Tucson Amateur Packet Radio Corporation

The TNC Cabinet kits are in "beta test." This means that a few have been shipped to selected sites for construction and evaluation of the assembly instructions. The next 100 or so will follow this testing -- so hold on! Your cabinet may be arriving soon!

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Steve Mendelson, WA2DHF, filed this report with Westlink, an national audio newsletter:

Steve: "Winner of the first Technical Achievement given by the Hamvention was Lyle Johnson, WA7GXD, for his work on the packet radio terminal node controller. How did Lyle feel?"

Lyle: "I am incredibly honored and certainly very moved to be able to receive the award on behalf of the efforts that were done by so many people."

"I was out of the country an awful lot earlier this year, and I came home, got a phone call late one Sunday night, and a fellow told me that I had won the award, and I was just completely taken by surprise and shocked."

(Editor's note: having observed the above interview from just out of earshot, I know Lyle said considerably more. However, this transcript, is all that was broadcast following the weekend at Dayton)

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TAPR would like to express its appreciation to ICOM America and Larsen Electronics for the loan of 1.2 GHz equipment at the Dayton Hamvention.

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The British publication Radio and Electronics World, in the March 1984 issue, contains two OSCAR related articles. The first describes the scientific payload on OSCAR-11, the other is a description of Keplerian elements and how they relate to OSCAR-10 elliptical orbits. An SASE to PO Box 575, Wharton, NJ 07885 will bring a copy.

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From Byte Magazine: "Rose Bowl Scoreboard Snafu done with Portable Computer"... During January's Rose Bowl, a scoreboard prank by two CalTech students was made possible by two computers and radio modems. The students, who are now being prosecuted for trespassing, used an Epson HX-20 notebook-size portable computer with an RF modem to tap into an IBM breadboard they'd attached between the scoreboard and its operators. The students put several messages on the scoreboard's scratch-pad area and finally changed the names of the teams to show CalTech trouncing rival MIT, instead of UCLA beating Illinois. The students later held a seminar called "Packet RF Control of Remote Digital Displays."
President’s Corner

by Lyle Johnson, WA7GXD

Dayton

Spring launches the Hamfest season, and Dayton is the premier event. Dayton, 1984, was no exception -- yet this Hamvention was exceptional.

The weather was fine. 14 acres of flea-markets were scrutinized by a jostling throng. Innumerable HTs were blaring. And packets were flying on 1.2 GHz...

However, this year Dayton was different than any other Hamvention. This year, Dayton recognized packet radio. We were placed on the map.

Every year since 1955, Dayton has selected an outstanding Amateur to be honored as the "Amateur of the Year." This year's selection was Dave Pollie K6AQ. The committee has made so many excellent films introducing Amateur Radio to the general public.

Since the mid '70s, a "Special Achievement Award" has been presented to an outstanding Amateur deserving recognition different in nature from the Amateur of the Year award. This year, ETHEL Smith, K4IMB, founder of the YLRL, was honored.

In 1984, a third award was added. The "Technical Excellence Award" was created to recognize an individual or small group for outstanding accomplishment in a technical area of Amateur radio.

And this year, that award went to Packet Radio. To TAPR. For our TNC.

Because the award must be made to a named individual, I was honored to receive the first ever Technical Excellence award on your behalf...

A small group of people poured man-years of effort into the TNC design. A larger group of people expressed confidence in the project and undertook the Beta test: an unprecedented experiment in the annals of Amateur radio history. And an even larger group of people have taken the next step, developing applications for the new mode.

An informal survey taken at Trenton and again at Dayton indicates that there are about 1200 Amateur packet stations, worldwide, that have been active at least once. The TAPR TNC is standard equipment in about 900 of these stations.

To say that these results are gratifying is an understatement.

However, with our increasing "legitimacy" comes increased responsibility. It is no longer enough to show the apparent advantages of packet (error-free, multiple concurrent QSOs, etc.). We must now attack the question of networking with the same energy and dedication that produced the TNC.

What we now have is a so-called level-two interface. This simply means that we can "packetize" information into small chunks and send that information to another station that we specify that is within radio range. Now, this is quite an accomplishment in itself.

But it is not enough. We need a system that will allow us to send information to stations beyond our "local" area. Ultimately, the system must be able to determine how to get a packet from location A to location B without the station operator at either end knowing how to route the packet.

What we have been calling "level three" in our loosely applied Amateur parlance, or simply "linking," is in fact much more. We need to design and build linking hardware -- devices with multiple channels at various rates and perhaps even various protocols -- and provide enough memory for the software folks to come up with workable routing schemes. The effort involved will make the TNC development seem like child's play.

The system that many of us have been kicking around would consist of up to four two-port controllers. Each port would be capable of supporting a "link" -- perhaps 1200 baud AX.25 level 2, like a TNC, or maybe 56 kilobaud AX.25 level 3, or AMTOR, or... A motherboard would support these controllers and have the routing information needed to switch the various packets between the proper ports to allow multiple-hop connections between locations that are not in the local radio domain.

The initial (prototype) hardware will most likely consist of 2-80 microprocessors and support chips. The interface to the motherboard will be either Direct Memory Access (DMA) control or multi-port RAM.

The designs are being worked out now for the initial configuration. If you have some inputs to this design, please write to the TAPR PO Box and mark the envelope "LINKING". Expertise in hardware and especially software will be needed for development and testing.

1984 -- the year of Linking -- the year of Packet.

New Packet Radio DX Record: On May 6 at about 16:00 UTC a new Packet Radio DX record of 15,700 km was established between Paul, VK2AQQ (near Sydney) and W3JWI (near Washington). This QSO took place using the AMSAT-OSCAR-10 satellite near its apogee, with elevation angles of 12 degrees in Australia and 11 degrees in Maryland. VK2AQQ was running about 180 watts output and used a VADG TNC, while W3JWI had to run about 200 watts and used a TAPR TNC. Both TNC's ran the AX.25 protocol. VE2AQG had previously QSO'd VE1PAC (a.k.a VE1SAT/V6G) and KL7GNG in North America, but this was the first QSO from VK to mainland U.S. Eavesdroppers on channel listening to the QSO included VE1SAT/VE1PAC, KL7GNG and N6AN. To our knowledge, the previous DX records were held by ZL1AOX who QSO'd WA2LQO on 10 meters (14,380 km) and W3JWI on both 40-10 and 10 meters (13,580 km).

****************************************************************

From the mailbox: "WHAT HATH TAPR WROUGHT?" was one of the first packets transmitted in Vermont. KIAUE and WIGHT, both in the Burlington area, initially established two-way packet radio communications on May 10, 1984.

Walt Grant, W1CET, who has an appliance operator's approach to amateur radio and a super­ official acquaintance with digital communications, found the TNC kit a pleasure to build and inter­ face with his terminal and radio. KIAUE, a systems engineer who has a shack full of home­ built computers and radios, was impressed with TAPR's engineering and quality control.

Both operators report a keen interest in packet radio among other amateurs in the area now that 1200-baud signals are actually on the air.
UOSAT-2 Status

by Martin Sweeting, UoSAT Programme Manager

The UOSAT Team at the University of Surrey successfully re-established command over the UOSAT-2 (Editor's note: This spacecraft is also known as UOSAT-B and AMSAT OSCAR-11) spacecraft at 2132 BST 6th June on orbit 1418 using the hitherto inoperative VHF command uplink.

Following a successful launch by NASA on 1st March, UOSAT was placed in geostationary orbit and switched off the 145 MHz downlink under computer control as instructed and then refused to respond to ground commands. A lengthy series of tests to attempt to home in on the nature of the spacecraft's problem were undertaken over a period of 10 weeks - culminating in the successful reception and tracking of the known very low level microwatt signal which is continuously radiated from the microwave receivers on the spacecraft.

This breakthrough, by an outstation of SRI International in Greenland, confirmed, for the first time after UOSAT-2 fell silent, that the spacecraft primary power systems were functioning and that the Surrey groundstation was indeed tracking the spacecraft accurately.

The next day - March 14th on orbit 1876 - the Surrey command station suffered difficulties in switching the 145 MHz transmitter back on using the UHF command uplink. The data subsequently transmitted from the spacecraft allowed the command team to proceed with cautious diagnostic routines to attempt to pinpoint the cause of the problem. After four weeks of exhaustive and painstaking slow tests and analyses, the problem has been identified and isolated to a small area of circuitry - about 5 components - that directs command data received by the spacecraft from the VHF uplink to the command decoder. This crucial circuit has triple redundancy, one for each of the three command receivers, and the same fault has not yet occurred on the other circuits. In keeping with the design philosophy of 'redundancy through different technologies', there are also two routes whereby this area of circuit can be bypassed using either the primary spacecraft (1802) computer or the Digital Communications Experiment (DCE).

Once the problem had been fully understood, the DCE was programmed - using the UHF uplink to provide a 'bypass around the fault area' - and, when activated on orbit 1418, restored the VHF uplink back to full capacity. The DCE was chosen to do this task firstly as it would leave the primary spacecraft computer free to concentrate on the complex navigation and attitude control & stabilisation tasks now imminent, and secondly as the DCE requires a shorter 'start-up' sequence transmitted to get it going! The final configuration will depend on operational requirements and the by-pass may be provided by either (or both) computers.

Initial results indicate that the VHF/UHF antennas, antenna feeds, hybrid and diplexers are all performing excellently supporting low error-rate full duplex operations at 145 MHz. The current unfavourable attitude of the spacecraft gives rise to a marginal UHF uplink due to antenna directivity - aggravated by low temperatures. This should improve if the spacecraft becomes earth-pointing following attitude control manoeuvres and stabilisation.

In the immediate future, UOSAT-2 operations will entail a checkout of the spacecraft functions; detailed navigation analyses and attitude manoeuvres to prepare for gravity gradient stabilisation before the various experiments can be activated on a regular basis.

(continued on page 19)

Packet Status Register June 1984

From the Editors

by Paul Barnett, N0CRN

It has been some time since we took over editing of PSR, and I decided it was time for a few explanations, apologies, and requests.

Pat Snyder, NAWTM, and I generate very little original material, and we depend on a continuing source of contributions to put together something every 6 weeks to 2 months. I OK, OK, so we haven't been very good at publishing a newsletter on a regular basis, but we now have the process down to the point that we aren't trying something new every issue. The problem is that an issue seems to come due about the same time that either Pat or I is swamped with other obligations.

Our motto is: "All the news that fits, we print," subject to the amount of effort that it takes us to massage submitted material into acceptable form. So, the preferred methods of submission are in order, as follows:

(1) A Wordstar document file, 50 columns per line, left and right justification. Pat and I use an IBM-PC or one of the clones, so we can read any 5-1/4 inch diskettes written by MS-DOS or its cousins (either 320K or 360K). We also have a way to read 8-inch CP/M disks if that is your pleasure. If you send us the diskette(s) in a mailer, we will try to get them back to you in a reasonable amount of time.

(2) We have access to a number of electronic mail services, the public one being CompuServe Information Service. If your ID is 70225,1252, and then mail us a reminder, I will log in and download it. Please, please (a thousand times please) do not attempt to send formatted text via electronic MAIL! Right-justification adds extra hard spaces between words, and we have to spend hours deleting them out by hand. Attempting to send a Wordstar file this way also causes a lot of grief, because some systems are thoroughly confused by the control characters used by the program for formatting controls. Because of these problems, we will be discarding anything we receive that has the above problems, unless we are really hurting for material. Anything that is all upper case will be ignored altogether.

(3) Short letters of praise, news from your local area, etc. may be mailed to us. Please try to type or print them, and remember to use a new ribbon (no thermals, please). Pat Snyder, K6M, has since reported (around 6/1) that his TNC, PY2BZ0, in Sao Paulo reported by phone 5/5 that his TNC was down and expected to be back on OSCAR-10 soon. KA6M has since reported (around 6/1) hearing PY2BZO on AO-10, but has not yet "connected".

************************************************************

Several TNCs are in 7S thanks to ZS1FE/KE3D and ZS6AVK's efforts over the past year. We have also had reports that DL stations should be on soon.

(continued on page 19)
Kit Oscillator Problem

by Lyle Johnson

TAPR has recently received reports of field failures of the 7.3728 MHz oscillator on the TNC. The symptoms are improper reset or failed operation.

Careful analysis of the problem indicated that the oscillator, U1A, U1F, X1 and associated components on the kit board, would free-run at 22 to 49 MHz.

The problem has been duplicated and confirmed here in Tucson. There is a fix, however!

It appears that the Fairchild 74LS14 ICs shipped in kits starting about January may exhibit this symptom, sometimes when cold and starting up, other times when warm. The simple cure is usually just a power off/on cycle or two. This is not a fix, however.

We tested several Fairchild, Hitachi and National parts as well as the Signetics 74LS14s that are scheduled for the next 1200 or so kits. The Fairchild parts are the most susceptible to this fault, but the others may do it as well.

The fix is as follows:

1. Replace R12 (1.5 k) with a 1k 5% carbon film resistor.
2. Replace R13 (1.5 k) with a 1k 5% carbon film resistor.
3. Carefully cut the trace on the top side of the PC board that goes from the lower end of R8 to U1 pin 5.
4. Add a 470-ohm 5% carbon film resistor from the lower end of R8 to U1 pin 5. This resistor will be R87.
5. Add a 4.7k 5% carbon film resistor from U5 (6809) pin 37 to U1 pin 5. This resistor will be R88.
6. Replace U1 with a 74LS04 IC.

An alternate fix, previously circulated, required changing R12 and R13 to 1k and adding a 20 or 22 pF capacitor at location CY. This fix has been documented and supplied with TNC kits shipped after 6 April 1984. It appears to work in most cases, but the modification outlined above is better.

A secondary benefit may be a reduction in the rate of NOVRAM “forgetting” symptoms — this has not been confirmed, however. Feedback in this area would be appreciated. Some oscillators before the mod had the symptom of starting at a very high frequency, then locking on to the crystal after a few hundred milliseconds, often requiring a toggle of the RESET switch to bring the TNC up.

A common symptom of this is a high frequency, then locking on to the crystal area would be appreciated. Some oscillators have not been confirmed, however. Feedback in this area would be appreciated. Some oscillators before the mod had the symptom of starting at a very high frequency, then locking on to the crystal after a few hundred milliseconds, often requiring a toggle of the reset switch to bring the TNC up.

As far as MODEM goes, what is really needed is a higher level packet protocol for file transfer. Using MODEM is a very inefficient way to go in the long run. MODEM provides CRCed data in the correct order, something the TNC is already doing for you.

Binary File Transfer

by Harold Price, NK6K

In response to recent grumblings about transparent mode not being, and "Why doesn't MODEM work through the TNC", the following is offered, and applies only to those who wish to run binary (8 bit) data through the TNC.

As page 4-25 of the general release TNC System Manual states, to get true 8 bit transparency, you must set both AWLEN to 8 and PARITY to 4 (none). After modifying these parameters, you must reset the board with the reset command. The serial parameters are only changed after a reset, allowing multiple change commands to be entered before you get halfway betwixt and between. A casual thought, there should be no reason why you can't run 8 and 4 all the time, since most people you'll be talking to have AND 7FH in their terminal driver, and input parity is stripped on input in command and converse mode anyway.

If you are really using the MODEM series of programs thru the TNC, you must also set your PACLEN to 255, otherwise the default 120 will split MODEM packets among AX.25 frames. The possible delay between one frame and the other may cause the receiving MODEM to timeout. You may have to increase the timeout values in any case, since the packet technique means you won't get any data until the entire frame has been received. This may cause enough delay to end to cause MODEM to get upset.

Note that this handling of PARITY is different than rel 2.x software. Someone somewhere computed that the TNC couldn't handle 8 bits and a parity bit (total of 9). Version 3.1 can, but to make binary data go between normal micros, you must have AWLEN 8 and PARITY 4.

I tested this with a program that dumped 00H thru a TNC to itself in transparent mode. The program checks the incoming bytes, and does indeed find a mismatch with PARITY=3 (default). I tested both BETA 3.1 (on beta board #28X) and 3.1 (on kit board #217).

Which brings up another point, when reporting bugs please tell us what software rev you are running, and what hardware rev. If you give us the serial number, we can also correlate the incremental minor fixes or known shipping errors (like the run of boards that had 20 ohm instead of 2k pots).

Also, if you have some doubt as to what is actually going into your packets, get a third party to listen to the freq with TRACE $2100 set. This will give you the actual data in hex that was received.

To review:

Rev 3.1 needs AWLEN 8 and PARITY 4.

Rev 3.0 had a problem with PARITY, I think you were stuck with PARITY 3 no matter what.

Rev 2.x worked different, I haven't got one anymore, and you shouldn't either. Contact TAPR for info on free software upgrades, or check with your local group.

As far as MODEM goes, what is really needed is a higher level packet protocol for file transfer. Using MODEM is a very inefficient way to go in the long run. MODEM provides CRCed data in the correct order, something the TNC is already doing for you.
Pete Eaton Resigns

by Lyle Johnson, WA7GXD

On May 9th, I received a telephone call from TAPR Executive Vice President Pete Eaton, WB9FLW. The purpose of the call was singular: Pete was resigning from Office in TAPR.

Pete explained that he had devoted the last 2-1/2 years of his life to Amateur packet radio activities, but the time had come for him to end his "retirement" and direct his energies into his personal life. He requested that we respect his decision.

Reluctantly, but in conformance with Pete's desires, I accepted. Pete's will be a tough act to follow.

He was first involved with TAPR in early 1982. He represented TAPR at the Dayton Packet Forum that April, showing off one of the then-new Alpha boards.

In June, 1982, he founded SLAPR, a St. Louis-based packet group that achieved national recognition. He was SLAPR's President from its inception until last December, when he resigned to more fully devote his energies at the national and international levels.

Acting as Beta Coordinator for the St. Louis area, Pete went into every corner of the metropolitan environs and spoke of Packet to every ham he met. The St. Louis Beta site was the first on the air, with Beta boards hand-carried from Tucson, by Pete, on January 31, 1983.

In June of '82, he flew to San Diego to help work the Convention that launched TAPR as a more-than-Arizona organization.

During the summer of 1982, Pete located a transformer manufacturer in Illinois to make the custom power transformers for the Beta boards.

He also came to Arizona and video-taped the June TAPR meeting and subsequent introductory tape that followed.

During the October, 1982, AMSAT-sponsored meeting that adopted the AX.25 protocol, Pete accepted the responsibility for getting the Beta PC board laid out.

When push came to shove in November, 1982, Pete arranged to have a couple prototype Beta boards made and shipped to Tucson. He then came himself and spent nearly a month with us in Tucson, working 16-hour days, day after day, to help haunch the Beta production.

He was with us on Black Thursday, and helped TAPR survive that crisis.

After spending so much time in Tucson, Pete nevertheless flew back for the Annual Meeting. This was less than 1 week after hand-carrying the Beta Boards to St. Louis...

He was primarily responsible for the Amateur Packet Radio booth at Dayton last year, working tirelessly for the professional appearance and good first impression that so many of you commented on.

He was on-camera for the "Introduction to Packet Radio" videotape done in Des Moines last summer.

Pete helped in the preparation of the kit TNC manual, and did considerable work on the PC-board illustrations.

He arranged for the kit board layout, and was one of the kit test-board assemblers (his is kit TNC number one...).

The 3-ring TNC manual cover was Pete's doing.

After his election to Executive Vice President at the Board of Director's meeting last February, he plunged into the tasks of coordinating the cabinet project and preparing for Dayton.

Pete was a prime instigator of the efforts to have the first-ever Dayton Hamvention Award for Technical Excellence bestowed on the TAPR TNC.

The new TNC brochure was arranged by him.

In the midst of all of this activity, Pete has travelled extensively throughout the midwest, spreading the word on packet to hamfests, clubs, conventions -- anyone who would listen.

As you can see, Pete Eaton has been a self-less dynamo, directing considerable energy, time and money into packet radio. Without his efforts, packet radio as a whole, and TAPR in particular, would not be close to the stature it presently enjoys. He has earned the nickname, "Packet Pete".

We will miss the insight, devotion and energy he brought to the Office of TAPR Executive Vice President.

We offer him our full support for his future endeavors, and wish him the best of the best in all he undertakes.

********

WASHINGTON (US) State Department officials here today announced that a pre-dawn raid has netted another shipment of a highly complex electronic component destined for the Soviet Union.

The super-sophisticated "7400 Quad Two-input Hand Gate," as it is known in elite industry jargon, could have been used in video games, officials said, adding that the shipment had an estimated "street value" of at least $10 million.

Other top officials, speaking under the condition that they not be identified, said the parts were worth about $1,000 apiece. "At least that's what we pay for them through the Pentagon's spare parts procurement program," commented one official.

Later reports from knowledgeable sources said that the "7400" components are manufactured in hidden factories in exotic jungle locations such as Malaysia and Puerto Rico and are blatantly sold over-the-counter in Radio Shack stores within blocks of the Soviet Embassy.

"With enough of these super-hi-tech parts, the Soviets could have constructed the world's fastest video game," said one spokesman. "Such a game would be superior to current American and Japanese models because it would also serve as an excellent space heater, and we all know how cold Moscow winters are."

Commenting on the raid, an obviously pleased President Reagan said, "It is obvious that one of America's greatest assets is its large pool of skilled youngsters ready to take the controls when the nation constructs its sophisticated space-based laser ICBM defense system. This technology would have given the Soviets the capacity to train THEIR youngsters to shoot down OUR missiles."

Packet Status Register June 1984
OSCAR-10 Linking

by Tom Clark, W3IWI

We conducted interesting gateway test on Sunday, April 1. This involved W3IWI operating the WB6UUT Packet BBS in the LA area thru Oscar-10 and NK6K's gateway. (Parenthetical comments added):

(First, I command my TNC to connect with NK6K)

CMD: nk6k
*** CONNECTED to NK6K

(Second, I command Harold Price's link TNC)

CMD: my
MYCALL A010
CMD: my w3iwi-1

(I change the call on Harold's TNC)

CMD: my
MYCALL W3IWI-1
CMD: nw
was ON
CMD: wb6uut v w6ozj
(link involved intermediate digipeater in LA)

CMD: c
Link state is: CONNECT in progress
CMD: *** CONNECTED to WB6UUT

Mailbox release 2.17b -- Please Stand-by...
What is your first name? Tom
Is "Tom" correct? y
Where are you located? Clarksville, MD
Is "Clarksville, MD" correct? y

Hello Tom

There is a theory which states that if ever anyone discovers exactly what the Universe is for and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable.

There is another which states that this has already happened. — Douglas Adams

SDPG Meeting 7 April -- Stay tuned for details!

Logged on at 10:14 AM 1 Apr 84
First message is #1590, next message will be #1728

Note: someone else is waiting to use the mailbox
Commands: Help, List users, Send, Read, Display, Browse, Call SysOp, Quit

Command: s
Message To: QST
Sorry, I don't know QST

Note: someone else is waiting to use the mailbox

Command: l
(list of current users deleted for brevity)

Note: someone else is waiting to use the mailbox

(Then I decided to see what some of the BBS mail looked like)

Message #1704 To: ALL From: WB6HHV
Subject: 820 drive power control
— Entered: 11:35 PM 29 Mar 84

Message #1728 To: ALL From: W3IWI
Subject: Hello Via Oscar-10 Satellite
— Entered: 10:25 AM 1 Apr 84

It turns out that Xerox left in the automatic deselection of all drives after a timeout period with no disk activity. They also left in the logic to make sure the drive is up to speed when starting a new access. This works for both 8 inch and 5 1/4 inch drives, when using the standard ROM monitor supplied. This means that you can hook up a solid state relay to control the AC motor, and control the relay with the drive select line (continued on page 19)
HF Linking

by Tom Clark, W3IWI

This is a report on HF packet gateway activity. This describes the use of WB4APR's gateway operating between 145.01 MHz (1200 baud) and 18.145 MHz (300 baud). Bob's hardware consists of back-to-back Vancouver TNC's interconnected via a Vic-20 and a "switchboard" program written in BASIC. The following QSO took place from 14:30 through 16:00 UTC on April 8 between W3IWI in Maryland and W9TD in the Chicago area. I added notes in ( ) parentheses. The [ ] brackets are added by APR's Vic-20 program to convey status info.

(cmd:c wb4apr-5 v wb4jfi-5)
(I used the WB4JFI digipeater between WI and APR)
(cmd:*** CONNECTED to WB4APR-5)
AMRAD EASTNET HF GATEWAY
⇒ band hf
(his hdwe requires that the switchboard be set up)

[W3IWI =/= W9TD]
⇒ [HF IS SELECTED]
⇒ connect w9td
[GATE OPEN 103849]

(WB4APR time-tags some Vic-20 responses in EST)
[TRYING CNCT WITH W9TD]
*CNCT=W9TD
[W3IWI =/= W9TD]

(lower case is W3IWI, upper case is W9TD)

hello
who's there?
hi gary, this is tom, w3iwi
am i making it?
HELLO, TOM

SIGNALS ARE WEAK
was just talking with wbrpk on satellite.
he will be here soon, too.
OK, I SAW YOU CHECK IN HERE YESTERDAY NEVER
he will be here soon, too.
NO, I HAVN'T EVEN GOT MY PSR YET
was just talking with wbrpk on satellite.
WHO'S THERE?

SIGNALS ARE WEAK to begin with.

(by the way, did you see the report on our satellite gateway operation?)
YES, I HEARD OF IT

(comedy of errors... bob's minute time zoned you, and then something he sent (twice!1) locked up my tnc hard so it was like totally groddly who knows?)

(by the way, did you see the report on our satellite gateway operation?)
YES, I HEARD OF IT

(gee -- this wrks pretty well. bob reported he disabled the timer.)

SIGNALS ARE WEAK to begin with.
IS HE TALKING ON VOICE CHANNEL?
occasionally he interjects a note of sarcasm [OMX]
(WB4APR interjected something on the link...[ ] denotes sysop comments)

[MOVE FREQ UP A BIT]
[TO GET AROUND A COMPUTER BIRDIE ON MARK FREQ]
OK gary?

'LL FOLLOW [OK HERE]
HELLO?
[OK LOOKS GOOD NOW.]

(other chitchat between WB4APR and W9TD deleted)

HELLO again (still?)
DID TERRY EVER GET HIS SCC BOARD TO RUN PACKET?

you mean the s-100 board?
HE HAD AN ARTICLE IN AMRAD LETTER ABOUT Z1LOG SCC BOARD

i don't know the status for sure, he was close, but that has been the story for months. i don't see/talk to him very often. shall we try a file transfer -- i'd like to see how good this link is.

(try again, he's in the middle of something)
I ONLY HAVE TERMINAL HERE
ok, let me try anyway

(try again, he's in the middle of something)

(http://www.bobbradley.com/hf/linking.html)

The TAPR TNC will be made available in three forms: complete kit, partial kit and minimum kit.

The complete kit contains all parts specified in the TNC parts list, including PC board and pre-programmed (EP)ROMs. In addition, the TNC System Manual with Binder and dividers is included. This is the form of the TNC kit that most people order, and is the recommended form unless you are in very special circumstances (price = $240).

The minimum kit includes only the PC board, pre-programmed address decoder and pre-programmed (EP)ROM set containing the complete TNC software. This kit is intended for those who have access to the other needed parts to complete the TNC. The TNC uses some very specialized components, so be sure you have access to them before you order this version (price = $82.50+$8 S&H).

The partial kit includes the minimum kit as well as all parts in the following categories as specified in the TNC parts list (see TNC Systems Manual, Appendix F): 1% Resistors, Trimpots, Mylar Capacitors, and Connectors. In addition, the following parts are included: Custom Power Transformer; heat Sink, MOLEX Power connector housing and pins; 7.3728 MHz Crystal; 1N5400 Diodes; 2206 IC, 2211 IC, 2212 IC, MF-10 IC; 1933 IC and 6264 IC. This version of the kit is intended for those who have ready access to the more commonly available parts used in the TNC. As noted above, this is not the recommended version unless you are in very special circumstances (price = $199+$18 S&H).

Our present allocation of PC boards and EPROMs are all dedicated to satisfying orders for complete kits, which have priority. However, we have had a lot of inquiries regarding PC boards and partial kits. Since we do not have the manpower or resources to cater to orders for one of this and three of that, we have decided to make the TNC available as described above.

From the mailbox: Packets were flying in Nebraska on March 19 between Lyman Nelson, WB8IEK, and Jerry Morris, W8BRUS. Contacts were also made with a number of stations in Iowa (NWBB, NDAS, KCGO, WB8GQI) via a voice repeater.
by Lyle Johnson, WA7GXD

"Trenton? What in the world am I doing in Trenton?" I kept asking myself this question as I sloshed through the drizzle, occasionally glancing toward the grey skies in the faint hope of seeing a wandering patch of blue. The wind, careless of the 80 degree temperatures of home, gusted and blew. Trenton...

I had arrived Friday night on the same flight from St. Louis that carried TAPR VP Pete Eaton (yes, it was pre-arranged). We met up with Bill Reed, Dave Cheek, Harold Price and Walt Linstruth at Philadelphia International (I suspect people want to get a LONG way from there) and, renting two cars, drove to Trenton.

The evening was filled with discussions of packet activities, including PACSAT, the GAS controller (not really packet, but...) and ideas for linking. Outside, the wind was rising.

Saturday dawned -- well, the gloom lessened. Those of us responsible for various aspects of the PACSAT project met in a room all morning long. A break for lunch and we were at it again. Timetables. Interfaces. Reviews of OSCAR 11. Modem designs. Goals. Dreams. Hopes.

By midafternoon, we had accomplished all that could be accomplished for PACSAT. We headed for the Trenton Computerfest, using obsolete F3 for 2m "linking." The skies darkened. Rain cascaded about us. We drove on.

Locating the campus (the Computerfest is held at Trenton State College), we parked and started walking fast toward the dampness and the wind sought us out. We entered the confusion, checked out the flea market (mostly wet fleas) and went to the commercial halls.

There were some really good deals to be had. There were also some bad ones... We met up with many packeters -- Paul Rinaldo of ARRL, Terry Fox of AMRAD, Doug Lockhart of VADCG -- and some lively discussions developed.

Leaving early (ya gotta stay warm...), we headed for the Packet Dinner. More discussions. More linking ideas. More heat.

The dinner was great. There were about 35 to 40 people, all discussing various aspects of Amateur digital communications. AMTOR. Packet. ( Mostly Packet.)

Afterwards, we all followed the ARRL Digital Committee to their hotel (so we could get a sneak preview of the Proceedings for the Conference and generally disrupt the meeting). The meeting was held and several important points regarding legal and other aspects of Amateur digital activities were discussed. Those of us not on the committee tried really hard to only observe, and the meeting went very well.

Sunday morning, we again headed out into the New Jersey weather, found the College, and proceeded to the Conference.

I don't have a count, and I make no claims to being an accurate estimator of crowds, but there must have been upwards of 100 people in attendance. The handouts disappeared. People were alternately listening attentively and asking questions.

Paul Rinaldo, W4R1, opened the Conference and showed a videotape of real-time color TV, in motion, sent and decoded from a 56 kbps packet stream. Eyes glistened.

A number of speakers were given the opportunity to make their presentations to the attendees.

I would fill this PBR if I attempted to explain all the presentations. Suffice it to say that this year's Proceedings fill a volume of 135 pages, compared to last year's 76!

If you are really interested in seeing what is being proposed and implemented in Amateur packet radio, get a copy from the ARRL. They are $18.00 postpaid in the US.

There are papers on linking, networks in general, the software approach, the TAPR TNC, OSCAR 11, hf gatewaying, AMTOR, a new Vancouver protocol -- and packet radio at the horse races!

Phil Karn forwarded a netnews item from Don Mitchell, at Bell Labs, on Don's specialty: cryptography and related fields, which includes error detecting codes. Looks like we didn't make a bad choice with X.25!

These are the results of an experiment to test the quality of various error detecting codes. The table shows failures to detect errors in 131972 tests on 128-bit messages.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Number of Bits Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP/IP</td>
<td>8</td>
</tr>
<tr>
<td>PUP-I</td>
<td>12</td>
</tr>
<tr>
<td>Brand X</td>
<td>24</td>
</tr>
<tr>
<td>UUCP</td>
<td>100</td>
</tr>
<tr>
<td>Hash</td>
<td>40</td>
</tr>
<tr>
<td>Crypto</td>
<td>13</td>
</tr>
</tbody>
</table>

TCP/IP is the Department of Defense standard protocol, and is implemented in Berkeley Unix 4.2 and in some commercial packages. PUP-I is the Xerox datagram standard, which adds 32-bit integers shifting the result after each addition. Both are fast and easy to compute.

"Brand X" is a cute reference to AT&T's Datakit switch, which internally passes 9-bit bytes as part of each 16-byte packet. As with all parity schemes, it fails utterly when you have an even numbers of errors. UUCP is used almost universally between UNIX systems over dialup telephone lines, and consists of a practically indecipherable ad-hoc hash code.

"Hash" is equivalent to taking the whole message as one big "number" and reducing it modulo 65521 (one word at a time). It is mathematically related to X.25, and is almost as good. "Crypto" is cipher block chaining, which is an mode of of the data encryption standard (DES). Both take forever and a day to compute.

A good error code means more than a good hashing algorithm. DES is a nearly perfect hash, but fails to detect 1-bit errors. CRC is in addition to being a good hash, detects ALL small-number-of-bits errors.

The point is that schemes which are specifically designed to do error detection, particularly those based on feedback shift register techniques (CRC), are the best. Unfortunately, for those situations where a software algorithm is necessary, it is tempting to invent your own because CRC is expensive to do in software.
CA BBS Activity
by Harold Price, N6K6K

In our ever continuing effort to show up the rest of the northern hemisphere, here is the current list of active users in the LC/SD area. Of the 36 Bulletin Board users below, 23 have logged in at least once in the past seven days. The area now has 2 CPM host systems, one gets most of the general stuff from this net and AMSAT TMAIL. Also one mailbox system and one Experimental digital repeat/repeater with back to back 202 modems for bit regen. We also have a 120 character 10 second teleport. VE6L loged thru it to UUT yesterday and pulled 9k bytes thru in about 15 minutes.

Enough TNCs are on the air to ensure multiple digipeat paths linking Santa Barbara to San Diego and most points in between. Some users are so far out in the boonies that they need a multi-digipeat hop to talk to anyone else. N6DPU must go WA6ER->WB6UUT. There are other examples. Even a mountain top repeater wouldn't help this guy. I throw this in just to bug the "protocol experts" and "purists". Sure, multihopping looks ugly in the header, and sure, it boggles the mind when thinking about efficiency. But it enabled us on the west coast to get 50+ boards over 15,000 square miles linked into a common knowledge, and an integrated pool of misfit routing stuff. We watched for a level three protocol. And that's what ham radio is all about. Using what you've got to get the job done.

We'll move to level three PDQ when one is available, but until then we'll keep moving data. I doubt all this was all started by something I got in the mail about one of the newer packet board producers to hit the scene. The one that says something like "Our board is pure and good, and we didn't implement any of the tack-on warts, like multihopping." I had a neat line here, but it may have been considered libelous so I took it out. I'm basically a nice guy.

Anyway, here is the user list. Not everyone in the area is a BB user, and if you don't check in for three weeks or so, Lynn throws your ID out.

Call, Name       Location       Last Access
KA6AIO, Dave     Mission Viejo  18:39 PM 12 Mar 84
W6AOK, Bill      Hermosa Beach  1:06 AM 18 Feb 84
WD6WMP, Tim      Seal Beach      8:00 PM 13 Mar 84
K6AT, JACK       SANTA ANA      2:37 PM 15 Mar 84
KS6IT, JIM       CORONA    9:19 PM 11 Mar 84
WA6HJY, Gray     Capistrano Beach 4:33 PM 23 Feb 84
W5BNH, Leon      san diego     12:21 PM 3 Mar 84
WA6CTH, RICH     POINT LOMA    6:53 AM 15 Mar 84
WA6GGR, Dave     Diamond Bar   4:06 PM 28 Feb 84
N6CBK, bob       glendale      1:59 AM 15 Mar 84
W6BCYT, Brian    San Diego     4:12 PM 3 Mar 84
N6CPD, Howard    Mission Viejo  9:09 PM 27 Feb 84
W6BNB, Bob       Encinitas Cn. 3:23 PM 14 Mar 84
WA6ER, JACK      LAGUNA HILLS 11:18 PM 29 Feb 84
WB5EKU, Don       Sepulveda     5:26 AM 15 Mar 84
WD6FPY, BILL     SAN DIEGO (EAST) 2:12 PM 15 Mar 84
W6HHFV, Mike     Mira Mesa    7:59 PM 14 Mar 84
KD6HR, Pete      Woodland Hills 11:20 PM 9 Mar 84
W6HRD, Roland    Altadena      7:20 PM 6 Mar 84
W6KAV, Marion    Palos Verdes  9:41 PM 11 Mar 84
W6LLLE, hoppy point loma 6:51 PM 10 Mar 84
W6NIO, Chuck     San Diego     3:23 PM 15 Mar 84
WA6CTH, Rich     Lynwood Beach 12:57 AM 15 Mar 84
W6GOLJ, JIM      PALOS VERDES  9:09 PM 2 Mar 84
W6QIP, Roger     Glendale      5:22 AM 12 Mar 84
K6RYA, Howard    LA MESA    8:26 PM 29 Feb 84
W6ER, John       ENCINITAS 12:40 AM 15 Mar 84
N6TE, Harry      La Jolla    9:05 PM 13 Mar 84
W42MP, Al        Santa Ana, CA 9:39 PM 13 Mar 84
WB6HJY, STEVEN   ENCINITAS 7:10 AM 10 Mar 84
W6VRC, ROBERT    ET TONO   1:26 PM 10 Mar 84
W3BYNM, Skip     Palos Verdes 9:26 PM 13 Mar 84
WA6SNM, Jim      SAN DIEGO     6:40 PM 29 Feb 84

Message Headers
by Mike Brock

I'm trying to standardize on some sort of header within whatever transmission media messages take. What you see listed above is what I'm using now. All fields must be present. If they are not used just leave data following it blank but leave everything up to and including the colon. The details of it's structure is as follows:

M669: PRR-SDG-840405-01

Message number which is filled in by the station that receives the message from the user. PRG stands for Packet Radio Gateway (for the sake of something arbitrary to put in this space) SDG is three letters for San Diego, 840405 is the date in 2 digit year, month, day sequence, and 01 is the first message of the day.

TIME: 05 APR 84 20:35:00

This column holds the time of the message. It is the time stamp filled in by the first gateway station when the message is received. Time is UTC.

TO : WB6HHV

The destination station(s) by call sign. This one will need some work since I do the routine manually right now and I just happen to know there are users. This will no doubt change when we figure out some of the routing/linking stuff. The format for multiple calls is seperation by a space or a comma. Multiple lines are acceptable as long the colon is in column 5. There is no text before the colon on extended lines.

CC :

The stations to copy. Same format and comments as the TO field.

FROM: WB6HHV

The originating station's call.

VIA : WB6HHV-2 San Diego Gateway 05 APR 84 20:35

The path and time stamps of the path taken. Each station other than the originating and destination station will provide it's path to the message. Stations after the first one will add a new line just before the SUBJ: field. The first six characters of the added line will be "via:", which will be followed by information similar to that shown. The times given are when the station receives the message not when it transmits it on to the next station.

SUBJ: Gateway Headers

This is the subject from the originators message. Tom suggested a maximum of 32 characters and I've seen that in other places as well but I see no reason to restrict it to less than a line.

TEXT:

This is the real heart of message. This is the text from the originators message. Tom suggested keeping the lines to 64 characters or less but again I don't see a real need for this. I suggest keeping it to 80 characters or less because that is the way I expect most messages to arrive.

This is what I'm using as an experiment. The gateway operation is a completely manual for the moment so it is a bit of work to do all of this. On the other hand, I think it will give them a chance to play with formats and see what is it that we really want. One other item that I would like to address under the subject of headers is message forwarding i.e. the destination station(s) will provide a message when we really want. One other item that I would like to address under the subject of headers is message forwarding i.e. the destination station(s) will provide a message number which is filled in by the station that receives the message from the user. PRG stands for Packet Radio Gateway (for the sake of something arbitrary to put in this space) SDG is three letters for San Diego, 840405 is the date in 2 digit year, month, day sequence, and 01 is the first message of the day.

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FROM: WB6HHV

The originating station's call.
TNC Modem Tuning Indicator

by Lyle Johnson, WA7GXD

Many users of the TAPR TNC have expressed the desire for a simple tuning indicator that would enable them to easily tune in a packet transmission in non-FM modes. If you are among this group, read on.

Background

For normal VHF-FM packet activity, a tuning indicator is not needed. One simply tunes the receiving radio to the local packet channel, and the FM audio recovery process assures that the demodulated FSK tones are at the right frequency (pitch).

On HF and OSCAR, however, the modulation method used is typically FSK (generated by injecting audio tones into the microphone input of an SSB transmitter). Thus, accurate recovered audio pitch is not assured, and careful tuning is required. To make matters worse, the tuning accuracy required is on the order of 20 Hz, and becomes more and more critical as the data rate (baud) increases for a given shift.

The XR2211 FSK demodulator IC used in the TAPR TNC was originally designed for use on baseband (audio) links, such as a telephone line. Thus, tuning indicator outputs were not considered needed as part of the IC design.

Development

Examination of the 2211 phase-locked-loop demodulator used on the TNC reveals that the information needed for a tuning indicator is in fact present. Please refer to your TNC schematic diagram, sheet 3. In the following discussion, the IC callout will be given first, followed by the Beta board callout in parentheses.

U18 (U18) is the XR2211 PLL demodulator. Note that there is a block marked "VREF" with an output at pin 10. This reference voltage is used in the 2211 to determine when an incoming signal is above or below the center (free-running) frequency of the PLL. C24 (C12) is simply a filter on this reference voltage to suppress high frequency noise.

The block marked "FSK" in U18 (U18) is simply a comparator that determines whether the voltage at the output of the loop detector filter C20/R45/C21 (C25/R13/C11) is above or below the pin 10 reference voltage. The filter voltage is developed in the loop detector and is proportional to the frequency of the incoming signal. It is used to steer the 2211's VCO to the incoming signal frequency to maintain lock.

The voltage at the output of the filter (pin 8 of the 2211) is below the reference voltage when the applied signal frequency is above the vco center frequency, and above the reference voltage when the applied signal is lower in frequency.

What is needed, then, is a voltmeter that can read the instantaneous voltage at pin 8 and have its scale calibrated in frequency.

A practical circuit is presented below.

(continued on page 11)
Implementation

The signal voltages from the XR2211 are buffered by Op Amps U1A/U1B. These are configured as a voltage follower to present a high impedance to the '2211; the loop data filter (pin 8) is especially sensitive to loading. The voltage follower outputs are then attenuated to 1/2 the actual level by R1 and R2 for U1A and by R6 and R7 for U1B.

Each buffered channel is then applied to a peak detector circuit consisting of an Op Amp section (U2A/R3/R4 and U2B/R8/R9) whose positive peak output is sampled by a detector (D1/C1 and D2/C2). Each channel’s reference point (the non-inverting input) is tied to the other channel’s signal.

Perhaps an example will help clarify the circuit operation: Consider the case where the applied frequency to the '2211 is below the vco center frequency. The voltage at the output of the loop data filter (pin 8) will be some value more positive than the reference voltage generated at pin 10. This means that the output of U1A will be lower than the output of U1B. U2A will see its input pins to the same value (basic Op Amp operation). Since the non-inverting (+) input is more positive than the inverting (-) input, the output voltage will rise. When the output voltage is exactly twice the input voltage difference, the inputs will be matched and the output will stabilize.

U2B, on the other hand, will have its + input lower than its - input, so its output will be driven towards ground. This will back bias D2, effectively forcing U2B to the ground rail.

In the case of a signal frequency above the vco center frequency, the opposite will occur and U2A will go to ground on its output, with U2B providing a voltage at its output proportional to the difference in voltages received from the '2211.

The voltage differential between the '2211 pins 8 and 10 is proportional to the frequency difference between the vco center frequency and the applied signal.

The time constant C1/R5, or C2/R10, determines the peak “hold” time of the circuit. The values given provide good operation of the circuit, but you may wish to experiment. The idea is to have the hold response time with a hold time longer than the slowest applied data rate.

The outputs of R5 and R10 are applied to identical LED bar-graph displays. The National LM3914 is used, as it has a linear response (don’t use the LM3915 with its logarithmic weighting!). The ten outputs are passed to a 10-LED bar-graph display, with the LM3914 set to provide a “moving dot” as opposed to a “stretching bar”.

The brightness of the display is set by R11 and R12. Q1 is tied to the otherwise unused data carrier detect output of the '2211 (pin 6), asserted by pullup R13 when no signal is being received. Q1 is off, forcing the LED displays to minimum intensity. When a signal is detected, Q1 is turned on, causing the display to operate at normal brightness.

Each display will show a moving dot, proportional to the applied frequencies. With the hold time introduced by C1 and C2, the dot will tend to hang at the location corresponding to the high or low tone frequency of the input FSK signal.

Calibration

With the demodulator configured for operation at the data rate desired (see the 300 baud and 1200 baud modem configuration articles elsewhere in this PSR), set the TNC to the CALIBRATE mode.

Verify the calibration of the '2211 center frequency to be exactly 1700 Hz (or whatever frequency you have configured it for).

Now, select the low tone (1600 Hz for 300 baud operation). Place a jumper at J3 pins 3 and 5 (Beta boards simply ensure that J8 is in place) to cause the output of the 2286 FSK modulator to loop back to the input of the '2211 demodulator.

Adjust the frequency of the 2286 to the exact value desired. Next, adjust R5 on the tuning indicator so that the two middle LEDs of DSP1 are glowing and flickering with equal intensity. This is important that both LEDs be glowing.

Select the high tone adjust the 2286 for the value desired. Then, adjust R10 on the tuning indicator so the two middle LEDs of DSP2 are glowing with equal intensity.

Remove the loopback jumper and set the TNC up for normal operation.

Operation

When operating on FM, the center LEDs on DSP1 and DSP2 should glow when receiving packets. (Don’t observe the displays carefully in this mode. You may notice that one or the other of the center LEDs glows brighter than the others, and this tendency will vary with the data that is being received. This is due to the loop filter characteristics at pin 8 of the '2211. The loop filter is properly configured to be -3db at the design data rate, so when a number of “0”s are sent in HDLC format, the peak output voltage at pin 8 of the '2211 is slightly less than at lower data rates. It is the lower voltage that causes one of the center LEDs to tend to be brighter than the other.

After gaining familiarity with the patterns to be expected with a properly tuned signal, change modes to FSK and try to tune in a 300 baud FSK signal (16.14" Hz). DSP1 is a packet standard HF frequency) or a 1200 baud OSCAR signal (145.835 MHz downlink). The correct tuning will be greatly simplified with the use of this circuit.

With a short “training” period, it is easy to tune in a stable signal to an accuracy of 10 Hz.

Construction Hints

At present, no kit is available for this tuning indicator. However, TAPR is planning on having a PC board and parts kit available. As in all TAPR projects, do not send money or orders until the kit is officially announced in PSR.

Not counting the PC board, the cost to build the indicator should not exceed about 12 to 20 dollars.

No special precautions need to be taken regarding parts layout. You may find it most convenient to place the LED displays horizontally, with one display immediately above the other. An alternative display method, which will save a bit of money and space, is to parallel the LM3914 outputs and drive a single 10-element LED bar-graph display. In this case, the display may be easier to interpret if the the outputs are cross-connected (pin 1 of U3 tied to pin 10 of U4, pin 10 of U3 tied to pin 11 of U4, etc.). However, the calibration of the indicator may prove more challenging in this case.

Credits

The design of the tuning indicator presented here was done by Eric Gustafson, N7CL, who is also the person most responsible for the modem sensitivity and 300 baud modifications.

Packet Status Register June 1984
Modem Sensitivity Modifications

by Lyle Johnson, WA7GXD

See the end of this Note for ordering instructions for parts [i]s to accomplish these modifications. TAPR parts kits come with complete assembly instructions.

NOTE: DO NOT attempt ANY modifications until the TNC has been constructed, tested and successfully used on-the-air!

Improved Sensitivity

TAPR is currently conducting experiments to improve the already excellent performance of the TNC modem. While the results are still coming in, field testing by a number of packeteers has indicated that modem performance may be improved by about 2 db under weak signal conditions with the following modification. The improvements are particularly applicable to hf and OSCAR-10 operations.

NOTE: Beta part number callouts are in parentheses following kit callouts.

(1) Change the value of C20 (C2S) from 0.01 µF to 0.0047 µF. C20 is located on header 034.

(2) Change the value of R46 (R14) from 30.1 k to 47.0 k. R46 is on header U34.

(3) Attach a 4.7 k resistor from U18 pin 7 to +12 volts.

Kits: A good place to add this resistor is at the plate-through hole at the right of the trace just below U21/just above Cl9 and K39. The other lead should be carefully soldered to the trace leading to pin 1 of U18.

Beta: The 4.7k resistor just below and to the left of U18 pin 7 should be removed. Replace it with another 4.7k resistor. The right end of the resistor should be installed as before, but the left end should be re-routed to the rightmost hole of the +12 volt bus in the wire-wrap area. This is the hole just below and to the left of the 4.7k resistor.

(4) Kits: The trace from U18 pin 7 passes under R76, R77, R78 and R79 on its way to J3S. Just to the right of these resistors and the plate-through hole adjacent to R78, cut the trace carefully, exposing about 1/16 inch (0.2 mm) of bare PC board. Scrape some of the coating off of this trace for a distance of about 1/8" (0.4 mm) on the side that leads away from R78.

Beta: On top of the board, locate the trace which coming from J3 which goes to a plate-through hole near the left end of J3. Turn the board over and follow this trace until it ends at a plate-through hole under U17 (in line with pins 14 and 27 of U17). Carefully cut the trace near the plate-through hole under U17, exposing about 1/16" (0.2 mm) of bare board. Scrape some of the coating off of this trace for a distance of about 1/8" (0.4 mm).

(5) Attach a VN10KM transistor as follows:

Kits: Drain to the plate-through hole adjacent to R76; Source to the ground strip at the bottom of R74; Gate to the trace from U18 pin 7 (cut in [4] above).

Beta: On the solder side of the board, attach gate to the trace leading back to J3S; Source to U17 pin 28; Drain to the plate-through hole mentioned in step [4] above.

(6) Beta only: Install a 4.7k resistor on the solder side of the board. One end should attach to the U17 pin 27 and the other end should be soldered to the "top" side of the 0.1 µF capacitor between U17 and U25 (this is the side that goes to U25 pin 14).

(7) Recalibrate the demodulator center frequency to 1655 Hz by typing:

    cal:3/1894

while in the calibrate mode.

300 Baud Modifications

For 300 baud use (such as on hf), a 200 Hz shift appears optimum. To incorporate these changes on your TNC, make the following changes:

(1) Change C21 (C11) from 0.0022 µF to 0.01 µF.

(2) Change R46 (R14) from 30.1 k to 227 k.

(3) Set the modulator low tone to 1600 Hz (cal:1/1152).

(4) Set the modulator high tone to 1800 Hz (cal:2/124).

(5) Set the demodulator center frequency to 1700 Hz (cal:3).

Note that these parts mount on header U34 on the kits; they are part of the circuit board assembly on the beta boards.

Special Radio / Modem Combinations

While the default FM modem filter configuration works satisfactorily with the radios listed below, special filter values have been calculated and are presented for those interested.

<table>
<thead>
<tr>
<th>Resistor</th>
<th>Icom 2A</th>
<th>Kenwood 7950</th>
</tr>
</thead>
<tbody>
<tr>
<td>R51</td>
<td>10.0 k</td>
<td>10.0 k</td>
</tr>
<tr>
<td>R52</td>
<td>51.0 k</td>
<td>47.0 k</td>
</tr>
<tr>
<td>R53</td>
<td>57.1 k</td>
<td>45.5 k</td>
</tr>
<tr>
<td>R54</td>
<td>10.0 k</td>
<td>10.0 k</td>
</tr>
<tr>
<td>R55</td>
<td>10.0 k</td>
<td>10.0 k</td>
</tr>
<tr>
<td>R56</td>
<td>14.3 k</td>
<td>10.0 k</td>
</tr>
<tr>
<td>R57</td>
<td>18.0 k</td>
<td>10.6 k</td>
</tr>
<tr>
<td>R58</td>
<td>38.6 k</td>
<td>20.7 k</td>
</tr>
</tbody>
</table>

HF/OSCAR Flat Filter

While covered in greater detail in PSR 9 (January, 1984, pg 6), the following data is provided for completeness.

<table>
<thead>
<tr>
<th>Resistor</th>
<th>Icom 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>R59</td>
<td>23.7 k</td>
</tr>
<tr>
<td>R57</td>
<td>18.0 k</td>
</tr>
<tr>
<td>R56</td>
<td>11.4 k</td>
</tr>
<tr>
<td>R55</td>
<td>10.0 k</td>
</tr>
</tbody>
</table>

(continued on page 19)
Modem Modifications Tests

The following articles detail the results of individual tests of the modem sensitivity modifications described on the previous page.

by Steve Goode, K9NG

I have done additional testing of the new recommended modifications. I modified CAPRA's [Chicago Area Packet Radio Association -- TAPR's first affiliated clubl] kit board by changing C20 to a 0.0047, R46 to a 47k within 0.5% and moving it to 12v, buffered the HDLC chip with a 10k pull-up to 5v and a hot carrier diode to the fsk slicer output since I did not have a FET to use for a buffer. The total board operation was tested by using a test setup similar to the one described in the QEX [August, 1983] article where I checked the packet probability of reception. The kit transmit audio was used as a transmitter and feed to the IDC box and HP 6640 generator. The generator output went to the SYNTOR receiver and its output was run to the modified kit board and my unmodified Beta board. The generator was then set at different levels and 100 packets were sent at each level. The kit board PTT was also used to pulse the 8640 on and off. The number of packets received by each board was then counted and is tabulated below (with the number being received/1 sent):

<table>
<thead>
<tr>
<th>RF LEVEL</th>
<th>KIT BOARD</th>
<th>BETA BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>-121 dbm</td>
<td>2/100</td>
<td>2/100</td>
</tr>
<tr>
<td>-120.5</td>
<td>11/100</td>
<td>7/100</td>
</tr>
<tr>
<td>-120</td>
<td>26/100</td>
<td>19/100</td>
</tr>
<tr>
<td>-119</td>
<td>58/100</td>
<td>55/100</td>
</tr>
<tr>
<td>-118</td>
<td>83/100</td>
<td>79/100</td>
</tr>
<tr>
<td>-117</td>
<td>98/100</td>
<td>94/100</td>
</tr>
</tbody>
</table>

As you can see, both boards fell apart at the same level.

I also tested the performance of the boards in a simulated Rayleigh fading field. At -107 dbm into the receiver in a Rayleigh field with an average 8 Hz Doppler the kit board received 61/100 and the Beta board received 67/100.

Unfortunately, I cannot report a significant improvement with the modifications in a FM channel. 

by Gary Kaatz, W9TD

The following is a commentary on the results of measurements made on my Beta TNC before and after the modem modifications.

To make the measurements repeatable, I built a pseudo-noise (PN) generator. This consisted of a 17 stage shift register with an XOR gate tapped at the 17th and 12th stages and the output fed back to the beginning. The clock to the PN generator was above 28 kHz and the noise spectrum was measured to be flat out to nearly 10 kHz. The PN was summed with the modem transmit audio and both signals were equipped with gain adjustments to simplify setting the signal-to-noise ratio (S/N) and the absolute audio level into the modem's receive input. Measurement of the S/N ratio was done at the output of the MF-10 so that the bandwidth of the system was known. Since pin 1 of the MF-10 has a significant amount of clock feed-thru which is not filtered out in the Beta TNC [the kit TNC is filtered], I used an RC filter with a corner of 7.2 kHz at the input of the HP4880 that I used for measurements. The MF-10 header for flat frequency response, published in PSR 9, was used.

The Packet Probability of Reception (PPR) was measured by sending 50 packets, and dividing the number correctly received by 50 (see Steve's paper in QEX 118 for an explanation of the terminology). This was measured for several values of S/N. The packets were used empty, just a carriage return, and therefore contained 168 bits. A Bit Error Rate (BER) can be calculated from PPR by the following formula:

\[ \text{BER} = 1 - \frac{\text{PPR}}{100} \]

Prior to any measurements, the modem was aligned and the bandwidth of the MF-10 filter was measured. The 3dB bandwidth was 2200 Hz and the equivalent noise bandwidth was 2162 Hz. The audio level fed to the TNC was -16 dm (0.12Vrms). The level at the output of the MF-10 was then -15dm (0.14Vrms).

Before presenting the results I would like to make some comments on the modifications. I found that when only the gain setting resistor between pins 11 and 12 of the 2211 was increased to 47k [46k in the kit TNC, R14 on the Beta board] and the output at pin 7 pulled up to 12v, the TNC was deaf. The increased amount of voltage required to tune the VCO was causing slew rate limiting at 1200 baud and lower. Therefore, I had to reduce the loop capacitor [C20 in the kit, C25 in the Beta] from 0.1µF to 0.047µF to ease the slew rate problem. I can confirm that reception of 1800 baud was possible, but only over nearly noiseless channels, and that the ringing at the data filter (pin 8) was also reduced.

TAPR 202 Modem Performance at 1200 Baud

<table>
<thead>
<tr>
<th>S/N (dB)</th>
<th>PPR (X10^{-3})</th>
<th>BER (%)</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.4</td>
<td>100</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>11.7</td>
<td>74</td>
<td>1.79</td>
<td>98</td>
</tr>
<tr>
<td>9.54</td>
<td>32</td>
<td>6.76</td>
<td>74</td>
</tr>
<tr>
<td>6.65</td>
<td>36</td>
<td>12.79</td>
<td>36</td>
</tr>
</tbody>
</table>

The modem modifications are seen to produce an about 2dB improvement in a flat channel. 1800 baud operation was found to have a PPR of only 89% in a noiseless channel and 28% when the S/N was 16.4 dB. The optimum signal level for the modified modem was also sought. The dynamic range was beyond my meter's baud rates were no problem. This extended from 0.69V rms down to 15.4mV rms, the range of adjustment at the summing node. It should be noted that my modem was modified for larger dynamic range as specified in PSR #9. For a S/N of 9.5 dB, the optimum level was found to be about -10 dBm (0.245Vrms).

by Ted Huff, K4NTA

[The following article is excerpted from the FADCA/BEACON for April, 1984]

In the February issue of the FADCA/BEACON there was an article by KV7B and W8RKP on modifications to the TAPR Beta and Kit TNCs. I made these modifications on my own TNCs and found good results. The mod is rather simple and I would recommend it to anyone using the TAPR gear who thinks that his board may not hear well...

I did a little test to find out just what improvement, if any, I had made. I connected a step attenuator in the antenna line of my Icom 1C-22A. Of course, I unplugged the mic first. Then, before any modifications were made, I asked (continued on page 20)
BER Performance of TAPR TNC Modem

by Steve Goode, K9NG

(The following article is reprinted from the August, 1983 issue of QEX. It is must reading for anyone interested in the noise performance of their TNC's modem. Note that the modem tested in this article is the unmodified Beta board system.)

Any packet operator who simultaneously monitors the channel with their TNC has probably heard packets that the TNC did not print. This raises the question, "What signal strength should it possess to print a packet?"

The 20 dB quieting sensitivity of a receiver is a known factor to most hams who operate on VHF and would be helpful if some measure of performance was done on the TNC in relation to the 20 dB quieting level (20 dBQ) of the receiver.

**Bit Error Rate**

Data transmission systems are normally measured on the basis of their Bit Error Rate (BER). The BER is defined as the probability of not receiving the transmitted bit properly at the receiver. This is expressed in percent or in direct decimal form. For example, a system may have a BER of:

\[ \frac{1}{10^3} = 0.1\% \]

or 0.1%. The chance of receiving the transmitted bit incorrectly is one in every 1000 bits. On the positive side, the chance of receiving the bit correctly is 100% - 0.1% or 99.9%. BER is measured by comparing the transmitted data bits with the received data bits and counting the number of errors. As is true for all digital systems, the BER for packet radios is dependent on the input signal to the receiver. The correct way of measuring performance, therefore, is a graph of BER versus input to the receiver.

**Test Setup**

The test setup used to measure the BER of the Tucson Amateur Packet Radio (TAPR) TNC modem is shown in Fig. 1. The modem was calibrated before the tests using a frequency counter and the internal calibration routine. The Bit Error Rate Tester (BERT) shown in the figure generates a pseudo-random data stream and is connected to the TNC modem by removing JP11 [JP4 on the kit TNC] and connecting the data into the input of the modem. JP3 [JP5 pins 17 and 18 jumper for the kit TNC] is removed and the modem output is connected to the BERT. BERT retimes the received data with an internal clock and the transmitted data is delayed to allow for transmission and reception delays. The transmitted and received data streams are then compared and a BER is displayed.

For these tests, the output of the TNC modem was connected through an IDC box into the fm input of an HP 8440B signal generator. The IDC box contains the pre-emphasis and clipping circuitry of a Motorola Motran transmitter. The receiver used for these tests was a Motorola VHF Syntor. It had a 20 dBQ sensitivity of -121 dBm (0.2 µV).

**Interpreting the Data**

Now that the BER performance of the modem is known, what are the odds of receiving an uncon- nected packet or maintaining a packet QSO for 15 packets? As said before, the Bit Probability of Reception (BPR) is 100% minus the BER. Since each bit is independent of another, the probability of receiving two consecutive bits correctly is:

\[ \text{BPR} \times \text{BPR} \]

(continued on page 15)
The probability of receiving three consecutive bits correctly is:

\[ \text{PRR} = \frac{3}{2 \times 2 \times 2} \]

and so on. Thus, the probability of receiving \( N \) consecutive bits is:

\[ \text{PRR} = (1 - \text{BER})^N \]

All flags, control bits and data bits must be obtained correctly before receiving a packet. For a maximum 128 byte length packet through a [single] digipeater, this is 1240 bits. Therefore, the Packet Probability of Reception (PPR) is:

\[ \text{PPR} = (1 - \text{BER}) \]

The probability of receiving a packet for a given signal level and packet length can now be calculated. Let's take a signal at 20 dBQ, on the 1200 bps curve. It has a BER of:

\[ \text{BER} = 2.2 \times 10^{-3} \]

For a 1240 bit packet length, this gives a PPR of:

\[ \text{PPR} = (1 - 2.2 \times 10^{-3}) = 0.998 \]

or 2 packets received in every billion sent. Not very good odds. We can convert from a given PPR to a BER by solving equation [1] for BER. The BER required for a PPR of 98% is:

\[ \text{BER} = 1 - 0.98 = 2 \times 10^{-3} \]

It corresponds to about -119 dBm, and to a 23 dBQ in the Syntor. We can also calculate the level for a PPR of 99% to be:

\[ \text{BER} = 1 - 0.99 = 10^{-2} \]

or about -116 dBm. This corresponds to 25 dBQ in the Syntor. This shows that the fast quieting effect of an FM receiver takes the PPR from 10% to 99% for a change of only 3 dB in input signal strength.

What are my odds for maintaining a packet QSO for 15 packets? We must first know the odds of not retrying out for the current packet. To maintain a packet QSO, one packet should be received correctly in every set retry count or it will retry out. Let's call this the Remaining Connected Probability (RCP). This is the probability that the packet will be correctly received at least once for the set retry count \( L \). Since the probability of not receiving a packet is 100% - PPR, the RCP is:

\[ \text{RCP} = 1 - (1 - \text{PPR}) \]

Assuming the other station receives your acknowledgments, calculate the probability of maintaining a QSO for \( M \) number of packets. This is called the QSO Probability for \( M \) packets (QPM) and is obtained by raising the RCP to \( M \):

\[ \text{QPM} = \text{RCP}^M \]

If we assume a maximum retry count of 10 at -119 dBm, the QP15 (QSO probability for 15 packets) would be:

\[ \text{BER} = 2.2 \times 10^{-3} \]

\[ \text{PPR} = (1 - \text{BER}) = (1 - 2.2 \times 10^{-3}) = 0.998 \]

\[ \text{RCP} = (1 - 0.998) = 0.002 \]

\[ \text{QPM} = 0.002^{15} = 0.000000000022 \]

This data also raises questions such as: can the TAPR TNC sensitivity be improved? Would alternate modulation techniques provide even greater improvement and would it justify changing the modem standard? Experiments will have to be made to answer these questions. I am interested in hearing from anyone who does on-the-air test or has done bench tests similar to these on the TAPR or other modems with FM receivers.
Modem Comparison

by Steve Goode, K9KG

[The following is a letter received from Steve Goode, K9KG, last fall when he first evaluated the performance of the kit TNC modem to the Beta TNC modem]

I took a Bit Error Rate curve of the new TNC today. Its sensitivity is equivalent to the old Beta TNC board and follows the same BER curve when tested with the same FM system as the Beta board. I also tested the dynamic range of the new board. It has a dynamic range of 31 dB. From -2 to +31 dB from the Beta board optimum input, the new TNC has the same BER. The LEDs begin to light at about +22 dB, giving a 9 dB range where the LEDs can be on with no degradation in system sensitivity [Steve had a pre-production kit; the kits generally released have audio LEDs that come on about 10 dB sooner]. The upper limit of dynamic range is when the MF-10 goes into limit. This can be seen on a 'scope, so if you watch the input to the 2211 and it is out of clip (and the TNC is printing something) then you are within the optimum setting for the new board.

I also re-tested the effect of allowing the transmitter to go into clip. Again, the clipping action of the transmitter and receiver circuits degrades system sensitivity, so both the transmitter and receiver should be kept out of clip. I also tested the effect of de-emphasizing before modulation. This degraded performance with the new TNC.

I also removed the MF-10 and pre-emphasized the receiver output [this is the suggested system from GLB]. This system performed about 1.5 dB worse. Removing the MF-10 with no reshaping of the transmit audio degraded system performance by about 2 dB. Therefore, the optimum system still seems to be keeping the transmitter and receiver out of clip and, contrary to GLB's statements, the MF-10 does produce about a 2 dB improvement in system performance.

At Dayton, three different packet radio TNCs were in evidence.

The TAPR TNC, fully dressed in the new cabinet, was busily operating three different systems at Booth 302 (the TAPR booth).

AMSAT was monitoring the activity on 1.2 GHz (with radio graciously loaned to us from ICOM) with a TAPR TNC and video terminal.

GLB was present with their PK-1 controller, and showing a prototype of their PKR-1 digipeater (TNC with attached radio in a single case). Very interesting.

AEA introduced their PKT-1. This unit is based on the TAPR TNC design, housed in a cabinet and modified to run on +12-volts dc.

At the recent annual meeting of NZART, the New Zealand national society, Ian Ashley, ZL1A0X was presented a certificate of merit for his pioneering work in packet radio.

Deviation Adjustment

by Gary Field, WA1GRC

[The following article is reprinted from the March issue of the NEPRA PacketEar]

Newcomers to packet radio may not realize the importance of proper deviation adjustment; however, underdeviation will result in poor noise tolerance, and overdeviation will result in high error rate and inter-channel splatter. Proper deviation is approximately +/- 4 kHz peak deviation. This keeps the sidebands toward the middle of the passband away from the phase-distorting rolloff frequencies. Since every packet station is using different combinations of equipment, no “fixed” set of potentiometer settings will produce proper deviation. This adjustment must be performed when a station is first set up for packet; it normally will not change much with time providing none of the equipment is replaced or serviced. The best method of adjusting deviation is to use a deviation meter; however, since most hams do not have access to one of these, an alternate, less precise but adequate method will be outlined here.

The only test equipment required is an extra FM receiver operating on the same frequency as the packet transmitter, and your ears. This receiver should have IF filters no wider than 15 kHz. Filters wider than this will result in overdeviation when you use the following technique.

(1) Connect the tone output from the TNC to the radio, connect a 50 ohm dummy load to the transmitter output and turn the radio on.

(2) Turn the tone output from the TNC all the way down.

(3) Turn on the extra receiver and set to the same frequency as the packet rig. It is generally best not to connect an antenna to this receiver.

(4) Slowly increase the audio output level from the TNC. The tone in the extra receiver should get louder and louder until no further increase in output is noticed. STOP when this point is reached.

(5) Decrease the output from the TNC until a definite decrease in volume is noted (about 3 to 4 dB). Set the output of the TNC slightly below this level.

Let me explain why this method works: When the audio level into an FM radio is increased, a corresponding increase in RF bandwidth is caused. What we have done is use a receiver with a known IF bandwidth to tell us when the RF bandwidth is equal to the IF bandwidth. This happens because when we start deviating past the edges of the IF filter, no further increase in volume will result; the signal will only get more distorted. If your signal sounds louder or softer than most of the others on the channel, you should suspect that your deviation is not optimum even if your packet station seems to work fairly well. Do not use distant noisy signals for this comparison, but most others should sound about the same.

After a while you will be able to recognize packet signals which are not properly adjusted for deviation and also tone calibration.

Tone calibration is not a problem with the TAPR TNC since a very nice software calibration function is included in the onboard PROM; however, other TNCs must be calibrated using a frequency counter. The two tones must typically be set to within 20 Hz if good performance is to be expected.

********
TAPR Modem Measurements

by Tom Kneisel, K4GFG

[The following article is excerpted from the FADCA>BEACON for April, 1984]

In the few weeks since I've had my new TAPR kit, I've been looking at the radio side of it and wondering how to get the best performance out of the RF channel. Here are some observations that may be of interest to you.

First the receiver audio section has a bandpass response as shown in Fig. 1. Between 1200 and 2200 Hz, the slope is about 8 dB per octave, which results in an amplification of the 2200 Hz tone about 7.5 dB above the 1200 Hz tone (if they were to be input to the board at equal levels). I then measured a commercial hand-held portable radio, the Motorola MX350. Its receiver audio response is shown in Fig. 2. This de-emphasis rolls off the received audio at 2200 Hz by about 6.5 dB relative to the 1200 Hz tone.

We find then that the receiver plus TNC board together appear to form a fairly flat response combination, with the TNC board compensating for the receiver rolloff to within about 1 dB. Lyle Johnson of TAFR has written that the Exar 2211 demodulator ship is very sensitive to amplitude imbalance of greater than 3 dB, and that a 6 dB imbalance will render the channel inoperative. If true, this would seem to require that the tones be transmitted with nearly equal deviation by the transmitter. A good way to do this with minimal phase distortion would be to bypass the transmitter audio circuits altogether. This is not always practical, and Gary Field has suggested how to reset adjust transmitter audio circuits for drive level and deviation.

I then measured my 2m transceiver and found that my Yaesu FT 221 receiver has a de-emphasis of only 2 dB between 1200 Hz and 2200 Hz. Using the speaker output did work, but not well on weak signals. I decided to bypass all the audio shaping in the Yaesu and to pick up the receiver signal off the discriminator. What I needed was a flat response filter for my TAPR TNC. Fortunately TAPR's Dan and Margaret Morison have detailed the changes to the TNC filter header U30 that result in a very flat response with linear phase.

To test how well this works, I took the (no-signal) noise out of my receiver's discriminator, summed in the TNC's transmit audio tones, and fed this audio to the TNC receive input. Putting the TNC in the full duplex mode and transmitting packets of a single text character, I found the results shown in Fig. 3. PPR is the packet probability of reception, as described in Steve Goode's article in QEX (and reprinted elsewhere in this issue of PSR). The curves show that the modifications recommended in February's FADCA>BEACON (and included elsewhere in this issue of PSR) yield about 2 dB improvement. In general, the board has good S/N performance. These tests were done with audio in noise which is presumably parabolic in spectral shape (more noise at higher frequencies).

In Ottawa, Canada, one of the earliest amateur packet radio systems anywhere has recently started the conversion from a 9600 BPS all digital FSK system on 220 MHz using a polled protocol to an AX.25 TAPR based system on 145.01 MHz.

The early Ottawa work (1978) was based on a need for very high efficiency and high data throughput systems that used a very simple 2K byte protocol and much modified VHF Engineering kit radios to support digital transmission. Very limited attempts were made to popularize the polled protocol - the work was later eclipsed in popularity by the Vancouver and still later the Tucson software and hardware efforts.

A major demonstration of packet linking is planned for August 1984. A 2 Metre handheld radio, TAPR TNC, and Radio Shack Model 100, all operating on a rechargeable battery, will be taken to the peak of Whiteface mountain for tests into lower New York state as well as Vermont, New Hampshire, and Massachusetts. Whiteface mountain (about 5000 ft.) is located in northeastern New York state and was a key location in the 1960 Winter Olympic games. A digital repeater on Whiteface is a possibility in the future.
During the visit to Dayton, I got an opportunity to attend the Packet Radio presentation and meet some of the movers and shakers. Two people whom I especially admire, Lyle Johnson, WA7GXD, President of Tucson Amateur Packet Radio Corp. and Gil Boeike, WZ2UP, of GLB Electronics took turns on the platform along with representatives from SLAPR, Dayton (Hami Valley FM Association), AMRAD, and the ARLR (Paul Rinaldo, W4RI).

After the presentation I got to meet Gil and ask him if he minded my modifying the code in the PK-1. He said heck no and to call the company later to get specific answers to my questions (which I subsequently did, and to which they responded in writing with specific answers to my questions. This is without any knowledge of my questions carefully though because firmware is a really touchy subject. I have a real warm feeling about the GLB folks. I think their aim is to please.

The next morning I got to visit briefly with Lyle Johnson, WA7GXD, who is certainly one of the most energetic and creatively people I have encountered. I can understand how he has been such a sparkplug for the TAPR activity). There are currently six sources of TNC's or alternate methods of getting into Packet Radio: AEA's, Ashby and Son's (KATKN & KAOQEG), GLB's, Bob Richardson's (WAUCH), TAPR's, and VADCG's. Someone in AMRAD is working on a TNC called a PAD (Packet Assembler - Disassembler) which is apparently slanted toward S-100 Bus Computer systems. AEA (Advanced Electronic Applications) announced its TNC at the Hamvention but had no representative on the program.

AEA has a handsome design that looks like something from the TAPR TNC. for a price of about $500. I saw no evidence of the Ashby and Son's at the show but I have missed some. Likewise, I saw no evidence of Bob Richardson's (WAUCH) Radio Snack model 1 and 3 program, but it was respectfully mentioned by Gil Boehm from GLB. It seems that since Bob and Gil are neighbors, they regularly communicate on program design questions but developed their programs independently.

Gil defended the GLB's Spartan design by stating that he Value Engineered the problem to strike an economical compromise in hardware vs. software trade-offs and decide whether to add audio shaping and filtering to the PK-1. He was challenged by a later AMRAD speaker who felt that the five bucks the filter would have cost would be a cheap 1.5 dB improvement if one were working satellites. Later when Gil answered a question about whether the TP-1 would run 300 Baud for HF operation, he answered both points when he stated that its design goal just didn't include those applications.

There is no absolute answer to the question, "Which is better, the GLB or the TAPR?" It depends for which use the TNC is intended. For the benefit of you who have not been following this discussion, the following salient differences exist between the two.

The TAPR TNC costs approximately $250.00 in kit form, has an optional cabinet for about $70.00, runs Vancouver and AX.25 protocol and runs on 120 V Acc. The TAPR documentation is complete and adequate to support the PK-1 and its many features. The TAPR hardware was designed for flexibility in order to enable as many conceivable modifications as possible so that it could be used for other applications. It has a socket for an external modem in case one is impatient with 1200 Baud, or just wants to try external hardware. It uses audio filtering and decodes the RS-232-DI headers. As already mentioned, with the GLB you roll your own if you want audio filtering or shaping. If you run out of Packet things to do with the TAPR TNC, you can get the EPROM programmer from TAPR, plug it into the socket provided on the TNC and do your own thing. These functions are simply not part of the requirements in the GLB design concept. (Like a friend of mine said, "if you want the Penguin to fly you should have included it in the spec).

The GLB documentation has come a long way since I bought mine. It is now 35 typewritten pages bound looseleaf between a couple of nice blue covers, with a command cross reference chart printed on the back for easy reference. Also, it now has a schematic! The manual is certainly adequate to support the PK-1 and its many features. The TAPR TNC can be made to operate the radio side from 50 to 1200 Baud half or full duplex while the GLB PK-1 is restricted to 600 and 1200 Baud, half duplex. NSMS and I experimented with 600 Baud over a noisy path and it didn't seem to be any better than the 1200 Baud speed. So far, I have enjoyed my particular application, using it portable with the Model-100 computer as a

(continued on page 20)
In a demonstration of the flexible design of the spacecraft, the UOSAT-2 mission has been revitalised. The result is that we are now back to where we were on orbit 3 after launch and we have to proceed with the commissioning of the spacecraft and its experiments. We do not yet know whether there are any other 'gremlins' in the spacecraft, nor what the operational implications of the one-board computers for the 'bypass' will be on the planned experiments.

The UOSAT Team would like to thank all those who have given support through the dark passages of the last months and particularly to Bob Leonard and his team at SRI International and to Harold Price (AMSAT/VITA) for providing the necessary software for the DCE at short notice - transferred from California by electronic mail.

MESSAGE HEADERS continued from page 9)

MESSAGE HEADERS continued from page 9)

quite simple: just generate a new header with new dates, including the subject. Let the station doing the forwarding enter some text if desired and then specify the message to be forwarded. The format would be something like this:

```
MSG#: PRO-SDG-840404-01
SUBJ: #20 supplies
TEXT:
```

This is sort of the way that telemail does it.

Good grief! This whole thing is getting out of hand. I was just going to suggest that you stop using this type of format to get a feel for it when sending messages to Lynn. I'm making the assumption that you are a gateway station. Well I guess now that it has grown into a substantial message I'll send it to everyone and see what sort of flaming arrows it draws. I am not familiar with the CCITT MHS so this might look quite different on both parts of it. This is based on the suggestion by Tom Clark with my own bias and thought thrown in for good measure. Again, it is my intent to try using something just to help figure out what it is we really want when this whole thing is finally automated. This message is actually a bad choice for an example since it only to the people with direct access to this medium. I suggest this header only for messages that travel outside to people who are not potential 'gateways'.

CAPRA (Chicago Area Packet Radio Association) has become the first TAPR-affiliated group.

Affiliation provides your local area with a clear, direct line of speedy communications with TAPR. In addition, TAPR can provide you with names, addresses, and etc., of enquirers, TAPR members and kit owners on a semi-regular basis. Further, your club can provide us with a one-page flyer that we can send to others who contact us from your area.

TAPR desires to see strong, local packet organisations flourish in the true spirit of Amateur radio. Affiliation may help us assist you in achieving this goal.

Affiliation provides your local area with a clear, direct line of speedy communications with TAPR. TAPR has available parts kits for most of these modifications. Just send your name, callsign, mailing address, TNC serial number and a check or money order for the amounts listed below to the TAPR PO Box marked "ATTN: Modem Parts Kits".

Improved Sensitivity Mod Kit $ 5.00

300 Baud Mod Kit (Kit TNC) 5.00

300 Baud Mod Kit (Beta) 2.00

Note: The Kit TNC 300 Baud kit contains a new header U34, plus new C20, C21, C22, R44, R45, R46 and R47 to provide a complete 300 Baud plug-in assembly.

Please do not include any correspondence not directly related to your parts order; TAPR has volunteers at various locations performing these services, so including unrelated items will only cause delay in taking action on (or perhaps loss of) the other information.

Credits

The improved sensitivity and 300 baud demodulator mods are a result of extensive investigations conducted by Eric Gustafson, N7CL. The filter resistor mods are due to the efforts of Dan Morrison, K77B, and Margaret Morrison, K77D.

In addition, TAPR would like to thank all who have been assisting in the testing of these modem enhancements.

From the mailbox: The first PA-PA (the Netherlands) packet radio QSO took place on April 23, 1984 on 144.625 MHz at 1200 at 1800 GMT between PABHYS and PA3BNG.

OSCAR-10 LINKING continued from page 6)
without having to worry about a timer circuit. The delay is a little short, on the order of 5 to 10 seconds, but it seems to work quite well on the 8 inch drives.

Mike

Display Message (Serial number): 1728

Message #1728 To: ALL From: W3IWI
Subject: Hello Via Oscar-10 Satellite
-- Entered: 10:25 AM 1 Apr 84

(The message that I entered above was displayed)

Display Message (Serial number): 1728

The message that I entered above was displayed)

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The message that I entered above was displayed)
George, WD4BRF, sent me the default beacon every 10 seconds. I then switched in attenuation until I got about 50% copy on an average of about 24 packets.

Then the modifications were made and more attenuation was added until I got the same 50% copy. On one board I gained 4 dB and on the other about 2 dB.

Adjustment of the XR2211 center frequency was the most difficult part of the job. On the Beta boards the 1700 Hz calibration routine does not work very well (this is a hardware problem cured on the kit TNC and included in the Beta upgrade kit). I used the procedures outlined in the January 1984 PSR.

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The officers of the Tucson Amateur Packet Radio Corporation are:

Lyle Johnson .... WA7GXD ... President
Heather Johnson .. N7DZU .... Secretary
Chuck Green ..... N0AD1 .... Treasurer

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The decision on which TNC to buy is a personal one. One has to first determine the function he wishes to perform. Lyle, WA7GXD, put it most succinctly when he commented that the TAPR TNC was intended for the bearded experimenter down in the basement (he sports a handsome bush). On the other hand, Gil claims the GLB PK-1 was not intended to be all things to all people.