initialized, it gives the user a choice of adding a call to the end of the list or removing a call from the front of it. If option 1 is selected, the program asks for the callsign and calls the ADD-REAR procedure. If option 2 is selected, the program calls the REMOVE-FRONT procedure and prints the callsign on the display. See Listing 2 for a printout of a program run.

Obviously, this is far from being a complete net-management program. After the check-ins are acknowledged, it would be useful to put them on another form of a list. A circular list might be a useful structure to use. This can be created by having a queue where the rear element points to the front element. With the calls in a circle, one can keep going around the list, thus periodically seeing if the stations are still there.

As you can see, PL/I is very different from Basic. The block structure of a PL/I program, as well as the ability to declare structures of data and refer to them by addresses (pointers), makes it easier to use for many programming projects. It does, however, have its disadvantages. The programs have to be complied and linked before they can be executed—a process that can sometimes take up to two minutes, depending on the speed of the disk drives and the length of the program. If there is an error in the program, it has to be fixed using a text editor and recompiled before it can be run. This can be a slow process. However, it does encourage a programmer to get his program logic worked out *before* he starts to write the program; the user of an interpreted language is often tempted to work out the program logic as he is writing it!

Next month, I'll go into some other languages. It is hoped that this will provide you with an adequate sample of the various languages available for microcomputer users and will be helpful when you are deciding which language compiler to buy.

Listing 2. Sample run of the net-control program.

```
A>QUEUE

1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST

1


CALL -->AF2M

1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
1


CALL -->WB2IBE

1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
1


CALL -->KI2U

1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
2


AF2M
1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
2


WB2IBE
1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
1


CALL -->W2NSD/1

1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
2


KI2U
1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
2


W2NSD/1
1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
2


LIST IS EMPTY
1. ADD CALL TO LIST
2. REMOVE CALL FROM LIST
```

LETTERS

FRESH AIR

Just picked up the November issue of *73* and I couldn't help but comment on a letter sent you by the gentleman who has refused for over fifty years to have his mind "cluttered...with code just to pass some test."

I can certainly remember the challenge I had as a youngster of twelve in earning that General ticket. The difficulty at the time, though, was understanding that electronic theory. As I recall, I couldn't quite understand why I was required to know all that theory when an understanding of telecommunications operation should suffice.

Fortunately, for some, the FCC has provided a portion of the radio spectrum for those of us who have not the inclination to clutter our minds with code or theory. Ten-four, good buddy?

Thanks for a refreshing breath of fresh air called *73* and best wishes for another prosperous year.

Lou Devillon K4ZRP
Jupiter FL

CB TO SHUTTLE?

This article was in my local newspaper this evening (New Bedford *Standard-Times*, New Bedford, Massachusetts, December 5, 1983). I thought that you might get a kick out of it. It is amazing what will get into print these days.

Chuck Doherty WB1AIP
So. Dartmouth MA

CBer claims to hear voice from space

By David Foster
STANDARD-TIMES STAFF WRITER

ACUSHNET — John Worthington was driving down Route 24 in Raynham Saturday night when his citizens band radio suddenly crackled with what seemed to be the voice of orbiting Spacelab Commander John Young.

Officials at Space Center in Houston were doubtful today that the conversation could have taken place, but said they would "check it out."

Worthington, of 339 Main St., said he talked to Young, who is orbiting the Earth in the space shuttle Columbia, for about a minute at 9:47 p.m. Saturday.

He recalled the voice as saying, "Spaceship Columbia, we are currently entering the east coast of the United States, broadcasting on 27.4 meghertz, channel 19. Does anyone between the states of New Jersey, New York, Connecticut and Massachusetts have the copy on us?"

Worthington, 44, a garage supervisor for The Standard-Times, said he acknowledge the transmission, but got no response at first. Young rebroadcast the entire message, and Worthington repeated his response, Worthington said today.

"At that point, he received me loud and clear. He asked me for my location, my call letters, which I gave him."

They conversed briefly, he said.

"He tried to get back to me again, but he started to fade out," Worthington said. "He said, 'Traveling at 12,000 miles an hour, I guess it's impossible for us to carry on a very long conversation.' And then he was gone."

"The thrill went down my spine like you wouldn't believe. You can dial the phone any time you want, but how often can you call outer space?" Worthington said.

A NASA spokesman said the agency couldn't be sure that Young didn't talk to Worthington, but said they would check it out. A spokesman for the American Radio Relay League, which represents ham radio operators, said it was impossible for a CB radio operator to talk to Spacelab.

"There's just simply no way," said Wayne Yoshida, from the league's office at Space Center.

Yoshida said ham operators are communicating with Spacelab, but that is on a completely different frequency.

For his part, Worthington is "99.9 percent sure" it was Young he talked to, and not an earth-bound hoaxer. "Hey, who can tell anything? I just know that if it was a ground station, he wouldn't have faded out."

Worthington said he plans to write a letter to Young to confirm the conversation.

CUCKOO'S NEST

I have hesitated to write this until both my blood pressure and NASA STS-9 were back to ground level. Many of us, including yours truly, were shocked, discouraged, and dismayed by the operational procedures of some hams during Owen Garriott's history-making flight aboard the *Columbia*.

Though there had been months of preparation regarding the operating frequencies to be used by Garriott and earthbound stations, dozens of hams insisted on calling W5LFL on his dedicated transmit frequency. As if that wasn't bad enough, all of the self-appointed "policemen" monitoring 145.55 MHz got on to chastise the offenders. All of which resulted in chaos on the frequency.

Some of the language heard during this period was downright embarrassing to listeners, both hams and SWLs. I heard of one ham who had gathered some non-ham friends around his rig in hopes that they would hear W5LFL on one of his passes. Instead he was embarrassed to hear language and behavior which would make channel 19 seem tame.

I, for one, am totally disgusted with the level of operation on the ham bands and on 2 meters in particular. It seems that we traded in our common sense, self-respect and basic intelligence when we received our ham licenses at the FCC office.

Maybe it is my past training in the US Army Signal Corps which causes me to be extra sensitive to careless operation. I was taught that if you don't know how to oper

ate your equipment properly on the correct frequency, you don't operate. Also, if you don't have anything intelligent to say, you maintain radio silence.

Now, don't go saying that I'm dragging the ham community down in the mud. There are thousands of dedicated men and women on the bands that do operate in a sensible fashion. To those people, I tip my hat!

Let's keep the bands free of the cuckoos. Maybe next time Owen flies over, he'll find more ham-ers than jammers.

Bill Shaughnessy KB1DY
Arlington MA

GRENADA CONNECTION

Wednesday, October 26, *The Boston Globe* front-page headline read: "US-Led Forces in Grenada...Two GIs Dead, 23 Wounded." *The Herald*, Boston's second daily paper, had this headline: "Two US Troops Die in Swoop on Grenada."

The news media was "tongue-tied!" No reporters were allowed on the island so nothing was coming out, and to prove it, both papers carried almost identical headlines. This is by no means a vendetta against the press, but throughout the years, with all the great technical advancements, the ham-radio operator is still the front line of communications to the outside world when a crisis breaks.

The key to the entire situation was the safety of the one thousand or more American students attending the two medical colleges on the island, St. George's and the American Medical School.

My vigil began on the 25th when I monitored an emergency frequency, 14.302 MHz, designated by the FCC to handle health and welfare traffic. The True Blue Campus at St. George's was the "hot spot" for the four pieces of traffic I received from concerned parents, which I passed to net control.

The following morning, 26 October, at 1245 zulu (8:45 am EDST), things began to really pop. Still monitoring the same emergency frequency, I could feel the crescendo building as more and more people became involved, when suddenly I heard an almost whispered message: "QSY to 350.9, QSL?" Roger. The point 9 caught my curiosity. That's a no-no; it's outside the regular band. Something must be cooking. Although I wasn't invited, I followed the two mysterious hams to their clandestine rendezvous. Bingo! I hit pay dirt.

"This frequency is operating by the authority of the FCC and the use of this frequency by any persons other than those designated by the FCC is prohibited and risks the penalties of illegal operations."

MASSACHUSETTS GOVERNOR PROCLAIMS HAM RADIO WEEK

Declaring that hams all over the world are always in the front lines of communications during every crisis (Grenada) as well as devote themselves daily to the safety, health, and welfare of the general public, Massachusetts Governor Michael S. Dukakis signed a proclamation designating November 7-12 as Ham Radio Week.

Shown (left to right) are Dick Lindzen KA1SA, Irv Geller K1ON, Bill Sidell WA1HXQ, Paul Dumais W1LJO, Tony Ruggelo K1CET, and Neal Lipson K1NDF, all members of the Middlesex Radio Club of Newton, Massachusetts.

This warning was repeated throughout the day.

I was not permitted to transmit on this frequency, but there is no law saying I cannot tape the information that was being passed between those who had the authority.

Mark KA2ORK was the Grenada connection. He was a student at the American Medical School and he did a tremendous job. Cool, absolutely cool. Hour after hour he went on handling all kinds of traffic: "The Marine Commandant is aware that your food and water supply is running low," "the four students you were concerned about who live off campus were contacted and are OK," "we received, though we think it's corny, from the State Department, 'Cavalry is coming up through the Canyon'—we will pass it along anyhow."

My tape recorder was getting "red hot," so I called the ABC TV affiliate station for the Boston area and played a short blast for the news manager. Within twenty-five minutes, 1505 zulu (11:05 EDST), one of their top reporters and a two-time Pulitzer-Prize-winning photographer were sitting in my shack, glued to my receiver and tape recorder. Mark was really feeding us like a gang of kids waiting for the ice-cream man!

There was a phone patch between John Copycinski, a staff member at St. George's Medical School, and his wife, Rose, in Newark, New Jersey, coming over the air while the lights and camera were being set up in the shack. "Hi, honey, I am doing fine and everyone here is doing a great job. I'm coming home soon. Right now we are waiting for the Marines to land on the beach and there has been some fighting. All the students are safe and OK. They will probably evacuate us soon. Don't you worry, now. Give that little Polish princess, Stephanie, a great big kiss for me. Don't worry, you will soon see my smiling face coming through the door. I love you and miss you. Over."

During their three-hour stint, Jim Boyd, the reporter, kept in close touch with his station, while Stanley Foreman did his lights, action, and camera bit, including a one-on-one interview between Jim and me.

All of which resulted in a five-minute lead-in segment on their TV station (Channel 5) 6:00 pm news program. I was told the President of the US does not get that kind of coverage.

The Boston Herald asked for my tapes and did a two-column story on the following morning. And local radio station WEEI called and did a phone interview with me.

So, the hams were "cooking" while the media was "stewing." Thank you very much, Mark Barettella KA2ORK of Ridgefield, New Jersey, my Grenada connection. 73.

Bill Sidell WA1HXQ
West Newton MA

QTH SWAP

During the period between the beginning of July and the end of October, 1984, my wife and I intended to revisit the western states of the USA which we toured extensively in 1981. On this occasion, however, we would like to exchange our home, car, and station for a period of about three months with a ham living somewhere not too far from the west coast of the US. What we would like from the exchange would be the use of a modest but well and suitably equipped motor home to permit touring around the western states.

The Isle of Man is a very beautiful island which is green and lush at all seasons. It is unspoilt by industrial developments with a much slower pace to life than on the English mainland. We do not, however, achieve southern California temperatures, even in high summer, being nowhere more than six or seven miles from the sea.

I would like to hear from anyone interested in the above offer of an exchange of QTHs, and of course will reply to all who may wish to enter into further detailed discussion.

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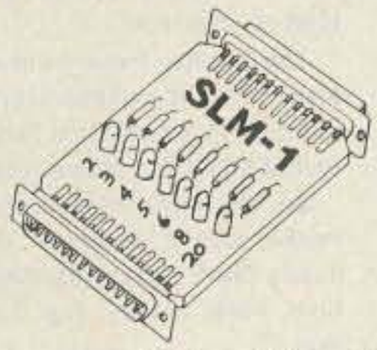

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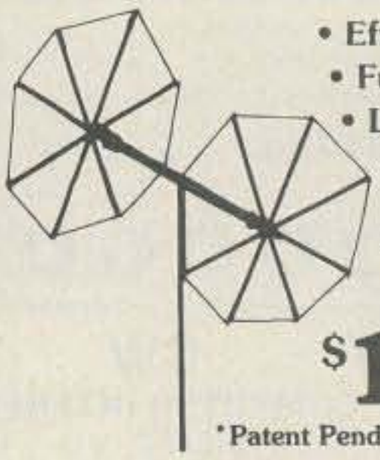

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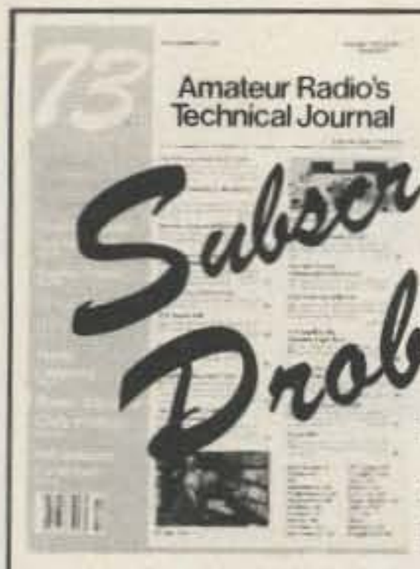

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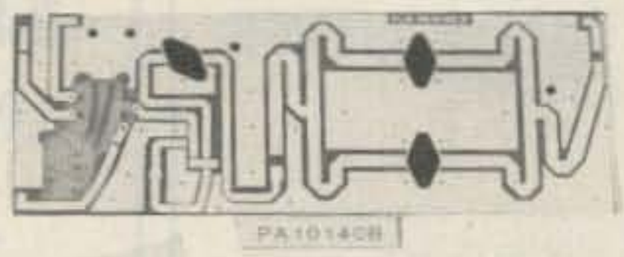

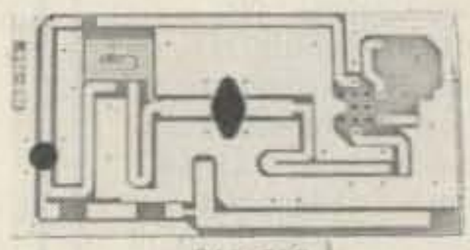

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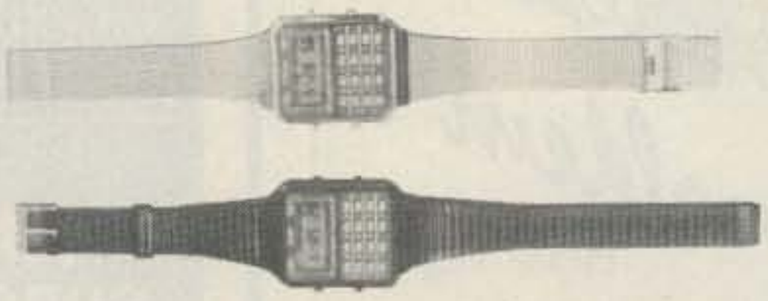

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SD1004	15.00	SD1127	3.50	SD1283	10.00	SD1478	21.00
SD1009	15.00	SD1133	14.00	SD1289-1	15.00	SD1480	60.00
SD1009-2	15.00	SD1133-1	14.00	SD1290-4	15.00	SD1484	1.50
SD1012	9.90	SD1134-1	3.00	SD1290-7	15.00	SD1484-5	1.50
SD1012-3	9.90	SD1135	8.00	SD1300	3.00	SD1484-6	1.50
SD1012-5	9.90	SD1136	15.00	SD1301-7	3.00	SD1484-7	1.50
SD1013-3	13.50	SD1136-2	15.00	SD1305	3.00	SD1488	39.00
SD1013-7	13.50	SD1143-1	12.00	SD1307	3.00	SD1488-1	28.00
SD1014	11.00	SD1143-3	17.00	SD1308	3.00	SD1488-7	27.00
SD1014-6	11.00	SD1144-1	3.00	SD1311	1.00	SD1488-8	28.00
SD1016	15.00	SD1146	15.00	SD1317	10.00	SD1499-1	39.00
SD1016-5	15.00	SD1147	15.00	SD1335	3.00	SD1520-2	18.00
SD1018-4	15.00	SD1188	10.00	SD1345-6	5.00	SD1522-4	33.00
SD1018-6	15.00	SD1189	24.00	SD1365-1	2.50	SD1528-1	24.00
SD1018-7	15.00	SD1200	1.50	SD1365-5	2.50	SD1528-3	34.00
SD1018-15	15.00	SD1201-2	10.00	SD1375	7.50	SD1530-2	38.00
SD1020-5	10.00	SD1202	10.00	SD1375-6	7.50	SD1536-1	41.00
SD1028	15.00	SD1212-11	4.00	SD1379	15.00	SD1545	34.00
SD1030-2	12.00	SD1212-12	4.00	SD1380-1	1.00	SD1561	79.00
SD1043	12.00	SD1212-16	4.00	SD1380-3	1.00	SF4557 Mot.	25.00
SD1043-1	10.00	SD1214-7	5.00	SD1380-7	1.00	SK3048 RCA	5.00
SD1045	3.75	SD1214-11	5.00	SD1405	40.00	SK3177 RCA	15.00
SD1049-1	2.00	SD1216	12.00	SD1409	18.00	SMS7714 Mot.	2.50
SD1053	4.00	SD1219-4	15.00	SD1410	22.00	SRF750 Mot.	36.00
SD1065	4.75	SD1219-5	15.00	SD1410-3	21.00	SRF1018 Mot.	5.00
SD1068	15.00	SD1219-8	15.00	SD1413-1	18.00	SRF2147 Mot.	22.00
SD1074-2	18.00	SD1220	8.00	SD1416	50.00	SRF2356 Mot.	38.00
SD1074-4	28.00	SD1220-9	8.00	SD1422-2	24.00	SRF2378 Mot.	16.00
SD1074-5	28.00	SD1222-8	16.00	SD1428	33.00	SRF2584 Mot.	40.00
SD1076	20.00	SD1222-11	7.50	SD1429-2	15.00	SRF2821 Mot.	25.00
SD1077-4	4.00	SD1224-10	18.00	SD1429-3	15.00	SRF2857 Mot.	20.00
SD1077-6	4.00	SD1225	18.00	SD1429-5	15.00	TA8894 RCA	15.00
SD1078-6	24.00	SD1228-8	POR	SD1430	12.00	TIS189/MRF966	3.55
SD1080-8	6.00	SD1229-7	13.00	SD1430-2	18.00	TP312	2.50
SD1080-9	3.00	SD1229-16	13.00	SD1434-5	30.00	TP1014 TRW	5.00
SD1084	8.00	SD1232	4.00	SD1434-9	30.00	TP1028 TRW	15.00
SD1087	15.00	SD1240-8	15.00	SD1438	26.00	01-80703T04/	
SD1089-5	15.00	SD1244-1	14.00	SD1441	91.00	458-949 Mot.Comm.	65.00
SD1095	15.00	SD1262	12.00	SD1442	15.00	TXVF2201 H.P.	450.00
SD1100	5.00	SD1263	15.00	SD1444	6.00	62803 RCA	100.00
SD1109	18.00	SD1263-1	15.00	SD1444-8	6.00	TA7205/2N5921	80.00
SD1115-2	8.00	SD1272	13.00	SD1450-1	28.00	TA7487/2N5920	75.00
SD1115-3	8.00	SD1272-2	15.00	SD1451	18.00	TA7995/2N6267	150.00
SD1115-7	2.50	SD1272-4	15.00	SD1451-2	18.00	SRF2092 Mot.	18.00
SD1116	5.00	SD1278	20.00	SD1452	20.00	MRF479	8.05
SD1118	22.00	SD1278-1	18.00	SD1452-2	20.00		

We Can Cross Reference Most RF Transistors, Diodes, Hybrid Modules And Any Other Type Of Semiconductor.

• DIODES (HOT CARRIER,MICROWAVE,PIN,SCHOTTKY,TUNNEL,VARACTOR,GUNN) •

1N21	$ 3.40	1N21B	$ 3.40	1N21BR	$ 3.40	1N21C	$ 3.40
1N21D	4.00	1N21DR	4.00	1N21ER	6.00	1N21RF	5.00
1N21WE	5.80	1N21WG	5.80	1N22	5.00	1N23A	10.00
1N23B	3.40	1N23C	3.40	1N23CR	3.40	1N23D	4.95
1N23DR	4.00	1N23WE	5.00	1N25	7.50	1N25AR	18.00
1N28WE	10.00	1N29	10.00	1N32	20.00	1N53A	55.50
1N76	26.00	1N76R	28.00	1N78	26.00	1N78A	20.00
1N78B	26.00	1N78D	28.00	1N78DR	28.00	1N78R	28.00
1N149	6.00	1N150MR	18.00	1N415	4.00	1N415C	4.00
1N415G	15.00	1N416D	5.00	1N416E	6.00	1N446	10.00
1N831	10.00	1N833	10.00	1N950	4.00	1N1084	2.00
1N2930	15.00	1N2932	15.00	1N3540	15.00	1N3712	11.00
1N3713	18.00	1N3714	11.00	1N3715	16.00	1N3716	10.00
1N3717	14.00	1N3718	10.00	1N3721	14.00	1N3733	10.00
1N3747	21.00	1N4386	20.00	1N4396	15.00	1N4785	11.00
1N4812B	9.00	1N5139A/B	4.25	1N5140A/B	4.25	1N5141A/B	4.25
1N5142A/B	4.25	1N5143A/B	4.25	1N5144A/B	4.25	1N5145A/B	4.25
1N5146A/B	4.25	1N5147A/B	4.25	1N5148A/B	4.25	1N5167	5.50
1N5453	3.75	1N5465	7.65	1N5711	1.00	1N5711 JAN	2.00
1N5713	5.00	1N5767	2.00	1N6263	1.00	1S2199	15.00
1S2200	15.00	1S2208/9	1.00	8B1087/48R869558	65.00	8D3020	65.00
A2X116M Aertech	50.00	BB105B	1.00	BB105G	1.00	BD4/4JFBD4 G.E.	15.00
BL161 Bomac	5.00	CMD514AB C.M.	POR	D4060 Alpha	POR	D4159 Alpha	POR
D4233B Alpha	POR	D4900 Alpha	POR	D4959 Alpha	POR	D4987M Alpha	POR
D5047C Alpha	POR	D5147D Alpa	POR	D6503 Alpha	POR	D6506 Alpha	POR
DGB6158-98 Alpha	POR	DMD6022 Alpha	POR	DMD6460A Alpha	POR	DP20054 Crown	POR
GC1691-89 GHZ	31.35	GC1602-89 GHZ	31.35	GC1607-40 GHZ	31.35	GC2531-88 GHZ	37.40
GC2542-46 GHZ	37.40	GC3208-40 GHZ	37.40	GC17044 GHZ	50.00	HP33644A-H01	125.00
HP5082-0112	14.20	HP5082-0241	75.60	HP5082-0253	105.00	HP5082-0320	58.00
HP5082-0375	POR	HP5082-0386	POR	HP5082-0401	POR	HP5082-0438	POR
HP5082-1028	POR	HP5082-1332	POR	HP5082-2254	POR	HP5082-2302	10.70
HP5082-2303	5.20	HP5082-2696	POR	HP5082-2711	23.15	HP5082-2727	POR
HP5082-2800	1.00	HP5082-2805	4.45	HP5082-2835	1.00	HP5082-2884	POR
HP5082-3039	6.70	HP5082-3040	36.00	HP5082-3080	2.00	HP5082-3188	1.00
HP5082-3379	1.50	HP5082-6459	POR	HP5082-6462	POR	HP5082-6888	POR
HP5082-8016	POR	HP5082-8323	POR	K3A Kemtron	7.00	MA450A	POR
MA475	POR	MA40008	POR	MA41487	POR	MA41765	POR
MA41766	POR	MA43004	48.00	MA43589	POR	MA43622	POR
MA43636	POR	MA45104	27.00	MA47044	POR	MA47051	25.50
MA47100	3.05	MA47202	30.80	MA47771	POR	MA47838*	POR
MA47852	POR	MA49106	37.95	MA49558	POR	MA86731	125.00

* OUR STOCK CHANGES DAILY SO CALL IF IF THE PART YOU NEED IS NOT LISTED

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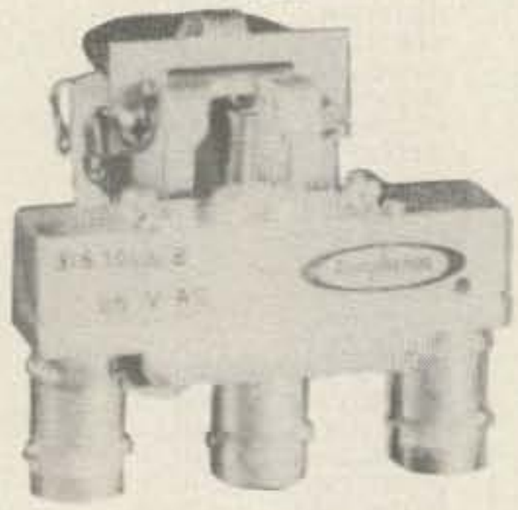
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

COAXIAL RELAY SWITCHES SPDT

Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.

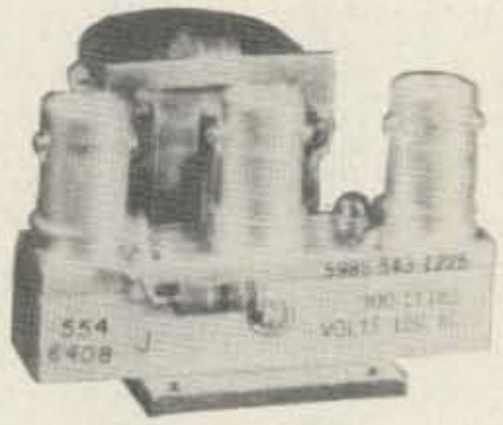
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



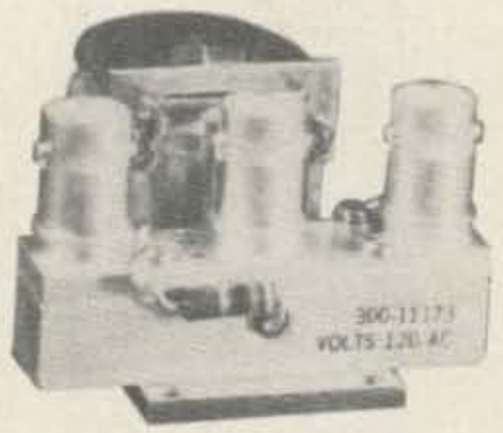
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00

$8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

TOUCH TONE PAD

This pad contains all the electronics to produce standard touch-tone tones. New with data.

$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.

$19.99 or 10/$149.99

INTEGRATED CIRCUIT.

		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

MOTOROLA MRF559 RF TRANSISTOR

hfe 30min 90typ 200max.
ft 3000mhz
gain 8db min 9.5typ at 870mhz
13db typ at 512mhz
output power .5watts at 12.5vdc at 870mhz.

$2.05 or 10/$15.00

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EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

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HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_o), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2C39/7289	$ 34.00	1182/4600A	$500.00	ML7815AL	$ 60.00
2E26	7.95	4600A	500.00	7843	107.00
2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
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DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

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List of Advertisers on page 114

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 6

Some would key the rig, most wouldn't. None would both key and modulate. Eventually I found the KLM mike—worked fine, once I'd found it. Now why is it so difficult to have some standardization on mike connectors? Come *ON*, you manufacturers.

Okay. Receive on 145.55—no problem. I decided to use the tunable vfo for the receiver and the synthesizer for transmitting so I could switch between 144.91-.93-.95-.97-.99- 145.01-.03-.05-.07-.09 quickly. My HT on 145.55 zeroed in the receiver and I was ready to roll.

The rig seemed to be working fine, with all sorts of guys chirping in on the .55 channel before the expected orbit, complete with others telling 'em to get the hell off the downlink channel and others testily demanding call-letter identification by everyone breaking in. The usual crapola.

About five minutes before the orbit, the uplink channels began to fill with callers. It sounded just like a DX pileup on 20m. I checked all of the ten uplink channels and found all ten piled high with signals. Having operated from planes many times over the years, I doubt if LFL could sort anything out of that mess. Even at two or three miles up, the channels turn to garbage as several stations try to use the channel at once.

Some ops, confused by the complexity of having to transmit on one channel and receive on another, got the two mixed up, filling the uplink channel much of the time with alternating calls and put-downs. I don't know if anyone else waited to hear LFL before calling (it didn't sound like it on the uplink channels), but I held my peace, waiting to hear if *Columbia* was even going to be on on this orbit. Silence from above.

The chorus kept up for the twenty minutes of the orbit, plus about five minutes on either end just in case. What a jungle.

1984 *CALLBOOK*

Despite the ARRL trying to put the venerable *Callbook* out of business, the new edition came out. I don't know why the *Callbook* seems to be so much more up to date than the ARRL version, but it sure does. At any rate, the 1984 *Callbooks* arrived ($19 each for the US and foreign editions), so after making sure that I am still alive, I checked out the US ham census figures to see how many new hams we have.

It's easy to see why most of the ham dealers have gone broke and why we have so few American ham manufacturers these days—hardly any new hams. The overall increase was about 2.6% over 1983—pitiful. Novices are up 9.4% this year. Techs are up 0.5%. Generals are down 0.7%. Advanceds are up 1.3%. Extra class is up 7.2%. That's awful!

In the heyday of amateur radio (1946-63), we grew at 11% per year steadily. Since 1963, the average growth has been the same as this last year—2.6%—and that's for twenty years now. Indeed, if we had not stopped our growth short in 1963, we would today have over two million US hams—just double the Japanese ham population, which makes sense when you figure that they have almost exactly half our total population.

Would we have lost one after another of our consumer electronics industries if we'd kept up supplying our country with career high-tech people via amateur radio? I think not. I've written about this for several years now, but I haven't seen any signs of anyone really giving a damn. I am bringing it up again because I've seen some magazines poo-pooing this with claims that we're back into a much higher ham growth. Well, we aren't. Nothing has been done to improve matters yet.

FOREIGN HAM SUBSCRIPTIONS

A couple months ago, I wrote mentioning that many hams in many foreign countries have currency restrictions which make it almost impossible for them to get *73*. Hundreds of readers have been kind enough to send in gift subscriptions to help these DX hams and I've been getting copies of the letters of thanks which have been forthcoming. It's almost sad to see how appreciative these lucky chaps are of your thoughtfulness. Try it and see for yourself. The regular DX subscription is $45, but if you send $25, I'll go the other $20 and we'll let more DX hams know that we Americans are the good guys.

See List of Advertisers on page 114

73 INTERNATIONAL

from page 78

lot of customers. Waiting for the pileup, I told Bill it was my birthday (40 years). I spent the following two hours receiving reports and greetings. When the propagation changed, I turned the beam to Europe and received reports of 20 over S9. It was really a nice present. Friends from my home QTH told me that the XYL was listening to my transmitting frequency and that she was passing a lot of 88. When I went back, she told me she will apply for a license to be able to talk to me when I am away.

In fact, our group is planning other expeditions for next year, and you can bet they will be to some of the top-wanted DX countries. For the moment we do not intend to give more details; in these days it's very easy to hear people saying they are planning to go here and there, to listen for them next week from the moon, but nothing comes out of it! We will advise all DX bulletins a few weeks in advance, but only if everything will be 100% sure. But let's go back to Taiwan.

We did not work too much during the nights as the bands were dead and we had no authorization to operate on 40 and 80, but I spent some time listening and can give you assurance that it will be no problem to work BV from W6; even with the 12AVQ I was in the position to copy W6 on 40 and 80. It was evident that JA signals were well above S9 and VK/ZL on a 5 level.

The propagation from BV was not too good during our stay. We had only two good openings on 20 and three on 15. More or less the same situation for Europe, but with longer opportunities. In total we had 3329 contacts on SSB and 2050 on CW. 341 stations worked on 20 meters from US SSB, 317 on 15, 138 on 20 CW, and 201 on 15 CW. All this thanks to the beautiful job done by Tim and his group. Without their help and assistance, it would not have been possible to do anything.

Apart from the radio activity, we had the opportunity to visit Taiwan and spend some time with the local people. Taiwan is a 13,800-square-mile island with a subtropical climate situated 700 miles south of Japan and 100 miles from the mainland. The standard of living is very high and the number of cars, television sets, and air conditioners is unbelievable.

The philosophy of Chinese hospitality is based on what Confucius said 2500 years ago: "There is no pleasure to surpass the greeting of friends coming from afar." I can assure you that this is still valid. We had the opportunity to meet the local authorities, including directors of the Ministry of Communications and others, and had a wonderful party organized for us by the CRA.

It is difficult for me to express my feelings in a language that is not mine; it's difficult even in Italian! I can only repeat a few words Tim said to me when we left: "It is the end of a short adventure, my friend; it can be the start of a long friendship. Long life to you my friend."

Thank you, Tim!

de I2MQP

Left to right, I2MQP, BV2A/B, I2BVS, and I2NYN.

The party: I2MQP and I2BVS (standing) present an honorary membership on the DX Blue Team to Tim Chen BV2A/B. On the left of I2MQP is Mr. Pong, Deputy Director, Ministry of Telecom.

LIBERIA

Brother "Don" Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
Monrovia
Republic of Liberia

Amateurs around the world are helping the lepers in Liberia. In the August, 1983, issue of *73*, the Liberia column gave in some detail the effort of the amateurs of Liberia to come to the help of the lepers at Ganta. The response to their "A8" special prefix (this is Echo-Lima-land) has been one-hundred-percent positive. Even beyond that, many of the amateurs volunteer the comment that they are happy some of their numbers are involved in a project that is so worthwhile.

At the date of this writing (11/23/83), the Ganta Leprosy Center has received a total of $2,243.02 from the contributions of amateurs in various parts of the world, and even as these funds were coming in, two of the mud huts in which the lepers are living literally collapsed. They are being rebuilt with the money received from the amateurs, and without that money there would probably have been no rebuilding at this time. There is another month of "Alpha 8 calling," and we hope that during this time we can do better.

Presently, the Center is directed by Dr. (Sister) M. Chambers, who is assisted by Theresa Hicks (a religious of another order). In the area of medicines, they are funded by the German Leprosy Relief Association and the government of Liberia. They have four hundred and forty patients. One hundred twenty of these patients are totally dependent, another one hundred twenty are ambulatory, and two hundred are outpatients (off campus).

There is a new medication in use in the form of Rifampicin capsules. With Dapsone daily and Rifampicin monthly, non-infectious leprosy can be cured in six months. Infectious leprosy can be cured in two years with Dapsone administered daily, Lamprene three times per week, and Rifampicin monthly. With the previous medicines, the cure took up to five years.

The immediate need at the Center is funding for new houses. Those presently in use are so dilapidated that large pieces of wall and or roof are breaking loose and falling down in rough weather. The mud in the walls has become washed out so that the walls are porous and house bugs and rodents. The remaining part of the story is not pleasant even to think about. In other areas, there is always need of bandaging, gauze dressings, medical adhesive tape, and cotton wool.

When the amateurs of Liberia began this project, they had visions of making sixty-thousand contacts, and with a small contribution from only a majority of these contacts, the houses could have been built. As it works out, it is evident that such a goal was a bit ambitious. On the other hand, a few of the amateurs contacted made sizeable contributions and a few others have taken upon themselves the job of doing a little fund-raising of their own and have then sent in the money. As a result, the total at this date is not unmeaningful.

Reports are now coming in from people who have received the Alpha 8 QSL card, and they are very pleased. The word is that the card is oversize, that it has pictures, and that it is very beautifully done. We, here in Monrovia, have not seen the card yet, but we are gratified to know that they are being received and that they are a bit more than the ordinary.

Should anyone wish to contact the Leprosy Control Center directly, address: Dr. Margaret Chambers, Ganta Leprosy Center, Box 1010, Monrovia, Liberia, West Africa.

For me, personally, this program has been a grand experience. Aside from the fact that we are helping the lepers, I have a new appreciation of amateur radio and its amateurs. The response from all over the world has been positive and courteous. I have received nothing but praise and good wishes. The greater the need or the greater the emergency, the more sure you can be that the amateurs will be there.

MONROVIA'S NEW REPEATER

Big news! The brand-new (second-hand and rebuilt) repeater is twenty Watts. With a good antenna location, it should cover the city of Monrovia and we, the local amateurs, should have HT communications over the greater part of the city!

That part is all true and it is fine, but what about the amateurs who do not live in greater Monrovia? The situation in Liberia is different from that in the States. In the States, there are many repeaters and amateur operators have a wide choice. They even have scanners. More important than that, they have other types of communications available. Here in Liberia, amateurs who find themselves in outlying areas are almost totally dependent on their radio.

Until now, there has been one repeater in operation. It is at Bong Mines, which is an excellent location. They have skilled technicians who maintain it and make changes when it is necessary. It covers most of Liberia, but when an amateur finds hmself 120 miles "up country," he has problems and cannot always make the repeater. For a very interesting story concerning this situation, read the Liberia column and the story of Mark H. Munson, M.D., EL5G, *73*, September, 1983.

Monrovia itself is about 65 miles from the Bong Mines repeater, so the little HT has a bit more than it can handle, and even home sets with their higher power and better antennas will not make the repeater unless everything is working well. The new Monrovia repeater will solve this

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SD1441	(F)	150W	130-175	83.50
2N6081	(s)	15W	130-175	7.75
2N6082	(s)	25W	130-175	9.75
2N6083	(s)	30W	130-175	9.75
2N6084	(s)	40W	130-175	12.00
2SC1955	—	1W	130-175	15.00
2SC2289	—	5W	130-175	20.00
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. . . Simple installation . . . excellent instructions . . .
. . . Switched filters to new 930S when I traded my old 830 . . . same solid improvement! . . .

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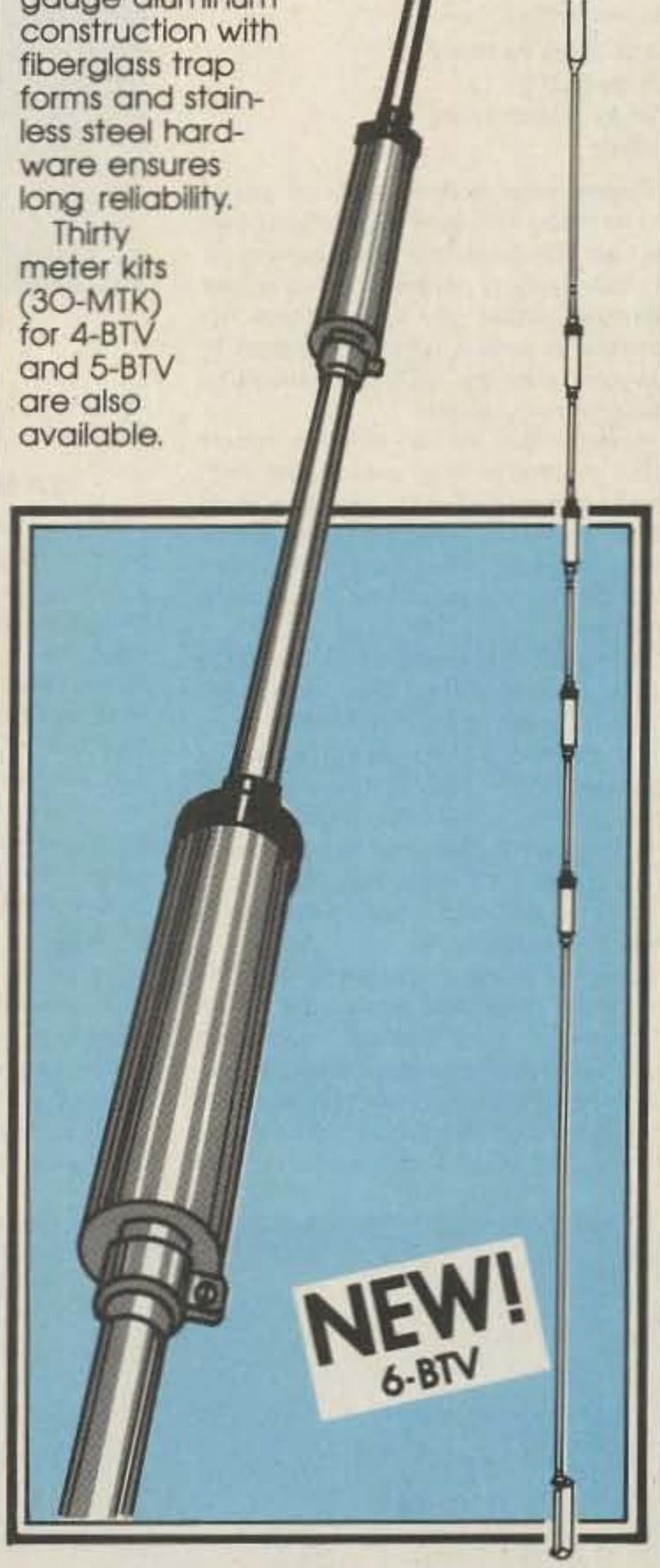

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problem nicely. While we are solving our problem, we are, however, cutting out the amateurs outside.

Can our repeaters be made to talk to each other? The experts around here say "yes." In view of the fact that there will be only two repeaters in Liberia, they expect no interference and they think it can be done. No one has presented a feasible plan yet, although it must be added that until now the question has been quite remote.

Whatever happens it is evident that we will either find a way or go back to the one-repeater operation. We cannot cut out our amateur friends on the outside.

THE NETHERLANDS

Henk Meerman, Jr. PD@DDV
Zandvoorterweg 33
2111 GR Aerdenhout
The Netherlands

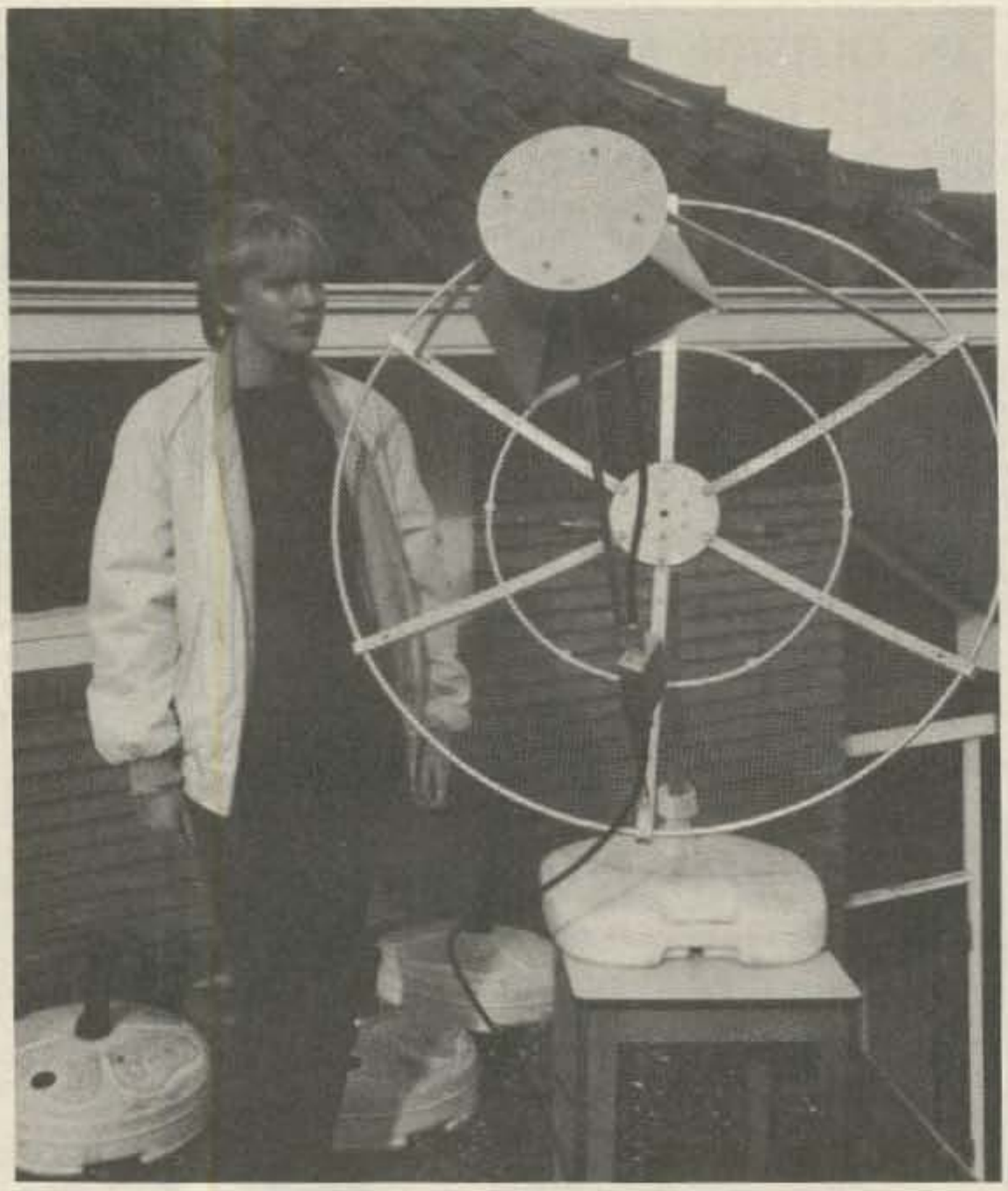
B.A.W. Aries PA3BWQ
Schuberthof 3
2742 BT Waddinxveen
Holland

Finally, after several weeks of postal and transport strikes over the whole country, I am able to write another column for *73*. Everybody is relieved that life has taken its normal way again. It was impossible to send a letter or a parcel to someone; also, the national finance was completely out of order.

Nevertheless, we had some extremely good conditions this season on VHF. Some hams worked as far away as Iceland on two meters with FM mode and simple beam antennas. Yours truly had to miss all of the fun because of a serious antenna breakdown.

Last year, the youngest of our three Dutch Radiosocieties, the NCV, celebrated 10 years of existence with a party for all members. There also was held an open day for the public, during which they were active with their club station, P14HLM, on HF, CW on all bands. A complete amateur TV station on 70 cm also was on the air, which made contact with a mobile ATV station.

The mobile unit made some stops to give some demonstrations to the public. Furthermore, they had an operational weather-satellite station receiving Meteosat 2 (1.6 GHz). A dish was placed on the roof of the club building with a converter from 1.6 GHz to 137 MHz. To get a satellite picture on a monitor, an FX-655 Vraase Fax memory unit was used.



PD@DDV's YL and the antenna used to receive Meteosat II.

SIX METERS IN HOLLAND

Although 50 MHz is not an amateur band in Holland, there are a few amateurs with a special license who operate on that band. They are allowed to do experimental transmissions on the following frequencies: 53.875 MHz, 53.925 MHz, and 53.975 MHz in CW only. The maximum power they use is 25 Watts. Many hams hope that this band will become a ham band in the future, although the license conditions are not very clear. There are some rumors that it will be assigned to the land mobile service, so let's keep our fingers crossed.

I'd like to end this column by writing about the Veron PACC (PA Century Club) Award. To earn this well-known Dutch award, you have to work at least 100 different Dutch amateur stations and have proof of it by means of a QSL card or another written confirmation. Only contacts made after the first of June, 1945, are valid for this award. There are stamps available for 200 to 900 different worked stations, so the certificate can be expanded in the future when you work more Dutch stations.

de PD@DDV

UIVER MEMORIAL AWARD

It is fifty years ago that the legendary London-Melbourne Race, organized by the Australian chocolate manufacturer McPherson Robertson was held. KLM Royal Dutch Airlines participated in that race with the then brand-new, all-metal, low-wing standard airliner Douglas DC-2 in a field of other aircraft mainly built for speed. This famous aircraft, named *Uiver* (stork), won the first prize in the handicap section and came in second in the speed section. Most remarkable was the fact that KLM conducted this flight as if it were a regular airline flight, carrying three paying passengers in all possible comfort and some 500 pounds of mail.

To commemorate this famous event, the Netherlands Broadcasting Corporation NOS conceived the idea to make a documentary of this flight which will be shown serially on television in October, 1984, the month in which the Melbourne Race took place 50 years ago. The idea was born to have this flight repeated, not with a modern Boeing 747 airliner, but with a Douglas DC-2. The apparently last airworthy DC-2 in the world was found in the United States, bearing registration NC39165 and owned by Colgate W. Darden.

The total costs for the entire *Uiver* project, including the film production, are tremendous, and in order to raise these costs, the *Uiver* Memorial Foundation was established. The funds for the commemoration flight were sought from major sponsors and the public.

The aircraft arrived at Schiphol and was given the new equipment necessary to conduct the flight in the modern aviation world. The aircraft carried exactly the same paint scheme, registration PH-AJU, name *Uiver*, and contest number 44 as the original aircraft. The flight schedule took this aircraft across a route from Amsterdam to Melbourne as close as possible to the route followed by the *Uiver* in 1934. That flight took 90 hours, 17 minutes, but the memorial flight lasted from December, 1983, until February, 1984.

Amongst Dutch radio amateurs, it was suggested that an award could be issued, and profits gained by the issuance of this award could be made available to the Foundation as a contribution of radio amateurs to this event.

de PA3BWQ

NEW ZEALAND

Des Chapman ZL2VR
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New Zealand

ZL LICENSING STRUCTURE

There are three grades of amateur license plus a Novice (non-renewable) license available in New Zealand. The amateur-radio examination and licensing structure is under the control of the New Zealand Post Office, the radio regulatory body in ZL. The radio regulatory area is controlled by the Radio Branch of Post Office Headquarters and administered by

Inside the NCV club building.

PE1BTU demonstrating the satellite receiver.

See List of Advertisers on page 114

2M REPEATER AND SIMPLEX FREQUENCIES

Repeater Name	Repeater Output	Repeater Input
665	146.65	146.05
670	146.70	146.10
675	146.75	146.15
680	146.80	146.20
685	146.85	146.25
690	146.90	146.30
695	146.95	146.35
700	147.00	146.40
705	147.05	147.65
710	147.10	147.70
715	147.15	147.70
720	147.20	147.80
725	147.25	147.85
730	147.30	147.90
735	147.35	147.95

Simplex Name	Calling Frequency
6475	146.475
6525	146.525
6575	146.575
7425	147.425
7475	147.475
7525	147.525
7575	147.575

70 CM REPEATERS AND SIMPLEX FREQUENCIES

Repeater Name	Repeater Output	Repeater Input
850	438.50	433.50
855	438.55	433.55
860	438.60	433.60
865	438.65	433.65
870	438.70	433.70
875	438.75	433.75

Simplex Name	Frequency
330	433.30
335	433.35
340	433.40
345	433.45

the Radio Inspectors Branch in each of the 17 Post Office Engineering Districts throughout the country.

The Novice license is available for one year *only*. It cannot be renewed, only upgraded. The basic requirements to pass the Novice exam are:

- a simple written examination in elementary principles of electricity and radio communications,
- a written examination on the Radio Regulations as they pertain to the Amateur Service, and
- a Morse test, sending and receiving 6 words a minute of each for 3 minutes; the receiving test has to be written.

A full pass in all three sections above entitles the Novice (callsigns with the first suffix letter N, e.g., NAA, NAB, etc.) to operate CW and AM, including SSB, on the bands 3525–3575 kHz and 28.10–28.60 MHz, with the restricted power of 10 W input to the final stage.

The next level, the Grade III license, requires a written paper on the theory of electricity and radio communications as well as the paper on Radio Regulations, but no Morse test. The Grade III licensee may operate on all amateur bands above 51 MHz only, on all modes except CW. The callsign issued to a Grade III licensee has the first suffix letter a T or U, identifying him as a VHF operator.

To progress to Grade II, the Grade III operator needs only to pass a Morse test, both sending and receiving, at 12 wpm, each for 3 minutes, the receiving test to be written. A pass to Grade II brings the allocation of a full callsign, either a two-letter (if one is available) or a three-letter one, which the amateur will hold for life whilst licensed within ZL. Previously, ZL amateurs changed callsigns when they changed their residential address to another ZL District, e.g., 1, 2, 3, or 4. But since 1980, callsigns have been allotted on a life basis, and as long as the amateur pays the license fee, no matter where he resides, he retains the original call issued. The only requirement is to notify the regulatory body of any change of address.

The Grade II operator is entitled to operate on the bands 1800–1950 kHz, 3.5–3.9 MHz, 28–29 MHz, 50–51.15 MHz, and all bands above 51 MHz, on all modes, CW included on the VHF bands.

Grade I is the top grade of amateur license in ZL; to obtain this license, it is necessary for the Grade II operator to have operated on the 3.5–3.9-MHz band under a Grade II license for a period of 12 months and to have had more than 50 contacts on that band. In addition to the operating qualification, it is necessary to show, by a further Morse test, that he/she is still capable of sending and receiving 12 wpm under the same test conditions as before. Applicants satisfying these requirements are granted a Grade I Certificate which entitles them to operate all bands and all modes allocated to ZL amateurs.

The theory examinations are conducted by the New Zealand Post Office in various examination centers throughout the country, twice each year, on the first Wednesdays in March and September, between 1:30 pm and 4:30 pm. The Morse test can be arranged anytime during the year by making an appointment with the Radio Inspector's Office in your local area and paying the examination fee of $NZ6.00. The fee for the theory examinations are $NZ13.00.

VHF IN ZL-LAND

The VHF scene in ZL is very much alive. Amateurs are active in operating and experimentation on all bands, as can be seen from the ZL Amateur Radio Records Chart in the box. ZL amateurs are doing their thing with VHF/SHF experimentation; as can be seen from the Record Chart, ZLs hold at least three world records for three different frequencies. ZL VHFers are also active in satellite work, moonbounce, ATV, packet radio, etc., and many are members of AMSAT. I shall cover some of these special areas in another column.

Under the ZL licensing structure, there is a non-Morse license available as outlined previously in this column. These T calls, so-named after the first letter of the suffix of the original calls issued to non-Morse licensees, are able to operate the bands form 51 MHz upwards on all modes except CW. Approximately 33% of the ZL amateurs are T calls, and these, plus the VHF enthusiasts from Grade II and I operators, make the VHF fraternity quite large in comparison with the total amateur population in New Zealand.

The most popular of the VHF bands are 6m, 2m, and the fast-growing 70 cm; all the other VHF/SHF bands are attracting the VHF experimenters who are keen to see what can be built and operated on these higher bands. Six meters is, of course, the VHFer's DX band and has been made available only to the Grade III operators in recent years. Previously, they were confined to 2m upwards, but an amendment to the licensing structure a year or so ago enabled the Grade III licensee to use a small part of the 6m band also.

Two meters is very popular, there being a very efficient network of 2m repeaters throughout the country, giving excellent coverage for most areas. There are at present 30 repeaters in the North Island and 16 in the South Island, providing extensive coverage. The repeater offset is 600 kHz plus or minus, negative below 147 MHz and positive above 147.05 MHz. (See box for the 2m repeater and simplex frequencies.) ZL repeaters, unlike those in North America, do not have a CW identification or timers built into their installations.

70 cm is in its infancy in ZL. However, there are 8 repeaters in the North Island and 3 in the South, located mainly in the main metropolitan centers with a couple of exceptions. This frequency is becoming very popular where it is available and will spread further afield in due course (see box).

VHF beacons also are operated by the various clubs (Branches) throughout the country, ranging from three on 6m to two on 10.25 GHz and one on 24.20 GHz. In all, there are 32 VHF beacons, including one lonely 10m beacon on 28.230 MHz located at Upper Hutt, near Wellington.

Other VHF activities scattered through the year's program include VHF/SHF contests; 2m, 6m, and other specific frequency contests; VHF/SHF Field Days; VHF/SHF DX Weekends; and probably the highlight of the VHF year, the VHF Convention held on Easter weekend (in a different city each year, where VHF enthusiasts gather to "Nog and Nosh", dine and dance, socialize, attend technical lectures and demonstrations, participate in transmitter hunts (fox hunts) with various twists, e.g., blindfolded, pedestrian, talk-in, a Mobile Rally, various other social and VHF-associated activities, and, of course, the usual trade displays and the inevitable "Trading Tables." Last year's convention at Christchurch attracted VHFers from Cook Islands (ZK) in the North to Queenstown (ZL4) in the South.

This year's convention is at Auckland with the theme, "Space Communications"; it has a full program of technical lectures on the convention theme supported by working demonstrations and lectures on amateur satellite and moonbounce techniques, as well as the usual round of social activities.

BITS 'N' PIECES

More members of the ZL Old-Timers

AMATEUR RADIO RECORDS

March 1983

It is well known that amateur-radio operators can talk all over the world. However, there are amateur bands in the Very High Frequency (VHF) spectrum—above 30 MHz—which require special efforts to cover distances beyond the horizon. Also, the higher the frequency used, the more difficult communications become. The following are VHF records held by New Zealand amateur-radio operators. The callsign in parenthesis is the current callsign held, and /P indicates portable operation.

Band	Record	Stations	Date	Distance (km)
6 Meters (52-MHz band)	Overseas	ZL3NE to VE1AVX (Canada)	11/16/80	15,555
2 Meters (144-MHz band)	Internal	ZL2ARW/P to ZL1BJP/P	2/3/82	1,069
2 Meters (144-MHz band)	Overseas	ZL2HP to VK5BC (Australia)	12/23/65	3,195
2 Meters (144-MHz band)	Moonbounce	ZL1AZR (ZL2AZS) to SM7BAE (Sweden)	3/4/69	18,298 (World Record)
70 cm (432-MHz band)	Internal	ZL2ARW/P to ZL1BJP/P	2/3/82	1,069
70 cm (432-MHz band)	Overseas	ZL2TGZ to VK2RU (Australia)	2/8/82	2,480
70 cm (432-MHz band)	Moonbounce	ZL3AAD to DL9KR (West Germany)	3/23/80	18,630.9 (World Record)
70 cm (432-MHz band)	Television	ZL2TWS/P to ZL2ASF/P	1/31/82	373.1
23 cm (1296-MHz band)	Internal	ZL1THG/P to ZL2ARW/P	1/30/82	687
23 cm (1296-MHz band)	Overseas	ZL1AVZ to VK2BDN (Australia)	2/9/82	2,131
12.5 cm (2300-MHz band)	Internal	ZL1THG/P to ZL2ARW/P	1/31/82	687
9 cm (3300-MHz band)	Internal	ZL2AQE/P to ZL2ARW/P	3/6/83	547 (World Record)
5 cm (5800-MHz band)	Internal	ZL2AQE/P to ZL2ARW/P	1/29/83	225
3 cm (10,000-MHz band)	Internal	ZL1THG/P to ZL2BFC/P	1/25/81	390
1.25 cm (24,000-MHz band)	Internal	ZL2ARW/P to ZL2TRV/P	12/8/79	18.5

The VHF records are administered on behalf of NZART (Inc.) by H. N. Wiggins ZL2BFR. All claims must be made in writing to PO Box 1718, Palmerston North, giving frequencies, date, callsigns used, locations of both stations, and confirmed distance.

RC-850 REPEATER CONTROLLER

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- Specifications/price subject to change

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1410 1410G	144	160	10	225 265
1412 1412G	144	160	30	199 239
2210 2210G	220	130	10	225 265
2212 2212G	220	130	30	199 239
4410 4410G	440	100	10	225 265
4412 4412G	440	100	30	199 239

1. Models with G suffix have GaAs FET preamps. Non-G suffix units have no preamp.
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The antennas and residence of LA3XI. His QTH is one of the best in Norway, high up on a hill.

Svein Ovenstad LA3XI and his dog.

Club have reached the mark where they qualify for 50-year certificates—congratulations to them all. They are ZLs Bill Forbes 2OW, Bob Wright 2FX, Jim Fish 1GF, Dave Shepherd 2KD, Jack Crickett 1DY, Jock White 2GX, Bob Glassey 2ACG, C.H.R. Crawford 2JV, Dick Tout 2PO, Roy Yorke 1WY, and Dave Masterton 4LF.

Silent Keys of recent months were Norman Walding ZL2GZ, September, 1983, Peter Rothschild ZL2TY, October, 1983, Ted Pratt ZL1FY, March, 1983, and Jack Parminter ex-ZL2OU, aged 83 (who relinquished his call two years ago after holding it since 1935), in September, 1983.

NORWAY

Bjorn-Hugo Ark LA5YJ
N-3120 Andebu
Norway

As promised in earlier columns, a presentation of Norwegian DXers was bound to come, and here is the first one. I am proud to present to you my good friend Svein Ovenstad LA3XI from Lierskogen, 40 km south of Oslo on the western side of the Oslo fiord. He's forty years old, married with two more-or-less grown kids. He got his license in 1962, got the taste of DXing in 1963–64, and has ever since been totally devoted to that part of the hobby.

Around 1967–68, he was tearing up the 80-meter phone band with his tremendous signal from a rhombic stretched around his property. At that time, the activity on 80-meter DXing was rather low all over the world. Only a few had discovered the wonderful DX openings occurring on 80 meters. So his efforts really paid off. You still may hear him on the lower bands, but only occasionally, even though he does a good deal of listening. But I can assure you that if a rare one comes up, he'll be there.

Mostly you will find him scanning the 20-, 15-, and 10-meter bands very thoroughly, and if a new one is expected, he'll be nailed to that chair till he works him. This is quite understandable since he has put so much effort into reaching the DXCC Honor Roll. His standing as of November 15th was: phone 318, mixed 320, and CW 280.

He surely made it happen himself. Daily work is with an aircraft company, the Braathen SAFE airlines, as a Senior Engineer. Beside his DXing and work, he is a passionate hunter, and he and his dog are really making it quite unsafe for wildlife during the hunting season up in the mountains.

One of the most interesting parts of the story about LA3XI has to do with the kind of gear he is running. Here it is: a Drake TR-7 with RV-7 remote vfo, MN-2700 tuner, a home-brew linear giving the legal power of 600 Watts input, and a Hy-Gain TH6DXX (it used to be a 20-meter, 6-element monobander with a 17-meter boom) with a tower height of 21 meters. On the lower band, he is now just running a 40-meter sloper which he, with his Drake tuner, manages to run with a fairly good result on the other bands.

Svein has, in many years, together with LA8CJ and the late LA1KI, been the major source of first-hand DX information, always double-checking any rumors and passing the word rapidly around to all others. Earlier last year he was elected president of the LA-DX group, and he really deserved to be the first choice to hold the seat after our dear LA1KI.

In Norway, there is very little news to tell right now, but everything seems to point towards a good season for low-band DXing. W6s and W7s are starting to come through as usual at this time of the year, over the long path. And the cold and snow have come as well. Storms are breaking over the country, and the hams are very busy getting the last antennas up, so everything is just normal.

Speaking of antennas, I've been trying to get a good one up for 80 meters, but the bobtail curtain doesn't really seem to be the right one on my property. So we're trying to finish getting up that 5/8 vertical again and have already found out that a full-size, two-element quad just happens to be a little bit too large for the property, since the terrain is sloping on one side (and, of course, the house is a little too hard to move). Now the planning machine is really running at full speed again—for a mini-quad, two-element delta-quad at this moment!

I'm really wondering what I'm gonna settle with. Time is critical; winter is coming, and since I have only the weekends available (with my father celebrating his 70-year birthday and the *CQ* WW contest both on the same weekend), I'm getting just a little tense.

I have learned through the years and from my own experiences that I'm absolutely not the only one suffering from that kind of nuisance, and since I have managed the previous seasons, I probably will make it this time as well!

Have a good time, and work lotsa good DX, will you?

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

NEWS FROM POLAND

The most important event organized by PRAA (Polish Radio Amateurs Association) in June, 1983, was the Telegraphy Championship of Poland. The Championship took place on June 11th and 12th in the Youth Palace in Cracow. Seventeen competitors entered the contest. Jozef Czystowski SP3JHT, before Adam Sucheta SP9DH, won the quality competition (reception and transmission). Jozef Czystowski, before Andrzej Sikorek SP7OU, won the reception speed competition, but Adam Sucheta was better than Jozef Czystowski in the transmission speed competition. Jozef Czystowski gained an advantage over Adam Sucheta in the general classification. Among juniors, Jacek Szaro SP-0022/KS was the best. The Gorzow Wielkopolski Section of PRAA won the first place among all teams taking part in the Championship.

Constant activity sponsored by the Headquarters of PRAA, not only in the organization of competitions, makes for the revival of radio clubs in Poland, but not without problems. Some time ago a free hand at promoting new clubs was given, and this seemed to stimulate the work of hams. Some new little clubs that tried to paddle their own canoes were born in recent years, but not always did they get along with each other. First and foremost, lack of equipment did not allow them to pack on all sail. Furthermore, as a result of the suspension of PRAA in December, 1981, ties of friendship between one radio amateur and another were broken.

To meet the needs, the Headquarters of PRAA invited entries for a contest of radio amateurs' output. The contest is intended to promote the designing of new shortwave rigs, measuring devices, and auxiliary apparatus. Best designs are to be publicized and manufactured by Poles residing abroad. The contest started September 1, 1983, and ends March 31, 1984. On March 31st, the jury opens entries and generally evaluates the documentation furnished. Then at a second stage of the contest entries are more carefully screened. Decisions on results are made at an exposition of all the best entries picked at the second stage. The final judgment is based on:

- parameters of device,
- modernity and originality of solution,
- use of homemade sub-assemblies,
- practicability, and the
- clarity of documentation.

The Technical Commission of PRAA looks forward to the results of the contest. New solutions to equipment problems suitable for publication in magazines and books would be its fruit. The Technical Commission hopes that some of the innovations will be carried to production. This would improve supplies for hams in Poland. There are quite a few designers of shortwave equipment in my country, and the contest is raising new hope of more and better equipment.

PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril
2765 Portugal

Here we are once again to give you news about ham activity in this country.

In my previous column, I wrote about reciprocal agreements that we have with several countries in Europe, Africa, and North and South America. However, on November 11, 1983, an important meeting was held in Lisbon with the Spanish and Portuguese governments, and a reciprocal agreement was signed on that date with this neighbor country.

When requesting a ham license under reciprocity, you have to send the following information with the petition: name, call, date of birth, nationality, place of birth, father's name, mother's name, profession, place staying in Portugal, number of present license, validity, passport number, place of issue, validity of the passport, and dates of operation in Portugal.

Always remember that under the reciprocity rules only 30 days are authorized, and a car registration number is necessary if a mobile station is used. Please address all this to REP (IARU member), Rede dos Emissores Portugueses, Rua D. Pedro V, #7-4, 1200 Lisboa, Portugal, and include US$30 for expenses. Finally, do not forget a Xerox® of your present ham license and passport.

NEW REGULATIONS

During the WCY we celebrated in 1983, Portuguese hams had the opportunity to receive the new Regulations for the Amateur Service, in force since July 21, 1983, and issued by the Ministry of Communications. Its contents are so controversial we easily find out that it does not have all the elementary basics of good regulations; this certainly is due to a lack of knowledge of the amateur-radio hobby. For examples:

- The output power attributed to the different classes is incompatible with the equipment and components available today.
- RFI and TVI—this chapter is a bit confused and hard to understand. According to the rules, the ham has the highest responsibility and is charged with finding solutions, including payment for devices to be connected in receiving equipment. We do not have any government institution supervising the production or the manufacturing of electronic or electric apparatus. This means that high-pass filters or other such devices are seldom used in such equipment.
- We are not allowed to use all the classes of emission for the Amateur Service, and permission to use J8E type seems strange.
- The subdivision and use of the allocated frequencies does not comply with the IARU Region 1 band plan (HF), which is practical in the countries of that region. It is inexplicable that hams with higher class licenses cannot operate frequencies allocated to lower classes, which we all used before. Superior classes have had a loss of privileges.

According to the new rules, we have four different classes:

Class A (the highest) hams are allowed to operate amateur-radio stations with a maximum output power of 600 Watts in every Amateur-Service band.

Class B operators—same as above, with no more than 300 Watts output.

Class C operators are allowed to use stations with maximum output power of 150 Watts with some limitations concerning frequencies and emission types.

Class D—same as above, with no more than 60 Watts.

However, the critical point of this regulation is the fact that a ham having an A or B class license cannot use frequencies and emission types where the other classes can, as follows:

- on 40 meters—A and B: 7.000 to 7.100 kHz, A1A, F1A; 7.050 to 7.100 kHz, A3E, C3F, while D class: 7.000 to 7.050 kHz, A1A, F1A, A3E.
- On 10 meters—A or B: 28.200 to 29.700 kHz, A1A, A3E, C3F, F3E, F3F, while C class: 28.200 to 29.700 kHz, A1A, A3E, F3E, F3F, and D class: 28.00 to 28.100 kHz, A1A, F1A, and 29.000 to 29.100 kHz, A3E, F3E.

NEW BANDS AND 160 METERS

Many times we asked for the use of the new bands and also 160m but we were not lucky, then suddenly the good news came. (As they say, better late than never.) So as of November 4, 1983, Portuguese hams are allowed to work the new bands, as well as 160m on a secondary basis, according to the following: 1.830 to 1.850 kHz, 10.100 to 10.150 kHz, 18.068 to 18.168 kHz, 24.890 to 24.990 kHz.

Maximum output power for any of these bands is 60 Watts, and microphones must be kept out of the rigs, that is, CW *only*.

Best 73 from Portugal.

SOLOMON ISLANDS

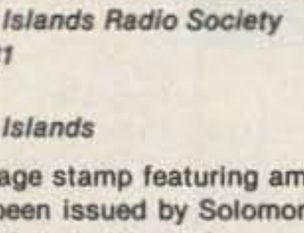
Solomon Islands Radio Society
PO Box 81
Honiara
Solomon Islands

A postage stamp featuring amateur radio has been issued by Solomon Islands as part of their World Communications Year set released on December 19, 1983.

The stamp, featuring the Solomon Islands Radio Society amateur station, callsign H44SI, is available on a special commemorative cover. The price of the cover is US$1.00, 5 IRCs, or equivalent, including postage.

The complete World Communications Year set of three covers featuring a total of 6 stamps is also available at a cost of US$6.00 or equivalent, including postage.

All orders should be forwarded to the Solomon Islands Radio Society, address above.



SWEDEN

THE SWEDISH DX FEDERATION

The Swedish DX Federation is the national umbrella organization for Swedish DXers and DX clubs. It was originally established in 1956 and reorganized in 1969. It has more than 1800 individual members and some 40 local DX clubs.

The Federation publishes a monthly offset-printed magazine in Swedish, *Eter-Aktuellt*. Through "DX-Kop," Swedish DXers can buy report forms, books, receivers, etc. The Swedish DX Federation produces regular DX programs, broadcast via the Voice of the Andes (Ecuador) and Deutschlandfunk (Federal Republic of Germany).

Member clubs are supported by the DX Federation in different ways. Examples of these activities are: supplying pamphlets about DXing, producing tape recordings and slides to be used at club meetings, completing material for a DX course for beginners, etc.

The annual meeting of the Swedish DX Federation, the DX Parliament, will be part of EDXC 84 (the European DX Council 1984 conference, in Stockholm, June 8-11, 1984). At the DX Parliament, the members of the board of directors are elected and decisions are made concerning future activities of the Federation. This part of the conference will be held in Swedish, while the rest of EDXC 84 will be in English.

We of the Swedish DX Federation are very pleased for this opportunity to work together with Radio Sweden International in arranging the 1984 EDXC conference. During the 1970s, participation in the DX Parliaments declined. One reason for this has been that many foreign DXers and station representatives have chosen instead to participate in the EDXC conferences. To some degree, the EDXC conferences have "competed" with our DX Parliaments. This is one reason why we are very happy to be able to hold the 28th DX Parliament as part of the 18th EDXC conference. We hope to combine the enjoyable atmosphere of past DX Parliaments with the somewhat larger EDXC conference.

Welcome to Stockholm June 8-11, 1984!

AWARDS

DAYTON HAMVENTION ADDS NEW AWARD

The Dayton Hamvention is adding another award this year. The award will be given for technical excellence. It will go to an individual making a significant contribution to amateur radio in the technical field.

The coveted Amateur of the Year and Special Achievement awards have long been a fixture of the Hamvention. The award for technical excellence will round out the awards by recognizing those keeping amateur radio at the forefront of the state of the art and fostering interest in technical achievement.

Anyone wishing to nominate a candidate for any of the awards should do so by writing to: Awards Committee, Dayton Hamvention, Box 44, Dayton OH 45401. The nomination(s) should provide as much information as possible about the individual(s), emphasizing the accomplishments justifying the award(s). The closing date for nominations is April 1, 1984.

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KEN-PRO KR-500 elevation rotator ..... $179.

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Prices and Availability Subject to Change

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1228 new computer interface, RTTY/CW/ASCII/AMTOR ..... call
941C Tuner/Meter/Ant. Switch/Balun $81.00
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313 VHF Conv for HT 36.00
989 3KW Tuner 285.00
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900 Tuner 45.00
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10M,6M,2M,220	$680	$880
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Both kit and wired units are complete with all parts, modules, hardware, and crystals.

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- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

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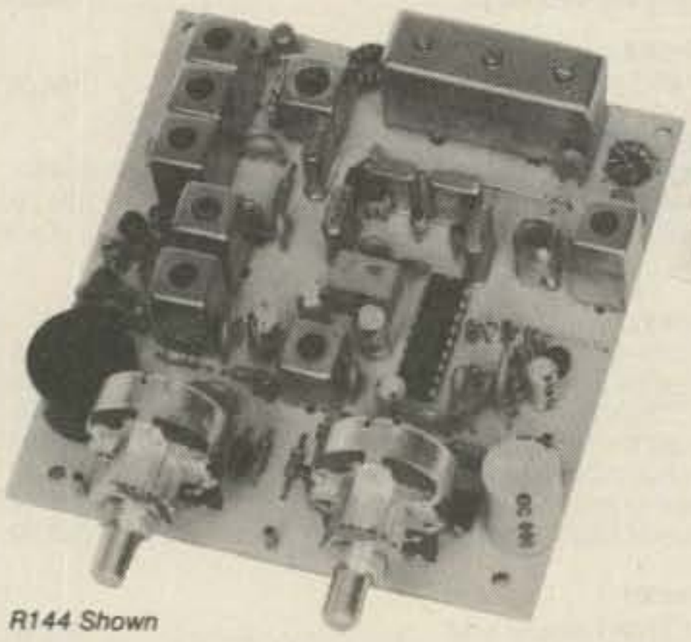

R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
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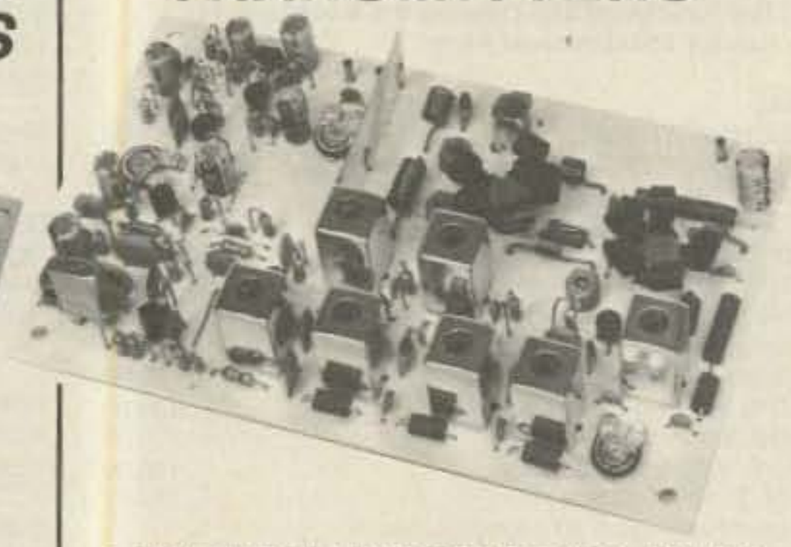
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118.
  Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

TRANSMITTERS



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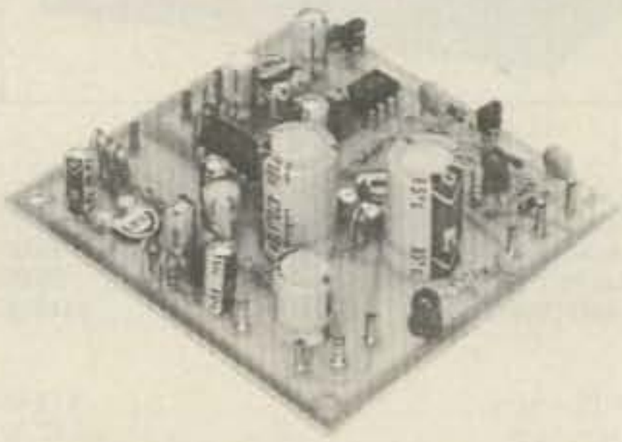

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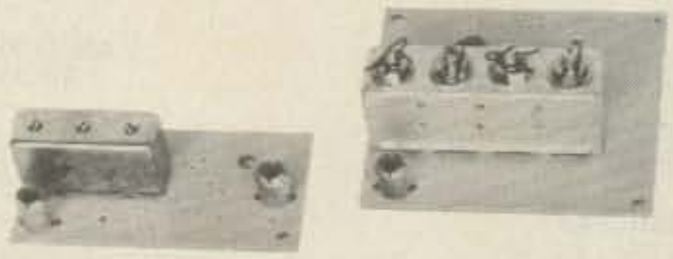

- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

HRF-144 for 143-150 MHz	$38
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HRF-432 for 420-450 MHz	$48

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Model	Tunable Freq Range	Noise Figure	Gain	Price
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LNA 50	40-70	0.9 dB	20 dB	$39
LNA 144	120-180	1.0 dB	18 dB	$39
LNA 220	180-250	1.0 dB	17 dB	$39
LNA 432	380-470	1.0 dB	18 dB	$45
LNA 800	470-960	1.2dB	15 dB	$45

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Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
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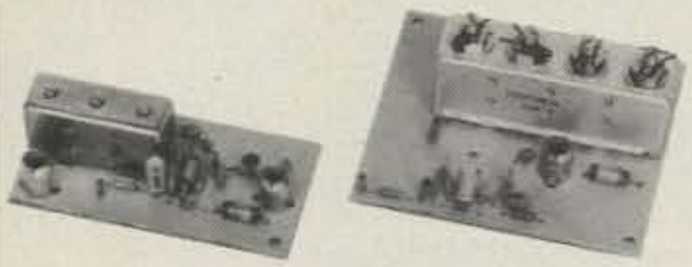
- P432W, UHF Wired/Tested $36

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
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HRA-( )	450-470 MHz	$79

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
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SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

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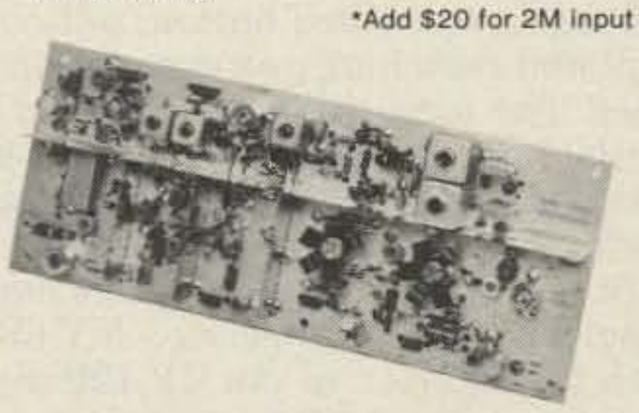
For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

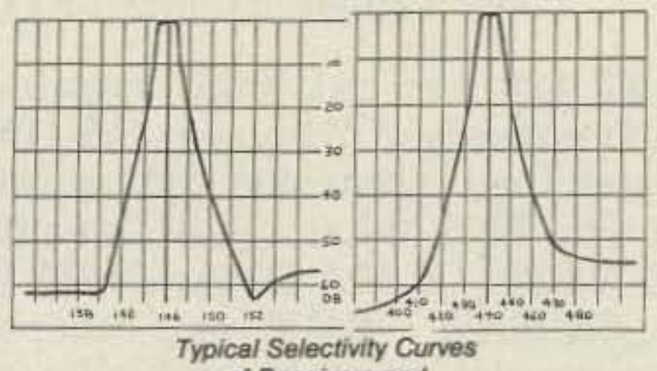
	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
	28-29	145-146
Model XV2	28-30	50-52
Kit $79	27-27.4	144-144.4
Wired $149	28-30	220-222*
(Specify band)	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
	28-30	435-437
Model XV4	50-54	432-436
Kit $99	61.25	439.25
Wired $169	144-148	432-436*

*Add $20 for 2M input



VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



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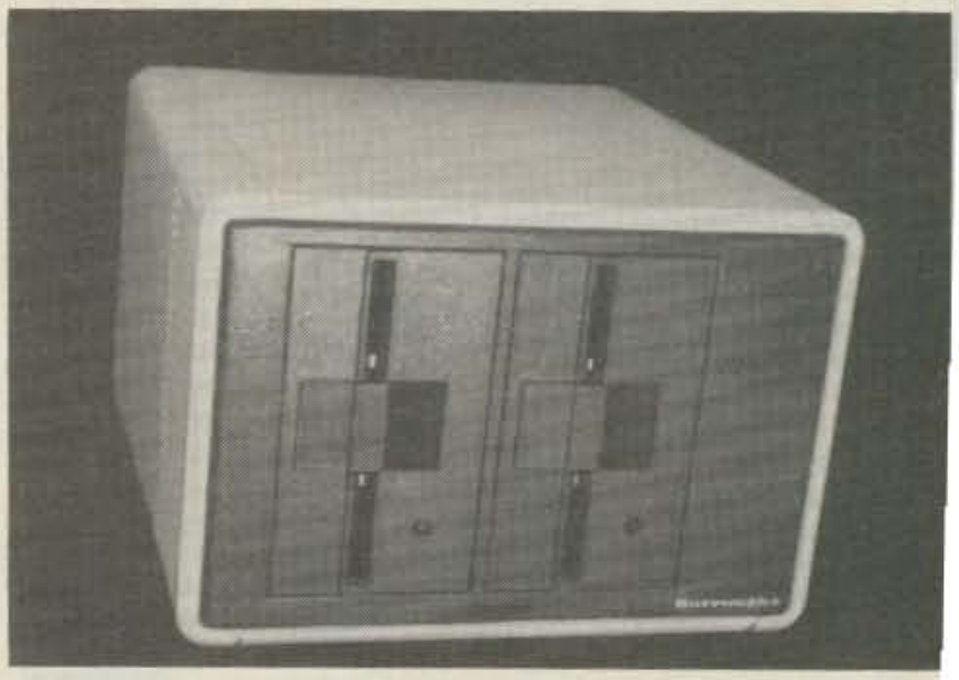
SELF STANDING COMPUTER TERMINALS

We acquired a small number of these beautifully made computer terminals which were made by a major U. S. manufacturer. We do not know all the details about them at press time, but we can tell you that someone lost over $2000 on each of them. They lose you win. The terminals feature 3 micro-processors for powerful capabilities, 106 key, Hall Effect ASCII keyboard, 10 user definable keys, EAROMs, 16K RAM, 48K ROM, serial RS 232 asynchronous data communications, (synchronous optional), selectable baud rates of 75-38.4K BPS, high resolution, 12" green screen, composite video monitor, 80 X 25 line scrolling display, built-in reverse video option, self-contained, lightweight, tightly regulated switching power supply & more than can be fit in this space. The terminals were designed to be daisy chained around a central host computer and used as individual work stations. The host system could then selectively address any machine in the network for any message it may have. All units are visually inspected prior to shipment. An operators manual is provided w/ each unit.
Shpg. wt. 55 lb. model no. MT 686 $289.00
With the addition of our TP 420 dual FDD system below, you can create your own office system.

We offer the following as options: schematic pac. 3 lb.	$ 10.00
USRT for synchronous data comm. w/ installation data	$ 10.00
25' RS 232 cable, 1 male & 1 female DB 25 connector	$ 20.00

TP 420 DUAL MINI-FLOPPY DISC SYSTEM

The TP 420 is an extremely versatile mini floppy disc drive system. It consists of 2 Shugart SA 400 5¼" floppy disc drives, associated logic, controller card, power supply, cooling fan, and case. The TP 420 has a built in controller card which features: Z 80 A CPU, Z 80A DMA, Z 80A CTC, Intel 8271 controller chip, 6K RAM, ROM, plus other goodies. We have been told that the serial interface controller card within the TP 420 will support up to 4 8" drives from the unused port on it. The con troller card can be easily removed should you wish to use it on some other system. Also built in is a tightly regulated, switching power supply which runs on 115/230 v 50/60 hz.. The TP 420 is shipped w/ the interface cable for the MT 686, data, & schematics. Shpg. wt. 22 lb. Stock no. TP 420 $300.00

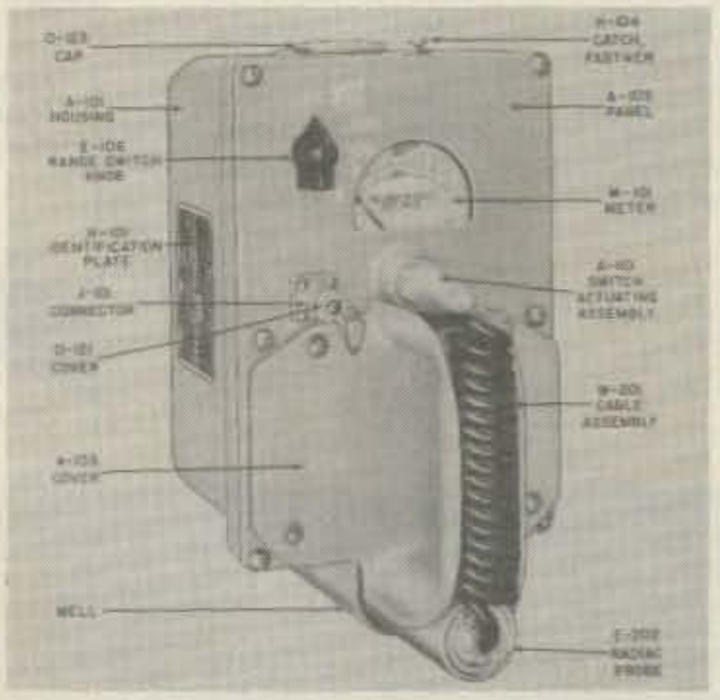


PDR-27 NAVY RADIATION METER

Just released by the US Navy. They appear to be in excellent condition and include the fitted aluminum transit case. Batteries not furnished but are available in most electronic supply houses. 4 ranges 0.5 to 500 mr/hr. Removeable hand probe, detection of Beta and Gamma radiation. With todays world conditions and perhaps proximity to a nuke power station, it might provide a little insurance to own one of these instruments. With no facilities to check or test, we offer AS IS, visually OK Schematic provided with each. We have some accessories and offer as an option although not required for operation.
Shipping wgt. 22 lb. PDR-27 Rad Meter $50.00

PDR-27 phones $7.00	Approx. 100 page Instr. Book $10.00
Hi Sensitivity GM tube $10.00	Low Sensitivity GM tube $5.00

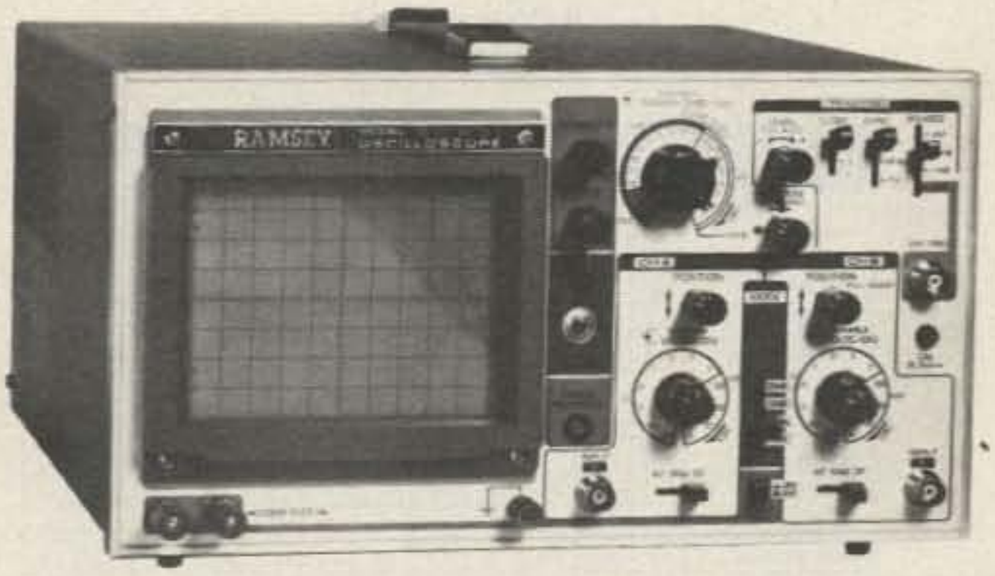
The above listed tubes are already installed in the meter.
We are offering these as spares if desired.



PHONE ORDERS accepted on MC, VISA, or AMEX
No COD's. Shpg. extra on above.
Send for free 72 page catalogue jam packed w/ bargains.

RAMSEY

THE FIRST NAME IN ELECTRONIC TEST GEAR



NEW FROM RAMSEY 20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit that will allow you to easily test resistors, capacitors, digital circuits and diodes • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • high quality rectangular CRT • front panel trace rotator • Z axis • high sensitivity x-y mode • very low power consumption • regulated power supply • built-in calibrator • rock solid triggering • high quality hook-on probes

$399.95 high quality hook-on probes included

RAMSEY D-1100 VOM-MULTITESTER

Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95

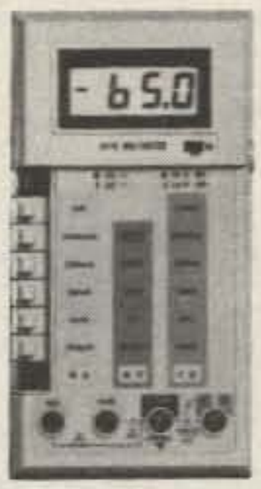
test leads and battery included

RAMSEY D-2100 DIGITAL MULTITESTER

A compact easy to use unit designed to operate like a pro. Featuring • 3½ digit LCD • low BAT. indicator • all range overload protection • overrange indication • auto-polarity •Transistor tester • dual-slope integration • vinyl carrying case

$54.95

h_{FE} test leads, battery & vinyl carrying case included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • In-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$59.95

test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95

wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95

wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM over timebase... $59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95

wired includes AC adapter

BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95

wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95

wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01Hz resolution & built-in signal preamp/conditioner

$49.95

wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp

$44.95

wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95

wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

master charge — BankAmericard VISA

PHONE ORDERS CALL
716-586-3950
TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days: if not pleased return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 • orders under $10.00 add $1.50 • NY residents add 7% sales tax • all kits have a 90 day parts warranty. Wired units have a one year parts & labor warranty.

RAMSEY

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14526

e List of Advertisers on page 114

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Azden, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Bloomington IL

Rohn Towers—Wholesale direct to users. 23% to 34% discount from dealer price. All products available. Write or call for price list. Also we are wholesale distributors for Antenna Specialists, Regency, and Hy-Gain. **Hill Radio, 2503 G.E. Road, PO Box 1405, Bloomington IL 61701-0887, 663-2141.**

Boise ID

Rocky Mountain area's newest ham dealer. Call RJM first for AEA, Azden, KDK, Ten-Tec, Butternut, Cushcraft, and more! **RJM Electronics, 4204 Overland, Boise ID 83705. 343-4018.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Ann Arbor MI

See us for products like Ten-Tec, R. L. Drake, DenTron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN, and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104, 668-8696.**

Livonia MI

Complete photovoltaic systems. Amateur radio, repeater, satellite, and computer applications! Call Paul WD8AHO. **Encon Photovoltaics, 27600 Schoolcraft Road, Livonia MI 48150, 523-1850.**

Hudson NH

Look!—hams, SWLs, and experimenters: parts, books, gear, antennas, towers. Call for quotes. **Polcari's ELECTRONICS CENTER, 61 Lowell Road (Route 3A), Hudson NH 03051, 883-5005.**

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Scranton PA

ICOM, Bird, Cushcraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, AEA, Vibroplex, HamKey, Amphenol, Sony, B&W, Coax-Seal, Cover Craft, J.W. Miller/Daiwa, ARRL, Ameco, Shure. **LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.**

Dallas TX

IBM PC/Apple aftermarket products; hobbyists' electronics project kits: $50.00 complete modem kit, subscription/satellite TV decoder kits, EPROM programmer/duplicator, popular memory IC testers, data sheets, application notes, and more than 6000 parts in stock. Semiconductors, discretes, video products, tools. Please write for your free literature/catalog. **Independent Electronics, 6415-06 Airline Rd., Dallas TX 75205.**

Baltimore/Washington

Avantek transistors, amplifiers, oscillators, and LNAs. Coaxial cable and connectors. Blonder Tongue dealer with Microwave laboratory. **Applied Specialties, Inc., 10101G Bacon Drive, Beltsville MD 20705. Wash. 595-5393, Balt. 792-2211. 7:30 am to 6:00 pm, Monday thru Friday.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the May '84 issue must be in our hands by March 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14A	14A
ARGENTINA	21	14	7A	7B	7B	7	14	21A	21A	21A	21A	21
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	14B	14	14	21	21A
CANAL ZONE	14A	14	7	7	7	7	14A	21	21A	21A	21A	21
ENGLAND	7	7	7	3A	7	7B	14	14A	21A	21	14	14B
HAWAII	21	14	7B	7B	7	7	7	7B	14	21	21A	21A
INDIA	7	7B	7B	7B	7B	7B	14	14A	14	14B	14B	7B
JAPAN	14	14B	7B	7B	7B	7	7	7B	7B	7B	14B	14A
MEXICO	21	14	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	14	14B	7B	7B	7B	7B	7B	14B	14B	14	14	14
PUERTO RICO	21	14	7	7	7	7	14	14A	21A	21A	21	21
SOUTH AFRICA	14	14	7	7	7B	14	21	21A	21A	21A	21	14A
U. S. S. R.	7	7	7	3A	7	7B	14	21	21A	14	7B	7B
WEST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

ALASKA	14A	14	14	7	7	7	7	7	14	14	14A	21
ARGENTINA	21	14	7A	7B	7B	7	14	21A	21A	21A	21A	21
AUSTRALIA	21A	21	14B	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7A	14A	21A	21A	21A	21
ENGLAND	7B	7	7	3A	7	7B	7B	14	14A	21	14	14B
HAWAII	21A	14A	7A	7	7	7	7	7	14	21	21A	21A
INDIA	7B	14B	7B	7B	7B	7B	7B	14B	14	14B	14B	7B
JAPAN	14A	14	14B	7B	7B	7	7	7	7B	7B	14B	14A
MEXICO	14A	14	7	7	7	7	7	14	14A	21	21A	21
PHILIPPINES	14A	14	14B	7B	7B	7B	7B	7	14	14	14	14
PUERTO RICO	21	14	7	7	7	7	7A	14A	21A	21A	21	21
SOUTH AFRICA	14	14	7	7	7B	7B	14	21	21A	21A	21	14A
U. S. S. R.	7B	7	7	3A	7	7B	7B	14	14A	14	7B	7B

WESTERN UNITED STATES TO:

ALASKA	14A	14	14	7	7	7	7	7	14	14	14	14A
ARGENTINA	21	14A	7A	7B	7B	7	7B	14A	21A	21A	21A	21
AUSTRALIA	21A	21A	14A	14	14B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	21A	21A	21A	21
ENGLAND	7B	7	7	3A	7	7B	7B	7B	14	21	14	14B
HAWAII	21A	21	14A	7A	7	7	7	7	14	21	21A	21A
INDIA	14B	14A	14	7B	7B	7B	7B	7B	14B	14B	14B	7B
JAPAN	21A	14A	14	14B	7	7	7	7	7	7B	14	21A
MEXICO	21A	14A	14	7	7	7	7	7A	14A	21	21A	21A
PHILIPPINES	21A	14A	14	14B	7B	7B	7B	7	14	14	14	21
PUERTO RICO	21	14	7	7	7	7	7	14	21A	21A	21A	21
SOUTH AFRICA	14	14	7	7	7B	7B	7B	14	14A	21A	21	14A
U. S. S. R.	7B	7B	7	3A	7	7B	7B	14B	14	14	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

MARCH

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

MEET THE NEW YAESU FT-102

The FT-102 is factory equipped for operation on all present and proposed Amateur HF bands. An extra AUX band position is available for special applications. Equipped for SSB, CW, and AM (RX), the FT-102 may be activated on FM and AM (TX) via the optional AM/FM-102 Module.

The all-new receiver front end utilizes a low-distortion RF preamplifier that may be bypassed via a front panel switch when not needed. Maximum receiver performance is yours with this impressive lineup of standard features: IF Notch Filter, Audio Peak Filter, Variable IF Bandwidth Control, IF Shift, Variable Pulse Width Noise Blanker, Independent SSB and CW Audio Channels with Optimized Audio Bandwidth, and Front Panel Audio Tone Control. Wide/Narrow filter selection is independent of the Mode switch.

The celebrated transmitter section is powered by three 6146B final tubes, for more consistent power output and very low distortion. An RF Speech Processor, Mic Amp Audio Tone Control, VOX, and an IF Monitor round out the transmitter lineup.

Futuristic panel design and careful human engineering are the hallmarks of the FT-102. Convenient pop-out controls below the meters may be retracted when not in use, thus avoiding inadvertant mistuning. Abundant relay contacts, rear panel phono jacks for PTT, microphone/patch input, and other essential interface connections make the FT-102 extremely simple to incorporate into your station.

SPECIFICATIONS

TRANSMITTER–Power Input: (1.8–25 MHz) SSB, CW 240W DC; AM 80W DC (28–29.9 MHz) SSB, CW 160W DC, AM 80W DC, FM 160W DC; Spurious Radiation: Better than – 40 dB.
RECEIVER–Image Rejection: Better than 70dB from 1.8–21.5 MHz. Better than 50dB from 24.5–29.9 MHz. IF rejection: Better than 70 dB. Selectivity (– 6 dB/ – 60 dB): SSB, CW, AM; 2.7/4.8 kHz (with no optional filters). Width adjusts continuously from 2.7 kHz to 500 Hz (– 6 dB).

Special Supplier of Ham Radio Equipment for the Sarajevo 1984 Winter Olympic Games
YAESU

CIRCLE 48 ON READER SERVICE CARD

-102

e SP-102 External Speaker/Audio Filter features a large, high-elity speaker with selectable low- and high-cut audio filters. e front panel A-B switch allows selection of two receiver uts for maximum versatility. Also available is the SP-102P eaker/Patch.

e your Authorized Yaesu Dealer today for a hands-on monstration of the rig that everybody's talking about. It's the -102, The Transceiver of Champions!

FV-102DM

The FV-102DM Synthesized External VFO tunes in 10 Hz steps. Keyboard entry of frequencies, UP/DOWN scanning, and 12 memories make the FV-102DM a "must" for serious DX or contest work.

FC-102

The FC-102 Antenna Coupler is capable of handling 1.2KW of transmitter power, with an in-line wattmeter, separate SWR meter, and A-B input/output selection expanding your station's capability. The optional FAS-1-4R allows remote selection of up to four antennas via one coaxial cable connected to the FC-102.

Price And Specifications Subject To Change Without Notice or Obligation

1082R

83

YAESU **ELECTRONICS CORPORATION** 6851 Walthall Way, Paramount, CA 90723 (213) 633-4007
CINCINNATI SERVICE CENTER 9070 Gold Park Drive, Hamilton, OH 45011 (513) 874-3100

Scan the World.

SSB, CW, AM, FM, digital VFO's, 10 memories, band and memory scan, optional 118-174 MHz coverage...

R-2000

The R-2000 is an innovative all-mode SSB, CW, AM, FM receiver that covers 150 kHz–30 MHz, with an optional VC-10 VHF converter unit to provide coverage of the 118-174 MHz frequency range. New microprocessor controlled operating features and an "UP" conversion PLL circuit assure maximum flexibility and ease of operation to enhance the excitement of listening to stations around the world.

R-2000 FEATURES:

- **Covers 150 kHz–30 MHz in 30 bands.** Uses innovative UP-conversion digitally controlled PLL circuit. UP/DOWN band switches (1-MHz step). VFO's continuously tuneable across the band and from band to band.
- **Optional 118-174 MHz coverage.** Through use of innovative microprocessor technology, frequency, band, and mode data of stations in the 118-174 MHz range may be tuned, displayed (full frequency, ie., 146.000.0), stored in memory, recalled, and scanned, using the R-2000 front panel controls and frequency display, allowing maximum convenience and ease of operation.

  The optional VC-10 VHF converter unit may be easily installed on the rear panel of the R-2000.
- **All mode: USB, LSB, CW, AM, FM.** Provides expanded flexibility in receiving various signal types. Front panel mode selector keys, with LED indicators.
- **Digital VFO's for best stability.** 50-Hz step, switchable to 500-Hz or 5-kHz. F. LOCK switch provided.
- **Ten memories store frequency, band, and mode data.** Complete information on frequency, band, and mode is stored in memory, assuring maximum ease of operation. Each memory may be tuned as a VFO. Original memory frequency may be recalled. AUTO. M switch for automatic storage of current operating data, or, when off, selective storage of data using M. IN switch.
- **Lithium battery memory back-up. (Est. 5 yr. life.)**
- **Programmable memory scan.** Scans all memories, or may be programmed to scan specific memories. HOLD switch interrupts scanning. Frequency, band, and mode are automatically selected in accordance with the memory channel being scanned. The scanning time is approximately 2 seconds per channel.
- **Programmable band scan.** Scans automatically within the programmed bandwidth. Memory channels 9 and 0 establish upper and lower scan limits. HOLD switch interrupts scanning. Frequency may be adjusted, using the tuning control, during scan HOLD.
- **Fluorescent tube digital display (100-Hz resolution).** Built-in 7 digit fluorescent tube digital display indicates frequency or time, plus memory channel number. DIM switch provided. The display may be switched to indicate CLOCK-2, FREQUENCY, CLOCK-1, and timer ON or OFF by the front panel FUNCTION switch.
- **Dual 24-hour quartz clocks, with timer.**
- **Three built-in IF filters with NARROW/WIDE selector switch. (CW filter opt.)** 6-kHz wide or 2.7-kHz narrow on AM. 2.7-kHz automatic on SSB. 2.7-kHz wide on CW, or, with optional YG-455C filter installed, 500-Hz narrow. 15-kHz automatic on FM.
- **Squelch circuit, all mode, built-in, with BUSY indicator.**
- **Noise blanker built-in.**
- **Large front mounted speaker.**
- **Tone control.**
- **RF step attenuator. (0-10-20-30 dB.)** Four step attenuator, plus antenna fuse.
- **AGC switch. (Slow-Fast.)**
- **"S" meter, with SINPO "S" scale.**
- **100/120/220/240 VAC, or 13.8 VDC operation** (with opt. DCK-1 cable kit).

Other features.

- RECORD output jack.
- Audible "beeper" (through speaker).
- Carrying handle.
- Headphone jack.
- External speaker jack.

Optional accessories:

- VC-10 118-174 MHz converter.
- HS-4, HS-5, HS-6, HS-7 headphones.
- DCK-1 DC cable kit.
- YG-455C 500-Hz CW filter.
- HC-10 World digital quartz clock.
- AL-2 Surge Shunt

More information on the R-2000 is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street
Compton, California 90220.

KENWOOD

...pacesetter in amateur radio

Specifications and prices are subject to change without notice or obligatio