PACKET STATUS REGISTER

January 1985
Number 13

Tucson Amateur Packet Radio Corp.

VOTE for the candidates of your choice in the Board of Directors election! Instructions for voting, descriptions of the nominees, and a ballot are all contained in the last pages of this PSR. Do it today, before it is too late, and make your voice heard!

The Minnesota Repeater Council, under the insistent guidance of Rick Whiting, W0TN, has reserved a 100 KHz portion of the 2-meter band from 145.000 to 145.100 MHz for digital communications, including packet radio. Coordination of individual stations among the set of 5 frequencies (145.01, 145.03, ... 145.09) is left to the users of that spectrum. At this moment, 145.01 MHz is the frequency of choice for all known packet stations in the state.

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PSR Mail Bag

I operate the wide area digipeater K4NTA-1 here in Stuart, FL. It is located where I work, which happens to be a CATV company. The antenna is up 300 feet on the main receiving tower using 7/8" 75 ohm hardline. The TNC is a TAPR Beta board driving a GE Master. All this is not unusual, but I also use this TNC by remote control from home.

I use two 4800 baud RF modems made for data communications on the cable system. This remote controlled TNC has worked out very well. It is like operating packet from a mountain top, even though we don't have many mountains here in Flordia.

We have wide area coverage digipeaters in Jacksonville, Melbourne, Stuart and West Palm Beach. W1BEL's home station provides the link into the Tampa area on the West coast of Flordia. Digipeaters are planned for Okeechobbe, Miami, Orlando, Tampa, Lake Wales and Ocala. All of this activity is on 145.010. Presently we have two PRBBS stations on line, K4NTA in Stuart and WD4LHF in West Palm Beach. Connections are routinely made with all areas that have packet activity. I estimate that there are around 100 stations on in Flordia now.

We are planning such things as PRBBS linking for message exchange and would like to hear from others working on this. Another project is to connect the Heathkit Computerized Weather Station (ID-4001) to the packet net. I have heard that there was something from the Heath User Group that told how to do it (not the packet part). Any HUGers out there with the info? I will be using a TRS-80 III, so I am mainly looking for information on the weather end.

Ted Huf
K4NTA
Stuart, Florida

The Tucson Amateur Packet Radio Corp. will have its Annual Meeting on Saturday, February 9, 1985. The meeting will be held at:

Granada Royale Hometel
Tucson International Airport
Tucson, AZ

We have reserved the Granada Theater, which will seat up to 120 people comfortably, and all seats have a good view of the proceedings.

The meeting is scheduled for 9 AM to 5 PM, with a catered lunch. The cost for the meal is $5.00.

We expect to have a very interesting series of presentations on current packet radio techniques and applications, networking proposals, what TAPR is doing, and so forth. In addition, we will have a question and answer period during which you can express your views.

We would like to encourage all regional packet groups to pool your resources and send a representative to the meeting so we can hear what is happening with packet in your area.

There will be an opportunity for you to vote if you neglected to mail in your ballot (in this issue!) for the Board of Directors election.

Finally, there will be an "unofficial" packet radio dinner Saturday night.

Come and express your views. Harangue your Directors. Have a good time. And participate in the future of packet radio.

If you wish to stay at the Granada Hometel, room rates are $69.00 (single) and $79.00 (double), which includes breakfast. The phone number is: 602-573-0700. TAPR is NOT reserving a block of rooms at reduced rates (we would have to pay for them if they weren't filled!), so it is up to each individual to make reservations.

Please let us know as soon as possible of your intentions to attend. We need to get a fairly accurate head count to the caterers by the end of January. Write to the TAPR PO Box and mark the envelope: ATTN - Annual Meeting.

Note to Board members: due to the severe time constraints of a Saturday night BoD meeting, this year the Board will meet on Sunday, February 10th, from 9 AM until adjournment.

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South Georgia is comming alive with Packet. I came on with a TAPR TNC followed by KF4JF, KB4JF, WB4ZNW and KA4DPF. We have connected with Atlanta via KF4JJ and to Jacksonville, FL. via WB4RCY-1. We are anxious to test linking north to south. KA4DPF and I use 145.01 most of the time.

Wayne Harrell WD4LYV Rt. 1 Box 368
Sycamore, GA. 31790 912-567-2643

President's Corner

by Lyle Johnson, WA7GXD

This issue of PSR contains a ballot for election of five Directors. Please read the associated material, including the article explaining the structure of your organization, then select the five candidates that you believe will best serve you, TAPR and the interests of Amateur packet radio at large, mark your ballot and mail it in. **PLEASE DO IT TODAY!**

Since the publishing deadline for the last PSR, there has been, once again, a lot of activity in packet. I'm not referring to on-the-air operating activity; rather, I'm referring to planning and group interaction.

During the weekend of September 15th, 1984, the ARRL Ad Hoc Committee on Digital Communications met at ARRL Headquarters in Newington. There were two primary issus regarding packet radio on the agenda. The first was adoption of a Level Two standard protocol. The second was agreement on an approach to networking, or Level Three.

A document describing AX.25 Level Two, with modifications on previous implementations to solve a few outstanding minor difficulties, was presented. After considerable input from various committee members and observers, the document, authored by Terry Fox, WB4JFI, was adopted by the committee and submitted to the ARRL Board of Directors in late October, where it was approved.

Another document, describing the V-2 protocol by Doug Lockhart, was examined by the committee. However, it was felt that V-2 offered no substantial additional benefit over AX.25 and the committee essentially took no action.

Two very different approaches to Networking were discussed. The first, an approach based on virtual circuits, is called AX.25 Level Three and is documented in the Proceedings of the Third ARRL Computer Networking Conference held in New Jersey in April, 1984. A strong case was made for this protocol by its proponents.

The other approach, based on a protocol called IP, uses a technique called datagrams. It is widely used in the defense establishment as well as various universities and hotbeds of UNIX activity. Like the virtual circuit advocates, a very good case was made for datagrams by its proponents.

After considerable discussion, a sort of play-off was proposed. Basically, each group is to code up software implementing a defined subset of Level Three goals to run in identical hardware environments. Tests will then be conducted and, hopefully, agreement achieved for a concerted effort at getting a full-blown Level Three protocol implemented, then on to Level Four.

Why am I taking so much space in this PSR to bring this to your attention? I think it is important to realize that packet radio is not the private domain of any group. What we are seeing is a collection of talented individuals willing to work together to achieve something for the common good. Just as parochial issues were laid aside by the vast majority of Amateur packeteers to adopt AX.25 Level Two as a standard link level protocol, so we are witnessing significant cooperation among various packet groups to work on higher layers of protocol, to eventually bring about the national and international communications facility that we all envision.

While the work involved in working out an effective link level protocol, demonstrating packet techniques to Amateurs worldwide, seeding the market and demonstrating to commercial interests that packet is a viable marketplace for their wares, encouraging experimentation at all levels, fostering cooperation among diverse groups and helping implement various unique applications for existing packet gear has been enormous, it is kindergarten compared to the work that is now challenging us all.

In order to facilitate the comparison of the proposed protocols, TAPR is making available an SCC adapter for the surplus Xerox 820 single-board computers that were selected as the common vehicle for implementation. This allows experimentaiton with both the Zilog SIO and SCC chips for HDLC operation in the radio environment.

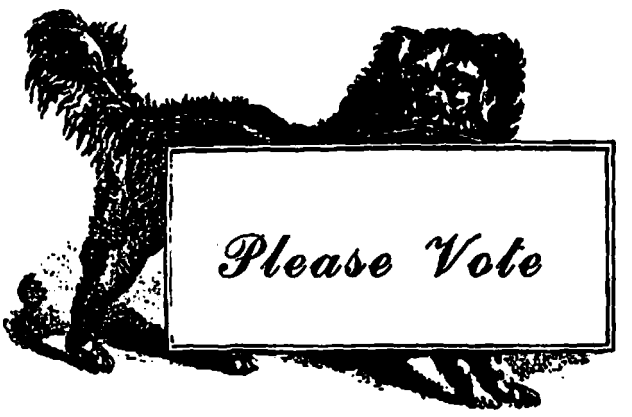
What is TAPR's position in this protocol evaluation? Encouraging proponents from both persuasions to get ready for the test!

The weekend following the ARRL meeting, I was privileged to attend the ARRL/Central Iowa Technical Society (CITS) conference in Des Moines. I was given the opportunity to describe the networking proposals and give a very brief tutorial on the similarities and differences in them. Jeff Ward, K8KA, discussed the ARRL Technical Section and Ralph Wallio, WØRPK, gave an enlightening presentation the 6-meter Meteor Scatter (METSCAT) work he had been doing with Bob Carpenter, W3OTC, in Washington, D.C.

Ralph has a dedicated, hard-working team of enthusiastic packeteers assembled in Iowa, and they described various network strategies they are striving to implement.

All in all, it was a very worthwhile meeting. I understand Ralph has an edited videotape available of the proceedings relating to packet radio. Contact CITS c/o Ralph Wallio, WØRPK, Rural Route Four, Indianola, Iowa 50125.

Happy packeting!



A Proposed Network for the interconnection of Amateur Digital Packet Radio Stations

Brian Kantor, WB6CYT
University of California, San Diego

Introduction

The growth of digital communications in the amateur radio service during the past few years has been nothing short of incredible. More than anything else, the ready availability of digital packet communications using sophisticated packet controllers such as the Vancouver [VADCG], Tucson [TAPR], and GLB devices has introduced packet communications to many hams who would not otherwise have become involved in digital communications. Beyond these packet controller's function as sophisticated replacements for mechanical teleprinters, they provide a means for the establishment of message systems and bulletin boards by permitting direct connection to personal computers.

While some use of packet radio has been made on the HF bands below 30 MHz at lower data transmission rates, the greatest activity is currently on VHF-FM (particularly 2 meters). Since dependable VHF communication is limited to (at most) a hundred miles or so from one home station to another, the number of stations that can be contacted by packet radio is somewhat limited.

Repeaters and Digipeaters

Since the digital transmissions are converted to and from audio signals using standard modem technology, it is possible to send packet transmissions through ordinary voice repeaters. There are both technical and social problems with this practice, however, which make it unwise to do so.

Technically, many voice repeaters have audio response characteristics that, while not really noticeable with voice transmissions, introduce significant distortions that reduce the reliability of digital retransmission. Additionally, Morse code or voice identifiers, frequency or signal strength telemetry tones, and 'over' beeps all may be confused as packet signals by the less sophisticated packet controllers.

Socially, the harsh sounding modem tones generated by the packet equipment are annoying in the extreme for voice users, leading to jamming, interference, and general unhappiness. Also, many packet controllers recognize only packet modem tones, so they do not acknowledge that a frequency is busy when it is occupied with voice transmissions, and may transmit on top of an existing voice conversation.

Digital repeaters, known as *digipeaters*, provide a means for automatically retransmitting packet signals, but because packet acknowledgments must be returned from the far end of the connection over the possibly multi-hop link path, the effective rate of transmission is greatly decreased. Also, there is currently no collision checking when signals are digipeated. Thus, in case of a packet collision, current digipeaters cannot detect the collision and retransmit the packet that was destroyed by the collision. The originating station must therefore await the lack of acknowledgement from the far end of the connection and resend the packet. Repetition of sent packets from the originating station may very well occupy large amounts of a

Much of the work in this paper is the direct outgrowth of continuing discussions with Mike Brock, WB6HHV and others in the Southern California packet radio community.
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network's available transmission capacity.

The Network Solution

We feel that the solution to these problems lies in a dedicated network for packet communications, much like the packet switching networks that regularly move millions of characters of data across the country and around the world every day.

The network is simple. Each community (or geographic area) has at least one Packet Network Controller [PNC] to serve as a network *gateway* which would be the access to the packet network for that area. These stations would function automatically, without a human operator, and would serve to provide connections for local and network users. Each PNC would have at least one neighbor PNC, and could make logical connections to and through the adjoining PNCs.

The Structure of the Network

AMPRNET[1] is structured as a mesh of PNCs, each having one or more neighbor PNCs to which it can connect via radio links. Each of these PNCs has connections to other PNCs, and so on, until all PNCs in the network are reachable through one or more hops. Connections between nonadjacent PNCs are made by having adjacent PNCs relay the packets between the two endpoints of the logical connection.

Every PNC has a routing table which describes at least one path to every other accessable PNC. By using this table, it is possible for any PNC to contact any other PNC, possibly through a number of intervening relay hops. The routing table is dynamically built and updated as the network topology changes with nodes coming in and out of service.

[1] Thanks to Hank Magnuski, KA6M for the network name.

The User View of the Network

A connection is established via the network in two distinct steps. First, a user connects to the local PNC. We have chosen the use of the ssid (station sub identification field) value 14 (fourteen decimal) as the reserved designator for PNC stations, so a connection initiated from (for example) a TAPR TNC might appear as

CONNECT WB6CYT–14

which would instruct your station to connect to the PNC run by WB6CYT. A 'connected' message, followed by a 'network ready' message would appear on your screen.

Next, you would instruct the PNC to attempt to connect to the station you wanted to call. In order to do this, you must know the identification of the PNC serving his area. So, for example, to contact Harold Price in Los Angeles, you might instruct the PNC to connect you to his packet station via one of the Los Angeles PNCs:

CONNECT NK6K@WB6YMH
(the – 14 is implied here)

assuming that WB6YMH was operating that PNC. The network will take care of establishing the connection and all routing of packets necessary. When the conversation is finished, disconnecting from either end will cause the virtual connection over the network to be closed as well. Note that connections may be entirely local with only the local PNC involved; this provides a more reliable local-area repeated connection than current digipeater technology can.

We plan to have the PNC supply other services as well. Among those planned for are

- Who's On Listing
- Network Status
- Time and Date Server
- Site Security Monitor

Network Protocols

While there are many proposals to establish a standard protocol for linking

of amateur packet stations, there currently are no experimental results showing a clear advantage for one choice over another.

The protocol chosen must take into account two different aspects of the network. First, there is the question of transport between nodes of the network, and second, the format of the data carried by the network. These are not necessarily solved by the same answer.

The *transport* protocol describes the method chosen to carry messages between nodes of the network. While for a hardwire line a simple serial ASCII link would be sufficient, for the more common radio links, a reliable means should be chosen. In our research, we found that the present implementation of the *AX.25* protocol (used by TAPR, VADCG, GLB, and others) would serve well. It has error detection and correction, is efficient, and both software and hardware for its use are readily available. For these reasons, we have chosen to use the AX.25 protocol for most node-to-node radio links on the network.

The *AMTOR* communications protocol also has some distinct advantages for links that are on the HF amateur bands. In cases where the links between network nodes are to span large distances, the AMTOR protocol could be used and we think it would serve well.

The format of messages carried by the network is independent of the transport protocol used. Because it is expected that links will fade and suffer interference, and that nodes will fail, it is wise to use a protocol that is robust enough to recover from many such problems. After extensive searches of the literature and considering the base of already installed software and systems, we have chosen the *Internet TCP/IP* mechanism for the message protocol.[2]

TCP/IP is designed to operate with an unreliable transport system, and its performance improves when the underlying transport system is more reliable. It incorporates packet reassembly and reordering mechanisms that can cope with lost packets, packets received out of order, and duplicated packets. Since the network routing scheme described below will accomodate a failed node by routing around it as long as a path exists between the endpoint network nodes of a connection, it was a great advantage to chose the TCP/IP protocol which would correctly utilize such a facility.

TCP/IP also has other advantages which we think places it as the top contender for the internal message protocol. It has been proven by over 10 years of use on the DOD Arpanet/Milnet/Internet; implementations are available for computer systems ranging from VAX mainframes to the IBM PC; it is completely defined and documented; other facilities which use the TCP/IP protocol for file transfer and remote computer use already exist; and much of the software needed to implement TCP/IP is available at no charge.[3]

Therefore, it is planned to implement the network such that all inter-PNC communication is performed using Internet Protocol [IP] datagrams to allow for maximum flexibility in the routing and transport of data, regardless of the kind of link used between nodes. This allows direct interconnection to the Internet or any other IP compatable network should such be desired.

Hank Magnuski, KA6M, has obtained a Class-A Internet network number assignment for amateur packet radio.[4] It is anticipated that each PNC

[2] A special note here to thank Phil Karn, KA9Q for his suggestion that TCP/IP could run on top of AX.25 - Phil, it was a brilliant idea and solves a problem we'd been discussing for some time.

[3] Among other sources, Professor Jerome Saltzer of MIT has implemented TCP/IP for the IBM PC. His implementation is available and can be reproduced at no charge, although MIT retains the copyright.

[4] This is registered with the Defense Communication Agency's Network Information Center as network number 044.xxx.xxx.xxx AMPRNET as documented in Internet RFC 870 dated October 1983.

will have its own unique block of host numbers assigned. In the case of manufactured PNCs, the PNC host addresses will be assigned when the unit is shipped. For homebrew units, a central registry will assign the number. Since these numbers are 24 bits long, several million numbers are available. The number merely identifies the PNC address and is much like a hardware serial number. It does not have to be changed when a PNC is sold or moved or assigned a new callsign. (For those of you familiar with the internet, an address resolution protocol is used to map the PNC internet address numbers to the PNC callsign dynamically.)

Routing on the Network

Routing tables are automatically built and maintained by network nodes. When first activated or after a system reset, the PNC has no connections to neighboring stations. Whenever a PNC has no connections it sends a broadcast beacon message periodically (probably every 10 minutes) until it has established at least one connection to a neighboring PNC. When a neighboring PNC receives such a beacon, it attempts to open a connection to the PNC sending the beacon message. Whenever any node-to-node network activity is detected, routing tables are updated by all PNCs that received the messages so that each will understand the most recent network connectivity. Routing tables may also be exchanged to provide updates.

If a PNC already in the routing table has not been active for a length of time, a message is sent to that PNC to check that it is still active. This is called *pinging*, and will probably be performed after 30 minutes of idle time has elapsed.

If an attempt to communicate with a neighboring PNC fails for any reason, whether during normal packet relaying or as a result of a failed ping, that PNC is deleted from the open connections list and routing table, and will no longer be used for packet relay by the PNC detecting the failure. Thus, the network will recover from and route around any failure that does not isolate a node. When the failed PNC recovers, its beacon or other activities will alert its neighbors that it has returned to service.

Connections between PNCs need not be radio links. Modems, hardwire lines, optical fibres, or other means will serve as well. In these cases, the messages sent by the PNC over these links are identical to those that would have travelled over the AX.25 virtual radio circuit, so there will be no difference in operation with these other types of links.

Acknowledgements

My deepest thanks to Mike Brock WB6HHV, for his invaluable suggestions on the design of the network, as well as his help in preparing this document.

My thanks also to the many people of the Vancouver Amateur Digital Computer Group and of Tucson Amateur Packet Radio Inc, and to Phil Karn KA9Q, Rod Hart WA3MEZ, Harold Price NK6K, and Skip Hansen WB6YMH for their contributions and suggestions.

References

Beattie, J. Gordon N2DSY. *Networking Considerations for the Amateur Packet Network*

Borden, David W. K8MMO. *The Eastnet Network Controller*

Bruninga, CDR Robert E. WB4APR. *Eastnet: An East Coast Packet Radio Network*

Bruninga, CDR Robert E. WB4APR. *HF Packets: Modems and Gateways*

Fox, Terry WB4JFI. *ISO Reference Model Review*

Saltzer, Jerome A. *PC/IP Users Manual.*

Tannenbaum, Andrew. *Computer Networks.*

TAPR, Inc. *TNC Users Manual.*

DARPA Internet RFCs are available from the Defense Communications Agency Network Information Center at SRI International, Menlo Park, CA. Many technical libraries also have copies. Of special interest are numbers 765, 768, 791, 792, 793, 813-817, 826, and 870.

Board of Directors Election

The Tucson Amateur Packet Radio Corporation is governed by a Board of Directors. The Board consists of 15 directors, each of which is elected for a three-year term. Every year, five seats are up for the nomination/election procedure. By staggering the terms, the Board is able to achieve long-term stability while still being responsive to the membership on an annual basis.

The Board's purpose is to elect TAPR's officers, with each officer serving a one-year term, and provide general guidance to the organization. The Board meets on an annual basis, the meeting to occur on the second weekend in February. The terms of the following members of the present Board of Directors are about to expire in 1985:

Mike Brock, WB6HHV	Mike Parker, KT7D
Dave Henderson, KD4NL	Bill Reed, WD0ETZ
Dan Morrison, KV7B	

The following packeteers have been nominated for the five seats to be filled. A brief summary is provided of each candidate's qualifications and philosophy about TAPR and packet radio. Please read this section carefully, then mark your ballot (on the back page of this PSR) with no more than five candidates and mail it to TAPR:

Paul Barnett, N8CRH

Paul, a system software analyst with one of the larger computer companies, became involved in Beta testing with a borrowed board and became co-editor of PSR in early 1983. He is currently serving as Vice-President and Secretary/Treasurer of the Minnesota Amateur Packet Radio group (MAPR), who spend most of their time promoting packet radio in the area in and around Minneapolis and St. Paul.

Paul's desire is to do all he can to further the cause of Amateur packet radio on a national basis, encouraging and assisting in the kind of advanced development (particularly high-speed linking) that will keep the current explosion going. He doesn't think his support should stop with sending in his annual dues, and wants to encourage other members to do the same.

Mike Brock, WB6HHV

Mike has been a member of TAPR since mid-1982. He is the San Diego area Beta Coordinator, and has been active in promoting packet radio in southern California. He has participated in the development and testing of the TAPR TNC kit, and has been very active in the detailed digital hardware design for a multi-port network level controller for Amateur packet usage.

Professionally, Mike is a digital hardware design engineer with strong microprocessor experience. In addition, he understands the problems associated with remote site operation, including interference and reliability considerations.

Andy Freeborn, N8CCZ

Andy is the TAPR Beta site coordinator for the Colorado area, has been active in packet radio since mid-1982 and was an organizer of the Rocky Mountain Packet Radio Association (RMPRA). Since the summer of 1982 he has devoted his efforts to the introduction of packet radio to the Amateur radio community. While making no claims as to technical expertise in either electronics or software, he has a firm grasp on both.

Andy is a retired U.S. Air Force Colonel, having served for 30 years. His military background includes duty as a combat fighter pilot, flight operations, air defense operations and command of five operational units.

He believes that the greatest contribution he can make to TAPR is in the area of management guidance. The success of the TAPR TNC has diverted the time and talents of the TNC developers to non-R&D administrative work. One of Andy's objectives as a Board member will be to seek out administrative methods which will free the time of these people so they can direct their energies to R&D.

Skip Hansen, WB6YMH

Skip was one of the early supporters of TAPR, member #89. He was a TAPR Beta-test participant. He was an early experimenter in Amateur digital radio, experimenting with ASCII and later with the VADCG TNC. Skip provided the first high-visibility 24-hour digipeater in southern California and provided the first "host computer" services on packet in this area. he has used packet on Oscar 10 and is one of the 21 Amateurs permitted to experiment with automated gateways under a Special temporary Authorization (STA) from the FCC.

Skip is involved in several of TAPR's current projects. Professionally, he has worked in both RF and digital design. He is currently in technical management at a microcomputer manufacturer.

David Henderson, KD4NL

As a member of the TAPR Beta software team, Dave implemented the link level software on the TAPR TNC and designed the multiple level digipeater protocol which was later added to the AX.25 Level Two specification.

He brings to the TAPR Board of Directors his experience as a computer professional with strong talents in the digital communications area. His primary interests are in designing better networking for packet radio and in evolving the current systems into a better network for Amateur radio.

Gary Kaatz, W9TD

Gary is an RF engineer for Motorola in Schaumberg, IL. He has served as President of the Chicago Area Packet Radio Association (CAPRA) since its founding, and has proved a tireless worker. Along with Steve Goode, K9NG, he has been extremely active in experimenting with packet radio hardware and software. He has provided technical and operational assistance with new stations getting on the air and has assumed responsibility for planning programs and clinics for all of CAPRA's meetings.

Dan Morrison, KV7B

Dan's involvement in TAPR extends back to the earliest days when the Alpha test was being organized. During Beta Test, he was the National Test Coordinator. In addition to this task, he designed the modem filters and assisted in other aspects of the modem design. Dan has also assisted TAPR in many other ways, from technical problem troubleshooting to licking stamps for the PSR.

As the organization enters a more mature phase of existence, he looks forward to TAPR's maintaining its position of leadership in the research and development of this most exciting aspect of Amateur radio, and would like to continue to be part of it.

Bill Reed, WD0ETZ

Bill was one of the organizers of SLAPR and a TAPR Beta test participant. He put one of the early CP/M-based packet BBS's on the air in St. Louis. Now in Dallas, he is stirring interest in that part of Texas in the packet field.

Bill was heavily involved in the construction of the engineering model of the DCE aboard Oscar-11, and organized the group that did the PC board layout for that project. He is now ground station manager for the PACSAT project.

TAPR Board of Directors Election Ballot
Vote for five (5) candidates:

_____ Paul Barnett, NØCRN

_____ Mike Brock, WB6HHV

_____ Andy Freeborn, NØCCZ

_____ Skip Hansen, WB6YMH

_____ David Henderson, KD4NL

_____ Gary Kaatz, W9TD

_____ Dan Morrison, KV7D

_____ Bill Reed, WDØETZ

Any ballots with more than five candidates marked will be disqualified. After selecting the candidates of your choice, detach this ballot, place it in an envelope, and mail it to:

TAPR
P.O. Box 22888
Tucson, AZ 85734

ATTN: BALLOT

PLEASE mark the envelope with "ATTN: BALLOT" so that it will not get misrouted! The ballots will be counted at the Annual meeting on Saturday, February 9, 1985. A last-minute opportunity to vote will be extended to those present, but please don't wait!

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

The officers of the Tucson Amateur Packet Radio Corporation are:

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

PSR Mailing address: (For PSR material only)
Minnesota Amateur Packet Radio
c/o Pat Snyder, WAØTTW
565 Redwood Lane
New Brighton, MN 55112

Via Digital Radio Net:
Pat Snyder (WAØTTW,298Ø)

TAPR HF Net:
21.28Ø MHz 7.158 MHz
19ØØZ Sundays 21ØØZ Sundays

The Packet Status Register is edited and prepared by the following members of the MAPR group in the Twin Cities using material contributed from wherever we can get it:

Pat Snyder ..... WAØTTW
Paul Barnett .... NØCRN

Tucson Amateur Packet Radio Corporation
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PSR

Check YOUR address label for membership EXPIRATION date !