PACKET STATUS REGISTER

TAPR

Tucson Amateur Packet Radio Corporation
A Non-Profit Research and Development Corporation

President's Corner

The organization has been very busy since the last PSR was published. Let me try to hit on some of these things and then spend some more time talking about an Amateur mode I think we should all be very interested in as digital operators.

Please find in the center of the *PSR* a Membership Questionnaire. Some members have received this questionnaire with their renewal notices. If you have not already received the questionnaire, please take a moment to review it, fill it out, and send the questionnaire back to the office. You can mail it back, fax it back, or better yet, check out http://www.tapr.org/question to do your questionnaire via the questionnaire Web page. You'll have to enter it directly. The questionnaire asks several questions from one done several years ago, so that we can track answers to see how the membership has changed. We look forward to seeing your responses.

The 1995, 14th annual ARRL Digital Communications Conference, held in Arlington, Texas, and co-hosted by TAPR and the Texas Packet Radio Society went very well. I think everyone there was happy with the final outcome. Attendance, while good, can only be something to be improved upon in the future. There is no reason why the DCC shouldn't attract 200-300+ participants. There will be a full writeup on the conference further

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Look for TAPR at these Upcoming Events

May 17-19, 1996   Dayton HamVention

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President's Corner, continued...

in the *PSR*, so I will not spend much time on the subject here. As with any national gathering, the technical discussions and sharing of energy on projects were the big winners. These types of events only serve to fuel everyone for another period until the next gathering. I look forward to seeing everyone next year.

The big news regarding the Digital Communications Conference for the next three years is the recent joint conference agreement signed between TAPR and the ARRL. As of September, 1995, the TAPR annual meeting and the ARRL Digital Communications Conference will be merged into one annual meeting. 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. TAPR has been working on this proposal for over a year now and we are all very happy that the conclusion was positive. 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. Anyway, there is a lot more to all this and you should read further in the *PSR* about the full details and what to expect next.

TAPR attended the ARRL SW Division conference held upon the Queen Mary in Long Beach, California. The conference was very nice and we got to meet many TAPR members who came by to say hello. This part of the US holds a large percentage of TAPR members (at least 25%), and we plan to continue attending for the foreseeable future. Many of the ARRL leadership were present and we got an opportunity to talk briefly to many of them. In addition, there were several in-depth discussions with smaller technical groups regarding the upcoming spread spectrum issues and technical projects that might result. It was a most enjoyable event. Next year's convention will be in Mesa, AZ.

TAPR will be present in force as usual during the AMSAT conference the first of October. There are strong ties between the two organizations and we are happy to see that P3D and RUDAK-U are beginning to come together and gain closure as the launch date approaches. Listed later in the *PSR* is the list of continued donations towards the RUDAK-U project since we printed the list last Spring. I would like to thank everyone who has donated. If you haven't made a donation towards the project, we are still accepting.

On the same weekend as the AMSAT meeting in Orlando, the first ever Repeater Coordinator's Meeting is being held in St. Louis, MO. From the agenda, the results could be significant. ARRL President Rod Stafford, KB6ZV, and Ralph A. Haller, Deputy Chief, Wireless

Telecommunications Bureau, of the Federal Communications Commission are both attending. This level of involvement from the ARRL and FCC only adds importance to any possible outcome. Some of the items being discussed include: 1) Response to FCC's request that it be provided a single point of contact with the coordination community, through which the FCC would recognize and support local and regional coordinators, 2) Determination of whether coordinators would support repeater licensing, subject to the applicant's acceptance of coordination recommendations and with provisions for trial or temporary operation, 3) Procedures for bringing coordination issues that cannot otherwise be resolved to the FCC for action; rules changes required to improve coordination process, 4) How to develop standards for service by coordinators, dispute resolution, how appeals of local coordinators' decisions should be handled and orderly succession of coordinators/coordination bodies, and 5) The extent to which coordinators should coordinate emitters other than repeaters, whether coordinators should attempt to resolve interference between repeaters and other kinds of Amateur stations and how the introduction of new technologies should be recognized and encouraged by the coordination community. While digital issues will not be high on the agenda, as a group, we had better watch closely what happens at this event. Item five could present an interesting outcome for the digital community, depending on how people feel. Luckily, we will have at least one TAPR Board Member and several other TAPR members present to help bring the word back to the digital community regarding the event. We hope to at least be able to come away from the meeting with a list of digital representatives, so that discussion within the digital community can continue after the meeting.

We are still working on getting to 3,000 members by the end of the year. As of right now, it looks like we might be short of that number. We will continue to work the membership area and hope TAPR members are helping to spread the word and recruit new members. The long term membership goal within TAPR is to reach 5,000 members. Why 5,000, you might ask? Financially, 5,000 members can support the next step in the organization, that of again opening a real office. Without a steady stream of money from membership, we will continue to have to rely on volunteers manning the office. Dorothy, at the office, easily puts in 40 hours a week. TAPR has been extremely fortunate to have Heather, and now Dorothy, to handle the office. Can TAPR find someone else as dedicated to run the TAPR office after these two? I am not so sure. The importance of growing to support a real office is something that TAPR needs to do in order to provide stability in the long term. Anyway — keep spreading the word!

Now for a note on the future — and that note is Amateur Spread Spectrum. This issue of the *PSR* will have two articles concerning Amateur Spread Spectrum. One article is by Steve Bible, N7HPR, recently graduated from the Naval Post Graduate School (Congratulations, Steve!), regarding Spread Spectrum issues. This is a reprint from QEX and I would like thank Jon Bloom, KE3Z, editor of QEX for allowing TAPR to reprint this article. The second article is from Dewayne Hendricks, WA8DZP, chairman of the TAPR Regulatory Committee. The Regulatory Committee has been working on issues regarding Spread Spectrum for several months now and TAPR will be shortly (if not already by this printing) submitting a NPRM (Notice of Proposed Rule Making) in conjunction with the ARRL to the FCC regarding rule changes for Amateur spread spectrum operations.

Why the sudden interest in Spread Spectrum you might ask? Actually, Amateur spread spectrum falls into a line of logic that TAPR has been chasing for three or four years now. In 1992, the board of directors stated that a primary long-term goal should be the development of higher-speed access for users. At the last two annual meetings we had late night skull sessions discussing how to get users to higher speeds using conventional narrow band systems. When all discussions were done — two things were obvious with traditional thinking and technology. First, that those with technical ability had been doing faster speeds since the early 80s and second, that typical Amateur operators were not willing to pay above $500 to gain marginal increases in speed. At the 1995 annual meeting in St. Louis, MO, it was becoming obvious that the Amateur community had to take advantage of the research and development money being spent on new wireless technologies. When you combine the newer RF devices being manufactured for part 15 devices and PCS applications, along with the continuing increases in computing power — a simple answer appears: "We must exploit Amateur spread spectrum technology in order to break out of the 1200 baud user mold!"

We have been getting input from the various developers for some time about all this, but we have held off until we had a track set for TAPR. I now see Amateur spread spectrum as something the organization needs to grab hold of and become a moving force within the Amateur community. Amateur spread spectrum, to me, has a lot of the same characteristics that packet had for us in the early 80s. It could bring the pizazz missing for many of us in regards to digital operations back into the picture.

This is something long-term TAPR will continue to work towards. TAPR can only try to act as a focal point. If a project happens — it happens. If a group of Amateurs want to work with TAPR on developing new technology,

then it comes together. TAPR can drive some issues, but when it comes to technical advancements, the most successful TAPR projects have been those that have come to TAPR to be done. One project we are actively gaining closure on currently is that of providing the user radios for PANSAT, which is a DSS satellite. We have been having meetings with the Naval Post-Graduate School for some months now and I hope in a future *PSR* we can outline the results of what the PANSAT user radio within a TAPR project will look like.

If you want to keep up with the Amateur spread spectrum issues, take a look at http://www.tapr.org/ss. TAPR is now maintaining the Amateur spread spectrum page and with the help of Dewayne and Steve, we should have all the latest info on this web page.
Until next quarter.
Cheers - Greg, WD5IVD

TAPR Projects

TNC-95

The TNC-95 alpha boards arrived just before the DCC. One board has been built and is under test. The other alpha boards will be built up shortly. The beta-test group has been selected and we hope to have beta-testing going as quickly as possible.

TAPR CD-ROM

The TAPR board discussed at its board meeting in Arlington the possibility of doing a CD-ROM. Plans are moving forward in this area. If you have some thoughts on what should be on a TAPR CD-ROM, drop a note to the TAPR office.

TAPR/AMSAT DSP-93

Of the 180 units done this summer, less than 10 remain to be sold. This will make 300 DSP-93s sold. The code development continues and looks great. We are looking at doing another 100+ units this spring and the office will take orders for this shipment.

TUC-52

The alpha boards have been run and should be under test as of this printing. The three personality boards (PCON, TrackBox, and METCON-II) are under design and will be started after the alpha-testing of the main system. For full details see *PSR* #53, although some of the basic design has changed. During the initial stages of the PCON (Packet Printer Controller) project, the group decided to develop the processor board as a separate board from the interface board. This would allow the processor board to be used in other TAPR projects in the future. We have informally dubbed this system the "TAPR Universal Controller 52" or TUC-52. METCON-II will be an expanded version of the (now sold out) popular METCON-I, which is used for remote control and telemetry. A small development group has been formed to look at the possibility of porting the (no longer available) very popular TrakBox code onto the TUC-52. PCON, continues to be in its most basic form, a printer controller that serves to convert serial asynchronous ASCII data to a format suitable for driving a common personal computer parallel printer (or a low-speed ASCII/BAUDOT serial asynchronous teleprinter).

AN-93

What can we say? We continue to work the last aspects of this project. This project has seen more strange turns and twists than any TAPR project. This must be because we introduced it when the project was started. Not to be repeated. The last of the active parts are expected to arrive — they were on allocation. Brian Straup, NQ9Q, who was testing and writing the documentation, has now been sent off to Asia on business for a month. We promise to get this project completed and out the door as soon as possible. On the good side, the boards look really good and the testing showed good results. Just have to finish the last 2% of this project.

Digital Rules Clarified by FCC

The FCC, responding to a request from the ARRL, has clarified its rules regarding Amateur Radio stations' use of digital codes.

The ARRL, in a letter to the Commission, said that some Amateurs had expressed concern about the propriety of using the CLOVER, G-TOR, and PacTOR codes on the HF bands (below 30 MHz), because FCC rule 97.309(a) "appears to authorize" only Baudot, AMTOR, and ASCII codes. The League told the Commission that it had worked with the developers of CLOVER, G-TOR, and PacTOR to document the technical characteristics of those codes, and asked the FCC to remove any doubt about their legality on the HF bands.

The FCC agreed, saying that the use of the three modes does not conflict with its objective of preventing the use of codes or ciphers intended to obscure the meaning of the communication.

As a result, the FCC added a paragraph (4) to Part 97.309(a) to read:

(4) An amateur station transmitting a RTTY or data emission using a digital code specified in this paragraph may use any technique whose technical characteristics have been documented publicly, such as CLOVER, G-TOR, or PacTOR, for the purpose of facilitating communications.

Nominations Sought for TAPR Board of Directors

Tucson Amateur Packet Radio is incorporated in the State of Arizona as a non-profit scientific and educational institution. It is recognized by the IRS as a 501(c)3 tax-exempt organization for these same purposes. TAPR is governed by a 9-member Board of Directors. Each member of the Board serves a three year term. Every year three positions are up for election.

Board members are expected to attend two board meetings held in conjunction with the Dayton HamVention and the ARRL and TAPR Digital Communications Conference. They participate in the decision-making process and provide guidance to the officers. They receive no pay and must defray their own expenses to attend meetings. Board members should be prepared to be active in the continuing Board deliberations, which are conducted via the Internet. Active participation in TAPR activities by Board members is important to the furtherance of the objectives of TAPR. The officers of TAPR are elected by the members of the Board at the annual Board of Directors meeting.

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

*Keith Justice, KF7TP	1996	
*Gary Hauge, N4CHV	1996	Secretary
*Bob Hansen, N2GDE	1996	PSR Editor
Greg Jones, WD5IVD	1997	President
John Koster, W9DDD	1997	
Mel Whitten, K0PFX	1997	
John Ackermann, AG9V	1998	Vice President
Jim Neely, WA5LHS	1998	Treasurer
Barry McLarnon, VE3JF	1998	

Nominations are now open for seats expiring in March 1996 (marked with an asterisk).

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

Nominations and biographical sketches should be submitted to the TAPR office no later than December 15th, 1995.

Ballots will be mailed the first of January directly to the membership and be due on or before March 1st, 1996. Results will be announced on March 15th, 1996.

Responsibilities of a board member include:

1) Attendance at both board meetings each year.

2) Regular participation with the continuous session of the board (currently held over the Internet). Typically this requires a minimum of 3 hours a week, although sometimes much more is required during active board discussions.

3) Participation with TAPR projects as volunteered. Board members, while not required, are involved with various project management, ongoing organization and/or supervision/liasion positions. Active board participation with various projects make many of the most important projects and tasks possible. Board members are expected to take an active part in TAPR in some form.

All nominated members will be placed on the ballot and the highest vote receivers will be placed in the open board positions. Two board meetings will be held in 1996; one will be during the Dayton HamVention and the other during the ARRL and TAPR Digital Communications Conference. All directors shall serve for a term of three years.

RUDAK-U Donations

Thanks to the following individuals and groups for donating to the RUDAK-U fundraiser since the Spring 1995 issues of the *PSR*. RUDAK-U donations to date total $4500. We are still $1500 short of obtaining the $6000 goal. TAPR would like to especially thank Friends of Wireless for their $500 donation.

Certificate Level:

Tod West - KB9AIL
Patrick Moore - KI7FW
Charles Greene - W1CG

Significant Certificate Level:

David Kent - KE4JTF
Wilmington, NC VHF Association
John Bandy - W0UT
Robert Westby - N8XCX

Plaque Level of Donation:

Friends of Wireless (James Fordes, Secretary)

1995 ARRL Digital Communications Conference

Johan Forrer

The DCC this year was buzzing with activities. Two outstanding workshops, excellent papers, and interesting talks on Amateur radio networking infrastructure developments, future satellites, and other digital issues made it a busy time. In addition, meeting old friends and the opportunity to make new ones is always enjoyable. Not to mention the informal discussions over a beer late at night, listening to exciting things taking place. Unfortunately, a significant proportion of happenings never make it into the proceedings, so it made the extra effort to be there all that much more worthwhile, as the 130 people who attended the conference can attest.

If you missed it, then you should plan on attending the 1996 ARRL & TAPR Digital Communications Conference meeting, tentatively scheduled for September, 1996, in the Western U.S.

The conference began on Friday afternoon with the APRS workshop, led by Keith Sproul, WU2Z. Keith is the Chair of the TAPR APRS Special Interest Group, developer of the Macintosh version of APRS, and a leader in the area of APRS technology. The workshop hit a lot of different areas and many who attended had good comments regarding the content. Keith's high level of enthusiasm is a plus and helped the presentation.

Saturday morning's session consisted of two parallel tracks. The main track presented the more technical papers, while the other track focused on introductory topics. It was hard to decide which one to participate in. In my case, I was involved in presenting material as well, so keep in mind that I can only relate what I could fit in these busy few hours.

The organizers had an excellent idea to make room for a series of introductory presentations: digital communications in general, HF digital, digital satellite communications, and packet networking. Besides giving beginners an opportunity to pick up a wealth of ideas, this also gave local Amateurs an opportunity to hear what digital communications were about. The introductory sessions were an experiment and proved very successful. Something that will have to be tried again in the future. The room was full at all times.

The main track had these presentations:
- AX.25 Transport Layer Drivers for TCP/IP, Tim Hayes, N2KBG
- NETMGR: A Graphical Configurator for ROSE X.25 Networks, Donald Rotolo, N2IRZ

14th Annual ARRL DCC Proceedings Abstracts

Not everyone that had papers in the proceedings were able to attend the conference. Here is the list of papers that were published in this year's DCC. The complete abstracts can be found on the TAPR web pages. The proceedings are available from the ARRL for $12. TAPR now offers past proceedings covering the 1st through 12th conferences. Check with the TAPR office for more details. All past ARRL CNC and DCC abstracts are available on-line and can be searched via the TAPR Web Page. http://www.tapr.org.

Availability of Seventy 9600 baud Packet Channels on Two Meters
by Bob Bruninga, WB4APR

Introduction: Unbelievable? Not Really! With the advent of the latest 9600 baud packet radio modems, there is an unexploited mechanism for opening up dozens of half duplex data channels without ANY impact on existing voice and data band plans. Read this proposal thoroughly before jumping to any conclusions.

The WA4DSY 56 KILOBAUD RF Modem: A Major Redesign
by Dale Heatherington, WA4DSY

Abstract: In 1987 I designed a 56 kilobaud RF modem which was sold in kit form by GRAPES, the Georgia Radio Amateur Packet Enthusiast Society. This paper describes how the WA4DSY 56 kilobaud RF modem was radically redesigned to lower cost, reduce size, and improved reliability, manufacturability and usability. The reader is referred to the ARRL publication Proceedings of the 6th Computer Network Conference, page 68 for details on the original design.

Extended Sequence Number (modulo-128) option for AX.25
by Rob Janssen, PE1CHL

Abstract: An extension to the AX.25 protocol is proposed, to enhance the efficiency of transmissions of large numbers of small packets on half-duplex interlinks. The sequence number space is increased from 8 to 128 to accommodate larger values of MAXFRAME, and procedures are described to enable monitoring of extended sequence number frames, and resequencing in case of frame loss.

DSP-93 Update: The TAPR/AMSAT Joint DSP Project
by Greg Jones, WD5IVD, Bob Stricklin, N5BRG, Robert Diersing, N5AHD

Abstract: This paper discusses the geniuses of the TAPR/AMSAT Joint DSP project. The end result was the TAPR/AMSAT DSP-93. As of July 1995, 300 units have been made available to Amateurs for construction. Items to be covered include: a history of the project, history of the DSP-93, DSP-93 design, current software suite, code development, and comments on the successful use of Internet for project support.

Introduction to Programming the TAPR/AMSAT DSP-93

by Ron Parsons, W5RKN, Don Haselwood, K4JPJ, Bob Stricklin, N5BRG

Abstract: The purpose of this paper is to give a brief overview to assist potential programmers, new to the TAPR/AMSAT DSP-93 environment, insight into the tools and techniques available when developing for the DSP-93. The full developers/programming guide is available from TAPR.

- TAPR/AMSAT DSP-93, Frank Perkins, WB5IPM
- Convolutional Decoders for Amateur Packet Radio, Phil Karn, KA9Q
- Modeling Some Data Communications Functions Using Excel, Tom McDermott, N5EG
- Data Radio Standard Test Methods, Donald Rotolo, N2IRZ

After presenting my introductory talk on HF digital, I slipped out to hear the end of Frank Perkins' presentation on software development issues for the DSP-93. I don't know how many people really appreciate how successful the DSP-93 modems are — this is due to the outstanding efforts of the DSP-93 software developers such as Frank. One very useful tip that I picked up from Frank's talk was the problem that the "ABS" function introduces when used in detectors. The "SQUARED" function is what one really needs, this is because the absolute value of a band-limited signal turns out to be not band-limited and subsequently cannot be lowpass filtered. In addition, Frank had a video tape with sound that made for a great presentation.

Tom McDermott's talk on using Excel for evaluating DSP solutions was next. It was obvious that Tom has uncovered a powerful tool for serious DSP work. Using built-in Excel functions besides several routines that he developed himself, the point-and-click, drag-and-drop metaphors makes quick work of analyzing sampled signals. When Tom's book becomes available, we will have further opportunities to try these ourselves. Looks like a reasonably inexpensive alternative to other programs.

The morning session broke for lunch and then gathered together for the single track afternoon session. Presentations during this session included:
- An Introduction to FlexNet, Gunther Jost, DK7WJ
- The Tulsa NWS TexNet Interface Project, Bob Morgan, WB5AOH
- Graphical Information Systems and Ham Radio, Keith Sproul, WU2Z

After the afternoon session, the conference split into three breakout sessions. The three sessions covered:
- HF SIG / HF Digital Issues, Conducted by Johan Forrer, KC7WW,
- APRS Topics and Issues, Conducted by Keith Sproul, WU2Z, and
- RUDAK-U/P3D Topics and Issues, Conducted by BDale Garbee, N3EUA.

Each was very well attended. However, any time you have multiple simultaneous sessions, you always have some level of interest conflict.

An Introduction to FlexNet
by Gunther Jost, DK7WJ, Donald Rotolo, N2IRZ

Introduction: Features and operation of FlexNet packet networking software are discussed. Details of the software architecture, RMNC and MS-DOS hardware platforms, applications, user interface, adaptive parameters, and routing techniques are presented.

Convolutional Decoders for Amateur Packet Radio
by Phil Karn, KA9Q

Abstract: This paper describers two freely available convolutional decoders written in the C language. One implements the Fano algorithm for sequentially decoding three rate 1/2 K=32 codes while the other implements the Viterbi algorithm for maximum likelihood decoding of the rate 1/2 K-7 NASA standard code. Both support 8-bit soft-decision decoding with arbitrary metric tables and perform according to theory. Using GCC 2.6.3 under BSDI/OS 2.0 on an AMD 486DX4-100 CPU, the Fano decoder runs up to 375 kb/s while the Viterbi decoder runs at a constant speed of 75.1 kb/s. On a 90 MHz Intel Pentium, the speeds are 594kb/s (Fano) and 118 kb/s (Viterbi). This is fast enough to be useful in many Amateur packet radio applications. The code is available over the Internet.

Data Radio Standard Test Methods
by Burton Lang, VE2BMQ, Donald Rotolo, N2IRZ

Abstract: The Data Radio Standard Test Methods document is introduced and explained. The document consists of a number of standardized test methods, written in a clear, step-by-step format. Each test method is designed to be easy to perform, including the proposed DRSTM database of measurement data.

Modeling some Data Communications Functions using Microsoft Excel 5.0
by Thomas C. McDermott, N5EG

Abstract: Recent enhancements to the Microsoft Excel spreadsheet program, version 5.0, provide some interesting features that may be of interest to those designing or analyzing data modems. This paper looks at the following examples: 1) bit error rate of a modem vs Eb/No in additive white gaussian noise (AWGN), 2) phase-locked loop response vs. loop filter parameters, and 3) modem eye patterns vs. channel response, and shows how each can be modeled with Excel 5.0.

Building a Packet Network
by Karl Medcalf, WK5M

Abstract: Since the beginning of Amateur packet radio, users have tried to push the limits. This has taken many forms: how far can I get, how much data can I pass, how fast can I go. In 1987, Software 2000, Inc. developed the NET/ROM code, which replaced the EPROM in TAPR clone TNCs, in an attempt to improve the packet situation. This code provided the first attempt to build a network using Amateur packet radio. Much of the current network software throughout the world is based on this code, and new implementations continue to arrive on the scene. This paper will present various viewpoints on network construction, and does not intend to imply that any one concept is superior to any other. It is intended to provide node operators (current and future) with ideas for consideration to help improve the existing system.

DAMA - Another Network Solution
by Karl Medcalf, WK5M

Abstract: This paper will discuss some of the drawbacks to the most widely used networking system (NET/ROM and its derivatives), and one idea to help alleviate some of the problems. It will explain, in some detail, the DAMA (Demand Assigned Multiple

The "HF issues" session and Phase3D talk unfortunately ran parallel — I missed a couple of good presenters, and I would have loved hearing Bdale Garbee's talk. Anyway, we had excellent participation on important HF digital issues. I gave brief overviews on the status of the HF channel simulator, Adrian's MFSK, and Pawel's OFDM modems. The HF ionospheric simulator work appears to be of some interest and a few moments was spent on that. Paul Rinaldo, W4RI, brought up an interesting idea — how to evaluate adjacent channel interference. The Watterson model, for example, only deals with the variations due to the ionosphere. It would be interesting to have some means for evaluating different situations due to other nearby digital transmissions.

Phil Karn's progress on Pentium-powered DSP was noteworthy and stirred interest — that would be an interesting one to watch in the future. This was followed by a lively discussion on FCC regulations and the future of using our proposed multi-tone HF modems. It appears that it would be possible to obtain either STA or experimental licenses to experiment. Paul kindly offered to help look into this.

What helped promote our ideas a bit, was the live demo that we put on afterwards. Walt, K5YFW, brought his computer to give folks the opportunity to see Pawel's 15-carrier modem in operation. Some mentioned that the audio has a striking likeness to 300 baud HF packet. Many would be fooled into thinking that it was indeed packet — this is because it does not sound like a wideband signal at all. I suspect that a demo such as this may win many over. We also played with the DSP sound card and played with Adrian's, G4ZHZ, signal processing software. I think he did a very nice job to package several really nice functions, i.e., several CW filters and others for SSB, RTTY, and FAX. This also includes a Hilbert transform with which one could slide the output audio pitch to wherever audiuo frequency you wanted, kind of like a digital BFO. I played some audio from a cassette tape and the ability to shift audio in this manner without clicks, pops or other artifacts, is really amazing — all made possible by DSP.

There was not very much equipment on display except for PacComm that showed a diverse range of Amateur digital equipment. I did however, take a bit of time to look over the new Pactor II hardware — the hardware is very well made, and the technology very advanced. If you are interested in reading a bit more about the technical aspects of this hardware and about some of the software tricks that make up Pactor II, be

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Access) protocol as proposed and implemented in some areas of the world.

The Tulsa National Weather Service TexNet Interface Project
by Bob Morgan, WB5AOH, Greg Jones, WD5IVD

Abstract: This paper details information concerning the interface to the NWS system in Tulsa by the TexNet network and how it can be replicated by other networking systems at other NWS sites. Several functions are provided from the TULSWX node including: automated severe weather alert broadcasts, emergency service broadcasts, color weather radar images using the NexRad Doppler (the WSR-88D), and the dissemination of messages directly to various EOCs and spotting groups.

An Update on TexNet and the Texas Packet Radio Society
by Bob Morgan, WB5AOH, Greg Jones, WD5IVD

Abstract: This article shows the current status and updates the progress and accomplishments, since the last published article in 1990, of the Texas Packet Radio Society, TexNet network, and other projects. The topics for this update codes the growth of the organization, the expansion of the network, the reliability aspects of the network, the latest firmware, and continuing projects.

DSP-93 Programming Hints
by Frank H. Perkins, Jr., WB5IPM

Introduction: The TAPR/AMSAT DSP-93 is surprising user-friendly to program, considering it has a 40 MHz Harvard-architecture DSP processor under the hood. Applications can be successfully developed with only a PC and an oscilloscope. So far, more than a half dozen radio Amateurs have developed and published applications for the DSP-93, including N5EG's windows-based oscilloscope and spectrum analyzer for the DSP-93, W3HCF's super-hot HF modem, a collection of satellite and terrestrial modems by this author, plus Mac versions of the spectrum analyzer and oscilloscope displays by W5RKN. In this paper, I offer you several hints on programming the DSP-93 that will hopefully get you around a couple of rough spots I have encountered. These hints are intended for someone with a working knowledge of assembly language programming, the 320C25 instruction set and the Programming Guide for the DSP-93.

NETMGR: A Graphical Configuration for ROSE X.25 Packet Switch Networks
by William Slack, NX2P, Donald Rotolo, N2IRZ

Abstract: NETMGR is a windows-based graphical configuration utility for ROSE X.25 Packet Switch networks. This paper describes the features and usage of the software in detail.

Graphical Information Systems and Ham Radio (The future of APRS technologies)
by Keith Sproul, WU2Z

Abstract: GIS is a major buzz-word in the scientific and computer graphics communities. GIS, or Graphical Information Systems (also sometimes called Geographical Information Systems) is the display of significant amounts of data on a graphical system, usually a map of some kind. This paper discusses various Amateur GIS and the future of Amateur GIS.

AX.25 Transport Layer Drivers for TCP/IP
by Mark Sproul, KB2ICI, Tim Hayes, N2KBG

Abstract: Current TCP/IP over packet radio is largely implemented with KA9Q's NOS and its many variations on PCs and NetMac on Macintoshes. NOS was written before good general purpose networking software was available and was written as an monolithic do-everything program. Today's multitasking operating systems have built-in networking support and there exists a large base of good server and client software for all platforms (Macs and Windows) that use this networking ability. Because of

sure to ask the folks at PacComm for a data sheet — it's very well written.

I left the best for last — Phil Karn's Saturday evening dinner presentation. In essence, the theme was what the future holds for Amateur radio, not only the digital modes, but how to best utilize our portion of the RF spectrum. A large portion of the presentation was devoted to a walkthrough of Phil's web pages on coding. This is a remarkably well done, common-sense audio/visual overview of the mathematical magic of some important issues regarding future digital transmission of data and voice: bandwidth, power, information theory, and most important, the mindset of the average Amateur. Phil did an outstanding job entertaining us with his vision, and all this with his usual good humor.

The only low point at the banquet was the prize drawings. Something to be worked on in the future. Several of the prizes did not show up as planned and copies of Windows 95 were given away instead. This drew mixed emotions from several in the dinner group. All said and done, the good food and terrific presentation made up for any shortcoming at the end.

The ARRL Future Systems Committee and the ARRL spread spectrum ad-hoc committee met for a brief time after the banquet.

On Sunday, Dewayne Hendricks, WD8DZP, conducted a workshop focusing on wireless communication devices and their application and use in the Amateur Radio Service. Dewayne is an expert in the area of commercial wireless systems; his company WarpSpeed Imagineering, focuses on wireless Internet. This workshop presented a great opportunity for those present to learn a lot about the Personal Communications Technology (handheld and small business wireless systems). After the presentation, it was agreed that Dewayne should present a followup workshop next year at the DCC.

Although I had a lot to do on my way home (like working on a business plan), I could not help but think about the impressions that the conference left: the contrast between wide band vs. narrow band. I have no doubt in my mind about the technological advantages that wide band offers, but what makes me most excited is to think of all the opportunities that lie ahead in digital RF technology and DSP. Wouldn't you agree that this is something to look forward to?

I would like to thanks all the folks that made the conference a success: the ARRL and the hosts TPRS and TAPR. Well done and much thanks. Also to the software developers that helped make the demo: Pawel, and the Finn's, Adrian and Walt for bringing his computer equipment. Well done.

these things, a large, monolithic program is no longer needed and is actually a severe handicap. By implementing a transport layer AX.25 driver for use with system's native TCP/IP protocol stack, the existing programs that utilize TP/IP for Internet activities can be used for Amateur packet radio activities. These include many excellent free and shareware programs for both Macs and Windows machines.

The Puget Sound Amateur Radio TCP/IP Network
by Steve Stroh, N8GNJ

Abstract: The Puget Sound Amateur Radio TCP/IP Network (also know as WETNET, the Washington Experimenter's Tcp/ip NETwork), centered in the Seattle, Washington metropolitan area, has built an extremely functional packet radio network based on TCP/IP networking and cellular RF techniques. The network encompasses more than eighteen separate Local Area Networks, an estimated 200 users, four 9600 baud bit regenerative repeaters, and a full time Internet gateway. This paper is intended to provide an overview of an operational Amateur Radio TCP/IP network.

6PACK - a 'real time' PC to TNC protocol
by Matthias Welwarsky, DG2FEF, Tom Sailer, HB9JNX

Abstract: During the development of the PC/FlexNet software package, there was a strong desire to use the existing hardware, especially the very widespread TNC2, which populates almost every packet radio station nowadays. Sysops of the TheNetNode digipeaters also showed much interest, since many TNN nodes use TNC2 devices connected using a KISS token ring. 6PACK provides: data transparency, predictable capacity requirements on the ring, data and realtime information is distinguished, fast response to changing channel usage is provided, automatic ring setup replaces a channel number, and data is protected by a checksum.

Skimming the Layers
by Ken Wickwire, KB1JY

Abstract: Many parents have recently announced the rebirth of HF radio through the midwifery of digital signal processing. Newer and older hams have discovered or rediscovered the ionosphere as the place where PacTOR, GTOR, CLOVER and APRS hang out. Other Amateurs connected with commercial or government HF are excited about the increasing use of automatic link establishment (ALE), and of data modems with serial- and multi-tone waveforms, forward and reverse (ARQ) error correction, and equalizers. Government HF standards committees are well into the development of sophisticated software for adaptive communications at the Data Link and Network layers of HF data-transmission systems. The purpose of this paper is to describe what it means to "measure HF digital performance" on the air, and to give an overview of what's needed (and available) for making such measurements. It will turn out that in most cases the hardware needed to assess over-the-air performance comes with the system to be assessed: if you have the system (usually a computer, a radio modem and an HF transceiver with an antenna), you have all the hardware you need. A surprising amount of freeware or shareware is also available. This paper surveys some of that software.

Recommendation for Hierarchical Address Protocol
by Dave Wolf, WO5H, Roy Engehausen, AA4RE, Hank Oredson, WORIL, Greg Jones, WD5IVD

Introduction: The TAPR BBS Special Interest Group recommends the adoption of the x.3.4 hierarchical address protocol. This paper outlines that recommendation. The full proposal is available via Internet.

Spread Spectrum — It's Not Just For Breakfast Anymore!

Steven R. Bible, N7HPR
Harold E. Price, NK6K

[The following article is reprinted from NK6K's Digital Communications column which appeared in the June 1995 issue of QEX, published by the ARRL.]

Don't blame me, the title is the work of this month's guest columnist, Steve Bible, N7HPR (n7hpr@tapr.org). While cruising the net recently, I noticed a sudden bump in the number of times Spread Spectrum (SS) techniques were mentioned in the Amateur digital areas. While *QEX* has discussed SS in the past, we haven't touched on it in this forum. Steve was a frequent cogent contributor, so I asked him to give us some background. Steve enlisted in the Navy in 1977 and became a Data Systems Technician, a repairman of shipboard computer systems. In 1985 he was accepted into the Navy's Enlisted Commissioning Program and attended the University of Utah where he studied computer science. Upon graduation in 1988 he was commissioned an Ensign and entered Nuclear Power School. His subsequent assignment was onboard the USS Georgia, a trident submarine stationed in Bangor, Washington. Today Steve is a Lieutenant and he is completing a master's degree in computer science at the Naval Postgraduate School in Monterey, California. His areas of interest are digital communications, Amateur satellites, VHF/UHF contesting, and QRP. His research area closely follows his interest in Amateur radio. His thesis topic is Multihop Packet Radio Routing Protocol Using Dynamic Power Control. Steve is also the AMSAT Area Coordinator for the Monterey Bay area. Here's Steve, I'll have some additional comments at the end.

Steve Spreads It On (ok, that one was Harold)

The column title says it all. What was once a communications mode shrouded in secrecy has entered the consumer market in the form of wireless ethernet links, cordless telephones, global position service (GPS), Personal Communications System (PCS), and digital cellular telephony (CDMA). And what are radio Amateurs doing with spread spectrum today? Perhaps very little since AMRAD performed early experiments in Amateur spread spectrum in the 1980s and formed the early regulatory rules that govern Amateur radio today. In this column I would like to reintroduce the topic of Amateur spread spectrum communications, discuss what it is and how we can experiment with spread spectrum today. Hopefully this column will prod you into thinking again about spread spectrum communications and see that there are several low cost building blocks available on the market today. Interspersed throughout the column I'll throw in the Part 97 rules and regulations that deal directly with Amateur spread spectrum.

Historical Background

In 1980, the FCC expressed a desire to extend spread spectrum communications outside of the military-only realm and allow radio Amateurs to experiment with spread spectrum communications. The FCC in following Title 47, Section 303 of the Code of Federal Regulations (CFR) shall ...

(g) Study new rules for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest...

What this meant was that a new mode of communications was opening up for experimentation and exploration by radio Amateurs.

In 1980 AMRAD took the lead and forged the beginnings of Amateur spread spectrum experimentation. The results of their experimentation were documented in the AMRAD Newsletter, *QEX*, *QST*, and compiled into a single book entitled *The ARRL Spread Spectrum Sourcebook*. This is a good book and recommended for anyone learning about spread spectrum communications. Though it is becoming a bit dated by today's standards and advances in technology since the late 1980s, it is nonetheless a good guide and provides a historical perspective into the merging of SS into Amateur radio. At the end of the column I will include a selected bibliography so that you can find other sources of information ranging from the practical to theoretical.

What is Spread Spectrum?

A spread spectrum system is one in which the transmitted signal is spread over a wide frequency band, much wider, in fact, than the minimum bandwidth required to transmit the information being sent (ref. 1). Spread spectrum communications cannot be said to be an efficient means of utilizing bandwidth. However, it does come into its own when combined with existing systems occupying the frequency. The spread spectrum signal being spread over a large bandwidth can coexist with narrowband signals only adding a slight increase in the noise floor that the narrowband receivers see. As for the spread spectrum receiver, it does not see the narrowband signals since it is listening to a much wider bandwidth at a prescribed code sequence which I'll explain later.

First, let's introduce five types of spread spectrum techniques:

Direct Sequence Systems - Direct sequence is perhaps one of the most widely known and utilized spread spectrum systems and it is relatively simple to implement. A narrow band carrier is modulated by a code sequence. The carrier phase of the transmitted signal is abruptly changed in accordance with this code sequence. The code

sequence is generated by a pseudorandom generator that has a fixed length. After a given number of bits the code repeats itself exactly. The speed of the code sequence is called the chipping rate, measured in chips per second (cps). For direct sequence, the amount of spreading is dependent upon the ratio of chips per bit of information. At the receiver, the information is recovered by multiplying the signal with a locally generated replica of the code sequence. See figure 1.

Frequency Hopping Systems - In frequency hopping systems, the carrier frequency of the transmitter abruptly changes (or hops) in accordance with a pseudo random code sequence. The order of frequencies selected by the transmitter is dictated by the code sequence. The receiver tracks these changes and produces a constant IF signal. See figure 2.

Time Hopping Systems - A time hopping system is a spread spectrum system in which the period and duty cycle of a pulsed RF carrier are varied in a pseudorandom manner under the control of a coded sequence. See figure 3. Time hopping is often used effectively with frequency hopping to form a hybrid time-division, multiple- access (TDMA) spread spectrum system.

Pulsed FM (Chirp) Systems - A pulsed FM system is a spread spectrum system in which a RF carrier is modulated with a fixed period and fixed duty cycle sequence. At the beginning of each transmitted pulse, the carrier frequency is frequency modulated causing an additional spreading of the carrier. The pattern of the frequency modulation will depend upon the spreading function which is chosen. In some systems the spreading function is a linear FM chirp sweep, sweeping either up or down in frequency.

Hybrid Systems - Hybrid systems use a combination of spread spectrum methods in order to use the beneficial properties of the systems utilized. Two common combinations are direct sequence and frequency hopping. The advantage of combining the

two methods is to capitalize on characteristics that are not available from a single method.

Why Spread Spectrum?

To answer the question "why should I use spread spectrum" could easily degenerate into a simple listing of advantages and disadvantages. However, spread spectrum has many different unique properties that cannot be found in any other modulation technique. As radio Amateurs, we should exploit these properties and search for useful applications. Think of spread spectrum as another useful tool in our repertoire of modulation methods toolbox. For completeness, I will list some advantages and disadvantages that you will see for typical spread spectrum systems. Bare in mind that these come

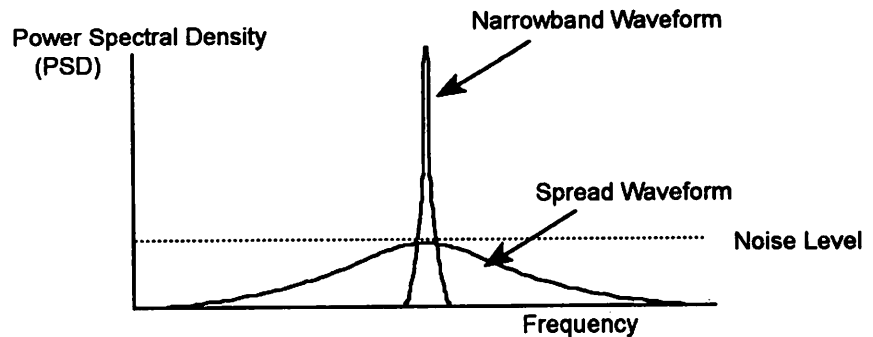**Figure 1.** Comparison of a narrowband signal with a Direct Sequence Spread Spectrum signal. The narrowband signal is suppressed when transmitting spread spectrum.
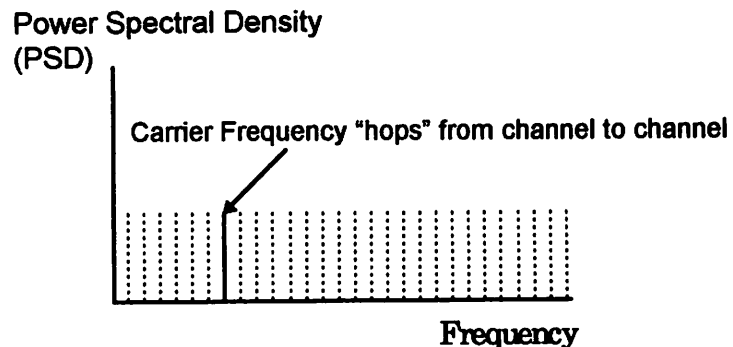

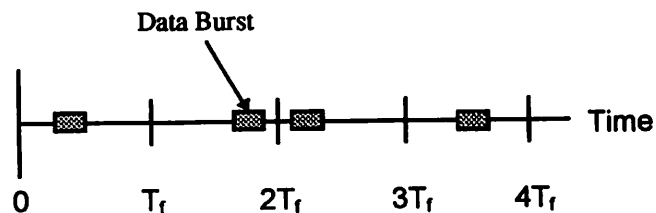**Figure 2.** An example of Frequency Hopping Spread Spectrum signal.

Figure 3. Time Hopping Spread Spectrum. Each burst consists of *k* bits of data and the exact time each burst is transmitted is determined by a PN sequence.

about because of the nature of spread spectrum, not because they are direct attributes.

Advantages:
- Resists intentional and non- intentional interference
- Has the ability to eliminate or alleviate the effect of multipath interference
- Can share the same frequency band (overlay) with other users
- Privacy due to the pseudo random code sequence (code division multiplexing)

Disadvantages:
- Bandwidth inefficient
- Implementation is somewhat more complex.

Other Properties

There are several unique properties that arise as a result of the pseudo random code sequence and the wide signal bandwidth that results from spreading. Two of these are selective addressing and code division multiplexing. By assigning a given code to a single receiver or a group of receivers, they may be addressed individually or by group away from other receivers assigned a different code. Codes can also be chosen to minimize interference between groups of receivers by choosing ones that have low cross correlation properties. In this manner more than one signal can be transmitted at the same time on the same frequency. Selective addressing and Code Division Multiple Access (CDMA) are implemented via these codings.

A second set of properties is low probability of intercept (LPI) and anti- jamming. When the intelligence of the signal is spread out over several megahertz of spectrum, the resulting power spectrum is also spread out. This results in the transmitted power spread out over a wide frequency bandwidth and makes detection in the normal sense (without the code), very difficult. Though LPI is not a typical application for radio Amateurs, it would best to rename this property as reduction of interference. Thus spread spectrum can survive in an adverse environment and coexists with other services in the band. The anti- jamming property results from the wide bandwidth used to transmit the signal. Recall Shannons Information-rate theorem:

$$C = W \log (1 + S/N)$$

C = capacity in bits per second
W = bandwidth
S = signal power
N = noise power

where the capacity of a channel is proportional to its bandwidth and the signal-to-noise ratio on the channel. By expanding the bandwidth to several megahertz and even several hundred megahertz, there is more than enough bandwidth to carry the required data rate and have even more to spare to counter the effects of noise. This

anti jamming quality is usually expressed as "processing gain."

So for the radio Amateur, the properties of code division multiplexing, coexistence in an adverse environment, and processing gain, are all excellent reasons to experiment with and find useful applications for spread spectrum in the Amateur radio service. Coupled with these reasons, Amateurs can also enjoy increased data rates in digital data (packet radio) that cannot be done with conventional Amateur or commercial radios due to physical (i.e. bandpass filters) and rules restrictions. For example, narrowband systems in the 70 cm band are limited to a maximum data rate of 56 kbps and a bandwidth of 100 kHz, there are no such restrictions in the 33 cm band and up.

Perhaps one of the most important reasons to use spread spectrum is its ability discriminate against multipath interference. A RAKE receiver implementation for direct sequence allows individual signal paths to be separately detected and the coherently combined with other paths. This not only tends to prevent fading but also provides a path diversity effect resulting in very rugged links in terrestrial mobile communications (ref. 2). RAKE is not an acronym. It is called RAKE because the filter arrangement of the receiver is like a garden rake

Building Blocks

Spread spectrum signals are demodulated in two steps:

1) the spectrum spreading (direct sequence, frequency hopping) modulation is removed, and

2) the signal is demodulated.

The process of despreading a signal is called correlation. The spread spectrum signal is despread when the proper synchronization of the spreading code between the transmitter and receiver is achieved. Synchronization is the most difficult aspect of the receiver. More time, research, effort, and money has gone into the development and improving of synchronization techniques than in any other area of spread spectrum. The problem of synchronization is further broken down into two parts: initial acquisition and tracking.

There are several methods to solve the synchronization problem. Many of these methods require a great deal of discrete components to implement. But perhaps the biggest break-through has been from Digital Signal Processing (DSP) and Application Specific Integrated Circuits (ASIC). DSP has provided high speed mathematical functions that can slice up in many small parts and analyze the spread spectrum signal to synchronize and decorrelate it. ASIC chips drive down the cost by using VLSI technology and creating generic building blocks that can be used in any type of application the designer wishes. With the fast growing Part 15 and

Personal Communications System (PCS) spread spectrum market, many ASIC manufactures have been designing and selling ASIC chips that take care of the most difficult problem in spread spectrum — despreading and synchronization. With a few extra components, the Amateur can have a fully functioning spread spectrum receiver.

One manufacturer of a spread spectrum demodulator ASIC is UNISYS (Unisys Communications Systems Division, DSP Components, Dept. 9065, M/S F1F12, 640 North 2200 West, Salt Lake City, Utah 84116-2988; Phone: (801) 594-4440; Fax: (801) 594-4127). Their PA-100 performs the functions of despreading and demodulation, carrier recovery loop (frequency or phase), Pseudo Noise (PN) code detection, PN code tracking loop, data synchronization, and automatic gain control. It is programmable and offers a wide range of choices in data rates, modulation types, processing gains, PN codes, loop bandwidths, and tracking and acquisition procedures. It is capable of chipping rates up to 32 Mcps and data rates up to 64 Mbps. The PA-100 is controlled via a simple 8-bit interface. The chip is a 208-pin plastic Metrix Quad Flat Package (MQFP). The cost of the chip is $167.00 in single qty and $67.00 in lots of 1000.

Where does Part 15 fit into all this?

Many of the spread spectrum devices on the market today are listed as Part 15 devices. This refers to the device operating under the provisions of Title 47 Section 15.247 of the Code of Federal Regulations (CFR). There are three frequency bands allocated to this service:

902 - 928 MHz (26 MHz bandwidth)
2400 - 2483.5 MHz (83.5 MHz bandwidth)
5725 - 5850 MHz (125 MHz bandwidth)

Operation under this provision of this section is limited to frequency hopping and direct sequence spread spectrum. No other spreading techniques are permitted. Section 15.247 defines the technical standards that these systems must operate under. For example, the maximum peak output power of the transmitter shall not exceed 1 watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. This equates to a maximum transmitter EIRP of +6dBW (1 watt into a 6 dBi gain antenna)

Part 15 equipment operates on a secondary basis. Users must accept interference from other transmitters operating in the same band and may not cause interference to the primary users in the band. Primary users are government systems such as airborne radiolocation systems that emit a high EIRP; and Industrial, Scientific, and Medical (ISM) users. Thus the Part 15 device manufacturer must design a system that will not cause interference with and be able to tolerate the noisy primary

users of the band. And this is where spread spectrum systems excel because of their low noise transmissions and ability to operate in an adverse environment.

Amateurs should realize that under the present Part 97 rules and regulations governing Amateur spread spectrum today, taking a Part 15 spread spectrum device and adding an amplifier to it would break the rules. Even though it would be transmitting within the Amateur spectrum, it more than likely would not be using one of the specified spreading codes assigned to Amateur operation (refer to Sec. 97.311 Section (d) - SS emission types). However, this should not deter the radio Amateur from using Part 15 devices in their experimentation or use in the Amateur service. The device should be monitored to ensure that it remains under the Part 15 regulations and as such, no Part 97 regulations apply. Amateur traffic can flow though Part 15 devices, and they do not require a callsign since they do not require a license. However, the radio Amateur should realize that when the traffic enters the Amateur bands, for example, through a gateway, then Part 97 rules begin to apply.

Further Part 97 Rules and Regulations

Any radio Amateur contemplating experimentation of spread spectrum in the Amateur bands (excluding Part 15 devices) should become familiar with the present Part 97 rules and regulations governing it. Here are some excerpts that bear emphasizing:

Sec. 97.119 Station identification

(a)(5) By a CW or phone emission during SS emission transmission on a narrow bandwidth frequency segment. Alternatively, by the changing of one or more parameters of the emission so that a conventional CW or phone emission receiver can be used to determine the station call sign.

Sec. 97.305 Authorized emission types.

Spread Spectrum is permitted on the following bands (over the entire band unless otherwise indicated):

UHF: 70 cm (420-450 MHz), 33 cm (902-928 MHz), 23 cm (1240-1300 MHz), 13 cm (2300-2310 and 2390- 2450 MHz*)

SHF: 9 cm (3.3-3.5 GHz), 5 cm (5.650-5.925 GHz), 3 cm (10.00-10.50 GHz), 1.2 cm (24.00-24.25 GHz)

EHF: 6 mm (47.0-47.2 GHz), 4 mm (75.5-81.0 GHz), 2.5 mm (119.98- 120.02 GHz), 2 mm (142-149 GHz), 1mm (241-250 GHz), Above 300 GHz.

Operation on all of the above bands are on a secondary basis. No Amateur station transmitting in these bands shall cause harmful interference to, nor is protected from interference due to the operation of the primary service.

(*Note: Recent rule making has allocated 2390-2400 MHz and 2402- 2400 MHz to the Amateur community on a primary basis.)

Sec. 97.311 SS emission types

[Note: Sections (a) through (d) set the technical standards for spread spectrum emissions.]

(e) The station records must document all SS emission transmissions and must be retained for a period of 1 year following the last entry. The station records must include sufficient information to enable the FCC, using the information contained therein, to demodulate all transmissions. The station records must contain at least the following:

(1) A technical description of the transmitted signal;

(2) Pertinent parameters describing the transmitted signal including the frequency or frequencies of operation and, where applicable, the chip rate, the code rate, the spreading function, the transmission protocol(s) including the method of achieving synchronization, and the modulation type;

(3) A general description of the type of information being conveyed, (voice, text, memory dump, facsimile, television, etc.);

(4) The method and, if applicable, the frequency or frequencies used for station identification; and

(5) The date of beginning and the date of ending use of each type of transmitted signal.

(f) When deemed necessary by an EIC to assure compliance with this part, a station licensee must: (1) Cease SS emission transmissions;

(2) Restrict SS emission transmissions to the extent instructed; and

(3) Maintain a record, convertible to the original information (voice, text, image, etc.) of all spread spectrum communications transmitted.

(g) The transmitter power must not exceed 100 W.

Rules Reform

Needless to say, by today's standards, practices, and improvements in technology, the above Part 97 rules and regulations on Amateur spread spectrum are extremely restrictive especially in the case of the few fixed spreading codes dictated by section 97.311 (d)(1). The ARRL is reviewing the suggestions from the ARRL Futures Committee for changes to these rules and regulations to allow less restriction and freer experimentation.

Getting Around the Rules - Legally

In the mean time there is a Special Temporary Authority (STA) to allow Amateur spread spectrum experimentation. Under this STA Section 97.305(c) is waived to the extent that particular Amateur stations are authorized to transmit spread spectrum emissions on frequencies in the 6 meter (50 - 54 MHz), 2 meter (144 - 148 MHz), and 1.25 meter (222 - 225 MHz) bands. Section 97.311(c) is waived for these stations to the extent

that the prohibition against hybrid spread spectrum emissions is lifted; and Section 97.311(d) is waived for these stations to use other spreading codes.

To participate in this STA it is requested that you have a bonafide purpose of experimenting and advancing the art of Amateur spread spectrum. Contact Robert Buaas, K6KGS, 20271 Bancroft Circle, Huntington Beach, California 92646. Please include your name, address, callsign, expiration date of your license, and the details of your experiment. Do include an abstract of the project and a proposed set of goals you are trying to obtain. The information that you collect through your experimentation will be helpful in the advancement of Amateur spread spectrum but will also be useful for justification for rules changes before the FCC.

Areas to expand and research Typical SS applications such as wireless ethernet use point-to-point communications. They link two subnets over distances of several miles with external Yagi antennas and less than one watt of power. Amateurs would rather use the traditional CSMA/CA technique they are familiar with in todays packet radio. However, with the requirement of correlating the spreading code it would require a network node to have multiple receivers to listen in on the channel and detect when an outlying node is trying to communicate with it. Heres where Amateur radio experimentation can advance the art of spread spectrum, by creating a CDMA spread spectrum packet radio network. By using the techniques employed by GPS, relatively short codes can be use to minimize receiver acquisition time. These codes would also need to have good cross-correlation properties to minimize multiple access interference between nodes.

Power control is required to control the reuse of the frequency beyond code division multiplexing. It also behooves us to explore good power control to limit interference and to reduce the power consumption and drain on batteries.

Routing of packets through a network is typically a software issue, but with the ability to do code division multiplexing, how do we route packets from one subnet to another when they do not use the same code sequence? Driving cost down has always been a top goal of any designer, and even more so since the Amateur is experimenting with their own money. Amateurs tend to be a frugal lot and will find any means available to build a system that costs as little as possible. This spawns innovative and creative methods to achieve this means. Then these means tend to be passed back to the commercial sector and benefit everybody.

CDMA is not the exclusive province of direct sequence systems; CDMA can also be used with frequency hopping. TDMA is not the exclusive province of

narrowband systems; TDMA can also be used with direct sequence or frequency hopping.

Spread Spectrum Isn't New

In the 1982 AMRAD letter (reprinted on page 4-11 of the ARRL SS Handbook), Hal Feinstein, WB3KDU, wrote,

> Spread spectrum has found its way into packet radio. Spread spectrum allows each node to have a unique code which acts as a hard address. Another node in the system can send data to that node by encoding that data with the spread spectrum address for the receiving node. Traffic for other nodes does not interfere because it would have a different code. Among the reasons cited for employing spread spectrum for packet switching are privacy, selected addressing, multipath protection and band sharing. But it is interesting to note that a load is taken off the contention collision approach because now a single frequency is not in contention among the nodes wishing to transmit. The load is divided among the nodes addresses, and each that is interested in sending data to a target node competes for that node only.

This is the CDMA part of SS. This is one of those areas the FCC really wants hams to experiment with. I think the paper has a lot of insight and it was written over 13 years ago.

PANSAT - A Spread Spectrum Satellite

The Space Systems Academic Group (SSAG) at the Naval Postgraduate School (NPS) in Monterey, California is actively designing and building an Amateur satellite named PANSAT (see figure 4). PANSAT is the acronym for Petite Amateur Navy Satellite. PANSAT is to become a packet digital store-and- forward satellite vary similar in capabilities as the existing PACSATs in orbit today. The tentative launch date of PANSAT is late 1996, early 1997 as a Get Away Special (GAS) payload from the Space Shuttle.

One big difference between today's PACSATs and PANSAT is that PANSAT will use direct sequence spread spectrum as the communications up and downlink.

PANSAT is being designed from the ground up as an Amateur satellite. The only military mission of PANSAT is as a training vehicle for the education of military officers in the Space Systems Curricula by the design, fabrication, testing and operation of a low-cost, low earth orbit (LEO), digital communications

satellite. One of the engineering objectives of PANSAT includes the evaluation and performance of spread spectrum packet radio communications using the Amateur community as the user base.

In order to facilitate the evaluation of spread spectrum performance the SSAG is designing a low cost spread spectrum modem and RF package to be presented to the Amateur community in a kit form. The goal is to have the design of the spread spectrum radio/modem available before the launch of PANSAT to allow Amateurs to build and become operational via terrestrial means. This presents an exciting exchange of technology and the ability for the Amateur to build a low cost unit to experiment with. As the design and development progresses they will be presented in the Amateur press.

Future and Summary

Now is the time to begin experimenting with spread spectrum communications on a wider scale. Technology has advanced to the point where Amateurs can afford to build systems. The building blocks are available now in the form of Application Specific Integrated Circuits. The recent flood of consumer devices that employ spread spectrum has also driven the price down. In many cases the Amateur can either use these devices under their present type acceptance or modify them for Amateur operations. However, the Amateur should remain aware of the rules and regulations governing the particular device whether it falls under Part 15 or Part 97 of the FCC Rules and Regulations and remain within their guidelines. If the Amateur wishes to expand beyond the present Part 97 rules in bonafide experimentation, they are encouraged to join in the Special Temporary Authority.
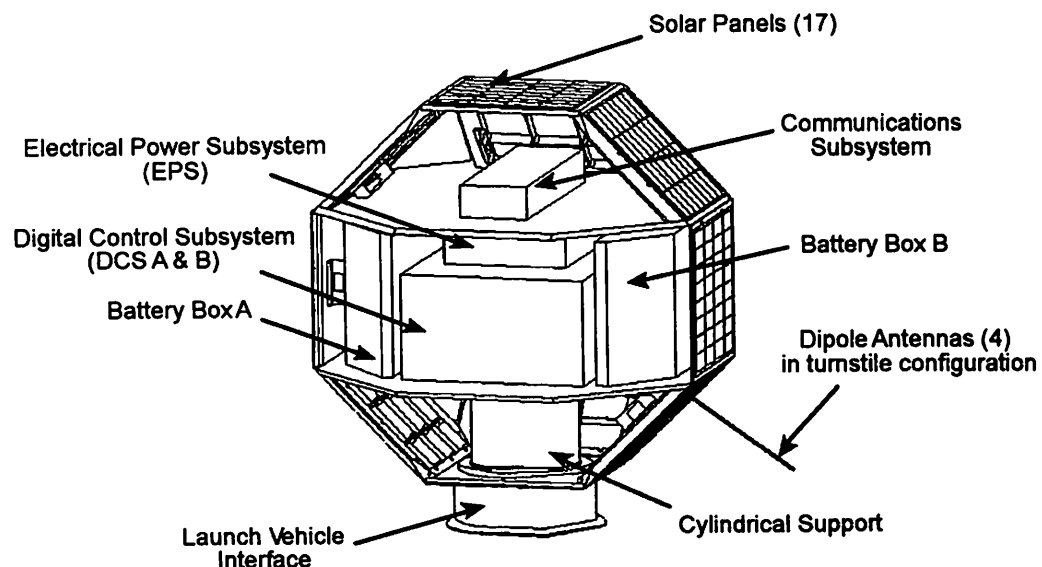

Figure 4. A cut-away view of PANSAT, a Direct Sequence Spread Spectrum satellite being designed and built at the Naval Postgraduate School in Monterey, California.

Spread spectrum systems exhibit unique qualities that cannot be obtained from conventional narrowband systems. There are many research avenues exploring these unique qualities. Amateurs in their inherent pioneering nature can and will find new and novel applications for spread spectrum communications that the commercial sector may not even think of. And due to the frugal propensity of the Radio Amateur, they will certainly find the least expensive way to implement it, thus driving down the cost.

Amateurs should realize that there is plenty of room to explore spread spectrum techniques. All that remains now is to pick up a few good books on the subject and warm up the soldering iron. And as you progress upon this road less traveled, make sure you take notes along the way. Then share your discoveries with your fellow Amateur to help all of us expand the horizon with this exciting mode of communications call spread spectrum. It is no longer shrouded in secrecy and it's not just for breakfast anymore!

WEB Crawling

Here are two Web pages of interest. I've started a general Amateur radio SS page, http://www.tapr.org/ss. See also the PANSAT page at http://www.sp.nps.navy.mil/pansat/pansat.html

TANSTAAFL from NK6K

Harold here with a final word. Way back in 1983, we pitched packet as a way of sharing a narrow band channel in the time domain. Compared to the then current technology, ASR 33 or glass TTY and keyboard, with real-time hand typed text, we could place several users on a channel where only one fit before. Now, of course, there are too many users, too many bytes, and too few channels (at least for the RF modems we have). SS, with its non-interference properties, also promises free channel sharing. Is it a free lunch? What is the limit on channel re-use, and on sharing between narrow band and SS users? The question seems to be akin to "how many angels can dance on the head of a pin?" As with most real systems, modeling can only take you so far, especially with the number of variables that would be involved in an Amateur SS system. Here is a case where hams can again add to the practical, rather than theoretical, knowledge pool. We have to take advantage of the spectrum we have, the STA we have, and actually put some hardware on the air and see what happens. Let's actually experiment, and not ignore SS because it might interfere with other modes. Let's find out if it does, and see what can be tweaked to avoid it. We have the relative luxury of being able to try new things on the air, without proving we can generate revenue from them before spectrum is allocated. Get on with it.

Selected Bibliography

Books

Extensive research oriented analysis:
M.K. Simon, J. Omura, R. Scholtz, and K. Levitt, *Spread Spectrum Communications* Vol. I, II, III. Rockville, MD. Computer Science Press, 1985.

Intermediate level:
J.K. Holmes, *Coherent Spread Spectrum Systems*, New York, NY. Wiley Interscience, 1982.

D.J. Torrieri, *Principles of Secure Communication Systems.* Boston. Artech house, 1985.

Introductory to intermediate levels:
G.R. Cooper and C.D. McGillem, *Modern Communications and Spread Spectrum*, New York, McGraw-Hill, 1986.

R.E. Ziemer and R.L. Peterson, *Digital Communications and Spread Spectrum Systems*, New York, Macmillan, 1985.

R.E. Ziemer and R.L. Peterson, *Introduction to Digital Communications*, New York, Macmillan, 1985.

Practical:
R.C. Dixon, *Spread Spectrum Systems*, John-Wiley & Sons, 1984.

Journals

There have been several special issues of IEEE publications that are devoted to spread spectrum systems.

IEEE Transactions on Communications: August 1977 and May 1982.

IEEE Journal of Selected Areas in Communications: May 1990, June 1990, and May 1992.

References

(1) R.C. Dixon, *Spread Spectrum Systems*, John-Wiley & Sons, 1984, page 7.

(2) K. Gilhousen, Qualcomm Inc., USENET newsgroup discussion.

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 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.

DAS — It's Not What You Think

Paul Newland, AD7I
ad7i@tapr.org

In the December (1995) issue of *QST* you should find an article by me describing "DAS" — A DTMF Accessory Squelch. This gizmo functions in several ways. As described in the *QST* article, DAS is a SELCAL (Selective Calling) decoder designed to watch a channel for your individual DTMF ID sequences as well as the LiTZ signal (ARRL's Priority Alert Signal — 3 seconds of DTMF zero). A kit of parts will be offered by TAPR. Well, that's all fine and good you might say, but why is TAPR involved with a SELCAL decoder? And why should I care about this gizmo?

At its heart, DAS is a small module that consists of a DTMF detector, a microcomputer, a couple of relays and some LED drivers. The *QST* article describes the system in terms that should interest most hams. I would now like to describe DAS in terms that may be of interest to packet radio node operators.

There are two main functions for DAS in the packet radio environment. Both are related to the control of a remote packet radio node system:

1. As a reset controller, DAS can be programmed to close a relay for 2 (or 5) seconds when it hears a particular DTMF sequence on a radio channel. The sequence can be as short as one symbol (kinda silly) or as long as 21 symbols (not going to hit that one by accident). Use that relay to drive the reset circuits of your various mountain-top packet radio node components and you have a remote master reset switch.

2. As a controller, the second relay as well as the four LED driver outputs can be set to "active" or "inactive" to be used as on/off control signals for external devices. The status of these values is automatically saved to EEPROM so that if you have a power hit the status values are not lost when power is restored.

Why use DTMF instead of packet? Why not use METCON? Well, for a reset and/or control system, there is value to making use of a device that is "out of the system." If you have a packet problem, using packet may not be the best way to remotely hit the "big red reset button." The DTMF controller also doesn't have to take commands from the same RF packet channel (where it might take you a couple of shots of DTMF to get through, if ever), although you can use the packet channel for DTMF if that meets you needs. The DTMF signals to control a remote packet node can be sent via a wide coverage repeater channel, or a lonely, rarely used simplex voice frequency. Use whatever best suits your application. Think of DAS as simply another tool in your toolbox of packet radio system elements.

We are not sure of the interest level in the kit for this project — it may be large, it may be small. The *QST* article will hit the streets about November 20th. TAPR's first run will be a kit to support 50 modules plus another 50 bare boards, which is a conservative run. It's more than likely that we will sell out of the module kits fairly fast. We want to give TAPR members first shot at these kits, so we are establishing a "waiting list." Here's how it will work:

If you would like to reserve a DAS unit, send a standard US Postal Service white post card (20 cents, 3.5 x 5.5 inches) to TAPR, 8987-309 E Tanque Verde Road, #337, Tucson, AZ 85749-9399. All your information should be on the non-stamped side of the card. Draw a horizontal line about 1 inch from the top of the card. Write "DAS" in the upper left corner, above the line. Write the number of units you want to reserve (5 max) in the upper right corner of the card, above the line — circle the number. Below the line write your name, address, callsign, daytime phone number and TAPR membership number (it's on the mailing label from your last issue of *PSR*). Priority will be established by the order in which TAPR receives them, not postmark date.

Sometime between November 15th and November 30th (inclusive) you must call TAPR on 817-383-0000 to place your order. We don't know the cost at this time but it will probably be somewhere between $50 and $90. If we don't hear from you by November 30th, then you will lose your reservation. Of course, if you reserve a unit and later determine that you will not need it, please call to cancel your reservation. If you have questions about any of this, please contact me via internet e-mail.
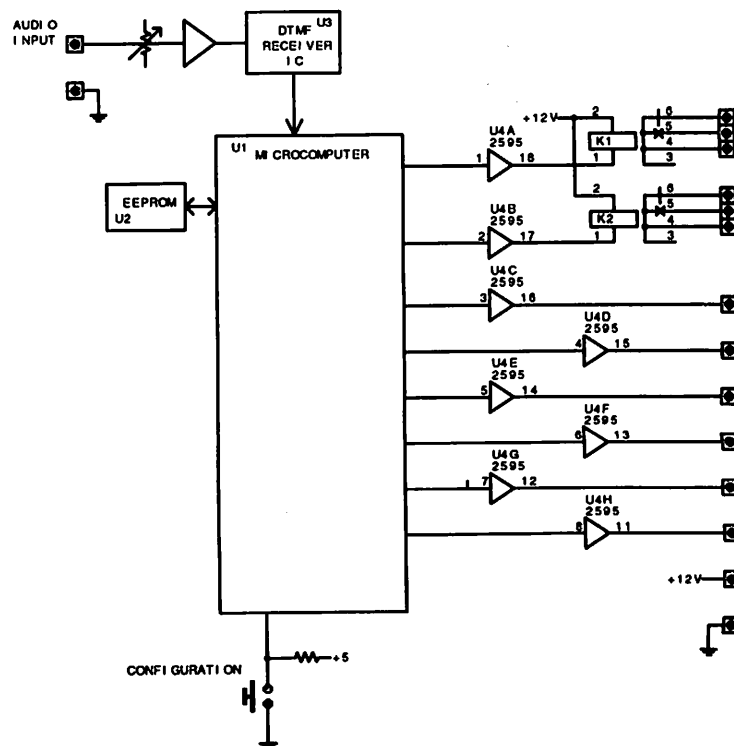
Book Review — *Packet Radio: What? Why? How?*

Presley Smith

The new book from TAPR called *Packet Radio: What? Why? How?* contains a collection of articles and information on many different packet radio topics. The introduction for this book states the goal is to "provide information to beginning and intermediate packet operators."

This book covers a broad range of topics from an introduction to packet radio for the beginner to DX Clusters to the use of packet BBS systems. This book gives the reader good overview of all the various types of packet capabilities that exist today. Since this book contains an overview of many different topics, none of these topics are covered in full detail. This book is an excellent overview for someone who would like to understand all the various capabilities that exist with packet radio today.

The book starts with an introduction to packet radio. The first two sections summarize the basics of packet radio and how to get started with packet. The first section gives a broad overview from direct connects to packet networks to packet satellites. The section details equipment needed and has a summary of networking schemes with packet radio.

Operating HF packet is the next topic. This section details the what is needed in a transceiver, computer, and TNC. This section also gives an overview of the various HF modes such as RTTY, AMTOR, PacTOR, CLOVER, and GTOR and lists some of the most popular frequencies.

The next sections of the book cover the selection and purchase of packet equipment with sections on Terminal Node Controllers (TNC), antennas, and radios. Topics include the tradeoffs between various models of TNCs from BayCom TNCs which require the computer to function as the TNC to the sophisticated Digital Signal Processor (DSP) TNCs that are available now. The section on radio selection also has information on importance of having the proper deviation in the packet setup.

The next few sections deal with operating your packet system. There is a section on Eliminating POOP (Poor Operating On Packet) from Packet. This section is an overview of good operating practices on packet and has information on the proper way to use beacons and how to set various parameters in your TNC for optimal performance. The need for a good Elmer is mentioned in several sections of the book.

Jim Neely's Beginners' Frame sections are next. These sections include "Command Settings" which has information on the various settings for your TNC parameters, "Basic Problems" which contains hints on solving various problems, "Packet Software" which reviews various packet software programs that are available such as PACKET-GOLD and LAN-LINK. The

next section is "STS/MIR Packet" which overviews the operation of packet on the U.S. Space Shuttle missions and the packet operation on the Russian MIR space station. (Note: the STS frequences change on various missions and are not right in the book and the MIR callsign has changed from what is in the book. Check with AMSAT for the correct information.) Next sections are the "Packet BBS" which is an introduction to using a packet BBS and "TNC Alternatives" which has additional information on TNC kits.

The next sections include information on operating HF packet. Sections include "HF TNC Settings" and a tutorial on operating APLINK which is a HF mailbox. In these sections the proper equipment setup and the procedures for using APLINK are detailed.

The next sections of the book contain information on digipeating and the use of various network capabilities. The commands for various systems such as DX Cluster, Net/Rom, and KANode systems are provided. An overview of packet BBS commands is also provided.

An overview of the various packet networks is contained in the next sections of the book. Included are sections on the Rose network with an introduction to the system and a summary of commands and how to use them. Next is an overview of TexNet commands and how to use the TexNet system. The final section on networks has information on TheNet+ with information on how to use the system and a summary of the commands.

Packet BBS systems and how to use them is the topic of the next section. This section includes information on the various commands available on these systems and also a list of common TO fields that are used in bulletins found on packet BBS systems. Also included in these sections is information on how to format messages for the National Traffic System (NTS).

In summary, this book covers a broad range of topics that provide a good overview of most of the capabilities of packet radio that exist today. The book is made up of a collection of articles that have been written on various topics from various sources. As a result, the expertise level of the information varies widely with some topics discussed in more detail than others. Since each article was written separately, the flow of the book is not as smooth as it could be. The book is not a tutorial but is a very practical guide for someone who is interested in the capabilities of packet radio and wants to know more about what is available today. The strength of this book is it's introduction to the broad range of topics covering all aspects of packet radio today.

One Reader's Reaction

[The following dialogue refers to the article "Packet and HTs" which appeared in TAPR's Packet Radio General Information booklet and the new Packet Radio: What? Why? How? book. In the original article, Norm Sternberg, W2JUP, put forth the idea that packet stations with small signals should not be used on shared channels
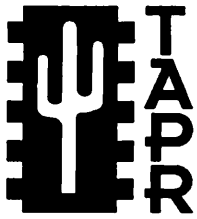
Membership Questionnaire

TAPR

The TAPR Board of Directors want to hear from you! There are issues that need to be answered from the membership in order for TAPR to make necessary decisions in future long-term planning. Please take a few moments to respond to this survey and mail it back, fax it back, or better yet, use http://www.tapr.org/question. A generous space has been left at the bottom for your comments. Thank you.

Please remember that TAPR officers, directors, and other people that make things happen are amateur volunteers just like yourself. They do packet things after dinner until they struggle to bed at 3am. TAPR is not a commercial entity, but rather a fragile confederation of persons who band together because they can do more as a team than they can as individuals. They have jobs and families to take care of, too. Anyone, everyone, is welcome to become directly involved in TAPR activities. All you have to do is volunteer the necessary time and skills... In a nutshell: TAPR is all of us!

Name:

Call:

Occupation:

1. Age:
a. <18
b. 19-25
c. 26-35
d. 36-50
e. >51

2. Number of years as a TAPR member:
a. 1 year
b. 2-3 years
c. 4-5 years
d. >5

3. I joined TAPR to:
a. receive the TAPR Packet Status Register
b. support packet/digital development
c. both

4. Number of years doing amateur digital communications:
a. 1 year
b. 2-3 years
c. 4-5 years
d. >5

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

(Circle all that apply)

6. I view information TAPR publishes in the Packet Status Register as:
a. Informative
b. Technical
c. News
d. Other : _____

7. My main interests are:
a. VHF/UHF
b. HF
c. SHF
d. Technical Design/Development
e. End User
f. Networking
g. AX.25 (packet)
h. TCP/IP
i. RTTY/AMTOR/PACTOR/ GTOR, etc
j. BBS Sysop
k. Satellite Operations
l. Other : _____

8. Other organizations I belong to:
a. ARRL
b. AMSAT
c. Other Regional Groups :
_____
_____
_____

9. TAPR should focus on:
a. Developing Kits
b. Publications
c. Membership Growth
d. Education

10. When TAPR makes a kit, should it be a complete kit:
a. yes
b. no

11. TAPR should do R&D in technology, but stay out of the production business:
a. yes
b. no

12. Having very similar equipment by many manufacturers is confusing. TAPR should license technology on an exclusive basis :
a. yes
b. no

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
b. no

14. TAPR is an organization whose time is past ? We should close:
a. yes
b. no

15. TAPR is important to the continued growth and future of packet radio development and should stay in existence:
a. yes
b. no

16. I believe that TAPR should be active in petitioning the FCC on actions which directly affect Digital Communications:
a. yes
b. no

17. At its March '95 Board Meeting, the following goals were set for TAPR. Please rate each goal.
1. I strongly disagree, 2. I disagree,
3. no opinion, 4. I agree, 5. I strongly agree

a. Work on issues regarded user access speeds   10 20 30 40 50

b. Increase membership
                10 20 30 40 50

c. Work on Special Interest Group activity   10 20 30 40 50

d. Continue to watch spending
                10 20 30 40 50

e. Gain closure on current projects
                10 20 30 40 50

f. Increase activity in national issues
                10 20 30 40 50

Thank you very much for taking the time to answer these questions. (NOTE: This form is designed to be folded in thirds and mailed without an envelope. <u>Do not forget to apply postage.</u>) You can also Fax to (817) 566-2544. If you have Web access you can fill out this entire form from http://www.tapr.org/question

FINAL COMMENTS: Please use the remaining space to offer any suggestions you may have regarding TAPR, its role in Amateur radio, how it may better meet your needs, etc.

- **Fold Here** -

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

- **Fold Here** -

Comments continued:

because not all stations will be able to hear it, and collisions will result.]

Dear TAPR,

I am not sure who to address this comment to, but it is one I have wanted to make for sometime. When I first got interested in packet radio, I ordered a copy of *Packet Radio General Information*. After reading Jim Neely's article "Beginners' Frame Packet and HTs." I sold the new never used TNC I had bought and didn't consider packet again until the operator of the local BBS asked to me try it. I told him I didn't want to as the result of reading Jim Neely's article. All I could afford was to use my HT. I couldn't afford to buy another radio and a TNC as well. He almost exploded. He called our organization (my member number is 4694) every name under the sun and said we were killing the growth of packet in remote areas such as ours here in Bemidji, MN. After being on packet for about half a year I have to agree.

I don't think TAPR is trying to limit the growth of packet, but the affect of much of your literature such as Jim Neely's article is doing that. We had a round table tying together repeaters from here to Montana and down into South Dakota. There were operators who had read what they could on packet and decided against trying it because they couldn't afford another rig. Remember those of us who live in rural areas have incomes from 1/2 to 2/3 of those of you who live in cities. There is a simple solution. You need to include a line that not using HTs may not be true in remote areas. After all we have people here who can reach the BBS only with a beam and high power because they are so far away. There is very little chance of hearing them if you are to the side of their beam. FM repeaters have grown here very nicely because HTs are cheap, but packet has not. It was the feeling of the round table members that it is because were are constantly warned about not using HTs on packet. We would love a few "hidden terminals" here in northern Minnesota. I must ask why I can pick up my HT and link repeaters to talk to a friend in Billings, Montana, but my only local BBS may go off the air from lack of use. (This last summer all the BBSs went off the air because of lightning hits — only one chose to come back on the air. He has less than 25 users. If he loses the station to lightning again this summer he will replace the equipment.) I have set my computer watching the 145.01 channel for the last month. It counted only 13 call signs either directly heard or heard the BBS answering. Only the DX cluster seems to have "real users." Traffic passes through Bemidji on the "backbone" but of course we cannot use that system directly. It used to have a port but low usage forced it to close. We really need to have more people join us on packet. Each year we add a few more new hams and many buy HTs. They avoid packet after reading about the problem of 'hidden terminals.

Please, please, please, please remember those of us who live in remote areas and change the wording of your publications.
Sincerely, V.C. Angell, KC0EM

Dear VC,

Your message was passed along to me for a response. Thank you for taking the time to write.

If you read the article in question more carefully, you'll notice that I just reprinted an article by Norm Sternberg, N2JUP. Norm is an old hand at packet and was the author of the original PK-232 manual. I'd like to add that the article is referring to areas that are congested and offer the possibility of the dreaded hidden terminal syndrome.

If you live somewhere that precludes the possibility of hidden terminals, the article wasn't aimed at you. Also, if, as you mentioned, digi's and BBSs are a long distance apart, then you might give serious thought as to the problems of weak signals getting there at all.

I write for a rather diverse audience and I also try to pass along any and all information that will help make the readers more knowledgeable and able to make more informed decisions. I have no idea why anyone would take what was written in that article as a reason not to even try packet. I hope you will reconsider and use the information you receive to help you make informed decisions,   73...Jim Neely WA5LHS

Dear Jim,

My letter reflects the concerns of Amateurs who joined in a roundtable via linked repeaters. Almost all the literature currently being printed seems to think everyone lives in a high use area such a Philadelphia. We all decided to take a book or article and write about our concerns. I monitored our local 2 meter repeater, and it was used 14 times today from 6 AM to now, 7:14 PM. I also monitored the local BBS. It was used twice. The DX cluster was used once not counting incoming DX announcements. All we want from writers or editors is a line included about working in remote areas. We have no TCP/IP or even KA-Nodes.

You asked why someone would not get on packet after reading W2JUP's article. We have perhaps 35 Amateurs living in the city limits of Bemidji. All of us could easily use an HT to access the local BBS. Our odds of hearing our more remote hams who are using beams to use the BBS is not good unless we are in line between them and the BBS. Anyway, the local library has a copy of *Packet Radio General Information*. After reading it (it was the first thing I had read beyond a few *QST* articles) I abandoned my effort to get on packet. No one wants to be a problem. If you are new, you assume something like this article is giving good solid advice. You have no way of knowing that your area is NOT a "complex packet radio environment." So you avoid packet at least until you can afford a 40 watt rig and a Ringo at 75 feet. I think you misjudge the power of written words from TAPR. I have chatted with at least two other people who went to the library, and after reading the same article did something else rather than packet. It hurts our growth.

Anyway, I will read your reply to everyone over the linked repeaters. Thanks for your reply. -"VC" KC0EM
[Postscript: The next printing will have a clarification of this topic along with several other updates.]

Packet Radio in Education: Managing Information for the Future.

David Moore

This is the second of several articles that will appear in the PSR concerning Amateur/packet radio and its potential use 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.

"Neighbors share resources and come together to create community, enhancing the special qualities of individuals while enriching the well-being of all. Electronic links, used for teaming, are creating new neighbors among schools, classrooms, teachers, students, and other members of the community." [1]

As we enter into the 21st Century, the use of information will become more of a complex management issue for students and teachers alike. With the increased dissemination of data, educators will become facilitators of that data and students will be forced to become knowledge users.

The Texas Library Association recently stated that "by the year 2000, 71% of all jobs will involve the use of information." [2] How we use that information will depend on how well students have been instructed in the use of real world management of information. What I am suggesting is a new delivery system for communication instruction in the classroom. We must have fundamental changes in the way we think, learn, and work. These changes will be technology-based. Students of the 21st century will need to understand technical systems, know how to deal with the overwhelming amount of information, know how to evaluate and analyze information, be problem solvers, be able to adapt to change, and be continual learners. In other words, they must know how to interact with information and technology.

To make the necessary changes, education must first have an open mind. One such change is that of teacher vs. facilitator. A teacher traditionally lectures 90% of the class time. Students are, in turn, passive listeners. Neat rows prevail in most classrooms. Alfred Bork stated recently that "if you want to destroy learning in a classroom, you tell your students to close their books, get out paper and a pen, and tell them to give back on paper what you have taught them." [3] Creativity does not exist in this type of classroom. In the real world, success for the future will mean thinking for a living. The task is to prepare our youth to function effectively in a world of advancing technology.

The methodologies for education in the 21st century will involve the teaching concepts, problems solving, research and development, and looking to the future. What the classroom deals with today is one of teaching skills, project making, following a plan, and dealing with the past and present.

Probably the first question educators will ask is why should we fix it (education) if it isn't broken? Tom Peters said that 'if it ain't broken, fix it anyway.' [4] This makes sense if you look at what has taken place in the classroom for the past thirty years. If the classroom is carefully studied and analyzed, the risk I am suggesting is not a risk at all but a plan of action that will take the classroom of today well into the next century.

The plan for changing the classroom is not one of reformation but transformation. The first point of identification is that of formation of a vision. Point One: computer technology, and more specifically telecommunications, must be used as as basis for new curriculum areas. The main road block, in many cases, for using telecommunications in the classroom is a simple telephone line installed in the student work area. In more than just a few schools, getting this simple phone line is a major problem. Telecommunications is needed for connection to the outside. It is a basic human need to connect with others for information. The student of tomorrow will need a way of dissemination of data because of the doubling of information every 18 months.

With the use of telecommunications in the classroom, students will have increased opportunities for establishment of real and direct contact with their peers locally, nationally, and internationally. Through the use of computer and modem, satellite transmission, and Amateur radio, students will be "in touch" with the world. Products of such a curriculum will be the personalization of the study of foreign languages, social studies and other subjects, and a powerful, realistic motivation for students.

The curriculum would not be changed as such, but would rather expand the scope of existing course

materials. The use of telecommunication components would add vitality and motivation to any discipline. One of the most important aspects of telecommunications is that of using Amateur radio in the classroom. The use of Amateur radio, even though not widespread, has been part of the curriculum for many years. The focus has been anything but pen pals. Foreign languages are being studied. Data from science experiences are being compared and analyzed. And students are learning more about themselves by discussing issues important to themselves and others around the world. One such ongoing Amateur radio project is discussing social issues between schools in New York and Hungary. In most cases, education takes far too long to catch up with technology. The use of Amateur radio has been in existence and affordable for more than fifty years. But there are hundreds of schools with Amateur radio sites around the world at the present time. Amateur radio contacts will give students a practical, realistic and personal perspective with which to view everyday life and the world. Dr. John Wollstein, of Teleclass International, stated that "this perspective will be the motivational factor that will create the confidence necessary to become truly educated." [5] It is only by connecting with classrooms, schools, and individuals that students can feel a real sense of global awareness.

With the use of technology as the main focus for instruction, teachers will become facilitators (and knowledge users). As stated earlier, teachers can no longer maintain a classroom with neat rows and where students become deposits of data. Teachers will need to retool their ideas for classroom management. Teachers will become guides for students. Students, in turn, will become 'users' of information. Teachers fall in the same category as students when it comes to the use of telecommunications. The use of such modes of communication as E-mail systems and Amateur radio, affords the teacher a forum for development of added curriculum for the classroom. With the ability of 'downloading' information from a multitude of sources, the teacher adds vast channels of gathering information and dissemination of that information. By telecomputing with other teachers across the nation, a teacher can expand his or her knowledge concerning additional subject areas and also review current teaching techniques. They can have available in their classroom (and home) a complete Library of Congress or a world data base of atmospheric information ready to be used in the classroom. Technology education can never be a stagnant program. Educators will be required to retrain, rethink, and change their mindset.

And what of the menu for telecommunications? The menu provides the way students choose access and in the way teachers use that access. Telecommunications is a variety of platforms for classroom utilization. Choices are based on availability and the knowledge that students will be using a variety of ways to communicate with others in the future.

That availability should include computer and modem, satellite stations, phone, data lines, and Amateur radio sites. Teachers will be agents of change, but students will be empowered to become — knowledge users. [6]

References

1. John H. Gibbons, ed. *Linking for Teaming: a new course for education.* Washington D.C.: Congress of the United States, Office of Technology Assessment, 1989.

2. Fact Sheet, Texas Library Association. 1990.

3. Private conservation with Dr. Alfred Bork. University of North Texas, 1991.

4. Tom Peters. *Thriving on Chaos.* New York: Alfred A. Knopf, 1988.

5. John Wollstein. Teleclass International brochure. 1990.

6. David Moore. Distance Learning keynote speech at Texas Computer Education Association, Corpus Christie Texas, 1991.

OTA Wireless Report Available

Dewayne Hendricks

This is to let you know that the recent Office of Technology Assessment's *Wireless Technologies and the National Information Infrastructure* study has just been posted in electronic form at their WWW site at http://www.ota.gov/. It is available as a text file without the illustrations or as an Adobe Acrobat file with complete illustrations.

You can also ftp the study using the following URL which points to the Acrobat version: ftp://otabbs.ota.gov/pub/pdf/wireless/

This report is a major 290 page study which examines the role that wireless technologies will play in the evolving National Information Infrastructure (NII), and identifies the challenges that policymakers, regulators, and wireless service providers will face as they begin to combine wireless systems with existing wireline networks.

PacComm TNC for the TAPR/AMSAT DSP-93

PacComm announces the availability of a TNC to fit in the TAPR/AMSAT DSP-93. (Note that this is a TNC board only - PacComm is not selling the DSP-93).

This TNC uses the Zilog Z-181 microprocessor which is the same one used on the new PacComm PicoPacket. Contained in this surface mount 100 pin package are a Z-80 CPU, one channel of 8530 SCC, a UART, some parallel I/O lines, and a memory management unit.

The TNC board fits above the upper DSP-93 board, but under the DB25, front panel pot, power input connector, etc. The following items/steps have been taken to allow easy installation and interface to the DSP-93 unit:

» Mounting holes match with DSP-93 boards.
» Spacers are provided. Existing screws are reused.
» The TNC connects to the computer with the DB-25 on the DSP-93 case which formerly was used to connect to a TNC's modem disconnect header.
» A connector on the underside of the TNC mates with the DSP-93 modem disconnect header which formerly was connected to the 25 pin rear panel connector.
» Pins on the underside of the TNC mate with the 4 conductor AC supply connector (J205).

Features

- Easy Installation. The circuit board is the same size as the DSP-93 boards to fit easily into the DSP-93 cabinet.
- Baud rates for all ports are set by software commands. This makes automated DSP-93 operation possible.
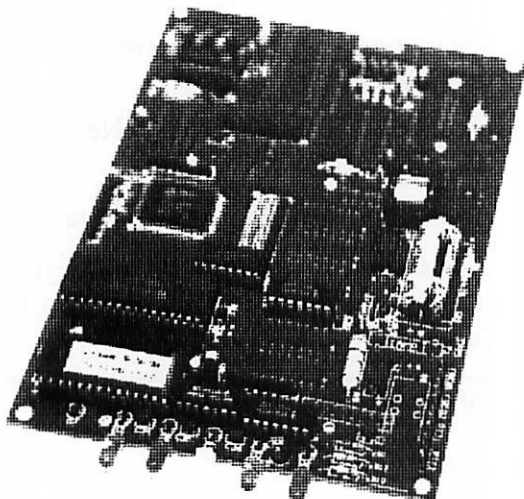
- Baud rates up to 57600 bps are supported.
- The EPROM has KISS mode and all of the 'TAPR' style commands and features. It will NOT run a TNC-2 EPROM since it uses an SCC and not the SIO chip. The code has all the familiar TAPR commands however, and you should not notice the difference.
- A 'pass through' function allows the DSP to be loaded via the TNC's connection to the computer.
- Eight parallel input/output lines are provided for software control of radios, antenna switches, etc. to allow automatic station control.
- The four 'Freq' and 'PTT' lines on the DSP 20 pin modem header each go to a 3 pin header wired so that a 2 pin jumper may be applied to select either pull-up or grounding.
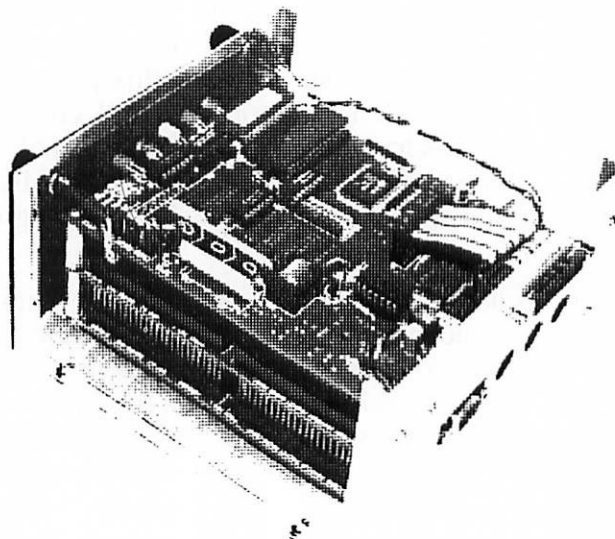- The TNC draws only about 60 mA, and is powered by the DSP-93 power cube.

Installation

Unless you want to have the TNC LEDs visible through the front panel, the TNC can be installed with no soldering and no metal work other than bolting in the spacers and mounting screws.

» The second UART port on the TNC is configured to drive the DSP loading port. This is done by removing the DSP loading port RS-232 chip and plugging in a connector from the TNC.
» A template is provided for drilling holes in the front panel for the DCD PTT, STA, CON, and power LEDs. These LEDs do not interfere with any of the front panel markings.

Ordering Information

- Price: $99 plus shipping of which $10 will be donated to TAPR/AMSAT.
- Includes firmware manual, installation instructions, command reference card, hardware, and drilling template.

PacComm Packet Radio Systems, Inc,
4413 N. Hesperides St, Tampa, FL 33614-7618

Voice: +(813) 874-2980
Facsimile: +(813) 872-8696
BBS: +(813) 874-3078 (V.34)
CompuServe: 76576,2003
Catalogs and Orders: (800) 486-7388
Internet: dsptnc@paccomm.com

New Internet Network Addresses for DRIG

Jeff Wallach

Amateurs who have been using the Dallas Remote Imaging Group FTP site at: ftp.drig.com and the WWW server at: http://www.drig.com/ will notice that the server was unreachable for the week of September 25.

Dallas Remote Imaging Group was notified by our Internet service provider that due to their business 'dispute' with MCI, all of the MCI local loop circuits for the 56 kbps frame-relay routers would be disconnected.

Unfortunately, there was no advance notice from our service provider and the 56 kbps line did indeed go down on September 25, along with over 150 other customer sites!

Dallas Remote Imaging Group has secured another Internet service provider and is switching from a 56 kbps ethernet frame-relay circuit to a 128 kpbs ISDN circuit (two bearer channels). Inbound ftp, WWW, and telnet users should see a marked performance improvement over the 56 kbps network.

Due to the new InterNIC situation, we also had to switch our entire CLASS C IP address range. This means that the IP address for the servers are changing as follows:

Old IP Address	Host Name	New IP Address
204.77.64.2	ftp.drig.com	206.104.84.2
204.77.64.2	www.drig.com	206.104.84.2
204.77.64.208	bbs.drig.com	206.104.84.208

Since the Network IP address range changed to the 206.104.84.XXX network, domain name services will not be active until InterNIC updates their root servers and ISP associated named.host/named.rev files. [This should be done by the time this is published.] If the normal hostnames do not work, then please try the explicit IP addresses of 206.104.84.2 to contact the FTP and WWW servers.

All regular e-mail to members@drig.com will be unaffected by this change, as our MX records are with another provider.

Any questions, please feel free to send e-mail to: jwallach@drig.com or, call the DRIG office at 214-394-7325.

Thanks for your support and interest in the Amateur Space Program.

*** Connect Request

This column is where you can get in touch with other packeteers who may have similar needs or interests. If you have a question about packet radio, or are looking for a particular type of unusual hardware or software, this may be the place for you. Send your requests to TAPR at any of the usual addresses. Also, please help your fellow Amateurs by responding to requests that you know the answer to.

Question:
I'm working with the ARRL's part97.txt (from the ARRL infoserver, and available via oak.oakland.edu:/pub/hamradio/arrl/infoserver/rib/part 97.txt. That file, which says:

Part 97—Amateur Radio Service
(current as of April 26, 1995)

...gives this text for 97.109e

> (e) No station may be automatically controlled while transmitting third-party communications, except a station participating as a forwarding station in a message forwarding system.

While the version dated 11/8/93 says:

> (e) No station may be automatically controlled while transmitting third-party communications, except a station retransmitting digital packet radio communications on the 6 m and shorter wavelength bands. Such stations must be using the American Radio Relay League, Inc. AX. 25 Amateur Packet-Radio Link-Layer Protocol, Version 2.0, October 1984 (or compatible). The retransmitted messages must originate at a station that is being locally or remotely controlled.

Now, if the ARRL's file is accurate, the FCC deleted the AX.25 requirement and nobody told me. I must have had my head stuck in the ground or something.

So, is it true? Can I now start sending raw IP with periodic identification?

Thanks, Bruce, AB6YM

Response:
Yes, the ARRL's file is accurate. This change was part of the message forwarding rules change of last year. To use the correct terminology, [54 FR 39535, Sept. 27, 1989, as amended at 59 FR 18975, Apr. 21, 1994].

I don't know if you saw the FCC Report and Order at that time, but this was all covered there. As to where your head was, well I'll leave all of that to you.

Yup!! You can now start sending raw IP with periodic identification. Let the games begin.

— Dewayne, WA8DZP

Spread Spectrum and the Amateur Radio Service

Dewayne Hendricks WA8DZP

Abstract

This paper reviews the current status from a regulatory perspective of the use of spread spectrum (SS) in both the amateur and commercial services.

Introduction

Back in 1989, Al Broscius, N3FCT, [1] discussed the use of commercially available Part 15 SS devices that were becoming available in the market, for use in the Amateur radio service (ARS) for packet radio operations. He identified several commercial systems that were then available and made the following recommendation:

"To responsibly address this technology, we feel Amateur operators should experiment with the commercial systems now available in establishing long distance communication paths using high-gain antenna systems coupled with the maximum legal power of one watt, determining interference levels seen by weak signal receivers attributable to spread spectrum transmissions, and carefully introducing this technology to computer bulletin board operators who could financially support development of an unlicensed computer Internet."

To the author's knowledge, very little effort has been made by the Amateur radio community to pursue this recommendation. For instance, although there have been reports by various hams of their experiences with such devices on various USENET newsgroups over the last several years, there has been no written report of such experiences in ARS publications such as *QEX*, *PSR* or DCC proceedings. So while there are now millions of SS devices out in the world today in the hands of the average consumer, SS remains an unrealized technology in the world of Amateur radio.

Commercial SS Activities

Since the Broscius article in 1989, there has been a lot of activity in the commercial sector regarding SS. As a result of the request and feedback of many manufacturers of Part 15 devices, the FCC changed the rules in 1990 in order to make it possible to produce devices under Part 15 which could operate at higher data rates, and to close up some of the holes in the previous version of the regulation that had been issued in 1985.

In January, 1991, Apple Computer filed the now famous Data-PCS petition with the FCC which asked for the allocation of 40 MHz in the 1850-1990 MHz band for a new radio service to be used for high-speed, local area network services. Some important points of the petition include:

- be accessible to users of personal computers without imposition of licensing obligations, network connection fees, or air-time charges;
- be open to any computer manufacturer's products and any network access and usage scheme that complies with the regulatory requirements.
- be regulated in a manner that assures non-discriminatory access to assigned frequencies by compatible devices for like purposes; and
- have flexibility built into the initial regulatory scheme to encourage innovation in, and the evolution of, Data-PCS technologies and services.

In 1993, the FCC allocated 20 MHz for this new service, in the 1910-1930 MHz band. In addition, ten additional MHz were allocated this year by the FCC for this service in the 2390-2400 MHz band. Lest you forget, this ten MHz of spectrum is part of the current ARS allocation which runs from 2390-2450 MHz. The ARS was made primary in this band by the FCC and the Data-PCS service now shares this band with the ARS on a secondary non-interference basis.

Finally, Apple Computer, in May 1995, petitioned the FCC for yet another new service called the NII Band (National Information Infrastructure). In this case, they are asking the FCC to:

- allocate for use as part of the NII Band the 5150-5300 MHz band, a shared private-government band that currently is not heavily used within the United States and has been allocated throughout most of Europe for unlicensed wireless local area networks;
- allocate for use as part of the NII Band the 5725-5875 MHz band, a shared private-government band that currently is used by unlicensed Part 15 technologies, industrial, scientific and medical ("ISM") devices, and Amateur radio operators;

This comes to a total of 300 MHz!! Again, lest you forget to notice, about 150 MHz of this is coming out of the ARS allocation at 5.7 GHz. Apple describes the essential characteristics of this new service as follows:

"The NII Band will be fundamentally different from any other wired, licensed-wireless, or unlicensed service. Unlike licensed-wireless services, no single entity will have an exclusive license to provide service using the spectrum. Unlike both licensed-wireless and wired services, availability will not be determined by a service provider's deployment plan or the economics of a fee-for-service offering.

Unlike traditional Part 15 operation, NII Band devices will not have to contend with unpredictable and uncontrollable interference, a host of different devices employing a variety of modulation schemes and power levels, and the continuing threat of giving way to incompatible services.

Unlike Data-PCS offerings, the NII Band will support very high-bandwidth transmissions and communications over longer distances. Unlike the proposed unlicensed bands above 40 GHz, the NII Band will support certain in-building and longer-distance communications that are not feasible using very high frequencies and will be amenable to more rapid product deployment.

The NII Band would promote the full deployment of a National Information Infrastructure ("NII"), extending the effective reach of the NII by making possible high-bandwidth access and interaction throughout a limited geographic area — where mobility is key — both on a peer-to-peer, ad hoc basis, and through wireless local area networks. Moreover, it would provide for unlicensed, wireless, wide area "community networks" connecting communities, schools, and other groups under-served by existing and proposed telecommunications offerings.

The NII Band would advance a host of public policy objectives, including assuring that all segments of society have access to the "information superhighway;" extending advanced telecommunications offerings to schools, libraries, hospitals, and government agencies; and promoting the participation of small businesses, businesses owned by women or minorities, and pioneering firms in tomorrow's telecommunications marketplace."

As you can see this is a very ambitious proposal. If it makes it thru the rulemaking process at the FCC, then in the near future the average consumer will have in their hands communications facilities which will make the current technologies and practices of the ARS look like something from the age of 'spark gap' transmitters. To date, it is estimated that there are about 60 million Part 15 devices out in the world. Of these, about eight million are SS devices. One can expect to see lots of exciting wireless products announced and SS technologies will be a major part of many of these new offerings.

Amateur Radio SS Activities

Little has changed in the Amateur radio service as far as high-speed SS packet radio is concerned in the period since 1989. Most of the commercial SS equipment available today on the market cannot be operated under the current Part 97 rules. One event of note, however, was the publishing by the ARRL of the "Spread Spectrum Sourcebook" [2]. This is an excellent attempt by the League to acquaint the average ham with the technology of spread spectrum. Another excellent reference on packet radio technology and the use of SS appears in [3].

About the time of Apple's Data-PCS petition, Robert Buaas, K6KGS, submitted a request for an STA (Special Temporary Authorization) to amend Part 97 to allow relaxed usage of SS technology in the ARS. Buaas' request was granted by the FCC in 1992 and he was awarded an STA that had been renewed several times and remains in effect as of today. There is a recent *QEX* article which covers the STA and SS technology [4]. An earlier *QEX* article which describes the STA appears in [5].

Since the original STA was granted, Buaas and the other hams who are authorized to experiment under the STA have performed many experiments using SS technology both with existing Part 15 SS devices and homebrew hardware that was developed for the purpose of the experiments. This work formed the basis for the ARRL Board of Directors to pass a motion in January, 1994 to have their counsel submit to the FCC a petition for rulemaking to modify the SS rules in Part 97. Nothing was filed with the Commission in 1994, however the League's Board reaffirmed its decision this year at their January meeting. At this time, the author can report that both the League and TAPR will be submitting petitions for rulemaking to the FCC to change the SS rules. This filing will be the joint effort of both organizations during the past year to come up with a set of rule changes which will allow the Amateur community to make the most effective use of SS technology in the ARS.

Future issues of *PSR* will provide more information on the petitions and how they are moving thru the formal rulemaking process. In addition, in the coming year TAPR will be launching an initiative to better acquaint the average ham with this technology and make it possible for him to experiment with it thru the availability of new hardware.

To sum up, the ARS has a lot of catching up to do with the commercial sector in this area. SS technology is not magic and is by no means the solution to all of the world's problems. However, it can make possible some new avenues for the deployment and availability of high-speed packet radio systems to the Amateur radio community in the future.

References

[1] Broscius, A. "License-Free Spread Spectrum Packet Radio," 8th ARRL Computer Networking Conference Proceedings, p.16 [1989]

[2] American Radio Relay League "Spread Spectrum Sourcebook," ARRL, [1991]

[3] Lynch, C.A. and Brownrigg, E.B. "Packet Radio Networks - Architectures, Protocols, Technologies and Applications," Pergamon Press [1987]

[4] Price, H. "Digital Communications", *QEX*, p. 22 June, [1995]

[5] Rinaldo, P. "CDMA Spread Spectrum STA", *QEX*, p. 2 June, [1992]

APRS at the Marine Corps Marathon 1995

Bob Bruninga, WB4APR
bruninga@nadn.navy.mil

This year we had fewer GPS trackers and relied almost entirely on the Dead Reckoning features in APRSdr.EXE. This program can dead reckon objects along the marathon route without operator intervention except when needed to correct for long term drift between the runner and the Dead Reckoned object. The lead runner goes about 9 Knots and the tail goes about 4 Knots. Also, these tracks DO follow the exact course, where GPS vehicles often do NOT reflect the real path of the runner (where vehicles are not allowed). We also DR'ed the lead Handicapped, Woman, Special-Olympics and PACK.

Master-Slave

This year we also operated three 486 color laptops and two larger VGA displays all connected to the single APRS TNC. Only one laptop was operated by the APRS operator as master, and all other laptops were placed in slave mode in front of the other voice net controllers, so they could independently zoom in to areas of their immediate interest. If we had had more VGA monitors, each laptop could have also driven an extra large display. The small size of the laptops fit unobtrusively at the operating positions.

Impressions

This year was dissappointing compared to last. The 70 + hams who have been the ONLY dispatch authority for the last 18 years and who had always done an OUTSTANDING job, were surprised when they started directing ambulances and found they were already moving under other authority. Apparently, with the new 800 MHz radios out there, the variety of ambulance companies could ALL communicate with the County dispatcher. In the past, each ambulance company had their own radios and could NOT communicate except via a HAM rider. This year, not one general, doctor, or person in distress ever popped into our tent to get the latest (a CONSTANT occurrence in the past). Even the Marine Corps had cute little commercial HTs instead of the hoot-n-holler field phones they used up to last year!

Overnight the hams slid from heroes to a footnote... The mood in Net control was gloomy.

What this tells me, is that technology moves on... Hams have always prided themselves on their emergency response, primarily because of their frequency agility. But with programmable radios EVERYWHERE, the hams no longer have an edge. We have had programmable HTs for 15 years. Now that everyone else has them, what NEW capability can ham radio bring to such an event?

How about APRS?

Good question. But how many years will it be until most hams that get out there at 4 AM will trade in their Commodore 64s? We had only 5 GPS trackers show up this year versus 11 last year, and fewer than a handful of APRS operators. With my 6 screens, it still looked impressive in Net Control, and the one screen we placed in the Marine Corps tent had a Lieutennant GLUED to it the whole event as if it were a crystal ball... but it was a façade. I was the only operator that had ever touched APRS. (The other few APRS operators were out on the road). We just haven't gotten the attention of the emergency response hams in the area.

I do not solicit APRS for these local groups since that would appear to be a conflict of interest for me, but in those area where at least ONE person on the INSIDE of the EMERGENCY COMMS. groups has gotten turned-on to APRS, there seems to be a lot more success. But I still have not seen any APRS articles in the major ARES publications.

Get those operators TRAINED. With a multiple screen setup, you only need ONE good APRS operator at the master, but everyone in the emergency response team, should be familiar with the basic CURSOR, ZOOM and MAP display. The P and L list also comes in handy. Good luck guys!

Online Index for Conference Proceedings

TAPR is proud to announce the creation of ARRL Amateur Radio Computer Networking Conference and Digital Communications Conference Index and Abstracts (Web Pages).

Abstracts from all thirteen ARRL CNC/DCC proceedings can be viewed from either the Packet Radio Page, Virtual Library, or via the TAPR Page, (Products, Publications area).

The direct link is:
http://www.tapr.org/tapr/html/cncindex.html

This page has links to all 13 proceedings with abstracts from all the articles. Search capability is in the works.

If you have proceedings articles available on the Internet, please contact TAPR about generating a link from the abstract pages to your pages.

Silent Key: KD5SL

Adam Tate, AB5PO

Shelton, KD5SL, passed away sometime between August 4 and 6, 1995. The exact cause of his death is currently unknown, but Milton, KA5JPH, reports that he died while napping in his chair, evidently a peaceful passing. Hams suspected that something wasn't right when Shelton failed to show up for the 9:00 pm net Sunday on 145.49 repeater. After playing the Newsline and taking check-ins to the net, Gary, KC5BMA, drove over to Shelton's house. After receiving no answer to his knocks at the door, he called Robert, Shelton's younger son, who entered the house.

KD5SL's life was marked by many interesting experiences. He studied Chemical Engineering at LSU during the late 30s and early 40s. He then joined the U.S. Navy, serving as an Ensign and attending radar and electronics school at Harvard and MIT. After obtaining his J.D. degree, he worked for the Navy as a civilian, then before the U.S. Patent Office as a patent attorney for Ethyl Corporation. My recollection is that he settled in Baton Rouge in the early 1960s.

Having already been active in CB radio, Shelton obtained his first ham license in 1979. He served as president of the Baton Rouge Amateur Radio Club (BRARC) in 1983, then went on to found RASC, the Radio Amateur Service Club, in 1984. In 1986 he began work with packet, then, the newest mode in ham radio, and started Baton Rouge's first packet BBS. Over the years he built BTR's packet facilities to be the best in Louisiana and among the best in the country, including nodes/digipeaters on 145.01, 145.07, 145.09, and 446.1 MHz, and his ever-growing packet BBS with forwarding facilities on 15, 20, and 30 meters. Beginning in 1992, he maintained a telephone BBS which at one time included more than 10 CD-ROMs online. Last but certainly not least, he built and maintained the 145.49 repeater since the founding of RASC.

KD5SL was also well-known for his activities in public service. In the four years that I have known him I have seen him work countless balloon championships, road races, hurricane shelters, Senior and Special Olympics, LPB telethons, outdoor concerts... the list goes on. His dedication to public service in Baton Rouge will probably be his most-missed quality.

Shelton was known to all of us as a powerful and sometimes stubborn leader, but there was never any doubt that he could get any job done. When I first discovered ham radio in 1991, Shelton was my first contact/Elmer, and I soon discovered that he never missed the chance to help out another young person in ham radio. Instead of brushing off the company of youths, he recognized their contributions to this hobby, and treated them as he would his own friends. He will be sorely missed.

```
/*****************************************************
 crc16.c - A "low calorie" method of calculating
 16 bit CRC, as opposed to the (high calorie)
 table driven versions.  Less filling, taste great.
 ****************************************************/

crc16(s, n) /* return CRC16 for n chars in string s */
unsigned char *s;
unsigned int n;
{
    register unsigned short crc, x6, x7;
    register short i, x, p;

    crc = 0;

    for (i = 0; i < n; ++i)
    {
        x7 = (x6 = (x = (crc & 0xFF) ^ s[i]) << 6) << 1;
        p = (x >> 4) ^ x;
        p = (p >> 2) ^ p;
        p = -(((p >> 1) ^ p) & 1);
        crc = (crc >> 8) ^ (p & 0xC001) ^ x7 ^ x6;
    }
    return(crc);
}
```

CRC Errata

Joe Travis
n6ypc@adnc.com

I just got through reading the summer issue of the *PSR* and wanted to notify you of a typo in one of the articles. Actually, it is in the "C" code for calculating 16-bit CRC which appears on page 15. Near the bottom of the page, the two 'for' statements read as:
```
for (i = 0; i  256; i++)
for (j = 0; j  8; j++)
```
they should be corrected to read as:
```
for (i = 0; i < 256; i++)
for (j = 0; j < 8; j++)
```
And in case anyone is really interested, I'm including a listing which is a more efficient method (in memory usage) for calculating a 16-bit CRC. I can't take credit for the source on this one and unfortunately the original author is unknown.

HF-SIG

Johan Forrer, KC7WW

Several noteworthy achievements are of interest for this issue.

1. High Speed HF modem developments.
2. Initial test results for the high speed HF modem.
3. DSP developments.
4. HFSIG activities at the DCC.

Those that may have monitored traffic on HF-SIG, have noticed that two "new" HF modems are under development. One approach, being developed by Pawel Jalocha (SP9VRC), is based on orthogonal frequency division multiplexing (OFDM), or simply known as a parallel tone, or multiple carrier modem. The objective for this development is to enable the transmission of simultaneous streams of data, in fact, multiple data bits within each baud. Error-control coding combats the nasty nature of the HF channel, such as fading, multipath, QRM, and QRN.

A second approach being worked on is based on multiple frequency shift keying, MFSK. The objective for this approach is to achieve communications in adverse conditions, typically with very low signal levels, or in situations of drastic QRN or QRM. In this case, very low data rates are used in conjunction with special signal detection methods. Here "slow data transmission is better than no transmission at all."

Note that both these systems rely very heavily on DSP hardware and software. In addition, wider than the usual CW bandwidths are employed.

High Speed HF modem developments

(Thanks to Pawel, SP9VRC for this summary).

Here is a short summary to keep everybody informed about the multi-tone DQPSK modem. The modem has evolved to the following configuration:

Modulation type: There are 15 tones ranging from 750 to 2500 Hz spaced 125 Hz. Each tone is modulated with DQPSK (four states = 2 bits/symbol) at 83.33 symbols/second. Raw data rate is 2500 bps.

Peak to RMS ratio (crest factor): Not very good... about 4.0

Frequency error correction: The receiver can correct a frequency error of up to +/- 60 Hz. There are outputs provided for steering the transceiver's UP and DOWN buttons for automatic frequency error correction.

Forward error correction: What is implemented now is basically a block-type FEC with the block size of 15 bits. Every bit of a given block is transmitted on a different carrier. The intention is that a selective fading/interference would affect least amount of bits in a block. The bits of one block can be all transmitted at one time or they can be spread out in time by an arbitrary factor. This feature helps to recover burst errors if at one time all carriers get wiped out by a spark or a lighting discharge.

The FEC schemes are:

Scheme #0: No FEC, effective data rate is 2500 bps.

Scheme #1: 11 "real" data bits + 4 CRC bits form a 15-bit block. The receiver can correct one flipped bit per 15-bit block. Effective data rate is 2500*11/15 = 1833.33 bps

Scheme #3: 5 data bits are mapped into a 15-bit codeword from a set of 32 codewords with the hamming distance greater than 7 be-

tween each two selected from the set. These are actually Walsh functions. The receiver can correct up to three flipped bits per 15-bit block. Effective data is 2500*5/15 = 833.33 bps

Hardware platform: The code is being developed on a DSPCARD4 by ALEFNUL (credits here to Jarkko Vuori, OH2LNS, and Kaj Wiik, OH6EH) but it runs as good on the EVM56002 from Motorola (thanks to Johan Forrer, KC7WW, who ported the DSPCARD4's basic system).

Communication protocol: The modem understands KISS, thus it is oriented towards sending frames. These can be AX.25 frames but in principle there is no real limit here, as KISS can carry any frame.

Initial test results for the high speed HF modem

Some real on-air tests have been done already by Timo Sivula and Joni Becklund, OH2NJR, on a short (10-15 km) HF range. AX.25 protocol was used. The result... well, the modem works, especially when you use the FEC scheme #3. There are certainly troubles and they concentrate around the tranceiver's passbands and driving levels.

Future plans:
- Double the number of carriers and then I can use the block size of 60 bits which is suitable for RS codes with 4-bit symbols. The alternative is to add a block-sync sequence and then you can use FEC with any block size.
- Use longer FFT and better window to make the symbols "narrower" in frequency. The ones I use now have significant sidelobes.

It would certainly be helpful to have more testers, thus anybody willing to join please join in! You

need a shortwave tranceiver, a PC, and a DSPCARD4 or an EVM56K. -Pawel, SP9VRC.

Congratulations to Joni and Timo for being the first to log a QSO with this modem. For those interested in the Motorola DSP module used for these experiments, please see my article in QEX, August 1995. The software is available in the HF-SIG program library: ftp.tapr.org/tapr/SIG/hfsig/upload/evm56k1c.zip.

DSP developments

Those that have been following Intel's native signal processing (NSP) public relations efforts challenging the future of DSP chips, may be pleasantly surprised to hear about Phil Karn's latest experiments using a 90 MHz Pentium processor. Phil already achieves 256-point floating point FFTs on the order of 320 microseconds. This already is quite realistic for several DSP applications. We are following this development with great interest.

HF-SIG activities at the DCC

The DCC this year was buzzing with activities. Two outstanding workshops, excellent papers, and interesting talks on Amateur radio networking infrastructure developments, future satellites, and other digital issues made it a busy time. In addition, meeting old friends and the opportunity to make new ones is always enjoyable. Not to mention the informal discussions over a beer late at night, listening to exciting things taking place. Unfortunately, a significant proportion of happenings never make it into the proceedings, so it made the extra effort to be there all that much more worthwhile.

The "HF issues" session and Phase3D talk unfortunately ran parallel - we missed a couple of good participants, and I would have loved

hearing Bdale Garbee's talk. Anyway, we had excellent participation on important HF digital issues. I gave brief overviews on the status of the HF channel simulator, Adrians's MFSK, and Pawel's OFDM modems. The HF ionospheric simulator work appears to be of some interest and a few moments was spent on that. Paul Rinaldo, W4RI, brought up an interesting idea - how to evaluate adjacent channel interference. The Watterson model, for example, only deals with the variations due to the ionosphere. It would be interesting to have some means for evaluating different situations due to other nearby digital transmissions. Phil Karn's progress on Pentium-powered DSP was noteworthy and stirred interest - that would be an interesting one to watch in future. This was followed by a lively discussion on FCC regulations and the future of using our proposed multi-tone HF modems. It appears that it would be possible to obtain either STA or experimental licenses to experiment. Paul kindly offered to help looking into this.

What helped promote our ideas a bit, was the live demo that we put on afterwards. Walt, K5YFW, brought his computer that we set up to give folks the opportunity to see Pawel's 15-carrier modem in operation. Some mentioned that the audio has a striking likeness to 300 baud HF packet. Many would be fooled into thinking that it was indeed packet - this is because it does not sound like a wideband signal at all. I suspect that a demo such as this may win many over. We also played with the DSP sound card and played with Adrian's, G4ZHZ, signal processing software. I think he did a very nice job to package several really nice functions, i.e., several CW filters and others for SSB, RTTY, and FAX. This also includes a Hilbert ısform with which one could sliae the output audio pitch to wherever audio

frequency you wanted, kind of like a digital BFO. I played some audio from a cassette tape and the ability to shift audio in this manner without clicks, pops or other artifacts, is really amazing - all made possible by DSP.

Late breaking news

Chris Imlay, N3AKD, who is in Washington, D.C., informed me that he and Paul Rinaldo, the ARRL's liason with the FCC, checked the most recent FCC regulations and found no reason why we could not use our multitone modems on HF, except for unattended operations, where there now is a 500 Hz bandwith restriction.

This is good news. I take it from this good authority then that we can conduct our experiments on an international basis, something that would not have been possible with either an STA or experimental license.

We are indeed greatful for Paul and Chris' interest and assistance in this regard.

Anyone interested in participating in some local trials with the new modem? All that is needed is a 386/486 computer running NOS, the Motorola EVM, a rather simple PTT interface, and an appropiate cable to connect your SSB transceiver to the EVM. The August QEX contains a description of the DSP56002EVM with references to the location of the program code and interface schematics. Let me know if I can be of further assistance.

DSP-93 Kit Orders

TAPR will be taking orders until the middle of January for the next batch of TAPR/AMSAT DSP-93 kits. The number of parts ordered will be determined by the number of kit orders received by that time. Order by January to get your kit this spring!

DSP-93 SIG

Ron Parsons, W5RKN
rparsons@bga.com

Activity in the DSP-93 SIG has remained high since the Summer 1995 PSR. There were several DSP-93 related papers at the 1995 ARRL Digital Communications Conference in early September. There were two papers on programming the DSP-93 (Parsons, et al. and Perkins) as well as a general update paper on the project (Jones, et al.).

Several new and enhanced modems for the DSP-93 have been released as well as a version of the W9GR-like audio processing software. The latter provides both a command line interface to control the audio processing as well as a Windows user interface. The Windows program will not only control the audio processing parameters of the DSP-93 but also provides named settings so the operator may save (for later retrieval) the settings he has found useful for a particular function.

Many of the kits from the June production run are now reported up and running and in service. The number of "help calls" on the dsp-93 listserver has dwindled to a very slow trickle. I hope this "no news" indicates "good news."

Several users have expressed interested in supporting the DSP-93 under Linux. A loader has been contributed to the DSP-93 library.

Two TNCs that will fit into the DSP-93s case have been announced. The first to hit the street will probably be the one from PacComm. Its price is $99 plus shipping of which $10 gets donated to TAPR. Contact PacComm for more details. The TAPR project TNC-95 is also making progress.

Gear for Starting a Satellite Station

Walter K. Daniel, KE3HP

Here are two approaches for starting a satellite station based on my experience of the past few years. Perhaps the most important beginning point is reading The Satellite Experimenter's Handbook (TSEH) from the ARRL.

1. Digital satellite reception, spacecraft telemetry

If you are mostly interested in receiving information from digital satellites, you can easily begin with DOVE (DO-17). The gear needed for DOVE will also allow you to receive SAREX, Mir, and AO-21 transmissions. Transmitting to the Shuttle or Mir is possible if you don't mind odd hours or if you invest in a beam antenna (see "You, too, can contact space!" by Michael Bass N7WLC/5 in the May/June 1993 issue of The AMSAT Journal).

The three components you need are a 2m FM transceiver, a 2m antenna, and a packet terminal node controller or TNC. I started off with an HT (Kenwood TH- 27A, about $300 new), but any decent 2m FM rig will work. Start with an omnidirectional antenna such as a quarter-wave ground plane. You can build one (see TSEH for details) or buy one such as the MFJ-1740 for about $13. My first TNC was a PacComm HandiPacket portable, but any VHF TNC such as the MFJ- 1270 (about $120) is fine. Of course, you need a computer to use with the TNC.

DOVE transmits packet telemetry and messages on 145.825 MHz. You can also receive traffic from the Mir packet mailbox on 145.55 MHz. In recent years, the cosmonauts haven't been using voice much, but you're suitably equipped if they do. The Shuttle sometimes carries SAREX (Shuttle Amateur Radio Experiment) and can transmit packet or voice on 145.55 MHz. In addition to its FM repeater and digital voice downlinks, AO-21 has been transmitting some packet telemetry on 145.987 MHz recently. Finally, you can also work terrestrial packet and 2m voice for repeaters and nets.

If your long-term goal is to work the Pacsats, you can plan ahead for 9600 bps FSK operations. Some of the new FM rigs have 9600 bps modem connectors so you don't have to perform surgery on the radio. You can buy a PacComm TNC with the 9600 bps modem installed for a bit over $200, not too much more than the cost of a TNC. The versatile DSP boxes cost much more, but offer capabilites to work many digital modes including 9600 bps FSK.

2. Analog (Voice and CW) operation

If you are mostly interested in speaking to or exchanging CW with other hams, try RS-10 Mode A and/or RS-12 Mode K. For more details, see my article "Getting Started with RS-10" in the August 1993 QST or the article by Robert Capon WA3ULH "Working Satellite RS-12..." in the February 1994 QST.

For reception of either satellite, any HF or 10m rig will work. I have a used Uniden HR-2600, but you can still buy them new for $200. A 10m dipole antenna works well — build your own or buy one (about $20). To transmit to RS-10, you need a 2m rig with CW and USB modes. These rigs are not as common as FM rigs and cost a bit more. My Kenwood TR-751A cost about $600 new. To transmit to RS-12, you need to use the 15m band. The RS-12 transponder input lies in the Advanced/Extra class subbands, so make sure you have the privileges before you transmit.

The RS-10 CW beacon at 29.357 MHz is strong. The RS-12 CW beacon is also strong at 29.408 MHz. Operation on these satellites is full duplex (you hear yourself from the satellite), so headphones are necessary. If you have a 2m multimode rig like I do, you can work other non-satellite modes: 10m voice or CW, 2m FM voice for nets and repeaters, 2m terrestrial packet with a TNC, and terrestrial 2m SSB or CW weak-signal operation.

The addition of a 70cm antenna ($60 for a small yagi) and a 70cm-to-10m downconverter (about $100) will turn a Mode A station into a Mode JA station. The only satellite currently operating JA is FO-20, but Phase 3D will likely spend some time in this mode. The addition of a PSK modem (about $200) and TNC ($120) brings Mode JD capability for the 1200 bps Pacsats. Alternatives include the combined PacComm TNC/PSK modem (about $270) or a DSP box.

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'

ARRL and TAPR Digital Communications Conference

The following is the proposal that was submitted to the ARRL for consideration that led to the creation of the ARRL and TAPR Digital Communications Conference. The result of this proposal and later effort from both organizations ended with an agreement which should be signed by the time of this publication. There will be a lot of work in the next few months getting the 1996 ARRL and TAPR DCC meeting scheduled and also getting the Joint Conference Committee organized and functioning. Currently the 1996 ARRL and TAPR DCC is scheduled to be held in the Western U.S. sometime in September, 1996. There are already organizations lining up to host the conference after 1996, which was one of the goals. There should be full information available regarding dates and location in the next issue of the *PSR*.

This does mean that there will not be a TAPR Annual General Meeting in the spring. This fact was taken into consideration by the TAPR board when originally discussing the proposal. The board felt that by having the combined meeting in the Fall and our activities during Dayton in the spring, this gives TAPR two major events a year to coordinate and provide a nexus for members to attend.

Here is the proposal. Take a read. If you have questions, either Keith or Greg are glad to discuss any of the issues.

Proposal for the Merging of the ARRL Digital Communications Conference and Tucson Amateur Packet Radio Annual Meeting.

Proposal:
TAPR proposes that the TAPR Annual Meeting and the ARRL Digital Communications Conference be combined into a single yearly event called the "ARRL and TAPR Digital Communications Conference".

Rationale:
TAPR believes that this joint conference agreement will be of mutual benefit to both organizations and to the Amateur public we serve.

In the early days of Amateur digital communications, it made sense for TAPR to run its own annual meeting, a small affair concentrating on TAPR projects, where project developers could report on progress and discuss about the best way to do things. Three years ago, TAPR made a deliberate decision to move away from its old focus and towards an organization which would serve a broader audience of Amateurs involved in digital communication, and would encourage active participation by this wider group in the affairs of the organization.

During those early years, it also made sense for ARRL to sponsor the Computer Networking Conferences, in order to nurture the development of digital Amateur communication technology during its fledgling period.

Now, with the recent changes within TAPR and the maturation of Amateur digital communication, TAPR believes these two conferences should be combined into a single yearly event. This belief is reinforced by the burgeoning cost of attending conferences and the growing efficacy of electronic communication. While the in-person contact provided by a conference is crucial in establishing relationships, we now see that much of our day-to-day "business" is efficiently carried out via electronic means. Thus, conferences, while still important, can come at less frequent intervals.

More specifically, the joint conference agreement will produce these benefits:

1. The Amateur digital community will focus on just a single event, where the very best papers will be presented. The proceedings should be even better than those of either of the two individual meetings.

2. With additional assistance from TAPR, the organizational burden on regional organizations that have not had experience in running a national conference will be relieved. This should enhance the consistency of the conference, thus heightening the level of quality.

3. Travel costs are reduced for those folks who would otherwise be attending both meetings.

4. With a larger group of attendees, we will gain economy of scale and be able to present more variety of workshops, invited speakers, etc.

Mission:
TAPR believes that the conferences should foster a broader perspective on digital communication than they have at times in the past. TAPR's foundation has of course been in packet, but the future promises a much broader view of digital communication than that. We see the need to encourage papers on other modes such as digital voice and television. We also need to encourage more international participation and involvement by regional organizations, as well as by other technical organizations. In other words, this conference should grow to include the widest possible

participation by those who can benefit from it and contribute to it. Part of the charge of the co-management team (see below) should be to foster this broadened mission of the conference.

Co-Management Team:

The co-management team (Joint Conference Officers) will maintain an overview of the conference and give general direction for the future. It will consist of one representative from TAPR and one from ARRL. In addition to serving as liaison to the two organizations, it will select members for the yearly conference planning and management committee (the Conference Committee). The two members of the co-management team will also serve on the Conference Committee. This team also confers with the Board of Directors of TAPR and the ARRL in selecting the meeting site and conference local host organization. It also recommends a yearly budget to the parent organizations.

Conference Committee:

The Conference Committee is responsible for the detailed organization and execution of the conference. It coordinates logistics with the local host organization, plans the program, orders advertising and manages promotional efforts, solicits papers, coordinates with contributing organizations, solicits attendance by vendors, etc. It is envisioned that several members on this committee will serve for multiple years, thus giving continuity to the committee. The TAPR Treasurer or TAPR Executive Committee, if the Treasurer is not available, will approve any expenditures by the Conference Committee as well as approve any contracts regarding the conference before being signed.

Proceedings:

The ARRL will continue to publish the conference proceedings. ARRL does an excellent job in publications. TAPR will provide whatever technical assistance is called for.

There has been some discussion of refereeing the proceedings. We do not believe this is needed at this time, although we do not rule out the possibility in the future. We are Amateurs, after all, and do not expect perfection from our cohorts. Proceedings will continue to be used as a means to determine presentation order and time.

Time/Place:

The meeting will cycle through eastern, central, and western U.S. cities in successive years. Criteria for selection will include interest by regional or local groups, convenient low-cost air service, and reasonable hotel rates. We believe this is needed in order to build both the local and national attendance important to the success of the meetings. Since most Amateurs pay their own way out-of-pocket, or with frequent-flier miles, we need to ensure good air access by major carriers.

The conference should continue to be held in the early fall. This gives some breathing space after Dayton, avoids family holidays, and keeps the spring open for regional conferences.

Several cities in the Western U.S. are being considered as the site for the 1996 conference. It was last held in the western US in 1991. RATS and NEDA are interested in hosting the DCC on the East coast in 1997 and a Chicago digital group is interested in 1998. These sites would begin the movement pattern as outlined above.

Trial Conference Term:

TAPR proposes to combine the two conference for 1996, 1997, and 1998 on a trial basis. In the spring of 1998, the two organizations will evaluate the experience and decide whether to continue the arrangement or return to separate conferences beginning in 1999.

TAPR respectfully submits this proposal for the consideration of the ARRL Board of Directors.

Sincerely,
Greg Jones, WD5IVD,
    President, TAPR
Keith Justice, KF7TP,
    TAPR Annual Meeting Committee Chair

Kitting Location Change

PackIt, Inc. informed TAPR that it would no longer be able to provide kitting operations. PackIt has been doing kits for TAPR since the early days of the organization. We have a new location in Florida going on-line. Barefoot Trading Company, in Cape Canaveral, will be providing TAPR with space for its kitting operations. This changeover has left us with a shortage of kits — while the inventory is being packed, shipped, and prepared at the new location for kitting. We should have kit inventories back up to normal some time by the end of October or the first of November. We look forward to this new relationship and hope that it continues for a long time. Many thanks to Heather Johnson, in Tucson, who helped with the transition, and continues to be a big help when the call comes for volunteers!

Packet Radio Web Page Facelift

The packet radio web page (http://www.tapr.org/tapr/html/pkt home.html) has been changed to make finding things a little quicker. Check out the packet radio bibliography and other items. Two basic articles on Packet Radio are available for the beginner. Also be sure to check out the Real Audio on the TAPR home page.

Goldberg, Godles, Wiener & Wright

TAPR is pleased to announce that it has retained the firm of Goldberg, Godles, Wiener & Wright to serve as counsel with respect to matters before the Federal Communications Commission affecting the interests of the Amateur radio service, particularly with respect to digital communications.

TAPR's FCC Regulatory Committee, chaired by Dewayne Hendricks, WA8DZP, will be the main contact with the law firm regarding pending issues — after such issues have been resolved by the TAPR Board of Directors.

Currently, the Amateur spread spectrum issues are being handled.

We are fortunate to have a legal firm of this caliber representing our interests in the FCC arena and look forward to important issues being taken up by the TAPR FCC Regulatory Committee in the future with regards to digital issues.

Office Hours during Holiday Period

The TAPR office will be closed from December 18th, 1995 to January 15th, 1996. Thus the last day of office hours is December 15th with the office reopening on January 16th, 1996.

Software Librarian

TAPR will be accepting applications from interested individuals wanting to take over as software librarian. Bob Nielsen, N6SWE, is stepping down from the position. Bob has been instrumental in the growth of the software_lib on Internet. While you might think that the position is all fun, there is a lot of hidden work involved. Maintaining the Internet software_lib area is only one aspect of the software librarian. Contact the TAPR office if you are interested (email tapr@tapr.org) and the selection committee reviewing the position will get in touch with everyone interested.

TAPR Software Library
Current as of 12 October 1995.
Items with ** notation have been updated since the last listing in *PSR*. Disk numbers listed with an "A" are two-disk sets. All ftp filenames listed below should be preceeded with "/tapr/software_lib".

Disk No.	Name	Version	ftp Filename
1.	APLINK	Ver. 7.01	/bbs/apl701.exe
2.	AA4RE BBS	Ver. 2.12	/bbs/bb212.zip
3.	CBBS	Ver. 7.30	/bbs/cbbs73.zip
4.	EZPAC	Ver. 1.1	/misc/ezpac11.zip
5.	MONAX		/misc/monax.zip
	PRAFFIC	Ver. 2.05E**	/misc/praf205e.zip
	PACKHACK	Ver. 8**	/misc/phack8.zip
6.	Ham Comm	Ver. 3.08	/misc/hco308.zip
7.	TNC-2 Manual and EPROMs	Ver. 1.18A	/tnc/eproms.exe
			/tnc/hostmode.exe
			/tnc/tncdocs.exe
8.	Text conversion Utilities		
	7PLUS	Ver. 2.02	/utils/7plus20.exe
	LHA	Ver. 2.11	/utils/lha211.exe
	PKARC	Ver. 3.6	/utils/pk36.exe
	PKZIP/PKUNZIP	Ver. 2.04G	/utils/pkz204g.zip
	R95	Ver. 4.0	/utils/r9540.exe
	UUENCODE/UUDECODE	Ver. 5.40**	/utils/uuexe540.exe
	ZOO	Ver. 2.10	/utils/zoo21.exe
9.	ROSERVER PRMBS	Ver. 1.73	/bbs/rsvr173.zip
10.	ROSE X.25 SWITCH	Ver. 3.7**	/switch/rzsw37.zip
			/switch/rswd33.zip
11.	KA9Q NET	Ver. K36**	
	Executable and Documentation		/tcpip/netk36ex.zip
	Source Code		/tcpip/netk36sr.zip
12.	WXN Weather Svr.	Ver. 5.11	/misc/wxn511.zip
13.	TNC1 CODE & TNC2 Notes		/tnc/tnc1src.zip
			/tnc/tnc2not.zip
14.	WINLINK	Ver. 1.2	/bbs/wnlink12.zip
15.	WA7MBL BBS	Ver. 5.14	/bbs/mbl514.zip

16.	W0RLI BBS	Ver. 18.05	/bbs/rli1805.exe
17.	YAPP	Ver. 2.0	/terminal/yapp.zip
18.	INTRO TO TCP/IP		/tcpip/tcpintro.zip
19.	LAN-LINK	Ver. 2.32	/terminal/ll232.zip
20.	ARESDATA	Ver. 1.6	/misc/aresdata.zip
21A.	MSYS	Ver. 1.18	/bbs/msys118.zip
22.	G8BPQ NODE	Ver. 4.08a	/switch/bpq408a.zip
23.	Utilities now on disk #8		
24.	THS	Ver. 2.50	/terminal/ths.zip
25.	VE4UB NTS	Ver. 091891	/misc/ntsve4ub.exe
26.	NM1D DOSGATE	Ver. 1.14	/misc/dosgate.zip
27.	SV7AIZ BBS	Ver. 4.51	/bbs/aiz451.exe
28.	TEXNET	Ver. 1.6	/switch/tprs16.zip1
29.	Intro To Packet Radio, A Tutorial	06-16-95	/misc/intropkt.zip
30.	MICROSAT Ground-station Software		/sat/microsat.zip
	PB	04-30-92	
	PG	02-25-92	
	PFHADD	03-24-92	
	PHS	12-21-90	
31.	No Longer Available (see 38)		
32.	PAMS-Personal AMTOR Mailbox	Ver. 2.09	/bbs/pams209.zip
33.	TNC-2 Z-80 Monitor	Ver. 2.00	/tnc/monz80.zip
34.	GIL (Graphics Interchange Lang.)	Ver. 1.03	/misc/gil1-03.zip
35A.	PAKET	Ver. 6.1	/terminal/paket61.zi
36A.	F6FBB BBS	Ver. 5.15	/bbs/f6fbb515.zip
37.	TPK	Ver. 1.82	/terminal/tpk182.zip
38.	JNOS (Executables, docs.)	Ver. 1.10L**	/tcpip/jnos110l.exe
			/tcpip/docs110l.zip
39A.	JNOS (Source Code for 38)	Ver. 1.10L**	/tcpip/jn110l.zip
40.	SP Packet	Ver. 6.50	/terminal/sp650.exe
41.	TAPR Deviation Meter Source and Tools		/misc/devmtr.zip
42.	PCTOR/PC-PACTOR	Ver. 3.02	/terminal/pctor302.zi
43.	METCON ROM Code	Ver. 1.07	/misc/metcon.zip

Orders for any of the above disks should be sent to the TAPR office. New submissions or updates should be sent to the software librarian c/o the TAPR office.

Software Library Descriptions

In addition to supplying various kits and firmware, TAPR maintains a library of packet radio-related computer software. This software is available by anonymous ftp from ftp.tapr.org, and from the TAPR office on disk (see order form).

Additions to the software library are always welcome, however we do request that they be submitted either by, or with the expressed permission of, the author. TAPR attempts to provide the latest versions of all software; updates are appreciated. TAPR reserves the right to screen any submissions and restrict the library content as necessary. Both freeware and shareware are acceptable.

Orders, new submissions, or updates to the TAPR software library should be sent to the TAPR office. Software may also be uploaded to the /tapr/software_lib/UPLOAD directory. Please read the README file in that area. Please direct any questions to softlib@tapr.org.

The following is a brief description of the current listings in the TAPR software library:

1. APLINK - A concurrent AMTOR MBO and packet BBS system by Victor D. Poor, W5SMM.
2. BB - A multiconnect packet mailbox program by Roy Engehausen, AA4RE. Requires the use of AEA or WA8DED host mode or G8BPQ switch software for operation.
3. C-BBS - Packet BBS program written in C language. Originally written by Hank Oredson, WRLI, current version by K3RLI and AG3F.
4. EZPAC11 - A menu-driven NTS message formatter by Mike Imel. Disk also contains a copy of WA7MBL's YAPP terminal program.
5. MONAX - A program for monitoring a packet radio channel and gathering system statistics. Described in a paper (included on the disk) presented in the 6th ARRL Computer Networking Conference by Harold Price, NK6K and Skip Hansen, WB6YMH. Also included are PRAFFIC (IW3FQG) and PACKHACK (K7EA).
6. Ham Comm - A DSP RTTY program with VGA spectrum display, oscilloscope, tuning indicator, all realtime. Uses simple 1 chip interface, schematic included, all parts available at Radio Shack. Powered by serial port.
7. Manual and EPROM's for TAPR TNC2 - Assembly & operating manuals for TAPR TNC-2 plus EPROM images for latest firmware, KISS & state machine.
8. Binary-to-ASCII conversion utilities - R95, 7PLUS, UUENCODE/UUDECODE - Utility programs to permit sending binary files by packet radio. Compression/archiving utilities - Utilities for archiving and un-archiving .ARC, .ZIP, .ZOO and .LHZ files.
9. ROSERVER/PRMBS - A packet radio BBS with telephone modem support by Brian Riley, KA2BQE.
10. ROSE - The ROSE switch by Tom Moulton, W2VY.
11. KA9Q NET - Executables and source code for the NET version of TCP/IP by Phil Karn, KA9Q, with enhancements by Joe Buswell, K5JB.
12. WXN Weather Server - A multi-user weather server that runs as an application on the G8BPQ switch. Uses the Heath ID-5001 Advanced Weather Computer for weather data. Includes PC user program that runs on a TNC-2.
13. TNC-1 source code - Sources for the TAPR TNC-1 firmware. TNC-2 Software notes - Notes on TNC-2 software versions
14. WINLINK - A BBS system for AMTOR, PACTOR, CLOVER, and packet by Vic Poor, W5SMM and Hans Kessler, N8PGR.
15. WA7MBL BBS - Packet BBS system by Jeff Jacobsen.
16. W0RLI BBS - Packet BBS system by Hank Oredson, WRLI.
17. YAPP - A packet terminal program by Jeff Jacobsen, WA7MBL. Supports split-screen operation, ASCII and binary file transfer.
18. INTRO TO TCP/IP - Much descriptive and reference information on TCP/IP.
19. LAN-LINK - Packet terminal program by Joe Kasser, G3ZCZ. Also supports the non-packet modes of PK-232, KAM and MFJ-1278.
20. ARES/Data - A packet radio data base system for emergencies by Weo Moerner, WN6I and Dave Palmer, N6KL.
21. MSYS - A multiconnect BBS with telephone modem, terminal, node and TCP/IP support by Mike Pechura, WA8BXN. Requires KISS mode.
22. G8BPQ NODE - A NET/ROM-compatible multiconnect software packet switch by John Wiseman, G8BPQ, which can be run standalone or in conjunction with a BBS package, ARES/Data or DX Cluster software.
24. THS - A terminal program for TNCs with WA8DED firmware or the DRSI PC*PA by Peter Heinrich, HB9CVV.
25. NTS traffic generator - A software package for generating NTS traffic by Bill Bowman, VE4UB.
26. NM1D DOSgate - A program allowing remote operation of a PC via packet radio by Rich Bono, NM1D.
27. SV7AIZ BBS - a multiuser, multiport BBS by Spiros Kavalaris, SV7AIZ for WA8DED/AEA host, DRSI or KISS TNC running G8BPQ switch.
28. TEXNET Applications - Software for use with the TEXNET switch by Texas Packet Radio Society.
29. INTRO TO PACKET RADIO - A tutorial on Packet Radio by Larry Kenney, WB9LOZ.
30. MICROSAT Ground Station Software - Programs and information for use with the MicroSats (AO-15, DO-17, WO-18 and LO-19) as well as UO-14 by Harold Price, NK6K and Jeff Ward, G/K8KA.
32. PAMS - A Personal AMTOR Mailbox System by Victor D. Poor, W5SMM.
33. TNC-2 Monitor - A Z-80 monitor for the TNC-2 and clones by Paul Newland, AD7I.
34. GIL - Graphics Interchange Language - Permits a convenient way to tramsmit more than just ASCII text messages, such as animated graphics drawings or diagrams over digital radio links.
35. PAKET - A TNC-2 program with features such as windowed operation and multi-connects.
36. F6FBB BBS - Supports 15 languages, YAPP support, multiconnects, compressed message forwards
37. TPK - French language terminal program with many features by Gerard Regnard, F1EBN.
38. KA9Q NOS - Executables and documentation for KA9Q's NOS version of TCP/IP software, with enhancements by Gerard van der Griten, PA0GRI, Johan Reinalda, WG7J, and James Dugal, N5KNX.
39. KA9Q NOS - Source code for Executables on Disk 38.
40. SP (Eskay Packet) - Hostmode program by DL1MEN for WA8DED firmware with additional support for Baycom modems & KISS TNC's.
41. TAPR Deviation Meter - Source code and tools.
42. PACTOR - PCTOR runs AMTOR (CCIR476-6) on a PC compatible. All AMTOR modes & listen are supported. Requires external HF Modem such as CP-1, ST-6, DJ6HP or similar. Also includes PC-PACTOR for read only of PACTOR traffic on a PC compatible. Written by Johan Forrer, KC7WW.
43. METCON - Source code and tools.

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Non-Profit Research and Development Corporation

Order Form
November 1995

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.

Office Hours: Tue-Fri 9am-12pm, 3pm-5pm CST

Kits / Firmware / Publications

Qty	Item	Unit Price	Total Price	Kit Code	Information
____	DSP-93 w/ wall transformer (US)	$ 430.00	____	16	check with office on ship date, no discount
____	DSP-93 w/o wall transformer	$ 420.00	____	16	for international orders only, no discount
____	AN-93 HF Modem	$ 90.00	____	3	limited kits available.
____	TAPR 9600 bps Modem	$ 80.00	____	6	
____	Bit Regenerator	$ 10.00	____	1	used for regenerative repeater operation
____	Clock Option	$ 5.00	____	1	used for regenerative repeater operation
____	PK-232 Modem Disconnect	$ 20.00	____	2	simplifies connection of external modems
____	PK232MBX Installation Kit	$ 20.00	____	2	for installation of 9600 modem in PK-232MBX
____	XR2211 DCD Mod.	$ 20.00	____	2	
____	State Machine DCD Mod.	$ 20.00	____	2	
____	State Machine DCD w/Int Clock	$ 25.00	____	2	For KPC2 or other TNC w/o 16X or 32X int clock
____	METCON-1 Telemetry/Control				Metcon-1 kits no longer avaiable.
____	Voltage-to-Frequency module	$ 30.00	____	3	Plenty of the Option Kits!
____	Temperature-to-Freq module	$ 40.00	____	3	
____	A-D Converter	$ 45.00	____	3	
____	Elapsed Time Pulser	$ 35.00	____	3	
____	32K RAM w/ TNC2 update docs	$ 20.00	____	2	
____	TNC-2 1.1.9 w/KISS EPROM	$ 15.00	____	4	includes 1.1.9 Commands booklet (below)
____	1.1.9 Commands Booklet (only)	$ 8.00	____	2	full TNC-2 command set for 1.1.9
____	TNC-2 WA8DED EPROM	$ 12.00	____	2	8 connect version for ARES/Data standard
____	TNC-1 WA8DED EPROM	$ 12.00	____	2	
____	TNC-2 KISS EPROM	$ 12.00	____	2	
____	TNC-1 KISS EPROM	$ 12.00	____	2	
____	PK-87 WA8DED EPROM	$ 12.00	____	2	
____	Packet Radio: What? Why? How?	$ 12.00	____	2	130 pages. TAPR's Packet Radio book.
____	BBS Sysop Guide	$ 9.00	____	2	60 pages. by: Barry Buelow, WA0RJT
____	TAPR's 94 Annual Proceedings	$ 7.00	____	2	Papers from the Annual Meeting (Tucson)
____	TAPR's 95 Annual Proceedings	$ 7.00	____	2	Papers from the Annual Meeting (St Louis)
____	PSR Set Vol 1 (#1 - #17 '82 - '85)	$ 20.00	____	5	
____	PSR Set Vol 2 (#18 - #36 '86 - '89)	$ 20.00	____	7	
____	PSR Set Vol 3 (#37 - #52 '90 - '93)	$ 20.00	____	7	
____	NOSIntro, Intro to KA9Q NOS	$ 23.00	____	5	Ian Wade, G3NRW, TCP/IP over Packet Radio
____	ARRL CNC Proceedings 1st - 14th	$ call	____	.	Individual Proceedings, call for prices
____	Entire Set ARRL CNC 1st - 12th	$ 90.00	____	36	9 Proceedings from 1981 to 1993
____	TAPR Badge	$ 10.00	____	0	include Name and Call for badge
____	3 1/2" Disk from TAPR Library	$ 3.00	____	0	$3 per disk. See TAPR Software Library List

Sub-Total Kits/Firmware/Publications/Disks: _____

_____ **:Added Total of Kit Codes**
(Example: 9600modem w/ BitRegen: 6 + 1 = 7)

Members 10% Discount (Kits & Publications): − _____
(Except were noted)

_____ **:Member #** (Place New, if joining)

_____ **Total Sales** (Sub-Total minus Discount)

_____ **Texas Residents add 7.75% tax**

____ Membership (each year) .... _____ **Membership** (New or Renewal)

For Total Kit Codes between:

$15 per year US and possessions,
$18 Canada/Mexico, $25 elsewhere
(*Join and place NEW in above Member #*
 to receive your 10% member discount!)

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

TOTAL Order Amount _____

Add an additional $3.00 for US Priority Mail
Kit Codes above 55 or INTERNATIONAL orders
Please call TAPR for Shipping & Handling Amount

Credit Card #_____ (Visa/Mastercard Only)

Expires: _____ Signature: _____

Name: _____ Callsign: _____ City, State: _____

Address: _____ Zip, Country: _____