PACKET STATUS REGISTER

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A Non-Profit Research and Development Corporation

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In This Issue...

President's Corner

What an interesting year 1996 has been and it looks like 1997 is going to be as or more interesting! TAPR met many of it goals for 1996. That of 1) moving Spread Spectrum issues forward, 2) getting the joint ARRL and TAPR DCC off the ground, 3) increasing membership activity, 4) and lots of other neat projects and concepts. I hope we can keep up with the pace of what is happening.

The big news since last November was that the FCC granted TAPR's request for a Spread Spectrum STA. This was really great news and we already have a number of folks operating under the STA (http://www.tapr.org/ss/tapr_sta.html). If you want to participate in the STA, just use the on-line application or request one from the office.

The sad news I have to report is that FreeWave Technologies, Inc. of Boulder, CO (www.freewave.com), after deciding to sell us their DGR-115 radios at board level for $250 each, decided to cancel the agreement several days after it was announced on the TAPR web page and to the membership via the Internet list. The units were first mentioned in the last *PSR*. We discussed the issue with FreeWave for three weeks, but were forced to finally give up once it was apparent that no solution was possible. This is too bad, since I felt that it was an excellent opportunity for both FreeWave and TAPR. TAPR would have gotten a radio in the hands of the membership

Look for TAPR at these Upcoming Events

May 16-18, 1997	Dayton HamVention
Sept. / Oct.	ARRL & TAPR Digital Comm. Conf. - Baltimore Area

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and FreeWave would have received high quality technical feedback for future implementation. I know there was a lot of interest in this radio and I hope that all those who showed excitement will not let this setback affect their thinking and plans about doing new technology.

It is becoming apparent that Part 15 manufacturers are seeing amateur radio operations in our bands, using their Spread Spectrum technology, as a threat. I don't believe that getting equipment from these sources in any type of recognized group purchase is going to be possible in the future. The Part 15 coalition, which Proxim, Metricom, and others are involved with, have stated that they plan to fight the rules changes as set forth under RM-8737. They want Part 97 operations on bands where they are selling equipment to be limited to the same technical requirements they currently have to operate under: low power, almost no antennas, etc. While the engineers and others at various companies that we have been discussing group purchases with are enthusiastic about the possibility of getting equipment to us, by the time the decision reaches higher levels, resistance begins to build. In addition, now that the FreeWave purchase has fallen through, is it a good thing for amateur radio that we work on purchases like this? Some at the FCC already see amateur radio as an obsolete entity. This could be one reason for the suggested Part 5 rule changes. They see amateur radio not providing the necessary technology development, so the answer is to change the Part 5 rules so more commercial entities can test their RF devices. Would we be walking into a pit if we go out and get lots of Part 15 equipment operational on our bands. The easy answer on the part of the FCC would be to collapse Part 97 into Part 15. If all we do is make part 15 equipment operational, why allow part 97 operations? I think it is even more important now to stress the experimental and developmental nature of our hobby and to press the point on several fronts. While getting Part 15 equipment operational was a solution to several short term issues, I don't believe (now) that it would have been a good direction in, say, two years. Would have getting the FreeWave radios into the amateur market via TAPR set a trend that we could not recover from? I don't know, but it might be fortunate that FreeWave decided that they didn't want to sell us radios without additional stipulations. Something serious to think about. TAPR can now focus on getting amateur technology into the amateur hobby and to that extent, several projects have been started and will be pushed to completion.

On another topic—I have not mentioned the following yet in the *PSR*, because it was still very tenuous and considered to be in the wait and see stage for several months. Now that it looks like we might get funded, let me outline what has happened. This last August I flew to Freemont, CA and spent several days at Dewayne

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Secretary	Steve Bible, N7HPR
Treasurer	Jim Neely, WA5LHS

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

Article submission deadlines for upcoming issues:

Spring 1997	March 15, 1997
Summer 1997	June 15, 1997
Fall 1997	September 15, 1997
Winter 1998	December 15, 1997

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 communications, 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.

Hendricks' home. During that period we wrote and submitted a grant to the National Science Foundation (NSF) concerning a proposal for TAPR to design and build a Spread Spectrum radio to meet some of their educational networking needs, which happens to be just like what we need on the amateur radio bands. Anyway, the NSF grant has been progressing through channels for the last several months and we should be hearing about the outcome before Dayton. If the grant is accepted and funded, which I think we have a very good chance of now, we will have some money to invest in research and development of a TAPR Spread Spectrum radio design or designs that could be a significant contribution to the amateur radio hobby. I'll write a lot more when we know the final status of the proposal and how it will positively affect TAPR.

The Texas Packet Radio Society held its Fall Digital Symposium this past December in Austin, Texas. TPRS was kind enough to allow me to take up a considerable amount of presentation time discussing what TAPR was doing and the future of Spread Spectrum communications in regards to networking and other interests. I was very pleased to see many members of both TPRS and TAPR present at the meeting. My presentation was done by pulling up my overheads over a wireless link at 256Kbps at my laptop from the Linux server sitting on the other side of the room. Very impressive way to demonstrate the potential for future access. We just need access to the technology at a price we can all afford. It was very positive to see the good turnout at this meeting and showed to me that the future for regional groups is not as bleak as many think it is.

The group attending the 1996 TPRS Fall Digital Symposium, Austin, Texas

Dayton '97 is scheduled for May 17-19th. John Ackermann, AG9V, has informed us that we will be able to use the NCR facility again this year for the Friday evening event. If you didn't make it last year, you really should think about attending this year.

You will find in this issue of the *PSR* a ballot for this year's board of directors election. We have four excellent candidates running for the three positions available. Please take the time to vote, either by mailing in your ballot or via the electronic means we are making available for the first time. This is your opportunity to select who sits on the board and determines the future of TAPR.

Until next quarter and lots more fun!
Cheers - Greg, WD5IVD

Call for Papers: AMSAT-NA Annual Meeting & Space Symposium

The 1997 AMSAT-NA annual meeting and space symposium will be held on Oct.17-19,1997 at the Airport Delta Hotel in Toronto, Ontario, Canada. This is the first call for papers to authors who wish to present papers at this event. Topics for all amateur satellite disciplines are sought from the AMSAT community. Authors and titles are requested by March 1st with abstracts by June 1st. Final versions are due by August 1st. We also encourage those not able to attend, to consider submitting a paper for publication in the Proceedings of the symposium. Submissions and enquiries should be made to:

Wayne Chandler, VE3WHC
By internet:ve3whc@amsat.org
By mail:W.H.Chandler
Box 6,Carlisle,Ont.,L0R1H0.
Canada.

Message from the Editor

My apologies for the tardiness of the last several issues. Hopefully things will be back on track starting with the next issue. The schedule we're shooting for looks like this:

Issue	Deadline	Delivery By (in the U.S.)
Spring 1997	March 15, 1997	May 5, 1997
Summer 1997	June 15, 1997	August 5, 1997
Fall 1997	September 15, 1997	November 5, 1997
Winter 1998	December 15, 1997	February 5, 1997

This schedule will get each issue to you in plenty of time before each of the annual events (HamVention, DCC, Elections).

There have also been some printing problems with the last two issues (blank pages, mis-cut, etc.). If you have received a defective copy, please contact the office for a replacement.

We're also looking for two or three people to help with the production of the *PSR*. If you are willing to spend a few hours each month, we have some opportunities for you to help TAPR provide a better publication. If you think you might be interested, contact me at psr@tapr.org, 607-735-4266 (day), or 607-733-3218 (evening). Please include your phone number in any messages.
73, Bob, N2GDE

TAPR Board of Directors Elections

The following four members have agreed to run for the three available positions on the board of directors. You may vote for these individuals and/or any write-in candidates using the ballot printed on the next to last page of the *PSR* or using the on-line election web page (details below).

Deadline for balloting is March 15th, 1997. Board members elected will serve a three year term.

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

- Greg Jones, WD5IVD, wd5ivd@tapr.org
- John Koster, W9DDD, w9ddd@tapr.org
- Mel Whitten, K0PFX, k0fpx@tapr.org
- Steve Stroh, N8GNJ, n8gnj@tapr.org

Greg Jones, WD5IVD (Board Member, President)
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A ham since 1977, I originally got involved in packet radio due to TAPR's efforts during the great TAPR TNC II development in 1985 and have been active ever since. My primary interest in amateur radio is digital communications. I have served as an officer or a board member of TAPR since 1989. This last year has seen a lot of personal time put into TAPR in the area of Spread Spectrum technology acceptance in amateur radio. I hope to get reelected in order to continue the various initiatives that were started the past several years.

If you have any questions, my phone is always answered by me or my machine. I am _still_ working on my PhD at the University of Texas, Austin, but at least I am now ABD (all but dissertation). I check my Internet mail daily, so that is the best way to contact me. Call me or write me if you have input - we are always looking for folks to get involved or help out with problems. My two primary amateur goals are to see TAPR improve and grow as an organization and see more educational items disseminated, like Tom McDermott's recent TAPR publication.

John Koster, W9DDD (Board Member)
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A ham since 1959, I've always been interested in digital forms of communications starting with RTTY in 1960. The past 11 years I have been very active in packet, and was deeply involved with the TexNet Support Group until elected to the TAPR board. I was the head of the Software Group and supported the TexNet code from 1989 to 1992. I am interested in the development of radios and modems for high speed operation. I now handle printed circuit board production issues with the local board houses TAPR uses.

I'd like to thank everyone for the opportunity I was given to serve as a board member. During my first term as a board member of TAPR, I feel that I have received more than I was able to give the organization. Getting the opportunity to work with a number of dedicated and experienced people at the national level has been a learning and rewarding experience. I am asking you to elect me to a second term so that I may use that knowledge and experience to help TAPR meet its objectives of improving the speed and performance of the digital modes.

Mel Whitten, K0PFX (Board Member)
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My amateur radio career began at age 12 with continued interest in all the digital modes from high speed CW and Teletype to Packet Radio. I have served as an officer in various radio clubs and I am currently vice-president of the Missouri Amateur Packet Society. Working with MoAmPS and other packet groups, I was instrumental in developing the high speed backbone of eastern Illinois and Missouri. As a sysop for the MSYS BBS in St. Louis and a node operator for a Gracilis switch and the MO-CALIF worm hole, I remain active in day-to-day packet activities.

My interest in Packet Radio began when St Louis was chosen as one of the beta sites for TAPR's TNC. This was the beginning of a long time association with TAPR and engineering support in the development of the TNC1 and TNC2 and currently supporting user's questions on TAPR's 9600 baud modem. As a board member, I would utilize my past experience and knowledge in making those decisions that will help TAPR meet its goals and vision for the coming years.

Professionally, I have worked for a large telecommunications company for the past 26 years and I am currently a senior development engineer. It is because of these qualifications that I ask for your support toward my election to TAPR's board of directors.

Steve Stroh, N8GNJ (Secretary)
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I'm 37 and employed by The Boeing Company in Seattle, Washington as a Network and System Administrator. I'm self taught on PCs and Networking, and active on the Internet since 1992. I am married to Tina Stroh who is a Registered Nurse, and Father of Meredith, age four.

I got into Packet and first joined TAPR in the mid 1980s in the Cleveland, Ohio area shortly after becoming licensed. Advanced Packet is my preferred mode (9600 baud and faster, TCP/IP, Internet connectivity), and I hope to get more involved in Amateur Digital Satellite and HF Digital communications in the next few years. I'm one of the coordinators of the Puget Sound Amateur Radio TCP/IP Group, an informal group that has constructed a network of 1200 and 9600 baud repeaters that run primarily TCP/IP in Western Washington.

My initial involvement with TAPR was assistant chairperson of TAPR's Networking Special Interest Group (NetSIG) several years ago, then Chairperson. I was the local coordinator for the 1996 ARRL and TAPR Digital Communication Conference in Seattle. I became TAPR Secretary in late 1996 at the request of the Board of Directors after I apparently took minutes too well at the 1996 Fall TAPR Board of Directors meeting. I was asked, and accepted the job of documentation for TAPR's Spread-Spectrum STA, as well as being one of the initial STA participants. I was active in the formation of the TAPR North American Digital System Directory. I'm currently working on a proposal to the TAPR BoD for local (US) and International groups to formally affiliate with TAPR.

I am not running "against" any of the current BoD members whose terms expire in 1997. My motivation for running for Board of Directors is partially to bring some representation to the BoD from

the Pacific Northwest. I hope that my experience as a user of TCP/IP will be a useful addition to the BoD. I'm extremely proud of being heavily involved with TAPR at this critical time for Amateur Radio, when Amateur Radio is fighting harder than ever to prove its relevance and importance in comparison to other users of spectrum. I'm especially proud of TAPR's direct involvement with the FCC.

I feel strongly that digital modes should be the preferred "transport" in Amateur Radio, just as digital modes have become the preferred "transport" in all types of commercial RF communications. I'm particularly looking forward to effective digital video and voice. I also feel strongly that Amateurs are their own worst enemy when it comes to accommodating new modes such as Spread Spectrum, and that TAPR will have to work very hard to "make the case" to Amateurs that it is truly in Amateur Radio's best long term interest to accommodate new digital modes on all Amateur frequencies.

Other thoughts and opinions about Amateur Radio's future were detailed in my article "One Person's View of TDCC '96", published in the Fall 1996 *PSR*. If you agree with those viewpoints, I would appreciate your vote to elect me to the TAPR Board of Directors.

Voting for the TAPR BoD Candidates

Please find the mail-in ballot on page 31. At the Fall Board of Directors meeting, the board voted to accept ballots by electronic means. This year, you can vote using the ballot printed in this *PSR* or by electronic means using the World Wide Web.

To vote, either send in the paper ballot or access http://www.tapr.org/elec. You will be asked to give your **membership number and check number** which can be found to the right of your membership number on the mailing label of this issue. If you have problems using the web page, contact Dorothy at the office and we can investigate.

We look forward to your comments on this new way of collecting votes in both traditional paper and newer electronic form.

Paper Ballot is on Page 31 of this Issue.

Welcome to the new TAPR Software Librarian

TAPR would like to welcome Greg Eubank, KL7EV, as the new TAPR software librarian. Greg will be taking over for Allan Finne, KB5SQK. Allan had to step down because of his new work commitments.

Greg brings a fresh approach to what the software library could be providing and has a lot of new plans he has been discussing. We look forward to Greg's tenure in this position and Greg is already doing some major work on the library. Greg can be reached at kl7ev@tapr.org for anyone who has information regarding upgrades or comments on the software library area.

Welcome aboard Greg!

F6FBB Web Pages: FBB BBS Development

Richard Saue, LA4SGA
Richard.Saue@jur.uib.no

Hi! Be advised that F6FBB has his own web page dedicated to F6FBB development:

http://www.f6fbb.org

There you will find information about the development status of FBB DOS/Win/Linux versions, expected release time, information about FBB forward protocols etc.

The new release (7.01) for all three operating systems is due to be released soon.

New Modem for DSP-93

Mac Wheatley, AF4IY
mwheatle@tsystems.com

I uploaded a new modem program for the DSP-93. It's named KS12V10.ZIP and is on the tapr.org/dsp93/upload directory. The modem itself is not that interesting but some may find it useful as another example of programming techniques. It is fairly well documented and could be used as a template for a more exciting modem or other DSP-93 applications.

Features:

- Bell 202, 1200 Baud AFSK tone detection and generation.
- Performs HDLC Frame assembly and disassembly.
- Implements open squelch carrier detection.
- Communication with modem uses KISS protocol over the DSP-93 UART link.

The KS12V10.ZIP file should contain the following files:

README.TXT — This text file
KS12MAIN.OBJ — Object code that is downloaded to DSP-93
KS12USER.PDF — User Manual in Adobe Acrobat format
KS12TECH.PDF — Technical Description in Adobe Acrobat format
KS12MAIN.ASM — DSP-93 Source code file #1
KS12AIN.ASM — DSP-93 Source code file #2
KS12AOUT.ASM — DSP-93 Source code file #3
KS12IIN.ASM — DSP-93 Source code file #4
KS12IIOUT.ASM — DSP-93 Source code file #5
KS12KIN.ASM — DSP-93 Source code file #6
KS12KOUT.ASM — DSP-93 Source code file #7
KS12DATA.TBL — DSP-93 Source code data file #8

TAC-2 Questions and Answers

Tom Clark, W3IWI
w3iwi@amsat.org

Question:

You mentioned that the Motorola ONCORE has timing performance on the order of 20 - 30 ns, and the Garmin / Trimble on the order of 300 nsec. How does Selective Availability (SA) affect all of this? If I understand you correctly, then SA should limit the on time mark (OTM) in an absolute sense to approximately +- 100 meters.

Thus, assuming a propagation of about 1 ns per foot, and assuming 3 feet per meter, I would expect a propagation error on the order of +- 300 ns. This agrees with the Garmin / Trimble number. How does the Motorola improve this number by an order of magnitude? Also, can one assume that SA causes an error that has a mean error of zero in the long run? If so, maybe the Motorola somehow averages over a period of time to lower the absolute error.

Answer:

No — you can do much better than 100M = 300 nsec! First — take a look at some of the plots on my ftp site. Although aleph is still down, I've had the disk mirrored onto another host, so it is available there:

ftp://bootes.gsfc.nasa.gov/GPS/totally.accurate.clock/

The performance figures I give are RMS values, and they refer to operation with the existing GPS constellation, SA and all. The "100M" SA spec is a 3-sigma (essential peak-to-peak) value, and the average is smaller. The value refers to recovered positions, and are essentially the definition of the performance of each of the GPS satellites.

The reason that the ONCORE is so good is that it can be operated in a mode where the user can constrain the position to be known, and then all pseudorange data is used in a least-squares sense to solve for the clock. In this case we have only one unknown (the local receiver's clock) but are observing N satellites, so we can achieve an improvement of sqrt(N-1). This works because the SA dithering is not coherent between the different GPS satellites. I call this "zero-D" operation (as opposed to the more normal 2-D and 3-D operation of the GPS rcvr).

Then we achieve additional improvement by time-domain filtering. Any isolated 1PPS pulse derived from GPS has the noise of SA, plus the instrumental noise of the receiver, plus other errors. Part of the ONCORE's instrumental "noise" is a ~6 second, 104 nsec p-p sawtooth due to the fact that the 1PPS pulse is derived from zero-crossings of a ~9.5 MHz internal oscillator. Observations of SA show that it is a band-limited process with a zero value long-term mean; the relevant periods range from a few seconds to ~1/2 hour. All of these effects are minimized by making the real measurement span be averaged over the longest possible time interval. The ~20 nsec refers to a few hours of averaging, while a shorter interval yields more like ~50 nsec RMS. The plots on aleph/bootes serve to illustrate this point. See in particular the plots name oso*.gif — the two plots show a 2 day and then 6 week comparison against the Hydrogen Maser at the Onsala Space Observatory in Sweden. The ftp server also shows similar results at other observatories around the world.

The lower cost Garmin is not as good. In addition to a ~2 usec systematic bias it shows discontinuities at the ~500 nsec peak-to-peak level (my ftp server, as well as the article in the recent TAPR *Packet Status Register* shows the Garmin performance). The Garmin is a sequential receiver that does strange things sometimes (witness the abrupt timing discontinuities), and it cannot be constrained in position (except that the height can be fixed in a "2-D" mode. Hence the Garmin produces timing at levels comparable to those you indicated, but DEFINITELY not as good as you can do with a "proper" receiver!

Question:

Concerning the accuracy of adding a GPS stabilized xtal oscillator... What limits the absolute error to 1e-9 or 1e-10? Is it basically a tradeoff in the loop filter time constant that one needs to pick to keep the oscillator in lock? It seems likely that if one picks a longer time constant, then the jitter due to SA (and other things) would average out closer towards zero. However, the longer the time constant one picks, the more jittery the oscillator will get due to its own instability. Is my thinking correct on this?

Answer:

Basically, your explanation is correct. But let me give a bit more insight into the issues, and then discuss what I plan to do:

If you look at a crystal oscillator, it is EXTREMELY clean on short period stability (tens to hundreds of psec at 1 second), MUCH better than any of the GPS receivers. Just how good depends on the quality of the crystal oscillator.

Where GPS shines is that the long-term performance mirrors the aggregate stability of all the Cesium standards onboard the satellites, and then in turn, the ground-based comparisons of the aggregate constellation clock with respect to the ensemble of standards at the US Naval Observatory that constitute the national master clock.

My measurements on the ONCORE show that at any time longer than a few hours, GPS yields the ~30 nsec performance (or ~300 nsec RMS with the less capable Garmins).

To put in some numbers, 30 nsec at one hour (3600 sec) = 1:10e11. Perhaps your HP106 is good enough to yield this performance with a ~1 hour loop time constant, perhaps not. But it should easily make 1:10e10. Since the Garmin is not as good by an order of magnitude, and since it might be used with a cheaper & more mortal crystal oscillator, it can probably be used at the 1:10e9 level. Clearly, the properties of the optimum filter depend on both the GPS and crystal oscillator characteristics.

The TAC Oscillator Controller (TOC) we are working on as the next phase of the project is designed to allow the the user to "close the loop." We want to average (perhaps in a somewhat fancy filter) a large number of time interval measurements. From this we derive an analog correction voltage that can be used to steer the crystal.

We have worked out a clever circuit using BCD rate multipliers that can handle both a high resolution (1:10e6) D/A conversion and the necessary division of the xtal reference to 1PPS. The original plan was to do this in off-the-shelf CMOS logic but the critical chip (4527) was a bit too slow and the board real estate too much, so we have done an initial cut at implementing the design in a 1" square programmable ASIC.

Clearly the time-interval averaging and filtering algorithms are best done in a small computer. Right now, we are considering the Parallax BASIC STAMP 2 for this task. In addition to having enough CPU power self-contained in a small 24-pin DIP package, it has an internal time-interval counter (albeit with only 2 usec resolution) that makes for a simple design usable at the ~1:10e9 level. This meets most amateur needs (1 Hz of frequency control at 1 GHz). For a higher resolution version, the same ASIC would be used with a better time-interval counter.

The current idea (after we get the TAC out the door) is that there will be a 2nd PCB, also 3"x4.5" in size and plugging into the TAC, that will constitute the TOC. It will include a (relatively) cheap xtal oscillator, but a better oscillator (like your HP106) could be mounted off-board. The TOC will have the ASIC, STAMP CPU, and some other support circuitry on it.

The initial TAPR TAC offering will be for the TAC-2 circuit board only. It will be offered in 2 flavors — PRO/AM. The AMateur version will have only those parts needed for minimalist support of the GPS20 (or the older ONCORE BASIC). The PRO option will add the parts that support the Motorola or Trimble receivers and possibly a more efficient switching power supply. The PRO version has additional low-impedance, lab quality buffered outputs also. The basic TAC-2 circuit board supports all the options and it is pretty trivial to upgrade from AM to PRO at a later date (adding parts and changing a few jumpers from their default positions).

Multi-Casting

[Recent discussions on BBS-SIG have been about how to improve network efficiency by multi-casting. (Multi-casting is when messages are received by multiple stations simultaneously.) Here are some excerpts from that discussion.]

PACSAT Broadcast Protocol

Tim Cunningham, N5DE
n5de@amsat.org

I have used the PACSAT Broadcast Protocol for some time as a SatGate BBS station and from what I have been hearing in the group, it is applicable in many ways to fit into the current terrestrial system using existing equipment. Hundreds of stations can simultaneously receive data in parallel without being connected to the server. In many cases, I can receive files without ever connecting to the PACSAT server, because somebody else requested the same files and my station captured them before it had to send a request. It certainly reduces the congestion dramatically, while increasing the efficiency of transferring data to the masses. In some cases, you may have received a portion of a file from somebody else's request, thus, the software will only request the portion that is missing since it keeps track of the missing holes. Rather than requesting the entire file, your station will only request the holes needed to fill what you have already captured. I can say that I have requested 1 Megabyte files and received them in a few seconds, because I captured all the data from other requests, but I was only missing a small hole out of the entire file. In this way, the software is very efficient.

In addition, you can selectively request files for download on a very selective basis with the equation file. The equation file is used to tag a file for a download request action.

For those wishing to read more about the PACSAT protocol please investigate the following sites:

www.amsat.org
ftp.amsat.org

The following file gives very descriptive details about the PACSAT Broadcast protocol:

ftp.amsat.org/amsat/satinfo/pacsat/pacdoc.zip

PACSAT Protocol Spec.

Karl F. Larsen, K5DI
k5di@juno.com

This is from the AMSAT file pacdoc.zip which contains a wealth of information on how PACSAT works.

> A spacecraft is inherently a broadcast device. It transmits from on high, and many users can hear it at the same time. To optimize the available downlink time, we are recom-

mending the use of a broadcast protocol. This protocol adds information to the basic AX.25 data frame to permit many stations to make simultaneous use of a single file download session. When one station in Maryland requests the current orbital element sets, there is no need for stations in Toronto and Miami to do the same, they should be able to make use of the information as it is downlinked to Maryland if they are all in view of the satellite at the same time. To make use of a broadcasted frame of data, each frame must be tagged with the file it belongs to and the position within that file that the data belongs in.

There should also be enough information for a station to determine if it has all of the data belonging to a file, and if not, to request that just the missing parts of the file be retransmitted. The specification titled "PACSAT Broadcast Protocol" describes a method of providing this additional information.

With a broadcast protocol, a groundstation can simply monitor the downlink and accumulate files of data. Since files gathered in this way will have been unsolicited, the format of the contents may not be known to the user. For example, if one asked for a file of NASA format orbital elements, one can make a good guess that the resulting file contains NASA format orbital elements. However, if a "random" file is captured, its contents may not be understandable simply from inspection. Some additional information, such as a file name, data type, description, creation date, etc., may be required. Each broadcasted file, therefore, needs a header in a standard format with this information.

The specification titled "PACSAT File Header Definition" describes a method of providing this information.

We hope that the broadcast protocol promotes efficient use of the downlink. It should reduce the number of requests for files of general interest. It should also reduce the uplink loading, since a broadcasted file does not receive an ack for each frame or group of frames. In the best case, only one "ack" is sent for an entire file, and that would be the request to stop broadcasting it.

Even though the sky-to-ground link is broadcast in nature, the ground-to-sky link is not. PACSAT "sees" many ground stations at one time. For this reason, a connected-mode, non broadcast file transfer method is also defined, and is described in the paper on "PACSAT File Transfer Level 0".

From this it's clear that what I see as necessary elements are present. I noticed the fact that the basic AX.25 packet is modified to contain data necessary for a broadcast mode. Can Clover and the other "made for HF forwarding" hardware/software work with a modified AX.25 packet? It's clear it works fine with plain AX.25 but I don't know a thing about CLOVER or PACTOR.

Using the PACSAT Protocol

Edson W. R. Pereira, N1VTN
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Karl: the only difference between a plain AX.25 UI frame and an AX.25 PACSAT frame is the PID. 0xF0 for plain AX.25 and 0x8B for PACSAT. Anything else related to the PACSAT protocol is in the PACSAT frame header which is part of the DATA field of the AX.25 frame. This method is the same encapsulation method used by other protocols running over AX.25 such as NET/ROM, TCP/IP, etc.

The original PACSAT broadcast protocol does have most of the characteristics we are looking for. If it is implemented over AX.25, it inherits some of the deficiencies of the AX.25 protocol; however, it is still much more efficient than AX.25 connected mode. I know AX.25, even in UI mode, is not very efficient, but we already have the tools to use it as it is and test the multicast concept in HF, and higher bands. There are several implementations for user software: DOS, Windows, Mac and Linux. It uses a normal TNC in KISS mode. Initially, reusability of the current software should be strongly considered in my point of view.

The PACSAT protocol also works very well in half-duplex. It depends on how the server is implemented. If no manual requests are done by the client, all transmissions from the client to the server will happen right after a PB: frame or an OPEN: 12a frame. The key here in this case is how the request windows are scheduled. If the server goes to RX mode right after the "invitation for request" frames are sent, there is no problem. I have tested this.

I am planning to test the PACSAT multicast engine on HF in a few weeks. At this point, I have it working at 9600 bps on UHF without any serious problems. If anyone is interested in participating, please let me know. You will need a 300 bps packet TNC with KISS, and WISP, or PB, or SatLink. These software packages were originally designed for the PACSATs and can be found on the AMSAT FTP server. Once the basic stuff is working, I plan to implement server-to-server communication and add support for other TOR modes.

The way it works is more or less like this:

The BBS exports the messages to be multicasted to a file. The file is then broken into several smaller files with PACSAT headers, each one containing one message. Information about the message will be contained in the headers. Things like from, to, subject, BID or MID, BBS, etc. will all be in the headers. The receiving station periodically requests an updated directory (list of headers) from the server. Then the receiving station parses the directory and compares it to a local equation file. This will allow selection of what messages or bulletins to receive. After the selections are made, the receiving station may request messages or bulletins from the server.

The important thing is: all transmissions are framed following the PACSAT broadcast protocol. No successfully received frames are wasted. Frames may be received out of sequence, one today and one tomorrow, but it doesn't matter.

The server will periodically transmit a list with all the stations on the broadcast (multicast) queue. This will inform all receiving stations when it is time to request hole fills, directory, or new files.

After a message or bulletin is received, an import file will be built and the BBS can import it.

What do you think about this procedure? Any ideas or suggestions are welcome.

Disadvantages of the PACSAT Protocol

Dirk, G1TLH

If you have a message that is to be sent to more than one place AND each of those places can work the sender, then it has been shown by many people, in many studies that it is MUCH more efficient to multicast. This is particularly true if you get the protocol correct. In essence you can show that, for a reasonable network, you can multicast to N stations with an average of just over two messages (total), i.e. it takes just over two messages to reliably distribute a message to any number of stations on a reasonable network. There is a fair amount of experimentation likely to be required to actually achieve this rate for HF (or other frequencies) as the figures refer to ethernet. But don't use that as an excuse not to try.

A number of people have come up with suitable protocols, including me, but the only one in daily use today is the PACSAT protocol. FBB doesn't count because it only multicasts the headers, not the whole packet itself. There is a rumour that the DPBOX people have some sort of protocol as well, but I have never seen it in use.

I personally don't think that the PACSAT protocol fits in very well with ground based communications although I know it has been successfully used in that role.

One of the complaints that is frequently voiced is that the only thing people think of (on packet) is BBSs. If all that you want to do is shift files around then the PACSAT protocol, while over the top in implementation, is a perfectly adequate model. The problem is that there are several good applications which tend to get ignored which are not file transfer oriented such as DX cluster notification, chat servers, etc.—all these things are better served using what I shall call Group Communication (GC) (rather than Multicast which is really just one mechanism for doing GC).

There are other things which could be done with GC such as distributed databases, process migration, the list is nearly endless. None of these is remotely file-based and thus the PACSAT model is not, directly, applicable.

Your comments about holes being filled is exactly the point about a GC protocol, this is part of what it is about. But we should not get bogged down in looking at file transfer. The PACSAT implementation is capable of being modified easily so that it works on top of a generic GC protocol.

If you would like further criticisms, they center on some of the assumptions of the protocol about filenames. As you are obviously aware, the filename, or handle by which a file is distinguished onboard a satellite, is essentially a number. This number works fine in the context of a very few originating stations or BBSs (or satellites), but doesn't scale well on the ground — Who, what, or how are filenames issued, how does this filename (however generated) correspond with a message, is a message a file?

In the days of G8LTPQ (the first person that I know who was doing experiments on GC a couple of years before PACSAT) tried to solve this problem by passing the BID thru a one way function (actually a CRC-32) to try to get a fairly unique identifier, but this didn't prove to be adequate. Even Tanenbaum (Modern Operating Systems, etc.) is finding that a 56-bit "capability" as he calls it, isn't enough if the network is big enough (and ours is BIG by his standards).

In conclusion, yes we need Group Communications. In the meantime, I recommend some of the papers on GC which you will find on:

http://www.cs.cs.vu.nl/

You won't get any source unless you are really an educational establishment. But the papers themselves are compelling evidence of the effectiveness of properly implemented GC.

Multicasting with DPTNT

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DPTNT does indeed implement a PACSAT style broadcast mode server (and also a client). Find it at (with source code for ham use):

http://www.snafu.de/~wahim/

DPTNT is a nice BBS too for Linux, I might add. Very powerful.

Multicasting with DPBOX

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For those following the multitask discussion, I set up DPBOX, a very good looking BBS software package for Linux and then read the manual. It is well written and

gives details and examples of how to do things, in English. Here is what the DPBOX manual says about the DPBOX PACSAT mode:

> The up-to-date most advanced feature of DPBOX is the built-in PACSAT Broadcast Server and the Broadcast Receiver.
>
> The PACSAT Broadcast Mode was developed for satellites, but it works well terrestrial, too. The theory is that usually many users read out the same files of a BBS. It would be much more efficient if the BBS 'broadcasts' the files simultaneously to all interested users, so HF channel load will be lowered dramatically. In practice, this means that a local BBS offers a second channel, 9600 baud data speed recommended, where 24 hours a day all incoming mails are 'broadcasted' in a special protocol. The files are repeated, of course, depending on their age. New files are often retransmitted, older ones less often. With today's German mail count, a cycle time of about 30 minutes for the files of the last 24 hours is reasonable. This means, that a user starts reception, for example when coming home, and about half an hour later, he has all new files of the day on his own system. If he stays tuned for longer, he has the chance to catch older files, too, but usually, they were received by him the day before and therefore deferred. Note that the user doesn't need a transmitter for this mode, so this is fine for SWLs too. When the user wants to write mail, he has to leave the broadcast frequency and connect to the BBS on another channel in the usual way.
>
> Take 5 minutes to think about this feature and its implications for the packet radio network. Assuming that about 90 percent of all traffic is the readout of BBS files, the digipeaters will get a lot of free time and bandwidth with this technique.
>
> DPBOX includes both sides of this amazing mode: The Server and the Receiver. NEVER USE THE SERVER IF NOT ACTING AS A LOCAL BBS, it will create an incredible amount of QRM! Normally, you only should use the Receiver.
>
> Received files are sorted in your own BBS, according to the selection mechanisms with REJECT.BOX, RUBRIKEN.BOX etc.
>
> One word about satellites and DPBOX: In general, the protocol used on UO-22 and KO-23 is the same as within DPBOX. But note: due to small sized antennas I never caught a whole file from those satellites. I cannot promise it works all right. A main problem is the 'request mode', a feature that is not used terrestrial (here, distorted data blocks are resent automatically in the cyclic time slices of the BBS). So better don't use DPBOX interactively on the satellites. But it should be OK for monitoring.

So like he says, take some time to think about the application of the PACSAT protocol to BBS use. It's sure interesting. I haven't got DPBOX running yet. I need to see if I can run both DPBOX and TNOS in the same computer under Linux and share the 3 TNCs now connected to TNOS. GOD!

More on DPBOX

Joachim, DL8HBS
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I am the author of DPBOX for linux.

With interest I read the thread about multicasting (nice word, who invented it?).

We have been using it at DB0GR in Berlin for several months now to push out the new files of the BBS to the users. In my opinion, the PACSAT protocol definition is one of the best (beside AX.25 itself) we have in amateur radio. It is really flexible, one can extend it and it has very low overhead.

It does NOT need a full duplex channel. I am not sure if I would propose to use it on shortwave frequencies, but a perfect application could be to maintain one BBS at a prominent hillside to broadcast on VHF or UHF to fill up the BBSs in a wide area around the central BBS. This is fine for flood distributed bulletins, but not for private mails.

My primary intention when implementing the protocol in the BBS software some years ago however, was to minimize local digipeater load from user readouts. At that time, we had 700 local users on the BBS, but only 1200 bps radio ports. I did not want to invent a proprietory protocol because you need user clients to make it a success, and I didn't want to write client programs for each existing operating system. The PACSAT protocol was used by AMSAT for some years at that time, so user clients existed. After studying the complete documentation, it was obvious that one could not write a "smarter" protocol, PACSAT broadcast protocol is really excellent!

Implementation might look a bit difficult at first, but it isn't really that hard. It is no simple "lets implement it this Sunday" - protocol, but it offers wonderful flexibility and a clear design, unlike many that we see in amateur radio.

Please write me if you need assistance setting up DPBOX/TNT, my email has changed, it is jschurig@zedat.fu-berlin.de.

Complete archives of dpbox_221096 are in ftp.tapr.org (still in linux upload folder), ftp.ucsd.edu (still in incoming) and ftp.funet.fi. Current version number of DPBOX is v5.03.01, of TNT v0.9s.

Project homepage is: http://www.snafu.de/~wahlm/ newest sources are first released here.

The Automatic Position Reporting System An Overview and Introduction

Arie Booleu, N2ZRC

Many of you have heard discussions about a packet radio program called The Automatic Position Reporting System, (also called APRS.) It's a system which, unlike PBBSs, nodes and DX clusters, uses an unconnected protocol to transmit your exact position, a symbol denoting the type of station you're running and a brief comment about it. It also uses direct keyboard-to-keyboard "chatting," has direction-finding capabilities, and much more.

How does it work? In a simplistic form you transmit a packet which contains your callsign, exact latitude and longitude, information on your transmitter's power, your antenna's height, gain and pattern as well as a brief comment of your choosing along with some symbols necessary to make the system work. With this information your station appears graphically on a map (actually, one in a series of many maps) on the monitor as would other stations that are on frequency. Since this is an UNCONNECTED protocol, on-air packets can be kept to a minimum.

Consider this. When you connect to a local station using standard AX.25, you send a connect request to that station, they acknowledge that packet, send you a connected packet which you must then acknowledge. The same thing happens with EVERY packet you, or the other station, sends. With APRS you only send ONE packet to convey your information. If it's not received on the first transmission, APRS retransmits it using a decaying time delay (that is, the second packet is sent twenty seconds after the first, the third forty seconds later, the fourth a minute later, the fifth two minutes later etc. until, after a day, you're only sending six packets a day!) This makes more efficient use of the frequency.

APRS uses four different kinds of digipeaters, which use the aliases RELAY, WIDE, ECHO and GATE. RELAY stations (the default setting) are base stations used to digipeat low-power portable and mobile stations. WIDE stations will digipeat packets addressed either to their specific callsign or the generic WIDE to other VHF stations and WIDEs. An ECHO performs a similar function on HF and a GATE digipeats either from VHF to HF, HF to VHF or HF to HF. When setting up APRS for your location you'll set your digipeater path based on the situation at that QTH and where you want your information to go. When using APRSDos (and soon WinAPRS and MacAPRS) for keyboard-to-keyboard communications, which are the only comms in which ACKs are used, you can also set alternate digipeater paths. Not only does this direct your message via the shortest possible route, but it also reduces QRM.

The program also interfaces with popular weather stations such as those made by Davis and Peet Brothers, thus allowing for real-time weather data which is available at the touch of a key. The potential for this during a SKYWARN situation is obvious. You'll get wind speed and direction, temperature, rainfall amounts by the hour and 24-hour period and, in some cases, barometric readings. Such weather data can also be entered manually if a station has the information but not the hardware.

There is also a Direction-Finding mode which can be used by stations with either a beam or omni antenna! When the "fox" transmits, stations can call, by voice (on another frequency!) or keyboard their beam headings and/or signal strength. Using the antenna gain figures for these stations, circles are drawn on the map. The "fox" will usually be located where these circles converge. If you have one of the many "doppler" antenna systems it can also be used.

If DX-ing is your thing, there's also a "DX-mode" which also uses the UI protocol by simply monitoring the DX cluster frequency. As new spots are posted, they appear on the map with their callsign. Their location is based on the callsign prefix of the spot. Obviously, since you're not connected to the cluster, this isn't meant as a replacement to your normal AX.25 program, and you can't SEND messages, you can receive them (the program will flag yours and display them when asked.) It's just another tool for your county- or country-hunting efforts.

If, like me, you have a Global Positioning System (GPS) receiver with NMEA-0183 output, this too, can be utilized with amazing results! Your mobile or portable position can be regularly updated. Using such a "stand-alone tracker" you don't even need a computer. All you'd need is an H-T, TNC and GPS! Think about the possibilities for such a setup in something like a marathon, walkathon or even for someone shadowing an important official.

APRSDos was written to be able to run on just about any PC compatible computer from the latest Pentium Pro down to a lowly 8086. Heck, I know several people that use it with a Hewlett-Packard HP-200 palmtop! Maps are available from a large-scale map of the whole world to extremely detailed street-level maps. There's even a mail-reflector about it to which you can subscribe. It's lots of fun, has many potential ARES/RACES/SKYWARN uses and I'm sure you'll enjoy playing with it!

APRS Tracks

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An Apology

I apologize for the brevity of this column. Hectic holidays, the flu, and a major computer problem (some of it occurring simultaneously) is to blame.

Current APRS Software

There was a flurry of programming activity at the end of 1996 resulting in the following versions of APRS software: APRSdos 7.7f, MacAPRS 2.7.3, and WinAPRS 1.2.3. At the rate that the APRS authors update their software, these version numbers are likely to change by the time this sees print, but as a public service, I mention the current version numbers here for those who may be playing with older versions. By the way, you can fetch copies of the current versions of APRS from ftp.tapr.org by following the path of /tapr/SIG/aprssig/files.

WA1LOU Web Page

The WA1LOU web page (www.tapr.org/~wa1lou) is up and running. It contains FAQs on various topics including APRS and GPS. The FAQs are works-in-progress because they are being continually updated to reflect the current state of the art. See you there!

Getting On Track With APRS

Getting On Track With APRS is the title of my new book that was published by the ARRL earlier this year. All the APRS software authors (Bob Bruninga, WB4APR, Keith Sproul, WU2Z, and Mark Sproul, KB2ICI) checked what I wrote, so what you read are just the facts, man.

The Table of Contents of the book is (1) What Is APRS? (2) History Of APRS, (3) Hardware, (4) Software, (5) Getting Around In APRS Maps, (6) Picking A Path, (7) Tracking, (8) Adding Objects To Maps, (9) Keyboard Communications, (10) Displaying Other Data, (11) Direction Finding, (12) Monitoring Telemetry, (13) Monitoring DX Clusters, (Appendix A) Map Making, (Appendix B) Glossary Of Terms, (Appendix C) Commands. Also, check out page 153 for my 11-year-old daughter's interpretation of APRS using Kid Pix on her Macintosh IIci.

May Your Paths Be Efficient

If you are in southern New England, anywhere east of downtown Wolcott, you can find my APRS digipeater station (WA1LOU-15) on 145.79 running some flavor of APRS 24 hours per day. As soon as the spring weather arrives (as opposed to the first day of spring), I plan to raise the digipeater's antenna to about 1000-feet ASL/501-feet HAAT and replace its coax for better coverage of the Quad-State Area. Send me a packet and say hello. Good-bye, until then (or see you at Dayton).

DGPS Tests in Baltimore/Washington Area

Tom Clark, W3IWI
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This message is to inform the APRS users in the Baltimore/Washington area that I've re-instituted the W3IWI-13 high accuracy DGPS beacon on 145.79.

First, let's define DGPS (Differential GPS). Your small GPS receiver works by obtaining the time (for position) and frequency (for velocity) data on several (at least 4 for a 3-D position) GPS satellites. The timing is measured with a precision of about 100 nsec and the frequency with a precision of about 0.1 Hz relative to the clock oscillator in your GPS receiver. To get a 3-D position/velocity you need to observe a 4th satellite to "set" the receiver's clock and determine its frequency offset. The timing measurements are usually expressed in distance units and are called pseudo ranges (PR); the frequency data is often called pseudorange rate (PRR) or apparent doppler offset.

Your receiver munches on the PR/PRR data based on data transmitted by the GPS satellites (at 50 bits/s, in 1500 bit messages sent once every 30 seconds, which include high accuracy Keplerian elements, time tags, information on the offset and rate of the GPS satellite's atomic clock, etc.) to produce the position/velocity estimate. The accuracy of the estimate is limited by several factors:

a. Inaccuracies in the broadcast Keplerian elements
b. Inaccuracies in the broadcast clock models
c. Delays that the signals experience passing thru the ionosphere and troposphere
d. RF Multipath at the receiver
e. Inaccuracies & noise within your receiver
f. Dilution of precision because the spacecraft to observer geometry is imperfect and changes with time.

Items (a) and (b) arise in part because they depend on measurements made on the ground with instruments that have all the errors, in part because the physical models don't account for everything (like the Keplerian elements not fully accounting for all the Relativistic corrections, solar radiation pressure on the satellite, inaccuracies in the gravity model, etc). Such errors can amount to a few meters in position.

The most serious (a)+(b) error is that the DoD intentionally degrades the spacecraft's atomic clock performance and may not send the "world's best" Keplerian elements under the policy known as Selective Availability (SA). The most significant SA error is the

dithering of the clocks, which results in users seeing their position wandering around by up to 100 meters and speed errors of 1-2 km/sec, even when fixed.

The concept of DGPS attempts to fix several of these errors by doing the following:

1. A high-quality receiver is set up at a permanent site and its position is established accurate to a few cm.

2. This receiver only uses the visible GPS satellites to solve for clock errors and assumes its position is know perfectly.

3. The PR and PRR errors resulting from these assumptions are then broadcast on a separate radio link a few times per minute.

The accepted format for the DGPS data is specified in documentation published by the Radio Technical Committee, Maritime (RTCM) and RTCA (A=aircraft). The common format is officially named RTCM SC-104, but is usually just called RTCM. The data bits are a binary string encoded similarly to the GPS 50 bps downlink with 30-bit words (24 data bits, 6 error correction bits).

RTCM SC-104 data is now routinely transmitted as GMSK data (usually 100 or 200 bits per second) by the Coast Guard in the 280-320 kHz range from sites every few hundred km along the U.S. coast and inland waterways. DGPS data also is commercially available on subcarriers of FM broadcast stations.

These DGPS signals do more than just remove the effects of SA. Since the receiver that generates the correction data is using the same algorithms and data as the user to perform the orbital dynamics calculations, small errors in the ephemeris cancel out, as do errors in the clock models.

If the DGPS site is within about 50 km of you, the atmospheric corrections are similar at both ends. Hence the effects of the errors (a)+(b)+(c) are to a large extent canceled. In controlled zero-baseline tests (both the DGPS generator receiver and the test receiver operating from the same antenna, hopefully producing a known answer), I have seen sub-meter performance from the Motorola ONCORE receivers and at levels of a few meters from a Garmin GPS-45 with PR/PRR correction messages arriving every 20 seconds.

About 2 years ago, I put the W3IWI-13 DGPS beacon on the air on 145.79 and it operated for several months. The commercial receiver I was using to generate DGPS bits was needed elsewhere, the radio blew up and the antenna came down in an ice storm. I've recently re-instituted the service. Here is the setup:

- Site: The Goddard Geophysical & Astronomical Observatory (GGAO) near the intersection of Powder Mill Rd & The B-W Parkway. At GGAO, my group operates the GODE permanent GPS site for the International GPS Service for Geodynamics (IGS). The GODE antenna position is know at the mm-level with respect to the ITRF (International Terrestrial Reference Frame), and the antenna has a multi-port RF power splitter.
- GPS: The RTCM SC-104 signals are generated by a Trimble 4000SSE Geodetic receiver operating from the GODE antenna. The receiver's clock is derived from an external Hydrogen Maser atomic standard, accurate and stable at levels of 1/10e14. The 4000SSE generates RTCM SC-104 bits at 4800 bps and is set to a message rate of 20 seconds.

The above widgets and facilities are clearly non-amateur! The amateur interface is an RS-232 connector at 4800 bps).

- Amateur: Conventional packet station (TNC-2, IC-27 radio, 8db gain collinear antenna on 30' tower).

When I had W3IWI-13 on last time, I sent DGPS data once every 30 seconds, digipeating thru WB4APR-1. The 30 second rate proved a bit too slow and the APR-1 link was too marginal, so my plans are to use a 20 second rate with no digipeaters this time (also, APR-1 is off the air now). The coverage area should be 30-50 km radius, including Baltimore, Washington & Annapolis. The DGPS data are UI frames addressed W3IWI-13>DGPS. The RTCM SC-104 station ID is 0073 (decimal).

As you monitor the UNPROTO frames, the RTCM data will appear as a random string of text characters. When the 30-bit words are transmitted in pseudo-ASCII, 6-bit nibbles are padded to 8 bits and all the resulting characters are non-user-hostile (I hesitate to say user friendly since they are gibberish hieroglyphics!) in that they are all printable (your screen won't clear at random times and there should be no bells!).

You can use the W3IWI-13 DGPS data by just plugging your TNC into your GPS receiver and enabling RTCM (most GPS receivers expect 4800 baud data). In my earlier tests, I was able to get performance of a few meters at my home QTH about 25 km from the GGAO/GODE site. When DGPS is running, you will find that your "I'm stopped but the $*%S#@& GPS still says I'm moving 2.3 MPH" problems will disappear. We haven't tested it for a long time, but APRS software used to support DGPS data just fine, passing UI frames addressed to DGPS on to the GPS receiver. You'll know its alive when you see W3IWI-13 beacons. Please send me reports, especially if you are able to make use of the DGPS data.

METCON-2 Status Report

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Several years ago TAPR introduced METCON, a telemetry and control system. Unfortunately, that system is no longer available for new applications. This paper describes the METCON-2 system, a replacement for and an improvement to the original METCON system.

The METCON-2 system, is functionally similar to the original METCON system, however there are some differences. First, instead of using a single-chip 8751 as the microcomputer system, METCON-2 uses the new TAPR Universal Controller 8052 (TUC52). This is a small single board computer that is capable of running BASIC with a rudimentary file system (as well as assembly coded applications programs). TUC52 has been described in previous TAPR documents.

The METCON-2 system consists of several boards, some of which are optional. In its most basic form, METCON-2 consists of a TUC52 controller board and a METCON-2 personality board. These two boards recreate the original METCON functionality, which is 8 bits of binary over-voltage-protected inputs, frequency counter for each of the binary inputs, and 8 bits of control output. Additionally, METCON-2 will provide the ability to program the system in BASIC for advanced control and measurement functions.

One item missing from METCON-2 is the isolated form A (SPST) relay contacts. To save money and space METCON-2 provides open collector current sink outputs instead of dry relay contacts. However, for those applications that require dry relay contacts, a new MULTI-RELAY module has been designed. This module is designed to connect directly to the METCON-2 personality board and provide 8 relays with form C (SPDT) dry contact outputs. An additional change provided by METCON-2 versus the original METCON, as requested by many users, is that all connections to the outside world are by means of screw terminals rather than the lever wire-compression terminals. This should improve interconnections in those environments where vibration is a problem.

METCON-2 will be fully compatible with the original METCON VTF (Voltage/Temperature to Frequency converter) Module as well as the A/D (analog to digital converter) Module.

In addition to the modules described above, we will have a new module available soon which is called the "Heavy Duty Relay Module." As the name implies this is a relay module that can control a large current circuit (up to 20A at 15 VDC). This module is compatible with the drive capability of METCON-2, METCON or any signal source that provides at least 4 volts and 100 uA of current drive.

We plan to have the METCON-2 system ready to demo at the Dayton HamVention in May of 1997.

In addition to the modules described above, we have two other modules on the design table.

One module is a serial expansion I/O module that provides an additional 16 bits of binary input and 16 bits of binary output. These modules can be cascaded to provide an almost unlimited number of binary I/Os. The module can connect to METCON-2 or perhaps a PC with proper software. Again, this concept is just on paper at this time and has no scheduled completion date.

The other module is a 3-1/2 digit VOM-like module that can report measurement values to METCON-2 or a PC. Again, this concept is just on paper at this time and has no scheduled completion date.

If you have questions about any of these devices or would like to help with the design process by means of developing software, laying out boards, testing or other activities, please let me know by email. My address is "ad7i@tapr.org"

Messages IDs: BID, MID and LID

Arthur J Martin
[illegible]

Hank Oredson, W0RLI

The following questions and answers may be useful to anyone who would like a relatively clear explanation of message IDs.

I asked the questions and Hank, W0RLI, provided answers in clear detail. There may be disagreement, but then the world isn't perfect, anymore.

Question:
I admit to confusion on my part as to what the "real BID" is or why there is both a MID and a BID if only one unique ID is really needed per message.

Answer:
The BID is unique to the BODY of the message (thus the same BODY may be entered by different people at different BBS systems, but only one copy will ever appear at a given BBS.) The MID is unique to ANY message.

An example:

w0qrm enters a message with BID ORBS-297.M at w0rli, it is msg # 21

BID: ORBS-297.M
MID: "Message 21 at W0RLI"

n7qsy enters a message with BID ORBS-297.M at wa7sjn. it is msg # 39

BID: ORBS-297.M
MID: "Message 39 at WA7SJN"

Note that the display format of a MID is undefined, but the display format of a BID is just the BID text.

So let's say that the first message forwards to n2qoe before the second one does. It then becomes (for example) message 397 at N2QAE. Is that it's BID? No. Is that it's MID? No. So we also have a LID (Local ID) which in this case is:

LID: "Message 397 at N2QAE"

Plus the BID and MID:

BID: ORBS-297.M MID: "Message 21 at W0RLI"

If some BBS attempts to forward the second message to you, it is rejected because you already have that message BODY, known by BID ORBS-297.M

Question:
I know I've asked this before, but if the message on the PBBS has the same unique ID that it started out with, how do we know that it did not create a duplicate getting here, even if there was a character dropped somewhere along the line (possible communication link problem, including the computer COMport/UART)?

Answer:
Well, there is the problem noted above, of the THREE identities of a particular instance of a message. And that very same message, in some other instance of it's existence, may well have spawned a duplicate.

Question:
If the unique ID is different when it gets to my BBS, then a dupe may have been created and who knows where that will route to.

Answer:
Yes, that's right.

Question:
Is there enough data available in the message to be able to detect that type of *ID change enroute with software and perhaps be able to identify the probable cause of the change in the *ID?

Answer:
The only way to do more checks involves message content signatures.

Comment: I hope that the above will provide some food for thought about the whole topic of message identity.

New WIN95 & NT Packet Programs

Saki, SV2RQ
sv2rq@sv2ram.tsl.grc.eu

SV2AGW's New Packet Radio Program

A new era in packet radio programs is here! The AGW Windows packet program written by George Rossopoulos, SV2AGW, is here. This program does anything a packet user would probably want and runs only under Windows '95 and NT. It doesn't run under DOS. The whole package consists of the following programs:

1) AGWPE.EXE "The Packet Engine" as SV2AGW calls it, is the TNC driver program. This is the program in which we have to set the right TNC parameters.
2) AGWFWD.EXE This program serves the Unattended mode forwarding, which is the automatic message transfer between us and the BBS. Your presence in front of your PC, or at home, is not indispensable.
3) AGWBBS.EXE carries the BBS list and our personal messages list.
4) AGWTERM.EXE is a terminal program, for real-time connections, with anybody we would like to connect to. The program features binary transfer using YAPP.
5) AGWCLUSTER.EXE for the automatic Cluster connection. We do not have to connect to the local Cluster manually. This is done automatically by this program.

It is extremely easy to set up the program. Thus an installation file is not needed. Despite its ease of installation, SV2AGW says that his program is made only for the "power user," the one who wants all the programs he'd like to use simultaneously, in one single pack!

The program works with any TNC in KISS mode. For the time being it does not work with Baycom-type modems, but fortunately SV2AGW has plans for setting it up for them as well.

The program is in public domain for Radio Amateur use only and can be downloaded from the Internet with a WEB browser at the following address:
http://www.forthnet.gr/sv2agw

You can communicate with SV2AGW-George, as well, by sending him a message at:
SV2AGW@SV2RAM.TSL.GRC.EU

You can also get the program by sending him two formatted 1.4M diskettes, an SASE envelope and 4 IRCs if sent from Europe, 8 IRCs outside Europe, to his home address:

George Rossopoulos (SV2AGW)
G. Mystakidi 49
Thessaloniki-Macedonia
GR-54250 GREECE

Check the Internet site mentioned above, as SV2AGW has plans of writing more packet programs based upon NORD-LINK code supporting NODE and DAMA operation, and capable of PACSAT communications via this NODE.

North American Digital Systems Directory

Have you ever wanted to know if there might be a Packet BBS in a distant city where a friend lives? Or what the frequency is of the PacketCluster station in your area? Many times it isn't easy to find out about digital services in a distant area. In the past, one way to get this information was to consult the packet listings in the American Radio Relay League (ARRL) Repeater Directory. But that's now a thing of the past.

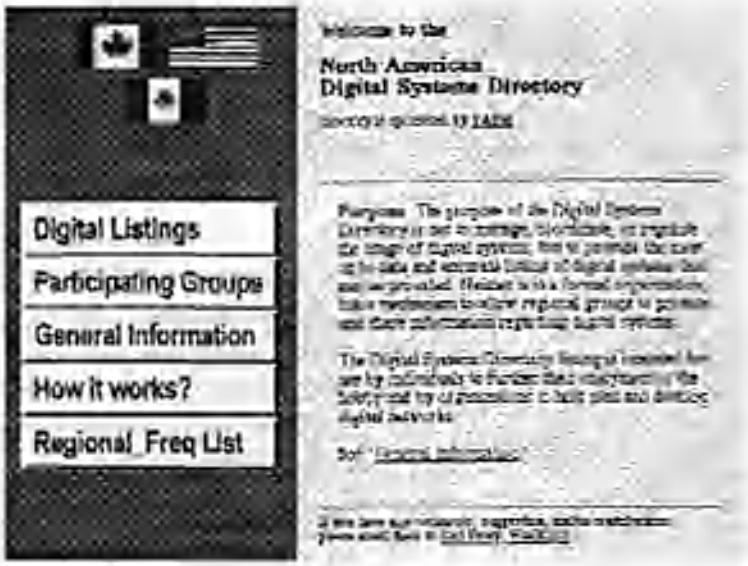
In late 1996, the ARRL announced that they will no longer publish the digital listings in the 1997 edition of their Repeater Directory. TAPR President, Greg Jones, WD5IVD, and a team of volunteers representing a number of regional groups quickly defined and developed an all-electronic World-Wide-Web based replacement, known as the North American Digital Systems Directory (NADSD). Visit it at URL: http://www.tapr.org/directory.

The NADSD is comprised of information provided by regional, state and local organizations, as well as by individuals. This allows information to be maintained and updated more frequently than if it was published annually in a book. Individuals are encouraged to give their data to the appropriate regional group for submittal to the NADSD. However, in situations where this is not possible, data from individuals will be accepted. Registration is a required step for becoming a recognized data provider and is done electronically also. (URL: http://www.tapr.org/directory).

Data providers from 37 States and 5 Provinces have provided data so far. Be sure to look through the lists for your area and let your regional club know if something is missing or incorrect. If your state is not listed, try to find the "official" listmaker and tell him/her about the NADSD — and if you can't, consider submitting the data yourself. Data is especially needed for the states of Alaska, Hawaii, Idaho, Kansas, Kentucky, Montana, Nebraska, New York, North Dakota, Rhode Island, South Carolina, Utah, Wyoming, provinces of Ontario and Manitoba, and all Mexican states.

All systems using digital modes are welcome to be listed in the NADSD for United States, Canada, and Mexico. This includes Amateur (digital) satellite gateways, Net/ROM-TheNET nodes, TCP/IP gateways (to the Internet and multiple frequencies), BBS, PacketCluster, and APRS. If it is a digital system (excluding personal mail drops) it is appropriate for it to be listed in the NADSD.

The purpose of the Digital System Directory is not to manage, coordinate, or regulate digital systems, but is to provide the most up-to-date and accurate listing



of digital systems there is. Regional groups already supporting the NADSD project include: TwinsLAN, Texas Packet Radio Society, Ohio Area Repeater Council, Puget Sound Amateur Radio TCP/IP Group, Northern California Packet Association, Northern Illinois Packet Radio Frequency Council, Indiana Digital Experimenters Association, Central Lakeshore Experimenter's Digital Organization, HogNet Packet Radio Association, YCCC Sysops Association and the Missouri Amateur Packet Radio Society. TAPR encourages other regional groups to support this project by contributing data for their respective areas.

Data formatting for the NADSD this year will be the same as that used by the ARRL in previous years — ASCII files, tab-delimited fields. All field definitions remain the same as in previous years. Some additional fields (defined in the on-line info) have been added for future use and are optional this year. For now, all fields can be viewed by everyone. In the future, the contributor will be able to specify which fields cannot be viewed publicly. For now, data contributors are cautioned to submit only data that they are willing to have publicly viewed. Data contributors should carefully consider if they want to list backbone frequencies.

For further information on this project, to see the on-line lists, or to review the "frequently asked questions" (FAQ) list, visit the Web site. You may subscribe to an e-mail list, REGIONAL_FREQ, on which digital listing issues are discussed. You can subscribe via the TAPR Listserv at http://www.tapr.org. If you do not find the information you need at these sources, contact Carl Estey via e-mail (wa0cqg@tapr.org).

Packet Radio in Education: Integration of Packet Radio into K-12 Gifted and Talented Programs

Gayle Toms

This is the sixth of several articles that will appear in the PSR concerning amateur/packet radio and its potential in K-12 educational applications. These papers were assembled over several summers of teaching a graduate level course at the University of North Texas. Many thanks to the Texas Center for Educational Technology for allowing TAPR to reprint this information. As part of TAPR's goal in education, we hope that these articles will be disseminated to a larger group that can take the concepts and ideas to a next step or final application/implementation. If you have a teacher or educator as a friend, please pass these articles along.
—Greg Jones, WD5IVD

Reprinted from:
Jones, Greg (ed). Infusing Radio-Based Communications Tools into the Curriculum. Texas Center for Educational Technology. 1995. 136 pages. http://www.tcet.unt.edu

Many public schools must provide special educational opportunities for students classified as gifted and talented. One opportunity which would certainly be considered unique is Packet Radio. The purpose of choosing the gifted and talented group to begin using Amateur and Packet Radio is to develop a method of introducing it into the schools. We hope, during the process of using the equipment for the gifted and talented classes, all students will receive a benefit from the technology.

Each teacher of gifted and talented students in the Red Oak ISD is required to attend special inservice training sessions that focus on teaching strategies and teaching suggestions for this group. One such training program could be developed to study for the Codeless Technician License examination. The teachers would then supervise various activities over amateur radio. Before they acquire the license, numerous activities could be initiated from monitoring amateur radio activity.

There are presently three elementary schools in the Red Oak ISD and a fourth to be opened 1994. These schools have grades K-4. This would be an excellent opportunity for networking the grade levels among the schools.

Kindergarten may need to concentrate on voice communication because writing skills at this level are very limited. The gifted and talented students are not separated from the other students during their school day as they are in the higher grade levels. They are usually given individual directions or added dimensions to regular assignments. These students could be the moderators of classmate dialogue. They could keep a record of the frequencies on which communications are made, and listen to other broadcasts during free-choice activity sessions.

First grade gifted and talented classes can continue to advance with the activities as in kindergarten and expand those to include an introductory discussion of radio waves and satellites. Toward the end of the year, when their writing skills have begun to develop, some short E-mail messages to the other first grade gifted and talented classes could be sent. Greater cooperation with scheduling may be necessary with voice communication since separate class times are scheduled for gifted and talented classes beginning in first grade.

By second grade, the students can write E-mail messages, listen to NOAA broadcasts and discuss weather patterns, and monitor other frequencies. A system of pen pals might be initiated with the other second grade gifted and talented students.

Third and fourth grade gifted and talented students can continue with the suggestions for first and second grade and, if equipment is available, begin getting satellite images and discussing geographic forms and weather patterns from visual images. Third and fourth grade students may also want to begin statewide correspondence with other third and fourth grade students through ROSE, TexNet, or NETROM.

Some students might show an interest in obtaining their own amateur radio license by this age. Assistance can be found through radio contacts during their gifted and talented classes. There is an Ellis County Amateur Radio Club which could offer assistance to the schools.

Technology funds at this time are being used solely to equip and update computer labs in all the schools in the district. With limited resources, it may be difficult to acquire any of these funds which are considered to benefit a greater number of students. However, special funds are set aside for gifted and talented programs. The necessary equipment could be purchased by each school and used by all grade level gifted and talented students. Each school will need to determine the most appropriate placement of the equipment. The equipment will certainly not be restricted and students not in the gifted and talented program should be introduced to the equipment and technology.

There are no essential elements for gifted and talented students. The students are to be challenged and regular curriculum enhanced. The teachers of the gifted and talented students may want to meet regularly to coordinate activities. These activities will include language arts curriculum in writing E-mail messages, science activities, social studies, geography, and perhaps even math. The possibilities seem endless and the opportunities worthwhile.

PACTOR Mode Demodulator Test Results

Marvin Bernstein, W2PAT/AFA1DA

An investigation of the data speed of the Pactor mode has made use of an Air Force Military Affiliate Radio System High Frequency for more then two years. The frequency used for this test series is approximately 7.9 MHz but the actual assigned frequency cannot be disclosed. The tests have been made between a MARS Member in Kansas sending ASCII files to the Member in New Jersey, a distance of just over 1000 miles. Transmissions have been undertaken on a fixed time schedule without regard to the HF propagation conditions. The first test each day is held at 1340 Zulu in the morning and the second test is at 2330 Zulu in the evening.

This report is the second one of a series that will detail the results of an extensive High Frequency Pactor Mode test. The first report was published in the *Digital Journal* and the TAPR *Packet Status Register*[1]. It is important to point out that this long series of Pactor Mode tests, which started in April 1995, is still continuing. The object of this program, is to learn more about the circuits used in the demodulator which converts the audio tone output of the receiver into DC voltage changes required by the computer. The pactor mode is used only as a tool that accurately allows evaluation of the transmitted ASCII file data speed and in this way, to determine the effects of changes in the system or circuit.

As of the date of this report, a total of sixteen investigations have been completed, each of which consists of 25 tests. Each test involves one Kam to Kam run to obtain the propagation data speed, and then a second run of the system under investigation. Approximately 3.1K bytes of file is sent twice for each of the 25 tests, or about 155K bytes for each of the 25 tests.

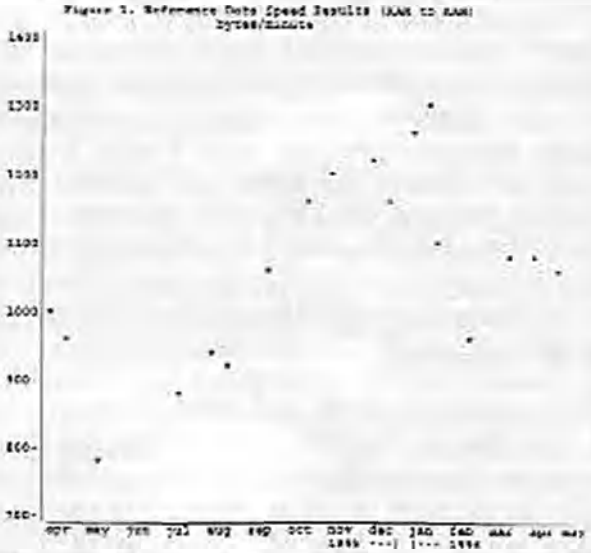
In this long investigation, two different TNCs were tested as well as six tests of a demodulator which used 88 mH toroids with changes in the demodulator circuit and the use of a digital signal processor. Two tests which compared the performance gain with the W9GR DSP-2 unit in the filter and DE-noise modes, when used with the KAM TNC, one test with a Timewave DSP in the filter mode on the input of the Kam. The MFJ-1278B operated with a switched capacitor filter and also with the W9GR DSP Filter. In addition, tests were made with a narrow band commercial unit, with and without the use of the W9GR DSP filter. The last test used a quartz crystal demodulator to determine if filtering and detection at 6 MHz would result in significant speed improvements. The audio tones were input to an LM-1496 balanced modulator chip, filtered in a six crystal 6.0 MHz ladder filter, detected with a two crystal resonator discriminator and a dual operational amplifier used to increase the DC voltage levels.

This investigation is NOT concerned with Pactor Mode HF DATA SPEED, but rather the speed results allow for the accurate evaluation of changes in the demodulator and systems with the resulting effects upon data speed.

Reference Data Speed Results

The data speed depends to a large degree on the HF propagation conditions as well as the presence of noise. It has been determined that QRN, static, and the natural noise from lightning strikes, is especially destructive and results in large decreases in speed. Due to these causes, a reference data speed is required for each test, and so a Kam to Kam transmission is a part of every daily test. To prove conclusively that these added tests are required, the Kam to Kam data speeds have been shown in the form of a graph.

Figure 1 shows the plotted average data speed for the Kam to Kam transmissions from the start of testing, April 1995 to May 1996. The plotted data shows a decreasing speed from April to May but after July there is a steadily increasing data speed for the rest of the year.



The Kam to Kam reference data speed peaks in the Months of January and early February due to lack of QRN and above average signals. During the last part of the Month of February, speeds decreased due to lower signals strengths. From March to May, speeds decreased both due to the beginning of spring storms and decreased signal strengths. There were no tests made during the month of June, 1996 due to vacations.

The average pactor data speed for the whole test interval of one year is 1112 bytes per minute. During this test period, 3.1 million bytes of test files were transmitted from Kansas to New Jersey. The average signal strength over this period of time was 2.6 S-units. A test was made with a Measurements Corporation standard signal

generator which indicated that this value of signal strenth, 2.6 S-units, was equal to 3 microvolts.

Table 1

Dates 1995	Standard Deviation Bytes/Minute	Average Signal S - Units
08 April - 22 April	260	3.0
22 April - 06 May	267	3.1
07 May - 21 May	280	2.7
11 July - 20 July	212	3.1
02 Aug - 20 Aug	291	2.9
21 Aug - 01 Sept	281	2.0
04 Sep - 20 Sep	235	2.5
21 Sep - 07 Oct	259	2.0
08 Oct - 23 Oct	331	1.3
24 Oct - 07 Nov	340	1.9
08 Nov - 01 Dec	249	2.5
02 Dec - 17 Dec	266	2.6
1996		
18 Dec - 05 Jan	222	2.1
05 Jan - 20 Jan	237	3.0
21 Jan - 09 Feb	192	3.3
10 Feb - 25 Feb	315	2.6
26 Feb - 10 Mar	326	2.8
15 Mar - 30 Mar	284	2.5
30 Mar - 21 Apr	234	2.3
22 Apr - 09 May	285	2.2

Table 1 lists the starting and ending dates of each of the tests, the standard deviation and the average signal strength from the start in April 1995 to the last test in May 1996. The standard deviation is a calculated value which indicates the spreading of the individual test measurements of the data speeds.

The average signal strength was determined by observing the S-meter on the Icom-745 transceiver during the test, taking the lowest and highest readings, and averaging them. This was done every day, and finally the test average was calculated from all the individual readings and is shown in the Table.

It is important to observe that the standard deviation readings are relatively uniform, with an average value of 261 bytes per minute over the 13 months of tests. The lowest value is 192 for the period 21 Jan. to 09 Feb. when the average signal strength was 3.3 S-units. The highest value is 340 bytes per minute during the period 24 Oct. to 07 Nov. when the average signal was weaker at 1.9 S-units. There is a direct correlation between strong signals and low standard deviation values since under those conditions, pactor data speeds are high with little variation due to noise and propagation changes.

Demodulator Test Results

The following information contains the results of the investigation of the components of the demodulator that were constructed. The use of the G4BMK software pactor program, BMK-MULTY, was continued since it allows a very simple interface to the 386 computer serial port. The second section of the LM-558 dual operational amplifier easily supplied the required RS-232 voltage levels. [2]

There were unrelated systems that were included in the year of tests so to avoid confusion concerning the results of this work, it has been assembled into an ordered document. While a new circuit was designed and constructed, the investigation continued with other systems. The second part of this report, will deal with the actual results of the investigation of elements of the experimental demodulators that were constructed for these tests. A very simple circuit was built to evaluate changes in this circuit with any resulting improvement in the data speed. Six tests were completed and the following table has the information on the circuit and the percentage change in the data speed compared to the standard reference obtained with the Kam to Kam test. This speed was normalized to 100% so that the information then can be compared to that obtained with the experimental circuit.

Test Number	Reference Speed	Demod. Speed	Difference
1.	1201 Bytes/min	1085 Bytes/min	Minus 9.7 %
2.	1152 "	1187 "	Plus 3.0 %
3.	1212 "	1249 "	Plus 3.1 %
4.	1165 "	1218 "	Plus 4.5 %
5.	1265 "	1327 "	Plus 4.9 %
6	1109 "	1223 "	Plus 10.3 %

Test Number Experimental Circuit

1. Two 88 Mh toroids, tuned to 2110/2310 Hertz. Driven by an NPN emitter follower transistor. Output of the tuned circuits rectified with half wave diodes. Dual operational amplifier used to raise voltage level.
2. Input to (1) with W9GR DSP Filter.
3. (1) Circuit modified, Half Wave changed to Full Wave Rectifier. DSP Filter not used.
4. (3) Circuit added to input, soft diode clipper and 741 hard clipper. DSP Filter not used.
5. (4) Circuit added after first DC operational amplifier consisting of a DC restorer to reduce fading effects of one of the tone frequencies. DSP filter not used.
6. (5) W9GR DSP filter added to input.

The DSP equipment used was the W9GR version 2. [3]

Conclusions

1. The simple demodulator consisting of 88 mH toroids and half wave diode rectification was about 10 percent slower than the Kam.
2. With the 1992 version of the W9GR DSP RTTY Filter mode used on the input of the simple circuit, the data speed increased 12.7 percent. That system ran 3 percent faster than the Kam.

3. The simple demodulator circuit tone rectification was changed from half-wave to full-wave and the data speed increased more than when the DSP Filter was used. The relative data speed increased by 12.8 percent and was faster by 3.1 than the KAM.

4. The soft/hard clipper circuit was added to the full wave modified simple demodulator and that resulted in a 1.4 percent data speed increase.

5. The DC Restorer, a form of Automatic Threshold Control (ATC), only increased the data speed by 0.4 percent.

6. Finally, after all the circuit modifications were made, the W9GR DSP filter was again used, and it now resulted in a 5.4 percent speed increase. Therefore, with all the changes and use of the DSP Filter, the total increase in speed of the simple demodulator was only 20 percent. Further, the highest data speed for the experimental demodulator was only 10.3 percent faster than the reference speed of the KAM.

7. With a very simple demodulator circuit, the addition of the DSP filter resulted in a relatively large increase in data speed. As improvements were made to this simple circuit, the DSP unit did not provide the same percentage speed increase, as would be expected.

Once again, it is important to understand that the actual values of the data speed, using the pactor mode, is not the object of this long term investigation. It is to learn more about how effective the demodulator design can be made to increase the data speed in the presence of noise and weak signals.

Next Report

The next report will contain information on the relative speeds of the Kam reference compared to the use of the LM-565 Phase Locked Loop integrated circuit and a unique new design in which the filtering and discriminator functions are done at a frequency of 6 MHz. There will also be information on the W9GR version 3 Digital Signal Processor and its performance with the Kam TNC as well as some data on the MFJ-1278B TNC.

I wish to acknowledge the huge amount of effort by Conrad Steinel K0UER/AFA3VP, Emporia, KS in his meeting the scheduled test times. He has been punctual and reliable and willing to interrupt his own personal daily life to get on the air and run the test files. It has been a pleasure for me, to have him participate in the long term investigation that is still in progress. Without his help, this report on the work could not be published. Furthermore, I wish to also acknowledge the help of both our XYLs. We would forget about the schedule occasionally and they would remind us of the time so we could complete yet another test.

1. High Frequency Performance Of Two Different Pactor Systems; *Packet Status Register*, Tucson Amateur Packet Radio Corp., Winter 1996, issue # 61

High Frequency Performance Of Two Different Pactor Systems; International Digital Radio Association, *Digital Journal* Volume 44, Number 3, March 1996

2. Schneider Systems P.O.Box 5964, Asheville, NC 28813 704-274-4646

3. *QST*, Sept. 1992 Low Cost Digital Processing For The Radio Amateur. Dave Hershberger, W9GR.

$3 PACSAT XMTR mod to TAPR-2 TNC's

Bob Brudage, WD4AJR
wb4apr@amsat.org

OK, I took out the scope and verified that a 1200 baud clock is indeed available on the Receive Data Clock pins on the modem disconnect header of my Tiny-2 TNC. So anyone can add a PACSAT manchester transmitter modem to their standard TAPR TNC-2 with the following components:

1) 7403 chip, quad 2-input NAND (Open Collector) wired as an XOR (59 cents).

2) RC low-pass filter (59 cents).

3) SPDT switch to select between PACSAT and normal AFSK (122 cents).

Construction

Connect the 7403 as an XOR to modem TXD and RXClock on the modem disconnect header. Add pull-up resistor and RC low-pass filter. Then connect a switch between this audio and normal audio to your Mic connector. OK, you should add a pot for setting audio level, but that will drive the cost up a buck or so. Mount switch on front panel.

NO, I haven't tried it, hoping someone else that routinely receives PACSATS will try it and tell us.

Question

Is the 7403 open collector NAND gate the easiest way to make an XOR? It's been a while since I have played at the gate level. I used one NAND to get the 11 pattern and two NANDS as inverters to drive the last NAND to get the 00 pattern. Then wire-ORed the outputs to get the final XOR function. Is this right? I couldn't find an XOR chip exactly.

Wireless Digital Communications: Design and Theory

Now available from the TAPR office!
We just got the books and they look GREAT!

Wireless Digital Communications: Design and Theory
by Tom McDermott, N5EG
334 pages, ISBN: 0-9644707-2-1
Includes a 3.5" disk containing programs used in book.

http://www.tapr.org/tapr/html/pub.wdcdat.html

Preface

Amateur radio communication has progressed in many ways since its beginning in the early 1900's. General communications progressing from spark to CW and voice from AM to FM and SSB. Similarly, data communications as a mode of amateur communications has progressed from using on-off keying (OOK) to FSK, and from RTTY to more modern modes of communications (synchronous and error-correcting). There has been a lack of good technical background material in amateur radio literature on the principles and design of synchronous digital modems.

The wealth and quality of literature in the professional world in the subject area is astounding, but much of it may not be readily accessible to the radio amateur, whether for reasons of advanced mathematics, or simple lack of availability.

In writing this book, the aim has been to bring a concise group of topics covering a broad spectrum of amateur synchronous digital communications subjects to print in one place, and to make it readily accessible to the radio amateur. This text aims to present the information in a clear and straight-forward manner, with the maximum use of graphical and computer-assisted aids, and with a minimum of rigorous mathematical theory. However, digital communications deals with the application and solution of statistical phenomenon, and a minimum background is necessary. Where practical, the appendices provide short summaries of some of the important mathematical concepts that will be needed in understanding certain areas.

Overall, the field of digital communications could be generally broken into two categories: bandwidth-limited communications and power-limited communications. Much of the professional literature focuses on the former, while in practice the amateur is many times concerned with the latter. This text focuses more on the subject of power-limited communications and emphasizes, through examples, the circuits and problems of the latter category of applications.

With time and the increasingly more crowded HF bands, however, the radio amateur will adopt more sophisticated data modems, offering higher throughput and narrower bandwidth operation under the demanding propagation conditions of the HF medium. This trend has already started and should accelerate as the cost of technology, particularly Digital Signal Processing, continues to decrease. So, this text includes information on the subject areas of DSP-based modem filters, and on forward-error-correcting codes, whose use by the radio amateur will become dominant within a few short years. While the data rate of VHF and UHF communications will increase, it is expected that, for the radio amateur, these will remain power-limited applications for some time.

In the preparation of this text, I have relied on the study of a number of exceptionally well written textbooks, and to the IEEE literature in the area, and these should be consulted whenever more depth or broader interest is desired. I would like to thank the reviewers of the text for many helpful comments, related both to the readability of the material, ...

(more in the book!)

Thomas C. McDermott, N5EG

Accessing TAPR via the Internet

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

Information Server

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

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

Internet E-Mail

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

World Wide Web

http://www.tapr.org/tapr
http://www.tapr.org/tapr/html/pathome.html

FTP

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

Amateur Radio Prior Art Invalidates Internet Applet Patents

Greg Aharonian

There has been much discussion lately about software patents for Internet "applets" and related technology, the Eolas patent application for one, and Prodigy's attempt to cash in on Java for another. One of my readers recently forwarded me the following story and example of prior art that will impact any of the Internet "applet" patents. It shows you how tricky this prior art search stuff can be.

In the very early days of amateur packet radio, a group at the Linkoping University in Sweden built an experimental packet radio network they called Softnet. The distinguishing feature of Softnet was that every network packet was a program, written in Forth, that was interpreted by the receiving node. For example, a packet could forward itself by prepending a Forth routine to do so.

The idea was cute and powerful, but the obvious problems of security and stability kept it from being accepted by the ham community. Here are some relevant quotes from papers presented at the ARRL Computer Networking Conferences:

> "In Softnet each node acts as an interpreter of packets containing FORTH statements which are immediately executed. The statements are typically 'treat the rest of the packet as data and forward it to node B', but they can also define new functions as 'forward all my packets to node C'."

– From Jens Zander, SM5HEV, "SOFTNET - Packet Radio In Sweden", First ARRL Amateur Radio Computer Networking Conference, October 16-17, 1981. Appears in Pioneer Papers on Packet Radio 1981-1985, ARRL, ISBN 0-87259-022-4.

> "The main concept behind SOFTNET is that all packets are considered to be programs of a **network language**. These programs are interpreted in the nodes as soon as they arrive. Nodes can be programmed by any number of users simultaneously without unwanted interaction."

– From Jens Zander and Robert Forchheimer, "SOFTNET - An Approach To High Level Packet Communication", Second ARRL Amateur Radio Computer Networking Conference, March 19, 1983. Same volume as above.

Copies of the ARRL proceedings are available from
http://www.arrl.org/catalog
http://www.tapr.org/tapr/html/cncindex.html

It would indeed be ironic, by the way, if the main societal contribution of amateur radio's early work in packet radio were to be the shooting down of the many bogus patents filed by commercial companies over a decade later when they finally (re)discovered what we hobbyists had been quietly doing all along.

In fact, there are a fair number of issued and pending patents for which these papers are relevant prior art. The obscurity of the reference (as I hadn't thought of searching the amateur radio world for software prior art), illustrates the complexity of finding, acquiring, organizing, and distributing software prior art, a complexity missing from current sanctioned efforts to deal with software prior art. The problem continues to get worse and worse.

[Editor's Note: One source reports that the references cited above were found by searching the CNC index on the TAPR web site.]

Greg Aharonian, Internet Patent News Service
P.O. Box 404, Belmont, MA 02178
617-489-3727, patents@world.std.com
For info on a free subscription, send 'help' to:
patents@world.std.com
For prior art search services info, send 'prior';
for software patent alert service, send 'alert'.
For WWW patent searching, try
http://sunsite.unc.edu/patents/intropat.html

Application of the DTMF Accessory Squelch (DAS)

Eric Estill, N6GPE
EEstill@aol.com

I've been using my DAS to insure family communication. The story goes like this.

I have a wife and 2 boys ages 15 and 12. My wife and oldest son are hams, the youngest is not yet. I keep a 2M base station on in the family room, so I can call in on the way home from work.

The problem in the past was that the TV is also in the family room, so if there was any sound on the radio, some how it would wind up on micro-volume so that nothing could be heard. It seemed to be an auto function of the radio, because no one in the family ever turned the volume down, it just got there somehow. The end result was that when I called home, no one answered.

DAS to the rescue. I built my DAS kit and put it on the speaker in the family room. I put a buzzer on the radio and a remote busser on the side of the intercom in the kitchen. Not only does it buzz in the family room and kitchen, if someone listening for a call puts the kitchen intercom on mic and the other end on speaker, the buzzer can be heard on any end of the intercom.

This has been a success. Very few calls get missed these days and the radio stays on 24 hrs a day, just in case there is a LTZ call.

Would I use a 110V relay? I don't think so, but give a ham an option and a "requirement" usually presents itself. I could flash the kitchen lights with the buzzer, hi hi.

The bottom line is, it still works, it does what I wanted it to, and I'm a happy ham.

TAPR Has a Club Callsign: KT7APR

TAPR has been assigned the callsign KT7APR by the FCC (effective 12/10/96) KT7APR—see it! Paul Newland, AD7I, and Bob Nielsen, W6SWE, have been working on getting a callsign for TAPR since Dayton 1996 when the issue was discussed informally at the booth. While Paul Newland, AD7I, is currently trustee, we will be moving the trusteeship to Dewayne Hendricks, WA8DZP, so that KT7APR can be used on future FCC operational issues. It is a benefit when dealing with the FCC that TAPR has a callsign, since the organization can be issued an STA directly instead of to members in the organization. Thanks to Paul and Bob for their work.

Update on FreeWave Technologies 900Mhz FHSS Radio intended Group Purchase

First, as some of your are aware, TAPR had negotiated a special group purchase agreement with FreeWave Technologies, which would have allowed TAPR to offer the FreeWave DGRN-115 spread spectrum radio to our members who are participating in the TAPR Spread Spectrum STA. An initial order of 65 units was placed the first of December with the purpose of getting units so that the radio could be evaluated to determine which options we wanted to request documentation for common interfaces written, and we could get the purchase process setup with FreeWave. When the order was placed, we were told that we could expect delivery before the end of 1996. However, when we finally received a confirmation of our order from FreeWave we were informed that we would not receive delivery of the units until January 17, 1997.

The later delivery from FreeWave caused us to revise our plans and we decided to start taking orders for the radio from the SS STA participants. We made this decision due to the fact that our current STA term is only six months and although we expect that it will be renewed, we didn't feel that we could waste any time in getting hardware into the hands of our STA participants.

The first of January, we were informed by FreeWave that they were canceling the special purchase agreement with TAPR and that TAPR will receive no other units from FreeWave other than the initial units that we purchased in our first order. There was a special web page discussing the purchase. We removed the links and later the page when the discussions with FreeWave began deteriorating. We sent several messages to FreeWave offering different alternatives for continuation, but FreeWave never responsed back to these messages. TAPR has notified everyone that had signed up for the $399 version of the purchase that it has been canceled and no money will be deposited or cashed, since no order can be placed with FreeWave. Any checks for radios will be mailed back.

January 17, 1997 passed and finally FreeWave contacted us and wanted additional terms before the purchase of the 65 radios would be processed. These additional terms could not be agreed to by TAPR, since one of them could limit future development of SS technology by TAPR. After discussing the issue with our legal counsel, the TAPR board, and the people involved in the purchase, TAPR decided to cancel the order for the 65 radios.

TAPR regrets this turn of events, but we will continue to work on other possible means to get Spread Spectrum technology into the hands of our members.

STA On-line Application

TAPR requested a Special Temporary Authority (STA) to conduct an experimental program to test spread spectrum emissions over amateur radio on April 10, 1996. On November 6, 1996, the FCC Wireless Telecommunications Bureau granted the TAPR request for an STA.

TAPR is making an application for participation in the STA available for any member of TAPR to use. The URL is:
http://www.tapr.org/ss/tapr_sta.html

Please note that all areas of the application must be filled out. These will be reviewed by the STA holders and a committee within TAPR. The more detail you can provide in the general answer areas the better.

The STA holders reserve the right to add individuals to or remove individuals from the STA at anytime. The application will be used in order to determine eligibility in the STA as well as provide information to the database and final report of the STA.

Responsibilities of STA stations:

- Stations will be required to maintain the highest standards in operational practices.
- Stations will be required to submit a report before the end of the STA that will be used in the final report.
- Stations must have a dependable Internet e-mail service so that information and discussion regarding the STA can be held.
- Stations must hold at least a Technician Class license
- Stations must be aware that any transmissions conducted pursuant to the requested STA will be secondary in nature, and must cease immediately in the event of harmful interference.
- Stations must be a current member of TAPR.

1997 Dayton HamVention Packet Event!

The 1997 "Packet BASH" sponsored by TAPR and the Miami Valley FM Association will be held on Friday of the Dayton HamVention. The BASH will again be held at the NCR location south of Dayton. It was a great spot and we look forward to having a second year there.

A buffet dinner, a raffle for some neat prizes, a great program, and lots of fun will cost approximately $20 per person. More on the final price once we have a contract on the dinner. Keep an eye on TAPR-BB and the Web pages.

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

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

1900	Dinner
1945	Welcome
2000	Keynote Address
2030	Raffle
2045	TAPR SIG Meetings

For more information, send email to "packbash@ug9v.ampr.org" or stop by the TAPR booth at Dayton for schedule and map.

Attention PacComm TNC for DSP-93 users

There are new EPROM images for the DSP-93 which (we hope) will fix the data overrun problem with the PacComm TNC for data from the DSP-93 to the TNC. The images are at:

ftp://ftp.tapr.org/tapr/dsp93/upload/U102_218.OBJ
ftp://ftp.tapr.org/tapr/dsp93/upload/U103_218.OBJ

1997 ARRL and TAPR Digital Communications Conference Update

TAPR and the ARRL are working on finding a hotel for the 1997 ARRL and TAPR Digital Communications Conference. We are looking at a date in October with the location to be in the Baltimore area, either around the harbor or near the airport. More information will be disseminated in the coming weeks as a location, hotel, schedule, workshops, and registration prices are fixed by the conference committee. AMRAD will be one of the regional hosts of this year's conference and we all look forward to working with them in the coming month to generate an excellent conference.

GPS-20 Group Purchase

TAPR continues to arrange group purchases for the Garmin GPS-20. Contact the TAPR office to find out the status of the latest order. http://www.tapr.org/gps has full details on the purchase.

Area Code Change

The TAPR office phones will undergo an area code change in May.

Like many others in the U.S., the TAPR office is about to be affected by an area code change. In May, the new area code will be changed to 940. There has been some delay on the issue, because the phone company was trying to split Denton county in four area codes and there was a lot of movement to try to cut this down. Now it is only three area codes.

Starting in May, the phone numbers will be:

940-383-0000	Office Voice
940-566-2544	Office Fax

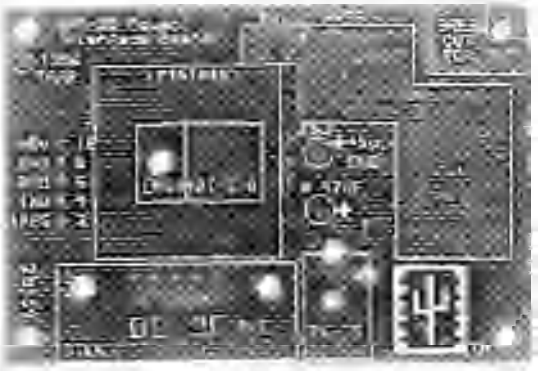
TAPR Kits Update

The N2IRZ GPS-20 Power Supply and Interface Board

The N2IRZ GPS-20 Power Supply and Interface Board is a compact 5 volt power supply and RS-232 interface board for the Garmin GPS-20 Global Positioning System engine. The power supply portion provides a filtered, short-protected 5 volt DC output to operate the GPS-20. The interface portion provides a simple and convenient method of providing the required 5 volt power to the GPS-20, as well as a 9-pin female sub-D connector for supplying the RS-232 data to a computer or TNC. Also provided on the DE-9 is the one pulse-per-second output.

The power supply is designed around the National Semiconductor LM2490T-5.0 low-dropout regulator. This rugged regulator, designed for the rigors of automotive use, supplies a well-regulated 5 volt output with a wide input range of 5.4 to 25 volts. This exceptionally low input voltage allows battery operation from 5 NiCds or 4 alkaline cells. To further improve portable operations, the power supply uses wide temperature range components, from -40C to +85C, more than enough for most applications.

The easy-to-assemble single-sided PC Board, which is the same size and form as the GPS-20, is silkscreened and solder masked for convenience.



GPS-20 Power PCB (actual size)

A small prototyping area, for modifications or additional circuitry, is provided. The power input jack is a standard 5.5 x 2.1mm coaxial jack, the same as found on most TNCs. The regulator is self-protected against overvoltage transients to 60 volts, short circuits, over temperature, over current, and reverse polarity input.

Although anyone could make their own power supply, this new TAPR kit offers an excellent price/value ratio. Add the convenience of a feature-packed under-an-hour kit, and the deal is irresistible!

TAPR intends to offer the GPS-20 Power board as part of an accessories kit for the GPS-20. This kit will include the interface board with parts, standoffs with screws, RF MCX to BNC bulkhead connector with coax, and will have a JST preassembled cable that fits the GPS-20 connector. No cost has been determined for this accessory kit yet, but the kit should be useful for those building future TAC-2 or MIC-E kits as well as wanting to use your GPS-20 as a standalone unit. Keep an eye on the TAPR Web page and the next *PSR* for full details.

TUC-52 and METCON-II Personality Board

The TUC-52 is very close to going to beta test. Paul Newland, AD7I, has begun the process of design and layout of the first personality board for the TUC-52, which will be the METCON-II.

Paul has written an article in this *PSR* about the new METCON design. The goal is to try to have METCON-II kits available at Dayton or shortly thereafter. The METCON-II should be very versatile.

DSP-93 Update on kits for Spring

Gary Hauge has finished a set of kits and they should be available at the office for sale by the time of this printing. Currently, about 10 units have been ordered of the 25 available. If you have been waiting for a TAPR/AMSAT DSP-93—here is your chance to join the gang of happy DSP-93 owners! The new 2.18 EPROMs are in the TAPR dsp-93 ftp directory (ftp://ftp.tapr.org/tapr/dsp93/). Dave Lamont has been the only person to give any feedback. If anyone has tested or is testing, be sure to contact Ron Parsons, w5rkn@amsat.org with your results.

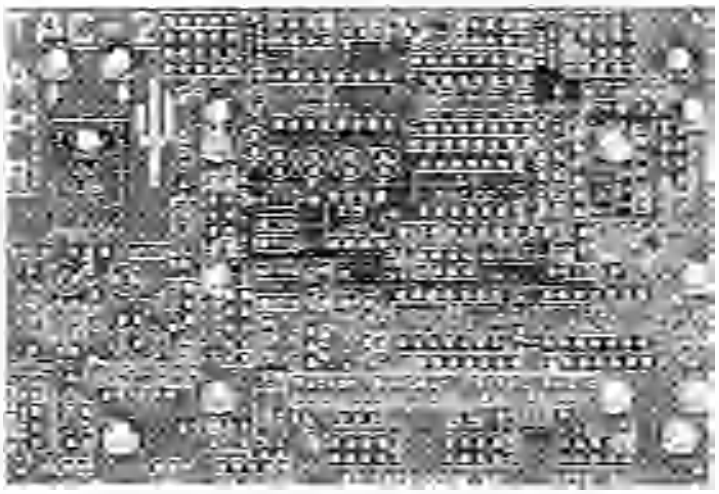
Moe Wheatley AE4JY, (mwheatle@traystcms.com) has designed a simple watchdog timer for the DSP-93 which will reset the box if either PTT line stays active for more than about a minute. It uses one 74HC86 and a few discretes. The schematic, single sided pcb layout, and some documentation can be downloaded from
http://www.mindspring.com/~ae4jy/projects.htm
The files are in Acrobat .pdf format.

AN-93: PC Modem for HF

We had hoped to have kits available by the end of 1996. The docs didn't get completed and the tune-up and installation parts of the docs are being tested before kits are shipped. Once the docs are verified, then the kits will begin shipping.

TAC-2: Totally Accurate Clock

The TAC-2 project moved to revision B boards the first of January. The development group, made up of Tom Clark, W3IWI, Paul Beckman, WA0RSE, Steve Bible, N7HPR, Rick Hambly, Ron Parsons, W5RKN, Lyle Johnson, WA7GXD, Frank Perkins, WB5IPM, and John Ackermann, AG9V continue to test the units. The docs are being written and beta testing with a very small group will take place afterwards. We are looking at having the kits



available at Dayton. Check the TAPR web page
http://www.tapr.org/tapr/html/tac2.html
for details on the kit, and articles in *PSR* #64 p.5 and *PSR* #63 p. 29-35. The group has also been looking at the design of GPS Disciplined Oscillators based on the TAC-2. More in future *PSR*s on what possibilities might be available in the future.

TNC-95

The TNC-95 project is still on hold until firmware is ported. The software developer has a working unit and we expect working code sometime in the future.

APRS MIC-E Project

The TAPR APRS MIC-E beta testing began in December. If you are not familiar with the MIC-E project, it began several years ago with the creation of a PIC chip processor that is now sold commercially by Clements Eng (http://home.navisoft.com/agrelo/clement.htm). In 1996, Gwyn Reedy, WA1BEL, President of PacComm approached TAPR about handling the amateur version in a semi-kit solution. TAPR and PacComm had been discussing such a possibility for over a year and the MIC-E looked like a good project to try. The agreement TAPR has with PacComm is that they are handling the commercial side of the project, with TAPR handling an amateur version of the PacComm unit in a semi-kit form. This allows PacComm to focus on the commercial side and allows TAPR to handle the amateur side via its traditional volunteer methods and provide a unit to the amateur radio market. The board will be built by PacComm and provided to TAPR to put into a kit that will be assembled into a box, hooked up to a GPS, and interfaced to a radio by the members purchasing the unit.

The MIC-E (Mic Encoder) installs between your radio microphone and radio and allows your GPS unit to transmit APRS AX.25 frames at designated intervals without needing a TNC! Very useful in many settings. You can listen to a discussion of the MIC-E by Bob Bruninga, WB4APR, while Bob uses one, or read over the text about the APRS MicEncoder at http://www.tapr.org/tapr/html/virtual.html

The units are planned to be a semi-kit. This means that the board has already been assembled, but interface wires, box, and other items will still need to be configured and assembled for proper use.

The beta testing began in December with the purpose of beta-testing being to generate and correct the kit documentation, ensure hardware problems are nonexistent in more variations not possible during the alpha-testing and that the software is functioning adequately in a wider range of applications. In addition, the beta-testers will become the core expert group to help others when the units are made available to everyone. The beta testing thus far has been very positive. The beta units had a few quirks which can be overcome in the production version. Also, a number of features have been determined to be needed to help improve its performance and usability in the production version.

TAPR selected a small group of people in November to test the beta version of the TAPR APRS MIC-E adapter. The following people are involved with the beta testing:

Alan K. Umagat, WC7R, Prescott, AZ
Mike Parker, K7TD, Tucson, AZ
Don Illman, VE7TBI, Victoria, BC
Steven Boyle, KD6WXD, Mountain View, CA
Cliff Buttschardt, K7RR, Morro Bay, CA
Stan Horzepa, WA1LOU, Wolcott, CT
William Covey, W1GTT, East Lyme, CT
Sam Guccione, K3BY, Camden, DE
Neil Lauritsen, KA3DRK, Clearwater, FL
Rich Garcia, N2CZF, Jupiter, FL
Steve Dimse, K4HG, Summerland Key, FL
Ralph Fowler, n4neq, kennesaw, GA
David Chesser, KA9NHL, Dekalb, IL
Henry Van Bogaert, N9WMM, Midlothian, IL
Larry Keenan, K9ORP, Hudson, IL
Don Rosier, KA0HEF, Overland Park, KS
Tom Kinahan, N1CPE, Westboro, MA
Kevin Kelly, N6OAB, Lusby, MD
Will Clement, N3XLM, Arnold, MD
Bob Bruninga, WB4APR, Glen Burnie, MD
Jonathan R Brockmeier, KB8SWB, Holland, MI
Tony Drumm, AA0SM, Rochester, MN
Rich Josephson, ?, St. Cloud, MN
Bo Duncan, KI3G, Kansas City, MO
Dale Lau, WA0NKE, Kansas City, MO
Wilmar Gall, WA0EL, Kansas City, MO
Bob Derdetian, N2FH, Bridgeton, NJ
Mark Sproul, KB2ICI, North Brunswick, NJ
Bill Healy, N8KHN, Incline Village, NV
Alan Crosswell, N2YGK, Briarcliff Manor, NY
George V. Chapel, N2AIG, Scotia, NY
Michael E. Young, WB8CXO, Monroe Falls, Ohio
Steve Causar, AH7F, West Carrollton, Ohio
Mark Humphrey, KE3XY, Chester Springs, PA
Gould Smith, WA4SXM, Knoxville, TN
Mark Fiddelke, WB0NOO, Nashville, TN
Bob Wimmingham, KC5EJK, Dallas, TX
Henry Burford, KA0TTY, Coppell, TX
Mike Herbert, WB5QLD, Hurst, TX
Ron Parsons, W5RKN, Austin, TX
Frank McJunkins, K7RSD, Seattle, WA

If you have questions about what is happening in the beta-testing, or want to see the unit in operation, the above list is a good place to start if you see someone in your area. We are hoping to get the necessary changes made to the board in the next month or so and then make them available to the membership soon after. This should be before Dayton, if all goes well.

Keep an eye on the TAPR web page for updates on the beta testing and final production.

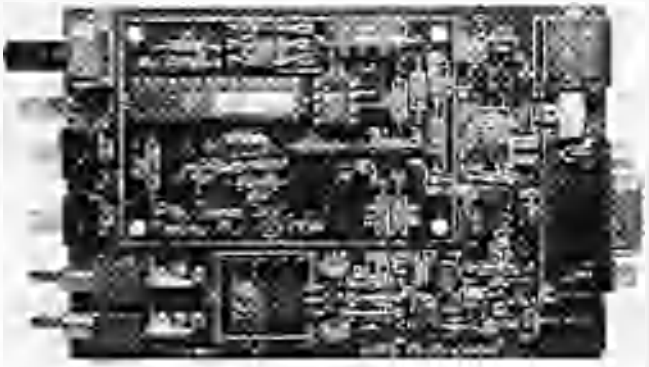


Photo of MIC E board outside the case.

TAPR Publications

Wireless Data Communications: Theory and Design, by Tom McDermott, N5EG, is shipping! Dorothy has already shipped over 300 books in the first 3 months. The book looks like it is going to be as good as we thought it would be. Have a look at the details on http://www.tapr.org/tapr/html/publications.html

We printed 1000 copies of the book and it looks like we might be doing a second printing before the end of the year.

John Ackermann's TCP/IP book has another chapter completed and we are working on adding the required graphics to the book. Work needs to be done to integrate the chapters and graphics and then get the second reading of the text. We had looked at Dayton for an introduction, but due to schedules it looks like the printing date will be pushed back.

Tom McDermott, N5EG, Greg Jones, WD5IVD, Lon Cecil, WB5PKI, Bob Stricklin, N5RRG, and John Kosier, W9DDD, at Tom's first book signing party! (January 5th, 1997).

1997 CD-ROM

The TAPR 1997 CD-ROM should be hitting the production house the first of February and be available the first of March. The CD has been rebuilt from the ground up and a lot of html code has been put together to help navigate around the CD using any number of browsers people have. Using a web browser locally on your computer to access the information should make information easier and faster to find and review. If you don't have a computer which supports the necessary browser software, don't worry, you can still get all the data directly from the CD like before. The CD will again be a ISO-9660 standard, which will allow it be accessed on any number of platforms. The price will not change from last year — $20, + $4 s/h. Keep an eye on TAPR-BB and the web page for information before the next *PSR*.

TAPR Software Library Update

Greg Eubank, KL7EV
kl7ev@tapr.org

There have been a number of changes to the TAPR software library over the last month. The library has been completely reorganized with a new numbering scheme and put on 1.44 mbyte (3.5") disks. A number of disks have been combined together and several updates and new additions have been added to the Library!

WXN has been updated to version 6.00b and a new weather server program called WXMASTER has been added to the library, with support for additional weather station equipment. Another new addition to the library is a program called VPAKET, which is a Windows 95/Windows 3.1 Graphical Packet Terminal Program. Another new Windows based terminal program called WinPak has also been added to the library! Last, but not least; there is a new TCP/IP socket driver program called DAJD written by Darren Jofford. This driver is supposed to give you control to test and view TCP/IP connections and precisely control what is being sent and lets you see what is received!

A lot of effort went into the move to 1.44 meg disks and a couple of problems which could have spelled trouble were caught prior to sending the masters in for duplication! Please bear with me, if I missed anything, as with any change, Murphy is likely to make his presence known. I look forward to getting additional program updates and new software offerings which I hope to be able to add to the already FULL Library! The library now consists of almost 20 disks full of packet related programs. Well, that is all I have to report on the TAPR Software Library for now, so 73s from Greg and thank goodness all that -55 degree weather is gone. (for now)

Regional Digital Organizations List (1/1/97)

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

Amateur Radio Research and Development Corp (AMRAD)
PO Box 6148
McLean, VA 22106-6148
Newsletter: AMRAD Newsletter

American Radio Relay League (ARRL)
225 Main St
Newington, CT 6111
Internet: INFO@ARRL.ORG
http://www.acs.oakland.edu/barc/arrl.html
Newsletter: QEX / Gateway

Arizona Packet Radio Association
8402 E Angus Dr
Scottsdale, AZ 85251

The BlueRidge Video and Digital Society (BVDS)
c/o Lee McDaniel WB4QOJ
PO Box 7673
Roanoke, Virginia 24019
Internet: wb4qoj@intrlink.com
http://www.intrlink.com/~spanky/wb4qoj/w
b4qoj.htm

Carolina Digital Coordinating Council
c/o Chris Collingford KE4CCU
210 Bypwick Pl.
Charlotte, NC 28270
http://ham.wb4ssk.org/cdcc
Internet:ccmt@vnet.net

Central Illinois Packet Radio User Society, Inc (CIPRUS)
c/o Larry Keeran K9ORP
RR 1 Box 161
Hudson, IL 61748-9750

Central Iowa Technical Society (CITS)
c/o Ralph Wallio W0RPK
1250 Hwy G24
Indianapolis, IA 50125

Chicago Amateur Packet Radio Association (CAPRA)
PO Box 8251
Rolling Meadows, IL 60008
Newsletter: The CAPRA Beacon
Internet: cberg@ews.com
http://www.pyrotechnics.com/capra/

Cincinnati Amateur Packet Radio Experimenters Society (CAPRES)
c/o John Schroer IV K4BGRH
948 Haleesworth Dr
Forest Park, OH 45240

CLEDO (Central Lakeshore Experimental Digital Organization)
c/o Stephen D. Goff, NR8VX
762 W. Main St.
Bellevue, Ohio 44811
Internet: n8vx@amebellevue.com
http://www.amebellevue.com/n8vx/cledo/in
dex.html

Colorado Digital Eclectics (CODE)
3631 Brentwood Terrace
Colorado Springs, CO 80910
Internet: info@code.org
http://www.code.org/code/

Colorado Digital Working Group
c/o Ted Cross, N0LAK
30165 Diana Rd.
Pine, CO 80470
Internet: ted@rmnd.com
http://www.rmnd.com/hamradio/dwg.html

Colorado Packet Association (CDPA)
c/o John Radomski KT0H
2050 S Fairplay
Aurora, CO 80014

Connecticut Digital Radio Association (CDRA)
c/o William Lyman, N1NWP
219 So Orchard St.
Wallingford, CT 06492
Internet: lyman@neu.edu

Eastern Washington Amateur Radio Group (EWARG)
Pat Dockrey, NO7M
Post Office Box 644
Spokane, WA 99210
Internet: nisvc@ieway.com

First Coast Amateur Digital Association (FICADA) [North East Florida]
c/o Bill Layfield KD4UIK, President
2822 Tinsley Road
Jacksonville, Florida 32218-4677
Internet: kd4uik@juno.com

Florida Amateur Digital Communications Association (FADCA)
c/o Joseph Kunz, WB4TFM
812 Childers Loop
Brandon, FL 33511
Newsletter: FADCAllocation

Georgia Radio Amateur Packet Enthusiast Society (GRAPES)
P.O. Box 676
Griffin, GA 30224
http://www.mindspring.com/~hobm/grapes/
grapes.html
Newsletter: Grapevine

Indiana Digital Experimenters Association (IDEA)
c/o John Hartman N5AAA
14659 Wellington Ct.
Noblesville IN 46060-4356
http://www.ideanet.org

Kansas Digital Coordinating Committee
1544 N 1000 RD
Lawrence KS 66046-9610

Mississippi Amateur Radio Digital Association (MARDA)
c/o Patrick J Fagan WA5DYV
2412 E Birch Dr
Gulfport, MS 39503

Missouri Amateur Packet Radio Society (MoAmPS)
c/o Tom Hammond, N0SS
5417 Scruggs Station Rd.
Lohman, MO 65053
Internet:thammond@mail.state.mo.us

Mt Asculney Amateur Packet Radio Association
c/o Carl Breming N1CB
54 Myrtle St
Newport, NH 03773

Mt Beacon Amateur Radio Club
PO Box 641
Wappingers Falls, NY 12590

Nevada Packet Coordination Committee (NPCC)
PO Box 12116
Reno NV 89510
Internet: ki3v@connectus.com
Newsletter: The NPCC Rag

New England Packet Radio Association (NEPRA)
PO Box 208
East Kingston, NH 03827
Newsletter: NEPRA PacketEar

New Mexico Packet Radio Society (NMPRS)
c/o Brian Milchitsky, N5ZGT
1021 Dakota SE
Albuquerque, New Mexico 87108
Internet: n5zgt@swcp.com

North East Digital Association (NEDA)
PO Box 563
Manchester, NH 03105
Internet: neda@teledm.com
http://www.ans.org/~ans/neda/NEDA.html

Northern California Packet Association (NCPA)
P.O. Box 61716
Sunnyvale, CA 94088
http://ncsmith.com/~ncpa
Newsletter: NCPA Downlink

North Mississippi Digital Radio Association (NMDRA)
c/o Craig Lindsey, KC5AUG
PO Box 5054
Mississippi State, MS 39762-5054
Internet: craig@verner.sasc.msstate.edu
http://www.sasc.msstate.edu/~craig/NMDRA

Ohio Packet Enthusiasts Club (OPAC)
c/o Bob Hall WB8WGA
840 Rive Ridge Blvd
Gahanna, OH 43230

Ontario/Western NY Packet Advisory Group (OWNYPAG)
c/o Paul Savini KB2KRB
779 Englewood Avenue Apt. 1
Kenmore, NY 14223-2330
Internet: as785@freenet.buffalo.edu

Pacific Packet Radio Society (PPRS)
PO Box 51562
Palo Alto, CA 94303

Packet Association of Western New York (PAWNY)
P.O. Box 1856
Cheektowaga, NY, 14225-8856
Internet: info@hamgate.suny.eric.edu
http://hamgate1.suny.eric.edu

PacketEast of North Carolina
Network and Frequency Coordination for Eastern North Carolina
c/o Gary Pearce KN4AQ, VP

116 Waterfall Ct.
Cary, NC 27513
Internet: kn4ag.gary@tands.net

Packet Radio Organization of Montana (PROM)
c/o Glenda Allen KE7TB
165 Cimifer Rd
Libby, MT 59923

Pennsylvania Packet Association (PaPA)
c/o Bryan Slatsnic WA3UPN
9 Wild Cherry Dr
DuBois, PA 15801

Puget Sound Amateur Radio TCP/IP Group
c/o Steve Stroh N8GNU
14919 NE 163rd Street
Woodinville, WA 98072
Internet: stroh@halcyon.com
http://www.wetnet.ampr.org

Radio Amateur Satellite Corp (AMSAT)
PO Box 27
Washington, DC 20044
http://www.qualcomm.com/amsat/Amsathome.html
Newsletter: AMSAT Journal

Radio Amateur Telecommunications Society (RATS)
c/o Brian Boccardi, N2MPM
PO Box 93
Park Ridge, NJ 07656
http://www.rats.org

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

San Diego Packet Radio Association (SANDPAC)
c/o Barry Gershenfeld
5085 Arroyo Ludo Av
San Diego, CA 92117
Newsletter: San Diego Packet Radio Association Newsletter

South Carolina Amateur Radio Digital Society (SCARDS)
PO Box 1281
Columbia, SC 29202
Newsletter: SCARDS Newsletter

Southern Amateur Packet Society (SAPS)
c/o Wayne Harrell WD4LYV
Rt 1 Box 568
Sycamore, GA 31790
http://www.mindspring.com/~cparc/saps.htm

Southern California Digital Communications Council (SCDCC)
PO Box 2744
Huntington Beach, CA 92647-2744
Newsletter: The I-Frame

Southern Oregon Amateur Packet Radio Association (SOAPRA)
c/o Albert D. Lawson
232 Talent Ave. #36
Talent, OR 97540
Internet: wb7awl@soapra.org
http://soapra.org

Tennessee Backbone Operators Network Environment (TBONE)
c/o Terry Cox, KB4KA
110 Fisherville Rd.
Collierville, TN 38017-4100
Internet: tacox@fedex.com

Tennessee Network (TENNET)
c/o Jeffrey Austen K9IA
2051 Clearview Drive
Cookeville, TN 38506
Internet: jra1854@intech.edu

Texas Packet Radio Society (TPRS)
PO Box 50238
Denton, TX 76206-0238
Internet: wo5h@tapr.org
http://www.tapr.org/tprs
Newsletter: The TPRS Quarterly Report

Tucson Amateur Packet Radio Corporation (TAPR)
8987-309 E. Tanque Verde Rd #337
Tucson, AZ 85749-9399
Internet: TAPR@TAPR.ORG
http://www.tapr.org
Newsletter: Packet Status Register

TwinsLAN Amateur Radio Club
PO Box 32301
Fridley, MN 55432
Newsletter: The TwinsLAN Beacon

Utah Packet Radio Association (UPRA)
c/o Bart Van Allen KA7ZFD
11883 S Kinney Cir
Riverton, UT 84065

Wake Digital Communications Group (WDCG)
c/o Randy Ray WA5SZL
9401 Taurus Ct
Raleigh, NC 27612

Western Michigan Packet Radio Association (WMPRA)
PO Box 4612
Muskegon, MI 49444

Wisconsin Amateur Packet Radio Association (WAPRA)
PO Box 1215
Fond Du Lac, WI 54935
Newsletter: Badger State Smoke Signals

Canada

Hamilton and Area Packet Network (HAPN)
Box 4466 Station D
Hamilton, ON L8V 4S7 Canada

HEX 9 Group
PO Box 151
Orillia, ON L3V 6J3 Canada

Manitoba Digital Emergency Communications Groups (MDECG)
c/o Jim Townsend, VE4CY
2109-55 Garry St.
Winnipeg, MB R3C 4H4 Canada

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

Ontario/Western NY Packet Advisory Group (OWNYPAG)
c/o Paul Savini KB2KRB
779 Englewood Avenue Apt. 1
Kenmore, NY 14223-2330
Internet: aa585@freenet.buffalo.edu

Ottawa Amateur Radio Club Packet Working Group
Lincoln Heights Postal Outlet
P.O. Box 32032
1386 Richmond Road
Ottawa, ON K2B 8B0
Internet: ba@bydes.carleton.ca

Vancouver Amateur Digital Communications Group (VADCG)
9531 Odlin Rd
Richmond, BC V6X 1E1 Canada
Newsletter: The Packet

Vancouver Area Packet Organization (VAPO)
c/o Rob Reid, VE7FU
6510 Bradford Place,
Delta, B. C. V4E1G3 Canada
Internet: rreid@axionet.com
http://mindlink.net/rob_reid/vapo.html
Newsletter: VAPO Gazette

Winnipeg Amateur Radio Packet group (WARP)
c/o Chris Setla, VE4SET
158 Fairlane Ave
Winnipeg, MB R2Y 0B3 Canada

TAPR Software Library

The following is a brief description of the current programs in the TAPR software library.

101. BBS Servers

APLINK - A concurrent AMTOR MBO and packet BBS system by Victor D. Poor, W5SMM.

AA4RE - A multiconnect packet mailbox program by Roy Engehausen. AA4RE Requires the use of AEA or WA8DED host mode or G8BPQ switch software for operation.

102. BBS Servers

F6FBB - BBS Supports 15 languages, YAPP support, multiconnects, compressed message forwards.

103. BBS Servers

WINLINK - A BBS system for AMTOR, PACTOR, CLOVER and packet by Victor D. Poor, W5SMM and Hans Kessler, N8PGR.

W0RLI - Packet BBS system by Hank Oredson, W0RLI

104. Misc. Programs

EZPAC1L - A menu-driven NTS message formatter by Mike Imet.

Ham Comm - A DSP RTTY program with VGA spectrum display, o-scope, tuning indicator, all real time. Uses simple 2 chip interface, schematic included, all parts available at Radio Shack. Powered by serial port.

ARES/Data - A packet radio data base system for emergencies by Wes Moerner, WN6I and Dave Palmer, N6KL.

NTS - Traffic generator Software package for generating NTS traffic by Bill Bowman, VE4UB.

DOSgate - Allow remote operation of a PC via packet radio by Rich Bono, NM1D.

INTRO - Introduction to Packet Radio by Larry Kenney, WB9LOZ.

GIL - Graphics Interchange Language Permits a convenient way to transmit more than just ASCII text messages, such as animated graphics drawings or diagrams over digital radio links.

105. Misc. Tools Disk. Programs for monitoring a packet radio channel and gathering system statistics.

MONAX - (NK6K & WB6YMH),

TRAFFIC - (IW3FQG),

PACKHACK - (K7EA)

107. TAPR TNC/Tools disk:

TNC - Manual and EPROMs for TAPR TNC-2

Assembly & operating manuals for TAPR TNC-2 plus EPROM images for 1.1.8a firmware, KISS & state machine

TNC-1 - Source for the TAPR TNC-1 firmware

TNC-2 Notes

MONZ80 - Z-80 monitor for the TNC-2 by Paul Newland AD7I.

DEVMTR - TAPR Deviation Meter Source code & tools.

METCON - Source code and tools.

109. Utility - Programs for Binary-to-ASCII conversion / compression and archiving.

110. MICROSAT - Ground Station Software and information for use with the MicroSats (AO-15, DO-17, WO-18 and LO-19) and UO-14, by Harold Price, NK6K and Jeff Ward, G0/K8EA.

111. KA9Q NET

Executables & source code for NET version of TCP/IP by Phil Karn, KA9Q, enhancements by Joe Buswell, K5JB

TCP INTRO - Description and reference information on TCP/IP.

112. Weather Server Programs

WXN - A multi-user weather server that runs as an application on the G8BPQ switch. Uses the Heath ID-5001 Advanced Weather Computer for weather data. Includes PC user program that runs on a TNC-2.

WxMaster - Version 0.1 is a Windows 3.1 application which reads and displays data log information from a Peet Brothers Ultimeter 2000. It shows current weather data in text form and will graph several types of data in a 24 hour plot. WxMaster will also connect to a TNC and send packets formatted for APRS.

113. Terminal - Windows Packet Terminal Programs

VPAKET - Graphical Packet / Digital Radio Terminal Application For Windows 95/3.1

114. Terminal - Packet Terminal Programs

THS - Terminal program for TNCs with WA8DED or DRSI PC*PA by Peter Heinrich, HB9CVV.

TPK - French language terminal program with many features by Gerard Regnard, F1PBN

SP - EsKay Packet Terminate program by Sigi Kluger, DK4NB for WA8DED firmware & support for Baycom modems & KISS TNC.

PCTOR - by Johan Ferrer, KC7WW runs AMTOR (CCIR476-6) on a PC. All AMTOR modes & listen are supported. Requires an external HF Modem (CP-1, ST-6, DJ6OP or similar.)

116. Terminal - File Transfer/Packet Terminal Programs

LAN-LINK - Packet terminal program by Joe Kasser, G3ZCZ. Supports non-packet modes of PK-232, KAM and MFJ-1278.

PAKET - TNC-2 program with features such as windowed operation for multi-connects by Tony Lourdale, VK2DIU.

117. Terminal - File Transfer/Packet Terminal Programs

YAPP - A packet terminal program by Jeff Jacobsen, WA7MBL. Supports split-screen operation, ASCII and binary file transfer.

WINPACK - Windows Packet Radio program. Needs Win 3.1 or later, at least a 386 and at least 4MB of RAM. This program subject to the conditions in LICENCE.TXT.

118. KA9Q NOS - Executables and Documentation

JNOS - JNOS 1.10M - Executables and documentation for KA9Q's NOS version of TCP/IP software, enhancements by Gerard van der Grinten, PA0GRI; Johan Reinalda, WG7J, and James Dugal, N5KNX. Author - James P Dugal, N5KNX; Email: jpd@usa.net or n5knx@k5axh.#lft.la.usa.noam

This code is a continually developing piece of work, and as such, it should be seen as BETA software, no matter whether it is indicated as such or not. You should not expect this to be a 'plug and play' solution to tcp/ip over packet radio. If you experience problems feel free to contribute 'constructive' criticism to the author or the discussion group.

DAJD - DAJD Sock 0.2A - Socket Driver.

http://www.zynet.co.uk/dajd/

Author - Darren Jefford

E - Mail - dajd@g6gon.zynet.co.uk

Ideal for Programmers writing TCP/IP Servers. DAJD Sock allows you to test connections and precisely control what is being sent and see what is recieved. Ideal for Internet Users DAJD Sock allows multiple connections to a wide variety of TCP/IP Services including Telnet, TTY - Link, Finger and more!

119. KA9Q NOS - Source code for Executables on Disk 118.

120. Switch-Server Programs

G8BPQ - NET/ROM-compatible multiconnect packet switch by John Wiseman, G8BPQ, which can be run standalone or in conjunction with a BBS package, ARES/Data or DX Cluster software.

Orders for any of the above disks, or submissions and updates to the TAPR software library should be sent to the TAPR office.

TAPR Software Library

In addition to supplying various kits and firmware, TAPR maintains a library of packet radio-related computer software. This software is available by anonymous FTP from ftp.tapr.org, and from the TAPR office on disk. The FTP library may also contain software which is not available from TAPR on disk. The file /tapr/software_lib/00-index.txt contains the complete list.

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

Software may be uploaded to the /tapr/software_lib/UPLOAD directory. Please read the README file in that area. Please direct any questions to softlib@tapr.org.

Current as of 06 January, 1997

All ftp filenames listed below should be preceeded with "/tapr/software_lib"

Key: [UPD] = Disk file is updated since last listing
[NEW] = New addition to the TAPR Software Library

Disk No.	Pgm Name	Version	ftp Filename
101. BBS - Servers			
	APLINK	VER. 7.01	/bbs/adr701.exe
	AA4RE	VER. 2.12	/bbs/bb212.zip
102. BBS - Servers			
	F6FBB	VER. 6.15	/bbs/
103. BBS - Servers			
	WINLINK	VER. 1.2	/bbs/wnl12.exe
	W0RLI	VER. 19.8	/bbs/w0rli/mbs.exe
104. Misc - Programs			
	EZPAC	VER. 1.1	/misc/ezpac11.zip
	Ham Comm	VER. 3.0	/misc/hamcom30.exe
	ARESDATA	VER. 1.5	/misc/aresdata.zip
	VE4UB NTS	VER. 091891	/misc/nts4ub.exe
	NM1D DOSGATE	VER. 1.14	/misc/dosgate.zip
	Intro to Packet Radio	6/16/95	/misc/intropkt.zip
	GIL	VER. 1.03	/misc/gil1-03.zip
106. Misc - Tools			
	MONAX		/misc/monax.zip
	PRAFFIC	VER. 2.05E	/misc/pra205e.zip
	PACKHACK	VER. 6	/misc/phack6.zip
107. TNC - Tools			
	TNC-2 EPROM's	VER. 1.1BA	/tnc/eproms.exe
	Host Mode docs		/tnc/hostmode.exe
	Manual		/tnc/tncdocs.exe
	TNC-1 CODE		/tnc/tnc1src.zip
	TNC2 Notes		/tnc/tnc2not.zip
	Z-80 Monitor		/tnc/monz80.zip
	TAPR DevMetel source & tools		/misc/devmtl.zip
	METCON source & tools	VER. 1.07	/misc/metcon.zip
108. Utility - Archive/Conversion Programs			
	TPLUS	VER. 2.02	/utils/7plus20.exe
	LHA	VER. 2.11	/utils/lha211.exe
	PKARC	VER. 3.6	/utils/pk36.exe
	PKZIP/PKUNZIP	VER. 2.04G	/utils/pkz204g.zip
	R95	VER. 4.0	/utils/r9540.exe
	uuencode/uudecode	VER. 5.40	/utils/uuexe540.exe
	ZOO	VER. 2.10	/utils/zoo21.exe
110. Microsat - Ground Station Software			
	PB	04/30/92	/sat/m/crosat.zip
	PG	02/25/92	"
	PFHADO	03/24/92	"
	PHS	12/21/90	"
111. TCP/IP - Telnet/SMTP/Ftp Programs			
	KA9Q NET	VER. K86	/tcpip/net486ex.zip
			/tcpip/net486s.zip
	INTRO TO TCP/IP		/tcpip/tcpintro.zip
112. Weather - Server Programs			
[UPD]	WXN Weather Svr..	VER. 6.00b	/weather/wxn600b.zip
[NEW]	WxMaster	VER. 0.1	/weather/WXMASTER.ZIP
113. Terminal - Windows Packet Terminal Program			
[NEW]	VPAKET	VER. 3.2	/terminal/vpaket32.zip
114. Terminal - Packet Terminal Programs			
	THS	VER. 2.50	/terminal/ths.zip
	TPK	VER. 1.82	/terminal/tpk182.zip
	SP (Eskay Packet)	VER. 6.50	/terminal/sp650.exe
	PCTOR	VER. 3.02	/terminal/pctor302.zip
116. Terminal - File Transfer/Packet Terminal Programs			
	LAN-LINK	VER. 2.32	/terminal/ll232.zip
	PAKET	VER. 6.1	/terminal/paket61.zip
117. Terminal - File Transfer/Packet Terminal Programs			
	YAPP	VER. 2.0	/terminal/yapp.zip
[NEW]	WINPAK	VER. 6.10	/terminal/winp610.zip
118. NOS - KA9Q Network Operating System			
	JNOS (Executables)	VER. 1.10M	/tcpip/jnos110m.exe
	JNOS (Docs)		/tcpip/docs110m.zip
[NEW]	DAJD (Socket Driver)		/tcpip/DAJDSOCK.ZIP
119. NOS - KA9Q Network Operating System			
	JNOS (Source for 118)	VER. 1.10M	/tcpip/jnos110m.zip
120. Switch - Server Programs			
	G8BPQ NODE	VER. 4.08a	/switch/bpq408a.zip

Ballot for TAPR Board of Directors Election

All Information Must be Provided:	Vote for up to three:
Name (printed):	____ Greg Jones, WD5IVD
Member Number:	____ John Koster, W9DDD
Check Number (from mailing label):	____ Mel Whitten, K0PFX
Signature:	____ Steve Stroh, N8GNJ

Mail to: TAPR, 8987-309 E. Tanque Verde Rd. #337, Tucson, AZ 85749-9399. Must be received by March 15, 1997. 30,

Kits	Price	Qty	Total	Kit Code	Information
DSP-93 w/ wall transformer (US)	$430.00			15	check with office on ship date, no discount
DSP-93 w/o wall transformer	$420.00			16	for international orders only, no discount
DAS (DTMF Accessory Squelch)	$68.00			1	limited kits available. As soon as Dec 95 QST
AN-93 HF Modem	$90.00			1	limited kits available.
TAPR 9600 bps Modem	$80.00			6	
Bit Regenerator	$10.00			1	used for regenerative repeater operation
Clock Option	$5.00			1	used for regenerative repeater operation
PK-232 Modem Disconnect	$20.00			2	simplifies connection of external modems
PK232MBX Installation Kit	$20.00			2	for installation of 9600 modem in PK-232MBX
XR2211 DCD Mod.	$20.00			2	
State Machine DCD Mod.	$20.00			2	
State Machine DCD w/Int Clock	$25.00			2	for KPC2 or other TNC with 16X or 32X int clock.
METCON-1 Telemetry/Control					Mascon-1 kits no longer available.
Voltage-to-Frequency module	$30.00			3	Plenty of the Option Kits!
Temperature-to-Freq module	$40.00			3	
A-D Converter	$45.00			3	
Elapsed Time Pulser	$35.00			3	
Firmware					
32K RAM w/ TNC2 update docs	$20.00			2	
TNC-2 1.1.9 w/KISS EPROM	$15.00			4	Includes 1.1.9 Commands booklet (below)
1.1.9 Commands Booklet (only)	$8.00			2	full TNC-2 command set for 1.1.9
TNC-2 WA8DED EPROM	$12.00			2	8 current version for ARRL/Dad standard
TNC-1 WA8DED EPROM	$12.00			2	
TNC-2 KISS EPROM	$12.00			2	
TNC-1 KISS EPROM	$12.00			2	
PK-87 WA8DED EPROM	$12.00			2	
Publications					
1997 TAPR CD-ROM	$20.00			4	ISO 9660, 650 Megs of info! w/ hard copy pages
Wireless Digital Communications	$39.99			8	300+ pages w/disk by Tom McDermott, N1EG
Packet Radio: What? Why? How?	$12.00			2	120 pages. TAPR's Packet Radio book
BBS Sysop Guide	$9.00			2	60 pages. by: Barry Dudum, WA0RJT
TAPR's 94 Annual Proceedings	$7.00			2	Papers from the Annual Meeting (Tucson)
TAPR's 95 Annual Proceedings	$7.00			2	Papers from the Annual Meeting (St Louis)
PSR Set Vol 1 (#1 - #17 '82 - '85)	$20.00			6	
PSR Set Vol 2 (#18 - #36 '86 - '89)	$20.00			6	
PSR Set Vol 3 (#37 - #52 '90 - '93)	$20.00			6	
NOSIntro, Intro to KA9Q NOS	$23.00			8	by Vivek G3NRW, TCP/IP over Packet Radio
ARRL CNC Proceedings 1st - 15th	call				Individual Proceedings, call for prices
Entire Set ARRL CCC 1st - 15th	$110.00			144	10 Proceedings from 1981 to 1994
Other					
TAPR 11oz Coffee Mug logo	$11.00			1	Logo in black and microwavable gold
TAPR Badge	$10.00			3	include name and Call for badge
3 1/2" Disk from TAPR Library	$3.00			1	$3 per disk. See TAPR Software Library List

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.

Tucson Amateur Packet Radio
8987-309 E. Tanque Verde Rd #337
Tucson, Arizona • 85749-9399
Office: (817) 383-0000 • Fax: (817) 566-2544
Internet: TAPR@TAPR.ORG • www.tapr.org
Non-Profit Research and Development Corporation

January 1997

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

Membership	Price	Number of Years	Total
United States	$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 $4	Add $5	Add $6	Add $7

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

_____ **TOTAL Order Amount**

☐ Charge my credit card (check one):
☐ VISA ☐ MasterCard

Acct. #: _____
Expiration Date: _____
Signature required: _____

Name / Call: _____

Street Address: _____

City / State / Zip: _____

Country: _____ Phone Number: _____

Internet E-mail: _____