

# PACKET



# STATUS

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### President's Corner

by Lyle Johnson, WA7GXD

Since the last PSR I have had the privilege to attend two major meetings.

In late July, AMSAT-UK sponsored a meeting at the University of Surrey, near London, England. A years-in-the-making vacation with my four oldest sons and my wife was winding down in Europe and we took the opportunity to attend most of the four-day event.

Virtually every aspect of the Amateur Satellite program was covered in presentations by a number of folks from all over the world. I don't remember any Australians, but the other five inhabited continents were well represented.

Packet radio was very much a centerpiece of proposed satellite programs.

Sometime late in 1990, the Soviet Union will launch an earth resources satellite with an Amateur payload aboard. RS14 will include the RUDAK-2 experiment, developed by the German group whose RUDAK-1 experiment was included in the AO-13 launch. RUDAK-2 includes a number of digital modes and also marries DSP technology to the system to allow for very flexible configurations. This should prove to be a very interesting satellite!

If you ever have the chance to go to the UK in late July, make an effort to attend the AMSAT-UK Colloquium. It is definitely worth the effort.

In late September, the Ninth ARRL/CRRL Computer Networking Conference was held in London, Ontario, Canada. Just as the satellite conference had a large percentage of packet radio, the networking conference had a large percentage of satellite-related papers.

Now, many of you are not on the satellites and some of you are probably perturbed that I am writing about them here. Please bear with me and consider the following.

It is interesting to note that the adoption of AMRAD's AX.25 protocol as a "standard" was done in Washington, D.C., in October, 1982. The pressure point was the imminent launch of Phase 3B (becoming Oscar 10 after launch). This satellite would have an international footprint, and some standardization of packet protocol was necessary to allow various packet stations to communicate. Prior to this time, most packeteers (maybe 200 worldwide) were running "Vancouver" protocol with "San Francisco" modifications. A more flexible protocol was needed. TAPR was preparing to implement a dynamic addressing protocol. It, too, would have had a problem addressing a global community. The driving force that caused us all to work toward a standard solution was a satellite.

Now, the limited bandwidth of the MicroSats are driving a broadcast protocol. Such a protocol is needed on terrestrial links as well — just listen to the chaos just above 14.1 MHz as the auto-forwarding BBS's try and get packets through. Once again, satellite-driven needs may be providing solutions for all of us.

## Back to the Conference

A number of interesting papers were presented, and more were published. There seems to be some focus on improving HF digital operations. W7GHN presents a paper on a new scheme he dubs "Clover." It uses precise frequency control and DSP techniques to achieve very narrow band operation with adaptive signaling techniques to battle QRN. Other papers included digitized speech with high quality at 2400 bps and forward error correcting codes to reduce retries. High-speed interface cards for the IBM PC bus, advances in the KA9Q TCP/IP software package and position location by using GPS satellites are also included.

The Proceedings are available from the ARRL for \$12. Worth every penny.

## Elections

In this issue of PSR is a call for nominations for the TAPR Board of Directors. Five seats are up for grabs. We need folks with organizational expertise even more than we need techies on the Board at this time. Twist a few arms and submit a name or two. If you can help, submit your own name. Get involved!

Until January,

Happy Packeting!

## TAPR 1991 Annual Meeting

The 1991 annual membership meeting of Tucson Amateur Packet Radio will be held in Tucson on Saturday, March 2 and Sunday, March 3. Additional details will appear in the January issue of *Packet Status Register* and in bulletins through the packet BBS network and on CompuServe.

## TAPR Board of Directors Election

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

TAPR is governed by a 15 member Board of Directors. Each member of the Board serves a three year term, hence there are 5 positions to be filled each year. Board members are expected to attend the annual Board Meeting, normally held in Tucson in conjunction with the annual TAPR Membership Meeting. They participate in the decision-making process and provide guidance to the officers. They receive no pay and must defray their own expenses to attend meetings. Board members should be prepared to be active in the continuing board deliberations, which are conducted privately in a special conference session on CompuServe. Active participation in TAPR activities by board members is important to the furtherance of the objectives of TAPR. The officers of TAPR are elected by members of the board at the annual Board of Directors meeting.

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

Franklin Antonio, N6NKF	1992
Mike Brock, WB6HHV	1991 *
Tom Clark, W3IWI	1993
Pete Eaton, WB9FLW	1993
Andy Freeborn, N0CCZ	1991 *
Bdale Garbee, N3EUA	1992
Steve Goode, K9NG	1992
Eric Gustafson, N7CL	1992
Skip Hansen, WB6YMH	1991 *
Lyle Johnson, WA7GXD	1992

Phil Kam, KA9Q	1991 *
Don Lemley, N4PCR	1993
Dan Morrison, KV7B	1991 *
Harold Price, NK6K	1993
Dave Toth, VE3GYQ	1993

Nominations are now open for the seats expiring in February 1991 (marked with an asterisk).

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

Nominations and biographical sketches should be submitted to the TAPR office no later than 1 December 1990.

Ballots will accompany the January issue of *PSR* or will be mailed directly to the membership. Results will be announced at the annual TAPR Membership Meeting in March 1991.

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## 9600 BPS FAX Test Results

by Jeff King, WB8WKA

Between 7/25/90 and 8/6/90, the amateur radio stations of WB8WKA and WA8OOH tested a "V.29 FAX modem" chip, the Yamaha 7109, between their respective packet radio stations. Distances involved were about 7-8 miles over urban terrain. Results were quite positive with respect to the performance of the radio link.

### Radio Equipment

Equipment and power levels used are shown in the figure. Additional

WA8OOH Livonia MI ICOM 28A (5 watts)	WB8WKA Farmington MI Kenwood 7950+amp (160watts) GLB TNC2A NOS on IBM AT
MFJ 1270 TNC MSYS V1.08 on IBM AT	

radios were also tested. At WA8OOH, good results were also obtained with a 215 Kenwood HT at 200-300 milliwatts. A Kenwood 7730 was also tested with very poor results. Past experience with this radio and the failure of any PL to function correctly on it may need further investigation.

At WB8WKA, tests were also run at power levels less than 160 watts with excellent results, but due to the sharing of the radio with one of the Detroit/Windsor TCP/IP LANs, running lower power full time was not practical. In addition, an ICOM 2AT was tested at 100mw with excellent results.

Signal strengths at both stations were full scale, even at lower power levels. The antenna used at WB8WKA consisted of a AEA ISOPOLE at 50' while at WA8OOH we had a Hustler G7 at 20 feet. All tests were conducted on 2 meters.

### Throughput

As was to be expected, throughput took a dramatic step up. About one megabyte of files were moved via TCP/IP, with the throughput hovering around 100 bytes/sec. While this is certainly nowhere near "9600 baud," it was a significant jump over earlier

TCP/IP testing at 1200 baud. It is thought that there may be some incompatibilities between MSYS TCP/IP and net/nos. Tests will be run later this week between two MSYS stations to see if this figure can be improved upon.

In AX.25 operations, ("user" to bbs) operation was, simply put, a dream. By using the "XF" command in MSYS, full packets were transferred. Setting "X22" allowed a full screen to be transferred at a time. Throughput was about 1 page a second, which worked out to be about 6000-8000 bits per second. From a "user" perspective (I was the user in this case) it made operating the BBS much more enjoyable. Since many of the LAN's in the southeast Michigan area are crowded, the additional speed did not go to waste.

If I may quote WA4DSY, "Oh where, oh where is my HIGH SPEED DIGITAL?" What this means of course, is that we were not able to fully exercise the modems due to MSYS and/or our TNC's not being able to go beyond 9600 baud. The TNC's were modified for 19200 baud operations but we experienced dropped characters. In any type of KISS operation, it is important for maximum throughput that your DATA link (async link) be at least twice as fast as your radio link. As we were not able to achieve this, then our hope is that much faster throughput can be obtained.

### General Impressions

Audio setup is much more critical. Tones will tend to sound undermodulated. In addition to audio setup, a "keyup delay" circuit must be setup as well. This is due to the fact that these modems send a "training sequence" upon keyup. This must be held off until the radio is fully keyed up (generally 100-200ms). Once these parameters are set up, things seem to be fairly stable and the modems can be relied upon in day to day operations.

### Improvements

An easier method for tuneup needs to be developed. If possible, mounting inside the TNC would also help. Current carrier detect in the Yamaha chip is useless. We have been unable to get the state machine DCD to work on this chip but it is needed. Current layout

uses +/-5V, this needs to go. It should run on only +5V. Also, it needs a programming header and mode select DIP switch.

Existing PC (a carbon copy of the PRUG circuit board) needs to be improved. Quite a bit of digital noise exists on this chip and a re-layout of the PC board would help greatly.

### Thoughts

While my original idea of the use of this modem was "networking," more and more, I am beginning to feel this will be the next step for the end user. In many applications such as the DX cluster, TCP/IP, and BBS operation, the increase of speed on the user LAN, is becoming more important. While this modem should be a fine performer on our "network backbones," the ease of implementation and the fact that IT CAN BE USED ON EXISTING RADIOS UNMODIFIED should be quite appealing for the amateur that wishes to increase LAN throughput.

### What's Next?

In the next week or two, I need to re-layout the circuit board to include the improvements I have found. In addition, I DESPERATELY need schematics for TNC's. I have schematics so far for the TNC1, TNC2, PK232 and DRS1. If you have schematics for any other TNC, PLEASE send a copy to the address below:

Jeff King WB8WKA  
22816 Maple Ave  
Farmington, MI 48336

Also, if you would like copies of the article describing this chip, please send a SASE to me at the above address.

### Beta Test

So far, about 16 people have expressed interest in participating in a beta test of this modem. What this basically means, is that we will all get together and make a group buy of parts and such to reduce our costs. In addition of course, to the sharing of information that a beta test implies. With a professionally done PC board and all parts I expect costs to be on the order of 60-70 dollars. This is assuming we can get a decent discount of the YM7109 (fax chip) as it alone goes for \$55!

# FAX Modems and Packet Radio

by Lyle Johnson, WA7GXD

## Background

There has been a lot of interest expressed in recent months about faster-than-1200 bps operation of packet on 2 meters.

Kantronics pioneered in the faster-than-1200 bps area commercially when they offered the KPC-2400, a 2400 bps QPSK modem system as part of their KPC line. This didn't gain wide acceptance, although MFJ has now joined the fray with a "turbo" option for their TNCs. Like the Kantronics, this is based on an Exar QPSK chip.

More recently, Japan's Packet Radio User's Group (PRUG) has been experimenting with V.29 FAX modems for the past couple of years. The Pacific Packet Radio Society (PPRS) ran an experiment using these modems in the San Francisco area several years ago.

V.29 is an international standard that specifies a method to send data at 9600 bps over the standard telephone network in a half-duplex fashion. It is this standard that is implemented in virtually all of today's FAX machines. Part of the interest in adapting these modems to packet use lies in the fact the FAX market has mushroomed, making single-chip modems for V.29 widely available at reasonable prices.

Other experimenters have eschewed V.29 and made use of direct FSK systems. Most of this work is based on efforts made by Steve Goode, K9NG, and reported several years ago. The most recent incarnation of Steve's system is the G3RUH modem which is becoming quite common.

The advantage of a FAX modem approach is that no modifications are needed to your radio. You simply attach it to your TNC as you would any other TNC modem and you are ready. The direct FSK systems require connections to the modulator and demodulator inside the radio, bypassing the audio circuits, deviation limiters, and so forth. In other words, you have to take the covers off, do

some work and have access to some test equipment.

## A Little Analysis

With a number of you asking me about this technology, I thought I would perform some simple analyses and report to all of you via this issue of PSR.

Most radios in common use on 2 meter packet seem to take around 300 mSec to key up and stabilize, and have the other station's radio detect your signal and also stabilize. This corresponds to a setting of TXD 30 on a TNC 2.

V.29 FAX modems require a 253 mSec keyup period beyond the radio's in order to send a special "training sequence" which the receiving FAX chip uses to synchronize and match itself to the radio channel (including the radio transmit and receive filters) response. This adaptive equalizing is what allows these chips to work with almost any radio.

A direct FSK system, on the other hand, requires you to get the radio system properly matched up. As a result, it needs only a few mSec to get the "scrambler" synchronized.

1200 bps and 2400 bps systems likewise only need a few mSec to get synchronized to the incoming signal.

I wrote a spreadsheet to analyze radio performance making the following assumptions:

- 1) A prioritized ACK would be sent at the conclusion of an originating frame;
- 2) No delays for random backoff are considered;
- 3) No data is piggybacked onto the ACK (RESPTIME 0 in a TNC 2);
- 4) No digipeaters are in the path.

Three different data sizes were considered: 1 single frame with an 80-byte data field, a single frame with a 256-byte data field, and a maxframe 7 transmission with all data fields equal to 256 bytes. This corresponds to a typi-

cal keyboard-to-keyboard user, a file transfer scenario, and something in between.

I also ran this same set of data with radios that turnaround in 40 mSec (most 2 meter multimodes, such as the Kenwood TS-711A, meet this requirement) and again with radios that turnaround in 10 mSec (like the Kantronics DVR).

The FAX modem chips also offer 4800 and 2400 bps data rates. I have included them in the tables that follow for comparative purposes. Finally, I have included a "ROC" (Rockwell) FAX modem with a fast-train option. While this isn't available as a single-chip yet, it is available as a small PC board assembly.

TABLE 1 - 300 mSec Radios

MODEM	ACK	DATA FIELD		
		80byte	256byte	7*256byte
1200 bps Exar	0.433	0.967	2.14	13.06
2400 bps QPSK	0.377	0.643	1.23	6.69
2400 bps FAX	0.449	0.715	1.30	6.76
4800 bps FAX	0.403	0.537	0.83	3.56
9600 bps FAX	0.592	0.658	0.81	2.17
9600 bps FSK	0.334	0.401	0.55	1.91
9600 bps ROC	0.365	0.432	0.58	1.94

See Table 1. With a slow radio sending short frames, such as in a keyboard QSO, the variation in performance is no more than 50% better than 1200 bps. The fastest method (9600 FSK) would take 0.73 seconds (.334 + .401) compared to 1.4 seconds (.433 + .967) at 1200 bps. The 9600 bps FAX modem takes 1.25 seconds, hardly an improvement over 1200 bps at all.

At the other extreme, file transfer, 1200 bps takes 13.5 seconds while direct FSK takes 2.2 seconds - 6 times faster! The FAX modem takes 2.75 seconds, which isn't much worse than the FSK case.

The 4800 bps FAX mode is better at keyboard QSOs than the 9600 bps mode (!) but falls off as the frames get longer, taking nearly 4 seconds to send a file and get an ACK.

Finally, the Rockwell modem is nearly as fast as the direct FSK in all cases.

What happens if we have a faster radio? Let's look at the 40 mSec (multimode radio class) case; see Table 2.

**TABLE 2 - 40 mSec Radios**

MODEM	ACK	DATA FIELD		
		80byte	256byte	7*256byte
1200 bps Exar	0.173	0.707	1.88	12.80
2400 bps QPSK	0.117	0.383	0.97	6.43
2400 bps FAX	0.189	0.455	1.04	6.50
4800 bps FAX	0.143	0.277	0.57	3.30
9600 bps FAX	0.332	0.399	0.55	1.91
9600 bps FSK	0.074	0.141	0.29	1.65
9600 bps ROC	0.105	0.172	0.32	1.68

**TABLE 3 - 10 mSec Radios**

MODEM	ACK	DATA FIELD		
		80byte	256byte	7*256byte
1200 bps Exar	0.163	0.677	1.85	12.77
2400 bps QPSK	0.087	0.353	0.94	6.40
2400 bps FAX	0.159	0.425	1.01	6.47
4800 bps FAX	0.113	0.247	0.54	3.27
9600 bps FAX	0.302	0.369	0.52	1.88
9600 bps FSK	0.044	0.111	0.26	1.62
9600 bps ROC	0.075	0.142	0.29	1.65

As might be expected, the 1200 bps case shows little difference when transferring files, while all 9600 bps methods show little variation amongst themselves with large blocks of data.

The direct FSK system is faster in all cases, again with the Rockwell system a close second.

A 9600 FAX modem system needs 0.73 seconds for a keyboard transmission and ACK, a 1200 bps system needs 0.88 seconds. The best to worst ratio is now 7.7, compared to 6 with the slower radios.

Moving on to a 10 mSec radio system, we get the results in Table 3.

These results are almost the same as with the 40 mSec radios. The biggest difference here is in the use of direct FSK for keyboard QSOs. An exchange would only take 0.155 seconds. We could get almost nine QSOs crammed in the same 1.4 seconds our present system with 300 mSec radios at 1200 bps takes for a single exchange!

To get a better idea of what radio turnaround time buys us with fast radios (or costs us with our present clunkers), let's look at Table 4.

**Table 4 - 1200 bps, 2400 bps and 9600 FAX with Various Radios**

MODEM	1200 bps Exar		2400 bps QPSK		9600 bps FAX	
	80EX	256*7EX	80EX	256*7EX	80EX	267*7EX
RADIO SPEED						
10 mSec	0.84	12.93	0.44	6.49	0.67	2.18
40 mSec	0.88	12.97	0.50	6.55	0.73	2.24
300 mSec	1.40	13.49	1.02	7.07	1.25	2.76

The 80EX means 80 byte info exchange (includes ACK); the 256\*7EX means a maxframe, maximum length packet with ACK.

We can see from this that slow data isn't hurt too badly by a slow radio if we are sending long files, but it costs us a lot if we are sending short bursts. In the 1200 bps case, the slow radio costs us 100% more time, but only 3% more when sending files.

In fact, faster radios would buy us about double at any data rate with the modems under consideration.

At the other end of the data spectrum, sending files, the slow radio costs us 26% with the FAX modem.

**Closing Thoughts**

If the 9600 FAX modem is better in all cases, should this become a new "standard" for TNC's?

If life were really this simple, it might. But there are four things that detract from using it.

The first is cost. The FAX modem chip that is presently the least expensive is the Yamaha YM7109C. It costs around \$40 in small to medium quantities. Contrast this to the \$10 cost of a typical 1200 bps modem, and you get a net increase in cost to manufacture of about \$30. This would translate to a

retail price increase of \$50 to \$90. Thus, your \$129 TNC would cost more like \$199.

The second is compatibility. There are hundreds of thousands of TNCs in the world today, and almost every one of them runs 1200 bps (A)FSK. The FAX modem chip has no compatible mode. Further, to run the FAX chip in any mode but V.29 9600 bps requires a microprocessor to be hung on the FAX chip's bus, further complicating things (meaning more money).

The third is the S/N ratio required for the FAX chip to work. Most 1200 bps systems will work with a SINAD (roughly S/N at the audio output jack of the radio) of 18 to 20 dB. The FAX modem chip requires 22 dB for a usable bit error rate. There is no free lunch, as they say.

The fourth is DCD operation. Some sort of tone detector may be needed to indicate the presence of the V.29 1700 Hz carrier. Otherwise, the 253 mSec training time would leave a 253 mSec hole in our DCD ability, which would mean a large number of collisions, reducing throughput. V.29 modems are expecting a private telephone line, not a shared radio channel, and their DCD is not suitable for radio use.

Still, the advantages of sending data faster, perhaps being usable through voice repeaters, and the multi-path resistance of FM might make such a modem attractive to many packeteers.

**R.S.V.P.**

TAPR could make a kit to add into a TNC 2 or similar unit. Such a kit might cost \$80 to \$90 to purchase. If you think this would appeal to you, let the office know. Who knows? V.29 may be a viable means to get faster operation on crowded channels....

## Thoughts on a Dream Amateur Packet Network Trunk

by Jack Taylor, N700

For some time, I have been pondering on the subject of packet network expansion. Our user applications seem to be growing faster than the networks' capability to handle them. Progress is being made in some parts of the country though. The northwest has an extensive 220 MHz 1200 baud simplex backbone in place covering Montana, Idaho, Washington and Oregon. A few other states have made substantial backbone upgrades as well. Perhaps the most significant improvement is seen in the northeast. The plan of attack there has been to avoid the typical "hidden transmitter syndrome" by cross-banding on each of their backbone nodes. They claim a 5-fold improvement in thruput, even at 1200 baud, with this technique. However, as the complexity goes up, so does the expense.

Locally (Arizona) our user base is fairly stable in overall numbers. If we put out a call for money, we can possibly collect \$1,000 if the plea sounds reasonable. But to install a 56k baud backbone trunk across the state, there is little chance our local resources would be sufficient to fund this type of effort. Additionally, we have problems at VHF/UHF in being able to coordinate wide channel frequencies necessary to support the higher baud rates. Some of our sites have over 300 transmitters in the vicinity which leads to unresolvable problems with desense and intermod. Even if we had a wide band trunk with high speed PS-186 switches, this type of environment would have an adverse effect on network thruput.

Given these circumstances, attention then is shifted to the possibilities of using amateur microwave spectrum for packet network development. We know intuitively this would be even more expensive and complex than assembling a VHF/UHF backbone trunk. But is it? We also know, that in the long run, the wide channels available at microwave frequencies will be required to satisfy the 1.25 Mbps streams

necessary to support anticipated growth. It would thus seem feasible to explore in detail the pros and cons of developing an amateur high speed microwave packet trunking network.

Assuming our amateur digital technology is pushing the state of the art, the possibility exists that federal and private grants might be available to help fund network development. Even if it isn't state of the art, it is possible that grants could be obtained from the Federal Emergency Management Agency (FEMA). FEMA has available a variety of programs which makes available assistance in the form of matching funds, or in some cases, 100% outright grants. To qualify, the local packet group would have to be closely affiliated with its state Civil Defense organization. This approach would also be politically desirable for the amateur community in general. If Civil Defense/RACES offices had access to state or area wide packet networks in times of emergency, it would, as a minimum, justify retention of appropriate amateur VHF/UHF/microwave bands.

To further explore these thoughts, a conference on Dream Networking was held in Tucson on the 25th of August. In attendance were interested members of the Arizona Packet Radio Association (AZPRA). Rich Ide, N7LDI related his experience with IBM where it was much easier to obtain surplus parts donated from the company, than it was to receive actual cash for approved projects. Morgan Hoaglin, WW7B reported as Red Cross Communications Officer; he was in the process of setting up a BBS which would have land line access to the Arizona Red Cross office in Phoenix.

AZPRA Technical Director Brian Cassel, W5VBO presented a paper outlining his ideas on the topic of "The DREAM Amateur Packet Radio System". He stressed the following (paraphrased) points:

- 1) Network goals must conform to funding.
- 2) The amount of funding will depend on the extent the network idea is "sold."
- 3) The network could be sold as:

a) **Emergency Backup.** Long distance carriers are working to cut over to fiber optic transmission systems within the next two years. Fiber systems are subject to disruption due to earth shifts or terrorist attacks. An amateur network must have capacity to carry high volumes of traffic during emergencies.

b) **Emergency Weather Services.** Off the shelf sensors are now available which, when installed at specified packet nodes, could provide basic weather data to a centralized collection and processing point. This data could be made available to any network user for emergency or personal use.

c) **Microsat Applications.** Evolving microsat technology may soon allow simultaneous "broadcast mode" exchanging of BBS files from orbiting packet satellites. Gateway ground stations could efficiently update all BBS's intertied to the network in specified areas. This system, if implemented, could greatly reduce nationwide BBS to BBS forwarding congestion. Also this technique has significant commercial or 3rd world country applications.

d) **Educational Uses.** With only a licensed operator, TNC and terminal, many educational opportunities exist through the network. Weather and satellite categories could be studied at several levels by different layers of education. Such studies could include: satellite orbiting mechanics, analysis of telemetry, network data studies (MONAX type monitoring), VHF propagation analysis (gathered from NODES broadcasts) and advanced networking concepts. The data from this network could lead to encouraging the establishment of more school and university amateur club stations.

- 4) It can easily be seen that the development of a Dream Network would be of great advantage to many. But the amateur community would also be faced with the challenge of managing and maintaining the system. In addition to the technical challenge, if grant funding were received for network develop-

ment, it would be necessary to collect, maintain and submit documentation at all levels of installation and operation. This may be more of a burden than some areas have the capability to undertake. Obviously if we are to pursue this quest, we will have to do considerable advance planning in all areas of organization, operation, and maintenance if it is to succeed.

Brian further reported that some assets are currently available from one of the commercial companies. Art Marshall, W1FJI said he would coordinate the issuance of a letter from AZPRA stating our interest in establishing an amateur microwave packet network, and indicating our willingness to accept selected donations from these firms. AZPRA would also seek status as an IRS-approved non-profit entity, for obvious reasons. It was agreed before any attempts to obtain network funding, it would be necessary to have a draft network plan in hand. The plan, in addition to network routing, should address the network management issues identified above. It was generally understood that the Dream Network is a long term goal and as such, it would not impact the current AZPRA backbone upgrade projects.

Following the meeting, an additional thought has surfaced. If the long distance firms are phasing out their microwave systems, would there be a chance they might donate their facilities to an amateur group? This would be a coup indeed, if entire networks could be transferred in place to us amateurs! Typically these systems go to the same locations our dream network would cover. There exists a good possibility commercial gear in the 4 and 6 GHz range could be tweaked onto the amateur bands. From a systems viewpoint, it would be very desirable to have a trans-continental network placed in our care, rather than just focusing our attention on the local Arizona scene.

But a national network would require an organization larger than AZPRA to take on this responsibility. The question naturally arises, who? Would TAPR have the resources or the willingness? Possibly. How about the ARRL? Possibly. Even as a gift, the cost of electric and site rents might be

larger than what individual amateur groups would be able to support. Would a government agency be willing to underwrite operational costs for a trial period? Worth looking into. If it should be determined the amateurs could take on this responsibility, how would they go about lobbying for it?

Large companies normally do plan ahead and with only two years before they switch over to the fiber optic system, they probably already have traditional concepts in mind towards disposing of these assets. They certainly don't want to see the equipment fall into the hands of their competitors, so it is quite likely they will scrap it. At this point in time, we don't know for certain whether or not the commercial firms will be unloading complete networks. But if they do, donating it to the amateurs with the understanding it won't be used commercially has good possibilities all the way around. It would seem timeliness is important here and negotiations should be started as soon as possible.

Would it be better if "we" held dialog with FEMA about our plans with the hope they would support us, and in turn, negotiate a transaction with the commercial carriers? These decisions would be up to the national amateur organization, if any, that would be willing to tackle this project.

Meanwhile, AZPRA's best course is to quietly follow-up on getting into a position to receive any network type donations, should they appear.

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## 9th Computer Networking Conference

by Greg Jones, W5IVD

This year's conference was jointly sponsored by the American Radio Relay League and the Canadian Radio Relay League. The conference was held at the London Regional Art Gallery and Museum, in London, Ontario, which provided a very nice facility for the conference. Harry McLean, VE3GRO, started the morning, before 9am (a first?), by welcoming everyone to the conference and went on to say how proud the CRRL was to host this year's network conference in Canada. Paul Rinaldo, W4RI, was introduced

and also welcomed everyone to this year's conference. Paul stressed the importance of having the Network Conference and also made some points about the future of digital communications with respect to how we use our hobby. Paul continued by introducing this year's honorary Sergeant-at-Arms — Dr. Dave "Death" Toth, VE3GYQ. The conference had a very good attendance this year with just over 130 people in attendance. The large majority of amateurs present were from Canada, which was nice to see. The hospitality suite hosted both nights was a good place for everyone to meet and discuss what they were doing and what had happened that day at the conference. There were also a number of rooms Saturday night showing the latest technology in packet radio.

Keith Sproul, WU2Z, started off the conference discussing work on long distance packet mail forwarding via satellite. Keith talked about future planned use of satellites for mail forwarding instead of using slow HF packet. He outlined a solution with two stations in a zone, with one receiving full time and the second roaming to send traffic to other fixed stations over the satellite.

Harold Price, NK6K, presented both his and Jeff Ward's, G0/K8KA, presentations on PACSAT. Jeff was unable to attend. Harold spoke on why their first assumptions on using PACSATs were not correct. The series of five papers discuss and describe the current solution of a broadcast protocol being used currently on UOSAT 14.

Bob McGwier, N4HY, presented an overview of the current RUDAK II design for Hanspeter Juhlen, DK1YQ. Bob showed a number of slides taken on his last trip of RUDAK II and of the people involved. Bob then reported on the latest news concerning various DSP projects. Bob showed the AEA DSP-232 box and the TAPR-AMSAT DSP board. The AEA unit will be a standalone and has over 40 modems currently designed for use. The AEA DSP is based on the Motorola 560001 processor and design will allow users to upload new code into the unit as necessary instead of having to replace EPROMS. Software will be available for people to write their own. The

TAPR-AMSAT board was shown and is based on the TI TMS320C25 and is a XT/AT PC plug-in board. It will have similar software available.

Glenn Elmore, N6GN, presented a technical overview on how the amateur community was utilizing bandwidth and discussed the need for high speed amateur radio network. Kevin Rowett, N6RCE, followed after Glenn and discussed the HubMaster, which they are building as a solution to support higher speed networking.

John Bloom, KE3Z, discussed future thoughts about digital networking. What is a network of the future going to look like? Possibly voice/data networks? These direction and goals need to be thought about to be able to compete with the other concerns who wish to take over our resources in the future. Amateur Radio needs to present a clear plan on what it intends to do in the future.

Armin Langi discussed a system called CELP which is a high-quality speech processing system for packet radio transmission and networking.

W. Kinsner, VE4WK, discussed his paper on forward error correction for packet radio. The paper is very good and should be read.

Don Lemley, N4PCR, discussed the problems associated with current networking and talked about the need for faster digital networking, software, and radios for such networks to be available. The PackeTen project is a digital hardware and software networking solution which will allow compatibility with the standards today and allow for some type of transition in the future.

After lunch, Phil Anderson, W0XI, spoke about both 9600 baud operations of the G3RUH with the Kantronics Data Engine and DVR2-2. Phil also discussed BPQ Node working in an enhanced network.

Tom Clark, W3IWI, first discussed future HF operations and solutions with the almost available DSP products to implement different encoding and modulation schemes to have better HF digital operations. Examples of modulation schemes could be Multi-Tone, QPSK, or QAM. Second, Tom talked about how current

message transfer protocols are inadequate and thus cause massive amounts of extra congestion. Tom discussed a new file transfer protocol which would allow for a more efficient and robust method for transfer on HF. Tom finished up talking about his recommendation for handling broadcast bulletins on VHF, which he calls BULLPRO.

Dwayne Hendricks, WA8DZP, discussed current development of TCP/IP in the Mac environment. Dwayne talked about the future of having this capability available in the new Apple Communications environment which will be available in System 7.0. This looks to be very promising to Mac TCP/IP users.

Phil Karn, KA9Q, updated work on TCP/IP. Currently no new platforms have been finished, but a few new commands have been worked on by Phil and he has worked on improving operations at higher speeds. Phil continued on with a discussion on his paper talking about MACA (Multiple Access Collision Avoidance).

James Grier presented some work that had been done at the Air Force Institute of Technology concerning the designs for a packet network for the Air Force.

Frank Warren, KB4CYC, finished the afternoon speaking on software he had developed as a utility for NTS work. The Station Traffic System software supported a variety of handy things to help the NTS operator.

The day finished with dinner at "Captain John's and Susie Wong's," a local eatery. Much food and fun was had by all. There is no set location for next year's Network Conference, so hope to see you wherever it may be! Stay tuned as news develops.

## SNS and TPRS Agreement

by Greg Jones, W5IVD

The Texas Packet Radio Society (TPRS) has been working with Southwest Network Services (SNS) to make available to TPRS, circuits to cities in Texas and many other states. The lines now available are 9600 bps, point to point circuits, and our intention is to extend coverage of the TexNet Network to such cities having individuals wanting to support and join in this effort. A few of the cities available outside of Texas are Oklahoma City, Tulsa, Baton Rouge, New Orleans, Birmingham, Atlanta, and Nashville. These circuits are available now. Future cities include Denver, Los Angeles, San Francisco, Phoenix, and more.

TPRS is the sole contact and coordinator for these services. DO NOT attempt to contact SNS or its employees for information on these facilities. Not every location meets all the needed criteria for an amateur packet node (i.e., roof access for antennas), but any amateurs in these or other such locations WHO HAVE A REAL, SERIOUS, HONEST interest in participating are encouraged to write TPRS stating such or you may call Harry Ridenour, NOCCW, at (512) 654-4405 between 1200cdt-2300cdt. Such contacts will NOT be handled by packet. We think this is a great opportunity and hope to be able to get interested groups or club involved.

### Renew Your Membership!

TAPR doesn't send out constant reminders when your membership has expired. Our only way of communicating your expiration date to you, is the date on the address label for this issue. Please check it and renew if required. Your membership is very important.

## FIRST IMPRESSIONS: What is a "First Impression?"

by Lyle Johnson, WA7GXD

Most Amateur Radio journals contain product reviews. In many cases they appear to be carefully worded bits of diplomacy written to avoid the wrath of the advertisers who support the magazine.

To me, a product review should include measured performance and should be conducted by a person qualified to evaluate the product. Many times I have seen reviews in the computer press that go something like this...

"The Foo-Bar C Compiler" by R. E. Viewer

I got a sample copy of the Foo-Bar C compiler and it is really neat. The manuals have lots of pictures and appear to have been printed on a laser printer.

I have only ever programmed in BASIC before, but I wanted to learn C and the Foo-Bar compiler seemed like a good choice to me. I loaded the sample "Hello.world" program and it worked, following the step-by-step instructions.

None of the other examples worked, but this is because I was checking a beta release of the compiler. Foo-Bar assures me that the real version won't have any bugs. The Foo-Bar compiler supports a mouse and I think Foo-Bar has a great product. I strongly recommend the Foo-Bar compiler for anyone who wants a C compiler for their computer.

Such reviews are a complete waste of paper in my opinion.

In some Amateur journals I have seen reviews of transceivers by Novice licensees. Now, a Novice, by definition, hasn't had much experience in the field. It is useful to get a newcomer to assist in a review to see if the manuals are written so that a non-experienced person can correctly set up and safely operate the item being tested. However, the actual review should be done by someone experienced in the product area and the equipment should be

thoroughly exercised in its intended environment and for its intended use.

I think TAPR can serve the packet community by doing careful product reviews on equipment unique to our mode.

Product reviews aside, I also think it is useful for Amateurs to be aware of new products in a less formal context. It is with this in mind that I have written a couple of "First Impressions" for this issue of PSR.

First Impressions seeks to provide a look at a product by "kicking the tires, slamming the doors and peeking under the hood."

Products will be compared with similar products to give the reader a feel for the device in a context to which (s)he can relate.

A (hopefully) valuable section of the First Impression will be a sub-section entitled "Product Pointers."

Recommendations will not be made as to who should purchase this device or why it is the best widget since corn flakes. Keep in mind that an exhaustive analysis is impossible. Impressions are subjective rather than analytically objective. Negative statements do not necessarily mean that a product is bad.

### Product Pointers

This section will include "gotchas" and observations of differences in the product from that which a user might have come to expect while using similar products.

In particular, information will be included here to clarify features or functions of the product that might otherwise cause confusion or frustration.

### Conclusion

I would greatly appreciate feedback from as many of you as care to write to me. There are two First Impressions in this issue of PSR. I would like to know if you find the information useful, the format adequate, what improvements you would like to see in the format, suggestions, etc.

Please let me know through the TAPR office address. Don't send it via the packet network as this could be construed as conducting business! Thank you.

## FIRST IMPRESSIONS: PacComm PSK-1 PSK Modem

by Lyle Johnson, WA7GXD

PacComm, through Digital Signal Systems, is the first licensee of the TAPR PSK modem. PSK (phase shift keying), due to its improved performance in weak signal environments, is used on a number of amateur satellites. In addition, Amateurs in various places are using PSK on HF and reporting improved performance over FSK techniques.

### Background

FO-12, launched in 1986 and in service until late 1989, pioneered the use of 1200 bps PSK satellite communication in Amateur radio. The TAPR PSK modem design is based on a design from the JAMSAT FO-12 team.

The satellite designers chose PSK as the modulation format due to the inherently greater efficiency of PSK as a simple modulation technique.

In fairness, it should be pointed out that the 20 to 25 dB improvements of "PSK versus FSK" quoted several years ago from some sources were comparing AFSK/FM (standard 2-meter packet practice) to PSK through a linear (SSB) system. This was an apples-and-oranges situation, because a PSK modem run through an FM transceiver will be markedly worse in terms of weak signal performance than a pure PSK system.

UO-14, for example, uses a pure FSK system at 9600 bps and is working quite well in the Amateur Satellite Service.

DO-17 (DOVE) uses AFSK/FM on 145.825 MHz. It is pretty easy to compare the results of copying a DOVE pass versus copying a PSK-based MicroSat pass (PSK wins).

Until the PSK-1, you had three choices for obtaining a PSK modem: buy a kit from TAPR, buy a kit from G3RUH, or home-brew one. The Costas Loop design used in the TAPR system is theoretically capable of 3-6 dB better weak signal performance than the squaring loop used in the other design.

## Design Features

The PSK-1 offers a number of new features in the PSK modem design:

- 1) AGC to improve tolerance of the demodulator to widely varying signal strengths.
- 2) Internal microprocessor to allow setup re-configuration.
- 3) Capability to demodulate and decode 400 bps PSK telemetry frames from AO-10 and AO-13 spacecraft.
- 4) Front panel diagnostics via multiple LED display.
- 5) Setup can be changed through a rear-panel serial port or via two buttons on the front panel.

## Common Features with Other PSK Modems

- 1) Automatic doppler tracking of the received signal.
- 2) Tuning display to make it easier to acquire the satellite (or other PSK) signal.
- 3) Ability to bypass the PSK modem and re-connect your TNC's (A)FSK modem to your 2-meter radio.
- 4) Selectable polarity of the doppler tracking output.

## Front Panel

The PSK-1 front panel consists of a Power LED to indicate power is on, a bargraph display for tuning, a LOCK LED to indicate that the PSK demodulator has achieved synchronization with the received signal, and UP and DOWN LED's to indicate the direction you should tune your radio (or the direction it is tuning your radio) to track the received signal. This latter is used for tracking doppler shift at 70 cm when receiving satellite signals.

## Rear Panel

The rear panel has VHF and UHF radio 5-pin DIN connectors, an 8-pin DIN modem disconnect, power jack, an 8-pin mini-DIN serial port connector for commanding the PSK-1 and monitoring 400 bps telemetry, and a power switch.

## General Impressions

The PSK-1 comes with a complete set of cables and connectors for everything but the serial port. I think an

unterminated connector for this port would be useful for most Amateurs and expected to have found one in the box. Spares for all the connectors except this one are readily available through sources such as Radio Shack.

The IC's are socketed (I personally like this for troubleshooting purposes).

I have interfaced the PSK-1 to a TAPR TNC 1, TAPR TNC 2, AEA PK-232 with TAPR modem disconnect, and a Kantronics Data Engine to verify the modem disconnect and bypass mode functions. It works well in analog loopback mode, demodulating its own PSK signals over a wide range of input signal levels.

My satellite antennas are presently out of commission, so I had to decode satellite passes with a simple 70 cm dipole antenna clamped to my window frame. I was actually able to decode a few frames with this lash-up! Hopefully, this situation will be rectified before the next PSR deadline and I can give you an update on performance "on the air."

The unit I received would not respond to front panel switch commands, but worked OK when commanded through the serial port. A few hours spent with the unit with an oscilloscope, DVM, using the PSK-1's internal debugger, etc., revealed the problem to be mechanical in nature. The fix is outlined in Product Pointer Number 5, below.

Once operational, the front panel control system is quite simple to operate. Pressing the button labeled "FUNCTION" activates the left-most tuning indicator LED. A label beneath this LED indicates the "MODE" function has been selected. Choices for MODE are "SAT" "PSK" or "400." A second LED will flash over one of the these three labels, indicating the current MODE. Repeatedly pressing the "SELECT" button will then step the flashing LED through the available choices. Simply stop pressing when the MODE you desire is flashing. Pressing the "FUNCTION" button again will move the indicator to the "MODEM" position, where the flashing LED may be placed to select "IN" or "OUT." Joint/Split and AFC options may similarly be configured. When no input has been received from

either button for a few seconds, the display will revert back to its normal function of tuning indication.

## Product Pointers

While doing the interfacing, I ran into a few "gotchas" that I will point out in the hope it will save you some problems.

- 1) Unlike the TAPR design, power must be on if the PSK-1 is attached to your TNC and you wish to operate your TNC in any mode. This is true even if you are not using the PSK-1.

The TAPR unit uses physical switches to route the modem disconnect intercepted RXD and DCD signals, as well as to route the radio connector audio signals. Thus, power can be removed when the TAPR PSK modem is bypassed.

The PSK-1 uses CMOS switches under control of the internal microprocessor. Therefore, power must be applied to the PSK-1 if it is cabled to your TNC.

- 2) The transmit circuit requires a x8, x16 or x32 clock to generate "manchester" transmissions to the various satellites. The proper clock selection must be made for the satellite to be able to decode your transmission. This option is not selectable from the PSK-1 front panel or serial port. It is a jumper that must be physically positioned on the PSK-1 PC board.

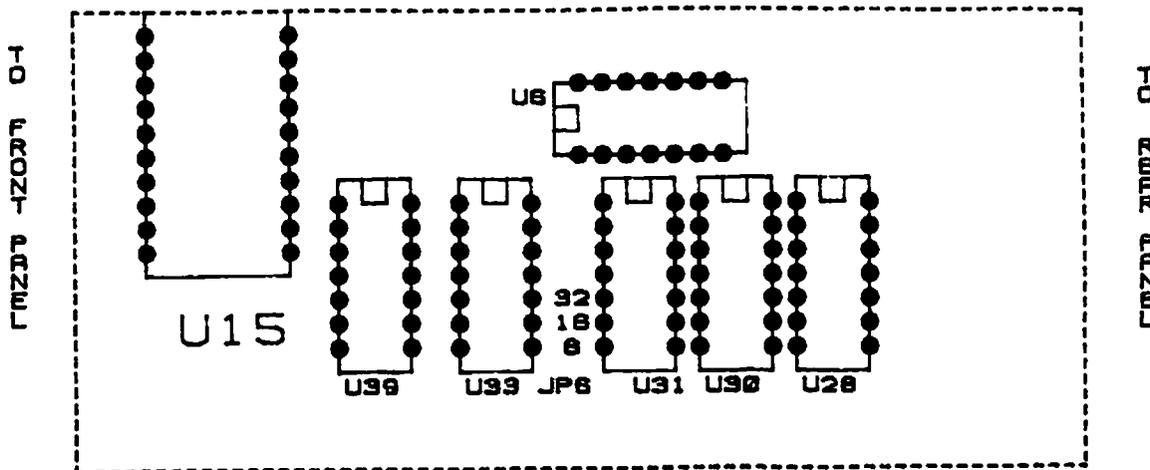
The jumper comes from the factory set for x16. This is suitable for TNC 2-based TNCs such as the MFJ units, PacComm Tiny-2 and Micro-2 and TNC-200s, GLB TNC-2A, AEA PK-80 and TAPR TNC 2.

The x32 position is needed for TAPR TNC 1, Heathkit HD-4040, AEA PKT-1, AEA PK-232, Kantronics Data Engine and other TNCs using an 8530 HDLC chip.

The PSK-1 manual correctly refers you to setting jumper JP6 to pins 5&6 to get x32 operation. Unfortunately, the present manual doesn't show the pinout of the JP6 and it is opposite to what you might intuitively expect.

Refer to the illustration for placement information regarding JP6.

- 3) The unit will not do loopback in "manchester" mode. To do this would



require retuning of the PLL demodulator.

4) The UHF radio connector is not compatible with the TAPR PSK modem!

Unfortunately, the connector is physically identical to the TAPR connector.

It is unlikely that damage will occur if you mix up these cables. It is guaranteed, however, that your system won't work if you use a TAPR cable with the PSK-1 or vice versa.

Most folks don't have both a TAPR and a PacComm PSK modem, but for those that do, and have already wired up a TAPR cable, an adapter cable will sort things out for you. I don't know if PacComm intends on changing the PC layout to correct this incompatibility.

The PSK-1 uses a different method to step the radio. There may be a problem when stepping ICOM radios with this cable, so check your radio manual first! It should work OK with Kenwood and Yaesu radios (radios that use GND or +5 volts to command stepping).

5) The front panel switches...

The front panel switches are very sensitive, and the slightest depression will activate them. The PC board in my unit is smaller than the cabinet by a few ten-thousandths of an inch, allowing it to rattle slightly. The front panel usually exerts slight pressure on a plastic part of the switch, causing it to appear to be activated to the internal microprocessor, which eventually ignores the depression.

The fix was simple. I added a small washer between the front panel and the cabinet's plastic bezel. This spaces the front panel far enough away from the PC board that the switches are free. The front panel selection system now operates flawlessly.

PacComm indicates that future boards will be reconfigured to recess the switches so this will not be a problem.

6) Be sure to read the manual for an important tip when placing the PC board into the case. There is a voltage regulator tab that must slide into a special groove for proper heatsinking. This is found on page 22 in the March 1990 edition of the PSK-1 manual.

## FIRST IMPRESSIONS: Kantronics Data Engine

by Lyle Johnson, WA7GXD

The Kantronics Data Engine is the (digitally) highest-performance TNC currently on the market.

It is based on the NEC V40 microprocessor chip and the Zilog 8530 SCC HDLC controller. It includes 64k bytes of RAM and EPROM standard, and is expandable to 256k bytes of RAM and 768k bytes of ROM using parts available today. The radio HDLC ports are interfaced to the microprocessor using a technique called direct memory access (DMA). This means that an incoming (or outgoing) packet can be received or sent without the microprocessor having to deal with each and every character or byte. The processor only intervenes on a frame-by-frame basis.

What this means to the user is that the Data Engine can loaf along with both radio ports running at 56 kbps. However, unless it is running as a packet switch, there will be problems getting all that data into or out of your PC's asynchronous serial port! The real meaning here is that this TNC shouldn't have a problem running 9600 bps, or even 56 kbps, in your shack.

The Data Engine is modular in concept. The basic TNC is a four-layer "motherboard" into which optional in-

ADAPTER CABLE		
DIN 5-PIN MALE TO PSK-1 UHF	DIN 5-PIN FEMALE TO TAPR PSK CABLE	FUNCTION
1	5	STEP UP
2	2	GND
3	4	RX AUDIO
4		DON'T CONNECT
5	3	STEP DOWN

ternal modems may be installed. It has space for two such modems.

Like most Kantronics products of recent vintage, it allows both radio ports to be operated simultaneously. The unit may thus serve as a "gateway" between the ports.

Unlike other Kantronics offerings, this one is designed around a standard hardware HDLC chip, making modem interfacing a simple task rather than a difficult or impossible chore. See "Interfacing the TAPR PSK Modem to the Kantronics Data Engine" elsewhere in this PSR for an example.

### Design Features

The Data Engine offers the following new ideas to the TNC marketplace:

1) Lots of memory. This gives plenty of space to buffer packets, provide message storage for the "personal mailbox" feature, keep up with new protocol enhancements, etc.

2) Fast HDLC I/O. DMA allows operation at 56 kbps. With careful software design, it may be capable of even faster operation....

3) Plug-in modems. There is no hard-wired modem on the TNC's main PC board.

4) Multi-layer PC board. The Data Engine uses a 4-layer PC board. This contributes to better RF interference characteristics (but is no guarantee of "quiet" operation). There are a couple of other multi-layer boards I am aware of in pocket-size TNCs (from Heath and PacComm) but this is the first "full size" unit to offer this technology.

5) LOAD mode. This allows you to upload user-written software into the Data Engine and exercise it. Primarily useful for software developers.

6) G8BPQ has written code that fits in an EPROM and makes the Data Engine a dual-port packet switch compatible with NET/ROM protocol. The EPROM image for this is available from the Kantronics BBS.

### Other Features

Features the Data Engine shares with other TNCs includes:

1) TAPR-style command set.

2) KISS interface (mostly used with TCP/IP and satellite operation).

### 3) HOST mode.

Kantronics has defined a new host mode and included it in the Data Engine. Until now, only WA8DED EPROMs and AEA products offered this feature. The Kantronics implementation is different than the WA8DED interface, which is in turn different than the AEA interface.

### 4) Radio ports.

The Data Engine uses a 15-pin DA-15S connector. Kantronics consulted with TAPR during the design phase of the Data Engine to maintain compatibility with the proposed radio interface port of the TAPR/AMSAT DSP project.

Along with the modular concept of the Data Engine, a few internal jumpers allow the radio port to be used as a modem disconnect. This makes it relatively straightforward to interface modems that are too bulky to fit internal to the Data Engine. A unit that comes to mind is the GRAPES WA4DSY 56 kbps modem.

I interfaced two different external PSK modems to the DE1200 port. See the article elsewhere in this PSR for more details.

### Front Panel

The front panel of the Data Engine includes a POWER switch and an AUX switch. The latter is for software-definable features.

There are eight (8) LEDs, labeled A1 through A8. They provide the usual PTT, DCD, CON and STA functions under software control. More about these under "General Impressions," below.

There are two "windows" in the front panel to allow internal modems to provide displays, such as bargraph tuning indicators.

### Rear Panel

The rear panel has (radio) PORT 1 and PORT 2 DA-15S connectors, a power connector for +12 vdc input and an 8-pin RJ-series "modular phone jack" style RS232 connector.

The PC board mounted interface connectors are of the shielded variety, and the rear panel cover plate is attached to the shield covers of the connectors.

### General Impressions

The Data Engine comes with an RS-232 cable, unterminated at the computer end. Unfortunately, this cable is not shielded and the connector type isn't shieldable. This port supports hardware flow control and, apart from the connector chosen, is compatible with other TNC serial ports.

A DA-15P connector is provided with each modem. The test unit had a single DE1200 1200 bps FSK modem, so a single shielded DA-15P mating connector was provided, along with a length of shielded cable to interface to a radio.

A power connector with attached red and black wires was provided. This is not a cable, so I had to ty-wrap it into one. The power connector is not the normal 2.5 mm style normally encountered. This connector latches when plugged into the TNC so problems of intermittent or flaky power connections are unlikely.

The default setting of the DE1200 modem (0,HALF,1200) uses the "open squelch" or "sine-wave" DCD circuit. This proved to be reliable when operated with Yaesu FT-208R and a Kenwood TS-711A FM receivers. I didn't perform any measurements regarding DCD response time.

An on-line "help" system provides brief remarks about the various commands and their arguments. This is possible due to the large (1 megabyte) address range of the V40 microprocessor.

Unlike other Kantronics products I have used, all IC's on the Data Engine are socketed. This is not the case with the DE1200, but most of them are socketed on that board as well. As you have probably guessed, I am a firm believer in IC sockets....

### Product Pointers

1) Opening the case and sliding the TNC out is simple. Just loosen the screws on the rear panel and catch it as it slides out. Re-installing it into the case, however, is a bear. The front panel LEDs seem to have a propensity to almost line up (seven out of eight). In the end, you have to remove the front panel, wiggle the LEDs and generally mess around with the unit before the front will co-operate.

To be fair, many TNCs are like this, including the venerable TAPR TNC 2.

2) If you have to reset the unit by disconnecting the backup battery, the jumper is under the PORT 1 modem, so that device has to be removed.

3) Use an ohmmeter to wire up the RS-232 cable!

The Data Engine manual shipped with the unit gives an incorrect color code for the wires. Errata sheets shipped with the unit included an update page for the RS-232 interface with no color code given. I mistakenly assumed the color coding from the original manual was correct...

4) If you have other TNC's in your shack, you might want to wire up the DA-15 connector to an interface plug. All my radio cables are set up for TNC 2 style radio connectors, so I made up a cable using a Radio Shack 5-pin female DIN connector as follows:

DA-15P	5-pin DIN	FUNCTION
1	3	PTT
2	4	RX AUDIO
3	1	TX AUDIO
8	5	RFDCD
9,10	2	GND/SHIELD

#### 5) Front Panel

The front panel LEDs are labeled A1..A8. This is OK, since they are software defined and their function could change with time, but it might be useful to have their "normal" functions printed below them. These functions are:

FUNCTION	PORT1	PORT2
PTT	A1	A7
DCD	A2	A8
CON	A3	
STA	A4	

A5 signifies "mail waiting"  
A6 is unused

#### 6) COMMANDS

The version 1.02 software uses a few commands that are different than what you are probably accustomed to. This isn't bad, you just need to be aware of it. A few that come to mind are:

PERM  
MODEM  
MONITOR

The TNC 1 had a PERM command to save user parameters. Battery-backed RAM in the TNC 2 simply saved the last state of the commands when power was removed. The Data Engine requires the use of PERM with an argument of either "ALL" to save everything or "command" to save a particular command (like "PERM TXDELAY"). Don't make the mistake of customizing your Data Engine to your station and then turning off power before you PERM your changes. I won't mention any names, but I know someone who actually did this...

Satellite users are accustomed to issuing a FULLDUP ON/OFF to select full duplex or half-duplex operation. The Data Engine embeds this information in a MODEM command which specifies a setup (lines run to the modem board from the microprocessor to configure it), full or half duplex, and the HBAUD, or radio channel data rate. To find out the defaults, simply type MODEM at the cmd: prompt.

The MONITOR commands are quite different than most other TNC's. Again, consult the manual.

#### 7) Radio Connection Information

The Data Engine manual includes information for wiring up the RS-232 and power connectors. It includes no information for wiring up the radio.

The Modem manuals (DE1200, DE9600, etc.) contain the information you will need for wiring up the PORT to RADIO cabling, at least on the Data Engine PORT side of the cable.

## Bits in the Basement

by Bdale Garbee, N3EUA

A lot of neat things have happened since my last column. My wife Karen N1FED and I spent a wonderful vacation in France, including dinner with members of the TCP/IP community near Paris. The Rocky Mountain Packet Radio Association (RMPRA) dissolution is complete, and a new organization... the Colorado Packet Association (COPA)... is being organized to fill the void. In the basement, KOYUM and I have just about solved the million or so little problems associated with getting two 56k modems running with PC/DRSI card lash-ups,

WOYNE and I are building a 1200 baud full duplex repeater to solve some local throughput problems, and I've spent amazingly little time writing software. IP in France For the last couple of years, "vacation" in the Garbee household has been a nebulous term. Most of my time off from work at HP has been spent trucking off to one or another ham gathering, for a jam-packed weekend, often including one or more presentations on high-speed packet, working a booth, or something like that. We've squeezed in a few short visits with family over holidays, but that's about it. So, when my parents invited us to join them in Paris for 3 weeks this summer... well... it sounded too much like a real vacation to pass up!

Before we left for France, I contacted Remi Hutin, FE6CNB, who I had exchanged email with some time ago. Remi graciously offered to gather up some of his friends who are running TCP/IP on packet radio, and invite us all to dinner. Remi's wife Nathalie cooked a superb dinner for the dozen or so of us, including my parents, and we all had a really wonderful time! If I got it all straight, there are three clusters of IP activity in France, one of which is centered around Paris. Remi is operating a station 24hrs/day with both a multi-lingual PBBS program, and the PE1CHL NET program. This provides a gateway between the PBBS and SMTP mail systems, and causes his machine to serve as the focal point of their efforts, particularly since Remi has Internet access at work and therefore an easy way to get software updates. Most of the other users in the area are running Macintosh systems, using the latest release of MacNet. There was some discussion before dinner about Remi grabbing the sources for the Mac version from the U.S., so that they could fix a bug or two that they've found. It was at the same time frustrating and pleasing that the French IP community seems to be working through many of the same growing pains that we have here in Colorado. In particular, they're discovering the frustrations of RF paths that "almost work," are trying to get the different cells of IP activity connected over the existing NET/ROM network in France, and are just on the shy side of achieving a critical mass of folks to

make operating TCP/IP more than an oddity.

Other than the evening with Remi and friends, we managed to stay pretty far away from our day to day routine! The only electronics I carted along was a brand-new Panasonic paperback-size shortwave radio, which brought us the BBC alternating with a local classical music FM station in Paris. We managed several days in museums, a weekend in a 16th century chateau between Le Mans and Tour, and a bunch of time sight-seeing around Paris. And the food was, of course, wonderful!

### The Flood of '90

Mother Nature must have a mean streak somewhere. I've been pretty good about cleaning the pine needles (we call them 'leaves'...) out of the gutters on the house, but somehow one of the downspouts got solidly clogged. Along came a real downpour one night not long back, and we discovered the hard way that the low spot on the back gutter was directly over one of the window wells for the Bit Basement. The result was nasty. Most of my floppies were lined up on the floor being organized, and were destroyed by the mud that came in. The AT clone I do NOS and NOS-IN-A-BOX code on had water in it, but was still running because the water hadn't quite gotten up to the bottom of the motherboard yet! Good thing too, because all of the backups were on the floor.... Lots of my schematics and data books on the table by the AT (right under the window in question) were nasty goop by the time I got to them a day or so later....

I took the event as a sign from my favorite deity that it was time to clean up the basement (!!!!). And I did, with lots of help from Karen. In fact, this is a sufficiently miraculous event that we bought a roll of film to document the evidence. I've had a few queries about just exactly what I'm hiding in the Bit Basement, so maybe I'll get the film developed in time to include a few pictures with my next column. If Bob is desperate for filler material, he may even print one or two in for your amusement! To make things doubly nasty, Don Lemley N4PCR of Grace Communications, suffered a flooded basement the same night! But in his case, it was a backed up sewer... you

can guess the rest. It's a good thing I'm not a superstitious kind of guy.

### 56KB Modems

In the basement, Fred K0YUM and I have been working every Sunday for some time trying to get the bits and pieces of our 56kb WA4DSY modems together, with a pair of DRSI PCPA cards and KA9Q's "hs" driver in NOS. It has been, shall we say, educational?

John Conner WD0FHG and I participated in the original beta-test of the DSY modems, and at that time we were very impressed with how easily the modems went together once we had all the parts in one place (though finding and getting all of them without going broke took most of a year — I sure am glad they're shipping kits now, and not bare boards!)... but we were never able to make the kludged TNC-2's work at 56kb on the radio side. So, after lots of effort, we got frustrated and never got the units on the air. Fred has been a wonderful catalyst. His enthusiasm has gotten me interested in hacking on the 56kb hardware again, and making the silly things work. And his persistence has kept me working through some really frustrating problems. If you're thinking about messing around with the DSY modems, or any high speed modem design, for that matter, I strongly suggest you find someone else to work with... it really makes a difference! Some of our problems were just plain stupid, like interrupt conflicts in the XT clone at one end keeping us from hearing anything, naive selection of a receive buffer size larger than the maximum configured interrupt buffer size, resulting in not hearing anything on the other end, destroying an old 150W PC supply being used to power one modem when we hooked up the transverter with a rubber duck a couple of inches away and keyed down... who would have guessed it was that RF susceptible? Anyway, it's been a struggle, but we're very close to going on the air for real. We've got packets flowing one way solidly, and will have the other direction going next Sunday, I'm sure.

The world needs a good power supply design to take unregulated nominal 12V DC in, and provide an amp or two each of plus and minus 5V DC, regulated. I dug around a bit at work, and it looks like a circuit based

around the LT-1070 switching regulator IC from Linear Technologies would be really clean and not very expensive. Since the DSY modems need +/- 5V, maybe this would be a good kit for GRAPES or TAPR? Someone care to volunteer? Maybe by next time I'll be able to wax poetic about the joys of a 56kb link between my QTH in Black Forest, and Fred's in Denver! Then I'll have a real need for a couple of packet switches.... Cross your fingers for us....

### 10Ghz Stuff

I mentioned long ago that John, WD0FHG, was working on putting schematics and PC Board artwork for the N6GN 10Ghz modem design (73 mag 10/89, and Ham Radio mag 12/89) into EE Designer III on his AT. He's been at 95% complete for quite some time, missing the board geometry of a few stupid parts like PCB BNC connectors. John and I are working to get this finished up soon, and KE3Z at the ARRL Lab has agreed to help test out the PC Board design by running a couple of boards and building them up in the lab.

If the design works, we've got enough parts to build up 6 links in the Bit Basement, and it's highly likely that we'll try to find some neat way to put them all to use! Maybe an all-digital run for the ARRL 10Ghz contest next year? 10Ghz packet mobile... nah...

The astute observer may have noticed one of N6GN's 10Ghz packet dishes in the photo collage advertising the 1991 Handbook in the latest issue of QST....

### NOS

Since the last issue of PSR, we've pretty much completely switched over from running the pre-NOS version of TCP/IP to running the new NOS version of NET in this area. There are some rough edges still, but there are a lot of neat new features, too. Since I've gotten a lot of questions about NOS lately, let me say a few things here.

First, I hope I've made it very clear that I have no intention of working on documentation or integration of the NOS version of KA9Q's software, as I did for the pre-NOS version. It was an almost full-time job for me, and my

priorities have changed. Whether Phil will try to fill the gap himself by producing adequate documentation and installation aids is unclear. But don't be too scared off, particularly if there's someone in your area already running NOS. It's not that hard to get going.

The most intriguing recent addition to NOS, which isn't exactly working right at the moment, is a preliminary implementation by Anders Klemets of the RSPF routing protocol. RSPF is an attempt to deal with some of the problems posed by the routing mechanisms in NET/ROM and the RIP support already included in NET, and it is tailored specifically for packet radio. I have high hopes that a fully functional RSPF implementation will give us the tool we need to build intelligent, dynamically routed IP networks. We'll see as time progresses. Another neat development is that work is underway again on NNTP clients and servers. There is a brief paper in the CNC proceedings I received today about the use of NNTP for packet discussions. I've talked before in this column about my belief that Usenet-style messaging may be the application that holds packet radio together and gets more folks interested and involved. The Terakoya news system by JK1LOT and friends is an excellent start, but it uses SMTP mail for forwarding articles from system to system. NNTP is a "real protocol" for transporting articles between databases, and between a database and a news user interface. Good NNTP support for NOS will be a big step in the right direction.

We're also very pleased that MSYS seems to be catching on with the local PBBS crowd. The latest version is very impressive, with few problems noted so far. I've had little to do with MSYS myself, except for FTP'ing the bits to my machine at home, and mailing out floppies to some local sysops. All of the neat stuff isn't fully functional yet, but I'm looking forward to the day very soon when we have solid PBBS to/from SMTP mail gateways working, and can forward PBBS traffic over our emerging IP backbone....

### **Winfree**

I recently had the opportunity to replace the aging HP9000/550 running

as the unix machine 'winfree' in my basement with a not-quite-as-aging HP9000/330. Unlike the obsolete custom-processor 550, the 330 is a 68020-based machine that can run the most current revision of HP-UX, complete with integrated TCP/IP support. The transition went very smoothly, and I've now got a machine on the air full time that sports a mail gateway, and a USENET News installation.

We're looking forward to getting NNTP working in NOS, and using winfree as the hub for news groups for COPA, etc. The new winfree has also made it possible for me to provide a real domain name server for use with NOS, and it's been fun to play with on the air. I can't suggest strongly enough that you investigate finding a Unix machine with real TCP/IP support to act as one of the hubs in your local TCP/IP community. It really makes a difference! And with the price of full-blown Unix for 386 and 486 systems, it costs little more to put a fair Unix system on the air than it does to put up a heavily-loaded full-service PBBS. Think about it!

### **More V.29 in Japan**

As I'm writing this, I've just received the first burst of data on a new project in Japan, that puts what amounts to a TNC-2 clone with a V.29 9600 baud "FAX modem" on a PC plug-in card (designed for the NEC PC-98, actually). I haven't had time to look over the data package I received by email yet, but this is yet another sign of the popularity of V.29, particularly when used at 7200 baud, in Japan. I'll try to have more to say next time. I also have a pair of bare boards and Yamaha chips for the PRUG TNC-2 daughter card. Several other folks have reported that they are investigating the Yamaha V.29 modems, and it's likely that we'll hear more before long.

### **Kantronics Data Engine**

Phil Anderson at Kantronics reports that sales of the Data Engine have been brisk. I've talked about the base unit here before. When you order one from Kantronics, it comes with a daughter card for 1200 baud AFSK on one port. I recently got my hands on a pair of the new G3RUH/K9NG-compatible 9600 baud daughter cards for the Data Engine, and hope to give them a workout

soon. I also received a couple of flyers that talk about different configurations, in particular you can get a unit with one 1200 baud modem, and one 9600 baud modem. As far as I know, the Kantronics Data Engine with 9600 baud modem, and one of the Kantronics DVR2-2 radios, is the only off-the-shelf 9600 baud packet solution available in the U.S. today. Worth checking out...

### **NOSINABOX**

Don Lemley and Milt Heath of Grace Communications worked with me on a paper for the ARRL CNC this year. By the time you read this, the conference will have come and gone, and for the first time in several years, I won't have been there. The problem with amateur radio conferences is that the travel expense comes almost entirely out of my own pocket...and my pocket is empty at the moment....

The paper is a discussion of the rationale for NOSINABOX, along with some details of the initial implementation for the Grace PackeTen card, available now. It also talks about some of the things Don and I would like to investigate in the future. In concert with a paper by Don and Milt on the PackeTen card design, look for a copy of the conference proceedings to see what we're up to.

Vacations, floods, 56kb modems, house painting, and so forth have all conspired to keep me from working on NOSINABOX for the Data Engine and PS-186. My level of motivation varies wildly, as does my available time. But progress is being made, and you'll probably be able to try out NOSINABOX on these platforms before the next PSR. In the meantime, the Grace PackeTen is available NOW for about the same price I expect the PS-186 to sell for, and it is a really neat, fast design. If you haven't checked it out, you owe it to yourself to do so...

### **Travel Next Year**

I've started thinking about where I'd like to go next year. I really enjoy attending ham gatherings around the country, and around the world, seeing what other folks are doing with packet radio. It's fun to discover and discuss common problems, and a neat way to keep up with what is happening.

If you know of a hamfest or conference or whatever next year in your

area that might be fun for me to attend with Karen, wherever you are, then drop me a line. The only real limiting factor will be the travel budget, so if there's some chance of trading a presentation on one or another aspect of high-speed packet for a hotel room and/or expenses, so much the better!

### Newsletters

I have also been really excited over the last few months to have interesting newsletters show up in my mailbox from various parts of the country. The stack next to my keyboard includes newsletters from NCPA, TPRS, and CAPRA, with others scattered around the house. A lot of really neat things are going on. Would it make sense for me to dedicate a portion of "Bits in the Basement" each issue to highlights from the various newsletters I get? Let me know what you think. And if you or someone you know puts out a packet-related newsletter, and the club treasury can afford a complimentary copy now and again, I'd love to see what's up in your area too.

One of the goals I've had for this column is to try and help share information about neat things that are going on in our little niche of the hobby... when I was first getting started, N6GN and I thrashed through a flurry of mail messages trying to figure out how I could avoid focussing on too narrow a set of people, and too narrow a set of activities. The newsletters help this a lot, as do your letters and electronic mail messages...

### Until Next Time

As always, I really appreciate hearing from you. Let me know what you like and don't like about Bits in the Basement, and I'll know what to do to keep this column as useful and exciting to you as possible!

I am reachable as [bdale@col.hp.com](mailto:bdale@col.hp.com) on the Internet, via any number of PBBS systems in this area (N3EUA @ W0LKD, W0LJF, KA0WIN, etc), on CompuServe as 76430,3323, or by paper mail at:

Bdale Garbøe, N3EUA  
4390 Darr Circle  
Black Forest, CO 80908

I'm miserable at answering paper mail, though, so try one of the electronic mail paths first, if you can...

Until next time!

## Interfacing the TAPR DCD State Machine to the Kantronics KAM HF

by Lyle Johnson, WA7GXD

Numerous packeteers have asked me if the TAPR DCD State Machine could be interfaced to the HF port on the Kantronics KAM. Not having a KAM, all I could say was, "Probably, but we haven't tried it."

At Dayton this year, one fellow promised to interface it and let me know how it worked. I gave him a DCD State kit free of charge to do this task. Neither he nor the kit have been heard from since!

However, another ham, WA1JSG of Miami, Florida, indicated he would send me his KAM, realizing I would have to do some surgery on it to perform the interface. As luck would have it, his unit arrived just before I left Tucson for an extended summer vacation in Europe.

Over the Labor Day holiday (a U.S. holiday that occurs the first weekend in September), I opened the KAM and began testing, measuring, etc.

For the record, the unit I had is S/N 61828 with firmware revision 2.85. The mods worked well on this unit; I don't know what changes may have been made between this PC board and other revs, nor what effect other revisions of firmware may have on the performance of the unit.

I discovered that differential NRZI data was present on the microprocessor (U26; Hitachi HD63B03XP) at pins 17 and 18. The NRZI data is also available at connector K8 pins 13 and 14.

Careful monitoring with a digital storage oscilloscope revealed that positive-true DCD was generated from the KAM HF modem and applied to pin 24 of U26. I monitored off-the-air signals in packet, RTTY, AMTOR and CW modes, adjusting the RF gain on my TS-440S to weaken the signal so DCD was not reliably asserted by the KAM circuitry. This test revealed that modes other than packet did not appear to make use of the DCD signal at pin 24.

This is important because it implies that adding the DCD mod will have no negative effects on operation in other HF modes.

The KAM provides no clock at a 16 or 32 times multiple of the data rate on the HF port. There is a clock at about 40 times the data rate, but this is not the correct ratio for our use. The internal clock option of the DCD State machine kit has to be used.

Finally, since the KAM HF port is not capable of 1200 bps operation, the DCD clock can be optimized for 300 bps operation by using a different clock output pin than the default (which is set for 1200 bps).

### Step by Step

As you build the DCD State Machine kit, DO NOT install the jumper pins at the CLK jumper or at JMP. These pins are too tall to allow the completed assembly to easily fit inside the KAM case. No component on the PC board may rise taller than the body of a socketed IC. If your DCD kit uses an electrolytic capacitor for C2, consider replacing it with a tantalum. Recent kits use tantalum capacitors at C2 for reasons of physical size.

At the CLK jumper, install a piece of insulated wire from the center pin to U4 pin 15 (on the bottom of the DCD PC board). This will select the internal clock at the proper multiple for best operation at 300 bps packet operation.

Use a small piece of cut-off resistor lead to wire the JMP location pins 2 and 3 together. This sets the State Machine for positive-true DCD input.

The DCD PC board will fit snugly just above U26 and the timer chip, U23. I used a piece of Radio Shack double-sided foam tape for this purpose. Please consult the figure to clarify wiring.

Connect the wiring harness as follows:

- Brown (pin 1) to pin 14 of the IC (74HC4070) near the lower left-hand corner of U26 (+5 VDC).
- Red (pin 2) to the empty hole nearest the edge of the KAM PC board labeled C53 just below U26 (GND).
- Violet (pin 7) to the other hole at C53 (DCD in).

- Gray (pin 8) to the DCD State Machine push-on jumper which is no longer used. Push this over K8 pins 13 and 14 (NRZI in).
- Yellow (Pin 4). Carefully pry U26 from its socket, bend out pin 24 and reinstall. Solder the yellow wire from the DCD State Machine to this free pin (DCD out).
- Carefully align the PC board over U26 and U23. It should still allow you to swap the EPROM at U22, the TCM3105 modem IC at U5 and the serial EEPROM at U25.
- Reassemble your KAM and enjoy more-accurate DCD on HF packet!

## Notes from the TAPR Office

by Heather Johnson, N7DZU

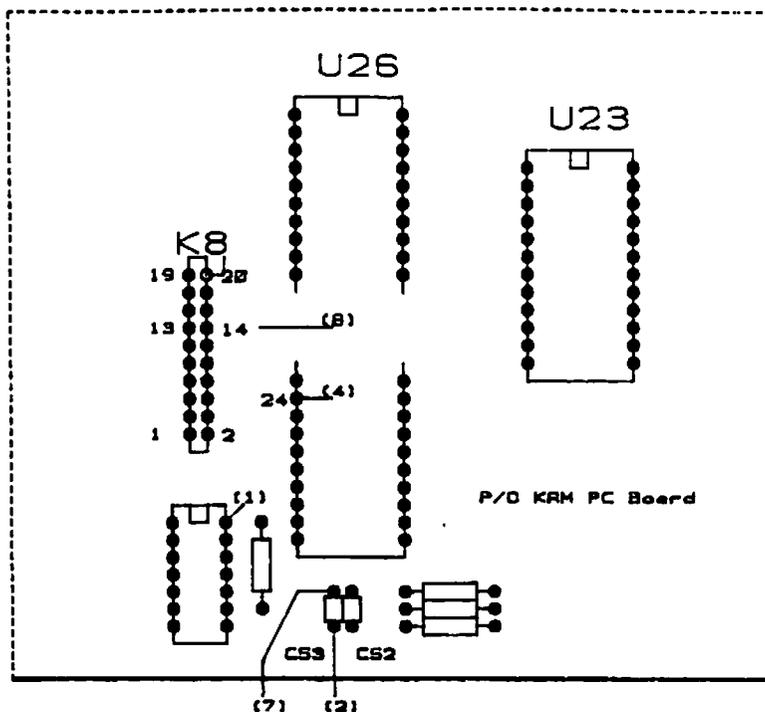
Hello again!

I had a great time with Lyle and our four oldest children this Summer visiting England and Switzerland! One of the highlights was attending the AMSAT UK Colloquium at the University of Surrey. It was stimulating to be in a setting where SO many nationalities were represented! I was told that there were twenty-nine countries involved!

I treasure the opportunity I had to meet these people and to witness each contributing valuable information for the good of all! I also found it great fun to meet men that Lyle has told me about for so long; men who have contributed so much, and made their mark in our outstanding hobby! If any of you get an opportunity to attend this convention in the future, I think that you will both enjoy and benefit by it.

Thank you AMSAT UK.

As you have all noticed, most of the address labels, membership cards, etc. coming out of the office are done manually. On the one hand, like Grandma making pie from scratch, you can tell that each of you is given human attention. On the other it may make you wonder why we, who claim to be high-tech, are archaic in this area. I am becoming more computer literate, so expect to see some changes in the near future! "Onward and upward" as they say!



### NOTE:

Numbers in (parentheses) refer to wire number from the TAPR DCD State Machine wiring harness.

I have a few short comments:

1. If you have called our old telephone number (602-323-1710) and been frustrated by the operator not giving you our correct number please take note of our correct numbers:

Voice (officially answered Tuesday through Friday, 10 a.m. - 3 p.m. MST) 602-749-9479. ("Shhhh," don't tell anyone, but I often answer the phone, when possible, at other than "official hours" as I would far rather communicate with you than with my answering machine!)

FAX (always available) 602-749-5636.

2. When ordering a DCD kit, please tell me WHICH TNC you plan to install it in, as I have extra information to send you that isn't incorporated into the documentation yet.

3. Start making plans to come to the 1991 TAPR annual meeting. Once again there will be a hospitality suite to help welcome you.

4. I am so grateful to those who help answer the technical questions that I receive. We have some more volunteers!

Carl Wall, VE3APY, 27 Stockbridge Ave., Toronto, Ontario, Canada, M8Z 4M6. Carl says he will help anyone in the local area with memory upgrade mods to their TNC-2 or clone.

Joe Subich, AD8I, 7415 Hagerty Rd., Ashville, OH 43103 does a lot of TNC-2 and clone repairs and can answer BBS/HF operating questions.

PSR #39 lists our other super volunteers.

5. A big and hearty welcome to all of the RMPRA folk. We solicit your input and consider your participation of high value.

Until next time, 73s!

# Interfacing the TAPR PSK Modem to the Kantronics Data Engine

by Lyle Johnson, WA7GXD

## Background

The new Data Engine (DE) from Kantronics offers a number of unusual features. See the "First Impressions" article in this issue of PSR for more details.

Data Engine modems are designed as plug-in modules to prevent obsolescence and maximize flexibility. Unfortunately, the internal form factor allowed for a plug-in modem makes it very difficult to design an internal PSK (satellite) modem.

## PSK Modem

The TAPR PSK modem is designed to work in conjunction with an existing 1200 bps modem. Specifically, the transmit PTT circuit with watchdog timer is "borrowed" from the host. This additional circuit would have to be added to use the TAPR modem with an unused modem "slot" in the DE. This wouldn't be too hard to design, but it would mean making another PC board. It would also mean dedicating a radio port and adding cost for those who simply want to add a PSK modem to their Data Engine.

The standard Data Engine comes with a 1200 bps modem, the DE1200. This unit is based on the TCM3105 modem chip, and includes additional circuitry to allow "open squelch" operation without DCD falsing.

The internal modem, of course, occupies the modem connectors, so a different means of interfacing the PSK modem had to be devised. Kantronics consulted with TAPR prior to specifying the radio connector pinout. As a result, the Data Engine's DA-15S (15-pin D-series) connector conforms to the proposed pinout of the TAPR/AMSAT DSP radio connector. It also has enough pins to serve as a combination radio and external modem disconnect.

I attempted to work out a modification scheme to the DE1200 modem that would allow the Data Engine to work properly without having an exter-

nal PSK modem attached after the modifications were completed, and without modifying the radio cabling. I also wanted the external PSK modem to operate normally when attached to the Data Engine. To make it all more fun (ahem!), I tried to not violate the DA-15 connector pinout.

## Required Signals

All special signals for the PSK modem interface have to be run to otherwise unused pins on the DA-15 radio port connector. These signals are:

1) 32x Transmit clock, TTL levels. This signal is available within the Data Engine and may be tapped with a small jumper added to the DE1200 PC board.

2) Transmit Data signal, TTL levels. This signal is also available and can be tapped with a jumper on the DE1200 board.

3) DCD in and out at TTL levels. The PSK modem must be able to intercept the DCD signal from the DE1200 and insert its own DCD signal when in PSK mode. Fortunately, the DE1200 allows an external DCD input, and the Data Engine can be commanded in software to use this external DCD instead of the DE1200's normal DCD. We only have to use this input rather than intercept the normal DCD.

We will make use of the RFD CD input at pin 8 of the DA-15 connector. There is an auxiliary DCD we could use instead, but it requires a positive polarity DCD rather than the negative polarity provided by the TAPR PSK modem. To get at an unused TTL inverter on the DE1200 modem board is more trouble than it is worth, so I decided to sacrifice the RFD CD function.

4) RXD in and out at TTL levels. This is also so the PSK modem can drive the HDLC chip inside the TNC rather than have the normal 1200 bps modem provide this signal.

## Data Engine Considerations

In the Data Engine, the HDLC controller is a CMOS chip. When the DE1200 is installed, the fastest data that will be applied to the HDLC chip is 1200 bps. This means we can insert a series resistance of about 10K ohms between the TCM3105 modem chip

and the Z85C30 HDLC chip with no undesirable effects.

The 10K resistance will be trivial for the PSK modem's output to override, yet allow normal operation of the modified DE1200 in a Data Engine with standard cabling or with no PSK modem attached.

The modified DE1200 now meets all of our design criteria. We have only to assign pin numbers to the DA-15 connector, then get on with the modifications!

The DSP radio connector specifies several input and output pins with suggested functions. The ones we will use are: pin 14 - RTS (TTL output) for X32 clock; pin 12 - SPARE 1 (TTL output) for TXD from the Data Engine; pin 4 - +DOWN (TTL output) for RXD input to the Data Engine.

The last pin violates the suggested direction for the pin. The other input, Pin 15 - CTS, is used by the DE1200. Pin 13 - SPARE 2, pin may be wired to supply power to an external device and I refrained from using it to prevent possible damage to a PSK modem that could be connected to a Data Engine which has +12 volts DC on this pin. This pin could be wired up to optionally provide power to the PSK modem when the Data Engine is turned on.

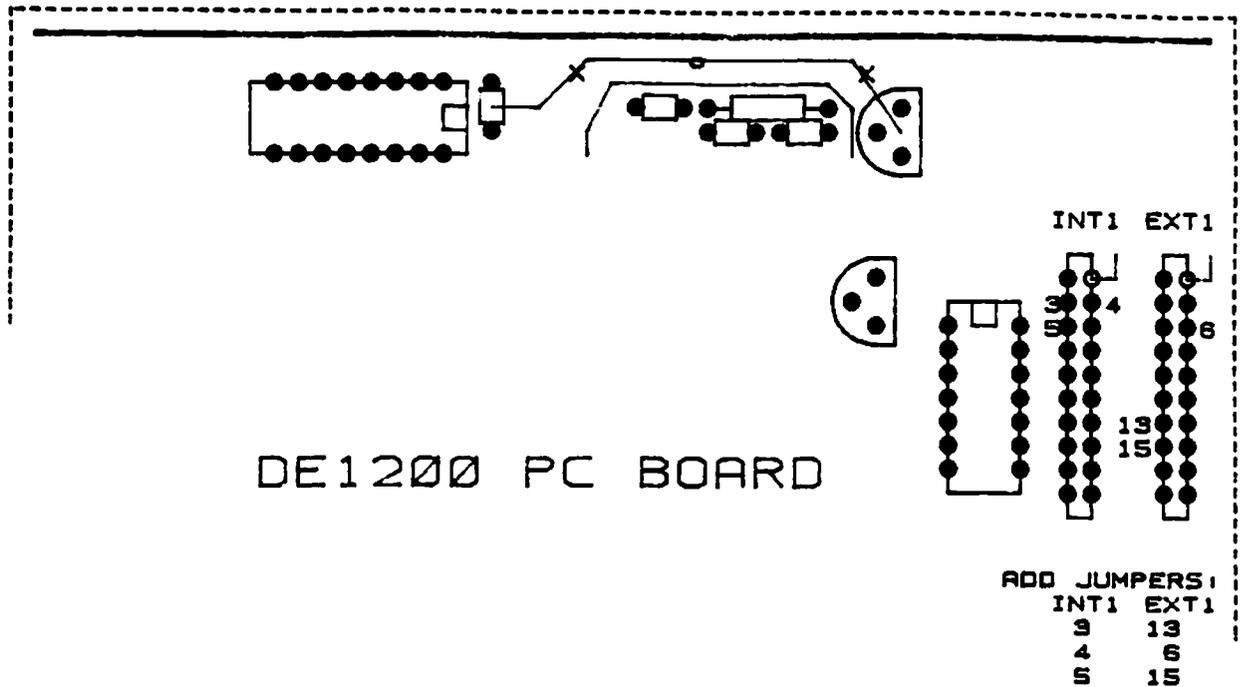
## Mods to the DE1200 Modem Board

- 32X CLOCK - add a jumper from INT1 pin 5 to EXT1 pin 15.
- TXD OUTPUT - add a jumper from INT1 pin 3 to EXT1 pin 13.
- RXD INPUT - add a jumper from INT1 pin 4 to EXT1 pin 6.

Cut the trace that routes from the TCM3105 modem chip to INT1 pin 4. I cut it on the top of the board between the words "COPYRIGHT" and "1990" on the silkscreen legend. It is the small trace just below the printing (not the trace beneath the printing). See the illustration for details.

Scrape the solder mask from the trace on either side of the cut and carefully solder a 10k resistor to bridge the cut. I scraped the area just to the left of and below the "C" in "COPYRIGHT" and below and to the right of the "." in "CO.". The resistor fits easily in the space remaining. Just be sure the lead of the resistor doesn't touch the screw

CUT TRACE AT "O"  
 SOLDER 10K RESISTOR ACROSS "X"



at spacer SP2 when you re-install the modem board!

If you haven't already done so, add a jumper at the "V23" position to make the DE1200 use the 1300/2100 Hz tone pair rather than the 1200/22000 Hz tone pair when sending. This will help DCD operation at stations receiving your transmissions.

Inspect your work, then re-install the DE1200 modem and get the Data Engine on the air. Verify that the DE1200 works as before.

### Cable Wiring Between the Data Engine and the PSK Modem

Prepare the following cable. I suggest using shielded cables for all connections, and grounding the shield to the cases of the connectors.

In my shack, I have standardized on 5-pin DIN connectors for all my data equipment. Thus, I use a female 5-pin DIN on adapter cables such as this one. This way I can switch between various TNCs at will. If you want to use a male 5-pin connector, the pinout remains the same.

The cables should be long enough to allow you to place the equipment according to your preferences, and with enough slack so you can operate the equipment with the covers off to troubleshoot. It shouldn't be longer, though, or you will simply be increasing your chances of RFI.

NOTE: Don't make the cables a multiple of 19" if you expect to have much 2-meter RF in your shack, unless you enjoy pain...

### PSK Modem Considerations

Be sure to set the clock jumper for 32X clock in the Manchester (satellite) mode. This is JP6 pins 5&6 in the PSK-1 (see page 29 of the March 1990 PSK 1 manual) and PAD-2 for the TAPR PSK modem (see page 23 of the March 1990 TAPR PSK Modem manual).

If you are using the PacComm PSK-1, it must have power ON whenever you use the Data Engine and have the two units cabled together — even if you are planning on using the internal

Cable Wiring Between Data Engine and PSK Modem			
DA-15P	DIN-5	DIN-8	FUNCTION
14		1	32X CLOCK (TTL)
12		6	TXD (TTL)
4		5	RXD (TTL)
8		4	DCD (TTL)
11		2,7	GND (DIGITAL)
1	3		PTT (OPEN DRAIN)
2	4		RXA (AUDIO)
3	1		TXA (AUDIO)
9,10	2		GND (AUDIO)
	5		DO NOT CONNECT
		3	DO NOT CONNECT
		8	DO NOT CONNECT

DE1200 FSK modem. The TAPR PSK modem may have power removed under this circumstance. If you plan on using the PacComm PSK-1, see the "First Impressions" article in this PSR for some important notes.

### Data Engine Software Commands to Enable the PSK Modem

Enter the command  
MODEM 2, FULL, 1200  
for satellite operation, or  
MODEM 2, HALF, 1200  
for terrestrial applications which are not full duplex.

Be sure to enter  
MODEM 0, HALF, 1200  
for normal (A)FSK operation. The "0" selects the "open squelch" DCD output from the DE1200, while the "2" tells the Data Engine to accept DCD from the RFDCD input which is driven by the PSK modem.

### Conclusion

I have made these modifications to Data Engine s/n 850 01470 and DE1200 modem s/n DEM 1198. I used an early TAPR PSK modem and a PacComm PSK-1 s/n P10252. All units worked as described above. These mods will allow you to use the Data Engine in your satellite shack without sacrificing a radio port to the PSK modem.

Have fun!

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## DSP Progress

by Lyle Johnson, WA7GXD

In the last PSR, I described a little of the effort involved in getting a PC board layout done for a board as complex as the DSP 1. Never mind the complexity of the circuitry itself, which also takes a while to dream up and turn into a schematic diagram!

The first five prototype boards were delivered in late June. The first one was populated and testing was begun just before I left for a month's vacation in early July. At the time I left for vacation, almost nothing worked...

Since early August (I am writing this in late September), a lot of progress has been made. Design errors have been found and repaired. Several equations describing the program-

mable logic had errors and have been corrected. It is nice to use program-mable logic, though, since most errors can be fixed simply by re-programming the parts! Without boring you with the details, there are only two known "gotchas" remaining on the board.

The 8530 interface is working just fine.

The DSP memory can be loaded by the host PC and the DSP can then run the program loaded.

All DSP I/O ports, including the handshaking 16-bit port to the PC and the analog I/O are working as expected.

The A/D and D/A can be clocked by a phase-adjustable free-running clock under DSP control, or they can be directly strobed by the DSP under software control.

The PC status and control registers work.

A debugger/monitor is being written by Dan Morrison, KV7B, and all attempted functions are working properly, with more to come.

The two big bugs are:

1) The 16-bit wide PC access system isn't working. The PC accesses the board as an 8-bit peripheral. It is being tested in an old, non-IBM AT "clone" and I understand there is a lot of variation in clones as to their reaction to I/O wait state requests. This problem is being worked on, but until the board is tested in more platforms we won't know if it is a generic problem or a problem specific to certain motherboard manufacturers and/or chip sets.

2) The bigger bug is one that causes the DSP to crash when the PC accesses DSP memory while the DSP is running. There is a simple workaround, but it steals more cycles from the DSP for each access. This one is getting all our attention now and I will be surprised if it is still a problem by the time this PSR reaches you.

There are two prototypes running as this is being written, and two more should be up within a week's time. At least one software developer has a prototype board on a full-time basis. We expect to place two more boards in

other software writer's hands as soon as the boards come to life.

Once we have the two bugs squashed, we will do another board layout, then build a couple more boards. As soon as the hardware is thus proven, and a minimum number of applications exist to make the board useful, we will get into the documentation cleanup and kit production phase of the project.

It remains to be seen if this board can be kitted or if it must be assembled and tested. A six-layer board is not trivial to build. On the other hand, with care and the proper tools it is nothing to be afraid of.

Watch this space. This project is hot!

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## Software Library Update

by Bob Nielsen, W6SWE

Since the July, 1990 issue, the following changes and additions have been made to the TAPR software library:

### Revised:

Disk 1 APLINK - version 4.19  
Disk 6 PKTTERM (shareware demo of Packet-Plus and Packet-Gold) version of 8/22/90  
Disk 10 ROSE switch - version of 7/13/90  
Disk 16 WØRLI BBS - version 11.13  
Disk 19 LAN-LINK - version 1.58  
Disk 21 MSYS - version 1.09  
Disk 22 G8BPQ switch - version 3.59, plus several utilities (MH, BPQTERM, HELP and MONITOR) by Paul Hounslow, G4YFE have been added to disk

### New:

Disk 20 TEXNET Applications - ver. 1.5 - software for use with the TEXNET packet switch by Texas Packet Radio Society.

In addition, TAPR is now offering all of the library selections in 3-1/2 inch, 720K MS-DOS format. The two-disk sets in 5-1/4 inch 360K format will fit on a single disk in 3-1/2 inch format.

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State Machine DCD Mod.	17.50	.....	_____	_____
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TNC 2 WA8DED (27C256)	12.00	.....	_____	_____
TNC 1 WA8DED (2x2764)	12.00	.....	_____	_____
TNC 1 KISS (2764)	12.00	.....	_____	_____
TNC 2 KISS (27C256)	12.00	.....	_____	_____
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PSR sets, Issue #1 to present	25.00	.....	_____	_____

**SOFTWARE** - Please circle disk numbers requested.

- |  |  |
|--|--|
| 1. APLINK - W5SMM - Runs MBO & BBS                 | 16. WØRLI BBS - WØRLI - BB system  |
| 2. BB - AA4RE - A multiconnect Mailbox             | 17. YAPP - WA7MBL - Terminal program   |
| 3. C-BBS - K3RLI/AG3F - BBS w/sources              | 18/18a INTRO TO TCP/IP - Much info on TCP/IP*  |
| 4. EZPAC11 - M. Imel - NTS formatter               | 19. LAN-LINK - G3ZCZ - Terminal program  |
| 5. MONAX-NK6K/WB6YMH - Gathering system stats      | 20. ARES/Data - WN6I,N6KL - Emergency data system  |
| 6. Packet S/W - WB6UUT - for PK 87,88,232          | 21. MSYS - WA8BXN - BBS/TCPIP/node System using KISS   |
| 7. PBBS Lists - W9ZRX - Master PBBS lists          | 22. NODE - G8BPQ - Packet switch/BBS networking pkg.   |
| 8. R95 - WD5IVD - Binary conversion utility        | 23. COMPRESSION/ARCHIVING Utilities, .ZIP, .ARC, .ZOO & .ICE                                       |
| 9/9a ROSESERV - KA2BQE - BB and server for ROSE*   | 24. THS - HB9CVV - Term. program for TNCs w/WA8DED firmware  |
| 10. ROSE Switch - W2VY - The ROSE executibles      | 25. NTS Traffic Generator - VE4UB  |
| 11/11a TCP/IP Plug & Play - KA9Q*                  | 26. NM1D DOSgate - NM1D - Remotely operate PC via packet   |
| 12/12a TCP/IP Sources - KA9Q*                      | 27. SV7AIZ BBS - SV7AIZ - Multiuser, multiport BB system   |
| 13. TNC-1 Source code - TAPR - TNC-1 Sources       | 28. TEXNET Applications - Software for use with TEXNET packet switch by Texas Packet Radio Society |
| 14. TNC-2 Software notes - N2WX - 1.1.0 thru 1.1.7 |  |
| 15. WA7MBL BBS - WA7MBL - BB system                |  |

\* Indicates two-disk package (one disk in 3-1/2 in. format). We attempt to provide the latest versions of all software.

Total disks circled - 5-1/4 in. MS-DOS format (9, 11, 12 & 18 are 2 disks ea) \_\_\_\_\_ x \$2.00 = \_\_\_\_\_

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