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DIGITAL Journal

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What's All This DSP Stuff About Anyway?

Part 2

by Doug Hall, KF4KL
4400 Duraleigh Road • Raleigh, NC 27612

Last time I gave an overview of Digital Signal Processing and its application to Amateur Radio. This month I'll go into more detail as we begin to examine the specific parts of a *dsp* system.

A *dsp* system consists of three main components: 1) an analog-to-digital (A/D) converter, 2) a central processing unit (CPU), and 3) a digital-to-analog (D/A) converter. As you'll recall from last month, the A/D converter converts "real-world" analog signals into digital values or numbers which are passed on to the CPU for processing. This processing is the whole purpose of the *dsp* system - to improve or enhance the input signal in some way that makes it more useful. The processed values from the CPU are then passed to the D/A converter which converts them back in to "real-world" analog signals which we can use. The function performed by the *dsp* system is determined by the software which runs on the CPU. By changing this software we can make the *dsp* system do many different things.

It's a good idea to examine each part of the *dsp* system separately so we can see how the parts work together and how the performance of one part can affect the whole system. This time we'll look at one of the most important parts, the analog-to-digital (A/D) converter.

A/D Converter

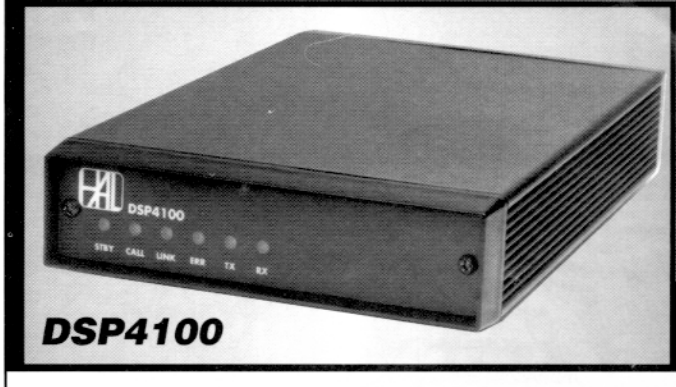
Recall that before our *dsp* system can process any information it must convert it into a digital format. The time varying analog signals which we encounter in the real world mean nothing to the *dsp*. A *dsp* system processes numbers, and it's the job of the A/D converter to provide the *dsp* with a sequence of numbers which represent the analog signal we're interested in processing.

The A/D converter is usually an integrated circuit (IC) which has an analog input pin and a number of digital output pins. The A/D converter measures the voltage level on its analog input pin and outputs a binary (base 2) number on its digital output lines representing this value. Figure 1 shows a block diagram of an A/D converter.

The resolution of the A/D converter is determined by the number of digital output lines it has. If, for example, the A/D converter has 8 digital output lines, then it could resolve the input value into any of 256 (2 to the 8th power) steps. If the analog input has a range of 0 to 5 volts, each step would represent 5 volts divided by 256 steps, or about 0.02 volts per step. We would call such a converter an 8-bit A/D. With such a converter,

(Cont'd on page 26)

DSP4100



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The principal goal of the IDRA is to advance digital technology as it applies to amateur radio and promote the wisest use of the digital podion of the spectrum. Being a member makes you a partner in advancing these digital goals. IDRA is a not-for-profit corporation and contributions to the Society are deductible for income tax purposes to the extent allowable under the tax laws of the United States.

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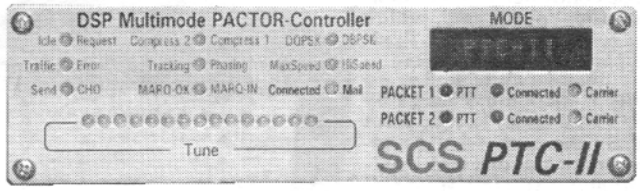
The most powerful DSP-Modem is now available:

SCS *PTC-II*

The Multimode-Multiport-Controller with PACTOR-II, the fastest digital mode on HF!



The PTC-II-Hardware:

- Three simultaneously available communications ports: HF and up to two VHF/UHF Packet ports.
- Separate transceiver control port for remote operation of Icom, Kenwood and Yaesu equipment.
- True 32-bit system with the Motorola RISC processor 68360 as CPU, clocked at 25 MHz.
- 16-bit Motorola DSP 56156 clocked at up to 60 MHz (computing power: 30 MIPS).
- Expandable to 2 MB of static and 32 MB of dynamic RAM, firmware stored in flash memory.
- Modem tones programmable in 1 Hz steps.
- All digital modes can be implemented.
- All advantages of the PTCplus are also included.

The PACTOR-II-Mode:

- In good conditions up to 30 times faster than AMTOR, up to 6 times faster than PACTOR-I.
- Most robust digital mode: Maintains links in conditions with a signal to noise ratio down to minus 18 dB.
- Best bandwidth efficiency: Even using the fastest mode, PACTOR-II requires less than 500 Hz (at minus 50 dB).
- Automatic frequency tracking allows the same tolerance when connecting as with PACTOR-I (+/- 80 Hz).
- Newly developed on-line data compression system (PMC) reduces the data by about factor 2.
- Fully backwards compatible with all known PACTOR-I implementations, including automatic switching.
- Utilizing of the latest coding technology.

For more details on the PTC-II and PACTOR-II see the January to April '95 issues of the Digital Journal!
Basic PTC-II with 512k static RAM: 950 US$, Airmailing: 35 US$ - VISA and MASTER cards are accepted!

SCS - Special Communications Systems

Roentgenstrasse 36, D - 63454 Hanau, Germany, Phone/Facsimile: +49 6181 23368

Beedle Beedle

A series of digital snippets

by Crawford Mackeand, WA3ZKZ
115 S. Spring Valley Road • Wilmington, DE 19807

It is always good to QSO and hear "You are my first RTTY QSO" or PACTOR or whatever. Or to be able to report back to a colleague on the signals from a new equipment set-up. Although one of the major hassles of earlier days, excessive noise radiation from the computer, seems to have just about died away, the converse problem of RF in the digital works still seems to afflict many new systems, so let's look at some basic principles.

The main points of difficulty are magnetic couplings, electrostatic couplings and ground loops.

For the first... use twisted pairs for all signal wiring, and route signal systems away from low frequency AC fields. (Yes, power frequency pick-up can be a problem too, so stay away from 60 Hz transformers and AC power cables).

The second is usually simple too. Regular shielding will usually perform well enough but RF pickup is very dependent on the length of the conductor one is trying to protect. The short traces of a modem CPU are often no problem, but the cables to the keyboard and monitor (and the radio equipment) are much longer. So shielded twisted pairs are a good start.

Ground loops are a bear. Don't have them! Make sure that each piece of equipment is individually grounded by a single short heavy ground wire to a short heavy ground bus. (I use aluminum strip, about 3/4 x 3/16 at the back of the bench.

Next, make quite certain that the shields on the signal cables are grounded AT ONE END ONLY. It is preferable to connect the shield to ground at the driven device alone. (If the cable has bidirectional signals in it, choose one end and be prepared to experiment 0. Of course, the signal neutral wire for unbalanced systems like TTL-to-TTL must carry through end to end inside the screen. Don't cut that off with the screen connection! And if a device must drive two outputs, like a TNC and a tuning scope, use individual cables from the source and don't daisy chain them.

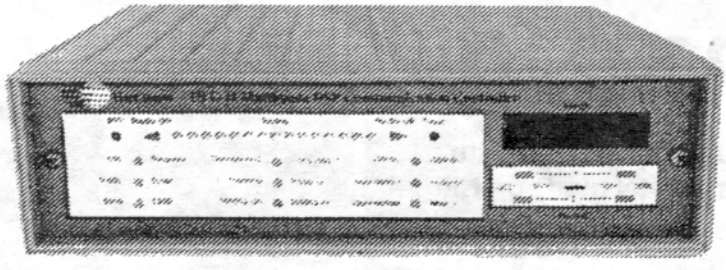
When you have done all of that, it may still not be enough. The PC and its friends are not really designed to work in an rfloaded environment, and we are hams, and we do want to take advantage of the low prices of the mass market, don't we? So what else can be done? I do presume that you have that bus connected to a good station ground. One very good plan is to locate the antenna as far away as possible, and a lot of good that is to the owner of a small lot! But every little helps.

Then comes ferrite to the rescue. Much ham equipment today is well decoupled internally for rfwith individual ferrite cores and bypass capacitors on signal and even on power leads, but the computer is probably not. You will not likely want to dive into it to add little beads and discs, so the best you can do is often to decouple the whole external cable or cables with a split core ferrite choke.

At this point you have done all the predictably good and technical things and should be clean and tidy. And if not, this is where some good amateur cut and try is in order. Good luck... it can be done... it is done. And again, pleased to be your first QSO on this mode or with this rig.

The PacComm PTC-II

The PTC-II is a new multimode controller and "communications platform" which contains powerful and flexible hardware and firmware.



Built in the United States by PacComm under license from S.C.S., the group that developed both the original PACTOR and PACTOR-II.

The PTC-II offers the most robust HF digital protocol available to radio amateurs, but it should not be overlooked that the PTC-II is configurable as a triple-port multimode controller supporting packet data rates of 1200 and 9600 bps and numerous other modes.

- A step-synchronous ARQ protocol.
- Full support of memory ARQ.
- 10 character MODE display, multi-colored LED tuning and status displays.
- Watchdog timer on HF PTT port.
- Specialized communication program provided.
- Firmware contained in Flash memory. Easy upgrade.
- Long-path capability for worldwide connectivity.
- Full compatibility with PACTOR-I (the original PACTOR), AMTOR, and RTTY.
- Automatic switching between Level-1 (PACTOR-I) and Level-2 (PACTOR-II) at contact initiation.
- All-mode mailbox with up to 32 megabytes of storage.
- Occupies a bandwidth of under 500 Hz - use your 500 Hz CW filters.
- DBPSK modulation yields 200 bps (uncompressed).
  DQPSK modulation yields 400 bps (uncompressed).
  8-DPSK modulation yields 600 bps (uncompressed).
  16-DPSK modulation yields 800 bps (uncompressed).
- Independent of sideband; no mark/space convention. Center frequency adjustable between 400 and 2600 Hz to exactly match your radio's filters.
- Differential Phase Shift Keying with two continuously transmitted carriers. 100 symbols per second. Constant bandwidth irrespective of actual transmission speed.
- Powerful Forward Error Correction (FEC): High performance convolutional coding. Constraint length of 9. Viterbi decoding using soft decision point. Coding rate varies between 1/2 and 7/8.
- Intelligent data compression monitors compression ratio and self-bypasses if not being effective. Huffmann compression for English or German text. Markov (2 level Huffmann) compression. Run-Length encoding for repeated sequences.
- Limited availability. Packet modems available later. $995. Packet modems are optional at extra cost.

DSP firmware now supports audio filtering.

PacComm Packet Radio Systems, Inc.
4413 N. Hesperides Street, Tampa, FL 33614-7618 USA
Switchboard: +813-874-2980 Facsimile: +813-872-8696 Orders/Catalog Requests: 800-486-7388 (24 hr. voice mail)
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DAYTON DREAMS

by Dale Sinner, W6IWO
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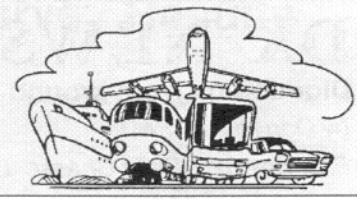

There's an old tune with words that go something like this: Have you ever seen a dream walking? Well I did. Have you ever seen a dream talking? Well I did, etc. Maybe you don't remember the tune, but maybe you have had another dream that goes something like this: You lay awake at night having this recurring dream that takes you to the Dayton Hamvention. You dream of seeing many hams you have QSOed over the years. You dream of roaming around Hara arena determined to see everything, examine every product, and turn the knobs on all the new radios. Then you browse the miles and miles of flea market to dig out those elusive little trinkets you have been trying to find for years. Wow, what a dream! You awake in a cold sweat and have trouble going back to sleep again. This dream is driving you crazy! What am I going to do, you ask yourself?

My fellow Ham, I've have the answer!

Why not make that dream come true this year? The IDRA has made it real easy for you to attend by making rooms available, scheduling famous speakers, hosting a hospitality suite, and arranging gala

dinner affairs. The IDRA even has a booth at the Hamvention. These fantastic programs are all yours. There is no charge for any of the programs, just the dinners. All you need to do, is show up. Do I have your attention?

As we have done in past years, a great dinner has been arranged. In fact, two dinners are in store; one for Friday night and then again on Saturday night. The first dinner on Friday night will be the DX and Contesters dinner which is gaining in popularity. The second dinner is our famous Digital Journal Dinner (see ad this page). Everyone who is anyone will be at this dinner. Our program for the evening will feature the famous DXer Glenn Vinson, W6OTC; our president Paul Richter, W4ZB, will speak; a door prize will be presented and there will be a few other surprises. You'll have a great time so don't miss this gala affair.

I'll bet your breaking out in a cold sweat about now. There's more. Our fabulous hospitality suite will be open both Friday and Saturday nights. Here is the place to greet and have an eyeball QSO with many of the digital gang. Swap tales, tell lies, shake some hands, greet and meet new friends, swap some more tales

and tell some more lies. We all have a good time at these gatherings. You probably will stay late because its fun. Maybe you'll plot a DXpedition right here or maybe connive to beat Jay Townsend, WS7I, in one of the upcoming contests. Are you getting excited?

Wait, there's even more. The IDRA will have two outstanding speakers for the Digital forum on Saturday at the Hamvention. To whet your appetite, we have a great speaker on the fundamentals of DSP. This session will be at the primary level. Guaranteed, upon leaving Dayton, you will be more educated on DSP.

That's just a teaser. We really have more great speakers scheduled for your enjoyment. Special technical sessions will be held at our hotel on Friday morning. The IDRA has arranged for us to hear from three different hams talking about subjects of interest to all digital hams. Details will be announced later as they develop. I'll bet you're getting excited about now.

So you say, where do I stay, etc? The IDRA has thought of all these things and made it very easy for you to attend. If you need a room, we have a block of rooms at the Radisson Inn where many of the above events will take place. All you need to do is make up your mind today, then call, FAX, or CompuServe me at the numbers at the end of this article. I'll reserve a room in your name and take care of everything for you.

Made up your mind yet? How about the cost of rooms, you may wonder? Most all the rooms have two double beds. The room cost is $86.00 per night plus tax. Should you decide to share a room with a friend, then your cost per night will be less. Now, you don't have to spend your nights at the Radisson, but it is real convenient and it is not much higher than a lot of other hotels in the area. Plus, you will not need transportation, there will be a bus available to and from the arena at no charge. Hey, what else can I say to get you excited?

Call me today and make a reservation for a room. I'll take it from there and keep you informed as things develop. If you have ever gone to Dayton on your own, you know how important these arrangements can

be. Dayton can be a mad house. Here are the numbers where you can reach me. Telephone/FAX (619) 723-3838 or CompuServe 73074.435. Now it's up to you. The ball is in your side of the court, don't drop it, do something today. Don't wait until it's to late to get a room. They do go fast and our first announcement has already filled many requests. Make your dream come true.

I'm excited! How about you?

73, de Dale, W6IWO

Digital Journal Dinner

(Sponsored by IDRA)

Dayton Hamvention
Saturday May 18, 1996
Regency Ballroom - Radisson Inn

Order tickets now for this dinner. This is the premiere dinner of the digital gang. Don't miss it. Ticket information and menu as follows:

Menu

Salad Bar
Chicken Marsala
Roast Beef au jus
Whipped Potatoes
Peas & Carrots
Bread, butter
Beverage
Dessert Table

Ticket Info

Wayne Matloch, WA6VZI
Rte 2 Box 102
Cibola, AZ 85328
Tel: (205) 857-1004

Make checks payable for $23.00 per dinner to Wayne. Sorry no credit cards.

No-host bar 6:00 to 7:00 PM
Dinner served at 7:00 PM

DX NEWS

Digi-doings from around the globe

by Don Hill, AA5AU

P.O. Box 625, Belle Chasse, LA 70037 • e-mail: aa5au@aol.com

Results of the Digital Journal Survey - RTTY's Top 10 Needed Countries

The results are in! Digital DXers have a current *Most Needed Countries* list. TG9VT conducted what may have been the very first RTTY *Most Needed Country Survey* in the January 1990 issue of the RTTY Journal. In that survey there were 17 countries tied for the top spot needed by 100% of the respondents. In the 1994 survey by W2JGR and K0RC, there were only two countries at the top of the list. They were Heard Island (VK0/H) and Yemen (7O). This year, there is a change at the top.

This year's list results from a wide variety of input from not only DJ readers, but from anywhere I could find someone who would give me their input. I received lists not only via postal mail, but from the Internet and fax as well. This survey's respondents ranged from I5FLN, needing only 3 more to have them all, to several stations that had not quite reached DXCC. There were 75 total responses, greatly up from the last survey. TG9VT's survey had a total of 101 participants. The postal service in Guatemala was not reliable at that time. Interestingly, nearly all of the input was received via Amtor back then.

This year there is only one country needed by everyone. That is North Korea (P5). Now that Pratas Island (BV9P) and Scarborough Reef (BS7H) have been officially added to the the ARRL DXCC Countries list effective April 1, 1996 for contacts made after January 1, 1995, we have three more countries to chase. There are now 329 active DXCC countries.

The survey conducted this time around proves something that has not been known before by most Digital DXers. Besides North Korea (P5), which has been activated only briefly on CW and SSB to obtain DXCC status, all other DXCC Countries have been worked on the HF digital modes, mainly RTTY.

In the second spot are Libya (5A), Yemen (7O), and Heard Island (VK0/H). Each of these countries were worked by one of three operators. W4PK, who has been on RTTY since 1959, has 5A. G4BWP has 7O and I5FLN has VK0/H. Since the 1995 5A1A CW/SSB operation has not been approved by the ARRL, there is still a big question mark about Libya. Likewise, the situation in Yemen (7O) is still not right for Amateur Radio either. The Heard Island story seems to be the main interest these days with two groups going head-on to see who will be able to pull it off. Both teams have RTTY operators. So whatever happens, the odds of getting this one in the log in the next year or so appear good at the moment.

St. Peter & St. Paul Rocks (PY0/S) is tied with Kermadec Island (ZL8) for the third most needed country. The last effort to PY0/S in '94 was cut very short due to the generators getting wet during landing. A full-scale ZL8 operation has been announced. Several New Zealand hams plan on activating this rare island in May 1996 signing ZL8RI. The DXpediton is scheduled for 11 days from May 4 to May 14, 1996. Ron, ZL2TT, confirmed that he and one of the JA operators will handle the RTTY chores. I hope we all go to Dayton with this one in the log.

Bhutan (A5) sits alone in 4th place. Jim Smith, VK9NS, has been trying to get this one on the air with frequent visits. He has operated as A51JS briefly in the past year or so, but not on RTTY. Should he be successful in his efforts, we may see this one come up on Digital in the near future. There is also word out of Japan of a possible trip from there as well.

Jim Smith is also involved with one of the countries listed in the 5th spot. That is Macquarie Island (VK0/M). The only ham on Macquarie in early '96 has been Warren, VK0WH. Jim is his QSL manager and has helped Warren to handle the massive pileups he had on CW and SSB. Unfortunately, Warren has no RTTY gear. Kerguelen Islands (FT8X) is tied with VK0/M. Two French operators were reported to be on Kerguelen with RTTY gear. Keep your eyes and ears open

Number 6 on the list is Andaman & Nicobar I. (VU/A). There has been no RTTY operation from these islands in a long time. Perhaps further into the upcoming sunspot cycle we will get our chance. It doesn't look good for this year.

Next is Crozet I. (FT8W) and Trindade (PY0/T), tied for 7th position. It would be nice if one of the groups vying for Heard I. could activate Crozet I. during their trip. There was news in early February that PY1UP was heading to Trindade for 3 months. An E-mail was sent to the source of that announcement asking about RTTY. A prompt reply was received saying there was too little time before he set sail to obtain gear and training on how to operate it. What a pity! Most of us need that one.

Pagalu Island (3C0) stands alone in 8th place. This country ranks high on the other modes, especially on the WARC bands. This one is ripe for a DXpedition. Be ready, it just might happen. And it might include RTTY. Stay tuned for details if they surface.

Central Kiribati (T31) is 9th. The last known RTTY operation from Central Kiribati was T31AT in June 1985. There are two teams wanting to put this one away on RTTY. Good luck to both of them.

Rounding out the top ten are Bouvet (3Y) and Auckland & Campbell I. (ZL9). Although there was a Russian plan to activate Bouvet, nothing has been reported about that proposed effort. A ZL9 operation this year seems as remote as it's location. But anything could happen in DXing.

Thanks to the following operators for supporting this survey (in order received): AA6TY, W2UP, W6OTC, W2JGR, N4VZ, AE5H, W6JOX, W1VXV, N4CC, WB2CJL, W4EEU, WB4UBD, KI4MI, AA9DX, W4VQ, W1EW,ZS6EZ, KF2OG, K9UQN, W5HTY, W5ZPA, AA4M, WB6AFJ, WD6L, NJ7H, N3UN,

(Cont'd on page 14)

Digital Journal Most Needed Countries Survey Results

%	Prefix	Country
100	P5	North Korea
98	5A	Libya
98	7O	Yemen
98	VK0/H	Heard Island
92	ZL8	Kermadec Island
90	A5	Bhutan
90	PY0/S	St. Peter & St. Paul Rocks
84	FT8X	Kerguelen Islands
82	VK0/M	Macquarie Island
82	VU/A	Andaman & Nicobar
80	FT8W	Crozet Island
80	PY0/T	Trindade & Martim Vaz
78	3C0	Pagalu Island
77	T31	Kiribati, Central
74	ZL9	Auckland and Campbell
73	EP-EQ	Iran
70	3Y	Bouvet
70	9N	Nepal
70	VU/L	Laccadive Islands
69	FT8Z	Amsterdam & St. Paul
66	TT	Chad
66	XW	Laos
65	JX	Jan Mayen
64	KH4	Midway Island
61	TI9	Cocos Island
60	1S	Spratly Island
60	KH5/K	Kingman Reef
60	ST	Sudan
60	ZS8	Prince Edward & Marion
58	3A	Monaco
58	A6	United Arab Emirates
58	KH5/P	Palmyra & Jarvis Island
58	T33	Banaba (Ocean) Island
58	TN	Congo
57	ST0	Southern Sudan
57	VK9/W	Willis Island
57	YA	Afghanistan
56	FR/T	Tromelin Island
56	OJ0	Market Reef
56	XY-XZ	Myanmar (Burma)
54	3D2/R	Rotuma Island
54	JD1/M	Minami Torishima
53	3X	Guinea
53	7T-7Y	Algeria
53	VP8/S	South Sandwich Islands
52	3B6,7	Agalega & St. Brandon
52	S7	Seychelles
52	ZK3	Tokelau Islands
50	8Q	Maldive Islands
50	ZD9	Tristan de Cunha & Gough.
49	3B9	Rodriguez Island
49	FW	Wallis & Futuna Islands
49	VK9/C	Cocos Keeling Island
49	YK	Syria
48	CY0	Sable Island
48	HK0/M	Malpelo Island
48	SV/A	Mount Athos
46	9U	Burundi
46	D4	Cape Verde
46	EL	Liberia
46	S2	Bangladesh
45	FH	Mayotte
45	TJ	Cameroon
45	VK9/X	Christmas Island
45	VP8/G	South Georgia Islands
45	ZK1/N	Cook Islands, North
42	3D2/C	Conway Reef
42	4J-4K	Azerbaijan
42	A9	Bahrain
42	FO/C	Clipperton Island
42	J5	Guinea-Bissau
42	T5	Somalia
42	XU	Kampuchea (Cambodia)
42	YI	Iraq
41	4P-4S	Sri Lanka
41	KH7	Kure Island
41	KH8	American Samoa
41	KH0	Mariana Islands
41	TL	Central Africa
40	3V	Tunisia
40	5V	Togo
40	AP-AS	Pakistan
40	YJ	Vanuatu (New Hebrides)
38	1A0	Sov. Mil. Order of Malta
38	3W/XV	Vietnam
38	9M2,4	West Malaysia
38	GD, GT	Isle of Man
38	KP5	Desecheo Island
37	EX, UM	Kyrgystan
37	FR/J/E	Juan de Nova & Europa
37	KH9	Wake Island
36	3Y/P	Peter I Island
36	A7	Qatar
36	JD1/O	Ogasawara
36	KH1	Baker and Howland
36	T30	Kiribati, Western
36	ZB2	Gibraltar
36	ZK2	Niue
34	3C	Equatorial Guinea
34	4J1	Malyj Vysotskij Island
34	5H-5I	Tanzania
34	5R-5S	Madagascar
34	9V	Singapore
34	BV	Taiwan
34	EK, UG	Armenia
34	FR/G	Glorioso Island
34	H4	Solomon Islands
34	KC6	Belau/Palau (West Carolina)
34	SU	Egypt
34	VK9/M	Mellish Reef
34	XT	Burkina Faso
33	3B8	Mauritius
33	5T	Mauritania
33	CE0X	San Felix & San Ambrosio
33	E3	Eritrea
33	KH3	Johnston
32	4K2, UA1	Franz Josef Land
32	HQ-HR	Honduras
32	T2	Tuvalu
32	TR	Gabon
32	V8	Brunei
32	VK9/N	Norfolk Island
32	YS	El Salvador
30	3D2	Fiji Islands
30	C2	Nauru
30	C3	Andorra
30	EY, UJ	Tajikistan
30	FK	New Caledonia
30	KP1	Navassa Island
30	UJ-UM	Uzbekistan
30	ZL7	Chatham Island
29	5B	Cyprus
29	5U	Niger
29	9M6,8	East Malaysia
29	HS	Thailand
29	OX	Greenland
29	P2	Papua New Guinea
29	VP8/O	South Orkney Islands
28	CE0Z	Juan Fernandez Island
28	D6, FH8	Comoros
28	ET	Ethiopia
28	FP	St. Pierre & Miquelon
28	FR	Reunion Island
28	VK9/L	Lord Howe Island
28	VP8/H	South Shetland Islands
28	VU	India
28	ZC4	British Sov. Bases Cyprus
26	9L	Sierra Leome
26	DU-DZ	Philippines
26	FY	French Guiana
26	HZ	Saudi Arabia
26	OY	Faroe Islands
25	7Q	Malawi
25	JY	Jordan
25	OD	Lebanon
25	V6	Micronesia
25	XX9	Macao
25	YN	Nicaragua
24	3DA	Swaziland
24	4U1/U	United Nations HQ, NYC
24	7P	Lesotho
24	9I-9J	Zambia
24	C5	The Gambia
24	SV5	Dodecanese (Rhodes)
24	TF	Iceland
22	V2	Antigua & Barbuda
22	4L, UF	Georgia
22	CY9	St. Paul Island
22	EZ, IH	Turkmenistan
22	S0	Western Sahara
22	TG, TD	Guatemala
22	VS6	Hong Kong
22	XF4	Revilla Gigedo
22	Z3, 4N5	Macedonia
21	ZK1/S	Cook Islands, South
21	5N-NO	Nigeria
21	FO	French Polynesia
21	JW	Svalbard
21	KC4	Antarctica
21	KH2	Guam
21	PY0/F	Fernando de Noronha
21	S9	Sao Tome & Principe
21	SV9	Crete
21	T9, 4N4	Bosnia-Herzegovina
20	V4	St. Kitts & Nevis
20	9H	Malta
20	9X	Rwanda
20	EA9	Ceuta and Melilla
20	EI-EJ	Ireland
20	HC8	Galapagos Island
20	HV	Vatican City
20	J3	Grenada
20	JT-JV	Mongolia
18	KG4	Guantanamo Bay
18	5Y-5Z	Kenya
18	6Y	Jamaica
18	A4	Oman
18	CE0A	Easter Island
18	GU, GP	Guernsey
18	HL	South Korea
18	J7	Dominica
17	TK	Corsica
17	5X	Uganda
17	9Q-9T	Zaire
17	BY, BT	China
17	C8-C9	Mozambique
17	CP	Bolivia
17	D2, D3	Angola
17	EU-EW	Belarus
17	J6	St. Lucia
17	PZ	Suriname
17	TZ	Mali
17	VQ9	Chagos Island
17	VR6	Pitcairn Island
17	ZA	Albania
16	ZD7	St. Helena Island
16	9Y-9Z	Trinidad & Tobago
16	CN	Morocco
16	ES	Estonia
16	GJ, GH	Jersey
16	J2	Djibouti
16	TU	Ivory Coast
16	UA2	Kaliningrad
16	V5	Namibia
16	VP2M	Montserrat
16	VP2V	British Virgin Islands
14	YV0	Aves Island
14	9K	Kuwait
14	J8	St. Vincent
14	T32	Kiribati, Eastern
14	UN-UQ	Kazakhstan
14	V7	Marshall Islands
14	VP2E	Anguilla
13	YB-YH	Indonesia
13	8R	Guyana
13	CT3	Madeira Island
13	ER, UO	Moldova
13	FJ, FS	Saint Martin
13	HK0/A	San Andres & Providencia
13	LY, UP	Lithuania
13	T7	San Marino
13	TA-TC	Turkey
13	TY	Benin
12	VP9	Bermuda
12	5W	Western Samoa
12	6V-6W	Senegal
12	CU	Azores
12	PJ5,6,7,8	St Maarten,Saba,St. Eustat.
12	YO-YR	Romania
10	4U1/I	ITU HQ, Geneva
10	A2	Botswana
10	C6	Bahamas
10	HB0	Liechtenstein
10	IS0	Sardinia
10	OA-OC	Peru
10	OE	Austria
10	OK-OL	Czech Republic
10	VP8	Falkland Islands
9	CM, CO	Cuba
9	CT	Portugal
9	LA-LN	Norway
9	OH0	Aland Island
9	YL, UQ	Latvia
9	Z2	Zimbabwe
9	ZD8	Ascension Island
9	ZF	Cayman Islands
8	8P	Barbados
8	9G	Ghana
8	A3	Tonga
8	EA6	Balearic Islands
8	FM	Martinique
8	HC-HD	Ecuador
8	LZ	Bulgaria
7	4X/4Z	Israel
7	GI, GN	Northern Ireland
7	GM, GS	Scotland
7	TI, TE	Costa Rica
7	VP5	Turks and Caicos Islands
7	YT-YU	Yugoslavia
7	ZR-ZU	South Africa
5	9A, YU2	Croatia
5	EA8	Canary Islands
5	HA, HG	Hungary
5	HI	Dominican Republic
5	KP4	Puerto Rico
5	OM, 4N3	Slovak Replublic
5	UA8, 9, 0	Asiatic Russia
5	UR-UZ	Ukraine
5	ZL-ZM	New Zealand
4	CV, CX	Uruguay
4	FG	Guadeloupe
4	HH	Haiti
4	HO-HP	Panama
4	KL7	Alaska
4	P4	Aruba
4	PJ2,4,9,0	Neth. Ant,Bonaire,Curacao
4	S5, YU3	Slovenia
4	SV-SZ	Greece
4	V3	Belize
4	ZP	Paraquay
3	HB	Switzerland
3	KH6	Hawaii
3	LX	Luxembourg
3	OF-OI	Finland
3	OZ	Denmark
3	SA-SM	Sweden
3	UA1,3,4,6	European Russia
1	CA-CE	Chile
1	GW, GC	Wales
1	JA-JS	Japan
1	KP2	Virgin Islands
1	PA-PI	Netherlands
1	SN-SR	Poland
1	VK	Australia
0	DA-DL	Germany
0	EA-EH	Spain
0	F	France
0	G	England
0	HJ-HK	Colombia
0	I	Italy
0	K,N,W,A	United States
0	LU	Argentina
0	ON-OT	Belgium
0	PP-PY	Brazil
0	VE, VO	Canada
0	XA-XI	Mexico
0	YV-YY	Venezuela

Digital Hints, Tips & Operations

Information to help you get the most out of your time in the shack

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HIGH FREQUENCY PERFORMANCE OF TWO DIFFERENT PACTOR SYSTEMS

A series of tests of the *HF* performance of two different Pactor systems began in early 1995 in order that information could be obtained on these systems which have major differences. A message was sent out on the AF Mars Packet Network, asking if any other member had the software Pactor system and a response was received from another Member in Kansas. This member agreed to participate in testing the data speed of both the Kam Plus and the second system.

This investigator initiated an expanded series of tests on *hf* in a four months period in 1994, of the data speeds of Pactor and G-tor, and a report of the results was published in 1995 (1). The *hf* data speed of every radio communication system is dependent upon the signal to noise ratio and also the propagation conditions in the path between the two linked stations. In the case of the Pactor mode, it has been determined that there is significant difference in data speed at low signal levels depending upon the Pactor system used.

An interference free frequency has been available in 1995 and thus an expanded test has continued with another objective, that is to compare different systems. The mode was Pactor and the different systems used for the first test series was a KAM sending files to a second KAM. The speed was then compared to the second system, which used the G4BMK software program BMK-MULTY (2).

Two members of the Air Force Military Affiliate Radio System (MARS) transmitted on a High Frequency, approximately 7.9 MHz to conduct the tests. Operating on the MARS frequency allows the tests to be run free of the kind of interference found on the regular amateur bands. This then provided a means to determine the data speed differences due to the type of Pactor systems used.

Two tests were run each day, the first at 9 AM Eastern Time and the second at 9 PM Eastern Time. A file was sent from the Mars Member in Kansas to this Member in New Jersey using a KAM TNC at each location. The time required to complete the file transmission was determined with a stop watch. Both stations then changed to the software Pactor system and the file was sent a second time. The next day, the same test was run again, but the systems were reversed, that is the software system was used first and the KAM test was run second. This was done to remove some of the uncertainty due to changes in propagation noted during the earlier tests.

The software Pactor program requires a modem to change the two tones to RS-232 type dc voltages and this was accomplished with older terminal units used for RTTY. These units were a Heathkit model 3030 at the Kansas Station and a Frederick Electronics Corp., model 1202R VF Telegraph Receiver at the New Jersey Station. This unit was originally a very narrow bandwidth (85 Hertz) terminal unit, that was modified to accept 200 Hertz shift. The post-detector amplifier bandwidth was also changed to pass 200 baud signals.

The resulting test data speed has been graphically shown by plotting the RUNNING AVERAGE of each system to demonstrate that short and long term *hf* Propagation causes very large excursions of the information. This displays the effect of averaging the data and indi-

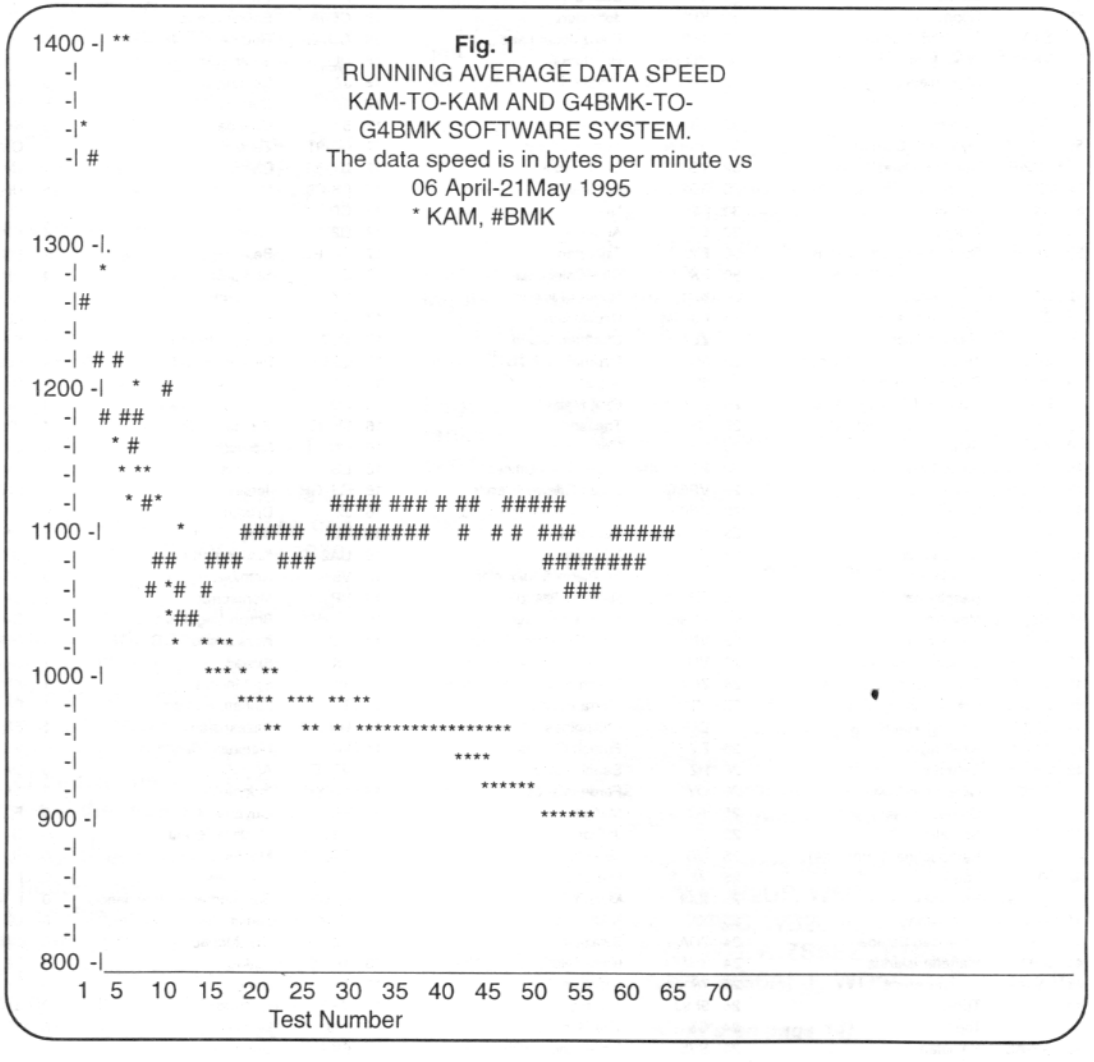


Fig. 1
RUNNING AVERAGE DATA SPEED
KAM-TO-KAM AND G4BMK-TO-
G4BMK SOFTWARE SYSTEM.
The data speed is in bytes per minute vs
06 April-21May 1995
* KAM, #BMK

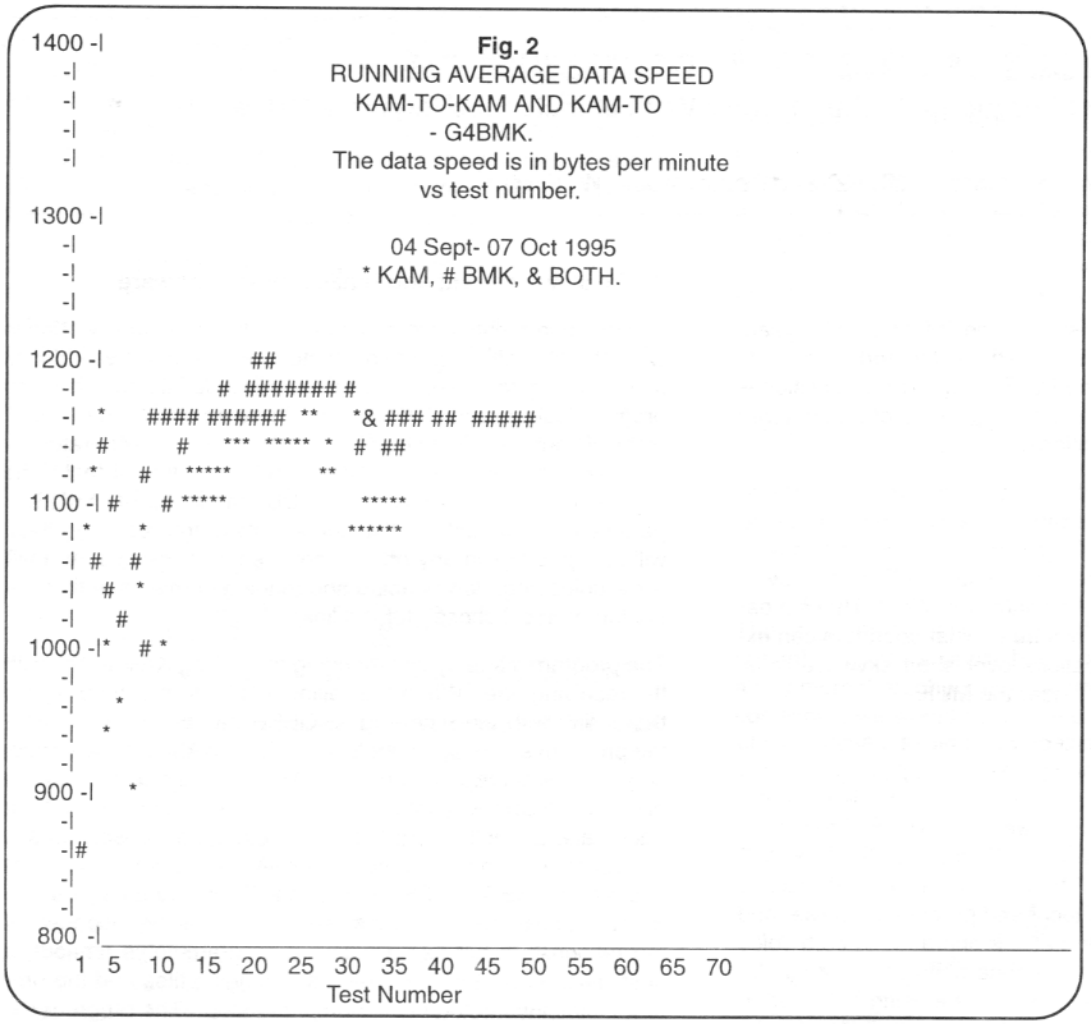


Fig. 2
RUNNING AVERAGE DATA SPEED
KAM-TO-KAM AND KAM-TO
- G4BMK.
The data speed is in bytes per minute
vs test number.

04 Sept- 07 Oct 1995
* KAM, # BMK, & BOTH.

cates the required length of each test series to provide enough information to prove useful.

In Figure 1, the use of graphs to show the data speed measurements clearly indicate that there is large scatter in the values of each data point. It demonstrates that continuing the tests for several weeks, and averaging the test data does result in greater confidence in the information obtained by the tests.

The first ten sets of data points show little correlation between the data speeds of the two systems even for the same test date. However after the 15th set of data, a much more uniform trend is shown for the remainder of the test period. As noted in the four months test of 1994, QRN is the most destructive natural cause of reduced *hf* data speeds. The very large decrease in speed shown for both modes at the beginning of the test on 6 April 1995 are the result of unstable propagation, however.

The stable data range shown from the 15th to 55th test period dates from the 22nd of April to the 8th of May 1995. The falling data speeds after the 8th of May appear to be due to QRN, since the signal strengths recorded in the data log book are not abnormally low. The BMK software average data was determined to be 17% faster then the KAM Pactor data speed. These results indicated that the weak signal performance of the commercial demodulator was substantially better then the demodulator in the KAM.

In Figure 2 it shows somewhat similar results at the very beginning of the test, with widely scattered data points. Beginning with the tenth test, the plotted data again begins to smooth out, due to the averaging effect. However in this series of tests there is very much less data speed difference between the KAM/KAM and the KAM/G4BMK tests. Based on the average data speeds at the end of the test, the G4BMK software system is 8 % faster then the KAM speed. It should be noted, however, that this second test did not use the software system both ends of the transmission path.

The major difference in this test is the use of a simple demodulator circuit, consisting of two 88 mH toroids tuned to the Mark and Space frequencies. Diodes are used to rectify the audio tones, and the *dc* voltages

then amplified in a two stage operational amplifier. The purpose of this test was to determine if a very simple demodulator, using a *dsp* filter on the input of it, would equal or surpass the performance of the unit used in the first test. The *dsp* filter was the 1992 version of the W9GR kit published in QST. (3) The arrangement of a very simple demodulator and a very sophisticated Digital Signal Processor did not result in a better performance than the first test, using the commercial telegraph unit. This converts the audio tones to approximately 18 Khz, then filters at that frequency, limits the signals and finally uses a discriminator to obtain the DC voltages needed. These voltages are then passed through two stages of operational amplifiers to increase the voltage levels.

These two test programs made use of the KAM/KAM data speed results each time with the object of having a REFERENCE data speed to increase the accuracy of the comparison. The High Frequencies show very large changes in path loss and distortion that requires a substantial number of data speed tests that then must be averaged to obtain useful data.

The scheduled series of Pactor tests have continued and wont be completed until early in 1996. Presently, the testing program has been changed to determining the elements of the demodulator used with the BMK software program which are important in improving the data speed results. It is expected that a final report will be written in 1996 which details all the results of these tests and possibly have some recommendations on those elements of a demodulator that contributes to improved performance with *hf* Data Signals.

I wish to acknowledge the dedication of Conrad Steinel, K0UER/AFA3VP Emporia, Ks. in actively participating in this extensive test program. It is expected that he will have sent more then three million bytes of ascii text files by the time this extended Pactor evaluation has been completed.

1. Data Speed Tests of *HF* Pactor and G-tor Modes. Packet Status Register, TAPR, Spring Issue # 58

   Data Speed Tests.
   Digital Journal, International Digital Radio Association, Vol 43, July 1995, Number 7

2. Spheretron/Schnedler Systems
   P.O.Box 5964, Asheville, NC 28813

3. QST, Sept. 1992.
   Low-Cost Digital Processing for the Radio Amateur. Dave Hershberger, W9GR.

On-Air Measurement Comparisons

of HF TOR and Packet Throughput - Part 1: Near Vertical-Incidence-Skywave Paths

Combined research by:
Ken Wickwire (KB1JY), Mike Bernock (KB1PZ) and Bob evreault (W1IMM)

1. Introduction

There has been much discussion in the last couple of years about the relative merits of the new HF digital modes, such as PacTOR, GTOR, CLOVER and PacTOR II. The discussion—sometimes informed and sometimes not—has often centered on throughput in various conditions.

In these discussions of HF throughput it is common * for operators to refer to measurements made over "standard" one-hop skywave paths; that is, fairly long paths on which fading (and resulting inter-symbol interference) is usually slight, and average signal-to-noise ratios are comparatively high. These measurements paint an optimistic picture of what operators can expect in day-to-day communications over short skywave links, and those not always operated near the MUF.

In this paper we report on an extensive series of measurements of AMTOR, PacTOR, GTOR and packet throughput (in characters/s and characters/s/Hz) made over near-vertical-incidence-skywave (NVIS) paths using software specially written to automate measurement and statistical analysis of results. The NVIS paths studied, which are from 25 to 200 miles long, frequently display strong multipath, high local and propagated noise, and strong interference from other stations operating in both voice and digital modes. (Horizontal antenna polarization at all stations allowed us to be fairly certain we were using NVIS rather than surfacewave propagation, and this was confirmed by the fading we observed most of the time.) With the sunspot number hovering around ten, the maximum usable frequency on our links has also been dangerously close to (and probably sometimes below) our operating frequencies, especially at night.

All the stations in the tests have Kantronics KAMs with software versions that allow them to run in the three TOR modes, in addition to HF packet. All measurements were made using transmitter output of around 100 watts, and all stations used sloping longwires or dipoles. These setups can be viewed as reflecting average station capabilities. For the TOR modes, we used the KAM's default values for the various baud-rate-adjusting parameters (GTTRIES, GTUP, etc.). For packet, we fiddled with PACLEN, MAXFRAMES AND HBAUD to increase throughput (see below).

The majority of measurements were at 3.606 MHz LSB, with some at 7.085 MHz LSB and 1.815 MHz LSB. They were made over all daylight hours and also in the evening, after dark; a few were made in the middle of the night. Interference usually prevented throughput tests from about six to ten in the evening (2300Z-0300Z) on 3.606 and 7.085 MHz. The tests covered the period from September, 1995 to January, 1996.

The rest of the paper describes the measurement and statistical analysis software, the paths between stations and layout of antennas, a statistical summary of the data, a discussion of the statistical results and concluding remarks.

2. The Measurement and Data-analysis Software

Our measurements were automated by two programs written in C for the Macintosh operating system (PC versions would look similar except for the different I/O calls to a serial port). The first program, called kamTORtest.c, runs throughput tests in AMTOR, PacTOR and GTOR, usually one after the other, separated by about 20 seconds. At the start of TOR throughput tests, the receiving station is in the TOR STANDBY mode, with its ARQBBS parameter set to ON. In this configuration, the receiving KAM will accept a link in any one of the three TOR modes, and will allow uploading, downloading and reading of message files using the protocol chosen for the link.

The program starts by commanding the calling KAM to link with the receiving one. When the calling KAM informs the program that a link with the receiving ARQBBS has been established, the program sends commands to the local KAM to send a message, enter its subject, upload an ASCII text file, send an end-of-message symbol (Cntrl-Z) and disconnect from the BBS. In each case a function in the code called chkresponse() parses the serial-port input from the local KAM for the appropriate response ("LINKED", "MESSAGE SAVED", etc.) and passes program control to the next step as soon as it finds the response. If the response is not found before a programmable timeout, a notification is sent to the screen and logging files and the program continues to the next appropriate step. The program deduces from the type of TOR call being made what prompts to look for, and what responses to send.

As the program runs, timers set by the computer's clock measure "link time," "negotiation time" and "message transfer time." Link time is the time (in seconds) between sending the link command and receipt by the program of the "LINKED TO" notification. Negotiation time is the time between sending the link command and the start of message-file transfer. Message transfer time is the time between start of character-by-character uploading of the file to the local KAM and receipt via the local KAM of the MESSAGE SAVED notification (activated by the corresponding signal from the receiving KAM).

Throughput is calculated by the program by dividing the number of characters sent by the message transfer time. Experiments suggest that a file size of about 3000 characters produces the highest throughput consistent with shortest run time, and most of our experiments involve files of that size. Note that since the message transfer time includes the few seconds needed for the receiving station to send the MESSAGE SAVED frame, our throughput measurements are slightly pessimistic from the standpoint of the file-receiving station. This is a small price to pay for completely automated measurements.

The packet throughput measurements are made by a program called kamPKTtest.c. It operates like the TOR program, with the appropriate changes to the response-checking and prompt-answering code. For packet tests, receiving KAMs are in com-

mand mode, which allows them to accept calls to their packet BBS made with the appropriate MYPBBS callsign. For many of our NVIS tests, we have used the KAM's remote access mode, which allows us to call up a receiving KAM over a VHF link between tests and change its HF receiving mode from TOR STANDBY to command (packet) mode, or vice versa. This has allowed us on many occasions to compare TOR and packet throughput at nearly the same time.

Both throughput-measuring programs write their results to "capture" files and to a common archive file. The capture files, which contain relatively detailed, time-stamped records of the most recent test, are over-written during each new test; they can be saved by renaming them. The archive file stores appended, time-stamped data in abbreviated format that can later be analyzed by the statistical analysis software. Both the TOR and packet programs write in nearly the same format to the archive file. Here's a snippet from the archive file:

Date	GMT	Call	Mode	Lt	Xt	Chr	Tpt	Nt	Huf	[Rem]
08.12.95	15:10:06	KBJY	AMTOR	2	551	3000	5.44	73	1	
08.12.95	15:14:57	KB1JY-3	PACTOR	13	176	3000	17.05	59	1	
08.12.95	15:19:14	KB1JY-3	GTOR	2	151	3000	19.87	56	1	
08.12.95	15:36:01	WIMM	AMTOR	2	523	3000	5.74	69	1	
08.12.95	15:39:23	W1IMM	PACTOR	3	124	3000	24.19	29	1	
08.12.95	15:42:47	W1IMM	GTOR	5	111	3000	27.03	45	1	
08.12.95	16:01:36	KB1PZ-1	PACKET	4	714	3000	4.20	72		[pacl=40/maxf=2/hb=200]
08.12.95	16:16:14	KB1PZ-1	PACKET	5	430	3000	6.98	318		[pacl=40/maxf=4/hb=200]

The labels after "GMT" stand for callsign of the called station, transfer mode, link time (s), transfer time (s), characters transferred, throughput in characters/sec, negotiation time (s), Huffman compression (1=ON; relevant only for PacTOR transfers) and remarks (added by hand after the data are collected). The data in the archive file are analyzed off-line by a program called summary.c. This program reads the archive file line-by-line looking for the mode string (AMTOR, PACTOR, GTOR or PACKET). As it moves through the file to the end-of-file character, the analysis program keeps running totals on a mode-by-mode basis of throughput and other data, from which it calculates statistics such as the average and standard deviation of the throughput. The statistics are printed to a summary file after the pass through the archive file. Switches in the summary code can be set to pick out specific data for analysis. (For example, we select station callsigns to distinguish NVIS from one-hop skywave data.) Since the summary program was written to analyze archive files of fixed format but arbitrary length, summaries of the data collected so far can be made at any time.

Here's the output of the summary program for all the NVIS tests run up to 29 Dec. 1995:

Statistical Summary of TOR/Packet Tests, including negotiation times:

29.12.95 12:32:42
no_amtor_links = 225, no_amtor_negotiation_times = 69
E(link_time_amtor) = 3.02 s, sd(link_time_amtor_amtor) = 3.17 s
E(xfer_time_amtor) = 473.5 s, sd(xfer_time_amtor) = 234.6 s
E(negotiation_time_amtor) = 82.8 s, sd(negotiation_time_amtor) = 30.2 s
E(no_file_chars_amtor) = 2355.3, sd(no_file_chars_amtor) = 975.9
E(thruput_amtor) = 5.20 cps, sd(thruput_amtor) = 1.13 cps, sd_mean(thruput_amtor) = 0.08 cps
max_thruput_amtor = 6.33 cps, E(thruput_amtor/Hz) = 0.015 cps/Hz
no_pactor_links = 343, no_pactor_negotiation_times = 94
E(link_time_pactor) = 5.45 s, sd(link_time_pactor) = 8.40 s
E(xfer_time_pactor) = 146.2 s, sd(xfer_time_pactor) = 90.1 s
E(negotiation_time_pactor) = 38.9 s, sd(negotiation_time_pactor) = 22.7 s
E(no_file_chars_pactor) = 2451.1, sd(no_file_chars_pactor) = 1111.3
E(thruput_pactor) = 17.81 cps, sd(thruput_pactor) = 5.49 cps, sd_mean(thruput_pactor) = 0.30 cps
max_thruput_pactor = 25.10 cps, E(thruput_pactor/Hz) = 0.046 cps/Hz

no_gtor_links = 334, no_gtor_negotiation_times = 75
E(link_time_gtor) = 5.54 s, sd(link_time_gtor) = 10.32 s
E(xfer_time_gtor) = 120.1 s, sd(xfer_time_gtor) = 95.9 s
E(negotiation_time_gtor) = 59.0 s, sd(negotiation_time_gtor) = 31.0 s
E(no_file_chars_gtor) = 2530.3, sd(no_file_chars_gtor) = 1582.4
E(thruput_gtor) = 23.49 cps, sd(thruput_gtor) = 10.05 cps, sd_mean(thruput_gtor) = 0.55 cps
max_thruput_gtor = 44.12 cps, E(thruput_gtor/Hz) = 0.053 cps/Hz

no_packet_links = 161, no_packet_negotiation_times = 83
E(link_time_packet) = 8.94 s, sd(link_time_packet) = 10.73 s
E(xfer_time_packet) = 592.2 s, sd(xfer_time_packet) = 387.5 s
E(negotiation_time_packet) = 114.4 s, sd(negotiation_time_packet) = 71.7 s
E(no_file_chars_packet) = 2369.8, sd(no_file_chars_packet) = 1122.4
E(thruput_packet) = 4.96 cps, sd(thruput_packet) = 3.17 cps, sd_mean(thruput_packet) = 0.25 cps
max_thruput_packet = 17.34 cps, E(thruput_packet/Hz) = 0.012 cps/Hz

There are fewer negotiation times than links in these data because we started calculating negotiation times after the measurement campaign was already underway. The symbols E() and sd() stand for the expectation (average) and standard deviation of the measurement in parentheses. The standard deviation of a set of statistical measurements reflects their spread about their average. Roughly speaking, about two-thirds of a set of measurements will be within one standard deviation of their mean and over 90% will be within two standard deviations of their mean.

In the case of the four throughputs, we have also calculated the "standard deviation of the mean" (sd_mean) of the throughput (in characters per second) and the average throughput per Hertz of signaling bandwidth. The standard deviation of the mean (equal to the standard deviation of the throughput divided by the square root of the sample size) is an assessment of the variability of the mean itself (which has its own statistical variability). The sd_mean's above suggest that our sample sizes are big enough to give us pretty high confidence that if we collected many more throughput measurements under roughly the same conditions, we would not get average throughputs that differed from the ones above by more than about half a character per second.

To calculate the average throughputs per Hertz [e.g., E(thruput_packet/Hz)], we divided the average throughput by the average signaling bandwidth. We calculated the latter using the formula for "necessary telegraphy bandwidth" (from the 1992 Dept. of Commerce *RF Management Handbook*) BW = *baud rate* + 1.2 x *shift*, where *shift* for most of our tests was 200 Hz. For AMTOR, the baud rate is of course 100; for PacTOR, GTOR and packet, we used the rough average of the baud rates chosen automatically in the PacTOR and GTOR modes and manually in packet. Our estimates of these average baud rates were 150 (PacTOR), 200 (GTOR) and 175 (packet). The resulting average bandwidths were AMTOR: 340 Hz, PacTOR: 390 Hz, GTOR: 440 Hz and packet: 415 Hz.

3. Layout of Paths and Discussion of Antennas

The stations used for the NVIS tests are in Bedford, Mass. (KB1JY-3), Norfolk, Mass. (W1IMM), Derry, N.H. (KB1PZ) and Augusta, Me. (KB1JY-2). Bedford used an 80m dipole up 30 feet for most tests, and sometimes a terminated, bottom-fed 125-ft longwire pointing southwest (not, of course, ideal for these tests). Norfolk used an 80m dipole up 40 feet. Derry used an off-center-fed 80m dipole up 30 feet. Augusta used an unterminated, top-fed 125-ft longwire pointing southwest. The links (followed by lengths and rough estimates of the percentage of data collected over each link) are

Bedford-Norfolk (35 miles, 40%)
Bedford-Derry (25 miles, 30%)
Augusta-Bedford (170 miles, 10%)
Augusta-Norfolk (200 miles, 10%)
Augusta-Derry (150 miles, 10%).

All of these links run more or less north-south.

4. Statistical Summary of results

The results of our NVIS tests (as of Jan 4, 1996) are summarized in the table of statistics below. Throughputs are in charac-

ters/sec and times are in seconds. The first column gives the average throughput and its standard deviation, the average throughput per Hertz, the standard deviation of the mean throughput and the maximum observed throughput. The second column gives the number of links and the mean and standard deviation of the link time. The third column gives the number of negotiation times and the mean and standard deviation of the negotiation time. The fourth and fifth columns give the means and standard deviations of the transfer time and the number of transferred characters.

5. Discussion of Results

5.1 General Observations

Before we talk about the numbers, here are some observations on communications quality in general. First of all, one should keep in mind that we have not collected data on the fraction of tries in each mode that we were successful in linking, "negotiating" and transferring a file. Our observations, however, suggest that during most days, all three TOR modes can get files through on most tries in the absence of strong interference. When noise or interference picks up, or NOAA reports say that the ionosphere is disturbed (which happened a couple of times during our tests), AMTOR usually times out on a try (during either the linking, negotiation or transfer phases) more often than PacTOR or GTOR.

It is not uncommon under difficult conditions (especially those leading to marginal SNRs) for PacTOR to out-perform GTOR in terms of throughput, although GTOR has higher average throughput. This seems to confirm the rumor that GTOR needs high SNRs for high performance.

In the early evening, there was almost always increased interference for about an hour after 5 PM local time (2200Z) on all frequencies. This usually went away on 80 and 160m, but frequently persisted until almost midnight on 40m, where short wave broadcast interference was common. During these periods of interference it was rare to see a file transferred in any mode on any ham band. (An automatic link establishment (ALE) system, such as prescribed in MIL-STD-188-141A, could probably have found a frequency without interference.)

Statistical Summary of NVIS Throughput Data

Mode	E(thruput) sd(thruput) E(tput/Hz) sd_mn(tput) max_tput	No_links E(lnk_tm) sd(l_tm)	No_neg_tms E(neg_tm) sd(neg_tm)	E(xfer_tm) sd(xfer_tm)	E(No_char) sd(No_chr)
AMTOR	5.20 cps 1.13 cps 0.015 cps/Hz 0.08 cps 6.33 cps	226 3.02 s 3.16 s	70 82.4 s 30.1 s	473.5 s 234.0 s	2358.1 974.7
PacTOR	17.83 cps 5.50 cps 0.046 cps/Hz 0.30 cps 25.10 cps	344 5.44 s 8.39 s	95 38.7 s 22.7 s	146.1 s 90.0 s	2452.7 1110.1
GTOR	23.52 cps 10.06 cps 0.053 cps/Hz 0.55 cps 44.12 cps	335 5.54 s 10.30 s	76 58.7 s 30.9 s	120.0 s 95.8 s	2531.7 1580.3
packet	5.68 cps 3.53 cps 0.014 cps/Hz 0.25 cps 17.34 cps	197 8.73 s 10.48 s	119 102.7 s 66.9 s	556.7 s 367.6 s	2484.9 1043.1

Our packet throughputs have gradually increased as we have learned more about the parameter settings that work best on NVIS packet. In fact, we have recently achieved average packet throughputs 20-30% higher than AMTOR throughputs, although not as high as PacTOR or GTOR. The parameters we have adjusted to do this are HBAUD, PACLEN, MAXFRAMES, FRACK, SLOTTIME, RESPTIME and PERSIST. (Since we have tried to choose frequencies and times where there is little interference, we have set PERSIST very high and FRACK, SLOTTIME and RESPTIME low for aggressive use of the channel.) These high packet throughputs have been achieved, however, *only during the day*, and by means of very frequent, manual, changes of HBAUD, PACLEN and MAXFRAMES. (Our experience with HF packet has convinced us that an adaptive protocol that adjusted those three parameters using feedback on throughput could go a long way toward polishing HF packet's tarnished reputation.)

After about 5 PM local time, packet throughput rapidly falls, and for most of the night, *no packet transfers have been possible* on 80 and 40m. IONCAP predictions for our links say that the maximum usable frequency (MUF) is around three MHz at night and no greater than about seven MHz during the day. This probably explains our low nighttime transfer probabilities on 3.606 MHz, and especially on 7.085 MHz. (Had we used an ALE system, or been able to operate on all links on 160m at night, we might have had a different story to tell.) As a general rule, outside of the daytime packet "success window," and the late nighttime "black-out," the packet transfer success rate has only been about 50% on our NVIS paths.

5.2 Discussion of the Statistical Results

The table above shows that PacTOR and GTOR average throughputs are about four and five times greater than AMTOR throughput, with packet recently overtaking AMTOR. (Remember that although we have been raising packet throughput, packet's overall *transfer probability* is much lower than those of the TOR modes.) The relatively small standard deviation of AMTOR throughput reflects the mode's restricted ability to adapt to changing conditions. Packet, PacTOR and GTOR have higher throughput standard deviations than AMTOR (in that order) in accordance with their wider scope for quick adaptation to a changing channel. (Remember that PacTOR and GTOR can automatically change data rates.)

The wide variability of packet and TOR throughput is also reflected in the relatively large differences between their average and maximum observed throughputs. (Attainment of anything near maximum observed TOR throughput—which is very close to the theoretical maximum in each case—is quite rare on NVIS links. More can probably be done using our techniques to push up maximum packet throughput, but the results would be too far from normal values to be useful guides to performance.)

There are no striking differences between average link times for the TOR modes. Packet takes, on average, at least 80% longer to link than TOR, however. Obscured by the summary is the fact that individual link times can occasionally be much greater (over a minute sometimes) than their averages.

PacTOR takes the least time on average (about 40 seconds) to negotiate a BBS upload, followed by GTOR (a minute), AMTOR (80 seconds) and packet (almost two minutes). The relatively large average AMTOR negotiation time is due in part to AMTOR's complicated negotiation protocol (callsign confirmation, etc.).

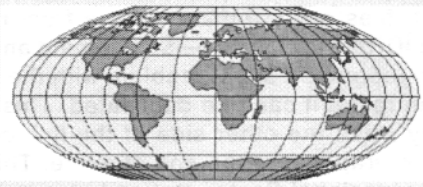
(Cont'd on page 31)

The International Scene

A regular look at happenings from around the digital globe

Received from various sources

Edited by Jim Mortensen, N2HOS



BARTG

At the committee meeting on 13th January 1996 the job of BARTG Publications Manager changed hands yet again. All BARTG publications and back issues of Datacom are now available from: Ken Godwin (G0PCA). 11, St. Lukes Way, Allhallows, Kent ME3 9PR. Please enclose an SASE. Telephone: 01634 271548.

G3/G3/G3/G3/

Peter G3IRM never ceases to amaze. In addition to his pursuit of the elusive CCW contacts, he just happened to be the second applicant to complete the "95 countries in 95" affair. For someone who "made no special effort, just operated when I pleased," that's not too shabby a record. But there is more. He is now interested in Arizona Microchip products. "These RISC chips do make life interesting and easier. It's just a question of what I can make them do. So far I have a square wave generator which isn't too bad after a few day's effort. Some of them have A-to-D converters and output lines so I have been wondering if there is a chance that a little *dsp* may be possible." No telling what we will hear next from him!

EA7/EA7/EA7/EA7/

"Hello . . . I am EA7YBZ and have owned a Clover card since November 1994. I've worked a lot of countries and, after some TVI problems with a neighbor, I've reduced the average power to a maximum of 25 watts. That's okay for a QSO with my usual friends in Europe so I hope the propagation will be better two or three years from now so I can work more people in more countries. Some weeks ago I worked Dennis VK4DAE at 2300Z on 14066 with only 20 watts and linked for at least ten minutes!!"

Pepe goes on to describe the European traffic jams around 14066, particularly the problems with Pactor MBO's on that QRG. Automatic calling seems to be at the source of the issue! (Remember, it is not legal at that QRG in the USA!). He feels that "intelligent people will go .5Hhz up or down until a clear frequency is found. Pete is QRV on Clover from 14065.5 to 14066.5 1500-2000Z.

JA3/JA3/JA3/JA3/

My old friend Taka san JA3BN dropped by via E-mail the other day. We hadn't been in touch since propagation dropped out the bottom of the barrel, but we used to be active with quite regular keyboard contacts on 15 meters. Come to find out, he now has a website on the Internet, and it is an interesting one indeed. He will take you through his shack, talk about his equipment, awards, show his log summaries (he is on every available mode) and talk about his favorite mode. It is well worth a visit. Stop by <http://www.hotline.co.jp/~tomando/ja3bn/> and get a special treat. His E-mail address is <ja3bn@mb.infoweb.or.jp>.

CP5/CP5/CP5/CP5

There is other interesting news as well. Mike CP5VW writes that the Internet is becoming available there as well at prices 'normal' people can afford. "The cost runs about $25-30 (US) per month and since there is still little competition among providers, time limits are low—5 to 15 hours per month is typical. I think that will change in time." Meantime, he is awaiting Express 3.5 to improve his BBS. We will hear more from him soon. Mike's address <mburke@ns.entel.net>.

While we think of the Internet as a phenomenon concentrated in North America, there is growing evidence that the explosion is spreading like the plague. It is said that "two-thirds of the world's population has never made a phone call." Not much longer at this rate. A good example is Benin, one of the many, many countries of the world with unreliable land line connections (unable for the most part to handle any data transmission). The French government is giving Internet service to this small country and will provide 28K speeds and unlimited time for $10 (US) per month!

The only other evidence that I can offer at this time is the deluge of E-mail received from every corner of the globe concerning the release of Express 3.5! I worked all continents in one day and didn't lift a finger beyond the mouse on my computer. Hi!

DK4/DK4/DK4/DK4/

Fred, who is currently in OH not DK reported on Express 3.5. (He downloaded the file from ON4KVI and ran some tests before receiving the airmailed disk. Though it took four hours . . . Fred is not noted for patience!). To the DOS lovers of the world, the real reason he likes the software is that "I don't have a 1 Meg hard drive in my head and I like it that I don't need to remember dozens of keystroke combinations to use this program." Translation: Fred likes Windows and his mouse.

He really likes the new Image Editor, the tuning device for the TOR signals and the expandable QSO screen among the new features. "But most important, the bug disturbing Pactor has been killed. No more link problems. It is really astonishing that such a big program has only so few bugs."

There is one confirmed bug. The picture that is supposed to pop up over the tuner when the link is made (assuming the CMP image is in your file) is not popping up. Unless other problems show up soon, that will soon be fixed in a small patch. In the meantime you may, of course, send and receive pix and view them in the image editor. Peter TY1PS reports that a few people have difficulty loading the PCC files. "All of these problems have been tracked down to either the wrong HAL files being present on the hard disk or the presence both old and new files. Get rid of the old files so you won't risk loading the incorrect one. Be sure that you have the latest HAL files! And, remember, if your serial number is less than

600, you need a special set of files." (Note: the latest HAL files are always available from HAL BBS, or from the IDRA Disk Library—$5 postpaid anywhere). One person reported a slight problem with the word wrap control feature but it can't be duplicated. This operation is used only when the other side of the link does not automatically wrap text at the end of a line. This is the case with an occasional Pactor station but is not a common situation.

RW1/RW1/RW1/RW1/

There are other ways to communicate. Fax, for instance. Sergey RW1AF enjoyed receiving an envelope full of Digital Journal's. He really enjoyed them and is looking forward to becoming a member of IDRA. Home base is St. Petersburg. Most of the note described the difficulty of making cash transfers outside the country. And, so far, credit cards are unworkable primarily because the banks demand a deposit larger than your credit line! Keep the faith, Sergey, it will all work out soon.

NEW DX MODE?

Cliff W6HDO reports in a flash bulletin that a 1600 mile 160 meter link in BPSK was confirmed on 3 February 1996. "Lyle Koelher indicated partial printing of the W6HDO (null) BPSK beacon! As before, there was no audible signal and Lyle did have to make adjustments after first noting that consistency was present in the jumbled characters he was receiving. A slight adjustment (a part of the DeCarle BPSK program) fixed that. Then the usual happened—a computer 'birdie' swept past and wiped things out. These observations seem best just before dawn at the receiving station, in this case 1200Z. Whether this is propagation or a simple lack of broadcast intermodulation is on of the items all this experimentation is all about!

"Lyle was not using exotic gear at all but rather an IC706 with a good whip and preamp in a 250 Hz filter. The key again is good frequency stability and recall. John West has shipped a sample Max Carter MAX800 receiver to Lyle for further tests."

Congratulations to all!

(Cont'd from page 6)

AB8K, N2CQ, WA4WIP, OH2LU, JF1MGI, K5KR, N5GGO, W6/G0AZT, N3KK, KB4GID, V31JU, K6WZ, I5FLN, KA5CQJ, W4PK, AB6NB, KD5ZM, KQ4QM, KD6TO, K5KLA, WS7I, SM5FUG, K0BX, G0ARF, G4BWP, OZ7GI, K4FJ, WX5L, JR2BNF, OH2BGD, 4X6UO, KF2XF, JH7QXJ, N5FG, KB3X, KB2ZP, W5VSZ, K6YUI, WB5IGF, OH3SR, N2PAQ, WB8YJF, N0FAC, KA2DFO, N2FF, VE3XJ, OH2GI, and KE6XJ. That's a fine list of Digital DXers.

Digital Doings

MADAGASCAR, 5R. Gerard, F2JD, hopes to activate this one on CW, SSB and RTTY in September. QSL via F6AJA.

UGANDA, 5X. Peter, ON6TT, has announced that he will be in Uganda from six months to two years on assignment for the UN. He will be moving around the continent and hopes to activate as many as possible of the following countries: 9X, 9U, 9Q, 5H, ST, ST0, T5, 5Z, E3, and ET. Peter only operates SSB and RTTY. He still plans on taking 2 months off from his African trip to participate in the Heard Island DXpedition. No dates on either trip yet.

THE GAMBIA, C56. DL2RUM, DL7BO, DL7DF, DL7UFR and DL7URH will operate two stations from near Banjul March 4 to 18. RTTY will be included. QSL via DL7DF.

CHRISTMAS I., VK9/X and COCOS KEELING I, VK9/C. Another group of German hams were to activate both these islands in early February. Juergen, DL7UFN, was to operate RTTY. Nothing was heard when this went to press.

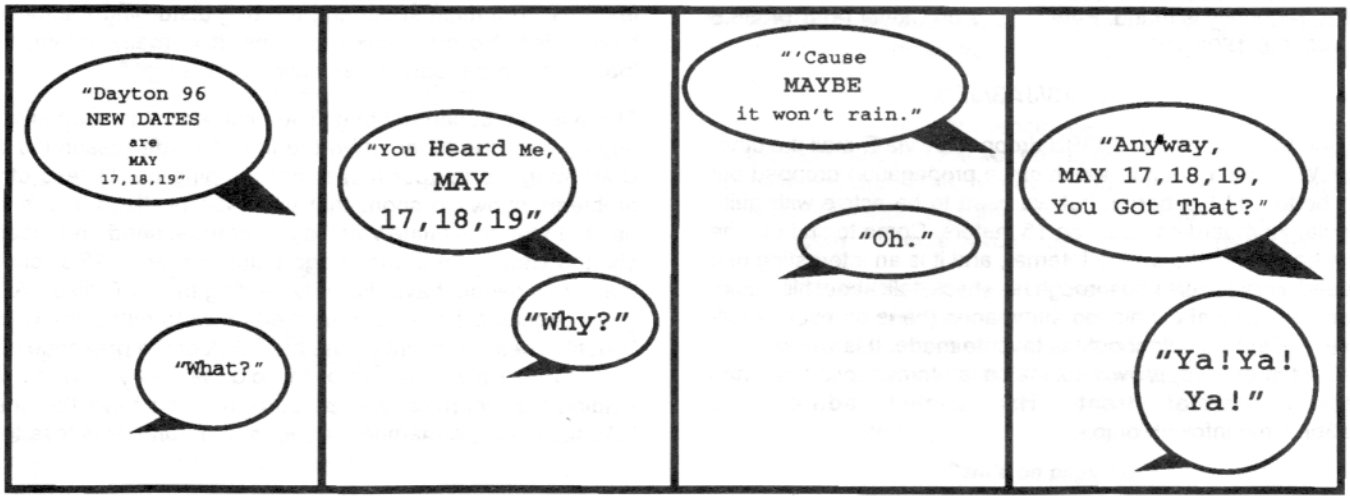
KAMPUCHEA, XU. Mike, VS6WV, has been active as XU6WV on CW. He said he hopes to be up on RTTY as soon as he gets settled in Phnom Penh later this year. QSL via Box 2011, GPO, Hong Kong.

IRAQ, YI. Starting Jan. 27, and continuing into February, there were six stations signing from Iraq on RTTY. There were YI1D, YI1FC, YI1RS, YI1US, YI1HK, and YI1ZN. It is unclear what has spawned such an increase in activity from this normally rare country. It is a pleasant surprise indeed.

Just In! Myanamar, XZ. The Central Arizona DX Association has announced a DXpedition to this rare Asian country for April 2-16. The operators will be K5VT, KC5AYR, AB6ZV, AA7NO, AA7WP, KF3AY, N7WTU, WA7MTF, WA7LNW and WY7K. Three operators have been assigned to RTTY.

See you in the pileups, 73 de Don, AA5AU

1996 DAYTON HAMVENTION



Across the Pond

Digital news from our European neighbors

Edited by Neal Campbell, ON9CNC
Internet: neal.campbell@ping.be

More Clover

I hope after last month's article some of you have been intrigued enough to tune around and possibly have a first Clover QSO. It would seem that new Clover users are appearing every day, as I am continually meeting and hearing new amateurs. This month, we will explore a couple of important topics: Clover operating practices, and digital band plans.

Let's get started!

Before getting started on Clover, the amount of information you need to understand can seem intimidating. I remember the first time I read my owners manual for my P38 card: 8PSM, phase dispersion log units, wiring diagrams and critical tuning requirements. I also remember looking for how to go from sending data to receiving data.

In order to put your mind at ease, let me say this up front: **Clover is the simplest mode to operate**. Once you establish a few operating practices, you will find that everything is very simple.

Power brokers

I love operating RTTY contests. When I am working at a really nice station running a big amp, the feeling of power can be very addictive. I was lucky enough to be at ON4UN's station during the 1995 CQWW RTTY contest. ON4UN has one of the nicest and well-designed stations I have ever seen. Running 1500 watts with his 3 element full-size 40m yagi is a thrill that can ruin returning home to your own station. As much as I covet ON4UN's setup, you can forget the amp when running Clover. Clover is so efficient during normal conditions that I regularly run less than 10 watts for QSOs with stateside on 20 meters.

Besides not needing the power, another of Clover's advanced benefits is the bandwidth requirement. Unlike Packet, Clover really can comfortably stay in a 500 Hz window. With high-powered amps, some inadvertent splatter or weak front-ends of some transceivers can prevent others from best using our very rare spectrum. If conditions are poor enough that 100 watts on both sides cannot maintain a good contact, it is doubtful that an amp will help out for long. Usually 100 watts will not maintain a link just as the band is closing down, solar activity is wiping everything out, or jamming/inconsiderate operators are claiming the territory as their own. Going high-power might give you enough time to say 73, but that is about it.

Until you have logged many contacts and quite a few hours operating Clover, leave the amp off. Most likely, the station you will be working will not have one, so you gain little by being tremendously stronger than the other guy. One of the greatest things about Clover is that you can see the signal strength of received signals by both sides of a contact. I always adjust my power to match the signal strength of the other station. Of course, hams using PCI-4000/M cards can enable auto-power control, which will allow the card to manage the output signal. Using an amp will be counter-productive to this effective feature.

Listen, listen, listen

As we all learned by reading the Handbook while waiting for your license to arrive, developing good listening skills is an important aspect of operating in every mode. I have found with Clover it is very important. As I will explore a bit later in this article, we are jammed in a very small segment of 20 meters. There are two main frequencies that everyone monitors for Clover activity: 14066.0 and 14065.5 (*lsb*). Many new Clover users listen to one of these frequencies, hear nothing for a few seconds and start sending CQ.

Most Clover users already have pretty nice stations (although it is not a requirement). I know that with a yagi with any F/B directionality, you are hearing only 10-30 degrees of the horizon. Just because you do not immediately hear a signal does not mean there is not a QSO in progress 50 or 60 degrees to the side. More often than I care to report, someone starts CQing while I am linked with another station. Depending on their signal strength, it can either be a short-term irritation or a QSO killer if they continue to broadcast CQs. Likely, no one is answering their CQ because they hear that two stations are already on the frequency.

My recommendation is to listen for a while. I always leave Express running on my computer. I tune into 14066, go downstairs get a cup of coffee, come back in a few minutes and see if any copy is on the screen. If not, I turn my antenna 30 degrees to the left and listen for a bit. If nothing is heard, I will listen 30 degrees to the right of my original direction. If its still clear, I start calling CQ. If you hear a QSO in progress and do not want to link to either once their QSO has ended, move up or down 500 Hz and start listening again.

One last request: Listen towards Europe occasionally! Many times I will monitor a QSO between two stateside stations, waiting for the opportunity to work a new state or a new Clover contact. At the end of the QSO, one station will call CQ a couple of times then go QRT. If you will point your yagi towards Europe and if propagation is at all cooperative, I am sure that a lot of DX would love to work you!

Tune in, turn on

If you read the Operator's Manual that you got from HAL Communications, they stress how important accurate tuning is to Clover. I have found that their advice is a bit overstated. Another great feature about Clover is that it always shows you how much you are off-frequency from the other station. When tuning to a station already linked with someone else, it is quite easy to get within 10 Hz by using the tuning indicators included with most programs.

If you are tuning and see a CQ appear on your screen and the station doesn't continue calling long enough for more adjustment, it is likely that a good contact is still possible with each

station 30 Hz away from each other. By all means try to get as close to the other station as possible. Just don't worry about it if you are 12 Hz off. As long as the copy is good, don't worry.One thing not do, however, is change tuning while you are in a contact. It can really slow things down greatly as both sides will spend some time adjusting. When I am linked with someone, I will usually hit the LOCK button on my transceiver to prevent accidental changes. If I think that better tuning is required while linked to another station, I will often tell the other station that I am going to re-tune before doing so. This is advantageous because he might start re-tuning also, which will result in both of us walking all around the band!

Filters, DSPs and Processors

If you come from the RTTY side of digital radio as I do, you know that good, narrow and very sharp filters can be the difference between snagging that very rare DXpedition or maintaining a run frequency in a contest.

Filters can be a bit confusing on Clover. I use a Yaesu FT1000D, and with some adjustment of my shift control I can comfortably copy Clover signals with the 500 Hz filter. As Fred, DK4ZC has said, using the 500 Hz filter is more for listening comfort than ability to copy signals. HAL Communications reports that using 600 or 900 Hz filters are just as effective as a 500 Hz filter and is easier to tune. One of the reasons that this is true is the effectiveness of the DSP filters coded into the HAL firmware files. I normally use the 2.0 Khz filter unless there is a lot of activity nearby, and then switch to the 500 Hz.

One warning: I have heard reports that some filters are not very linear and could cause some distortion of the audio signal. With the complexity of the Clover audio waveform, it is possible that tight 500 Hz filters might distort the audio and nullify any advantage you might have believed gained. I would recommend monitoring Clover QSOs and experimenting before trying it out with real QSOs.

In RTTY contests, I often use my MFJ 784 *dsp* filter between the P38 card and my computer. I have yet to find a good setting that does a better job than just using the filters in the P38 firmware. Is anyone using *dsp* filters with Clover?

One last word of advice concerns usage of your transceiver's processor. HAL gives very good instructions on how to initially calibrate running Clover in your Operator's Manual. However, since Clover requires *afsk*, I sometimes forget to turn off the processor before switching to Clover. This is a big mistake! My processor (actually the compression I believe) can really distort the Clover audio. Often when I see a number in the ECC box of my Express screen for my signal, it is due to forgetting to turn off the processor. Having in on might not distort your signal, but it does at my station.

CQ CQ where are you?

Unlike any of the 'TOR modes that I have used, you do not use *fec* mode to call CQ. In Express, click on the CQ button, or type ALT-Q to call CQ. In the HAL-provided software, hit ALT-F9. Because *fec* mode is bypassed for calling CQ, you can sometimes miss hearing a station. With Pactor, G-Tor, and Amtor, *fec* broadcasts usually signify that someone is calling CQ, a link has just broken down, or a multi-station QSO is in progress. In all cases, I will stop and copy for a while to see who is there.

A Clover CQ sounds very similar to any other Clover signal, except that you will not hear another station. Luckily, Express or other Clover-friendly programs will let you know when it copies a CQ. Within Express, clicking on the Link button, or typing ALT-N will bring up a dialog box with the station's call you are monitoring already inserted. Click OK and Express will start trying to link with the other station.

There are two types of link requests with Clover: Normal and Robust. Use Robust link mode when you are trying to contact a station to which you have a very good path. I almost always use Robust link mode, because that is more reliable. Normal mode uses very short bursts of signal to establish the link.Robust mode uses much longer bursts which are always more successful.

For P38 users running Express 3.0.x, Express will only allow Normal mode link requests. This is due to a published limitation by HAL Communications that was later eliminated. Express 3.5 now allows Robust link mode for P38 users.

Suggested frequencies for listening for Clover CQs (all in *lsb*): 14066, 14065.5, 10135, 7030-7040, 7065.5, 3580-90.

How do I turn it over to you?

For those who are familiar with TOR modes, Clover can be quite a strange experience. The biggest adjustment (ignoring the increased speed, multi-data functionality of programs like Express and *fec*-less CQs) is the lack of concept of a sending and receiving station. Just as in Packet, Clover is a bi-directional protocol so that each station can send and receive information at the same time. As with your first Packet contacts, this can get a bit messy. When in chat mode, I usually adopt the protocol of waiting my turn to type, and signify that I have finished typing the exchange by signing. I see this protocol quite often, so it appears to be a common courtesy. Some stations use special characters like ">>" or "KK" to signify a handover.

It is not required to follow any protocol, however. The technology allows bi-directional communications, and if you want to use it in chat mode, its fine. If you find it confusing to either station, however, please use a handover signal.[1]

Breaking up isn't hard to do

One similarity with TOR modes is that someone must initiate a link shutdown procedure. Otherwise both stations will continue to chirp away quite happily. At the end of a QSO, one station will usually ask the other station to kill the link (or "Please l/d"). In Express, to kill the link just click the End button or type ALT-E.

We have discussed the ways and means to establishing your first Clover QSO, using Express. We will take a spin around Express 3.5 next month.

Where do we go from here?

Much discussion has occurred lately on the Clover E-mail reflector (you are a member, aren't you?) concerning band plans. Due to the price and availability of the P38 card, more hams are trying and enjoying Clover than ever before. This is great news, and this article is dedicated to urging more of you to try it. The down side to so many new users is that we have outgrown our comfortable little spot around 14066-14065. Now, it is quite difficult to find a clear spot below 14070 for a contact.

If, like me, you have tried calling CQ around 14060, you have inadvertently been stepping on the QRP CW frequency. Just like other digital allocations (tried finding a clear frequency on 2 meters lately?), conflicts can quickly develop between BBS's

and keyboard amateurs. Below 14070, there are many BBS's, using Pactor and Clover. As BBS's are supposed to do, they scan for anyone trying to connect to them, and periodically link with each other to pass mail and bulletins. There are several that regularly use 14066, which has been their tradition for many years.

Instead of developing very poor relations with other digital enthusiasts, usually resulting in massive amplifiers and occasional jamming, we must define a better way to accommodate all of our new friends.

On the Clover reflector (see below for how to join), several suggestions have been made. One prominent ham suggests no Clover sub-band, instead using 14099-14060. Another ham has suggested that we use 14066-14065.5 as a hailing frequency, find a clear spot in the 14099-14060 allocation and QSY. Another ham suggested only using 14065-14060 for keyboard contacts and leaving the 14065-14070 range for BBS's.

One thing is certain: we must find a solution. The second thing is that the solution must be a workable compromise for everyone. BBS stations have a right to be on the air, just as keyboard hams. They do not, however, have a right to the frequency if it is occupied! Nor, below 14100, do they have the right to operate automatically, at least in the USA.

What is your idea for solving this problem? Please help us find a better way!

By the way, if you are interested in joining the Clover E-mail reflector, send E-mail to: Majordomo@iea.com, and in the body of the message enter "subscribe adrs-digital" followed by your Internet address. A E-mail reflector is a way to have a multiparty discussion using E-mail. Everyone sends their comments in a mail message to the mail reflector's address. The reflector then sends a copy to all members of the reflector. Its similar to a mail repeater!

73 and see you on the bands! . . . Neal

[1] Note: more throughput is attained by ignoring such protocol. And for the slow typers of the world, the lack of a turnover protocol is a real blessing—Ed.

Good QSLing Practices

NTS . . .

The National Traffic Service

by Tom E. Housworth, N3PGG
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E-mail: n3pgg@aol.com

Hello everyone my name is Tom N3PGG. Jim N2OS asked me to write about a subject I've found very interesting during my relatively short tenure as an Amateur Radio Operator. It's called the National Traffic System or NTS.

Licensed in 1993 while living in Maryland, I was serving my last two years of a 26 year hitch in the US Navy stationed in Washington DC. I, like most service men and women, have been stationed all over the world and have floated around on aircraft carriers for a little over six years. It was during these long periods away from loved ones that RadioGrams via MARS permitted us to stay in touch. I researched joining the MARS organization but came to realize it was a little to rigid for my taste and gravitated to NTS via the Maryland Emergency Phone Net.

What a super bunch of guys! Not only did they teach all newcomers proper procedures but they embraced all modes of communication to send and receive traffic. I cut my teeth on Packet through the extensive networks on the east coast. In April 1995 having retired from the USN, I returned to my home in Missouri and rapidly became involved in NTS in the Midwest. I now am the Missouri Section Traffic Manger, run the 10th Region NTS MBO using Winlink and most recently have been appointed the Assistant Net Manager for the Central Area Net Daytime (CAND).

The remainder of my column this month will be used to give you the basis behind the NTS. This information is taken from (and used with their permission) the ARRL's Public Service Communications Manual (PSCM).

"The National Traffic System plan is a means for systematizing amateur traffic handling facilities by making a structure available for an integrated traffic facility designed to achieve the utmost in two principal objectives: 1) rapid movement of traffic from origin to destination, and 2) training amateur operators to handle written traffic and participate in directed nets. These two objectives, which sometimes conflict with each other, are the underlying considerations in the National Traffic System.

"NTS operates daily. The personnel consist mainly of those operators who, while interested in traffic handling, are unable, either through necessity or inclination, to spend more than one or two periods a week in this pursuit. Thus, NTS is a step away from the traditional 'iron man' type of traffic handling which characterized our trunk lines of yesteryear. If you can spend one regular period a week handling traffic and are interested in doing so, NTS can use you.

"The National Traffic System is an organized effort to handle traffic in accordance with a plan which is easily understood, is basically sound, and which utilizes modern methods of network traffic handling in general acceptance today. NTS is not intended as a deterrent or competition for the many independently organized traffic networks. When necessitated by overload or lack of outlet for traffic, the facilities of such networks can function as

alternate traffic routings where this is indicated in the best interest of efficient message relay and/or delivery.

"One of the most important features of NTS is the 'system concept.' No NTS net is an independent entity which can conduct it activities without concern for or consideration of other NTS nets. Each net performs it function and only its function in the overall organization. To whatever extent nets fail to perform their functions or perform functions intended for other nets, to this extent is the overall system adversely affected.

"Nets may sometimes find it necessary to adopt temporary expedients to ensure the movement of traffic, and this is considered improper operation only when no attempt is made to return to the normal schedule. Nevertheless, improper operation of any NTS net is the concern of all NTS nets, and every effort should be made to assist in returning any non-functioning or improperly functioning net to its normal operation.

MEMBERSHIP

"Individual station participation in NTS is recognized by issuance of certificates. Organizationally speaking, the 'members' of NTS are the nets which participate therein. Most of such nets were created and organized for NTS purposes only and operate at specific times for specific purposes to be described later. Procedures are somewhat specialized, particularly at Region, Area and TCC levels.

MODE

"The NTS is not dedicated specifically to any mode or to any type of emission, nor to the exclusion of any of them, but to the use of the best mode for whatever the purpose involved. The aim is to handle formal written traffic systematically, by whatever mode best suits the purpose at hand. Whether phone, CW, RTTY, Amtor, Pactor, Clover, Packet or (amateur) carrier pigeon is used for any specific purpose is up to the Net Manager or Managers concerned and the dictates of logic. There is only one National Traffic System, not separate systems for each mode. Modes used should be in accordance with their respective merits, personnel availabilities and liaison practicalities. Whatever mode or modes are used, we all work together in a single and thoroughly integrated National Traffic System."

End of excerpt from PSCM.

As you can see, the NTS if fairly well organized and the use of digital modes are welcomed! The faster the better especially with error free transmission capabilities. I suppose the real question is, does it work? For the most part yes, the California Earthquake, Hurricane Marilyn destruction in the Virgin Islands and the Oklahoma City tragedy are recent examples of moving significant numbers of messages into disaster areas. Most of this traffic is considered 'Health and Welfare'—family members from all over the world obviously want to know if their loved ones in the affected areas are alive and well. Depending on the severity of damage, electrical power may not be available which eliminates the telephone or Internet email.

In the Virgin Islands, amateur radio operators were receiving messages and giving them to a local AM Radio Station (on generator power) who would read them over the air. Most of the incoming messages arrived satisfactorily but the problem was getting responses back out. Until telephone service was re-established, most of the families on the mainland remained very worried. It seems to me that the likelihood of future Hurricanes in this area is a sure thing. If the amateurs in that area would acquire emergency generators, laptop computers, *tnc*'s, small *hf* rigs and wire antennas, they could immediately be on the air capable of receiving and transmitting digital 'Health and Welfare' messages.

The routine day-to-day NTS messages mostly consist of Holiday, Birthday or other 'Hey how's it going?' messages. These do serve a purpose though in that they keep the Nets running and serve to help identify routing problems within the system.

With most organizations, when you have human intervention, you have human induced problems. Some of these are attributed to using older computers that will only support Amtor. Don't get me wrong, it works but why drive a Model 'T' when Corvettes are readily available at a reasonable price? The premise behind forwarding messages is establishing reliable forwarding partners in the various Regions. The longer one has been in the Digital MBO business, the more forwarding partners he or she has. Here's where one of the problems begins. . . these 'old timers' have an extensive network that works for them. If you play your cards right, you're allowed to enter their system but only in a limited capacity.

In other words, they are permitted to control most of the digitally transmitted traffic. My experience was that I could only transmit and receive traffic to one of these stations. When I asked permission to start

checking into other regional MBO's that had Pactor capability, I was given an emphatic NO! The excuse was 'These guys are not part of the NTS System and will allow the traffic to be sent via Packet and it will get lost.'

When I asked permission to check into the established Amtor-only stations in order to forward directly to them, I again was told NO! In fact when I tried to check into one particular MBO in the Northeastern US, I found that I was locked out of his system. Now I ask you, are these operators concerned with moving traffic expeditiously? I'm not a rocket scientist but I'd say they're more concerned with controlling the traffic than welcoming newcomers with faster transmission capabilities and ('boo! Hiss!') new ideas.

In closing, I have found that even though the PSCM does not discriminate in their use of MODES, in the 'real world' our fellow amateurs do! A system is only as good as it's weakest link. Unfortunately the weakest link it the NTS is a few of it's self proclaimed 'NTS Only' MBO's.

Hopefully this has aroused your curiosity. Next month I will take you a little deeper into the principles of the system and walk you through the journey of one message as it moves from originator to destination.

Until then, 'Here's to you digitally' from

Tom/N3PGG

Contesting & Special Events

The latest & greatest digital contesting news

by Rich Lawton, N6GG
14395 Bevers Way • Pioneer, CA 95666

— RTTY Contests - Coming Events —

Date:	Contest:	
MAR 16-17 '96	BARTG Spring RTTY	(English)
APR 6-7	EA WW RTTY	(Spanish)
APR 27-28	SP DX RTT	(Polish)
MAY 11-12	VOLTA RTTY DX	(Italian)
JUNE 8-9	ANARTS WW Digita	(Australian)

— Reminders for Logs —

DJ WW Digi WPX (February 10-11)
Logs must be postmarked before March 13.
Mail logs to:

Jay Townsend WS7I
Box 644
Spokane WA 99210-0644

DARC HF RTTY, Part I (February 17-18)
Logs must be received by April 5.
Mail logs to:

Werner Ludwig DF5BX
Box 1270
D-49110 Georgsmarienhutte
GERMANY

BARTG Spring RTTY (March 16-17)
Logs must be received by May 31.
Mail logs to:

John Barber G4SKA
Box 8, Tiverton
Devon EX16 5YU
ENGLAND

— — COMING UP: — —

BARTG SPRING RTTY CONTEST
16-18 March 1996

Sponsored by British Amateur Radio Teledata Group.
Third full weekend in March (Ref: BARTG, G4SKA)

Contest Period: From 0200Z Saturday to 0200Z Monday (48 hours)

- Maximum operating time allowed: 30 hours for single op and SWL entries.
- Multi-operator stations may operate the full 48 hours.
- The 18 hours of rest periods may not be less than 3 hours each.

MODE: RTTY only ***BANDS:*** 80, 40, 20, 15, and 10M

CATEGORIES: 1) Single op, all band 2) Single op, single band 3) Multi-op, all band 4) Multi-op, Multi-transmitter 5) Short Wave Listener

NOTE: Categories 1, 2, and 3 may not transmit on two or more bands at the same time. No station may enter more than one category.

EXCHANGE: Send: RST + QSO number + Time in UTC.

MULTIPLIERS: Each DXCC country, including first QSO with W, VE and VK, counts as a multiplier on each band. Each call district in W, VE, and VK will count as an additional multliplier on each band. (Band mults) Also, each continent (6) will count once, not once per band.

QSO POINTS: Count 1 point per QSO. Same station may be worked on other bands. Duplicate contacts on same band receive zero points and must be clearly marked in the log.

FINAL SCORE: Total QSOs x total multipliers x number of continents (max 6)

LOGS: Use separate logsheets for each band. Logs must show: BAND, DATE and TIME (UTC), CALLSIGN, MESSAGE Sent and Received, COUNTRIES and POINTS claimed. Summary sheet must show full scoring, times of operation, and address for correspondence. Include names and callsigns of all multi-op station operators. Computer generated logs containing all specified info are welcome.

DEADLINE: Logs must be received by May 31 to qualify.
Mail logs to:

JOHN BARBER G4SKA
PO BOX 8
TIVERTON, DEVON
EX16 5YU, ENGLAND

AWARDS: Certificates will be awarded to the top 3 stations in each category, the top 5 single operators in each continent, and to the top single operator in each W/VE/VK call area. Your comments would be much appreciated. Please include them with your log.

COMMENTS: This is a 48 hour contest, but only 30 hours operating time allowed for single ops. The time off periods must be 3 hours minimum length and listed in the summary sheet. This contest gets great activity from all over the world. Try to plan your off times to be during the least productive time of day, such as when propagation does not favor your area. The fact that W/VE/VK call areas count as separate countries on each band means that CQing should be the most productive way to make a good score for the W/VE/VK ops. Also, band multipliers helps to alleviate the QRM on the high bands, by spreading out the CQers to other bands. Don't forget the WAC bonus of six multipliers.

— EA WW RTTY Contest —
6-7 April 1996

Sponsored by Seccion Territorial Comarcal De Aranda De Duero. The first full weekend in April.
(Previously was in February) (Ref: EA1MV)

CONTEST PERIOD: From 1600Z Saturday to 1600Z Sunday. (24 hours)

BANDS: 80, 40, 20, 15, and 10M (five bands)

CLASSES: A) Single op, all band C) Multi-op, all band
B) Single op, single band D) SWL.

EXCHANGE: EA stations send RST + CQ Zone + Prefix of province.

All others: sent RST + CQ Zone

MULTIPLIERS: Each DXCC Country, CQ Zone, and Spanish Province on each band. Spanish Provinces are: A, AB, AL, AV, B, BA, BI, BU, C, CA, CC, CE, CO, CR, CS, CU, GC, GE, GR, GU, H, HU, J, L, LE, LO, LU, M, MA, ML, MU, NA, O, OR, P, PM, PO, S, SA, SE, SG, SO, SS, T, TE, TF, TO, V, VA, VI, Z, ZA. (52 EA provinces)

NOTES:

1) All multipliers count once per band (Band Multipliers).

2) First QSO with EA station on each band counts as an additional multiplier, along with province.

3) CQ Zones now count as multipliers. (new this year)

4) QSOs with stations in your own country are valid for multiplier credit but have ZERO QSO point value.

QSO POINTS: On 20, 15, and 10M: Count 1 point for each QSO on your own continent, and 2 points for for the rest. On 80 and 40M: Count 3 points for each QSO on your own continent, and 6 points for the rest.

FINAL SCORE: Total QSO points x total multipliers.

AWARDS: Plate to winner in each class. Certificate to winner in each DXCC country in each class. (Must have 50 or more QSOs.)

LOGS: Use separate logsheets for each band. Include a Summary sheet to show scoring and other essential information.

DEADLINE: Mailing deadline is June 9. Mail entry to:

EA RTTY Contest Manager
Antonio Alcolado, EA1MV
P.O.Box 240
09400 Aranda de Duero (Burgos)
SPAIN

COMMENTS: This is a 24 hour contest. Note the date change. It used to be on the 2nd full weekend of February, but now is 1st full weekend in April. CQ Zone now counts as multiplier on each band (new this year). Point bonuses encourage low band operation. This contest uses band multipliers - work the same country on different band gives new multiplier. **QSOs with stations in your own country are valid for multiplier credit but have ZERO QSO point value.** Use separate dupe and multiplier sheets for each band. **Handy tip:** make an alphabetical check-off list of EA Provinces for each band. It gets confusing when changing bands.

-+- Growing Popularity of Digitals -+-

It's true. Digital modes are really flourishing. Referring to January '96 QST, Exec V.P. Dave Sumner K1ZZ, mentioned that in his "It Seems to Us" editorial, page 8: "...RTTY DXing and data modes are growing in popularity."

Most of us who are into RTTY DXing and Contesting already know this, even though propagation conditions are rather poor these evenings... not to mention these days. It is a healthy and good feeling that we in the Digitals are in the forefront of an upbeat trend in ham radio, and being recognized as such.

Some may have doubts when listening around the bands during the evenings. Sure... there are more CW and SSB signals than the digis, but the digis are difinitely gaining. If the bands are open at all, for every 5 or 10 CW sigs you hear, you'll hear 2 or 3 digitals on in their subbands. A year or so ago it seemed more like 1 or 2. And consider this: when you hear Amtor, Pactor, or Clover in QSO, that's TWO stations on the air simultaneously. Also there's lots of BBS's silently standing by on their spot frequency, awaiting your call.

And here's another point to consider: how many of you are just listening? I recall a conversation I had with famous DXer, Don Wallace W6AM, some 45 years ago. He said, "Rich, for every CW signal you hear on the band, there are 9 others listening." And, you know, he's right. And that should apply to all modes.

The curious can prove this to some extent by trying this experiment. If you can hear one signal that's more than a skip distance away, then the band is open, and an "an attractive CQ" (or 3) will, more than likely, raise someone.

There's a bunch of reasons for the attractiveness of the digital modes, and most are based on the exploding popularity of Personal Computers, and the inexplicable enchantment of keyboard/screen QSOs. For instance:

• Innovative and intriguing VHF Packet nets for DX spotting and DX chatter.

• Appealing multi-mode TNCs and software at reasonable prices.

• Explore new modes for graphics, drawings, and now even colored pictures.

• Lots of BBS stations on spot frequencies, ready for you to browse and/or leave messages, or pick up latest news on DXpeditions, addresses, etc.. Easy to down-load and print out for hard copy.

• Desire of people in DX countries to learn english, the main language in ham communication and computer software. Spelling, grammar, slang... it's all there on the digis.

• Urge of DX operators to communicate with english-speaking hams without having to become a really proficient CW artist, or, maybe being self-conscious about their possible accent while on SSB.

• Having fun hamming, while learning to touch-type on a keyboard.

• Hearing-impared hams can compete in the DX pileups or enter contests and not even have to hear a single sound. It's all on the monitor screen! You haven't lived until you've actually *seen* a massive DX pileup!

• Contesting software combines making the actual QSO with the logging, keeping score, tracking duplicate QSOs, etc., and is a perfect union of a PC, a TNC, and QSO logging. WF1B's software even goes beyond that: Just pressing the "Home" key will take a callsign on the screen and put it in the transmit window without your even having to type it! Follow that with pressing "F2" and your rig will immediately transmit his call and the exchange. CW and SSB contesting software can't do that because the call has to be typed in.

Finally, here's something else to consider: Chitchats on the digitals can be shared with your family or kids, by having them simply watch the screen as the conversation unfolds. There is a fascination with keyboard talk, and when they see the novelty of chatting with with someone in Albania, or Argentina, or Bosnia (I worked a Club station in Sarajevo in the ARRL'96 RTTY Roundup)... well, there's just nothing like it!

-+- POOR SPELLERS OF THE WORLD - UNTIE! -+-

((73)) See you in the pileups, Rich, N6GG

P.S.

Drop me a line with an idea to share,
Or, drop me a line with an item to air.
Drop me a line with anger to bare...
But don't drop ME... 'cause I care!

The Contest Chair

Hints, Tips, Techniques & Inspiration for better scores

by Ron Stailey, AB5KD
504 Dove Haven Dr. • Round Rock, TX 78664 • Internet: ron481@austin.email.net

Hello Contesters and DXers. It's March again and time for the BARTG contest. The last of the Big Three: Roundup, WPX and BARTG, or that's what I call them anyway. BARTG is considered by many to be Europe's best, it is definitely a true classic in RTTY contesting. Normally there are lots of DX stations on to add to your DX count. I hope to see all of you in the pile.

From the looks of things the FCC is going full speed ahead with the Vanity callsign program. I see messages on the local DX cluster of people receiving their Form-610Vin the mail. I remember back in '76 when only Extra class could get a 1 X 2 call. The NCJ, a fairly new magazine back then, started a Who's Who column. They first their listed the old call and then their new call. Example: WB5IZN - K5TM. I would like to see this done again, so everyone will know who everyone is. When the vanity callsigns get rolling, send me a note with your old and new call in it. We will have a list every month in the Digital Journal. You can reach me via Internet-<ab5kd@easy.com>, vhf packet-<ab5kd@w5syt.#aus.usa.na> or snail mail, call book address.

It's just two months until the Dayton Convention. We are going to have the 2nd annual Contesters/DXers dinner on Friday night again this year. We have a nice program lined up this year, with another fantastic dinner to go along with it. The doors will open at 6:00pm with a cash bar. Dinner will be served at 6:30 sharp.

The dinner this year will be:

Chicken Cordon Bleu
Boneless Breast of Chicken
Stuffed with Center Cut Ham,
Swiss and Cheddar Cheese
Served with Rice Pilaf,
Baked Potato, Warm Bread, and Beverage.

The price, including tip is a mere $19.00, along with the after dinner program. Dinner tickets are ready for your order now.

The After Dinner Program:

By popular request, Ray Ortgiesen WF1B, will M.C. the program again this year. Ray seems to have that special knack to make the program move along smoothly.

Our First Speaker: Rick Davenport KI1G, operator of K1NG during CQ/DJWW RTTY Contest. Rick attempted to set a new world record in Single Operator Assisted category (SOA). Not only did he attempt it, he didn't even leave the USA to set a new World record. Every year someone attempts to break a North American or USA record, very few ever set a new World record from the USA. Rick is a true contester in ANY MODE. He will have a slide show and talk about the contest. His presentation will be one we can all learn from.

Our Second Speaker: Jay Terleski WX0B, will talk about stacking antennas-single tower and double tower contest stations. Jay is an antenna expert in any language. I'm sure some of you use his antenna stack match sold by Dunestar. If you have ever planned on stacking antennas, whether mono-banders, tribanders or just plain old wire antennas, he can sure help improve your contest scores, or add to your DX count. You sure don't want to miss Jay's talk and slide show.

Our Featured Speaker: Tony Deprato WA4JQS / VP8BZL / VP8SSI / 3Y0PI, will talk about past and FUTURE DXpeditions. He promised to fill us in on what happened to the RTTY gear at Peter-I. Tony has several original VP8SSI / 3Y0PI original Tee-shirts just like the ones the operators wore at Peter-I. The dinner tickets will be numbered and we will have a drawing for these Tee-shirts. They should be a real collectors item. Tony will also have a slide show along with his presentation.

Awards Presentation:

Plaques will be presented for both CQ/DJWW'95 and WPX'96 contests. It should be an interesting evening, from start to finish. We have a full schedule for the Contesters/DXers dinner. One I'm sure you will enjoy. I don't think you will find anything in Dayton that's better than this line-up for Friday night. I have made arrangements for larger accommodations if necessary. We need to know our approximate size as soon as possible. Please make your reservations as soon as you can.

This month we are going to hear from Dan Hearn N5AR, Dan is an Electrical Engineer. He retired from ARCO (Research Dept.) some 10 years ago. He was a featured speaker on Receiver testing at the ARRL National Convention in Arlington, Texas in '89. He has made several talks at Ham-Com over the years. Be sure to read Dan's (Strong Points: and Needs:) of each radio tested. It's quiet possible Dan can give you some ideas of which radio you want to purchase next time around.

Receiver Noise and Dynamic Range

by Dan Hearn N5AR

Note: MDS is same as "noise floor." All measurements made using 500 Hz filter

Omni VI MDS = -141 dbm
FT-1000MP MDS = -141 dbm
IC-775*DSP* MDS = -142 dbm
TS-870S MDS = -144 dbm

Dynamic range is measured using 20*Khz* spacing. ARRL and most experimenters use 20*Khz* also. The manufacturers may use any spacing. I have seen spacings between 50*Khz* and 160*Khz*. I do not believe any of them use 20*Khz*. They seem to choose whatever spacing gives them a good number, hi!

Omni VI D.R. = 98 db
FT-1000MP D.R. = 103 db
IC-775*DSP* D.R. = 96 db
TS-870 D.R. = 100 db

Third order intercept point may be calculated. It is 1/2 the dynamic range minus the 2 tone overload signal.

Omni VI I.P. = + 6 dbm
FT-1000MP I.P. = + 14 dbm
IC-775*DSP* I.P. = + 2 dbm
TS-780 I.P. = + 6 dbm

NEW RADIO CHECK POINTS

1. How does it change bands? Single button? Easy or clumsy?
2. What do the memories store? Frequency? Mode? Filter

3. Does it have variable pitch for *cw*? Coupled sidetone? Is it single knob or up/down push buttons? Do you have to go into a memory every time you want to change it?
4. Is there a built in tuner? Can the tuner memorize control setting for various frequencies. Does it automatically use these settings as you change bands/frequencies?
5. How is *dsp* used? Auto notch? Auto APF? Variable high cut/low cut transmitted audio? Receive audio? Noise Processor..? Digital PST SST? Can only one *dsp* function a time be used? How difficult is it to switch between functions?
6. How are filters selected? Can you access any filter you want in any mode?
7. Is operation of the radio easy explained to guest operators for multi contest operations?

Omni VI TESTS and FEATURES
SN-09A10564

Transmitter:
PA:100w; bipolar transistors; SWR meter; Speech Processor-audio Type; *cw* Pitch, coupled sidetone; QSK - fast and slow, delay time adjustable 1/15ms; No clicks or thumps in receiver.

Receiver:
Band select PB's have 2 memories per band i.e. 3505*Khz*; *cw* mode, 500hz filter, RIT/XIT setting and 3795*Khz*; *LSB*, 1.8*Khz* and RIT/XIT; covers only ham band frequencies with overlap; Pass Band Tuning; RIT/XIT range +/-9.99*Khz*; AGC 2 position-fast and slow; auxiliary antenna input; most of PB switches have indicator lights; filter selection is by PB switches labeled 2.4, 1.8, 0.5, 0.25, and NAR; filters available for the 6.3*Mhz* IF are 2.4, 1.8, 0.5, and 0.25 BW; filters available for the 9*Mhz* IF are 1.8 and 0.50 (only one may and it is selected by the NAR PB; there is room for a maximum of 4 filters in the 6.3*Mhz* IF (this may sound complicated but, actually, it is simple. There is a row of 5 push buttons and you just push the one for the selectivity desired).

***DSP* Applications:**
An automatic notch filter for carrier (s) nulling; digital LPF for *cw* with cutoffs at 600, 800, 1000,1200, and 1400Hz; programmable offset *cw* transmission.

Digital Interface:
25 pin D connector with standard serial cable to computer; interface electronics provided in radio; output simulates ICOM 735 but has additional capabilities; *baud* rates can be 1200 up to 19,200.

Strong Points:
Very low composite noise on L.O. system; excellent QSK system for *cw*; legendary customer service.

Needs:
Lacks many features included in recent radios in the same price range.

ICOM 775-*DSP*
SN-01038

Transmitter:
PA: 200w. 28 volt field effect transistors; keyer; includes memory keyer, dual jacks, front and rear; *cw* pitch coupled with sidetones, can use squelch pot to vary; *cw* reverse-pushbutton can select either sideband to copy; monitor - for checking *ssb* audio and processing distortion; TX frequency response - panel tone control, *dsp* LPF/HPF set point; speech processor - *rf* type; *ssb* generator - digital phase shift network (PSN) or analog filter type may be selected by menu (Either may be used for receiving *ssb* as well); antenna tuner is built in and automatic.

Receiver:
Band select PB -3 memories per band (Frequency and mode are stored in memory. The manual does not mention it but the filter selected is stored also in the radio tested); Control pushbuttons - essentially all have indicator lights behind them or a word or symbol appears on the large readout when they are pushed; sub- receiver - must be used on the same band as the primary receiver (It also must use the same filter. This is because the signals for both receivers are sent into a common IF strip and uses a common audio amp); pass band tuning - dual PBT is used, one in each IF; filters - room for wide, medium, and narrow filters in each of the 9*Mhz* and 455*Khz* IF amplifiers and are selected be various combinations of 3 PB switches; there are 99 memories with the usual storage and scan features; second antenna connector is on the rear panel and is selectable from the front panel; there are 2 pre-amps available, one for the 21*Mhz* and higher and the second is for use in the lower bands (a rotary switch selects either of these or inserts an attenuator if desired); AGC Selection is adjustable over a wide range; noise blanking is available and the width and level are continuously adjustable.

***Dsp* Applications:.**
Automatic notch and automatic APF tracing are available. Noise reduction is provided with a single pot in/out and degree of noise processing.

Digital Interface:
Level Converter - An optional external level converter is required for computer control of the IC-775-*dsp*; normal baud rate is 1200 but speeds up to 19,200 are *adjustable* via the dual menu which the radio uses for selection.

Strong Points:
Outstanding LO system with very low C/N ratio; triple memories per band are unique in HF transceivers and very useful; tuning all the ham bands for 'birdies' with antenna off found only one on 1899*Khz* and it did not move the S meter; the dual PBT system is very effective in removing nearby QRM; continuously variable AGE allows very long time constant for working loud stations without the usual noise between sentences; the *dsp* processor is far from perfect but it works as well as the best external units and is very easy to turn on and adjust with it's single knob control (It definitely improves S/N ratio, but at the expense of reduced HF response which hurts intelligibility); the digital PSN *ssb* signal was praised for its improved intelligibility over analog systems though the audio is not hi-fi and your voice is a bit like a slightly processed voice (Adding the speech processor to the PSN signal was very effective at the other end of DX QSO's).

Needs:
The QSK keying system is noisy and could be improved; the system for selecting filters is kind of clumsy to use and I prefer the system used by Kenwood in recent radios which has a PB for each IF; the radio which I tested developed an internal short which kept kicking the internal breaker (It was repaired by Icom rapidly and returned by UPS overnight. I know of a local who also had a breakdown in his new 775. He was given another radio in place of the broken one. Let's hope that these bugs are worked out soon).

KENWOOD TS-870S
SN-70100021

Transmitter:
PA: 100w, 12volt - bipolar junction transistors - external 12v power supply; keyer is a built-in K1 Logikey, programmable by key, with auto serial number generation and memories; *cw* rise/fall times programmable; *cw* pitch - coupled with sidetone - var. 400 to 1000hz in 50Hz steps; press "*cw*" push button to alternate *usb/lsb*; monitor is built in for checking signal quality; bandwidth is adjustable between 1800hz and 3000Hz; carrier frequency may be set 0Hz to 500Hz; in addition, Hi-boost, combination filter, and Low boost are available (this is called "transmit equalizer"); speech processor—low frequency and high frequency response may be raised

or lowered in 5 steps; the method of generating *ssb* signals is not determinable; the automatic antenna tuner can store up to 18 control settings.

Receiver:
This radio does not use individually labeled band buttons and the manual suggests using the keypad to punch in the desired frequency, then the mode button; memories are tunable , allowing one to put in several entries per band if desired; receiver selectivity is unique and utilizes one or more internal (unswitchable) quartz filters which establish the maximum bandwidth on receive (output of the last IF amplifier, at 11.3*Khz*, is digitized by two 24 bit A/D converters); on *ssb*, slope tuning is available; on *cw*, the same two knobs control bandwidth and center frequency with one of the LED bars on the S-meter indicating variations; 100 memories are available and store receive frequency and mode as well as transmit frequency and mode; a connector for a second antenna is on the rear chassis and is PB selectable; a pre-amp is turned on and off when the AIP PB is pressed; AGC-programmable release times, or manual with panel knob; noise blanker has variable trigger levels.

***DSP* Applications:**
Detection - the sales brochure claims better S/N ratio and lower distortion than with the analog circuits we have been using; it also says "in *ssb*, *cw* and fsk modes you can tune the filter sharp enough to attain over 100db of noise reduction with virtually no signal loss;" two auto notch filters are available via push-buttons on the front panel called "auto notch" and "beat cancel".

Digital interface:
Comes standard with a built in 57.6 Kbps interface and Windows compatible software. AD sub 9pin connector provides data/control access to the radio.

Strong Points:
Kenwood has apparently successfully applied *DSP* at IF frequencies without compromising the dynamic range of the receiver. (WA5Z tells me that it may be no accident that Kenwood chose 11.3*Khz* for the last IF and Yaseu 10.24*Khz* because there are precision, low cost A/D converters available for this frequency range developed for the CD player consumer market); the carrier point shift on *SSB* is a good feature that is beginning to show up in some other new radios; the manual that comes with the TS-870S is really well written, and that is a necessity because many hams are going to be turned off by the difficulty of adjusting to a radio so different from the one they have been using; the windows based interface will make those who use computer control smile; the many filter combinations on receive and transmit offer great flexibility.

Needs:
The lack of band stacking registers makes this radio harder to operate than others of recent vintage (if you change bands frequently and go from one mode to another you will get tired of having to cycle through other bands to get there. When you operate split frequency it is even more of a pain); the system for changing *cw* pitch is less user-friendly than those in other recent radios; many features of the *dsp* can be used only one at a time; but overall, this radio is a bit of a pioneer in some of the things it does.

YAESU FT-1000MP
SN-5F010137

Transmitter:
PA: 100w, 12v bipolar junction transistors - internal 12v power supply; keyer is internally programmable, with memories and number generator; *CW* pitch is coupled with sidetone, variable with panel potentiometer; push *CW* mode button to alternate *usb/lsb*; built-in monitor; speech is *dsp* processed according to an internal algorithm to improve intelligibility; *ssb* Generator is a "balanced, filtered carrier;" internal automatic tuner with 39 memories.

Receiver:
Band selection uses band labeled pushbuttons with 2 level band stacking registers as in FT-1000D, and stores mode, frequency and filter selection; pushbutton selection of any filter in either IF is done easily (lighted windows with BW labels show clearly the selections); *dsp* filtering offers carrier-shift for each mode and several different equalization curves; automatic notch filtering at IF frequency is available; 99 memories store 2 frequencies, modes, IF filter, split frequency status, and RIT/XIT settings; two transmit antennas connectors and a separate receive antenna connector are provided; three pre-amps are provided, each optimized for strong signal resistance or low noise as required for the various bands; a variable threshold blanker is available with narrow and wide pulse width selection.

***DSP* Application:**
Yaesu provides selectable equalizer curves rather than separate high and low cuts; *dsp* is used for signal detection but we have no specific information about the process; noise reduction-two concentric front panel knobs select a type of filter (band pass, band reject, LP or HP) and one of four independent processing algorithms.

Digital Interface:
The interface is internal and terminates in a DB9 connector on the rear panel. A 12 page section of the manual covers the instructions set up.

Strong Points:
The application of *dsp* technology at the last IF frequency is very similar to the Kenwood TS-870S but more choices are at the operator's fingertips on the front panel; the noise blanker in this radio acts like that in the FT-1000D and is very effective at improving the readability of weak signals in noise; the presence of the band PB system with 2 level stacking was retained from the FT-1000D and is unsurpassed for ease of band change; the filter selection scheme is the best available in my opinion.

Needs:
The display panel is multicolor and I found that the unlit digital segments in the readout are clearly visible and very annoying—the monochrome displays have some of optical filters which effectively blank out the background.

Next Month:

We will visit with Ray Ortgiesen WF1B, probably the most popular callsign in RTTY contesting today. Ray will talk about how RTTY by WF1B got started in the beginning through Ver-2.25. He will also talk about his contesting experiences, and maybe what's new for the future.

The Next Three Contests:

Contest Dates	Start Time	End Time	Operating Time
EA Apr 06-07	1600*Z* Sat	1600*Z* Sun	No off times
SP Apr 27-28	0000*Z* Sat	2400*Z* Sun	No off times
VOLTA May 11-12	1200*Z* Sat	1200*Z* Sun	No off times

Volta is a rate contest, that uses a chart based scoring system. The farther away you are, (in distance) the more points you get for each contact. RTTY by WF1B now supports the Volta contest. Many DX stations will be looking for U.S.A. stations to work.

Until next time,

73's, de Ron AB5KD

"Remember" Big antennas high in the sky work betterthan little ones close to the ground..

DIGITAL SATELLITES

How to work 'em and more out-of-this-world info

by David Medley, KI6QE/VK2IMJ
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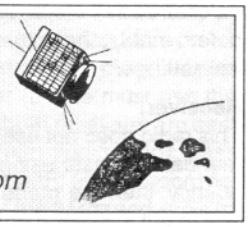

SATELLITE SOFTWARE

Taking a look at
LOGSAT Professional

Several weeks ago I received from our Editor a copy of a new and interesting piece of Satellite Software called LOGSAT Professional. After using it for a while I became so interested that I have been prompted to write my impressions of it. At the same time I will make some comments about other software packages that I have referred to in previous articles.

Satellite tracking software to date has been largely DOS oriented and the best has still been the oldest. I have used QUIKTRAK for many years and have always liked its flexibility and ease of operation. INSTANTRAK is another good one but I was always turned away from it because of its inability to interface with and control my radio without some fairly complex third party type modifications. There have been other packages all for DOS with nothing particular to recommend them over the two just mentioned.

Last year there emerged a new and very sophisticated package from New Zealand called WiSP. This is a windows 3.x oriented program and was a quantum leap forward in Satellite software. Not only does it control all the necessary tracking functions, including azimuth, elevation and radio frequency but it interfaces also with the TAPR Trakbox as well as the Kansas City Tracker. It has the ability to track multiple satellites and to switch between them automatically. A version for Windows95 is in the works. This package is available through AMSAT.

Now we have another Windows package called LOGSAT and I first tried running it with Windows95 on a Pentium100 machine. It loaded OK but the first thing I noticed was that no Icons were created. I then found that entering something in the Logbook caused machine lock up so I quickly concluded that it would not work properly with Windows95. This was a disappointment but then you can't have everything. ** So I loaded it up to a Windows 3.1 machine and all was well. As an aside ALL these tracking programs, including the oldies, run so much better on a fast machine and a math coprocessor is really a must, otherwise the speed is sooo slow.

So for the remainder of this article I will talk about LOGSAT. This is a very large and complete package and I am only going to hit the highlights and the features which impressed me the most.

First, as the name implies, it includes a logging as well as a tracking function. I am of the generation which grew up with mandatory logging and it has become such a habit that I still do it. Apart from anything else it is nice to have a record to look back on and if you are a contester or a QSL collector then logging is still a must.

The software comes on a single 3 ½ inch floppy and the set up could not be much simpler. From the FILES menu select the RUN function and type A:Setup. You will be shown a setup screen which is pretty self evident. The very first entry gives you access to a database which contains almost every city in the world. You merely select your city or town and the program then fills in your Latitude and Longitude. These are things I never can remember so this feature is a great boon. Then there is the question of time. This was always a big pain with some of the earlier DOS based programs but here it is so easy. You need to know the offset between your local time and GMT, thats all. Set your computer clock to your local time and you can do this accurately from the US Naval Observatory or the National Bureau of Standards as I will explain later. Right at the end of this screen is a little check box for extra DX information. Be sure to check this and I will explain why when we come to the logbook. Exiting from this screen you get another small screen called License Information. This is a bit of a misnomer because all it asks for is your Name and Company. Here I just put in my callsign as the Company.

Having done this the program will load and you will be greeted by a voice message if you have multi-media capability. This greeting message sounds like a passage from a NASA launch sequence and is a nice touch. You will get subsequent short voice messages as you explore the software.

Now you will see a typical Windows screen with which you should feel quite comfortable. Starting from the left hand side you might want to check the Printer Setup from the FILES pull down menu. If you already have a printer set up in windows you will probably find it already there. If not you can go ahead and set it up now.

The next pull down is an EDIT menu which you can use with any open file. No further comment is needed here. Then we come to LOGBOOK. The menu here allows you to create a new Logbook and save it under any name that takes your fancy. In fact you can create as many logbooks you want, consistent with the storage capacity of your machine, of course. Once you have created and opened a logbook you can enter QSO data. Do this through the appropriate ICON. (This one looks like a pencil writing in a book). Here you will see a screen with much of the data already filled in. If you checked the little DX box in the setup screen you will see already there the country you worked. Pretty neat. Takes a few seconds to do this and you have your log entry on file. If you want to check up on your geography select one of the map icons on the far right and there you will se the location of your contact marked with a little red ring.

The next pull down is CALLBOOK. When I first saw this I jumped to the conclusion that a regular callbook database was built in but a little thought would have disclosed that there was no way this could be on a 3 ½ inch disk. Too bad but what this does is build a callbook from the QSO data you enter in the logbook. When you access this and make a search for a callsign you get a world map with the country marked.

Now we come to the Satellite Menu. Already in the database are 963 satellites. First thing you do is select which satellite or satellites you want to follow. When you do this you will see a little note at the bottom of the screen which gives you the age of the Keplerian Elements. I really like this as it gives you an instant idea of when you need to update. This you can accomplish from this screen as it gives you the facility to make manual entries or bulk entries from a file which you have probably downloaded from the World Wide

Web. From this screen you can select various types of map projection , you can examine the satellite's schedule and its Keplerian elements. And you can set up your Kansas City Tracker to be driven directly by the software. Unfortunately it does not give you interface with your TAPR Trakbox which is a pity really. The Help screens here are really great and make up completely for the absence of a printed manual. Buried in the Help material for satellite tracking you will find a really good explanation of Keplerian elements together with a most helpful diagram.

The next screen is labeled ANTENNAS. This is a collection of engineering programs which show you the various properties of dipole antennas. To me this is more an educational feature than one of much practical use because only dipole antennas are covered. Not too many of us use dipoles any more for satellite work. Again the help material is great.

Now we come to UTILITIES. The only one I need to mention here is the time updating utility. If you have a modem attached to your machine you can dial directly into the Naval Observatory and update your clock. Only takes a few seconds. If you prefer it you can change the phone number to the National Bureau of Standards or any other time provider. Accurate time is most important particularly for tracking Low Orbitors.

There is so much more I could write about this program but I have covered enough to whet your appetite I believe. The program is one of the most user friendly I have seen and it took me only a small number of minutes to feel very comfortable with it.

** I subsequently discussed this with LogSat software and they have advised me that what I have is probably a shareware version, although the disk is not marked as such. They tell me the full version works with Windows95.

Grandpa John's Pocket Watch and WWV

by Havana Moon

I have an old Waltham pocket watch. It once belonged to my grandfather, and when my father gave it to me many years ago, he told me a story about the watch and a radio. I have never forgotten it.

He loved that watch. He was a stickler for time. Never late. Ever. The worn pewter timepiece was a faithful companion. And only grudgingly did Grandpa John admit to himself that it might one day begin to fail. And when that day came, just as he knew it would, Grandpa and the watch made a trip to the White River. Out he went to the Cowboy's old, tumble-down barn, where above the doorway, turning slowly at the end of a rusty chain, hung a huge, old pocket watch.

High atop the ramshackle building, strung between two rickety poles, was a sagging stretch of corroded wire which wound its way through a broken window to the back of an ancient radio. Inside, in the dust and the shadows, lined up row after row, were old wooden benches covered with clocks and watches and radios.

A rough and ready man who walked with a limp, he never answered to any name but Cowboy. He'd been a desperado in his youth, my father told me - -surely a man with a past. His size and reputation belied the delicate skill with which he handled the tired old watches and clocks that passed through that doorway for repair.

He was an odd man. Silent, intense. He waited each day at the railroad station for the Missouri Pacific to arrive. He never met anybody. Just waited. As though he were waiting for time itself.

As watched matters go, it took a long, long, time. Days stretched to weeks, weeks to a month and still the Waltham lay on the bench out in the barn at the White River. But Grandpa John wasn't known for his patience. He called or visited the Cowboy once - at least once - each day. It wasn't that it hadn't been repaired; the Cowboy was a craftsman who took great pride in his work. No, you see, the Cowboy was listening for WWV. Conditions were poor and the trustworthy, reliable old time signal couldn't be heard in the hot southern summer. But the Cowboy, knowing Grandpa's regard for accuracy, insisted on waiting for the signal from WWV. No compromise. That watch had to be set right. Just right.

I was just a kid when my father told me this story for the first time, and I really didn't understand the answers he patiently gave to my never ending questions about just what Grandpa's pocket watch had to do with a radio. That is, I didn't understand until the day that I became the proud owner of a Hallicrafters Sky Buddy, chosen with great care from among the dozens of others that made up the Cowboy's vast collection. And then I did begin to understand. Comic books took a back seat to copper wire. I risked my life more than once climbing to the top of a pecan tree to hang that longwire just a little bit higher. Antenna design became an all consuming pastime for me and my buddy Don. Neither of us would be outdone. Steal hubcaps? Never. But copper wire? That was another story.

There were arguments each Saturday afternoon after the weekly Western at the Laura Movie Theater. Arguments that turned to fist fights on more than one occasion over whose letters had been read on HCJB or TGNA, whose antenna was longer - and if not longer, whose was higher - and most importantly, who could really hear VVWV the best.

I could. I'm sure of it. Because my Hallicrafters was bigger and better than his BC348 - even though it, too, had been chosen with just as much care from the Cowboy's vast collection.

Grandpa's watch stopped one day at 6:51. But it didn't matter to him, because, y'see, Grandpa and the Cowboy had both gone some time before to a place where there is no time.

The watch now rests in a glass case on a shelf over my radio. That's where it's been for years. Oh, the radio has changed from time to time Hallicrafter, Nationals, Hammurlands and Yaesus have come and gone. Today it's an NRD. But always, the shiny silver watch sits on the shelf over the radio. Except for one six-year period of my life when it was packed away in the dark. The radios that surrounded me then weren't the kind that lent themselves to the display of memories. Those years were spent in innocuous, lost and dangerous places. It was a time I've left behind me. And yet it's with me still.

I still tune to WWV. Its steady, quiet ticking is soothing, hypnotic. I especially like to listen when I'm alone in the dark. My eyes always turn to Grandpa's watch. It somehow catches the glow from the dial and reflects it back to me. In spite of its inefficiency and in spite of its age, it's still perfectly accurate. I know I can count on it. Two times, every day.

Havana Moon was a pseudonym used by William T. Godbey KB2OOR, who for twenty years was the foremost US expert on clandestine and shortwave numbers transmissions. We never guessed! Bill was a faithful member of our Thursday morning breakfast gathering, a gentle and good friend and now a silent key. We miss him. We can only wish we had known of his secret past while he was alive.
De Jim N2HOS.

(Cont'd frm page 2)

a 5 volt signal on the analog input pin might result in a binary value of *11111111* (the maximum value for an 8 bit binary number), while a zero volt signal would produce a binary output of *00000000*. The rightmost digit in these binary numbers is called the least significant bit (LSB) and represents the smallest detectable change in the input signal. The leftmost digit is called the most significant bit (MSB). A/D converters come in different sizes, from simple 4 bit A/Ds to extremely expensive A/Ds with more than 20 bits.

An A/D converter with more bits allows us to handle a wider range of analog voltages, or to detect smaller changes in the analog input voltage. As the number of bits in the A/D goes up, so does the dynamic range available to the *dsp* system. The cost goes up, too. A simple 8 bit A/D may cost $3 to $4, while a 16 bit A/D of reasonable quality may cost $20 to $30. Very specialized A/D converters for video or instrumentation applications may cost hundreds of dollars.

How many bits do you need?

Proper selection of an A/D must take into account more than just cost. Remember that the number of bits in our A/D converter ultimately determines the smallest change we can detect in the input signal. In the case of our 8 bit A/D, input values of 2.50 and 2.51 volts would produce the same digital output, since the minimum step is about 0.02 volts. This inability to detect small changes is called quantization error, and all A/D converters exhibit it. But by choosing an A/D with enough bits, we can minimize this error to the point that it's not a problem in the intended application. For example, A/D converters for telephone system use can get by with fewer bits than those used in digital music applications since the fidelity requirement is lower and the signal need not be reproduced as accurately to give satisfactory results. Incidentally, the sound cards found in many PCs today are often referred to as "8-bit" or "16-bit" sound cards, and this refers to the number of bits in their on-board A/D converters.

There are other things to consider when choosing an A/D converter. Each A/D takes a certain amount of time to convert an analog voltage into a digital output. This time is called the A/D's conversion time, and in general the more bits the A/D has, the longer its conversion time will be. Typical A/D conversion times range from microseconds to milliseconds depending on the number of bits and the technique used by the A/D to convert the value. Since a *dsp* system takes a series of digital values to represent the analog signal, the conversion time of the A/D can ultimately dictate the highest frequency we can work with. At some point the system will have to wait for the A/D to do the conversion. Just as more bits in the A/D translates to higher cost, so does faster conversion time. In both cases, having more than you need is just throwing money away, while having less than you need will adversely affect the performance of the *dsp* system.

Using the digital data

Now that we can convert our analog input signal into digital data, what are we going to do with all these numbers? Where do they go after they leave the A/D converter? Next time I'll discuss the central processing unit (CPU) and the digital-to-analog (D/A) converter, and show how (with a little software) we can do some useful things with the numbers we get from the A/D converter. After that we'll look at the *dsp* system as a whole, and see how it's used in some popular amateur radio *dsp* applications. In the final installment well look ahead at what *dsp* will bring to amateur radio in the years to come.

CCW

by Peter Lumb, G3IRM
2 Briarwood Ave. • Bury St. Edmunds
Suffolk, UK IP33 3QF

** CCW - 35 Khz up on all bands - plus/minus 1Khz **

Operating schedules:

VE3RAT - Low power beacon believed to operate continuously on 18.101
G3IRM - Tuesdays at 1900z on 10135 - Thursdays at 1900z on 7035 - Saturdays and Sundays
at 1900z on 14035.
VE3OXX - Sundays at 2000z on 7033
W6HDO - Thursdays at 0500z on 7035 and at 1830z on 14035.
W6HDO or WB6RIJ on Saturdays and Sundays at 1900z on 14035.

There has been no activity to report over the last two months. I must admit that I have missed one or two operating times and have had no replies to calls during the period. The only letter I have had relating to activity was from DJ2ZV who has been listening but who has not heard any signals either. There does appear to have been some activity among the LOWFER operators in the States and Bill de Carle has been updating his software regularly throughout the past year - more on this in a moment. There is also a story going around that there may be a LOWFER band in the UK in the near future though it will probably be on about 73 Khz. This is the usual way they seem to do things over here. Foryears there were attempts made to get a 'citizens' band allocation and, when it did come, it was on some strange *uhf* frequency. Persistentent attempts by campaigners managed to get the usual 27 Mhz band allocated. Where they dreamed up 73 Khz I do not know unless it has some connection with the more familiar meaning of 73!

COHERENT updates

Bill de Carle released version 3.1 of COHERENT in January 1995 and it included provision for the Max Carter LOWFER receiver board together with 100 memories. There were also some modifications to the way the mouse operates. You may have gathered that Bill is now concentrating on modifying the program for the benefit of LOWFER operators who seem to be his most ardent followers. In all the revisions during the year there have been minor improvements and additions to those I now mention. Version 3.2 came out in February and version 3.3 in October with just one important addition. This was the inclusion of double speed (24 w.p.m.) CCW. The pricing policy was also changed. Orders for the sigma-delta board now include the COHERENT and SPECTRAL programs free.

BPSK has been available for some time and some improvements were made to this in version 3.4 which also appeared in October. With any PSK mode the effect of minor mistuning can be a nuisance and some radios were found to do funny things when pulsed to change up or down in frequency. This has been cured and Bill now considers version 3.4 as the weak signal version of COHERENT due to other improvements he has made (though it may not run on 286 computers). Test results are awaited. Major alterations were made in version 3.5 also released in October with provision for PSK, not differential PSK known as BPSK. In theory PSK carries a 3 *db* advantage over BPSK but time bases must be rock steady. Again in October Bill came up with a major revision now called version 4.0. This adds another new mode called PSKL which uses what is called lattice coding. A sixteen bit frame is used for each ASCII character. The original Leech lattice uses 24 bit frames and I assume Bill is now working on this. Results are claimed to be astonishing.

With the old PSK about one in three characters appearing on the screen will be an error. With the lattice method only one in thirty characters will be wrong. With a speed penalty of 1.6 PSKL gets the error rate down to one in five hundred! An article by Bill may have appeared in the December issue of the LOWDOWN magazine if space was available. Full details of how this works is on Bill's revision sheets supplied with the latest disk. A few more amendments were made in version 4.2.

COHERENT now includes CCW, BPSK, PSK and PSKL though there has been no news of anyone attempting to use the last three modes on the *hf* bands. Version 4.3 makes the system more robust and includes a flashing OVERRUN! if there is a UART overrun. Finally in November along came version 4.4 which I think is the latest but, with the speed at which Bill produces revisions, I would not be surprised if there is now another update. This version cures the overruns on a 386 machine. At the request of W6HDO Bill has also written a short program called TUNER which is calibrated plus/minus 1 Hz either side of 800 Hz.

(Cont'd on page 31)

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The Last Word

from the editor

by Jim Mortensen, N2HOS
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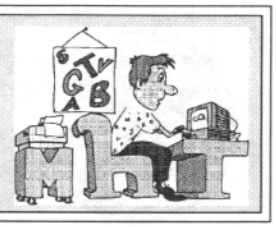

It does seem strange to run two articles on a single subject in one issue, and run them back-to-back to boot. This issue is full of throughput measurement and, at least to some, it might seem like overkill. But there is method to our madness. In the first place, this is an imperfect world and there is virtually no way to create a totally fair test that encompasses all factors influencing throughput. Conditions are infinitely variable to begin with and even carefully designed tests such as these sometimes produce strange results. And to a certain extent, the equipment can be unpredictable as well. So our rule is, 'more is better.' The Digital Journal will continue to publish the results of any intelligently designed comparisons, at least as long as the interest survives. Hopefully the data will settle at least a few of the arguments going on out there.

Having said that, we wonder about this continuing interest in the subject of speed. Throughput is most always discussed in a context that suggests "Finally, at last, we have a mode or modes that can keep up with our expanding needs." That said it can be argues that, except for those few who operate BBSs with very high traffic loads, today's speeds leave our needs and our throughput ability in the dust. Very few keyboarders feed the computer enough data during a QSO to keep even with RTTY (our slowest speed mode), let alone any of the newer, faster ones. Our concern, it seems to me, should focus on increasing our personal ability to create higher volumes of data for transmission in shorter periods of time, rather than on the raw speed of the modes available to us. Let's utilize speed instead of measuring it.

This means we must change the way we view our digital QSO's. A Pentium 133 mhz machine with a $1000 TNC doesn't change a thing if the person at the keyboard still types via hunt and peck "Hi, my name is Jim and the QTH is . . . " and presses F2 for the brag sheet, then types two lines about the local weather . . . and having nothing else to say, signs off. What a pity! Where are the files, the pictures, the diagrams? They lay there, available but unused, and the speed of the hardware and the power of the software—all of which looks so good on the long brag sheets, produces nothing but frustration. It's a little like driving to the neighborhood super market in a Ferrari or pulling a small wagon with a Kenworth! Too bad. But, if you are in to speed measurements there are some interesting facts here. Both articles are worth careful study for there are significant observations in each. We thank those who took so much time out of their daily schedule to perform the tests with such care.

At one time I was a conscientious log keeper. Back when propagation produced startling results each day, at a time when QSL cards were high on my list of most-wanted mail, accuracy was an essential. I was as careful with the run-of-the-mill QSO's, too. There are a stack of those great ARRL logbook forms scattered around the two houses, even after the move. Once in a while I run into one unexpectedly and enjoy thumbing through it. It happened again last week when I cleaned out an overflowing cabinet. Only a small percentage of the contents survived, the log among them. Part of it covered the period when I started working QRP. Such contacts amaze me more now than then.

Imagine this one (I am sure Ben doesn't remember), on Christmas Day in 1988 I worked KR6E on 28088 RTTY with .125 watts! New York to Hollywood fares were never cheaper. The next day on 15 meters I worked VE7FOP on the same power. Twenty-four hours later 5U7XX showed up on 21087. I managed the pileup at 1755Z and snagged my first 5U, and then went back at 1825Z and worked him again, on five watts! There were others . . . Eddie as VP5, VK9ND, but perhaps the record was JA9BFN, again on 15 meters and again at .125 watts. And, so on.

The January portion of the log covered my first look at the Roundup . . . and the page is full of familiar calls—WH6I, AA5AU, WM6H, XE1VV, OH2LU, SM4CMG, HC5K and so on. But, even in that brand new contest, half or more of the page was DX. It was difficult not to work it. Hi!

Will it ever come back? Oh, yes. As all drought ends, as every winter turns to spring, as all worms turn, propagation will bounce back to and perhaps be even better than in those heady days of the late 80's. Take today, for example. This is Saturday and the WPX contest is on. And I am trying to write this column and work a little of the contest at the same time (and I always thought I could do two things at once!). Just this very moment I turned up my full 100 watts and worked JA5EXW in a modest little 20 meter pileup. A few hours earlier in came A22 on the back of the beam on 15 meters. I made the contact with no movement of the antenna. Maybe we are seeing the first signs of the end of a long winter of propagation.

What does it all mean? My son (not a ham, but a computer whiz) nudged me into trying Quarterdeck's WebTalk. What's that? What for? Well, I wasn't at all certain what it was and managed to keep deferring the what for. It wasn't too difficult. A second license is part of the WebTalk package. Easy . . . except my part of the bargain required me to download a 2meg file from the Quarterdeck site, then punch in the serial number before I could use it. I tried six or seven times. Each time I passed the half-way mark, and one time the 90% mark and was then cut off by them. Finally, I sent a snippy note to my son Art and said, "I don't think they want me to do this." I thought for a day or so I had dodged the technical bullet. Then the phone rang and it was Quarterdeck, apologizing for the abuse and offering irresistible bargains, including (you guessed it, WebTalk at half price). And they sent it overnight, free. Stuck!

I loaded the program with ease and, after a brief pre-phone-call-phone-call, managed to tune up the computer, the sound system and the mike. Then, as if I had been doing this all my life, I dialed up my SLP connection, logged into WebTalk central and, there it was. "N2HOS, you have a call from Arthur 505, do you accept or reject the call?" What could I say? After a few minutes of back and forth we got the hang of it and spent a pleasant 18 minutes chatting about the marvels of the Internet. The sound quality was excellent, better than a normal phone call. After hanging up (or shutting down or whatever) it dawned on me that this was not your ordinary phone call. It felt more like a SSB QSO than anything else, except there was no QRM or QSB. No worry about propagation either as I found out the next day. I discovered that on the night before our conversation Art had gone into one of the waiting rooms on the WebTalk center and started a chat with someone in VK4. Twenty minutes after they began he knew a lot more about the system than he had known before (he doesn't read manuals either).

While we used simplex (only because the computer Art was using had an old sound card in it) anyone with a modest computer, sound and modem can use duplex and converse in a completely normal fashion. And it is free! No tolls, no upcharge . . . free. Well, New York to Florida is no big deal. But, guess who has been given the serial number for the other license on my package? And guess who is getting 28K Internet service this month? Peter TY1PS (the long suffering guru of Benin) will join me in yet another experiment. Hi!

What if it works as well? What if I can pick up the mike and chat with Peter anytime I wish for as long as I wish for no cost? Then 'communication,' as we have known it all these years, will never be the same again. Ham radio will never be the same again. The world will never be the same again, for some of the wildest dreams will have all come true. Telephony will have reached that magic point where anybody can talk to anybody else, anywhere in the world, any time they wish . . . for no cost. There will be no barriers, regulatory or economic, standing in the way of wide-open communication. Profound changes will take place, in all countries, everywhere. If you think the new telecommunications law in the US is going to make a big difference, 'you ain't seen nothing yet!'

Is it all more Internet hype? I think not. If I had the time, I think I would be chatting to people all over the world right this minute, joining the crowd already there. And you can, too. The software (including the two site licenses) is less than $50. There is shareware and freeware as well. Maybe there is a free lunch after all.

There is a change of address on the Editor's web site. Tune now to <http://home.earthlink.net/~n2hos>. Or, switch over from the IDRA page. Either way, we are trying to keep things up to date, particularly the Flash page. There you will find the latest news that cross this desk. And you can always send an E-mail note from either site.

Another new columnist joins us this month. Tom N3PGG <n3pgg@aol.com> made the mistake of sending me a copy of his NTS newsletter. Zap! I knew he had to join up with the Digital Journal. And, he did and we are very pleased. I am sure you will agree. Welcome aboard, Tom.

Next month Neal ON9CNC takes us by the hand for a stroll through Express 3.5. It's off to a good start. As Ben KR6E said, "It is vastly superior to any previous effort!" Try it now.

73 de Jim N2HOS sk

(Cont'd from page 12)

In PacTOR transfers of files consisting entirely of upper-case characters we confirmed the fact that Huffman compression does not raise throughput when applied to such files. This is because upper-case characters occur rarely in standard English text. If you want to send ASCII files with PacTOR and expect to take advantage of Huffman compression (which uses frequency-of-occurrence counts to decide on compressed-byte-size), don't send a lot of upper-case text.

6. Concluding Remarks

We hope that our data will clarify discussions of the amateur HF digital modes. In particular, our results should put throughput measurements of Clover, PacTOR II and even more advanced systems in perspective. We hope to be able to report someday on the performance of those newer modes, and we encourage those already in a position to do so to publish their findings.

****

Biographical info:

Mike Bernock, Bob Levreault and Ken Wickwire work for the MITRE Corporation near Boston, where they have been involved for several years in digital and voice communications in the HF and VHF bands. Bernock has worked for over ten years on SINCGARS, the Army's tactical VHF combat net radio. Levreault and Wickwire have also been involved in the development and use of the military and federal standards for HF automatic link establishment (ALE), advanced HF data modems and robust HF data-transmission protocols. They participate regularly in SHARES preparedness exercises and in the recently established worldwide experimental ALE network run by the DoD. The three are also regular users of the club station at MITRE (WA1PHY), which runs digital gateways for packet radio, TCP/IP and the APRS mapping system. They long ago accepted the fact that it is impossible to keep radio out of one's private life, whether it belongs there or not.

* *See, for example, the report by Bernstein in the July, 1995, issue of the Digital Journal.*

(CCW - Cont'd on page 26)

Cliff W6HDO came up with an interesting hint in a recent letter. He used COHERENT version 3.2 to listen to WWV tones. When the carrier was moved exactly 800 Hz, COHERENT *bpsk* shows exactly 400 Hz mark and 400 Hz space indication. Then press <ESC> followed by <SYNC> for a few seconds, then <ESC> again. If you are exactly on frequency the cursor will move one space to the right for each second tick and print nothing. If not, gibberish will be printed.

My computer update

Now to bring you up-to-date with the computer story. My local dealer contacted the makers who asked for it to be returned to them. Two weeks later it came back and, guess what, the same faults were there. I had pointed out that the flickering may not be noticed for some time and that it may last for anything between a few seconds and several minutes. When we again contacted the makers they admitted that they could not find any faults and had therefore returned it. Why, I ask, do they think it was sent to them if there were no faults? It was again returned and, after four weeks, they finally admitted that they had seen the faults and that they could cure the boot fault by fitting a new board but there was nothing they could do about the flickering screen! Pressing them further they admitted that there was a design fault and all their laptops would have to be recalled. Of course, as a complete redesign would be necessary this could take several months. In the meantime they would be returning my machine so that I could continue to use it if I could tolerate the flickering screen.

What I do not understand is how it is possible to design a computer, build prototypes to test, start up production of the finished design, distribute the computers to dealers and sell them without finding out there were design errors. Mine is a model which has been in production for at least a year and there must have been a fair number sold yet it is not until I buy one that the faults are discovered. Surely other machines must have been the same. The problem I now have is that they do not answer letters and offer few explanations. The only contact I have with the makers is at secondhand from my dealer or by use of the telephone and I not like telephone conversations which can be refuted at any time - I like things in writing.

The problem I had loading new programs was a funny one and has still not been cured but I have discovered a way to do it myself. When setting up DOS the loading would stop part way through with a message indicating that the disk was unreadable. To my further annoyance it did the same when trying to install EXPRESS 3. Surely the disks were not faulty as I had been able to install both programs on a desktop machine. Then I remembered a program in PCTools called diskfix with which a disk can be rejuvenated. It reads the disk, re-formats it and writes the data back to the disk. I did this and in both cases the programs loaded correctly. How do I explain that? I can't. There was an interesting letter in Bob Pease's column in Electronic Design on the subject of computer faults in the issue of January 6th. Read it if you get hold of a copy, it makes my problems look insignificant. That is how the story stands at the present time.

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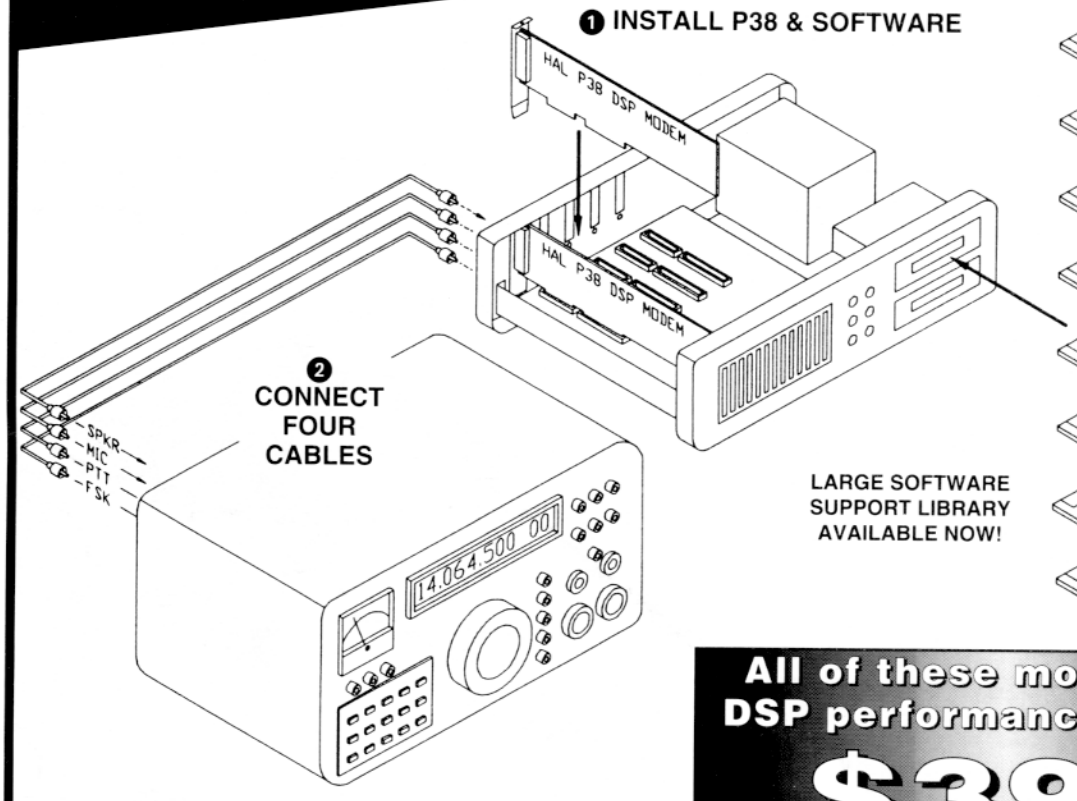

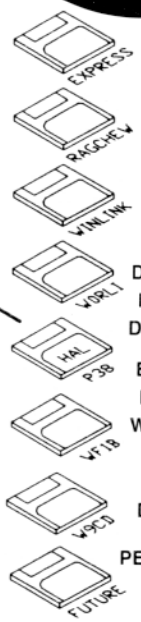

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