Northern California DX Foundation

Newsletter

Winter 1995

Steve Thomas, N6ST, Editor

The YKØA Story

by Tom McShane, NW6P

Sunday Nov. 20, 1994

Depart USA at 1420 for Frankfurt.

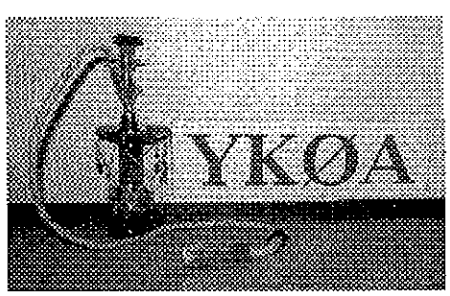
Monday Nov. 21, 1994

West Coast DXers meet K3NA in Frankfurt for flight to Damascus. Arrive 1900 local time where we are met by Omar Shabsigh, YK1AO and Marwan Midani, YK1AU. Operators have no problems getting luggage through Syrian customs in Damascus. Our Syrian hosts transport us to the Al Jalaa Cham Hotel located about a mile from our operating site. Omar and Marwan discuss the DXpedition over coffee and beer and review our itinerary for next week.

Tuesday Nov. 22, 1994

Tom, NW6P, Rusty, W6OAT and Omar depart for the airport to clear our advance shipment of equipment through customs while the rest of the team assemble Omar's station and 2 beams which shipped two weeks previously. Clearing customs was uneventful but a lengthy process. We first had to go to center city Damascus to get the air shipment paperwork from Lufthansa; then to the Syrian Telecommunications Establishment to pick up an engineer who will verify that the equipment is actually an FT-990, FT-900, PK232, and Alpha 89 that we are authorized to bring into the country. Next we go to Customs to get the import licence that is shown to the Syrian National Bank where we pay an import licence fee, then to Customs where we get paperwork allowing us to proceed to the Cargo area where the goods are inspected by the STE Engineer. After he records the serial numbers and signs off on the documents we get a final OK to remove our goods. We rented a truck to carry 371 kg, 20 boxes, to the YKØA site. At 1330 when we arrived to offload the gear the rest of the team were asking where we had been for so long! While we were at the airport the team had assembled one C-3 and the 40 meter 2 element beam that had arrived in Damascus 2 weeks earlier.

The computer gurus N6TV, K3NA, and WØYK, put together a local area network of 4 PCs interconnecting the 3 radios. The 4th PC monitored all three radios. In the next room there were members of Syrian State Security and STE personnel who will be monitoring all transmissions from YKØA and recording them on audio tape! Ed Muns, WØYK demonstrated our PC network and offered to add the Syrian monitors as a node on our network if they could obtain an IBM compatible PC. They were very interested in doing this and proceed to get a PC brought to their room.

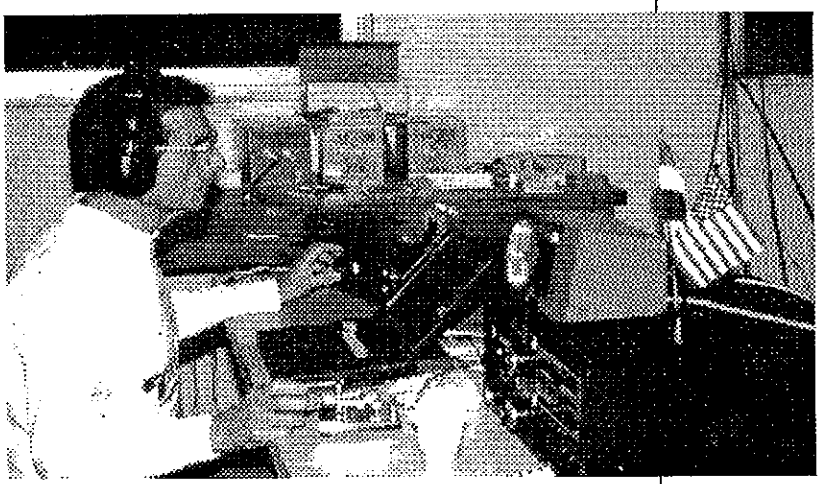


The rest of the afternoon was spent erecting the 2 Force 12 C-

3s and 40 meter beam and networking the PCs. Late in the afternoon the Syrian monitors bring an IBM PC to their room and Ed adds them to our network. They soon realize that there is no need for the audio recordings as long as they can get digital copies of all QSOs. By early evening we are QRV on 40m and 30m. N6TV and K3NA operated through the night. The monitors stayed at their posts.

Wednesday Nov. 23, 1994

20 meters opened at dawn. By 8:00a.m. local time the



night shift is relieved and antenna work proceeds—K6ANP, W6OTC, W6OAT, and NW6P put up a full size 80m loop and construction begins on the Battle Creek Special. By noon it starts to rain. This isn't supposed to happen in the desert but we have a good ol' midwestern downpour despite our QTH. The loop is up but the Battle Creek Special is not finished. Glenn W6OTC gets going on RTTY—a first from Syria. We are on the air 80 to 10m with 3 rigs and 2 amps. There seems no end to the number of Europeans and Asians calling YKØA.

Thursday Nov. 24, 1994

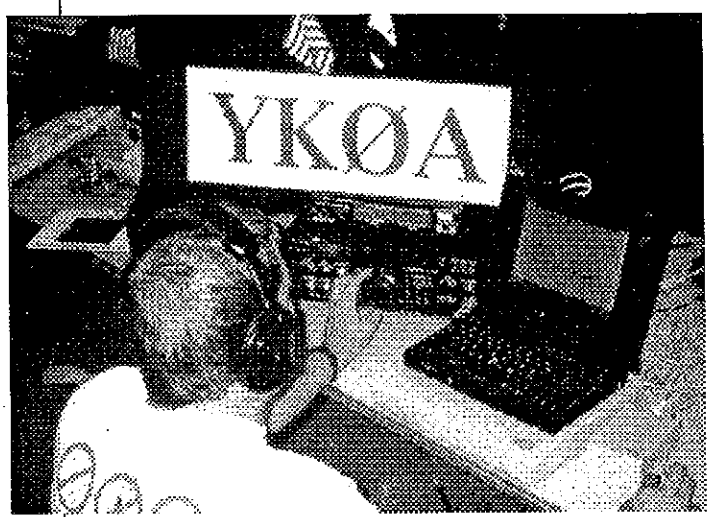
More rain—we have to get the Battle Creek Special erected. It goes together very nicely but takes 5 of us to get it up and guyed properly. We lay out the radials. Interference between the two C3s effects the SWRs and makes us relocate one of them as far from the other as we can get. Unfortunately there is not enough coax to really do the job right but performance is acceptable. We are soaked from the rain and chilled from the cold. It is snowing on nearby Mt. Hermon and in the Golan Heights 40 miles away.

Tom, Rusty, and Ed join Omar and Hikmat YK1AM for a meeting with the head of the Syrian Telecommunications Establishment, Mr. Obied—the person who signed our licences. He was very cordial and stated that the STE intends to keep the callsign YKØA active as a club station to be built at our operating site. They will allow visiting hams to come to Syria as guest operators at YKØA. We are very encouraged by the STE's positive attitude towards amateur radio.

First West Coast 40m contacts are made that evening. QSOs continue through the night. We are on 80m and 160m with the Battle Creek Special. Receive signals are weak at our end. Operators acsribe the low signals and quiet band to conditions and the vertical antenna. N6TV is told on 40m cw that "half the USA is calling YKØA on 80 and 160, why do we not respond?" It turns out that the front end of the FT-990 is shot.

Friday Nov. 25, 1994

Ed Muns had a TS-50 in his suitcase which he brings to the shack to replace the FT-990. The Alpha 91 power supply blows up. Repairs are made but the microprocessor board is also shot. We are now down to 1 amp and the 50w TS-50 instead of the FT-990. Murphy strikes again! W6OTC concentrates on 20m RTTY. Good opening to West Coast



USA. Marwan makes his first DX QSO. It's a station in Indonesia whom he contacted on 40 meter SSB. Marwan is thrilled at his success. Contacts continue to

continued on page 4

Newsletter Mailing

by Steve Thomas, N6ST

If you look at the mailing label for this newsletter you will see a date. That is the date of your last contribution to the Northern California DX Foundation. If the date doesn't seem right, please let us know so we can research the records to correct any errors.

This newsletter is being mailed to those who havecontributed since the start of 1992. If one of your friends hasn't received the newsletter, you might ask them when they last contributed to the Foundation and give them a copy of the contribution form on the back cover. In the near future we plan to send out a letter to those who haven't contributed since 1992 asking for their continued support.

Odds and Ends

by Eric Edberg, W6DU

Illness of some of NCDXF directors during last fall and winter forced postponement of the meeting intended to analyze and re-evaluate the mission of the Foundation. That meeting is now scheduled to occur in late spring. Setting a date for a full day meeting, acceptable to eleven directors, seems as though it should be a simple matter. Not so. We are all busy and in many cases participate in weekend contests. There seems to be some kind of contest every weekend.

I am pleased to announce that Dick Dievendorff, AA6MC, has recently joined our Board of Directors. Dick returned to the States several years ago after a long assignment in England where he had been quite active in DXing and contesting.

Thank you to the many who have been sending changes of address. I am pleased to note that the number of Newsletters which have been returned has been greatly reduced. It would be nice to have that number approach zero. Obviously that is impracticable, but we all like to dream, don't we?

There is still some confusion about what the date on the mailing label means. It has been mentioned herein several times but apparently needs restating. It is the date your last contribution was entered in NCDXF records. We realize that many magazines use a label dating procedure to show the end of a subscription. We feel it would cause even more confusion to change our system in conformance with their procedures.

be made on all bands.

Teams are agreed for the contest. K3NA, W6OAT, W6OTC, and K6ANP will take the first 6 hours then WØYK, WA2TMP, NW6P, and N6TV will operate for 12 hours, then the other team is on for 12, etc.

Saturday Nov. 26, 1994

Contest begins at 2 am local time. 40-80-and 160 are all strong through the night then 20 opens at dawn, followed by 15. Great 10 meter opening from about noon until 7 p.m. We used the delta loop on 10 while the two C3s are on 15 and 20. 40 meters is open from 2 hours before dusk all through the night. 80 meters and 160 meters are very active all night long. We keep the amplifier on 40 and run barefoot on 80 and 160. The Battle Creek Special is really a terrific antenna and well worth bringing to Syria.

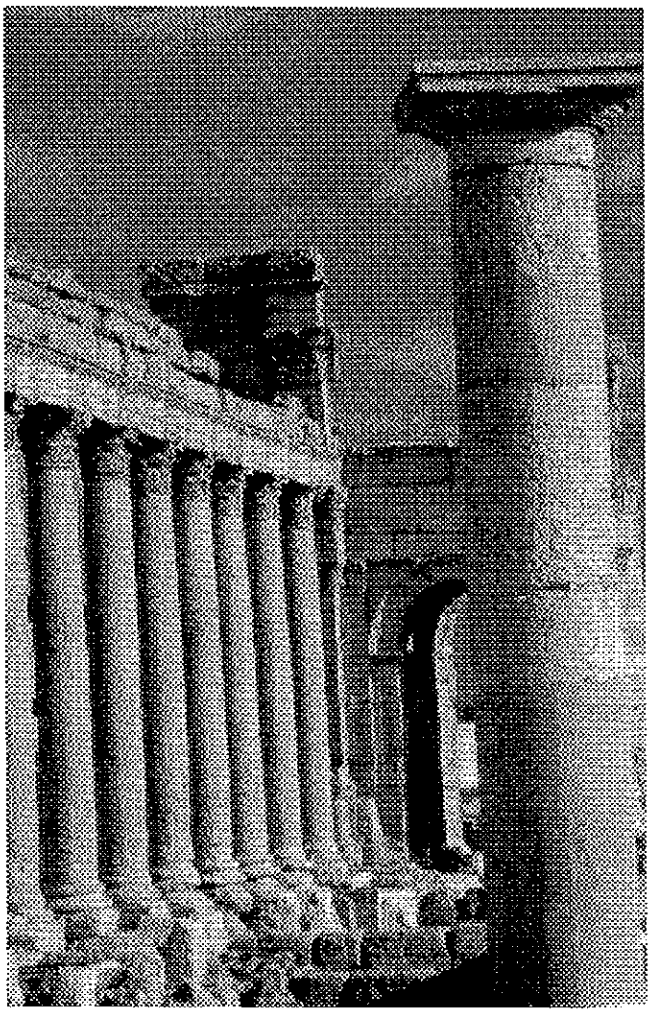
Sunday Nov. 27, 1994

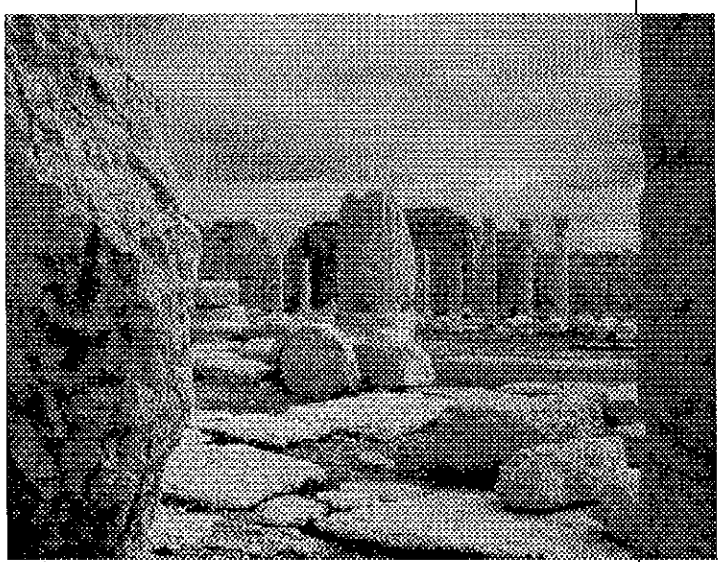
20-15 were strong all day. 10 meters opened from about noon until dark but less strong than Saturday. 40-80-160 meters continued very active. We missed having the other FT-990 and amp. Tonight we use the one remaining amp on 80 and 160, and run barefoot on 40.

Monday Nov. 28, 1994

Contest ended at 2 a.m. local time. We had about 7,500 QSOs for 11.7 million points—good for a win in our area and probably in the top two or three worldwide. Glenn W6OTC operated RTTY for a few hours before calling it a night. We're back on the air with 2 transmitters from about 8 a.m. We concentrate on Japan but Euros and Russians don't cooperate.

Omar tells us he just learned that Customs requires our gear to be at the airport 48 hours before departure. This will close down 2 stations Monday and the third one Tuesday at noon. This is two days ahead of plan but we cannot do anything about it. All but one station is packed for shipment. Omar says the outbound weight has to be the same 371 kilos as inbound. We are 40 kilos short. We buy hammers to ship home to add to the weight! First they are autographed in Arabic—maybe we can auction them at Visalia. Hand luggage is added and finally we are at 371 kilos. Shipping cost is about $6.20 per kilo!





Keeping the one remaining station on the air pays off as we get a brief (and weak) 20 meter short path opening to the West Coast and get another West Coast station in the log.

Tuesday Nov. 29, 1994

N6TV and WA2TMP leave for the States at 5 a.m. NW6P and K6ANP are on 20 meters for

the band opening determined to get some SSB contacts. Len quits after 20 minutes saying, "Life is too short for this!" Tom takes over, listens to the huge, unruly pile and QSYs to cw after 15 minutes! The Euros just couldn't be controlled, at least not by these cw ops. Glenn verifies that Omar's PK232 works and the last YKØA station goes QRT at 11a.m. We pack up the remaining station and antennas.

Omar arranges for a shopping expedition in the Damascus "SOUK". It's the world's biggest flea market! Great fun.

Wednesday Nov. 30, 1994

We travel 200km to Palmyra, an ancient city at a large oasis in the desert northeast of Damascus. Palmyra is 5 times as large as Ephesus in Turkey. No one in our group had ever seen any ruins this big. Rusty compared it with Luxor in Egypt. Tom, Ed, and Len make fools of themselves riding camels. We were the only tourists there and had the whole place to ourselves. Palmyra is definitely worth the trip.

Dinner that night with YK1AO (Omar), YK1AN (Michelle), YK1AM (Hikmat), and YK1AU (Marwan). This was a Syrian feast that started with 15 appetizers including lamb brains and testicles! Rusty was the only one who could eat the bright red chili pepper paste that Syrians spread on pita bread. He actually liked it!

Thursday Dec. 1st

At 7:30a.m. we fly to Frankfurt where Eric K3NA departs for Washington, DC and the rest of us are met by several members of the DLØWW Contest Club. YKØA team members are hosted to dinner with lots of beer and a meeting with about 20 members—most of whom worked us on 5 or 6 bands.

Friday Dec. 2, 1994

We leave Frankfurt at 1030a for the USA. YKØA is temporarily QRT. 15,000 QSOs are in the log.

Special Event Operation

Floyd, Virginia -The Foundation for Amateur International Radio Service (FAIRS) will operate KK4WW, US5WE, UA4LCQ, 8R1WD and S21AM in their own countries 1400z May 6th to 1400z May 9th to celebrate the 4th anniversary of FAIRS. General portion of 40, 20, and 15 meters. For certificate send QSL and 9x12 inch SASE envelope to FAIRS P O Box 341 Floyd VA 24091

Newsletter Name

by Steve Thomas, N6ST

Marilyn Bagshaw, N6VAW, sent in a list of possible names for the NCDXF Newsletter. Her contributions are:

Northern California DX Foundation...
- Flag (meaning to signal)
- Signal
- Fetch (to deliver or bring)
- QNB (act as a relay between)
- Shortpath
- Beacon.

Jack, W6VD suggested the name DX Siren with the name flanked on one side by a cartoon of a seductive damsel sitting on a rock and singing and on the other side a cartoon of a modern siren eminating a loud blast. He comments that the purpose of the Foundation and it's Newsletter might be construed to involve both concepts.

Jack says, "by our support, we lure and encourage the DXpeditioner to the rocks, reefs, shoals and islands of the world/and in the Newsletter we proclaim the coming and past events. All of this whips the DX community around the world into a frenzy that is contageous!"

I also reveived several responses saying to leave the name just as it is. The board has not decided on any name change. Additional comments are welcome.

SVØAA Celebrates 63 years licensed

Charles Jackson, SVØAA, recently celebrated 63 years as a licensed radio amateur. Charles was licensed in 1931. To mark the event he sent a contribution to the Northern California DX Foundation in the amount of $63.00. One dollar for each year he's been licensed. Thanks for the donation and best wishes for many more years on the air.

The NCDXF/IARU International Beacon Network—*Part 1*

This worldwide beacon network, in operation for almost 15 years, is now being expanded to a multiband system.

By John G. Troster, W6ISQ and Robert S. Fabry, N6EK
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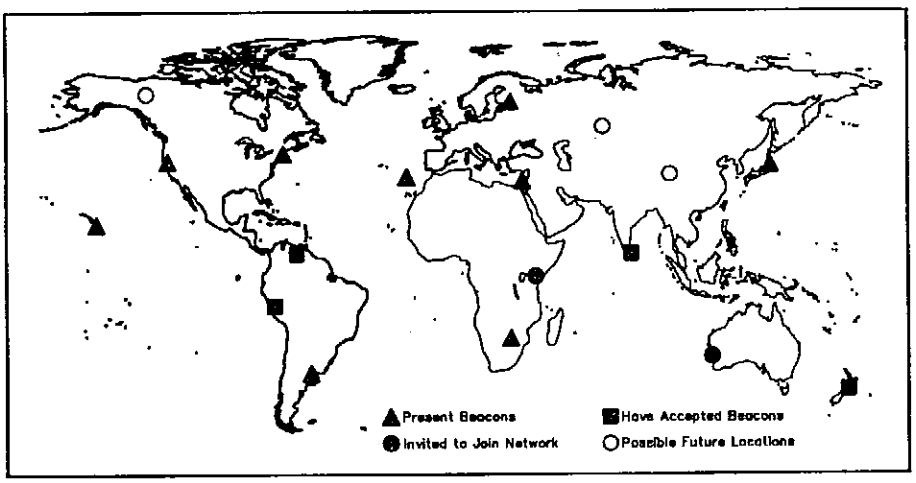
Assistant Coordinator, IARU International Beacon Project
1175 Colusa Ave
Berkeley, CA 94707

The present 14.1-MHz beacon network is one of those neat achievements that comes about when the vision, technology, and cooperative energies of many people combine to create something unique and useful. The worldwide network consists of nine frequency-sharing CW beacons that have been in operation continuously for almost 15 years. The network is there for every listener to use as a do-it-yourself propagation tool. Each beacon transmits a one-minute message every 10 minutes, 24 hours a day.

Over the next year or so, the network will be modernized and made even more useful. New beacons will be added to the nine that are now active, and all of them will be able to operate on up to five bands. The transmissions will be shortened to 10 seconds, so that the listener can monitor 18 beacons in three minutes. This two-part article explains how the current network evolved and how you can expect to use the modernized network.

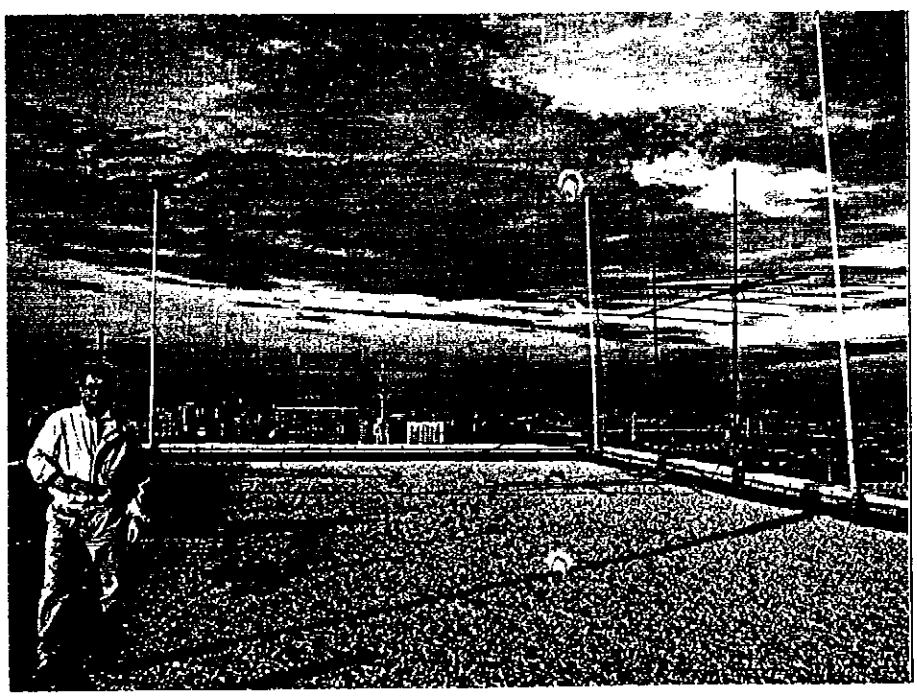


The NCDXF/IARU International Beacon Network, showing existing and future beacon locations.

Phase I, the First Beacon

The 14.1-MHz beacon network was the creation of the Northern California DX Foundation (NCDXF).[1] The first beacon was designed and built from scratch by Jim Ouimet, K6OJO, in 1979, based on a suggestion by O. G. "Mike" Villard, Jr, W6QYT. You may remember Mike as the person who introduced SSB on the amateur bands in the late 1940s. This "Phase I" beacon was duly licensed by the FCC for operation on 14.1 MHz with the call sign WB6ZNL/B (with the /B indicating a beacon transmitter). The transmitter was heavy and it came to be known among the workers as the "guy-wire anchor," but it did its job as planned, transmitting for 75 seconds every 15 minutes for over a year. It featured Mike's idea of decreasing the power in 10-dB steps by transmitting a long dash at each of four power levels: 100, 10, 1 and 0.1 W.

The power stepping was a completely new idea for Amateur Radio beacon technology. It is much more useful to know what power level can be heard than to merely know the signal strength of the received signal. The knowledge that a certain power level can be



Dave Rosen, K2GM, chief operator at the 4U1UN/B beacon, on the roof of the United Nations building. The 14.1-MHz beacon antenna is a dipole at the far end of the roof.

Table 1

Present 14.1-MHz Beacon Network Transmitting Sequence

Time	*Station*	*Location*
00:00	4U1UN/B	United Nations, New York
00:01	W6WX/B	Stanford University, California
00:02	KH6O/B	Kaneohe, Hawaii
00:03	JA2IGY	JARL, Tokyo, Japan
00:04	4X6TU	Tel Aviv University, Israel
00:05	OH2B	Helsinki Technical University, Finland
00:06	CT3B	AARM, Madeira Island
00:07	ZS6DN/B	Transvaal, South Africa
00:08	LU4AA	RCA, Buenos Aires, Argentina

The same sequence repeats every 10 minutes. W6WX/B also transmits for 10 seconds every two minutes at 21.150 MHz followed immediately on 28.200 MHz; the call sign and one dash at each of four power levels are transmitted.

Table 2

Transmissions by Each Beacon in the Present Network

Power Level (W)	*CW Message*
100	QST de (call sign)
100	. _____ (9-second dash)
10	.. _____ (9-second dash)
1	... _____ (9-second dash)
0.1	.... _____ (9-second dash)
100	SK (call sign)

Total transmission time: 57 seconds
Speed: 22 wpm

heard compares the signal to the background noise. Sometimes an S3 signal is perfectly usable; sometimes it is totally useless. The power levels give the listener a better feeling for the quality of the propagation. If you heard only one power level yesterday but hear all four today, then the band is in better condition today. Anyway, it's more fun to tell a friend that you heard the South African beacon at 0.1 W than to report that a 100-W signal was S5.

Phase II, Worldwide Expansion

The horrible prospect of reproducing eight or more of these beacon behemoths for a worldwide network stirred the creative juices of Dave Leeson, W6QHS. Dave designed a beacon that consists of a small controller box to work in conjunction with the Kenwood TS-120S transceiver. The controller used the Intel 8748 computer-on-a-chip to adjust the power output of the transceiver directly via the transceiver's ALC input. This chip combines an eight-bit microprocessor with a 1024-byte EPROM. Jack Curtis, K6KU, wrote the assembly language program for the microprocessor firmware. Jack had used a similar chip for his popular Curtis Keyers.

The late Cam Pierce, K6RU, engineered this prototype beacon into production with the help of Merle Parten, K6DC, and between 1982 and 1985 nine beacons were built and distributed worldwide.[2,3] During this expansion period, the call WB6ZNL/B was changed to W6WX/B.

The time slots during which the various Phase II beacons transmit on 14.1 MHz is given in Table 1, and the format for each transmission is shown in Table 2. Listeners who are not able to copy code at 22 wpm can figure out which beacons they are listening to according to the time that they hear each beacon. Table 1 provides the necessary information.

International Amateur Radio Union

In 1984, Alberto Shaio, HK3DEU, then Secretary of Region 2 of the International Amateur Radio Union (IARU), proposed that the IARU beacon program follow the general NCDXF frequency-sharing plan used by the 14.1-MHz network. Later, that proposal became the basis for NCDXF and IARU cooperation, and in recent years the two groups began planning together to expand the network and to develop a prototype multiband beacon. NCDXF provided the engineering, and IARU offered the international associations to help obtain locations for an expanded network and to disseminate beacon information worldwide to all 140 IARU member societies. Much of the funding will also be provided through the IARU.

After many years of operation it is apparent that the Phase II beacon network should be expanded to cover more of the world. The format of the transmissions should be changed to reduce the time it takes to listen for all beacons. And the beacon network should be expanded to cover more bands.

14.100 MHz Guarded Frequency

Almost from the beginning of the 14.1-MHz beacon network, the IARU drew up a band plan that suggested a 1-kHz "guarded" beacon frequency at 14.1 MHz. This guarded frequency was reaffirmed at the Region 2 IARU meeting in Curacao in 1992 and also has been adopted by IARU Regions 1 and 3. Recently, however, digital stations have swamped this frequency. It would be quite helpful to their fellow amateurs, and a courteous thing to do, for the operators of those digital stations to move either up and down in frequency and to avoid transmitting on exactly 14.1 MHz.

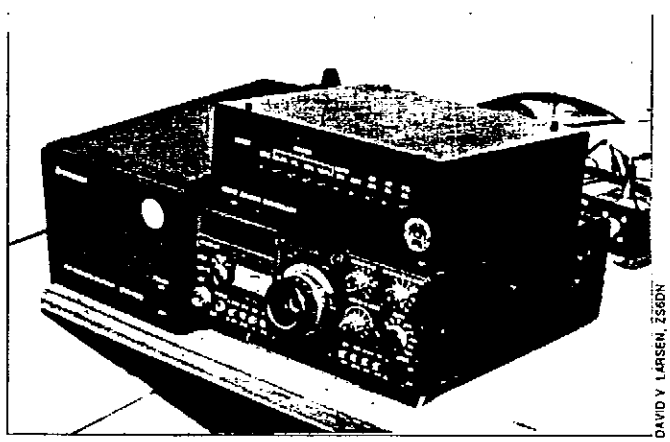
Expansion

The Phase II beacon network does not provide adequate worldwide coverage. With IARU assistance, we contacted five national societies and asked them to accept beacons and join the network. The societies that accepted are Radio Club Peruano, Radio Club Venezolano, New Zealand Association of Radio Transmitters, and Radio Society of Sri Lanka. The Wireless Institute of Australia and the Radio Society of Kenya have been invited, but they have not replied at the time this is being written. We hope to find one or more locations in Central Asia and to add other beacons later.

Transmission Format

Many people find the 10-minute cycle of the beacons too slow. As more beacons are added, the cycle would get even longer if we maintain the one-minute format for each beacon transmission.

We experimented with shortening the transmissions. We assumed that each beacon would send its call followed by four equal-length long dashes, one at each power level. We recorded simulations of a network of beacons with 15 seconds per beacon, then with 10 seconds, then with 7.5 seconds. We played these recordings for the NCDXF Board and they recommended the 10-second format. The same recording format was



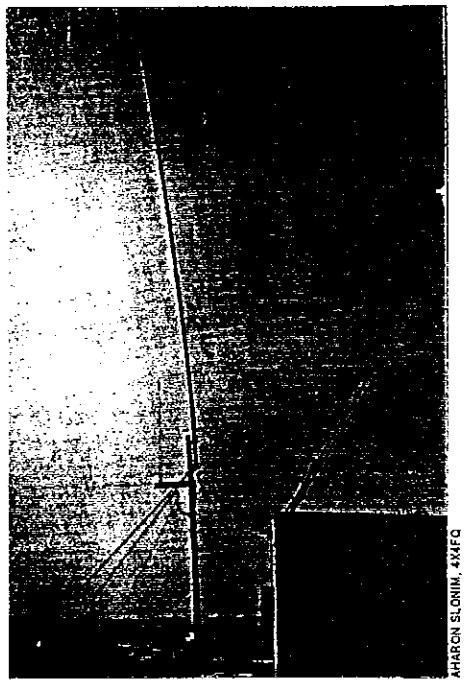
DAVID V LARSEN, ZS6DN

The 14.1-MHz beacon at ZS6DN/B, with the controller sitting on top of the transceiver.

Lance Ginner, K6GSJ, secures the vertical antenna for the W6WX/B beacon, as Bob Fabry, N6EK, watches, atop Mt Umunum, overlooking San Jose, California.

Kenwood TS-140S Transceiver Donation

Bob Ferrero, W6RJ, of Ham Radio Outlet, and former president of the NCDXF, contacted Kenwood Communications Corporation about a possible discount on the Kenwood TS-140S transceivers that are the heart of the beacon system. Paul Middleton of Kenwood responded with the donation of 16 TS-140S transceivers to the network. We are deeply grateful to Kenwood for their generous endorsement of the beacon project. This magnificent gift was presented by Kenwood in memory of Jim Rafferty, N6RJ, the former Vice President of Ham Radio Outlet. A small plaque will be attached to each transceiver with this inscription: "This Kenwood TS-140S transceiver was donated to the NCDXF/IARU International Beacon Project by Kenwood Communications Corporation and Ham Radio Outlet In memory of Jim Rafferty, N6RJ."



The antenna for the 4X6TU/B beacon, mounted on the physics and astronomy building of Tel Aviv University.

played for the delegates of IARU Region 2 at a meeting in Curacao in September 1992. The delegates concurred that 10 seconds sounded about right. This timing allows 18 beacons to transmit in sequence around the world in three minutes.

Multiple Bands

Expanding the beacon network to cover additional bands will provide valuable additional propagation information. The Phase III network will transmit on the 14, 18, 21, 24 and 28-MHz bands. (The 10-MHz band is not included because the band is still shared with other services, but it could be added later.) In addition to the listener being able to detect band openings on an individual band, he will also be able to quickly check all five bands to see which band has the best propagation to a particular part of the world.

To select frequencies for five-band operation, Bob Knowles, ZL1BAD, International Coordinator of the IARU Monitoring Service was asked to study the bands from 14 to 28 MHz. His report, based on the work of the IARU worldwide volunteer monitoring system, was instrumental in developing the tentative primary frequencies: 14.100, 18.110, 21.150, 24.930, and 28.200 MHz. Alternate frequencies at the high and low ends of each band also are being considered, but at the time of ZL1BAD's report there was interference from commercial stations outside the high end of some bands that could be copied inside the amateur bands. We are continuing to study the situation and will be able to re-program these frequencies if necessary by issuing a firmware upgrade.

Phase III, the W6WX/B Prototype

A new control unit has been built that can key a Kenwood TS-140S on five bands. This unit is now in operation at W6WX/B, but is restricted to operation on 14.100, 21.150, and 28.200 MHz because those are the frequencies for which it is licensed by the Federal Communications Commission. The technical aspects of this new beacon design will be described in Part 2 of this article.

New Format

W6WX/B transmits its regular one-minute message in its turn on the 14.1-MHz network at 0001Z, and every 10 minutes thereafter, just as it has for 15 years. When it has completed its 14.1-MHz one-minute message, it switches to 21.150 MHz and transmits for 10 seconds in the new format, "W6WX/B, dah-dah-dah-dah." It then immediately switches to 28.200 MHz and sends the new-format message. The 21 and 28-MHz message is repeated every two minutes. The other seven beacons will continue to transmit their one-minute message on 14.1 MHz only until they are replaced by multi-band equipment.

When the new beacons are in place, each will be able to transmit its call sign and four dashes on each of five bands. Ultimately, we hope all beacons will be licensed by their governments for five-band operation.

Financing

The three IARU Regional Executive Committees were solicited for funds to build and distribute the beacons in their respective Regions. Region 2 (North and South America) responded with a pledge to fund one beacon, at an estimated cost of $2500 per beacon, plus $1000 for continuing support. Region 1 (Europe, CIS and Africa) did the same. The ARRL Foundation generously contributed $5000. We hope that other major national amateur organizations will also become sponsors. John Downing, K6YRU, of the Downing Foundation, which has funded NCDXF with several grants, provided funds for prototype Phase III beacon construction.

Conclusion

The present 14.1-MHz beacon network is for everyone, whether you are a DXer looking for general band-opening information, or a contester looking for spot-opening information, or perhaps a high school or college student working on your science project, or a laboratory researcher, or SWL, or just a rag chewer who would like to find out what's new. Get the 14.1-MHz habit now. Flip in your CW filter and listen along.

DXpeditions even find the beacons useful. Bill Schmieder, KK6EK, in his recently published book *3YØPI, Peter I Island Antarctica* remarked that conditions at one point were very poor. So just to make sure conditions were as bad as they sounded, he "listened on 14.1 for the beacons, but...heard nothing."[4]

In part 2 of this article, we will discuss the implementation of the beacons for Phase III, including the use of a GPS satellite receiver to provide timing.

Notes

[1] J. G. Troster, W6ISQ; O.G. Villard Jr, W6QYT; J. K.Ouimet, K6OPO; C. G. Pierce, K6RU; "The WB6ZNL Beacon," *QST*, Jan 1980, p 57.

[2] J. G. Troster, W6ISQ, and C. G. Pierce, K6RU, "World-Wide Beacon Net: The Possibilities Abound," *QST*, Jun 1983, p 27.

[3] J. S. Stover, W5AE, "20-Meter Beacons Revisited," *QST*, Dec 1988, p 60.

[4] R. Schmieder, KK6EK, *3YØPI, Peter Island Antarctica* (Walnut Creek CA: Cordell Expeditions, 1994). QST

The NCDXF/IARU International Beacon Network—*Part 2*

In Part 1, the beacon network was described; this part explains the underlying technology including the use of a GPS receiver for accurate timing.

By John G. Troster, W6ISQ and Robert S. Fabry, N6EK
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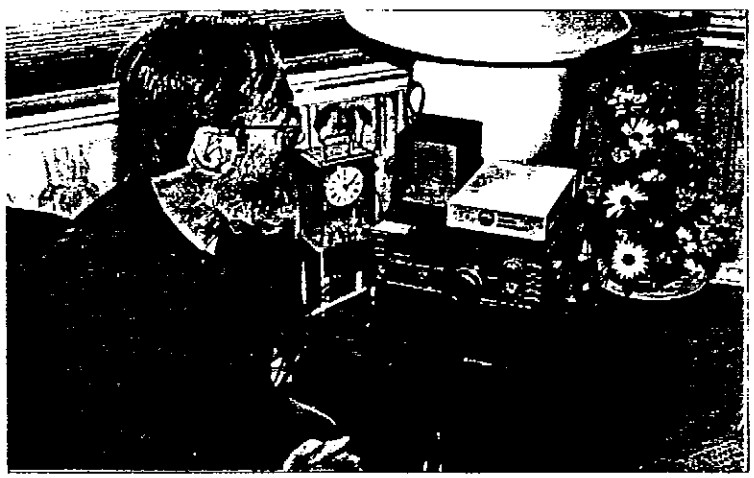
Photos by John G. Troster, W6ISQ

Part 1, in last month's *QST*, presented a short history of the 15-year-old 14.1-MHz worldwide beacon network that we call Phase II. The Phase II network introduced two important innovations in beacons. First, by transmitting at four power levels it allowed casual listeners to learn much more about the robustness of the propagation path than had previously been possible. It's great fun to know you just heard a 0.1-W signal from halfway around the world! Second, by sharing a single frequency among many beacons, it not only cut down on the spectrum needed by the beacons, but it also simplified listening—the listener does not have to tune to a different frequency for each beacon. In the Phase II network, each beacon has a 1-minute time slot once every 10 minutes in which it is to transmit. The downside of this arrangement is that it takes 10 minutes to listen for 10 beacons: many people find this too long.

The soon-to-be-operational Phase III network will improve on Phase II by allowing more beacons. It does this by shortening the transmissions in order to make listening for the beacons faster. It also will allow the beacons to operate on five bands. The present and possible future locations of beacons in the Phase III network were shown in the map in Part 1 of this article.



N6EK with an entire multiband beacon unit.

Time Standard

In order for frequency-sharing to work, each beacon must know precisely when its time to transmit has come. Each Phase II beacon uses a 6-MHz temperature-compensated crystal oscillator (TCXO) for its time base. Each beacon transmits when it is first put on line, and every 10 minutes thereafter. Each beacon is started manually, and must be started within a fraction of a second of the correct time for its transmission.

In practice, the Phase II beacon's internal clock drifts 1 or 2 seconds per month. The transmission sequence allows 3 seconds of "guard time" between one beacon's transmission and the next; after a drift of 3 seconds, a beacon's transmission may overlap that of its neighbor. As a practical matter, it is necessary to reset each beacon's internal clock every four to six weeks, and this resynchronization is the most demanding operational aspect of the Phase II beacon network. We owe a great deal of appreciation to the individual amateurs and amateur organizations around the world who have undertaken the responsibility of faithfully operating the beacons for so many years.

The other operational problem with the Phase II network is that no distinction is made between an intentional synchronizing power-up and a randomly timed power-up after a power failure. If you have heard a beacon transmitting at a wildly incorrect time, a randomly timed power-up that has not been yet discovered by the beacon operator is the cause.

WWV Timing Solution

A first attempt to solve the synchronization problem used the 0.8-second 1500-Hz tone broadcast by WWV and WWVH at the start of each hour to keep the internal clock synchronized. The transceiver used for the beacon transmissions was switched to WWV, its audio output was fed into a 1500-Hz detector and the detector output was made available to the microprocessor. Spurious responses were minimized by measuring the precise duration of the detected tone and by knowing approximately when the start of the hour should occur. In tests in California this scheme worked well, but there was a concern that the scheme could not be depended on to work well in every corner of the world and in every phase of the sunspot cycle.

GPS Timing Solution

The final synchronization scheme uses the Global Positioning System (GPS) satellites to provide a timing standard. Rather than do this from scratch, it has proven cost-effective to use a commercial unit, the Accutime GPS receiver made by Trimble Navigation.[1] This unit combines the antenna and receiver in a small plastic housing, requires 2 W at 12 V dc and provides two outputs: a pulse at the beginning of every second that is specified to be accurate within 1 microsecond

[1]Notes appear on page 51.

Beacon Hunting from Northwest Connecticut

"Sure—I can monitor 14.100 MHz and log some beacons over the weekend for W6ISQ's article." It sounded like a piece of cake: log some beacons, write up a little blurb, and get back to my planned weekend fun of replacing the water line from the house to the road. But actually *hearing* the beacons proved to be more difficult than digging the 55-foot-long, 4-foot-deep trench for the water line.

It's not that I was trying to monitor the NCDXF beacons with a direct-conversion receiver hooked up to an unwound 10-foot reel of hook-up wire. Though perhaps modest to some, the equipment consisted of a Kenwood TS-440S/AT loaded with primo IRCI crystal IF filters, and the choice of a rotatable Mosley TA-53-M at 73 feet or a Cushcraft A3, fixed south, at 36 feet. The Yagis are switch-selectable.

What became immediately apparent was that packet stations—*strong* packet stations—on both sides of the supposedly *guarded* beacon frequency, made for tough going. I could hear 4U1UN, W6WX, CT3B and LU4AA regularly, as propagation supported the paths, of course. But copying the other five stations in the existing beacon network proved fruitless.

Amateurs with bare-bones stations trying to log beacons on 14.1 MHz will no doubt experience varying degrees of frustration. I believe that users of stock HF transceivers with only a 2.1-kHz IF filter are going to get eaten alive by packet stations on or near the beacon frequency. This isn't to say that basic HF stations won't be able to hear any of the beacons. But in order to make the most out of the NCDXF beacon system, here is a list of things that might help:

- A good receiver—robust front-end design that doesn't overload easily; quality IF crystal filters with steep skirts and negligible ringing; IF shift or passband tuning; audio filtering or tailoring.
- Rotatable, directional antenna or antennas. One Yagi or quad is nice; two of them is at least three times as nice as one. Trust me on this.
- A high degree of patience.—*Jeff Bauer, WA1MBK, Chief Operator, W1AW*

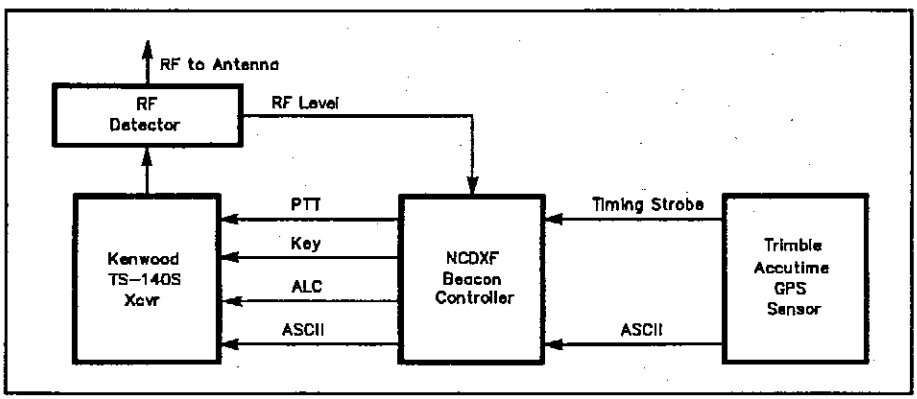


Figure 1—The block diagram of a Phase III beacon, showing the control-signal and RF paths.

(much better than we need!) and a serial-data line on which ASCII-character packets are sent.

The GPS receiver sends many different types of packets over the serial data line. Normally, a GPS receiver is used to provide location, as in the recent *QST* article on an automated direction finder[2] and the recent *QST* product review of the Trimble Scout GPS receiver that automatically displays Maidenhead grid locators.[3] Unlike those GPS applications, we ignore the packets that tell us our latitude and longitude, and use only the packets that specify the time (in UTC) and those that tell us that the GPS unit is "healthy."

Art Lange, W6RXQ, who works for Trimble, has provided technical guidance in the use of GPS timing. Within Trimble, Art championed the marketing of a self-contained stand-alone timing product. (Art was also the person who pushed internally to have the hand-held Scout unit display Maidenhead grid locators, a feature whose only known application is ham radio!)

Beacon Controller

A controller serves as the brain of each Phase III beacon (Figure 1). The other components are a Kenwood TS-140S transceiver, the Trimble Accutime GPS receiver and an RF detector that produces a voltage proportional to the RF output voltage. The major functions of the controller include receiving and interpreting ASCII timing packets from the GPS receiver, sending ASCII character strings to the transceiver to initiate frequency switching, controlling the power level of the transmissions from the beacon using the ALC of the transceiver and keying the transceiver to send Morse code. The controller uses the Intel 8748 computer-on-a-chip that was also used for the Phase II beacon controller, and which remains a cost-effective choice. It combines an 8-bit microprocessor with a 1024-byte EPROM (erasable, programmable read-only memory). The program for the 8748 is written in assembly language.

Timing

The once-a-second timing pulse from the GPS receiver is used to interrupt the microprocessor so it can add 1 to its internal clock and initiate a transmission when appropriate. The time packets from the GPS receiver are used to set or correct the clock's value. In addition to validating the parity on the characters from the GPS receiver, the controller requires two time packets in a row that agree as to the correct time before it sets or resets its internal clock. In practice, the time packets and pulses from the GPS receiver have rarely been garbled, but this arrangement means that a time drift from a lost or extra timing pulse will normally be corrected within 10 minutes and that nonsensical time packets will be ignored.

When the beacon is first powered up, the GPS receiver does not know where it is or what satellites to look for. It takes a few minutes for the GPS receiver to orient itself. The controller knows this. When first powered up, the controller waits until the GPS receiver declares itself "healthy," and then waits until it has received two time packets that agree. This process can take as much as 15 minutes.

Decoding the time messages is somewhat tricky. The program first assembles individual characters by watching an input connected to the serial-data line from the GPS receiver. It accumulates characters until it has a valid packet. If the packet is not a time packet, it is ignored. If a time packet arrives too close to the beginning of a second it is ignored, since there is an ambiguity as to whether it refers to the second just ending or to the second just starting. Unfortunately, the time-of-day information in the packet is provided as a floating-point number rather than as an integer. Converting the 48-bit floating-point number to an integer using 8-bit arithmetic is lots of fun. The entire algorithm for extracting the time of day from the character stream sent by the GPS receiver was written and tested as a C program on a PC before it was coded in assembly language.

Frequency Control

Setting the frequency of the transceiver is relatively easy; the program sends the rig a string of ASCII characters. In the case of the Kenwood TS-140S, for example, one can set the frequency to 14.1 MHz by sending to the transceiver the characters

"FA00014100000;" (the ";" is one of the characters that must be sent to the transceiver—it is not an ordinary punctuation mark). Each character must be bracketed with start and stop bits and the bits must have a specific duration on the wire, just as with computer serial ports and telephone modems. In this case, the program sets the value for the wire into one of the output bits and then loops, doing nothing until it is time to set the next value. (We might have used specialized UART chips for sending characters to the TS-140S and for assembling characters from the GPS receiver, but there was no need to add such hardware cost in this case.)

Output Power Control

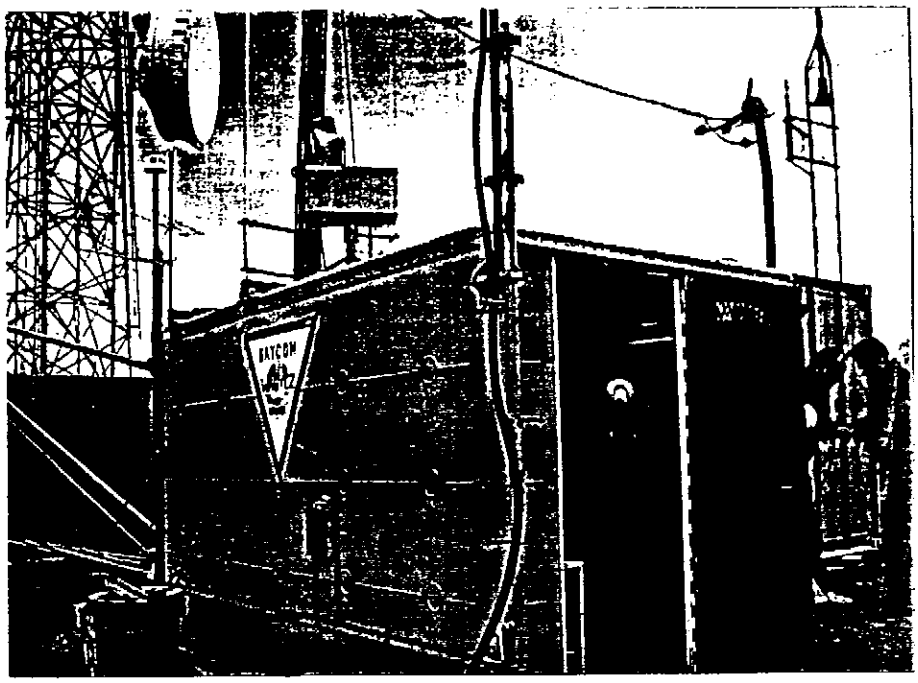
The output power level is controlled by adjusting the ALC input to the transceiver, using analog circuitry. A diode detector attached to the RF output of the transceiver produces a voltage proportional to the RF output. This voltage goes through a voltage divider, the ratio of which is controlled by the microprocessor. The output of the voltage divider is compared with a fixed reference voltage in an operational amplifier string that produces an ALC voltage for the transceiver to force the output of the voltage divider to match the reference voltage.

The tricky part of all this is to design the control circuitry so the keying envelope is smooth at all power levels and so the power level is accurate at all frequencies. It was necessary to provide a microprocessor-controlled ALC bias voltage so the ALC voltage is approximately correct for the desired power level before the transceiver starts to transmit.

Keying

The keying is accomplished electrically with one section of a 7417 open-collector driver chip. The program for sending Morse code, written by Jack Curtis, K6KU, was carried over from the original beacon. The messages to be sent by the beacon are stored in the memory as a string of ASCII characters, rather than as a string of dots and dashes. To send a character, the character is looked up in a table that specifies the dot and dash representation of the character. As one might imagine, a 1 bit in the specification stands for a dot and a 0 bit stands for a dash; the tricky part is to find some simple way to specify how many dots and dashes a particular character requires.

The solution is useful for any program that sends Morse code. The unused bit positions are filled with a 1 followed by enough 0s to fill the byte: A is encoded as 1010000 for dot-dash; B is encoded as 01111000 for dash-dot-dot-dot; and so on. If you have written any bit-twiddling programs, you can probably imagine the algorithm for sending the character specified in such a way: If the high-order bit of the specification is a 1, send a dot, otherwise send a dash. Shift the specification left one bit position, throwing away the old high-order bit and filling the low-order bit with a 0. If the specification is now 10000000, exit; otherwise, go back to send the next dot or dash.



The W6WX/B housing on Mt Umunum. K6GSJ (l) and N6EK (r) are working on some of the coaxial cabling. The GPS unit is mounted on the pole at the far left corner of the housing.

Further Ideas

One can imagine building a computer-controlled beacon monitoring station and attaching it to the packet networks used by DXers. Such a device could include a computer-controlled transceiver for listening to the various frequencies and a GPS receiver for accurate timing. Perhaps DXers could call up the actual propagation history for the path from their location to particular beacons for the past hour, day, month or year.

The value of knowing that you can hear a particular power level is much more than the information provided by existing propagation prediction programs, because those programs do not fully account for atmospheric noise. Perhaps a systematic history of actual propagation, such as might be available with automated monitoring stations, could provide the raw data for refining these prediction programs so they could forecast signal-to-noise ratios instead of merely signal levels.

Another interesting possibility arises from the extremely precise timing of the beacon transmissions. Since the GPS receivers provide synchronization to the nearest microsecond, one could easily calculate the travel time for the radio signal from the beacon to the monitoring station to within a few microseconds. Would this allow one to determine the actual pattern of ionospheric reflections that occurred? Could this information shed light on unusual propagation modes such as skew paths? Fascinating possibilities exist, and need only be tested and developed by the users!

Conclusion

When complete, the Phase III beacon network will allow you to check for band openings on a particular band (any of the five bands from 20 to 10 meters) in 3 minutes. Or, you will be able to track the same beacon through five bands to determine the band that has the best propagation to that area. We are in for some interesting propagation experiences in the next several years as the sunspot count begins to move up from the approaching minimum. We can hardly wait!

Notes

[1]Trimble Navigation, OEM Sales, Post Office Box 3642, Sunnyvale, CA 94088, 408-481-8000.

[2]R. Flanagan and L. Calabrese, "An Automated Mobile Radio-Direction-Finding System," *QST*, Dec 1993, pp 51-55.

[3]M. Wilson, "Product Review: Trimble Scout GPS Hand-Held Global Positioning System Receiver," *QST*, Mar 1994, pp 77-ff.

Bob Jones, KH6O, SK

We were saddened to learn of the passing of Bob Jones, KH6O, on September 14. Bob operated the Hawaiian 14.1-MHz beacon, KH6O/B, for 13 years. The beacon was originally operated at Honolulu City College, when Bob was teaching there; after his retirement, it was moved to his home. Bob was a very conscientious beacon operator, a well-known 40-meter CW enthusiast, and a fine person. We send our condolences to Bob's widow, Virginia, and their family.—*W6ISQ and N6EK*

Letters

Dear John, W6ISQ,

This is mostly a fan letter. My October QST arrived after the November issue, so I read your articles in reverse order. I've listened to 14.1 MHz hundreds of times. From Turkey 4X6TU and OH2B are standard fare. I've never heard LU4AA and KH6O from here, and the rest are fairly rare. I've decided to help the beacon project out a bit, so you'll find a cheque enclosed.

Before reading the articles, I'd had some serious discussions with the local ham club about installing a beacon on the nearby Elma Dagi (Apple Mountain) for 21.15 MHz. Obviously, with the sophisticated Phase III program in sight, it would be unnecessary from a world-wide perspective to have another beacon near Ankara, Turkey, since I assume the propagation is not very different from 4X6TU. If by chance the local support for the 4X6TU beacon dries up, then you might keep Ankara in mind. The ANTRAK ham club is very active, with lots of excellent technical talent available. One of the sparkplugs in the club is Tahir Dengiz, TA2T, a senior Transportation Ministry official who directly supervises the Director of the Turkish equivalent of the FCC. He is an electronics engineer, like many others in the club, and is fluent in English.

The idea of tightening up the timing schedule for 3-minute cycles for the beacon system is excellent. My major suggestion is to institute some strict control over the transmit frequencies of all of the beacons. With the close-by digital QRM at 14.1 MHz, when all beacons are not transmitting on very close to the same frequency, then narrow receiver filters can't be used. Having owned a TS-140S some time ago, I know that its frequency stability leaves a lot to be desired. Could a special crystal oven be installed in the TS-140S rigs to get the frequencies within about 100 Hz or so? Another alternative would be to switch to an another transceiver, such as the Ten-Tec OMNI VI, which has a built-in oven for the frequency-controlling crystal. Ten-Tec specifies a 50 Hz frequency accuracy after 1-2 minutes warm-up, I think- their gear normally outperforms that standard, given Ten-Tec's reputation for publishing conservative specifications. By contrast, the Ten-Tec Scout, which would not be appropriate for a beacon rig, has a 100 Hz frequency accuracy specified. I realize that eighteen OMNI VI's would cost more money, but maybe a discount could be worked out with Ten-Tec in trade for some publicity which they could use for their advertising. I'll send a copy of this letter to the President of Ten-Tec.

Meanwhile, please accept my word that the beacon network is a most worthy endeavor, and future enhancements you wrote about sound fantastic.

73,

J. Bruce Prior, TA2ZO (AA3DK)

Dear OMs,

First of all MNI TNX for the recent Newsletter which was (as always) very interesting.

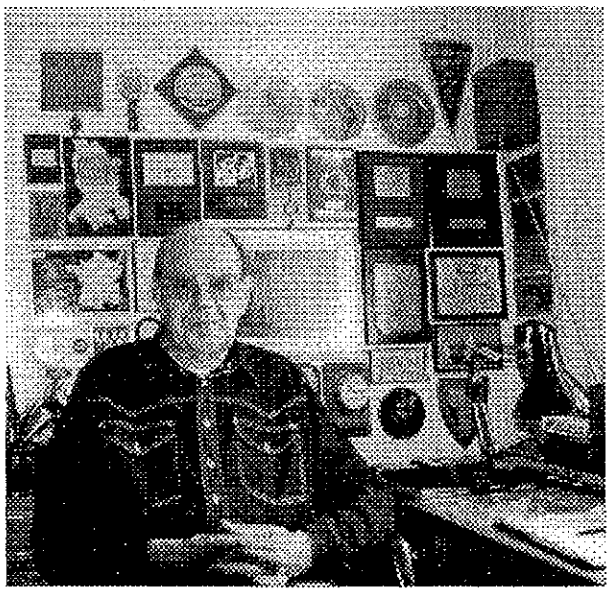
As enclosure I send you today $10.00, my contribution for 1994 and 1995.

Perhaps it will be of interest to you that I have obtained the new WAE-TOP Nr. 1 - CW as first SWL and several other more or less difficult awards, CW only. My actual score is 670 awards, trophies, plaques, etc., hi.

The also enclosed picture shows an OT-SWL, 73 years now.

All good wishes and cheerio!

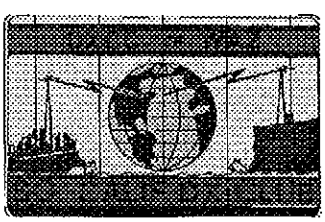
de, Peter DEØDXM, NCDXF # 2095

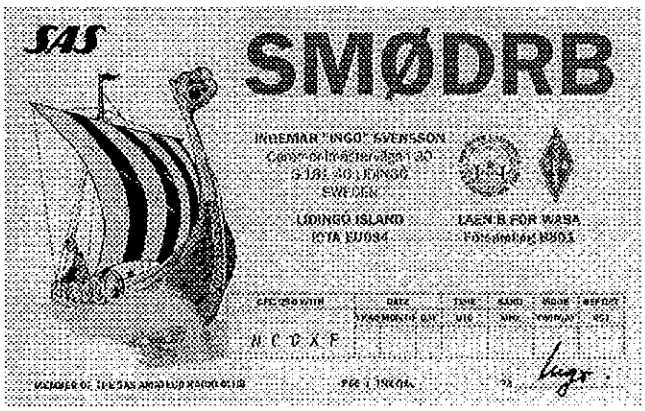


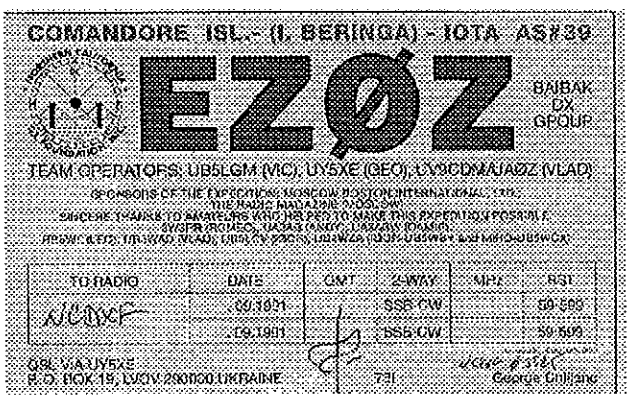
SCDXC Elects New Officers

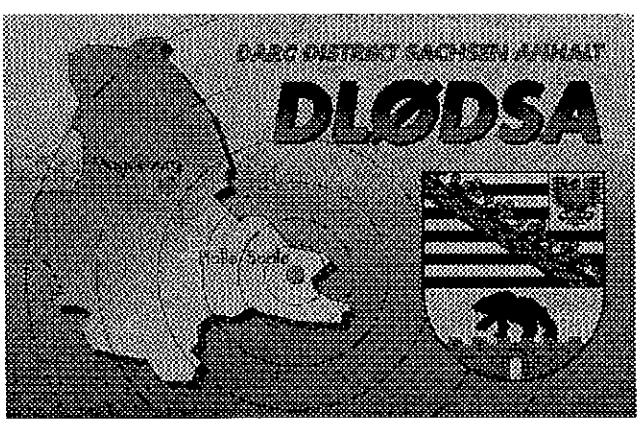
The following amateurs have been elected to serve as officers of the Southern California DX club for 1995:

President:	Harvey G. Shore, K6EXO
Vice-president:	Richard A. Bongeorno, WU6T
Secretary:	Willem A. Angenent, KN6DV
Treasurer:	Leonard Svidor, W6AUG
Membership:	Larry D. Shapiro, KJ6HO
Director:	Allan C. Breller, KJ6ZH
Director:	Joseph A. Locascio, K5KT
Director:	Robert W. Selbrede, W9NQ









Letter

London, Ont., Canada

Dear OMs,

Money Order for $10.00 enclosed. Our Canadian dollar is kind of weak these days so the money order (with bank charges waived) cost $14.26 Canadian. I prefer this method of supporting DXpeditions though I also enjoy the newsletter. It's only one ham's opinion perhaps, but I think your Editor has a "CLASS" callsign.

73,

Graham, VE3ST

Big Hitters

Our sincere thanks to all who contributed to the Northern California DX Foundation, regardless of the size of the donation. Our special thanks to the following individuals who donated so generously. If you see a callsign more than once, that person donated more than once during the year.

Big Hitters - 1994

$100 or more

AA6IR, AA6MC, AB4JI, AG5S, DL2HQH, DL2VPO, DL312WW, DL8CM, HB9DDM, JA1EM, JA3AFR, JA7RHJ, K2AZ, K2PLF, K4KUZ, K6HHD, K6ITL, K6JYO, K6LDQ, K6MA, K6OZL, K6RK, K6SQL, K6TMB, K6TMB, K8CFU, K8DD, K8GG, K8MFO, KI6WF, KI6WF, KK6QM, KP4AM, LA6VM, N1CYA, N6HR, N6LDQ, N7NG, N7NG, NW6P, OH5NQ, RX4HW, South Florida DX Association, VK5WO, WØCD, WØYK, W1PCD, W1PNR, W4WJ, W6DU, W6EEN, W6EEN, W6FAH, W6GO, W6ISQ, W6ISQ, W6OAT, W6OSP, W6OSP, W6OSP, W6PVE, W6QHS, W6RR, W6TGI, W6WKE, W6ZH, W6ZM, W7NCO, W8UVZ, WA2HZR, WA6HXM, WA6TJM, WA8LLY, WB6IRC, WB6UOM, WB6UOM, WB6ZUC, XYL of W6YFW, K6DC, W8MEP, W6CPL, WB6WCW, KE3AY and NK6F.

$200 or more

I15Ø156, K6DT, N8CEO, VE3MR, W5ZPA and W6ESJ.

$400 or more

WB6ZNH

$500 or more

Alaska DX Association, KØIR, K3ZO and W6JZH.

$1000 or more

N6HVZ

$2000 or more

XYL of KH6IJ

Big Hitters 1995

So far in 1995 we have a good group of Big Hitters

$100 or more

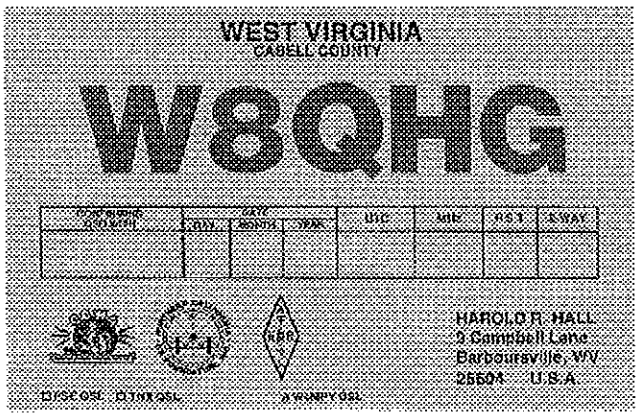
AA6T for AA6T and NS6G, DL8CM, GØ27SM, JA1EM, JA1EOD, JA3BKP, K6ANP, K6ITL, K6MA, K8EJ, KP4AM, N1CYA, N9BUL, W1PCD, W4AI, W8UVZ and YV5LTR.

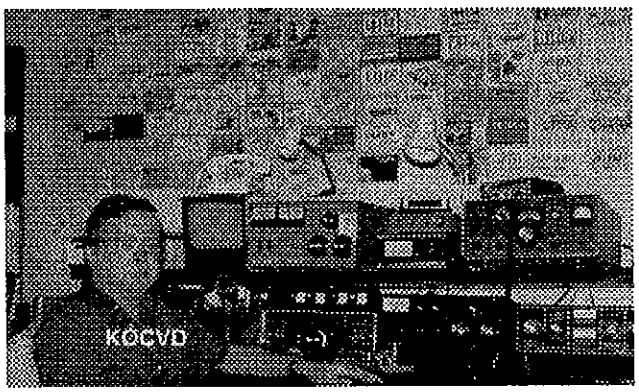
$200 or more

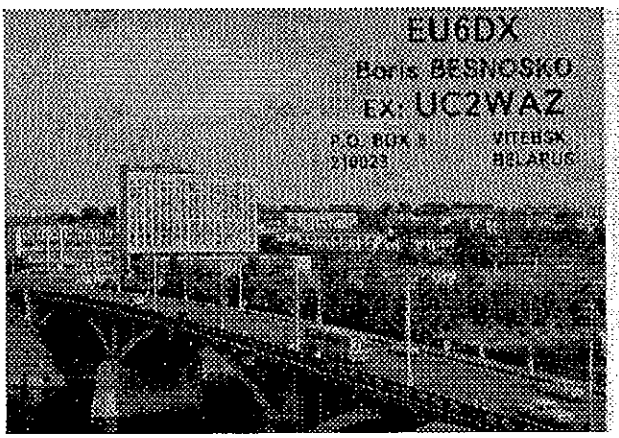
W9ZR

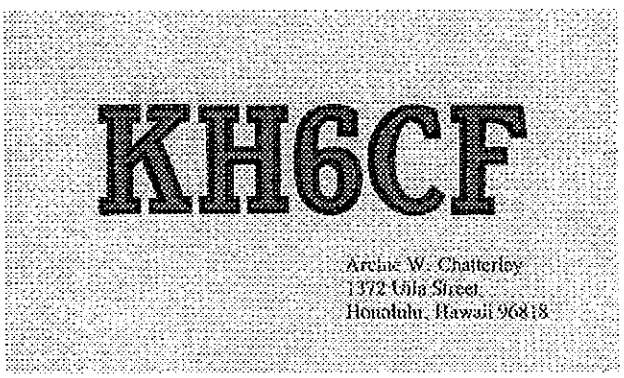
$1000 or more

W6PVE estate









New Shows

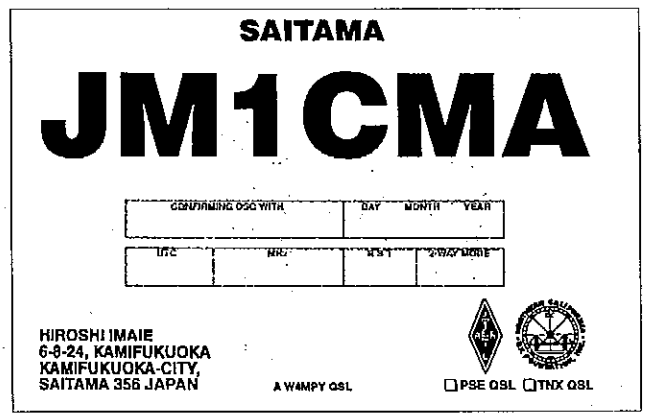
by Ron Steiner, K6KEO

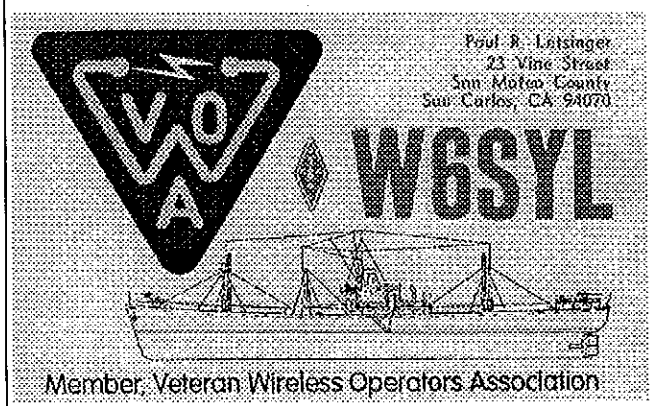
We have received some material for the slide and video library.

The first one is a video on the October, 1992 Malyj Vysotskij Island, 4J1FM/4J1FW multi-national operation. The video is very well done and above average quality. It runs 43 minutes. We received it courtesy of Frank Smith, AHØW, ex: 4J1FM.

The second new item is a slide show courtesy of Bob Fabry, N6EK. Here is his description of the show which I received with the slides and audio tape.

"J76EK & J76YL, Dominica 1993 by N6EK and KA6VVX, 69 slides with a 40 minute audio tape. The subtitle of the talk is 'Can this marriage survive a combined vacation and Dxpedition?' The tape was recorded at the 1994 Christmas banquet of the Northern California DX Club and covers both the radio operation and tourist highlights of Dominica, the friendly and beautiful 'Nature Isle of the Caribbean'."





Slide Shows and Videos

The Northern California DX Foundation has a number of slide shows and videos available for loan to organizations wishing to show them at meetings. Clubs borrowing materials are responsible for postage in both directions. The amount involved can be learned from the postage on the package when it comes to you and is usually about $2.90. Please give the name of your club, the day of the month you meet and more than one choice of program in case there is a great demand for the item. Correspondence should be addressed to Ron Steiner, K6KEO, 3154 Dominic Dr, Castro Valley, CA 94546.

Available Slide Shows:

1. Kingman Reef and Palmyra Island expedition of 1974 (148 slides)
2. K5YY on Africa of 1978 (62 slides)
3. Colvins on Easter, Galapagos, San Andreas, etc 1984 (140 slides)
4. W6REC & ZL1AMO, Kermadec 1984 (58 slides)
5. AHØC (Saipan) CQWW Contest Operation of 1983 (82 slides)
6. 1985 Clipperton expedition (191 slides)
7. Ponape Island by N6HR, travelogue (81 slides)
8. Pribilof Island operation of 1982 (48 slides)
9. Midway by NA6T & KD7P (120 slides)
10. Antarctica, Arctowski, Palmer, Peter, Macquarie stations (101 slides)
11. VR6, Pitcairn, Mar/Apr 1979 by ZL1AMO & ZL1ADI (51 slides)
12. SMØAGD 1982 Pacific DXpedition (150 slides)
13. 9U5, Burundi by ON5NT (57 slides)
14. TYA11, Benin by ON5NT (61 slides)
15. VK3DXU/2, Lord Howe Island by K2UO (52 slides)
16. 3A, Monaco, by F6EYS & F6HIX of 1984 (43 slides)
17. 5X5, Uganda by DJ6SI of 1985 (115 slides)
18. Market Reef, July 1983 by PAØGAM/OHØ/OJØ
19. KX6DS, Marshall Island (34 slides)
20. Andorra, by DL1HBT, DL3HAH, DL5BAD, DL4BBO, DL4BAH (50 slides)
21. 1986 Clipperton Dxpedition (176 slides)
22. Peter I Island, 3Y, of 1987 (127 slides)
23. KP2N, 1986, CQWW DX CW contest (55 slides)
24. OFØMA, Market Reef, 1987 (28 slides)
25. Abu Ail, AI5AA, by DJ6SI, 1988 (65 slides)
26. XX9CW by DK7PE, 1986 (16 slides)
27. 1988 Palmyra by K9AJ, KP2A, WA2MOE, WØRLX, F6EXV, JA5DQH (93 slides)
28. 1988 Kingman by the above operators (96 slides)
29. 1988 4U, KC4, VK9Y, VK9X and 9V1 by W7SW (73 slides)
30. Banaba Isl, T33JS+T30 & T27 by KN6J & VK9NS (80 slides, 80 minutes)
31. XF4L by XE1L, XE1OH, XE1XA, OH2BH, OH2U, JH4RAF, W6RGG & N7NG
32. Publishing the DX Bulletin by Chod Harris 24 min
33. Rotuma 1988 by W6SZN, 73 minutes
34. 4J1FS, MV Isl, 1989 with Finnish, Soviet & American DXers by K7JA 16 min
35. ZS8MI, Marion Island by Peter Sykora, ZS6PT 1 hour
36. Y63-KC6-P29, Micronesia/Melanesia by KQ1F & K1XM 20 min
37. YL DXpedition to Wallis Isl June 1989 by NM7N, N7HAT, N4DDK, KAØMX 20 min
38. A51JS, Bhutan by VK9NS, Jim Smith 1 hour
39. HC8X, Galapagos by KQ1F 34 min
40. Faroe Island May 1991 by N6HR 28 min
41. Palmyra Island, KP6AZ, 1963 by W6FAY
42. Dominica 1993 by N6EK & KB6VVX

Available VHS videos:

1. XU1SS (plus BVØYL and BVØJA) (35 minutes)
2. 7J1RL of 1976 and 1978 (includes ZK9ZR, Mellish Reef)
3. VK9ZR DXpedition of 1978 (plus Ogasawara)
4. Frankford Radio Club ARRL phone parody + JH7YFL WWCW
5. JF1IST/7J1 DXpedition to Okino Torishima of 1979 (25 minutes)
6. Australian travelogue - Climbing Big Ben, Heard Island (55 minutes)
7. Ham Radio in the South Cook Islands by ZK1CA & ZK1CT (70 minutes)
8. VR6 by ZL1AMO & ZL1ADI (copy of slide show above)
9. Looking Up in Rio Linda, 1986 by W6GO/K6HHD (45 minutes)
10. Revillagigedo, XF4DX, of 1987 (15 minutes)
11. Northern Texas Contest Club - towers and contesters (45 minutes)
12. It Started With A Broken Fence - JH3DPB Tall Tower tale (15 mintes)
13. Pile Up Busters, Humorous. (10 minutes)
14. FG/W2QM/FS, French St Martin, DXing Senior Style - Another Wrinkle to DXing
15. 1984 Laccadive Island DXpedition, VU7WCY, plus 1983 VKØHI from TV (60 minutes)
16. The K6UA contest station story (25 minutes)
17. HKØTU DXpedition of 1983, Malpelo (25 minutes in Spanish)
18. The Ship That Shouldn't Have - VKØJS Heard Island DXpedition (90 minutes)
19. The New World of Amateur Radio (28 minutes)
20. SØRASD 1987 by the Lynx Group, The Western Sahara Story (37 minutes)
21. Auckland Island 1988 by ZL1AMO, ZL1BQD, N7NG (60 minutes)
22. Dr. Owen Garriot's First Talk to hams about the Space Shuttle
23. Russian Ham Radio Tour by WA6WXD, Oct 1986 (45 minutes)
24. 3Y DXpedition 1987 - W4VWA copy of the slide show
25. Peter I 1987, from JA7ARW
26. 1979 Spratly Isl DXpedition by K4SMX, K1MM, VK2BJL, N2OO, N4WW & KP2A
27. 1988 Malyj Vysotskij Island by OH2BH, UZ3AU, OH5NZ, UR2AR, OH2RF, UW3AX 23 min
28. 3W8DX & 3W8CW by HA5MY, HA5WA, HA5PP, HA5BBC, Nov. 1988 Produced by W4BRE
29. Aruba, P4ØV CQWW Test (12 min)
30. A Message from Barry Goldwater, K7UGA (12 min)
31. Navassa of 1988 by N2EDF, K2SG, KE4VU, KD2NT, N4GNR, KT2Q, W3GH (38 min)
32. Rhodes, SV5, by N2OO & SVØAA, April 1989 (40 min)
33. NO1Z/KH1, Howland Isl 1988 by NO1Z, 7J3AAB, TR8JLD, VK9NS & VK9NL (20 min)
34. Boeing ARC at the Electronic Convention and Great Wall of China (audio tape + VHS 30 min)
35. KC Club DXpedition to Tonganoxie Island (30 min)
36. Tuvalu 1989 by K6EDV and ZL1AMO (27 min)
37. Visalia Convention of 1990 recorded by W6NLG (2 hours)
38. Rotuma, 1988 copy of the slide show (73 min)
39. XW8CW & XW8DX 1989 by HA5PP & HA5WA (27 min), produced by W4BRE
40. XU8CW & XU8DX 1990 by HA5PP & HA5WA Produced by W4BRE (27 min)
41. All China Amateur Radio DFing Competition + BY1PK (32 min)
42. ZS8MI by ZS6PT, partial copy of the slide show (40 min)
43. Jim Smith, A51JS, VK9NS, visits the SF Bay Area by WA6BXV (80 min)
44. R9ZF/NN7A, NN7D & W7YS, Aug. 1989 Lake Teletskoye, Siberia (30 min)
45. VU7, Laccadive Isl 1984 (65 min)
46. VU7, Andaman Isl 1987 by Combatore Radio Club (30 min)
47. 3Y5X Bouvet 1989. Video by JF1IST (in Japanese, good photography) 35 min
48. VR6TC speaks to the Turlock ARC. 1991 by K6IMN (125 min)
49. 1990 World Radiosport Team Championships in Seattle (25 min)
50. ICOM's "More Than Radios" The legacy we leave to the young. (25 min)
51. T33R-T33T Banaba, Nov 1990 by SM7PKK, TF3CW, OH1RY (22 min)
52. This is ATV by Western Washington AT Society (12 min)
53. New Horizon: South Pacific Adventure by AA6LF (55 min)
54. YB3ASO:Indonesian Stations and Sightseeing by W7TSQ 25 min
55. XF4L of 1989 by JH4RHF, XE1OH, OH2BH, W6RGG, XE1L, OH2BU and N7NG 25 min
56. ET2A by W4IBB, Jack Reeves May 91 12 min
57. ISØXV by UW3R et al July 1990 35 min or 2 hours (your choice)
58. Jarvis 1990 by K3NA and KN3T 35 min
59. 3CØCW, Annobon 1991 by the Garrotxa Club of Spain
60. Araucaria DX Group of Brazil, about contest stns and ops 30 min
61. 9L1US by Dave Heil, K8MN Ed. by Jim Hurst, West Ga College & W4VWA (45 min)
62. Dave Heil, K8MN visits Finland. Edited by Jim Hurst & Henry Owen, W4VWA (35 min)
63. Penguin Isl. 1990 from a slide show by Wayne Mills, N7NG, Produced by MoBre (15 min)
64. PJ9W-1990, "Spirit of Victory", Radioteam Finland, Produced by WA7LNW (48 min)
65. Empire of the Air; The Men Who Made Radio Recorded by KI6YB
66. Contest Night Live, by the Kansas City DX Club (30 min)
67. DXing Kansas City Style, by the Kansas City DX Club (30 min)
68. VP8ANT/G3CWI The story of Richard Newstead on Adelaide Isl(45 min)
69. H44 Soloman Island DXpedition (12 min)
70. VP2EOH 1992 by Northern Ohio DXA (29 min)
71. Christmas Island March 1990 by JH1LBR. English audio by WB2CHO
72. VP8SSI South Shetlands 1992. (46 min)
73. More About Radios by Zman Productions - an intro to the hobby (28 min)
74. Navassa Isl., Jan 1992 by WA4DAN, AA4VK, NØTO, KW2P & AA4NC (25 min)
75. Getting Started In DXing by CQ Communications (52 min)
76. The Radio Ham, starring Tony Hancock English Comedy (26 min)
77. Project Irma, The DX Truth-O-Meter, Northern Cal DX Convention, 1993 (25 min)
78. ZL9DX, Auckland Isl '93 by ZL1OK, ZL1AVC, ZL2TPY, HH4RHF & JR4DUW (28 min)
80. V63-KC6-P29 by KQ1F & K1XM slide copy by Jim Hurt & Harry Owen W4VWA (25 min)
81. Desecheo, KP5, 1992/3 with KW2P, NØTG, WA4DAN, WØRJU & AA4VK (28 min)
82. E35X, Eritrea, May 31-June 10, 1993 by LA6VM, LA1EE, JF1IST, LA9DL, LA7XK (17 min)
83. AH1A, Howland Isl '93 by ON6TT, WØRLX, K9AJ, WØCP, KØEU, W9IXX, K4UEE, F6EXV, G4LJF (2 hr)
84. 9G1AA, Ghana by PA3AWW, PA3FUE, PA3ERA, PA3DEW & PAØTUK (55 min)
85. 9MØS Spartly Islands 1993 by N7NG, WA6AUE, OH6DO, JA5DQH, OH1NYP, 9V1YW, 9M2FM, OH2MAK & OH2BH (30 min)
86. Journey to Peter I, 1994 (30 min)
87. ZD8SXW, Tristan da Cunha, 1994 by G3SXW (18 min)
88. Last Voise from Kuwait, 9K2DZ (25 min)
89. Malyj Vysotskij Island 4J1FM/4J1FW October 1992 by AHØW ex: 4J1FM

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