PSR Quarterly

OCTOBER 1985 #17

PACKET
STATUS
REGISTER

TUCSON AMATEUR PACKET RADIO CORPORATION

PRESIDENT'S CORNER

Lyle Johnson, WA7GXD

Gad Zukes! (would you believe "Golly!"?)
Whoever said that radio amateurs do nothing between Field Day and the first snow hadn't been exposed to packet radio! Before I discuss current happenings, however, let me remind you packet old-timers of what was happening exactly four years ago...

A Little History (or, Happy Birthday to TAPR!)
October, 1981, has to go down in Amateur radio history as a very significant month. The weekend of October 16 and 17, 1981, saw a gathering of Hams in Gaithersburg, Maryland, for the ARRL Amateur Radio Computer Networking Conference (now known as the First ARRL etc.). A landmark event, it was the first non-regional gathering that I am aware of that addressed the new topic of Amateur packet radio. (The Proceedings of that first conference are out of print, but an anthology called ARRL Amateur Radio Computer Networking Conferences 1-4 is available from the ARRL for $18.)

****

The last few months have seen more activities within TAPR than since the founding of the organization.

****

If you drag out your October, 1981 issue of QST and turn to page 28 you will see the article "The Making of an Amateur Packet-Radio Network" by Dave Borden and Paul Rinaldo. This article is the one that got some of us in Tucson seriously thinking about an HDLC type of packet radio network.

In the Air Force, Captain P. J. Eaton (soon to "retire" and become "packet" Pete Eaton, civilian) was droning away in a C-130, having read (and re-read) the "CMOS Super Keyer" article on page 11. Being totally bored, he idly thumbed through the issue and read the packet article. He stopped being bored... (Remember, Pete, you're having a good time!)

One of the attendees of the October conference, Den Connors, KD2S (and first TAPR President) gave a talk at the Tucson Chapter of the IEEE Computer Society on Thursday, October 29th. He was speaking about Amateur packet radio and using a 6809 to do it. (Sounds pretty silly, huh? Open the hood of your TNC 1, or HD4040, or PKT-1 ...) Well, a couple of those kind of people who hang around such places afterwards (yeah, Hams) caught some of Den's enthusiasm and the result was a proposal for a meeting to see what could be done to stir up something in Tucson. The evening picked was Friday, November 6th.

The "Getting Started" portion of the QST article quoted $250 for a VADCG board and parts, plus surplus "202" modem, four-voltage supply... The price is what caused the group of six people (not all were Hams) meeting that November evening to decide to build a complete TNC with modem and power supply on a board for $125. And thus began Tucson Amateur Packet Radio - TAPR. (Yes, there were those who didn't like the name even then!)

Back to 1985...

The last few months have seen more activities within TAPR than since the founding of the organization.

There has been, and continues to be, tremendous amounts of energy expended on TNC 1, TNC2, NNC (what's that?) and 9600 bps modem development. Let's take these one by one.

TNC 1

Version 4.0 software has been running on a simulator. Harold Price, NK6K, has been busily coding in Pascal. During late September, he came to Tucson and worked on integrating the Pascal and Assembler routines. At this writing (28 September), there is light at the end of the tunnel. It isn't all working yet, but...

On another front, WA8DED in California has written some code for TNC 1 that is especially designed for host computer use. Ron has been beta-testing several versions prior to release, and the results are encouraging.

The moral? TNC 1, contrary to what some folks might try to lead you to believe, is very much alive and well and evolving. It is still the standard.

TNC 2

There are several articles in this issue dealing with TNC 2. You guessed it, some articles are for modifications! Hams are never content to leave things alone, and it only took a few days of having TNC 2s out in the field (incidentally, there are over 500 units shipped!) before suggestions started coming in.

In fact, there is a new TNC 2 Rev 2 board that will be shipping this month! Improved modem dynamic range and reduced RFI are the obvious performance improvements. A "PTT" LED graces the front panel for easier interpretation of the link condition. And double the memory (32k EPROM, 16k RAM) is now standard for software expansion. All this at no increase in price! (Please understand that TAPR is driven by technology, not marketing or profit -- we are trying to have fun!)

Rev 1 owners can easily upgrade their boards with the instructions in the update article.

****

TNC1...is very much alive and well and evolving. It is still the standard.

****

Elsewhere in this PSR you will see an announcement about the availability of a TNC 2 OEM package. It is the intent that, as soon as standard "reputable" Amateur manufacturers can crank up and get TNC 2s on dealer shelves, TAPR can ramp down kit production and expend energy on other facets of packet development, like the NNC described below.

NNC

The Networking Node Controller (NNC) project is well underway. After waiting for nearly two years to see some real action on this front, TAPR has decided to take the bull by the horns and do something!

A lively discussion on the VHF/UHF Linking Conference of DRNET resulted in the generation of a design for an NNC as well as a physical form factor ("form factor" is engineering talk that simply means we figured out how big its going to be) to mesh with activities going on in various places.

A fairly detailed description of the NNC appears elsewhere in this PSR, but the NNC is basically a four-channel TNC with lots of memory. It consists of two basic boards, one digital and one analog. A third board allows the use of a floppy disk drive for software development. A high-speed SCSI port is on the beast to allow a "real" networking controller to plug in someday and coordinate the activities of several NNCs.

Artwork is enroute to Tucson while I write this, and October should see the prototype NNCs take their first breaths.

The modem board will have four XR2206/2211 modems for 300 and 1200 baud usage, a tuning indicator and a master clock generator. This will allow simple access to the NNC by the traditional 300 baud HF and 1200 baud VHF routes. Of course, we want higher speed ports as well so...

9600 BPS MODEMS

TAPR, working closely with the lab at the ARRL, now has available 9600 bps modem boards! This is the K9NG design, and is fully described by a paper Steve presented at the Fourth Networking Conference (The Conference Proceedings are available from the ARRL for $10 postpaid). The board is provided with the hard-to-locate filter capacitors, a state machine EPROM, and several pages of notes. This is not a kit for the faint-of-heart; rather, it is a tool for dedicated experimenters to get 9600 bps links up and running.

DIRECTORS

Please read the article about the TAPR Board of Directors nominations. Nominations are now open, so get your candidate's name in the hat!

Well, there you have it. TNC 2 sales started on August 19th and over 1000 have sold, and more than 500 have shipped. The PC board has been redesigned and will be shipping in October. A design for the NNC has been committed to artwork. Software is evolving for TNC 1 and TNC 2. 9600 bps modems are shipping. TNC 2 OEM rights have already been sold to at least one well-known Amateur manufacturer. If hams do nothing in the summer, wait'll you see what the next three months bring! Lyle

****

TNC-2 MANUAL MISPRINTS

There are a few errors that crept into the documentation for TNC 2. While no one is admitting as to how such a thing could even be possible, the correct information (we hope!) is printed below.

There are several typographic errors in the manual, most due to the tired Diablo printer (it gave up the ghost during the printing - some of the typing was done manually!). This article will not deal with trivial errors; it will focus on those erors that may cause confusion.

Thus warned, let us proceed!

Schematic Diagram:

Sheet 1

The "G" pin of U12a is incorrectly marked as pin 5. It should be marked as pin 15.

Sheet 2

We haven't found any errors on this one -- yet!

Sheet 3

The power table lists U5 as a type 74HCT373. It is rather a type 74HCT374.

System Manual

Chapter 6

CALSET (page 6-13) incorrectly shows a default value of 2060. There is not default; the number may be random from 0 through 65535.

PACTIME (page 6-44) states that the time is calculated as n*100 milliseconds, but the explanations for EVERY and AFTER use units of seconds. The explanations are incorrect; the units are 100 milliseconds as stated in the formula.

****

EDITORS COLUMN

Gwyn Reedy, W1BEL

THE FUTURE OF AMATEUR RADIO

Much breast-beating about the advancing age of the amateur population and many proposals for gaining new recruits have been in the amateur publications lately. I certainly agree something needs to be done, in fact lots of things. Each proposal is based on the experience and understanding of the person that generated it. My observation, after 31 years of amateur radio, is this: I have never seen as much interest in getting into amateur radio among the people I meet, and it is almost completely based on the desire to join the packet revolution. These people aren't young kids looking for excitement, but are people in their twenties, thirties, and forties that have known about amateur radio for a long time and never before were motivated to seek a license. A surprising number of persons that let their license lapse due to lack of interest are also becoming interested in participating. Most packet enthusiasts feel that digital communication is the wave of the future for amateur radio in a technical sense. I believe it is also the key to maintining our numbers and vitality. Let's not be shy about proclaiming our appeal. We need to make additional efforts to involve those persons in leadership positions in the amateur world in packet activity so they can experience, first-hand, its pleasures and potentials. We also need to broaden the appeal of packet radio by having it accepted as a communication method, rather than emphasizing it as an end in itself.

****

The members of TAPR... are amateurs that want to forge ahead with technology in our methods of communication.

****

Our ranks have mostly been filled with experimenters so far, but the recent explosion in numbers is changing that. Like other new modes in the past, many people are getting on packet out of curiosity and the desire to be 'where it's at.' We are still in the stage of emphasing the mode of communication, rather than the content of the message itself. To some extent, that fascination with the transmission method is the essence of amateur radio. I feel that amateurs get on the air for two categories of reasons: 1) To use communication media for enjoyment. This includes ragchewing, DXing, contesting, experimenting with equipment and propagation, etc. 2) To communicate, i.e., to get a message to someone. Emergency communication, phone patches, and traffic handling fall in this area. These categories overlap, of course. We are still in the 'do it cause it's fun' stage, just like SSB and FM went through at their beginning. While those modes provided improvements in communicating ability in some fashion over what preceeded them, they didn't really alter the approaches to communicating. To me, that is where packet networking's potential lies. In the past, tuning the bands provided random communication potential, and the unpredictability of who you could communicate with at any moment added much excitetment to the hobby. But if you needed to get through to someone, a schedule or net was required, and then you were dependent on good propagation. With our growing packet network, you will be able to contact any amateur anywhere with reasonable certainty. As we see the reliability and convenience of communicating through this network, we will devote more of our attention to saying something meaningful to those we communicate with. And there needs to be no loss of spontaneous communication. The magazines like to feature articles about the 'information revolution.' Well, it is also happening in amateur radio, and it's called packet. Happy packeting.

PROFILE OF A "DOER"

A doer is just what the homemade word implies, one who does things, an achiever. Even more to the point, a doer is one who makes things happen. That implies strong motivation and willingness to work, as well as the ability to motivate others to appropriate action. TAPR is full of doers. The members of TAPR (and the packet revolution everywhere) are amateurs that want to forge ahead with technology in our methods of communication. The TAPR Directors, Officers, and the developers that built the hardware and software for which TAPR is famous are doers of the first order.

****

We should look on TAPR as "us" rather than "them" because each member is an integral part of the organization.

****

The nature of TAPR needs to be reiterated frequently. TAPR is a club of radio amateurs that has incorporated as a non-profit business for legal protection of its members and for tax purposes. It is NOT a commercial business in the conventional sense. TAPR is all of its members, not only the Officers and Directors. We should look on TAPR as "us" rather than "them" because each member of TAPR is an integral part of the organization. This packet radio activity is a hobby to all of the members. They have jobs, families, religious and social obligations etc., This part time, hobby aspect to the group makes TAPR's accomplishments all the more amazing in comparison to commercial businesses.

Because of their functions, the contributions of some TAPR persons are more widely recognized than others. I want to single out one person for attention this time, because it is my impression that he is the 'glue' that has kept TAPR together through the hectic pressures of TNC development. This is in no way meant to diminish the significance of the contributions of the persons not mentioned this time. In fact, the reason I'm writing about this person is that he has no hardware or software expertise to contribute. On a list of technical contributors to any of TAPR's packet projects, his name would be left out. Neither is he a prolific writer in packet publications. But, I am convinced there would be no successful projects to take pride in if he had not been intimately involved in 'getting things done.'

'Packet Pete' Eaton, WB9FLW, is this energetic person. He is famous in the packet community for his visits to hamfests across the country promoting packet radio in general and TAPR in particular. I want you also to know he is a first class leader and manager as well, and has invested much more energy and enthusiasm behind the scenes than has shown in public. Thanks Pete!

Editor's Comments

HISTORIC FIRSTS!

I want to poke a bit of good natured fun at claims of 'first xxxxx,' where xxxxx can be nearly anything. Recognition for achievement is a strong motivating factor in human performance. Generally it is more socially acceptable if the recognition is not self-announced, but that also has it's place. What comes to mind in this regard is situations where my children will say, "I got here first," without ever announcing a race to get somewhere. It's so much easier to win a race if the competition isn't aware that it IS competition. I'm sure we've all had that experience. In amateur activities, we see many of these claims. I categorize them in three ways: 1) Publicized, carefully controlled and documented actions. 2) Accomplishments of some merit, but which were not announced as competitions. 3) Very specific events that intrinsically had little competition potential.

A good example of category one is the Pacific Packet Radio Society Golden Packet Award. It is well defined, and PPRS will decide and announce the winner. An example of category three is the sidebar in this issue about using three bands and 14 digipeaters to talk to oneself. These are firsts of the 'Guiness World Record' variety. They are fun. [You too can be a winner. Why, I myself, am the first person named Gwyn to be the PSR editor. Actually, with a name like that, I'm usually the first person named Gwyn to do anything!!]

Category two can be a problem, meaning feelings can get hurt. Last issue, Howie, N2WX, claimed that FADpad/TNC2 software was the first implementation of AX25 version 2. Now Lynn, WB6UUT, says the WA8DED code was the first. Actually, I heard someone implemented it on a VIC-20 shortly after its adoption by the ARRL Ad Hoc Digital Committee last fall. So, no hard feelings intended. We won't be able to accurately indorse anyone's claim unless we tighten up the rules and make a call for entrants. Does implementation mean a) when you wrote programming specifications on a notepad [you did spec it first didn't you, HI], b) when you got a clean assembly run, c) when you put it on the air in test status, d) when you announced its availability, e) when you actually made it available, or f) some other criteria?

Like I said, I'm having fun with this. The claims do no harm, but it doesn't make sense to take them overly seriously. What does make sense is doing a top-quality job and receiving public acknowledgement for it. I commend both Ron Raikes, Howie Goldstein, and the untold others who have implemented AX25 V2 in their basements without telling anyone. We owe tremendous gratitude to these people that have contributed freely to our hobby.

CONTRIBUTIONS TO PSR QUARTERLY

I am grateful to those persons that have invested the effort in writing for this publication. As you look at what is included in this issue, you see that much of it is 'one time' material, such as TNC2 updates. Therefore, I request persons that have not yet contributed to seriously begin preparation of material for the January issue. In other words, don't think your inputs are not needed just because this is a good-sized issue. If you have an idea and want to discuss it, contact me via any of the following means: Write to the address on the back cover, send a message via the MailBox system to W1BEL @ KC2FF (or @ K4NTA on HF), Compuserve (ID 76576,2003), DRNET (ID 2975), telephone (813) 689-3355 after 9 PM Eastern time.

****

TNC-2 OEM PACKAGE AVAILABILITY

Tucson Amateur Packet Radio Corporation, in pursuit of its charter to do research and development in Amateur digital communications and make the results of that research and development available, is now supplying complete manufacturing packages for interested parties.

The package consists of PC board artwork, schematics, manuals (both printed and on diskette) and license to duplicate and distribute TNC 2 (or its derivatives). This is much the same as the earlier TNC 1 OEM package, which spawned the AEA PKT-1, the Heath HD-4040, the Kantronics Packet Communicator, the Packeterm IPT, the HAL...

Unlike the TNC 1 OEM package, which is still available for only $500, the TNC 2 OEM package costs $5,000 plus limited royalties. For further details, contact the TAPR office.

****

```
Msg#  TR  Size  To     From   @ BBS  Date    Title
454   Y   1044  W1BEL  N2WX   TPA    850907  Forwarded from N2WX at 0032ET
1542  N    981  W1BEL  K4NTA  TPA    850906  F Y I, Maybe for PSR

At  K4NTA: 1208  From WORLI  Rcvd 850906/0816, Sent 850906/1816
Via WORLI: 6358  From K1BC   Rcvd 850905/1300, Sent 850906/1215
Via WORLI: 57    From K1BC   Rcvd 850906/0440, Sent 850906/1258
At K1BC:   4839  From K1BC   Rcvd 850905/0428Z, Sent 850905/0439Z

4834 BN   681 ALL    K1BC          850905 Historic first?
```

This msg is being filed by the following route:
A terminal at K1BC-1 talking to a TNC-1 with WA8DED code in it ---> K1BC-1 sending on 223.10 MHz ---> Being relayed by K1BC/R audio repeater at Weston MA to WORLI-1 on 224.70 ---> Gatewaying at WORLI-1 to 145.01 ---> Digipeating via K1EA Harvard MA to N1DL in Sudbury ---> Gatewaying from 145.01 to 14.103 MHz at N1DL: From N1DL to WORLI-0 on 14.103 ---> Gatewaying at WORLI-0 back to 14501 MHz ---> From wOrli-0 via KD2S-1 Digipeater in Lowell MA ---> to K1BC-0 BBS in Lexington MA, or about 3 feet from where I am typing this.

3 bands (220, 145 and 14 MHz), 10 TNC's (I think), 3 Gateways, and a BBS.
Hooray! The Network Grows! 73, de Bob, K1BC

BBS NEWS AND VIEWS

TOM CLARK, W3IWI

Last time in this column I told the story that the BBSs in our mid-Atlantic area had served as the "glue" that finally bound people together. The W3IWI PBBS has now celebrated its first birthday and in that year well over 7000 messages went thru the system. The neighboring systems in NJ, PA and WV have accounted for a total message traffic in excess of 18,000 messages. WORLI has reported that the message total in the Boston area was at a similar level (> 18,000 total messages as of the end of September). During the month of September, the W3IWI BBS generated > 200 kbytes of logging data alone, with 143 users and with the BBS connected to some user one year ago, with an average "doubling time" of about 4 months. The packet revolution has arrived!

****

A nifty trick can be done with the TNC2 that permits it to emulate a W0RLI mailbox on receive.

****

My system runs with two VHF input ports (145.01 and 145.05), although one of these channels will QSY to 220 when we get 9600 baud running on EAST-NET. Since my last column, WORLI has released his 10.0 software. We have been working to sort out minor incompatibilities between the TNC1 and TNC2 and my 145.01 port now runs a TNC2. In the Baltimore/Washington area we are already feeling the pinch of too many users on the air and we are trying to devise ways to minimize QRM. For example, we have been fine tuning channel priorities by suggesting that keyboard users use short DWAIT (e.g. 4), BBS's take a lower priority by using DWAIT 8 while those doing file transfers use DWAIT 12 (TNC2 users: quadruple these numbers because of your higher resolution timers).

During the past year, I spent nearly six weeks in the Fairbanks, AK area. For those of you not familiar with Alaska's geography, Fairbanks is in the middle of the state, about 400 miles from Anchorage, and has a population of about 50,000. Anchorage plus Fairbanks account for about 90% of the state's population. With the help of KL7GNG and KL7NO we have introduced packet radio to the Yukon. During my trips, we got the KL7GNG BBS (another WORLI system) on the air with three initial users (KL7GNG, KL7NO and W3IWI/KL7). We showed the capabilities to the Arctic Amateur Radio Club who immediately saw the potential for a number of public service functions like relaying checkpoint info from points along the route of dog sled races (in the winter) and boat races (in the summer). Within months, the Fairbanks area has become a real hotbed of activity with something like 20 users (I dare to suggest that Fairbanks has the largest per capita population of TNC2s of any metropolitan area in the world!), all focusing their activity on the KL7GNG PBBS. They have just begun linking experiments to the "outside" world (VHF links to Anchorage and HF links to "civilization").

The packet BBS software that has reached the greatest level of maturity is due to the efforts of Hank Oredson, WORLI. This runs on a virgin Xerox 820 board (still available for $50-$75) with 8" or 5" floppy disk drives and a TNC1 or TNC2. I have been asked a lot of questions about getting an X820 up and running so let's spend some time answering some oftasked questions. The first of these concerns the availability of supporting documentation. I would recommend that anyone planning an X820 system get a copy *of the August* '85 AMRAD NEWSLETTER. In that issue, N4ICK has made a compendium of useful X820 tips. Andre informs me that the August issue can be obtained for $1.50 by writing:

Andre Kesteloot, N4ICK
AMRAD
Box 6148
McLean, VA 22106

Or it will be included as one of the copies if you join AMRAD for $15 annual dues (use the same address and indicate you want the Xerox special issue). My good friend, Ron Dunbar, W0PN, also produced a lot of helpful notes on the X820 which I have combined with other possibly useful X820 trivia in a series of disk files that have made the rounds of a number of *BBSs*. *If* you really need a copy, I could provide it on disk (1st preference IBM-PC format 5" disks, or if need be on 8" SSSD IBM 3740 format CP/M files). However, I must insist that you provide the diskettes and pay adequate postage!

The next most frequently asked question concerns disk formats for the X820/WORLI BBS combination. 8" disks are to be preferred although there does exist 5" (Xerox format) support. However the storage capacity of the 5" disks is very limited and the "official" "supported" software distribution is on 8", so you have to find somebody to do media conversion for you. In the 8" format, two physical drives are supported. Either of these may be either single- (i.e. Shugart SA-800 or equivalent) or double-sided (i.e. SA-850). If you use double-sided drives, the software treats it as two separate logical drives. Each logical drive can store 241 kbytes of data, although the WORLI software plus supporting files requires 100-300 kbytes (depending on the volume of mail on the system).

Here at W3IWI I use two SA-850's, so the user sees 4 logical drives (named per CP/M convention A:, B:, C: and D:). The system software and supporting files are distributed between the A:, C: and D: drives, leaving about 600- 700 kbytes of user space (which often isn't enough with 100+ active users). Some of the "system" files which chew up space include:

CBIOS.COM (part of the CP/M system loaded during a 2-step boot)
TNC.COM (the BBS program itself)
CONFIG.TNC (ASCII Text file with BBS commands, prompts and control information)
MAIL.DAT and MAIL.BAK (the file containing user messages, and the backup copy of same)
LOG.TNC (an ASCII text file containing a rather detailed BBS transaction log)
CALLS.TNC (an ASCII listing of all calls heard by the BBS when not connected to a user)
FWD.TNC (an ASCII text file which controls routing for message forwarding)
USER.DAT (a database file which contains information on each BBS users including name, last time connected, message number at last connect, priviledges, etc.)
MON.TNC (an ASCII text file used to save the "J" listing of recent acitvity)
MSG.TMP (temporary file used while receiving message from user)
plus normal CP/M utilities like PIP, SID, STAT, SYSGEN, WS, etc.

Most BBS sysops "hide" these files from user view by issuing a command like STAT *.COM $SYS or STAT MAIL.* $SYS (but the files are still there!). Users are cautioned that ONLY the files I have noted as being ASCII text files can be listed without devastating results: the BBS does not like to send binary data!

I am often asked about how to obtain the software. With over 100 systems on the air, it has become impossible for WORLI to personally take care of all the distribution of disks. He usually sends out new releases to a few select people, who then each have their own distribution lists; I personally have supplied about 20 systems with software. Bob Clements, K1BC also distributes the code to a number of subsidiary users by ARPANET. So the best way to get software is to ask somebody that already has it. Try not to write Hank unless it is really necessary; we all profit from having him spend his efforts working on code rather than copying disks! The ad hoc "Christmas Tree" distribution network would be greatly aided if somebody would volunteer to maintain a "central registry" data base with information on which systems are currently active, their current software revision level, which TNC's they are using etc.

Another frequently asked question concerns the portability of the software -- "Can I run a WORLI BBS on my Veebelfetzer CP/M system?". WORLI has written the software in a CP/M environment in Z80 macro-assembler. However, the software makes heavy use of the X820 hardware configuration and is interrupt driven. As a result, few of the efforts to change the basic environment have been successful. With minor changes it will run on the Digital Research (a.k.a. Ferguson) Big Board (which has strong family ties to the X820). The WORLI Z80 macro-assembler source code is available for those who want to take a crack at it, but I would offer the following advice. To be useful, a BBS needs to be dedicated to that function; it should be available 24 hours per day. Few of us want to tie up our "good" personal computers to provide BBS services, and X820s are quite cheap. Therefore it makes sense to bite the bullet, outfit an X820, and dedicate it to serving a BBS function.

****

Let me expound on how these systems might evolve in the future.

****

A related question concerns compatible software for other computers. The big point in compatibility concerns automatic message forwarding (more on this a bit later). I know of two compatible alternative implementations. The first has been written by VE3FXI in "C" to run under OS9; Dwayne sent the following note to me:

"Tom, the 'C' Source Code for my PBBS is available if any one wants it for cost of media and postage. Media and format preferably 5 inch OS9 format, but other formats with effort on my part are possible.

"It is actually only compatible with RLI as far as message forwarding goes, and supports message handling much differently internally, as well as offering use of sub-directories for File Uploads/Downloads etc. The command suite is somewhat different except for RLI message forwarding compatible 'S' command ('SP' is not supported). Message forwarding is handled through '@' direction which means I do not need to have large forwarding tables.....

"It is not so new as it has been running locally since Aug 84 but back then it didn't support message forwarding, since there was no one to forward to ! Address any further questions etc. by mail to:

Dwayne Bruce
29 Vanson Ave.
Nepean, Ontario, Canada, K2E 6A9

Another WORLI compatible system has been written by Bob Bruninga, WB4APR, to run with the TNC1 command set using a Commodore C-64. Bob's software is written in BASIC and is designed to run with all messages stored in RAM (he uses battery backup power and reports no glitches resulting in lost mail in months of operation). Bob's software uses cassette tape for backup and does not even use a disk drive. With a virgin C-64 it can service one TNC in BBS mode, and with a couple of added TTL chips it can service two as a full gateway. Bob indicates that he will supply the software on tape for $5.00 to defray his costs and he can be reached at:

Bob Bruninga, WB4APR
59 Southgate Ave.
Annapolis, MD 21401

I often receive questions like "I'm trying to get the RLI software running but I am having problems with .....". To help WORLI sysops with their problems, Jon Pearce, WB2MNF, has written a "SYSOP GUIDE". This hitchhiker's guide to BBS-dom, like its galactic counterpart, is designed with "DON'T PANIC" in mind. Jon has collected his experiences and augmented them with inputs from WORLI and me; he tries to keep it up to date with the frequent evolutionary software changes from WORLI. At the time of this report, Jon is in the process of updating the document from WORLI release 9.8 to 10.0. Jon requests that you pay the postage costs for sending this document to you -- about $2.00 should take care of domestic postage. He can be reached at:

Jon Pearce, WB2MNF
109 Pine Cone Trail
Medford NJ 08055

Let me expound on how these systems might evolve in the future. The present WORLI BBS/Gateway systems support only a single user at a time. There are two reasons for this. The first is that (until very recently) our TNCs could only support one connection at a time. But this is changing. Ron Raikes, WA8DED, has written a nice firmware package for the TNC1 and its hardware compatible units which supports 4 users (and can be recompiled to support several times that number). This firmware is already in use on the W6IXU BBS in the Los Angeles area. A few of us have "beta" test firmware for the TNC2 written by Howie Goldstein, N2WX, for the TNC2 and "PADpad" TNC which supports up to 10 simultaneous users. Harold Price, NK6K, is in the testing phase with his Revision 4 TNC1 code which will support 37 (!) different users. And I understand that AEA's new PKT-64 also supports multiple users. So, the TNC limitation is evaporating.

The next hangup on increasing flexibility concerns the BBS's computer. The X820 was a good choice since it was cheap and readily available. But it is simply too small an "engine" for a multi-user system. The 64 kbyte memory limitation is severe; WORLI currently uses the entire X820 memory space. Also, the X820's hardware configuration does not lend itself easily to expansion to more disk space. If you enjoy hardware modifications, accessory boards are available to increase memory up to

1 Megabyte and to modernize the disk controller. Also, the recent advent of cheap 10-20 megabyte Winchester disks at cheap prices should cause us to rethink the disk storage questions.

But in defense of the current X820 configuration, we should again stress that its low price and ready availability plus the heroic software effort by WORLI has offered the opportunity to have a highly competent BBS in many diverse areas from Alaska to Florida, from Norway to New Zealand. If we are going to develop a higher performance "engine", then it seems obvious that we should have reproducability as one of the primary considerations.

On a couple of recent trip to the Boston area, WORLI, K1BC and I chatted into the wee small hours about this problem -- what is the next "engine"? My personal preference is the IBM-PC (and compatible clones). At hamfests recently I have seen oriental gentlemen showing their offshore PC-clones for as little as $700 when equipped with 256k RAM, two 360kbyte floppies, video board, etc. A 10 meg hard disk can be had (with controller) for $300-400. Big Blue has set the standard that assures compatibility with their open architecture. But MSDOS is not a multitasking operating system (maybe it will be with DOS 4.0 or with WINDOWS or Concurrent CP/M) and multiuser activities would be much easier to implement with true multitasking.

Hank had an Atari "Jackintosh" running at his house, and we discussed that as a possibility. The consensus was that the operating system plus closed architecture made this not be the "engine" of choice.

Another very interesting machine is Commodore's new Amiga. The architecture is open, software support looks good, and multitasking is inherent in the operating system. But none of us have an Amiga! And will it even survive in the fickle marketplace?

The final "engine" we discussed was the 64180, both as described by Steve Ciarcia in his recent BYTE articles and as used by WA7GXD in the new TAPR Network Node Controller (NNC). This is basically a CMOS Z80, but with the ability to address a lot of memory. The problem I see with this approach is that we don't have a readily available multitasking operating system to support it that is CP/M compatible. But the OASIS OS is available and a Canadian firm also offers a multitasking OS, so if the the BBS applications are rewritten to run under one of these OS, we might be in business. The Turbodos OS also might be used to service several users on slaved 64180 boards. We invite your comments on this topic.

As a final topic for this issue, lets discuss networking (particularly as it applies to BBS message forwarding today). Right now, we are all waiting for one of the pundits to present to us some working network software. This may be TCP/IP or it may be virtual connections -- hopefully it will be transparent at the user level. Until these Level 3/4 implementations are ready to use, we have only two networking "hooks" available. One is our digipeaters (a bit of level 3 thrown in at level 2) and the second is the BBS message forwarding (all the way up at level 7). The BBS forwarding is simplicity itself. At predetermined times, a BBS automatically calls up its neighboring BBS and passes any messages it has for that area. The receiving BBS neither knows nor cares whether the calling station is an individual user or another BBS. The sending station keys his transmissions on certain "trigger" characters sent by the answering station. The sending station looks for a ">" character and begins the message transmission. The dialog looks something like this:

Sending Station	Receiving Station
1. [connect]	[signon banner text]
2 .	(B,D,....)>[cr]
3. S K9DOG @ NOVA < W3IWI	[prompt line] [cr]
4. INFORMATION WANTED	[prompt line] [cr]
5. [message text]	
6. Ctl-Z	(B,D,....)>[cr]
[repeat 3. - 6. until done]	
7. [disconnect]	

All the text in (1.) is superfluous but the receiving station makes no distinction between a normal user and a BBS forwarding mail. In (2.), the ">[cr]" is the trigger that permits the transmission of a message. In (3.) the [cr] terminator would normally be a part of the "Subject:" prompt and would trigger the sending of the Subject: line. In (4.) [cr] would be part of the "Send msg. end with Ctl-Z" prompt to trigger the transmission of the message text in (5.) and the Ctl-Z terminator in (6.). The receipt of the ">[cr]" in (6.) is the acknowledgement that the previous message has been received (whereupon most BBS's automatically "kill" the original message).

In (3.) we see the routing information for the message. In this case K9DOG is known by the originator to be a user of the NOVA BBS. The BBSs along the route only need to know how to get messages to other BBSs, not the calls of all the users at that BBS.

The "< W3IWI" in (3.) is a recent addition to WORLI BBS's (beginning with release 10.0). Previous to that release, the call of the sending BBS appeared in the message "From" field since the from call is taken from the call sent at connect time. The new addition specifies the original "From" call at the originating BBS and preserves it as the message meanders thru the network of linked BBSs.

FIFTH ARRL AMATEUR RADIO COMPUTER NETWORKING CONFERENCE

(Reprinted from October QEX)

The Fifth ARRL Amateur Radio Computer Networking Conference will be held during the weekend of March 7-9, 1986, in Orlando, Florida, in conjunction with the Florida State Convention. The Florida Amateur Digital Communications Association (FADCA) will host the conference.

Technical papers are invited on all aspects of amateur digital communication including packet radio, RTTY, AMTOR, modems, computer-based message systems, terrestrial networking, gateways, teleports and satellites, and meteor scatter. Topics of interest are protocols and standards, network and system architecture, hardware, software, and applications.

The deadline for camera-ready papers is February 1, 1986. If you plan to present a technical paper, please request an author's kit from Paul Rinaldo, W4RI, at ARRL Hq, 225 Main Street, Newington, CT 06111.

****

Normally each BBS appends a line at the top of the message text with traceback information showing the route the message followed. It is not unusual to see a message that has gone thru 6-8 "hops" have accounting information longer than the message text.

A nifty trick can be done with the TNC2 that permits it to emulate a WORLI- compatible mailbox on receive. This then lets your nearby BBS auto-forward your mail to you. To do this, we make use of the TNC2's CMSG and CTEXT commands to answer all "calls" with the characters necessary to "pace" the sending of mail. First you have to set CMSG ON and then (assuming you have PASS set to the default $16 = ctl-V) you enter something like the following example which will allow up to 3 messages to be sent to you:

```
CTEXT Welcome to W3IWI-1[ctl-V][CR] (or whatever
you want)
[ctl-V][CR]          (ack the TO: field)
[ctl-V][CR]          (ack the TITLE: field)
[ctl-V][CR]          (ack the ctl-Z at the end)
[ctl-V][CR]
[ctl-V][CR]
[ctl-V][CR]
[ctl-V][CR]
[ctl-V][CR]
[ctl-V][CR]
[CR]
```

Be certain there is no space between the ">" and the [ctl-V][CR].

You should inform your local BBS sysop that you are prepared to accept autoforwarded mail and he will put you into his FWD.TNC list. He will probably delete your messages automatically after he sends them to you, so it is your responsibility to make certain that your system is on-line and ready to copy. If you take your printer/computer off-line, you should disable your TNC by issuing the command CONOK OFF and/or CMSG OFF.

You may have trouble with the ctl-Z that the BBS sends to you as a terminator for each msg. In CP/M-based systems, ctl-Z is the End-of-File marker and if your terminal program puts it into the file, then the subsequent messages will not be "reachable". Also some terminals (like the ADM-3) use ctl-Z as a clear screen character which may also cause some grief. Here I use ASCOM as a terminal emulator program (both in CP/M and MSDOS) filter out all ctl-Z characters on input.

73 de W3IWI

****

EPROM PROGRAMMING ADAPTER

The TAPR TNC 1 EPROM programming adapter, described in the July PSR Quarterly, enables you to program 2764 and 27128 generic EPROMs. With a simple mod, it can support the "A" versions of the INTEL "intelligent" algorithm, a 2764 can be programmed in under two minutes, a 27128 in under four.

TAPR has about two dozen semi-kits available. These kits include the PC board, ZIF socket, IC sockets, most ICs and most discrete components. THIS IS NOT A COMPLETE KIT!

Price, including limited documentation, is $35 postpaid in the US.

****

MODIFICATIONS TO THE TNC-2

INTRODUCTION

TAPR has delivered over 500 TNC 2s. This month (October), TAPR will be shipping a revised PC board (Rev 2). For those of you with Rev 1 TNC 2s, the following list of board modifications will bring you very close to the improved performance available from the Rev 2 boards.

The modifications address the following areas:

a) On-board modem receive dynamic range
b) Susceptibility of TNC 2 to rf fields
c) Radiated emissions from TNC 2
d) Revised memory mapping for 32k EPROM and 16k RAM

If you have experienced difficulties in any of the areas covered by (a) through (c) above, TAPR recommends you perform these modifications to your TNC 2. If you desire to use later versions of software that will include multiple connections, TAPR suggests you perform the memory modifications.

ACKNOWLEDGMENTS

TAPR is grateful to Eric Gustafson, N7CL, and Dan Morrison, KV7B, for developing and testing many of these mods.

PROCEDURE

All trace cuts and added parts are shown in the two illustrations that accompany this article. Figure 1 is the component side of the PC board, while Figure 2 is the solder side. Please refer to these figures when performing the modifications.

A) -5 volt supply

The -5 volt supply may have a few hundred millivolts of noise. Since much of this noise is synchronous, and related to the clock of the MF-10 filter, it contributes to degradation of the demodulator at low signal levels.

To clean up the -5 volt supply:

1. Remove R4 (10k, quadrant 1, Assembly pg. 13).
2. Cut ground trace of R4 (see cut A, Figure 2).
3. Install a 1 uF to 10 uF electrolytic capacitor in place of R4 (+ end away from edge of PC board).
4. Connect end near edge of PC board to adjacent pin on R5.

B) Isolating Digital and Audio Grounds.

The analog and digital ground paths are insufficiently decoupled. The result is a higher-than-expected noise floor at the demodulator input. The following mods provide significantly greater isolation of the two ground systems, resulting in much-improved weak-signal demodulation capability.

To break ground loops and isolate audio ground:

1. Break heavy ground trace between C21 and U8 pin 4 (see cut B, Figure 2).
2. Break heavy ground trace between anode end of CR12 and RS-232 connector pin 7 (see cut A, Figure 1).

3. Connect jumper from RS-232 connector pin 7 to power ground near on-off switch (see Jumper 1, Figure 2).
4. Break heavy ground trace under RS-232 connector (see cut C, Figure 2).
5. Install a 10 uH RF choke across this break.

C) +5 volt Power Supply

The +5 volt power supply may have up to a few hundred millivolts of digital noise on it. Since this supply is common to both digital and analog circuits, this noise can contribute to degraded modem performance.

To reduce the noise on the +5v power supply:

1. Remove the +5-volt regulator (Q3) from the PC board.
2. Mount this regulator to the cabinet, screwing it to one of the "top rails" (see Assembly manual, Fig. 6, page 60). A #4 self-tapping screw is the proper size.
3. Use short jumper wires (insulated!) for the regulator input and output leads (the two outside pins).
4. Use a shielded wire to connect the center (ground) pin of the regulator as follows:
   - Connect the inner conductor only to the center pin of regulator Q3.
   - Connect both the inner conductor and the shield to ground at the ground lug of P1 (see Figure 2).
5. Changing bypass capacitors from 0.01 uF to 0.1 uF may be helpful.

D) Reducing Noise on +5 and -5 Volt Supplies

In addition to the above steps, the following step is helpful for both supplies:

1. Replace R80 with a 10 uH RF choke (Quadrant 2, Assembly page 15).

E) Reducing Radiated Noise

TNC 2 uses a crystal oscillating at 4.9152 Mhz (nominal). This results in a harmonic (the 30th) at 147.456 MHz. TNC 2 also uses dividers, and the 59th harmonic of the 2.4576 Mhz energy is at 144.998 MHz (pretty close to 145.010). There are several ways to reduce the strength of this energy. The first four steps relate to an antenna effect of some of the conductors on the PC board, the later steps slow down the edges of the worst digital offenders. While there is some work involved, the results are well worth it!

To reduce the radiation efficiency of the TNC at VHF:

1. Delete (bottom of board) ground trace from corner of board near J2 to pass-thru near U25 pin 15 (see cut D, Figure 2).
2. Cut the same trace (edge of board, bottom side) just before it becomes adjacent to the audio ground trace (near pass-thru near cathode end of CR15) (see cut E, Figure 2).
3. Cut the ground trace on the top of the board near the edge at the same location as in above step 2 (see cut B, Figure 1).
4. Cut the ground trace running (top of board) under the LEDs right where it joins the fatter trace leading towards BATT1 (see cut C, Figure 1).

To decrease the radiated noise from the board:

5. Install a 220 pF cap from U4 pin 3 to ground.
6. Install a 0.01 uF cap from U4 pin 6 to ground.
7. Install a 100 pF cap from *U10 pin 12* to ground.
8. Install a 0.01 uF bypass capacitor at J2 pin 3 (PTT) to ground (see Figure 2).
9. Install a 0.1 uF bypass capacitor across the power input pin of P1 to ground (see Fig 2).

To pull the crystal frequency in case a "spur" is on 145.01:

10. Replace C47 with a 60 pF trimmer capacitor (available from most Radio Shack stores) and adjust the trimmer to pull the "spur" to 145.00 MHz. If the crystal won't pull low enough, adjust the trimmer to put the "spur" on the high side of 145.01 MHz.

F) For the Strong of Heart

If packeteers in your area do not overdeviate their transmitters (many do!), the audio repeaters used are actually flat (most aren't) and you want to squeeze the last possible dB out of the low end of your demodulator's dynamic range, this mod MAY be for you!

1. Remove U18 (MF10).
2. Install a small wire jumper from pin 1 to pin 17 of the now-vacant MF-10 socket.
3. Verify that you can still work packet radio!
4. Cut the trace supplying the clock signal to the MF-10 (now you can't easily use the MF-10 again -- think twice about cutting this trace!) (see cut D, figure 1).

F) Memory Modifications

TNC 2 Rev 2 utilizes a 27C256 EPROM (32k bytes) and includes a pair of 6264 8k RAMs for a total of 16k of bbRAM.

WARNING: The following modifications will not allow you to use a pair of 2764 EPROMs in your TNC 2. This will mean purchasing a new EPROM. You may want to wait until there is a new software release that is not compatible with your present configuration before you perform this modification.

1. Cut the trace tying JMP5 pins 1 and 2.
2. Install a jumper at JMP5 pins 5 and 6.
3. Cut the trace from U24 pin 20 to U12 pin 11.
4. Add a jumper from U24 pin 20 to U13 pins 2 and 3.
5. Cut the trace from U24 pin 27 to JMP6.
6. Add a jumper from U24 pin 27 to U25 pin 27.
7. Cut the trace from U24 pin 28 to R52.
8. Add a jumper from U24 pin 28 to U25 pin 28.
9. Add a jumper at JMP6.
10. Replace U24 with a 6264 8k static RAM, low-power type.
11. Replace U23 with a 27C256 EPROM containing TNC 2 software.

That's all for now!

****

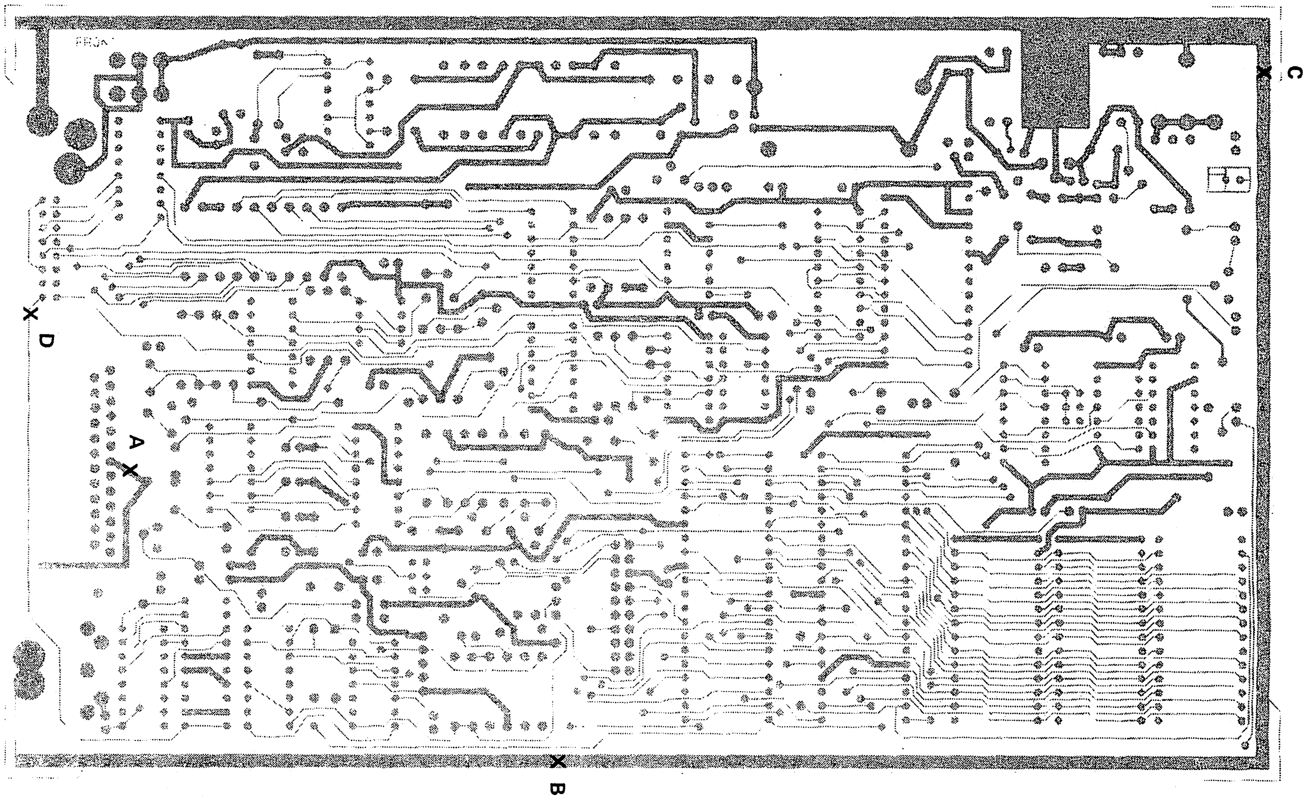


Figure 1 – TNC 2 REV 1 Component Side

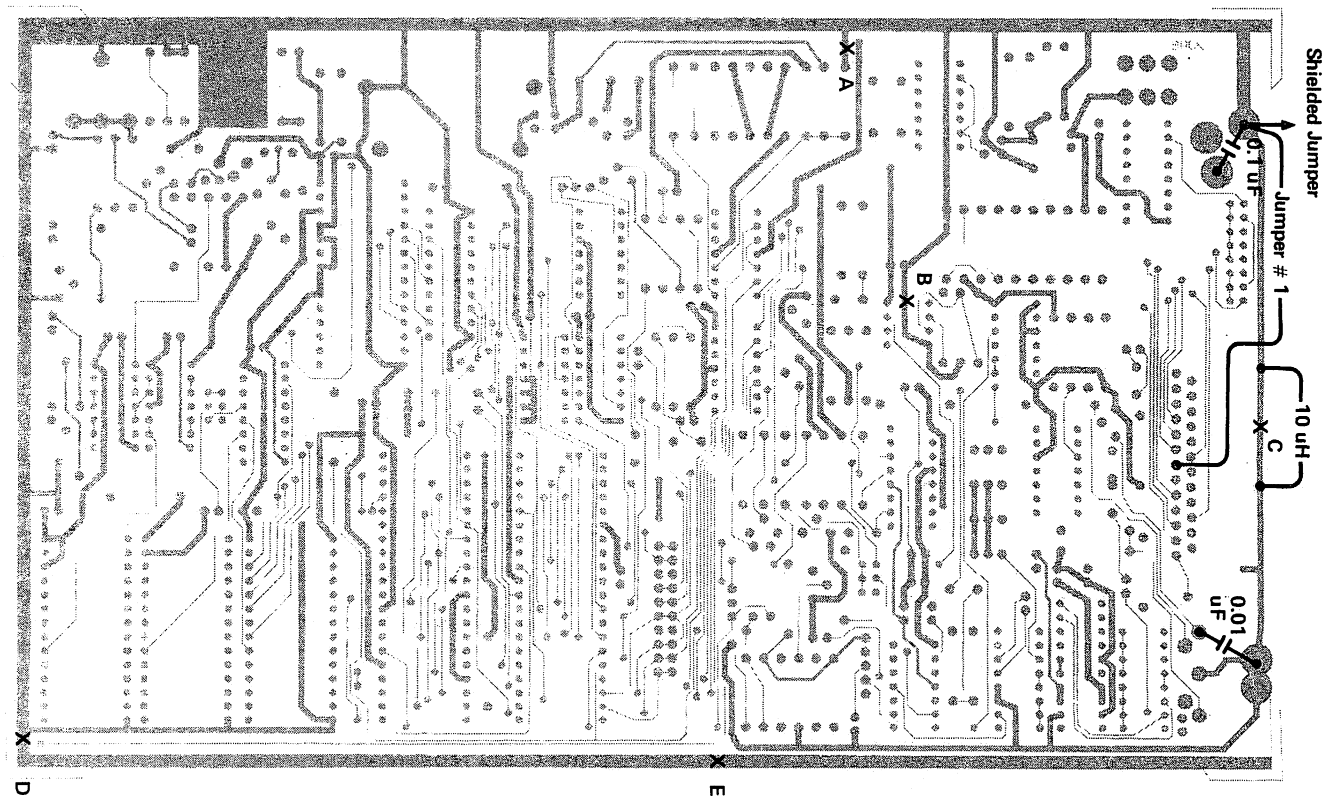


Figure 2 – TNC 2 REV 1 Solder Side

THE TAPR NETWORK NODE CONTROLLER

Lyle Johnson, WA7GXD

PART 1 - WHY?

Most of you have heard of the "7-layer" model for data communications. TNCs do levels 1 (modems) and 2 (links).

But, everyone (including myself) has been talking up a storm about levels 3 (network) and 4 (transport). Three and Four tend to go hand-in-hand and seem to be generically referred to as "networking."

The general idea is that, using your existing packet radio station, you should be able to connect to a networking node and thence to any other packet station on this planet (and maybe one or two off-planet!). This will take some time in coming -- and may never come -- but there are several intermediate steps that must be taken if we are to have any chance of reaching this ambitious goal.

Step one has been taken. With about 6,000 amateur packet stations in service today, there is a viable "user community" that can take advantage of extended servcies. And, joy of joys, pay for it! Like a local club forms to sponsor a repeater, so will local packet groups eventually start sponsoring network nodes for increased services, faster data transfer, and helping to form a reliable, high-speed packet "backbone" system for inter-city traffic.

Step two, then, is a box that multiple stations can simultaneously connect to, and through. Two key points are implied here. Firstly, multiple connections to a single station on a single frequency must be possible. Secondly, in networking you connect to the next station in a "path" rather than digipeat through the next station.

Multiple connections are already here. Both TNC 1 and TNC 2 have prototype software in testing today that supports multiple connections. Eventually, this will mean that several stations can connect to a local bulletin board station (BBS) and scan, leave messages, etc., without waiting in line for one-at-a-time service. This means, of course, that the BBS software must be able to support multiple users at once.

Again on the software front, proper level three procedures will enable you to send a packet to the next station in line to get to a distant station AND GET AN ACKNOWLEDGEMENT FROM THAT STATION. Contrast this to the digipeat strategy in use today, where you pass a packet on to the next station, but the ACK must come from the intended, distant station. As many folks in crowded areas know, the digipeaters are getting clogged. Networking promises to alleviate much of this congestion.

Of course, all of this software means increased memory requirements for stations providing these services. This is part of the reason for the latest TNC 2s having doubled ROM and RAM. And this is also part of the reason TNC 1 has a programmable memory-mapper. TNC 1 can easily hold 32k of EPROM and 32k of RAM (minus a total of 4k from these two spaces for the I/O).

But proper networking requires some "networking stations" that will need more horsepower than any TNC can give.

Enter the NNC.

PART TWO - WHAT?

The TAPR NNC design is the result of much thought and discussion by members of the US packet community over several months. The DRNET service (provided through NJIT) has allowed inputs and discussions from all over, and the design has benefitted greatly from this open debate.

The unit consists of three boards at present.

The (digital) heart of the NNC is the processor board. This 5.75" by 7.75" unit contains a microprocessor, four HDLC ports, two async ports, a parallel printer port, a battery-backed real-time clock, up to 1/2 megabyte of memory (up to 1/4 megabyte of it battery-backed RAM) and a SCSI bus. Those may have been terms unfamiliar to you, so let me elaborate.

o microprocessor

The 64180 processor is a like a Z80, only better. (Actually, there are those who will argue that ANYTHING is better than a Z-80!) In addition to a high speed 8-bit processor, this chip contains two channels of direct memory access (DMA) control, for really fast input-output (I/O) operations, a memory-management unit (MMU) to allow use of up to 1/2 megabyte (512 k bytes) of memory, an interrupt controller, a pair of serial ports (see async, below), a crystal-controllable oscillator -- and it is all CMOS for low power and long life. It also contains a pair of 16-bit programmable timers (useful for lots of functions).

Being Z80 compatible, it can make use of the TNC 2, KE3Z multi-port digipeater, KA9Q "C" and other level two code that has already been developed (and debugged?).

o four HDLC ports

In addition to being able to support multiple connections on a given rf channel, this box has four HDLC ports, so up to four channels can be in use at the same time.

Presently, the WB4APR gateway and the multiple WORLI gateway stations are the most prevalent multiple-port systems running, and they require multiple TNCs - one per port. The NNC, on the other hand, will not require the use of any TNCs to allow multiple port operation. (The KE3Z dual-port digipeater also does AX25 Level Two without external TNCs.)

Two of these ports can make use of the high-speed DMA controller on the NNC for really fast operation (say, 256 kilobits per second) when suitable modems are available. And it can go a long way towards helping in the development and debugging of suitable modems.

In addition, with a little care it should be possible to configure the NNC such that a single, full-duplex high-speed DMA port is available instead of a pair of half-duplex ones.

These ports are based on the use of a pair of SIO/2s. The SIO was chosen over the contending 8530 for a few reasons, but availability in CMOS, cost and full "mode 2" interrupt support certainly were factors.

o two async ports

The 64180 has a pair of built-in serial ports for asynchronous (start-stop) data. These ports are buffered to be RS-232-like and are available for connecting up a terminal or serial printer. Especially during code development, these ports should prove very useful.

o parallel printer port

A standard "centronics" parallel printer port is provided. In addition, a second pair of 8 bits are available for general use (flashing lights and blowing whistles, for example), although the real-time clock uses three of them.

o real-time clock

A battery-backed real-time clock is optionally configured on the board. This may prove useful for logging, statistical usage data, and the like.

o 1/2 megabyte memory

Sixteen (16) bytewide memory sockets are provided. Eight (8) of them are battery-backed and may be selected (via a single jumper set) for eight 6264L devices (8k bytes each for a total of 64k bytes of bbRAM) or eight 43256L devices (32k bytes each for a total of 256k bytes -- 1/4 megabyte -- of bbRAM).

The remaining eight sockets are individually configurable for 32k byte EPROMs or 32k byte RAMs. 8k byte RAMs may be used in some sockets as well. None of this second group of eight are battery-backed.

o SCSI bus

The SCSI bus allows data transfers exceeding 1 megabyte per second. It is a half-duplex bus, and it can allow up to eight devices (boards). This bus may be DMA-driven for high speed operation.

One advantage of the SCSI bus for the NNC is that it allows multiple NNCs to be tightly coupled for fast passing of packet information in a really crowded site.

A potentialy greater advantage, however, is that this bus will allow NNCs to become slave processors for a really powerful master processor. For example, it is quite possible that in a few years (or months?) the NNCs will be straining to keep up with the traffic load. Experience may prove that a 68000, 32000 or similar processor may be the best way to handle Level Four (Transport) protocols, make routing decisions, etc. SCSI will allow a graceful evolution in the capability of the Amateur packet network without requiring supermicros at this early stage in the network's development.

So much for the primary digital board. A network that only works on wires is pretty useless in Amateur radio. We need to interface to radios, which means we need modems. And, for the forseeable future, HF will play a great part in long-haul traffic, while many packeteers will choose to continue to operate VHF at 1200 baud.

The four-port modem board will utilize the well-proven XR2206/XR2211 design. One channel will typically be configured for 300 baud, 200 Hz shift and one channel for 1200 baud local VHF access. This leaves two channels for future expansion, or temporary use, or ???

The board will also include a tuning indicator that can be jumpered to any of the four modems. A crystal-controlled clock oscillator will also be provided, with appropriate taps for common data rates. Each modem will also have a state-machine for NRZ <--> NRZI conversion.

Finally, we have the (optional) piggy-back floppy disk controller board. This board allows software development and testing to be done right on the NNC. No support computer required!

All of the boards in the NNC are four-layer boards. This was done to reduce noise, make the boards more immune to RFI and in some cases to allow the density of the components required to meet the physical size constraints. But four-layer boards are expensive and more easily damaged by improper soldering techniques. Thus, TAPR will be investigating the practicality of having these boards wave-soldered and with all sockets, connectors, and discrete components pre-wired.

Testing commences this month. Deliveries? Maybe for the December holidays (and maybe not!). Price? Heh, heh, heh...

The Revolution Continues!

****

TNC-2 PUSH-TO-TALK INDICATOR

Tom Clark, W3IWI

One of the minor annoyances with the TNC2 is the absence of a positive transmit indicator; this note will describe a simple modification to make the Power LED serve double duty by adding a PTT function. The scheme is simple -- the LED driver is modified to provide two brightness levels: bright for normal operation and dim while transmitting.

First of all, a parts list; you will need to obtain the following:

- 1 kohm (1/4 watt, 5 or 10%)
- 1.5 kohm (ditto)
- 7 inches of #30 wire-wrap wire
- 2 each 1" pieces of insulated sleeving

(1) Remove the 470 ohm resistor R34 adjacent to the battery and replace with the 1.5 kohm resistor. Solder both ends, but leave the end nearest the battery a bit long for the moment.

(2) Cut the trace on the PCB between pins 11 and 12 of U14 (if you refer to the TNC2 schematic #3, you will find that U14 has 3 unused gates - this modification uses 2 of them).

(3) Run the wire-wrap wire from U14 pin 11 to U7 pin 9. I tacked this wire down several places along the board using dabs of cyanoacrilate "super glue" to keep it neat.

(4) Put the 1" long sleeving over each end of the 1 kohm resistor. Make a hook in one end and loop around the lead of the new 1.5 kohm R34 nearest to the battery (the end that goes to the LED). Solder the other end to U14 pin 8. That's it!

The way this circuit modification works is as follows: when you are in receive, the LED is being driven by +5V thru R34 and a high output level from the gate at U14 pin 8, resulting in normal brilliance. When you transmit, U14 pin 8 goes low, resulting in lower current thru the LED. If you wish to reverse the sense of the LED (dim on receive, bright on xmit), take the U14 end of the 1 kohm resistor to pin 9 instead of to pin 8.

SOUTHNET II PACKET CONFERENCE

HOSTED BY GEORGIA TECH AMATEUR RADIO CLUB
SPONSORED BY GEORGIA RADIO AMATEUR PACKET ENTHUSIAST SOCIETY (GRAPES)

NOVEMBER 23 & 24, 1985
ON THE CAMPUS OF GEORGIA TECH, ATLANTA, GA.

****

UNVEILING OF THE NEW TAPR NETWORK CONTROLLER
BY LYLE WA7GXD & PETE WB9FLW

****

UNVEILING OF THE NEW GLB PORTABLE TNC
BY ED JACKSON OF GLB

****

DEMONSTRATIONS OF NEW PRODUCTS BY OTHER VENDORS
DEMONSTRATIONS OF ALL CURRENT TNC HARDWARE

****

SOUTHNET COMMITTEE AND ORGANIZATIONAL MEETING

****

AWARDS FOR SOUTHNET PACKETEER OF THE YEAR
OTHER AWARDS FOR SOUTHNET PACKTEERS

TECHNICAL SESSIONS

PROGRESS OF DIGIPEATERS IN SOUTHNET REGION
9600 BAUD MODEM PROJECT UPDATE
220 MHZ LINKING PROJECT STATUS REPORT
NETWORKING PROPOSALS AND WORKSESSIONS
WORLI GATEWAY MAILBOX UPDATES
XEROX 820 COMPUTER POTPOURII

NON TECHNICAL SESSIONS

FORMATION OF A PACKET OPERATORS GUIDE
PETE'S FAMOUS "PACKET PRIMER" (OR EQUIVALENT)
DEMONSTRATIONS OF OF ALL CURRENT TNC'S
USER INFORMATION GUIDES AND PRODUCT INFO

****

GRAPES will provide airport pickup and delivery service if you make arrangements with Bill Crews, WB2CPV, at least three weeks prior to the conference. Airfares to Atlanta are very reasonable if made at least a month in advance using Supersaver rates.

A mailing will be made to the known packeteers in SOUTHNET in early November containing maps of the meeting location, a detailed agenda, other particulars of the meeting, and information on Atlanta sights. If you live out of the SOUTHNET area, write to the address below in order to get the package mailed to you.

There will be an informal get-together at an eatery near the campus Friday evening, and a banquet on Saturday evening.

A large static display area with tables and power for equipment will be provided. A wide area digipeater will be accessible through a digipeater operating on campus. There will be two large and one medium rooms for forums. These rooms are equipped with the standard audio-visual equipment. A lounge area will be available in close proximity to the meeting area.

Speakers, please let us know your intentions by sending the information below to:

BILL CREWS, WB2CPV
1421 HAMPTON RIDGE ROAD
NORCROSS, GA. 30093

1. NAME, ADDRESS, CALL, PHONE
2. AMOUNT OF SPEAKING TIME REQUIRED
3. AUDIO VISUAL AIDS REQUIRED
4. BRIEF ABSTRACT OF YOUR TOPIC

!!!!!!!!!!!!! SEE YOU THERE !!!!!!!!!!!!!!!!!!!!

BOARD OF DIRECTOR NOMINATIONS

TAPR is YOUR packet organization. It is governed by a group of 15 Directors, elected by the membership. Each Director serves a term of three years. Five directors are elected each year.

The Directors, meeting in Tucson each February, elect the officers and set the tone of the organization for the next year.

Directors are expected to attend the annual Board meeting, and must be able to cover their own expenses to the meeting, including travel and hotel bills.

The current directors, and the date of their current term's expiration are listed below.

Expiring February, 1988.

Mike Brock, WB6HHV
Andy Freeborn, N0CCZ
Skip Hansen, WB6YMH
Dan Morrison, KV7B
Bill Reed, WD0ETZ

Expiring February, 1987.

Tom Clark, W3IWI
Pete Eaton, WB9FLW
Margaret Morrison, KV7D
Harold Price, NK6K
Pat Snyder, WA0TTW

Expiring February, 1986.

Mark Baker
Marc Chamberlin, WA7PXW
Den Connors, KD2S
Chuck Green, N0ADI
Lyle Johnson, WA7GXD

To get on the list of potential candidates, simply submit your name (or have someone else do it if you can!). TAPR will contact all those nominated, give them a chance to decline, then request a short write-up on the candidate's qualifications for publication in the January PSR Quarterly. A ballot will also be in that issue.

So, get on your salesman's hat, convince your friends that you (or they) should serve on the TAPR Board and get the nominations to the TAPR office before December 1st, 1985.

AEA AND HEATH TNC OWNERS

TAPR still has a limited supply of TNC 1 manuals available. This 240 page document provides detailed information that may not be present in the documents supplied with your TNC.

Get the "original" now for only $20 postpaid while they last.

****

ANNUAL MEETING ANNOUNCEMENT

The TAPR Annual Meeting will occur in Tucson on Saturday, February 8th, 1986. Details about the location and time will appear in the January PSR Quarterly.

Mark your calandar and plan to attend! It should prove to be a very interesting time!

****

A DIGITAL TUNING INDICATOR FOR HF PACKET

John Langner, WB2OSZ

(Reprinted from the NEPRA PacketEar, August 1985)

It is quite feasible to tune in RTTY signals by randomly fiddling with the dial until it seems to work, but HF packet is MUCH more difficult. Instead of five minute monologues you must catch one second bursts on a channel often shared by several stations. Loss of even a single bit causes the entire packet to be missed - not just a garbled character.

Over the last couple of years, several tuning indicators with LED bar graph displays have been devised. All have from 20 to 40 LED segments, each activated by a narrow range of frequencies, roughly 10 or 20 Hz wide. (Figure 1.) This instantly reveals the frequency of the audio signal making accurate tuning very quick and easy. An AFSK signal appears as two spots along the display. (Figure 2.)

Most of the circuits are minor variations on the "Toni Tuna" and use analog techniques. (See the article in Radio Communication, August 1982 by A. J. Oakley, G4YHD.) The frequency of the signal is first converted to a voltage, with a frequency to voltage converter or by taking the VCO control voltage from a phase locked loop. A low pass filter removes some of the junk and a few 3914 bar graph display drivers select the appropriate LED. Very cheap and simple.

The range of frequencies may be easily adjusted by tweaking a few pots. But there are problems. To calibrate it you need a very accurate source of tones such as a signal generator and a frequency counter. Adjacent LED segments correspond to frequencies that differ by only about one percent. Would you trust a cheap analog circuit to stay well within one percent tolerance with temperature changes, voltage fluctuations, and component aging?

****

To avoid all these problems, I used a digital approach.

****

To avoid all these problems, I used a digital approach. (Figure 3.) A crystal controlled counter measures the period of each cycle of audio. The resulting count is used to activate the corresponding LED. The type of display is the same as the analog approach, but NO calibration is required. Even with the cheapest crystal, component aging, and everything else, the accuracy is still an order of magnitude better than the display resolution.

A unique feature of the circuit is the comparison of each audio cycle length with its predecessor. The display is enabled only when two adjacent measurements are the same. This makes the display much sharper and easier to use under noisy conditions.

For more information, see the March 1983 issue of 73 magazine. A limited number of PC boards with complete documentation are still available from the author for $10.00.

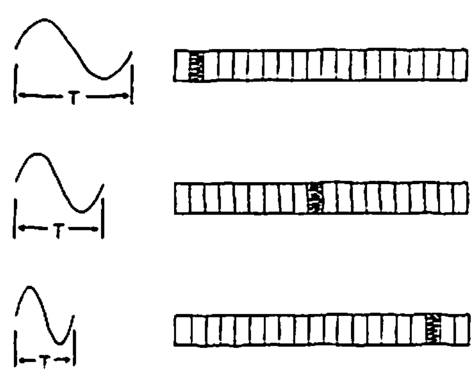


Figure 1.

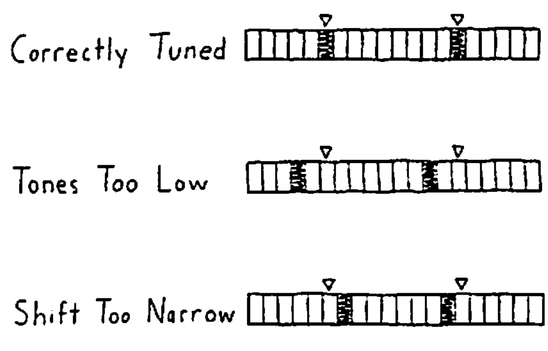


Figure 2.

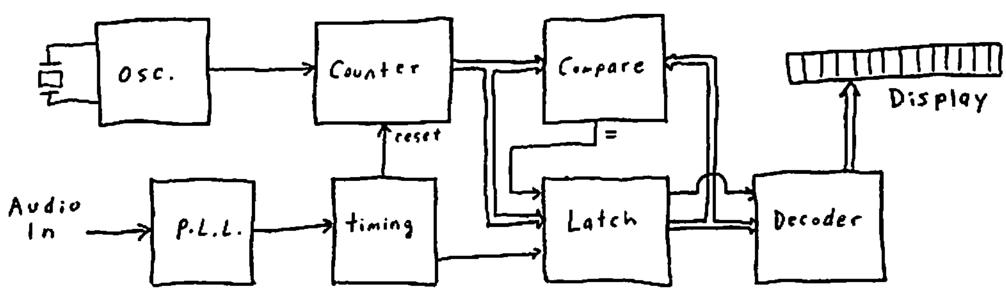


Figure 3.

Below is the text of an AEA Product Release Announcement dated October 2, 1985. It is with great satisfaction that TAPR has come to agreement with AEA to offer to the Amateur Public an assembled version of its TNC 2.

PK-80 UNIVERSAL PACKET CONTROLLER

AEA is pleased to announce the model PK-80 Terminal Node Controller which is designed for use with any dumb ASCII terminal. The PK-80 will also work with any computer having a serial RS-232 port and a terminal software program.

The AEA model PK-80 is the same design as the famous TAPR TNC 2 kit. With the PK-80, you will receive a completely wired, tested, and calibrated unit having a one year warranty.

PK-80 SOFTWARE FEATURES
----

*AX.25 VERSION 2.0 IS FULLY IMPLEMENTED
*MULTIPLE CONNECT WITH UP TO FOUR STATIONS SIMULTANEOUSLY FOR NET OPERATIONS OR ROUNDTABLE DISCUSSIONS
*SPECIAL "CONNECT CHECK" FEATURE TERMINATES PATH IF CONNECTION IS LOST (POLL FINAL BIT IS FULLY IMPLEMENTED)
*USER DEFINABLE MESSAGE FOR AUTO RESPONSE TO A CONNECT
*DATE/TIME STAMP OF INCOMMING MESSAGES OR CONNECTIONS
*MONITOR REJECT COMMAND
*82 SOFTWARE COMMANDS POSSIBLE FOR ACCOMMODATING THE MOST DEMANDING REQUIREMENTS
*ONLY THREE COMMANDS ARE NECESSARY TO MAKE STANDARD "CONTACTS"
*MHEARD COMMAND LISTS LATEST STATIONS HEARD AND TIME THEY WERE MONITORED

HARDWARE FEATURES
----

*Z-80 ONBOARD CPU
*16K PROGRAM EPROM, EXPANDDABLE TO 32K
*8K RAM
*HARDWARE HDLC FOR FULL DUPLEX (ESPECIALLY NICE FOR SATELLITE OPERATION)
*TRUE DATA CARRIER DETECT (DCD) DISTINGUISHES BETWEEN ACTUAL PACKET DATA AND INTERFERRING QRN
*WORKS WITH 300, 1200, 2400, 4800, AND 9600 BAUD TERMINALS
*BATTERY BACKED-UP RAM FOR STORAGE OF ALL SELECTABLE PARAMETERS (INCLUDING BEACON TEXT MESSAGE)
*BUILT-IN FREQUENCY COUNTER AND SOFTWARE FOR SELF-CALIBRATION
*MODEM TUNING INDICATOR PORT ALLOWS ADDITION OF EXTERNAL TUNING INDICATOR FOR HF AND SATELLITE OPERATION
*OPERATES FROM EXTERNAL 12V DC
*PCB LAID OUT WITH LATEST COMPUTER AIDED DESIGN (CAD) EQUIPMENT
*FRONT PANEL LED INDICATORS:
  CON- Indicates when you are connected to another station. A hardware connect signal also appears at terminal connector for bulletin board use
  DCD- Shows when packet data tone is received
  STAtus-Indicates when last packet has been acknowledged
  PWR- Power on/off indication

The cost of the PK-80 will be $ 219.95 Amateur Net

****

To: All

Many folks will ask "Why buy a TNC 2 from TAPR?". Good question! TAPR will continue to produce the TNC 2 kit until AEA can produce their PK-80 unit in quantity. It should be noted that all TNC 2 kits now shipped have 32K ROM and 16K RAM (double that of the PK-80). One last little surprise is that all remaining TAPR units will be sold with all CMOS parts (except for the modem chips which are only available in NMOS) at no increase in price. This makes the TNC 2 current drain below 100 ma.

This is in no way meant to "upstage" AEA PK-80. TAPR is DELIGHTED that AEA will be making this product available. TAPR still has a sizable debt to pay off, so by buying a TNC 2 you will be helping TAPR go forward to networking. On the other hand if kit building isn't your bag and you want a full featured unit, your wait is about over!

Best Wishes & 73
For TAPR: Pete WB9FLW

Subject: ALJ-1000 Product Announcement
Distribution: Open, please give widest possible coverage

During the last six months Andy Freeborn N0CCZ and John Connors WD0FHG of the Rocky Mountain Packet Radio Association (RMPRA) have designed the perfect accessory for TAPR's NEW TNC 2 KIT.

The ALJ-1000 is the result of many hours of research and development. Completely solid state, it has gone thru numerous improvements to keep power consumtion to a minimumn.

Here are some of the comments that were recived during field testing:

"I'm amazed at the simplicity yet utilitarian nature of this remarkable device" -WD0ETZ Dallas,TX-

"Never in the history of our great hobby has such an elegant design been made available to our fellow Amateurs" -AD7I Red Bank,N.J.-

"A milstone [did he mean millstone or milestone?? ed.] in digital communications development! Once again Packet Technology leads the way" -K0PFX St Louis,MO-

"I don't know how I got along without it!" -K9NG Chicago,IL-

Andy and John have informed TAPR that the ALJ-1000 will be ready for shipment with TNC 2. The Rocky Mountain Group will take on the responsibility for production and calibration of the units. But we've saved the best for last, the ALJ-1000 will be included in every TNC 2 kit at no additional charge!

TAPR wants to publicly express its deep appreciation to Andy, John and the RMPRA for their selfless devotion in order to bring this new technology to the Amateur Community.

M 11019 J. Gordon Beattie Jr. (N2DSY,2990)
KEYS:/RATS/N2DSY/SWINGING BY MY TAIL !/

Ok I will be the first, and probably the only one to plead ignorance in public:
What in the hell is an ALJ-1000 ?

NOW, FOR SOMETHING COMPLETELY DIFFERENT...
(A REVIEW OF THE WA8DED TNC FIRMWARE)

Lynn W. Taylor, WB6UUT

TAPR deserves a lot of credit for designing the original TAPR TNC -- both hardware and software -- as the number of products based on their design attests. In any such project there are tradeoffs and design choices that are made. There are other ways that those choices could have been made. Now Ronald E. Raikes, WA8DED, has produced an alternative choice for TNC firmware. How does this new firmware differ from the original, and what are the advantages offered by it?

First of all, I believe the WA8DED firmware gets the credit for being the first implementation of AX.25 Layer 2 Version 2. [Such claims need wide exposure to smoke out competing claims before being accepted as fact. ed.] For those who have not yet run the new protocol, you are in for a treat! If two minutes pass with no activity on the link, the TNC sends a poll to the other station. This station responds to the poll, and the link is verified -- no more coming home to discover that someone connected to you and didn't disconnect. Additionally, when retries occur, the sending station polls the other station asking if the last packet was received, instead of sending the whole packet -- this takes much less network time if the ack simply got lost, or if the path has faded out. Version 1 is of course supported.

The user interface also differs -- while the TAPR firmware offers three modes (command, converse and transparent), the WA8DED firmware offers only two. One mode is a man-machine interface, and the other is for machine-machine communication. It is not necessary to change modes to give commands, and the TNC never changes modes by itself. Anyone who has written software that communicates with the TNC will appreciate this, as well as those of us who keep sending "conv" over the air. Operating with this firmware is simple: in the user mode, if a line begins with an escape, it's a command, if it begins with anything else, it's data. To establish a connection, you type: <escape> C WA8DED W6AMT-3. Note that "C" is the full connect command, and typing the word "connect" is not allowed. Also, the "via" used by the TAPR TNC is missing. When the connection is established, the TNC will respond with:

```
* (1) CONNECTED to WA8DED via W6AMT-3 *.
```

When the link is established, simply typing will transmit data to the other party. When you are done, simply type: <escape> D. Dumping commands to the TNC at top speed is very reliable -- I have never had the TNC miss a command.

Of course, it is possible to get fancier: if you are already connected to a station, and want to talk to someone else, typing <escape> S2 will select virtual TNC #2, and another connection may be established. The firmware behaves much like 5 TNC's with an intelligent RS-232 switch. While you are on channel #2, all data received on channels 1, 3 and 4 are stored inside the TNC. Channel zero is the "CQ" channel, and always sends UI frames. As you may have guessed by now, the "1" in the connect message example above signifies a connect on channel 1.

Typing <escape> L gives you a status display, which looks like this:

```
* L
 (0) CQ via W6AMT-3 W6AMT-2 W6AMT-1 W6AMT
 (1) W6IXU via W6AMT-3 W6AMT-2
     receive 6   send 0   unacked 0
 (2) KA6IQA via KA6IQA-1
     receive 0   send 0   unacked 0   retries 7
 (3)
+(4) WB6UUT via KA6IQA-1
     receive 0   send 0   unacked 1   retries 0
```

This display shows connects on channels 1 and 4, a connect in progress on channel 2 and no connection on channel 3. Six lines of text have been received from W6IXU, the connect with KA6IQA has been retried 7 times, and 1 packet has been sent to WB6UUT, but the acknowlegement has not yet been received. The number of unacked frames never exceeds "MAXFRAME." With this firmware, you are always sure if the retries are mounting up.

Other items worth mentioning are a monitor mode which shows the digipeat list, including a mark showing which digipeater you are hearing, and decoding the control byte of the packet, and an "unattended" mode. In unattended mode, the TNC automatically sends a user defined message when it receives a connect.

****

Because of the differences in philosophy and purpose, it is hard to judge which is better, TAPR or WA8DED.

****

While there are advantages, this firmware does have some disadvantages. The biggest one, of course, is the lack of a transparent mode. This is not a complete oversight: host mode is transparent, and a small program can be used to send pure binary data over the air. Also, there are a number of programs out there which are designed to use the TAPR user interface. That software will not operate with the WA8DED firmware until the program authors write versions tailored for it. I hope those new versions will appear rapidly -- the advantages are significant.

Because of the differences in philosopy and purpose, it is hard to judge which is better, TAPR or WA8DED. Each has its own strengths and weaknesses. My personal preference is WA8DED; my recommendation: try it yourself and see!

This firmware (version 1.0 at this writing) is in the public domain for the non-profit use of individuals. If you are interested in getting a copy, look around: it is available on popular computer networks now (such as ARPANET and USENET) and will be on others soon. Copies have also been sent to many areas for distribution. If you need help finding a copy, contact:

Ronald E. Raikes, WA8DED
9211 Pico Vista Road
Downey, CA 90240

Include a self-addressed stamped envelope (please, don't send EPROMs).

****

AX.25 VERSION 2 MULTI-CHANNEL TNC FIRMWARE

(version 1.0)

This firmware supports the full AX.25 link-layer protocol, version 2.0 as described in the ARRL specification dated October 1984, as well as the pre-existing version 1.x. This implementation supports multiple simultaneous link connections with either version protocol. This release has been assembled for a maximum of four connections, although any reasonable number of connections is possible by changing one MAXLNK symbol in the source equate file.

COMMAND DESCRIPTION

The 'A' command is used to enable or disable the automatic insertion of LINEFEED characters after CARRIAGE RETURN characters to the terminal. This parameter is stored in NOVRAM.

The 'B' command is used to set the terminal baud rate, using one of the following parameters:

Parameter	Baud rate
1	50
2	75
3	110
4	135
5	150
6	300
7	600
8	1200
9	1800
10	2400
11	3600
12	4800
13	7200
14	9600
15	19200

After setting the baud rate with the 'B' command, the value must be PERMed, and will then take effect following a reset. Baud rates above 4800 may not be reliable with sustained input (commands or information) from a host computer due to the slow cpu clock rate and non-vectored interrupt architecture.

The 'C' command is used to initiate a link connection. Note that NO 'v' or 'via' is used between the destination call sign and the digipeater call signs. A 'C' command may be issued on a channel already in use to change the digipeater call signs, but not the destination call sign. A 'C' command issued when channel 0 is selected sets the unproto path. Attempting to connect to the same station on more than one channel is not permitted.

The 'D' command is used to initiate a link disconnection. A 'D' command issued during the establishment or disestablishment of a link will cause an immediate return to the disconnected state. A 'D' command issued on a disconnected channel will reinitialize the connection dependent parameters to the values stored in channel 0.

The 'E' command is used to enable or disable the echoing of input (commands and information) to the terminal. This parameter is stored in NOVRAM.

The 'F' command is used to set the frame acknowledgement interval. This interval is used to compute the timeout interval before a packet is retransmitted, using the formula:

time (seconds) = frame ack * (2 * number of digipeaters + 1)

A separate frame acknowlegement interval value is maintained for each connection channel. The value stored in channel 0 is used to initialize each connection channel after a reset or disconnection, and is the value that is stored in NOVRAM.

The 'G' command is used to interrogate virtual tnc channels when host mode is enabled. If no parameter is specified, the next chronological item (information or link status) will be returned, provided there is one. This command is invalid in terminal mode. A later section is devoted to host mode operation.

The 'H' command is used to set the HDLC baud rate. Non-standard values are rounded down to the next possible baud rate. In this case, use an 'H' command with no paramter to display the value actually set. This parameter is stored in NOVRAM. HDLC rates up to 9600 baud are supported if the fast clock mode is enabled.

The 'I' command is used to set the tnc source call sign. The initial value is all blanks. After the source call sign has been entered, the 'PERM' command should be used to save it for use during subsequent operation. Changing the tnc source call sign while connected is not permitted.

The 'JHOST' command is used to select between terminal and host modes. A later section is devoted to host mode operation.

The 'K' command is used to calibrate the tnc modem. The following parameters set the calibration modes listed:

Parameter	Calibration
1	FREQUENCY COUNTER
2	TONE LEVEL & NULL

The frequency counter mode will display the measured frequencies on the terminal. When each mode is selected, jumpers settings are displayed as well as the appropriate ajustment points. The values shown in parenthesis are the normal targets for 1200 baud operation.

The 'L' command is used to display the link status of one or all channels. Information displayed includes the connection path, number of receive frames not yet displayed, number of send frames not yet transmitted, number of transmitted frames not yet acknowledged, and the current retry count. A '+' character preceeding the channel number indicates the currently selected channel. Operation of this command when host mode is enabled is somewhat different, and is described in a later section.

Continued on next page.

The 'M' command is used to set the frame monitoring mode. The command parameter determines the types of frames monitored, and is a list of desired frames chosen from the letters in the following table:

LTR	FRAME
N	None
I	I frames
U	UI frames
S	Supervisory frames
C	Monitor while connected
R	Monitor received frames (addressed to)
T	Monitor transmitted frames (addressed from)
+	Call signs to be included (maximum of 8)
-	Call signs to be excluded (maximum of 8)

The '+' and '-' parameters may not be used together. If either is used, it must be the last parameter (followed by one to eight call signs, if applicable). If no list of call signs is specified to be included or excluded, all call signs will be candidates for monitoring. Entering a '+' or '-' with no call signs will empty the list. This parameter is stored in NOVRAM.

****

It is not necessary to change modes to give commands.

****

The 'N' command is used to set the maximum number of times a frame will be transmitted without receiving an appropriate acknowledgement, before a link failure is assumed. A separate maximum number of tries value is maintained for each connection channel. The value stored in channel 0 is used to initialize each connection channel after a reset or disconnection, and is the value that is stored in NOVRAM.

The 'O' command is used to set the maximum number of unacknowledged I frames that may be outstanding at any one time. A separate maximum number of unacknowledged I frames value is maintained for each connection channel. The value stored in channel 0 is used to initialize each connection channel after a reset or disconnection, and is the value that is stored in NOVRAM.

The 'PERM' command is used to change the parameter values stored in NOVRAM to those that are currently set.

The 'QRES' command is used to restart the firmware as if a hardware reset had been issued.

The 'R' command is used to enable or disable the digipeating of frames. This parameter is stored in NOVRAM.

The 'S' command is used to select the current channel number. This parameter is stored in NOVRAM.

The 'T' command is used to set the transmitter keyup delay interval. The parameter is specified in 10ms increments. This parameter is stored in NOVRAM.

The 'U' command is used to enable or disable unattended modes. If QST mode is not used, previously entered text will be retained if new text is not provided. If QST mode is selected, the interval and text must be supplied. The QST interval is specified in minutes from 1 - 65,535.

The 'V' command is used to select whether version 1 or 2 protocol will be used to initiate a link connection. A separate protocol version value is maintained for each connection channel. The value stored in channel 0 is used to initialize each connection channel after a reset or disconnection, and is the value that is stored in NOVRAM. Interrogating this parameter during a connection will reflect the protocol version currently being used on that channel. Changing the protocol version during a connection is not permitted.

The 'W' command is used to set the digipeater wait interval. The parameter is specified in 10ms increments. This parameter is stored in NOVRAM.

The 'Y' command is used to set the maximum number of connections that may established by incoming requests. This command has no effect on the operators ability to initiate outgoing connection requests. This parameter is stored in NOVRAM.

The 'Z' command is used to enable or disable flow control and xon/xoff handshaking to the terminal. If flow control is enabled, output to the terminal will be inhibited while entering commands or information. If flow control is disabled, output to the terminal will not be restricted. Flow control and xon/xoff handshaking should be disabled during periods in which the tnc is operated without a terminal, to avoid suspending output which will consume buffers. If xon/xoff handshaking is enabled, crt scrolling may be stopped and started using CONTROL-S and CONTROL- Q characters. Flow control and xon/xoff handshaking are not performed when host mode is enabled. This parameter is stored in NOVRAM.

The '@' command is a software maintenance command. A parameter of 'B' will display the number of free buffers. A parameter of 'C0' will select timing parameters for the slower cpu clock rate. A parameter of 'C1' will select timing parameters for the faster cpu clock rate. The 'C' parameter is stored in NOVRAM and must be PERMed if the change is to stay in effect following a reset. The 'P' parameter is used to set the protocol id byte for each channel and is supplied and displayed in hexadecimal. A parameter of 'S' will display the current link state. The 'T2' parameter is used to set the timer T2 interval, just as the 'T3' parameter is used to set the timer T3 interval. The timer intervals are specified in 10ms increments, and both are stored in NOVRAM. Timer T2 controls the amount of delay between the time an information frame is received and the time the resulting response frame is sent. This delay allows multiple frames to be acknowledged with a single response. Timer T3 is used maintain link integrity. If there is no activity during the T3 interval, the tnc will poll to verify the distant station is still connected.

****

THE RADIO AMATEUR TELECOMMUNICATIONS SOCIETY NETWORK INFORMATION BULLETIN

In this article we hope to impart our plans for RATSNET and the thoughts that went into the process. There has been a great discussion on how the various functions needed by packet radio operators will be implemented. These concerns, when addressed in a functional manner, were easily resolved. This paper will use a function-oriented structure to explain the various features and options.

Many RATS members are experienced packet-switching professionals who are familiar with the real issues of network software, hardware, implementation, operation, performance analysis and use. As our proposals began to take shape, other industry experts were consulted and their comments incorporated in the plan. Finally, RATS [along with AMRAD (Washington, D.C.)] are the longest active packet groups in the eastern part of the country. This tenure has provided the practical operational experience in actual use of the system as it has evolved.

We should begin by getting a handle on the function of the packet radio Terminal Node Controller (TNC) and the AX.25 LINK LEVEL protocol. The TNC using the AX.25 protocol takes up to 256 bytes of terminal or computer data, puts it in a protective envelope and then transmits it across a link to another station. The receiving station verifies the error free status of the message using envelope information and then hands off the data to the receiving terminal.

Let us remember that the TNC uses a LINK protocol which was designed to allow two stations to establish a direct, point-to- point connection while sharing a radio channel with other station pairs. There has been an addition to this protocol to allow users to link to others beyond their local area. This function has been provided by digipeaters. The basic problem with the digipeaters is that they do not provide any hop-by-hope error recovery. This means that if a digipeater "drops" a packet, the source station must use a lengthly timeout recovery procedure to resend the lost packet. This situation worsens geometrically as the number of digipeaters in a path increases. It is virtually impossible to use more than two or three digipeaters in any path in the EASTNET.

The proposed RATSNET system will be based on a series of access nodes which will support the present TNC users with an improved level and range of services. The nodes will be Z-80 family machines supporting one or more user access and trunking channels. Access channels will be on 145.01-.09 MHz. Trunking will be on other bands.

LOCATING A NETWORK SWITCHING NODE

Now there is a problem: How does a station locate a network switching node ? RATS nodes can be found by typing: "C RATS" at the "cmd:" prompt in the TNC. We can also support: "C QRZ". This latter case should cause any digipeater or switch receiving this connect request to send a disconnect. The first case will cause RATS nodes to respond with a disconnect. This simple procedure will allow users to "uncover" switching nodes and digipeaters.

NETWORK SWITCHING NODE SERVICES

The users will connect to their local switch. The switch then will provide the TNC user with a function menu (which can be turned off !). The list will include support services such as time/date, active user list, user directory assistance, and group broadcast announcements.

The menu will appear as shown below:

```
**** CONNECTED to N2DSY-2
Good Afternoon, Please note that there is a club
meeting at 8 PM on Friday evening at NJIT. Check
the WA2VKH PBBS for details. (A)ctive users (C)all
(D)irectory assistance
Time/date:::>
```

Please note that many users can simultaneously access a switching node. This is NOT a WORLI single user gateway approach to networking.

The format for each of the displays or submenus has yet to be finalized, but let's discuss them.

ACTIVE USERS

This is a simple command which shows which users are currently linked to the switch and also provides an indication of their connection status.

****

The proposed RATSNET system... will support the present TNC users with an improved level and range of services.

****

CALL

The "Call" option provides the user with a reliable circuit to the station requested. That point may be a station in the local area network. If the station requested is already connected to the switch but not to another user then the switch will effect that connection. Note that this is different than a digipeater connection in that there are two logical links each with independent error control to the switch. If the requested user is not connected to the switch, then the user supplied information will direct the switch to establish a link to the other user.

This scheme also allows a user to request a connection to a user that is served by a different switch. The network trunks are used to carry the user's connection request to the destination switch. Trunking of user data over the backbone network uses the CCITT X.25 Level Three NETWORK protocol. This protocol has been adopted by every data network arond the globe. This scheme provides a uniform mechanism for establishing a connection to a remote device and also allows different users' data to share a trunk by providing a "logical channel" on that trunk.

DIRECTORY ASSISTANCE

Now users may not want to keep track of complicated numeric sequences. They have the option of using a terminal program with a "dialing" menu personalized for the individual operator or the user may use the "Directory assistance" capability. This function allows the user to probe remote switches for the desired station. The request for information contains the callsign and the Data Country Code and the Area Code (or whatever has been decided). If the first station in the destination Area doesn't have a listing then the request will be passed to each of the other switch nodes in the area. The requestor will either be provided with a node address and other pertinent information (user's PBBS address?) or a negative response. This scheme would have prevented the routing/addressing problem experienced by users and operators of the WORLI PBBS's. Presently, all PBBS need all PBBS callsigns and routes. Formerly, this problem was extended to the user level.

Now there is another pleasant capability in this scheme: the requested user could be in another city or country. This is made possible by using an implicit addressing scheme. After observing the SOUTHNET plan to use area codes we decided that a modified version of CCITT X.121 as implemented by GTE Telenet and Uninet was what we would use. This is outlined in the "Procedings of the ARRL Fourth Networking Conference". This numbering plan allows the worldwide amateur packet network to route based national, regional and local subnetwork hierarchies. Complete national and international routing tables could be contained in less than a 1000 bytes.

LEVEL TWO TNC AND LEVEL THREE PAD USER SUPPORT

The RATSNET is set up to support level three users directly. This is easily done because AX.25 Layer Three is used between switching nodes. By examining the Protocol ID byte in the AX.25 header the support required for a particular user can be determined and automatically provided. The present AX.25 version 2 Link Layer (level 2) protocol units (TNCs) use the protocol ID of "FXH". This upper nibble indicates AX.25 Link Layer (level 2) capability. AX.25 Network Layer support will be indicated by bits 4 OR 5 (ref Low=0, High=7) being set to "1". The other bits may be set in any fashion consistent with the CCITT Recommendation X.25 (1984). The key is that these two bits will NEVER be set to "1" at the same time.

The question comes up really quickly: ""Why a level three user ? Can't we continue with the TNCs as they are ?" We can and will support the present and future populations of TNCs, but we will evolve to a point where all users will not need the menu driven approach described above to establish a connection to a remote user. The Network Layer (level 3) terminal/host interfaces are called PADs (Packet Assembler/Disassembler). These can have the same user interface as the TNCs, but they will access the network a bit differently. They will "LINK" to their local switching node using the same protocol as the TNCs use when a "Connection" is made on a TAPR- style unit. The difference is that the user will then place a "CALL" (like a telephone call) to users who are local and/or remote. This calling procedure can be used to obtain information from switching nodes, user directories, file servers or user terminals.

This optional level of protocol support will be available for users who want it. It can coexist on the same channel with the AX.25 Link Layer Protocol supported by TNCs. There should be no problem with a TNC connecting directly to a PAD and communicating using the AX.25 Link Layer Protocol. downward compatibility is to be maintained. It also should recognized that Network Layer PAD users will be using the SAME LINK PROTOCOL, but they will have enhanced capabilities indicated by PID. Further reading can be found in the proceedings of the last few ARRL Networking Conferences.

TRANSPORT PROTOCOLS IN RATSNET

The use of Transport protocols by users of the network is welcomed and expected. It is preferable that CCITT X.224 be used, but such protocols as the U.S. Defense Department's TCP or other homegrown protocols will be used. It should be understood that the architecture chosen by RATS does provide for a few enhancements which lessen the requirement for such protocols.

The first feature of the RATSNET architecture and CCITT X.25 Layer Three is that it guarantees a low level of unsignaled errors. If we drop a packet we indicate it by active intervention, not by an end-to-end timeout. This allows for rapid error recovery at the point of failure.

The second feature of RATSNET is the sequencing of data. We will not deliver packets to an network node or user out of order. This causes nodes and user terminals to consume machine resources and often results in a long end-to-end recovery cycle.

The third feature of RATSNET is the use of a fixed path with automatic re-routing in the event of failure. The Network Nodes route based on the digits supplied. This information is only required when a path is established. The overhead on data packets is reduced to a minimum because routing information is not required in subsequent packets.

Lastly we felt that the transport support used should be commensurate with the need for error control. Transport level error recovery is not something we should have for all user sessions. CCITT X.224 provides for an upwardly compatible series of error control features which can be selected when a session is started on the Network. We also felt that Network Nodes should not provide Transport Protocol support bcause they are NOT at the endpoints fo the circuit. TRANSPORT PROTOCOLS ARE END TO END, NOT ALMOST END TO ALMOST END.

RATSNET LAYOUT

There are five RATSNET switching nodes planned. Three are current sites with digipeaters. The current sites cover the entire area from the lower Hudson River valley north of New York City to the lower end of Delaware Bay south of Philadelphia. This system has links to other parts of EASTNET. Through these links, users of RATSNET can contact stations beyond the main coverage area.

The present RATSNET usees 145.09 MHz for BOTH local access and trunking. This is being changed to a system of local accees channels on 145.09 and 145.07 MHz and linking on 220 and 440. By using two local access channels we can reduce the contention experienced by users. Similarly, RATSNET will use 220 MHz to link to other groups while using 440 MHz between RATSNET switching nodes.

In our next article we will discuss the availability of hardware and software for this network. For more information contact Gordon Beattie, N2DSY (201-387-8896) or Tom Moulton, W2VY (201-596-2930) or via DRNET.

****

TNC MODEM TUNING INDICATOR #2

Dan Vester, KE7CZ
HC 61 Box 1764
Dewey, Az 86327

Upon joining the burgeoning ranks of packeteers, I was as excited as a kid in a candy store! In the area where I live (85 miles northwest of Phoenix), I can not receive any VHF packet activity (yet), and therefore, all of my packet activity has been on HF. As I soon found out, though, life as an HF packeteer without a tuning indicator is like being a kid too short to reach the candy jars at the candy store! You can see the goodies, but you can't get 'em unless someone drops one right in your hand. Thus began my quest for a suitable tuning indicator.

Since I have the Heathkit clone of the TAPR TNC-1, my search naturally started in the Heath manual, and after reading the section on the Tuning Indicator Interface, I charged forward. Through a packet contact (one dropped in my hand), I obtained the address of TAPR's office, and stopped by on my next trip to Tucson. I joined TAPR, and bought most of the back issues of PSR. In PSR # 11, I found Lyle Johnson's article on the Tuning Indicator mentioned in the Heath Manual, and immediately built it up. It was a great help, and made HF packet contacts much easier. At last, I had an arm long enough to get into the candy jar!

After using this indicator for a while, though, I came to the conclusion that there should be a simpler way to display the in-tune indication. I had difficulty visualizing which direction to move my receiver tuning knob when presented with two sets of moving dots, which moved in opposite directions no matter which way I tuned the receiver. (I know, I'm a simpleton, but so be it, I had to find a better solution!). Incidentally, these comments are in no way meant to degrade the work done by Lyle Johnson and Eric Gustafson in designing the Tuning Indicator in PSR #11. Without their work I would not have had the idea to improve on their design, and I offer my variation on their design with all due respect to them.

With the above experience and thoughts in mind, I decided that the simplest and easiest tuning display to interpret is the tuning meter found on many FM receivers, that is, the center tune meter. If I could somehow have just one moving dot instead of two, and all I had to do was center that one dot in the display to be tuned correctly, even a simpleton like me should be able to quickly tune in a packet station. That is precisely what I ended up with, as shown on the accompanying schematic, and described below.

CIRCUIT THEORY

Examination of the XR-2211 FSK Demodulator Data Sheet and Exar's Application note AN-01 reveals that during operation of the demodulator, the filtered DC voltage output of the XR-2211's phase detector present at pin 8 should be approximately equal to the the reference voltage input of the FSK comparator (pin 10) when the input signal is exactly centered around the VCO's center frequency. In fact, a crude tuning indicator can be made by monitoring the voltage at pin 8 of the XR-2211 with an FET voltmeter, and tuning the receiver until the average dc voltage at pin 8 is equal to Vref at pin 10 (about 5.3 volts). If you try this, however, you will quickly discover that due to the NRZI data format used in packet radio, some ascii characters will cause the DC voltage to deviate from Vref quite a bit, due to a predominance of binary 0's or 1's, depending on the character. This makes it difficult to accurately tune a signal with this simple tuning indicator, although it's better than no tuning indicator at all!

One solution to this variation problem is to buffer the pin 8 voltage, and heavily filter it to remove the variations. Unfortunately, this slows the response of the tuning indicator to the point of making it unusable except on very long packets.

****

If I could somehow have just one moving dot instead of two, and all I had to do was center that one dot in the display...

****

A better solution is to measure the maximum and minimum deviations of the voltage at pin 8, and mathematically average these 2 voltages to arrive at the average DC voltage of the demodulated AFSK signal. The instantaneous voltage at pin 8 corresponds to the frequency of the AFSK signal. The average of these max and min deviation voltages corresponds to the exact midpoint of the 2 AFSK frequencies being used. If we could electrically do this averaging, then by tuning the receiver until that average DC voltage was equal to Vref, we would have the received packet station tuned in exactly. This approach would eliminate the large voltage deviations we saw with our crude FET voltmeter tuning indicator, provided that we use peak detectors with time constants considerably longer than 5 bit times at 300 baud.

Follow me through a description of the schematic of the Tuning Indicator, and you should see how the circuit performs the functions of:

1) Measuring maximum and minimum voltages at pin 8 of the XR-2211.
2) Mathematically arriving at the average DC voltage of these 2 voltages.
3) Providing a visual indication of this DC voltage, which corresponds to the midpoint frequency of the received AFSK signal.

Detecting the max and min Voltages:

Op amp U1D is simply a voltage follower with a very high input impedance, which buffers the Pin 8 voltage. The output of U1D drives 2 peak detectors, one formed by D1 and C3, and the other formed by D2 and C4. As the voltage swings positive at the output of U1D, capacitor C3 is charged to the highest voltage reached by the U1D output, and the capacitor holds this peak voltage even after the U1D output begins swinging back down. Similarly, as the U1D output reaches it lowest voltage, diode D2 discharges capacitor C4 to that minimum voltage reached by U1D. We thus now have two voltages present, the one on C3 representing the highest voltage reached by the output of U1D, and the one on C4 representing the lowest voltage. (The forward voltage drops of D1 and D2 introduce an error, but fortunately, they are opposite in polarity, and cancel each other out.) The rate of decay of these two voltages is determined by R1 and R2, and the time constant for these two peak detectors was chosen to give a reasonable holding time while still allowing rather rapid response to receiver tuning changes.

Mathematically averaging the detected voltages:

Op amp U1A is configured as an analog summing amplifier, with the 2 previously detected voltages applied through resistors R3 and R4 to the summing node (pin 2 of U1A). The reference leg of the summing amplifier (U1A pin 3) is connected to Vref of the XR-2211, thus one of the summed voltages (C3 voltage) is higher than Vref, and the other summed voltage (C4 voltage) is lower than Vref when the packet signal is properly tuned in. This results in an output voltage at U1A pin 1 approximately equal to Vref (5.3 volts) when the packet signal is properly tuned in.

As the receiver is tuned off frequency, the output voltage of the summing amp (U1A pin 1) will go higher or lower, depending on which way the receiver frequency is moved. The gain of the summing amplifier is set by resistor R5, and the value shown in the schematic was chosen to provide a full scale display swing of approximately plus or minus 100 hz. The output of the summing amplifier is fed to an RC low pass filter formed by R6 and C5. This low pass filter removes noise from the signal to make the LED Bar Graph display more readable. U1B is simply a voltage follower buffer amplifier to drive the low input impedance of the LED Bar Graph display.

Displaying the Results:

Specific details of the Bar Graph display can be found in the data sheets for the National LM3914 bar graph display driver. Briefly, U2-U3-U4-U5 form a 20 element LED bar graph expanded scale voltmeter. The bar graph is operated in a moving dot mode rather than a bar graph mode to make it easier to interpret, and also to keep the current low that we are pulling from the 12 volt supply of the TNC. Normally there will be 2 adjacent LED's lighted on the display, due to noise and overlap of each LED's voltage segment.

When the two lit LED's are exactly in the center of the display, the receiver has the packet station tuned in exactly, and as the receiver is tuned off frequency, the dot will move right or left on the display, depending on which direction we are tuning the receiver. Each LED in the display represents the receiver being out of tune by 10 hz, and since this is the smallest step that most synthesized receivers can be moved, it becomes very easy to tune a packet station in to within 10 hz.

Trimpot R12 is the calibration resistor for the voltmeter, and it's function is to move the center point of the expanded scale LED voltmeter. The calibration procedure will be covered later in the article.

Transistor Q1 serves to modulate the brightness of the LED display. When the XR-2211 locks onto an AFSK signal the LED display is turned on to full brightness. Resistors R7 and R13 set this maximum brightness, and the values shown result in an LED current of about 12 ma. Resistor R8 sets the minimum brightness of the display when the XR-2211 is not locked, and the value shown results in about 0.5 ma of *LED* current. Thus the LED display shows the relative frequency of the packet station and the lock status of the XR-2211.

One note for those of you who are really looking for an inexpensive way to go is to completely eliminate the LED bar graph, and simply monitor the output voltage of U1B with a voltmeter. It doesn't even have to be an FET meter, almost any 10 to 12 volt DC voltmeter will do as U1B has a very low output impedance, and is capable of supplying up to 20 ma of current. If you choose to go this route, you will need to increase the value of R5 to get more gain out of the summing amplifier, otherwise all of the action will take place in a 250 millivolt range of your voltmeter. Note that changing the value of R5 does not affect the summing amplifier output voltage when the packet station is tuned in (about 5.3 volts), it only affects the magnitude of the voltage swing at U1A pin 1 as the receiver is tuned off frequency from the packet station.

Although this circuit was designed for the TNC-1, it is my understanding that the TNC-2 modem is identical to the TNC-1, and therefore, this circuit should work on a TNC-2. I have not personally verified this though, so you're on your own if you have a TNC-2.

CONSTRUCTION

I fabricated the circuit on a piece of fiberglass perfboard (the type with the holes on .100" centers). The board was .900" high by 6" long, and built so it mounted onto the rear surface of the front panel. The two 10 LED displays were mounted end to end on the perfboard near one end, and a rectangular hole cut into the front panel of the TNC cabinet. This hole was cut using a sheet metal nibbler, and is exactly .400" by 2.000", so that the display fits it snugly. The displays are flush with the front surface of the panel, immediately above the existing TNC LEDs, making it look like an original part of the TNC from the outside. The perf board is secured to the front panel by a couple of 4-40 threaded standoffs, which were epoxied to the rear of the front panel, this eliminating any new screw holes through the front panel.

Parts layout is not critical, except for C2, which should be on the back of the board, soldered directly across pins 4 and 11 of the LM 324. I strongly recommend using IC sockets, as trying to replace a non-socketted IC in a hand wired board like this can be a real nightmare. I used insulated wirewrap wire for all point-to-point connections, and a short length of ribbon cable with a 5 pin connector to connect to the TNC's PCB plug J7.

You may substitute other op amps if you have them in your junk box, as just about any op amp will be suitable for this low frequency audio application. Q1 is not critical, and almost any NPN transistor will work. All resistors are 1/4 watt. You should use 5% or better tolerance resistors for R3,R4,R7,R9,R10, and R13. All others may be 10% if you like. R12, the 1K pot, should definitely be a 10 turn trimpot, as it's adjustment is rather touchy. R12 should be mounted so you can easily adjust it when the board is mounted in the TNC cabinet.

Be sure to use LM3914 bar graph display drivers, as they are linear in response. Although the LM3915 and LM3916 appear to be identical to the LM3914, they are logarithmic in their response, and the display will not function properly with them.

CALIBRATION

After assembling the indicator, mount it as described, and connect it to the TNC. Set the TNC in the CALibrate mode, and verify that your calibration is correct for either 300 or 1200 baud, depending on whether you're set up for HF or OSCAR use. Once you have verified your calibration, exit the CAL mode, and disconnect the TNC radio port (J3) from your receiver. Connect a clip lead (or make up a test plug) from J3 pin 3 to J3 pin 5. This connects the MIC output to the RCVR input of the TNC, and allows it to talk to itself.

Now, from the cmd: prompt, issue a connect request to your self using yourself as a digipeater several times (make sure you are enabled as a digipeater). For example, in my case:

```
     cmd: DIGI ON
     cmd: C KE7CZ V KE7CZ,KE7CZ,KE7CZ,KE7CZ
```

You would use your own call letters, of course. In a moment you should get the familiar message:

```
     *** CONNECTED TO KE7CZ
```

Now send yourself several fairly long packets. I have a repeating keyboard, and I do this by holding one of the keys down until I have several lines displayed on the screen. While all of these packets are being sent back and forth through all of the digipeaters (yourself), adjust R12 on the Tuning Indicator until the two LEDs in the center of the 20 LED display are lit up. You will notice that occasionally one LED 3 or 4 positions off center will light up, but that the majority of the time, the 2 LEDs in the center will be the ones lit. After all of your packets have completed their journey and acknowledgments have been completed, you should see the display go very dim, and the moving dot bounce around dimly due to noise. Try sending yourself several more packets, and get used to how the display looks during normal operation. It should be bright and centered during packet transmission, and dim and most likely off center between transmissions. When you're done getting familiar with the display, issue a disconnect request or turn off the TNC.

****

You will find after a short period of use, you can not only quickly center a station in one or two transmissions, you can also tell how far off frequency another station is.

****

OPERATION

After completing the calibration, remove the clip lead or test plug from J3, and connect the TNC back up to your receiver. Find some packet stations, or attempt a connection, and practice tuning in stations while observing the display. I think you will quickly see how easy it is to tune a packet station to within 10 hz. If you switch from LSB to USB, you will notice that the action of the tuning indicator reverses, that is, you will have to turn your receiver tuning knob the opposite direction on USB as you do on LSB to center the moving dots. Since with the NRZI format, it doesn't matter which sideband you use, pick the sideband that gives you the most natural feel for using the Tuning Indicator, and always use that sideband.

If you switch your TNC from 300 to 1200 baud, as when going from HF to OSCAR use, you should find that the Tuning Indicator does not need to be re-calibrated. The scale will be different, i.e. 400 hz full scale instead of 100 hz, but the center point should stay the same. I haven't verified that, but in theory, that's the way it should work. I'm sure if it doesn't work that way, somebody will let me know!

You will find after a short period of use, you can not only quickly center a station in one or two transmissions, you can also tell how far off frequency another station is. For instance, if the moving dot is off center by 6 dots on the first transmission you hear, you know that the other station is off frequency 60 hz, since each dot represents 10 hz. Immediately move your receiver dial 60 hz in the appropriate direction, and on the next transmission, you should be exactly tuned in. The sideband you use will determine which direction is the appropriate direction to turn your receiver dial. I prefer to use USB, which ends up meaning that when I see a station that is 6 dots left of center, I turn my receiver dial to the left (CCW) 60 hz to get on frequency. If the station is 6 dots right of center, I turn my receiver dial right (CW) 60 hz.

Good luck, and happy packeting. With a little practice, you'll be able to pull in those elusive weak packet stations you've been chasing, and you, like I, will at last have both hands in that delicious candy jar of DX packeting!

****

FROM: paul newland, ad7i
TO: tnc-2 users
SUBJ: operation with IC2AT
85.05.19

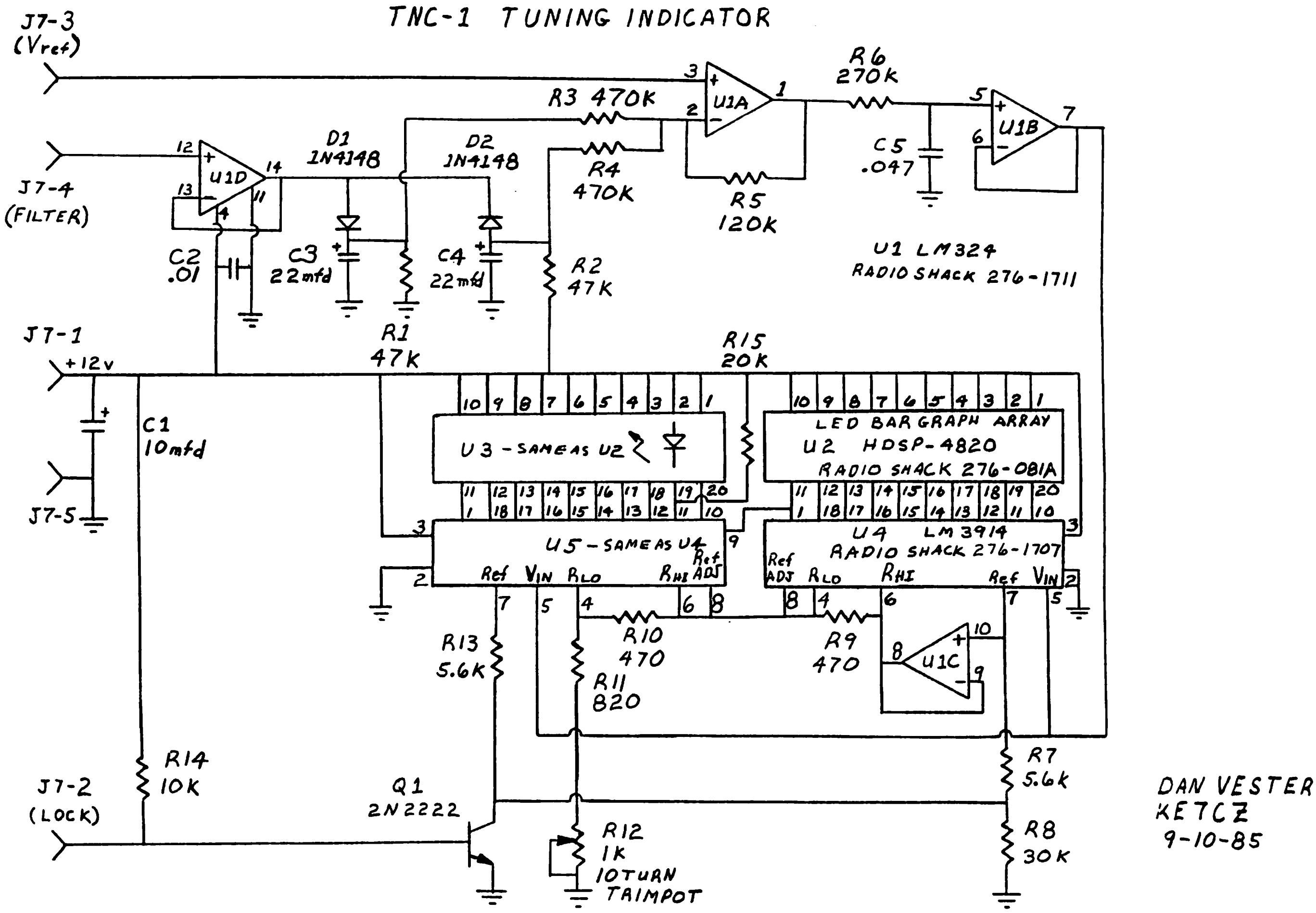
I recently hooked up TNC-2 to an IC2AT and would like to share with you the results. First, the 2206 chip on TNC-2 is sensitive to RF from the HT. So, when you make up your cables, be sure they are a suitable length to get the HT away from the TNC (i used about 6 feet of cable). I made up the cable as follows. Both discrete components fit inside the shell of the DIN connector.

```
    IC2AT                          TNC-2
------------------           ----------------------

 SPK-GND --------------------------*- p2 (GROUND)
 MIC-GND ---------------------------|
 SPK-AUD ---------------------------- p4 (RX-AUDIO)
 MIC-AUD ----------------*---|(------ p1 (TX-AUDIO)
                         |  0.1uF
                         Z  1K ohm
                         |----------- p3 (PTT)
```

This seemed to work pretty well. However, be sure to be on the lookout for RF getting into the TNC and modulating the tones generated by the 2206. The easiest way to check this is listen to the signal with another radio while useing the calibrate function to send steady mark and space tones.

****



9600 BPS MODEM KITS

The K9NG 9600 bps modem semi-kit is now available. The kit, consisting of a PC board, several pages of documentation, a pre-programmed State Machine EPROM and the temperature-stable capacitors needed for the various filters, costs $25 postpaid in the US.

THIS IS NOT A COMPLETE KIT! It is intended for experimenters with the expertise to properly interface the device to a radio. The hope is that, after several radios are modified and working, the interface information may be compiled and a "real" kit made available for general use.

Note that, if the unit is scaled to 4800 bps operation, it should be possible to use it on 2 meters, increasing data throughput on existing channels with (hopefully) minimal modifications to the radio.

At this writing, the initial run of 100 boards is nearly depleted. Contact the TAPR office for updates on availability.

****

TNC-2 RADIO HOOKUP TIP

Earlier this week Tom (W2VY) brought his TNC-2 over to my apartment for a test run using my XEROX-820 system and my Kenwood TH-21 AT handitalkie. With a little work we were able to get the system working and I was on packet. The connections for the Kenwood are as follows:

The outer part of the sub-mini plug (earphone) is the common ground. The tip of this plug is audio out.

The microphone plug is a stereo mini plug. The inner tip is unused for this connection. The middle connector of the plug is the microphone connection. It should be connected to the TNC through a 0.2 uf cap to provide DC isolation. The outer part of the plug is the PTT. It is shorted to ground by the TNC to key the transmitter.

We found that the output of the TNC had to be quite high to give an acceptable transmitted signal.

John Howell N2FVN

****

HAMTRONICS FM-5 SHIELDING

Jeff Ward, K8KA

This note describes WB1DNL's modification to the Hamtronics FM-5. Two FM-5 boards built in the ARRL lab were found to have instability in the transmitter because of feedback from the high-power output stage to the oscillator and multiplier stages. To correct this, sheilds made from copper clad circuit board material were installed on the FM-5.

The accompanying drawing shows where the shields were added. Three pieces of board were used. The boards extend above the FM-5 board to the height of the final-amplifier heat sink (2 1/2 inches). The boards are notched slightly to clear Z11/Z12, L9, Z19, R27 and C33. The boards were soldered together at the two points where a right angle is formed by the junction of the circuit boards. Holes were drilled at the approximate locations shown, and wires were soldered to the shield boards, pushed through the new holes in the FM-5 board and soldered to the FM-5 ground plane.

This addition made it possible to tune both of the FM-5s for clean output with the aid of a spectrum analyzer. Adjustment of L8, L9 and L10 (by spreading the turns) was performed as well.

****

FLOWERS

M 10228 Howard Goldstein (N2WX,2987) 8/ 3/85
KEYS:/JULY 85 PSR/

Just got my PSR..great job Gwyn!!!

M 10348 Tom Clark (W3IWI,2976) 8/ 3/85
KEYS:/PSR/KUDOS/TNX GWYN/

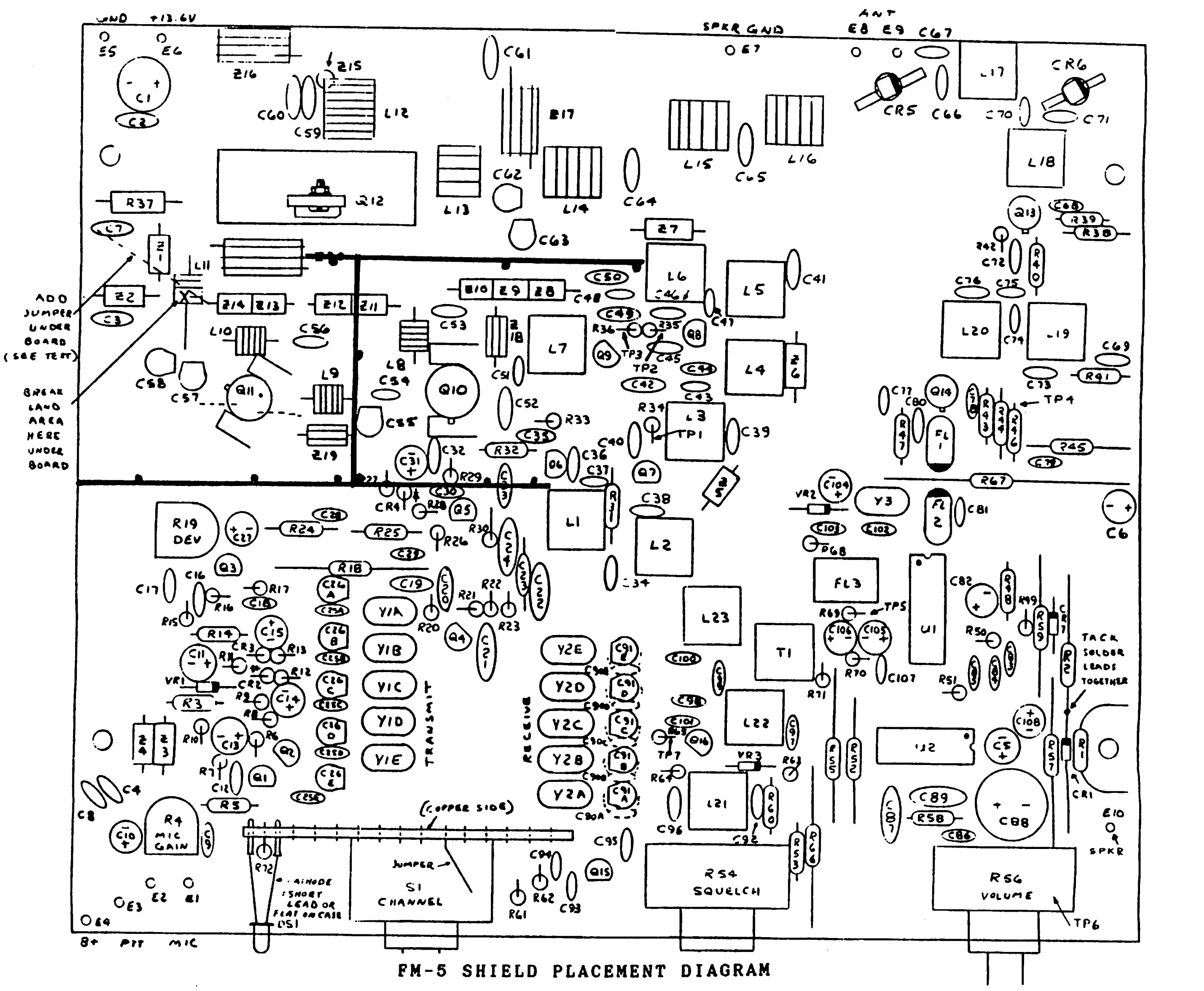
Gwyn, just got my PSR and wanted to offer my complements. I appreciate the mixture of technical/administrative/philosophy/operating that you chose.

M 11738 Mike Brock (WB6HHV,2985) 8/ 8/85
KEYS:/PSR/CONGRATS/
TO: W1BEL, WA7GXD, WB9FLW, WB6HHV

Gwyn, The guys here in San Diego were favorably impressed with the latest issue of the PSR. The compliments were on the order of " this was the best PSR I've seen". I didn't ask for comments on the voice net, the guys stepped forward on their own! Congrats on a job well done.

M 11989 ANDY FREEBORN (N0CCZ,2983) 8/ 8/85
KEYS:/THANKS FOR A GREAT PSR!!!/

Gwyn, I have been deicidedly remiss in not getting on here and thanking you for the FANTASTIC change in PSR. It was really terrific.



FM-5 SHIELD PLACEMENT DIAGRAM

SWITCH SELECTABLE FIRMWARE ON THE TAPR TNC-1

Lynn W. Taylor, WB6UUT

Recently, I was faced with a dilemma. New TNC firmware written by WA8DED here in California offered some nice features not available with the standard TAPR firmware, while new software products for the Mac, and an ongoing earlier project required the standard fare. Switching EPROMs (even with ZIF sockets) still required removing the screws in the case and reinitializing.

Studying the TNC design itself provided the answer: The TNC presently "bank selects" two sections of NOVRAM by switching the high-order address bit. If the existing 2764s in the TNC are replaced with 27128s, the ROM capacity of the TNC would be doubled. Simply connecting the high-order address bit to the NOVRAM bank select would then allow two versions of TNC firmware to be resident simultaneously, each with its own bank of NOVRAM for operational parameters.

The modification is performed as follows:
1) Remove U5, U9, U10, U11 and U12.
2) On the component side of the board, follow the trace from U5 pin 20 to the via near the zero in U10 on the silkscreen. (note: a "via" is a small pad used to pass signals from one side of a board to another). Verify this by measuring continuity from U10 pin 26 to the via, and from U5 pin 20 to the same via.
3) Cut the trace entering the via on the component side. I also recommend cutting the same trace where it connects to JP-8 to eliminate the possibility of noise problems.
4) Add a wire from the via to pin 17 of U27 -- the NOVRAM "bank select" pin.
5) If you intend to bank select all 4 EPROMs (not necessary in my case), add a wire from U9 pin 26 to U10 pin 26.

The hardware modification is now complete. It is now necessary to prepare the EPROMs. Comparing the pin-out of the 2764 to that of the 27128 reveals only one difference: pin 26 is not connected on the 2764, and is the high-order address line (A13) on the 27128. If any of your EPROMs are the same for both versions of the firmware, or are unused (the firmware I am using resides in only two EPROMs), they may be used without change. For each EPROM which must be bank selected follow these steps:
1) Locate the two 2764's which share one chip location (for example, U9 or $8000.
2) Copy firmware version "A" into a 27128 starting at location $0000.
3) Copy firmware version "B" into the same 27128 at location $2000.
4) Repeat the above steps for U10 ($A000), U11 ($C000) and U12 ($E000).
Be careful not to mix addresses in the chip -- in other words, if you load version "A" at $0000 in one EPROM, make sure that all of version "A" is burned into the low half of the EPROM.

To complete the task, with NOVRAM bank 0 selected, initialize the TNC from EPROM. Set all parameters as desired and PERM them. Repeat this process with NOVRAM bank 1 selected, set parameters, and PERM again. Now you may select between firmware revisions by simply setting the NOVRAM bank select switch and hitting reset.

Continued >>>

Acknowlegements: I would like to extend my thanks to the TAPR hardware team (notably Lyle Johnson) for providing the answer already on the board, and to the TAPR software team (Margaret, Harold and Dave) for helping bring packet radio to the masses. I would also like to thank Ron Raikes, WA8DED, for writing an independent version of the firmware, which supports multiple connects, and has a radically different user interface, and provided the firmware which now resides in my EPROM bank 1.

AN INTRODUCTION TO NETWORKS

T. C. McDermott, N5EG
Networks SIG, Texas Packet Radio Society
(Continued from the July PSR)

This article describes some requirements for network node hardware. One of the key concepts is the idea of modular implementation - to allow for changes in the way a network is designed.

The network that has been evolving from the description in the previous article can be implemented in a backbone type of network. In this network there are two channels that are accesible at any node, the high-speed inter-node communication channel, and the 2-meter AX.25 channel. Thus the description of the hardware assumes that there are two synchronous channels per node.

Each node has the capability to move traffic along between nodes (all on the high-speed channel) and also to drop and add traffic to the high-speed channel from the low-speed channel. One of the first assumptions is that the high-speed channel will operate at 9600 bits-per-sec (b/s). For a number of reasons (the formost of which is availability) the K9NG type of FSK modem on the 220 MHz band will be utilized. There are some performance advantages to be obtained with PSK, but the slow carrier-recovery loops that are normally used are not always compatible with the fast T/R-switching times needed in packet service. The low-speed channel will compatible with AX.25 TNC's, and thus is a 1200 b/s channel on the two meter band.

We have thus partitioned the node into three major elements:

1. High-speed channel hardware.
   This includes 220 MHz radio, antennas, power splitter, 9600 b/s FSK modem (K9NG).
2. Low-speed channel hardware.
   This includes 2-M radio, antenna, and 1200 b/s AFSK modem.
3. Node-control computer.
   This includes 2 synchronous interfaces, T/R control circuits, RAM, ROM, and fail-safe sequence decoder.

A simplification of the high-speed radio circuitry is to have only one 220 MHz transmitter and one 220 MHz receiver per node. Two high-gain directional antennas are used, with a 3-dB power splitter near the antennas. Thus communications with the northerly and southerly nodes is possible with one radio. Extension of this concept to three or four nodes is possible but the RF losses start to get high. The design of the high-speed portion (the backbone) allows access to the node only by other nodes. This is done to eliminate direct channel contention between users and the inter-node communication. The users of the network do not, and indeed CANNOT communicate with it on 220 Mhz.

Continued on next page.

The protocol on 220 MHz (in this implementation) is TEXNET-IP, which IS NOT compatible with AX.25 (and indeed, for the reasons expressed in part 1, should not be compatible with AX.25).

The 2-Meter section can use a commercially available FM radio, and AFSK modem design.

Each of the radio sections contains logic-level interfaces to the node control unit. This is done to facilitate the changeout of the node control processor should a new design or network protocol standard become available. It is anticipated that resolution of the various trade-offs involved in the implementation of a network will take several years to occur. In order to solve a pressing need within TPRS, the need for long-haul communication, we will go ahead and implement TEXNET with an eye towards changes and evolving standards.

The node control computer consists of a Z80-SIO chip (which has two synchronous HDLC-type serial channels), a Z80 (4 Mhz.) microprocessor, 16K of ROM, 32K or RAM, some timer circuitry to develop the 1200-hz, 9600-hz, and 1200 x 32 = 38400 hz. clocks. The node also has two time-out timers to prevent transmitter lock-up on the 145 and 220 MHz units, contains NRZ/NRZI coder, decoder, and clock-recovery circuits for the 1200 b/s channel. It also contains a special state machine that listens to the 220 MHz channel and clock. This circuit recognizes a special sequence (that obeys the HDLC coding rules) and interprets the reception of this sequence as a overriding command that uses hardware to reboot the node processor. Each node contains a unique code in its state machine. The code is chosen to be sufficiently long that the mean time to false is 6*10^7 years (assuming random data).

A custom circuit board will be constructed to contain this controller. It may have been possible to modify one of the Xerox 820 boards, but it was felt that the changes required would reduce the reliability of the resultant assembly too much. The parts cost of byte-wide RAMs and ROMs has dropped recently, and these devices will should allow construction of the entire controller for slightly less than the price of just the 820 board when purchased surplus.

****

One of the objectives of this network design is to keep the cost of any node low.

****

The controller will be constructed mostly of CMOS circuitry, and will be powered at +5 V through a series regulator powered from +12 VDC. This will allow a single +12 V supply. The node will contain a gel-cel battery and a charger circuit. Thus the entire node will have something approaching uninterruptable power, while still having an acceptable power supply cost.

The node controller card will be connecterized at the logic-level interfaces to the radio circuits. In the event a new controller design emerges, then upgrading of the node can be as simple as replacing the card.

One of the objectives of this network design is to keep the cost of any node low. Our goal was $500.00. We anticipate that those groups who wish to joint TEXNET will assemble, place, and maintain their node, with the assitance of TPRS. We thus would release the design of the node to those groups, and perhaps sell or supply the circuit boards needed, as well as the software for the controller. In our design, each node will have the same software, except for routing tables. A first crack at the routing problem can be attempted with static routing tables, which will be in ROM, and different at every site.

The subjects of routing, and other network topics will be discussed in part 3 of this series. [McDermott reports he is now too busy building to write. ed.]

USING THE MACINTOSH WITH THE TNC-2

Jack Brindle, WA4FIB.

The TNC2 manual shows a diagram for connecting the modem to the Apple Macintosh. This diagram shows the TNC's Carrier Detect line connected to the Macintosh's handshake input. Few Macintosh terminal programs make use of the handshake input for carrier detect purposes. In fact, the Macintosh internal ROM serial drivers use this input for flow control. This is a more appropriate choice since the Macintosh is capable of driving the serial port at high data rates for long periods of time, causing the TNC to overflow its buffers. This occurs even though the TNC uses Xon/Xoff flow control, which responds too slowly to properly halt the data from the Mac. Testing of the TNC1, TNC2 and Kantronics TNCs have shown that they can control the CTS output line very quickly, stopping the Mac in time to hold off an overflow.

For these reasons, MacPacket users have been advised to construct an interconnecting cable that makes use of the CTS hardware handshake signal. The pinouts for this cable are shown in Figure 1.

Signal	MACINTOSH : DB-9	TNC: DB-25
Ground	1	-
+5V	2	-
Ground	3	7
TxD+	4	-
TxD-	5	2
+12V	6	20
Handshake	7	5
RxD+	8	-
RxD-	9	3

Fig 1. Macintosh-TNC Interface Cable connections.

Not all pins are connected on either connector. The connections on the Macintosh serial port DB-9 connector are provided for completeness. Remember, the Macintosh provides RS-422 output. This is a balanced transmission specification requiring two outputs from the drivers and into the receivers. Its strong point is the ability to communicate over long distances at fast data rates, surpassing the RS-232 specification while requiring additional wiring. The Macintosh can configure its drivers for either method. Simply use the (-) connections for RS-232! Some TNCs have also required that pins 4 and 8 of the DB-25 be connected to pin 6 of the DB-9. This is caused by a slight deficiency in the design of the TNC1 input drivers, and is indicated by the inability to transfer any data into or out of the TNC.

****

The Tucson Amateur Packet Radio Corporation is a nonprofit scientific research and development corporation. The Corporation is licensed in the State of Arizona for the purpose of designing and developing new systems for packet radio communication in the Amateur Radio Service, and for freely disseminating information acquired during and obtained from such research.

The officers of the Tucson Amateur Packet Radio Corporation are:

Lyle Johnson ..... WA7GXD ... President
Pete Eaton .... WB9FLW ... Executive VPM
Pat Snyder .... WA0TTW ... Secretary
Dan Morrison ..... KV7B ..... Treasurer

The Packet Status Register is the official publication of the Tucson Amateur Packet Radio Corporation. Explicit permission is granted to reproduce any material appearing herein, providing credit is geven to the author and TAPR.

TAPR membership and PSR subscription mailing address:

Tucson Amateur Packet Radio Corp.
P.O. Box 22888
Tucson, AZ 85734
(602) 746-1166

PSR editorial submission address:

PSR Editor
812 Childers Loop
Brandon, FL 33511
(813) 689-3355

MEMBERSHIP APPLICATION

Tucson Amateur Packet Radio Corporation
P. O. Box 22888, Tucson, AZ 85734

Name:____

Call Sign:___________________________ License Class:__________

Address:____

City & State:___________________________ Zip Code:__________

Home Phone:_________________ Work Phone:_________________

If you wish not to have any of the above information published in a membership list, indicate the items you wish supressed here:

____

I hereby apply for membership in TAPR. I enclose $12.00 dues for one year.

Signature:_______________________ Date:__________

PACKET STATUS REGISTER QUARTERLY

TUCSON AMATEUR PACKET RADIO CORPORATION
P. O. BOX 22888
TUCSON, AZ 85734

Check your address label for membership expiration date.