PACKET STATUS REGISTER

TAPR

Tucson Amateur Packet Radio Corporation

In This Issue...

President's Corner

by Bob Nielsen, W6SWE

HF Forwarding

Much has happened in the past two and one-half months regarding the HF forwarding situation. As I reported in the July issue (which actually came out in August), the ARRL Board of Directors adopted a report by the Committee on Amateur Radio Digital Communications recommending, among other things, that only semi-automatic forwarding of third party messages be permitted on the HF bands. This position met with immediate and sometimes quite vocal opposition from many in the packet community.

As the smoke cleared, several individuals started to work on alternative positions, intending either to convince the ARRL board to change their recommendations, or, if the ARRL petitioned the FCC to change the rules along the lines of the committee's recommendations, to file as comments directly with the FCC. Lyle Johnson, WA7GXD, contacted me with a suggested plan that would allow automatic forwarding in portions of the WARC bands. We discussed this idea and both felt that it would represent a possible area of compromise, although it would still have quite an impact on the current HF forwarding network. Lyle contacted Freid Heyn, WA6WZO, the ARRL Southwestern Division Director, who asked him to attend a meeting at the ARRL National Convention on August 22 in Los Angeles, to be attended by Southwestern Amateurs operating under the Special Temporary Authorization (STA) by which the current automatic forwarding takes place. Some of the members of the Digital Committee would also attend the meeting. I also had several discussions by letter and e-mail with Ed Juge, W5TOO, chairman of the Digital Committee, in which we both exchanged our views and concerns of the situation. Lyle attended the August 22 meeting as a representative of TAPR, presenting his plan and participating in the discussions.

As a result of that meeting, the ARRL Executive Committee set up a meeting of the Digital Committee with five representatives of the STA operators to take place on September 26. Additionally, on September 4, there was a Region 2 IARU meeting in Curacao that developed a band plan for digital operations in the HF bands. This band plan was a key to the consensus reached at the September 26 meeting, which proposes to establish small sub-bands within each of the Amateur bands below 30 MHz in which unattended fully-automatic operation would be authorized in the U.S. The full text of the Digital Committee's revised recommendations appears elsewhere in this issue of *PSR*.

While this recommendation goes well beyond the original recommendation of the committee, some may feel that it is still too restrictive. Remember however, that currently, automatic operation in the HF bands is prohibited, and that the STA was established as a temporary authorization only. The FCC said previously this year that it would not be renewed in 1993. Surely there are some CW and SSB operators in the U.S. or elsewhere who will object to even this modest digital authorization.

The committee intends to continue to study the issue and recommend changes if necessary.

The report has been submitted to the ARRL Board of Directors and will be studied by its Executive Committee prior to the preparation of any petition to the FCC. TAPR wishes to thank Ed Juge, W5TOO, for supplying a copy of the report so that we can publish it in *PSR*.

Overall, I support this position and urge the membership to do likewise, however, there are two areas where I believe it should be modified slightly and I have expressed these concerns to the chairman of the Digital Committee. The recommendation that unattended digital stations may only be licensed to holders of a General, Advanced, or Amateur Extra license should be changed to allow Technician class licensees to operate such stations in the bands above 50 MHz. Additionally, although the proposed wording for 97.109(e) would authorize fully automatic operation above 50 MHz, the wording of the proposed band authorizations of Appendix B of the report does not mention these bands at all. I assume these were oversights, as the committee was concentrating on the HF bands, but any regulatory changes should not inadvertantly add new restrictions to the VHF and UHF bands.

Board of Directors Nominations

In other news, it is time for nominations for the TAPR Board of Directors for the 1993-1996 term. Details appear elsewhere in this issue.

9600 bps Modem

Also, Lyle Johnson and Chuck Green have re-laid out the 9600 bps modem board to include several of the changes mentioned in his article in the July issue of *PSR*. We are completely sold out of the previous kits (also the K9NG modem kits), and any new orders will receive the new board. This board also permits the addition of a PSK modem without having to change cables.

As always, we would like to hear any comments you may have, on these or other issues. TAPR board members may now be contacted through the Internet, as described in an article in this issue.

73, Bob

TAPR Board of Directors Nominations

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

TAPR is governed by a 9 member Board of Directors. Each member of the Board serves a three year term; normally there would be three positions to be filled each year. At the 1992 annual Board meeting, the number of directors was changed from fifteen to nine. The number of expiring positions at this time is four. Three of these positions will be filled for a three-year term and one for a two-year term. At the 1994 election, five positions expire. Three will be filled at that time for a three-year term and two for a one-year term.

Board members are expected to attend the annual Board Meeting, normally held in Tucson in conjunction with the annual TAPR Membership Meeting. They participate in the decision-making process and provide guidance to the officers. They receive no pay and 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. Active participation in TAPR activities by Board members is important to the furtherance of the objectives of TAPR. The officers of TAPR are elected by the members of the Board at the annual Board of Directors meeting.

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

Tom Clark, W3IWI	1993*
Jerry Crawford, K7UPJ	1994
Jack Davis, WA4EJR	1994
Pete Eaton, WB9FLW	1993*
Greg Jones, WD5IVD	1994
Dan Morrison, KV7B	1994
Bob Nielsen, W6SWE	1994
Harold Price, NK6K	1993*
Dave Toth, VE3GYQ	1993*

Nominations are now open for seats expiring in March 1993 (marked with an asterisk).

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

Nominations and biographical sketches should be submitted to the TAPR office no later than 1 December 1992.

Ballots will accompany the January 1993 issue of PSR or will be mailed directly to the membership. Results will be announced at the annual TAPR meeting in March 1993.

Interfacing the TAPR 9600 bps modem to the AEA PCB-88

by Lyle Johnson, WA7GXD

KA1BOY lent the office his PCB-88 TNC to interface the TAPR 9600 bps modem. The bad news is that it took longer to get to than we thought; the good news is that the (electrical) interface is very straightforward!

The PCB88 includes a 26-pin modem disconnect header that is very similar to the one in a TNC-2.

PCB88 Mods

Please refer to the PCB88 component layout diagram located on page C-1 of the PCB-88 Operations Manual.

The PCB88 must be slightly modified to connect to the 9600 bps modem.

1) Locate modem disconnect header J1 on the PCB88 PC board. This is the 26-pin male header near the rear of the PC board.

2) On the solder (bottom) side of the board, carefully cut the following traces:
   Jumper from J1 pin 1 to J1 pin 2
   Jumper from J1 pin 5 to J1 pin 6
   Jumper from J1 pin 17 to J1 pin 18

3) On the component side of the board, temporarily place push-on shunts across J1 pins 1 to 2, 5 to 6 and 17 to 18.

4) Verify the PCB-88 works as it did before the modifications in this section.

9600 BPS Modem, Original Model

1) DO NOT INSTALL the 5-volt regulator IC U5.

2) DO NOT INSTALL the internal clock option.

3) DO NOT INSTALL the bit regenerator option.

4) Place a push-on shunt at JP2 (TNC 2).

5) Be sure no jumper is installed at JP3 (INT CLK).

6) On the circuit side of the PC board, carefully cut the trace from U14 pin 16 to P2 pin 11

7) Install a 26-pin male header at P2.

8) Proceed to MODEM CHECKOUT.

9600 BPS Modem, Rev 1

1) DO NOT INSTALL the 5-volt regulator IC U23.

2) DO NOT INSTALL the internal clock option.

3) DO NOT INSTALL the bit regenerator option.

4) Place a push-on shunt at JP3 (TNC 2).

5) Be sure no jumper is installed at JP2 (INT CLK), JP4 or JP5.

6) On the circuit side of the PC board, carefully cut the trace between P2 pin 11 and P2 pin 12.

7) Install a 26-pin male header at P3.

Modem Checkout

1) Fabricate a 26-pin cable to tie between the PCB-88 modem disconnect and the 26-pin male header on the 9600 bps modem.

2) Install the 26-pin cable, so that pin 1 of the modem goes to pin 1 of the PCB-88 disconnect, pin 2 to pin2 2, etc.

3) Install a jumper on the 9600 modem at JP4 (JP6 for Rev 1) labelled TNC MODEM. This will enable the internal modem in the PCB-88.

4) Verify the PCB-88 works as before.

5) Install a loop-back jumper at 9600 modem P1 pins 1 and 2.

6) Remove the TNC MODEM jumper from the 9600 modem (JP4 - original boards, JP6 - Rev 1 boards). This enables the 9600 modem.

7) Set PCB-88 HBAUD to 9600 and FULLDUP to ON.

8) Connect to yourself and verify the the PTT and DCD LEDs of the 9600 modem glow.

9) Disconnect from yourself.

Final Steps

The 9600 modem and PCB-88 are now checked and verified. You must now locate a suitable mechanical location for the 9600 modem and install it. If this is inside your PC, beware of electrical noise that may be induced by board location and cable routing. If external, be sure to use a suitable shielded enclosure and cabling between the PCB-88 and the 9600 modem.

Enjoy 9600 baud operation with your PCB-88!

Improved Data Slicer for K9NG Modem

by Brian Kantor, WB6CYT

When using the K9NG modem with a TNC-2, the following modifications can be used to de-glitch the data slicer output, which will improve clock and data recovery. These mods. were based on KD6HCN's modification to the TAPR-9600 modem.

Since you don't need the divide-by-2 circuit for a 32x clock, that flip-flop (U96) is available:

1. cut trace from U9 pin 9 to U9 pin 12 (or bend U9 pin 12 out of the socket.

2. cut trace from U2 pin 2 to U7 pin 13. It's easiest to do this on the top of the board near R11, or under R24. (R24 is not needed for most installations and may be omitted on your unit)

3. add a wire from U2 pin 2 to U9 pin 9.

4. add a wire from U9 pin 13 (or the 32x jumper hole, JP3) to U7 pin 13.

This synchronizes the data slicer output from the 16x clock, which really reduces the chances of metastability in the state machine. I've tested this mod. and it seems to help, best of all, no parts are needed to do it!

TAPR 9600 bps Modem Revised!

by Lyle Johnson, WA7GXD

Your acceptance of the new TAPR 9600 bps modem has been very gratifying, and several hundred have already been sold in the few months that they have been available.

Based on your feedback and requests, a revised version of the modem is now available. There are four primary changes to the modem circuitry.

1) A 20-pin second modem disconnect has been added!

This feature allows you to connect a second external modem to your TNC. This is especially useful for satellite operators who wish to use a TAPR PSK modem with their TNC along with a TAPR 9600 bps modem. The second modem simply plugs into the 9600 bps modem, and the 9600 bps modem attaches to the TNC.

2) Improved data slicer.

The original modem used an op-amp as a data comparator/slicer. This results in a compare time of several microseconds.

The new modem uses a comparator chip with a decision time measured in the tens of nanoseconds.

3) Circuit Mods included.

All of the modifications listed in *PSR* #47 are incorporated into the new board, including the meta-stability clock synchronizer.

4) Different Jumper Options.

The configuration jumpers are now slightly different. This results in the same programmable logic chips being useful for TNC-1, TNC-2, and PK232-type TNCs.

What remains the same is the use of a four-layer circuit board and the PC board size and mounting methods. The parts count of the new kit is slightly lower than the original version, and no jumpers are required.

We hope that you enjoy the improved version of this modem!

The HAPN-T 4800 Baud Modem

by Don Rotolo, N2IRZ
N2IRZ@WB2GTX.NJ.USA

[Reprinted from the Spring 1992 issue of By Any Other Name published by the Radio Amateur Telecommunications Society.]

The HAPN-T is a 4800 baud daughter board that is designed to fit onto a standard TAPR TNC-2 type modem disconnect header. Available as a kit or as a bare PC board, it has the great advantage of being able to work with Phase Modulated (PM) radios, as well as with true FM radios. This permits its use even with inexpensive HTs, normally unsuitable for operation above 2400 baud. With either type of radio, however, you still must tap directly into the modulator and receiver discriminator circuits, the same as for a 9600 baud modem. Not difficult, but you'll need a schematic.

The HAPN-T modem is easy to assemble in an evening, and has been found to work well, as long as the transmit deviation is properly set. They are a cost-effective solution for mid-speed packet links, especially when inexpensive PM radios are available. For true FM radios, 9600 baud is probably the better way to go. The modem kits cost US $48 which includes all parts, and the bare board costs US $15. Shipping and handling is US $5 per order, and a 10% discount applies to orders of five or more of any item. Write to the Hamilton and Area Packet Network (HAPN) at Box 446, Station D, Hamilton, Ontario, Canada L8V4S7.

Installing the HAPN-T into PacComm TNCs

The installation of this modem into PacComm Tiny-2 and Micropower-2 TNCs is simple and straightforward, and should take only a few minutes. Don't forget to set the TNC's radio baud rate to 4800!

1. Remove the shorting jumpers from JPRA and JPD on the TNC.

2. Cut the trace between pins 17 and 18 of the J5 modem disconnect header. Pin 1 of J5 is marked with a square solder pad.

3. Connect pin 5 of J102 on the modem to the center pin of JPD (DCD).

4. Connect pin 3 of J102 to the cathode of D9 (PTT).

5. Connect pin 2 of J102 to any convenient ground point, such as the center hole of the area reserved for S2 on the TNC.

6. Pins 1 and 4 need not be connected, assuming dedicated 4800 baud operation.

7. Connect the +12V pad on the modem to one of the terminals on the top of the TNC's power switch closest to U6 (switched 12 volts).

For dedicated 4800 baud operation, we made the following modifications to the HAPN-T to reduce the parts count:

8. Solder a jumper in place across J105 on the modem.

9. We eliminated the switching IC (U1) and installed jumpers between pins 1 and 14, 3 and 4, and 5 and 10.

TAPR Now On Internet

by Bob Nielsen, W6SWE
w6swe@tapr.ampr.org

TAPR is now accessible through the Internet. You may send e-mail messages (no long files, please) to the TAPR office at

tapr@tapr.ampr.org

and to any of the directors at

callsign@tapr.ampr.org

substituting their call for "callsign." Also, submittals for *Packet Status Register* may be sent to

psr@tapr.ampr.org

in addition to the CompuServe address on the front cover. This is not a direct connection, but is done by a dial-up line to a local Internet site in Tucson. Thanks to David Dodell, WB7TPY, for his assistance in setting up this access to the Internet.

Interfacing NB-9600/G3RUH to D4-10

Mark Bitterlich, WA3JPY
WA3JPY@WB4UOU.NC (packet)
mgb@tecnet1.jctc.jcs.mil (Internet)

[Reprinted from the NEDA Quarterly, Vol. 3, Number 2, published by the North East Digital Association.]

Due to numerous requests, I am posting modification instructions for the PacComm NB-9600 G3RUH modem to convert it to TTL input/output to drive a Kantronics D4-10 at 19.2K baud. Don't forget to change the radio speed jumpers in whatever TNC you are using, to 19.2K after these mods. are done.

I mention this only because I spent an hour trying to figure out why my mod. wouldn't work, only to finally realize I never changed the TNC speed to 19.2K to drive the blasted modem! It's the simple things that getcha!

All part numbers given are for the PacComm NB-96 modem.

TTL Input
Locate U10 pin 2, and the circuit board trace going to U5 pin 2.

1. Disconnect output of U10 pin 2 by either lifting the lead leg on the integrated circuit, or by cutting the trace. Lifting the leg on the IC is the easiest way to go about it.

2. Connect TTL receive data input from the D4-10 to the trace going to U5 pin 2.

Note: On Kantronics' 19K2/9K6 modem, they actually put in a jumper that lets you either drive U5 pin 2 directly from a TTL source (such as the D4-10) or when the jumper is installed, the input to this stage reverts to normal G3RUH operation with U16C acting as the receive filter for the analog input.

TTL Output
Locate U18 (74HC164) pin 3 and the trace going to Jumper-1 pin 1. Please note that Jumper-1 is normally jumpered from pins 2 to 3 with a header clip.

1. Connect a wire from Jumper-1 pin 1 to D4-10 transmit data input.

Note: On Kantronics' modem, they do the same thing. They disconnect the output of U18A (after C34) with a header, and allow you to drive the output with U18 pin 3 or the analog output from U18A as determined by the position of a header jumper. If it is desired to disable the audio output of the G3RUH modem, you can cut the trace after C34, or remove C34. I did neither and just let it run since I was no longer using the audio output, and I saw no harm in just leaving it run.

Lock Detector Modification
Locate resistor pack RS-2. It is a 100K resistor pack and its only purpose is to give 100K of resistance between pins 1 & 2, and 3 & 4. The other resistors in the pack are unused. The goal here is to change this resistance to approximately 50K; there are a couple of ways to achieve this:

A. Cut traces to RS-2 and install two 50K resistors. One between pins 1 & 2, and another between pins 3 & 4.

B. Leave everything intact and place a 100k resistor across pins 1 & 2, and another across pins 3 & 4. I used this method, although there is not much room to work, and soldering is very cramped quarters.

C. Use the unused portions of RS-2 to do the same thing as B above using wire-wrap wire.

Note: The value of 50K for the lock detector was chosen from notes given in the PacComm NB-96 manual. I have been experimenting with these values and have achieved what appears to be better results with values different from those reported. However, since I can not document WHY that is happening, and since it might be limited to my application, I will not go into details on what values I am using. I merely point this out so that if you happen to notice what appears to be poor DCD detection on good signals, this might be a good first place to look.

There were some suggestions given in the past to modify a Kantronics DVR2-2 to work with the NB-96 modem at 9600 baud. These suggestions consisted of bypassing one resistor and changing the value of another in the radio. The net result was to in-crease the audio output level of the radio to the modem, and to lower the transmit audio input level from the modem to the radio. I have found that increasing the audio output of the radio to the modem oftentimes results in worse performance and would recommend keeping it stock.

However, lowering the transmit drive level is required, but it seems to make more sense to do it in the modem rather than in the radio. If a 47K resistor is placed in series with the transmit audio output (internal to the modem) then it will duplicate Kantronics' design, and will offer easy adjustment of transmit deviation whether you are using a DVR2-2 or a D4-10. Of course, this is only necessary at 9600 baud, as when the above modifications are done, the output of the modem is TTL and not analog.

New Metcon Kit

by Lyle Johnson, WA7GXD

The Metcon-1 unit, designed by Paul Newland, AD7I, has undergone some minor changes we think you will like.

1) **Eight (8) inputs and (8) outputs are now supported.** The orignal kit supported only six (6) physical inputs. The new kit supports eight (8) physical inputs. Four (4) output relays are provided with the kit, the other four (4) output relays and their connectors are available as an option.

2) **Serial Port Connector.** The onboard serial port connector is now a standard DE9.

3) **Power Connector.** The input power connector is a wire-clamp type rather than the 2.1 mm barrel style used in the original kit.

4) **Other minor changes.** The PC board is the same length but slightly wider to accomodate the greater number of channels.

The regulator heat sink now easily clears all components near it.

The trace-to-groundplane clearances have been improved to avoid shorts. The groundplane surface area has been increased.

Packet Radio at 19.2kB – A Progress Report

by John Ackermann AG9V
ag9v@n8acv.#day.oh.usa
john.ackermann@daytonOH.ncr.com
Miami Valley FM Association,
Dayton, Ohio

Overview

This article briefly describes the technical aspects of the 19.2kB backbone and metropolitan area network (MAN) now operating in Southwestern Ohio. Although there has been a lot of discussion of fast packet radio systems -- from 56kB on up to 10MB -- in the packet world, the fact remains that ten years ago we knew that 1200 baud systems were only a stopgap and that we needed to move to higher speeds before packet would come into its own. Today, there is still a dearth of equipment commercially available to operate at speeds greater than 1200 baud. When Phil Anderson of Kantronics first started talking about his plan for a transceiver that would do 19.2kB out of the box, a group of hams here began to consider the possibility of building a high speed network to link the area's population centers, and to provide high speed user and server access as well. The Kantronics equipment doesn't represent the state of the art in fast bits. But, it is the first system that allows a major improvement in packet performance using off-the-shelf components designed for the task. To put it simply, the people funding the Ohio network wouldn't have put up their money for the sort of do-it-yourself approach that other high speed packet systems have required. Their goal was to build an infrastructure to support the general amateur community, not a plaything for tinkerers, and off-the-shelf equipment is what finally convinced the ham community that this system might actually work. The clubs and individuals involved, the Miami Valley FM Association, the Central Ohio Packet Association, the Ohio Packet Council, K1LT, N8XX, and AG9V, ended up building a backbone linking Dayton, Cincinnati, and Columbus, Ohio through a total of five network switches. The

backbone currently has about 150 miles of 19.2kB radio links and links to the existing Ohio 4.8kB network at Columbus. Additionally, in Dayton the MVFMA and AG9V have built a MAN around a full-duplex repeater to provide a hidden-transmitter free network at 19.2kB for end users and servers. The MAN is tied to the backbone through a switch. [I'll use the term "network" to refer generically to the backbone and MAN unless it is important to distinguish between them.]

RF Hardware

The Kantronics D4-10 [Since this article deals almost exclusively with Kantronics equipment, I should note that none of the folks involved in this project are affiliated with that company.] is a UHF radio designed expressly for data communication services. It is rated at 10 watts output, though our tests show that most radios put out about 12 watts. It has two crystal controlled channels and by default comes from Kantronics with crystals for 430.55MHz installed. The receiver is a completely different design than the earlier 2 meter DVR2-2 radio, and has much better spurious signal rejection. The radio has selectable receiver bandwidths, with a nominal 15kHz IF for voice and low speed use, and a 60kHz bandwidth for 19.2kB. The D4 supports normal analog signal inputs and outputs, but also has a TTL level I/O port which is intended for 19.2kB use. The TXD line on this port drives an FSK circuit that shifts the transmitted frequency +/- 10kHz from center for mark and space. The radio provides pulse shaping to meet FCC bandwidth requirements at 19.2kB, so the TXD signal need not be processed before feeding it to the D4. The RXD line comes from the output of a comparator that acts as a data slicer driven by the discriminator. DCD is driven by the D4 squelch, and PTT is a normal ground-to-key signal. Turnaround time is very fast. Using a squelch-derived DCD signal, two of the radios will talk to each other with a TXDelay of 5 milliseconds, though using 10ms or so probably is safer (these tests were done using the Ottawa PI card, which offers 1ms timer resolution). We've had several of the radios in service for five or six months and have had no failures. We have seen some long-term frequency drift but nothing beyond

what would be expected with 6 MHz crystals multiplied to 430MHz. Apart from one radio that has a serious stability problem over very small temperature excursions (we suspect either a bad component or a bad crystal), so far temperature stability has not been a problem. A pair of D4s talking to each other over moderate paths will tolerate a bit more than 4kHz of frequency error. We recently learned that Kantronics has come up with a couple of modifications to both improve frequency stability and increase the amount of tolerable frequency error; with these mods. the radios are supposed to tolerate about a 6kHz frequency error. We expect to have more information on these modifications soon and will be installing them in our radios. The only adjustment we've found to be somewhat critical is the threshold setting for the RX data slicer. This adjustment sets the point at which the slicer shifts from outputting a 0 to a 1 and ideally should be set to cause that transition at the center of the channel. We've seen a couple of radios where this adjustment (R17 -- a pot that sets the DC reference signal to the comparator) was out of adjustment. As a result, the radios wouldn't decode signals from an on-frequency transmitter, but would do just fine with a signal that was off-frequency in the direction of the threshold error. One of the mods. referred to above supposedly reduces the touchiness of this setting. Adjusting the threshold requires an on-frequency signal with tone modulation and an oscilloscope. Once the threshold is set, it seems to stay put. We think the problems we saw were due to initial misadjustment or to the banging around of some of the radios we have seen; none of the radios have required a second tweak. The D4 works well in high RF environments. The MAN repeater antenna has several other commercial and amateur VHF/UHF systems in close proximity, and at his house Lew, K0RR, runs 100W on 435MHz (OSCAR uplink) with only four feet of separation from the Isopole that's hooked up to the D4 on 430.95. He receives packets without error during uplink activity.

RF Paths

We were a bit concerned about whether 10 watt radios operating in a 60kHz bandwidth would have enough

power for the longish paths we needed to span. We have found that as long as the RF path is line-of-sight (or close to it), the D4's power is sufficient for paths of up to at least 50 miles. But that "LOS" qualifier is critical. Even on relatively short (10 mile) paths, if the antennas aren't in the clear and above the foliage at both ends, the path won't work. This was driven home during our testing this spring, when AG9V was trying to access the MAN repeater, which was at an excellent location, but with the antenna only about 20 feet above ground. AG9V is about 10 miles away and uses a 22 element K1FO beam up about 45 feet, but in a rather low and heavily forested area. Before the foliage came out, the path worked moderately well. Once the leaves were on the trees, however, signals totally disappeared. Raising the repeater antenna to its final height of 120 feet brought back rock-solid signals. Most of our point-to-point links use Cushcraft 11 element 435MHz yagis on 5 foot booms. We've found that surplus 3/4 inch 75 ohm CATV hardline works well. The slight mismatch doesn't seem to cause a problem on either our simplex links or on the repeater antenna.

Modems

We are using two different (very different) modem schemes. The backbone, which presently uses Kantronics DataEngines running G8BPQ node software (see below) uses the Kantronics 19k2/9k6 modem. This is essentially a G3RUH design with doubled clock rate and all the analog parts bypassed; the output of the scrambler is fed into the D4 TTL port. On the MAN, we're using a different approach. We are feeding HDLC frames directly into the D4's TTL port without using a scrambler or any other modem components. Essentially, we are treating the D4 as an RF modem. There have been many theoretical discussions about whether the scrambler is necessary to provide reliable clock recovery and demodulation of NRZI FSK signals, but our real-world experience indicates that using the K9NG/G3RUH scrambler as implemented in the Kantronics modem adds no significant benefit. We have a 35 mile path operational without a modem, and it seems to be just as reliable as similar paths using the

Kantronics modem. (It's been pointed out that the scrambler also allows use of a tracking data slicer, but since the Kantronics 19k2 modem uses the D4's internal slicer, that's not an issue here.) Using the modemless [technically, the D4 is acting as an RF modem when it's being driven with digital signal levels. I use the term "modemless" to contrast with systems using a separate device between the output of the PAD and the input to the radio.] approach requires that DCD be derived from the D4's squelch. This isn't a performance problem, as the D4 squelch is very fast and solid. The 5ms turnaround time noted above includes squelch response time, so it's apparent that there's no speed penalty in this approach. I'll leave for another time the argument about whether a system should recognize only data, or any signal, on channel as DCD. Note, too, that because this configuration doesn't scramble the data, it will not talk to 'RUH-type modems.

Bit Bangers

Several different devices have been tested as packet assemblers and HDLC generators. We have used the Kantronics DataEngine both with the 19k2 modem and our "modemless" configuration. We have several DEs in place running the G8BPQ network code and they do just fine supporting two 19.2kB links on the radio ports and a couple of slower links on the RS-232 port. The DataEngine has one problem -- if it is connected to high-speed modems that allow the RXD line to chatter when there's no signal present, the interrupts generated will saturate the V40 processor and prevent it from properly servicing the serial port. This isn't very noticeable when running the standard TNC-2 command set on the DE, but it is very apparent when running KISS mode, or using the G8BPQ node software. Kantronics says they're working on a software fix for this problem. A relatively simple hardware mod. can tremendously improve things -- simply gate the modem's RXD output with DCD so the chatter doesn't make it through to the DataEngine. We've made this change at our G8BPQ switch sites, and with it the DataEngine works well. To use the DataEngine to feed HDLC directly to the D4, we use an internal jumper board (available from

Kantronics for about $20) to provide the proper signals to the DE's radio port. One bit of hacking is required: you need to add a 4020 or similar chip to divide the 16x clock the DE provides down to 1x clock, and feed that back to the TNC. The mod. is no big deal; the chip fits neatly on the jumper board in "dead bug" style. Again, gating the RXD line will probably make the Data-Engine happier. A TNC with speeded up clock and components will also work well at 19.2kB. We've put three of PacComm's Tiny-2 TNC-2 clones with 10MHz crystal and CPU [the 10MHz "node version" of the Tiny-2 is available from PacComm for about $25 more than the standard model.] on line with no problems and full interoperability with our other HDLC generators. By doubling the crystal speed, the baud rates are also doubled, so the 10MHz Tiny-2 will support 38.4kB on the serial port and 19.2 on the radio port without any further modifications. The interface to the D4's TTL port is nothing more than a cable from the appropriate pins on the modem disconnect header. One minor annoyance is that the PTT line is not included on the Tiny-2's header. You can either hope that the SIO's RTS pin will sink the D4's PTT current, or pick up PTT from the Tiny-2 rear panel radio connector. The Ottawa PI interface card is theoretically the best PAD to use at these speeds because its DMA data transfer can handle higher speeds with less CPU load than a PC serial port. K0RR and AG9V used PI cards for their first experiments with the D4 over short-haul links. In the real world, the PI card works well for us, but in ping testing we see a troublesome loss of 5 to 10 percent of the packets sent even over near-perfect paths. We don't see this loss when using Tiny-2s. Dave Perry, VE3IFB, has revised the PI driver software for NOS, and that provided some improvement, but the problem still persists. This packet loss is almost certainly the result of some sort of timing glitch, but as yet we haven't tracked it down. In short, we'd like to use PI cards in our NOS-based systems and switches, but we are being cautious until we fix the dropping pings. The Ottawa folks have been very helpful, and I'm sure we'll get this licked soon. (This problem is unique to our setup with the D4 radios; others are using the cards with the 56kB

GRAPES modems and reporting excellent results.) The other problem with the PI card is that it doesn't work with computers other than PCs, or (at least for now) software other than NOS. In summary, at the moment the best price/performance ratio in bit generating hardware is the 10MHz Tiny-2 ($150) coupled with a 16550AFN UART in your serial card. The PI card ($120US) will be the best answer for PC NOS users once we get the timing bug worked out.

Repeater

The Dayton MAN is built around a full-duplex repeater. The repeater ensures that every station can hear every other station, and helps reliability by allowing use of high-gain yagis pointed at the repeater site. The repeater hardware is nothing special; it's simply two D4 radios connected back to back through their TTL ports. A 4049 CMOS inverter provides buffering. The only trick we learned is that since the D4 uses op amps rather than true TTL devices to drive the TTL port, hooking a pair of radios directly back-to-back won't work. You need to use some judicious pull-ups and pull-downs to get proper signal levels. The current controller has nothing more than the interface circuitry, a 15 second time-out timer, and a control function to drop the transmitter. The next generation will add appropriate ORing circuits so that a switch can use the repeater as a radio port. That will tie the repeater to the high-speed backbone. We also want to add a bit regenerator to help the quality of the transmitted signal. We'll do this because it's the right thing to do, but at the moment it doesn't appear that we are losing many frames due to distortion in the repeater. The repeater uses no squelch tail; PTT is driven directly by DCD. The D4 squelch and keyup time are fast enough to permit a TXDelay of 15 to 20 milliseconds through the repeater. The two D4 radios are connected to a small TxRx duplexer (four cavities with a little bandpass and a lot of notch filtering) and the duplexer feeds an 11.5dB gain Diamond fiberglass antenna through about 160 feet of 3/4 inch CATV hardline. The antenna is about 120 feet up at a site that towers (by as much as 100 feet) over the "rugged" Ohio skyline. Frequency separation be-

tween receive and transmit is 10MHz (420.95 in, 430.95 out) and we haven't noticed any desensitization. There are currently six stations using the repeater, with paths ranging from about 1 mile up to 35 miles. The Data-Engine, Tiny-2, and PI card are all being used to generate packets, and all three interoperate with no trouble. The repeater carries BBS, TCP/IP, Net-Rom, and PacketCluster traffic.

Switch Hardware and Software

At the moment, our nodes primarily use G8BPQ code running in Data-Engines. We hope to change over to NOS-based switches that can handle both IP and NetRom switching. Johan Reinalda, WG7J, has NOS running on the DataEngine, and we plan to start experimenting with that code soon. Apart from the inherent limitations of the NetRom protocol, the G8BPQ/DataEngine combination works very well, and we've seen switches run for months without a reset.

Frequency Allocation

Finding space for a bunch of 100kHz wide channels on the 70cm band isn't easy. The ARRL-recommended segment of 430-431 MHz happens to fall in the top of the 426.75MHz ATV channel. Among other things, this means that an ATV transmitter puts its audio subcarrier at 430.75; a local ATV repeater uses that channel for its output and that rude surprise required us to change the repeater frequency shortly after we started testing. Apart from ATV, the 420-430 segment of the band is used in Ohio for voice links, many of which are uncoordinated. After a lot of experimentation and negotiation (and with tremendous cooperation from DARA -- the HamVention folks -- who agreed to move a bunch of their planned voice links for us) we wound up with the 420.5 to 421.0MHz range free for our repeater input and point-to-point paths. It appears that we can coexist with the ATV signal in the 430.5 to 431.0 segment if we stay clear of 430.75. We haven't tested yet, but we suspect that operation below 430.5MHz may result in interference with/to the video signal. Kantronics ships the D4 by default with 430.55MHz crystals installed in channel 1; we got all our radios with that

channel and use the second channel position for our operating channels. We don't have any links assigned to 430.55, so it is available for temporary and testing use and we can grab any two radios and make them talk to each other. We recommend that others follow this practice and reserve 430.55 as a testing and experimental channel. The long and short of it is that frequency coordination will be a prime concern for users of D4 radios in populous areas. Living with ATV is likely to be the biggest challenge.

Expect another MicroSat in 1992

[Reprinted from OSCAR News, Number 97, October 1992, published by AMSAT-UK]

Tom Clark, W3IWI, is relaying information from David Liberman, XE1TU. David is project manager for UNAMSAT-1, the first Mexican Amateur satellite being built at UNAM, the Autonomous University of Mexico.

UNAMSAT-1 is another of the MicroSat series, and has much in common with AO-16/DO-17/WO-18/LO-19. As with the earlier MicroSats it will have five modules, each about 20 cm on a side. Four of the five modules are updated clones of existing MicroSat hardware/software and include the following:

- Dual 70cm PSK transmitters (designed by YT3MV)
- V40 CPU (designed by WA7GXD and others from TAPR, with modifications by I2KBD and ITAMSAT)
- Power system with BCR (by KE3Z/ARRL) and batteries
- 5-channel 2-meter FSK receiver (by W3IWI)
- Software similar to other Micro-Sats (by NK6K and G0/K8KA)
- AART bus architecture (by W3IWI and N5BRG)

The main differences from the earlier MicroSat configurations are that the V40 CPU will have 4 Mbyte of bulk RAM versus 8 Mbyte. UNAMSAT-1 will also be equipped with gallium arsenide solar panels (i.e. the BSFR technology flown on the MicroSats).

The innovative new addition in UNAMSAT-1 is the new on-board experiment in the 5th "TSFR" (This Space For Rent) module. UNAMSAT-1's primary mission is to act as a meteor sounder. It will contain a 40.097 MHz transmitter with 60 watts output during pulses, which can be varied from 1 to 10 msec. in duration, and with a pulse rate of 1 to 10 seconds, as controlled by a 68HC05 microprocessor. The meteor echoes will be detected on a receiver at the same frequency used to detect the returned echo, and measure its doppler shift. The use of the meteor sounder is to obtain research data on the full-sky spatial and velocity distribution of meteors, with the focus on a search for high-velocity meteors originating outside of our solar system.

The 41 MHz frequency for this transmitter is in accordance with the ITR frequency allocations table for scientific research, and both the 41 MHz and the Amateur frequencies have been licensed by Mexican authorities. The transmitter is frequency controlled and has a class "E" power amplifier.

The meteor receiver is a SSB 'zero-IF' design (suggested by W3IWI) and the return echoes are digitized and stored in the normal V40 MicroSat computer's RAM. After each pulse, the spectrum of the received signal will be determined using the on-board V40 as a DSP Fourier Transform spectrum analyzer. If a meteor echo is detected, the echo is saved for later transmission as a special Tlm frame.

The 1-10 second repetition rate for the meteor transmitter will be adjusted depending on the state of charge of the batteries and other spacecraft power requirements, as well as on the time domain requirements of the echoes.

Detailed telemetry formats for meteor "radar" are still being defined. Data will be sent using standard Amateur AX.25 packet specifications.

When UNAMSAT-1 is not involved in meteor research, it can be turned into a standard PACSAT message store-and-forward satellite. Also, still to be finalized, are the detailed 2-meter uplink and 70cm downlink Amateur frequencies.

XE1TU has been responsible for technical development of UNAMSAT-1 along with the team of hams and students at the University. The hams are XE1MGI, XE1XUS, and XE1YLS in Mexico City. Scientific direction for the project has been provided by UNAM Professor of Astronomy Arcadio Poveda. AMSAT-NA provided technical details of its MicroSat satellites to UNAM.

During the development of UNAMSAT-1, technical assistance from AMSAT-NA has been provided by W3GEY, N4HY, NK6K, W3IWI, and WD4FAB. ITAMSAT assistance was coordinated through I2KBD.

The UNAMSAT-1 launch will also be the beginning of a new era. Along with a larger meterological satellite, it will be launched by the Russian Space Agency, and by the Russian Academy of Sciences on a decommissioned SS-18 ICBM into an orbit about 1000 km high. At this time, the launch is scheduled for the first week of December 1992.

Students Participate in Packet Networking

by Conrad Ekstrom Jr. WB1GXM
Assistant Section Manager, New Hampshire Education G.E.A.R.S. Weather Project.

[From the N.E.D.A. Quarterly Vol. 3, Number 1, Winter 1992, published by the North East Digital Association.]

Increasingly, more school groups, licensed educators, and students, are using packet radio. School traffic between schools across town, and across the world can be seen daily, moving from node to node or via Aplink. Much of it is packet pen-pal traffic, school contacts, and teacher-to-teacher contacts.

The nature of this traffic is starting to change. KB0CUS, Chuck Bryant, Marlborough Elementary School, Kansas City, Missouri, uses this medium for the collection of material for this student newspaper, Bacon Bits. Recently, he was the national collection point and packet/landline interface for Geo Quiz, a geography game involving over 29 schools across the nation.

Closer to home, the Goshen-Lempster Educational Amateur Radio Society (GEARS) has been using packet as a way of collecting weather data from individual stations and schools for a science unit on weather. It will be used for graphing and comparing, both in science and in math classes.

Both licensed and unlicensed kids participated in integrating Amateur Radio into the science project, showing what Amateur Radio can do, and

motivating other students in becoming licensed Amateurs.

The project was initiated with an announcement at a meeting of the Mt. Ascutney Packet Radio Association (MAPRA) and by posting a packet bulletin on the local BBS.

The students, with my assistance, download the data during class. This was their first exposure to telecomputing and Amateur Radio. Several are now in GEARS's fifth Novice class.

Looking into the future, the continued technological advancement of packet can assist other school telecomputing projects. If you have any ideas for using packet in the schools, please contact me, the kids and I would love to hear from you!

What's Wrong with NET/ROM, TheNET, and TheNET-Plus?

by Scott Cronk, N7FSP
NAPRA Technical Vice-President

[From the NCPA Downlink, Winter 1991, Number 9, published by the Northern California Packet Association.]

First, there are three things wrong with each of these three node networking software systems. Each has the same problems, so it is not a case of "ours is the right one and the other two are wrong." That is old news since we haven't seen any improvements or updates now for several years to NET/ROM, but the TheNET and TheNET-Plus folks have forged ahead.

Problem No. 1 is that when you send data into one of these nodes, the information will not return an acknowledgement to the originating station of the packet until the information has been sent to the next node. In this case, the node is relaying the information to another node or user. So to visualize this, let's say that you have your local uplink node into the network. When the data is received by your local LAN, that node sends to the next node in the path to get to its destination, but will not send you an acknowledgement until the information has been relayed to the other node.

Problem No. 2 is that when you connect to a distant node and ask for a nodes listing, the entire listing must be received by each node in the connected path before it will be relayed to the next connected node, or end user.

To visualize this, let's say that you connect to your local LAN node, and then connect to another node in the network that is out of your local area and that there are a dozen other network nodes in the path. When you type "N" (for example) the information will start making its way across the network to the node at which you made your entry into the network, but you do not receive any information from your local node until the entire listing has been received at your local network node. This means that if the path was working and it failed for some reason, you will not even get a partial listing.

Problem No. 3 is when you connect to your local uplink node and you wish to connect to another node in another state (for example) and you issue a "C xxx" command; your packets are essentially digipeating from the node at which you uplinked the destination node. But, how can this be? We have been told that is why the nodes were developed, right?

The problem comes from the way that NET/ROM, TheNET, and TheNET-Plus handle the level 3 and level 4 connections. On a level 3 connect between nodes, you DO get node-to-node acknowledgements, but on level 4 layer connections, you're essentially digipeating across the network and backbone networks to your destination. This is one of the reasons why node hopping across the country will often be so difficult. If there is local activity that is keeping the net-

work busy in part of your path, and your packets are trying to traverse that part of the network, then it will be competing with the most aggressive timing parameters on the local connections.

Another factor that plays here is the timing parameters. Nodes operate the same way your TNC operates, with parameters like FRACK, PPersistance, DWAIT, and RETRY, and if your packets are 'digipeating' across the network in a level 4 connection, these parameters might well time-out your link connection before the data has even had chance to be relayed back to your last node connection.

This also is true for those BBS stations that advertise "xxxBBS." If you should connect to your local node and see a "xxxBBS" in the nodes listing (by typing "N") and see a BBS that you'd like to connect to but it is in another state or even another part of your network, there might be a dozen or more network nodes in the path to get to that station and you're essentially digipeating the entire route. It would probably be best if the "xxxBBS" nodes were to be limited in the network to the area of intended coverage anyway and not propagating throughout the network and across the states, but that is another story.

Best bet here is to 'stage' your connections. First, connect to the local LAN node, then type "N xxx" where "xxx" is the destination node. The node will then reply with any information that is available to get to the destination node, such as in Example 1.

In this example, I only ventured a short distance, which never left my house, but this very same method has been used for years to travel across the

Example 1:

```
C N7FSP-14
Connected to N7FSP-14
N ALKI
#ALKI:N7FSP-14> Routes to: ALKI:N7FSP-1
190 6 0 WSEA
C WSEA
#ALKI:N7FSP-14> Connected to WSEA:N7FSP-5
N ALKI
WSEA:N7FSP-5> Routes to: ALKI:N7FSP-1
    255 5 1 ALKI

    254 5 1 #ALKI2
    254 5 1 #ALKI3
C ALKI
WSEA:N7FSP-5> Connected to ALKI:N7FSP-1
```

Entered to connect to uplink node.
Connected!
Entered to the local uplink node.
This is a reply from the node.
Second line of reply from node.
Next node in path to destination.
Connected!
Entered to the local uplink node.
This is a reply from the node;
highest quality path to destination node;
possible back-up route;
possible back-up route.
Connect to highest quality path.
Connected!

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country from one state to another several thousand miles away! While I was living in San Jose, California, I used to be able to connect with nodes in South Dakota! Now that I'm again living back in Washington state, I still get connections from N7OO using various VHF and HF links from Sierra Vista, Arizona!

You'll find that there are places where you can skip several nodes in your connect path over a period of time, and that there are others that you must connect to to get past a place that has poor propagation conditions or heavy loading from BBS or user activity, but that your overall ability to get from one place in the network to the other will be vastly improved.

Disclaimer: NET/ROM or its equivalents are what we've got to work with, there may be other networking software packages out there that operate in a different way, but that doesn't mean that this software is inferior. However, knowing the limitations will better enable you to effectively use the existing software.

CLOVER Beta-Test

HAL Communications announces the availability of their PCI-4000. The PCI-4000 is a CLOVER modem for HF data communications which plugs into an AT-class PC-compatible computer.

CLOVER is a modulation method which reliably passes error-corrected data on HF radio at rates between 10 and 60 bps. This is a factor of 1.5 to 10 times faster than AMTOR, PACTOR, or HF packet. Under more typical conditions however, CLOVER throughput drops to about 20 to 40 bps (still 3 to 6 times faster than the other modes).

The PCI-4000 is expected to be in beta-test starting in November 1992, with a commercial release expected during the first quarter of 1993.

Any Amateur interested in purchasing a beta-test unit at a reduced price should contact HAL Communications at:

P.O. Box 365
Urbana, Illinois 61801
217-367-7373
FAX 217-367-1701

Notes From The TAPR Office

As I considered what to chat about this issue, I received a letter from one of you. I would like to quote from this correspondence:

"Permit me to be so presumptuous as to request a letter of support which expresses the value of using Amateur Radio as a means of exciting children about communications, science, and technology. Such a letter could be very valuable as an addendum to our proposal before the local school board."

Lyle and I have been blessed with 6 wonderful children, so that is probably the reason that I find myself thinking quite seriously when the subject of education comes up.

I have been brooding over such weighty questions as:

Why do the Japanese hams go out of their way to invite school children to their major ham events each year?

Why is it the exception rather than the rule for a ham to have members of his immediate family also Amateur Radio hobbiests? TAPR is headquarted in Tucson, Arizona, which is situated in the Sonoran Desert. We have the National Saguaro Monument at our doorstep. This beautiful forest boasts thousands of Saguaro cacti. (If you look at TAPR's logo you will see a Saguaro raising its proud arms high.) The Monument is full of huge, many-armed specimens... These are magnificent! Now, where are the "baby" Saguaros? And what about "teenage-size" plants? I begin to ask questions. I'm concerned that when these ancient plants, some as old as 200 years, fall to the ground... there won't be a replacement of them. Botanists from many places around the world are here studying that very question, because the young Saguaro population simply isn't there!

I could write an elaborate paper, making many comparisons between this amazing plant and what I have come to believe is the greatest hobby that it is possible to have. A hobby that is worth protecting!

As individual hams, do we really WANT our hobby to increase in num-bers? Do we want to go to hamfests and have to maneuver around noisy, excited children? Aren't our hambands already crowded? Do we really want our costly gear touched by immature hands that might leave food particles behind, or a scratch... or even something BROKEN?! Isn't this OUR domain? The kids have the TV, and computer games, and our spouse already has the telephone to communicate with! Besides, we work hard all day and need our hobby to RELAX with, don't we?

These questions are too weighty, so let's get back to the response I gave to the gentleman who started this discussion:

Dear Mr.-,

I am excited and enthusiastic about your interest in the future of our world -- our children. I believe that you could not choose a more important, long range vision. Communication, between our loved ones, our enemies, our neighbors, both near and across the oceans, helps to break down prejudices and misunderstandings. The Amateur Radio hobby can help to interest our children in electronics, space, geography, computers, adults (!), and communication, not to mention math and languages! We wish you success in your endeavors.

Life lived to its highest degree is seeing past our immediate gratification. It is looking at the bigger picture. May each one of us take on the job of planting and nurturing a little "Amateur" seedling.

Many thanks to:
J. Angus for his information on connecting the 9600 baud kit to the PacComm Tiny-2.

Hitoshi Kuwano, JM1OMH, and Mr. Kanno, JN1JDZ, for sharing information to improve TNC-2 firmware.

73,

Heather Johnson, N7DZU

P.S. We are completely sold out o Trackboxes. Thank you JAMSAT for sharing this project with us ! We have enjoyed working with you.

Our annual meeting is tentatively set for March 5,6, and 7,1993.

Our good friend James Eaton, Peter Eaton's Dad, is in the hospital. Your thoughts and prayers on his behalf would be very much appreciated. We want him back at Dayton with us next year!

Report and Recommendation to the ARRL Board of Directors from the ARRL Committee on Amateur Radio Digital Communications - September 26, 1992

At the request of the ARRL Board of Directors, the ARRL Digital Committee met today with five elected representatives from the group of Amateurs operating automatic HF message forwarding stations under FCC Special Temporary Authority originally dated July 7, 1987. What follows supersedes and replaces the Committee's June 13 report.

Additional data, not available at the time of the Committee's June 13 meeting, included:

A. Revised IARU Region 2 band plan resulting from the September 4, 1992 meeting in Curacao.

B. Additional feedback from Amateurs at large, and the STA community, received since the June 13 meeting.

The committee is revising its previous recommendation to include fully-automatic, unattended operation on the IARU "packet priority" sub-bands and semiautomatic operation in all digital sub-bands.

IARU Band Plan

The Digital Committee, at its June 13 meeting, was concerned about frequency usage and allocation in the US, and other countries, in effect at that time.

The September 4, 1992 IARU Region 2 meeting in Curacao produced a substantially revised band plan for digital modes. The new plan includes segments on all amateur bands between 80 and 10 meters for "digital modes," defined as including RTTY, AMTOR and packet (including new systems like PACTOR and CLOVER), but not FAX and SSTV. Within those segments, "packet priority" sub-bands were defined (except on 40 meters) in which digital modes other than packet are permitted, but may not claim protection from packet. It was agreed that CW remains a permitted mode throughout all amateur bands.

The Digital Committee and STA representatives believe strongly that no distinction should be drawn -- in terms of spectrum usage -- between digital modes. Technology development is advancing quickly. Any mode could be outdated and replaced with better, more efficient technologies at any time. Mode-specific plans will limit spectrum for development, and may reserve spectrum for modes soon to be obsolete.

For that reason, and in light of what follows, the Committee prefers the term, "automatic priority," instead of the IARU's term "packet priority." The Committee believes the following recommendations will better align the US band plan to the IARU Region 2 alignment.

Additional Feedback Received

There is reason to believe that many VHF and UHF operators overlooked the QST survey, assuming a "below 50 MHz" issue had little effect on them. The impact on message traffic between widely separated VHF and UHF packet bulletin boards was not immediately understood.

As mentioned in the Committee's June 13 report, every Committee member read every written comment submitted by the respondents. Those comments emphasized areas of great concern by many amateurs, and significantly influenced the Committee's previous recommendation. The concerns remain quite valid. The Committee believes new means are now available to address them, while, at the same time, enabling additional activities and developments that will benefit amateurs and the public interest.

A primary concern, among many amateurs is interference to stations under human control by stations under computer control. Except for a very few special situations, by tradition (and rule), one amateur station must not willingly or knowingly interfere with a contact already in progress, regardless of mode or the perceived importance of the communication in progress.

Semiautomatic operation has been defined by the Committee as requiring a local control operator at the calling station, to guard against interference to existing communications. The station being called operates automatically, but on a "speak only when spoken to" basis. Semiautomatic operation received a 2:1 majority (those favoring vs. those opposed) in the QST survey. The Committee interprets that response as a strong vote in favor of automated message handling, provided it can be a "good neighbor" to other spectrum users.

Initial survey respondents, while not favoring automatic operation, said (if automatic operation is permitted) they preferred sub-bands by a 4:1 ratio over any other proposed scheme. They did not favor the idea of exclusive sub-bands for specific modes.

The STA participants point to their commendable record in creating a nationwide network for moving hundreds of thousands of messages efficiently and without technical difficulties. Their efforts have lived up to Part 97.1(a), Basis and Purpose of the Amateur Service, "Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communications service, particularly with respect to providing emergency communications."

Countless pieces of traffic have been transported in national and worldwide emergency situations. Messages of a "hobby" nature have been an important vehicle allowing the network to be developed and maintained in a state of readiness.

The technical effort required to construct this network, both in hardware and software technology has been considerable, and certainly meets 97.1(b), "Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art."

Thousands of bulletin board operators (sysops) and tens of hundreds of thousands of digital operators have learned to originate,

relay and deliver message traffic by means not previously available. Part 97.1(d), "Expansion of the existing reservoir within the amateur radio service of trained operators, technicians and electronics experts," has also been served.

There is no question of the value provided by this message network to other Amateurs and to the public at large. The Committee acknowledges the success, both technically and functionally, of the STA experiment. There have been a few reports of interference to foreign phone stations where international band plans conflict. There are few if any reports of problems with other U.S. stations. The IARU accord minimizes or eliminates the concern for interference to foreign stations.

A major concern had remained, however, that unrestricted HF automatic operation permitted to all General, Advanced or Amateur Extra class licensees, could easily result in interference to other stations on a completely unacceptable level. Subdivision of bands by rule was previously rejected, in part because, "it will not work on a world wide basis because of the differences in the rules between regions and between individual administrations." The IARU has now provided a subdivision plan which has already met with international approval.

Recommendations

I. The Committee wishes to enable as many Amateur licensees as possible to contribute to, and enjoy, our service. The previous recommendation stands, to permit semiautomatic operation in any digital portion of any band. This privilege will permit a variety of experimentation and operations such as personal mailboxes and MSOs to co-exist with "live" users, on a non-interference basis.

II. By using the IARU Region 2 band plan, US operation will be in compliance with international agreement. Since the sub-bands designated by the IARU as "packet priority" will offer no protection from interference to other users of that space, including U.S. Amateurs, the Committee proposes fully-automatic operation by U.S. Amateurs within those segments of the band using any approved digital

data mode. It is recommended that those segments be dubbed "automatic priority," as a more accurate, descriptive term.

III. No packet priority segment was specified by the IARU on 40 meters, yet automatic networks have been operating there since the beginning of the STA. As we approach the sunspot minimum, and the MUF lowers, 40 meters will be badly needed for many propagation paths. The Committee therefore urges approval of a small automatic priority segment from 7.100 to 7.110 MHz.

Similarly, no digital segment was specified by the IARU for 160 meters. While there is little or no digital activity on this band, developing modes show promise of improving operation in this somewhat hostile (digitally) environment. The Committee feels it would be a valuable testing ground, and requests an automatic priority segment from 1810 to 1820 kHz. Specific frequencies recommended for automatic priority are listed in Appendix B.

IV. The Committee cannot over-emphasize our concern for protecting other spectrum users from the potential interference of automatic stations. To this end, the recommendation for automatic operation is made on the basis that protection by rule will be provided in the form of specific sub-bands to which fully automatic operation is restricted.

There is precedent for special use, by-rule sub-bands, as in 97.203(d) for beacon stations. Any other usage plans, within digital segments, should be by voluntary plan, not by rule.

The requested sub-bands should not place an additional enforcement burden on the FCC. Amateurs have always been largely self-regulating. The committee views the requested rules not as something else the FCC must spend time monitoring, but rather tools to enforce reported infractions.

V. By current standards, AX.25 is considered the least efficient protocol in use for digital modes. The STA representatives request, and the Committee wholeheartedly agrees, that AX.25 protocol be struck from 97.109(e) as a requirement, and replaced with the ability to use any accepted digital protocol.

Because investment in technology development is large, developers hesitate to widely publish details (competitive disadvantage) in the early stages. To address this issue, it is proposed that developers be allowed the latitude to use new protocols, during the developmental phases, so long as they file details of the protocol, privately, with the ARRL.

VI. Because digital technologies are developing rapidly, the Committee proposed to compile, and provide to the Board, a proposal for any desirable adjustment to Region 2 band planning, prior to future IARU Region 2 conferences.

VII. The Committee reinforces its previous suggestion that the League undertake publication of a tutorial-style operator's guide for HF digital operations clearly defining acceptable operating practices, voluntary-use band plans, DX windows and beacon frequencies.

Appendix A

The following is suggested wording for an addition to Part 97 authorizing automatic and semiautomatic digital mode operation. Note that RTTY, AMTOR, packet, CLOVER, PACTOR and future digital data modes are treated equally as "digital modes."

97.3 Definitions

( ) Unattended Digital Station - A station in the amateur service, using any accepted digital mode protocol for data or message transmission, and operated without a local control operator present.

( ) Semiautomatic operation - A two-way communication in which the control operator of a locally controlled amateur station manually initiates, monitors and controls communication between that station and an unattended digital station.

97.109 (e) No station may be automatically controlled while transmitting third-party communications, except a station retransmitting digital radio communications using an accepted protocol on the 6m and shorter wavelength bands, or on 10m and longer wavelength bands in sub-bands where automatic control is specifically authorized. The retransmitted mes-

sages must originate at a station that is being locally or remotely controlled.

97.216 Unattended Digital Station

(a) Any amateur station licensed to a holder of a General, Advanced or Amateur Extra Class license may be an unattended digital station.

(b) An unattended digital station may operate on any frequency authorized for digital transmission modes.

(c) No unattended digital station may initiate contact with another station or broadcast any undirected signal unless operating in a band or band segment where fully-automatic operation is authorized.

(d) The transmitter of an unattended digital station must be equipped with a functioning time-out timer that will insure no signal is transmitted for longer than five minutes in the event of the malfunction of control equipment or loss of contact with another station.

(e) Unless operating in a band segment where fully-automatic operation is authorized, the control operator initiating contact with an unattended digital station must be present at the local control point. The control operator must first ascertain that no interference will be caused to existing communications, must remain present for the duration of the contact, and must discontinue the contact if it becomes evident that the communications with the unattended digital station is interfering with other amateur communications.

Appendix B

It is recommended that all stations under automatic control be restricted to the following Sub-bands...

10 M: 28.120 - 28.129 MHz

12 M: 24.295 - 24.930 MHz

15 M: 21.090 - 21.125 MHz

17 M: 18.105 - 18.110 MHz

20 M: 14.095 - 14.0995 MHz
      14.1005 - 14.112 MHz

30 M: 10.140 - 10.150 MHz

40 M: 7.100 - 7.110 MHz

80 M: 3.620 - 3.635 MHz

160 M: 1.810 - 1.820 MHz

Software Library Update

by Lou Nigro, KW7H

In addition to supplying various kits and firmware, TAPR maintains a library of packet radio-related computer software. Disks are currently available in 5-1/4 in. MS-DOS format for $2.00 each, and in 3-1/2 in. for $3.00 each, including mailing (slightly more for foreign orders). In the future, possibly formats for other computers will be added. The current library listing contains the following entries (of which some are two-disk packages in the 5-1/4 in. versions only; single disks in 3-1/2 in.). Additions to the software library are always welcome, however we do request that they be submitted either by, or with the expressed permission of, the author. TAPR attempts to provide the latest versions of all software; updates are appreciated. TAPR reserves the right to screen any submissions and restrict the library content as necessary. Both freeware and shareware are acceptable.

Current versions in TAPR software library - As of 11 October 1992. Items with ** notation have been updated since last listing.

Disk No.	Name	Version	Date
1.	APLINK	Ver. 6.04	03-24-92
2/2A	AA4RE BBS	Ver. 2.12	03-31-91
3.	CBBS	Ver. 6.6	03-09-90
4.	EZPAC	Ver. 1.1	01-09-89
5.	MONAX		10-30-87
6.	Ham Comm	Ver. 3.08	03-08-91
7.	No longer available		
8.	R95	Ver. 4.0	01-25-92**
	7PLUS	Ver. 1.63	01-02-92**
	UUENCODE/UUDECODE		04-24-90**
9/9A	ROSERVER PRMBS	Ver. 1.58	07-31-91**
10.	ROSE SWITCH	Ver. 911130	11-30-91
11/11A	KA9Q NET	Ver. K5JB.K15	08-29-92**
12.	WXN Weather Svr. Ver. 3.19		04-20-92**
13.	TNC1 CODE		05-30-84
14.	TNC2 NOTES		03-28-90
15.	WA7MBL BBS	Ver. 5.14	02-11-90
16.	W0RLI BBS	Ver. 14.2	08-17-92**
17.	YAPP	Ver. 2.0	12-18-86
18/18A	INTRO TO TCP/IP		09-09-87
19.	LAN-LINK	Ver. 2.0	05-04-92**
20.	ARESDATA	Ver. 1.5	01-20-91
21/21A	MSYS	Ver. 1.13	02-11-92
22.	G8BPQ NODE	Ver. 4.06	09-10-92**
23.	UTILITIES		
	PKARC	Ver. 3.6	06-01-88
	PKZIP	Ver. 1.10EX	03-15-90
	LHA	Ver. 2.13	07-20-91
	ZOO	Ver. 2.01	08-25-88
24.	THS	Ver. 2.50	11-11-89
25.	VE4UB NTS	Ver. 091891	09-18-91
26.	NM1D DOSGATE	Ver. 1.14	11-29-89
27.	SV7AIZ BBS	Ver. 3.24	04-05-90
28.	TEXNET	Ver. 1.6	02-05-91
29.	INTRO TO PACKET RADIO		11-04-90
30.	MICROSAT GROUND-STATION SOFTWARE		
	PB		04-30-92**
	PG		02-25-92**
	PFHADD		12-21-90
	PHS		12-21-90
31/31A	KA9Q NOS	Ver. G1EMM 1.6	01-19-91
32.	PAMS-Personal AMTOR Mailbox	Ver. 2.03	03-15-92
33.	TNC-2 Z-80 Monitor	Ver. 2.00	09-02-91
34.	GIL	Ver. 1.03	03-30-91
35/35A.	PAKET	Ver. 5.1	04-06-92**
36/36A/36B.	F6FBB BBS	Ver. 5.14	03-31-92
37.	TPK	Ver. 164A	04-14-91**

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____	TNC-2 1.1.8a w/KISS EPROM	12.00	(includes 1.1.8 Commands booklet)	_____
____	TNC-2 WA8DED EPROM	10.00	(8 connect version for ARES/Data standard - 4, 12, 16 available)	_____
____	TNC-1 WA8DED EPROM	10.00	....	_____
____	PK-87 WA8DED EPROM	10.00	....	_____
____	TNC-1 KISS EPROM	10.00	....	_____
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4	9/A*	14	19	24	29	34	39/AB**
5	10	15	20	25	30	35/A*

* Indicates two-disk package (one disk in 3-1/2 in. format). ** Indicates three-disk package (two disks in 3-1/2 in. format). See separate list for descriptions of these software packages. We attempt to provide the latest versions of all software.

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