T·A·P·R

PACKET STATUS REGISTER

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In This Issue...

Next Scheduled PSR Issue: February 1989
Editorial Deadline: 02/15/89

PRESIDENT'S CORNER

by Andy Freeborn, NØCCZ

Things are really smokin' at TAPR. The 3 AM oil is burning and folks are excited. Not since TNC2 days has there been so much activity within the development teams.

Whats going on? Well, there are three major programs under way, a). the DSP program b). the AMSAT-NA PACSAT program and, c). a recently initiated high speed radio/ high speed modem project.

The DSP project (a joint TAPR/AMSAT project) was started last year by Dr. Tom Clark, W3IWI and Dr. Bob McGwier, N4HY. The DSP program moved along at a brisk pace until about June of this year. At that time Jan King, W3GEY, AMSAT V.P. Engineering, announced that the PACSAT program was going to be a reality. At the same time he laid out the development schedule. And it had a REAL short fuse. The schedule required that the satellites be ready for launch by 1 January 1989. Since that time the schedule has been eased by Arianespace to May 1989. Nevertheless Jan is pushing the developers hard for early readiness. The impact of the PACSAT program upon the DSP program is simply that most of the key developers in both programs are the same people. There are others in the DSP program that are pressing on, but until the PACSAT program is finished the DSP program has had to take a relative back seat in priorities.

The PACSAT program. The funding for the electronics, batteries and solar panels has been provided to AMSAT by TAPR. This is a program ideally suited to TAPR objectives, and most of the people involved in the work are key TAPR development folks. When operational the initial space based digital machines will provide us with a brand new testing ground for amateur digital communications. These first PACSAT machines, and their follow on brethern, will get the juices flowing in every redblooded packeteer.

The packet-RADIO program. We are never going to realize the true potential of amateur digital communications until we have radios that can respond to the truly high speed responses we need. The solution to that problem is now on the drawing boards of TAPR developers. The guidelines that they are adhering to are KISS (simple) and KIC (cheap, meaning inexpensive). The device that is planned will be a combination 2 meter radio and modem running at 9600 bps. It will have NO bells and whistles (KISS). Making it available to the amateur community as inexpensively as possible is a primary design goal (KIC). Don't look for a lot of the niceties (readouts, etc) that you find on commercial amateur gear. This program is still in the design stage as I write this and protoyping will be underway when you read it. We are hoping to be able to have a couple of them well enough along so that they can be demonstrated at the annual TAPR meeting on February 25th/26th.

CHANGE IN TAPR BOARD OF DIRECTORS

Dianne Marshall, AL7FG, recently informed the Board of Directors that she would no longer be able to devote the necessary time to Board activities. Dianne has submitted her resignation as a member of the TAPR Board of Directors.

Dianne lives in Ester, Alaska. She was an early packeteer and was heavily involved in some of the early packet development work done by the very active Alaska group. Many of you will remember ordering kits from them, the address was "One Dog Path", Ester AK. That's Diannes home. Today she is busily raising her family at the same location.

The TAPR Board and the membership all wish you well in your new 'career', Dianne.

The TAPR BoD has elected Pete Eaton, WB9FLW, to fill the unexpired term of Dianne.

IT'S ELECTION TIME AT TAPR TOO

I hope you haven't grown so tired of all of the national election talk that you won't consider this most important election for TAPR'ites. It's election time here too.

Tucson Amateur Packet Radio is a non-profit corporation licensed in the State of Arizona as a scientific and educational institution. It is recognized by the IRS as a 501(c)3 tax-exempt organization for these same purposes.

TAPR is governed by a 15 member Board of Directors. Each member of the Board serves a three year term, hence there are 5 positions to be filled each year. Board members are expected to attend the annual Board Meeting, normally held in Tucson. They participate in the decision making process and provide guidance to the officers. They receive no pay and they must defray their own expenses to attend meetings. Board members should be prepared to be active in the continuing board deliberations, which are conducted privately in a special conference section on Compuserve.

The officers and the Executive Committee are elected by the members of the Board at the annual Board of Directors meeting.

The current members of the Board and the expiration dates of their terms follow:

	Mike Brock WB6HHV	1991
	Tom Clark W3IWI	1990
	Pete Eaton WB9FLW	1990
	Andy Freeborn NØCCZ	1991
*	Steve Goode K9NG	1989
	Bob Gregory KB6QH	1990
*	Eric Gustafson N7CL	1989
	Skip Hansen WB6YMH	1991
*	Lyle Johnson WA7GXD	1989
	Phil Karn KA9Q	1991
*	Scott Loftesness W3VS	1989
*	Bob McGwier N4HY	1989
	Dan Morrison KV7B	1991
	Harold Price NK6K	1990
	Dave Toth VE3GYQ	1990

Nominations are now open for the seats expiring in February 1989 (marked with an asterisk).

To place a person in nomination please remember that he/she must be a member of TAPR. Confirm with the individual that he/she is willing to have their name placed in nomination. Send that persons name (your own if you wish to nominate yourself) along with yours and their calls, telephone numbers and addresses. The person nominated should submit a short bigraphical sketch to be published along with the ballots.

Nominations and biographical sketches should be submitted to the TAPR office no later than 3 January 1989.

Ballots will accompany the next PSR or will be mailed directly to the membership. Results will be announced at the annual TAPR meeting in Tucson on 25 February 1989.

Since the Board will meet in Tucson the day before the annual meeting, all voting must be done by mail. Ballots will not be accepted at the meeting. When you get your ballot be sure to mail it in right away.

Andy Freeborn NØCCZ President

DAYTON 1989 PLANS

by Peter Eaton, WB9FLW

Believe it or not it's time to start making plans for the Dayton HamVention! TAPR has already contacted DARA (Dayton Amateur Radio Association) to confirm our booth location for the coming year. The Hara Arena has just completed a new 40,000 square foot addition, this new area is adjacent to the vendors parking area. One big plus is the new facility is Air Conditioned! For those Dayton veterans this is a big plus, at this point we are seriously looking at moving to this new location.

Something else that will be new is our desire to have a little more "breathing room". The TAPR booth has always been a popular meeting place for Packeteers, it's also been a bit crowded! TAPR plans on having two booth spaces this comm- ing year. Just to wet your appetite each table will be showing off a new product. One of them is the much awaited for DSP unit and the other is really neat too, you'll have to stop by the booth though to find out what it is (there has to be some surprises!).

The TAPR gang will be staying at the Raddison Inn. This is the closest

Hotel to the Arena, it's also expensive, $86.00 for a double. We tried to get reservations at the less expensive Inns but they were already booked! With 35,000 attendees in 1988 the show makes finding hotel space anywhere in Dayton difficult even at this early date. We suggest you make your reservations for Dayton right away!

Bob Neben, K9BL, a Dayton resident will once again be the point man for the weekends entertainment. Bob has always outdone himself organizing the Saturday evening dinner. Again in '89 we hope to secure McNasty's for this popular buffet bash, it's a great way to unwind after a hectic day at the show. Bob will also be coordinating the Packet Forums, though it's too early to know the schedule and list of speakers. Rest assure that Bob will have the Best and Brightest in the Packet Arena as speakers.

Make sure to mark April 28, 29, and 30th off on your calendar for Amateur Radio largest get together. Hope to see you there!

TAPR ANNUAL MEMBERSHIP MEETING

The next Annual Membership Meeting of TAPR will be held in, you guessed it, Tucson, Arizona. There have been suggestions in the past that the meetings be held in other parts of the country. It seems that there are a couple of reasons that this has never come to pass. First, no one has volunteered to host a meeting elsewhere; but even more importantly, Tucson is just a great place to go to in February.

The 1989 meeting will be held on Saturday and Sunday February 25th and 26th. For those of you attending last years meeting you won't have any trouble finding the meeting place, nor will anyone for that matter. It will be held at the same location as last year, The Inn At The Airport. The Inn is located a short distance (more than walking distance, however) from the airport terminal, at 7060 South Tucson Boulevard.

The Inn At The Airport offers us special rates of $49.00 for either one or two persons in the room. Breakfast is included in the rate and there is a late afternoon cocktail hour free to those staying at the Inn. Reservations may be made by calling 1-800-772-3847. In Arizona call (602) 746-0271.

There will be the traditional Pizza bash and the Malibu Grand Prix for the Barney Oldfields in the group on Friday night. On Saturday night we will have our customary get-together, probably another Western affair, details of which have not yet been worked out.

In light of all the development work now in progress you can expect that there will be many interesting presentations. You won't want to miss seeing a full scale model of PACSAT, four of which are scheduled for orbit a few months after the meeting.

Those wishing to be on the speaking agenda should advise the TAPR office as soon as possible. The Sunday session should be concluded near or shortly after noontime for those planning afternoon departures.

CHECK THE MAILING LABEL

The mailing label on your copy of PSR shows the month and year that your your TAPR membership expires. Please check it to see if you are within a month or so of membership expiration. Keep up your membership. Reminder: TAPR has a new mailing address now. It is: TAPR, Box 12925, Tucson AZ, 85732.

SOFTWARE AND HARDWARE AVAILABLE FROM TAPR

HARDWARE

Hardware kits that are currently available from TAPR are shown below.

PSK Modem (incl. S&H)	$110.00
K9NG 9600 Baud Modem	$25.00
TNC2 Tuning Indicator	$25.00

FIRMWARE

The TNC2 software version 1.1.6 is available with KISS. Please see the article describing 1.1.6 features elsewhere in this issue. If you have been using version 1.1.4 or 1.1.5 with the 32k RAM you will be able to upgrade directly to 1.1.6. For those still using 1.1.3 it will be necessary to install the 32k RAM chips at the same time that you upgrade. Installation instructions are provided with the 32k RAM chips.

TAPR will program your EPROMs for $2 per TNC-worth plus a prepaid return mailer. If you choose to buy EPROMs from TAPR we will include the mailer and postage in the purchase price of the blank EPROM.

Prices as follows:

32k RAM (includes update doc)(ppd)	$20
Blank EPROM (27C256) (add $2 for programming)	$10
Blank EPROM (2764) (add $2 for programming) (may be 27C64 if available)	$5

PROGRAMMED EPROMs

TNC-2 WA8DED (27C256)
TNC-1 WA8DED (2 x 2764)
TNC-1 KISS (2764)
TNC-2 KISS (27C256)
TNC-2 1.1.5 w/loader (27C256)
TNC-2 1.1.5 w/KISS (27C256)
TNC-2 1.1.5 (27256)
TNC-2 1.1.6 w/KISS (27C256)

(each of the above is $12
including EPROM, programming,
mailer and postage)

SOFTWARE

W0RLI/VE3GYQ C BBS
(ver 8.05)
(1 diskette)
KA9Q TCP/IP
(3 diskettes)
INTRO to TCP/IP
(2 diskettes)
TNC-1 Source code
(1 diskette)

The current major release of TCP/IP is 871225.1. When a later major release is available it will be substituted.

All diskettes are $2 each including diskettes, mailer and postage. Please do not send blank diskettes, mailers or postage. For orders outside North America please add $2 for airmail delivery.

STATUS REPORT ON THE KA9Q INTERNET PACKAGE

by Bdale Garbee, N3EUA

The last "official release" of the KA9Q Internet Package (TCP/IP) was made on Christmas day, 1987, and was dated 871225.0. For the last couple of years I have served as the central documentation/integration/distribution coordinator. Despite the lack of a new major release in the last 10 months or so, a great deal of work has been done, which I'll try to detail in the remainder of this note.

There have been three major focal points in the "tcp-group" in the last year. The first, not surprisingly, is the work in progress to port the software to additional computer systems other than PC clones. To date, ports have been done to the Apple Macintosh, Atari ST, NEC PC-98XX, 4bsd Unix (though the value of this is questionable since TCP/IP is built into Berkeley Unix), Xenix, ATT System V Unix on 3B and 68000-based systems, the HP Portable and Portable Plus, and numerous MS-Dos based PC-clone systems.

In addition to the porting done to non-PC machines, support for numerous additional Ethernet and Packet interfaces has been added. The Pac-Comm PC-100, DRSI packet card, HAPN board, and the surplus Eagle Computer 8530 cards that are popular in the 56kb modem world are all supported to one degree or another with drivers built into the system. In addition, Phil Karn KA9Q added support for a defacto standard "packet driver" interface pioneered by FTP, Inc., which simplified adding support for many different Ethernet cards, including 3COM, Western Digital, Micom, TRW, and others. In addition, Russ Nelson (a prolific packet-driver author) has written new slip drivers that use the packet driver interface, and add support for the National Semiconductor 16550 UART chip, which is pin-compatible with standard PC 16450/8250 serial port chips, but adds 16-byte FIFO's for both transmit and receive, allowing higher data rates before the processor's maximum interrupt service rate is exceeded.

The second prime focus within the group has been providing support for additional protocols. Dan Frank W9NK has added support for TCP/IP connections over NET/ROM networks. While there are some performance issues associated with operating over NET/ROM, this should open the door for more people outside of major ham population areas to get involved in TCP/IP on packet radio. Work by several individuals has resulted in "packet mailbox" functionality for the AX.25 mode, allowing an AX.25 user to leave mail for the operator of a TCP/IP station that is unattended.

The final "big thing" that has happened is Phil's internal rewrite of the package to include a multi-tasking kernel. While this will initially not provide any great changes at the user level, it should allow easier integration of new protocol modules, meaning more and better user services. Things which are being discussed are automated routing protocols, a much improved mail handling system, a split-screen "talk" program to replace the current keyboard to keyboard 'telnet' mechanism, etc! There are also high hopes that the rewrite will facilitate porting of additional features to the Unix versions of the program.

The exact set of features that will be included in the next release is still under negotiation, but we anticipate that most if not all of the above will be included, as well as dramatically improved documentation, and better installation tools. One thing that will be somewhat different is that we are separating the major release by systems supported. Patty Winter N6BIS and friends at Apple Computer now have responsibility for the Macintosh version. While we will continue to use common sources for the documentation and system-independent portions of the code, they are free to add Mac-specific features and will issue releases independently of the PC version of the package. Bob Hoffman, N3CVL, is acting in a similar capacity as coordinator of the Unix version of the package.

Announcements will be made on Usenet, CompuServe, and in written forums such as this when the next official release is available. In the meantime, if you absolutely can't stand the anticipation, and are willing to live without adequate documentation (IE: this is not for the faint of heart!), beta release versions of the software, with some or all of the above features included, are available from louie.udel.edu on the Internet in the directory pub/ka9q, and over the phone from Howard

Leadman WB3FFV's BBS in Maryland. Copies of a slightly-updated version of the last official release are available from TAPR on PC floppies.

I welcome communication from users with suggestions for additional services, and from anyone who has modified or made additions to the package. I can be reached as bdale@hp-col.hp.com on the Internet, or as N3EUA@WB0BLV on packet.

APLINK — A DUAL PORT AMTOR/ PACKET BBS

by Paul Newland, ad7i
Post Office Box 205
Holmdel, NJ 07733-0205

APLink is a software system that runs on an IBM PC (or compatible). It provides an AMTOR mailbox via either an AMT-1 or PK-232 through the serial port. AMTOR users, via HF, can enter messages or bulletins to other stations. The commands are similar to VHF packet systems but without the verbosity that is often found on those systems.

An additional feature of APLink is that HF AMTOR users can enter messages to be automatically forwarded over the North American packet network. To do this, the SYSOP installs an additional serial port on the PC and connects this port to a TNC-2 (or clone) for a VHF packet interface. With this addition, AMTOR stations can enter messages for relay via VHF packet. Also, packet users can forward messages to remote AMTOR stations. This feature is used today by ocean going ham radio recreational sailors in the Caribbean, the Gulf of Mexico and the Atlantic who want to keep in touch with their ham friends back in the states. I use an APLink system in the San Francisco area to keep in touch with a friend in Honolulu. It truely has "long-haul" capability.

APLink was written by Vic Poor, W5SMM, and is available for ham radio use without charge. The software is distributed on a single 5-1/4" MS-DOS 360K floppy diskette. Those who would like to receive a copy of the software should send a floppy mailer that contains a formatted 360 K diskette, a self addressed label and return postage to me at:

Paul Newland, ad7i
Post Office Box 205
Holmdel, NJ 07733-0205

I am acting only as a "clerk" for this software dissemination process. I don't run an APLink system, although I am a frequent APLink user. Those who need answers to technical questions about establishing an APLink system should contact:

Craig McCartney, WA8DRZ
160 Montalvo Road
Redwood City, CA 94062

You can also leave a message for Craig on his APLink system. He scans mark frequencies of 14072.5, 73.5, 74.5 and 75.5 looking for AMTOR ARQ selcall WDRZ.

I would also encourage people to check into the APLink system that Craig has running. Because his system scans several channels users may need to "call" for up to 30 seconds before they get a response on the channel they are using.

We are seeking additional stations to run APLink to aid in system-testing the code, although the system is already pretty stable. The software is free for the asking.

TAPR'S NEW ADDRESS

Reminder: TAPR has a new mailing address now. It is:
TAPR
Box 12925
Tucson AZ, 85732.

UPDATE ON PACKET BBS SOFTWARE AND OPERATIONS

by David B. Toth, VE3GYQ (aka Dr. Death)

So what's happening in the "What's New Widyou" department ? Well, the two new features in the W0RLI code are hierarchical addressing schemes (as of version 7.xx) and a WP (White Pages) cache-server (as of version 8.xx). The current version released is version 8.09, and it appears to be relatively bug-free.

A full discussion of the hierarchical addressing specification would occupy a tad too much space, and for a full explanation of this feature, the reader is referred to the article in the ARRL Seventh Computer Networking Conference. Suffice it to say, we have adopted two (2) letter continent designators, three letter country designators, and the two letter state and province codes, so that a full address for my BBS would be VE3GYQ.ON.CAN.NA ... This can be thought of simply as "VE3GYQ which is in ONtario which is in CANada which is in North America". Other examples include N6VV.CA.USA.NA and W1AW.CT.USA.NA ... the advantage of this is that a BBS operator can now route stuff to a given HF gateway, based on additional address info. (Sure helps when you have KL7 BBSs in Florida !) For example, something to JA1ABC @ JA1KSO.JAP.AS will get routed to the N6VV BBS in California, because I have both AS (ASia) and JAP (JAPan) in my forward file entry for N6VV (but either one alone would have done it).

DO NOT, I REPEAT, DO NOT pull a stunt like this: SP W1ABC @ K1UGM.WB1DSW.N6VV in an effort to force the message from N6VV to WB1DSW to K1UGM. These are ADDRESSES not ROUTES, and the afore- mentioned stunt will send your message to the packet merry-go-round, bouncing between BBSs (trust me, it's the way the code will interpret the silly thing you did).

As for the WP cache-server, this is a nice twist. This is a feature that can be enabled or disabled, and most HF gateways have it enabled. If a WP query comes to such a BBS, and that BBS has the info in its database, IT will answer the enquiry, and kill the request. If it cannot answer the question, it passes it on via HF to the next server, and the process starts all over. As updates flow through such a server, its database is updated too. All of these entries have dates on them now, so that the database is purged based on age of the information.

It would be nice if everyone would take the cutesy (read silly) junk out of their headers, and put their real location in the header. It looks better in the database, since the headers of all messages coming through the BBS are scanned for BBS location and ZIP code.

The WP server should likely only be activated at high traffic nodes. These would include the HF gateways and key relay BBSs, as they would see enough info flowing by so as to make their databases expand quickly.

The current version of MBL code is version 5.12 . According to W3IWI, there are no immediate plans to add hierarchical addressing to the WA7MBL code. AA4RE is busy keeping his BB program updated to add the routing feature to it.

If you have any questions or comments, please send them to me via packet to

VE3GYQ @
VE3GYQ.ON.CAN.NA

73, Dave

IN THE MAILBOX

by Roy Engehausen AA4RE

Keep those cards, letters, and packet messages flowing. I can use all the news especially on the non-IBMPC based systems. Please drop me a quick note and share this information with us all.

HIERARCHICAL ADDRESSING

Past columns have discussed the pros and cons of zip code, area code and other routing schemes. Well Hank, WØRLI, has come up with the notion of hierarchical addressing.

A hierarchical address is composed of any number of fields delimited by dot ("."). The fields are in the order more to less specific from left to right (see examples below).

Examples:

```
WØRLI.NORCAL.USA
JA2XXX.32.J2NET.JPN.ASIA
 AMSAT
 MD.USA
 95Ø6Ø.CA.USA
```

How does forwarding work?

For each message, each field of the hierarchical address becomes a candidate key for routing the message. They leftmost field of the hierarchical address that matches an entry in any routing list is used to forward the message. For example:

```
JA2XXX.32.J2NET.JPN.AS
```

If JA2XXX is in my route list, I route to him directly. If 32 is in my route list, I use that route. If J2NET is in my route list, then I use it. If JPN is in my route list, then I use it. If AS (for Asia) is in my route list, then I use it.

Stations outside Asia would all have AS in their route list, routing their traffic to some nearby HF gateway which can route to Asia. The HF station that routes to Japan would route using the JPN part of the address. Inside Japan, the gateway station would route toward the JA2 districts using the J2NET part of the address. Inside JA2, stations would route toward the correct region using the 32 part of the address. Inside the 32 region, stations would route directly to JA2XXX using the first part of the address.

One useful way to think about hierarchical address is to think of the "." as meaning "is within" . Thus the address WØRLI.NORCAL.USA means "WØRLI, who is in NORCAL, which is in USA".

Under the standards proposed by N6VV, VE3GYQ, and WØRLI at the last ARRL Digital Communications Convention, two letter codes have been assigned for each continent. For country codes, there is a generally accepted international standard for abbreviations. These are used in international electronic message standards such as ANSI X.12 and EDIFACT. They are published by the International Standards Organization and known formally as ISO 3166-1981(E/F).

As a minimum, USA mailboxes will look like:

```
mailbox_call.state.USA.NA
```

The latest versions of the WØRLI and AA4RE mailbox programs support hierarchical addressing. As the concept spreads you will start to see more and more use of the hierarchical address. It certainly beats the zip code idea since it will work in all countries. Find out what your local mailboxes address is and start using it in your mail!

WØRLI SOFTWARE

Hank has issued many releases since the last PSR. The current version as this is being written is 9.00. Features are hierarchical addressing, roundtable, and automatic WP (white pages) lookup. The latter allows a mailbox to automatically reroute mail for someone to the home BBS shown in the user data file.

W0RLI V7 and higher require either a 80286 (standard in the PC/AT and clones) or a V-20 processor in your PC. The V-20 is a pin-for-pin compatible chip to the 8088 found standard in the PC and PC/XT. You can buy these mail order from any number of sources for about $10 and are a good investment. Not only does the V-20 have the extra instructions you need for the RLI code but it also is 10-15% faster and uses much less power.

Hank also is using some new BIOS functions that may not operate under old copies of COMBIOS, COM1BIOS, etc. Anyone wanting to upgrade their mailbox software should either use the BIOS routines that come with the RLI software or use MBBIOS.

The software can be obtained by downloading from the WA6RDH BBS at 916-678-1535 at 300/1200/2400 N81.

WA7MBL SOFTWARE

Latest version is 5.12 and it handles both multiconnect and single connect configurations. Distribution is via:

Wes Morris, K7PYK
7422 E McKinley Street
Scottsdale, AZ 85257

XEROX 820 SOFTWARE

The old Xerox 820 software has been updated to version 12.3. Bids are now handled as well as reverse forwarding. Contact N4XI @ N4XI.IN.USA.NA for information. Distribution is via:

Mike Anderson, KA9LQM
PO Box 958
Evansville, IN 47706

AA4RE SOFTWARE

The AA4RE mailbox program version 2.2 has just become available. The program features multiple ports and multiple connects per port. New for version 2 are hierarchical addressing and support for the AEA PK-87 and PK-232 TNCs.

The program requires a "HOSTMODE" TNC. Currently supported are the TNC-1, TNC-2 (and clones). Either NORD><LINK's or WA8DED's hostmode software must be installed. The AEA PK-87 and PK-232 are supported as well as the DRSI PC*PA and the PACCOM PC-110/120 cards.

MBBIOS version 3.2 is now available. There are only a few new features for the average user. If your are happy with your current version, don't change it.

You can get these programs thru CompuServe or send a FORMATTED diskette with SASE to either:

Frank McPherson KB7TV
16410 South 46th Place
Phoenix, AZ 85044
(602) 759-1854

5 1/4" or 3 1/2", Single or double density

or

Gary Mitchell, WB9TPG
220 East Eagle St.
Versailles, KY 40383
(606) 873-8329
WB9TPG@WB9TPG.KY.USA.NA

Source is also available. Source code requires another 360K diskette except for the mailbox program which needs two 360K diskettes alone. Gary can handle the standard 5 1/4" 360K disks while Frank can write on 5 1/4" or 3 1/2", single or double density (360K, 1.2MB, 720K, 1.44MB). Please don't send diskettes to AA4RE.

The software can also be obtained by downloading from the WA6RDH BBS at 916-678-1535 at 300/1200/2400 N81.

FEEDBACK WANTED

I would love to hear from you. Send any suggestions, comments, new tibits, and hate mail (in good taste of course) to:

```
PACKET:
AA4RE @
AA4RE.#NORCAL.CA.USA.NA
```

CompuServe: 76064,2107

Internet: ENGE @ IBM.COM

USMail: 8660 Del Rey Court
Gilroy, CA 95020.

PLEASE CHECK YOUR MAILING LABEL!!!

The mailing label on your copy of PSR shows the month and year that your your TAPR membership expires.

Please check it to see if you are within a month or so of membership expiration.

Keep up your membership.

Reminder: TAPR has a new mailing address now. It is:

TAPR
Box 12925
Tucson AZ, 85732

TAPR has a lot of interesting projects "in the mill." Your continued support of TAPR through your membership will help bring these projects to the Amateur Radio community.

Please continue to support TAPR through your membership renewals and new memberships!

HARDWARE HAPPENINGS

DSP 1 INPUT/OUTPUT INTERFACE DESIGN

by Lyle Johnson, WA7GXD

OVERVIEW

The joint TAPR/AMSAT DSP 1 project, as you probably know by now, is intended to provide the radio amateur with a general purpose digital signal processing appliance. The initial applications will probably include radio modems for such diverse tasks as HF, VHF/UHF and OSCAR packet systems using FSK, PSK and other techniques. Secondary functions may include SSTV, WEFAX, RTTY and AMTOR modems.

The system is designed to grow. The hardware is modular in design, with upgrades in hardware performance possible by a simple board swap.

The Ten Tec all-metal cabinet contains a multi-layer rear panel I/O board. A power supply board occupies the bottom of the cabinet. An optional secondary DSP board lies above the supply, followed by the primary DSP board and topped off with a general purpose processor (GPP) or a simple loader board. The GPP or loader occupies the top of the board stack so software updates in the form of EPROMs can be easily installed. Finally, a front panel board is attached to the front of the cabinet.

As of late October, the I/O board and power supply board layouts are complete. The remainder of this column will discuss these boards.

I/O BOARD CONNECTORS

There are several connectors that interface the I/O board to the outside world. They include power, CW key (+ and -), two radio connectors, parallel printer port, modem disconnect, serial port and two high-speed parallel ports.

POWER DISTRIBUTION

The power connector accepts +12 volts nominal. The design range is +10 volts minimum and +14 volts maximum, although voltages up to about +16 can be handled safely. A standard 2.1 mm power connector with center post positive is planned, just as on the TNC 2.

Power is routed through an LC low pass filter and fuse, then to the front panel switch via the GPP board, and finally to the power supply board itself.

The initial power supply board consists of standard TO-220 style +5 volt (LM7805CT) and +8 volt (LM7808CT) regulators, heat sinked to the cabinet bottom plate. An LTC1054 100 mA-capable charge pump generates a regulated -8 volt source.

The I/O board then distributes +8, +5, -8 and common to the DSP and GPP boards.

+8 and -8 volts were chosen to provide reasonable RS-232 drive levels as well as allow local +5 and -5 volt regulators for analog circuitry on the DSP board(s). This scheme is similar to the old S-100 power distribution strategy.

CW KEYING

There are a pair of RCA jacks used for CW keying outputs. They are driven in parallel by a single bit routed from the GPP board.

One output is for keying positive voltages to ground. It utilizes a VN10 power FET, good to about +60 volts, with spike and reverse polarity protection via a 1N4006 diode. The key line is decoupled for RF by a 100 ohm series resistor and a 0.001 uF parallel capacitor.

It is recommended that no voltages higher than +35 be keyed with this circuit with keyed current not to exceed 100 mA.

The second output is for negative polarity (such as grid-block keying). It uses a high-voltage PNP transistor returned to the +5 volt supply to effect keying, with reverse polarity protection and RF decoupling equivalent to that of the positive keying circuit.

It is recommended that voltages not more negative than -100 volts at currents not exceeding 10 mA be keyed with this circuit.

HIGH SPEED PARALLEL PORTS

A pair of high speed parallel ports are provided. One is a 16-bit wide input port, the other a 16-bit wide output port. These ports interface directly to the primary DSP board position.

Each of these sections has its own ground plane on the I/O board.

Each port has a strobe line which goes to ground when data is ready on the port, and an acknowledge line which is pulled to ground when the data has been accepted. The provider of the data handles the strobe; the acceptor the acknowledge.

37-pin D subminiature connectors are employed, with ground wires between each signal line. This provides a fairly constant impedance and good isolation between lines. It also helps minimize EMI/RFI problems.

These ports are options. It is anticipated that most users will never populate them nor require them. However, there may be some applications that need them, so they are included. After all, this is intended to be a DSP experimenter's device, not a "we've-thought-of-it-all-and-if-we-left-it-out-it's-because-we-know-you-don't-need-it" appliance!

SERIAL PORT

A 9-pin D series subminiature connector is used for serial data exchange between the DSP 1 and a host computer. The connector is wired to be compatible with an IBM PC/AT pinout. Tx and Rx data lines are provided, along with CTS/RTS handshake, DCD, DTR and DSR. RI is a no connect. +8 and -8 volt levels are used for RS-232 level compatibility.

The D connector is female, and a male-to-female, pin-for-pin extender cable can be used to connect directly to a PC/AT serial port (or a MicroVAX II console port...).

A Motorola MC145406 CMOS level shifter is used, and TTL logic levels are then interfaced to the GPP board.

PARALLEL PRINTER PORT

The parallel port uses a 25 pin D subminiature connector with a pinout the same as an IBM PC. Thus, inexpensive and readily available printer cables can be used. All lines are connected in hardware, although software drivers may not necessarily make use of all signal lines defined.

At a minimum, 8 data bits, strobe and acknowledge should be supported.

If the loader board is used in place of the GPP board, a means of connecting this port to a printer port for software upload is being investigated.

MODEM DISCONNECT

A 9-pin D subminiature connector is used for the modem disconnect. This is different than the 8-pin DIN connector used in the TAPR PSK modem; the choice was forced by mechanical design considerations.

The purpose of this connector is to allow the DSP 1, usually in concert with the simple loader option, to function as an external modem for an existing TNC. This would allow the DSP 1 to act as an efficient HF modem, or a PSK modem for OSCAR use, etc.

In most applications, it is expected that the user will opt for the GPP board which can then perform the normal TNC or multimode controller functions. Since the GPP option can be installed for less than the current going sale price of a used TNC, a user may want to consider purchasing the GPP option and selling his old TNC at a swap meet.

The modem disconnect is a simple pass through of signals, without filtering other than that provided by the multi-layer PC board, from the D connector to the GPP board.

RADIO PORTS

Each radio port sports a 15-pin D connector.

This decision was a painful one. The TNC 1 used a 9-pin D connector. The TNC 2 used a 5-pin DIN connector for space and economy reasons.

Unfortunately, more pins are required to implement a useful radio connector in today's progressing packet environment. Mechanical considerations suggested the use of a D series connector. 15 pins seemed a reasonable number. The functions included are:

1 pin - digital ground 2 pins - analog signal ground 1 pin - Tx audio out 1 pin - Rx audio in 1 pin - PTT out 1 pin - DCD (TTL level) input 2 pins - RTS/CTS (TTL level) interlock 4 pins - radio up/down tuning 2 pins - digital (TTL level) spares

The digital ground and analog grounds are separated for noise considerations. Separate digital and analog ground planes are provided on the multi-layer I/O board.

Tx and Rx audio levels are buffered, isolated through R/C pi networks for EMI/RFI considerations, and independent, rear-panel accessible level controls are used for each line (total of four adjustments). The lines are AC coupled since some radios return their audio internally to positive potentials, some to ground or negative potentials. Jumpers are provided for radios (such as some ICOM and KENWOOD models) which multiplex the PTT and Tx audio lines.

PTT is the usual TAPR circuit which employs a VN10 MOSFET switch with a 33 volt zener for protection. The PTT line is protected for RFI/EMI by a series resistor and parallel capacitor. The PTT line is also protected by a one-shot circuit with a time-out on the order of several tens of seconds to a very few minutes.

NOTE: There is no software selectable method of disabling the watchdog. Some commercial multi-mode units include such disabling circuits, which simply means that if the CPU goes crazy, it can do so in a manner which will enable it to disable transmit protection!

A DCD input is provided, again at TTL levels, for shared channel use. It is expected that the default definition of this pin will be to not activate the transmission sequence if the line is active. Alternatively, it may be used as a general purpose digital input line.

The RTS/CTS interlock provides a means whereby the GPP CPU can determine if the watchdog has timed out and then take appropriate action. It may also be employed to accommodate external radios or other devices which may require some turnaround time between activation of PTT and the commencement of data transmission.

Radio up/down tuning allows either a +5 volt level or a ground level to be applied to the up/down inputs of a radio to tune it. This is especially applicable for such things as Doppler correction in a satellite modem. Both polarities are commonly used, so pins were allocated for either case. In addition, jumpers with resistors are provided for those ICOM radios which use a three-level voltage scheme to tune up, down, or hold. The up/down drivers are open-drain with 4.7k pull-ups to +5 volts.

Two spare lines for digital I/O are routed directly to the GPP board for application specific needs.

OTHER DESIGN CONSIDERATIONS

The I/O board is multi-layer, meaning there is an embedded power plane and ground plane(s) internal to the board. This allows for better circuit layout and reduces the stray inductance of the power distribution system to negligible levels.

It aids greatly in reducing EMI/RFI susceptibility.

The analog ground is separate from the digital ground. They are joined at DC through a 10 microhenry choke to keep high frequency hash out of the audio system.

The audio system is designed to handle +/-2.5 volt signal levels with some headroom.

Up to two DSP boards may be installed in the DSP 1 system, each containing a pair of audio channels. For this reason, a scheme of multiplexing the two radio ports to the four possible audio channels is provided. CMOS multiplexers (CD4053) are included in the I/O board, along with a pair of TTL level control lines to allow any radio port to be switched to any audio port under GPP software control.

The I/O board contains only one set of 16-bit parallel I/O port connectors. These ports are connected to the primary DSP board position in the DSP 1 system. This is the only difference between the primary and secondary processors.

WRAP UP

The DSP 1 system is being designed to provide as much flexibility as practical and still be affordable. The rear panel I/O board is the power and signal interface to the real world, and it has been designed to provide the required functionality.

In the next issue of PSR, I hope to describe at least one of the processor boards in some detail.

Until then, happy packeting!

HAKKAIDO HAMVENTION TRIP REPORT

by Harold Price, NK6K.

I recently had the opportunity to go to Japan at the invitation of the JARL to attend the Hokkaido Hamvention. Hokkaido is the northernmost large island in the Japanese chain. The hamvention was the first large gathering of its kind on the north island, and was held in the city of Sapporo, site of the 1972 Winter Olympics. The hamvention lasted two days, and was well attended by both hams and vendors.

I was asked to represent TAPR and to give a talk on the early days of packet in the US and TAPR's role in it. I gave this talk in a well attended Saturday session, and I spoke in English. Dr. Masato Hata, JA3ODC supplied a translation. I would speak a few sentences, then he would translate. If you think plain public speaking is tough, try to keep your story straight while speaking in packets. About one third of the audience was keeping up with the English version. I could tell because this group laughed immediately after a funny comment, the remainder laughed 30 seconds later.

I also had dinner with the Hokkaido Packet Group (HPG), and with members of the Tokyo-based Packet Radio User's Group (PRUG). At that dinner, JR1VMX, who had designed the surface- mount micro TNC-2 that fits on a 2" x 3" board, showed me his latest effort, a laptop computer with TNC built in. He had taken a standard Japanese 16-bit battery powered LCD laptop, put the micro TNC inside, and added a 5-pin DIN connector to the side of the laptop case. The four status indicator lights were added near the keyboard. The micro TNC was powered from the laptop's battery and internally connected to the serial data chip, the only other item required was a handheld for a very portable station.

HPG had a large booth at the convention, with displays showing W0RLI BBS systems as well as home-grown systems. 9600 baud TNCs were shown using G3RUH modems. A NETROM map with 13 nodes was displayed, but I'm not sure how large a geographical area was represented. Graphics transmission using the NAPLPS protocol was demoed. At another booth, a ham was selling an interface that connected a standard commercial FAX (group 3) machine to an HF transmitter. As personal FAX machines are getting down below $1000 dollars now, and PC plug-in cards are less than $600, FAX may see more use on the ham bands.

JL1FGX gave a paper which showed the start of a 10Mbps modem using an FM TV transmitter and receiver at 10GHz. A scope was used to show a clean eye pattern and recovered clock. No packets were sent as there are currently no TNCs that will handle a 10Mbps data rate. Lyle?

The Japanese have good access to current North American packet news, I saw day-old AMSAT Telemail and Section 9 CompuServe printouts. I stressed the interest in the US of the activities of packeteers in other countries and asked that information on JA activity be placed on CompuServe and Telemail. One of the difficulties of course is that while many in Japan can read some English, very few in the U.S. can read any Japanese. Not only are we asking for information, we are also asking that they translate for us. Maybe TAPR should put $1000 a year up for translating the best recent Japanese papers for re-print in English.

I saw several other wonders at the hamvention, such as 24 GHz TV. I also met the only YL W0RLI bbs sysop (as attested to during last year's trip to Japan by W0RLI) Chisato Ueno, JG7GXQ.

No trip to Japan is complete without a trip to Akihabara, the electronics retail district of Tokyo. I was given a tour there by JAMSAT members Miki Nakayama, JR1SWB, and Tak Okamoto, whose call I keep forgetting. While the current exchange rate precludes finding any bargains, it was an interesting experience. There are a large variety of TNCs for sale; licensed TNC-2 clones, AEA PK-232 and PK-88 models sold by Ward, and various JA designs. The PK-88 was 26,000 yen, or about $200.00.

I also had a chance to talk about the AMSAT Microsat project, which is partially funded by TAPR, and the UoSat D spacecraft with several JAMSAT people on my last day in Japan. I enjoyed the opportunity to spread the word about TAPR's projects and goals, and solicit the continued exchange of information between all packet working groups.

Thanks go to Toshi Kawanishi, JA8RUZ, and to Masato Hata, JA3ODC, for making the logistics of the trip easy and for helping me over the language barrier; and to the JARL and the Hamvention president Tsuneno Hara, JA8ATG.

HAPN MODEM INSTALLATION IN THE PAC COMM TINY TNC-2

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The HAPN-T 4800 baud modem available from HAPN is designed for the normal TAPR TNC-2 or it's clones. I had a Pac-Com Tiny TNC-2 which was to be used for a node on a backbone, using the Tiny 2 as the Net-Rom host. The Tiny 2 is quite a bit smaller than the normal TNC-2. The question was, can I squeeze it in, or would I have to mount it externally? Happily, one can mount it inside the Tiny 2.

Build the modem per HAPN instructions, except for the following: Leave out the J100, J101, J105 jumpers. These will hit the top inside of the case of the Tiny 2 if installed. Instead, determine what jumpers will be needed for your installation, and install wire jumpers using the left over resistor ends from the modem construction. In my case, the modem/TNC was to be dedicated on 4800, so I left out the U1/ MC14551 switching IC. I then jumpered pin 1 to 14 and pin 5 to pin 10 of the U1 socket.

Install the 20 pin modem disconnect header on the place provided for on the Tiny 2, but only cut the trace between pins 17 and 18. None other have to be broken. The modem now can be placed on the break out header connector, it will fit nicely in place towards the front.

To interface with the radio used, I decided to stay with the conventional 5 pin 180 degree DIN plug. Using a 5 pin female connector, prepare set of 4 wires about 6 inches long attached to pins 1,2,3 and 4 of the connector. This will form a free hanging connector off the back of the Tiny 2. Connect pin 1 of the 5 pin connector to pin 5 of J103 of the HAPN-t modem. Connect pin 2 of the 5 pin connector to pin 2 of J103 of the HAPN-t modem. Connect pin 3 of the 5 pin connector to the cathode of D9 on the Tiny 2. This is the TX PTT lead. Connect pin 4 of the 5 pin DIN to pin 4 of J103 of the HAPN-T modem. Finally, to get the DCD signal from the HAPN-T modem to the Tiny 2, pull the shorting jumper off JPD of the Tiny 2, and connect a wire jumper from pin 5 of J102 of the HAPN-T modem to the center pin of JPD of the Tiny 2.

One last connection for +12 VDC has to be made from the spot provided for on the HAPN-T modem to the cathode of D6 on the Tiny 2, this is located by the power plug.

This is all that is necessary for fitting these two together. You may now go ahead and adjust the modem per HAPN's instructions. Make sure to set your radio baud rates properly, in this case for 4800.

I did not worry about being able to switch between 1200 and 4800 in this modification. Looking at the diagrams, it can be done, but with more difficulty, as Pac Com uses the pin 16 of the modem disconnect header for a ground, so you will have to find a different way around that.

This end result gives you a Net-Rom compatible, 4800 baud TNC/switch in a very reasonably priced and smaller package.

PLEASE RENEW YOUR TAPR MEMBERSHIP!!!

NON-TECH TOPICS

by Andy Freeborn NØCCZ

PACKET PETE IS BACK

After a too-long hiatus Pete Eaton, WB9FLW, is back in the saddle at TAPR. He has already shown his propensity for management talent as he now functions as the project coordinator for the new packet-RADIO project. If there is anyone around that can tie all the loose ends together, while at the same time keeping peace in the family it is Pete. WELCOME BACK PACKET PETE

PACKET-RADIO TEAM

Many of the TAPR development team volunteer regulars are committed to the PACSAT and DSP development programs. That makes it necessary that the packet-RADIO program proceed without placing undue demands on the talents of those committed to these other programs. Pete is busily twisting arms of potential new blood and other tried and proven TAPR developers.

NETWORKING CONFERENCE - 1988

The ARRL 7th Computer Networking Conference was held at Columbia MD the weekend of October 1st. As is usually the case at these meetings, the presentations really get the juices flowing. It's always exciting to hear the various speakers present their plans, projects and programs for the enhancement of packet radio technology.

NETWORKING CONFERENCE - 1989

The ARRL 8th Computer Networking Conference will be held in Colorado Springs. Tentative plans provide that the Conference will be conducted at facilities on the grounds of the Air Force Academy. The date is also tentative but it looks like it will be on the weekend of October 7th. Air Force plays at Navy that weekend so their will not be the usual football game crowds to contend with. Mark it on your 1989 calendar, or at the end of your 1988 calendar to remind yourself. I understand that the 1990 meeting will be in London, Ont. and the 10th anniversary of these meetings in 1991 will be held in Washington DC.

NNC RE-VISITED

In mid-October TAPR received an inquiry from the West German amateur software group, NORD><LINK, concerning their desire to obtain a TAPR Network Node Controller. The NNC was developed by TAPR as a software development system. We are currently (late October) communicating with them. It is likely that they will become the newest members of the NNC development group.

TAPR FINANCIAL STATUS

We started the year with about $69,000 available for continued development work. Our financial commitment to the PACSAT program ($21,300), DSP development work and the new packet-RADIO program eats heavily into that reserve. We are, however,financially sound. Once these two programs have reached the stage where they can be licensed to industry we will again focus on building our reserves.

WHILE RUMMAGING

A few weeks ago, while pawing through some old stuff in my filing cabinet, I came across a membership roster that I received shortly after I joined TAPR. It is dated 26 Sept. 1982 and contains the names of the then 173 members. It also identifies the 48 members that were on board at the time of chartering (the Charter Members). Thought you might be interested in who the early birds in TAPR were, so here they are. They are listed in order of membership number: KD2S, WA7GXD, N7AIG, Mark Baker, N0ADI, WA7PXW, AG7H, K7KZ, WA7FDN, Green Valley ARC, KB7KX, N7CEF, W7TX, WB7CKY, KT7D, KB7XP, KA7GXP, U of Ariz., WA7MSK, WA7GME, KV7D, WA6WZ0, WB7PXR, W7EGV, W1UUP, N4ABY, WB0ROT, K9BL, WB7QJL, W9JHJ, W8KOX, WB9FLW, W7KB, AI7F, KB0ZL, KA2BQF, WA6FPX, WB9GHD, WA4BGM, KA0NHL, N0RKH, K2VAC, KE3D, WB7NJT, W3IWI, W6UPL, W2DHT, K9ZNE.

TAPR MEMBERS OUTSIDE NORTH AMERICA

We thank you for your patience in the past in getting your copy of PSR. New mailing procedures have been implemented which will speed up the delivery of PSRs outside North America. By the way, for the trivia buffs, TAPR memberships have included hams in 31 different countries outside North America.

THIS SPACE FOR RENT

Editors of journals like PSR are constanly in search of new talent willing to contribute articles. If you'd be interested in publishing your ideas about packet radio or digital communications in general, please contact the editor at the address shownon the back cover.

This issuer we're pleased to have so much good information to publish. Our authors include a couple of first time contributors - and you could join them in the next issue with your own contributions!

Letters to the Editor are equally wlecome and will be shared with the readership as appropriate!

In any case, please share your thoughts with us about how we're doing!

INTERNATIONAL ROUTING DESIGNATORS

(HIERARCHICAL ADDRESSES FOR BBS'S)

Lew Jenkins, N6VV
David B. Toth, M.D., VE3GYQ
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It has become obvious by now that the work-horse of our so-called packet network is the venerable BBS program. In fact, some will argue that it has been too successful. Every time that a band-aid is needed to "fix" the network, it is applied through the various BBS programs. It is probably fair to say that the maintenance of the forwarding tables is a drudgery that most sysops could do without. This point also under-scores a serious problem faced by all networks: ROUTING.

With the introduction of W0RLI V7.00 and support for Hierarchical routing designators, we have an opportunity to improve traffic routing particularly for international traffic. Since N6VV is at the present time responsible for traffic to Asia and the Pacific, and occasionally Europe and Africa, he has implemented some Hierarchical routing designators which will assist him in international routing.

Using this structure mail can now be addressed :

```
JA1ABC @ JA1KSO.JPN.AS
       or
VK4AHD @ AX4BBS.AUS.AU
```

Starting today you can begin using Continental and Country designators for international traffic destined for Asia and the Pacific. A forward file may be set up to support the following codes:

** Continental Designators **

```
NA  - North America
SA  - South America
EU  - Europe
AS  - Asia
AF  - Africa
AU  - Australia
```

** Country Designators **

For country codes there is a generally accepted international standard for abreviations. These are used in international electronic message standards such as ANSI X.12 and EDIFACT. They are published by the
International Standards Organization and known formally as ISO 3166-1981(E/F).

Country codes (abbreviated list to show common country codes):

Argentina	ARG
Japan	JPN
Australia	AUS
Korea,North	PRK
Austria	AUT
Korea,South	KOR
Belgium	BEL
Lebanon	LBN
Bermuda	BMU
Liechtenstein	LIE
Bolivia	BOL
Luxembourg	LUX
Brazil	BRA
Malaysia	MYS
Brunei	BRN
Mexico	MEX
Bulgaria	BGR
Monaco	MCO
Canada	CAN
Morocco	MAR
Chile	CHL
Netherlands	NLD
China	CHN
New Zealand	NZL
Colombia	COL
Nicaragua	NIC
Costa Rica	CRI
Norway	NOR
Cuba	CUB
Pakistan	PAK
Denmark	DNK
Panama	PAN
Dominican Republic	DOM
Paraguay	PRY
Ecuador	ECU
Peru	PER
Egypt	EGY
Phillipines	PHL
El Salvador	SLV
Poland	POL
Finland	FIN
Portugal	PRT
France	FRA
Romania	ROM
French Polynesia	PYF
Saudi Arabia	SAU
German Demo. Rep.	DDR
Singapore	SGP
Germany, Federal Rep	DEU
South Africa	ZAF
Greece	GRC
Spain	ESP
Greenland	GRL
Sweden	SWE
Guatemala	GTM
Switzerland	CHE
Haiti	HTI
Syria	SYR
Honduras	HND
Taiwan	TWN
Hong Kong	HKG
Thailand	THA
Hungary	HUN
Turkey	TUR
Iceland	ISL
United Kingdom	GBR
India	IND
United States	USA
Indonesia	IDN
Uruguay	URY
Ireland	IRL
USSR	SUN
Israel	ISR
Venezuela	VEN
Italy	ITA
Yugoslavia	YUG

State and province codes shall be the recognized two-character code established by the American and Canadian Post Offices. These may also be found in the Callbook listings.

It is after we get down to the state/ province/county level where the trouble may begin. To understand why, we must examine how the BBS code goes about matching things in the route. The first principle is that it attempts to find a match between the items in its forward file and the left-most item in the address field. As an example, say that we send some-

thing to
W0RLI @ W0RLI.CA.USA.NA,
and that the only entries

that we have in the forward file are for CA. That match would be sufficient to allow the message to be forwarded. If W0RLI were found, that entry would take precedence (because it is more left in the field than CA) and would of course also ensure delivery. The best way to look at it is "W0RLI AT W0RLI which is in CA which is in USA which is in NA". So far so good.

But the Japanese network wants to use area routing numbers. For example,
JA1ABC @ JA1KSO.42.JPN.AS ... and everyone says, "So what, let them!" Of course, that is very mature of all of us, but the trouble is that the 42 in that string may also match wild-card ZIP codes that some folks keep in their forward file, such as 42*. The solution we propose is to use an agreed upon key character for designators below the state and province level, and we recommend the octothorpe, "#".

So now the above address would be JA1ABC @ JA1KSO.#42.JPN.AS . Other examples could be:

1) W0RLI @ W0RLI.#SFO.#NORCA.CA.USA.NA - W0RLI within SFO (San Francisco) within North California, etc.

2) VE3BTZ @ VE3GYQ.#LONDN.#SONTONCANNA - VE3BTZ at VE3GYQ in London, in Southern Ontario, in Ontario, etc.

There is another added benefit to this scheme. It involves Gatewaying between the BBS world and other networks, such as TCP/IP via SMTP. Much of the pioneer work in setting up the gatewaying protocols has been done by NN2Z, N3EUA, and PA0GRI, amongst others. The W0RLI BBS package allows for the forwarding of mail between the BBS world and the SMTP world. Of note is the fact that the WA7MBL package has allowed such message exporting and importing for some time now. This means that we can take advantage of the the TCP/IP hostnames and their domain or hierarchical format for forwarding. Thus it is possible to send mail from the BBS to VE3BTZ as ve3btz@pc.ve3btz.ampr.org or from SMTP to w0rli@w0rli.ca.usa.na and not have any ambiguity.

We expect that WA7MBL will also be implementing hierarchical routing in the near future. This system is still compatible with older style systems, as a system that handles hierarchical forwarding identifies with the H feature letter: [RLI-8.00-CH$]. If it does not get an appropriate response, it uses the left-most item in the "@ BBS" string as the "@ BBS" for the message.

The authors hope that this paper will serve as a starting place for improved message routing by means of implicit routing. Low-level (VHF) BBSs need only maintain state or province or country codes for distant BBSs, and route such traffic to their nearest HF Gateway. In turn, the HF station routes it to the desired state, where the receiving Gateway station would have a detailed list of the BBSs it serves.

Correspondence may be addressed to the address given at the start of this paper, or to VE3GYQ @ VE3GYQ.ON.CAN.NA or N6VV @ N6VV.CA.USA.NA .

DPLL DERIVED DATA CARRIER DETECT (DCD) FOR FILTER BASED AND SINGLE CHIP MODEMS

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INTRODUCTION

If you have a TNC which uses either the AMD7910 or the TCM3105 single chip modem, or a TNC which uses a modem based on audio filters like the PK-232, you can vastly improve the DCD performance of your modem for packet radio use.

These single chip modems were originally designed for land line use. The designers, who had no idea that the chips might one day be applied to a radio system, made some assumptions about the incoming signal that simply do not apply to the radio environment. The data carrier detect function for them was not nearly so critical a function of the modem as it is for us on a busy packet radio channel. For the intended purpose of these chips, there was expected to be only 2 stations involved on any 1 channel at 1 time and these stations were connected by a nice quiet twisted pair. Under these circumstances, the Carrier Detect (CD) function built into these chips is entirely adequate. In the packet radio environment, the built in CD function found in these chips is virtually useless.

Since I can't make the same defense for the designers of filter based modems specifically intended for packet radio from the beginning, I won't try to speculate about what drove their design decisions.

As packet operation matures and the "network" topology becomes more refined towards maximum effeciency, user input to the "network" will more frequently be by way of duplex systems which eliminate hidden terminals. As this change from what is now essentially an ALOHA channel occurs, the importance of proper DCD operation will become more and more important. I hope that both the users and the manufacturers will begin to pay nore attention to this aspect of modem performance than they have in the past. If they do not, the so far unfulfilled promise of packet radio allowing effecient SHARING of a single radio channel amoung multiple users wil remain just an unfulfilled promise.

It is for this reason that I developed the circuit presented here to allow retrofit of functional DCD capabilities to the considerable number of defecient TNCs currently in the system. This circuit will allow your TNC to be used with unsquelched audio thus avoiding the unnecessary delay of the squelch circuit found in typical VHF FM radios. This circuit also provides several other important beneficial characteristics for the DCD system.

First, since the assumptions used when the TNC software was written depend on DCD representing the presence or absence of a data carrier on the channel, it is important that the DCD circuit be able to distinguish a data carrier from noise or other non packet signals to a reasonable degree. The DCD circuits which simply detect the presence of ANY type of signal or noise on the channel are simply inadequate to this task. Since the DCD circuit presented here is based on the update signals in a Digital Phase Locked Loop (DPLL) which recovers both baud clock and data from an NRZI packet data stream, its output represents true detection of the data carrier.

Second, once a data carrier decision has been correctly made, it is important that the DCD indication remain valid through short fades, collisions, and while a signal too marginal to decode is on the channel. This is accomplished by providing a DCD "hang time" of approximately 5 to 8 character periods (this can be optimized) to hold the DCD output true through short dropouts from the above causes. This prevents a queued up TNC from piling on collisions, transmitting over a station which has a marginal signal, and beginning to transmit over a station which is still transmitting but whose signal received a short multipath hit during the packet.

Third, it is important that the DCD system NOT be sensitive to audio amplitude variations. It should respond in exactly the same way for any signal that the modem is capable of decoding regardless of absolute input amplitude. Since this DCD circuit operates from the data recovered by the modem, all amplitude information is suppressed before the DCD circuit even sees the signal.

NOTE! If your TNC uses the EXAR 2211 demodulator, this new circuit is unnecessary for you. Your existing DCD circuit can be more easily modified for correct operation without this circuit. The modification procedure for the 2211 demodulator is presented in the August 1988 PSR and is not repeated here.

CIRCUIT DESCRIPTION

The circuit diagram is presented in Figure 1. This is an ASCII representation of the schematic diagram. While this isn't really a proper "standard" diagram, I believe it is readable enough to be used to duplicate the circuit. It has the beneficial characteristic that it requires no CAD or special graphics software to be able to view the diagram. Thanks to Mykle Raymond, N7JZT, for making up this BBS forwardable ASCII schematic.

The circuit consists of the state machine used in the TNC-2 and some delay elements used to make the DCD decision. The state machine is formed from the 74HC374 and the 27C64 chips. The 74HC14 is used as a pair of retriggerable delay elements and for signal inversion and buffering.

The 27C64 with the state machine code already burned into it can be obtained directly from TAPR. If you wish to use this source for the part, please call Chris at (602)-323-1710 for price and availability information. This same code is in the state machine ROM in any full TNC-2 clone which uses the 2211 demodulator and Z80 SIO. If sufficient interest is shown in this circuit, maybe we can cajole TAPR into making circuit boards available. This would vastly reduce the wiring task.

One of the state machine signals (which was not used in the TNC-2) appears on pin 19 of the 27C64. This signal is the DPLL update pulse. As long as the DPLL is correctly locked to the incoming data, no pulses will appear on this pin. When the DPLL is not locked to an incoming data stream, there will be a continuous stream of pulses on this pin.

The DPLL update signal is used in this circuit to retrigger the first delay element so that it never times out so long as DPLL update pulses are present. If the pulses disappear, the delay element times out and generates the DCD signal.

The output from the first delay element keeps the second delay element triggered so long as DCD is true. When DCD goes false, the second delay element begins a timeout sequence which keeps the DCD output true until the timeout period expires. This is the source of the DCD "hang time".

While the circuit presented here is primarily intended for 1200 baud VHF FM operation, it will also work well for 300 baud HF packet work. If this is your application, the time constants on the delay elements will have to be adjusted.

The time constant of the "hang" generator (0.47 uF cap) will have to be increased for 300 baud operation so that the total capacitance is 2.0 uF.

The time constant which is optimum for the DCD generator (the 0.1 uF cap in fig. 1) will depend on a number of factors including the bandwidth of the radio used ahead of the modem.

You should pick a value for the DCD generator delay capacitor such that the DCD circuit produces approximately a 10 percent duty cycle of false DCD "ON" time. The false DCD ON time should be observed while monitoring receiver noise on a channel which is ABSOLUTELY free of ANY narrowband signals which fall within the demodulator's passband. This includes CW, RTTY, internal receiver birdies, AM carriers, computer spurs, packet data carriers, etc. A good way to assure this is to let the receiver monitor the S-9 or greater output of a noise bridge with no antenna connected. Remember to have the filter of appropriate bandwidth selected and centered over the modem passband. For HF packet, this is a 500 Hz filter as is normally used for CW and RTTY operation.

The DCD generator delay capacitor will probably need to be somewhere in the range of 2 to 4 times the 0.1 uF value used for 1200 baud.

Both negative true and positive true DCD outputs are provided so that you may use the polarity which is required by your TNC. Also, JMP1 and JMP2 allow the DCD circuit to be configured to operate correctly from either a positive or negative true CD output from whichever modem chip is found in your TNC.

TNC SIGNALS

Once you have constructed the DCD circuit, you will have to obtain some signals from your TNC for the new DCD circuit to use. You will also have to arrange for the output of this circuit to be substituted for the normal DCD signal used in the TNC.

The signals required for the DCD circuit operation are:

1. A sample of the data recovered by the demodulator in the modem chip.

2. A sample of a clock which has a frequency of either 16 or 32 times the baud rate (X16 or X32 baud clock).

3. The intercepted Carrier Detect (CD) signal from the modem chip. This is the CD generated by the modem chip based on amplitude of the input audio.

4. A source of + 5 volts. If you use all CMOS parts, the current requirements are minimal. The 74HC14 MUST be a CMOS part for the circuit to work properly.

5. Ground

There are so many different TNCs to which this circuit can be applied that I cannot give specific interface information for all of them. However, I can provide signal pin numbers for the 2 land line modem chips most frequently encountered and I can help with signal locations in the AEA PK-232 and PK-87, the Kantronics KAM, and the Pac Comm TINY-2 TNCs.

The signals of interest on the AMD7910 modem chip are:

1. Receive Data output (RD)——> pin 24

2. Carrier Detect (CD)————> pin 25
This signal is negative true for the 7910 chip.

The signals of interest on the TCM3105 modem chip are:

1. Receive Data output (RXD)——> pin 8

2. Carrier Detect (CDT)————> pin 3. This signal is positive true for the 3105 chip.

3. In TNCs which use the TCM3105 chip but do not provide another source of the baud clock, like the Kantronics KAM, you can use the signal at pin 2 of this chip. This signal is very close to 16 times the baud rate (19.11 KHz instead of 19.2 KHz for 1200 baud).

TNC INTERFACE

If your TNC has provision for a TAPR style modem disconnect header, these signals (including the X16 or X32 baud clock) will be easily located and conveniently interfaced at this header. If it doesn't have this header, you will have to fish around in the circuit of your TNC on your own to locate them.

SHAME ON THE MANUFACTURER OF A TNC WITH NO MODEM DISCONNECT HEADER!!

The absence of a standard modem disconnect header means you may not CONVENIENTLY use ANY external modem with the deficient TNC. Using a standard disconnect system, the external modem can provide a front panel switch to allow you to select between the external and the internal modem.

Modems which you might like to interface without loosing the use of the internal AFSK modem would include the BPSK / MANCHESTER FM modems required for several of the satellites.

In any case, the DCD signal currently used in your TNC will have to be disconnected and rerouted through the new circuit.

STANDARD HEADER SIGNALS

The signal locations on the TAPR "standard" modem disconnect header are as follows:

Receive Data is obtained from header pin 18.

Carrier Detect is obtained from header pin 2.

DataCarrier Detect (DCD) is inserted at header pin 1. Jumper from header pin 1 to header pin 2 is removed.

The X16 (TNC-2) or X32 (TNC-1 and possibly TNC-2 clones using an 8530 HDLC controller instead of the Z80SIO) baud clock is obtained from header pin 12.

COMMERCIAL TNC SIGNAL LOCATIONS

Here is the information you need to find the proper signals in several commercially available TNCs. This is not intended to be a complete list by any means. It merely represents the units which I have had available to apply this circuit to here locally. These are the only TNCs for which I have specific interface information at this time.

AEA PK-87

It is relatively easy to interface this new DCD circuit to the PK-87. This is because there is no requirement to switch back to the internal DCD circuit once the modification is installed. If this were an external special purpose modem, you would be forced to open the TNC case and move several jumpers whenever you wished to change the modem being used.

However, for our purposes in this modification, the jumpers provide convenient, easily located places to obtain and inject signals.

The Receive data signal is obtained from the center pin of JP4.

The Carrier Detect signal is obtained from the end of JP5 which connects to the modem chip.

The DCD output signal from the new circuit is inserted at the center pin of JP5. Use the NEGATIVE TRUE output. The jumper originally installed at JP5 is removed. The DCD indicator on the front panel will show the action of the new DCD circuit.

The X32 baud clock signal is obtained from pin 13 of U20 (a 74LS393 divider). Don't be tempted to get this signal from the "clock" line on J4, the external modem connector, as this is a X1 clock.

I see so many manufacturers sending only the X1 baud clock out to an auxiliary modem connector that I have to wonder if they simply don't realize that synchronous modems require a clock which is a multiple of the baud rate. Asynchronous modems can cheaply and easily divide the X16 clock to get X1 but it is hard for synchronous modems to derive a faster clock from the X1 signal.

AEA PK-232

The PK-232 is also relatively easy to interface.

The Receive Data signal is obtained from the center pin of JP4.

The Carrier Detect signal is obtained from the end of JP6 which is NOT connected to pin 3 of the external modem connector.

The X32 baud clock signal is obtained from pin 13 of U8 (also a 74LS393 divider).

The DCD output from the new circuit is inserted at the center pin of JP6. Use the NEGATIVE TRUE output. The jumper originally installed at JP6 is removed.

To use the new DCD circuit with a PK-232 on VHF FM 1200 baud:

1. Set the audio level from the radio so that the tuning indicator "spreads" fully even on the station with the lowest transmitted audio level on the channel.

2. The existing DCD threshold control should be set so thatthe existing DCD indicator LED on the front panel lights up whenever there is ANY signal or noise input to the TNC from the radio. Be sure that even the station with the lowest amount of audio on the channel lights this LED. This LED should extinguish when there is no audio input from the radio (dead carrier from repeater etc.).

If you wish to observe the action of the DCD signal generated by the new circuit, attach a 1 K resistor in series with a LED to the LED output of the new DCD circuit. The anode of the LED should be connected via the resistor to +5 volts. The cathode of the LED should be connected to the LED output of the new DCD circuit. If you wish, this LED can be mounted on the front panel where it is visible. Use a high effeciency LED.

PAC-COMM TINY-2

The Pac-Comm TINY-2 does include a modem disconnect header. It is labeled J5 on their schematic diagram. For this they get +1 attaboy.

Unfortunately, Pac-Comm attached J5 pins 11 and 12 to the wrong part of the baud clock divider chain. These header pins should have been in series with pin 1 of U10. This error results in there being a X1 baud clock signal on these pins instead of the X16 baud clock that should be there. So, even though they did implement a modem disconnect header, you will have to obtain the X16 baud clock from elsewhere on the circuit board. For this they get -1 attaboy (at least they are breaking even).

The X16 baud clock signal is obtained from U10 pin 1.

Receive Data is obtained from J5 pin 17.

Negative true Carrier Detect (CDT) is obtained from J5 pin 2.

NOTE! This is an inverted version of the CD output from the TCM3105 chip itself. Since this is a negative true logic signal, JMP1 on the new DCD circuit will be used instead of JMP2 which would normally be used for a TCM3105.

NEGATIVE TRUE DCD from the new circuit is applied to the TNC at J5 pin 1. Remove the connection between J5 pins 2 and 1. The existing DCD indicator LED will NOT show the action of the new circuit.

If you wish to observe the action of the DCD signal generated by the new circuit, attach a 1 K resistor in series with a LED to the LED output of the new DCD circuit. The anode of the LED should be connected via the resistor to +5 volts. The cathode of the LED should be connected to the LED output of the new DCD circuit. If you wish, this LED can be mounted on the front panel where it is visible. Use a high effeciency LED and increase the value of the series resistor to match brightness with the other front panel indicators..

If you wish to observe the action of the DCD signal generated by the new circuit on the built in front panel LED, you will have to do the interface a bit differently. First, you will get the negative true CDT signal from pin 1 of JPD. Then insert the LED output signal from the new circuit at either pin 2 of JPD or pin 2 of J5. Remove the jumper currently installed at JPD on the TINY-2 circuit board. If the new circuit is interfaced in this manner, the "RFDCD" signal can no longer be used. This is no great loss, however, as it will also no longer be necessary.

KANTRONICS KAM

Interfacing anything to a Kantronics box isn't a job, it's an adventure! Kantronics has an official policy of discouraging anyone from hooking any third party device to their TNCs. This includes external modems of any kind (Never mind that their crystal ball has proven cloudy at best in the past when trying to predict what modems might be popular or necessary in the future).

This policy was enunciated to me by persons in their technical support department in two separate telephone conversations. So it was not surprising to find that the modem disconnect header in the KAM while physically identical to the TAPR header, is electrically different.

What I did find a little surprising, however, was the fact that they also refuse to provide an individual owner any assistance with signal locations. They don't say they don't know, they say they WON'T help you! If you want, for instance, to interface a JAS-1 (FO-12) style BPSK modem to your Kantronics TNC, you are on your own as far as Kantronics is concerned. Potential Kantronics buyers who are interested in working digital modes through this and the upcoming MICROSAT packet store and forward satellites should take note.

It turns out that the necessary signals ARE available (for 1200 baud at least) in the KAM. It is indeed possible to interface either the 1200 baud BPSK / MANCHESTER FM modem required for the JAS-1 bird or this DCD circuit (or both) to the KAM. However, you can expect no help from the TNC manufacturer in your endeavor to get this done.

At this time it is unclear whether the required clock signal is available for the DCD circuit to operate at 300 baud on this TNC. Even if it is, it would be more trouble than it is worth to interface as it would either require two separate DCD circuits or a switching arrangement to allow the use of one for both modems.

Since it is unlikely that the filter / slicer modem used in this box is a stellar performer when working with small shift to baud rate ratio signals of the type used for HF packet, maybe we should only really concern ourselves with 1200 baud operation anyhow.

It is worth noting that for wider shift to baud rate ratio signals like RTTY, ASCII, and AMTOR the filter / slicer type demodulator performance is perfectly adequate. When the shift to baud rate ratio is greater than 1, as with these modes, most of the transmitted signal energy is concentrated around and very close to the two tone frequencies. When this is the case, the filter / slicer is the preferred method of demodulation. As these modes do not operate in a Carrier Sense Multiple Access (CSMA) environment like packet requires, the built in CD function is adequate for these modes as well.

For 1200 baud operation then, the signal location points of interest in the KAM are as follows:

The Receive Data (RXD) signal is obtained from pin 8 of the TCM3105 modem chip. The Kantronics schematic shows what appear to be some numbered pads (17 and 18) on this lead to the processor. These numbers actually refer to pin numbers on the modem disconnect header in the KAM.

The X16 baud clock signal is obtained from pin 2 of the TCM3105.

The POSITIVE TRUE Carrier Detect (CDT) signal from the modem is obtained from pin 3 of the TCM3105. This line from the modem to the CPU uses pins 7 and 8 on the header.

The connection between these 2 locations should be broken. JMP2 on the new DCD circuit will be used.

The DCD output from the new cir-
* BUS wire connections are in order vertically. Top pin goes to top pin bottom pin goes to bottom pin etc.

cuit is injected at pin 21 of the 63B03 CPU.

The front panel LED which normally indicates the CDT signal activity will show the action of the new DCD circuit.

Figure 1 - ASCII Representation of DCD Circuit Schematic

```
        //=================7 WIRE BUS * ================\\
      ||                                                 ||
+5   V>----------+--+----------------+--+--+--+--+-----------------+-----+
SUPPLY||         |  +---|(---G       |  |  |  |  |       ||      __|___  |
      ||         |     10UF          |  |  |  |  |       ||     | 14   | |
      || +-------+-----+       +-----+--+--+--+--+-----+ ||     |      | |
      |\-| 3   20     2|-------|10  28 27 26 23  1   11|-/|     | U3   | |
      |\-| 4          5|-------| 9                   12|-/|     |74HC14| |
      |\-| 7   U1     6|-------| 8          U2       13|-/|     |      | |
      |\-| 8          9|-------| 7                   15|-/|     |__7___| |
      |\-|13 74HC374 12|-------| 6       27C64       16|-/|        |     |
      |\-|14         15|-------| 5                   17|-/|        G     |
       \-|17         16|-------| 4                   18|-/               |
DATA>----|18 11 10 1 19|-------| 3 25 24 22 21 20  2 19|--/\/\/\/----+   |
FROM     +---+--+--+---+       +----+--+--+--+--+--+---+     4.7K    |   |
MODEM CHIP   |  |  |                |  |  |  |  |  |                 |   |
             |  |  |                |  |  |  |  |  |            +----+   |
CLK >--------+  +--+                +--+--+--+--+--+            |        |
INPUT FROM         |                |                           |  Q1    |   Q2
X16 OR X32 BAUD    G                G                           |      E-+-E
CLOCK SOURCE                                                    |   |/ 2N   \|
                                                                +-B-| 3906   |-B-+
GND >---G                                                           |\ (2)  /|   |
                                                                       C-+-C     |
                                  1N4148                                 |       |
DCD <--------+                 +----|<|----+         +-------------------+       |
OUT     U3D  |   U3C     U3B   |           |   U3A   |                           |
___    8 /|9 |   6 /|5   4 /|3 |   220K    |  2 /|1  |   470K                    |
LED <--0< |--+---0< |--+-0< |--+--/\/\/\/--+--0< |---+--/\/\/\/--G               |
OUT      \|        \|  |   \|  |                \|   |                           |
___                    |       |   0.47UF            |   0.1UF                   |
DCD <------------------+       +----|(-----G         +----|(-----G               |
OUT         100K                                                                 |
       +--/\/\/\/--G                                                             |
       |  U3F                                                                    |
       |13|\12                            __                     10K             |
 CD >--+--| >0-------+------------------< CD   <---------+-----/\/\/\/-----------+
FROM      |/         |                   JMP1            |
MODEM                |                 (AMD7910)         |
CHIP                 |  11|\10                           |
                     +----| >0----------< CD  <----------+
                          |/             JMP2
                         U3E           (TCM3105)
```

NOTE: Only JMP1 OR JMP2 installed NOT both! * BUS wire connections are in order vertically. Top pin goes to top pin bottom pin goes to bottom pin etc.

A DIFFERENT APPROACH TO NETWORKING

A PROPOSAL FOR STUDY - For the next level of Networking in Ohio

(Originally presented at the 1988 Annual Meeting of the Ohio Packet Council, Inc.)

By Hank Greeb, N8XX
November 13, 1988

ABSTRACT: This paper presents an alternative to the linear networks which we currently are using and building in Ohio and surrounding states. It overcomes the well documented "ALOHA" syndrome, where actual throughput of of a random access network is inversely proportional to the amount of data being introduced. This phenomenon results from nodes hidden by either topography or distance which cannot hear each other and cause collisions. The ideas presented build upon concepts previously discussed at the ARRL Computer Networking Conferences. The effective throughput of the system would be close to the baud rate of the links involved.

It has been theoretically proven, and observed in practice, that current linear "ALOHA" networks are very inefficient. ALOHA occurs in any carrier sensed, multiple access packet network when distant nodes cannot hear each other but which are mutually within range of intermediate nodes. The throughput under this situation is INVERSELY proportional to the amount of data in the system - exactly opposite of what is really needed! This happens on 145.01, 145.05, on 221.11 MHz., and on any other linear networking frequency. Congestion can be minimized by increasing the baud rate of the network, so it does not often get more that 20 to 25% of its "nominal" rate, (which is the maximum theoretical rate for such a system) but under high loading the effective throughput is something like 8 to 16% of the actual baud rate of the network.

Lemke, WB9MJN, has proposed a cellular network. (See "Cellular Area Coverage Transport Networks" by Donald V. Lemke, WB9MJN, in the proceedings of the ARRL 7th Computer Networking Conference). He proposes full duplex nodes on the 1.3 GHz. band. Adjacent nodes have inverted transmit and receive frequencies. It is assumed that the three directions would be handled by three pairs of frequencies for the three directions. Getting three transmitters to coexist with three receivers at a site might be a bit difficult, though it probably could be done.

The fellows at AMSAT have a somewhat different idea - they use four receivers and two transmitters at a site. They are connected through a computer which receives AX.25 frames on the four channels, and generates AX.25 frames on two output channels. (For details see various articles on AMSAT's endeavors by Tom Clark, W3IWI, Charles L. Green, N0ADI, Lyle V. Johnson, WA7GXD, Robert McGwier, N4HY, Harold Price, NK6K, et. al. in the previously mentioned proceedings.) The things are packaged in an orbiting satellite some 130 miles above the earth, and have a BBS, telemetry, and other goodies, but these things are irrelevant to the current paper.

What does a spacecraft have to do with terrestrial networking? Well, if we use such a functional module as a building block, let's see what kind of a network might be developed. We could have a node with three receiving channels (bands?). It would transmit on a fourth frequency (band?) We could use a fifth port (used typically on a satellite for two-way telemetry and control functions) for connection to a LAN.

Let's look at what a node in Fairfield might look like. It might receive from Brookville, Indiana, on one frequency, from Dayton, Ohio on a second frequency, and from Walton, Kentucky on a third. It would transmit on a fourth. If duplexers could handle three receive frequencies and one transmit frequency (or if the frequencies were on separate bands?) the channel could be full duplex. However, the concept could work on a simplex mode, albeit at a slower rate and possibility for collisions and retries. A fifth bidirectional port would be connected to the 144.91 MHz. LAN.

From a series of such sites we can build a hexagonal network with a path of redundancy around any node - so that the network would not fail if an individual node failed. (See Figure I for a part of such a network which could be put in place in Southern Ohio, Northern Kentucky, and Southeast Indiana.) Each node would be equipped with three receivers, one transmitter, and a computer designed to look like a multi-port TNC. We could use the receive and transmit modules from the Microsat modified for 51, 220 or 440 MHz (or all three bands). Or maybe someone might figure out if a 900 or 1250 MHz. duplexor could be made to work with three receivers and one xmtr on the same band. Glenn Elmore, N6GN, reports (in the TCP/IP network) that VERY inexpensive modules are available for a 900 MHz. personal (CB-type) band in Japan - maybe these could be imported for use in the U.S. 902 MHz ham band? Or, maybe we could adapt the ever cheaper 900 MHz. cellular telephone strips for such use? Or use 1.3 GHz. RSGB modules? Possibly we could use pairs near 51/54 MHz, near 221/224 MHz, and a duplex pair in the 440 MHz range, with equipment currently in use on MIDNET and OHIONET on 50/220/450 MHz. With this tack we could develop software and hardware to prove and debug the concept before we plunge into the unknown world of 900 or 1250 MHz? We'd connect to a LAN frequency using standard AFSK FM rigs (for now).

What sort of computer might work? I think that four TNC-2's and a couple diode logic arrays COULD be made to work to test the idea. Their cost (about $500 plus NET/ROM software and diode matrices to couple things together) PROBABLY makes it better to use more sophisticated computer power in the long run. Would a PS-186 handle the job? Would the TAPR NNC work? How about TEXNET? Would the microcomputer being used for the Microsat project be an economical and otherwise practical choice? The advantage of the MICROSAT hardware is that it MUST be available by May 1989, because THE BIRD WILL FLY!! at that time.

Simplex nodes COULD used, but the overall throughput of the system would be cut by at least 50%. Special attention would need be paid to turnaround time of tx to rx to be effective. Software would have to be designed to NOT transmit if a packet were being received by a node, nor to attempt to transmit data to a node when that node was transmitting. All in all, it would be MUCH better to work full duplex.

The job of the node controller would be to receive packets from the receive ports, queue them for transmission (if simplex), or send them along to destination if duplex. It would need to allow for TX turn-on time, inasmuch as when the node were idle there would be no need for the transmitter to be running, and would have to be able to handle routing and alternative routings to handle congestion and/or failure of a node. Third level protocol like NET/ROM would be a MUST.

The nodes could be connected to LANs, or merely act as a trunking switch. If desired, and if the switch were capable of handling an extra port, a BBS forwarding port could be added to eliminate BBS forwarding on the LAN frequency. Speeds and modes of modulation, etc, could vary - and would require only the cooperation of the owners of the three adjacent nodes.

The general idea was well received at the OPAC meeting, and we agreed to continue a dialogue on how best to improve and implement networking.

73 de n8xx @ kc8tw hg (hank) -sk-

FIGURE I - DIAGRAM OF THE PROPOSED NETWORK

Here's a diagram of the network which could cover parts of southern Ohio, northern Kentucky, and southeast Indiana. Exact sites are not critical, as long as nodes can hear each other, and are approximately on the circumferernce of a circle. A few calls are listed, as the holders are currently active in packet and helping with networking in various ways. I did not intentionally ignore others who may be helping with the networking efforts.

```
                  PIQUA                   ?????
                  R B,D,F                 R B,D,F
                  T E                     T A
                    !
                    !                       !
                    !                       !
                    !                       !
                    !                       !
\                   !                       !
 \                Dayton                 Columbus        Zanesville
               to Brookville        N8NN-?/145.07        K1LT-? & Indiana
                 /    \                /R A,C,E            R A,C,E
N8GTC-?         /R A,C,E\             / T F    \          /T D \
    \ R A,C,E  / T B     \           /          \        /      \
     \T D     /           \         /            \      /        \
      \      /             \       /              \    /          \
       N8XX-?/144.91      WA8ERQ-?/145.05        Logan         Caldwell
      Fairfield            Washington           R B,D,F         R B,D,F
       ! R B,D,D           Court House           T E!            T A !
       ! T A              R B,D,F!                  !                !
       !                  T C    !                  !                !
       !                         !                  !                !
       !                         !                  !                !
       !                         !                  !                !
      KA4BCD-?/144.95      NK8T-?/145.01?       Wellston      Parkersburg
       Walton,Ky            Hillsboro           /R A,C,E        R A,C,E
       / R A,C,E            /R A,C,E\          / T B   \        T F/
      /  t F \             /  t D    \        /         \       /
     /        \           /           \      /           \     /
to Carrolton   \         /          Portsmouth          Gallipolis
& Louisville    \       /            R B,D,F              R B,D,F
                 \     /             T A                  T C
                 Falmouth
               WB9TPG-?
               R B,D,F!
                 t E  !
                      !
                  To Lexington
```

RADIO SETUP AND OPERATION TIPS FOR HF PACKET

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During the course of several years of HF packet operation (both for pleasure and for modem performance experiments) I have had many QSOs where station configuration for HF packet was discussed. These discussions have convinced me that the majority of the stations using this interesting mode on HF are not properly configured for optimum performance. If packet was not touted as wonderful because it allows sharing the use of a channel between many stations, this would not be disturbing. However, packet HAS been thus promoted. Unfortunately, when a ham decides to accept performance degradation to his station (or a manufacturer decides to cheap out) on packet, it affects not only the performance of that one station but it degrades the performance of the channel for everyone trying to use it. It is for this reason that I am writing this very rudimentary guide to system configuration and operating practices for those contemplating using packet on the HF amateur bands.

RADIO SETUP FOR HF OPERATION

Setting up your TNC to Radio interface will follow exactly the same procedure as for Narrow Band Frequency Modulated (NBFM) operation. However, you will probably not need to set the modem audio output level of the TNC. You will, however, need to consider several characteristics of the radio which you were not forced to think about when dealing with a NBFM radio as is typically used at VHF. The other radio characteristics you will need to be aware of for HF operation are radio bandwidth, Automatic Gain Control (AGC) characteristics, and frequency alignment between transmitted signal and receiver passband.

The modem output level is less critical because linear mode radios typically have a transmit audio level control on the front panel and an indicator which tells you when you have set the level correctly. You will adjust the audio level just as you would for SSB operation.

If you are using the auxiliary audio input connector (other than microphone input), you MAY need to adjust the transmit audio level from the TNC modulator. This is because many auxiliary audio inputs are intended for phone patch audio. These levels are typically much higher than microphone levels. If you do adjust the output level of the TNC to a relatively high value for this type of application, do not operate the TNC with a VHF NBFM radio unless you take steps to assure that the audio level for the FM radio will not produce excessive deviation. If both radios are to remain connected to the TNC, you can set the level for the one requiring high level audio and then use some attenuation (series resistor) in the interface cable for the other radio.

The modem center frequency used by the TNC is usually either 1700 Hz or 2200 Hz. Most frequencies listed for packet operations in the HF bands were established using a modem center frequency of 1700 Hz (1600 and 1800 Hz tones) in lower sideband mode. Using the other center frequency results in a 500 Hz offset (2200-1700) between the two modem standards. So a listed frequency of 7093, for example, will cause you to have a frequency display on your radio of 500 Hz PLUS the listed frequency (IF you are also using lower sideband mode). Thus you should find the 7093 KHz packet activity centered around 7093.5 KHz.

If you are using a TNC which has an EXAR 2211 demodulator, it should be used with the TAPR tuning indicator or one that is functionally equivalent. Some commercially available TNCs come already equipped with this tuning indicator. This tuning indicator, when properly centered, is easily capable of 10 Hz alignment accuracy. It should be used as the tuning reference on any individual signal regardless of the frequency indicated on the radio dial.

NOTE: The signal actually transmitted by your SSB transceiver (F(emission) when using the TNC for AFSK HF packet operation using lower sideband) will cover a band of frequencies approximately 400 Hz wide and centered at the transmitter indicated carrier frequency (F(ind)) minus the modem center frequency (Fc).

So you would use:

F(emission) = F(ind) minus Fc

to determine the center of the band of frequencies you are actually radiating for band edge or netting purposes. Remember to consider that you will be occupying a few hundred Hz on either side of F(emission).

NOTE! Regardless of the type of modem, whether or not the modem has audio filtering built in, 300 baud AFSK modem performance on a High Frequency linear mode (SSB as opposed to NBFM) radio channel will NOT be optimum UNLESS a filter of approximately 500 Hz bandwidth is used in the radio IF strip.

If you are going to use a narrow filter, and serious HF operation is NOT recommended without one, it will be necessary to take steps to be certain that the filter passband is centered over the modem center frequency. If your radio has IF shift, this is a simple matter. To center your radio passband over the modem, use the procedure outlined in appendix G of the modem tuneup procedures article in the August 1988 PSR.

NOTE! This procedure is NOT appropriate for use with tuning indicators other than the PLL loop stress indicator like the one available from TAPR for the EXAR 2211 demodulator. However, it IS important when using an appropriately narrow radio IF filter in conjunction with ANY demodulator to center the radio passband over whatever center frequency is used by the modem. This is a bit more difficult without the tuning indicator for reference but it must be done in order for the modem to work properly with the radio.

If your radio has no provision for IF shift, you will have to determine the center frequency of the audio which is passed through the filter and realign the modem to the center frequency of the filtered audio. If you are lucky, this may turn out not to be necessary. If your TNC uses the EXAR 2211 demodulator and is equipped with a TAPR style tuning indicator, the tuning indicator and DCD LED can be used to give you an indication as to wether or not the modem is aligned with the filter. If the tuning indicator hovers around the center of the display when the modem is listening to noise being passed through the narrow filter as described in the above mentioned PSR article, realignment of the modem is unnecessary.

If you have determined that it is necessary to realign the modem center frequency to the radio filter center frequency, one of the 2 methods presented in that same PSR article should be used to make the radio filter center frequency (Fc) determination.

Once the required center frequency has been determined, the modem calibration can be carried out.

NOTE: It will not be possible to realign the modem center frequency if your TNC uses one of the single chip modems which were intended only for land line use. These include the TCM-3105 and the AMD-7910 chips. It will also not be possible for the user to easily realign the center frequency of modems based on complex multistage filters such as the AEA PK-232 and HAL modems. Contact the manufacturer for procedures to use for realignment of this type modem.

Set the modulator tones to Fc MINUS 100 Hz for the low tone and Fc PLUS 100 Hz for the high tone using the procedure given in the owners manual. Then align the demodulator to the modulator tones using the procedure outlined in the August 1988 PSR modem tuneup article.

Once your modem and radio have been coaligned, you are ready to begin experimenting with HF packet communications.

300 BAUD HF PACKET OPERATION

Much has been said and written about the relative merits of HF versus VHF packet operation. HF packet operation is made to appear more difficult than VHF NBFM packet operation by several factors. Some of these are:

1. HF propagation is much more time variable and is more prone to produce intersymbol errors than is VHF propagation.

2. On the "published" HF packet frequencies, many more stations are trying to use a single channel simultaneously than is the usual case on VHF.

3. Due to the wide area propagation characteristic of HF radio waves (sometimes nonreciprocal) the Carrier Sense Multiple Access (CSMA) feature of packet radio is less able to police channel access than on VHF where duplex repeaters or regenerators may be used to eliminate hidden terminals.

4. Many of the commercially available Terminal Node Controllers (TNC) for use on HF packet have Data Carrier Detect (DCD) circuits which are of limited use or no use at all on a HF packet channel. This further degrades the effectiveness of CSMA.

In order for the TNC to function properly on HF, the DCD circuit in the TNC MUST be optimized for the HF packet mode. It must be possible to adjust the DCD to ignore background noise while still being able to promptly respond to a valid data carrier. It must have a "hang time" feature that prevents DCD dropouts when short multipath hits occur or collisions put phase discontinuities in the received data carrier. With this "hang time" feature most multipath conditions will not cause the TNC to begin transmitting before the other station is in a listening mode. The DCD hang time also prevents the TNC from "piling on" a collision between 2 other stations on the channel. The DCD circuit in the TNC must NOT be affected by the fact that there is a large amplitude difference between different signals on the same channel. So it will not allow you to collide with a relatively weak station which is transmitting immediately after a relatively strong station has finished.

Modifications were presented in appendix D of the August 1988 modem tuneup article in PSR which will upgrade the DCD circuit performance of any of the EXAR 2211 based demodulators. This modification has also been published in the latest proceedings of the ARRL Computer Networking Conference.

A circuit which is suitable for application to the single chip modems and the filter type modems is presented elsewhere in this issue of PSR. This circuit will give these modems DCD the characteristics outlined above. I strongly recommend the use of this DCD circuit for serious HF packet work. This circuit was also published in the latest proceedings of the ARRL Computer Networking Conference.

5. Many of the stations on HF packet have no tuning indicator at all and many others have an indicator that is only marginally useful. Unlike VHF FM operation, frequency error between transmitter and receiver cause frequency errors in the modem tones. This is the reason that a good tuning indicator is absolutely essential for HF packet operation. The tuning indicator makes it possible for the operator to reduce the modem to modem frequency error to near zero. Reliable HF packet operation requires tuning errors of +\- 30 Hz or less.

Anyone contemplating HF packet operation should make sure that his transceiver is in proper alignment. I have measured differences in transmit versus receive frequency in excess of 400 Hz in a number of different transceivers. Not on old obsolete gear but on relatively new equipment like the Kenwood TS-430S. A tuning error this large will make packet communication impossible on a multiple access channel. On a shared channel, everyone on the channel must be both transmitting AND receiving within plus or minus 30 Hz of the intended frequency. This misalignment is usually relatively easy to cure by proper alignment of the various offset and reference oscillators in the transceiver.

6. Many of the stations currently operating HF packet do not have their radio bandwidth matched to the characteristics of a 300 baud 200 Hz shift FSK signal. This causes a severe degradation in modem performance resulting in unnecessarily increased numbers of retries and drastic reduction in data throughput for the SHARED channel.

Serious 300 baud binary FSK HF packet operation should not be considered without a 500 Hz filter in the receiver IF. An audio filter is NOT an acceptable substitute.

"Squeezing" the edges of SSB filters together with so called variable bandwidth tuning (VBT or PBT) to produce a 500 Hz bandpass is difficult to properly align and results in operation near the edges of what are actually 2.4 KHz wide filters where the group delay characteristics of the filters are particularly poor. So while this may or may not offer some marginal improvement over wide filters, it is not a good substitute for a real 500 Hz filter.

In spite of the above factors, HF packet communications can be a reliable and enjoyable mode. The trick is to operate in a manner that allows you to avoid the problems mentioned above. You should make sure that the DCD circuit in your TNC possesses the above mentioned characteristics before getting on HF in earnest. You should also configure your radio's receiver bandwidth to match the spectral characteristics of the HF packet FSK signal. These actions will allow you to avoid the modem performance degradation that results from excessive radio bandwidth and poor DCD circuit performance. However, you will still be affected by other station's problems in these areas when operating on a crowded packet channel.

If you do have your radio configured for the proper bandwidth, you will notice that many stations you connect to will seem to not be able to copy you as well as you copy them. Don't worry, your transmitter output isn't low, you are just observing the difference between a demodulator behind a radio with its bandwidth appropriately limited and a demodulator behind a radio which has far too much bandwidth for the mode.

The actual mechanics of operating the TNC in the HF packet mode are the same as for the VHF packet mode. The main differences that will be apparent to you will be the slower baud rates, the higher incidence of propagation related effects and QRM, and the requirement for accurate tuning. It will take some practice before you can rapidly acquire another station's signal and initiate a contact.

If the TNC has a "threshold" adjustment for the DCD circuit, It will be necessary for you to set this adjustment correctly for the bandwidth of the radio being used. The modifications for 2211 based demodulators presented in the August 1988 PSR provide such a control for TNC-2s and clones.

The adjustment is very easy to perform.

NOTE! These instructions do NOT apply to the envelope amplitude only based DCD circuits such as found in the unmodified single chip modems and filter based modems.

Simply tune the radio to a channel which has only noise (no signals whatsoever), then adjust the threshold control so that the DCD LED just flickers occasionally. Set it so that the DCD duty cycle is around 10 percent or so. DO NOT set the threshold control so that the DCD LED never comes on even when receiving a signal!

If your radio has a bandwidth which is wide compared to the packet signal spectrum, the DCD LED may not flicker at ANY setting of the threshold control when monitoring only noise. In this case, set the threshold control to its maximum sensitivity position. The data carrier detector will function normally when monitoring a signal in this case.

Tuning in a signal is relatively easy to do once you get the hang of it. You must wait until the other station is sending a packet, and then tune the transceiver so that the tuning indicator LED is centered. If the DCD LED is not lit, the tuning indicator information is NOT valid.

Once you have the other station tuned in, you may initiate a connect request just as you would on VHF.

Calling CQ on HF is a bit different than on VHF. One technique which has proven effective when NOT operating on one of the congested calling frequencies is to do the following:

1. Find a clear frequency and monitor it for long enough to make sure it really is clear.

2. Set "UNProto" to CQ if it isn't already. This is the default field for this parameter.

3. Command the TNC into converse mode.

4. Rapidly type a string of 15 to 20 carriage returns (<CR>). This will cause the TNC to send a continuous string of unconnected information (UI) frames. Since this will be a relatively long burst of packet transmission, the potential receiving station will have plenty of time to tune in your signal. To a receiving station this will appear on his screen as:

YOURCALL > CQ:

YOURCALL > CQ:

YOURCALL > CQ:

YOURCALL > CQ:

YOURCALL > CQ:

.
.
.
.

One for each carriage return you typed (and his TNC decoded).

Even a station which has no tuning indicator can eventually get you tuned in using this type of signal as he can tune around and watch his screen to see where printing is effective.

If you are meeting a friend on a schedule, you just set the "UNProto" field to HISCALL and do the same thing. When your friend finds you, this will appear on his screen as:

YOURCALL > HISCALL:

YOURCALL > HISCALL:

YOURCALL > HISCALL:

.
.
.

For as many <CR>s as you typed. Your friend will have little trouble finding you and tuning you in for the QSO.

5. After the TNC finishes sending the string of CQ packets, listen for 5 to 10 seconds to allow a station to attempt to connect with you. If you don't get any nibbles, send another string of CQ packets.

If you have separate VFOs, and you are on a clear channel not attempting multiple access operation, you should leave your transmit frequency fixed on your initial CQ frequency if you are called by a slightly off frequency station. Do any tuning to optimize reception with the VFO that controls only the receive frequency. Receiver Incremental Tuning (RIT) can be used for this purpose on a single VFO transceiver. If you use your main VFO to tune in such a station, you will soon find yourself chasing him up or down the band as the QSO progresses.

The above method of calling CQ is NOT appropriate for use on one of the crowded calling frequencies. On the calling frequencies, everyone is already tuned more or less to the same frequency. To call CQ on one of the calling frequencies do the following:

1. Find the "center" of the channel by tuning the radio so that the tuning indicator is centered on most of the signals.

2. Make sure your "UNProto" field is set to CQ.

3. Enter converse mode.

4. Occasionally strike a <CR> (2 per minute or so if DCD lets your packets clear the channel that fast) and wait for the TNC to get an opportunity to squeeze the packet into the activity on the channel. Allow some time after your packet has been sent for someone to attempt a connect with you and then send another CQ packet by typing a <CR>.

5. If (when) someone connects, immediately negotiate a QSY to a clear channel. Then call him on the new frequency as outlined above (in the clear channel CQ procedure) for a scheduled contact.

Please use care in selecting the QSO frequency so as to avoid unnecessary interference to other amateur services. As in all amateur communication modes, on packet it is also polite to listen before you transmit!

Monitoring a propagation beacon frequency will not necessarily be sufficient to reveal this activity to you. It is best to make a note of which INDICATED frequencies you should avoid so that your radiated packet spectrum will not get within several hundred Hz of one of the propagation beacons. In the 20 meter band, I believe these beacons use 14.100 MHz.

HF packet operation is fundamentally different than other modes of operation in 1 major respect. If you are on a clear channel, talking to only

1 other station, there will be long periods of silence. People using other modes and tuning around looking for a clear frequency to use may be fooled by the silence. Don't assume that an interfering station who shows up considerably after you have begun using the frequency is interfering intentionally, he may honestly not have been aware of your QSO in progress. For this reason, it is a good idea to keep the flow of the conversation going so that the lapses aren't too long. It can also be advantageous to have more than one packet QSO on the channel. However, if more than a very few get on the same channel, the throughput will fall off rapidly since the likelihood that all stations are properly configured and have working DCD circuits is small.

Here are a few simple suggestions for operating HF packet which should help to get you started.

1. Do NOT try to hold a QSO on one of the calling frequencies. Use the calling frequency only to establish contact and then MOVE OFF TO A CLEAR FREQUENCY to carry on the QSO. Current wisdom from both the ARRL and the IARU suggests sharing the RTTY / AMTOR subband with packet operation. Remember to be aware of the frequencies your station is actually transmitting so you can avoid interference to other services such as propagation beacons etc.

2. Configure your station so that you can hear the activity on the channel. This will allow you to easily avoid interfering with other stations and also to quickly diagnose the problem when throughput suddenly falls off for some reason (usually propagation or interference).

3. If possible, use the highest frequency band possible to communicate with any specific station. The closer you are to the maximum useable frequency (MUF) for the path the less intersymbol interference you will have from multipath effects. If you have a schedule with another station, arrange your times and frequencies accordingly.

4. Set the following parameters off unless you have some specific reason for doing otherwise:

DIGIPEAT = OFF (There is NO reason good enough to enable this function on HF.)

DWAIT = 0 (off)

AX25V2 = OFF (The automatic link maintenance features of version 2 just add unnecessary overhead to an already busy channel)

CHECK = 0 (off... An implementation bug in version 2 makes setting this timer to any nonzero value counterproductive if the possibility of connection to a non version 2 station exists (and it usually does))

CMSG (off)
RETRY = 0 (try forever.. but NOT if unattended operation. This allows YOU to be the one to decide when or whether to give up rather than the TNC. Typically you know more than the TNC does about whether the other station is still trying or is likely to recover from the latest fade.)

MAXFRAME = 1 (multiple frames off)

RESPTIME = 0 (some stations may have trouble copying your ACKnowledgements (ACKs) when you respond this fast. This is due to the fact that some radios pump up the AGC voltage during transmit and if the AGC time constant is long, they are essentially deaf for a while after transmitting. You will want to experiment with this value. In general, you will want to use the minimum useable amount.)

5. Set FRACK to at least 8. 10 or 12 may be better on a very busy channel.

6. Restrict your use of beacon transmissions as much as possible. If you MUST use a beacon, keep it short and keep the repetition rate as low as possible. More than once a minute is definitely too frequent. once or twice in 10 minutes is more polite. Do not allow your beacons to continue if you are not in attendance. Nobody wants to connect to you just to be ignored.

7. If your radio allows you to select the AGC time constant (fast or slow AGC), set it to the fastest setting available to you.

If you cannot select fast AGC, it may be advantageous under some circumstances to partially defeat the AGC function by reducing RF gain and increasing AF gain. The 2211 demodulator in TNC-2s and clones is extremely (but not completely) insensitive to absolute audio level. It will function properly with input levels from the low hundreds of millivolts up to many tens of volts (so long as the MF-10 has been removed). Thus, the variation in audio level produced by partially defeating the AGC system will not degrade the modem's ability to copy unless the variation is very large. As long as the audio level remains above the input threshold of the modem (100 millivolts or so) and below the level where the receiver audio amplifier clips, copy should not be significantly degraded.

NOTE! This does NOT apply to the filter based demodulators used in many TNCs. Most of these filter based modems are affected by smaller audio level variations than those described above. The 2211 demodulators which still have the MF-10 filter operational also have a severely limited dynamic range.

8. What about PACLEN?

Much has been written about the need to keep this parameter set very short (20 to 60) on HF. If you are going to operate on one of the crowded calling frequencies, this probably makes sense. It probably also makes sense if you are trying to send a fairly long file and band conditions are variable. However, for keyboard to keyboard operation I prefer to set this parameter to 255. Then, as long as conditions are good, I type relatively long packets. If I detect a problem getting a long packet through, I simply type shorter packets to send. In this way I can dynamically adapt the packet length I am using to current band conditions without having to resort to command mode to make the change. I usually find that on a clear channel, if conditions are any good at all, packets in the 200 character length range are easily supported the vast majority of the time without retries.

9. What about hardware timing parameters?

Most HF radios have turn around times that are considerably shorter than those of the typical VHF NBFM radio. Most HF radios (any that are useable for AMTOR for example) can turn the radio's resources around in approximately 20 to 30 milliseconds. This means that TXDelay, and AXDelay values in the hundreds of milliseconds that you have set into the TNC for VHF operation will work on HF but are unnecessarily long for most HF radios. Experiment with these values to find the minimum delay times that work with your radio.

The above hints should be enough to get you started on HF packet with the minimum of fuss and bother. None of these are hard and fast rules. They are all simply tactics that I have found to be productive when operating 300 baud binary FSK packet in the HF bands.

Please don't let the radio bandwidth and alignment considerations presented here deter you from getting on HF packet. Although there are more details to consider when configuring your station properly for HF packet operation than are usually contemplated in a VHF packet setup, none of them is difficult to understand or resolve. Once the majority of the stations using the HF packet channels are optimized for the mode, throughput for everyone will start to improve. Then, if we are permitted to tune the protocol slightly to improve its efficiency on HF, it may one day even be possible to hold a rational QSO on one of the calling frequencies. Until then, there is still plenty of fun to be had keyboard to keyboard in non channelized packet operation in the HF amateur bands.

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