

PACKET



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President's Corner

by Lyle Johnson, WA7GXD

I am writing this on Christmas weekend. 1990 has certainly been a full year for packet radio as well as a number of other aspects of Amateur radio.

The January launch of four MicroSats and two UoSats, followed by the February launch of FO-20, certainly put packet in the high frontier of space communications in an unmistakable way. The December SAREX mission capped the year for packet-in-space.

1991 should usher in the operational phases of UO-14, AO-16, and LO-19. Harold Price, Bob McGwier, and Jeff Ward have been working hard over the past few months to make these satellites a useful addition to global packet activity.

1991 should also see the oft-delayed launch of RS-14 which includes the RUDAK-2 experiment. RUDAK-2 (outlined elsewhere in this PSR) is a multi-function packet experiment built by the German AMSAT group (it's nice not to have to say "West German" any more) with amazing capability for modem experimentation. It also marks the first cooperative Amateur satellite project between the Soviet Union and the West. I hope this is a harbinger of future efforts.

DSP has been much ballyhooed of late. A progress report on the joint TAPR-AMSAT DSP project appears in these pages. Come to the Annual Meeting to see the DSP-1. Who knows, maybe you'll be able to buy one there as well...

It is time for a Board Election. Please read the statements by the candidates in this PSR, then vote for the five (5) board members of your choice.

Another new thing you will have in 1991 is a new President. I have immensely enjoyed serving you in this office, as well as in the position of being a Director. It really is time for new blood and fresh ideas, and I look forward to assisting your new President, then delving into projects rather than administration.

The DSP and packetRADIO projects are the two high-profile activities taking place right now.

Speaking of projects, there may be a surprise at the Annual Meeting. Oops, there. I may have let the cat out of the bag. What is it? I'll never tell...

1991 Annual Meeting

The 1991 annual meeting of Tucson Amateur Packet Radio will be held all day Saturday, March 2, and on Sunday morning, March 3 at the Inn at the Airport in Tucson. There will be a registration fee of \$10.00 for the meeting, with lunch available for \$5.00 and dinner for \$15.00. Coffee will be provided, and TAPR will also have a hospitality suite with a complete supply of kits and software disks available for purchase. A block of rooms is being held at the special rate of \$65.00 per night, single or double occupancy, including a full breakfast as well as an afternoon cocktail hour. The hotel offers free shuttle service from Tucson International Airport, however it is within walking distance. For reservations, contact the Best Western Inn at the Airport, 7060 S. Tucson Blvd., Tucson, AZ 85706, 1-800-772-3847 (602-746-0271 in Arizona). Be sure to mention TAPR when making reservations to obtain the special rate.

If you have a pet project that you want to share with your fellow packeteers, this is your chance! Overhead and slide projection facilities will be provided. Commercial suppliers of packet radio equipment are also invited to exhibit their products. Please drop a line to the TAPR office if you plan to make a presentation or if you wish a display table, so that we may make the necessary arrangements.

For further information, call the TAPR office at (602) 749-9479. Office hours are 10 a.m. to 3 p.m. MST, Tuesday through Friday.

DSPProgress

by Lyle Johnson, WA7GXD

The DSP Alpha prototypes have been built and exercised. Based on the results of the successes (and failures), the Beta layout was done in November. The new 6-layer board artwork was sent by modem to a prototype PC board house in Southern California and ten (10) prototypes arrived at the TAPR office on 20 December 1990.

I am writing this on 22 December 1990. The current plan is for me to build one (1) Beta unit and test it before 01 January 1991. The minor tweaks to the programmable logic will be proven on this board, then it will be exchanged for the Alpha prototype currently being used for application software development.

Assembly documentation will be written based on the first board, and a second board will be assembled by Chuck. The documentation will then be revised, and the Beta boards will trickle out to the Beta test sites for assembly and feedback. This feedback will be used to revise the documentation to initial production release, as well as to determine if kitting this board is viable, or whether we need to offer it assembled and tested.

We expect to be able to show the board at the Annual Meeting. It is possible that we will be able to sell a limited number of them at that time. Our goal is to offer them for sale at Dayton.

Please note, however, that as volunteers we cheerfully miss goals on a regular and ongoing basis...

METCON — A Simple Telemetry and Telecontrol System

by Paul Newland, AD7I
Post Office Box 205
Holmdel, NJ 07733-0205

METCON-1 is a simple telemetry and control system. (METCON is a contraction of teleMETry and teleCONtrol.) It allows a user, via a serial port, to read and control external electrical signals. METCON-1 uses a single chip microcomputer (an 8751) to allow the user to read and write on/off levels at the microcomputer's I/O ports. The keyword here is simple. Yes, a PC with some Data Acquisition cards would be a faster, more accurate and more powerful system. METCON-1 isn't intended to compete with those systems. Instead, METCON-1 fills the need for very low end (low cost, low performance) systems.

Standard Input/Output

Outputs are relay contacts so you can hook up anything you want, within reason. Certainly 24VAC/VDC at 1/2 amp would be a good upper limit. There are 6 outputs possible with the standard METCON-1 PC board.

There are several ways that signals can be input to METCON-1. The standard inputs to METCON-1 consist of 74HC14 inverters, protected by a series resistor (100K) and a pullup resistor (2.2K) to +5 volts. The other terminal for the input is system ground. Most systems will configure inputs as just a switch with both terminals wired back to METCON-1. The microcomputer can read the value at the output of the inverter and pass this along to the user via the serial port. There are 6 inputs possible with the standard METCON-1 PC board.

An added feature of each standard input is that METCON-1 can measure the frequency of the input signal (0-30 kHz) as well as simply tell if the input is high or low. By using external voltage-to-frequency converters, the frequency counter feature can be used as an analog to digital converter. See the section on sensors for more details.

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Commands

Commands are line oriented. The user can tell METCON-1 to set, clear, or display a bit on an I/O port. That provides basic operation. The user can also configure METCON-1 over the serial port.

Some commands are restricted and are available only to the system administrator. These are commands that do things like change the baud rate, system password, etc.

Advanced Features

Although METCON-1 is a simple system, it does have some nifty features. I'll cover only some of the highlights here.

There's a time-of-day clock that can be used for time stamping. You can tell METCON-1 to send you it's memory map every 15 minutes. You can also tell METCON-1 that you want to be informed, immediately, of any change on any input. There are data block read and data block write commands to aid those who want to have another computer control METCON-1; this is like a poor man's host mode. METCON-1 is also configured to get 8 channels of A/D data from an external module that uses a National Semiconductor ADC0838, if it's connected to METCON-1. We're planning an external module for those that want to do standard digital A/D conversion as opposed to voltage to frequency conversion (using METCON-1's built in frequency counter).

Sensors

Currently, we only have one sensor planned for METCON-1. It's a voltage to frequency converter sensor (VTFCS) that can also measure temperature. The advantage of a VTFCS is that it can be placed right at the source to be measured. The audio frequency signal is then carried back to METCON-1 via standard home telephone wires. These lines could be up to hundreds of feet in length. An additional advantage of a VTFCS, since it uses an opto-isolator in its output, is that the sensor can be totally isolated from the METCON-1 ground system (i.e., avoids ground loops).

The Future

We hope to have some of these modules available for the hearty ex-

RADIO-M1 / RUDAK-2

by L. Labutin, UA3CR

The joint work of AMSAT-U and AMSAT-DL for creating the set of equipment for the satellite RADIO-M1/RUDAK-2 is completed.

The idea of cooperation between two groups in the USSR and Germany was conceived in the spring of 1989. The discussion about what to do and how it was to be accomplished lasted until July of 1989, when a meeting of the representatives from each group was held in Surrey, where the mutual preliminary agreement was signed.

The final version of the agreement about the cooperation was signed in the Autumn of 1989, while work on the project was being done.

According to the mutual agreement, the group Orbita AMSAT-U develops and makes the linear transponder, command radio link, telemetry system, and power supply system, and decides all the questions with the official organizations about the placing of the equipment and launching.

The Rudak group of AMSAT-DL develops and makes the digital part, so called RUDAK-2. This part includes a digipeater and a mailbox (protocol AX.25). It provides possibilities for experiments on the transmission of information using modern digital methods. It also contains input and output RF circuits.

The complete set for a ground command station is being developed by AMSAT-U-Orbita and AMSAT-U-Sputnik groups. The Rudak group provides the special digital part of it.

During the launch and orbital test period, the ground command station will be situated in Molodechno, at UC1CWA, and in Moscow, at RK3KP. The ground command station for Rudak-2 only, will be situated near München-DK1YQ and near Hannover-DB2OS.

The final agreement was signed by: "RADIO-M1" - V.Chepyzhenko, RC2CA, technical director of the project, representing AMSAT-U-Orbita, and K. Meinzer, DJ4ZC, president of AMSAT-DL.

Project Manager for "RUDAK-2" is Hanspeter Kuhlen, DK1YQ. The coordinators of the project are P. Guelzow, DB2OS and L. Labutin, UA3CR.

perimeter by Dayton '91, however we make no promises.

In reading this article you might ask "if this is called METCON-1 does that mean there's a METCON-2?" The answer is yes and no. Yes, I would like to see a METCON-2 but no one is working on it. My vision is that a possible METCON-2 would use much of the same software but instead of using the 8751, METCON-2 would use the 8052 that INTEL has programmed with BASIC. This would allow the user to be able to write his own programs for METCON in BASIC. There would be hooks in the software to do the time-of-day clock, capturing input changes, and to run the frequency counter on an interrupt

basis. Once those hooks are in place the user could easily write the control program for METCON-2 and not have to worry about real time.

Hope to see you at Dayton!

Specifications of the RADIO-M1/RUDAK-2

by L. Labutin, UA3CR
V. Chepyzhenko, RC2CA
P. Guelzow, DB2OS

Mission

Piggy-back onboard the USSR geological research satellite.

Launch and Orbit

1. Launch (scheduled)
Time: Late 1990, day is not fixed.
Launch site: North Cosmodrom, Plesetsk
2. Orbit (planned)
Slightly elliptical polar orbit
apogee: 1000 km
Inclination: 83 degrees
Period: 105 minutes

Satellite specifications

1. Dimension and shape
Cylinder of height about 4 meters
diameter: 1.8 meters
2. System configuration
Professional geological research equipment, telemetry system, command link equipment, transponders and power supply, thermal control.
Amateur linear and digital transponders, telemetry system, command link equipment, power supply.
3. Attitude control
Satellite attitude will be maintained by the earth's gravity field using a rod 9 meters in length pointing away from the earth.
4. Planned service life: 3 years

Radio-M1/Rudak-2 System specifications

1. System configuration
Two sets of the equipment will be installed aboard the satellite:
 - Linear transponder #1 mode B and RUDAK-2 with sub-systems
 - Linear transponder #2 mode B with sub-systems.

The first set is considered to be the main. The second one is reserve. It can be taken into operation in case of failure of the first one.
2. Commands
Equipped with real-time program command function

3. Beacons and telemetry, set #1
CW telemetry 8 channels:
145.822 MHz 0.2 Watts
Digital telemetry 30 channels:
145.952 MHz 0.4 Watts
1100 bps, BPSK/FM, deviation 2 kHz
Digital telemetry Rudak-2:
145.983 MHz 3.0 Watts
1200 bps AX.25 BPSK (like FO-20)
4. Beacons and telemetry, set #2
CW telemetry 8 channels:
145.948 MHz 0.2 Watts
Digital telemetry 30 channels:
145.838 MHz 0.4 Watts
1100 bps, BPSK/FM, deviation 2 kHz
Digital telemetry 30 channels:
145.800 MHz 2.0 Watts
1100 bps, BPSK/FM, deviation 2kHz

5. Transponders set #1

- (1) Linear transponder: inversely heterodyned translator
Uplink passband 435.102 to 435.022 MHz
Downlink passband 145.852 to 145.932 MHz
Transmitter output max 10 Watts
Bandwidth (3db) 80 kHz
Uplink EIRP required about 100 Watts
- (2) Digital transponder Rudak-2: digipeater and store & forward packet communication (AX.25), telecommunications experiment with digital signal processing up to nearly 20 kHz, 1 MByte RAM disc, four separate uplink channels.

Uplink frequencies:

RX-1 435.016 MHz 1200bps, FSK, NRZIC/Biphase-M
RX-2 435.155 MHz (AFC) 2400 bps, BPSK, Biphase-S
RX-3a 435.193 MHz (AFC) 4800 bps, RSM
RX-3b 435.193 MHz (AFC) 9600 bps, RSM
RX-4 435.041 MHz (digital AFC) RX for RTX-DSP

Downlink frequency:

145.983 MHz 3 Watts

The downlink can be switched to the following operating modes:

- Mode 1: 1200 bps, BPSK, NRZI, (NRZ-S) [like FO-20]
- Mode 2: 400 bps, BPSK, Biphase-S [Oscar-13 beacon]
- Mode 3: 2400 bps, BPSK, Biphase-S
- Mode 4: 4800 bps, RSM, NRZIC (Biphase-M)
[like 4800 bps uplink]
- Mode 5: 9600 bps, RSM, NRZI (NRZ-S) +Scrambler
[like 9600 bps uplink]
- Mode 6: CW keying [only for special events]
- Mode 7: FSK (F1 or F2B), e.g. RTTY, SSTV, FAX, etc.
[for special events]
- Mode 8: FM modulated by D/A signals from DSP-RISC processor [speech]

6. Transponder, set #2
 Linear transponder: inversely heterodyned translator
 Uplink passband: 435.123 to 435.043 MHz
 Downlink frequencies: 145.866 to 145.946 MHz
 Transmitter output max: 10 Watt max.
 Bandwidth (3db): 80 kHz
 Uplink EIRP required: about 100 Watts
7. Antennas
 (1) 435 MHz receiving antenna (shared by analog and digital modes): Helix +3 db max RHCP.
 (2) 145 MHz transmitting antenna: Half wave dipole
8. Power supply
 From main power supply system up to 100 Watts
 Set #1 consumption 47 Watts
 Set #2 consumption 40 Watts
9. Weight
 Set #1 approx. 28 kg
 Set #2 approx. 22 kg
10. Size: 480x400x300 mm each set.

Telemetry of "RADIO-M1" — CW

Radio-M1 transmits Morse code (CW) and digital telemetry. CW telemetry will start as soon as the bird separates from the launch vehicle and Radio-M1 equipment will be powered by main satellite power system.

The CW Morse-Code telemetry frame consists of the registration call, RS14, and 8 four-digit lines in the following format:

```

RS14  1A 1B 1C 1D
      2A 2B 2C 2D
      3A 3B 3C 3D
      4A 4B 4C 4D
      5A 5B 5C 5D
      6A 6B 6C 6D
      7A 7B 7C 7D
      8A 8B 8C 8D
  
```

The 1A to 7A lines are analog telemetry data. Line 8A is calibration engineering parameter. The first digits from 1A to 8A are system status data: figure 6 means general operating status figure 2 means command operating status. The second digits from 1B to 8B (0 to 7) are numbers of line (channel). The third and fourth digits from 1C to 8D are analog telemetry data.

Definition and decoding of parameters:

Line No.	Parameter	Formula	Unit
0	Transponder power output	0.05N	Watt
1	Transponder PA Temp.	N	Grad. C
2	+24 V Regulated	N	Volt
3	+16 V Regulated	N	Volt
4	+9 V Regulated	N	Volt
5	+24 V Regulated	N	Volt
6	Inside Temperature	N	Grad. C
7	Service	N	.

Example:

6080	- 4 Watts	- general
6137	- 37 Grad. C	- general
6224	- 24 Volts	- general
6316	- 16 Volts	- general
6409	- 9 Volts	- general
2524	- 24 Volts	- command
2632	- 32 Grad. C	- command
2700	- 0	- command

Telemetry of "RADIO-M1" — Digital

Digital telemetry consists of 30 parameters and 2 constants. To receive the digital telemetry it is necessary to use an FM-receiver, modem, de-scrambler and PC compatible computer.

Definition and decoding of parameters:

Line No.	Parameter	Formula	Unit
1	Transponder 1 power output	0.2N ²	Watt
2	Transponder 1 PA Temp.	0.8N	Grad. C
3	DC/DC converter temp.	0.8N	Grad. C
4	+14 V Regulated	10N	Volt
5	+24 V Regulated	10N	Volt
6	+16 V Regulated	10N	Volt
7	+12 V Regulated	10N	Volt
8	+9 V Regulated	10N	Volt
9	+7.5 V Regulated	10N	Volt
10	+5 V Regulated	10N	Volt
11	+9 V Regulated (linear)	10N	Volt
12	+9 V Regulated (digi)	10N	Volt
13	Service	N	.
14	Service	N	.
15	Transponder 2 power output	0.2N ²	Watt
16	Transponder 2 PA temp.	0.8N	Grad. C
17	+24 V Regulated	10N	Volt
18	+16 V Regulated	10N	Volt
19	+10 V Regulated	10N	Volt
20	+9 V Regulated	10N	Volt
21	+7.5 V Regulated	10N	Volt
22	Status command link 1	.	.
23	Status command link 2	.	.
24	Status command link	.	.
25	Status command link	.	.
26	RPC +5V for RUDAK-1	2N	Volt
27	RPC +5V for RUDAK-RTX	2N	Volt
28	RPC +5V for RAMDISK	2N	Volt
29	RPC +14V-BUS Current	???	Amps
30	RPC module temperature	(N*28)-20	deg C
31	"Zero" of the comparator	0C	.
32	Reference voltage	6D	.

RPC = Rudak Power Conditioner.

$$N = \frac{(i-0C)1.16}{6D-0C}$$

where i = the value of the parameter in the hex form, or

$$N = \frac{(i-12)1.16}{96}$$

where i = the value of the parameter in the decimal form.

Bits in the Basement

by Bdale Garbee, N3EUA

Hello again! For the first time in many issues, I don't have a big trip to report on... We've managed to stay inside Colorado for some time now. My work at HP has kept me very busy, but enough time has been spent on radio projects recently that there are many things to talk about. I've also had some interesting mail which I will report on.

COPA

Particularly for those former members of RMPRA who are now members of TAPR, let me update a bit what has happened with the effort to organize a new group called the Colorado Packet Association, or COPA for short. Things are starting to fall together, albeit slowly.

On 1 December, Ed Wright W0LJF called a meeting in Castle Rock, CO. Attendance was very good, and included many PBBS sysops, node operators, our state repeater coordinator, ARRL section manager and head of the State Amateur Radio Emergency Service (SARES), a couple TCP/IP users, and me. I dragged along enough hardware to run a 56kb demo across the room, but other than that it was a purely business meeting.

A document was circulated and approved by vote organizing COPA as an autonomous division of SARES. This gives us an organizational framework with existing permanent 501(c)3 tax exemption, and yet allows us to maintain independent control of our actions and budget. It's a neat arrangement, and we thank the SARES folks for helping us out. We think it is obvious that an improved packet network in Colorado will benefit SARES, so the association is natural.

Elections were held, with the following results: W0LJF President, N0LEU Vice President, KA7EEJ Treasurer, and N1FED (my wife Karen) Secretary. In addition, we elected representatives from each geographic quadrant of Colorado and SARES, KB0CZV for Northwest, A10C for Northeast, WMOZ for South-

west, KQ0J for SARES, and yours truly, N3EUA for Southeast.

Two technical issues were addressed. One was the adoption of geographic quadrants NECO, SECO, NWCO, and SWCO for PBBS hierarchical address designators, and a suggestion that the Colorado Front Range packet backbone on 446.8 move to a frequency inside the band plan published since the adoption of that frequency, taking into consideration the need to interface with the Western Slope backbone. I agreed to act as the first COPA Technical Standards Committee chair, and to look into the 70cm frequency issue before the next meeting.

My apologies to those of you from outside of Colorado for whom this is no big deal... I'm apt to continue to report on the highlights of COPA activity that may have general interest, but will refrain from spending too much time on the topic from now on.

56kb Modems

In case you skipped over the last section, I actually demo'ed 56kb operation between two machines at a meeting on 1 December. It was a milestone for me, as K0YUM, W0DFHG, and I have only had modems working reliably for a couple of months. As this event indicates, a lot of attention in the Bit Basement has been focussed on 56kb operation since the last issue of PSR. We have two modems working absolutely reliably across my basement, using DRSI PCPA cards and the 'hs' driver in KA9Q's NOS software to run them. These are both the current revision of the WA4DSY design built from GRAPES kits by N6GN and then sold to me. We also have two units W0DFHG and I assembled from the beta-test PC boards, and one set of beta-test PC boards that are partially populated. Obviously, we'd like to have 5 working modems. The two current revision units have been mounted to rack panels with power supplies and cabling, and are very portable, as demonstrated by the trip to Castle Rock for the demo, where everything plugged in, turned on, and came up in about 10 minutes, including my AT and XT clones!

We've run into some problems with the beta RF boards that we're still

working on. They function adequately, but the receiver first LO won't tune to the expected amplitude despite component value tweaking. The best we can get is about 3.2V. And the amplitude at the output of the 455kHz IF filter is only about half the expected value. Part of this may be that we are apparently operating the modems near the limit of the receiver frequency range. The LO circuit is not very different on the current rev. PC boards, so I'm apt to hack one to current rev. and see if it tunes up better. Not sure what is wrong at the 455kHz filter yet. Let me emphasize again, though, that the current rev. kits are working great, the problems I'm having are strictly with the older alpha-revision PC boards.

The performance with the DRSI cards is sort of hard to talk about, because at the same time it is great and absolutely horrid. Let me try to explain. The configuration I ran for some time, testing the first two units we put online, was a 20Mhz 286-based AT clone at one end of my basement, using a PCPA card as the only interface, running NOS. At the other end of the 56kb RF hop was my 8Mhz V20-based XT clone, with two serial ports connected to TNCs using 16550 chips on the interfaces, a TRW PC-2000 ethernet card, and the PCPA card. After tweaking things, and clipping out the PTT hang-time capacitors in the MMT 430Mhz transverters, I was able to FTP the NOS sources from the AT over the RF hop through the XT to my HP 9000/350 workstation at the other end of the room across ethernet with a transfer rate of 6.5kbytes per second. This was using 1k packets, and a window size that allowed 4 packets in flight over the course of the 470k or so file transfer. This means I was getting about 93% of the theoretical bandwidth of a 56kb channel, in data! Including the acks, headers, and so forth. This is, obviously, pretty great. The down side is that the PCPA card and 'hs' driver absolutely guarantee that the PC clone is "flat-lined" for the duration of a packet transmit or receive. Nothing else happens, at all. In particular, even the 16550's overflow on the 9600 baud links to my TNCs, and the XT is absolutely useless from the keyboard when the modem is in operation. The fact that the ethernet remains functional at all is a tribute to

having an ethernet interface card in the XT with non-trivial amounts of buffer and a fast interface to the main bus.

This "war story" should make it absolutely clear, if it wasn't already, that the world needs better ways of interfacing to RF channels than dumb I/O hardware in an XT or AT clone! In fact, as soon as I can afford to do so, I intend to replace the DRSI PCPA cards with something better, and sell the boards. Yes, they work fine, but only if you can tolerate the utter blitz of the machine during transfers.

One of the guys at the demo in Castle Rock asked me about reliability of the modems. The pair that I demo'ed, which were built from current rev. kits, came up fine the first time, and have not been tweaked since. For several weeks, they were the only link between my 20Mhz AT software development system and the other machines in my basement... I did a lot of telnet and ftp traffic across them, with no glitches or gotchas. That's not quite the same as running one for a year on top of Pike's Peak, I admit, but it definitely says something... if only my XT were as reliable!

Power Supplies

I mentioned last time that I thought the world needed a good power supply to get from 12VDC nominal to +/-5VDC at an amp or so each. Why? Well, that is what a 56kb modem needs, among other things. I measured both of my current rev. board sets, and the current drains were in the neighborhood of 250ma at 5V, and about 80ma at -5V for both boards in normal operation. Fred Peachman, KB7YW, sent me a very simple little circuit that does the trick, using a 555 timer as an oscillator to switch a pair of power transistors to provide an inversion of the 12V input. He then uses a 7805 three-terminal 5V regulator to brute-force linearly regulate 12V to 5V, and a 7905 negative regulator to cut the negative voltage down to -5V. If you would like a copy of his design, Fred says he's reachable as KB7YW @ WB8LVP. If there's enough interest maybe he'll even write this up for PSR sometime. I have to confess, though, that I haven't duplicated Fred's circuit. There are a couple of reasons. One is that K0YUM found some supplies at a surplus shop in Denver that generate

+5 and +/-12 from 120VAC, for \$15 each. For the short term, this has given us what we need to get the rest of the modems working for essentially no effort and very little money (at least compared to the rest of our investments, HI!).

The other is that I managed to get myself to Westminster, CO, for a day-long seminar by Linear Technologies, and it looks really easy to do a very efficient switching supply based on the LT1171 or LT1172 100khz switcher parts. This has been a fun linear design exercise for me, since it had been several years since I designed a non-trivial analog electronic circuit. I haven't had time to prototype my design, but the only nasty piece is a toroidal transformer that I'm going to fabricate from a toroidal inductor, adding secondaries myself. It seems the more I learn about how transformers work the less I think I know!

If I ever get around to finishing this, I'll write it up and publish it somewhere. But, as I mentioned, K0YUM has solved the power problem for the moment, so on to more important problems.

10Ghz Stuff

Last time I mentioned that WD0FHG had finished the PC board layouts for the N6GN 10Ghz 1Mbit/sec link. Jon Bloom, KE3Z, at the ARRL lab had agreed to cut a couple of sets of boards to test out the design. Turns out he had to make some layout changes to accommodate limitations in the ARRL's current board making facility, which all made good sense. A set of the boards are in my hands now, and I'm working on populating them. There are several problems with the current board layout, and not having plated through holes is a bit of a pain, but I expect to have the boards up soon. A board set also went to N6GN, so we should know a lot more about the design soon. Once we get a chance to build up and test some of the boards, it seems likely that Glenn N6GN or someone will make PC boards available. When I have details I'll report them here. But, it's pretty obvious to me now that there are some things that I want to work on.

The current design is half duplex. Glenn and I talked once or twice about

how it might be possible to mutate the system into running full duplex. I think this would be worth investigating further, particularly since the nature of these links will be point to point. It's not like we'll have a collision problem, but there are noticeable differences in performance, particularly for interactive applications, when acks can flow in parallel with data. This is more of an issue at slower data rates than at ethernet speeds, but given the availability of switch hardware that can handle full duplex megabit data rates (the Grace PackeTen), I'm going to spend some time investigating this. Also, the design of the current circuit includes a digital interface modelled on the AUI connector on an Ethernet card (the DB-15). The levels are differential ECL, and there are separate transmit and receive pairs... but it is assumed that the interface card will do clock recovery on receive, and is self-clocking on transmit. This does not describe the interface of switch and end-user cards intended for HDLC operation, where the WA4DSY 56kb modem is a better match... the modem provides transmit clock, and extracts clock from data on receive, plus generates a carrier detect signal and reacts to a request to send, or PTT signal.

For use with cards like the Grace PackeTen, including a little additional circuitry on the FSK receiver PC board to provide an HDLC-compatible interface makes a lot of sense. Once we're at 10Mbit/sec, the AUI is probably still the right model, but since we can't easily slow down ethernet cards, the current design won't quite do 10Mbit/sec, and the existing interfaces at lower data rates are all optimized for HDLC... I'm thinking about working up the changes to do direct HDLC interface at RS-422 levels. More next time.

NOS

The letters that have shown up in my mailboxes the last few months have included a fair number of requests for more information in the column on what "NOS" is, what it is good for, and how to get it. That's a subject that could become an article unto itself. I'll try to hit a few high points here, and if there's continuing interest, I'll work

harder for next time. Let me know what you want to hear!

To start with, I think it makes sense to take a short walk through amateur TCP/IP history, particularly for those of you who have never heard Phil, KA9Q talk at a TAPR or other packet meeting.

A long time ago in a galaxy far away, called Pennsylvania, I met Phil Karn at the first meeting of MAPRC, the Mid-Atlantic Packet Radio Council. During the meeting, it snowed, so the three of us from Pittsburgh (Mike, K3MC, Bob N3CVL, and I) split a pair of hotel rooms with Phil, and we sat up most of the night talking protocols and what we thought the amateur packet world needed. By morning, we had all agreed to work together to develop TCP/IP based software for packet radio. Phil already had the core routines up and running on a Xerox 820. Mike went off to investigate TFTP and FTP, I went off to investigate SMTP, and Bob planned to look at ports to other hardware including some PDP/11 systems he had access to. The key is that all of us were motivated by having experienced the Internet protocols at work or at school, we shared a common vision of what it might be like to have a flexible, dependable platform for application development, and all of us were committed to making otherwise outrageously expensive protocol functionality available to the amateur community for free. We dragged a bunch of other folks into the project fairly quickly, and after a couple of false starts, got a "tcp-group" electronic mailing list going. A lot of hours and a lot of lines of code later, Andy Freeborn N0CCZ and I had the first TCP connect using KISS TNC's between our houses in Colorado Springs. Others had run TCP over packet radio before, but this was a milestone in that it was the first time of record that the KA9Q software was used with a KISS TNC successfully... still the most common mode of operation for TCP packet stations today.

At that time, the software included Telnet, FTP, and SMTP... and not much else. For a long time, functionality was added by a variety of folks to this original version of the "NET" software. Eventually, the limitations of the internal structure of NET became overwhelming. But by the time they did, a

lot of neat stuff had been added. AX.25 connections, a mini-PBBS sort of mailbox, drivers for a variety of interface cards, and ports to a variety of computers and operating systems. The last big hurrah for the pre-NOS version of NET was the "Dayton release," 890421.1. Some have continued to build new functionality around this version, including most notably KD8WK and PE1CHL. But for many of us, "pre-NOS" as it has come to be called, is history. NOS is a "New Operating System" version of NET, the result of a complete rewrite of the internals of the package by Phil, KA9Q. The rewrite placed a multi-tasking kernel at the core of the package, and restructured the interface between protocol and application code to use the Berkeley Sockets Interface, a defacto standard in the networking world. The primary goal was to make it easier for others to use NOS as the basis for new applications. In this regard, NOS has already been a great success!

Anders Klemets has rewritten the "mailbox" code to be an almost complete WORLI-style PBBS, all as part of the NOS package. This code is interesting to me mostly because it is being perceived by many as an alternative to something like MSYS, except that this is a primarily TCP solution with AX.25 BBS, instead of a primarily AX.25 BBS with TCP. K3MC and I have wasted many a late-night ice-cream and coffee session talking about this, I'm glad Anders took the time to make it reality. I will confess, however, that I haven't waded through the setup information, and so am not taking advantage of this functionality yet in the Bit Basement.

Considerable work has been done on NNTP by several people. NNTP is the Network News Transport Protocol, and is the standard way Usenet hosts on the Internet exchange News articles, and the way many News readers access a News database. I've talked at length in prior columns about News and the potential it has as an application to get more folks actively involved in packet radio. NNTP is at the moment the preferred way to actually implement the transport layer, as differentiated from the technique used by the Terakoya system by JK1LOT and friends, which involves sending articles as mail messages. If nothing else,

NNTP is a "pull" system, where the downstream receiver requests only what he wants, which potentially is more efficient than the upstream sender sending what is wanted and then some. As I write this, I've got NNTP up and running on winfree, and have a copy of NOS with NNTP support that I'm playing with at night. More next time.

Another area that has been receiving a lot of effort is the RSPF routing protocol I mentioned in the last issue of PSR. In a nutshell, my interpretation of the results of the effort to date is that any kind of automated routing protocol is a pain when it is used on 1200-baud, collision-prone channels. Progress is being made, and I'm a strong believer in the future of RSPF. I haven't played with the protocol yet, but am looking forward to doing so soon.

The biggest problems with NOS right now are that a) it is still in a state of constant and rapid flux, and b) documentation of the quality needed for new users (or even of the quality of my hack for the pre-NOS version) does not exist. Phil has written a command reference. NQ0I has worked on docs for the "mailbox". There has been a lot of talk on the mailing list about getting an organized effort going. But for now, caveat emptor!

If you want to try it out, many of the BBS systems that carried NET now have beta-release snapshots of NOS available. This includes the N8EMR and WB3FFV BBS systems, and probably others. The current bits are always available for anonymous FTP on the Internet from thumper.bellcore.com.

Winfree / Unix Packet

I mentioned in the last issue that I had migrated my Unix machine 'winfree' from an HP 9000/550 to an HP 9000/330. Thanks to the generosity of a TAPR member and reader of this column, winfree is now a 9000/350. Unfortunately, other than the upgrade, and adding some more disk space, I've had precious little time to work on services for the local community. I've got news installed and stable, am almost ready to unveil NNTP service, am running a .ampr.org nameserver, and will soon have the latest callsign database snapshot online... but who knows when

I'll get time to finish these, or do more. The rumor mill reports that there may be a ham from the Denver area at Dayton this coming April selling off as many as several thousand ATT 3B Unix machines at a fraction of their original cost. These aren't the most wonderful machines in the world, but running KA9Q networking software, they have the potential to be neat service-providing platforms, particularly when coupled with a good switch board like the Grace PackeTen to "fan out" the internal serial port to one or more RF channels. You'll hear more as I know more.

NOSINABOX

Things have been really weird on the NOSINABOX front since the last issue of PSR.

I've had a port of NOS running, but with lockup problems, on the Kantronics Data Engine since before Dayton this year. I've had a port of NOS in progress on the PS-186 since sometime in July. But, I haven't worked on either one very much since then. There are two interlocking reasons. One is that I have run into some annoying technical problems with the port, and two is that I've lacked the motivation to overcome the hurdles and finish the work. In the fall, I contacted AEA and Kantronics by FAX, and asked both vendors for production hardware to complete the ports with. Kantronics responded immediately by sending me the requested hardware, and reiterating their willingness to help in any way possible. I can't say enough good things about how easy it has been for me to work with and on the Data Engine, mostly because of the support from Phil Anderson, Mike Huslig, and the rest of the gang in Lawrence.

Mike Lamb of AEA responded quickly also, with a FAX indicating that production hardware would be available soon. I haven't heard anything since. I know not what conclusions to draw.

The lack of outwardly visible activity on the PS-186 from AEA leaves me unwilling to further pursue code for that platform. I am not sure that the Data Engine makes much sense running NOS except in a limited number of applications because of the relatively few ports it provides, and the fact that

for high speed modems, use as a TNC or "home switch" is not optimal because of the limited speed of the serial port to the computer. A port of the G8BPQ NET/ROM-compatible switch code for the Data Engine exists now and seems to work. Since NOS supports IP over NET/ROM, this is not an unreasonable approach to take if you want to run Data Engines on your network. My interest has been shifting away from the grungy details of making code work on diverse hardware and towards things like routing, network management and security, and neat new link hardware. What does all this mean? Well, for one thing, if you want a packet switch based on NOSINABOX, buy a PackeTen card from Grace. It's a neat board. Don Lemley, N4PCR, has done a great job independently porting NOS to the standalone environment. As discussed in two papers in the ARRL conference proceedings this year, the PackeTen card is based on the Motorola 68302 communications processor... which turns out to have some hardware features that dovetail nicely into the requirements of NOS. And the cost is not unreasonable for the performance received and the development and support effort it represents. KOYUM, WDOFHG, and I are buying some of the standalone boards to use in our emerging network in Colorado.

What Does It Cost?

There is a question I've been wrestling with for several months, as I try to understand what may be possible for COPA, and as I talk about fast packet switching hardware with other hams. What is the actual cost of installing and maintaining a packet facility?

If you have recently or are now in the process of installing a packet facility that will be shared by multiple users, in particular things like digipeaters, single or multi-port NET/ROM sites, a PBBS, a DX cluster, or whatever... I would like to ask you to take a few minutes to write down what it cost. What would be ideal is an explanation of what kind of facility this is, how many people it serves, what it cost to install including a line-item breakdown of what the pieces cost to whatever level of detail you can do easily (include antennas, feedline, any site costs, digital hardware, RF

hardware, software or firmware, etc), and what you know or estimate it is going to cost to maintain (repair from acts of nature, frequency of vandalism, rent for the site, electric or phone bills you have to pay, whatever comes to mind).

Send your responses to me via any of the methods detailed at the end of this column. If I get enough responses, I'll summarize the information next time in PSR, and comment on any particularly interesting tidbits. I went through this process a while back in the packet section of CompuServe, and it was kind of fun to see what other folks were working on.

CompuServe

Mentioning "Compuslave" reminds me that I wanted to mention that I've effectively left the HAMNET forum on CIS. The time required, and the cost involved in keeping up with the general content of the packet and satellite sections led me to stop participating. I am still involved in the TAPR board of director section of HAMNET, and am still checking in to read EASYPLEX once a week or so. Therefore, you can continue to use the CIS address to send mail to me, but do it with EASYPLEX or using the Internet gateway to get to my 'bdale@col.hp.com' address instead of putting the message in S9 of HAMNET, since I just won't see it there.

Until Next Time

I hope you've enjoyed my ramblings this time around, and that you had a healthy and happy holiday season. I spent most of mine recovering from strep throat and a sinus infection, but my brother Cabell (who graduated as a Civil Engineer from NC State University in December, way to go bro!) came out on Christmas day and stayed through the first. We had a great time, and other than not feeling great at the end, 1990 was a good year here in the woods. I look forward to seeing you at the TAPR meeting in early March, and at Dayton in April. In the meantime, keep those cards and letters coming!

I can be reached as bdale@col.hp.com on the Internet, as 76430,3323 on CIS, or by paper mail at 4390 Darr Circle, Black Forest, CO, 80908, USA. 73!

Compact Packet

by Lyle Johnson, WA7GXD

I have recently come into possession of an ATARI Portfolio "palmtop" computer. This is an MS-DOS machine with an 80C88 processor and 128K bytes of RAM. It has a full QWERTY keyboard (albeit for Santa's elves, not real human fingers for those who can touch-type). It also has an 8-line-by-40-character highly legible LCD display.

A serial port adapter plugs into one side and voilà! we have a pretty useful communications and storage device. The Portfolio is about the size of a VHS video cassette (thinner by about 1/3) and sells for under \$300 retail. It runs for about 20 hours on three "AA" cells.

I connected my unit up to a TASCOS (Heath) Pocket Packet and my ancient Yaesu FT-208R 2-meter HT and put the whole mess on packet, checking into a local BBS. With one of the newer micro-HTs, you could place the HT and TNC under the Portfolio and have a complete portable packet station only slightly larger than a VHS cassette!

This station is about one-quarter the size and weight of the briefcase portable packet stations of yesteryear that used the Radio Shack Model 100/102 or NEC PC8201/8300 along with a TNC-2.

The communications software for the Portfolio is pretty limited at this time (yes, it is MS-DOS but not all applications run on it) but I found a freeware communications utility for it on CompuServe called XTERM1. This software lacks a scrollback feature (believe me, it needs scrollback!). Once someone comes up with a better communications program, this could be a very useful packet tool.

If any of you run across (or write) a decent packet comm. program for this machine, let me know! Meanwhile, I'll struggle along...

DSPeculation

by Lyle Johnson, WA7GXD

The TAPR/AMSAT DSP project will soon yield a useful board for those who have IBM-compatible PCs. Standalone applications will be able to use the AEA DSP1232/2232.

There are a couple drawbacks to these units, naturally.

The TAPR/AMSAT unit requires you to have an IBM-compatible PC. This doesn't help if you are stuck with a no-expansion slot compatible, or a MAC or Amiga or Atari or Sun SPARCstation or ???

The AEA unit hangs on your serial port, so anyone can use it, but it will cost several hundred dollars.

Neither of these units is a rip-off in any sense of the word. Both offer plenty of value for the money spent. And both should be very flexible, with a one-time investment that won't need to be repeated when the next slick mode or modem comes along.

What if you are a cheapskate (like me), or broke (also like me), or for some other reason can't or won't part with \$300 to \$700 to play in the DSPark? Or, perhaps you just want a TNC or AMTOR device with a high-performance modem.

There may be hope!

Analog Devices has recently announced the ADSP-2105 DSP chip. The ADSP-2105 is a little brother to the ADSP-2101 DSP chip, a highly respected device with a matching (\$100) price tag. The 2105 can't do everything the 2101 can, because its internal memory is 1/2 as large and it has but a single serial port rather than two.

However, a 2105 plus a CODEC chip and a cheap 27256 EPROM can combine to make a DSP modem that should be able to take on FSK and PSK chores. I'm no DSP wizard, so I can't tell you where it falls off (for example, it may not be able to do a full-duplex 9600 bps FSK modem ala K9NG) but it seems to me that this chip can easily handle 1200 or 2400 bps full-duplex operation. Which means MicroSats, VHF/UHF packet, 2400 bps packet,

and plenty of HF packet modems (although it may lack the power to do the most sophisticated proposed HF modems).

The beauty of the 2105 is that it costs \$10. Yep, ten dollars. Half the ADSP-2101 at one-tenth the price. Add another \$10 for a Motorola MC145402 13-bit linear CODEC and \$5 for the EPROM and you have a very cost-effective DSP-based packet (or AMTOR/RTTY/etc) modem. Such a device could become a useful, inexpensive way to get your feet wet in DSP and wind up with a limited but capable modem experimentation platform. It could just plug in to a modem disconnect (or fit inside a Kantronics Data Engine) on an existing TNC...

If any of you software DSPractioners out there think you are interested in participating in a project like this, let me know. I can give you the parameters of the chip and you can see if you can squeeze a high-performance FSK or PSK modem implementation into it. If you can, and do...

This is not an official TAPR project in any sense, but who knows?

TAPR Packet Radio Video

by Greg Jones, WD5IVD

TAPR will be revamping the 1985 "Packet Radio" video featuring Pete Eaton, WB9FLW, talking about packet radio. After looking over the tape, it is amazing how timeless most of its sections are on how packet operates, and how you get started in packet. For the most part, the tape will be unchanged except for the reordering of two sections and the creation of a new "future of packet radio" section at the conclusion. This tape should be a good club presentation video on packet radio that could be used to supplement a live demo. It will be shown at the March annual meeting and availability of the tape will be announced then.

Notes from the Office

Hello once again....just a few comments from the TAPR kitchen where I want to comment about a few things that are brewing!

Of course, we wish each and every one of you a wonderful holiday, and a better year than you could presently wish possible. We're hoping to enrich your hobby this coming year with a few new products... however, we're a little bit cautious, and don't want to promise anything in any more detail than has already been passed around the grapevine, until it's actually in hard-copy form!

It is difficult to express our gratitude and respect for all of you who have so faithfully stood behind TAPR this year. THANK YOU! Every membership renewal we take as a vote of confidence, and we at the office, and all in TAPR leadership wish to let you know you are appreciated. Those of you who have gone farther and have offered suggestions, taken the time to write down documentation improvements, contributed towards the new products, etc, THANK YOU. Without you there is no TAPR.

It has been brought to our attention that it would help if those who offer technical assistance for TAPR have a packet address that they can be reached at.

Dave Medley, KI6QE, who helps to field PSK and DCD improvements on PK232 TNCs, has offered his assistance. KI6QE @WA6VQP.CA.NA. Any of you other wonderful fellows who don't mind also sharing your packet address to assist folk in any particular, or general, packet related subject, please inform me of it and I will communicate it to those in need. Muchas Gracias!

The K9NG 9600 baud kit is selling like hot-cakes at a bazaar, but we don't know how they are being used. Please share the recipes (I really have the kitchen in mind, don't I?....) One new thing, this same kit now comes complete with ALL the parts, not just the "hard to find ones," at no cost increase to you!

Looking forward to making you all welcome at the annual TAPR meeting.

73s,

Heather, N7DZU

Software Library Update

by Bob Nielsen, W6SWE

The December issue of *QST* contained a good description of the ARES/Data software by WN6I and N6KL. A new version of this package is now available from TAPR on Disk 20.

Also, there has been some confusion caused by the discussion of KA9Q's NET (TCP/IP) in that same issue; TAPR is distributing the "old" (890421.1) version of NET, not the NOS version. NOS is still under development and changes quite rapidly. In addition, the documentation is very minimal. When NOS becomes more stable and there is adequate documentation available, TAPR plans to distribute the software. For those hardy souls who wish to experiment with NOS in the meantime, both KA9Q's version as well as some modifications by others can be obtained from several BBS sources. Among these are WB3FFV at (301) 625-0817 and N8EMR at (614) 895-2553.

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

Revised:

Disk 1 - APLINK - version 5.00;

Disk 9 - ROSErver PRMBS - version 1.47 (disk 9a, the source code, has been dropped);

Disk 10 - ROSE Switch - version 901111;

Disk 16 - W0RLI BBS - version 11.15;

Disk 20 - ARES/Data - version 1.4;

Disk 21/21a - MSYS - version 1.10 (now on two disks);

Disk 22 - G8BPQ Switch - version 4.01

New:

Disk 29 - Introduction to Packet Radio (Tutorial) by Larry Kenney, WB9LOZ

Disk 30 - PACSAT Broadcast Protocol/Software by G0/K8KA and NK6K

TAPR attempts to supply the latest version of all software, however we cannot distribute what we do not have. Authors are invited to send updates to their software (and new offerings) to the TAPR office. The office can provide disks and mailers for updates upon request.

New TNC-2 Code Release fixes KISS DCD Bug

The KISS code released with 1.1.7 has a bug in the half-duplex mode. The TNC will ignore the radio channel DCD state and transmit on top of other stations. Full-duplex mode works properly, so this bug doesn't affect satellite operations. TAPR now has available a revised 1.1.7a release of firmware for the TNC-2 which fixes the DCD bug. Half-duplex mode now works as it should, deferring to other traffic on the channel.

Those who have purchased a 1.1.7 EPROM from TAPR may receive the new 1.1.7a EPROM at no charge by returning the 1.1.7 EPROM with your request. Version 1.1.7 operates correctly for non-KISS operation. We apologize for the inconvenience, and wish to thank Howard Goldstein, N2WX, Bob McGwier, N4HY, and Lyle Johnson, WA7GXD for their efforts in tracking and squashing this bug and integrating the fix into a new code release.

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.

Code to be Dropped from Technician Exam

from the ARRL Letter

The Federal Communications Commission will eliminate the Morse code portion from the Technician class Amateur Radio examination, thereby creating a code-free class of license.

The new rules will probably take effect 30 days after their publication in the Federal Register. According to Private Radio Bureau Chief Ralph Haller, the effective date could be as early as February, 1991.

Current Technician class licenses will be grandfathered, so as not to lose any privileges (including those below 30 MHz, which they share with Novices). The new codeless Technicians will have full amateur privileges above 30 MHz. "New" Technician licensees will, upon passing a 5-WPM code test before volunteer examiners, be issued a Certificate of Successful Completion, allowing them the same HF privileges as "old" Technicians.

Volunteer examiners will be required to notify the FCC of the 5-WPM Morse CSCE issued to "new" Technicians, so the FCC will have this information for enforcement purposes.

The current Novice class license will be retained without modification as an "alternate entry point" for persons willing to pass a Morse test without taking the more difficult Technician theory examination.

"Offering a codeless class of license that authorizes control operator privileges at stations which transmit exclusively above 30 MHz" the Commission said, "provides an entry level opportunity to otherwise qualified persons who find [telegraphy] a barrier to pursuing the purposes of the amateur service."

The Technician written examination will remain 55 questions; there will be no questions over and above the current Technician exam. "New" Technicians will not receive call signs singling them out as codeless licensees. At a Dec. 13 appearance before the FCC Commissioners, PRB Chief Haller noted the special efforts of

several PRB staffers for their work in formulating the Reports on both the codeless license and testing of the disabled.

The avalanche of letters from amateurs elicited a response from Commissioner James Quello, who noted "The large number of comments reflects the vitality of the [amateur] service."

William Cross of the PRB presented the item for the commissioners' consideration. He provided an excellent overview of the continuing contributions of the Amateur Service. "We will look to the Amateur Service" in the future, Cross said, "to expand the pool of experimenters, engineers, and technicians."

Cross noted a "concern within the amateur community" that the Morse code requirement may discourage some otherwise qualified people who could contribute to the service from entering it.

Cross reminded the commissioners of several specific contributions of amateurs, whom he called "pioneers:" the adoption of SSB by the US Air Force in the 1950s after hams proved the mode's viability, and the hams' early use of low-earth orbit satellites as well as their on-going Space Shuttle SAREX program.

"Society is well served by amateurs available world-wide," Cross said, "by persons ready, willing, and — most important — able to communicate" in times of emergency.

FCC Chairman Alfred C. Sikes said he saw the proposals as "Having the potential of creating an even more vital and dynamic service."

We Know You're Out There!

The Packet Status Register is looking for articles on all aspects of packet radio.

Does your area have a special purpose server node? What services does it provide? What are its unique features? How do you access it? What features would you like it to have that it doesn't have now? Write a short article and let everyone know what you're doing.

Have you interfaced a high speed modem to a particular radio? Send us the details so other experimenters can benefit and learn from your efforts.

What networking activities are taking place in your area? Have you overcome some nasty problems with unique solutions that would be interesting to others? How have you interfaced between different networking schemes? Was it successful?

Maybe you have an application you would like to see on packet radio, but doesn't exist yet. Write up a description of the features you think would be important. There may already be someone working on it who's looking for ideas.

Don't think you can write an article? Then write a short letter! Tell us what you're doing. Synergism doesn't work unless we all participate.

Submission details: paper or electronic is fine. Files should be plain ASCII, a blank line between paragraphs, no tabs. Graphics are encouraged; HPGL or PCX formats work best, but others are also acceptable.

If you have any questions, or would like to discuss an idea before writing an article, please contact one of the editors. Thanks!

TAPR Board of Directors Election

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

TAPR is run by a Board of Directors. There are fifteen members of the Board, each of whom serves a three-year term, with five positions filled each year. Board members are expected to attend, at their own expense, the annual Board Meeting held with the annual membership meeting in Tucson. They participate in the decision-making process and provide guidance to the officers. Continuing board discussions are held in a private section on CompuServe.

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

The current members of the Board and the expiration dates of their terms 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 Gustavson, N7CL	1992
Skip Hansen, WB6YMH	1991*
Lyle Johnson, WA7GXD	1992
Phil Karn, KA9Q	1991*
Dan Morrison, KV7B	1991*
Harold Price, NK6K	1992
Dave Toth, VE3GYQ	1993
Don Lemley, N4PCR	1993

This year's election is to fill those expiring board seats shown with an asterisk. The term of office will run until 1994. The candidates for the five positions to be filled are:

Jerry Crawford, K7UPJ
Andy Freeborn, N0CCZ

Greg Jones, WD5IVD
Dan Morrison, KV7B
Bob Nielsen, W6SWE

Your ballot is included in this issue of *PSR*. It is included as an insert so that the issue may be kept intact. Please mark your ballot and return immediately to the TAPR office. Ballots must be received no later than Friday, February 22, 1991 to be counted. Election results will be announced at the annual meeting on March 2.

The candidates' background and qualifications as submitted by them are:

JERRY CRAWFORD, K7UPJ

I have been a ham since 1961 and packet radio is the best thing that has happened in amateur radio since then. Packet radio provides tremendous opportunities for public service and other message passing as well as a fascinating aspect of our hobby which has helped improve the technical capabilities of many and brought us into effective utilization of computers. I am greatly impressed with the effort and extraordinary accomplishments of the volunteers in TAPR who have done so much to develop amateur packet radio capability. I would like to assist with continued contributions by TAPR. I believe we need to establish a strategic objective for TAPR, determine the steps to achieve that objective then implement necessary actions. I do not have the technical background of some other directors but can help with management and provide a users perspective on what needs to be done for enhancing packet radio to provide the greatest benefit.

I am in the U.S. Army Signal Corps, with an MSEE from University of Colorado and BS from West Point. I have an Advanced class license and also have had the calls DA2CY, ON8UA, DA1ET, WA6TXL and KN0GZJ and have been a member of TAPR since 1988 and am a life member of ARRL.

ANDY FREEBORN, N0CCZ

I first became associated with TAPR activities in 1982 when I became the TAPR Beta site coordinator in the Colorado area. I was elected to the TAPR Board of Directors in 1985. I was elected President of TAPR in 1988 and served two terms in that capacity.

I am a 30 year retiree from the U.S. Air Force. During WWII I was a combat fighter pilot in the European theater. In later years I commanded five different Communications-Electronics organizations in the U.S., Philippines and North Africa.

I have strived to fill the needs within TAPR for largely administrative and support tasks, thus relieving those that are better qualified to devote their efforts to technical development work. I make no claims as to technical expertise in either electronics or software but have a firm understanding of the amateur community needs in these areas.

I feel that there is much development work yet to be done in the area of high speed networking, signal processing and other practical applications of amateur digital communications. I would like to help guide TAPR to meeting the needs of the amateur community toward those ends.

GREG JONES, WD5IVD

Licensed since 1978. Working on a masters degree in Computer Science and Computer Information at the University of North Texas in Denton, Texas. Employed by Compaq Computer Corporation - Dallas Engineering as a Technology Planner, responsible for researching future telecommunications directions for Compaq. Member of ARRL, AMSAT, Texas VHF/FM Society, Secretary/Treasurer of TAPR, Vice President of Texas Packet Radio Society and editor of the TPRS Quarterly Report. Originally involved with packet through

the TNC II project. Involved with the TAPR packetRADIO project - responsible for documentation. Also involved with future development paths for TexNet and TPRS. Have presented papers at ARRL networking conferences as well as Dayton convention and TAPR meeting.

DAN MORRISON, KV7B

I would like to run for reelection to the TAPR Board of Directors. I have been associated with TAPR since its inception, and have participated in a number of TAPR projects, including TNC I design. Most recently I participated in the design of the TAPR/AMSAT DSP board, perhaps the most exciting project yet undertaken by TAPR.

It has been a great pleasure to be associated with some of the most technically savvy hams in this country, and I hope to continue that association for some time to come. Serving on the TAPR BOD through a large part of that association has been a great privilege, and I would like to continue that service.

BOB NIELSEN, W6SWE

Licensed since 1952, and a member of TAPR since 1988, I have served as editor of Packet Status Register and as Vice President for Member Services of TAPR during 1990. I hold an Extra Class license and am an Assistant Director for the ARRL Southwestern Division. I am employed by Hughes Aircraft in Tucson as a Senior Scientist working on radar guidance systems.

I have enjoyed working with TAPR for the past year both as editor of PSR and in reorganizing and updating the software library. I have taken steps to reduce costs in the publishing and mailing of PSR, such as obtaining a second-class mailing permit which will result in substantial savings over first-class mailing costs. With postage costs going up in 1991, this will hopefully minimize the fu-

ture impact on TAPR dues.

I am looking forward to further involvement in TAPR activities, both technical and administrative.

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The officers of the Tucson Amateur Packet Radio Corp. are:

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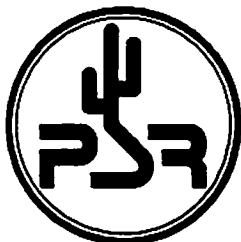
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