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In This Issue...

A New Vision for Amateur Radio Service 2
APRS QSY - Final Report..... 6
Bill Tynan, W3XO, to Step Down as AMSAT-NA President 13
FHSS Radio Design Update 14
FHSS Project Fund Raiser 15
Nominations Sought for TAPR Board 15
FlashCard Project..... 16
TAPR PIC-Encoder Project 17
APRS, Spread Spectrum Highlight DCC..... 18
17th Digital Communications Conference.. 18
Tim Mitchell, KA5RYF, SK..... 21
Abstracts from the 17th DCC Proceedings 22
New Product Announcement:
DSP Upgrade for the PK-232 24
*****Connect Request**..... 24
APRS for Palm III Under Development..... 25
FCC Office Of The Secretary Relocates..... 25
FCC'S NESS: Ensure Adequate Spectrum For Amateurs 26

President's Corner

What a great Digital Communications Conference this year! Many thanks to PRUG and CAPRA for hosting the conference with us and the ARRL. A recap of the conference is included further into the *PSR*. Next years conference will be held back in Arizona. Dan Meredith, N7MRP, and Keith Justice, KF7TP, are working with us as local hosts to nail a location and date.

There sure is a lot to write about in this issue, but just not enough time to get it all down on paper, so I'll hit the highlights. Project wise, things are cooking. The TAPR SS Radio project has made some great strides since the last *PSR*. The operating system and TCP/IP stack are now operational and ported onto the fully operational digital board. This is a huge milestone in the project. The team is focusing on the Qualcomm and Harris chips remaining on the digital board which provide interfaces to the RF board. After this, the RF board will be focused on. A full report of the project appears later. We still need donations for the development. We have received donations from the following people John Coonly, Andrew Skattebo, KA0SNL, and Gene Pentecost, W4IMT. I would like to thank these individuals for their donations. The level of funding is going to be a critical factor as the beta testing plans are made.

Look for TAPR at these Upcoming Events

May 14-16, 1999 Dayton HamVention

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President's Corner, continued...

The Linux Flash project that John Koster, W9DDD, has been working on is about to rollout. We hope this will be another project like the TAC-2, where we reach a new potential member outside of amateur radio to get them into what we do. Fifty kits will be available without the flash-card before Christmas. Keep an eye on the TAPR web page. Additional information on the project will appear later in this *PSR*.

The PIC-E development team is nearing the end of their evaluation kit (EVM PIC-E) with around fifty people to participate. John Hansen, W2FS, has written up some information concerning the project for the *PSR*. There was a lot of excitement at the DCC on PIC development and this kit is going to be able to help many of you who want to play without having to invest in development platforms.

We have worked a deal with a group concerning a surplus of TALNet radios/routers to be used under the SS STA. The deal will be for \$550 per radio/router, plus shipping/handling. These are 160Kbps DSS TCP/IP based systems on 2.4G. Contact the office if you want a pair of radios or one to go with an existing pair.

At the AMSAT meeting this past October, Bill Tynan, W3XO, formally announced his retirement as President of AMSAT-NA. Bill and I started our tenures around the same period and the several times we worked closely on TAPR/AMSAT related projects were successful. While we didn't necessarily see eye-to-eye on Spread Spectrum technology implementation in the ham bands, he was always a dedicated leader of AMSAT who put a lot of time and effort into the job. You did a great job while at AMSAT, Bill!

I'll finish this quarter's column with an article that Dewayne Hendricks, WA8DZP, and I wrote earlier this year and which was just printed in the DCC proceedings. I think you will see several themes that have been discussed in previous *PSR* issues, but it never hurts to cover these issues from time to time.

Cheers - Greg, WD5IVD

A New Vision for the Amateur Radio Service

Dewayne Hendricks, WA8DZP

Greg Jones, WD5IVD

Reprinted from 17th ARRL and TAPR Digital Communications Conference, p. 38

Vision Statement Concerning the Future of Amateur Radio

Amateur radio as a hobby has reached an important turning point. Many can point to various examples of why

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Article submission deadlines for upcoming issues:

Winter 1999

December 15, 1998

Spring 1999

March 15, 1999

Summer 1999

June 15, 1999

Fall 1999

September 15, 1999

Submission Guidelines:

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

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

things are changing; however, some of these examples are real and some are only periodic in nature, but the trend of activity and interest now as compared to five or even ten years ago is changing. The real issue which we must face is 'does the amateur radio service (ARS) base its future on the precepts created and tested over the last twenty years or do we look at new and novel ways of growing, sustaining, and protecting the hobby that we love?'

As active members in the ARRL, since first licensed, active members at various internal levels of the League, and very active in the area of amateur radio technology advancement that TAPR represents, we would like to take a few moments of your time to share some important thoughts on the matter.

The Commercial Future of Amateur Radio and how the ARS can benefit from the change

Amateur radio has prospered over the last twenty years as commercial manufacturers were able to grow radio sales in the US, with the amateur radio community as a secondary market to their already existing commercial markets. This resulted in a tremendous growth and usage of VHF/UHF and to some extent, HF, over the last several decades.

We now find many amateur radio vendors and manufacturers reducing their presence or even leaving the amateur radio market for other markets or to refocus on their older commercial markets as new communication systems threaten to take market share away. Some stores that have been in existence for some time have even begun closing their doors. This is to be expected with the sales of amateur radio equipment dropping off. Keep in mind that some say this is sunspot related, but can sunspot activity also explain the drop in the VHF/UHF market as well? Amateur radio is in the midst of a paradigm shift from the vast majority of communicators currently on the bands to a more balanced population representing technical, experimental, and hobbyist who just like to communicate with radios.

As vendors continue to leave the amateur radio market, it is up to organizations like ARRL, TAPR, and AMSAT (the three major non-profit amateur radio organizations in existence today) to grow our technology internally, instead of waiting for external forces to discover amateur radio as a market. If we wait for external market forces to come into play, we will find that these companies will probably rather seek out commercial markets where there is more profit potential, than the hobbyist market which uses our radio spectrum for recreation, learning, and public service.

TAPR has begun working in this direction, by working with the remaining manufacturers and looking elsewhere to non-traditional funding sources like the National Science Foundation (NSF). We see grants and other such

efforts as just a beginning in which to grow more money and more research that will hopefully benefit all of amateur radio in the long term. However, the amateur radio rules are going to need to be more proactive to allow for these types of new technology-oriented ventures to take hold and grow. Amateur radio must have rules that allow experimentation with new modes, without the need to get an STA or waiver each and every time someone wants to do something new. If we don't see this necessary flexibility in the future we will find that most potential amateur radio projects will end up operating under Part 5, Part 15, or any of a number of other services. Or worse yet, amateur radio operators will just ignore the current rules and build and operate equipment to provide the kinds of services that they desire.

While amateur radio has a great history with a rich tradition of introducing new ideas and technology, that process seems to have slowed as more communicators joined the hobby. It became more important to make sure these communicators and people who simply enjoy the hobby aspect of the service had no problems operating and the introduction of new systems and experimentation slowed as a result. It is true that while we have seen a lot of work in new digital and RF areas niche interest, none of this research has been widely adopted or been beneficial to the larger majority of the members of the service.

As an example, an organization like the ARRL is in a position to greatly influence the realization of expanded growth of amateur radio by supporting the efforts of small, innovative companies making contributions to the hobby and not large manufacturers whose primary business and marketing interests are in areas other than amateur radio. It is in the best interest of amateur radio service (ARS) to grow this cottage industry, because these groups could well become the next Collins, Drake, and other amateur radio-founded companies in the future. What we see today is that various members of the service are starting companies, but these new organizations are focused on other services, because the current FCC rules and the 'climate' of the hobby don't really allow for the easy introduction of new types of technology. These same companies are the ones that are now asking for more spectrum from the FCC for their products and services -- and where do they look? They look to amateur radio spectrum because they understand full well just how underutilized that spectrum really is.

What is to keep the ARRL or TAPR from creating its own "Co-Op" approach like REI or many other such organizations? Together both organizations have the membership base to easily support such an effort and the potential impact on the purchasing power from the total membership could lead to an environment where product development decisions were being made based on the

needs of amateur radio operators in the US, instead of those requirement being secondary to existing market needs and requirements as viewed by technology manufacturing companies located in other countries.

Experimental and Technological development are keys to the future

It has been a concern of ours and TAPR's for some time that there is a tendency to resist change when something new or novel appears on the amateur radio scene. TAPR, AMRAD, AMSAT, and other organizations represent the spirit of change and development within the ARS. Amateur radio can either choose to support various efforts within the community for the advancement of new technology or wait for external commercial forces to quickly take advantage and look for additional spectrum, most likely being the current ARS allocations. Not many amateur radio groups or individuals can sustain the effort required to make change happen under the current restraints to the introduction of new technologies. The expense of development, manufacturing, marketing, and to some extent the rules themselves affect the introduction of new technologies to the service. Most new operating interests within the hobby have been a result of the usage of other external technologies (i.e. Personal Computers, Internet, etc.), not of something grown from within the hobby itself.

It is important that ARRL, TAPR and AMSAT watch out for the interests of its diverse membership, but at the same time it must be working on providing support for various efforts elsewhere in the community that are emphasizing new technology and change. The ARRL doesn't have to lead, but it must be fully supportive of change and be willing to facilitate it as much as it can. While an open support policy might threaten some, it is imperative that ARS grow from within and it is equally important that the organizations take a leading role in helping to encourage the growth of new operational modes and techniques.

Amateur Radio should develop its own spectrum sharing partners

With regard to spectrum, we believe that the ARS can either continue to defend the spectrum we have, or look for those services with whom we can share our bands. We have to locate others that can help fully utilize our valuable spectrum, but not take away from the mission and operating flexibility of the ARS. For instance, this could be the creation of a low-power educational wireless service which could be overlaid on some part of the existing ARS spectrum or some other similar approach. The League successfully used this tactic several years ago when it joined with Apple Computer in lobbying the FCC to designate the 2390-2400 MHz band as a shared band with only the ARS and U-PCS as the incumbents.

The ARS should think about what services would be the most 'tolerable' on our bands. We can't say no to everyone forever, because that will likely result in our losing even more spectrum over time. By finding and locating or creating friendly sharing partners we 1) protect our spectrum on our own terms, 2) create a commercial need for equipment (if done correctly amateurs can leverage these devices into operational 'ham ready' units), and 3) bring users from the shared spectrum services into the ARS where applicable. This is one reason we have suggested the educational communication service concept. It would get members of the ARS into schools helping install wireless networks that might have rules like Part 15, but this direct contact with schools could easily lead to students getting interested in amateur radio because of the close working relationship formed when the local/regional ARS organization helps get the school wireless connections to the Internet.

TAPR Response to ARRL New Repeater Concept

TAPR has been working on a new 'high concept' repeater system that makes use of spread spectrum technology, in particular, frequency hopping to act as a stepping stone to a new generation of devices that can provide new levels of function and operational flexibility to the amateur radio community.

TAPR on its own as been working in this direction for the last two years. Its first step in this direction was the submission to the NSF of a proposal for what has come to be called the 'Internet Access Radio' (IAR) in the Fall of 1996. The first member in a family of such radios is currently under development and information on it can be found on the TAPR website at: <http://www.tapr.org/tapr/html/taprfhss.html>.

TAPR believes that today's communications technology is moving toward all digital transmitters and receivers. These advances in technology, combined with the swift evolution of cell based transmission and switching protocols is opening up a new set of possibilities for unique new services utilizing intelligent networks which will contain smart transmitter, receivers and switches. Today's Internet is perhaps the best example of a self-regulating structure which embodies these new technological approaches to communications in the networking domain. However to date, many of these innovations have not made it over to the wireless networking arena. TAPR feels that the radio networks of the future will involve a mixture of links and switches of different ownership, which terminate at the end-user via relatively short distance links. **What will then be required** is a built-in, distributed, self-governing set of protocols to cause the networks' behavior to make more efficient use of a limited, common shared resource: radio spectrum. Creating such a self-regulating structure for the optimal

sharing of spectrum will require much effort. One of the major problems which stands in the way of these new approaches today is the current FCC regulatory environment and the manner in which spectrum is managed and allocated under its rules.

One of the major hurdles that a wireless entrepreneur faces who wishes to develop innovative new communications products which involves radio is access to the requisite amount of spectrum. This process makes the involvement of the wireless entrepreneur with the government mandatory, which immediately puts them at a disadvantage when compared to entrepreneurs in the computer sector where government involvement is minimal. As a result, innovation has occurred at a much slower pace since the use of technologies such as spread spectrum require the use of more spectrum and not less in order for their advantages to become apparent when it is used for high-speed data transmission.

Historically, the current regulatory approach to radio has been based upon the technology that was in use at the time that the Communications Act of 1934 was framed, basically what we would call today, dumb transmitters speaking to dumb receivers. The technology of that time required reserved bandwidths to be set aside for each licensed service so that spectrum would be available when needed. Given this regulatory approach, many new applications cannot be accommodated since there is no available unallocated spectrum to 'park' new services. However, given the new set of tools available to the entrepreneur with the advent of digital technology, what once were dumb transmitters and receivers can now be smart devices which are capable of exercising greater judgment in the effective use and sharing of spectrum. The more flexible the tools that we incorporate in these devices are, then the greater number of uses that can be accommodated in a fixed, shared spectrum.

While the IAR proof-of-concept (POC) radio is under development, TAPR intends to make the case to the FCC that the current rules should be changed to reflect the use and advantages that smart spread spectrum packet radio devices can provide. TAPR's position is that a major improvement in spectrum use is feasible if the concepts to be employed in the IAR POC radio are put into widespread use. However, given the radical nature of some of the approaches in this project, it is appropriate to first, confirm the technical theories that we are putting forth and then to define the operational parameters for the implementation of these theories once they are confirmed. Then we will be able to approach the Commission with proposals that have a sound basis in fact and which should hopefully then be acted upon in a favorable fashion.

While development of the IAR POC is underway, TAPR has several projects underway that utilize existing Part 15 spread spectrum radios that are being adapted to

meet amateur radio operational requirements and which will be used for general packet radio and Internet access over wide-areas. One project uses OEM modules from Lucent Technologies and the other uses a radio provided by a member of TAPR's sister organization in Japan, the Packet Radio User's Group (PRUG).

Much of what we have in mind can be accomplished today with existing Part 15 radios. One of the author's of this article has such a system currently up and operational in the San Francisco Bay Area. The system uses two mountain top sites and can currently cover all of the South Bay Area, providing voice and data services to users at ranges up to 20 miles. Here are the characteristics of the system:

- Operates on 2.4 GHz.
- Radios use FHSS half duplex. Output power is 1W. EIRP is within FCC limits of 4 W EIRP.
- TCP/IP protocols are used.
- Accepted Internet protocols are used to handle voice and data traffic.
- System can be accessed by any device that uses the TCP/IP protocols and a similar data-radio.

Here are some of the things that this POC radio system can accomplish:

Can handle several separate voice conversations, bulletins, and data streams simultaneously?

Yes, using standard Internet protocols. Uses the H.32x standards.

At the core of the H.323 standard is a method for managing network latency, or the time it takes to send and acknowledge a packet. High-latency networks such as the Internet, where data packets must jump through many routers and subnets, have a tendency to wreak havoc on audio and video synchronization. To address this shortcoming, H.323's Real-Time Transport Protocol (RTP) time-stamps and sequences packets and reduces delays.

H.323 also specifies the coding and decoding of video and audio signals, optimizing data for lower bit rates and low-bandwidth connections. H.323-compliant products are now quite common on the market with Microsoft's NetMeeting being a good example. More information on H.323 can be found at: <http://gw.data-beam.com/h323/h323primer.html>.

Supports duplex (just like a telephone) and conferencing (just like a teleconference)?

Yes, again using standard Internet protocols, even though the actual radio link is half duplex.

Lets you know who else is monitoring and lets you contact them without interrupting anyone else?

Yes.

Is resistant to deliberate interference, and allows the control operator to "lock out" stations that are not following the rules?

Yes. We have full control to lock out users as required by a number of different methods.

Can share its operating frequencies with several similar repeaters nearby, with little degradation in the performance of any of them?

Yes. We are able to add new mountain top sites without the need for coordination.

Lets you use one radio to access all of these functions, and others such as PacketCluster and APRS, simultaneously?

Yes.

Puts the amateur allocations above 1 GHz to more intensive use?

Yes. In this case, 2.4 GHz is used.

Conclusion

We believe that amateur radio has been at a crossroads for the last several years and continues to wait for the "light to change" to indicate what the future will really hold in store for the service. The ARRL, TAPR, AMSAT, and other technology-oriented groups must take the initiative and forge ahead into the future on our own. We need to be proactive to change and challenges, and not take a position of "wait and see" for attitudes to change. There will be those members in all of our organizations that will hate what the future will bring, but past history and experience shows us that adopting a position of limited or no change only means that the change and growth will occur elsewhere. Change does not mean the total abandonment of the past traditions that we believe have made the amateur radio service what it is today. We can either bring about increased growth in our ranks or see that growth occur on the Internet and other areas that many of our members will perceive as much more fun and enjoyable ways to spend their time. Not following the course of change might be the wise political approach to adopt for now -- but is it unlikely to be the most productive one.

The issues and actions the we have raised are just some thoughts about where amateur radio is today and where it might be going. These are just first steps towards a new future and many more will be required to effect any real change. Long range planning is certainly important, but with the increased pace of change in society and the technology sector, amateur radio needs to take a fresh look at where it has been and just where it would like to go.

APRS QSY – Final Report

Greg Jones, WD5IVD,
Steve Dimse, K4HG,
Frank Bauer, KA3HDO,
Stan Horzempa, WA1LOU

Abstract

This little adventure began over a year ago when Frank Bauer, KA3HDO, Vice President of AMSAT Manned Space Operations approached the community with the issue of potential interference to the future of amateur radio operations aboard the International Space Station. Much discussion took place before the final proposal was put forth at the 1997 ARRL and TAPR Digital Communications Conference. At the conference, Frank presented his paper "Amateur Radio on Manned Space Vehicles: Improving Amateur Radio's Future Through Enhanced Space Frequencies." [Bauer, 1997] This paper discusses the basic issues of the proposal. What we have a year later is a nearly complete process of a large section of the amateur radio community voluntarily changing frequency. It wasn't easy or without debate, but the process showed that with adequate communications and lots of time discussing and educating people on the reality of the situation, that change can happen in the amateur radio service in a cooperative manner. This paper will discuss history leading up to the QSY, the APRS QSY proposal, major events in the process, results of the APRS QSY survey, current status of the QSY, who received money from the QSY fund, and finally what lessons were learned along the way.

Finally, this paper represents the formal report to be presented to TAPR, AMSAT, and the ARRL.

History of 145.79

As was posted in a message by Tom Clark, W3IWI, [Clark, 1997] the reason APRS started on 145.79 dates back to the 1990 era of packet radio in the local Maryland and Washington DC areas. Several hams in the area including Tom Clark, W3IWI, decided to open up the 145.50 - 145.80 segment to packet activity. They felt that the five slots in the 145.01-145.09 segment were inadequate for all the PBBS, linking, DX Cluster, simplex rag chewing, etc that was happening on packet radio. The local packeteers prevailed on the local FM folks to quadruple the available space which the packet community would administer. They elected to follow the local pattern of 20 kHz channelizing, using the odd tens kHz slots (300 kHz of spectrum yielding 15 available channels). Tom at that time, being very involved in AMSAT, understood the band-edge problems with regard to the satellite sub-band and thus placed 145.79 as a "reserved for experimentation." The plan was for this

frequency to be used for new technologies, especially modems.

At about this time, Bob Bruninga, WB4APR, began testing a "UI" frame (unconnected datagrams) protocol and asked about getting a frequency to test what he saw as a way for low-powered mobiles to transmit information to nearby stations working like the cellular telephone network with limited coverage. Tom suggested he use 145.79 with the implied reality that it was adjacent to the satellite band, that it was subject to occasional QRM, and that the concept was experimental.

As we all know, Bob's modest request a few years later became APRS, and 145.79 became APRS's national home.

The crux of our story begins when the post-Challenger shuttle program resumed and AMSAT Manner Space Operations resurrected the idea of SAREX carrying amateur packet hardware (the SAREX TNC/ROBOT). AMSAT tried very hard to find a suitable frequency for the SAREX ROBOT. Since it involved both up- and down-links, and since most radios were built for 600 kHz splits, they tried pairing frequencies like 144.950 with 145.550. This choice was not very well received by some packet radio communities. The reason being that in the late 1980's the 145.01-09 packet frequencies had been added to with the addition of 144.91-99. When SAREX began operations on 144.950, there were a lot of individuals who had packet radio systems running on 144.950 who were very unhappy about the intrusion.

This was one of the first cases of how do you fit into differing world-wide bandplans' operating frequencies for space missions that do not interfere with anyone else. The real problem here is that in Region 1, the 2M band is only 2 MHz wide (144-146 MHz). The situation is made even more difficult, since the band plan has to be agreed to by 50+ countries. For reasons that have to do with International governmental treaties negotiated at the WARC's, the amateur satellite service is restricted to the universal international parts of the bands, so any spacecraft using 2M must operate between 144 & 146 MHz -- no choice! In that context, the satellite community has convinced the entire, world-wide amateur community (thru the IARU) that 10% of the worldwide 2M band -- 145.80-146.00 -- must be reserved for space activities. Thus SAREX's usage of 145.55 was not well received by the Europeans either!

Now let's add MIR into the mix. The suggestion for the use of 145.20/145.80 for MIR came from an IARU Region 1 conference (Tel Aviv), and after the idea was announced to the rest of the world, it became obvious that it was not a good GLOBAL choice since 145.20 was heavily used elsewhere (in Europe, 145.20/.80 was a repeater pair which was being phased out -- which is why

the idea made some sense in Region 1). The problem in the US is that APRS is/was on 145.79. Although the proposal made since in Region 1, it didn't necessarily fit into Region 2.

As Tom points out in his e-mail [Clark, 1997], "The real underlying problem is that the 2M band is crowded, especially in Europe. 2M links for MIR/SAREX/ISS are desirable since EVERYBODY already has the necessary radios. The problems are compounded because the 2M band has, in general, been treated as a local coverage resource with emphasis on terrestrial repeaters -- except for the bottom-end "DX" and the top-end satellite chunks, the people who dole out frequency slots wear a "100 km radius" (i.e. 60 miles) localized set of blinders. The local repeater operator/coordinator has virtually no interest in what happens 1000 km away! Witness the fact that different parts of the USA adhere to 15 & 20 kHz channel spacings as a local option!"

Historically, we find ourselves here in the US using 145.79 because APRS at the time was considered a local experiment when it began. Add to this the reemergence of amateur radio activities aboard manned space missions that have very limited operating frequency constraints and the potential problem of interference between the two groups is very high.

The Proposal

The proposal to QSY APRS presented at the 1997 ARRL and TAPR Digital Communications Conference wasn't the first such suggestion. There had been several discussions and proposals before this one that looked at the issue of APRS being on 145.79 and 145.80 being used for space based operations. What made this proposal different was that all the elements were in place for a successful proposal. There was a clear outstanding need to reduce near band interference before the International Space Station began amateur radio operations. The facts already showed that orbiting crews endured significant frequency interference issues to achieve success that many simply turned off the radio. Thus, these frequency problems have limited the growth and success of this communication medium. The real downside to the interference issue was that the full potential of this facet of amateur radio to infuse new blood into the hobby through educational opportunities for students and its positive experience to the community has been somewhat stunted due to these frequency problems. The potential amateur radio promotion for successful amateur operations on the ISS is not disputed by anyone. How can anyone argue against the fact that communicating with astronauts and cosmonauts is an exciting and *challenging* facet of amateur radio. The APRS community was operating on two main frequencies: 145.79 and 144.39. The proposal to move everyone to one single frequency to help with creating a true national/international

agreement (with Canada) was a seen benefit to the now rapidly growing APRS community that is seeking increased coverage and ease of use between areas of operation. After much education on the subject, most could see the problem with the location of a frequency on board MIR and the ISS due to international limits for frequency selection.

In addition, several new items that past proposals didn't have were added. These included that each of the three major organizations (TAPR, AMSAT, and the ARRL) would donate money towards a QSY fund to help with the relocation. After all the discussion and debate, only \$1500 was spent towards helping QSY. Most sites simply changed frequency or paid for the cost locally. All three major groups (TAPR, AMSAT, ARRL) showed support by passing a motion on the issue at their board of directors meetings. A committee was formed to help coordinate the efforts of the QSY and open debate then began. The committee consisted of: Stan Horzepa, WA1LOU, TAPR APRS SIG Chair, Steve Dimse, K4HG, APRS QSY Proposal Liaison, Greg Jones, WD5IVD, President, TAPR, and Frank Bauer, KA3HDO, Vice President of AMSAT Manned Space Operations.

TAPR, AMSAT, ARRL

Once the three major organizations involved passed a motion at their board of directors meeting, the APRS QSY committee felt we had a chance to make this proposal work. Without the support from each of these groups, the proposal would have lost a lot of its positive energy. With the passing of each motion, the proposal gained strength that this was finally the right mix to solve the problem for everyone.

TAPR Board of Directors Positions Statement

- 1) TAPR, in support of its APRS SIG and the organizations of many APRS users, recognizes that APRS is a vital and exciting facet of amateur radio.
- 2) TAPR supports the experimentation of APRS through various amateur radio satellites and the International Space Station.
- 3) TAPR endorses the concept of an APRS-QSY Fund and will help set up and administer such a fund when the time becomes necessary to facilitate the potential QSY of APRS U.S. infrastructure.
- 4) TAPR approves a donation of \$500 to support the QSY initiatives when the fund is established.

AMSAT Board of Directors Position Statement

The AMSAT-Board also agreed (in cooperation with TAPR) to help an ongoing effort aimed at minimizing the impact of moving a large number of current Automatic Packet Reporting Systems (APRS) users off of 145.79 MHz. The Board agreed to donate up to \$500 to a fund to help defray needed expenses of various fixed frequency

APRS node operators in finding another "home" for their APRS operations in the USA. If the shift to another frequency eventually proves acceptable to the APRS community, it would help resolve one of the last remaining issues in clearing 145.80MHz for worldwide use by MIR, SAREX, and ISS.

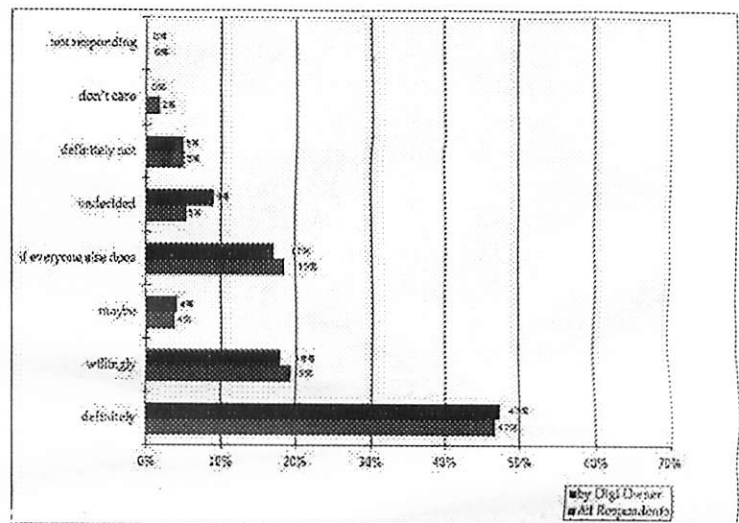
ARRL Board position statement on QSY [ARRL, 1998]

Whereas, the ARRL recognizes that APRS and SAREX/ARISS are vital and exciting facets of Amateur Radio, and Whereas, the ARRL recognizes the unique needs of APRS and SAREX/ARISS for nationwide frequencies, and Whereas, the ARRL supports the experimentation of APRS through various Amateur Radio satellites and the International Space Station, and Whereas, TAPR and AMSAT-NA have endorsed the APRS/Manned Space alliance and the "APRS QSY Activity" and have each pledged up to \$500 to the "APRS QSY Donation Pool," Be it resolved that the ARRL endorses the concept of an APRS/Manned Space compromise as a mechanism to share frequencies in the crowded two-meter band to minimize interference. Moreover, the ARRL pledges a donation of up to \$500 to support the APRS QSY initiatives once the fund is established.

TAPR APRS QSY Information Collection Questionnaire

One of the first things started by the committee was a survey. The purpose of the survey was two-fold. The first being a straw poll of the sentiment behind this issue. The second being the collection of information on who wanted to receive money from the QSY fund.

The survey was run from November 1st, 1997 until June 30th, 1998, at which time it was determined that saturation of the survey had resulted. Saturation being defined in this case as no significant change in the percentages (less than 2% over 3 months) shown in the



Graph showing the percentage of all respondents as compared to just DigiPepper Owner responses to the survey. The information submitted by the total group and digipeater owner sub-group are nearly identical.

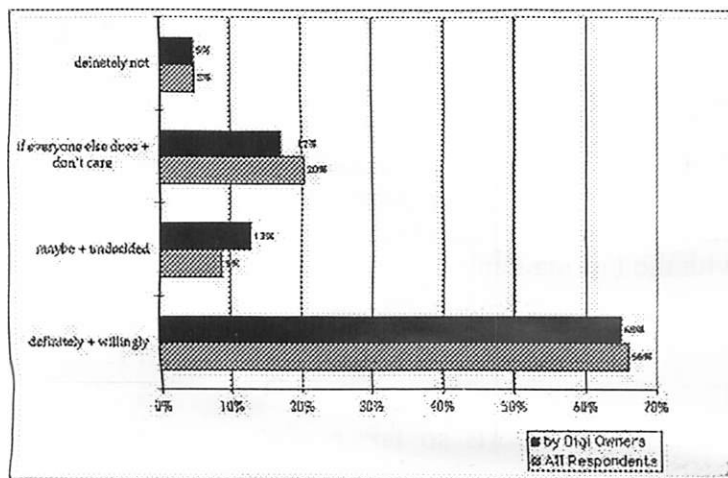
survey results. The survey generated 486 entries of which 146 (30%) indicated digiowners, 253 (52%) indicated end-users, and 87 (18%) made no indication of status. The committee had hoped to reach over 150 wide digiowners with the survey and consider the 146 as a successfully reached goal.

All Respondents (486) -	rank order	
definitely	227	47%
willingly	94	19%
if everyone else does	90	19%
undecided	25	5%
definitely not	24	5%
maybe	18	4%
don't care	8	2%
not responding	0	0%

All Respondents combination (486) -	rank order	
definitely + willingly	321	66%
if everyone else does + don't care	98	20%
maybe + undecided	43	9%
definitely not	24	5%

Just looking at Wide Digi Owners (146) -	rank order	
definitely	69	47%
willingly	26	18%
if everyone else does	25	17%
undecided	13	9%
definitely not	7	5%
maybe	6	4%
don't care	0	0%
not responding	0	0%

Just looking at Wide Digi Owners combination (146)		
definitely + willingly	95	65%
if everyone else does + don't care	25	17%
maybe + undecided	19	13%
definitely not	7	5%



This graph shows the combination of like feelings about the potential QSY.

Current Status of APRS QSY

The position of the organizations involved (TAPR, AMSAT, ARRL) has always been that it is the choice of the individual ham whether or not to QSY, and this decision needs to be made on a local basis. It is not appropriate for one group of hams to tell another that they have to move, or when they should move. This applies just as much to one group of APRSers telling another, as it does to AMSAT telling APRS it has to move. Some areas have a tougher problem and need more time. Please be considerate of this, and try to help these situations.

Jeff Brenton, KA9VNV, has maintained a web page tracking the actual success of the APRS QSY. The following information and map is from his web page (<http://www.dididahdidit.com/APRSFreq.htm>). Thanks to Jeff for allowing us to use some of his content in this article.

The map lists the reported frequencies for various areas of the United States which will be in effect by early June, 1998. Some areas are in the process of switching to 144.390; others have switched already. The following is a state by state breakdown <http://www.dididahdidit.com/aprsfrqt.htm>.

Note that Maine, and large areas of Montana, Nebraska, Wyoming, North and South Dakota, Texas, New Mexico, Arizona, Utah and Nevada do not have a formal "APRS network," and share existing packet networks with other users. These areas often run on 145.01, 145.03, and other frequencies "known for packet."

Alabama

North half of state on 145.79, with reports that everything south of Montgomery and Phenix City is on 144.39. This will change on or about October 31, 1998; see note on SERA below.

Alaska

No reported activity, but a lot of interest. As things develop, I have been promised information on the frequency or frequencies chosen.

Arizona

State is largely unreported, but Phoenix and Tucson report as being on 145.79, and other areas are believed to be sharing the local packet net(s), probably on 145.01 or 145.03. Current belief is that Arizona will remain on this way until/unless Southern California moves, but this may change.

Arkansas

Entire state is on 144.39.

California

California, from Bakersfield north, is on or converting to 144.39 as the digipeaters can be reached. South of Bakersfield, coordination problems will delay conversion

for an indeterminate length of time. DO NOT OPERATE ON 144.39 IN SOUTHERN CALIFORNIA UNTIL THE COORDINATION ISSUES HAVE BEEN RESOLVED!

[This additional information from Jim Keck, N6HNY: The General Membership of TASMA approved a motion to designate 144.390 MHz for APRS. The move is scheduled to be completed no later than 31 December 1998. This will allow time for some SoCA Wide's to gear up for the change and for the TASMA Technical Committee to work out some details in reallocating the ATV community to an alternate frequency.]

Colorado

State has officially changed to 144.39, and all WIDE digipeaters are reported as being operational there already.

Connecticut

All of state is now reported to be on 144.39.

Delaware

State has officially changed to 144.39 effective April 5, but not all digipeaters may be operational on this frequency yet.

Florida

Virtually all of the digipeaters within the state are reported to be on 144.39 at this time. Except, less than 30 days before Alabama, Georgia and Mississippi switch to 144.39, several digis west of Tallahassee in the Panhandle have decided to buck the national trend, and switch back to 145.79. A rumor says that this may be a temporary thing, and that all will be back on 144.39 when Alabama completes the change-over October 31. No confirmation has been received either way.

Georgia

Most of state is on 145.79, with the exception of the Columbus area, which is on 144.39 as of April 5, and the Savannah area switched in August. See note on SERA below.

Hawaii

No report.

Idaho

State is scheduled to be on 144.39 by now, along with Washington, Oregon, and BC.

Illinois

State has officially changed to 144.39, and all digipeaters are believed to have moved by now.

Indiana

State has officially changed to 144.39, and all digipeaters are reported to be operational on this frequency.

Iowa

State has officially changed to 144.39, and all digipeaters are believed to be operational on this frequency now.

Kansas

State has officially changed to 144.39 at the same time as Missouri.

Kentucky

State has officially changed to 144.39, and all but one digipeater are operational on this frequency. This remaining digipeater will change on or about October 31, 1998; see note on SERA below.

Louisiana

Shreveport area is on 144.39; no official report from other areas, but users report hearing most other LA stations on 144.39.

Maine

No report. However, being surrounded by areas on 144.39, it is believed that Maine will be on 144.39.

Maryland

Eastern sections are on 144.39 after April 5; western areas REPORT still on 145.79. However, several reports have been received that even the western section has moved, to match with West Virginia, Ohio, and Pennsylvania.

Massachusetts

State is on 144.39, although it is possible some digipeaters have not been moved yet.

Michigan

Southern peninsula on 144.39 as of March 15. Some areas of Upper Michigan share the local LAN frequency of 145.09; Rumours are this might change later this year.

Minnesota

State is on 144.39 as of the July 4th weekend. As a result, the northern portion of Wisconsin is now painted as being on 144.39.

Mississippi

Officially, as a member of SERA, the state is on 145.79. This will change on or about October 31, 1998; see note on SERA below. User reports indicate that the southern third of the state has already changed to 144.39, to connect with the Florida Panhandle.

Missouri

All reporting areas are on 144.39 as of April 1.

Montana

Only two reports so far, both from new stations establishing a new network in the state, and both plan to use 144.39. These fledgling nets are in the "NW corner" and near Helena.

South East Repeater Association (SERA) note: Per Ralph Fowler N4NEQ, on July 25, 1998:

"The APRS digipeater network in the 8 states coordinated by SERA (The South East Repeater Association), along with the Digis in Central and Northern Alabama, will be moving to 144.39 MHz on or about Halloween weekend (October 31) 1998.

"We have obtained recognition by SERA for APRS use of the new frequency, formerly allocated to AMSAT for future Oscar operations. SERA approves our use of this frequency with one major stipulation: We are to use proper engineering and RF practices to protect the 145.xx voice repeaters- whose inputs lie as close as 120 KHz from 144.39. Several digis are co-sited with these repeaters and others are very close. Our digipeaters must be outfitted with the proper filtration devices (band pass and notch cavities) to accomplish this task.

"Some digis will need little or no work and others will need total replacement due to the lowness of the frequency being used, hence the October date. This should give the owners ample time to make adjustments. Cost to the each digipeater owner will range from nothing to well over \$1,000.00! If users in the affected areas would like to contribute to the expenses that their local digipeaters will incur, you may contact the owner directly or through me.

"There are at least 48 digipeaters represented here. Since the approval by the SERA Board early this month, I have personally corresponded with the owners of all but 5 of them. After numerous attempts to contact these 5, I have decided to carry them as unknowns. I think they are all in the KY-TN-VA area. Of the 43 digis remaining, 5 of them (two in SC and two in distant GA border areas) elected to

not cooperate in the Group effort and already moved this past Spring- prior to the frequency being approved by SERA. One more is currently advertising that he plans to move this weekend.

"So... there you have it. Throughout history, we in the South have stuck together on causes that are important to us and have endeavored to always "do the right thing." We believe that an orderly study of all the implications of this move has taken place and that the outcome will be positive for all APRS users.

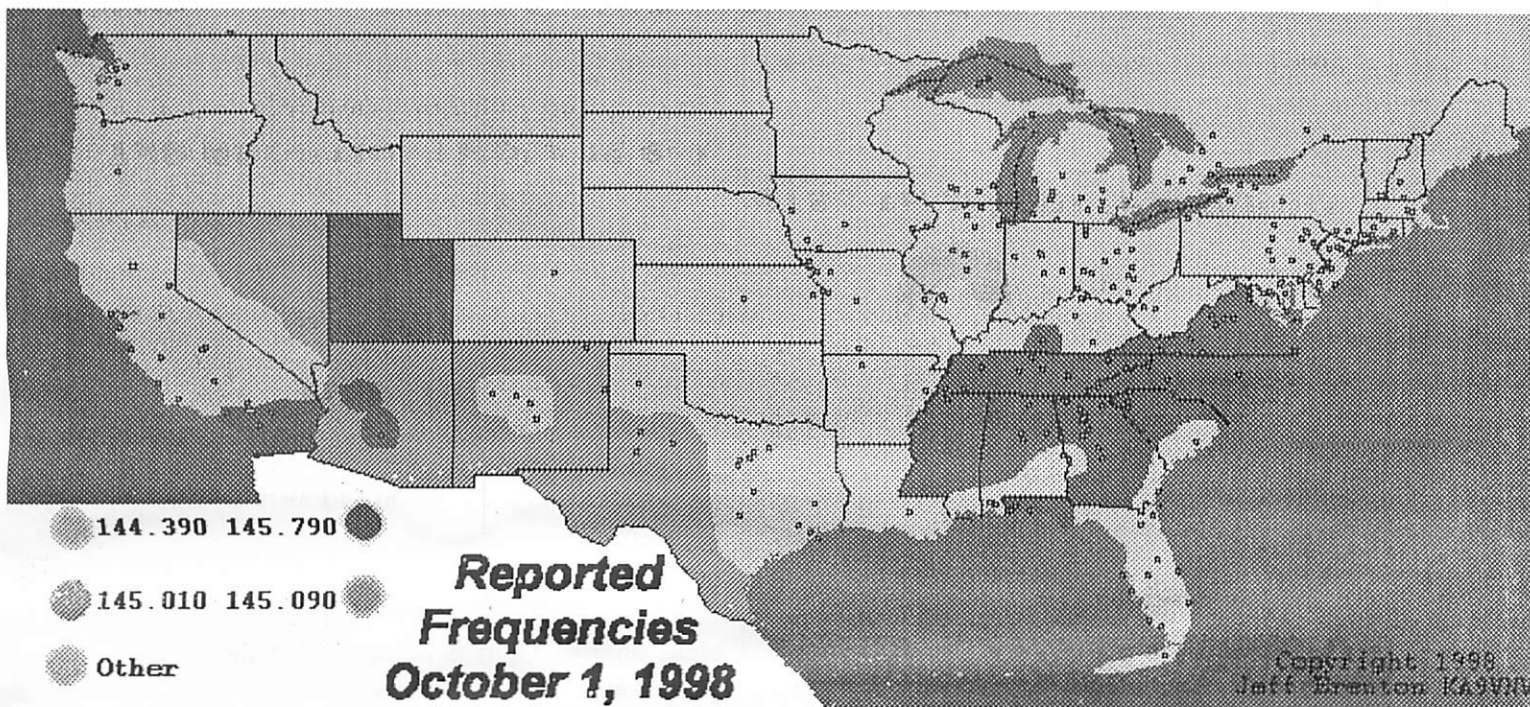
"This leaves one major area, Southern California, to remain on 145.79. Please be patient with them. The 144.39 frequency is coordinated to another user community, and there is no place to move those users. The issue is large and there ARE folks working on it. I know we appreciate the fact that MOST other users left us alone."

SERA is the official repeater coordination body for the states of Georgia, Kentucky, North and South Carolina, Virginia, West Virginia, Mississippi and Tennessee.

QSY Fund

In March of 1998 a message was sent to 19 individuals that had requested funding via the APRS QSY survey instrument. These 19 individuals represented only 3.9% of the 486 people submitting information to the survey. It seems that the vast majority of the APRS QSY has been self funded by groups and individuals.

The following 10 people requested \$1265 worth of the \$1500 collected from TAPR, AMSAT, and the ARRL. The remaining \$235 is on hold to an 11th group, until the QSY change has been made.



APRS QSY Frequencies as of October, 1998

Nebraska

State has officially changed to 144.39 at the same time as Missouri.

Nevada

Las Vegas area has moved to 144.39 as of July 19. Lake Tahoe and adjacent areas moved on 144.39 as of the end of August, and other areas bordering on California are also on 144.39, simply because they are using the NoCAL net. Other areas lack "APRS-specific" digipeaters, so check 145.01, 145.03, and similar generic packet channels. Late word is that, as an APRS network is established, it is to be on 144.39.

New Hampshire

State is on 144.39 after May 3.

New Jersey

State has officially changed to 144.39.

New Mexico

State has no official APRS frequency, however the Albuquerque area has good coverage on 144.39 from 4 digipeater. Most other parts of the state share 145.01 and 145.03 with other packet users.

New York

Most of state is on or changing to 144.39.

North Carolina

Most of state is on 145.79. This will change on or about October 31, 1998; see note on SERA below.

North Dakota

State is on 144.39. Not a lot of digipeaters as of yet, but this situation is being worked upon.

Ohio

State has officially moved to 144.39, with most stations confirmed to have moved. There are some hold outs on 145.79.

Oklahoma

Oklahoma has reported that their digipeaters moved to 144.39 during the first week of September. Visit the Radio Amateur Scientific Society Web page for additional information.

Oregon

State is officially on 144.39.

Pennsylvania

Eastern half of state and Lake Erie shore area are on 144.39. No reports from other areas, but this may be due to low activity (some say NO activity!). Try 144.39 first, then 145.79, west of the mountains.

Rhode Island

State has officially changed to 144.39.

South Carolina

Much of state is on 145.79. This will change on or about October 31, 1998; see note on SERA below. The Charleston area has already QSY'd to 144.39.

South Dakota

State has officially changed to 144.39 at the same time as Missouri and Nebraska.

Tennessee

State is on 145.79. This will change on or about October 31, 1998; see note on SERA below.

Texas

Eastern half of state, including Dallas/Fort Worth and Houston areas, and the Panhandle area are on 144.39. Areas along and 75 miles either side of Interstate 20, between El Paso and Abilene share the local packet network on 145.01. Other areas unreported, but may be on 145.79, 145.01 or 145.03.

Utah

Utah is moving to 144.39 as a network can be built. Digipeaters are scarce right now, especially outside Salt Lake City, but efforts to change that come next spring are underway. Expect the Las Vegas to Salt Lake City corridor to be the first major expansion, being worked on from both ends.

Vermont

State is on 144.39 as of May.

Virginia

Most of the state is on 145.79. This will change on or about October 31, 1998; see note on SERA below. All digipeaters in DC area, and along the MD/VA border north and south of DC, have reportedly moved to 144.39, and there have been reports of many VA stations seen on 144.39 during band openings.

Washington

State is officially on to 144.39.

West Virginia

Per report by the Tristate APRS Working Group [TAWG], West Virginia has moved to 144.39, to stay connected to their neighbors in Ohio and Kentucky. See note on SERA below.

Wisconsin

State is on 144.39. Not much reported activity in the north, but it should all be on 144.39 now, since Minnesota has moved.

Wyoming

No report. However, being completely surrounded by areas on 144.39, it is believed that the state will be on 144.39 as activity develops.

Canada

All provinces are officially on 144.39.

N9QGS, Ron Mallinowski,	\$30 for crystals.
N7ZEV, Frank Kostelac,	\$80 for crystals 2 digis in Las Vegas area
K7GPS, David Dobbins,	\$75 for recrystallizing/tuning a digi in WA state
K5QQ, Jim Baremore,	\$70 xtals/tuning an NM digi.
WB0WNX, Dave Kaplan,	\$50 xtals/tuning Iowa digi
W3NRI, Greg Harbough,	\$50 xtals for two trackers
W9JBL, John Leonard,	\$90 DCI filter for Chicago wide
N4VDE, Ricky Davis,	\$25 for crystals for SC digi
KU0G, Jim Duncan,	\$300 for 10 radios.
KE4DGH, Tommy Ellison	\$495.00 for new radio and notch filter for co-site voice repeater

Conclusion

It is a significant feat by the amateur radio service to complete a QSY of this magnitude within a single year considering that the proposal and shifting of a national amateur simplex frequency was widely accepted and implemented for the majority of the US in such a short period of time. While there are still areas of change to be made, progress on these fronts continues and we hope will eventually occur over time.

The amateur radio service as a whole and the APRS community itself can congratulate itself for making the QSY happen and leaving the future frequency for ISS operations much less occupied and interference free for future astronaut communications to other amateur radio operators.

We should not underestimate the significance of the task accomplished by the amateur radio service and APRS community since the 1997 ARRL and TAPR Digital Communications Conference. In completing a QSY of this magnitude from the initial proposal to a shift of frequency on a national level which is widely accepted and implemented in such a short period of time is an event few have been successful in achieving in the history of the amateur radio service. While there are still areas of change to occur, progress in these geographical areas continues and we hope will eventually QSY over time.

The amateur radio service as a whole and the APRS community itself can congratulate itself for making the QSY happen and leaving the future frequency for ISS operations much less occupied and interference free for future astronaut communications to other amateur radio operators.

References

1. Frank Bauer, KA3HDO. 1997 ARRL and TAPR Digital Communications Conference. Web Page: <http://www.tapr.org/aprsqsy/bauer/bauer.htm>
2. Tom Clark, W3IWI. Tue, 14 Oct 1997. aprssig@tapr.org. Subject: Re:Important: APRS and AMSAT-Please Read
3. Full information on the Board meeting can be found at arrl.org. Refer to ARRL Bulletin 8 ARLB008 From ARRL Headquarters Newington CT January 20, 1998.

Bill Tynan, W3XO, to Step Down as AMSAT-NA President

Space Bulletin 012 ARLS012
From ARRL Headquarters

AMSAT-NA President Bill Tynan, W3XO, will formally announce his retirement from office during the AMSAT-NA 16th Annual Meeting and Space Symposium October 15-19 in Vicksburg, Mississippi. An announcement also will appear in the next issue of The AMSAT Journal. Tynan, who turns 72 on Columbus Day, helped found AMSAT-NA in 1969 and has headed the organization for the past seven years. "I think it's time," he said, although he expressed regret that he did not get to see the Phase 3D Amateur Radio satellite get into orbit during his tenure.

Tynan said he'll recommend to the AMSAT-NA Board of Directors that Executive Vice President Keith Baker, KB1SF, be appointed to replace him. "He knows the organization, he's been my right hand," said Tynan. He said he plans to continue serving on the AMSAT-NA Board at least until his term expires next year and intends to remain active in AMSAT.

Tynan said the outpouring of support for the Phase 3D project was the highlight of his time in office. "The support of both the League and all our members to get where we are is the most gratifying and significant accomplishment," he said. Tynan noted that the Phase 3D satellite is completed and will undergo some final testing this month in the Washington, DC, area. However, he said there was "nothing new at all" to report on the possibility of a Phase 3D launch opportunity. Tynan said he'll be among those keeping a close eye on the European Space Agency's Ariane 503 test launch set for October 20. "One of our primary hopes is for an Ariane 5 launch," he said. Tynan said he's optimistic about the future of Amateur Radio in space.

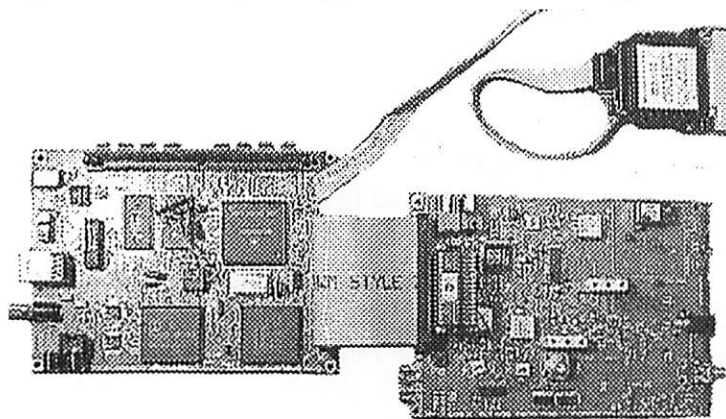
Licensed since 1945, Tynan edited the "Above 50 MHz" column in QST from 1975 until 1992. In 1988, he retired as senior engineer from the Johns Hopkins Applied Physics Lab. In 1996, he was honored as the Dayton Hamvention's Amateur of the Year.

Tynan remains active mostly on the VHF and UHF bands. Once he's free of the day-to-day affairs of AMSAT, he said he hopes to spend more time on the air, especially on 6 meters.

TAPR 900Mhz FHSS Radio Design Update

Below is the status since June. Tom McDermott, N5EG, presented a status report at the 1998 ARRL and TAPR DCC. The audio and overheads can be reviewed at <http://www.tapr.org/dcc>.

The project team has gotten the Qualcomm Q1900 convolutional coder/decoder (Viterbi decoder algorithm) working on the FHSS board. They are now able to send HDLC packets from the 68360 to the Q1900, loop them around with a couple of wires, and accurately decode them with the Q1900. They then can send them to the HDLC receiver on the 68360 and successfully receive the frames. This means that the register and HDLC driver code is working, and the clock, data, timing and signals into and out of the Q1900 are functional. The spec sheet for the Q1900 leaves a lot to be desired in the timing department - basically they ended up measuring all the signals with a scope to figure out what it is doing.



The digital board still needs to have the Harris DSP and the 2 A/D's checked out, but most of the digital board is now working properly. The team is now ready to move on to sending coded I+Q data to the QPSK modulator on the RF board. Bob Stricklin, N5BRG, has been working on that board, and is checking out some undocumented operational aspects of the Motorola part (like how it syncs the I/Q line).

The goals for the short term include:

1. Install the Qualcomm and Harris parts on the digital board being tested. Write access routines in C to talk to the registers on both parts. These routines handle the strange way the Harris part communicates and handles the addressing offset to the registers. The Harris stuff is working, but the team hasn't tested the Qualcomm stuff yet, but it should be easier to do I/O than the Harris stuff, by far!
2. Install a Dallas Semiconductor DS2401 electronic serial number chip on the board being tested. This uses PB4 to communicate to the processor. Have C code working to pull the 48-bit serial number out of the part.

This will become the Ethernet MAC address for the board. Will code it so that if the DS2401 cannot be read for some reason, that a default MAC address will be utilized from the conf.h file, and an error message will be dumped on the console.

3. Add the code to the 22V10 to do the decoding of chip-select and Read/Write for the Harris part, and the clocking for the Qualcomm part. Bob has installed a harness on it so that it can be reprogrammed right on the board. Really slick, Bob!
4. Complete the port from our current XINU 7.2.2 to version 7.9.
5. Program the HDLC serial channel on the 68360 to talk to the Qualcomm chip.

Some of the major goals achieved to date include:

CPU operational test, register verification	Complete
verify BDM working	Complete
RAM + FLASH testing	Complete
Ethernet I/F working	Complete
Modify PCB artwork and rebuild CPU board.	Complete

Some of the future goals regarding the CPU board include:

Develop simple stack running	Nearly Complete
- exchanges ethernet packets	
- 360 register I/O code	
- PC display / control of 360 registers	
- PC display / control of VLSI registers	

Write PIC & 360 code, use simple stack to verify	Started
- all VLSI registers can be read/written	
- (HARRIS, QUALCOMM, etc.)	
- 360 can talk to/from PIC	
- 360 can read/write packets via Ethernet I/F	
- 360 can talk on HDLC to Viterbi chip for data	

As reported in the last report, the VCOs are operational on the RF board. Now that the major elements of the digital board are completed, the team is focusing on the RF side of the project. Getting the OS and TCP/IP stack running before the 1998 DCC was a major achievement.

Some of the goals regarding the RF board still include:

Verify VCO spectral characteristics	Complete
Put Motorola QPSK encoder on board, drive from PIC (temporary data)	Complete
Add HARRIS 3724 Mod/Demod, test	Complete
Add Tx mixer, Tx PA, T/R switch	In Progress
Add Rx down converter, IF post amp	In Progress
Loopback testing	In Progress
Turn RF board artwork	

Until the next report.

TAPR 900Mhz FHSS Project Fund Raiser

As published in the last issue of the *PSR*, Bob Stricklin, N5BRG, Bill Reed, WD0ETZ, Tom McDermott, N5EG, and a highly competent group in support, are developing the TAPR 900MHZ FHSS Radio. We figure to spend at least \$10,000 this year on the project on things like another board turn, development software, parts, and other odds and ends that a project of this magnitude requires. Thus far, we have received a little less than \$2000 towards our goal.

We would like to thank John Coonly, Andrew Skattebo, KA0SNL, and Gene Pentecost, W4IMT for their contributions.

TAPR will be sending out a fund raising letter in the next few months in order to help fund all or part of the \$8,000 for this year's development. We would like to ask the membership to donate money towards the development effort to ensure that we don't have to take away from other important projects that also need cash this year to be completed.

When you get the note from TAPR asking for a small contribution, please take a serious moment and help bring this unique project closer to completion. If you have contact with a regional packet organization, contact them about contributing. Help fund a project that will lead to many new and exciting operational possibilities!

Donations above \$25 will receive a certificate indicating funding of TAPR FHSS Radio Project, while donations of \$250 or more will receive a plaque to let all know of their efforts with this project. All donations are needed large and small.

You can call the office at (940) 383-0000 or Fax (940) 566-2544 to make your donation by MC/Visa.

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 most of 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:

Steve Bible, N7HPR	1999 *	
Gary Hauge, N4CHV	1999 *	
Bob Hansen, N2GDE	1999 *	PSR Editor
Greg Jones, WD5IVD	2000	President
John Koster, W9DDD	2000	
Mel Whitten, K0PFX	2000	
John Ackermann, N8UR	2001	Vice President
Jim Neely, WA5LHS	2001	Treasurer
Barry McLarnon, VE3JF	2001	

Nominations are now open for seats expiring in March 1999 (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 31st, 1998.

Ballots will be mailed with the next *PSR*. TAPR will again use an Internet ballot, so read your ballot carefully. Results will be announced on March 30th, 1999.

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/liason 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. If elected, two board meetings in 1998 will be held. One will be during Dayton Hamvention and the other during the ARRL and TAPR Digital Communications Conference. All directors shall serve for a term of three years.

FlashCard Project

John Koster, W9DDD

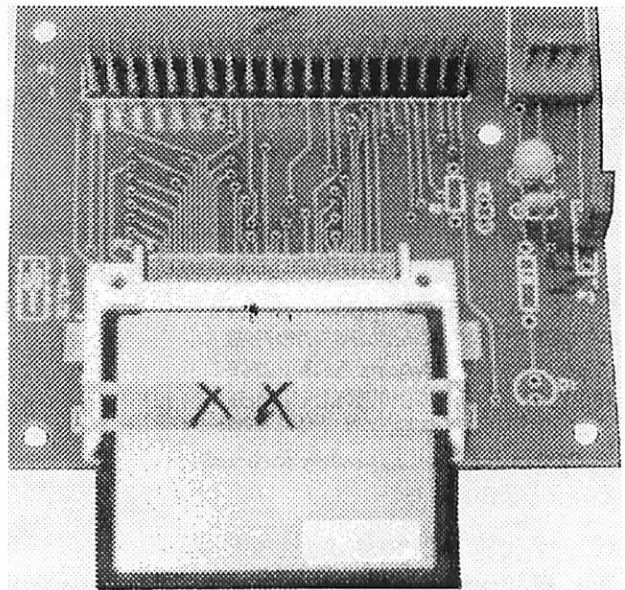
"A Linux Router Using A CompactFlash Card" is a project which has been developed that allows a CompactFlash card to be used as a boot device on a PC. It takes advantage of a feature of the CompactFlash Card that allows it to emulate an IDE hard disk drive. Linux has been used in the preliminary testing of the concept, but it should work with any node software anyone would want to use. John Koster, W9DDD, is the project developer with Allen Finne, KB5SQK, and Ed Geiger, KD4AB working on the Linux issues.

The project team was unaware of the work being done by the Linux Router Project at the time we started this project. However, one may find their web site to be an interesting reference <http://www.linuxrouter.org/>

Another site covering the booting of Linux from flash memory is: <http://users.bigpond.com/paulmoody/Mhow11c.html>

This project started in 1997 with discussions among several people at various gatherings about how to ruggedize a PC so that it could be used to run NOS or some other network node software at a remote location. Rugged power supplies and no moving parts were the two most mentioned criteria. How to store the software without a FDD or HDD was a prime question. Building an ISA bus card with a multitude of EPROM sockets was discussed as a first solution. Later talks between Allen and myself revolved around flash memory and how to make a system think it was a HDD. Shortly after these talks, a catalog arrived which had PCMCIA flash memory cards listed in it. The catalog listed two different types. One was listed as ATA. Hmm, I wondered to myself if that means it looks like a HDD? Prices weren't cheap, but at \$100 or so for 4MB of memory that didn't sound too bad. I began doing some research and I ran across a site that showed PCMCIA pinout with IDE type names on the signals. I then did some more searching and found that a couple of companies made adapters which connected the PCMCIA flash memory card to the IDE HDD bus.

We started with the purchase of an Adtron SDDA adapter and an 8MB ATA flash memory card. When the parts arrived, I plugged the flash memory card into a laptop PCMCIA slot and it looked just like a D: drive. It came already formatted for DOS. I plugged it into the SDDA adapter and connected it as the slave IDE in my desktop PC. I could read the DOS files I wrote to it while it was in the laptop. Isn't technology wonderful - when it works?



FlashCard Kit w/flash card attached

I told Allen about my success and he began working on a small Linux file system using a small IDE hard drive. I managed to install a minimum Linux file system from an older set of installation disks I had. This installation still had too many unneeded files installed to be useful. When Allen had completed his initial work, he built a binary image he thought would work and emailed it to me. After some problems getting it to copy properly from the HDD to the flash drive, I had a bootable Linux system with just the 8MB flash memory card.

At this time we approached TAPR about formalizing the project into a TAPR sponsored affair. After the TAPR BoD approved the proposal, I made a Circad library part for the 68 pin through-hole PCMCIA socket. Then I did a PCB design and preliminary layout.

A month after this, I started thinking about the CompactFlash card vs the PCMCIA flash card and started doing some more research. Although you can't get the connector for the CompactFlash card in a through hole part, it seemed that making the adapter for the CompactFlash card directly without a PCMCIA adapter into a PCMCIA socket was the way to go. We changed the design and I built an IDE buss adapter for the Compact Flash Card rather than the PCMCIA card.

In July of this year, I sent the PCB gerber files to the board house. Once the boards had come back, we built up two and they both worked!

Kit/Beta Testing Plan

The plan is to offer 50 Beta units at the end of 1998. Contact Dorothy at the TAPR office if you want to be one of the first fifty participants. The cost of the kit is expected to be \$49 for TAPR members plus shipping/handling.

TAPR PIC-Encoder Project Introduced at the 1998 ARRL and TAPR DCC

Several prototypes of the PIC-Encoder (PIC E), a new general purpose encoder based on the 16F84 PIC microcontroller were shown and demonstrated at the recent TAPR/ARRL Digital Communications Conference in Chicago. The PIC-E was designed to provide a generic interface between the digital world (in the form of serial data streams) and the amateur packet radio world (in the form of AX.25 packets) and is fully programmable by the user. The user can program the PIC microcontroller to take serial data from a GPS receiver or weather station and transmit it as formatted packet frames. Virtually any data that can be provided to the device as a serial input stream can be reformatted and transmitted as 1200 baud packet radio. At the DCC, the PIC-E was demonstrated as a minimal MIC-E™.

The PIC-E will be relatively inexpensive because it is based on only two chips: a Microchip, Inc. 16F84 microcontroller and a MX-COM, Inc. MX 614 Bell 202 modem chip. The 16F84 is a general purpose "computer on a chip" that can be programmed and reprogrammed over and over by the end user. The PIC can be programmed to receive incoming data streams and reformat them for transmission as AX.25 frames. It sends the resulting data to the MX614 that generates tones necessary to transmit 1200 baud packet over the radio's audio channel. The MX614 is a particularly interesting chip to use for this application because it also contains an "energy detect" circuit. If receive audio is routed to the MX614, it can determine whether the channel is in use and send this information back to the microcontroller. As a result, no additional VOX or carrier detect circuit is required to prevent the PIC-E from stepping on other channel users. The 614 can detect both digital signals and voice, so it is suitable for applications where digital and audio signals are mixed on the same frequency.

The PIC-E is an open system and it is hoped that many hams will use it as a platform for developing new and innovative applications. Almost any application that involves point to point or point to multi-point transmission of low-density data is a candidate for PIC-E development. To write applications for the PIC-E, however, you will need to learn how to develop PIC firmware. Don't worry, it is not all that difficult.

Most of what you will need to get started is readily available at little or no cost. The software to get started in PIC development is available for free at <http://www.microchip.com>. A discussion of the basics of getting started in PIC programming can be found in an article by W2FS in the October 1998 issue of QST. The Proceedings of the 1998 TAPR/ARRL Digital Communications Conference contains information on

how to implement AX.25 UI frames in a PIC microcontroller. While the 16F84 contains only 1K of program space, it turns out that this provides enough room not only to decode incoming serial data and construct outgoing packets, but to do a significant amount of processing and reformatting of the data as well.

To make it easier to program the 16F84 chip, the PIC-E has an on-board PIC programmer. As a result, to reprogram the chip, it is only necessary to connect a short serial cable between the PIC-E and a PC serial port and run the appropriate programming software.

The PIC-E will be offered initially by TAPR as a kit, which will be called the Evaluation PIC-E. Fifty (50) kits will be made and all parts will be included. The user only has to supply an enclosure and power. The purpose of the evaluation is to learn how users will deploy the unit and stimulate software development for new applications. Lessons learned from the evaluation kit will be used to design the follow on PIC-E. Estimated release date for the Evaluation PIC-E is January 1999.

The project team responsible for the PIC-E is: Steve Bible, N7HPR, project manager; Steve Dimse, K4HG, Byon Garrabrant, N6BG, John Hansen, W2FS, John Koster, W9DDD, and Dan Welch, W6DFW.

The price for the Evaluation PIC-E will be: \$49.00 US for members of TAPR + Shipping/handling

The Evaluation PIC-E kit is only available to TAPR members.

TAPR kits can be complex depending on the kitting experience of each builder. We don't think you will have trouble with the PIC-E kit, but it does require some knowledge and experience to successfully go from a kit to a finished, usable unit, depending on the mode of operations.

TAPR requires that Evaluation PIC-E purchasers provide VISA/MC information or checks/money orders with their initial purchases. Orders will be taken for the first fifty (50) units. After the initial batch of Evaluation PIC-E's are developed, TAPR will decide to either release additional EVM PIC-E kits or move towards a follow-on production PIC-E kit.

Orders for the Evaluation PIC-E can be mailed to the TAPR address: 8987-309 E. Tanque Verde Rd #337, Tucson, Az, 85749-9399, call (940) 383-0000 (Office Hours: Tue-Fri, 9am-12noon, 3pm-5pm Central Time), or fax (940) 566-2544.

MIC-E is a trademark of Bob Bruninga, WB4APR

APRS, Spread Spectrum Highlight Digital Conference

Jon Bloom, KE3Z

If developments displayed at the 17th ARRL and TAPR Digital Communications Conference were any guide, the momentum of the Automatic Position Reporting System (APRS) continues to grow. This year's conference — held September 25-27 in Rolling Meadows, Illinois — was notable for the announcement of a new Kenwood hand-held transceiver that includes a built-in TNC with support for APRS display and messaging as well as monitoring PacketCluster DX spots. The Kenwood TH-D7A "Data Communicator" is a dual-band (144/440 MHz) unit. It's expected to be on the market by year's end.

As it was last year, spread spectrum development again was another prime topic of discussion. One key difference from last year was the presence of real spread-spectrum hardware. A large contingent from the Packet Radio Users Group (PRUG) of Japan showed up with three experimental 2.4-GHz, direct-sequence spread-spectrum PRUG96 stations. This system, which comprises radio and computer components, is being developed in Japan by PRUG. At the conference, the three units were operated as a network transferring data among themselves at about 800 kbit/s.

Another spread-spectrum radio development project is the TAPR effort, spearheaded by Tom McDermott, N5EG. McDermott reported at the Conference that the project has moved considerably forward, with much of the development of the digital hardware and the software kernel now completed. A lot of work remains to be done, however, and no specific project completion date is yet forecast.

Dewayne Hendricks, WA8DZP, reported on experimental Amateur Radio spread-spectrum networks (under TAPR's FCC-granted special authority) in the San Francisco Bay area. One system he has tried uses Part 15 wireless LAN equipment, but operates under amateur (Part 97) rules. Another uses cable modems and transverters.

These technological efforts did not escape the notice of conference keynote speaker Dale N. Hatfield, W0IFO, Chief of the FCC's Office of Engineering and Technology. He expressed pleasure and approval at seeing the kind of experimental work that amateurs are engaged in, calling such efforts vital to the future of Amateur Radio.

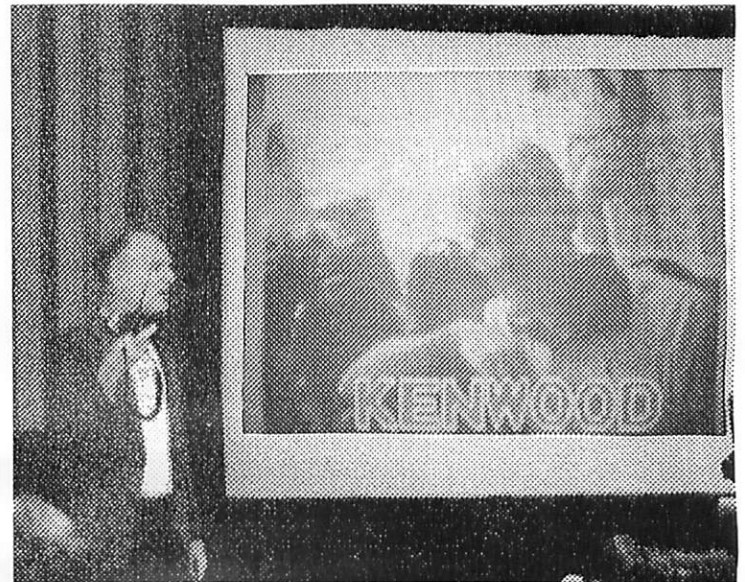
1998 ARRL and TAPR Digital Communications Conference September 25-27, 1998 Chicago, Illinois

Yes, another highly successful Digital Communications Conference! Special thanks go out to the workers at CAPRA for hosting locally and to PRUG (<http://www.prug.or.jp>) for being our first ever international co-host. Also, a very special thanks to Dale Hatfield, W0IFO, for attending and giving the keynote address on Saturday morning. Steve Stroh, N8GNJ, and Tina Stroh did an excellent job in working the arrangements with the hotel in Chicago once it was selected. As in years past, audio and photos from the conference will be available on the TAPR web site (<http://www.tapr.org/dcc>).

Next year's DCC will be hosted in Phoenix, AZ. The date of the conference should be selected by the end of the year.

The conference started Friday afternoon with the second annual APRS National Symposium moderated by Steve Dimse, K4HG. The symposium was full of talks and projects. Steve had his computer set up for a live web cam. You can still see the last image of mystery hardware 1 (<http://www.tapr.org/~k4hg/live.jpg>).

During the symposium, two mystery hardware projects were discussed. The first was a Kenwood Prototype Data communicator HT. This was a sneak preview provided by Kenwood to all those attending the DCC. By the time this *PSR* article is published, the HT should be available.



Bob Bruninga, WB4APR shows off the Kenwood Packet HT doing Video. Mel Whitten, K0PFX appears on the video display.

It is a full function dual band 5 watt HT with tons of APRS related features:

- 1200 / 9600 baud TNC built in
- GPS interface built in
- APRS displays built in
- APRS Messaging (with I-gates, it's like a nationwide 2-way pager)
- Receives all APRS packets
- APRS Mic-Encoder built-in
- APRS/GPS Single Port Mode built-in
- DX Cluster spots built-in

While the HT does not display maps, it does display range and bearing to all stations (40 max). It also displays their icon, Gridsquare, course and speed, Power, Antenna Height, antenna gain and directivity. It also displays Wind, Temp and Rain for all WX stations. If a graphics GPS is plugged in, then the GPS will show all stations as way points on its maps. With only the HT and a GPS with graphic display, you can do EVERYTHING in APRS (no laptop needed).

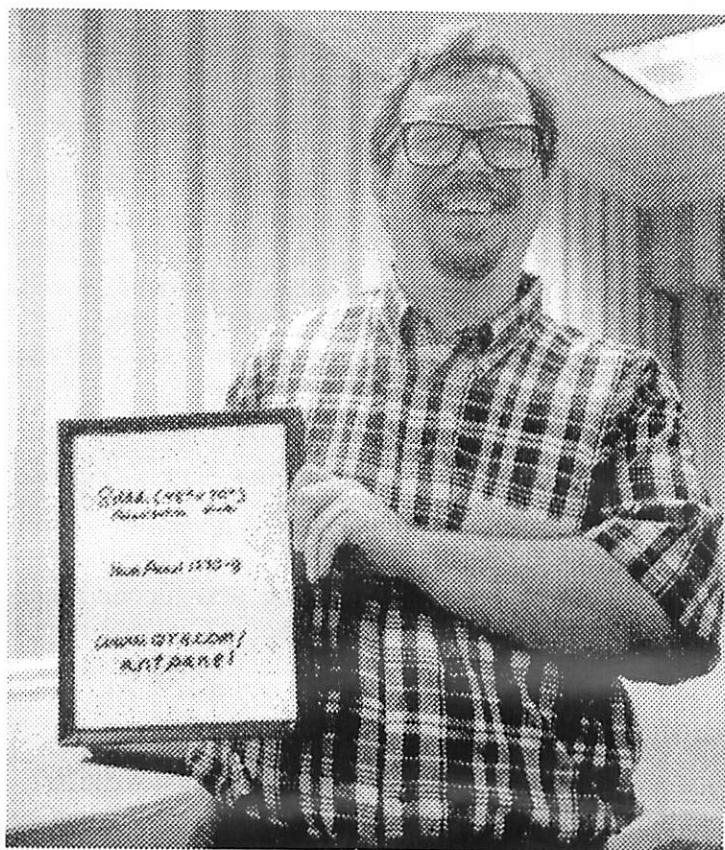
The second mystery hardware device is called the Pic Encoder, or Pic-E. This is discussed in detail in this issue of the *PSR*. It is designed as an enabling device, to allow others to have access to the joys of PIC programming for APRS. The hardware includes the modem and a flash-programmable PIC chip, with the associated circuitry. The unit is not designed as a Mic-E replacement. However, with software that will be available, you can use it as a weather encoder (plug into Peet Bros. or Radio Shack and radio...no TNC), a GPS encoder (similar to Mic-E), DGPS transmitter, etc. The real purpose, though, is to see what software others will come up with. This is a very easy thing to do; code modules for the AX-25 routines will be available.

Late Friday afternoon, a half-day seminar titled "Infrastructureless Technologies in Amateur Radio," presented by Don Lemke, WB9MJN, dealt with the pros and cons of DDMA (directivity division multiple access, a proposed infrastructureless technique) versus hubbed (cellular style) and other infrastructure dependent techniques. The technical seminar was very well attended and comments from the participants indicated that Don did a great job! The audio from his seminar is on the web page for those that couldn't attend.

Friday night saw the first ever DCC social, which was sponsored by PRUG. After the social, PRUG presented a series of technical papers highlighting their current development. The papers focused on the prototype direct-sequence radio operating in the 2.4 GHz band (there are slight differences in frequencies between the US and Japan in this band) which PRUG has designed. This prototype appears to be very well designed from an experimentation point of view.

As an overview of their project, all of the radio protocol as well as future planned software-executed forward-error-correction (FEC) is performed on a workstation. This workstation in-turn is attached via 10-base-T Ethernet cable to a Z80 module (and Ethernet NIC card) located with the radio. The advantage is that the long run of cable up the tower is 10-base-T cable, and the 2.4 GHz coax cable is kept to about 12 inches in length. This Z80 processor performs very limited functionality. It removes a temporary header used to send packets from the workstation to the Z80 (based on UDP/IP) and transmits the remainder of the frame on the radio. It performs the complementary function in the received direction.

The key advantage of this unusual encapsulation method is that all of the software that defines the network, the media access (MAC) protocols, the FEC codes, etc. resides within a single UDP process on the workstation (which can as easily be a PC). This means that experimentation with different MAC protocols, new routing protocols, etc. is easily accomplished and simple to develop. PRUG is cooperating with the Tokyo Institute of Technology to experiment with, and develop new protocols for packet radio using this technology. It's well suited for a university program because the researcher can spend most of the time focusing on the network aspects, and much less so on real-time issues,



Don Lemke, WB9MJN, showing off one of his patch antenna designs for 1.2G

software integration issues, etc. This makes it possible for a graduate student to complete a project in one or two semesters with the PRUG hardware. We will look forward to reading the papers published by these researchers on their spread-spectrum, network, MAC, and routing experiments at future DCCs, hopefully! It's a great example of how amateur radio can provide a foundation for and contribute to important technical work.



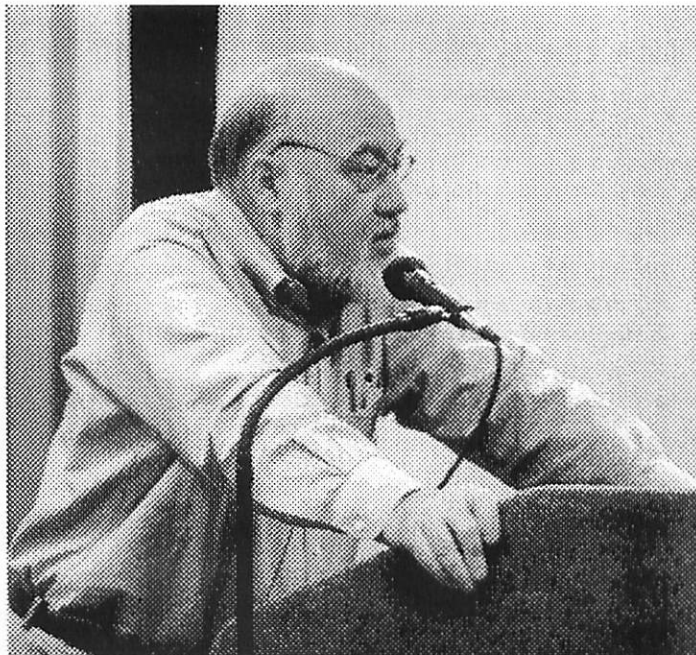
The PRUG Spread Spectrum radio was demoed on Friday night at the DCC.

The current raw data rate is about 800 kilobits per second and the spreading code is an 11-bit Barker sequence. All radios on the channel utilize the same spreading sequence, so collisions and multicasting are possible. Thus, the radio appears much like one channel in today's packet network except that the data rate is much higher. The channel access protocols are similar. PRUG presented a paper on the use of improved channel access protocols. They analyzed the theoretical throughput of a channel under CSMA/CD (current packet protocol) and MACA protocols (MACA was described by Phil Karn, KA9Q, in a 1991 DCC paper).

The social and PRUG session were a huge success!

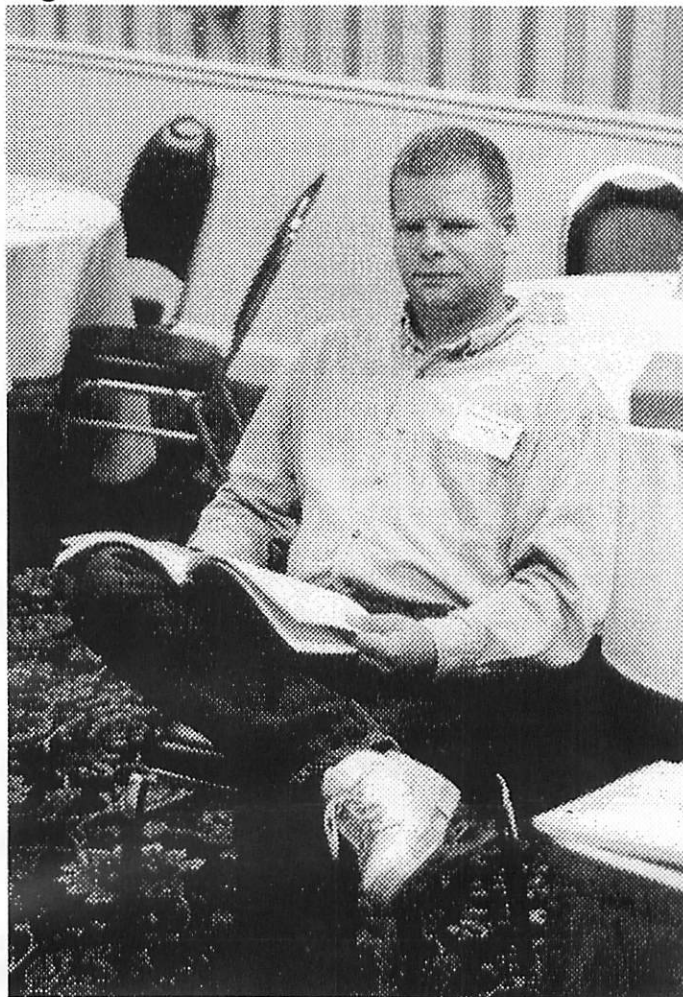
Saturday morning started early with a keynote talk by Dale Hatfield, W0IFO. Dale has just become the Chief of the FCC's Office of Engineering and Technology. Having someone at this level of the FCC attending the conference is a major accomplishment and recognizes the significance of the work of all in the hobby who participate in experimentation.

As with past years, Saturday was split into two strands -- a paper session and a session featuring selected topics. We decided this year for the selected topic strand to have fewer topics with more time to present. Four selected topics were presented. Steve Bible, N7HPR, presented an introduction to Spread Spectrum communications. This



Dale Hatfield, W0IFO

was followed by one of the best attended on PIC Development presented by John Hansen, W2FS, and Byron Garrabrant, N6BG. Instead of using the one hour assigned, the session went 115 minutes. PIC



Byron Garrabrant, N6BG.

development saw a lot of interest throughout the conference. Bob Bruninga, WB4APR, and Keith Sproul, WU2Z, presented an overview to APRS and discussed some of the latest happenings in the mode. The final topic was presented by Dewayne Hendricks, WA8DZP, who talked about MMDS and LMDS networking systems and how amateurs should look at implementing new networking technology. Thanks to all the selected topic speakers for taking the time to present more in-depth materials during the DCC.

The paper sessions included the following talks:

A new vision for the Amateur Radio Service

Dewayne Hendricks, WA8DZP, and Greg Jones, WD5IVD

A New Routing Method Based on Station ID

Norito Nemoto, JH1FBM

Back to the Packet Radio with MACA

Ikuko Kawamura, Hideyuki Ishinaka, Hiroshi Matsuno, JH4CIN

IP-Shield Machine (IPSM): An Ethernet Interface for High Speed Packet Radio

Satoshi Funada, 7M3LG

Internet to RF Messaging within APRS

Steve Dimse, K4HG

What's New for APRS in 1999

Bob Bruninga, WB4APR

APRS QSY from 145.79 to 144.39

Steve Dimse, K4HG, Greg Jones, WD5IVD, and Frank Bauer, KA3HDO

PropNET: A Proposal for an APRS-based Propagation-Research Tool

Evhen Tupis, W2EV

Spread Spectrum in the Amateur Radio Service: Current Status and Historical Notes

Dewayne Hendricks, WA8DZP, and Barry McLarnon, VE3JF

Optimized Channel Access Mechanisms for Decentralized Spread Spectrum Packet Networks

Matthew Ettus, N2MJI

Current Status of Amateur Spread Spectrum Radio in Japan

Katsuhiko Morosawa, 7K1NCP/JH0MRP/KD5EYI

Status Report on TAPR 900MHz SS Radio Project

Tom McDermott, N5EG

PIC-et Radio: How to Send AX.25 UI Frames Using Inexpensive PIC Microprocessors

John Hansen, W2FS

TAPR Linux Flash Card Project

John Koster, W9DDD

Quality Electronic Map Displays for APRS Motor Vehicle Navigation

Bruce Prior, N7RR

TAPR GPS Projects Update (TAC-2, DGPS, etc)

Steve Bible, N7HPR

For the banquet speaker, we were very fortunate to have Steve Roberts, N4RVE, of Nomadic Research Labs speak. Steve is the creator of the Winnebiko and Behemoth high-tech recumbent bicycles. His current project is focused on Microship technology (<http://www.microship.com/>). As expected, Steve gave a very entertaining presentation.

The Sunday morning seminar this year was a combination of two different talks. The first presentation, by Lyle Johnson, WA7GXD, focused on the upcoming RUDAK digital communications system scheduled to fly on the AMSAT Phase 3D satellite in the near future. Lyle discussed features, systems design, integration, and experiments. What and how the payload was looking like on the ground during testing was a very important part of the talk, since it gave realistic numbers to the potential communication systems that might be implemented on RUDAK. The second presentation was by Tim Shepard, KD1KY, regarding "Packet Radio Networks with Millions or Billions of Stations." This talk was based on his dissertation topic at MIT. The conference would like to thank both presenters for giving excellent talks for the Sunday seminar. The participants commented how they enjoyed the technical content in both talks.

The third Annual ARRL and TAPR DCC Student Papers Award had no papers submitted this year that could be considered for the travel award. If you know of a college student or high-school student that would benefit from attending the DCC and presenting a paper, please think about getting them to participate in the award next year. More information on the travel awards can be found on the DCC web page (<http://www.tapr.org/dcc>)

See you next year!

Tim Mitchell, KA5RYF, SK

Tim Mitchell, KA5RYF, became a silent key on October 6th, 1998. Tim was a great help in getting packet off the ground here in Kansas City, Missouri; we will miss him greatly .

David Ross, KA0VXR

ka0vxr@kcnet.com

Abstracts from the ARRL and TAPR 17th Digital Communications Conference Proceedings

132 pages. Price: \$15 Available from TAPR and the ARRL

What's New for APRS in 1999 by Bob Bruninga, WB4APR

Introduction: Since APRS was first introduced at the 1992 TAPR/ARRL Digital Communications Conference it has evolved to fulfill a growing need for tactical real-time digital communications. Trying to describe its usefulness is similar to describing amateur radio itself. The scope is so broad and the applications so widespread, that no single listing can be complete. Major milestones in that evolution were the transition from hand entered maps to the USGS CD ROMS, in 1994, the development of MacAPRS in 1994 by Keith and Mark Sproul followed by the official WinAPRS version in 1995. In 1997 Brent Hildebrand developed a special application called APRS+SA to take advantage of the very popular Delorme Street Atlas CD ROM maps. This improvement in maps to the street level was completed recently with the full integration of Precision Mapping system into the WinAPRS product in 1998. Along the way, Steve Dimse's javAPRS began the great migration of APRS onto the information super highway in 1996 by making APRS tracking available to anyone with a WEB browser, culminating in his debut of APRServe at the 1997 DCC in Baltimore Maryland which provides a worldwide Internet backbone for all APRS packet. Covered in paper: APRS National Freq, Internet Gateways, APRS digis, Digis in 1999, Mobile Satellite Network, Channel Capacity for 1999, Kenwood APRS Handheld communicator.

Internet to RF Messaging within APRS by Steve Dimse, K4HG

Abstract: This paper describes a new feature implemented within APRS system, which allows transparent messaging between stations on the Internet and RF sides of the network, as well as on two distant RF networks using the Internet as a link.

Co-evolution of Print, Computer, and Radio Technologies

by Roy Ekberg, W0LIQ and Martin Schroedel, K9LTL

Abstract: This is about standards for CAC (Computer Assisted Communications) proposed first in the 12th and 16th DCC proceedings. Our CAC Model 17 was entered in the ARRL's library under C-135-1. R&D work began in 1989 and continues.

Optimized Channel access Mechanisms for Decentralized Spread Spectrum Packet Networks by Matthew Ettus, N2MJI

Abstract: In a Spread Spectrum (SS) network with cooperative, minimum-energy routing, latency grows with the number of stations in the network due to the increasing number of hops which a packet must take en route to its destination. This is the principal factor limiting the number of stations in the network. Previously proposed channel access mechanisms for these networks were principally concerned with collision avoidance, to the detriment of latency, especially in light or moderately loaded networks. Additionally, while avoiding extremely low SNRs due to collisions, better results are obtainable for average SNR. Several new channel access mechanisms are proposed and simulated for the purpose of addressing the issues stated above. The results obtained indicated that there is potential for significant improvement in performance through the use of alternative channel access procedures.

IP-Shield Machine (IPSM): An Ethernet Interface for High-Speed Packet Radio by Satoshi Funada, 7M3LCG

Abstract: In PRUG96 project, we developed an Ethernet interface for high-speed digital transceiver, called IPSM-ZZ. IPSM deals with a only Media Access Control layer protocol. With its partner, Protocol Server deals with upper layer protocols. It allows us to develop upper layer protocols flexibly in common operating systems..

PIC-et Radio: How to Send AX.25 UI Frames Using Inexpensive PIC Microprocessors by John Hansen, W2FS

Abstract: This paper provides step by step documentation of how to implement AX.25 UI frames using inexpensive PIC microcontrollers. It is designed primarily for those who wish to implement packet radio UI beacons for point to multipoint communications. The article assumes some knowledge of programming concepts and PIC microprocessors. It also discusses the limitations that must be overcome in order to build a completely PIC based terminal node controller.

A New Vision for the Amateur Radio Service by Dwayne Hendricks, WA8DZP and Greg Jones, WD5IVD

Abstract: Amateur radio as a hobby has reached an important turning point. Many can point to the various examples of why things are changing; however, some of these examples are real and some are only periodic in nature, but the trend of activity and interest now as compared to five years or even ten years ago is changing. This paper discusses issues that need to be addressed with regards to technology changes in amateur radio.

APRS QSY from 145.79 to 144.39

by Greg Jones, WD5IVD, Frank Bauer, KA3HDO, Stan Horzempa, WA1LOU, and Steve Dimse, K4HG

Abstract: This paper describes the successful APRS QSY that was begun at the 1997 ARRL and TAPR Digital Communications Conference. It covers some of the issues and reasons behind the project.

Back to the Packet Radio with MACA

by Ikuko Kawamura, Hideyuki Ishinaka, and Hiroshi Matsuno, JH4CIN

Introduction: Karn introduced MACA in which was designed for packet radio network. It was used as the basis for the IEEE802.11 LAN standard. Thereafter, based on simulation studies of MACA, Bharghaven et al. fine tuned MACA to improve its performance and renames their new protocol MACAW. In this paper, we first investigate the performance of MACA under the no hidden terminal situation. By an analytic way, we will compare the throughputs of MACA and CSMA. We review CSMA and some kind of protocols considered as extended versions of CSMA, and point out that MACA has an ability to get the throughput exceeding one. A suggestion in conclusion in this paper will remind us that we are people who love amateur radio and have some interests in computer.

Spread Spectrum in the Amateur Radio Service: Current Status and Historical Notes

by Dewayne Hendricks, WA8DZP and Barry McLarnon, VE3JF

Abstract: This paper covers the current status of Spread Spectrum operations: Amateur SS in the USA, Amateur SS in other countries, What We've learned so far about spread spectrum operations and what they way ahead looks like.

Current Status of Amateur Spread Spectrum in Japan

by Katsuhiko Morosawa, JH0MRP

Abstract: We have practiced field tests using our PRUG96 system with SS transceivers, where we performed the 30km distance QSO. The output power of the transceiver is only about 30mW and the front gain of the antenna is 21dbi. We also confirmed that our system enables us to use the internet applications ('web browsing', 'videoconference' and so on) with practical speed.

A New Routing Method Based on Station ID

by Norito Nemoto, JH1FBM

Abstract: There are two problems on routing packets by means of IP address in a seamlessly wide area radio networks: (1) conflicting IP address on routing information and (2) little flexibility to accommodate and isolate the differences among local network policies. To solve them, it is important to use a routing method based

on the callsign of radio station. A new method is presented in this paper with an emphasis on the use of the callsign. This protocol employs Station ID (SID), which is a combination of callsign and a system number.

APRSstat: An APRS Network Analysis Tool

by Richard Parry, W9IF

Abstract: APRSstat monitors network traffic by connecting to an APRS telnet server and collecting network traffic statistics. The program is intended to run continuously as a background task on a UNIX/Linux system. It collects and saves network data for periods as long as a year. The data gathered by APRSstat is plotted using the companion program APRSgraph, which creates graphs as GIF images allowing them to be integrated into a web page. APRSgraph is executed as a cron job every five minutes providing near real time updates of network usage for daily, weekly, monthly, and yearly periods. Characters per minute is used to measure network traffic. A detailed example of the San Diego, California APRS network is included which displayed on the author's home web page. A cursory explanation of the software is also included in the paper. APRSstat and APRSgraph were written in perl and use perl modules GD and Chart for creating the graph GIF images.

Quality Electronic Map Displays for APRS Motor Vehicle Navigation

by Bruce Prior, N7RR

Abstract: This paper covers issues regarding how to improve map displays used in vehicles.

An Inexpensive PC-Modem for 76.8kBit/s User Access

by Thomas Sailer, HB9JNX/AE4WA and Johannes Kneip, DG3RBU

Abstract: This article describes a simple and inexpensive modem intended to link end users at 76.8kBit/s to the high-speed backbone network. The modem can be connected to standard PC's using the Enhanced Parallel Port (EPP) Interface.

Take the Next Step with the Next Generation Protocol

by Naoto Shimazaki

Abstract: This document describes an idea for use of IPv6 over the amateur radio network. IPv6 has huge address space and it supports realtime traffic. IPv6 realizes new applications. For example, managing IPv4 address is not easy. It is possible to encode out "callsign" into IPv6 address. It enables us to managing IPaddress much easier.

Half-Duplex Spread Spectrum Networks

by Darryl Smith, VK2TDS

Abstract: This paper is a response to the presentation of the TAPR SS Modem at the 1997 Digital Communications Conference in Baltimore, MD. At this

conference, topology's were proposed for use of the SS radios and modems in a network, which the author of this paper feels are rather limiting. This paper proposes to extend the topology's available allowing implementation of a network rather than a collection of communicating nodes. This paper also builds on a number of ideas brought up in the authors undergraduate thesis.

PropNET: A Proposal for an APRS-based Propagation-Research Tool

by Evhen Tupis, W2EV

Abstract: When does the band open? Over what paths did the opening occur? Was it open to more than one location at the same time? Wouldn't it be nice to have been alerted to the opening, while it was in-progress? Wouldn't it be nice to "log the opening", and "re-play" it at a future time? With a minimal investment in equipment and software, you may be able to answer these questions for yourself.

APRS and PropNET: Potential Tools for Collaborative Radio Propagation Research

by Scot Parker, K7LU

Abstract: PropNET is an APRS network operating on the six meter band whose primary objective is to monitor and study radio propagation. There is interest outside (as well as within) the amateur radio community in the long distance propagation modes that PropNET has been designed to study. The possibilities for collaborative research and potential benefits of inter-community cooperation are explored.

Alpha-test report of PRUG96 High-Speed Radio Link

by Shingo Watanabe, JG8OOM, Satoshi Funada, 7M3LCG, and Kunihiko Ohnaka, 7K4JBX

Abstract: The PRUG96 system is designed to create a reliable high-speed ham radio based computer network. This report describes a PRUG96 system using IP network protocol. We have an alpha-test structure to make it clear the weakness point of the system. The difference in the daily data throughput in various environments and error rate trend were measured.

On-Air Measurements of CLOVER II and CLOVER 2000 Throughput

by Ken Wickwire, KB1JY, Mike Bernock, KB1PZ, and Bob Levreault, W1IMM

Concluding Remarks: This paper is part of a series treating on-air measurement of throughput of various HF data-transmission protocols available to amateurs. Here we describe an extensive set of measurements of throughput for text and other files sent using the file transfer protocols implemented in the HAL CLOVERII and CLOVER 2000 terminal and firmware package. The files were transmitted over Near Vertical Incidence Skywave (NVIS) and one-hop skywave (OHS) paths. The

measured throughput data in our experiments were analyzed using software specially written to compute throughput statistics from our CLOVER data. Throughput statistics for compressed and uncompressed text, data, graphics and hybrid (Word and Excel) files are presented, and text throughput is compared with throughput using PacTOR and GTOR.

New Product Announcement: PK-232/DSP Upgrade for the PK-232/PK-232MBX

From Press Release Provided by Timewave

Timewave's customers swear by their DSP filters and PK-232 owners love the flexibility and reliability of the most popular data controller ever built. The PK-232/DSP rolls it all into one! The PK-232/DSP daughter board brings a new level of performance to the legendary PK-232 with sharp, accurate filters for all the data modes. Noise and QRM bounce off the new filters for cleaner copy with fewer errors than the old analog filters. Weak signals magically appear from the noise.

More Filters, Better Filters, Automatic selection

The PK-232/DSP brickwall filters have tighter bandwidth and steeper skirts for improved noise and QRM rejection. A new version of the PK-232 firmware (Ver. 7.2) allows a wider selection of filters than the original PK-232, so the filter can match the mode. The correct DSP filter is automatically selected when you choose a new mode. In PACTOR, the filter bandwidth automatically changes when the baud rate shifts in response to the error rate of the link. In Morse (CW), the operator can preset either 100 Hz or 200 Hz bandwidth. The PK-232/DSP is completely compatible with all existing software terminal programs for the PK-232. The upgrade kit is user installable and is shipping now. The upgrade price for the PK-232MBX TNC is \$125, If you need an upgrade for the PK-232 the price is \$150. See <http://www.timewave.com> for more detail.

For more information, contact Timewave Technology, 58 Plato Blvd. East, St. Paul, MN 55107: Tel 651-222-4858, email sales@timewave.com

*****Connect Request**

I need help on locating any group still working with the L.L.Grace DSP-12 platform.

Sydney F. Chiswell, W2ICZ
W2ICZ@buffnet.net
76 Chardon Dr.
Buffalo, NY. 14225-2314 USA

APRS for Palm III Under Development

Mike Musick, N0QBF
71301.3106@compuserve.com

From the APRS-SIG

palmAPRS Status

In a nutshell: we're in the home stretch!

The APRS program for the Palm III handheld organizer has stabilized considerably in the past several weeks, with a number of quirks and crashes found and fixed. Most of the basic function holes are getting plugged (a few minor ones remain), and we are making huge headway on getting the map support system nailed-down. The first public beta release should be on or about the Thanksgiving weekend.

What's In It?

Basic APRS functionality - receive and send object information, in both text and map-based displays, and send and receive messages. GPS support is through dual-port TNC's, though a GPS can be connected directly for off-air locator use. A comprehensive RDF support system is under development, but may not be included in the first beta.

Map display is in Palm III grayscale (light gray, dark gray and black). Maps will somewhat resemble the commercial mapping system look (like Street Atlas and Precision Maps) with thick and thin lines, and shading to convey feature importance. The initial palmAPRS versions will not have route numbers, but this feature is on the scope (street names, however, are not in the current development plan).

The design orientation is to use as a mobile station, with the Palm on or above the dash using any one of the commercially-available mounting systems. Display selections are "one-touch" with this concept in mind.

What's Not In It?

This list will (of course...) change as the program matures. For the moment, it doesn't support - weather data collection or display, direct Internet hookup, certain infrequently-used APRS protocols (such as grid square posits), overlay files, altitude displays, map labels... to mention but a few.

"HSP" switching between TNC and GPS is not possible on the Palm -- a dual-port TNC (PicoPacket or KPC-3 Plus with v8.3 firmware) will be required to be on-air with a GPS. Also, Palm Pilot Professional (and Palm Pilot Personal) support is looking less and less likely as development progresses.

What About Maps?

Good question. Because of the storage limitations of handheld devices, a new APRS map format was created which emphasized space economy over processing economy. It was also necessary to create a special format so maps could be downloaded to the Palm independently of the program. So the map data is unique to the Palm system. The map system more closely resembles the Mac/WinAPRS model, where the user selects from a list of wide-area coverages, with map data itself down to the street level in some cases.

There is currently a limit to map size in the number of points that it may contain (roughly 30000), which is due to file addressing limits within the Palm data management system. We are exploring options to get past this.

For the near-term, I will have to provide maps (from USGS 100K DLG source), which will be made available at no cost (requests within reason, of course). As the process matures, users can be seeded with the map generation program. A more "democratic" process is on the development list, which will probably embody conversion of APRSdos-format map files.

Where Can I Get palmAPRS?

When it's ready, at the TAPR FTP site.

OK... How Much?

As is required of all APRS programs, palmAPRS is slightly crippled shareware. The shareware fee will be \$40, and registration enables saving of station and program settings. Registration requirement will be waived for the beta versions; however, the beta versions will be time-limited. At this point I anticipate two beta releases.

Because most of the remaining development is "by rote" rather than requiring a huge concentrated creative effort or steep learning curve, I will gladly be available to answer questions and comments.

FCC Office Of The Secretary Relocates

Effective November 2, 1998, the FCC's Office of the Secretary will be relocated to The Portals, 445 Twelfth Street, S.W., Washington, D.C., 20554. The Commission expects to complete its relocation to The Portals within the next six months.

For information concerning paper filings, etc., see:

www.fcc.gov/Daily_Releases/Daily_Business/1998/db_981023/pnmc8062.txt

this has basic filing guidelines and information about the address change.



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FCC'S NESS: Ensure Adequate Spectrum For Amateurs

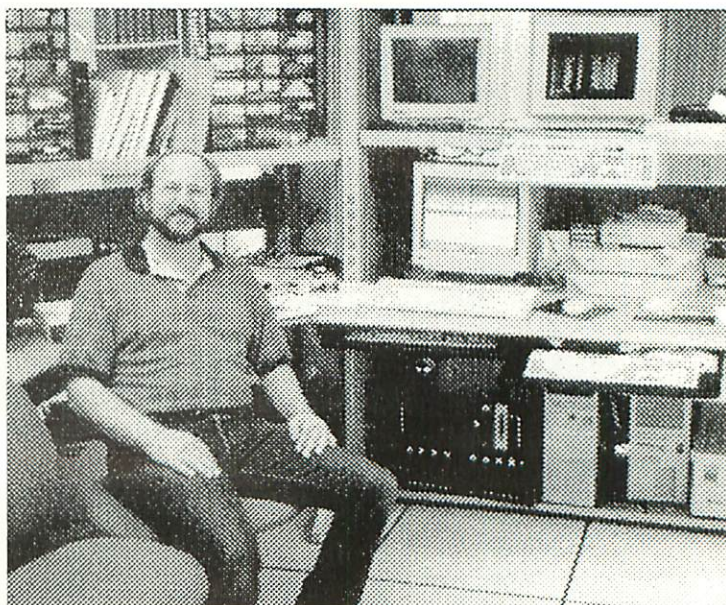
Source: The ARRL Letter
Vol. 17, No. 39

FCC Commissioner Susan Ness recently gave amateurs some cause for optimism. In remarks prepared for delivery September at the Personal Communications Industry Association of America's PCS '98 in Orlando, Florida, Ness promoted the notion that some spectrum should be kept off the auction block. The value to the public of certain spectrum uses "does not always translate into pure economic terms," Ness declared.

"For example, we need to ensure that adequate spectrum is available for public safety purposes, for unlicensed--that is, Part 15--uses, for the Amateur Service, and for experimental and scientific purposes," Ness said. "None of these needs would be met if auctions displaced judgment in the spectrum allocation process."

Addressing the topic "Blueprint for Spectrum Management," Ness said auctions work well but are not a substitute for the allocation process. The FCC, she said, must not back away from its fundamental duty to allocate "in accordance with the public interest."

The complete text of Commissioner Ness's remarks are available on the FCC Web site at <http://www.fcc.gov/Speeches/Ness/spsn815.html>.



Lee Ziegenhals, N5LYT at the TAPR.ORG site. The TAPR.ORG machine underwent a major upgrade in September. Thanks Lee!

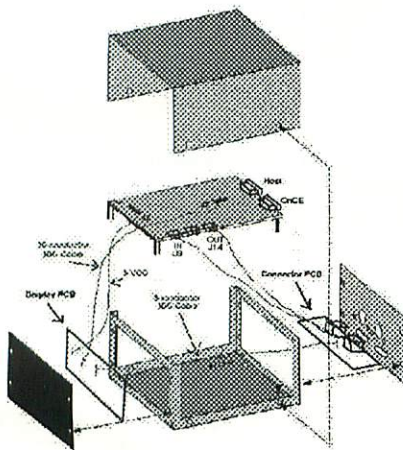
Kits/Publications Update

TAPR EVM56002 Interface Boards and Enclosure Kit

www.tapr.org/tapr/html/dsp56002evm.html

So far we have 70 orders for the EVM interface kit. The parts and enclosure are on order and as soon as they arrive and are packaged, we can begin shipping kits.

We plan on doing 125 kits based on the initial orders.



Just as an update, this kit provides:

An EVM Interface Board Kit and Enclosure for the Motorola EVM56002 DSP board. All parts -- including screws, standoffs, schematics, documentation (Assembly and Operations), and Software.

A Motorola EVM56002 DSP board IS NOT INCLUDED

The price is:

\$135.00 US for members of TAPR
or
\$150.00 US for non-members
+ shipping/handling

TAPR kits can be complex depending on the kitting experience of each builder. We don't think you will have trouble with the interface kit, but it does require some knowledge and experience to

successfully go from a kit to a finished, usable unit, depending on the mode of operations. For data radio applications (i.e. 9600 baud FSK), special modifications must be made to your radio for proper operation of the EVM interface. In addition, the interface kit requires that you have a Motorola EVM56002 unit. These can be purchased from several electronic distributors (see web page).

The interface kit has been discussed for about the last year, with a group coming forward late in 1997 to complete the design process. PSR Issue #69, Winter 1998, has the full description with photos. Current information on the kit is now available at www.tapr.org/tapr/html/dsp56002evm.html

This design of the radio interface for the Motorola DSP56002EVM is based on Johan Forrer's, KC7WW, original design. In February 1997, Douglas Braun, N1OWU, released his software suite for the EVM, based on the Finnish Alef Null group's work, and revised his interface to be more flexible than Johan's. The TAPR interface is a happy medium between Johan's and Doug's design. The goal is to make the interface flexible for past and present code developed for the EVM and to create a flexible programming interface for future programmers.

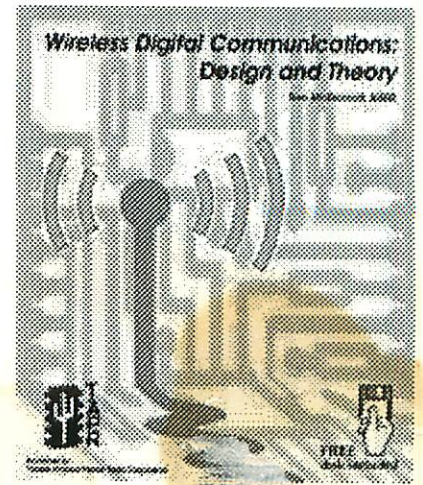
TUC-52 and METCON-II personality board update

The TUC-52/METCON-II project is getting closer to completion. The project team has tested both boards together and are debugging various small issues. The documentation is being written and the project team should be doing additional testing of the METCON-II board soon. It is planned to have kits of the TUC-52/METCON-II available before Dayton 1999.

TAPR Publications

Wireless Digital Communications: Theory and Design

We just sent *Wireless Digital Communications: Theory and Design*, by Tom McDermott, N5EG, into the printer's for a second printing. All the small corrections people had pointed out have been changed for the second printing. An errata page should be up on the web page soon.



TAPR Spread Spectrum Update

The SS Update publication has arrived at the office. The collection of articles on Spread Spectrum covers a range of issues on Introductory/Informative, TAPR related, Regulatory, and Technical/Theory. Tom McDermott, N5EG, provides the foreword of the book.

This book provides an extremely broad treatment of the subject of spread spectrum systems as applied to amateur radio. While little technical and social literature exists on this subject, the publication provides a convenient compilation of a fair amount of the significant work. It should appeal to an audience with a wide-ranging interest in the subject.

Contact Dorothy to get your copy.

Kits	Price	Qty	Total
Motorola EVM56002 Interface	\$150.00		
TAPR APRSTM MIC-EncoderTM	\$149.00		
TAC-2 (Totally Accurate Clock)	\$139.00		
Differential GPS (Member Price)	\$179.00		
DAS (DTMF Accessory Squelch)	\$68.00		
AN-93 HF Modem	\$90.00		
Linux Router FlashCard	\$49.00		
TAPR 9600 bps Modem	\$80.00		
Bit Regenerator	\$10.00		
Clock Option	\$5.00		
PK-232 Modem Disconnect	\$20.00		
PK232MBX Installation Kit	\$20.00		
XR2211 DCD Mod.	\$20.00		
State Machine DCD Mod.	\$20.00		
State Machine DCD w/Int Clock	\$25.00		
Firmware			
32K RAM w/ TNC2 update docs	\$20.00		
TNC-2 1.1.9 w/KISS EPROM	\$15.00		
1.1.9 Commands Booklet (only)	\$8.00		
TNC-2 WA8DED EPROM	\$12.00		
TNC-1 WA8DED EPROM	\$12.00		
TNC-2 KISS EPROM	\$12.00		
TNC-1 KISS EPROM	\$12.00		
PK-87 WA8DED EPROM	\$12.00		
Publications			
1998 TAPR CD-ROM	\$20.00		
1997 TAPR CD-ROM	\$10.00		
Wireless Digital Communications	\$39.99		
TAPR Spread Spectrum Update	\$18.00		
Packet Radio: What? Why? How?	\$12.00		
BBS Sysop Guide	\$9.00		
NOSIntro, Intro to KA9Q NOS	\$23.00		
TAPR's 94 Annual Proceedings	\$7.00		
TAPR's 95 Annual Proceedings	\$7.00		
PSR Set Vol 1 (#1 - #17 '82 - '85)	\$20.00		
PSR Set Vol 2 (#18 - #36 '86 - '89)	\$20.00		
PSR Set Vol 3 (#37 - #52 '90 - '93)	\$20.00		
PSR Set Vol 4 (#53 - #68 '94 - '97)	\$35.00		
ARRL/TAPR 1998 DCC	15.00		
ARRL CNC Proceedings 1st - 16th	call		
Entire Set ARRL DCC 1st - 16th	\$120.00		
Other			
TAPR 11oz Coffee Mug logo	\$11.00		
TAPR Badge	\$10.00		
TAPR Shirt - 4 styles			
3 1/2" Disk from TAPR Library	\$3.00		
GPS			
TAC-32 Software Registration	\$55.00		
Garmin GPS-20 (Member Price)	\$169.00		
Garmin GPS-25 (Member Price)	\$179.00		
Garmin GPS-20/25 Interface/Power Kit	\$40.00		
Garmin GPS-20/GPS-25 Data Cable	\$15.00		
Garmin GA-27 GPS Antenna	\$75.00		
Oncore VP GPS (Member Price)	\$269.00		
Oncore VP Interface/Power Kit	\$40.00		
Oncore GT+ GPS (Member Price)	\$169.00		
Motorola Antenna 97	\$65.00		
MCX Rt-Ang Connector w/coax pigtail	\$15.00		

Kit Code	Information
16	http://www.tapr.org/tapr/html/dsp56002evm.html
28	
10	Requires a GPS to operate
16	Requires a GPS to operate
3	As seen in Dec 95 QST
4	limited kits available.
7	
6	
1	used for regenerative repeater operation
1	used for regenerative repeater operation
2	simplifies connection of external modems
2	for installation of 9600 modem in PK-232MBX
2	
2	
2	For KPC2 or other TNC w/o 16X or 32X int clock
2	
4	includes 1.1.9 Commands booklet (below)
2	full TNC-2 command set for 1.1.9
2	8 connect version for ARES/Data standard
2	
2	
2	
2	
4	ISO 9660, 650 Megs of info! w/ html nav pages
4	ISO 9660, 650 Megs of info! w/ html nav pages
8	300+ pages w/disk by: Tom McDermott, N5EG
6	collection of articles on Spread Spectrum
2	130 pages. TAPR's Packet Radio book.
2	60 pages. by: Barry Buelow, WA0RJT
8	lan Wade, G3NRVW, TCP/IP over Packet Radio
4	Papers from the Annual Meeting (Tucson)
4	Papers from the Annual Meeting (St Louis)
4	1998 DCC Proceedings Chicago, IL
.	Individual Proceedings, call for prices
144	12 Proceedings from 1981 to 1997
4	Logo in black and microwavable gold
0	include Name and Call for badge
0	http://www.tapr.org/tapr/html/shirts.html
0	\$3 per disk. See TAPR Software Library List
0	
28	No Discount. (data cable included)
28	No Discount. (data cable included)
8	
2	No Discount.
8	mcx connector, mag and sunction mounts
28	No Discount.
8	
28	No Discount.
8	bnc connector, mag mount
2	No Discount.

Subtotal:

Added Total Kit Codes

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



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 Internet: TAPR@TAPR.ORG • www.tapr.org
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December 1998

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

Membership	Price	Number of Years	Total
United States	\$20.00		
Canada/Mexico	\$20.00		
International	\$25.00		

Renewal New Member

SubTotal

Membership 10% Discount

Except were noted Member #: _____ (Place new if joining)

Total Sales (Subtotal minus discount)

Texas Residents (7.75% tax)

Membership (New or Renewal)

Shipping and Handling

For Total Kit Codes Between

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

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

TOTAL Order Amount

Charge my credit card (check one):

VISA MasterCard

Acct. # _____

Expiration Date: _____

Signature on card: _____

Name / Call: _____

Street Address: _____

City / State / Zip: _____

Country: _____ Phone Number: _____

Internet E-mail: _____

