



PACKET

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President's Corner

TAPR in 1995: A Brief Review

1995 was a busy year for the organization. The TAPR/AMSAT DSP-93 was kicked out the door and became a successful kit as a result of the efforts by the DSP-93 development group. The TAPR first-ever fund raiser, for RUDAK-U contributions, wrapped up and we made most of the target goal of \$6000 to help support the construction of RUDAK-U. I know Lyle Johnson and the RUDAK-U development group have been busy getting the payload designed and ready to fly. Thanks to everyone who contributed. The changes made at Dayton in 1995 were well received, with TAPR now hosting the Digital Communications Forum, as well as working with the Miami Valley FM Association to host the Packet BASH Friday evening. It should be even better in 1996, since the dinner facility selected will hold lots more people and provide meeting rooms as well. The PSR! What can I say? I think we should all give a big round of thanks to Bob Hansen, N2GDE, for this past year's effort. The size and quality of the issues grew and I think we can expect the same type of quality in the publication in the future. The TAPR FCC regulatory committee, headed up by Dewayne Hendricks, WA8DZP, worked through the summer and into the fall on the

Look for TAPR at these Upcoming Events

May 17-19, 1996	Dayton HamVention
Sept. 20-22, 1996	ARRL and TAPR Digital Communications Conference in Seattle, WA
Oct. 11-13, 1996	ARRL Southwest Division Convention in Mesa, AZ

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President's Corner, continued...

Spread Spectrum regulatory issues. The filing with the FCC should be filed as of this printing.

The Special Interest Groups had their ups and downs this past year and I think everyone learned as we went. Overall the mail archives from the SIGs show a very positive direction and I look forward to seeing more developments from the HF-SIG on the Channel Simulator and HF digital modes, the newly created Spread Spectrum SIG on various SS technical issues and design developments, and the TNC-SIG which is working on enhancing TNC functionality.

TAPR published its first two books and lined up a book distributor to increase circulation. At the end of the year, three new books were begun while several other prospective books were suggested by TAPR members.

Projects had movement, the TNC-95 alpha boards, as well as the TUC-52 alpha boards, are working and the DAS kit was submitted by Paul Newland, AD7I, and is about ready to ship.

The ARRL and TAPR have joined conferences to forge the newly named ARRL and TAPR Digital Communications Conference, as well as signed an agreement for TAPR to distribute all past proceedings of the Digital Communications Conference.

We had our problems as well in 1995. The volunteer effort required to procure, kit, and ship kits always provides interesting fun. After much work at the end of 1995, I think TAPR has successfully transferred over 10 years of kitting activity in Tucson to Florida. Board member and organization secretary Gary Hauge, N4CHV, and Heather Johnson, N7DZU provided much of the work required to complete this job. Many Thanks! Membership growth was short of the targeted 3000 — something to work on in 1996.

That was just a snapshot of some of the more important points during 1995, but many more were not discussed. I am really happy about the things the organization was doing in 1995 and I think the membership can take pride in the accomplishment and direction during 1995.

With 1995 completed, what does 1996 look like? The TAPR FCC Regulatory Committee will continue to work with individuals on the issues regarding the rules changes for Spread Spectrum. While the ARRL filing was positive, it was far short of what had been discussed in meetings in 1995. The TAPR filing will request additional flexibility in the rules to allow Spread Spectrum to become an equal Amateur mode. These changes are assuredly necessary in order to see true growth within the Amateur bands of spread spectrum technology. More about these in this issue and future ones from the TAPR FCC Regulatory Committee.

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The Tucson Amateur Packet Radio Corporation is a non-profit scientific research and development corporation [Section 501(c)(3) of the U.S. tax code]. Contributions are deductible to the extent allowed by U.S. tax laws. TAPR is chartered in the State of Arizona for the purpose of designing and developing new systems for digital radio communication in the Amateur Radio Service, and for disseminating information required during, and obtained from, such research.

Article submission deadlines for upcoming issues:

Spring 1996	March 15, 1996
Summer 1996	June 15, 1996
Fall 1996	September 15, 1996
Winter 1997	December 15, 1996

Submission Guidelines:

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you, or someone you know, is doing something that would interest digital communicators, please contact the editor so that your work can be shared with the Amateur community.

The preferred format for articles is plain ASCII text; the preferred graphic formats are HPGL or PCX. However, we can accept many popular word processor and graphic formats. All submissions on diskette should be formatted for MS-DOS.

President's Corner, continued...

Our Internet node, TAPR.ORG has seen increasing activity as more and more Amateurs and TAPR members get connected to the Internet. TAPR will work on several improvements for this year which will include making the mail archives searchable, improving the RealAudio system, and looking at ways to add more content. We are looking at means to provide a faster conduit into the system to allow even more access than we currently can support. If you know someone using TAPR.ORG who is not a member, please be sure to remind them that membership makes the system viable. We have been extremely fortunate to have Lee Ziegenhals, N5LYT, volunteering as much time as he has with the system and the DataRace Company for allowing us to house our site at their location.

Later in the *PSR*, you will find the outcome of the membership questionnaire sent out at the end of last year. There are some interesting responses and trends uncovered from the data. We will be discussing some of the outcomes in more detail at the board level.

In this issue you will also find the ballot for the 1996 Board elections. We only had three TAPR members run for the three open positions. Thus, we will only be making the ballot available in the *PSR* this year. Please take a moment and read the bios of the members running and then place your vote.

As 1996 progresses, look for TAPR at the following events: Dayton, ARRL Southwest Division Convention in Mesa, AZ, ARRL and TAPR Digital Communications Conference in Seattle, WA. Also, if you have your TAPR badge, be sure to wear it, so others will know you are a TAPR member at conventions and meetings.

1996 TAPR Annual Meeting?

As was reported in the last issue of the *PSR*, there will not be a TAPR Annual Meeting held in the spring. TAPR and ARRL are combining the TAPR Annual Meeting and ARRL Digital Communications Conference into the ARRL and TAPR Digital Communications Conference for the next three years. This is to be tried as a test for the 1996, 1997, and 1998 conferences. In 1998, both organizations will review the joint conference agreement and determine if it should continue. What does this mean for TAPR and ARRL members, as well as Amateurs with an interest in digital communications? Basically, we will all have one event a year to attend instead of two — which should help everyone's budget, increase attendance, and raise the number of papers being submitted. See the announcement regarding the 1996 ARRL and TAPR DCC below.

1996 ARRL and TAPR DCC

TAPR and ARRL are proud to announce the dates and location for the first joint ARRL and TAPR Digital Communications Conference. 1996 marks the 15th anniversary of both conferences and it is fitting that they are joining into one conference for the next three years. The Digital Communications Conference will be held September 20-22, 1996 in Seattle, Washington near the SeaTak Airport. More details will follow over the next few months. The deadline for paper submissions will be near the end of July, so start thinking about those papers and presentations **NOW!** One of the goals of having one single yearly national event was to increase the number of submitted papers — so I hope that happens!

I really look forward to this next year and am excited about the many projects and tasks that TAPR has on its plate. As always — TAPR is only possible via the effort of those that get active and do things. Support can take many forms and I would like to personally thank all those who join each year, and to those that spend countless hours working on TAPR projects. Being President of TAPR would not be as much fun without all of you!

Cheers - Greg, WD5IVD

Dayton Hamvention Packet Event!

The 1996 "Packet BASH" sponsored by TAPR and the Miami Valley FM Association will be held on Friday of the Dayton HamVention. The BASH will be moved this year to a much larger site! So, if you were one of the folks that felt it was just too crowded for dinner — you were not alone. The reason for the move was that TJ's Restaurant was just a little small for 1995.

A buffet dinner, a raffle for some neat prizes, a great program, and lots of fun will cost approximately \$20 per person.

We hope that this will provide an opportunity for packet and digital radio enthusiasts to have a great night out while at HamVention.

The schedule of events is still tentative, but will look something like this:

- 19:00 Dinner
- 19:45 Welcome
- 20:00 Keynote Address
- 20:30 Raffle
- 20:45 TAPR SIG Meetings

For more information, send email to "packbash@ag9v.ampr.org" or stop by the TAPR booth at Dayton for schedule and map.

TUC-52

Paul Newland, AD7I

First pass of the TUC-52 PC board has been built. As a core, it seems to be working well. We do have a few layout issues to clean up but they are straight forward to deal with. Testing will continue with these first boards and we can (will) use them to develop applications based on "perf-board" prototypes of personality boards.

Efforts are well underway to develop a floating point Basic system customized for the hardware on TUC-52 (based on the old Intel 52 basic, which is based on an incarnation of Tiny Basic, which is based on, etc.).

We are also working on a personality module for PCON (printer controller functionality). The idea behind PCON is to allow a computer printer connected to a packet modem (with connectivity to a local BBS via radio) to provide the same convenience of "rip and read" hardcopy as that provided by land-line fax machines. This concept has been well received by many of the RACES/ARES people that use packet for their communication links. This will be a stand-alone system that will NOT require the use of a PC at the PCON printer location.

Another TUC-52 personality board will provide satellite tracking and doppler frequency adjustment for ham radio satellite communications. We hope to provide most of the features of the old TrakBox system along with a few new ones.

By next issue I hope we can report that the TUC-52 BASIC system is ready for release, that a TUC-52 Debug Monitor is ready for release and that a design and preliminary code are ready for the PCON system.

We are still in the process of collecting information regarding the requirements of the satellite tracking personality board so I can't give a good estimate of what we might have next quarter on that effort.

DAS — DTMF Accessory Squelch

Paul Newland, AD7I

As you may have seen, the December 1995 issue of *QST* included the article describing the DTMS Accessory Squelch (DAS) system. Of special interest to packet people is the mode of DAS that allows it to be used as a remote system reset controller. For more information on this refer to the *QST* article as well as DAS Application Note #5 (remote control).

We have received the PC boards and they work just fine. This project wasn't terribly complex so we had a good shot at getting it right the first time out of the chute, and fortunately we did so. So far, the response by hams to the DAS system has been good.

D A S (DTMF Accessory Squelch)

Application Note 5

Special Remote Control Applications And Operations

Paul Newland, ad7i@tapr.org

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Introduction

DAS (DTMF Accessory Squelch) acts like a switch connected in series between the speaker output of your VHF or UHF transceiver and an external speaker. DAS will monitor a radio channel for you, with the speaker switch open so the speaker remains silent, until someone sends one of the DTMF sequences you have selected. When DAS hears your personal Touch-Tone ID sequence on the radio channel it will light a LED, sound a buzzer and close the series speaker switch so that you can hear the audio of the calling station.

An introductory discussion of DAS was published in *QST*, December, 1995, pages 25-31. The "DAS Configuration Reference Guide," available from the TAPR FTP file server as well as the ARRL BBS [Note 1], provides a more complete description of each programming option, the purpose of the option and how the various options may interact.

This document, DAS Application Note 5, "Special Remote Control Applications and Operations," describes how you can make use of DAS for special remote control applications. One particular DAS application of interest to ham radio operators may be using DAS to control a remote radio transceiver.

General Purpose Remote Control

General purpose remote control can be handled by means of the PER-PLUS commands. These commands allow you to set either of the two relays on DAS to either an "energized" or "de-energized" state. You can also use PER-PLUS commands to set any of the six open collector outputs of DAS to either a "floating" or "current sink to ground" state. Additionally, you can set three of the open collector outputs used to drive the LEDs (LED0/URG, LED1/PER and LED2/GRP) to any of the six LED flash codes. You can not set the state of the output used for LED3/STA since that's used to display internal DAS status conditions.

A complete discussion on the use of the PER-PLUS commands is given in the "DAS Configuration Reference Guide" under the heading "General Purpose Controller Functions."

Reset Controller Functionality

DAS provides a capability to serve as a master reset controller. It's function is briefly described in the "DAS Configuration Reference Guide." If you haven't done so already, please review the "Reset Controller Functions" section in the Configuration Reference Guide.

In general, when DAS is functioning as a Reset Controller, it looks for the special sequence followed by a configured PER ID sequence. When DAS has detected both sequences it then closes K1 for two seconds which can be used to reset all devices at a site. It's expected that K1 on DAS will control additional relays that are mounted physically within each piece of equipment at the mountain top (or other remote location) that is to be reset. Assuming that a small reed relay, similar to Radio Shack 275-233, is used within each device to be reset, then the coils of up to 50 relays can be safely paralleled together and driven by K1. Each relay should include a clamp diode across the coil.

Relays are added within each piece of equipment because the "on-board" reset signal for each device should not leave the housing of that device. If a high impedance reset signal was routed outside the housing it may become susceptible to electrical noise in general and, electro-magnetic fields from radio transmitters specifically. As discussed above, a relay should be added within every device that is to be remotely reset and that relay should be within inches of the existing reset switch or within inches of the circuit board where the switch is wired. The contacts of that relay should be connected to the reset circuit of that device and the low impedance coil windings are brought out of the box, with suitable RFI filtering as may be needed, and are wired in parallel with any other similar purpose relays. These paralleled relay coils would then be connected to a series circuit consisting of the paralleled relays, K1's normally open contacts and a 12 volt DC power source.

Remote Radio Control

DAS provides a capability to control a remote radio transceiver. The DAS feature is called "K2 Control Mode." Its function is briefly described in the "DAS Configuration Reference Guide." If you haven't done so already, please review the "K2 Control Mode" section in the Configuration Reference Guide.

In the remote radio control application (like a remote base) it's assumed that there is an audio path between the user and the remote radio. That audio path might be implemented with a "4-wire" radio link, a 4-wire audio link or a 2-wire audio link [Note 2]. A dial up telephone line is an example of a 2-wire audio link.

Once the user has established a communications link to the remote transceiver, he can access that transceiver by entering a multi-digit access code (PER+33 in this

case). When the PER+33 command is detected by DAS it will activate K1. The remote transceiver system should be configured such that when K1 is active the receiver audio will be coupled onto the communications link back to the user. When the user wants to activate the transmitter on that transceiver he sends a momentary DTMF 0 signal to DAS. When DAS detects this DTMF 0 and then sees that the DTMF 0 has been removed from the audio path, K2 will be activated for 30 seconds or until DAS detects DTMF *, which ever comes first. K2 would be wired to actuate the transmitter's PTT circuit. With PTT active, any audio on the link will be transmitted by that remote radio transmitter. Normally the user will end the transmission with a momentary DTMF * to deactivate the transmitter and return to the receive mode. The 30 second timer provides a watchdog function so that if the user fails to send the momentary DTMF * the remote transmitter will not be on the air for more than 30 seconds. To deselect that remote transceiver unit the user would send DTMF * * * (3 stars).

In summary, use PER+33 to select a particular DAS unit controlling a particular remote transceiver. When a particular DAS unit has been selected its K1 remains active until that DAS unit is deselected. Use DTMF 0 to enable K2 and DTMF * to disable K2. Use DTMF * * * to disable both K1 and K2 and to deselect that DAS unit.

Please note the following. When DAS is in the "K2 Control Mode" DAS doesn't change output states until the appropriate DTMF signal is REMOVED from the audio input of DAS. Thus, the DTMF 0 used to enable K2 (and the transmitter) does not get transmitted by the remote transmitter. Additionally, the DTMF * used to disable K2 (and the transmitter) ALWAYS gets transmitted by the remote transmitter. Thus, to send a DTMF LiTZ signal via a remotely controlled transmitter the user will need to send a momentary DTMF 0 to activate the transmitter and then follow with the actual LiTZ signal.

Note also that if a user makes brief transmissions on a radio channel via a remotely controlled transmitter that receivers of that signal will demodulate a DTMF * at the end of each transmission. If a receiver is connected to a DAS unit with the STAR IS WILD CARD CHARACTER option set to active, that DAS unit may respond to what appears to be a series of Wild Card characters. The two second "end of sequence" timer keeps this from being a problem. As long as the transmissions do not occur at a rate faster than one every 2 seconds, those DAS decoders should not respond to the DTMF * used to deactivate the remote transmitter.

If the user has a need to transmit a DTMF * as part of a SELCAL sequence, the user will need to actually send DTMF * 0 on the link for each DTMF * actually transmitted by the remote transmitter. The DTMF * will

be transmitted by the remote transmitter but it will also cause the remote transmitter to become deactivated. The DTMF 0 will reactivate the transmitter, but will not be transmitted over the air by the remote transmitter. For example, to send the DTMF sequence 1*34# via a remote transmitter the user would send the following DTMF sequence:

0 1 * 0 3 4 # *

The first DTMF 0 enables the transmitter without that DTMF 0 signal being transmitted by the transmitter. The first DTMF * will be transmitted but it will also deactivate the transmitter at the end of the DTMF *. The second DTMF 0 will not be transmitted but it will reactivate the transmitter. The second DTMF * will be transmitted (and should have no effect on monitoring DAS units) and will deactivate the transmitter.

Notes

1. TAPR FTP File Server ftp.tapr.org, look in /tapr/das. TAPR on the Web at "http://www.tapr.org". ARRL BBS, 860-594-0306, 8-N-1, look in the FILES area, search on DAS.
2. The terms "4-wire" and "2-wire" are telephone system terms. They are derived from the number of "wires" needed to implement a particular circuit. The important considerations of these circuits are as follows. In a 4-wire circuit, the transmit and receive audio travels on totally independent circuits. The only cross-talk that exists in the 4-wire case is from the small capacitive and inductive coupling that may exist between the transmit and receive signal wires.

Cross-talk is typically non-existent in 4-wire audio circuits, for most practical purposes. In a 2-wire circuit, like the circuit between the telephones in your home and the telephone company's central office (the source of dial tone), the transmit and receive signals are carried on a 2-wire path. The transmit and receive signals travel on the same signal path — that one pair of wires. The telephone instrument and the central office switching ports each include balance networks that attempt to cancel out, or balance out, their own transmit signals from their own receive signal ports. In practice, the balance circuits don't work well because of the unknown characteristics of the wire pairs (which usually include inductors called loading coils). The important consideration for 2-wire circuits is that the lack of balance from transmit port to receive port can cause problems in the case of a remotely controlled radio transceiver. For example, DTMF signals demodulated by a remote radio transceiver might be detected by the remote DTMF controller (DAS) that's used to control the transmitter associated with that transceiver. Thus, if a "K2 Control Mode" DAS unit

was controlling a remote transceiver that used a 2-wire audio link, and that transceiver demodulated DTMF 0 from the radio channel, and that DTMF 0, perhaps because of poor balance, was coupled into the transmitter audio input port and was detected by the DAS unit monitoring that audio input, that remote transceiver will become active — and that's a real world problem. The only practical way to avoid this problem is by using a 4-wire audio link. Fortunately, most all radio links have 4-wire TX/RX cross-talk characteristics (low cross-talk), although they are often half-duplex paths.

FCC Affirms 219-220 MHz

The FCC has affirmed the secondary allocation of 219-220 MHz for Amateur Radio. The action, for the most part, denies a Petition for Reconsideration filed by Orion Telecom, an Automated Maritime Telecommunications System licensee. Orion had argued to rescind the decision to allocate 219-220 MHz to ham radio saying the 50-mile exclusion distance between AMTS and Amateur operations was insufficient to protect primary AMTS operations from harmful interference. Orion asserted that a 575-mile exclusion distance was necessary, which would have precluded Amateur Radio operation in many areas. AMTS coast stations use 219-220 MHz to receive, and 217-218 MHz to transmit.

The FCC did agree with Orion's concern that the Amateur rules do not adequately specify the frequency range of AMTS operations. The FCC amended its rules to specifically call attention to the fact that one must look at 217-218 MHz assignments to know what AMTS coast stations are operating in a given area.

ARRL Executive Vice President David Sumner, K1ZZ, says the League is pleased that the FCC reaffirmed its commitment to provide some relief to the Amateur Service at 219-220 MHz to offset the loss of access to 220-222 MHz. He says the ARRL has a procedure in place to ensure that Amateurs planning to use 219-220 MHz are aware of their obligations to avoid harmful interference to other services.

1996 ARRL and TAPR DCC

TAPR and the ARRL are proud to announce that the 1996 ARRL and TAPR Digital Communications Conference will be held September 20-22, 1996 in Seattle WA. More information will be disseminated as the schedule, workshops, and registration prices are fixed by the conference committee. The Puget Sound Amateur Radio TCP/IP Group will be the regional hosts of this year's conference and we all look forward to working with them in the coming month to generate an excellent meeting. Pull out your calendar now and make a note and then start looking for those plane ticket bargains for next September!

Membership Questionnaire

Greg Jones, WD5IVD

We received 450 questionnaires back from the membership. This represents about 18% of the current membership. There are some interesting notes to be seen in the various categories. TAPR did a similar survey in 1986, which was compiled by Gene Piety, KH6PP (TAPR PSR Issue #20, July 1986). I will be comparing some of the questions from that 1986 survey to this 1995 survey. I would like to personally thank everyone who took the time to submit a questionnaire. These numbers will be used in some future Board issues and should help the Board gain closure on these issues.

Occupation

The most reported occupation was retired, other included: Broadcaster, Cable TV Tech, Chemical Eng, Chemist, Clergy, Computer Scientist, Dentist, Dietary, Elec Engineer, Insurance, Lawyer, Medical Doctor, Naval Officer, Nuclear Eng, Park Ranger, Pilot, Professor, Programmer, Software Eng, Student, Surgeon, Teamster, TV Eng, Veterinarian, and a few more.

1. Age:

- a. .9%
- b. 19-25 .6%
- c. 26-35 6.1%
- d. 36-50 40.4%
- e. 51 51.7%
- missing .3%

This points to the fact that TAPR must work at getting younger technical people involved with what we are doing and developing. This is one reason we are looking into the possibility of hosting a student paper award held at the ARRL and TAPR Digital Communications Conference as a possible incentive to get students involved.

2. Number of years as a TAPR member:

- a. 1 year 9.4%
- b. 2-3 years 12.2%
- c. 4-5 years 16.4%
- d. 5 60.8%
- missing 1.2%

Question 2 and question 4 raise an interesting question. How could 60.8% of the respondents be in TAPR for over 5 years but only 31.6% have operated amateur digital communications for over 5 years. It is very positive to see the number of new members responding back to the survey and to see the number of people who have only recently begun digital communications.

3. I joined TAPR to:

- a. receive the TAPR Packet Status Register 5.2%
- b. support packet/digital development 8.5%
- c. both 84.3%
- missing 2.0%

The numbers in 1986 are very close: 5%, 6%, 85%, missing 4%.

4. Number of years doing amateur digital communications:

- a. 1 year 32.8%
- b. 2-3 years 22.2%
- c. 4-5 years 13.1%
- d. 5 31.6%
- missing .3%

5. I would be willing to pay higher dues of \$ _____

- No Change 10.1%
- \$17 - \$20 30.9%
- \$21 - \$25 9.7%
- \$26+ 4.5%
- missing 44.8%

This is an important issue since the Board of Directors has discussed dues on and off for the last year. With the increase in paper and mailing, dues will need to be increased sometime in the near future. This would seem to indicate that most members would support a slight increase in membership dues.

* Questions 6 - 9 do not total to 100% per question, since members were asked to mark all answer that applied.

6. I view information TAPR publishes in the Packet Status Register as:

- a. Informative 86.9%
- b. Technical 78.4%
- c. News 49.5%
- d. Other 1.5%

After seeing the responses, which if we had done this correctly, we would have done a test mailing first, it seems that News and Informative might be mistaken. Anyway, this indicates that most people see the PSR as a Information source and want to read about Technical issues. Makes sense, since this is what TAPR is based on.

7. My main interests are (ranked by %)

- a. VHF/UHF 72.6%
- g. AX.25 (packet) 52.6%
- h. TCP/IP 41.0%
- d. Technical Design/Development 37.4%
- b. HF 35.0%
- k. Satellite Operations 34.7%
- f. Networking 33.7%
- e. End User 27.4%
- i. RTTY/AMTOR/PACTOR/GTOR, etc 25.8%
- j. BBS Sysop 18.5%
- c. SHF 10.9%
- l. Other 5.8%

Question 7 was very interesting. Only a little over 50% of membership listed Packet (AX.25) as a prime interest, with under 50% saying that TCP/IP was their interest. VHF/UHF operations dominated at 72.6% with another 35% operating HF. Also, only 25.8% commented that they operated on HF digital mode. Networking and Satellite Operations were very close at 33.7% and 34.7% respectively. These percentages indicate a nicely disperse interest group makes up the TAPR membership.

8. Other organizations I belong to:

- a. ARRL 85.7%
- b. AMSAT 41.6%
- c. Other Regional Groups 26.1%

Including: BARC, FARA, SDCCA, AARC, AIR FORC, ALAMOGOR, AMSAT-UK, ARMY MARS, BOEING ARS, CAPRA, CIPRUS, CODE, DARA, FADCA, IDEA, IDRA, JARL, NAVY MARS, NCPA, NEDA, QCWA, RATS, RSGB, SANDPAC, SCDDC, SKIPNET, TARA, TCAPS, TENNET, TPRS, TWINSLAN

The large percentage of ARRL members was not a surprise or was the fact that a little under 50% belonged to AMSAT as well. Many of the larger regional groups appear in the list of other groups individuals listed.

9. TAPR should focus on:

- a. Developing Kits 72.9%
- b. Publications 59.6%
- c. Membership Growth 37.1%
- d. Education 62.6%

TAPR members ranked what they thought the TAPR focus should be as: Developing Kits, Education, Publications, and Membership Growth.

10. When TAPR makes a kit, should it be a complete kit:

- a. yes 73.3%
- b. no 9.1%
- missing 17.6%

The response in 1986 was very similar at: 73%, 17%, and 10%. Members agree that kits should be complete. Just a personal note, it is as difficult to gather a complete kit as get parts for a partial kit. When ordering parts, there is always one or two components that are hard to get — which are always the ones you would put in the partial kit. Just a side note — back to the survey.

11. TAPR should do R&D in technology, but stay out of the production business:

- a. yes 27.7%
- b. no 64.1%
- missing 8.2%

This question was a change from 1986. In 1986, the membership answered: 45%, 44%, 11%. This would seem to indicate that TAPR should think about doing some kits as partially completed kit or look at other arrangements. The Board of Directors will discuss this further.

12. Having very similar equipment by many manufacturers is confusing. TAPR should license technology on an exclusive basis :

- a. yes 10.6%
- b. no 83.3%
- missing 6.1%

The 1986 number are about the same as here: 6%, 91%, 3%. There is a drop in the number of No answers.

13. Similar equipment from many manufacturers increases competition and TAPR should continue its policy of non-exclusive licensing to anyone who meets the terms:

- a. yes 90.9%
- b. no 5.2%
- missing 4.0%

In 1986, the membership indicated: 94%, 3%, 3%. Members now feel a little stronger on this issue.

14. TAPR is an organization whose time is past ? We should close:

- a. yes .6%
- b. no 96.7%
- missing 2.7%

In 1986, all 249 surveys indicated 100% no. We had a few members that voiced a discontent with TAPR activity and I am planning on contacting them as I have time to better understand their position and answer their comments.

15. TAPR is important to the continued growth and future of packet radio development and should stay in existence:

- a. yes 95.4%
- b. no .9%
- missing 3.6%

In 1986, 100% answered 100% yes. The .9% here is a majority of the individuals answering yes to question 14.

16. I believe that TAPR should be active in petitioning the FCC on actions which directly affect Digital Communications:

- a. yes 90.3%
- b. no 5.8%
- missing 4.0%

In 1986, the membership answered 94%, 2%, 4%. Not much change. As you can tell from this issue and the past issue of the PSR, TAPR's FCC Regulatory Committee is beginning to gain closure on several issues it began last year. Working with the FCC regarding digital issues is something that TAPR is going to work on from time to time on important issues.

17. At its March '95 Board Meeting, the following goals were set for TAPR. Please rate each goal.

a. Work on issues regarded user access speeds

- 1. I strongly disagree 1.2%
- 2. I disagree 2.1%
- 3. no opinion 15.8%
- 4. I agree 37.1%
- 5. I strongly agree 36.5%
- missing 7.3%

In 1986, 60% strongly agreed to this item as compared to 36.5% this survey. The shift has been to agree and no opinion. The disagree items are similar to the 1986 survey. 3.3% disagreed with this goal.

b. Increase membership

- 1. I strongly disagree 1.8%
- 2. I disagree 2.4%
- 3. no opinion 20.7%
- 4. I agree 48.3%
- 5. I strongly agree 21.9%
- missing 4.9%

Over 70% of the TAPR membership agreed with the goal of increasing membership. 4.2% disagreed with this goal.

c. Work on Special Interest Group activity

- 1. I strongly disagree .6%
- 2. I disagree 6.4%
- 3. no opinion 32.2%
- 4. I agree 42.6%
- 5. I strongly agree 13.1%
- missing 5.2%

55% agreed with the Special Interest Group Activity, while 7% disagreed with SIG activity.

d. Continue to watch spending

- 1. I strongly disagree .6%
- 2. I disagree 2.1%
- 3. no opinion 23.4%

- 4. I agree 45.3%
- 5. I strongly agree 23.1%
- missing 5.5%

68% indicated they agreed with the financial issue, while 2.7% disagreed with spending issues.

e. Gain closure on current projects

- 1. I strongly disagree 1.2%
- 2. I disagree 1.8%
- 3. no opinion 19.5%
- 4. I agree 43.2%
- 5. I strongly agree 28.9%
- missing 5.5%

Over 70% felt that TAPR should gain closure on current projects, while 3% disagreed.

f. Increase activity in national issues

- 1. I strongly disagree 1.8%
- 2. I disagree 5.2%
- 3. no opinion 26.1%
- 4. I agree 41.3%
- 5. I strongly agree 20.7%
- missing 4.9%

62% agreed with working on national issues. Many of the international members commented on this question. Our apologies for this U.S. biased question. This is due to the fact that a large majority of TAPR members reside in the U.S. 7% disagreed. This and the SIG activity goal were the highest disagreement rate of the question 7 goals.

If we rank the goals by agreement we get a rank order of:

- a. Work on issues regarded user access speeds 73.6%
- c. Gain closure on current projects 72.1%
- b. Increase membership 70.2%
- d. Continue to watch spending 68.4%
- f. Increase activity in national issues 62.0%
- e. Work on Special Interest Group activity 55.7%

Thus we might say that the membership feels that TAPR should work on R&D regarding user access speeds, complete any projects that are started, continue to look at membership issues, while doing these watch the financial bottom line, then work on national issues and special interest group activities. That could be one explanation. To do this correctly, we would call up a random sample of the survey group and do qualitative interviews to fully flush out the data collected in this first pass. Unfortunately, we will have to postpone that more in depth and time consuming research for another time — or maybe another volunteer?

Comments

24.6% filed comments, which are listed here:

- Increase Conference and Workshop Fees by at least a factor of two.
- Consider offering "Finished Kits" with box/mounts/bezel for either the most popular kits or the ones geared towards beginners
- Keep up the good work — I like kits and you are one of the few places where they can be had. Keep up the development work. The TNC-1/TNC-2 were great! They set the standard — I would like to see work on a 9600 baud standard - I have several kits (modems).
- When will NK6K get my TAPR-1 going ?

- As a liberal I say "Keep TAPR like it is ?!"
- I'm a novice packeteer. Your pub is too tech for me. I support TAPR as a group for the work you do to keep it simple for users like me.
- Partial kits are fine. In a recent TAPR PSR, it was noted that TAPR was going to cater less to newbees. I think that is sad!
- Internet Services are Great!
- I would like to see TAPR develop a TNC kit or PC board. Stay away from SMT construction in future kits!
- Goals should be to enhance average ham's digital capabilities at lowest possible cost and come "sweat equity" — this is a ham tradition. Consider offering kits in 3 forms: custom parts only, full parts, full kits (box, etc). A list of known sources for additional parts would be nice supplement.
- How about instructional VHS video tapes that can be purchased or rented on major topics.
- Pioneering is a lonesome business, but unless someone does it nothing will ever be accomplished. There seems to be no other voice bring heard except that of TAPR in pushing the digital communications area. We need TAPR as the AMSAT of digital communications. At 83 there is little I can do for the organization except support it.
- The things that got me to TAPR are mostly gone. Good business fundamentals are probably important, but my perceptions is that the business aspects are now the controlling aspects, and that's not a good thing.
- Membership drives to those involved in daily use of the technology to maximize feedback and suggestions for future development. Should have close association with NEDA and similar groups, perhaps by use of steering committees. Should begin work on 5-10Khz 2Mbs link protocols and kit fabrication. Put the call out — to get a packet communicating committee/development team organized keep the good work going.
- I think it is important that TAPR and the ARRL work together. It will make out affect on the FCC much stronger and more effective. Because of some differences is consistency, the two organizations will not always have the initial view of an issue or the same the initial proposal solution, however the two organizations are each large and strong enough that if they take opposite positions with the FCC the affect is confusing and largely ineffective. If the two organizations come together on a compromise solution, even though it may not be the first choice of either group — it will probably be a better solution and more likely to be accepted.
- We need to be able to modify and use commercial no-license spread spectrum equipment under amateur rules. TAPR should work on the SS rules with the ARRL and FCC.
- TAPR has been extremely successful in developing standards, kits, fostering activities, meetings, etc. TAPR should state its current mission better. If TAPR can avoid the massive management and organizational staff needed for a national organization.
- Push for Manufacturers to set compatibility standards for radios having high speed data ports. How about a baycom like kit for 9k6 data.
- We are going to get into SPREAD SPECTRUM whether we like it or not. AMRAD got things started but I think the time has come for TAPR to get a kit going and do it right. You MUST see *QEX* this month (June 1995). The column by Harold Price is very very good and especially so regarding the history of spread spectrum..BUT more so the comments regarding the building of

PANSAT at the NPGS. Buried in the text, is the comment that a modem will be designed for reception of the PANSAT signals. TAPR should be doing this project. Building a satellite is hard enough let alone assembling a kit.

- Packet is and has been stagnant. TAPR should work on: 1) generating standards (modulation, BBS, packet, etc) and publicizing them, 2) better TNC/Radio/Computer interfaces which are easy to use, 3) cheap moderate speed radio and modems (9600bps to 56Kbps), 4) robust protocols which can be used over low speed, unreliable links. and 5) be more aggressive about sending out membership renewals.
- I joined to gain access to application notes on interfacing and converting commercial gear for packet use. Also to find out how others are handling LAN and linking-needs. TAPR should stay on the leading edge of amateur digital communications.
- I wish I was in a position to help you guys out more.
- Work with the ARRL on FCC issues.
- In the PSR provide clearer directions for ordering software and hardware. More kits and more educational materials for newcomers. Thanks for the work!
- I am very happy with TAPR taking time to look at new project and the information published in the PSR.
- As always, TAPR should do reasonable projects that small groups of individuals really want to do.
- Help for new packeteers. Maybe a column in the PSR.
- Please don't become too dependent upon the Internet. There are still places like my Spain QTH where phones are just not available. I was quite disappointed when the source code for the DSP-93 was not made available with the kit. I would have liked to expanded my DSP horizon by studying it.
- Great 9600 baud modem kit and support for PK-232! Don't ever loose Dorothy! She is fantastic as a human interface between member and organization. Thanks for every piece of help.
- I think amateur radio has a responsibility to develop a digital communications system independent of power companies and telephone companies. The Internet is NOT an amateur radio mode — no matter how convenient it may be. TAPR can be an important factor in making HF and VHF/UHF systems work more efficiently and should concentrate on that goal. PS. The PSR gets better with each issue. Thanks.
- In your CD-ROM, please include TPK's most updated version. I use it and find it invaluable. We are looking for a 56Kb link and would like as much info as you can make available in the PSR about making such a system work.
- Steven Bible wrote a QST Article on Packet Radio WWW. It is the most interesting thing I've seen on packet in 5+ years! Please encourage building high speed networks and possibly link up WWW sites. A packet web and all its possibilities has gotten me active again in packet activity. Young people are not excited about 1200 baud packet BBS after cruising the Internet. Lets keep the innovation going!
- There may be some overall benefit gained if TAPR was to work closely with other "specialist" data groups. TAPR should be developing kits which are useful for those unable to design equipment themselves.
- Keep the good work going with the PSR and support of packet radio.
- A national plan for packet utilization and coordination needs to be worked on. Too much time and effort is spent trying to figure out/convince operators who should operate where and when.

- TAPR is an insiders club. Technical info developed from member dues is not shared with the members.
- A very well-respected organization! Doing a very good job!
- I believe TAPR should be in the forefront of digital communication technology for the radio amateur. This means new technology dissemination and design and production of kit projects.
- I would like to see more articles on practical spread spectrum and digital voice.
- I think the questionnaire is a good idea!
- ADRS - IDRA - TAPR. Isn't it too much? I mean, do you/we really need three organizations (most probably more but these three I know) to support digital modes? I found it stupid when I learnt about ADRS split into ADRS and IDRA. Their programs are similar, if not identical. Isn't it just the will of some individuals to be (stay) president or chairman? Similar motions I can observe at the local political scene here in the Independent Slovakia. Funny and sad... Why not to join the power of hams who are interested in digital modes? Another idea: please realize what part of your (US Citizens) income is the average membership fee (of the US and Western Ham Organizations) and what part of MY income does it represent... What about a special membership rate for ex-communist countries?
- The creation of a TAPR CD-ROM is excellent. Thought should be given to scanning and distribution on the CD-ROM of regional club newsletters. This would be an excellent way to provide a wide variety of information with little work on the part of TAPR. Software updates should also be distributed via this means. Radio mods and databases similar to that in the ARRL repeater directory should be considered also for inclusion in the CD-ROM. Kits should be developed in area that the commercial vendors do not provide products for, such as in High-Speed data radios. The role of TAPR should be in the areas that regional and local clubs do not have the resources to develop. This includes both the technical and political aspects including being the 'National' voice for digital communications. Consideration should be given to changing the name to Digital Amateur Radio Society or something similar. The inclusion of Tucson in the name no longer serves a meaningful purpose.
- Digital communications will always be the new technology for quite some years to come. TAPR must continue to blaze the trails of new technology, and lead radio communications in digital communications. So TAPR must be.
- Being new to digital communications and being a hams 38+ years. I still believe ham radio is an exciting field. Your current goals are achievable and interesting — doing research at both highly technical and experimental backup with tech info - kits - hands on. Kit building techniques have changed over the years — from thorough hole to surface mount — sometimes it is best to invest in wired units nevertheless. The joy in assembling and results is Ham Radio. TAPR should stay technical, stay friendly, stay aware that there are hams that are interested in digital communications and where do I start?, star excited. Perhaps quarterly stress different levels. (i.e. highly technical to basics). Continue the kit program.
- The future of Packet is high speed. It is my understanding that the Europeans's are way ahead of us in this. I'd like to know more about this aspect of packet, I've also noticed that TAPR offers little or nothing for Apple Macintosh computer users. As a Mac User, I'd like to see this change.
- I suggest that TAPR devote more effort to educating those who are new to packet. Packet Radio: What? Why? How? is a start/ QST - New Ham Horizons concentrating in packet might be a model. I consider TAPR to be on the cutting edge. However, reaching down

to the neophyte, who I would guess comprises the broader base would certainly benefit amateur radio and eventually TAPR.

- To me packet looks quite well developed, actually TAPR should be going things politically like band allocations.
- I eagerly await delivery of my AN-93. Hope it arrives before I run out of paper for my Model 28! TAPR should continue to development of SS Techniques. Suggest develop kit based on the new part 15 SS chip sets.
- Would like to see more information for beginners in the PSR.
- Our club operates a 146.70 packet repeater using a MFJ-1270C which has been modified for repeater use. We would like to know what other groups are operating packet repeaters using this method.
- About half of these questions seem really strange!/? You have to ask good questions to get useful answers, I really wonder about these!
- I have been very happy with what TAPR has been doing so far. I have ordered quite a few kits and am working on your DSP-93 right now. I hope you folks can continue with the low cost kits and keep heading in the higher speed direction. 1200 baud is just too slow with the congestion. I have one final comment/observation: I imagine others have commented about these excessive use of BBS's to the exclusion of keyboard to keyboard users. We have that problem very severely here in the LA area. I was wondering if there would be some kind of BBS's on separate channels so others who want to talk to friends can still do so ? I have several BBS's hogging the channel for days at a time.
- Keep up the good work. I feel better about being a member of TAPR than almost any other organization I belong too.
- The TAPR organization is invaluable to the Amateur Radio Service. It has lead us into communicating by modern digital means, pressed us into utilizing computer aided technology, and provided the opportunity to learn this new technology and become an ever better pool of technicians. Hams would be very foolish not to support, aid, and take full advantage of the talents TAPR offers. Your leadership has made a most profound and valuable change in Ham Radio; you showed us how to communicate at high speed without the need for towers, large antennas or high power; through your efforts most public objections to the hobby can be eliminated by the use of a superior form of radio communication. In my opinion TAPR can do no wrong — whether it be spread spectrum, video or any other signal processing by digital means. My career was in Chemical R&D, this OM needs TAPR!
- PSR is very informative. I look forward to it. I also appreciate the discounts to members.
- Regarding Kit building/production: I strongly feel that the production of kits for the different aspects of digital communications is required for the quick enhancement of the hobby. With out a fast injection of tech hardware, the ability of users and network builders suffers. Also to the same end, the price of kits should be held to what covers the costs and makes a minor profit to cover the future. This does not mean that the kits need to be made in mass quantities, or become a serious competition to the commercial entities. If the kits cause the commercial entities to be hard pressed to improve their product, then that is a positive result! To that end then the kits only need to be complete for their purpose. ie: a board that is intended to be a daughter board, does not need a case design as an option. On the other hand, once a kit has been licensed to a commercial entity, and the entity is reliably producing the kit at a reasonable price, then the Tapr version of the kit doesn't need to be available, unless there is significant difference between the 2 versions.

- The good thing is that I can e-mail TAPR about any comments I have at any time...
- The only way to maintain dues at the current rate is through increased membership.
- I do not trust the ARRL and hope TAPR doesn't allow the ARRL to steal TAPR's information. I don't like the alliance between TAPR and the ARRL. I would like to see "closure" on my TAPR-I software! (I still have a letter from TAPR, telling me "not to worry, it will be done") As a Charter Member, I once stopped paying dues, but was talked into re-upping as part of the current crusade to recruit "new" members. I have been on packet 24 hrs/day since April of 1984, and am still waiting for the Network Node Controller! (Yes, I know we are "Volunteers") I don't hold out much hope for Packet, since the NNC never was done, and now think if packet doesn't get some speed and connectability, it will die. I do appreciate a decent Newsletter, but hold the political discussions if possible. And reprints of reprints aren't much fun, either. You want some good news? I wish I had some, except to say that I do appreciate what little has been done in packet, so I remain a bit hopeful.
- I think TAPR is just about on-target at present. The improvements in number and quality of PSR articles and the combining of the annual meeting with the ARRL DCC are important steps toward keeping TAPR occupying a strong role in the future of amateur digital communications.
- We need to make sure that we provide a vehicle for allowing information and understanding of new directions that we might be able to go toward. Then we need to allow the debates. This has been somewhat squelched on the NET-SIG. You see, I really think that some folks assume that new people will just know things. But they don't. You have to have an ongoing debate even though it is very unpopular with some. Just state the ground rules (such as civility) but NEVER try to censor the subject. This has really turned me off and I had to force myself to continue to support TAPR since I believe it is basically a good vehicle for change. One other thing. Is it my imagination or does TAPR officers/policy have a dislike for IDRA? I never see it promoted and it should be STRONGLY promoted. And IDRA strongly promotes TAPR. This bothers me. Maybe I am missing something, but this is the feeling that I get.
- Nice web page!!!
- I do not think TAPR should be a political forum or platform for anything national in scope. I do not think that TAPR has the funds to serve in a dual capacity as the ARRL. I do think that the TAPR has the propensity to petition the ARRL direct and get them to listen and act upon our concerns. To essentially go around the ARRL would be a waste of funds and effort. They are our representatives to the FCC. Please do not reinvent the wheel. The main point of interest that EVERYONE should be working towards is establishing networks that handle HIGHER BAUD RATES! The ax.25 networks today running 1200 baud are s l o w...so slow I have grown somewhat bored running a pure ax.25 bbs...so now running a JNOS bbs on same computer ...at 19,200 baud...but it is flaky at times..and I often have to jump back to 9600 baud.... We have the technology to support 9600 as the user entry level baud rate and higher rates for the various backbone networks. Lets see you guys work on THAT...cuz if you can network to the MOON at 1200 baud, no one is gonna do it for long without getting b o r e d with the speed. THERE! I feel better...
- The DSP-93 may be a nice kit but, is well beyond the price that I would like to spend on a hobby... I don't own a PK-232 or a TNC-2 and being a student I find it hard to justify the expense of packet now that the TCM3105 is no longer produced. ie: Baycom/PMP

- TAPR should be active in R&D while producing kits to expedite HAM interest. TAPR is vital to Ham radio and should continue to exist if at all possible. FCC and political action should be a last priority, as time allows. Thank you for the WWW survey.
- Close down TAPR — HELL NO!!!!!!!!!! If you mean faster networking speed, YES. Higher dues, Weelllllll, maybe, tapr is a good value at \$15 for members who are actively building, etc. I sometimes meet that criteria and sometimes just belong to keep up to date. The problem is that everyone seems to be increasing dues and supporting several 'worthwhile' organizations is getting to be a burden. LONG LIVE TAPR!!!!!!!!!!!!!!
- It seems to me that a large percentage of the TAPR membership resides in California, I would really like to see the meeting appear in or near southern California. I know this sounds self-serving but let's face the facts: There are more than twice as many TAPR members in California than there are in Texas or Arizona!
- I'm new to you organization and to Ham Radio generally. Though at times I have to struggle a bit to keep up with the technical writing I am coming up to speed and really appreciate being able to tap into the collective experience of so many talented individuals. I'm glad you decided to reach out to a nationwide audience and appreciate your efforts on behalf of both the "old-timers" and the "newbies". Thank you all for your continued efforts. Enjoy the holidays and best wishes for the coming year!
- An organization such as TAPR is an absolute MUST for the Digital/Packet community. ARRL cannot (and should not) do it all. In regards to Packet, the ARRL has too many different issues to spend lots of time on Packet, and other factions within ham-radio would get annoyed at the league. By being a SEPARATE (but somewhat affiliated) TAPR can devote all of its time to digital communications without annoying the other groups. Also, we (the digital community) need a place to go for leadership/standards/etc. as we try to move into the next generation of high(er) speed communications. I feel that TAPR's strong support of the different SIGs and its good presence on the Internet are VERY worthwhile and should be applauded. (Get a faster computer for the server) Also, you might implement something on the line of 'contributing member' who pays a higher fee, maybe \$50 instead of the normal fee.
- Keep up the good work!
- Hi Guys and Gals from "down under". I am very impressed with the way the TAPR is conducting its business. The WWW stuff is excellent, Please keep up the good work over there. I find the current format for PSR to be the best yet. As a matter of fact, I would be happy to pay \$30 for the service you provide. It certainly is worth it.
- I am a long time TAPR member and supporter (approx 12 years) and plan to continue as long as is possible. I basically agree with the goals as set forth by the board of directors and I am pleased with the way the organization is being run. The only real complaint I hear from others, comes from people who are dissatisfied because they do not get "Heathkit" type support and technical help. I think that the volunteer status of the technical support people should be made more forcefully to potential buyers of TAPR gear.
- I should have joined TAPR in 86 when I got my first TNC. Keep up the good work!
- TCP/IP packet needs higher user speeds as well as backbone speeds. Also up-to-date documentation on HNOS functions is difficult to get. Anyway, I'm pleased with TAPR advanced kits — just moved so DSP hasn't been built yet.

AX.25 Over Internet

David E. Barrett
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To those that have expressed a desire to link APRS locations by using the internet might find the following to be of interest.

AXIP encapsulation daemon.

Written by Mike Westerhof, KA9WSB, ported to Linux by Ron Atkinson N8FOW.

Description

A daemon that will allow you to use your linux machine as an AXIP encapsulating gateway.

Status

Not properly tested, but assumed to work OK.

System requirements

KISS TNC, any version of Linux supporting RAW sockets.

Detail

This daemon is the partner to the IPIP encapsulation daemon. It allows you to encapsulate AX.25 frames in IP to carry them across the Internet. This is useful for linking AX.25 networks in remote areas. Ron has supplied a Makefile for linux, and with it the software compiled without errors on my system running a recent version kernel. Ron has also written some README files which give you the detail necessary to compile the system and the original documentation describes how to configure it.

Where and How to obtain it.

This software is available from
<ftp://sunsite.unc.edu/pub/Linux/apps/ham/ax25ip.tar.gz>

Licensing/Copyright etc.

Freely distributable so long as the original copyright notice is not removed.

Contributed by:

Ron Atkinson, N8FOW

PSR Deadlines

Check page two for upcoming PSR deadlines. If you have something for publication, please contact Bob Hansen, PSR editor at psr@tapr.org. TAPR is looking for technical and introductory articles on the following subjects: information on general digital communications, applications using digital communications, equipment hints or modifications, future directions and standards, tutorials, and any regional packet news or information.

The Trip So Far in High Speed Digital Communication Via Spread Spectrum

John Hansen, WA0PTV
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Any sufficiently advanced technology is indistinguishable from magic. - Clarke's Third Law.

I've been following developments in high speed data transmission via spread spectrum radio devices for a number of years. However, since I was initially interested in it as a hobbyist and since the prices were considerably more than my toy budget, about all I did was read and wonder. A couple of things happened in the last year to change this dramatically. First I became Director of Academic Information Technology at a local college, which put me in charge of bringing connectivity to campus. This provided me with a significant budget allegedly for connectivity, but also, to more limited extent for research and development. Secondly, I attended this year's Network+Interop in Atlanta. There I ran into a company called BreezeCom (formerly Lannair) which was selling 2.4 Ghz spread spectrum devices that could push 3 mbits/sec over distances (they claimed) of over 3500 feet. They were actually demonstrating this equipment and it did appear to work.

There were a number of places on campus where I thought this technology had potential, though I wasn't exactly sure where it would go in first. So I figured the next step was to acquire some of it and cart around campus to see how it would perform over various paths. There are fundamentally two types of configurations in wireless networking today. First (and most expensive) there are wireless bridges. These are designed to make LAN to LAN connections and include bridging so that all the intraLAN traffic is not spewed out over the wireless connection. This is important, since the LAN generally runs at 10 mbits/sec and none of the current wireless systems will process data that fast. The second type of technology is the access point approach. Here you put up a centrally located access point and the end users then connect to this point via wireless units hooked to their own computers (called station adapters). Using the access point approach, a campus could have multiple access points and users could cruise between them, essentially the way cellular telephones do.

With the access point approach, no bridging is generally supplied so anything that comes out of the end user's ethernet card is automatically relayed on to the access point. Thus, you can run into problems if you try to use this technology to hook a LAN to the access point. Until I experimented with this technology, it was an open question in mind whether you could even hook a hub up to the end user side of one of these types of systems and have it work. A number of manufacturers I talked to, in fact, insisted it was impossible to hook a hub up to the station unit and have it work. This is

a key point, because while I have some uses that will clearly involve the single unit access paradigm, I also have some pressing needs for point to point, lan to lan links. On our campus, this would often involve very low data rates. An example would be a group of 30 computers set up in one room to submit registration information for students. Very very little data is involved, but I would not want to buy a "station unit" for each of the 30 computers. The cheapest vendor of equipment that is designed as a "wireless bridge" that I could find would cost close to \$5000 for one link. While this would be cheaper than buying a "station unit" for each of the computers, it still was more than I really wanted to pay.

I got to talking with the President of Breezecom about this and he said they were about to come out with firmware that would allow bridging, but that it wasn't available yet. He offered to let me beta test it. In the meantime, I asked if the bridging function was all that was required, wouldn't it be possible to use an outboard bridge or perhaps even a Windows NT box that had routing functions built in. He paused for a moment and allowed that it might work. That was enough for me to want to try it.

Access units from Breezecom come in two flavors but the price is the same in either case. The AP-10 is a unit with two integrated antennas in the transmitter that look a bit like rubber duck antennas. These are designed for distribution of ethernet within buildings. The second flavor is the AP-10D. It has no antennas, but comes with a pair of antenna connectors on it for installing external antennas. The company makes several external antennas. The simplest is a patch antenna in a plastic case somewhat larger than a pack of cigarettes. The company initially recommended hooking up two of these to the AP-10D. Only one of the two antennas is actually used at a time and the unit samples to see which provides the best connection. In practice, I have found virtually no difference in performance between using one and two antennas. Thus I would recommend starting with one. This is now the company's recommendation as well, unless you are in a place with lots of buildings and multipath problems. The patch antenna claims to have an h-plane beamwidth of 165 degrees and a gain of 8.5dBi. It is clearly directional, but I have no means of verifying this claim. My experimentation leads me to think it may be somewhat narrower.

The company also makes an omni antenna that has (if I remember correctly), a gain of about 6 dBi. If you are contemplating putting the antenna in a high location (We have a building in the center of campus that is 9 stories tall.. the next tallest building is 3 stories), there is a potential problem with the omni because it does not radiate down (or up) well. The retail list price of the AP-10 or 10D is \$1295, and the retail on the patch antenna and feedline (it comes with about 8 feet of cable) is \$125. I asked about educational discounts (as I always do) and was told to check with their

distributors. At that time, they had very few distributors and Breezecom agreed to sell to me for 10% off list. Since then, one of their distributors, GBC Technologies, has quoted me a price of just over \$1000 for the access point and \$78 for the patch antenna (though it is not clear whether that includes feedline).

The station units come in three flavors. First, there is a one-port adapter (SA-10 and SA-10D, depending on whether it has integrated antennas or connectors). This unit has one RJ-45 twisted pair connector. Second, there is a four port adapter (SA-40 and SA-40D) which has 4 RJ-45 twisted pair connectors. There is also a very interesting PCMCIA card for laptops. This is a really cute device that sticks out of a PCMCIA slot only about 1/2 inch and lets you cruise while being connected. The antenna is embedded in the card, and its range is rather limited (something like 300-400 feet) and its top data rate is 1 mbit/sec. Nonetheless, if one had an appropriate application it would be truly cool. The list prices are \$995, \$695 and \$395 respectively for these adapters. GBC has quoted me prices of something like \$770 for the 4 port adapter and \$540 for the one-port adapter. I didn't ask about the PCMCIA card, but since the rest of their prices seem to be about 25% off list, I would suspect that it will be in the range of \$300.

I bought a four-port adapter directly from the company. It took a long time (like 2 1/2 months) for me to actually get my hands on this equipment. Part of this is due to the fact that it is all imported from Israel (and this was about the time of the assassination there, though I have no idea whether this disrupted business enterprises or not) but part of it appears to be related to FCC approval. This is only my guesswork here based on indirect statements I've gotten from Breezecom and GBC. The original units that I bought directly from Breezecom had SMA connectors on them, making it a fairly simple matter to try out different antennas. It appears, however, that the FCC isn't keen on the SMA connector approach. I have heard from a number of manufacturers that the FCC is requiring "proprietary" connectors on this type of unit so people won't buy them and hook up Big Kahuna antennas and violate the law. As I understand it (my reference here is Steve Bible's excellent article ... see www.tapr.org) you can run 4 watts ERP from one of these stations without violating the law. Since the Breezecom unit has a power output of 50 milliwatts, you could legally get away with something around 19-20 dBi gain in the antenna system. However, even a modest sized dish can generate more gain than this.

In order to pacify the FCC, Breezecom is going to have to go to a proprietary connector as well. As yet, I have no information on these connectors. Replacing them would, of course, violate type acceptance, though for Amateur applications that wouldn't be much of a consideration.

My equipment showed up just after Christmas (how nice!). We got it up and running very quickly. There is a serial

port on each of the units and you connect it to your PC running a terminal program to manage it. Start by putting an IP address in it, beyond that there is little to manage, at least initially. We first set up both units in the same room, but then moved them progressively further and further apart. Finally, we mounted the access point on the 9th floor of the tallest building on campus and taped the antennas to the inside of the window with duct tape. Further experimentation leads me to believe this system will perform better if we can get the antenna outside (it is really designed to be mounted on the exterior of a building. We carted the station unit around campus with my laptop (which has an ethernet card in it) to test various paths. This was interesting because the unit runs off a 5 volt cube tap. If we had had a good sized 5 volt battery we could have literally gone anywhere and had a truly portable internet browser.

Testing from several locations on campus led me to conclude that we simply would not be able to find a clear path on campus that was far enough to really tax the capabilities of the unit - it worked everywhere we tried it. So the next step was to move off campus. Fortunately my house is located on a street that is adjacent to campus on the same side of the 9 story building that we put the antenna (gee, what a coincidence). It is close to a half-mile away from the access point. We took the equipment to my kitchen and taped the antenna to my glass patio door. There are pine trees in my backyard that block the line of site path to the access point, but it worked anyway.

A note or two on signal strength and speed is probably in order. There are six lights on the station adapter. One is for power. One lights up when you have a link to an access point. One flickers as data moves over the link. The other three show you the speed at which data is moving. One of the nice things about Breezecom's units is that if the path is not good enough to support 3 mbit/sec it will ratchet down to 2 mbit/sec. If that's no good it will go to 1 mbit/sec and if that doesn't work it will fall back to .5 mbit/sec. If all three lights are lit you have 3 mbit/sec. Two lights and one light represent 2 and 1 mbit/sec respectively. If the link light is on and there is one signal strength light flashing or no lights at all are on, that means you are at .5 mbit/sec.

With the setup described above, I get 1 light solidly on and a second one flashing. Breezecom advised me that if I went in through the serial link and locked the speed at 1 mbit/sec under these circumstances, throughput would actually go up, since it would no longer be switching back and forth between one and two mbit/sec. In fact when I did this throughput rose by about 20 percent. Over this path I can pass a 1 MByte file in under 9 seconds. When I take the antennas outside (just beyond the glass door) I get 2 lights. I took them to my attic, and after I peeled back the metal backing on the insulation, I got one light even though there was about 8 inches of snow on the roof.

We've had some pretty serious snowstorms during this testing period (on occasion I can't even see the building that has the access point on it) and I've not seen any degradation in throughput as a result.

So we come to the bridging issue. I bought a small hub and hooked two computers to it and ran the uplink port to the transceiver. It performed flawlessly even when I downloaded large files on both computers at the same time. Clearly the only barrier to lan to lan connections with this is that the unit will choke on too much data. I wouldn't want to try this on a lan with an application server running, certainly. By the way, the unit contains 8 megs of memory for buffering.

Frankly, the results astound me (hence the Clarke quote). I sit at home and treat my office machine hard drive as if it were just any other network asset. The campus link to the Internet is a T-1 connection (my first act as Director of Academic Information Technology was to upgrade this) and I cruise the net at a very respectable speed on this system from my home. When I used to dial up with a 28.8 modem and download a file, Netscape would report in the vicinity of 2.8 K/sec. Now I see numbers like 35k/sec. The bottleneck is clearly no longer between me and campus. Are we having fun yet?

Well, 8.5 dBi gain on 50 milliwatts is considerably below the legal limit. So the next step was to look into higher gain antennas. I called BreezeCom about it and they said they were coming out with a parabolic antenna shortly for just this purpose. One of their employees said they tested this successfully at a range of 20 miles. The president of the company later claimed 5-6 miles. They offer a 2 by 3 foot dish that has about 23 dBi gain for \$395 list. They put 25 feet of RG-8 coax on it to bring the gain down to the legal limit. However, I am aware of other sources of antennas. The company that was formerly DownEast Microwave sells loop yagis and claims they have actually sold some for precisely this purpose. They make a 1 foot yagi with 11 dB gain for about \$50, a 3 foot yagi with 17 dB gain for \$85 and a 6 foot loop yagi with 20 dB. These might be good choices for use with this system. However, I also knew that Bob Myers Communications was marketing an S-band 2 by 3 foot parabolic antenna that sounds extremely similar to the Breezecom unit (except I believe Breezecom said theirs was magnesium). Advertised mostly as an Oscar 13 mode S downlinke antenna, Bob says the gain of his unit is 25 dB and the price is only about \$60 ... so I ordered one.

A couple of days later we had the new antenna and took the entire set up to a hillside outside of town. The new site is about 4.8 miles from the access point as the crow flies. There used to be a clear view of the campus from out there, but trees have since grown up blocking the view. On the day we went there was also some fog. Bear in mind the access point antennas are still taped to the window indoors and no attempt has been made to re-orient them so that the hillside path was

optimized. I mention this simply to indicate that things could have been better. On the other hand, as we used it, this antenna had slightly more gain than would be legal under Part 15, and we did not use the requisite RG-8 attenuator in the line. From the ground we were unable to perceive any signal at all. However, John, WB2WXN was just crazy enough to go up on the roof of the house on this icy day with radio and dish antenna in hand. From the roof he saw a solid 1 mbit/sec link.

What can we learn from this? This equipment might well have a substantial number of applications within and on the fringes of the amateur service. I don't think that it is unreasonable to think that high gain point to point links could be established using this technology in an unmodified form that would span 10 or 15 miles or more. These links would be entirely within the Part 15 rules and, as a result, the fact that these protocols are currently illegal on the amateur bands would be irrelevant. Once the protocols do become legal, equipment modification might be possible to provide even greater range.

There may, however, be more significant opportunities outside the Amateur service. What is to prevent a local club of enthusiasts (though not necessarily Amateur radio operators) from pooling their funds to put up a central access point and then buying a full-time 56kbit (or faster) internet link for that site? The individual members would then each buy a station adapter for their homes and an appropriate antenna and enjoy high speed internet access. More importantly, what do these prospects portend for the future of Amateur packet radio? The vast majority of packet users are still running 1200 baud. Over the past decade packet radio has been responsible for bringing literally thousands of new people into the Amateur radio community. In an age of ready internet access and high speed wireless communication using Part 15 devices, how reasonable is it to assume that packet radio will attract any significant number of new users over the next decade?

The companies mentioned above can be reached at:

BreezeCom
2195 Faraday Ave Suite A
Carlsbad, CA 92008
619-431-9880 voice 619-431-2595 fax
If you like, you may mention my name.

GBC Technologies 609-767-2500
I've been dealing with Scott Haines at this company. Be advised that while this firm clearly has better prices, they are just a reseller and they know virtually nothing about the products themselves. If you want an SA-10D be sure you are adamant about it because their initial thought was that it was just a minor revision of the SA-10.

Bob Myers Communications
602-837-6492
bmyers@primenet.com

Packet Radio in Education

Ham Radio in the Schools: From the Start

Paula Weaver, M.Ed.

This is the third of several articles that will appear in the PSR concerning Amateur/packet radio and its potential in K-12 educational applications. These papers were assembled over several summers of teaching a graduate level course at the University of North Texas. Many thanks to the Texas Center for Educational Technology for allowing TAPR to reprint this information.

As part of TAPR's goal in education, we hope that these articles will be disseminated to a larger group that can take the concepts and ideas to a next step or final application/implementation. If you have a teacher or educator as a friend, please pass these articles along.

— Greg Jones, WD5IVD

Reprinted from:

Jones, Greg (ed). *Infusing Radio-Based Communications Tools into the Curriculum*. Texas Center for Educational Technology. 1995. 136 pages.

Preface

On June 3, 1991 I had only a vague idea about ham radio. This first day of an intensive summer media in education seminar for teachers at the University of North Texas was an overwhelming experience. The central focus of the seminar was Amateur radio technology. As a veteran teacher of young children, sometimes teacher of teachers, and doctoral student in the field of early childhood education I heard the philosophy of my profession through the jargon of Amateur radio. My amazement and enthusiasm on that first day of class was only the beginning.

By the end of the first week I found myself at the Ham-Com '91 convention in Arlington, Texas among some of the most helpful and knowledgeable ham radio people in the nation. Repeatedly during the five hour seminar for teachers I heard phrases such as "hands on learning; cultural exchange; relevancy to existing curriculum; polite protocol; application to real world science, math and technology; and learning to communicate." These concepts are the foundation of a developmentally appropriate curriculum for young children. Early childhood educators may use a different jargon, for example: concrete experience; taking turns; relevancy to the individual child; and language development; but the end result is not bound in the words we use to describe what we mean but rather in optimal learning for each student.

One of the concerns expressed at this seminar was how to get ham radio into the schools as an integral part

of the curriculum. The similarity of focus between the ham radio community and developmentally appropriate curriculum for young children provides a common basis from which many fruitful exchanges may take place. A secondary question concerning when the most appropriate age to focus on Amateur radio in the classroom was also raised. It is these two concerns I am compelled to address from the perspective of an early childhood educator. It is my hope that these comments will facilitate dialogue and learning between Amateur radio aficionados, teachers of young children, administrators, and young children.

Ham Radio in the School: From the Start

The double meaning found in the title of this addendum to the June 7, 1991 Ham-Com Education Seminar addresses both one possible avenue to get Amateur radio into the nation's schools, as well as when children can begin to learn about Amateur radio technology. A concept of when and how it is most appropriate for children to begin learning about ham radio is the most logical starting point. From an understanding of how young children learn, how quality early childhood classrooms are facilitated, and what teachers of young children seek, the avenues for getting ham radio into the school curriculum will be easily addressed.

Young children learn most easily through self discovery with things they can manipulate in an environment of individual support and questioning (Bredenkamp, 1987). These avenues of learning are shared by ham radio operators throughout the world. Elmering is different with young children than with adults in that the elmer must be guided by the child's questions, not by the need to impart specific information to pass a test. The goal of elmering a young child is to create and facilitate an eager desire to know about how things work and how the child can make what he or she is learning relevant to what is already understood. Unless a young child has had a lot of previous experience with traveling to other parts of the country he or she is very unlikely to understand about geography. Likewise, unless a young child has had many opportunities to play with batteries and wires he or she is very unlikely to understand about the difference in electricity and radio waves. To begin at the very beginning may be a challenge, but it is of utmost importance. The beginning, in this case, is the physical hardware necessary to use ham radio communications. It is not necessary to bring an entire ham radio station into an early childhood classroom for the children to play with! Bits and pieces of your unusable equipment are what young children need first. They will want to take things apart and ask why this thing is red and this other thing that seems just like it is yellow. They will

ask why there are so many wires and knobs. They will ask where you live and if you have any kids at your house. As an elmer for young children you will tell them where you live and that you might talk to them without a telephone from your house to their school sometime. You will explain that there are a lot of knobs and wires because they help get your voice from your house to the school. If a child wants to know how you do that, you may want to bring a simple experiment with batteries and walkie talkies to class the next time you come.

Concepts of technology, geography, and math must be approached at the child's level of understanding. Can you remember the first time you encountered the complicated technology of Amateur radio? If you can, try to imagine that you did not even know your telephone number or address yet. You will begin to understand a small fraction of a young child's need for time to discover and ask a great many questions. If ever the need for patience is apparent it is in the environments of young children.

Since the goal of elmering young children is to create and facilitate an eager desire to know about ham radio, an elmer for young children will need to know a little about how quality environments for children are structured. Most developmentally appropriate classrooms for young children are arranged in learning centers designed to facilitate open ended exploration of materials. Teachers alter the learning center goals and materials to meet the needs of the students. The children access the learning centers during specific parts of the day and are assisted by the teacher as the need arises. Because young children learn best through actual manipulation of real objects teachers provide these objects in the learning centers.

If a teacher had access to bits and pieces of unusable ham radio equipment it could easily be used in a learning center for technological exploration. Children could take equipment apart, classify components, discover similarities, compare, ask questions, and maybe even put it back together! Most teachers of young children are enthusiastic when they are offered free materials for use in their classrooms. If expert elmering is also offered it will likely be met with even greater zeal. This combination offers ham radio aficionados an excellent avenue to get ham radio in the schools.

This brief description of how young children learn, how early childhood classrooms are facilitated, and what teachers of young children seek has laid the foundation for an explanation of some possible steps for getting ham radio into the schools. Schools are often very careful about watching for strangers in their hallways. Therefore, if you do not know a kindergarten teacher personally you will need to call the school and ask for an appointment with the principal to explain your

plan. It might be appropriate to meet with the teacher at the same time. If you take a sample box of unusable bits and pieces of equipment with you it will be easier to be specific about your intentions. It would also be advantageous to bring your license and any ARRL or local club materials to this initial meeting. It is important to present any materials that will reveal your knowledge and credibility.

If the teacher or principal are not familiar with ham radio it would be a good idea to label the materials you take to the school. Again, think about what it was like for you before you knew anything about the technology of ham radio. Simple labels like vacuum tube, transistor, and fuse would be very valuable for a novice as well as for young children.

If there is a positive reception to the idea of leaving your box of materials with the teacher you will want to make plans to check back in a week or so to see how things are going. You may even want to offer to come to class one day and sit in the learning center to answer students' questions while they are working. Remember that young children learn best when they are allowed self discovery with materials and have opportunities to ask a great many questions. Do not plan to lecture young children. They may be polite, but they will not learn as much from being talked to as they will from self discovery and questioning.

As your relationship with the school and the children grows you may want to invite them to go on a field trip to your station to see how it works. In most schools a field trip is a complicated process, so do not be disappointed if they cannot arrange it. You can always bring in a handi-talkie and demonstrate it in the classroom. Most of the children will be familiar with the walkie-talkies used by the Teenage Mutant Ninja Turtles so your demonstration will have meaning for them.

There may be some question as to the value of putting so much time and energy into a program which will not yield a new crop of novice operators immediately. If, however, you can motivate curiosity, excitement, and enthusiasm for ham radio in a young child it is likely to grow with the child. You may very well need to organize a junior ham club by the time your kindergarten techies reach third grade. Even if your results are not that dramatic, the least that could happen is that schools will begin to understand the value of ham radio in the curriculum.

Reference list

Bredekamp, S. (Ed.). (1987). Developmentally appropriate practice in early childhood programs serving children from birth through age eight. Washington D.C.: National Association for the Education of Young Children.

Regional Packet Club List (1/1/96)

If you have corrections or additions to this list, please contact the office. TAPR hopes to keep this list as accurate as possible in order to refer information and individuals to their regional group(s).

Amateur Radio Research and Development Corp (AMRAD)

PO Box 6148
McLean, VA 22106-6148
Newsletter: AMRAD Newsletter

American Radio Relay League (ARRL)

225 Main St
Newington, CT 6111
Internet: INFO@ARRL.ORG
<http://www.acs.oakland.edu/barc/arrl.html>
Newsletter: QEX / Gateway

Arizona Packet Radio Association

8402 E Angus Dr
Scottsdale, AZ 85251

Central Illinois Packet Radio User Society (CIPRUS)

c/o Larry Keeran K9ORP
RR 1 Box 181
Hudson, IL 61748-9750

Central Iowa Technical Society (CITS)

c/o Ralph Wallio W0RPK
1250 Hwy G24
Indianapolis, IA 50125

Chicago Amateur Packet Radio Association (CAPRA)

PO Box 8251
Rolling Meadows, IL 60008
Newsletter: The CAPRA Beacon
Internet: cberg@svs.com

<http://www.pyrotechnics.com/~gdorner/capra.html>

Cincinnati Amateur Packet Radio Experimenters Society (CAPRES)

c/o John Schroer IV KA8GRH
948 Halesworth Dr
Forest Park, OH 45240

Colorado Digital Eclectics (CODE)

3631 Brentwood Terrace
Colorado Springs, CO 80910
Internet: info@code.org
<http://www.code.org/code/>

Colorado Digital Working Group

c/o Ted Cross, N0IAK
33165 Diana Rd,
Pine, CO 80470
Internet: ted@rmsd.com

<http://www.rmsd.com/hamradio/dwg.html>

Colorado Packet Association (COPA)

c/o John Radomski KT0H
2080 S Fairplay
Aurora, CO 80014

Connecticut Digital Radio Association (CDRA)

c/o William Lyman, N1NWP
219 So Orchard St.
Wallingford, CT 06492
Internet: lyman@nai.net

EastNet BackBone Network (EBN)

c/o John Gubernard, K2LSX
81 Harcourt Ave
Bergenfield, NJ 07621-1916

Eastern Washington Amateur Radio Group (EWARG)

Pat Dockrey, NQ7M
Post Office Box 644

Spokane, WA 99210

Internet: msvc@ieway.com

Florida Amateur Digital Communications Association (FADCA)

c/o Joseph Kuntz, WB4TEM
812 Childers Loop
Brandon, FL 33511
Newsletter: FADCABeacon

Georgia Radio Amateur Packet Enthusiast Society (GRAPES)

P.O. Box 636
Griffin, GA 30224
<http://www.mindspring.com/~bobm/grapes/grapes.html>
Newsletter: Grapevine

Indiana Digital Experimenters Association (IDEA)

c/o John Hartman N5AAA
14659 Wellington Ct.
Noblesville IN 46060-4356

International Digital Radio Association (IDRA)

P.O. Box 2550
Goldenrod, FL 32733-2550
Internet: adrs@iea.com
<http://www.iea.com/~adrs/>
Newsletter: Digital Journal

Kansas Digital Coordinating Committee

c/o Karl Medcalf WK5M
1544 N 1000 RD
Lawrence KS 66046-9610
Internet: medcalf@idir.net

Mid-Atlantic Packet Radio Club

c/o Tom Clark W3IWI
6388 Guilford Rd
Clarksville, MD 21029
Internet: w3iwi@amsat.org

Mississippi Amateur Radio Digital Association (MARDa)

c/o Patrick J Fagan WA5DYV
2412 E Birch Dr
Gulfport, MS 39503

Mt Ascutney Amateur Packet Radio Association

c/o Carl Breuning N1CB
54 Myrtle St
Newport, NH 03773

Mt Beacon Amateur Radio Club

PO Box 841
Wappingers Falls, NY 12590

Nevada Packet Coordinators Committee (NPCC)

PO Box 12116
Reno NV 89510
Internet: ki3v@connectus.com
Newsletter: The NPCC Rag

New England Packet Radio Association (NEPRA)

PO Box 208
East Kingston, NH 03827
Newsletter: NEPRA PacketEar

North East Digital Association (NEDA)

PO Box 563
Manchester, NH 03105
Internet: neda@teledm.com
<http://www.cam.org/~dino/neda/neda.html>

Northern California Packet Association (NCPA)

P.O. Box 61716
Sunnyvale, CA 94088
Newsletter: NCPA Downlink

Ohio Packet Enthusiasts Club (OPAC)

c/o Bob Ball WB8WGA
830 Riva Ridge Blvd
Gahanna, OH 43230

Oregon Digital Network Coordination Council (ODNCC)

7860 SW 69th Av
Portland, OR 97223

Pacific Packet Radio Society (PPRS)

PO Box 51562
Palo Alto, CA 94303

PacketEast of North Carolina

Network and Frequency Coordination for Eastern North Carolina
c/o Gary Pearce KN4AQ, VP
116 Waterfall Ct.
Cary, NC 27513
Internet: kn4aq.gary@mms.net

Packet Radio Organization of Montana (PROM)

c/o Glenda Allen KE7TB
165 Conifer Rd
Libby, MT 59923

Packeteers of Long Island (POLI)

c/o Alex Mendelsohn AI2Q
92 Hathaway Av
Elmont, NY 11003
Newsletter: The POLI Parrot

Pennsylvania Packet Association (PaPA)

c/o Bryan Simanic WA3UFN
9 Wild Cherry Dr
DuBois, PA 15801

Puget Sound Amateur Radio TCP/IP Group

c/o Steve Stroh N8GNJ
14919 NE 163rd Street
Woodinville, WA 98072
Internet: strohs@halcyon.com
http://www.wetnet.ampr.org

Radio Amateur Satellite Corp (AMSAT)

PO Box 27
Washington, DC 20044
http://www.qualcomm.com/amsat/AmsatHome.html
Newsletter: AMSAT Journal

Radio Amateur Telecommunications Society (RATS)

c/o J Gordon Beattie Jr N2DSY
206 North Vivyen St
Bergenfield, NJ 07621
http://www.webcom.com/~arfunk/rats.html

Rochester Packet Group

c/o Fred Cupp W2DUC
27 Crescent Rd
Fairport, NY 14450

San Diego Packet Radio Association (SANDPAC)

c/o Barry Gershenfeld
5085 Arroyo Lindo Av
San Diego, CA 92117
Newsletter: San Diego Packet Radio Association Newsletter

South Carolina Amateur Radio Digital Society (SCARDS)

PO Box 1281, Columbia, SC 29202
Newsletter: SCARDS Newsletter

Southern Amateur Packet Society (SAPS)

c/o Wayne Harrell WD4LYV
Rt 1 Box 368
Sycamore, GA 31790

Southern California Digital Communications Council (SCDCC)

PO Box 2744, Huntington Beach, CA 92647-2744
Newsletter: The I-Frame

Tennessee Network (TENNET)

c/o Jeffrey Austen K9JA
2051 Clearview Drive
Cookeville, TN 38506
Internet: jra1854@tntech.edu

Texas Packet Radio Society (TPRS)

PO Box 50238
Denton, TX 76206-0238
Internet: wo5h@tapr.org
http://www.tapr.org/tprs

Newsletter: The TPRS Quarterly Report

Tucson Amateur Packet Radio Corporation (TAPR)

8987-309 E. Tanque Verde Rd #337
Tucson, AZ 85749-9399
Internet: TAPR@TAPR.ORG
http://www.tapr.org

Newsletter: Packet Status Register

TwinsLAN Amateur Radio Club

c/o Kermit Kramer W0RFD
1121 Xerxes Av S
Minneapolis, MN 55405

Newsletter: The TwinsLAN Beacon

Utah Packet Radio Association (UPRA)

c/o Bart Van Allen KA7ZFD
11883 S Kinney Cir
Riverton, UT 84065

Wake Digital Communications Group (WDCG)

c/o Randy Ray WA5SZL
9401 Taurus Ct
Raleigh, NC 27612

Western Michigan Packet Radio Association (WMPRA)

PO Box 4612
Muskegon, MI 49444

Wisconsin Amateur Packet Radio Association (WAPRA)

PO Box 1215
Fond Du Lac, WI 54935
Newsletter: Badger State Smoke Signals

Canadian Clubs

Hamilton and Area Packet Network (HAPN)

Box 4466 Station D
Hamilton, ON L8V 4S7 Canada

HEX 9 Group

PO Box 151
Orilla, ON L3V 6J3 Canada

Manitoba Digital Emergency Communications Groups (MDECG)

c/o Jim Townsend, VE4CY
2109-55 Garry St.
Winnipeg, MB R3C 4H4 Canada

MARCAN Packet Network

c/o Ron MacKay VE1AIC
Box 188
Cornwall, PE C0A 1H0 Canada
Packet: VE1AIC@VE1AIC.PE.CAN.NOAM
Internet: rmackay@peinet.pe.ca

Vancouver Amateur Digital Communications Group (VADCG)

9531 Odlin Rd
Richmond, BC V6X 1E1 Canada
Newsletter: The Packet

Vancouver Area Packet Organization (VAPO)

c/o Rob Reid, VE7FU
6510 Bradford Place,
Delta, B. C. V4E1G3 Canada
Internet: rob_reid@mindlink.bc.ca
http://mindlink.net/rob_reid/vapo.html

Winnipeg Amateur Radio Packet group (WARP)

c/o Chris Setla, VE4SET
158 Fairlane Ave
Winnipeg, MB R2Y OB3 Canada

High Frequency Performance Of Two Different Pactor Systems

Marvin Bernstein, W2PAT/AFA1DA

A series of tests of the HF performance of two different Pactor systems was begun in early 1995 in order to determine their differences. A message was sent out on the Air Force MARS Packet Network, asking if any other Member had the software pactor system and a response was received from another Member in Kansas. This member agreed to participate in testing the data speed of both the Kam plus and the second system.

This investigator initiated an expanded series of tests on HF in a four-month period in 1994, of the data speeds of Pactor and G-tor, and a report of the results was published in 1995 [1]. The HF data speed of every radio communication system is dependent upon the signal to noise ratio and also the propagation conditions in the path between the two linked stations. In the case of the Pactor mode, it has been determined that there is significant difference in data speed at low signal levels depending upon the pactor system used.

An interference-free frequency was available in 1995 and thus an expanded test was continued with another objective, that is to compare different systems. The mode was Pactor and the different systems used for the first test series was a KAM sending files to a second KAM. The speed was then compared to the second system, which used the G4BMK software program BMK-MULTY [2]. Two members of the Air Force Military Affiliate Radio System (MARS) transmitted on approximately 7.9 MHz to conduct the tests. Operating on the MARS frequency allows the tests to be run free of the kind of interference found on the regular Amateur bands. This then provided a means to determine the data speed differences due to the type of pactor systems used.

Two tests were run each day, the first at 9 AM Eastern Time and the second at 9 PM Eastern Time. A file was sent from the Mars Member in Kansas to this Member in New Jersey using a KAM TNC at each location. The time required to complete the file transmission was determined with a stop watch. Both stations then changed equipments to the software pactor system and the file was sent a second time. The next day, the same test was run again, but the systems were reversed, that is the software system was used first and the KAM test was run second. This was done to remove some of

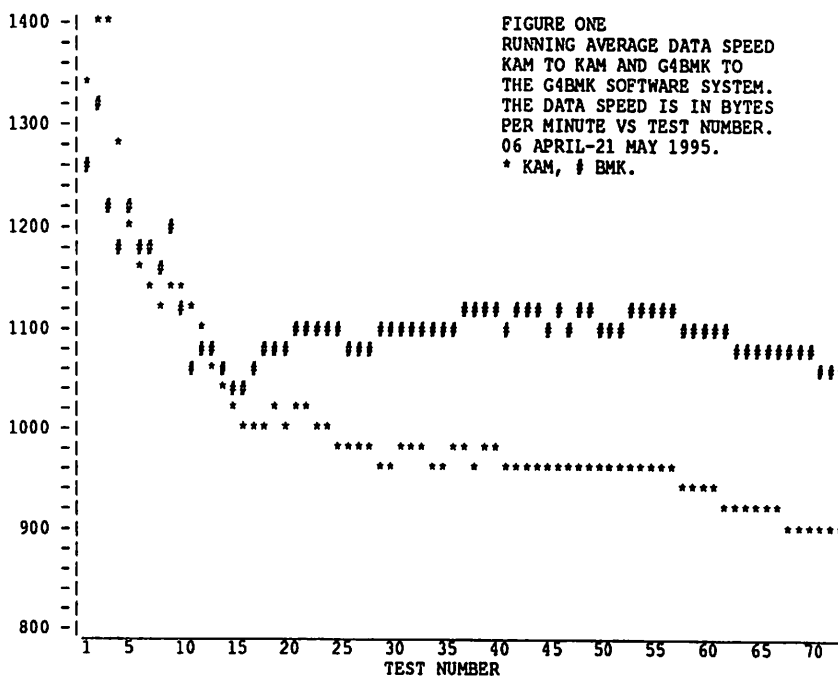
the uncertainty due to changes in propagation noted during the earlier tests.

The software Pactor program requires a modem to change the two tones to RS-232 type dc voltages and this was accomplished with older terminal units used for RTTY. These units were a Heathkit model 3030 at the Kansas Station and a Frederick Electronics Corp., model 1202R VF Telegraph Receiver at the New Jersey Station. This unit was originally a very narrow bandwidth (85 Hertz) terminal unit, that was modified to accept 200 Hertz shift. The post-detector amplifier bandwidth was also changed to pass 200 Baud signals. The resulting test data speed has been graphically shown by plotting the RUNNING AVERAGE of each system to demonstrate that short and long term HF Propagation causes very large excursions of the information. This displays the effect of averaging the data and indicates the required length of each test series to provide enough information to prove useful.

Figure One

The use of graphs to show the data speed measurements clearly indicates that there is large scatter in the values of each data point. It demonstrates that continuing the tests for several weeks, and averaging the test data does result in greater confidence in the information obtained by the tests.

The first ten sets of data points show little correlation between the data speeds of the two systems even for the same test date. However after the 15th set of data, a much more uniform trend is shown for the remainder of the test period. As noted in the four-month test of 1994, QRN is



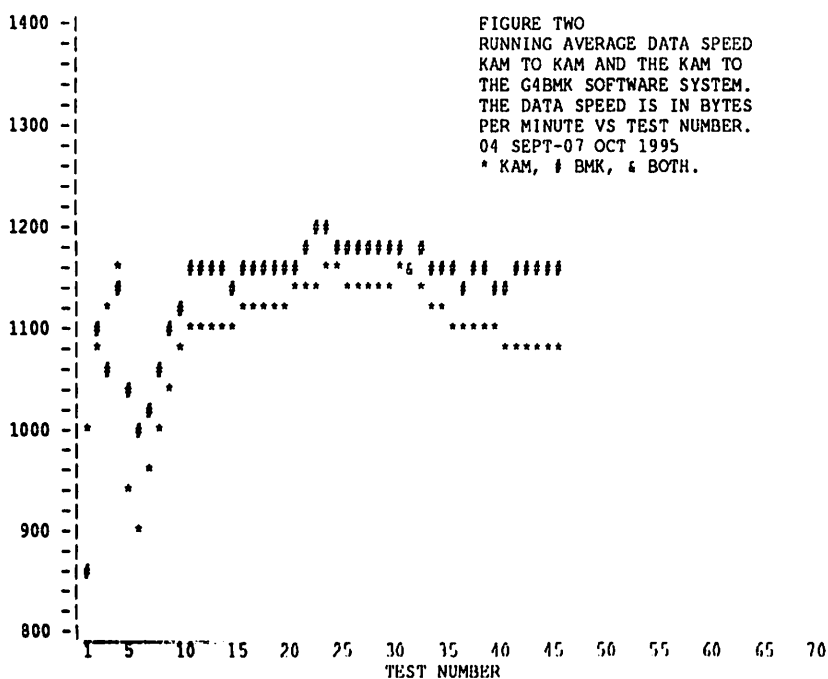
the most destructive natural cause of reduced HF data speeds. The very large decrease in speed shown for both modes at the beginning of the test on 6 April 1995 are the result of unstable propagation, however.

The stable data range shown from the 15th to 55th test period dates from the 22nd of April to the 8th of May 1995. The falling data speeds after the 8th of May appear to be due to QRN, since the signal strengths recorded in the data log book are not abnormally low. The BMK software average data was determined to be 17% faster than the KAM pactor data speed. These results indicated that the weak signal performance of the commercial demodulator was substantially better than the demodulator in the Kam.

Figure Two

This graph shows somewhat similar results at the very beginning of the test, with widely scattered data points. Beginning with the tenth test, the plotted data again begins to smooth out, due to the averaging effect. However in this series of tests there is very much less data speed difference between the KAM/KAM and the KAM/G4BMK tests. Based on the average data speeds at the end of the test, the G4BMK software system is 8 % faster than the KAM speed. It should be noted, however, that this second test did not use the software system at each end of the transmission path.

The major difference in this test is the use of a simple demodulator circuit, consisting of two 88 mH toroids tuned to the Mark and Space frequencies. Diodes are used to rectify the audio tones, and the dc voltages then



amplified in a two stage operational amplifier. The purpose of this test was to determine if a very simple demodulator, using a DSP FILTER on the input of it, would equal or surpass the performance of the unit used in the first test. The DSP FILTER was the 1992 version of the W9GR kit published in *QST* [3]. The arrangement of a very simple demodulator and a very sophisticated Digital Signal Processor did not result in a better performance than the first test, using the commercial telegraph unit. This converts the audio tones to approximately 18 kHz, then filters at that frequency, limits the signals and finally uses a discriminator to obtain the DC voltages needed. These voltages are then passed thru two stages of operational amplifiers to increase the voltage levels.

These two test programs made use of the KAM/KAM data speed results each time with the object of having a REFERENCE data speed to increase the accuracy of the comparison. The High Frequencies show very large changes in path loss and distortion that requires a substantial number of data speed tests that then must be averaged to obtain useful data.

The scheduled series of Pactor tests have continued and wont be completed until early in 1996. Presently, the testing program has been changed to determining the elements of the demodulator used with the BMK software program which are important in improving the data speed results. It is expected that a final report will be written in 1996 which details all the results of these tests and possibly have some recommendations on those elements of a demodulator that contributes to improved performance with HF Data Signals.

I wish to acknowledge the dedication of Conrad Steinel, K0UER/AFA3VP Emporia, Ks. in actively participating in this extensive test program. It is expected that he will have sent more than three million bytes of ascii text files by the time this extended Pactor evaluation has been completed.

References

1. Data Speed Tests of HF Pactor and G-tor Modes; *Packet Status Register*, TAPR, Spring Issue # 58. Data Speed Tests; *Digital Journal*, International Digital Radio Association, Vol 43, July 1995, Number 7.
2. Spheretron/Schnedler Systems
 P.O.Box 5964
 Asheville, NC 28813
3. Low-Cost Digital Processing for the Radio Amateur; Dave Hershberger, W9GR; *QST*, Sept. 1992.

MacAPRS 2.2.0 is FINALLY out!

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Both the 68K and Power PC versions are up on the TAPR server. Come and get it!!!

MacAPRS 2.2.0 has a lot of new features:

- Full support for the Peet Bros U-2000, including Pressure
- Better capabilities for switching Unproto-Paths
- The messages in the MESSAGE window are now able to be SORTED You can select which column is sorted by clicking on that column at the top of the window. You can sort by:
 - Who FROM
 - Who TO
 - Date/Time msg was RECEIVED
 - alphabetic sort by message content.

MAPS!! Lots of new stuff with MAPS:

- You can now put PC- MAPS directly into the MAPS folder and MacAPRS will recognize them WITHOUT having to convert them first! (Make sure you UN-ZIP them before you put them into the MAPS folder)
- Map LIST
This was added because of a 'PROBLEM' with Win-doze. :- (In Windoze, a MENU can only be as long as the screen is tall. i.e. if you have a 14" monitor, you can have so many menu items, and if you have a 17" monitor, you can have MORE items! Well, some people have LOTS AND LOTS of maps... WinAPRS would support this, but you could ONLY select those at the top of the list.. So, we added a window called MAP LIST, which shows LOTS of info about all of the maps. And, you can double click on a line (map) in this window, and it will bring that map up as a NEW map window.
- I now have a new source of MAP DATA, that I am starting to use. With this new data, I can create maps of LITERALLY any place in the world! Look at the following Web Pointers (These will be integrated into our normal Web stuff soon)

<http://www-ns.rutgers.edu/~ksproul/APRS/images/Boston.gif>
<http://www-ns.rutgers.edu/~ksproul/APRS/images/Florida.gif>
<http://www-ns.rutgers.edu/~ksproul/APRS/images/Japan.gif>

Pay close attention to the yellow cities!!!

There is a map made from this data up on TAPR, it is in the MacMaps folder and is called DCW HJ13.map.sit.hqx

I will be putting more of these maps up soon.. If you have a request (especially if it is outside of the U.S.) send

me PRIVATE mail, **not** to the SIG! and I will see what I can do.

NOTE!!! These new maps are FULLY backward compatible, even though they have new stuff in them, AND they are fully compatible with WinAPRS! (WinAPRS won't show the filled in yellow cities, at least for now)

The fact that we can do this good of maps for the entire world now opens APRS up to a lot more people!

I have played with maps in Europe, Australia, New Zealand, and Russia, and they are GOOD maps!

- Auto Configuration of Map Windows.

If you have a set of maps that you like to have come up every time you start the program, do the following. Rename each of them starting with a number (In numeric order of how you want them to appear) i.e.

- 1.usa.map
- 2.Mid Atlantic.map
- 3.New Jersey.map
- 4.MyLocal.Map

Put these maps in the TOP level of the MAPS folder (not in a sub- folder), and MacAPRS will load them in the order specified. The ONLY limitation to how many maps you can do this way is how much memory you have.

Also, after the program is running, you can RE-DO this, if you close ALL windows, and select AUTO CONFIG MAP WINDOWS from the WINDOWS Menu.

- Page-Up, Page-Down (and +/-) do zoom-in, zoom-out. Home and 'H' do HOME map (CMD-H does this too)

MacAPRS Guide File

David Chesser, KA9NHL
davidc@tbcnet.com

David Chesser (KA9NHL) and Tim Hays (N2KBG) have released the long awaited MacAPRS Guide file for the MacAPRS program. This guide file works with system 7.5 or system 7.0 with the proper extentions from Apple. The guide file is used as a help file when running MacAPRS. This guide file can be downloaded FTP from the (NIAN) Northern Illinois APRS Networks Web site <http://tbcnet.com/~davidc/aprs.html> Any response can be to Email davidc@tbcnet.com The guide file is being updated but may not keep up with current releases of MacAPRS.

New Net-SIG Moderator/Chairperson

I'm pleased to announce that Steve Stroh, N8GNJ, is the new Net-SIG moderator and chairperson.

Though I've cleverly timed this announcement for the new year, Steve has actually been doing the job for a couple of months, and doing it very well.

Steve is very active in both network building and tcp/ip in the Seattle area, and he's been a great contributor to Net-SIG.

There are a couple of reasons for this change. Primarily, I have too many other projects for TAPR and my local group (not to mention my family and employer!) to give Net-SIG the time it needs. But I think there's also value in change; Net-SIG is going on two years old and it could use new ideas and perspectives to keep it lively. I'll be remaining on as backup to Steve.

Please join me in welcoming Steve to his new role.

73, John Ackermann AG9V

Net-SIG

Steve Stroh, N8GNJ
strohs@halcyon.com

Fall 1995 was a busy time for the TAPR Net-SIG Mailing List. There were 301 messages posted from September through December. Some of the highlights were:

- A discussion was begun about incorporating TNC to TNC compression into the software of a typical TAPR TNC-2 compatible TNC. The initial discussions were very promising, and it appeared that compression was very "doable," and some talented folks were interested in the project.

- The breadth of knowledge represented on Net-SIG on the X1J and ROSE networking software is amazing, especially when an entire quarter's messages are viewed over the course of an hour. There is an absolute wealth of information residing in the TAPR Mailing List Archives.
- The glimpses of the many potential futures of Amateur Radio Digital Networking are impressive — there is some very powerful talent "lurking" on Net-SIG.
- A new Packet Radio modem, called "the GMSK modem" that offers potential over-the-air speeds of up to 28.8 KBPS and is backward compatible with the G3RUH 9600/19.2KBPS modem was announced on Net-SIG as well as other newsgroups and mailing lists.
- A discussion on conversion of land mobile radios for 9600 baud use. The overall favorite LMR for conversion to Amateur Digital 9600 baud appears to be the Motorola Mitrek family.
- The general tone of the discussions on Net-SIG indicated that it may be appropriate for TAPR to host a mailing list that parallels Net-SIG for TCP/IP networking issues. Current Amateur Radio TCP/IP mailing lists are focused on using TCP/IP as a BBS, and Amateur Radio TCP/IP software development.
- Net-SIG's leadership was passed from John Ackermann AG9V to Steve Stroh N8GNJ in December.
- Net-SIG remains moderated for the time being but may well return to unmoderated status in the near future.
- My special thanks to Tom Moulton W2VY for his always enlightening and unfailingly civil postings to Net-SIG.

Regional Frequency SIG

Dan Puckett, K5FXB
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AM

Early in October of 1995 the ARRL hosted an unprecedented meeting of the nation's Amateur radio frequency coordinators. The purpose of the meeting was to consider establishing some sort of single-point-of-contact between existing coordination organizations and the FCC. Many recognized digital coordinators were invited participants in the proceedings. Representatives from TAPR were also in attendance. A caucus of those present from the digital community revealed common interests and also common concerns about items in the published agenda for the meeting. Though eventually tabled due to lack of time for discussion, the two items of most concern were:

1. To determine the extent to which coordinators should coordinate emitters other than repeaters.
2. To decide how the coordinating community should respond to the introduction of new technologies.

Digital interests were promised by the leadership of the meeting that they would have the opportunity to participate in discussions of these topics at some later date. Following the meeting, attendees representing digital interests discussed among themselves the possibility of creating an Internet listserver to facilitate discussion and develop consensus before further meetings are scheduled. TAPR has volunteered resources to support this listserver. The focus of the list and instructions for subscribing follow.

TAPR Regional Digital Frequency Mailing List

REGIONAL_FREQ is an electronic discussion about:

1. Regional (and possibly national) digital bandplanning.
2. The relationship of digital organizations with established Amateur frequency coordination organizations (MACC, SERA, T-MARC, etc).
3. Proper characterization of "coordination" as it applies to Amateur digital networks.
4. The role of TAPR and regional digital groups in the formation of a proposed organization that will serve as a Single Point of Contact for the FCC, regarding Amateur frequency coordination issues.
5. Other topics as deemed relevant to the discussion at hand.

Access to REGIONAL_FREQ

To subscribe to this mailing list send a message to 'listserv@tapr.org' with the following line in the body of the message:

**subscribe regional_freq
FirstName LastName Callsign**
(use your own FirstName, LastName and Callsign)

REGIONAL_FREQ Archive

Past messages from the REGIONAL_FREQ are available in the TAPR.ORG archives. Send mail to 'listserv@tapr.org' with the following in the message body:
index tapr/regional_freq

Chairperson for the list is Dan Puckett (K5FXB)

SS SIG

Barry McLarnon, VE3JF
bm@hydra.carleton.ca
ve3jff@tapr.org

After a few false starts earlier in the year, the Spread Spectrum SIG got officially launched at the end of November 1995. By the end of January, there were nearly 200 subscribers on the mailing list, so there seems to be lots of interest in this topic! What's the SS SIG all about, you ask? Here's a quote from the welcome message:

This mailing list is for the discussion of topics related to the application of spread spectrum communications technology to Amateur packet radio networking. The emphasis of this SIG is on the technology of spread spectrum rather than regulatory or political issues. Suitable topics include:

- New SS chipsets and modem products, and their applicability to the Amateur service
- Performance reports on existing products (e.g., Part 15 WLAN devices)
- Relative merits of direct sequence, frequency hopping and hybrid approaches in Amateur SS applications
- Use of CDMA and other multiple access techniques to build packet radio LANs/MANs
- Dealing with shared allocations and interference in the UHF and higher Amateur bands
- Proposals for development projects in Amateur packet SS
- Sources of SS information: books, articles, web pages, FAQ files, etc.

We hope that this SIG will provide the spark to get some Amateur SS development going. The focus on the SIG so far has been mainly on where to find more information on SS (especially on the Internet), and reports about experiences with the

commercial wireless LAN hardware that can be operated without a licence in the U.S. (Part 15) and other countries. Some highlights:

Jerry Normandin reported that he has built up his own 900 MHz SS modems using OEM modules from Proxim. He's using some homegrown Unix X.25 software drivers, and has been able to get a range of about one mile so far, with a 19.2 kbps data rate. He's now working on increasing the range.

Glenn Elmore, N6GN, contributed some observations about the Metricom SS modems that are used in part of the high-speed network in California. They work reasonably well, but the throughput they provide is much less (by about an order of magnitude) than Glenn's 230.4 kbps modems, despite the fact that the nominal bit rate of the Metricoms is 100 kbps. The reasons are not clear, but Glenn thinks that part of the reason might be the overhead imposed by Metricom's link layer protocol. One thing that impresses him about the Metricom units is their remote diagnostic capabilities — they can be interrogated to get reports on signal strength, spectral occupancy, etc.

John Hansen, WA0PTV, reported on his recent experiences with some 2.4 GHz SS modems from BreezeCom (formerly Lannair). John is in the fortunate position of being to check out this stuff as part of his job at a college in Fredonia, NY. This equipment runs at up to 3 Mbps — the same ballpark as the better-known WaveLAN products, but apparently this is different technology (imported from Israel). It only puts out 50 mW, but you can put lots of gain in the antennas, up to the point where you hit the 4 Watt ERP limit imposed by Part 15. One interesting aspect about the BreezeCom modems is that they are adaptive: the data rate varies from 3

Mbps down to 2, 1 or 0.5 Mbps, depending on conditions. After testing the modems over a half-mile link between his home and the college campus for awhile, John obtained a high-gain S-band dish antenna from Bob Myers Communications and hit the road for some longer-range tests. Using this antenna in the field, with the standard antenna (8.5 dBi gain) supplied by BreezeCom at the campus end, John was able to get a good 1 Mbps link going over a distance of about 6 miles under less-than-optimal conditions (rain, some trees in the way, etc.). With prices well under \$1000 for these units, the possibilities are intriguing! [See the article about John's experiences elsewhere in this issue.]

We look forward to more reports of John's exploits, as well as from other experimenters working with SS technology. I know that there are other Amateurs using WaveLAN, SS modems from FreeWave, etc. — let's hear from you! This experience will be invaluable in determining the course of spread spectrum operations in the Amateur service. Let's make '96 the year that Amateur radio SS takes off!

HF-SIG

Johan Forrer, KC7WW
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HFSIG experienced a relatively quiet period which often is a good opportunity for experimenters to catch up a bit. I appreciate the patience of the group during my busy time.

Several topics of interest to those involved in HF digital communications came under discussion:

HF Channel Simulator

Alexander Kurpiers, DL8AAU, has announced that he will shortly

be releasing a version of an HF channel simulator based on the Watterson model. This version is implemented on a Texas Instruments evaluation module that uses a TI320C26 DSP chip.

The Watterson model is a simulation of the behavior of the ionosphere where typical propagation modes are created artificially. The model is documented in CCIR Report 549-2 and the test conditions are documented in CCIR Recommendation 520-1. Conditions such as: Good, Moderate, and Poor are simulated. These CCIR documents are available from ITU-R.

This is a very exciting development - watch HF-SIG for announcements and the upload area for the code. Congratulations Alexander, we are looking forward to using the code.

Slow Speed BPSK

Pawel Jalocha, SP9VRC, recently developed a new 1200 bps binary phase shift keyed (BPSK) modem for use on HF. After preliminary testing, Pawel decided to derive a slow speed version for robust HF signaling. This slow speed version transmits and receives ASCII text at 30 cps. These PSK modems run on both the Finnish "DSP Card 4" and the Motorola DSP56002EVM hardware. The waveform used for this modem is designed for extremely narrow-band operation. Normally such narrow-band operation is tricky due to frequency tolerances, however, the software automatically compensates for some off-frequency operation that helps a lot. One has to read Pawel's code to appreciate the elegance of the dual Harvard architecture of the 56002. Pawel exploits this to the fullest when dealing with complex number arithmetic — such as for vector multiplication in the Hilbert transform.

This kind of signaling has also independently been explored by some members involved in coherent CW (CCW). Cliff Buttschardt, W6HDO, has recently participated in a 900 mile distance BPSK contact in the 160 kHz experimenter's band. The conditions on those frequencies are extremely challenging. Congratulations Cliff! I also have heard from Paul Straks, PA0OCD, who is getting ready for slow speed BPSK experiments. Paul is also actively using the DSP sound card, the DSP56002EVM software, also on CCW.

Parallel Modem Testing

Paul Straks, PA0OCD, informed me further that a number of Dutch Amateurs are in the process of getting ready to test the 15-tone orthogonal frequency division multiplexed (OFDM) HF modem that was developed by Pawel Jalocha, SP9VRC. This modem has a raw data rate of 2500 bps, and with error correction coding (ECC), 833 bps. The code features AX.25 compatibility and requires a minimal amount of hardware.

HF Networking Using Standard TNC's

For many organizations operating in parts of the world where there is little or no infrastructure, there obviously is a need for a way of inexpensively communicating documents such as e-mail, and FAX. In this regard, HF radio offers unique opportunities, however, integrating existing Amateur radio TNCs into PC-based office applications remains a challenge. Ideas such as encapsulated TCP/IP was put forward as a means to utilize off-the-shelf TNCs in HF networking applications. This is an area where much more needs to be done.

NVIS

For the use of near vertical incidence propagation modes,

antennas for NVIS work are preferred for short to medium distance local communications. This approach relies on high angle of radiation instead of the usual low angle and is a natural choice for the type of networking mentioned above.

Nordic HF Conferences

Those interested in an excellent source for contemporary ideas on HF communications should browse:

<http://www.tclub.se/Radio/NordicHF>.

This web site contains some downloadable materials from recent NordicHF Conferences. The 1995 conference, for example, contains several papers on HF modems, DSP HF receivers, HF spread spectrum, and HF communications protocols. Thanks to Hakan Bergzen for pointing this out.

Sound Snippets for ALE, SLOWBPSK, and OFDM

I collected and composed a few sound files representing some of our recent work. These files are windows .WAV files and are located in the HF-SIG upload area. Look for the files "SOUNDS.ZIP" and "ALESOUND.ZIP". The latter file is from the HF research group at New Mexico State University.

EVM Interface

Several have now built the EVM interface from the schematics as published in the upload file area. However, there have been requests from a couple of experimenters that need help. Please get in touch with me at the e-mail address listed above if you are interested in a kit of parts. I will post an updated file for details on various part numbers and sources that will help you get your interface together — look for the announcement on HF-SIG.

Thanks for all the interesting contributions and please consider joining the on-the-air testing efforts.

TAPR/AMSAT DSP-93 Project Update

Ron Parsons, W5RKN

DSP-93 message traffic has been low after the spurt of builds from the last kit shipment.

PacComm began shipment of their TNC for the DSP-93. The version available as of the end of the year lacked KISS code but PacComm says they are working on the KISS implementation. See <ftp://ftp.tapr.org/tapr/dsp93/upload> for the latest EPROM images.

There is some activity concerned with getting the DSP-93 supported under Linux. See <ftp://ftp.tapr.org/tapr/dsp93/software/linux/> for further information.

Below is the current software list of code available for the TAPR/AMSAT DSP-93. All DSP-93 firmware and most of the source can be found on <ftp.tapr.org>

DSP-93 Software

9600 bps Modems

FSK93U1/2
Half or full duplex operation, active DCD
FSK93U1/2B
Weak signal optimized FSK93U1/2
FSK93K1/2
ISI comp. for KO-23/25, active DCD
FSKADP1/2
Like FSK93U1/2, but automatically adapts to the radio port initialization jumpers
TPRS931/2
TPRS with NRZI in/out, active DCD

1200 bps Modems

PKT931/2
Standard AFSK, active DCD
PKTADP1/2
Like PKT931/2, but automatically adapts to the radio port initialization jumpers
PSK93R1/2J
Satellite PSK, active DCD, SmartTune
PSK93R1/2Y Sat. PSK, active DCD, SmartTune, YAESU
PSK93R1/2K
Sat. PSK, active DCD, SmartTune, ICOM/Kenwood rigs

PSK93R1/2L
Sat. PSK, for weak signal work, ICOM Kenwood rigs
PSK93R1/2Z
Sat. PSK, Yeasu rigs, ground-to-tune
PSK93R1/2W
Sat. PSK, Yeasu rigs, ground-to-tune, weak signals
PSK93X1/2A
Sat. PSK, Yeasu rigs, 5V-to-tune
PSK93X1/2B
Sat. PSK, Yeasu rigs, 5V-to-tune, weak signals

HF Modems

HOT_HF93
RTTY/SITOR Mode B (FEC) modem, Viterbi soft detection, W3HCF Many features; bauds to 100, various shifts, etc.
HF_93HT1/2
300 bps FSK, active DCD, adpt. threshold
HF_93U1/2
AMTOR using TOR.EXE, adpt. threshold, WB5IPM Requires the use of the shareware program TOR.EXE to encode/decode AMTOR

Satellite APT Pictures

APT93R1/2W
Carrier-sync. pixels eliminate doppler bow
APT93R1/2A
visible light sync version

Satellite Telemetry

P3C93T1/2
AO-13 400 bps telemetry; Requires the use of P3C.EXE program by W8GUS to decode
UO93T1/2
UO-11 1200 bps telemetry decoder

Noise Processing

W9GR_93
Adpt. carrier null, channel enh,BP filters
CW93_D
CW filter

Instrumentation

D93WE series
Loader, audio oscilloscope and spectrum analyzer

Diagnostics

Monitor
Basic DSP-93 Monitor and SW utilities
DSP-93 tests
Check-out of all DSP-93 functions

BBS-SIG

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The BBS-SIG has been involved in a lively discussion of the hierarchical addressing scheme. While many of us hoped that the discussion had concluded last year, the TAPR recommendation has finally received recognition outside of the U.S. This resulted in a long discussion of EU/EURO and related items.

As an educational exercise, the discussion has been quite positive. Many of the Sysops were not familiar with the recommendation or the reasons it was created. My thanks to WORLI, AA4RE and others for their factual contributions.

For the record, let me say that the 4 letter continent codes were generated for valid technical reasons. TAPR is trying very hard to provide leadership and good operating practices for the digital modes. We stand by the recommendation.

The following are some general comments on the recommendation and the 4-letter continent designators.

Regarding TAPR

TAPR brought forward this recommendation in an attempt to bring some organization to the BBS Sysops and to bring closure to the discussion. In the absence of a formal organization with procedures for resolving such issues, TAPR was providing leadership and trying to achieve consensus.

In 1994, TAPR mailed a letter to a list of over 1800 U.S. Sysops. Among other things, the letter referred to the NOAM recommendation. The Sysop list

was compiled from packet message headers.

TAPR provides a number of free services to Sysops, such as maintaining a list of regional organizations which support digital modes and operating the BBS-SIG listserver on Internet. Both the recommendation and regional organization list can be accessed on the Internet at ftp.tapr.org or www.tapr.org.

Regarding the Discussion

The recommendation was not created in a vacuum. A heated discussion took place for over a year. It was conducted on packet, on Internet and in public meetings such as BBS-SIG meetings at Dayton. This was an ad hoc discussion, not something TAPR started.

The original discussion was primarily NO vs. NOAM and had little participation from Europe. When the recommendation was made, it included 4 letter designators for all continents. Now, Europe is becoming more aware of the recommendation and their discussion of it is quite understandable.

The most cited reference for the 4-letter continent designator is the work of Tom Clark W3IWI published in the Proceedings of the ARRL 9th Computer Networking Conference (1990). This constitutes prima facie evidence of the discussion now going on for 5 years! WORLI pointed out a reference to this discussion in 1987 at the TAPR annual meeting.

Regarding the "Standard"

Although it is widely accepted, there is NO document establishing a standard of NA, EU, etc. The argument that TAPR is not empowered to change NA to NOAM is invalid, since there is nothing to "change."

If you read the recommendation, you will see that it suggests the format x.3.4 where:

- x = a local identifier of unspecified length,
- 3 = the country code in 3 character format,
- 4 = the continent code in 4 character format.

A substantial number of details for BBS interoperability have been agreed to by the BBS authors. Sysops usually have little or no visibility of this, but benefit substantially from the "standard." In fact, this is more of a working agreement rather than a standard. While forwarding features require an agreement between a few individuals, BBS specific implementation requires cooperation between all Sysops.

The TAPR recommendation is just that, a RECOMMENDATION! It is intended to benefit the digital community. Those who chose to accept the recommendation, thank you. To those who chose not to, please attempt to evaluate the recommendation on its merits.

As Chairman of the TAPR BBS-SIG, I welcome the discussion of this and any other issue affecting Sysops, provided the comments are factual and not personal attacks.

Join Us at Dayton

It's never too early to start planning for Dayton. The BBS-SIG will meet again this year in conjunction with the HamVention. Given the international scope of the hierarchical address discussion, I would welcome all Sysops, from around the world, to join us if you plan to visit Dayton.

Be sure to visit the TAPR web site on the Internet to see the hierarchical recommendation and get updates on the latest Dayton plans.

New WinAPRS Mailing List

Mark Sproul, KB2ICI

We have created a new mailing list: winaprs@tapr.org

All discussion of WinAPRS should be moved to this mailing list, over 70 people have already signed up. From now on, only major announcements regarding WinAPRS will be made to the APRS-SIG. Also, there is a new FTP site for APRS:

<ftp://aprs.rutgers.edu/pub/hamradio/aprs/>

This is on a high-end unix machine with a LARGE number of allowed connections, it should NOT have the problems of the TAPR server. This is now the OFFICAL ftp site for MacAPRS and WinAPRS.

GPS: How does it work?

Al Chan, W6DNT
AlChan@aol.com
Al@w6dnt.ampr.org

Anyone interested in how GPS works may purchase the February 1996 issue of *Scientific American*, in which there is a 5-page article by Thomas A. Herring, associate professor at MIT.

Also, the following items may be of interest:

Measurement of Crustal Deformation Using the GPS.
(*Annual Review of Earth and Planetary Sciences*, Vol. 19.)

The Navstar GPS. Tom Logsdon, Van Nostrand Reinhold, 1992

GPS World. Monthly magazine published by Advanstar Communications, 859 Willamette Street, Eugene, OR 97401.

International GPS Service for Geodynamics site on the World Wide Web at <http://igs.cb.jpl.nasa.gov/>

The University Navstar consortium site on the World Wide Web at <http://www.unavco.ucar.edu/>

Sun Bar

Bruce Lockhart, SM0TER

[Reprinted from *Oscar News*, No. 108, published by AMSAT-UK.]

The Sun Bar is not a watering hole on a sunny tropical island as the name may suggest, but rather a simple device to accurately calibrate the position of satellite antennas in the azimuth and elevation planes. It can be used with TrakBox or similar satellite tracking devices. As many of

the popular azimuth rotators travel more than 360° when rotated end to end, a simple accurate calibration is required.

Hanspeter, HB9AQZ, wrote an excellent article in the August 1993 edition of *Oscar News* entitled "Determining True South." However, not being one for chasing shadows, I thought there must be an easier way to accurately calibrate TrakBox.

Sun Bar is simply a 5 foot rigid aluminum tube mounted parallel with the antenna to be calibrated. At one end of the tube is placed a cadmium sulfide, light sensitive resistor. The resistance of the device decreases as more light falls upon it. Two wires from the photo resistor are brought down to the shack and connected to an ohm meter. With Sun Bar pointing at the sun, the resistance is something in the order of 800 ohms with the device I used. More sophisticated methods could be developed, such as placing the photo resistor in a bridge configuration and possibly adding an operational amplifier. But for this experiment the ohmmeter was considered sufficient.

Using a tracking program such as Instant Track, the time when the sun is directly south can be determined. The antennas can be manually moved to this position and then slowly adjusted for minimum resistance. Using the TrakBox function "Monitor ADC values & Antenna position," the number of A to D converter bits for the minimum calibration value can be obtained. By rotating the antenna 360°, the maximum ADC calibration value is obtained.

The perfectionist will say it takes 50 seconds to rotate 360°. In this case I suggest you attach a plumb line to the antenna and mark the spot on the ground and then rotate exactly to this point again for the second value.

Calibration of the elevation antenna can be done in several ways. One method is to do a series of sun measurements and record the azimuth and elevation ADC values. By calculating the slope and intercept of the measured points, the calibration values can be obtained. The simplest method to do this calculation is by using a spreadsheet program or a scientific calculator.

A device that was introduced to me at the Dayton HamVention was the Smart Level. This is a level or inclinometer with an LCD display that can display to an accuracy of 0.1 degree. In addition, the device has a serial port at the 3.5 volt level. By adding a simple level converter interface, it can be connected to a PC serial port.

My elevation calibration was done with the mast leaned over at about 40°. The rotor set to zero position using the Smart Level, at this point the ADC value was recorded. The antenna was then rotated 90° and again the ADC value was recorded. The recorded ADC values are then entered into the TrakBox calibration table.

Virtual Meetings on TAPR Server

TAPR is proud to announce the creation of a virtual meeting, workshop, and seminar page on the www.tapr.org pages.

On our new pages, TAPR uses the RealAudio system to make presentations available for a few events that many Amateurs were not able to attend. TAPR is evaluating the RealAudio system, and its current implementation on the TAPR server is limited. The system only allows 6 concurrent connections, so if you find that an audio channel is busy — try back at another time.

Please let us know what you think about this — we really want to hear about your experience with these pages.

Currently, the virtual meeting pages include:

Ham Radio and More Show, August 13th, 1995

Hear the August 13th guest, Greg Jones, WD5IVD, President of TAPR discuss digital issues and what TAPR is doing.

1995 TAPR Annual Meeting, St Louis, MO.

Couldn't attend the TAPR meeting in March of 1995? Here is your opportunity to experience both of the Sunday workshops. The DSP-93 Workshop by Bob Stricklin, N5BRG, and Tom McDermott, N5EG as well as a seminar on Error Control Coding by Phil Karn, KA9Q are available. Using the Adobe Acrobat format (pdf) we have also provided the overheads; between the audio and the overheads you should be able to get a lot from the workshop you couldn't attend!

Repeater Frequency Coordinators Meeting, Oct 7th, 1995

Hear the entire meeting of the nation's repeater frequency coordinators who met with the ARRL and the FCC in St. Charles, Missouri, October 7th, 1995. Hear what was said by Rod Stafford, President of the ARRL and Ralph Haller, N4RH, Deputy Chief of the FCC's Wireless Telecommunications Bureau. Listen in on the eventual discussions, debates, and eventual outcomes. Read what Newslines published regarding the event.

Kitting Location Change

Barefoot Trading Company, in Cape Canaveral, began providing TAPR with space for its kitting operations in November. This changeover left TAPR with a severe shortage of kits — while the inventory was being packed, shipped, and prepared at the new location. Kits are now arriving at the office and backorders are being filled as quickly as possible. Our goal for this next year is to increase our inventory control effort so that the office has inventory to ship when ordered.

Mail Ballot to:

Tucson Amateur Packet Radio
8987-309 E. Tanque Verde Rd. #337
Tucson, AZ 85749-9399

Accessing TAPR via the Internet

There are several ways TAPR can be reached via the Internet.

Information Server

The Automated Information Server that TAPR provides allows anyone to request information on TAPR, products, newsletters, and lots of other files. To find out more about this service, send an e-mail message to listserv@tapr.org with the subject line "Request" and one or more of the following text lines in the body of the message:

help (for a brief set of instructions)
index -all (for a list of all files by topic area)
list (for a list of TAPR Mail Groups)
get tapr taprinfo.txt (for info on TAPR)

Internet E-Mail

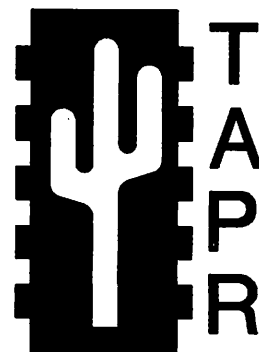
TAPR can be reached by sending mail addressed to tapr@tapr.org

World Wide Web

<http://www.tapr.org/tapr>
<http://www.tapr.org/tapr/html/pkthome.html>

FTP

The TAPR Software Library is available at 'ftp.tapr.org' in the directory /tapr/software_lib. Login in as 'anonymous', with a password of 'your_account@internet_address'.



TAPR Board of Directors Elections

The following three members have agreed to run for the three available positions on the board of directors. You may vote for these individuals and/or any write-in candidates using the ballot printed below. This is the only ballot you will receive; no ballots will be sent to members separately.

Deadline for balloting is March 31st, 1995. Those elected will serve a three year term.

The following TAPR members have been nominated for election this year to the TAPR Board of Directors.

Steven R. Bible, N7HPR

sr bible@mindport.net
n7hpr@amsat.org
n7hpr@tapr.org

I am 37 years old and I hold an advanced class license. I have been licensed since 1985. Professionally I am a Lieutenant in the U.S. Navy and I hold a Masters Degree in Computer

Science. My major interest in amateur radio has been the digital modes of communication ever since I built my first TAPR TNC-2 from a kit in 1986. Since that time I have delved ever deeper into the how's and why's of packet radio. In my college studies my interest would lean toward networking and data communications, all of which were influenced by packet radio. This is a great testament to amateur radio in fulfilling its role in creating a pool of self trained technicians and advancing the radio art.

Today my interests are in higher data rate digital communications. One area of special interest is Spread Spectrum Technology. I was first exposed to spread spectrum communications through the Petite Amateur Navy Satellite (PANSAT) project at the Naval Postgraduate School in Monterey, CA. From the PANSAT project I have gained practical experience and an appreciation for the technology. Spread spectrum has promising characteristics for amateur radio. I would like to see spread spectrum communications become a reality in amateur radio. Hopefully, a low cost solution for a spread spectrum radio for amateur experimentation is to be realized soon as the industry is quickly adopting wireless networking standards and chip manufacturers are bringing to market spread spectrum chip sets.

It is my hope that I can bring to the TAPR Board the drive and interest I have in digital communications. I would like to see TAPR stay on the forefront of digital communications and provide the support, training, and tools for amateurs to experiment. This will not only benefit amateur radio but also benefit academic institutions and industry in training skilled technicians and professionals in the art of wireless communications.

Bob Hansen, N2GDE

n2gde@tapr.org

My primary interest in Amateur radio is digital communications. Since becoming a TAPR member in 1989, I have served as the *Packet Status Register* editor and as a Board member. My educational background is electrical engineering, computer science, and business administration. Professionally, I am project leader and system designer for computer-based industrial machinery.

TAPR and its members have contributed a great deal to the packet radio community, but there is still much more that can be done. To remain effective, TAPR must also ensure that it has adequate resources to fund, and staff, its projects. I would like to continue to be involved in these efforts.

Gary Hauge, N4CHV

n4chv@tapr.org

Licensed in 1956, retired from the U.S. Air Force, and currently a Senior Research Engineer with Lockheed Missiles and Space Company at Cape Canaveral, Florida. A life member of the ARRL and AMSAT member. Active in packet radio since 1984. A sysop since 1985, and one of the original HF STA stations. A founding member of the Northern California Packet Association of which I served on the board of directors. I also documented the AA4RE BBS system.

I have supported TAPR with the documentation effort on the TrakBox, K9NG modem update, and the 9600 bps modems. I am active on the 1200 and 9600 bps satellites. I would like to contribute to the efforts set forth by TAPR, and feel that high speed, low-cost packet is the future. My interests are hardware implementation and documentation.

1996 Board of Directors Ballot	
Vote for 3 by placing X in box:	
<input type="checkbox"/>	Steven R. Bible, N7HPR
<input type="checkbox"/>	Bob Hansen, N2GDE
<input type="checkbox"/>	Gary Hauge, N4CHV
<input type="checkbox"/>	
<input type="checkbox"/>	
Your name, membership number, and signature are required for ballot to be valid.	
Name:	
Call:	
Signature:	
Member #:	

Kits Update

DSP-93 Update on Sales for Spring

Deadline for the Spring batch of DSP-93 units is February 15th, 1996. Currently about 10 units have been ordered of the 50 to be done. If you have been waiting for a TAPR/AMSAT DSP-93 — here is your chance to join the gang of happy DSP-93 owners! If you were waiting till the TNC-95 was ready to get a DSP-93, then the TNC-95 should be ready about the same time.

TNC-95

Prototyping speed was increased over the holiday break and the basic core system was brought to life. Development work continues and more will be reported in the next *PSR*. With the delays in the fall, the current goal is to try to release the TNC-95 kit with the next batch of DSP-93 units shipped in the Spring. If you would like to see a QuickTime movie of the alpha board under development, check out the TAPR web page under the Kit area. TNC-95 now has a development page showing what is happening with the unit during development.

AN-93

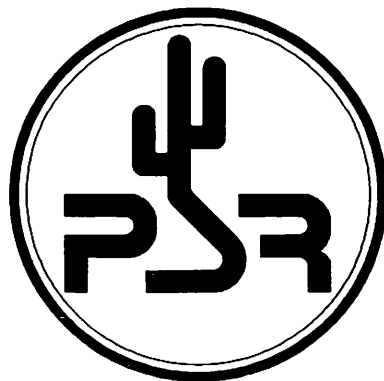
The AN-93 was very close to shipping before Christmas when a major omission was found on the board layout. Due to the error, a board is now required above one of the chips in order to correct the difficulty. The volunteer group working on this hopes to have the additional component available and tested as soon as possible so that TAPR can get this kit out the door. See previous *PSRs* for the SAGA of this kit.

DAS Update

Orders for the DAS kit have been brisk. The last issues regarding the kit are being finalized and they should be

shipping shortly. Code and application notes are being made available on the TAPR web site www.tapr.org and via [ftp.tapr.org](ftp://ftp.tapr.org) as Paul Newland, AD7I, releases them. In addition, an Internet mailing list has been created to handle DAS issues and questions. This looks like it is going to be a good kit for TAPR and should provide something a little easier than some of the more complicated DSP and radio modem kits — perfect for the beginning kit builder or experimenter and should be a good club project.

If you missed the last *PSR*, the DAS (DTMF Accessory Squelch) acts like a switch connected in series between the speaker output of your VHF or UHF transceiver and an external speaker. DAS will monitor a radio channel for you, with the speaker switch open so the speaker remains silent, until someone sends one of the DTMF sequences you have selected. When DAS hears your personal Touch-Tone ID sequence on the radio channel it will light an LED, sound a buzzer and close the series speaker switch so that you can hear the audio of the calling station. An introductory discussion of DAS was published in *QST*, December, 1995, pages 25-31. The "DAS Configuration Reference Guide," available from the TAPR FTP file server as well as the ARRL BBS, provides a more complete description of each programming option, the purpose of the option and how the various options may interact.



TAPR Publications

Wireless Data Communications: Theory and Design, by Tom McDermott, N5EG, is gaining closure. The layout is about complete, and when it is finished, it will have a last review by the author and two or three others and then it is off to the printers. We are looking at doing an initial run of 500-1000 books the first edition. Either a CD-ROM or a disk will be released with the book, including all the information that backs up the research in the book, so that readers can look at and change the information for their own knowledge, research, or modeling. No final price has been set yet. The book is going to be around 300+ pages.

John Ackermann's TCP/IP book should be heading to layout sometime during the spring. Initial comments from the reviewers were all very positive. John is including those comments into the document and adding some new information as well. This should be an excellent book added to the TAPR publications list.

No word on the 9600 baud Radio Modifications Book. The authors have not submitted their latest information, so that layout can begin. TAPR would like to have this book available before Dayton, but as with any volunteer effort, will wait for the authors to find time in their busy schedules to finish their work.

New Back Issues Volume

The TAPR office has assembled a new set of *PSR* back issues. Volume 4 of the *PSR* collection should be available in the office soon.

Kits

	Price	Qty	Total
DSP-93 w/ wall transformer (US)	\$430.00		
DSP-93 w/o wall transformer	\$420.00		
DAS (DTMF Accessory Squelch)	\$68.00		
AN-93 HF Modem	\$90.00		
TAPR 9600 bps Modem	\$80.00		
Bit Regenerator	\$10.00		
Clock Option	\$5.00		
PK-232 Modem Disconnect	\$20.00		
PK232MBX Installation Kit	\$20.00		
XR2211 DCD Mod.	\$20.00		
State Machine DCD Mod.	\$20.00		
State Machine DCD w/Int Clock	\$25.00		
METCON-1 Telemetry/Control			
Voltage-to-Frequency module	\$30.00		
Temperature-to-Freq module	\$40.00		
A-D Converter	\$45.00		
Elapsed Time Pulser	\$35.00		

Firmware

32K RAM w/ TNC2 update docs	\$20.00		
TNC-2 1.1.9 w/KISS EPROM	\$15.00		
1.1.9 Commands Booklet (only)	\$8.00		
TNC-2 WA8DED EPROM	\$12.00		
TNC-1 WA8DED EPROM	\$12.00		
TNC-2 KISS EPROM	\$12.00		
TNC-1 KISS EPROM	\$12.00		
PK-87 WA8DED EPROM	\$12.00		

Publications

Packet Radio: What? Why? How?	\$12.00		
BBS Sysop Guide	\$9.00		
TAPR's 94 Annual Proceedings	\$7.00		
TAPR's 95 Annual Proceedings	\$7.00		
PSR Set Vol 1 (#1 - #17 '82 - '85)	\$20.00		
PSR Set Vol 2 (#18 - #36 '86 - '89)	\$20.00		
PSR Set Vol 3 (#37 - #52 '90 - '93)	\$20.00		
NOSIntro, Intro to KA9Q NOS	\$23.00		
ARRL CNC Proceedings 1st - 14th	call		
Entire Set ARRL CNC 1st - 12th	\$90.00		

Other

TAPR Badge	\$10.00		
3 1/2" Disk from TAPR Library	\$3.00		

Kit Code

Information

16 check with office on ship date, no discount
 16 for international orders only, no discount
 3 limited kits available. As seen in Dec 95 QST
 3 limited kits available.
 6
 1 used for regenerative repeater operation
 1 used for regenerative repeater operation
 2 simplifies connection of external modems
 2 for installation of 9600 modem in PK-232MBX
 2
 2
 2 For KPC2 or other TNC w/o 16X or 32X int dock
 Metcon-1 kits no longer available.
 3 Plenty of the Option Kits!

Subtotal:

Added Total Kit Codes

All prices subject to change without notice and are payable in U.S. funds. Members receive 10% off on Kits and Publications. Please allow six to eight weeks for your order to be shipped. For specific information on kits, see Product Description flyer.



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Non-Profit Research and Development Corporation

January 1996

www.tapr.org • ftp.tapr.org • tapr@tapr.org
 Office Hours: Tue-Fri 9am-12pm, 3pm-5pm CT

Membership	Price	Number of Years	Total
United States	\$15.00		
Canada/Mexico	\$18.00		
International	\$25.00		

Renewal New Member

SubTotal

Membership 10% Discount

Except were noted

Member #: _____ (Place new if joining)

Total Sales (Subtotal minus discount)

Texas Residents (7.75% tax)

Membership (New or Renewal)

Shipping and Handling

For Total Kit Codes Between

1 - 3	4 - 7	8 - 15	16 - 27	28 - 55
Add \$3	Add \$4	Add \$5	Add \$6	Add \$7

Kit Codes above 55 or International orders must contact TAPR for amount.

TOTAL Order Amount

Charge my credit card (check one):

VISA MasterCard



Acct. # _____

Expiration Date: _____



Signature on card: _____

Name: _____

Company Name: _____

Street Address: _____

City/State/Zip: _____

Country: _____ Phone Number: _____